

DIVERSIFIED ENVIRONMENTAL SERVICES

BOX 6263, FORT ST. JOHN, B.C. V1J 4H7 PHONE/FAX (250) 787-9101

BC OIL AND GAS RESEARCH AND INNOVATION SOCIETY BOREAL CARIBOU TELEMETRY PROGRAM

FIXED-WING TELEMETRY MONITORING FLIGHT – DECEMBER 07-08, 2017

Date: Dec 20, 2017

Attention: Brian Thomson
BC Oil and Gas Research and Innovation Society
Victoria, BC

Executive Summary

On December 07-08, 2017, 106 boreal caribou collar frequencies and 13 wolf collar frequencies were scanned during a scheduled fixed-wing telemetry monitoring flight. Thirty unrecovered caribou collars assumed to have exceeded their battery lives were not scanned.

Of the 106 caribou collars scanned, 88 were heard transmitting normal VHF signals and one was transmitting a VHF mortality signal (Clarke VHF SCEK149). The remaining 17 collars were not detected. Of these, 15 are suspected to have exceeded their battery lives.

Background

Between December 17, 2012 and March 31, 2016, 240 individual adult boreal caribou were radio-collared in British Columbia's boreal caribou ranges as part of the *British Columbia Boreal Caribou Implementation Plan* (BCIP). These radio-collars are monitored by fixed-wing telemetry flights conducted at regular intervals throughout the year. Information collected is used to identify caribou mortalities and estimate annual adult female survival rate and population trend.

On December 07-08, 2017, Diversified Environmental Services (DES) conducted a fixed-wing telemetry monitoring flight under contract to the BC Oil and Gas Research and Innovation Society (OGRIS; formerly the *Science and Community Environmental Knowledge Fund* [SCEK]) on behalf of the Research and Effectiveness Monitoring Board (REMB).

Objectives

The objective of the December 07-08, 2017 monitoring flight was to determine the approximate location and VHF beacon status of all boreal caribou and wolf radio-collars believed to be active in BC's boreal caribou ranges. These included caribou and wolf collars deployed on behalf of OGRIS (*hereafter*, SCEK collars), caribou collars deployed on behalf of the Ministry of Forests, Lands, and Natural Resource Operations (MFLNRO), and wolf collars deployed for a University of Alberta research program funded by Nexen Inc.

Methods

The monitoring flight was conducted using a Cessna 180 fixed-wing aircraft equipped with 1 outward-facing directional antenna affixed to each wing strut. Collar frequencies were scanned using Lotek™ STR 1000 and Lotek BioTracker telemetry receivers. The flight was conducted at 1,000-1,500 m above ground level at an average speed of 160 km/hr. The VHF beacon status of all detected collars was recorded on hard copy forms. In the case of VHF collars (Lotek LMRT4), status was recorded as either normal (60 pulses per minute [ppm]) or mortality mode (120 ppm), and a location (+/- 1 km) was recorded using a hand-held GPS unit. As GPS/satellite collars are programmed to log multiple daily locations with high precision, additional effort to obtain collar locations after VHF signal detection is not necessary. Therefore, waypoints for GPS/satellite collars were typically recorded at the location from which the collar was heard, with corrections for estimated bearing and distance, unless the VHF beacon status indicated a collar malfunction or mortality, in which case, more precise locations were obtained.

Results

During the December 07-08, 2017 monitoring flight, 106 caribou collar frequencies were scanned, including 105 SCEK collars (53 Vectronic Vertex and 52 Lotek VHF) and 1 previously-deployed MFLNRO VHF collar. Thirty unrecovered collars assumed to have exceeded their battery lives were not scanned. In addition, 13 wolf collar frequencies were scanned during the flight, including 10 SCEK wolf collars (7 Lotek Iridium, 3 Lotek VHF) and 3 University of Alberta/Nexen collars (Lotek Iridium).

Results of the December 07-08, 2017 monitoring flight are presented in Table 1. Flight paths searched within and adjacent to each boreal caribou core habitat area are shown in Figure 1. Total flight line distance was 1,886 km. Of 106 caribou collar frequencies scanned, 88 were transmitting normal VHF signals and 1 (Clarke VHF SCEK149) was transmitting a VHF mortality signal. SCEK149 is assumed to have died since the September 18, 2017 monitoring flight.

The remaining 17 caribou collars were not detected during the December 2017 flight. These included 14 failed or failing Vectronic GPS collars that ceased GPS data transmission prior to the December flight and 3 Lotek VHF collars. Of the 3 VHF collars not detected, one is suspected to have exceeded its battery life earlier in the year (Fortune VHF SCEK086) and the other 2 were transmitting normal signals during the September flight (SCEK029, SCEK131). Vectronic GPS collar SCEK232 has not transmitted GPS data since June 01, 2017, but continues to transmit a normal VHF signal.

Of the 13 wolf collar frequencies scanned during the December 2017 flight, one normal VHF signal (BW038) and one mortality signal (BW0240) were detected. The remaining 11 wolf collars were not detected. These include 8 GPS/satellite collars whose GPS data transmissions ceased prior to the December flight.

There were no opportunities for First Nations field assistance on this monitoring flight.

Cordially,

A handwritten signature in black ink, appearing to read 'Brad Culling', with a stylized flourish at the end.

Brad Culling, R.P. Bio
Diversified Environmental Services
Fort St. John, BC

Table 1. VHF signal status and location of boreal caribou and wolf collars detected during the December 07-08, 2017 OGRIS fixed-wing telemetry monitoring flight.

ID	Species	Range	Core	Collar Type	Status	Date	Zone	East	North	Comments
SCEK112	Caribou	Calendar	Calendar	Lotek VHF	60 ppm	08-Dec-17	10	642222	6641881	normal
SCEK113	Caribou	Calendar	Calendar	Lotek VHF	60 ppm	08-Dec-17	10	645093	6636586	normal
SCEK120	Caribou	Calendar	Calendar	Lotek VHF	60 ppm	08-Dec-17	10	609005	6639369	normal
SCEK122	Caribou	Calendar	Calendar	Lotek VHF	60 ppm	08-Dec-17	10	647136	6662054	normal; in NWT
SCEK123	Caribou	Calendar	Calendar	Lotek VHF	60 ppm	08-Dec-17	10	599933	6623241	normal
SCEK125	Caribou	Calendar	Calendar	Lotek VHF	60 ppm	08-Dec-17	10	643839	6640402	normal; in NWT
SCEK134	Caribou	Calendar	Calendar	Lotek VHF	60 ppm	08-Dec-17	10	623342	6643797	normal
SCEK136b	Caribou	Calendar	Calendar	Vectr-Vertex	42 ppm	08-Dec-17	10	648379	6627605	normal
SCEK137	Caribou	Calendar	Calendar	Lotek VHF	60 ppm	08-Dec-17	10	628638	6668727	normal
SCEK146b	Caribou	Calendar	Calendar	Vectr-Vertex	42 ppm	08-Dec-17	10	610098	6637752	normal
SCEK180	Caribou	Calendar	Calendar	Vectr-Vertex	42 ppm	08-Dec-17	10	621945	6641261	VHF OK; last data Oct 30, 17
SCEK181b	Caribou	Calendar	Calendar	Vectr-Vertex	42 ppm	08-Dec-17	10	642018	6641109	normal
SCEK183	Caribou	Calendar	Calendar	Vectr-Vertex	not heard	08-Dec-17	n/a	n/a	n/a	VHF not detected; last data Oct 29, 17
SCEK126b	Caribou	Calendar	RRA-C	Vectr-Vertex	42 ppm	08-Dec-17	10	609177	6643666	normal
SCEK107	Caribou	Calendar	RRA-D	Lotek VHF	60 ppm	08-Dec-17	10	621571	6646872	normal
SCEK195	Caribou	Chinchaga	Etthithun	Vectr-Vertex	42 ppm	07-Dec-17	10	652144	6407650	VHF OK; last data Nov 05, 17
SCEK224	Caribou	Chinchaga	Etthithun	Vectr-Vertex	not heard	07-Dec-17	n/a	n/a	n/a	VHF not detected; last data Nov 05, 17
SCEK026b	Caribou	Chinchaga	Milligan	Vectr-Vertex	42 ppm	07-Dec-17	10	674338	6292481	normal
SCEK029	Caribou	Chinchaga	Milligan	Lotek VHF	not heard	07-Dec-17	n/a	n/a	n/a	VHF not detected
SCEK032	Caribou	Chinchaga	Milligan	Lotek VHF	60 ppm	07-Dec-17	10	654826	6325623	normal
SCEK033b	Caribou	Chinchaga	Milligan	Vectr-Vertex	42 ppm	07-Dec-17	10	650656	6335566	normal
SCEK035	Caribou	Chinchaga	Milligan	Lotek VHF	60 ppm	07-Dec-17	10	639160	6343603	normal
SCEK036b	Caribou	Chinchaga	Milligan	Vectr-Vertex	42 ppm	07-Dec-17	10	615935	6366833	normal
SCEK041	Caribou	Chinchaga	Milligan	Lotek VHF	60 ppm	07-Dec-17	10	637282	6346949	normal
SCEK054	Caribou	Chinchaga	Milligan	Lotek VHF	60 ppm	07-Dec-17	10	641731	6360703	normal
SCEK057	Caribou	Chinchaga	Milligan	Lotek VHF	60 ppm	07-Dec-17	10	661327	6325562	normal
SCEK059	Caribou	Chinchaga	Milligan	Lotek VHF	60 ppm	07-Dec-17	10	653140	6326575	normal
SCEK060	Caribou	Chinchaga	Milligan	Lotek VHF	60 ppm	07-Dec-17	10	636804	6356457	normal
SCEK061	Caribou	Chinchaga	Milligan	Lotek VHF	60 ppm	07-Dec-17	10	666962	6338172	normal
SCEK196	Caribou	Chinchaga	Milligan	Vectr-Vertex	42 ppm	07-Dec-17	10	636207	6363937	normal
SCEK198	Caribou	Chinchaga	Milligan	Vectr-Vertex	not heard	07-Dec-17	n/a	n/a	n/a	VHF not detected; last data Sep27, 17
SCEK201	Caribou	Chinchaga	Milligan	Vectr-Vertex	not heard	07-Dec-17	n/a	n/a	n/a	VHF not detected; last data Oct 16, 17
SCEK223	Caribou	Chinchaga	Milligan	Vectr-Vertex	42 ppm	07-Dec-17	10	650981	6325314	normal
SCEK226	Caribou	Chinchaga	Milligan	Vectr-Vertex	42 ppm	07-Dec-17	10	662688	6303234	normal
SCEK048	Caribou	Chinchaga	RRA-A	Lotek VHF	60 ppm	07-Dec-17	10	609607	6445220	normal
SCEK170b	Caribou	Chinchaga	RRA-A	Vectr-Vertex	not heard	07-Dec-17	n/a	n/a	n/a	VHF not detected; last data Oct 15, 17
SCEK189	Caribou	Chinchaga	RRA-A	Vectr-Vertex	not heard	07-Dec-17	n/a	n/a	n/a	VHF not detected; last data Oct 31, 17
SCEK213	Caribou	Chinchaga	RRA-A	Vectr-Vertex	42 ppm	07-Dec-17	10	598371	6450108	normal
SCEK214	Caribou	Chinchaga	RRA-A	Vectr-Vertex	42 ppm	07-Dec-17	10	594260	6451411	normal
SCEK215	Caribou	Chinchaga	RRA-A	Vectr-Vertex	42 ppm	07-Dec-17	10	635314	6450033	normal
SCEK009b	Caribou	Fort Nelson	Fort Nelson	Vectr-Vertex	42 ppm	07-Dec-17	10	518209	6553248	normal
SCEK166	Caribou	Fort Nelson	Fort Nelson	Vectr-Vertex	42 ppm	07-Dec-17	10	518931	6550770	VHF OK intermittent GPS data
SCEK007b	Caribou	Maxhamish	Capot-Blanc	Vectr-Vertex	42 ppm	07-Dec-17	10	473859	6578503	normal
SCEK066b	Caribou	Maxhamish	Capot-Blanc	Vectr-Vertex	not heard	07-Dec-17	n/a	n/a	n/a	VHF not detected; last data Oct 01, 17
SCEK076	Caribou	Maxhamish	Capot-Blanc	Lotek VHF	60 ppm	07-Dec-17	10	473081	6578779	normal
SCEK086	Caribou	Maxhamish	Fortune	Lotek VHF	not heard	07-Dec-17	n/a	n/a	n/a	VHF signal not detected; battery assumed expired

Table 1 cont. VHF signal status and location of boreal caribou and wolf collars detected during the December 07-08, 2017 OGRIS fixed-wing telemetry monitoring flight.

ID	Species	Range	Core	Collar Type	Status	Date	Zone	East	North	Comments
SCEK128	Caribou	Maxhamish	Fortune	Lotek VHF	60 ppm	07-Dec-17	10	523207	6635408	normal
SCEK129	Caribou	Maxhamish	Fortune	Lotek VHF	60 ppm	07-Dec-17	10	535762	6633331	normal
SCEK164	Caribou	Maxhamish	Fortune	Lotek VHF	60 ppm	07-Dec-17	10	529456	6633987	normal
SCEK177	Caribou	Maxhamish	Fortune	Vectr-Vertex	42 ppm	07-Dec-17	10	524623	6631978	normal
SCEK178	Caribou	Maxhamish	Fortune	Vectr-Vertex	not heard	07-Dec-17	n/a	n/a	n/a	VHF not detected; last data Oct 05, 17
SCEK205	Caribou	Maxhamish	Fortune	Vectr-Vertex	42 ppm	07-Dec-17	10	538705	6633130	normal
SCEK206	Caribou	Maxhamish	Fortune	Vectr-Vertex	42 ppm	07-Dec-17	10	541026	6624618	normal
SCEK208	Caribou	Maxhamish	Fortune	Vectr-Vertex	42 ppm	07-Dec-17	10	496040	6634958	normal
SCEK221	Caribou	Maxhamish	Fortune	Vectr-Vertex	42 ppm	07-Dec-17	10	541945	6628744	normal
SCEK062	Caribou	Maxhamish	Kiwigana	Lotek VHF	60 ppm	07-Dec-17	10	526823	6568827	normal
SCEK064	Caribou	Maxhamish	Kiwigana	Lotek VHF	60 ppm	07-Dec-17	10	525595	6571271	normal
SCEK168	Caribou	Maxhamish	Kiwigana	Vectr-Vertex	42 ppm	07-Dec-17	10	527093	6570194	VHF OK; intermittent GPS data
SCEK211	Caribou	Maxhamish	Kiwigana	Vectr-Vertex	42 ppm	07-Dec-17	10	527611	6573564	normal
SCEK231	Caribou	Maxhamish	Kiwigana	Vectr-Vertex	42 ppm	07-Dec-17	10	526153	6569011	normal
SCEK232	Caribou	Maxhamish	Kiwigana	Vectr-Vertex	42 ppm	07-Dec-17	10	526462	6569450	VHF signal detected; last data Jun 01, 17
SCEK015	Caribou	Parker	Parker	Lotek VHF	60 ppm	07-Dec-17	10	499686	6516966	normal
SCEK194	Caribou	Parker	Parker	Vectr-Vertex	not heard	07-Dec-17	n/a	n/a	n/a	VHF not detected; last data Nov 01, 17
SCEK238	Caribou	Parker	Parker	Vectr-Vertex	not heard	07-Dec-17	n/a	n/a	n/a	VHF not detected; last data Apr 05, 17
SCEK049	Caribou	Prophet	Prophet	Lotek VHF	60 ppm	07-Dec-17	10	559246	6458026	normal
SCEK161b	Caribou	Prophet	Prophet	Vectr-Vertex	42 ppm	07-Dec-17	10	648751	6464938	normal
SCEK217	Caribou	Prophet	Prophet	Vectr-Vertex	42 ppm	07-Dec-17	10	524535	6475437	normal
SCEK019	Caribou	Snake-Sahtaneh	Clarke	Lotek VHF	60 ppm	07-Dec-17	10	575504	6493138	normal
SCEK020b	Caribou	Snake-Sahtaneh	Clarke	Vectr-Vertex	42 ppm	07-Dec-17	10	582221	6485440	normal
SCEK024	Caribou	Snake-Sahtaneh	Clarke	Lotek VHF	60 ppm	07-Dec-17	10	564988	6506784	normal
SCEK025	Caribou	Snake-Sahtaneh	Clarke	Lotek VHF	60 ppm	07-Dec-17	10	577951	6489065	normal
SCEK068	Caribou	Snake-Sahtaneh	Clarke	Lotek VHF	60 ppm	07-Dec-17	10	563881	6499595	normal
SCEK070	Caribou	Snake-Sahtaneh	Clarke	Lotek VHF	60 ppm	07-Dec-17	10	577369	6494363	normal
SCEK145	Caribou	Snake-Sahtaneh	Clarke	Lotek VHF	60 ppm	08-Dec-17	10	592155	6543866	normal
SCEK148	Caribou	Snake-Sahtaneh	Clarke	Lotek VHF	60 ppm	07-Dec-17	10	556060	6460913	normal
SCEK149	Caribou	Snake-Sahtaneh	Clarke	Lotek VHF	120 ppm	07-Dec-17	10	568517	6500273	MORTALITY SIGNAL
SCEK150	Caribou	Snake-Sahtaneh	Clarke	Lotek VHF	60 ppm	07-Dec-17	10	602254	6479850	normal
SCEK152	Caribou	Snake-Sahtaneh	Clarke	Lotek VHF	60 ppm	07-Dec-17	10	576408	6498466	normal
SCEK156	Caribou	Snake-Sahtaneh	Clarke	Lotek VHF	60 ppm	07-Dec-17	10	559361	6501596	normal
SCEK157	Caribou	Snake-Sahtaneh	Clarke	Lotek VHF	60 ppm	07-Dec-17	10	580665	6486535	normal
SCEK193	Caribou	Snake-Sahtaneh	Clarke	Vectr-Vertex	not heard	07-Dec-17	n/a	n/a	n/a	VHF not detected; last data Oct 09, 17
SCEK218	Caribou	Snake-Sahtaneh	Clarke	Vectr-Vertex	42 ppm	07-Dec-17	10	574645	6496287	normal
SCEK220	Caribou	Snake-Sahtaneh	Clarke	Vectr-Vertex	42 ppm	07-Dec-17	10	601885	6485259	normal
SCEK239	Caribou	Snake-Sahtaneh	Clarke	Vectr-Vertex	not heard	07-Dec-17	n/a	n/a	n/a	VHF not detected; last data Jul 24, 17
SCEK240	Caribou	Snake-Sahtaneh	Clarke	Vectr-Vertex	not heard	07-Dec-17	n/a	n/a	n/a	VHF not detected; last data Aug 21, 17
SCEK103	Caribou	Snake-Sahtaneh	East Kotcho	Lotek VHF	60 ppm	08-Dec-17	10	635903	6562150	normal
SCEK105	Caribou	Snake-Sahtaneh	East Kotcho	Lotek VHF	60 ppm	08-Dec-17	10	631645	6555572	normal
SCEK088	Caribou	Snake-Sahtaneh	North Kotcho	Lotek VHF	60 ppm	08-Dec-17	10	625449	6550134	normal
SCEK089	Caribou	Snake-Sahtaneh	North Kotcho	Lotek VHF	60 ppm	08-Dec-17	10	606243	6571889	normal
SCEK090	Caribou	Snake-Sahtaneh	North Kotcho	Lotek VHF	60 ppm	08-Dec-17	10	611447	6570594	normal
SCEK092	Caribou	Snake-Sahtaneh	North Kotcho	Lotek VHF	60 ppm	08-Dec-17	10	623887	6580604	normal
SCEK097b	Caribou	Snake-Sahtaneh	North Kotcho	Vectr-Vertex	42 ppm	08-Dec-17	10	618589	6580682	normal

Table 1 cont. VHF signal status and location of boreal caribou and wolf collars detected during the December 07-08, 2017 OGRIS fixed-wing telemetry monitoring flight.

ID	Species	Range	Core	Collar Type	Status	Date	Zone	East	North	Comments
SCEK100b	Caribou	Snake-Sahtaneh	North Kotcho	Vectr-Vertex	42 ppm	08-Dec-17	10	637653	6562825	normal
SCEK229	Caribou	Snake-Sahtaneh	North Kotcho	Vectr-Vertex	42 ppm	08-Dec-17	10	612518	6570486	normal
SCEK230	Caribou	Snake-Sahtaneh	North Kotcho	Vectr-Vertex	42 ppm	08-Dec-17	10	596234	6568217	normal
SCEK096	Caribou	Snake-Sahtaneh	Paradise	Lotek VHF	60 ppm	07-Dec-17	10	592700	6485217	normal
BC1028	Caribou	Snake-Sahtaneh	Tsea	Lotek VHF	60 ppm	07-Dec-17	10	556110	6593003	normal
SCEK079b	Caribou	Snake-Sahtaneh	Tsea	Vectr-Vertex	42 ppm	07-Dec-17	10	555928	6586119	normal
SCEK082	Caribou	Snake-Sahtaneh	Tsea	Lotek VHF	60 ppm	07-Dec-17	10	554821	6595937	normal
SCEK127	Caribou	Snake-Sahtaneh	Tsea	Lotek VHF	60 ppm	07-Dec-17	10	552669	6606940	normal
SCEK131	Caribou	Snake-Sahtaneh	Tsea	Lotek VHF	not heard	07-Dec-17	n/a	n/a	n/a	VHF not detected
SCEK132	Caribou	Snake-Sahtaneh	Tsea	Lotek VHF	60 ppm	07-Dec-17	10	559918	6594694	normal
SCEK233	Caribou	Snake-Sahtaneh	Tsea	Vectr-Vertex	not heard	07-Dec-17	n/a	n/a	n/a	VHF not detected; last data Jul 12, 17
SCEK091	Caribou	Snake-Sahtaneh	West Kotcho	Lotek VHF	60 ppm	08-Dec-17	10	610360	6570717	normal
SCEK209	Caribou	Snake-Sahtaneh	West Kotcho	Vectr-Vertex	42 ppm	07-Dec-17	10	528642	6573284	normal
SCEK219	Caribou	Snake-Sahtaneh	West Kotcho	Vectr-Vertex	42 ppm	07-Dec-17	10	552825	6608338	normal
BW034	Wolf	Calendar	July	Lotek VHF	not heard	08-Dec-17	n/a	n/a	n/a	VHF not detected
BW043nex	Wolf	Calendar	July	Lotek Iridium	not heard	08-Dec-17	n/a	n/a	n/a	VHF not detected; last data June 14, 16
BW044nex	Wolf	Calendar	July	Lotek Iridium	not heard	08-Dec-17	n/a	n/a	n/a	VHF not detected; last data Apr 10, 16
BW002	Wolf	Chinchaga	Big Arrow	Lotek VHF	not heard	07-Dec-17	n/a	n/a	n/a	VHF not detected
BW053	Wolf	Chinchaga	Kahntah	Lotek Iridium	not heard	07-Dec-17	n/a	n/a	n/a	VHF not detected; no data since May 14, 17
BW038	Wolf	Clarke	Elleh	Lotek Iridium	50 ppm	07-Dec-17	10	574190	6470834	VHF detected; last GPS data Aug 29, 17
BW039	Wolf	Clarke	Elleh	Lotek Iridium	not heard	07-Dec-17	n/a	n/a	n/a	VHF not detected; last GPS data Sep 29, 16
BW040	Wolf	Clarke	Elleh	Lotek Iridium	not heard	07-Dec-17	n/a	n/a	n/a	VHF not detected; last GPS data Feb 13, 17
BW032	Wolf	Fortune/Tsea	Petitot	Lotek VHF	not heard	07-Dec-17	n/a	n/a	n/a	VHF not detected
BW049nex	Wolf	Fortune/Tsea	Petitot	Lotek Iridium	not heard	07-Dec-17	n/a	n/a	n/a	VHF not detected; last data Dec 22, 16
BW036	Wolf	Maxhamish	Fortune	Lotek Iridium	not heard	07-Dec-17	n/a	n/a	n/a	VHF not detected; last GPS data Jan 20, 16
BW024	Wolf	Snake-Sahtaneh	Kwokullie	Lotek Iridium	100 ppm	08-Dec-17	10	620566	6597854	MORTALITY DETECTED; last data Nov 17, 16
BW052	Wolf	Snake-Sahtaneh	Kwokullie	Lotek Iridium	not heard	08-Dec-17	n/a	n/a	n/a	VHF not detected; last data Nov 24, 16

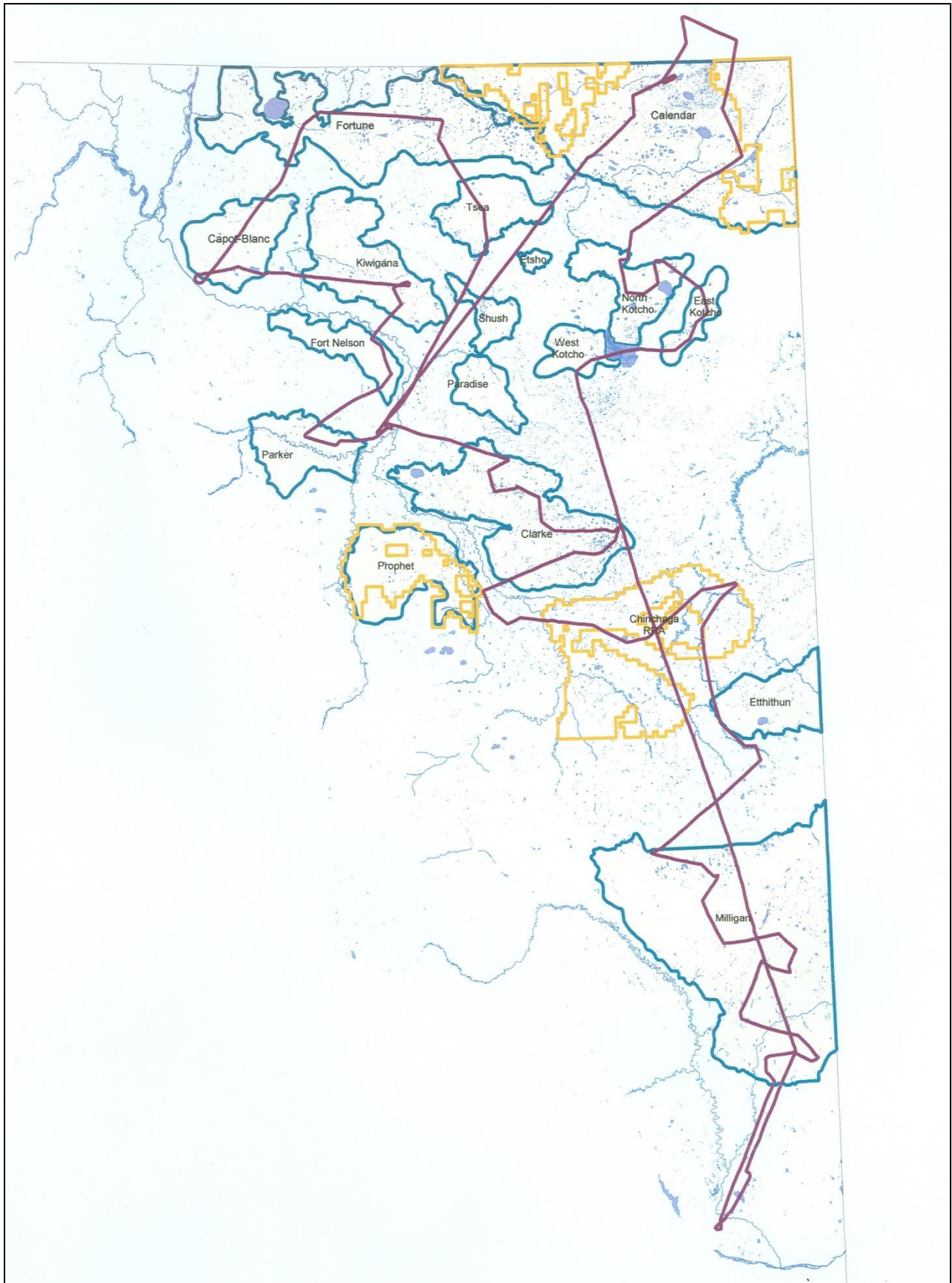


Figure 1. Flight paths flown during the December 07-08, 2017 OGRIS boreal caribou and wolf fixed-wing telemetry monitoring flight.