

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 – JULY 24-25, 2017

Date: July 31, 2017

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

Executive Summary

On July 24-25, 2017, 107 boreal caribou collar frequencies and 14 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 107 caribou collars scanned, 100 were heard transmitting normal VHF signals and 7 were not detected, including 5 GPS collars that ceased data transmission prior to the July flight. No mortality signals were heard.

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 July 24-25, 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 July 24-25, 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 July 2017 monitoring flight, 107 caribou collar frequencies were scanned, including 106 SCEK collars (54 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, 14 wolf collar frequencies were scanned during the flight, including 11 SCEK wolf collars (7 Lotek Iridium, 4 Lotek VHF) and 3 University of Alberta/Nexen collars (Lotek Iridium). Several unrecovered SCEK Iridium wolf collars assumed to have exceeded their battery lives were not scanned.

Results of the July 24-25, 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 2,254 km. Of 107 caribou collar frequencies scanned, 100 were transmitting normal VHF signals and 7 were not detected. No mortality signals were detected. The 7 undetected collars included 5 Vectronic GPS collars that ceased GPS data transmission prior to the July flight (SCEK170b, SCEK232, SCEK233,

SCEK238, SCEK240) one Vectronic GPS that ceased data transmission on the day of the flight (SCEK239), and one Lotek VHF collar suspected to have recently failed (Fortune VHF SCEK086).

Of the 14 wolf collar frequencies scanned during the June 2017 flight, 3 were transmitting normal VHF signals and one was transmitting a mortality signal (BW026 Kwokullie Pack). The remaining 10 wolf collars were not detected. These include 8 GPS/satellite collars whose GPS data transmissions ceased prior to the July monitoring 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 July 24-25, 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	7/25/2017	10	636440	6638291	normal
SCEK113	Caribou	Calendar	Calendar	Lotek VHF	60 ppm	7/25/2017	10	616584	6611584	normal
SCEK120	Caribou	Calendar	Calendar	Lotek VHF	60 ppm	7/25/2017	10	599238	6643383	normal
SCEK122	Caribou	Calendar	Calendar	Lotek VHF	60 ppm	7/25/2017	10	628230	6678504	normal
SCEK123	Caribou	Calendar	Calendar	Lotek VHF	60 ppm	7/25/2017	10	600496	6629318	normal
SCEK125	Caribou	Calendar	Calendar	Lotek VHF	60 ppm	7/25/2017	10	647453	6680224	VHF signal heard in NWT but not located
SCEK134	Caribou	Calendar	Calendar	Lotek VHF	60 ppm	7/25/2017	10	638214	6642517	normal
SCEK136b	Caribou	Calendar	Calendar	Vectr-Vertex	42 ppm	7/25/2017	10	612449	6608819	normal
SCEK137	Caribou	Calendar	Calendar	Lotek VHF	60 ppm	7/25/2017	10	638838	6640091	normal
SCEK146b	Caribou	Calendar	Calendar	Vectr-Vertex	42 ppm	7/25/2017	10	612217	6630831	normal
SCEK180	Caribou	Calendar	Calendar	Vectr-Vertex	42 ppm	7/25/2017	10	604391	6656879	normal
SCEK181b	Caribou	Calendar	Calendar	Vectr-Vertex	42 ppm	7/25/2017	10	616333	6608231	normal
SCEK183	Caribou	Calendar	Calendar	Vectr-Vertex	42 ppm	7/25/2017	10	590035	6617866	normal
SCEK126b	Caribou	Calendar	RRA-C	Vectr-Vertex	42 ppm	7/25/2017	10	593365	6653724	normal
SCEK107	Caribou	Calendar	RRA-D	Lotek VHF	60 ppm	7/25/2017	10	n/a	n/a	VHF signal normal but not located
SCEK195	Caribou	Chinchaga	Etthithun	Vectr-Vertex	42 ppm	7/24/2017	10	644338	6410034	normal
SCEK224	Caribou	Chinchaga	Etthithun	Vectr-Vertex	42 ppm	7/24/2017	10	639015	6416716	normal
SCEK026b	Caribou	Chinchaga	Milligan	Vectr-Vertex	42 ppm	7/24/2017	10	656330	6296635	normal
SCEK029	Caribou	Chinchaga	Milligan	Lotek VHF	60 ppm	7/24/2017	10	637949	6333301	normal
SCEK032	Caribou	Chinchaga	Milligan	Lotek VHF	60 ppm	7/24/2017	10	649255	6362839	normal
SCEK033b	Caribou	Chinchaga	Milligan	Vectr-Vertex	42 ppm	7/24/2017	10	624793	6347885	normal
SCEK035	Caribou	Chinchaga	Milligan	Lotek VHF	60 ppm	7/24/2017	10	623845	6353522	normal
SCEK036b	Caribou	Chinchaga	Milligan	Vectr-Vertex	42 ppm	7/24/2017	10	611040	6370489	normal
SCEK041	Caribou	Chinchaga	Milligan	Lotek VHF	60 ppm	7/24/2017	10	642772	6364940	normal
SCEK054	Caribou	Chinchaga	Milligan	Lotek VHF	60 ppm	7/24/2017	10	639027	6354108	normal
SCEK057	Caribou	Chinchaga	Milligan	Lotek VHF	60 ppm	7/24/2017	10	639811	6332873	normal
SCEK059	Caribou	Chinchaga	Milligan	Lotek VHF	60 ppm	7/24/2017	10	629592	6340305	normal
SCEK060	Caribou	Chinchaga	Milligan	Lotek VHF	60 ppm	7/24/2017	10	573916	6368254	normal
SCEK061	Caribou	Chinchaga	Milligan	Lotek VHF	60 ppm	7/24/2017	10	667983	6335887	normal
SCEK196	Caribou	Chinchaga	Milligan	Vectr-Vertex	42 ppm	7/24/2017	10	625716	6366045	normal
SCEK198	Caribou	Chinchaga	Milligan	Vectr-Vertex	42 ppm	7/24/2017	10	637361	6303919	normal
SCEK201	Caribou	Chinchaga	Milligan	Vectr-Vertex	42 ppm	7/24/2017	10	664315	6289168	normal
SCEK223	Caribou	Chinchaga	Milligan	Vectr-Vertex	42 ppm	7/24/2017	10	639927	6330273	normal
SCEK226	Caribou	Chinchaga	Milligan	Vectr-Vertex	42 ppm	7/24/2017	10	675474	6296880	normal
SCEK048	Caribou	Chinchaga	RRA-A	Lotek VHF	60 ppm	7/24/2017	10	604857	6427118	normal
SCEK170b	Caribou	Chinchaga	RRA-A	Vectr-Vertex	not heard	7/24/2017	n/a	n/a	n/a	VHF not detected; last data Jul 21, 17; prev low
SCEK189	Caribou	Chinchaga	RRA-A	Vectr-Vertex	42 ppm	7/24/2017	10	609946	6447557	normal
SCEK213	Caribou	Chinchaga	RRA-A	Vectr-Vertex	42 ppm	7/24/2017	10	605910	6441972	normal
SCEK214	Caribou	Chinchaga	RRA-A	Vectr-Vertex	42 ppm	7/24/2017	10	611481	6428608	normal
SCEK215	Caribou	Chinchaga	RRA-A	Vectr-Vertex	42 ppm	7/24/2017	10	637110	6443592	normal
SCEK009b	Caribou	Fort Nelson	Fort Nelson	Vectr-Vertex	42 ppm	7/24/2017	10	519967	6552380	normal
SCEK166	Caribou	Fort Nelson	Fort Nelson	Vectr-Vertex	42 ppm	7/24/2017	10	518041	6546184	normal
SCEK007b	Caribou	Maxhamish	Capot-Blanc	Vectr-Vertex	42 ppm	7/24/2017	10	448744	6573804	normal
SCEK066b	Caribou	Maxhamish	Capot-Blanc	Vectr-Vertex	42 ppm	7/24/2017	10	454306	6562596	normal
SCEK076	Caribou	Maxhamish	Capot-Blanc	Lotek VHF	60 ppm	7/24/2017	10	457226	6579709	normal
SCEK086	Caribou	Maxhamish	Fortune	Lotek VHF	not heard	7/24/2017	n/a	n/a	n/a	VHF signal not detected

Table 1 cont. VHF signal status and location of boreal caribou and wolf collars detected during the July 24-25, 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	7/24/2017	10	528099	6630654	normal
SCEK129	Caribou	Maxhamish	Fortune	Lotek VHF	60 ppm	7/24/2017	10	540175	6635752	normal
SCEK164	Caribou	Maxhamish	Fortune	Lotek VHF	60 ppm	7/24/2017	10	541241	6622126	normal
SCEK177	Caribou	Maxhamish	Fortune	Vectr-Vertex	42 ppm	7/24/2017	10	529809	6629828	normal
SCEK178	Caribou	Maxhamish	Fortune	Vectr-Vertex	42 ppm	7/24/2017	10	544290	6622704	normal
SCEK205	Caribou	Maxhamish	Fortune	Vectr-Vertex	42 ppm	7/24/2017	10	542919	6628470	normal
SCEK206	Caribou	Maxhamish	Fortune	Vectr-Vertex	42 ppm	7/24/2017	10	538638	6619357	normal
SCEK208	Caribou	Maxhamish	Fortune	Vectr-Vertex	42 ppm	7/24/2017	10	484203	6627242	normal
SCEK221	Caribou	Maxhamish	Fortune	Vectr-Vertex	42 ppm	7/24/2017	10	543496	6624568	normal
SCEK062	Caribou	Maxhamish	Kiwigana	Lotek VHF	60 ppm	7/24/2017	10	524223	6572700	normal
SCEK064	Caribou	Maxhamish	Kiwigana	Lotek VHF	60 ppm	7/24/2017	10	508819	6583927	normal
SCEK168	Caribou	Maxhamish	Kiwigana	Vectr-Vertex	42 ppm	7/24/2017	10	546081	6559218	normal
SCEK211	Caribou	Maxhamish	Kiwigana	Vectr-Vertex	42 ppm	7/24/2017	10	529340	6570738	normal
SCEK231	Caribou	Maxhamish	Kiwigana	Vectr-Vertex	42 ppm	7/24/2017	10	521518	6570864	normal
SCEK232	Caribou	Maxhamish	Kiwigana	Vectr-Vertex	not heard	7/24/2017	n/a	n/a	n/a	VHF signal not detected; last data Jun 01, 17
SCEK015	Caribou	Parker	Parker	Lotek VHF	60 ppm	7/24/2017	10	488325	6521191	normal
SCEK016b	Caribou	Parker	Parker	Vectr-Vertex	42 ppm	7/24/2017	10	478991	6510492	normal
SCEK194	Caribou	Parker	Parker	Vectr-Vertex	42 ppm	7/24/2017	10	489052	6520765	normal
SCEK238	Caribou	Parker	Parker	Vectr-Vertex	not heard	7/24/2017	n/a	n/a	n/a	VHF signal not detected; last data Apr 05, 17
SCEK049	Caribou	Prophet	Prophet	Lotek VHF	60 ppm	7/24/2017	10	549039	6445556	normal
SCEK161b	Caribou	Prophet	Prophet	Vectr-Vertex	42 ppm	7/24/2017	10	603187	6438027	normal
SCEK217	Caribou	Prophet	Prophet	Vectr-Vertex	42 ppm	7/24/2017	10	556495	6448425	normal
SCEK019	Caribou	Snake-Sahtaneh	Clarke	Lotek VHF	60 ppm	7/24/2017	10	569477	6505232	normal
SCEK020b	Caribou	Snake-Sahtaneh	Clarke	Vectr-Vertex	42 ppm	7/24/2017	10	589007	6487666	normal
SCEK024	Caribou	Snake-Sahtaneh	Clarke	Lotek VHF	60 ppm	7/25/2017	10	556748	6539984	normal
SCEK025	Caribou	Snake-Sahtaneh	Clarke	Lotek VHF	60 ppm	7/24/2017	10	563429	6498828	normal
SCEK068	Caribou	Snake-Sahtaneh	Clarke	Lotek VHF	60 ppm	7/25/2017	10	568303	6536521	normal
SCEK070	Caribou	Snake-Sahtaneh	Clarke	Lotek VHF	60 ppm	7/24/2017	10	573421	6502565	normal
SCEK145	Caribou	Snake-Sahtaneh	Clarke	Lotek VHF	60 ppm	7/25/2017	10	594378	6542026	normal
SCEK148	Caribou	Snake-Sahtaneh	Clarke	Lotek VHF	60 ppm	7/24/2017	10	571645	6449941	normal
SCEK149	Caribou	Snake-Sahtaneh	Clarke	Lotek VHF	60 ppm	7/24/2017	10	574925	6498668	normal
SCEK150	Caribou	Snake-Sahtaneh	Clarke	Lotek VHF	60 ppm	7/24/2017	10	602325	6487815	normal
SCEK152	Caribou	Snake-Sahtaneh	Clarke	Lotek VHF	60 ppm	7/24/2017	10	560688	6500212	normal
SCEK156	Caribou	Snake-Sahtaneh	Clarke	Lotek VHF	60 ppm	7/24/2017	10	544039	6499821	normal
SCEK157	Caribou	Snake-Sahtaneh	Clarke	Lotek VHF	60 ppm	7/24/2017	10	571546	6499526	normal
SCEK193	Caribou	Snake-Sahtaneh	Clarke	Vectr-Vertex	42 ppm	7/24/2017	10	564347	6501884	normal
SCEK218	Caribou	Snake-Sahtaneh	Clarke	Vectr-Vertex	42 ppm	7/25/2017	10	554182	6534869	normal
SCEK220	Caribou	Snake-Sahtaneh	Clarke	Vectr-Vertex	42 ppm	7/24/2017	10	604505	6483481	normal
SCEK239	Caribou	Snake-Sahtaneh	Clarke	Vectr-Vertex	not heard	7/24/2017	n/a	n/a	n/a	VHF not detected; last data Jul 24, 17
SCEK240	Caribou	Snake-Sahtaneh	Clarke	Vectr-Vertex	not heard	7/24/2017	n/a	n/a	n/a	VHF not detected; last data Jul 18, 17
SCEK103	Caribou	Snake-Sahtaneh	East Kotcho	Lotek VHF	60 ppm	7/25/2017	10	637769	6561495	normal
SCEK105	Caribou	Snake-Sahtaneh	East Kotcho	Lotek VHF	60 ppm	7/25/2017	10	641141	6578369	normal
SCEK088	Caribou	Snake-Sahtaneh	North Kotcho	Lotek VHF	60 ppm	7/25/2017	10	629937	6555599	normal
SCEK089	Caribou	Snake-Sahtaneh	North Kotcho	Lotek VHF	60 ppm	7/25/2017	10	604922	6597911	normal
SCEK090	Caribou	Snake-Sahtaneh	North Kotcho	Lotek VHF	60 ppm	7/25/2017	10	617914	6580181	normal
SCEK092	Caribou	Snake-Sahtaneh	North Kotcho	Lotek VHF	60 ppm	7/25/2017	10	606629	6594084	normal

Table 1 cont. VHF signal status and location of boreal caribou and wolf collars detected during the July 24-25, 2017 OGRIS fixed-wing telemetry monitoring flight.

ID	Species	Range	Core	Collar Type	Status	Date	Zone	East	North	Comments
SCEK097b	Caribou	Snake-Sahtaneh	North Kotcho	Vectr-Vertex	42 ppm	7/25/2017	10	600942	6585935	normal
SCEK100b	Caribou	Snake-Sahtaneh	North Kotcho	Vectr-Vertex	42 ppm	7/25/2017	10	639107	6563221	normal
SCEK229	Caribou	Snake-Sahtaneh	North Kotcho	Vectr-Vertex	42 ppm	7/25/2017	10	607111	6578867	normal
SCEK230	Caribou	Snake-Sahtaneh	North Kotcho	Vectr-Vertex	42 ppm	7/25/2017	10	583613	6589666	normal
SCEK096	Caribou	Snake-Sahtaneh	Paradise	Lotek VHF	60 ppm	7/25/2017	10	556470	6535611	normal
BC1028	Caribou	Snake-Sahtaneh	Tsea	Lotek VHF	60 ppm	7/24/2017	10	555240	6600968	normal
SCEK079b	Caribou	Snake-Sahtaneh	Tsea	Vectr-Vertex	42 ppm	7/24/2017	10	527762	6602343	normal
SCEK082	Caribou	Snake-Sahtaneh	Tsea	Lotek VHF	60 ppm	7/24/2017	10	553061	6599767	normal
SCEK127	Caribou	Snake-Sahtaneh	Tsea	Lotek VHF	60 ppm	7/24/2017	10	558287	6596095	normal
SCEK131	Caribou	Snake-Sahtaneh	Tsea	Lotek VHF	60 ppm	7/24/2017	10	555166	6597762	normal
SCEK132	Caribou	Snake-Sahtaneh	Tsea	Lotek VHF	60 ppm	7/24/2017	10	555097	6598851	normal
SCEK233	Caribou	Snake-Sahtaneh	Tsea	Vectr-Vertex	not heard	7/24/2017	n/a	n/a	n/a	VHF not detected; last data Jul 12, 17
SCEK091	Caribou	Snake-Sahtaneh	West Kotcho	Lotek VHF	60 ppm	7/25/2017	10	611361	6573787	normal
SCEK209	Caribou	Snake-Sahtaneh	West Kotcho	Vectr-Vertex	42 ppm	7/24/2017	10	525370	6567920	normal
SCEK219	Caribou	Snake-Sahtaneh	West Kotcho	Vectr-Vertex	42 ppm	7/24/2017	10	553824	6609562	normal
BW034	Wolf	Calendar	July	Lotek VHF	not heard	7/25/2017	n/a	n/a	n/a	VHF not detected
BW043nex	Wolf	Calendar	July	Lotek Iridium	not heard	7/25/2017	n/a	n/a	n/a	VHF not detected; last data June 14, 16
BW044nex	Wolf	Calendar	July	Lotek Iridium	not heard	7/25/2017	n/a	n/a	n/a	VHF not detected; last data Apr 10, 16
BW002	Wolf	Chinchaga	Big Arrow	Lotek VHF	60 ppm	7/24/2017	10	642128	6342834	normal
BW053	Wolf	Chinchaga	Kahntah	Lotek Iridium	not heard	7/24/2017	n/a	n/a	n/a	VHF not detected; no data since May 14, 17
BW038	Wolf	Clarke	Elleh	Lotek Iridium	50 ppm	7/24/2017	10	580657	6490933	VHF detected; GPS data normal
BW039	Wolf	Clarke	Elleh	Lotek Iridium	not heard	7/24/2017	n/a	n/a	n/a	VHF not detected; last GPS data Sep 29, 16
BW040	Wolf	Clarke	Elleh	Lotek Iridium	not heard	7/24/2017	n/a	n/a	n/a	VHF not detected; last GPS data Feb 13, 17
BW032	Wolf	Fortune/Tsea	Petitot	Lotek VHF	not heard	7/24/2017	n/a	n/a	n/a	VHF not detected
BW049nex	Wolf	Fortune/Tsea	Petitot	Lotek Iridium	not heard	7/24/2017	n/a	n/a	n/a	VHF not detected; last data Dec 22, 16
BW036	Wolf	Maxhamish	Fortune	Lotek Iridium	not heard	7/24/2017	n/a	n/a	n/a	VHF not detected; last GPS data Jan 20, 16
BW024	Wolf	Snake-Sahtaneh	Kwokullie	Lotek Iridium	50 ppm	7/25/2017	10	631463	6579463	VHF detected; last data Nov 17, 16
BW026	Wolf	Snake-Sahtaneh	Kwokullie	Lotek VHF	100 ppm	7/25/2017	10	616366	6573620	MORTALITY
BW052	Wolf	Snake-Sahtaneh	Kwokullie	Lotek Iridium	not heard	7/25/2017	n/a	n/a	n/a	VHF not detected; last data Nov 24, 16

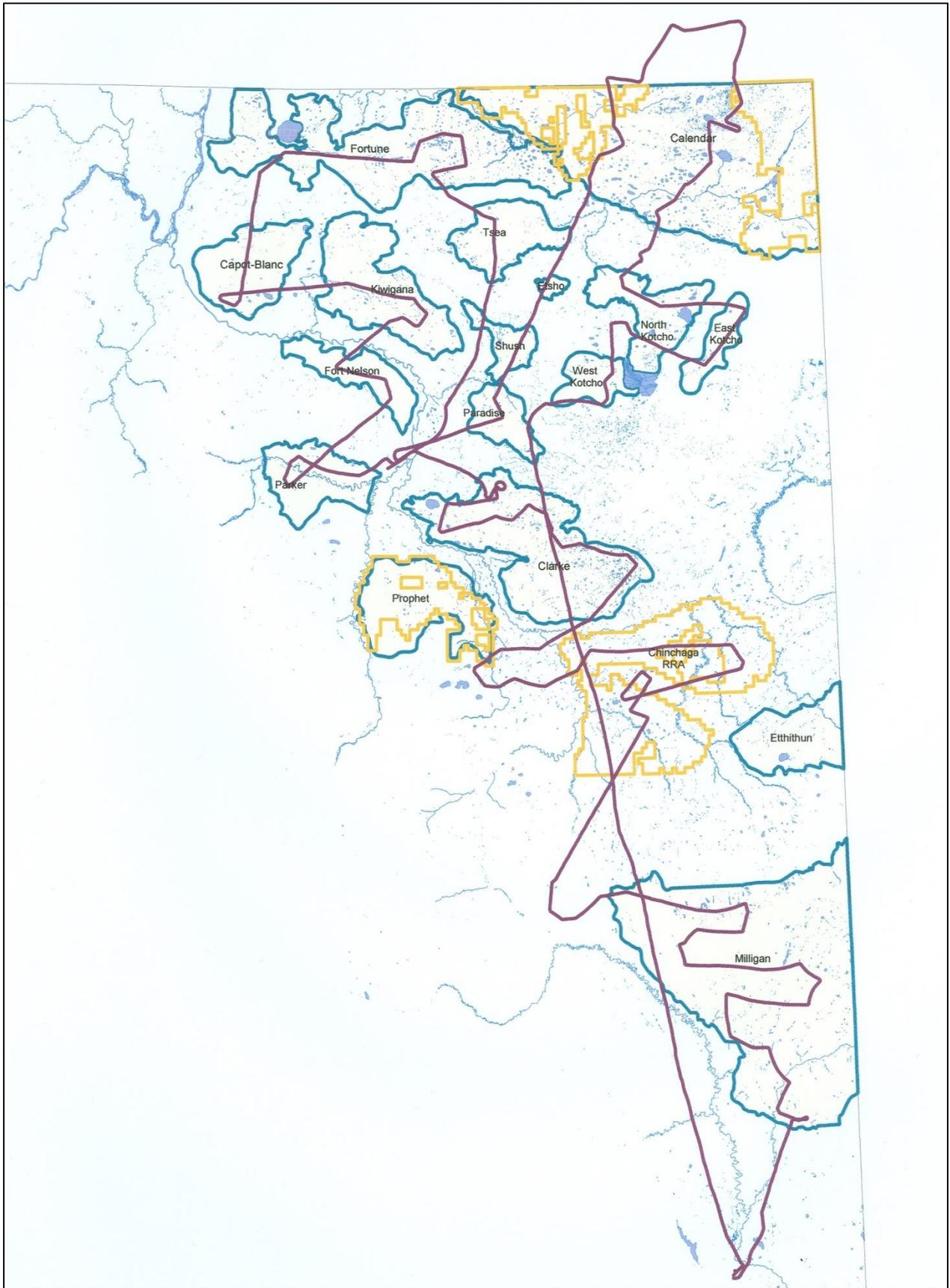


Figure 1. Flight paths flown during the July 24-25, 2017 OGRIS boreal caribou and wolf fixed-wing telemetry monitoring flight.