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Catalogue of Polar Bear (*Ursus maritimus*) Maternal Den Locations in the Beaufort Sea and Neighboring Regions, Alaska, 1910–2010

Data Series 568

U.S. Department of the Interior
U.S. Geological Survey

Cover: An adult female polar bear and her two cubs travel across the sea ice of the Arctic Ocean north of the Alaska coast, April, 2008. (Photograph by Mike Lockhart, U.S. Geological Survey.)

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Conversion Factors and Datum

Conversion Factors

Multiply	By	To obtain
meter (m)	3.281	foot (ft)
kilometer (km)	0.6214	mile (mi)

Datum

Horizontal coordinate information is referenced to the World Geographic Datum 1984.

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Abstract

This report presents data on the approximate locations and methods of discovery of 392 polar bear (*Ursus maritimus*) maternal dens found in the Beaufort Sea and neighboring regions between 1910 and 2010 that are archived by the U.S. Geological Survey, Alaska Science Center, Anchorage, Alaska. A description of data collection methods, biases associated with collection method, primary time periods, and spatial resolution are provided. Polar bears in the Beaufort Sea and nearby regions den on both the sea ice and on land. Standardized VHF surveys and satellite radio telemetry data provide a general understanding of where polar bears have denned in this region over the past 3 decades. Den observations made during other research activities and anecdotal reports from other government agencies, coastal residents, and industry personnel also are reported. Data on past polar bear maternal den locations are provided to inform the public and to provide information for natural resource agencies in planning activities to avoid or minimize interference with polar bear maternity dens.

Introduction

Polar bear (*Ursus maritimus*) research has been ongoing in Alaska since 1967. Research was initiated to address management issues including sport and subsistence hunting, and the establishment and expected growth of the petroleum industry in Alaska and neighboring Canada. Research has focused on developing indexes of population size and trend and identifying major aspects of life history that are strong determinants of those trends. Polar bears require dens of snow and ice that remain undisturbed throughout den tenure for the successful parturition and early development of neonates. Suitable denning habitat generally occurs on the leeward side of terrestrial banks and bluffs, or sea ice pressure ridges, where drifting snow can accumulate (Durner and others, 2003; fig. 1). Given this requirement, the timing and distribution of maternal denning were considered important information for management decisions on the conservation of polar bears.

This report meets the information needs of natural resource agencies in their efforts to minimize interactions between human activities and polar bear maternal dens. The data are derived from a mix of reported information, non-standardized and standardized surveys, and satellite telemetry records of polar bear maternal dens in the Beaufort Sea and neighboring regions between 1910 and 2010.

Methods of Discovery

Data in this report span a century of observations by local residents, visitors to the Arctic, industry personnel, and natural resources agents of Borough, State and Federal governments. Between 1965 and 1972, polar bear research and management was under the jurisdiction of the Alaska Department of Fish and Game (ADFG). The Marine Mammal Protection Act (MMPA) of 1972 resulted in the transfer of all polar bear research and management to separate divisions of the U.S. Fish and Wildlife Service (USFWS). In 1993, most Department of the Interior (DOI) biological research was moved into the National Biological Survey (later renamed the National Biological Service). Another transfer of DOI research occurred in 1996 when these duties became the responsibility of USGS Biological Resources Division (Wagner, 1999). Because these different agencies housed a continuation of the same research program, they are collectively referred to in this report as the Alaska Science Center (ASC). The ASC is presently the curator of polar bear maternal den records for the U.S. Department of the Interior.

Figure 1. A female polar bear as she emerges from her maternal den adjacent to a coastal bank on Foggy Island, near Prudhoe Bay, Alaska, April 2009. (Photograph by Rusty Robinson, Brigham Young University, Provo.)

Prior to 1980, much data on polar bear maternal dens in the Beaufort Sea and neighboring regions were collected through observations by coastal residents, guides of polar bear hunters, and through interviews with industry personnel (Lentfer and Hensel, 1980). Additional observations were made during autumn fixed-wing aircraft surveys of nearshore habitats by the ADFG (1965, 1967, 1971), the USFWS (1973, 1974, 1976), and by the USFWS during March and April (1973, 1974, 1975; Lentfer and Hensel, 1980). Opportunistic observations of maternal dens were recorded during spring (March and April) mark-recapture research (Lentfer, 1975; Lentfer and others, 1980) in northwestern and northern Alaska by the ADFG (1967–72) and the USFWS (1974–76).

From 1980 through 1994, capture-mark-recapture efforts were intensified to estimate the population size of polar bears in the southern Beaufort Sea (Amstrup and others, 1986, 2001). These efforts involved 4–6 weeks of fieldwork each spring and 4–5 weeks during some autumns. In 1981, radio tracking began after the development of very high frequency (VHF) radio transmitter collars that were suitable for deployment on adult female polar bears. In 1985, the ASC deployed the first successful satellite-linked radio transmitters (Platform Transmitter Terminal, or PTT) on polar bears. Between 1985 and 1994, VHF and PTT units provided data on polar bear movements, distribution, habitat use, and maternal denning.

Beaufort Sea-wide standardized VHF surveys were conducted by aircraft four times each winter during 1983–87, and twice each winter during 1988–91. A primary goal of these surveys was to collect data on the distribution of polar bear maternal dens (Amstrup and Gardner, 1994). Following 1985, location and sensor data from PTTs deployed on female polar bears in the Beaufort and Chukchi Seas (Garner and others, 1990) enabled the remote identification of maternal dens (Amstrup and Gardner, 1994; Fischbach and others, 2007). The ASC also continued to record observations reported by Borough, State, and Federal agencies, local residents, industry personnel, and other groups and individuals. Maternal dens were also observed and recorded by ASC personnel incidental to standard searches for polar bears during nearshore capture-recapture and radio-collaring efforts. The development of VHF radio tags combined with standardized high-altitude radio-tracking surveys of the Beaufort Sea and the deployment of PTTs provided data of maternal dens that was largely free from geographic biases inherent in other types of observations. Data resulting from these tracking methods allowed the ASC to develop a better understanding of the distribution and timing of polar bear maternal denning in Alaska and neighboring regions.

Following a hiatus in data collection that began in 1995, the ASC resumed polar bear field research in autumn 1997 (Regehr and others, 2006). Spring and autumn field research were conducted until 2001, after which the late-autumn ice formation that became typical prevented autumn captures. Between 1997 and 2010, the ASC continued to deploy PTTs and some VHF radio tags. Recent assessments of the distribution of maternal denning have been performed entirely with PTT data (Fischbach and others, 2007). Additional data have been collected through restricted VHF telemetry surveys over the nearshore Alaska Beaufort Sea, experimental surveys with Forward-Looking Infrared (FLIR; Amstrup and others, 2004) over likely polar bear denning habitat (Durner and others, 2003), and reports from local residents, industry personnel, and visitors to northern Alaska.

Because of the diversity of data sources and the substrate choice of polar bears (sea ice, fast ice, or land) the spatial resolution of the den location data varies. Many reported observations were recorded to the nearest minute of latitude and longitude because they were estimated from a hunter's memory of where a den was observed many years prior. Conventional, FLIR, VHF tracking, and PTT tag relocation observations were usually recorded to the nearest tenth to hundredths of latitude and longitude minute. Additionally, satellite observation location quality was dependent on signal quality. Most PTT locations, however, were ± 1.7 km of the true location of the animal (Fancy and others, 1988).

Because sea ice continually drifts (with the exception of nearshore fast ice), sea ice den locations are reported for a single point of the den tenure (generally the den entrance period, if available) and do not reflect the movement of the den during a winter of ice drift. Only measures of terrestrial or fast ice den sites visited on the ground or recorded near ground level from an aircraft with a Global Positioning System (GPS) receiver are within 100 m of the true location of the den.

Follow-up visits to dens, either by low-level aircraft reconnaissance or on-ground measures by personnel, resulted in improved estimates of den locations. For example, many dens discovered by satellite telemetry during early winter were surveyed with aerial VHF telemetry in late winter. The VHF telemetry location would supersede the previous satellite telemetry-derived location. Likewise, dens may have been visited on the ground following their discovery by satellite telemetry or VHF telemetry. Because ground-visits were the most precise mode of location determination, these superseded prior locations derived from either telemetry method. This process often resulted in minor changes of the recorded den location as new data became available. The records provided in this report are the best current estimate of a den location as of 2010. Subsequent observations of recently discovered dens (that is, during the year of this report) may refine those location estimates.

Field descriptors for each data record (see appendix 1) include the ASC assigned den identification number (DenId), the year that cubs would have emerged from the den (Spring_year), the data source (Data_Source), encounter method (Discovery_method), and location in decimal degrees (latitude and longitude). Field observations made prior to 1995 were recorded in North American Datum 1927 and post-projected as World Geographic Datum 1984. All Argos observations and field observations made after 1994 were recorded in World Geographic Datum 1984. The data provided here are maternal den locations, where "maternal den" represents a structure that was used by a pregnant bear to give birth to young and, should parturition be successful, continue to be used as shelter for developing neonates during late winter and early spring in the year following parturition. Whether a structure was a maternal den was determined by assessing the timing and duration of den tenure, assessment of temperature, activity and signal quality from PTTs, direct observations of females with neonates, visual inspection of the den following departure of the family, and visual inspection of the ground following snow melt. The USGS den data base also includes records of temporary dens not used for parturition, autumn exploratory dens that were apparently deemed unsuitable by the bear, FLIR hotspots that later showed no evidence of being a maternal den, and erroneous or questionable reports from other parties. These other records, which showed no compelling evidence that they were maternal dens, are not provided in this report. Because these other observations are excluded from this report, the reader will note gaps in consecutive DenID records in appendix 1.

Distribution of Den Locations

As of spring 2010, a total of 392 records of polar bear maternal dens had been collected by the ASC (appendix 1). This database included observations reported by other individuals or institutions (Discovery_method = REPORT, n = 69), observations from polar bear field research (Discovery_method = CONVENTIONAL, n = 40), dens encountered by FLIR surveys (Discovery_method = FLIR, n = 13), dens located by VHF telemetry relocations (Discovery_method = VHF_RADIO, n = 101), and dens discovered by satellite radio telemetry (Discovery_method = SATELLITE, n = 169). All VHF telemetry records were collected between 1982 and 2009, satellite records between 1986 and 2010, and FLIR records between 1999 and 2007. CONVENTIONAL observations were made between 1969 and 2010. REPORT observations were made between 1910 and 2007.

The encounter (discovery) method strongly influenced the observed distribution of den locations. SATELLITE and VHF_RADIO observations were distributed throughout the Beaufort and Chukchi Seas (figs. 2*A* and 2*B*). REPORT, FLIR, and CONVENTIONAL observations, however, occurred mostly near shore and on land (figs. 2*C* and 2*D*). The distribution of dens discovered by VHF telemetry also was dependent on the time period that the data were collected. Whereas VHF telemetry data collected between 1983 and 1991 were through systematic Beaufort Sea-wide surveys (Amstrup and Gardner, 1994), VHF telemetry missions after this period were restricted to nearshore regions (fig. 3).

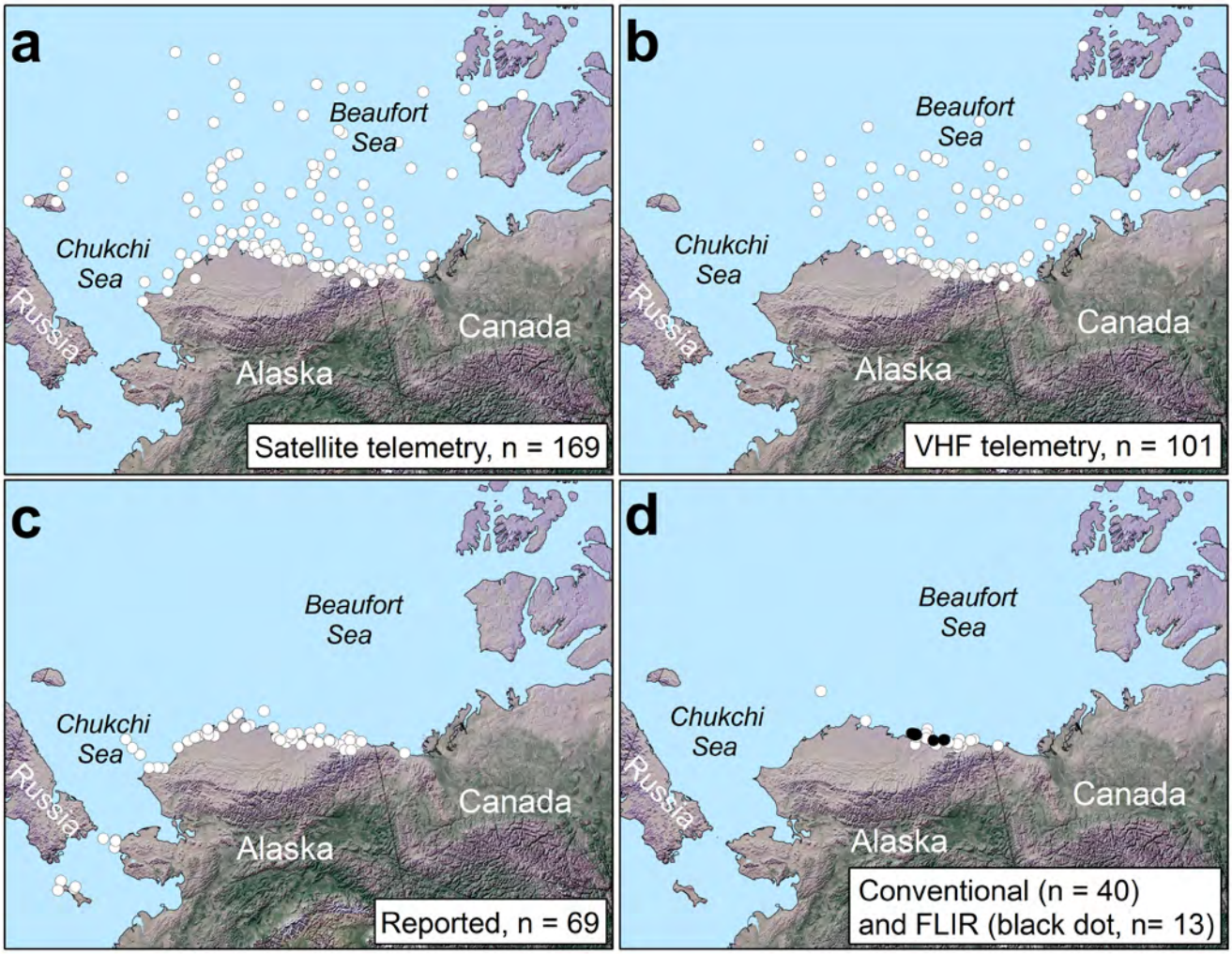

Figure 2. Distribution of polar bear maternal dens encountered through: (*A*) satellite telemetry, (*B*) VHF telemetry, (*C*) reported by others, and (*D*) during polar bear capture operations on sea ice and nearshore areas, and surveys with Forward-Looking Infrared (FLIR) of terrestrial denning habitat, Beaufort Sea and neighboring regions, Alaska, 1910–2010.

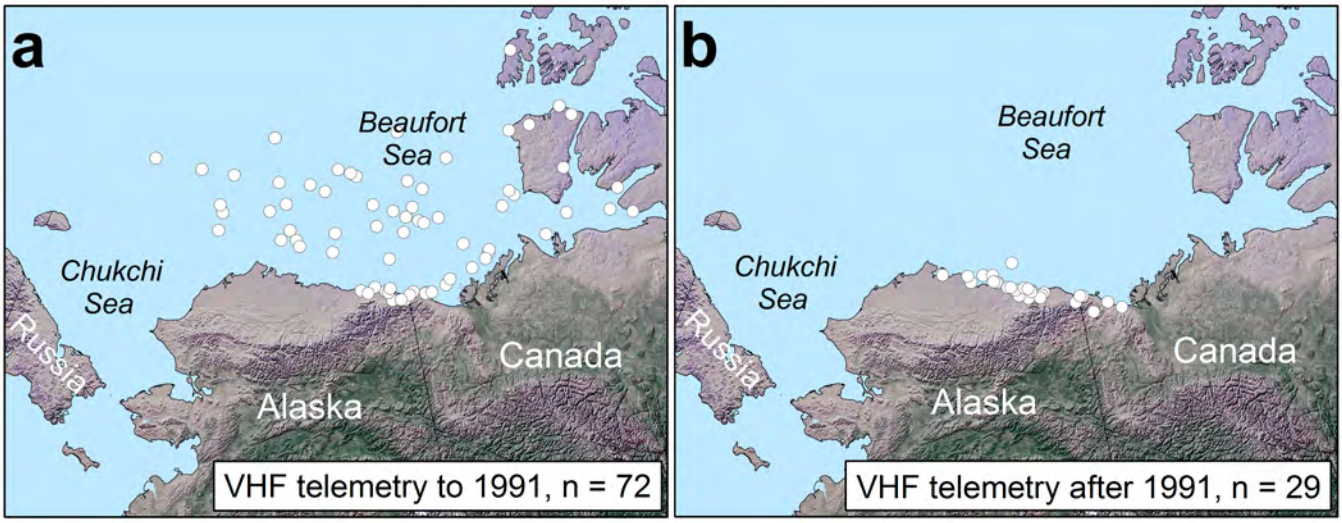

Figure 3. Distribution of polar bear maternal dens discovered by VHF telemetry (*A*) during 1981–91 when most data were collected through systematic surveys, and (*B*) after 1991 when VHF telemetry missions only occurred near shore, Beaufort Sea and neighboring regions, Alaska.

Summary

Records of maternal den locations in the Beaufort Sea and neighboring regions maintained by the U.S. Geological Survey, Alaska Science Center are provided to the public. Users are cautioned that observations of maternal dens are dependent on the method of data collection; thus, certain methods may provide a better representation of den distribution than others.

Acknowledgments

The authors recognize the contributions of Gerald Garner (ASC, deceased) who deployed satellite collars on female polar bears in the Chukchi Sea between 1987 and 1994. We also recognize the contributions of numerous local residents and industry personnel whose observations added to the data in this report. Primary funding for this work was provided by the USGS. Additional support was provided by the USFWS, British Petroleum Exploration – Alaska, ConocoPhillips – Alaska, ExxonMobil, Polar Bears International, the World Wildlife Fund, and prior to 1973, the State of Alaska. We appreciate the constructive suggestions by Gail Irvine (ASC), Karen Oakley (ASC), John Pearce (ASC), and Evan Richardson (Environment Canada) on earlier versions of this data report.

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Appendix 1. Records of Polar Bear Maternal Dens Collected by the USGS, Alaska Science Center

[See appendix 2 for a definition of Data_source and Discovery_method codes]

Record	DenID	Spring_year	Data_source	Discovery_method	Latitude	Longitude
1	126	1910	ASC	REPORT	70.0833	–149.1667
2	127	1910	ASC	REPORT	70.8333	–152.2500
3	128	1913	ASC	REPORT	70.1667	–147.3333
4	131	1917	ASC	REPORT	70.2000	–150.8333
5	179	1935	ASC	REPORT	70.9167	–155.0000
6	132	1951	ASC	REPORT	70.1667	–143.6667
7	177	1955	MMM	REPORT	63.7500	–171.7333
8	133	1957	ASC	REPORT	70.6662	–146.8394
9	199	1957	MMM	REPORT	63.5780	–170.4260
10	237	1957	MMM	REPORT	70.4470	–159.0408
11	134	1958	ASC	REPORT	70.5333	–149.8667
12	216	1965	MMM	REPORT	70.3100	–160.9900
13	135	1967	ASC	REPORT	70.5000	–148.0000
14	136	1968	ASC	REPORT	71.5000	–153.3333
15	137	1969	ASC	CONVENTIONAL	69.8330	–144.1333
16	138	1970	ASC	REPORT	70.5333	–148.0000
17	211	1971	MMM	REPORT	70.3840	–160.7970
18	139	1972	ASC	REPORT	70.8333	–155.5000
19	140	1972	ASC	REPORT	69.3000	–167.0000
20	141	1972	ASC	REPORT	69.5000	–168.0000
21	142	1972	ASC	REPORT	69.8333	–143.0000
22	143	1973	ASC	CONVENTIONAL	70.1000	–149.3333
23	144	1973	ASC	CONVENTIONAL	70.1854	–146.0610
24	189	1973	MMM	REPORT	70.3300	–150.0800
25	147	1974	ASC	CONVENTIONAL	72.2000	–160.5833
26	148	1974	ASC	CONVENTIONAL	69.9333	–144.4667
27	150	1974	ASC	CONVENTIONAL	69.8167	–144.5833
28	718	1974	ASC	CONVENTIONAL	69.9333	–144.4667
29	152	1975	ASC	CONVENTIONAL	70.4000	–147.6667
30	153	1975	ASC	REPORT	70.1833	–143.6667
31	154	1975	ASC	REPORT	70.2000	–143.5833
32	155	1975	ASC	REPORT	70.1000	–144.1167
33	156	1975	ASC	CONVENTIONAL	70.0333	–144.1667
34	244	1975	MMM	REPORT	69.9590	–142.9580
35	245	1975	MMM	REPORT	69.9160	–144.8140
36	246	1975	MMM	REPORT	69.6980	–144.3800
37	252	1975	MMM	REPORT	70.5570	–149.5150
38	157	1976	ASC	REPORT	70.0310	–143.6600
39	158	1977	ASC	CONVENTIONAL	69.9667	–144.7833
40	190	1978	MMM	REPORT	70.3300	–150.0700
41	161	1981	ASC	CONVENTIONAL	70.5540	–149.4476
42	162	1982	ASC	CONVENTIONAL	70.0265	–142.6845
43	163	1982	MMM	REPORT	65.5000	–167.6667
44	186	1982	INDUSTRY	REPORT	68.9333	–164.2333
45	540	1982	ASC	CONVENTIONAL	70.1180	–144.2670
46	622	1982	ASC	VHF_RADIO	69.5335	–141.4071
47	165	1983	INDUSTRY	REPORT	69.6500	–143.6667
48	178	1983	MMM	REPORT	71.1667	–157.0333
49	181	1983	MMM	REPORT	70.1333	–162.0000
50	202	1983	MMM	REPORT	65.7760	–167.7120
51	533	1983	ASC	VHF_RADIO	71.1000	–142.2500
52	702	1983	ASC	VHF_RADIO	69.5833	–138.8500
53	166	1984	ADFG	REPORT	68.9167	–164.8333
54	507	1984	ASC	VHF_RADIO	72.8000	–138.5167
55	513	1984	ASC	VHF_RADIO	72.5000	–139.5000

Appendix 1. Records of polar bear maternal dens collected by the USGS, Alaska Science Center—Continued

[See appendix 2 for a definition of Data_source and Discovery_method codes]

Record	DenID	Spring_year	Data_source	Discovery_method	Latitude	Longitude
56	516	1984	ASC	VHF_RADIO	74.1833	–150.3833
57	517	1984	ASC	VHF_RADIO	73.0500	–160.9667
58	518	1984	ASC	VHF_RADIO	73.3667	–136.8500
59	528	1984	ASC	VHF_RADIO	74.3333	–144.5000
60	529	1984	ASC	VHF_RADIO	72.5000	–153.0000
61	539	1984	ASC	VHF_RADIO	69.9524	–143.1785
62	544	1984	ASC	VHF_RADIO	69.7500	–140.4000
63	545	1984	ASC	VHF_RADIO	72.2667	–138.1833
64	546	1984	ASC	VHF_RADIO	74.5000	–160.0000
65	549	1984	ASC	VHF_RADIO	71.0000	–134.0833
66	626	1984	ASC	VHF_RADIO	73.1667	–143.0000
67	628	1984	ASC	VHF_RADIO	74.6667	–146.6667
68	630	1984	ASC	VHF_RADIO	74.2167	–117.3000
69	633	1984	ASC	VHF_RADIO	77.0333	–119.1333
70	704	1984	ASC	VHF_RADIO	70.4000	–131.8167
71	510	1985	ASC	VHF_RADIO	69.5863	–142.6056
72	541	1985	ASC	VHF_RADIO	73.9000	–148.5833
73	553	1985	ASC	VHF_RADIO	73.3333	–161.3333
74	554	1985	ASC	VHF_RADIO	74.5667	–164.1500
75	556	1985	ASC	VHF_RADIO	74.6333	–170.2333
76	557	1985	ASC	VHF_RADIO	73.8000	–138.3333
77	560	1985	ASC	VHF_RADIO	72.1333	–137.6667
78	564	1985	ASC	VHF_RADIO	70.0995	–145.6740
79	565	1985	ASC	VHF_RADIO	74.3000	–154.3000
80	583	1985	ASC	CONVENTIONAL	69.6000	–140.1500
81	629	1985	ASC	VHF_RADIO	69.6667	–140.8333
82	631	1985	ASC	VHF_RADIO	74.4833	–145.1667
83	167	1986	MMM	REPORT	63.3667	–171.7500
84	168	1986	INDUSTRY	REPORT	70.3000	–148.0000
85	501	1986	ASC	SATELLITE	72.0500	–152.0500
86	503	1986	ASC	SATELLITE	70.0000	–138.8333
87	511	1986	ASC	VHF_RADIO	70.0226	–142.7237
88	512	1986	ASC	VHF_RADIO	71.9667	–140.1167
89	515	1986	ASC	VHF_RADIO	72.8167	–140.8167
90	523	1986	ASC	VHF_RADIO	69.8916	–142.9327
91	525	1986	ASC	VHF_RADIO	69.7333	–137.0000
92	559	1986	ASC	VHF_RADIO	72.1333	–152.3000
93	562	1986	ASC	VHF_RADIO	72.3000	–147.8000
94	566	1986	ASC	VHF_RADIO	73.4833	–153.4333
95	567	1986	ASC	VHF_RADIO	70.1667	–144.2333
96	569	1986	ASC	VHF_RADIO	76.0000	–154.9000
97	571	1986	ASC	VHF_RADIO	72.3833	–161.2000
98	573	1986	ASC	VHF_RADIO	71.9000	–151.9667
99	576	1986	ASC	SATELLITE	73.4833	–153.8333
100	578	1986	ASC	VHF_RADIO	75.7000	–138.1667
101	579	1986	ASC	VHF_RADIO	71.6167	–148.3000
102	580	1986	ASC	SATELLITE	71.6000	–157.1667
103	582	1986	ASC	VHF_RADIO	72.1500	–154.0500
104	584	1986	ASC	VHF_RADIO	74.2333	–132.9333
105	619	1986	ASC	VHF_RADIO	74.1667	–121.7500
106	620	1986	ASC	VHF_RADIO	69.9667	–118.4167
107	621	1986	ASC	VHF_RADIO	69.4667	–116.5833
108	623	1986	ASC	SATELLITE	71.3667	–142.4500
109	632	1986	ASC	VHF_RADIO	72.0500	–126.9500
110	634	1986	ASC	VHF_RADIO	71.8333	–128.6667
111	635	1986	ASC	VHF_RADIO	73.7000	–116.5833
112	636	1986	ASC	VHF_RADIO	70.2500	–125.5000
113	637	1986	ASC	VHF_RADIO	72.1500	–120.5833
114	638	1986	ASC	VHF_RADIO	72.3667	–143.0000
115	639	1986	ASC	VHF_RADIO	70.5000	–131.6667

Appendix 1. Records of polar bear maternal dens collected by the USGS, Alaska Science Center—Continued

[See appendix 2 for a definition of Data_source and Discovery_method codes]

Record	DenID	Spring_year	Data_source	Discovery_method	Latitude	Longitude
116	640	1986	ASC	VHF_RADIO	72.2667	–127.2833
117	641	1986	ASC	VHF_RADIO	73.2167	–155.3667
118	644	1986	ASC	VHF_RADIO	69.9000	–136.4333
119	645	1986	ASC	VHF_RADIO	72.1833	–135.9167
120	646	1986	ASC	VHF_RADIO	70.5000	–116.5833
121	647	1986	ASC	VHF_RADIO	70.6333	–122.5833
122	648	1986	ASC	VHF_RADIO	74.3167	–124.3333
123	649	1986	ASC	VHF_RADIO	70.0667	–133.9167
124	233	1987	MMM	REPORT	70.4100	–151.8700
125	502	1987	ASC	SATELLITE	73.5333	–147.0500
126	504	1987	ASC	VHF_RADIO	69.6333	–139.1167
127	524	1987	ASC	VHF_RADIO	69.6000	–139.2333
128	526	1987	ASC	SATELLITE	69.7167	–134.4333
129	530	1987	ASC	VHF_RADIO	69.9775	–145.0028
130	535	1987	ASC	SATELLITE	69.5280	–141.0346
131	547	1987	ASC	SATELLITE	73.3833	–159.4833
132	572	1987	ASC	SATELLITE	74.2000	–145.8167
133	574	1987	ASC	SATELLITE	73.5333	–158.9000
134	627	1987	ASC	REPORT	69.9167	–142.4000
135	642	1987	ASC	SATELLITE	74.6167	–143.9333
136	130	1988	MMM	REPORT	65.8000	–167.7000
137	170	1988	ASC	CONVENTIONAL	69.9629	–144.5608
138	174	1988	ASC	CONVENTIONAL	70.1787	–145.9653
139	203	1988	MMM	REPORT	65.7680	–167.7060
140	505	1988	ASC	SATELLITE	69.9590	–144.5803
141	514	1988	ASC	SATELLITE	72.7167	–159.1167
142	542	1988	ASC	SATELLITE	76.1000	–160.7500
143	575	1988	ASC	SATELLITE	72.3333	–161.9167
144	577	1988	ASC	SATELLITE	77.2333	–157.0167
145	588	1988	ASC	SATELLITE	70.0668	–143.9921
146	592	1988	ASC	SATELLITE	76.1833	–166.9833
147	593	1988	ASC	SATELLITE	70.5500	–150.3667
148	595	1988	ASC	SATELLITE	77.8167	–157.9500
149	596	1988	ASC	CONVENTIONAL	70.5178	–149.1602
150	625	1988	ASC	SATELLITE	71.7167	–158.5667
151	173	1989	ASC	CONVENTIONAL	70.1763	–145.9537
152	508	1989	ASC	CONVENTIONAL	70.6833	–147.7667
153	519	1989	ASC	SATELLITE	70.1808	–145.9778
154	527	1989	ASC	SATELLITE	69.5500	–140.2500
155	536	1989	ASC	SATELLITE	69.9065	–145.1028
156	548	1989	ASC	SATELLITE	74.7667	–157.7833
157	550	1989	ASC	SATELLITE	71.8667	–138.0333
158	558	1989	ASC	SATELLITE	71.7500	–148.6333
159	568	1989	ASC	SATELLITE	69.6167	–139.0090
160	586	1989	ASC	SATELLITE	72.2540	–152.8650
161	589	1989	ASC	SATELLITE	71.8000	–140.1667
162	594	1989	ASC	SATELLITE	70.8000	–138.3667
163	597	1989	ASC	SATELLITE	69.4667	–139.7000
164	600	1989	ASC	SATELLITE	71.1333	–152.8000
165	602	1989	ASC	SATELLITE	70.0129	–143.0345
166	605	1989	ASC	SATELLITE	70.8333	–154.0333
167	643	1989	ASC	SATELLITE	73.8833	–146.3500
168	848	1989	ASC	SATELLITE	71.2717	–158.5300
169	850	1989	ASC	SATELLITE	70.5908	–163.0000
170	851	1989	ASC	SATELLITE	74.1410	–160.2367
171	200	1990	MMM	REPORT	65.7600	–168.8970
172	522	1990	ASC	VHF_RADIO	70.2333	–132.3000
173	532	1990	ASC	SATELLITE	69.9741	–144.7728
174	537	1990	ASC	SATELLITE	69.5500	–139.6333
175	552	1990	ASC	SATELLITE	71.2333	–160.5167

Appendix 1. Records of polar bear maternal dens collected by the USGS, Alaska Science Center—Continued

[See appendix 2 for a definition of Data_source and Discovery_method codes]

Record	DenID	Spring_year	Data_source	Discovery_method	Latitude	Longitude
176	555	1990	ASC	SATELLITE	73.1500	–171.9167
177	581	1990	ASC	SATELLITE	69.0333	–163.8500
178	587	1990	ASC	SATELLITE	75.4000	–141.7000
179	590	1990	ASC	SATELLITE	70.5562	–149.5825
180	599	1990	ASC	VHF_RADIO	69.5574	–141.7903
181	601	1990	ASC	SATELLITE	69.6833	–161.0167
182	603	1990	ASC	SATELLITE	71.3667	–178.7167
183	604	1990	ASC	SATELLITE	72.6167	–178.9167
184	606	1990	ASC	SATELLITE	72.0500	–178.6167
185	607	1990	ASC	SATELLITE	68.5000	–166.2833
186	608	1990	ASC	SATELLITE	70.9833	178.2167
187	609	1990	ASC	SATELLITE	71.1000	–181.2000
188	610	1990	ASC	SATELLITE	69.5333	–139.1500
189	611	1990	ASC	SATELLITE	72.7333	–155.4333
190	615	1990	ASC	SATELLITE	69.9299	–144.9753
191	849	1990	ASC	SATELLITE	72.8666	–163.0064
192	183	1991	ASC	CONVENTIONAL	70.5519	–149.4878
193	184	1991	ASC	CONVENTIONAL	70.5524	–149.4906
194	616	1991	ASC	VHF_RADIO	70.0266	–142.6881
195	697	1991	ASC	VHF_RADIO	69.6000	–138.5833
196	844	1991	ASC	SATELLITE	73.8178	–160.2362
197	854	1991	ASC	SATELLITE	70.8921	–154.5470
198	856	1991	ASC	SATELLITE	71.6946	–155.8145
199	187	1992	INDUSTRY	REPORT	70.1867	–145.9958
200	500	1992	ASC	VHF_RADIO	70.1248	–145.9077
201	506	1992	ASC	VHF_RADIO	69.6000	–140.5833
202	509	1992	ASC	VHF_RADIO	70.8167	–150.6333
203	520	1992	ASC	VHF_RADIO	69.9667	–144.4000
204	521	1992	ASC	VHF_RADIO	69.8288	–146.0663
205	531	1992	ASC	VHF_RADIO	69.9673	–147.0272
206	561	1992	ASC	SATELLITE	76.8667	–150.8000
207	591	1992	ASC	VHF_RADIO	70.1907	–147.3245
208	598	1992	ASC	SATELLITE	69.9969	–144.3990
209	617	1992	ASC	SATELLITE	69.7694	–141.1760
210	703	1992	ASC	VHF_RADIO	68.9667	–139.8333
211	904	1992	MMM	REPORT	70.6228	159.9380
212	188	1993	INDUSTRY	REPORT	70.1107	–147.1982
213	215	1993	MMM	REPORT	70.3010	–161.2500
214	223	1993	MMM	REPORT	70.8308	–158.0274
215	265	1993	MMM	REPORT	70.5010	–160.0370
216	551	1993	ASC	SATELLITE	70.1996	–143.6725
217	570	1993	ASC	SATELLITE	72.2833	–146.6500
218	585	1993	ASC	SATELLITE	75.5667	–142.2000
219	612	1993	ASC	SATELLITE	70.7667	–142.5333
220	613	1993	ASC	SATELLITE	70.8833	–153.7000
221	614	1993	ASC	SATELLITE	74.4333	–159.2833
222	618	1993	ASC	SATELLITE	69.6667	–140.3333
223	650	1993	ASC	SATELLITE	71.0000	–142.6833
224	651	1993	ASC	SATELLITE	73.8500	–143.7833
225	839	1993	ASC	SATELLITE	83.9210	–21.2320
226	847	1993	ASC	SATELLITE	71.7995	–142.9141
227	191	1994	LOCAL	REPORT	70.8317	–158.1480
228	196	1994	LOCAL	REPORT	71.2033	–156.9830
229	197	1994	LOCAL	REPORT	71.3833	–156.4700
230	217	1994	MMM	REPORT	70.6210	–159.8490
231	219	1994	MMM	REPORT	70.4510	–159.7780
232	220	1994	MMM	REPORT	70.6913	–159.8978
233	260	1994	MMM	REPORT	71.3900	–156.4550
234	652	1994	ASC	REPORT	69.1167	–138.0000
235	838	1994	ASC	SATELLITE	69.5920	–138.9420

Appendix 1. Records of polar bear maternal dens collected by the USGS, Alaska Science Center—Continued

[See appendix 2 for a definition of Data_source and Discovery_method codes]

Record	DenID	Spring_year	Data_source	Discovery_method	Latitude	Longitude
236	840	1994	ASC	SATELLITE	82.5310	–55.1190
237	845	1994	ASC	SATELLITE	78.8431	–161.7546
238	846	1994	ASC	SATELLITE	70.7362	–147.1222
239	853	1994	ASC	SATELLITE	74.2939	–146.5471
240	855	1994	ASC	SATELLITE	70.8639	–152.8327
241	938	1994	ASC	SATELLITE	69.7419	–164.1157
242	653	1997	MMM	REPORT	70.4294	–150.5564
243	654	1998	ASC	SATELLITE	70.5327	–151.7299
244	655	1998	ASC	SATELLITE	70.8875	–152.3556
245	661	1998	ASC	SATELLITE	72.4110	–143.4360
246	662	1998	ASC	SATELLITE	69.2660	–166.5020
247	664	1998	MMM	REPORT	63.6700	–170.3500
248	666	1998	MMM	REPORT	69.8300	–162.9800
249	691	1998	ASC	VHF_RADIO	70.2317	–146.4157
250	695	1998	ASC	SATELLITE	69.3659	–135.5328
251	668	1999	ASC	SATELLITE	69.8743	–142.5415
252	669	1999	MMM	REPORT	69.7698	–168.9210
253	671	1999	ASC	SATELLITE	70.5565	–149.4740
254	672	1999	ASC	SATELLITE	77.6480	–144.4370
255	673	1999	ASC	FLIR	70.1860	–146.0696
256	687	1999	ASC	CONVENTIONAL	70.5556	–149.4651
257	689	1999	ASC	CONVENTIONAL	70.0117	–143.0427
258	690	1999	ASC	CONVENTIONAL	70.1402	–147.3123
259	674	2000	ASC	SATELLITE	69.9679	–144.3856
260	675	2000	ASC	SATELLITE	69.9899	–145.1537
261	676	2000	ASC	VHF_RADIO	69.8994	–144.6558
262	677	2000	ASC	SATELLITE	70.2437	–147.8143
263	678	2000	ASC	SATELLITE	70.4883	–149.2445
264	679	2000	ASC	SATELLITE	70.8669	–152.7262
265	680	2000	ASC	CONVENTIONAL	70.5542	–149.5024
266	681	2000	ASC	SATELLITE	69.9394	–146.3728
267	682	2000	ASC	REPORT	70.5565	–150.1929
268	683	2000	ASC	SATELLITE	71.2295	–154.5607
269	684	2000	ASC	CONVENTIONAL	70.5564	–149.4734
270	692	2000	ASC	SATELLITE	70.8141	–158.1766
271	693	2000	ASC	VHF_RADIO	71.1943	–147.4569
272	694	2000	ASC	SATELLITE	71.3910	–147.8650
273	699	2000	ASC	SATELLITE	71.0000	–148.2240
274	705	2000	ASC	CONVENTIONAL	70.5565	–149.5830
275	762	2000	ASC	SATELLITE	69.9510	–146.0010
276	841	2000	ASC	SATELLITE	76.4006	–147.1222
277	842	2000	ASC	SATELLITE	71.6175	–153.8731
278	843	2000	ASC	SATELLITE	77.2860	–140.2860
279	852	2000	ASC	SATELLITE	72.7819	–154.6754
280	708	2001	ASC	SATELLITE	69.2729	–141.4087
281	712	2001	ASC	SATELLITE	70.1682	–146.6402
282	719	2001	ASC	SATELLITE	69.9275	–144.9195
283	720	2001	ASC	SATELLITE	70.1847	–146.5313
284	721	2001	ASC	SATELLITE	69.6904	–142.1039
285	722	2001	ASC	SATELLITE	73.2268	–149.7453
286	723	2001	ASC	SATELLITE	70.9655	–152.9200
287	728	2001	ASC	SATELLITE	70.5557	–149.5799
288	729	2001	ASC	VHF_RADIO	69.4274	–141.3878
289	730	2001	ASC	VHF_RADIO	70.0996	–145.6747
290	731	2001	ASC	SATELLITE	70.9271	–151.5323
291	732	2001	ASC	SATELLITE	71.1027	–154.9092
292	734	2001	ASC	SATELLITE	71.0997	–154.4445
293	736	2001	ASC	FLIR	70.5584	–149.5854
294	754	2001	ASC	SATELLITE	70.7300	–151.4400
295	755	2001	ASC	CONVENTIONAL	70.1756	–145.9559

Appendix 1. Records of polar bear maternal dens collected by the USGS, Alaska Science Center—Continued

[See appendix 2 for a definition of Data_source and Discovery_method codes]

Record	DenID	Spring_year	Data_source	Discovery_method	Latitude	Longitude
296	756	2001	ASC	FLIR	70.5565	–149.5831
297	759	2001	ASC	CONVENTIONAL	71.1093	–154.9644
298	942	2001	ASC	SATELLITE	74.5493	–121.5627
299	803	2002	ASC	SATELLITE	70.2079	–147.2392
300	805	2002	ASC	CONVENTIONAL	70.4983	–149.0932
301	807	2002	ASC	SATELLITE	70.5571	–150.2073
302	810	2002	ASC	SATELLITE	70.1761	–146.6760
303	811	2002	ASC	SATELLITE	70.1070	–145.8440
304	813	2002	ASC	SATELLITE	70.5101	–149.1243
305	821	2002	ASC	FLIR	70.1782	–145.9677
306	822	2002	ASC	SATELLITE	70.4397	–150.7249
307	823	2002	ASC	VHF_RADIO	69.8039	–144.8696
308	824	2002	ASC	SATELLITE	70.5813	–149.9351
309	825	2002	ASC	SATELLITE	70.5290	–149.2688
310	834	2002	ASC	SATELLITE	70.5700	–161.1690
311	837	2002	ASC	SATELLITE	70.2554	–161.9496
312	857	2002	ASC	SATELLITE	69.9145	–146.3440
313	861	2002	ASC	SATELLITE	70.8796	–159.2492
314	862	2002	ASC	VHF_RADIO	70.0558	–145.6945
315	863	2002	ASC	SATELLITE	70.1110	–143.2950
316	864	2002	ASC	CONVENTIONAL	70.1611	–145.8637
317	865	2002	ASC	VHF_RADIO	69.6323	–140.8578
318	876	2002	ASC	SATELLITE	70.0423	–137.4830
319	878	2002	ASC	SATELLITE	74.8720	–156.9794
320	915	2002	ASC	SATELLITE	74.0960	–116.0900
321	918	2002	ASC	SATELLITE	76.7850	–120.9530
322	921	2002	ASC	SATELLITE	73.9174	–124.4928
323	922	2002	ASC	SATELLITE	72.5500	–128.9970
324	939	2002	ASC	SATELLITE	73.7700	–124.9500
325	940	2002	ASC	SATELLITE	73.8090	–124.6308
326	884	2003	ASC	VHF_RADIO	70.5765	–151.9238
327	885	2003	ASC	SATELLITE	70.5320	–149.2790
328	886	2003	ASC	VHF_RADIO	70.8020	–152.2830
329	888	2003	ASC	SATELLITE	70.1512	–146.8656
330	889	2003	ASC	SATELLITE	70.5754	–151.9225
331	890	2003	ASC	VHF_RADIO	70.5000	–149.0960
332	891	2003	ASC	CONVENTIONAL	70.4876	–149.2457
333	911	2003	ASC	SATELLITE	70.1829	–145.9908
334	917	2003	ASC	SATELLITE	73.1530	–124.8117
335	903	2004	ASC	SATELLITE	70.1901	–147.6116
336	907	2004	ASC	FLIR	70.5559	–149.4692
337	910	2004	ASC	VHF_RADIO	70.7993	–149.6267
338	914	2004	ASC	SATELLITE	75.4980	–122.7108
339	916	2004	ASC	SATELLITE	73.9130	–124.5550
340	920	2004	ASC	SATELLITE	74.4967	–134.4024
341	923	2004	ASC	SATELLITE	69.5640	–141.5640
342	926	2004	ASC	SATELLITE	77.1800	–137.5200
343	928	2004	ASC	SATELLITE	72.0050	–145.3830
344	930	2004	ASC	SATELLITE	72.1000	–155.0200
345	957	2004	ASC	FLIR	70.4981	–149.0933
346	912	2005	ASC	SATELLITE	71.1566	–155.7226
347	913	2005	ASC	SATELLITE	69.9918	–144.4188
348	924	2005	ASC	SATELLITE	71.1860	–151.9790
349	927	2005	ASC	SATELLITE	78.8400	–168.7000
350	929	2005	ASC	SATELLITE	72.4100	–140.1220
351	931	2005	ASC	SATELLITE	73.1630	–140.2640
352	932	2005	ASC	SATELLITE	72.9490	–146.0720
353	934	2005	ASC	SATELLITE	69.3480	–138.3890
354	935	2005	ASC	SATELLITE	76.1216	–128.5100
355	936	2005	ASC	SATELLITE	73.3110	–133.7517

Appendix 1. Records of polar bear maternal dens collected by the USGS, Alaska Science Center—Continued

[See appendix 2 for a definition of Data_source and Discovery_method codes]

Record	DenID	Spring_year	Data_source	Discovery_method	Latitude	Longitude
356	937	2005	ASC	SATELLITE	71.3670	–138.3220
357	945	2005	ASC	SATELLITE	70.1856	–146.0631
358	947	2005	ASC	CONVENTIONAL	70.1800	–145.9737
359	948	2005	ASC	CONVENTIONAL	70.4909	–147.9874
360	949	2005	ASC	CONVENTIONAL	70.3134	–147.9887
361	960	2005	ASC	FLIR	70.4879	–149.2453
362	961	2005	ASC	FLIR	70.2114	–147.2406
363	962	2005	ASC	FLIR	70.5499	–149.4621
364	951	2006	LOCAL	REPORT	68.8490	–165.8050
365	952	2006	ASC	CONVENTIONAL	70.4033	–149.1279
366	954	2006	ASC	REPORT	70.0580	–145.5830
367	955	2006	ASC	REPORT	70.1503	–145.8755
368	956	2006	ASC	REPORT	70.1333	–145.9393
369	965	2006	ASC	FLIR	70.5562	–149.4664
370	967	2006	ASC	CONVENTIONAL	70.5590	–149.5327
371	968	2006	ASC	FLIR	70.5536	–149.4873
372	969	2006	ASC	CONVENTIONAL	70.0580	–145.5830
373	953	2007	ASC	VHF_RADIO	70.5529	–149.4858
374	972	2007	ASC	FLIR	70.4988	–149.0938
375	973	2007	ASC	FLIR	70.4988	–149.0938
376	974	2007	ASC	CONVENTIONAL	70.4997	–149.0949
377	975	2007	ASC	SATELLITE	70.5555	–149.5779
378	976	2007	MMM	REPORT	70.3160	–151.5043
379	976	2007	MMM	REPORT	70.3160	–151.5043
380	978	2009	ASC	VHF_RADIO	70.1865	–146.0127
381	979	2009	ASC	VHF_RADIO	70.3089	–148.1508
382	980	2009	ASC	VHF_RADIO	70.5299	–149.2692
383	981	2009	ASC	VHF_RADIO	70.5561	–149.5746
384	982	2009	ASC	VHF_RADIO	70.8568	–154.9792
385	983	2009	ASC	VHF_RADIO	69.1911	–138.2509
386	984	2009	ASC	VHF_RADIO	68.8873	–137.0253
387	985	2009	ASC	VHF_RADIO	70.2898	–147.7945
388	989	2010	ASC	CONVENTIONAL	70.0370	–146.9782
389	990	2010	ASC	SATELLITE	69.3637	–143.3613
390	991	2010	ASC	SATELLITE	70.8230	–153.9890
391	992	2010	ASC	SATELLITE	70.1320	–145.9370
392	993	2010	ASC	SATELLITE	70.1780	–145.9710

Appendix 2. Definition of Data-source and Discovery_method Codes Used in Appendix 1.

Data_source	
ADFG	Alaska Department of Fish and Game
ASC	Alaska Science Center
INDUSTRY	Petroleum and related industry personnel
LOCAL	Residents of coastal villages and homesteads
MMM	US Fish and Wildlife Service, Marine Mammals Management
Discovery_method	
CONVENTIONAL	Encountered during other ASC polar bear field research efforts
FLIR	Encountered with Forward-looking Infrared
REPORT	Reported to ASC from other individuals or agencies
SATELLITE	Encountered through satellite telemetry
VHF_RADIO	Encountered through VHF telemetry

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