BROWN BEAR TELEMETRY AND TRAPPING

SPECIAL REPORT

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Brown bear studies were continued during the 1967 field season with emphasis on development of techniques for instrumenting bears with radio transmitters and monitoring movements of instrumented animals. Information obtained was applicable to long range objectives of learning more of the life history of brown bear so that this information could be applied to improved management principles. The following is an account of the procedures used, the results obtained in 1967, and recommendations for future research and application to management.

Brown bears were trapped and tagged in the Karluk Lake area as in previous field seasons. Trapping operations were conducted between July 12-21 and again intermittently from October 11 to November 3. In July, 18 traps and 3 snares were distributed in the area of Halfway, Grassy, Thumb, Cottonwood, Salmon, Meadow, Cascade and Canyon Creeks. During the October-November trapping session 12 traps were active at Halfway, Grassy, Cottonwood, Alder and Thumb Creeks. In the latter season traps were set only near the stream's outlets and the beach of Karluk Lake while in July the traps were set farther upstream. This was done because of the lack of fish in the streams.

Trapping techniques were similar to those in previous years with one exception being the use of Sernylan, a different anesthetic, discussed in the next section.

Eighteen bears were trapped, tagged and released. The results of trapping are summarized in Table 1 and 3.

Table 1. Bear trapping at Karluk Lake, Alaska 1967

	No. of Days Operating	No. of Trap Nights	No. of Bear	Trap Nights per Bear	No. Traps Sprung
July	10	208	9	23.1	20
Oct-Nov	16	186	9	20.7	58
Total	26	394	18	21.9	78

The reason for the higher number of sprung traps during the fall was due to an apparently higher fox concentration at this time.

A CO_2 Cap-Chur Gun was used to immobilize free-roaming and trapped brown bears. Nine free-roaming bears were taken with the dart gun. Of these, 5 were males and 4 were females; 3 were yearlings, 1 was a subadult, and 5 were adults. Most of the free-roaming bears were taken incidental to the trapping operation. Details of weights, measurements and other information collected are presented in Table 3. "Sernylan", phencyclidine hydrochloride marketed by Park, Davis and Company, was administered to bears in 5cc darts using approximately 1cc (100 mg/cc) /100 wt.

Reactions to the drug were variable and not necessarily related to drug dosage. Nearly half exhibited muscular spasms and convulsions, being quite severe at times. Excessive salivation was also noted in approximately half of the bears drugged. Convulsions and salivation did not necessarily occur in the same bear. Irregular breathing was noted in one bear and five bears did not recover from the drug effects. Autopsies revealed hemorrhaged lungs and/or lungs contained excessive fluids. Death could possibly be attributed to second doses of drug or improper handling.

In an attempt to reduce the losses and injurious side effects of Sernylan, a tranquilizer "Tranvet", propeopromagine hydrochloride, marketed by Diamond Laboratories was administered to five of the bears during the fall trapping season. After the bear had become immobilized with Sernylan, 2.5cc to 4cc of Tranvet was injected intramuscularly into the animal. This tranquilizer reduced, and in some cases stopped muscular spasms, convulsions and the excessive salivation that was noted before the use of it. More detailed information as to dosage and effects can be found in Table 2.

Table 2. Dosages of Sernylan, Tranvet, and reactions of brown bears at the Karluk Lake area, Summer and Fall 1967.

Weight Lbs.	Age Yrs.	Sex	Sernylan Dosage(mg)	Time Out (min.)	Tranvet Dosage(mg)	Convulsions	Salivation	Remarks
150	1-1/2	F	125	3	-	Moderate	Moderate	Recovery started 2.3 hrs.
280	2-1/2	M	250 480 - 45 min.	6	-	Heavy	Heavy	On feet in 11 hrs.
205	2-1/2	F	125 50 - 35 min.	3	-	None	Slight	-
185	2-1/2	M	200	3	-	Slight	Slight	-
395	Adult	M	470	5-8	-	None	None	-
460	Adult	F	480 20 -1 hr.40 min. 20 -1 hr.45 min.	N.A.	-	N.A.	N.A.	Dead next day.
190	2-1/2	F	175	N.A.	-	Moderate	None	-
365	Adult	F	480 20 -3 hr.33 min. 20 -4 hr.38 min.	3	-	N.A.	N.A.	-
175	1-1/2	M	N.A.	N.A.	-	Severe	Severe	Dead next day.
500 est.	Adult	F	480	5	-	None	Heavy	-
100 est.	1-1/2	F	N.A.	N.A.	-	N.A.	N.A.	Dead next day.

(Cont.)

Table 2. (Cont.)

Weight Lbs.	Age Yrs.	Sex	Sernylan Dosage (mg)	Time Out (min.)	Tranvet Dosage (mg)	Convulsions	Salivation	Remarks
100 est.	1-1/2	M	125	3	-	Slight	None	Recovery started 1 hr.
100 est.	1-1/2	M	125 - poor inj. 50 - 20 min.	5	-	Slight	None	-
310 est.	4-1/2 est.	F	100 200 - 25 min.	5	-	Severe	Severe	Dead next day.
290 est.	4-1/2 est.	M	300	7	-	None	None	-
480 est.	Adult	F	300	27	-	None	Slight	-
455	Adult	F	250 75 -1 hr.20 min.	18	-	None	None	Gone in 3 hr.8 min.
230	4-1/2 est.	F	200	4	-	Severe	Heavy	Dead next day.
455	3-1/2 est.	M	400 100 - 25 min.	5 down 5 out	200	None	None	-
125	8 mos.	F	150	3	200	None	Slight	-
560	12+est.	F	480 100 - 20 min.	15 down 5 out	250	None	None	Recovery started 2 hrs.
820	7+est.	M	480	5	250 200	Severe Slight (for 1 hr.)	None	Recovery started 10 hrs.
510	5 est.	M	480	9	200	None	None	Never completely out.

Table 3. Bear Tagged - 1967

Tattoo No.	Date	Sex & Age	Location	Wt. (lbs)	Lgth. (in.)	LFFW (in)	LFFL (in)	LHFW (in)	LHFL (in)	Shldr. Ht. (in)	Girth (in.)	Neck (in)	Key
34-7	7/13	F 1.5	Grassy Pt.	150	58	5	5 3/4-2	4 1/2	8 1/4	33 1/2	31	-	
35-7*	7/13	M 2.5	Grassy Pt.	280	72	6	7 -2 1/2	5 1/2	10 1/4	43 1/2	46	25	
36-7	7/14	F 2.5	Grassy Pt.	205	65	5	6	5	9	39	-	-	
5-6	7/14	M 2.5	Thumb	185	63	5 1/4	6	4 3/4	8 1/2	40	37	21	R
37-7*	7/14	M Ad.	Canyon Cr.	395	73	6 1/2	6 3/4	5 3/4	11	46	47 1/2	29	T
549*	7/15	F 11.5	Thumb	460	71	5 7/8	7 1/2-2 7/8	-	10 7/8	45	-	-	D T R
38-7*	7/15	F Ad.	Thumb	365	73	6	7 1/2	5 1/2	10	41	-	-	T C
39-7	7/16	F 2.5	Canyon Cr.	190	65	4 3/4	5 1/4-2	4 7/8	8 5/8	36	38	21	
40-7	7/17	M 1.5	Grassy Pt.	175	63	5	6-2 1/4	5	8 1/4	36	37	21	D
655-56	7/19	F 8.5	Canyon Cr.	500e	79	5 3/4	7 1/4-2 3/4	5 1/8	10 1/2	-	46	25 1/2	R T C
#1 yr.*	7/19	F 1.5	Canyon Cr.	100e	54	4 1/2	5 1/2-2	3 3/4	7 3/4	31	-	-	D
#2 yr.*	7/19	M 1.5	Canyon Cr.	100e	55	4 1/4	5 1/2-1 3/4	4 1/4	8	31	-	-	
#3 yr.*	7/19	M 1.5	Canyon Cr.	100e	51	4 1/4	5 1/4-2	4	9 1/4	33	-	-	
NA 20*	7/19	F Ad.	Canyon Cr.	310e	72	5 3/4	7-2 1/2	5 1/2	9 3/4	41	-	-	D T
41-7*	7/20	M 4.5e	Cascade	290e	71	6 1/4	7 1/2-3	5 3/4	10 1/2	44	41	24	T
516-17	7/20	F 8.5	Canyon	480e	79	6 1/2	7-2 1/2	5 1/2	11	41 1/2	52	29	R C
42-7	7/20	F Ad.	Canyon	455	77	6 1/2	7-3	6	10 1/2	46	54	30	C
43-7	7/20	F 4.5e	Canyon	230	70	5 1/4	6 1/2-2 1/2	5 1/2	10	41	41	23	D T
44-7	10/18	M 5.8e	Cottonwood	515	78	6 3/8	2 1/4-7 1/4	6 1/4	11	49	-	31	T
45-7	10/19	F 3.8e	Thumb	375	72	5 7/8	6-2 1/2	5 3/4	10 1/4	46 1/2	-	-	
46-7	10/20	M 5.8e	Cottonwood	685	91	7 1/2	8	7	11 1/2	51	-	-	
47-7	10/20	M 3.8e	Halfway	440	76	6 1/8	2 7/8-7 1/2	6	11 1/4	46	-	30	T
48-7	10/21	M 3.8e	Halfway	455	81	6	2 5/8-7	5 7/8	10 1/2	36	-	28	
49-7	10/21	F 8 mo.	Thumb	125	55	4 3/8	1 7/8-5 1/4	4	7 3/8	25	-	21	T
50-7	10/22	F 12+e	Cottonwood	560	-	-	-	-	-	-	-	-	T C
51-7	10/23	M 7e	Halfway	820	96	7	8 3/4	8	11	61	-	35	T C
52-7	10/26	M 5.8e	Cottonwood	510	87	6 3/4	7	6 1/8	11 3/4	51	-	-	

Key: T = tooth pulled
R = recapture
D = dead
C = collar for radio
* = free-roaming bear
e = estimate

Using a dart gun allows more selection in capturing bears for tagging. This is helpful when representatives from a specific class is desired for other studies (such as adult females for radio telemetry). Also bears taken incidental of trapping operations increase the total number of bears tagged. Yet traps have more value for capturing bears in inclement weather and darkness -- times when the dart gun hunter will not be out. The dart gun should be used in combination with steel traps to facilitate capturing the maximum number of bears in the minimum of time.

MATERIALS AND EQUIPMENT

Transmitter Collar

Several construction methods of slip-on collars, harness transmitters and break-open collars have been designed for radio tracking. However, the circuit described by Tester, et al (1964 J. Wildl. Mgmt. 28(1):42-45) is very satisfactory for tracking Kodiak bear as well as deer and small mammals.

The radio collars for tracking the Kodiak bear were patterned from work accomplished on black bears by the joint efforts of the Bureau of Sport Fisheries and Wildlife at the Olympia Research Station, Washington and Washington Department of Natural Resources. The only additions made in our study were larger diameter collars, diodes, and adding an extra bank of batteries to increase transmitter field life.

The break-open collar design was used on brown bear because it was desirable to have a snug fit. Since a bear's head is larger than its neck, a slip-on collar would be extremely loose.

All the parts for construction of the transmitters were obtained from the Bureau's Olympia Research Station and Boyd's Hobby Shop, Tumwater, Washington. The latter is mentioned as a supplier because of his service and knowledge of working and experimenting in biotelemetry equipment with the Washington Department of Natural Resources.

Very few tools and electronic equipment were needed to construct the transmitter. The necessary tools were a needle-nose pliers, side cutting pliers, small file, screwdriver, 1/4-inch drill, several No. 60 bits, and soldering iron. The receiver which was used for tracking was necessary for reception of the signal from the assembled transmitter. A volt-ohm-ammeter or a diode receiver which measures the output strength of the transmitter completes the necessary instruments.

Circuit boards can be procured from Boyd's Hobby Shop or be made on a copper laminated epoxy board and etched. The technique of circuit board designs is described by Dodge and Church (1965 NW Sci. 39(3):118-122). A circuit board is shown in Figure 1.

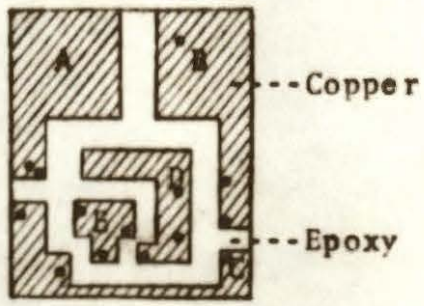


Figure 1.

Two possible outlets for crystals are from Texas Crystals, Inc. and International Crystal Company. These crystals will be made to your frequency specifications. However, there are many other sources that make crystals. Since the ends of the crystal are soldered to the circuit board use the pigtail leads rather than the pin type leads.

A 0.01 mf (microfarad) ceramic disc capacitor is the second fixed value component for each transmitter. However the above value is not critical. Capacitors of from 0.01 to 0.02 mf will work just as well.

The third fixed component is the transistor. There are several types, and even those of a given type should be tested before being attached to the transmitter as many of them will not work. The transistor may have either three or four leads. This fourth lead, which is called a case ground placed in the center, is not used and should be cut off. The three leads are arranged in V shape and looking toward the ventral side of the V from left to bottom to right are labeled Collector, Base and Emitter.

Care must be used when soldering the transistor to avoid heat damage. A good technique is to clamp a hemostat between the transistor and point to be soldered, so that the heat will be conducted away.

Four additional variable components complete the transmitter; a dipped mica capacitor of 50 mmf to 85 mmf, a 10 mf to 30 mf, 5 - 20 WVDC electrolytic capacitor, a 27K to 330K 1/2 or 1-watt resistor and a 1K 1/2 or 1-watt resistor.

The antenna collar is two strips of soft copper flashing 18 inches long, 3/4 inch wide and .025 inch thick. The length will, of course, vary depending on the neck size of the bear but averages 30 to 32 inches. Another 1 to 1-1/2 inches are needed when soldering the ends around the animal's neck.

Soldering the components to the circuit board does not have to be in any particular sequence but as a guide the method we used is described below:

1. The ends of the antenna are slightly filed to rid of any foreign material and soldered to the circuit board using rosin core colder exclusively.

2. Solder two 3/4-inch long bare wire leads to the inside of each antenna loop parellel to the board about 1/2 inch apart. These will be used later to attach the capacitor.

3. One crystal lead is soldered to copper tab connecting the antenna B and the second lead to center narrow tab marked D (see Fig. 1).

4. Insert the 0.01 mf ceramic disc capacitor into holes drilled in A and C as close to the circuit board as possible without bending the pigtails within the disc; solder and clip off the protruding ends.

5. Using a 1000 ohm resistor insert one lead into D in an upright position and bending the other lead to fit into E and solder.

6. Solder the electralytic capacitor into C and E.

7. We have used the Philco 2N1742 and the S7581-437 transistor (government surplus) with equally good results. The leads from the transistor, as described above, should be set so the Base is soldered to D, Collector to B and Emitter to C. Care should be taken as some transistors are PNP while others are NPN. If one uses the Philco 2N1742 transistor the positive electrolylic lead should be soldered to C.

8. Solder two insulated wire leads approximately 3 inches long to A and C which will be connected to the batteries for testing.

9. A fixed value capacitor or a variable capacitor can be used for testing.

10. Connect two batteries that have been soldered in 1.35V + 1.35V = 2.7V series to the two lead wires and check the transmitter with a volt-ohm-ammeter or a diode receiver. If working properly the diode receiver meter needle will pulsate from 25 to 50 uf.

11. Solder an equal number of diodes as you have banks of batteries to the battery positive lead in series from battery to circuit board (C for PNP) (A for NPN).

12. Dip the unit including the copper antenna in a corrosion resistant compound. We have used carboline Series "K". This is a clear plastic that is flexible when dry and does not need a catalyst.

13. After lead wires have been soldered to the batteries 3 or 4 applications of carboline should be applied to these as well, for waterproofing.

14. To protect the components of the transmitter we use Fiberlay and build up around them. This also offers additional waterproofing.

15. The Mallory 1.35 volt mercury batteries (E42N) were used in our bear studies. Each 1.35 volt battery is rated at 14,000 MAH. These are taped to the antenna collar with several layers of electricians tape.

16. Field attachment of the transmitter requires a snug fit to the animal's neck. After correct neck size is found solder a capacitor (this should read 25 to 35 uf on the diode receiver meter needle) to the two bare wires. (Note: as the diameter of the collar increases, the value of the capacitor will decrease.)

17. Pot the capacitor with fiberlay and wrap with tape.

18. Cut off excess copper antenna allowing one to one and one-half inch overlap of the antenna and tin with solder.

19. Attach collar on the bear's neck and clamp in place using a hemostat.

20. Place 1/4 inch plywood board or asbestos strip next to collar to protect animal's neck and solder the tinned ends of the antenna together.

21. Wrap the exposed antenna with several layers of electrical tape. This completes the construction and attachment of a transmitter to the animal's neck.

Aircraft Receiver

The radio receiver we use for bear tracking in aircraft was obtained from military surplus on a loan basis. The military designation is R-388/URR, having exceptional frequency stability and calibration accuracy. The receiver covers the frequency range from .5 to 30.5 megacycles. It is especially useful where it is desired to receive known frequencies without searching and frequent adjustments.

The R-388 is an 18-tube superheterodyne receiver that is divided into 30 1-mc (megacycle) dial switch positions. There is also a kilocycle dial that is graduated in 1-KC intervals which rotates 10 times to cover 1 megacycle. Headphone and speaker jacks are provided at the front of the panel and in addition there is a 400 and 600-ohm output terminal located at the back of the chassis. This unit weighs approximately 35 pounds.

A coaxial antenna input connector is located at the rear of the chassis. An antenna for reception of 500-kc to 30.5-mc signals can be made of either single wire or doublet.

A power source of 115 or 230-watt of alternating current providing at least 80 watts of power is required to operate the R-388. A transistorized converter is connected to the aircraft 12-volt DC battery and used for a power source in the Bureau-owned PA-18 Supercub. This is done to eliminate additional weight and avoid spilling of battery acid in the aircraft. The transverter weighs 5 pounds.

The R-388 is mounted in the baggage compartment and secured to the back seat braces, while the converter is fastened with a hook bracket on the window panel adjacent to the rear seat. From these mounting positions the pilot can switch the power source "on" and "off" and work the various frequencies for monitoring.

A coaxial cable cut to 15.2 feet was taped to the wing and elevator struts with a lead coming through the window and connected to the radio for an antenna.

D-11/M

The small transistorized portable receiver with a loop antenna called a D-11/M was purchased from Boyd's Hobby Shop, Tumwater, Washington. This receiver was designed by W. W. Cochran and is described in various wildlife publications. The receiver weighs 1-3/4 pounds including the batteries, is 5 x 4 x 3 inches and has adjustable frequency and volume controls. The loop receiving antenna is approximately

20 x 20 inches with a variable tuning capacitor. This loop antenna can be switched off and the D-11/M plugged into a larger fixed antenna.

The D-11/M is an excellent receiver for tracking on foot. The signal from a bear has been received from distances of 1-1/2 to 2 miles on the ground. At closer distances the animal's movements can be detected by a wavering of the signal.

The D-11/M was tested in the aircraft using a wire antenna. Audible signals could be received up to 3-1/2 miles. When flying to and directly over the transmitter there would be a buildup in strength and a "cone of silence" directly above it. The main disadvantage of the D-11/M in aircraft is that the set is very sensitive and needed constant minor adjustments. A radio of this type and size with crystal controls would be ideal.

Stationary Antenna

A Hy Gain Model 116DB antenna was modified and erected for a permanent station at Karluk Lake. The antenna system consists of two 3-element beams stacked and connected with a phasing harness to obtain maximum gain and directivity. The antenna was mounted on two 10-foot sections of TV masts and located on a prominent point.

Because of the mountainous area at Karluk Lake and movements of the radioed bears, the permanent type antenna station did not work satisfactorily.

Signal Generator

The signal generator is made up of 6 transmitting crystals with a knob switch for each crystal and switch for "off", "steady" or "pulse" beat. It is 5 x 3 x 2 inches and operates on two size AA 1.5 volt batteries. The function of the generator is to calibrate the D-11/M and R-388 so that a maximum strength signal can be heard.

METHODS

Four adult females were instrumented between July 15 and July 20. An additional adult female and male were radioed between October 11 and November 3. Five of the animals were trapped and one was shot with a dart gun. Two were recaptures of known age and four were unmarked bears. One of the recaptured bears had three yearlings while a second bear had only one.

Collars were affixed by use of solder and a propane soldering gun on the copper antenna. Fur was protected from heat of the soldering gun by 1/4-inch plywood boards and strips of 1/8-inch thick polyethelyne. The collar was then wrapped with electrical tape to protect the batteries, antenna, and electrical equipment. Each animal radioed had a different transmitter frequency. The frequencies used for bears were 30.07 megacycles for bear tagged 38-7 on Thumb River; 30.05 megacycles for 655-656 on Canyon Creek; 30.06 megacycles for 42-7 on Canyon Creek; 30.19 megacycles for 516-517 on Canyon Creek; 30.18 megacycles for 50-7 on Cottonwood Creek; and 30.17 megacycles for bear tagged 51-7 on Halfway Creek. Enamel paint was sprayed in a line from the neck to the rump and around the collar of two bears in hopes of later identifying the animal from the air. Although the animals were monitored several times they were never seen again to observe the condition of the paint. Colored plastic tape was wrapped around the collars of the two bears instrumented in the fall in hopes of future visual identification.

Tracking with the portable D-11/M receiver with a loop antenna was limited to areas in the immediate drainage. Usual procedure was to walk through a valley bottom, stopping approximately every hundred yards to listen for signals. Climbing to a nearby high point would give the receiver better range. Once a signal was heard, the D-11/M was turned over on its side with the gain frequency controls facing up and swung through a 360° circle. A primary and secondary volume peak was heard in this manner. The bear was in the direction the loop antenna pointed at the primary peak. Further assurance that the direction was not 180° off could only be given if the receiver was moved to another location.

Distance between the receiver was inversely correlated to the volume of the signal transmitted and to the frequency range of the signal. Thus a bear in the distant would give a weak signal that could only be picked up if the frequency knob was on the correct frequency; while a bear close to the receiver could be heard with the volume or gain all the way down and the frequency knob up to 10 kilocycles off the transmitter frequency.

Any movement of the bear's head could be detected if the receiver was held at one position with constant gain. This is because the collar, which is the antenna, would be turned alternately parallel and perpendicular to the receiver, resulting in correspondingly strong and weak signals.

A stationary yagi antenna was set up at Karluk Lake for monitoring from a fixed station. Because of the mountainous area surrounding Karluk Lake and movements of the radioed bears, the large yagi type antenna station did not work satisfactorily due to its immobility.

The R-388/URR receiver was used for monitoring radioed bears from the refuge aircraft. Before flying, the following procedure was conducted:

1. Fasten the antenna securely to the wing and elevator struts with electrical tape;
2. Check for loose antenna-radio connections;
3. Plug radio into inverter;
4. Check inverter leads and secure to aircraft battery with lock washers and nuts;
5. Put selectivity switch on "0";
6. Turn BFO switch to the "ON" position;
7. Turn BFO Pitch control to midposition;
8. Put Audio gain on "10";
9. Put RF gain on "10";
10. Turn Off-Standby-On switch to "ON";
11. Turn AVC switch "ON";
12. Turn inverter "ON";
13. Check band selector to correct frequency;
14. Turn on signal generator to selected frequency;
15. Find pulse signal on radio and adjust zero meter to calibration of frequency;
16. Adjust antenna control for maximum volume;
17. Adjust BFO dial for strongest signal;
18. Turn off inverter and signal generator until air-borne.

After being air-borne the inverter was switched on and the frequency selected of one of the bear's transmitters. The plane flew at altitudes ranging from 200 to 3,000 feet above the terrain and transmitting signals could be monitored from distances as far as five miles in this mountainous terrain. In the narrow valleys the range was reduced to a half mile at low altitudes.

When looking for an instrumented bear, the plane would fly systematically up and down each drainage. Once the signal was heard the plane kept flying in a direct line until the signal had peaked and diminished in volume. The area where the peak volume occurred was then circled at lower altitudes until the location was pinpointed. The radio frequency was then changed and a search started for the next bear.

A log was kept with each individual "sighting", including such pertinent information as date, time, weather, cover, food available, status of salmon run, etc. In addition, the location of the bear was plotted on the map whenever located.

RESULTS

The D-11/M has a range of up to a mile and a half when the bear and the receiver are in a line of sight. In some instances the instrumented bear could be approached within 30 yards, however at no time was the bear visually located. The yagi antenna had a similar range but its use was very limited.

The R-388 receiver used with the aircraft proved to be the best equipment for tracking bears. Several areas could be covered daily, giving many more "sightings" than with ground receivers. The optimum altitude was 1,000 feet above the terrain for tracking and 300 to 400 feet for pinpointing the location. Below this altitude the effective range is decreased, and at high altitudes one could miss a weak signal.

To date (12-18-67) there has been 100 locations plotted for the six radioed collared bears. The weather has been the biggest restriction in monitoring.

The sow with three yearlings, 30.05, was captured on July 19 in lower Canyon Creek. She had previously been caught in the same area and tagged in 1960. At that time she was a yearling and ear tagged 655-656. This sow lost one of her offspring on July 19 when it failed to recover from the drug administered. The sow remained in the immediate area until late afternoon of July 20. On July 21 she moved about two miles up the valley bottom of Canyon Creek. From July 22 to July 26 this bear could not be located although several of the adjoining drainages were covered by foot and from the air. However, on July 27 she was located near the area in which she was caught and instrumented. From July 27 to September 5 30.05 moved up and down about 1-1/2 miles of the stream on Canyon Creek (Figure 2). During the periods that 30.05 was monitored she stayed above some falls that prevented passage

Movement

Frequency 30.05

Tatoo No. 655-65-6

Dates Monitored: July 19 to September 5, 1967

Figure 2

of salmon. It is probable that she moved below the falls during the night to feed on salmon. Alder berries were ripening during this period and possibly the bulk of her diet was berries.

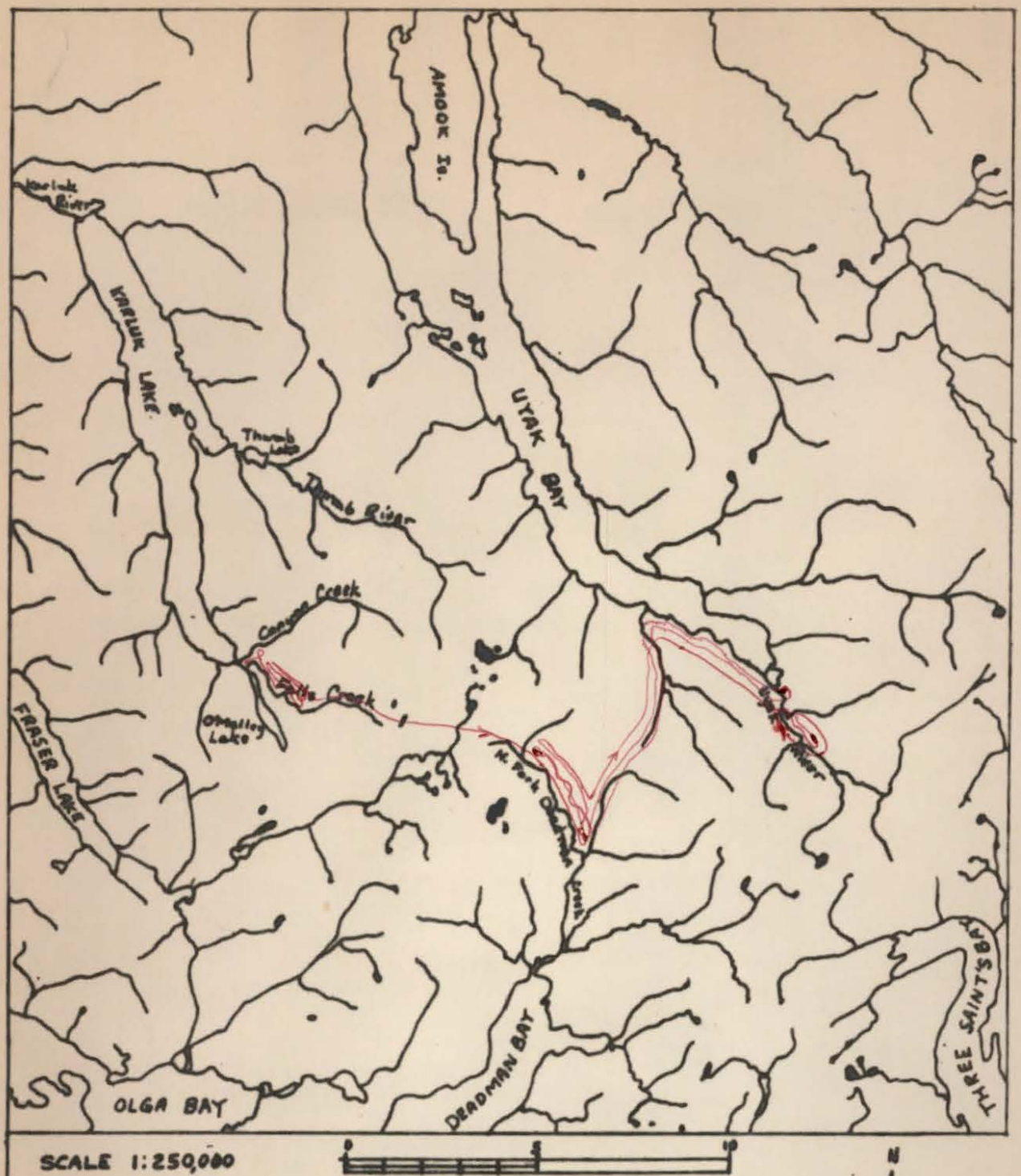
All of the surrounding drainages, or about 18 square miles, were monitored from aircraft on five occasions after September 5 without receiving a signal from this radioed bear. Either this bear moved a greater distance than expected or the transmitter quit functioning.

On July 20 a solitary female was instrumented with the frequency of 30.06. She was caught in a snare near the mouth of Canyon Creek. She remained in approximately a mile of the capture area until July 23. On July 24 she moved about two miles to Falls Creek Canyon and to higher elevations but returned the following day and stayed in this area through August 1. On August 2 she moved three miles to the head of Falls Creek and another four miles that night to the head of the North Fork of Deadman Drainage. By August 7 she had worked about four miles down Deadman Drainage where there was access to the salmon run. In the interim she evidently fed on berries. Between August 7 and 19 inclement weather prevented flying. On August 19 this bear was located on the stream at the head of Uyak Bay, a distance of eight miles from the last time monitored. By August 22 she had moved about ten miles back to the head of the North Fork of Deadman Drainage. The following day she had moved downstream about a mile and by the 25th had moved back to Uyak Bay. There was a good salmon run in the Uyak River at this time. From August 25 to September 17 this bear was monitored seven more times and each time along Uyak River and within two miles of salt water (Figure 3).

A monitoring search was conducted on September 27 and 28 covering over 20 miles range to the south, west and north of Uyak, Deadman and Karluk area. To the east is a range of steep, barren rock mountains that separates the Uyak area from the Kaiugnak and Three Saints Bay areas. On October 4 the latter two areas were searched and they too were fruitless.

The last time 30.06 was monitored (9-17-67) the transmitter was putting out a strong signal. It is possible the radio quit working but we feel that either the bear moved a greater distance than we were able to cover or, and most logical, the bear had moved to a steep narrow ravine and we missed receiving a signal.

Frequency 30.07 was assigned to the bear captured on July 15 on Thumb River about a mile above Thumb Lake. The



Dates Monitored: July 20 to September 17, 1967

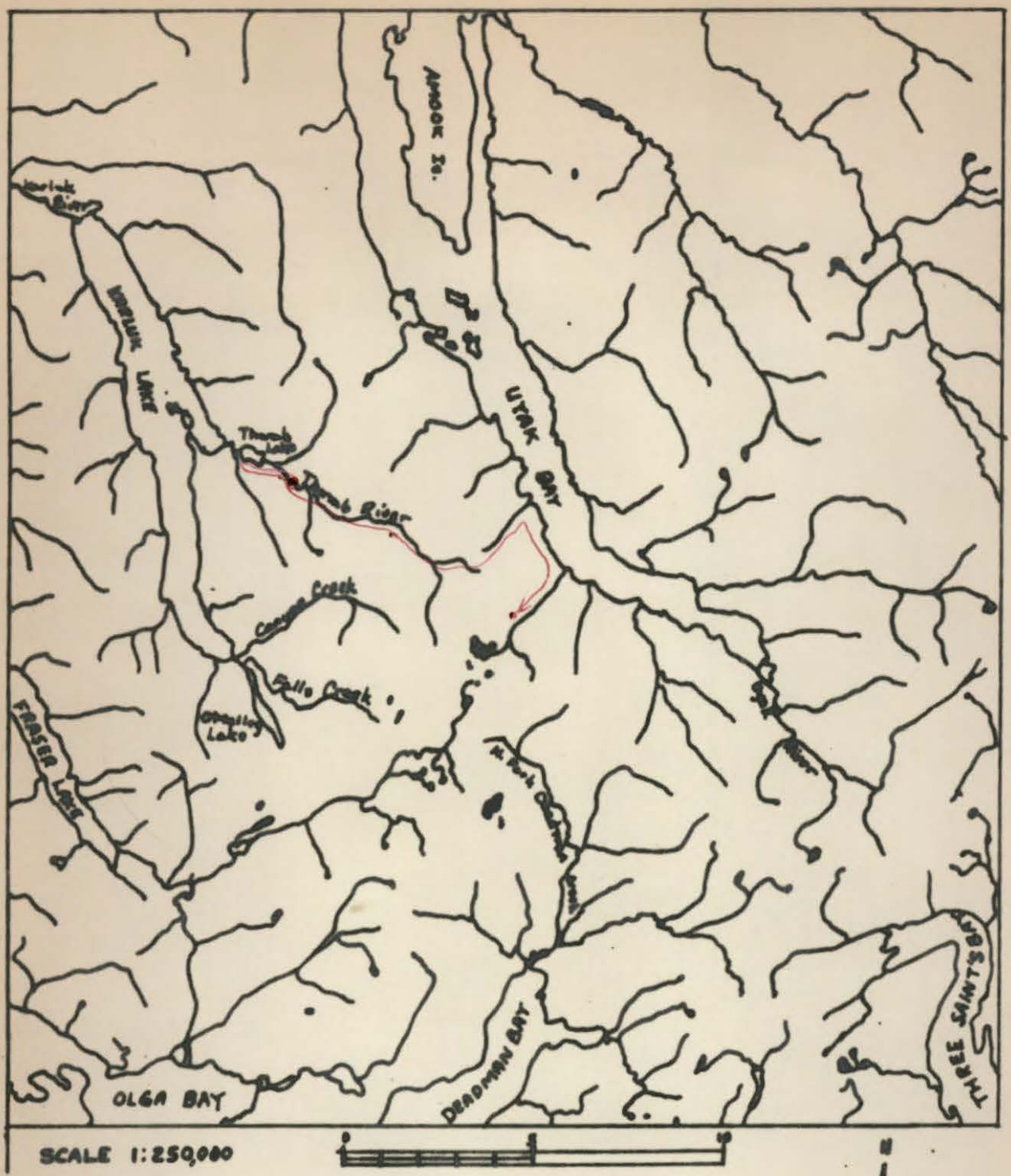
Figure 3

most extreme movement was two miles, between July 16-28, but always along the creeks and feeding on salmon. Between July 28 and August 1 she moved about eight miles into Uyak Bay Drainage. Here she remained on the alder slopes until August 7 when she began moving toward the head of the bay (Figure 4). After this date she was not located again although a radius of 15 miles were covered without receiving a signal. Either she has left the area completely or the transmitter is unoperational.

A female, caught when a six-month cub in 1959, was recaptured on July 20, 1967 in the flats between Canyon and Falls Creek. This is approximately a mile from her original capture. She was assigned frequency 30.19 and remained in the flats or about a mile radius until July 24. Between July 24 and July 28 she could be monitored in the Canyon and Falls Creek flats in the early or late hours but would move about two miles up the Falls Creek Canyon during the day. Sometime after July 28 and before August 1 she moved from Falls Creek into the North Fork of Deadman Drainage. She remained in the upper area of this drainage, presumably feeding on berries until August 25 as there was not a salmon run in this stream until about the 19th. On August 26 she again moved about two miles toward the head of the North Fork and by August 28 reversed her travel downstream. By September 2, 30.19 had moved four miles further into the Deadman Bay flats to within two miles of salt water. By this time the big salmon run was over but there were abundant fish carcasses in the stream.

Throughout September and October, whenever this bear was monitored she was found in the Deadman flats or within a radius of three miles. On November 3, a signal was received in the North Fork about two miles from the flats she had been in previously. While radio tracking for this bear on November 11, the den was found at the 1,500 foot elevation in an alder thicket. The fresh diggings of dirt on the new snow cover indicated the starting of two dens within a few feet of each other. The bear was monitored on November 17 at the same location so it can be reasonably assumed she will be using this den for the winter (Figure 5).

An old adult female accompanied by a cub was trapped at Cottonwood Creek on October 22. A collar was fitted to her with the frequency of 30.18. This bear stayed in the immediate area until October 24. On that date she was monitored in the forenoon while checking traps. However, in the afternoon she could not be located with the aircraft and radio. Also on this date the temperature had dropped to 22°F and considerable snow lay from the 500 foot level up. While radio tracking for bears on October 24 three family groups of bears were observed moving



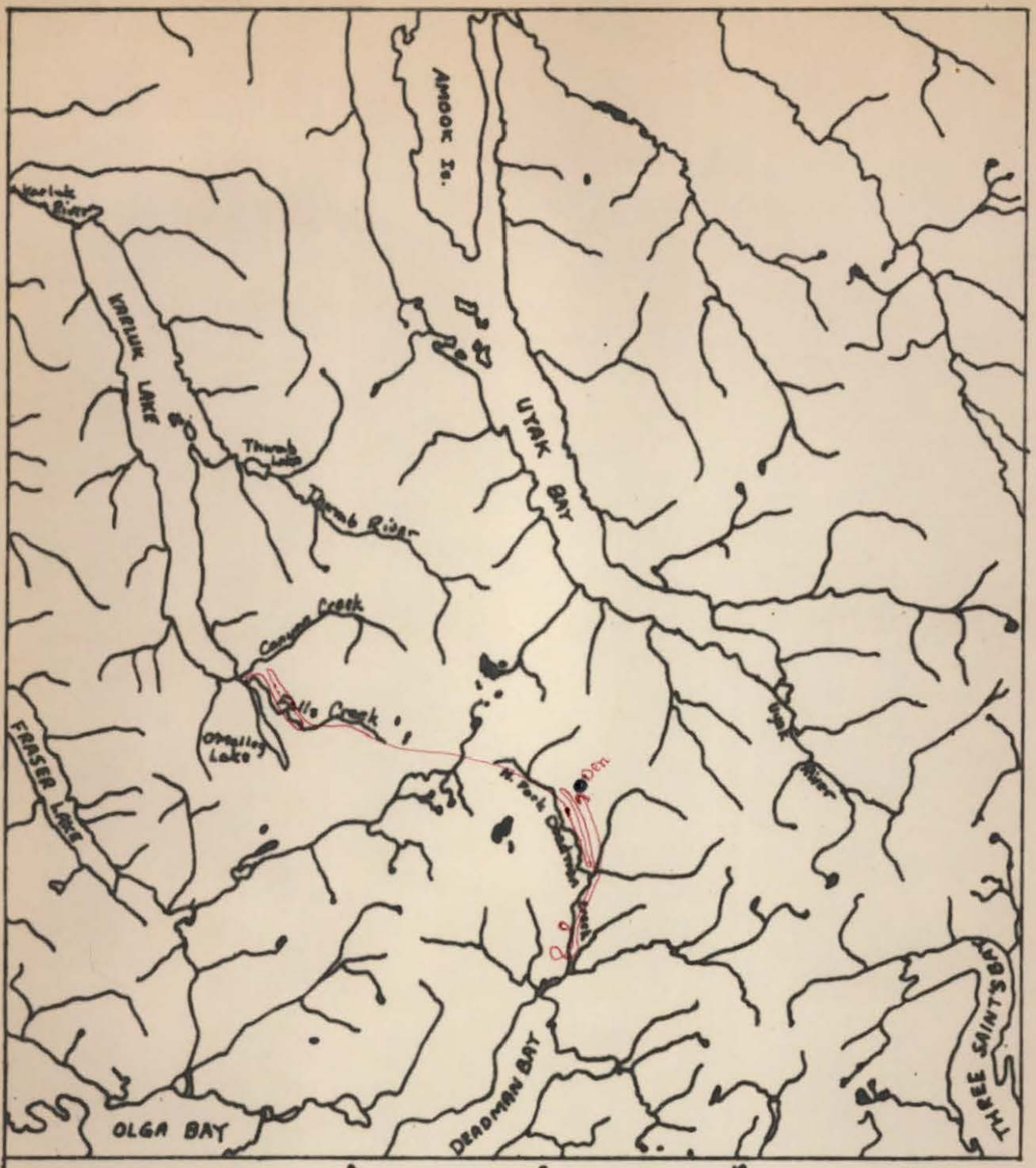
Movement

Frequency 30.07

Tubes No. 38-7

Dates Monitored: July 15 to August 7, 1967

Figure 4



Movement	Frequency	Tatoo No.
→	30.19	516-517

Dates Monitored July 20 to November 17, 1967

Figure 5

up the mountains above the 1,000 foot level and into the deeper snow. The combination of cold weather and snow may have stimulated their movement toward denning.

On November 11, 30.18 was monitored about 8 miles from the last recorded site. She had moved to the Uyak Bay and was best located at the 1,500 foot level and in dense alder. On November 17 and December 15 signals were received in the same location so it is reasonable to believe this bear has denned (Figure 6).

Only one adult male was instrumented with a radio transmitter. This was at Halfway Creek on October 23 (Figure 7). He was tattooed 51-7 and assigned a frequency of 30.17. A signal at Camp Island (Refuge field camp) was very audible from the radioed animal until 2100 that evening. A search was conducted both on the ground and by air using the D-11/M the next day and the R-388 on four other occasions later without receiving a signal. Flying conditions have not availed itself so that a thorough and systematic search could be conducted in other areas for this bear.

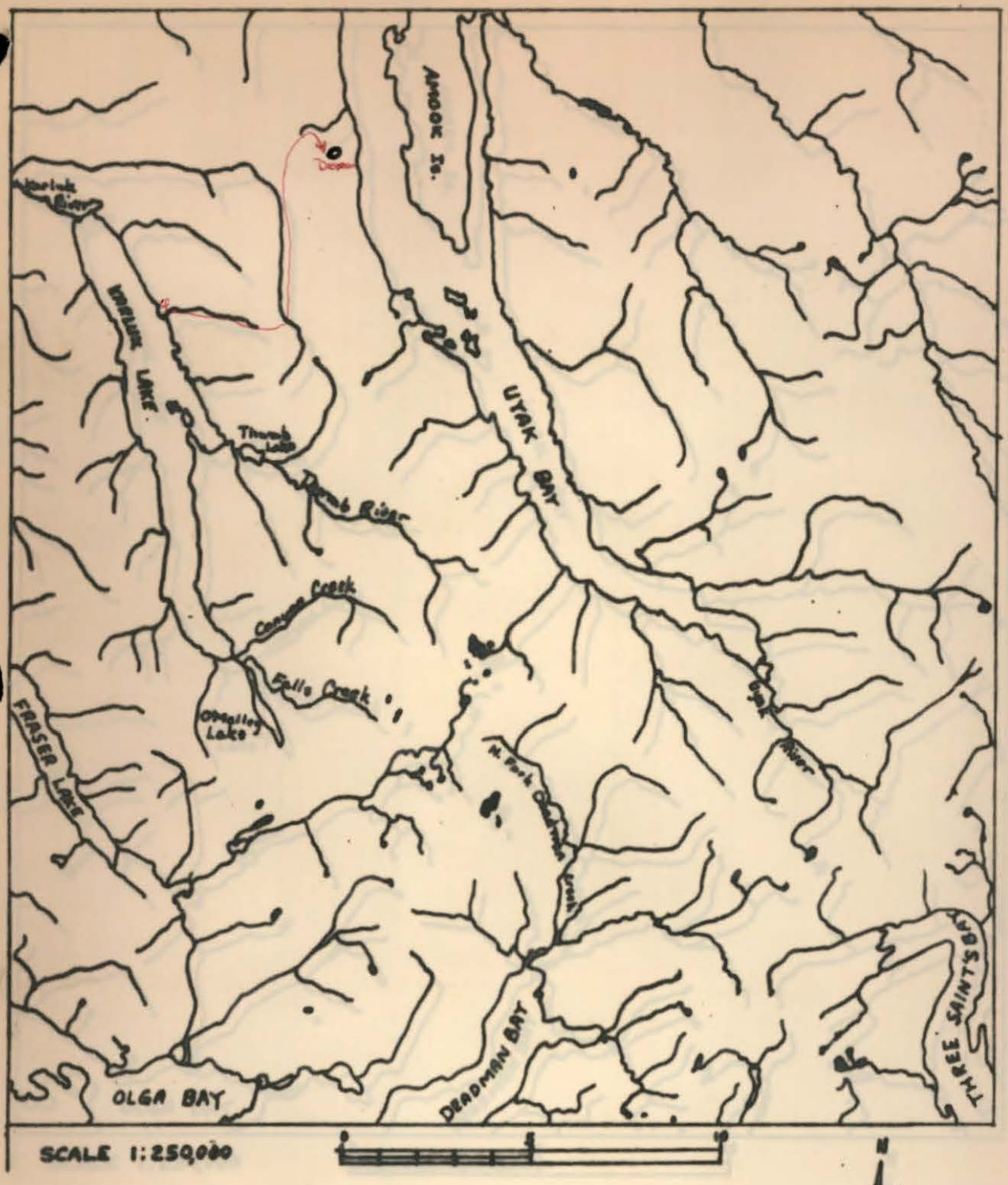
RECOMMENDATIONS

It is recommended that the pilot telemetry study conducted in 1967 be authorized to a full time study starting in 1968 and continued for a period of five years. This has been requested in a Refuge Study Outline in accordance to Bureau policy. (See attached copy.)

Although biotelemetry is still in its infancy (received recognition in 1962) it has surpassed most techniques by (1) obtaining information previously inaccessible, (2) precise date, (3) more data, and (4) less cost per unit of data.

The biggest barrier in carrying out this study on Kodiak Island is weather. Winds and inclement weather conditions often curtail flying for up to two weeks. In the late fall these animals should be monitored daily. Tracking radioed bears from aircraft are the only feasible means of gathering data as they move from one drainage to another.

The stated purpose of the Kodiak National Wildlife Refuge is to assure preservation of a natural unit of habitat for the Kodiak bear. The hunting pressure for brown bear has increased to the point where more emphasis on management of the bear population is needed. We need to know (1) natural mortality rate, (2) breeding behavior, (3) family and social characteristics, (4) habitat preference in spring, summer, and at



Movement → Frequency 30.18 Tatoo No. 50-7

Dates Monitored: October 22 to December 15, 1967

Figure 6

denning time, (5) diurnal and nocturnal movements, (6) distances travelled for food, denning and breeding, and (7) reproductive capacity.

It is therefore recommended that approval and funds be allocated to this study so that wise management can be carried out before the Kodiak brown bear becomes an addition on the Endangered Species list.

A break-open collar type transmitter and battery before components are encased in epoxy and taped for durability and waterproofing.

A bear radio collar ready for attachment. Collar weighs 4 lbs. 6 oz.

Volt-ohm-meter is used to adjust power output on transmitting collar.

Signal generator. This instrument has six crystals used for frequency adjustments of the D-11/M and R-388 receivers for maximum strength signals.

The transistorized power converter can be wired directly to aircraft battery or plugged into cigarette lighter to convert 12 volt DC to 110 volt AC for the R-388.

The R-388 (military designation) radio receiver has exceptional frequency stability and calibration accuracy. It is an excellent set for radio tracking bears from an aircraft.

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The D-11/M [illegible] has a range [illegible] This [illegible] in. on fe[illegible] bears

Biological Aide Gilbert monitoring a radioed bear. A primary and secondary volume peak can be heard when swinging the loop antenna in a 360° circle.

Assistant Refuge Manager Berns putting the final touches to a transmitting collar before attachment.

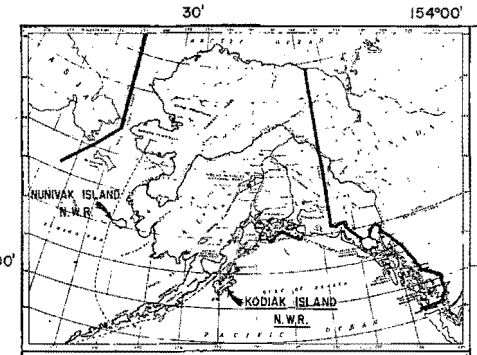
eted collar attachment. A layer of red
ic tape is used for possible visual
ification of the animal.

KODIAK ISLAND NATIONAL WILDLIFE REFUGE

UNITED STATES
DEPARTMENT OF THE INTERIOR

ELECTION DISTRICT NO. 13 — KODIAK, ALASKA

U. S. FISH AND WILDLIFE SERVICE
BUREAU OF SPORT FISHERIES AND WILDLIFE



LOCATION MAP

30' 154°00' 30' 153°00' 30'

58°00' 45' 30' 15' 57°00' 56°45' 30'

HEADQUARTERS
KODIAK

KODIAK ISLAND

KODIAK NATIONAL WILDLIFE REFUGE

SHELIKOF STRAIT

MARMOT BAY

WHALE ISLAND

UGANIK

KARLUK

LARSEN BAY

AYAKULIK

OLGA BAY

ALITAK BAY

CAPE TRINITY

TRINITY ISLANDS

AKHIOK

ALITAK

KAGUYAK

TWOHEADED ISLAND

PORTAGE BAY

OLD HARBOR

KILIUDA BAY

SITKALIDAK ISLAND

UGAK BAY

CHINIAK BAY

PACIFIC OCEAN

ALBATROSS BANK

● REFUGE FIELD HEADQUARTERS

COMPILED IN THE BRANCH OF ENGINEERING
FROM SURVEYS BY U.S.G.S., AND NATIONAL
PARK SERVICE

PORTLAND, OREGON AUGUST 1964

SEWARD MERIDIAN

Scale 400 0 400 800 1200 1600 2000 CHAINS
5 0 5 10 15 20 25 MILES

CONTOUR INTERVAL 200 FEET DATUM IS MEAN SEA LEVEL

6	5	4	3	2	1	
7	8	9	10	11	12	
18	17	16	15	14	13	
19	20	21	22	23	24	
30	29	28	27	26	25	
31	32	33	34	35	36	

TOWNSHIP DIAGRAM

TRUE NORTH 22½° MAGNETIC N

MEAN DECLINATION 1962

6R ALA 358 404