Keeyask Generation Project

Terrestrial Effects Monitoring Plan

Olive-sided Flycatcher & Rusty Blackbird Sensory Disturbance Monitoring Report

TEMP-2024-07

KEEYASK

Manitoba Environment and Climate Change Client File 5550.00
Manitoba Environment Act Licence No. 3107

2023 -2024

KEEYASK GENERATION PROJECT

TERRESTRIAL EFFECTS MONITORING PLAN

REPORT #TEMP-2024-07

OLIVE-SIDED FLYCATCHER AND RUSTY BLACKBIRD SENSORY DISTURBANCE MONITORING

YEAR 2 OPERATION

2023

Prepared for

Manitoba Hydro

By

Wildlife Resource Consulting Services MB Inc.

June 2024

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SUMMARY

Background

Construction of the Keeyask Generation Project (the Project) at Gull Rapids began in July 2014. The Keeyask Hydropower Limited Partnership (KHLP) was required to prepare a plan to monitor the effects of construction and operation of the generating station on the terrestrial environment. Monitoring results will help the KHLP, government regulators, members of local First Nation communities, and the general public understand how construction and operation of the generating station will affect the environment, and whether more needs to be done to reduce harmful effects.

Olive-sided flycatcher and rusty blackbird are migratory songbirds that are found in the Keeyask region. Both species are considered species at risk in Canada and are protected under the federal *Species at Risk Act*. In Manitoba, the olive-sided flycatcher is also listed as Threatened under *The Endangered Species and Ecosystems Act*.

Why is the study being done?

Both the olive-sided flycatcher and rusty blackbird are near the edge of their breeding ranges in northern Manitoba and are found in relatively low numbers in the Keeyask region. Both are species at risk, have been experiencing widespread declines throughout their ranges, and may be vulnerable to Project effects. The goal of this study was to monitor the effect of Project-related disturbance on these species near the north and south access roads, the areas where Project noise disturbance was expected to be greatest.

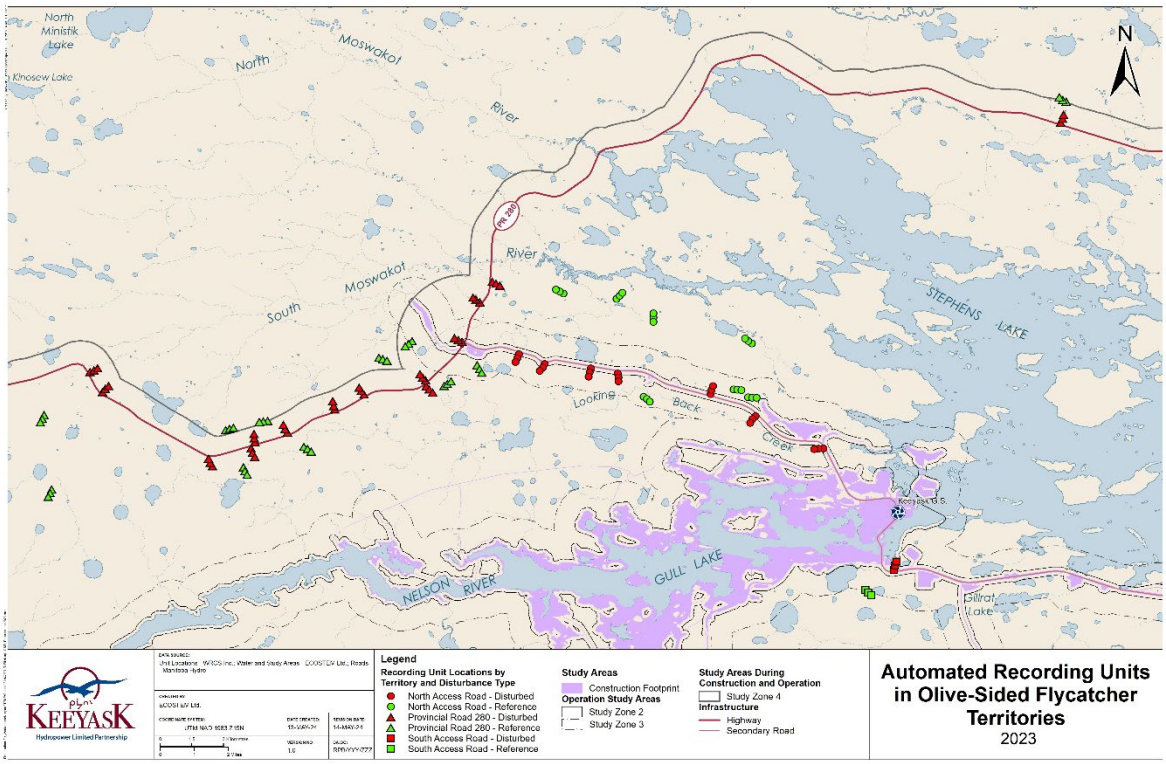
Rusty Blackbird

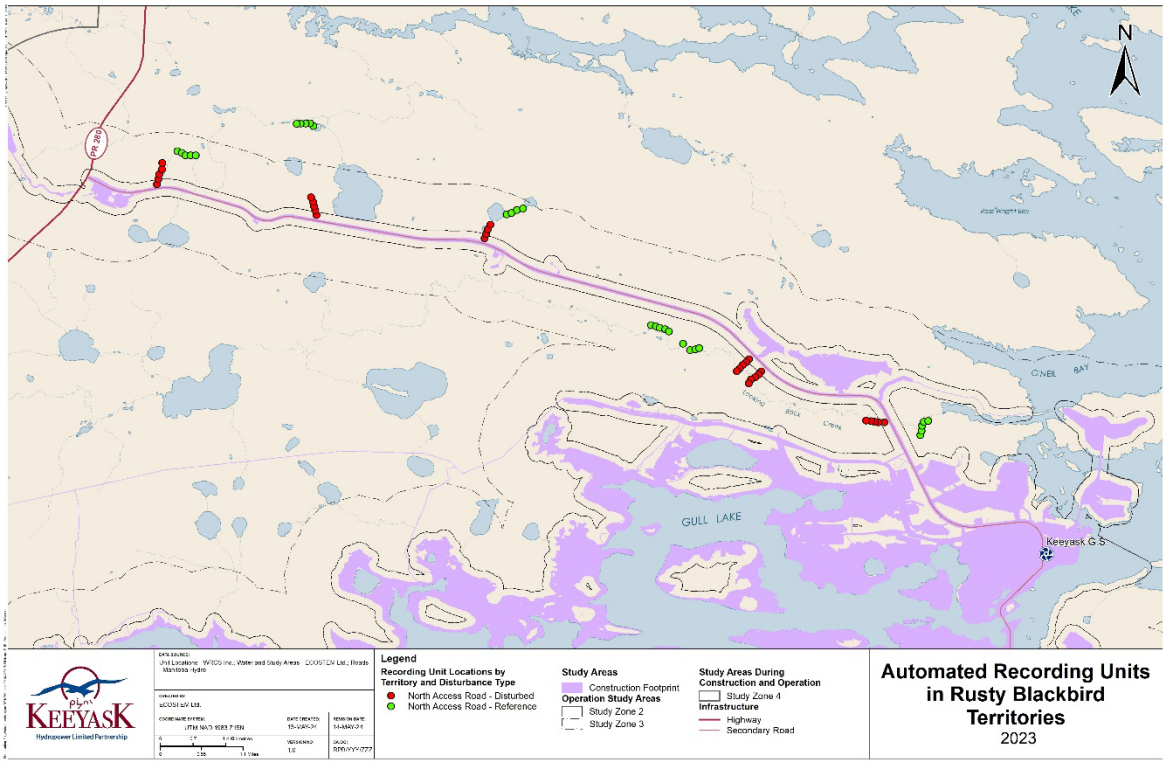
What was done?

Olive-sided flycatcher and rusty blackbird nesting territories were mapped near the North Access Road and South Access Road, which are Project-related sources of disturbance. Automated recording units, designed to record bird calls, were placed within the mapped territories. Territories near Provincial Road 280, an existing source of disturbance, were also included for comparison. For each territory surveyed at a disturbed site, a reference territory at a site with no disturbance was also surveyed.

Recordings were analyzed and olive-sided flycatcher and rusty blackbird calls were identified. In all, recordings from 53 territories were analyzed in 2023. Recordings made in 2016, 2017 and 2019 were previously analyzed. The amount of olive-sided flycatcher and rusty blackbird activity at each territory was evaluated for the three survey years during Project construction and the one survey year during Project operation.

Four-microphone Automated Recording Unit Housed in Protective Case





Olive-sided Flycatcher and Rusty Blackbird Territory Monitoring Sites

What was found?

Olive-sided flycatcher calls (an indication of activity in the area) were recorded at 40 (98%) of the 41 territories analyzed in 2023. The amount of olive-sided flycatcher activity appeared to be lower in territories at disturbed sites than in territories at reference sites near the North Access Road and the South Access Road. Olive-sided flycatcher activity seemed similar between territories at disturbed and reference sites near the Provincial Road 280, except for mean calls per territory which was higher at disturbed territories.

Rusty blackbird calls were recorded at 10 (83%) of the 12 analyzed territories in 2023. There appeared to be less rusty blackbird activity in territories at disturbed sites than reference sites near the North Access Road. Rusty blackbird territories were not successfully detected or monitored near the South Access Road or Provincial Road 280, and rusty blackbird numbers appeared lower in 2023 than during Project construction survey years (2016, 2017, and 2019).

What does it mean?

Disturbance caused by the Project access roads may have had a minor effect on the amount of olive-sided flycatcher activity at nearby nesting territories in 2023. However, the differences in activity at disturbed and reference territories were small and may in part be due to factors other than the Project. In contrast, near Provincial Road 280 there tended to be more olive-sided flycatcher activity as measured by mean calls per territory at disturbed sites than reference sites.

Disturbance along the North Access Road may have affected the amount of rusty blackbird activity at nearby nesting territories in 2023. During Project construction, activity levels were also lower in territories at disturbed sites near Provincial Road 280, suggesting that rusty blackbirds may be sensitive to disturbances on all types of roads. The lack of successfully detected and monitored territories on the Provincial Road 280 despite survey effort similar to previous years suggests that the lower numbers of rusty blackbirds observed is likely unrelated to the Project.

What will be done next?

Data collected from audio recordings in 2024 and 2025 will be used to map and measure olive-sided flycatcher and rusty blackbird territories to further evaluate potential Project effects on habitat use and distribution.

STUDY TEAM

We would like to thank Sherrie Mason and Rachel Boone of Manitoba Hydro and Ron Bretecher of North/South Consultants Inc. for logistical assistance in the field. We would also like to thank James Ehnes of ECOSTEM Ltd. for GIS support and mapping. Biologists and other personnel who designed, participated in, and drafted the survey results included:

- Robert Berger, Wildlife Resource Consulting Services MB Inc. (WRCS) – Design, data analysis and reporting
- James Ehnes, ECOSTEM Ltd. – Design
- Alex McIlraith, Independent Contractor - Design and bird audio recording analysis
- Thomas Wood, WRCS – Data analysis, reporting, field lead, survey personnel
- Levi Warkentine, WRCS – Field lead, survey personnel
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TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF MAPS

LIST OF PHOTOS

LIST OF APPENDICES

1.0 INTRODUCTION

Construction of the Keeyask Generation Project (the Project), a 695-megawatt hydroelectric generating station (GS) and associated facilities, began in July 2014. The Project is located at Gull Rapids on the lower Nelson River in northern Manitoba where Gull Lake flows into Stephens Lake, 35 km upstream of the existing Kettle GS.

The *Keeyask Generation Project Response to EIS Guidelines* (the EIS), completed in June 2012, provides a summary of predicted effects and planned mitigation for the Project. Technical supporting information for the terrestrial environment, including a description of the environmental setting, effects and mitigation, and a summary of proposed monitoring and follow-up programs is provided in the *Keeyask Generation Project Environmental Impact Statement Terrestrial Supporting Volume* (TE SV). The *Keeyask Generation Project Terrestrial Effects Monitoring Plan* (TEMP) was developed as part of the licensing process for the Project. Monitoring activities for various components of the terrestrial environment were described, including the focus of this report, olive-sided flycatcher (*Contopis cooperi*) and rusty blackbird (*Euphagus carolinus*) sensory disturbance effects monitoring, for the operation phase of the Project.

Olive-sided flycatcher and rusty blackbird are migratory songbirds protected under the federal *Species at Risk Act* (SARA). The olive-sided flycatcher is listed as Special Concern under the SARA and is listed as Special Concern by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC). In Manitoba, the olive-sided flycatcher is listed as Threatened under *The Endangered Species and Ecosystems Act*. Its breeding habitat consists mainly of mature coniferous forest with open patches created by natural disturbance (e.g., fire), wetlands, or forestry clear-cuts (Altman and Sallabanks 2012 in Environment Canada 2016). Snags (dead standing trees) and live trees left behind after logging are important for perching while foraging for flying insects in open areas (Altman and Sallabanks 2012 in Environment Canada 2016).

The rusty blackbird is listed as Special Concern under the SARA and has no designation under *The Endangered Species and Ecosystems Act* of Manitoba. Despite being a migratory bird, the rusty blackbird is not protected under the federal *Migratory Birds Convention Act 1994*. Rusty blackbirds inhabit the boreal forest during the breeding season, using wetland habitat such as sedge meadows, beaver ponds, muskegs, swamps, riparian scrub, and shrubby patches of willow and alder (COSEWIC 2017). Their diet consists mainly of aquatic invertebrates such as insect larvae and snails, and also grasshoppers, beetles, and spiders (COSEWIC 2017).

As part of the TEMP, pilot studies for olive-sided flycatcher and rusty blackbird were conducted in 2015, to identify and enumerate breeding pairs of birds in the Keeyask region. Sensory disturbance surveys were then conducted in 2016, 2017, and 2019, to determine if and how Project-related noise affects the distribution and abundance of each species (WRCS 2018, WRCS 2020, ECOSTEM Ltd. and WRCS 2021.). The north and south access roads were expected to be the main sources of sensory disturbance for olive-sided flycatcher and rusty blackbird.

Olive-sided flycatcher and rusty blackbird sensory disturbance effects monitoring during Project operation used similar methods to monitoring conducted during the construction phase to evaluate how olive-sided flycatcher and rusty blackbird distribution and abundance change due to Project operation. This report contains the results of the first year of the operation-phase olive-sided flycatcher and rusty blackbird sensory disturbance effects study.

2.0 METHODS

2.1 TERRITORY MAPPING AND AUDIO RECORDING

Olive-sided flycatcher and rusty blackbird nesting territories identified in previous survey years were re-visited in 2023. Additional sites were also surveyed to increase the sample size. A paired habitat sample design was employed to follow the TEMP methods (KHLP 2015). Survey sites represented either Project-disturbed or reference sites. Project-disturbed sites (disturbed sites) were within 500 m of the North Access Road (NAR) and South Access Road (SAR). Provincial Road 280 (PR 280) was included to compare an existing source of sensory disturbance with Project-related sensory disturbance. For each disturbed site, a reference site, located in similar habitat but beyond the expected range of sensory disturbance for olive-sided flycatchers and rusty blackbirds (500 m), was also surveyed (Map 1).

Surveys were conducted from June 3 to 26, 2023. Surveys began half an hour before sunrise and were completed no later than 10:00 am. At each survey site, observers watched and listened for olive-sided flycatchers and rusty blackbirds for a period of 10 minutes. If no bird was heard or observed, the observer repeated the process at the next site. When a bird was heard or observed at a site, observers marked its position using a GPS unit. The bird was observed until at least five perches were marked, defining its territory. Observers maintained a sufficient distance from the bird to avoid disturbance and record natural perch locations.

Three second-generation automated recording units (ARUs; Photo 1) were placed in the centre of territories at disturbed sites, at distances of 100 metres (m), 300 m, and up to 500 m from the nearest road for olive-sided flycatcher (Figure 1). Similarly, three ARUs were placed in each territory at reference sites, and 100 m, 300 m, and 500 m from a non-habitat patch edge such that they were centrally located through the long side of the habitat patch.

Four or five second-generation automated recording units (ARUs; Photo 1) were placed in the centre of territories at disturbed sites, at distances of 100 metres (m), 200 m, 300 m , 400 m, and 500 m from the nearest road for rusty blackbird (Figure 1). Similarly, four or five ARUs were placed in each territory at disturbed sites at distances of 100 m, 200 m, 300 m, 400 m, and 500 m from a non-habitat patch edge such that they were centrally located through the long side of the habitat patch.

In all, 185 recorders were placed at 53 nesting territories from June 9 to July 15, 2023; however, most recorders were retrieved by July 4, 2023. One-hundred eighteen ARUs were placed at 41 olive-sided flycatcher nesting territories (Table 1) and 67 ARUs were placed at 12 rusty blackbird nesting territories (Table 2).

The ARUs were programmed to record for five minutes at 10-minute intervals (i.e., six times per hour) for seven hours beginning half an hour before sunrise and for four hours beginning an hour before sunset in 2016 to 2019. In 2023, the sunset recordings were removed from the timer to

save battery power and memory. Audio recording units were typically left in place for 10 days, though some recorders remained in place for up to 20 days. Sixty-six recordings were made daily at each territory over the duration of the survey period between 2016 and 2019. Forty-two recordings were made daily at each territory in 2023.

Photo 1: Four-microphone Automated Recording Unit Housed in Protective Case

Photo 2: Avian Technician Performing Roadside Survey for Rusty Blackbird and Olive-sided Flycatcher

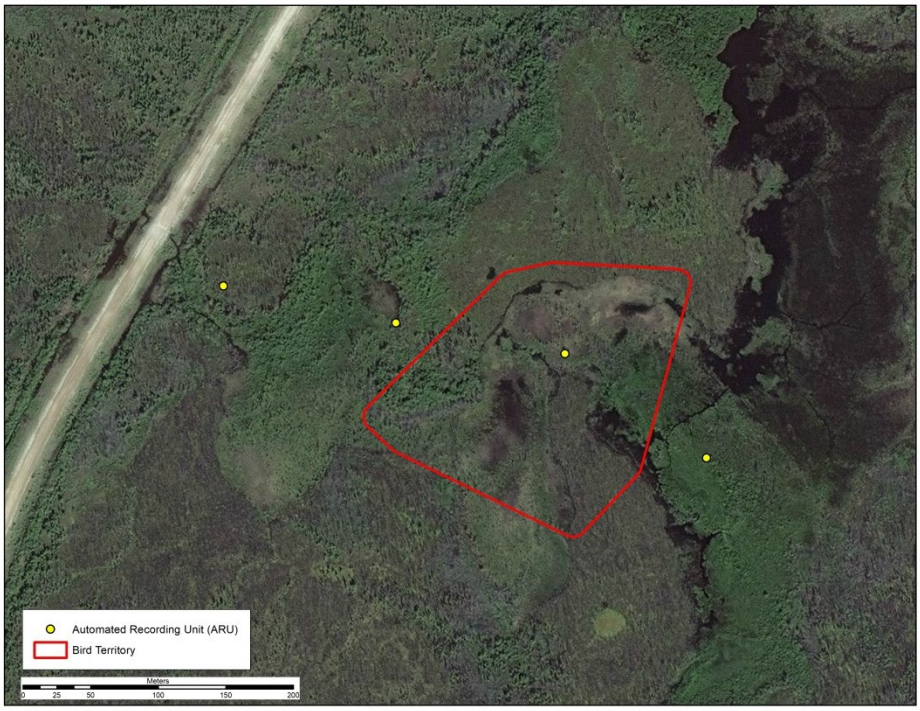


Figure 1: Example of ARU Placements Within a Bird Territory at a Disturbed Site

Table 1: Survey Effort for Olive-sided Flycatchers at Disturbed and Reference Sites, 2023

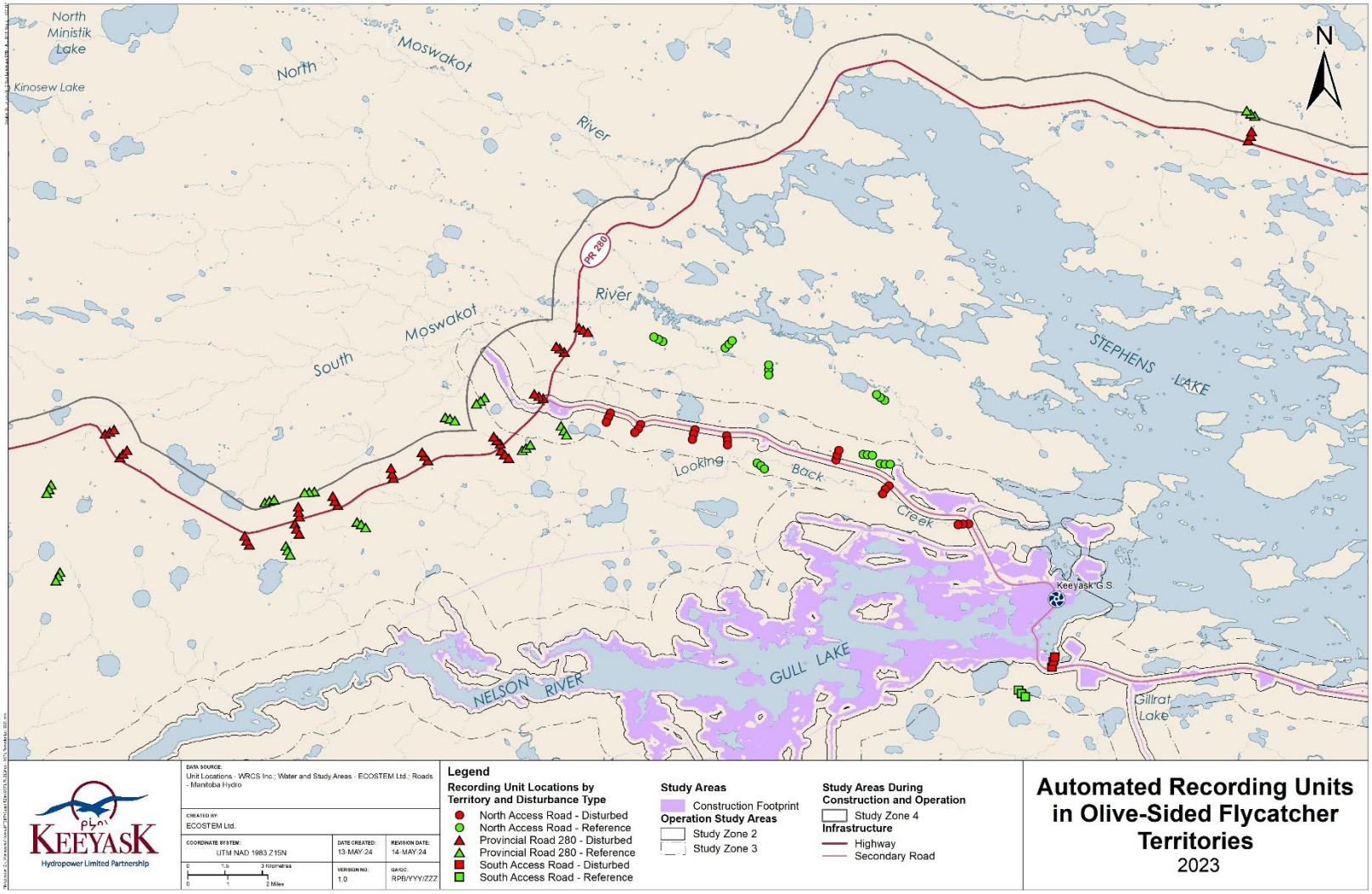
Disturbance Source	Disturbed		Reference		Total	
	Number of Territories	Number of Recorders	Number of Territories	Number of Recorders	Number of Territories	Number of Recorders
NAR	7	21	7	20	14	41
SAR	1	3	1	2	2	5
PR 280	14	40	11	32	25	72
Total	22	64	19	54	41[1]	118

1. Number of olive-sided flycatcher territories where individuals were detected on recorders

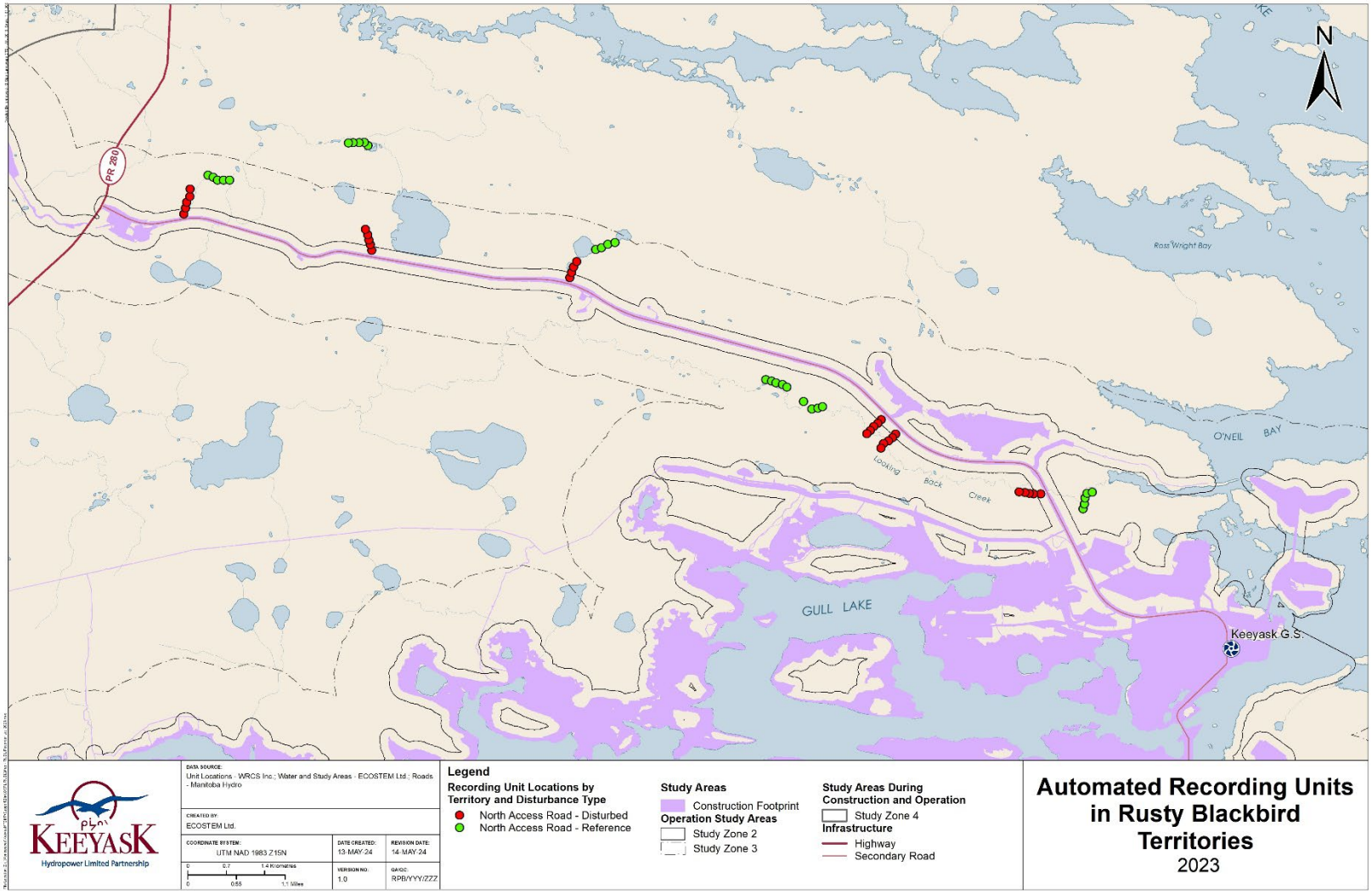
Table 2: Survey Effort for Rusty Blackbirds at Disturbed and Reference Sites, 2023

Disturbance Source	Disturbed		Reference		Total	
	Number of Territories	Number of Recorders	Number of Territories	Number of Recorders	Number of Territories	Number of Recorders
NAR	6	34	6	33	12	61
SAR	0	0	0	0	0	0
PR 280	0	0	0	0	0	0
Total	6	34	6	33	12[1]	44

1. Number of rusty blackbird territories where individuals were detected on recorders



Map 1: Automated Recording Units in Olive-sided Flycatcher Territories, 2023



Map 2: Automated Recording Units in Rusty Blackbird Territories, 2023

2.2 AUDIO RECORDING SUPPORT AND ANALYSIS

To identify the presence or absence of olive-sided flycatcher or rusty blackbird calls, analyses of bird vocalizations were performed using the statistical package R (Hafner and Katz 2018). A stepwise process was used to remove most false positives, where other species were initially identified as the target species. Classification of audio clips involved setting a threshold for target and off-target calls and calculating a difference between the two (see Appendix 1 for detailed analysis methods). All calls identified as olive-sided flycatcher or rusty blackbird were isolated and reviewed for potential false positives not removed during the initial identification process.

Recordings from a total of 41 olive-sided flycatcher territories (Table 3) and 12 rusty blackbird territories (Table 4) were analyzed in 2023. Recordings made in 2016, 2017 and 2019 were previously analyzed (Wildlife Resource Consulting Services MB Inc. 2020). Because recorders were left in place for varying amounts of time over the 4 survey years (i.e., one to 20 days), territories with fewer than seven days of recordings were removed from the analysis (n = 1 in 2016 and n = 2 in 2017). For olive-sided flycatcher, recordings were analyzed from 30 territories in 2016, 19 territories in 2017, 16 territories in 2019, and 41 territories in 2023 (Appendix 2, Table 2-1). For rusty blackbird, recordings were analyzed from 24 territories in 2016, 34 territories in 2017, 24 territories in 2019, and 12 territories in 2023 (Appendix 2, Table 2-2). Calls from the first recorder were analyzed, or from the next recorder with calls if the first recorder could not be included, to avoid double-counting calls in the preliminary analysis presented in this report. Only calls from the first seven to 10 days of recordings were included in the analysis, to standardize the results.

Table 3: Number of Territories with Olive-sided Flycatcher Recordings, 2023

Disturbance Source	Disturbed Sites			Reference Sites		
	Number of Territories	Number of Recording Days[1]	Number of Recordings[2]	Number of Territories	Number of Recording Days	Number of Recordings
NAR	7	195	8,190	7	175	6,846
SAR	1	30	1260	1	20	840
PR 280	14	349	14,658	11	283	11,886
Total	22	574	24,108	19	466	19,572

1. Maximum of 10 days selected per territory
2. Number recording days X 42 recordings per morning

Table 4: Number of Territories with Rusty Blackbird Recordings, 2023

Disturbance Source	Disturbed Sites			Reference Sites		
	Number of Territories	Number of Recording Days[1]	Number of Recordings[2]	Number of Territories	Number of Recording Days	Number of Recordings
NAR	6	60	2,520	6	60	2,520
SAR	–	–	–	–	–	–
PR 280	–	–	–	–	–	–
Total	6	60	2,520	6	60	2,520

1. Maximum of 10 days selected per territory
2. Number recording days X 42 recordings per morning

The amount of olive-sided flycatcher and rusty blackbird activity in territories at disturbed and reference sites near the NAR, the SAR, and PR 280 was evaluated with the percentage of days calls were recorded, the percentage of recordings on which calls were recorded, and the mean number of calls per territory over the seven- to 10-day analysis periods in all territories at each disturbance source. The percentage difference in each metric between territories at disturbed and reference sites at each disturbance source was calculated for comparison.

3.0 RESULTS

3.1 OLIVE-SIDED FLYCATCHER

Olive-sided flycatcher calls were recorded at 40 (98%) of the 41 territories analyzed in 2023. Olive-sided flycatcher nesting territories were roughly delineated by identifying the locations of singing birds relative to the ARUs, examples of which are depicted in Appendix 3, Map 3-1.

In previous survey years (2016, 2017, 2019) there was no clear trend in the amount of olive-sided flycatcher activity in territories near the North and South access roads (NAR and SAR). In 2023, olive-sided flycatcher activity was higher near the SAR than the NAR on monitored territories (Table 5). As only a few territories were found and monitored near the SAR, this result should be interpreted with caution.

In 2023, olive-sided flycatcher activity was higher on reference sites than disturbed sites near the NAR with large percentage differences in both mean number of olive-sided flycatcher calls per territory (27% percentage difference) and percentage of recordings with olive-sided flycatcher calls (42% percentage difference). In 2023, olive-sided flycatcher activity was higher near the SAR than the NAR on monitored territories (Table 5). However, the mean number of olive-sided flycatcher calls was lower near the SAR than the NAR (Table 6).

There was slightly less olive-sided flycatcher activity in disturbed sites near PR 280 than disturbed sites near the access roads in 2023 (Table 5, Table 6). The difference in olive-sided flycatcher activity near PR 280 between disturbed territories and reference territories tended to be small, were inconsistent between recording percentage of recording days and mean number of calls, and there was little difference between the percentage of recordings with olive-sided flycatcher calls.

Table 5: Recording Days and Recordings with Olive-sided Flycatcher Calls, 2016, 2017, 2019, and 2023

Year	Disturbance Source	Percentage Recording Days			Percentage Recordings		
		Disturbed	Reference	% Difference	Disturbed	Reference	% Difference
2016	NAR	69	74	7	13	13	0
	SAR	90[1]	60	40	10[1]	2	133
	PR 280	84	33	87	17	3	140
2017	NAR	61	49	22	9	6	40
	SAR	–	–	–	–	–	–
	PR 280	63	85	30	6	16	91
2019	NAR	82	97	17	8	27	109
	SAR	10[1]	30[1]	100	<1[1]	11[1]	193
	PR 280	37	70	62	3	14	129
2023	NAR	91	83	9	17	26	42
	SAR	100[1]	90[1]	11	22[1]	48[1]	74
	PR 280	63	71	12	13	14	7

1. Results from one site.

Table 6: Mean Number of Olive-sided Flycatcher Calls per Territory, 2016, 2017, 2019, and 2023

Year	Disturbance Source	Disturbed Sites		Reference Sites		% Difference
		Mean	Range	Mean	Range	Mean
2016	NAR	985	0 – 2,152	977	17 – 2,916	1
	SAR	269[1]	–	15[1]	–	179
	PR 280	1,146	4 – 3,728	695	1 – 2,694	49
2017	NAR	562	20 – 1,621	398	0 – 2,221	34
	SAR	–	–	–	–	–
	PR 280	223	0 – 483	1,696	187 – 3,204	154
2019	NAR	916	87 – 2,721	2,014	1,108 – 3,526	75
	SAR	3[1]	–	959[1]	–	98
	PR 280	181	3 – 509	1,675	1 – 3,493	161
2023	NAR	1,099	179 – 2813	1,444	39 – 4,000	27
	SAR	489[1]	–	2,080[1]	–	124
	PR 280	614	0 – 2567	291	44 – 406	71

1. Results from one territory.

When compared to all Project construction survey years, 2023 operations had a higher percentage of recording days with olive-sided flycatcher calls in territories near the NAR (Figure 2). There was a small decrease, but larger compared to combined Project construction, in percentage of recording days with olive-sided flycatcher calls for disturbed territories compared to reference territories on the NAR. Unlike Project construction years, there was only a small difference between disturbed and reference territories near the SAR. In 2023 the disturbed territory near the SAR had a higher percentage of recording days with olive-sided flycatcher calls compared to the SAR reference territory, which is opposite of the trend observed in SAR territories over the combined Project construction survey years. There was a small difference for territories near the PR 280, with calls recorded at a slightly greater percentage of territories at reference sites than disturbed sites.

When the percentage of recordings with olive-sided flycatcher calls in 2023 was compared to the combined Project construction survey period, the percentage was higher across all categories (Figure 3). The sites near the SAR had the greatest increase in the percentage of recordings with olive-sided flycatcher calls, and sites near the PR 280 had only a marginal increase. For territories near the NAR and SAR, the trend changed from little difference during Project construction to lower activity in disturbed territories. For territories near the PR 280 the difference in the percentage of recording with olive-sided flycatcher calls between disturbed and reference sites remained comparable to Project construction.

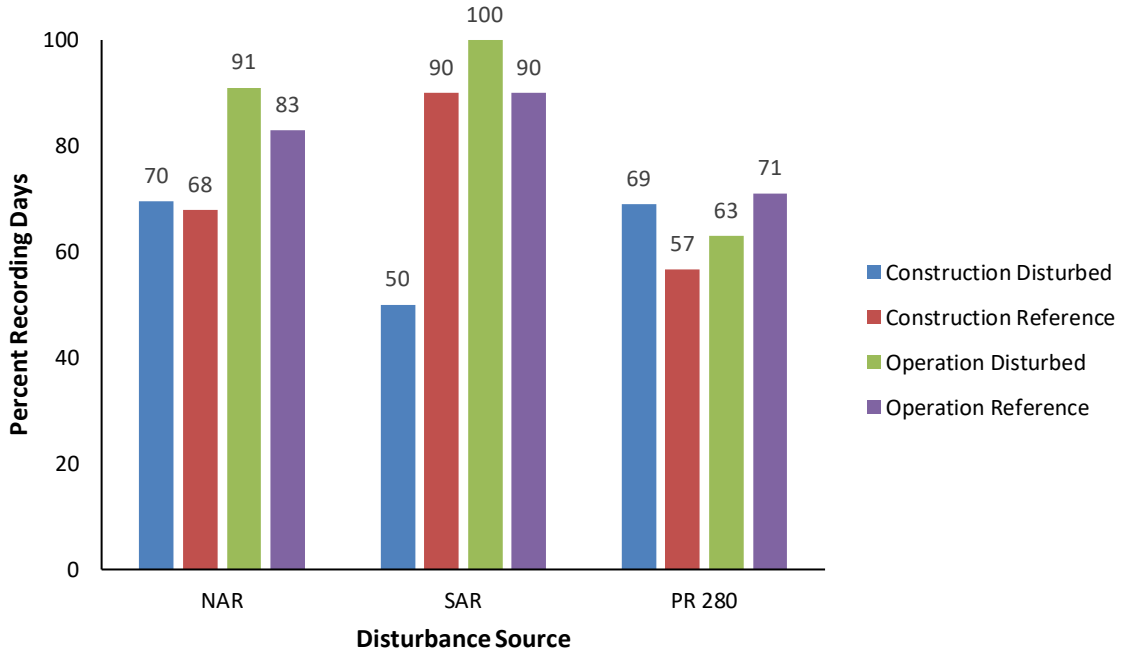


Figure 2: Percentage of Recording Days with Olive-sided Flycatcher Calls Over the Combined Project Construction Survey Period (2016, 2017, 2019) and 2023 (Project Operation)

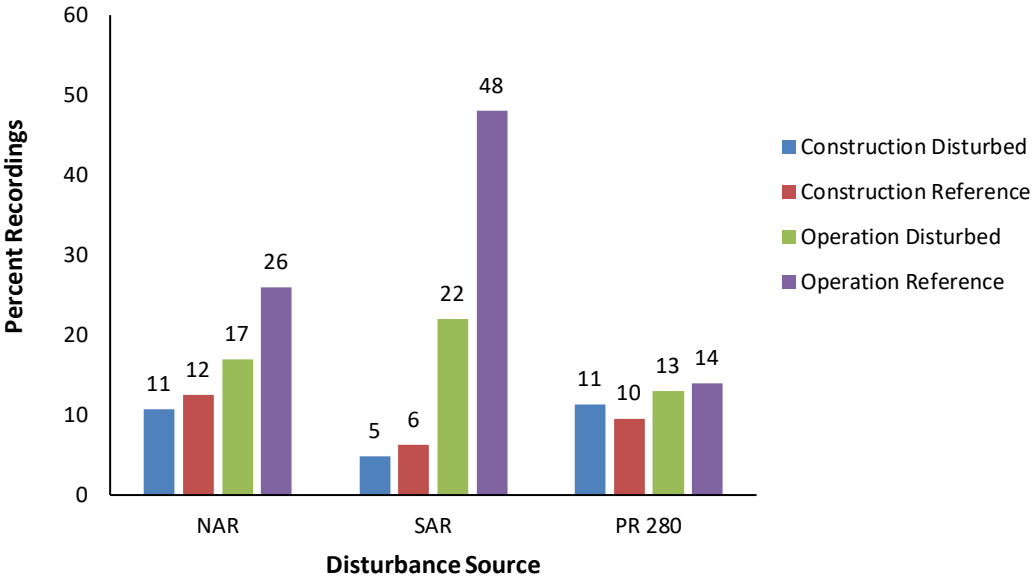


Figure 3: Percentage of Recordings with Olive-sided Flycatcher Calls Over the Combined Project Construction Survey Period (2016, 2017, 2019) and 2023 (Project Operation)

The difference in the mean number of olive-sided flycatcher calls was similar in territories at disturbed and reference sites near the NAR during Project construction and higher in reference territories in 2024 (Figure 4). The SAR had an even larger increase in mean number of calls between disturbed and reference sites than during Project construction. The mean number of olive-sided flycatcher calls on the PR 280 was lower overall than during construction, and also had the opposite trend of fewer calls in reference territories than disturbed territories.

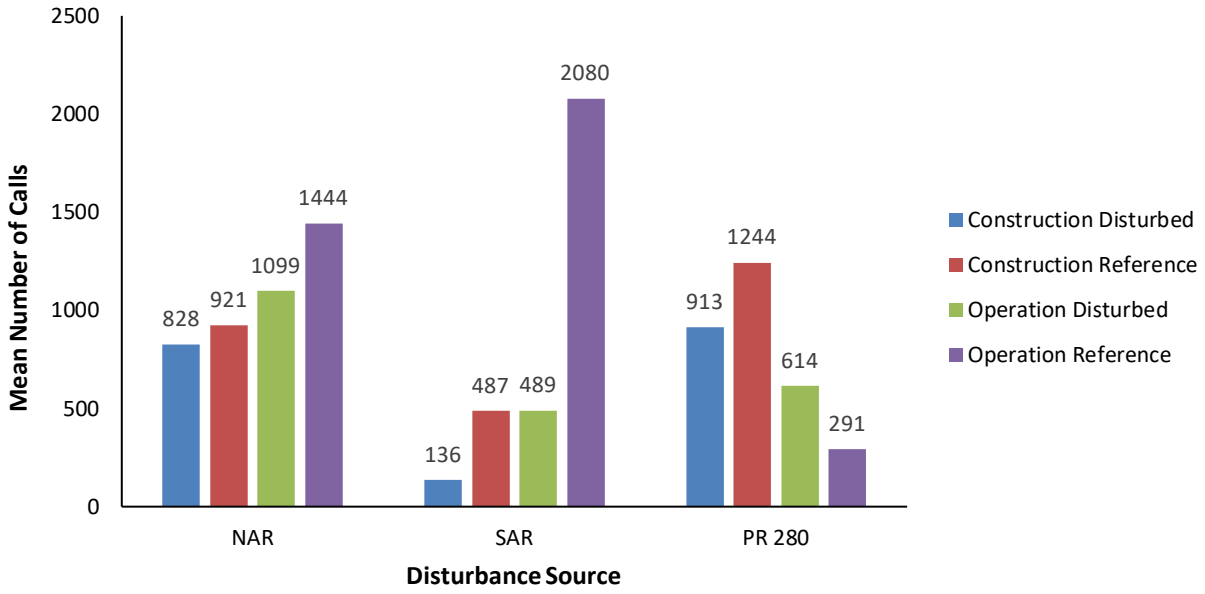


Figure 4: Mean Number of Olive-sided Flycatcher Calls per Territory Over the Combined Project Construction Survey Period (2016, 2017, 2019) and 2023 (Project Operation)

3.2 RUSTY BLACKBIRD

Rusty blackbird calls were recorded at 10 (83%) of the 12 territories in 2023 over the standardized analysis period. Rusty blackbird territories were roughly delineated by identifying the locations of singing birds relative to the ARUs, examples of which are depicted in Appendix 3, Map 3-2.

In 2023, rusty blackbirds were consistently recorded on a greater percentage of recording days in territories at reference sites than disturbed sites near the NAR, similar to what was observed in previous construction survey years (Table 7). The percentage of recordings with rusty blackbird calls was also greater at reference territories, but the difference was small (40%, Table 7). No rusty blackbird territories were detected or monitored near the SAR or the PR 280 in 2023.

Table 7: Recording Days and Recordings with Rusty Blackbird Calls, 2016, 2017, 2019, and 2023

Year	Disturbance Source	Percentage Recording Days			Percentage Recordings		
		Disturbed	Reference	% Difference	Disturbed	Reference	% Difference
2016	NAR	30	60	67	3	3	0
	SAR	70[1]	40	56	3[1]	1	100
	PR 280	24	40	50	1	6	143
2017	NAR	41	65	45	3	5	50
	SAR	70	83	17	4	11	93
	PR 280	36	60	50	3	2	40
2019	NAR	44	74	51	2	4	67
	SAR	30[1]	100[1]	108	1[1]	23[1]	183
	PR 280	30	37	21	1	1	0
2023	NAR	42	72	53	6	9	40
	SAR	–	–	–	–	–	–
	PR 280	–	–	–	–	–	–

1. Results from one territory.

The mean number of rusty blackbird calls per territory was similar for territories at disturbed and reference sites along the NAR in 2023 (Table 8). Unlike previous survey years, no rusty blackbird territories were monitored near the SAR or PR 280.

Table 8: Mean Number of Rusty Blackbird Calls per Territory, 2016, 2017, 2019, and 2023

Year	Disturbance Source	Disturbed Sites		Reference Sites		% Difference
		Mean	Range	Mean	Range	Mean
2016	NAR	125	1 – 744	75	48 – 129	50
	SAR	69[1]	–	32	8 – 55	73
	PR 280	21	1 – 61	322	11 – 842	176
2017	NAR	111	1 – 1,091	136	3 – 886	20
	SAR	53	1 – 127	296	70 – 670	139
	PR 280	44	0 – 116	36	21 – 50	20
2019	NAR	49	1 – 140	59	7 – 256	19
	SAR	21[1]	–	2,415[1]	–	197
	PR 280	48	11 – 85	28	5 – 51	53
2023	NAR	124	0 – 506	92	1 – 203	30
	SAR	–	–	–	–	–
	PR 280	–	–	–	–	–

1. Results from one territory.

The percentage of recording days with rusty blackbird calls in 2023 near the NAR territories was very similar to the percentage observed over the combined Project construction survey years (Figure 5). The percentage of recordings with rusty blackbird calls along the NAR was higher in 2023 as compared to the combined survey years during Project construction (Figure 6). In 2023 both percentage of recording days and percentage of recordings with rusty blackbird calls were lower on disturbed territories than reference territories, which matched the trends observed during Project construction survey years. The mean number of calls in 2023 was roughly similar to the mean number of calls observed in the combined Project construction survey years (Figure 7). Comparisons could not be made for the SAR and PR 280 because no rusty blackbird territories were successfully detected or monitored in those areas in 2023.

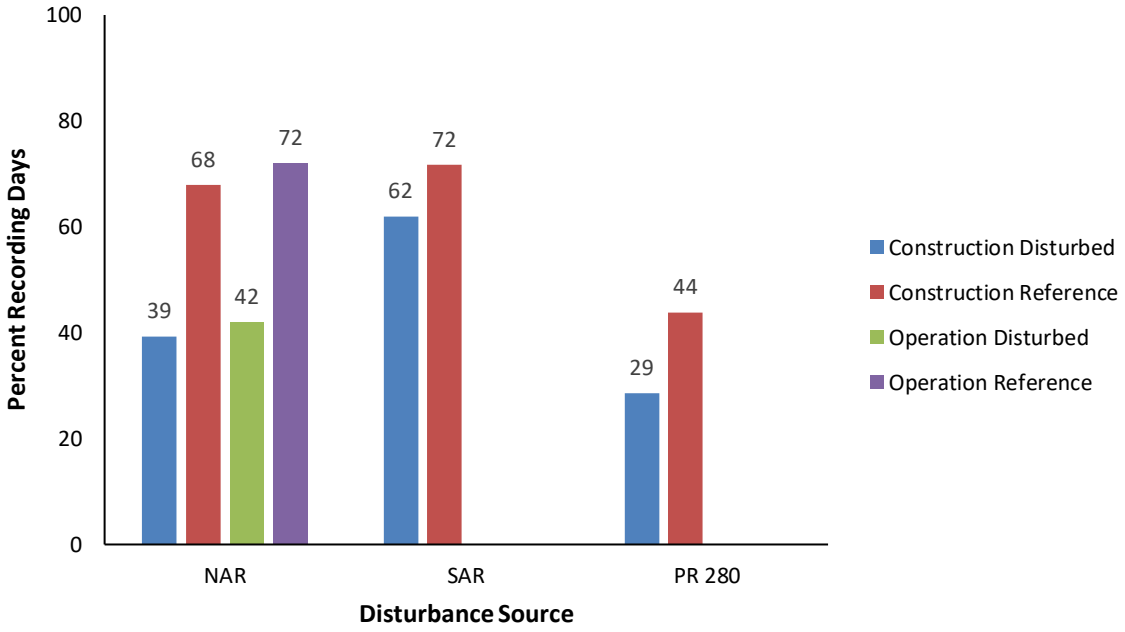


Figure 5: Percentage of Recording Days with Rusty Blackbird Calls Over the Combined Project Construction Survey Period (2016, 2017, 2019) and 2023 (Project Operation)

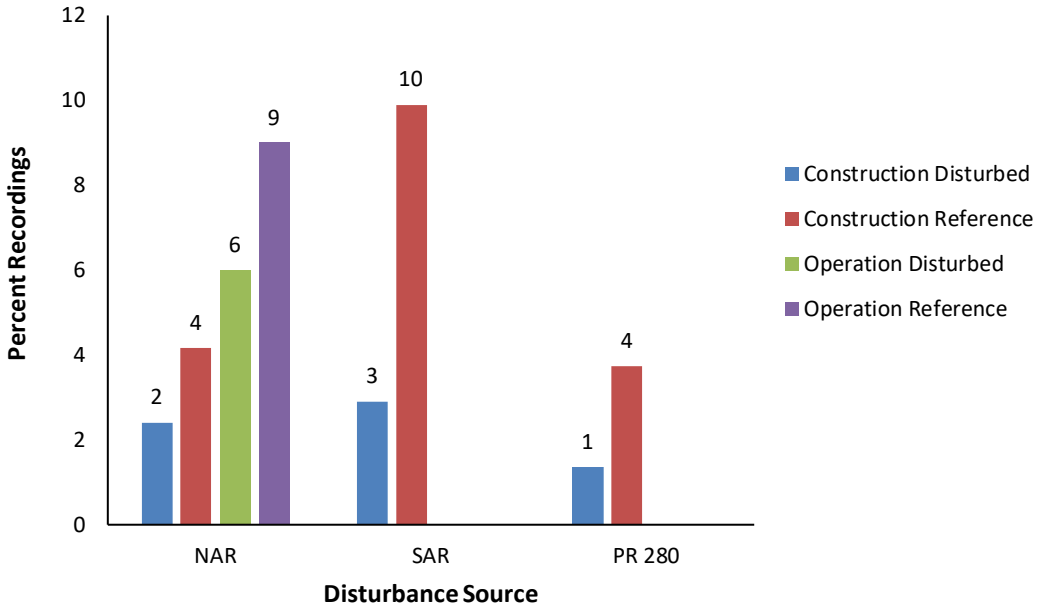


Figure 6: Percentage of Recordings with Rusty Blackbird Calls Over the Combined Project Construction Survey Period (2016, 2017, 2019) and 2023 (Project Operation)

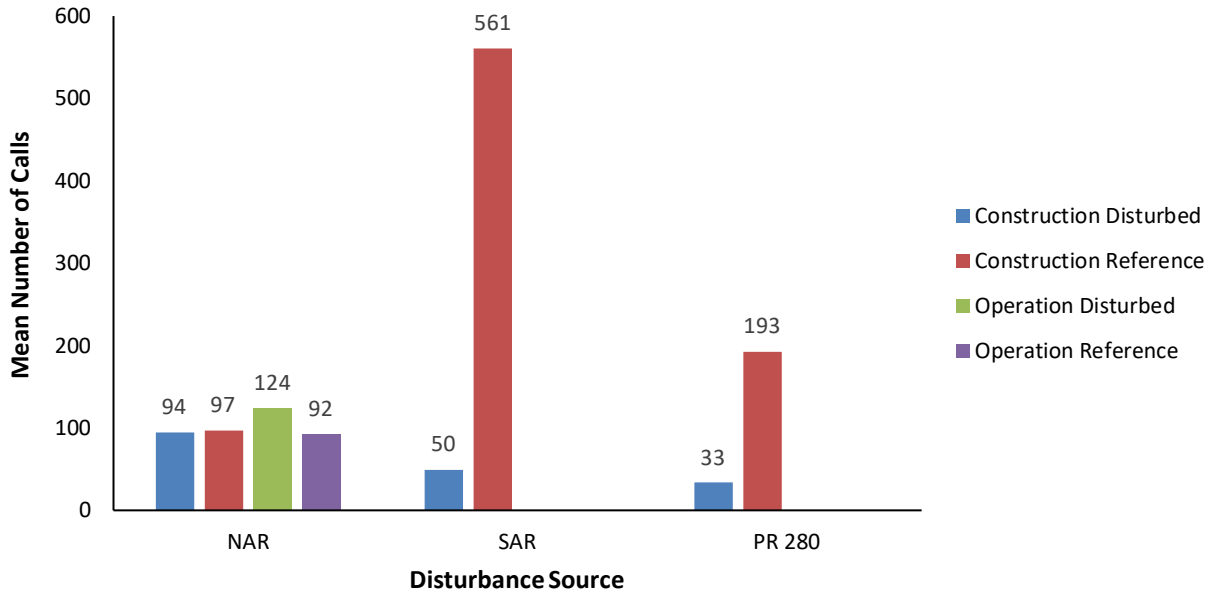


Figure 7: Mean Number of Rusty Blackbird Calls per Territory Over the Combined Project Construction Survey Period (2016, 2017, 2019) and 2023 (Project Operation)

4.0 DISCUSSION

Olive-sided flycatcher and rusty blackbird are species at risk and vulnerable to potential Project effects. Olive-sided flycatchers selected territories near the NAR and PR 280 during all four study years. Like Project construction survey years, there were few olive-sided flycatcher territories near the SAR in 2023, with one disturbed and one reference territory monitored. In 2023 rusty blackbird territories were only found near the NAR, unlike during Project construction survey years where their territories were found near all three monitored sources of disturbance. Fewer rusty blackbird territories (12) than olive-sided flycatcher territories (41) were found in 2023. In previous survey years rusty blackbird territories were found in similar or greater numbers than olive-sided flycatchers (WRCS 2018, 2020). The relatively low amount of rusty blackbird territories monitored, despite similar search effort as previous survey years, suggests that rusty blackbird numbers were lower in 2023. The substantial decline in rusty blackbird numbers is likely unrelated to the Project as they were detected along the Project-disturbed NAR, but not detected near the PR 280, a source of disturbance unrelated to the Project.

Olive-sided flycatcher activity appeared to be slightly lower at disturbed than reference territories near the NAR and SAR in 2023 as measured by mean number of olive-sided flycatcher calls per territory and percentage of recordings with olive-sided flycatcher calls. Lower olive-sided flycatcher activity at disturbed territories suggests that the access roads may be influencing olive-sided flycatcher activity. In 2023, the NAR was used less than during Project construction and the SAR had relatively higher traffic than the NAR. Territories monitored near the PR 280 had the opposite trend however, with slightly greater activity observed on disturbed territories as compared to reference territories as measured by mean number of olive-sided flycatcher calls and percentage of days with olive-sided flycatcher calls per territory.

No effect on territorial use by olive-sided flycatchers during Project construction or operation monitoring was predicted in the EIS. In 2023, olive-sided flycatcher activity was higher in reference territories than disturbed territories near the NAR and SAR, unlike the combined Project construction survey years which had little difference between reference and disturbed territories. However, few territories were measured near the SAR during Project construction years and in 2023, which likely influenced the results. Olive-sided flycatcher activity in 2023 near the PR 280 was similar to Project construction years, except for mean calls per territory which had the opposite trend of increased activity on disturbed territories compared to reference territories. While some measures of olive-sided flycatcher activity in 2023 suggest disturbance may be altering olive-sided flycatcher behaviour near the NAR and SAR, the lack of difference observed during Project construction, during which disturbance was likely higher than 2023, suggests that variables unrelated to the Project may be leading to decreased activity on disturbed olive-sided flycatcher territories relative to reference territories.

Rusty black-bird activity in 2023 was lower on disturbed than reference territories for territories near the NAR. The percentage of recording days and percentage of recordings with rusty blackbird calls were lower for disturbed than reference NAR territories. The mean number of calls was higher for disturbed NAR territories, but the difference from the paired territories was small.

Overall, territories near the NAR in 2023 matched the trends observed during Project construction monitoring, which suggests that the NAR is continuing to affect rusty blackbird habitat use during Project operation despite being used less than during Project construction years. The SAR had more traffic than the NAR in 2023, but no rusty black-bird territories were successfully monitored there.

To further study the potential effects of the NAR and SAR on olive-sided flycatchers and rusty blackbirds, bird response to sensory disturbance will be estimated by mapping call density as a function of distance from the roads, while controlling for differences in habitat. Potential Project construction and operation effects on habitat use and distribution will be evaluated.

5.0 SUMMARY AND CONCLUSIONS

In 2023, the second year of Project operation, olive-sided flycatcher activity was higher on reference territories than on territories near Project access roads. The same trend was not observed for territories near the PR 280, making conclusions difficult to draw. Rusty blackbird activity was similar to that observed during Project construction years in areas where they were detected, suggested that they are continuing to be affected during Project operation. The decrease in rusty blackbird numbers is unlikely related to the Project as territories were successfully monitored near the North Access Road but not near PR 280. Olive-sided flycatcher and rusty blackbird monitoring will continue in 2024 and 2025 to further evaluate potential Project effects on habitat use and distribution.

6.0 LITERATURE CITED

COSEWIC (Committee on the Status of Endangered Wildlife in Canada). 2017. COSEWIC assessment and status report on the rusty blackbird *Euphagus carolinus* in Canada. Committee on the Status of Endangered Wildlife in Canada, Ottawa, ON. 64 pp.

ECOSTEM Ltd. and Wildlife Resource Consulting Services MB Inc. 2021. Keeyask Generation Project Terrestrial Effects Monitoring Plan Report #TEMP-2021-13: Olive-sided Flycatcher and Rusty Blackbird Sensory Disturbance Monitoring. A report prepared for Manitoba Hydro by ECOSTEM Ltd. and Wildlife Resource Consulting Services MB Inc., June 2021.

Environment Canada. 2016. Recovery strategy for the olive-sided flycatcher (*Contopus cooperi*) in Canada. *Species at Risk Act* Recovery Strategy Series. Environment Canada, Ottawa, ON. 52 pp.

Hafner, S.D. and Katz, J. 2018. A short introduction to acoustic template matching with monitoR. Available from https://cran.r-project.org/web/packages/monitoR/vignettes/monitoR_QuickStart.pdf [accessed May 15, 2018].

KHLP (Keeyask Hydropower Limited Partnership). 2015. Keeyask Generation Project – Terrestrial Effects Monitoring Plan. Keeyask Hydropower Limited Partnership, Winnipeg, MB. 355 pp.

Wildlife Resource Consulting Services MB Inc. 2018. Keeyask Generation Project, Terrestrial Effects Monitoring Plan Report #TEMP 2018-13, Olive-sided Flycatcher and Rusty Blackbird Sensory Disturbance Monitoring 2017. A report prepared for Manitoba Hydro by Wildlife Resource Consulting Services MB, Inc., June 2018.

Wildlife Resource Consulting Services MB Inc. 2019. Keeyask Generation Project, Terrestrial Effects Monitoring Plan Report #TEMP 2018-13, Olive-sided Flycatcher and Rusty Blackbird Sensory Disturbance Monitoring 2017. A report prepared for Manitoba Hydro by Wildlife Resource Consulting Services MB, Inc., June 2018.

Wildlife Resource Consulting Services MB Inc. 2020. Keeyask Generation Project, Terrestrial Effects Monitoring Plan Report #TEMP 2020-15, Olive-sided Flycatcher and Rusty Blackbird Sensory Disturbance Monitoring 2019. A report prepared for Manitoba Hydro by Wildlife Resource Consulting Services MB, Inc., June 2020.

APPENDIX 1:
AUDIO RECORDING ANALYSIS METHODS

Automated Recording Units (ARUs)

Although there is extensive precedent for using automated recording units (ARUs) for avian studies (Shonfield and Bayne 2017)[1], we had difficulty finding an ARU to meet our needs. In some of the species at risk studies proposed for the *Terrestrial Effects Monitoring Plan* (TEMP), for example, it was necessary to estimate distance and direction to the vocalizing birds. This required more than two channels of audio recording. Study design also demanded a large number of recorders to meet sample size requirements. After surveying the available technology, no recorders were found that could record four channels at a reasonable cost. Wildlife Resource Consulting Services MB Inc. commissioned Myrica Systems Inc. to design custom ARUs and a local contract assembler was hired to build them.

There were a number of criteria to be met in the ARU design:

- **Time accuracy**: ARUs contained a temperature-compensated quartz clock with an accuracy of +/- 2 minutes per year over a range of -40°C to 85°C.
- **Flexible time scheduling**: Timing parameters included start times, recording duration, interval, and number repetitions. Recordings can be corrected for sunrise and sunset over the season; units were loaded with daily sunrise and sunset times determined from National Oceanic and Atmospheric Administration (NOAA) calculations given the year, latitude, and longitude.
- **Lengthy unattended run time**: The design was optimized for minimal power consumption. ARUs could be powered from AA, D and 6V lantern batteries as required to meet recording time requirements.
- **Audio sensitivity**: Microphones were mounted in a separate case containing low-noise pre-amplifiers. Gain was set to match the sensitivity of human observers trained to identify bird calls.
- **Noise insensitivity**: Filtering was designed to remove frequencies above and below the range of interest for the bird species being recorded. This reduces, for example, wind noise. Microphones were also fitted with open-cell foam “windsocks”.
- **Environmental tolerance**: ARUs were designed and components chosen to operate in the full range of temperatures expected in the field. Microphone cables were sheathed in metal braid to resist chewing by rodents. Electronics were protected in weather proof cases.
- **Directionality**: Each of four microphones was mounted in a recessed hole on each face of a square enclosure. This provided a degree of audio isolation of each from its neighbours. The ‘north’ microphone was labelled on enclosures to permit alignment in the field.
- **Data storage**: ARUs were fitted with secure digital (SD) cards (8 gigabyte [GB] or 32GB) as appropriate for each study. The audio sampling rate was also varied to match study, storage,

[1] Shonfield, J. and Bayne. E.M. 2017. Autonomous recording units in avian ecological research: current use and future applications. Avian Conservation and Ecology 12(1):14. https://doi.org/10.5751/ACE-00974-120114.

and analysis requirements (16.0 kilohertz [kHz] or 44.1 kHz). Files were compressed in Ogg Vorbis format (OGG) using a patent-and-royalty-free algorithm,, which provided no noticeable signal degradation. Each field recording consisted of two stereo recordings on the SD card (A and B). An audible time marker (click) was used to verify synchronization of the two stereo recordings.

- **Data identification**: Each ARU had a serial number label and was programmed with the same number in software. Recording file names contained the day of the year (DOY), hour (HH) and minute (MM) that the recording started. For example two stereo recordings would be labelled 1832110A.ogg and 1832110B.ogg. As a back-up, data were embedded within the audio file that included time, date, and serial number.

Pre-processing Data

For each survey year, field recordings from each recorder were copied from SD cards into a directory structure on a hard drive matching the respective year, study, and site. Each recording for olive-sided flycatcher and rusty blackbird was 300 seconds in length. Data from each year comprised several terabytes despite data being in compressed format. Data were kept in separate working and backup repositories.

Analysis of bird vocalizations was performed using the statistical package R[2]. In order for data to be analyzed in R, OGG files had to be converted to wave (WAV) format using either SOX[3] or LameXP[4]. It was determined that an audio bandwidth of 5.5 kHz was sufficient to recognize the species of interest in recordings. For this reason, OGG files were converted to WAV format with a sampling rate of 11.025 kHz; this reduced the storage volume of uncompressed data and speeded file reading during analysis.

[2]R (www.r-project.org), a free statistical analysis software environment. The Package 'monitoR' (https://CRAN.R-project.org/package=monitoR) was used. monitoR is described briefly in "A short introduction to acoustic template matching with monitoR." Sasha D. Hafner and Jonathan Katz. February 14, 2018 (available from www.r-project.org) and in more detail in: "monitoR: Automation Tools For Landscape-scale Acoustic Monitoring - PhD Dissertation. Jonathan Katz. The University of Vermont. May, 2015.

[3]SOX (http://sox.sourceforge.net) is a free command line application for converting formats of and processing data in audio files.

[4] LameXP (http://lamexp.sourceforge.net) is a free audio file format converter with a windows front end.

Species Detection

Templates were created from exemplars of species vocalizations (calls) of interest. MonitoR uses a method called template matching to identify species by their sounds. The method can be thought of as taking a low-resolution spectrogram and measuring its correlation against the spectrogram of a whole recording. In fact, templates can be plotted as spectrograms.

It was necessary to use multiple exemplars for a given species to cover the range in variation of calls. It was also necessary to measure correlation against other non-target sounds (calls and environmental sound) that also had a high correlation with the same species.

Due to the very large collection of recordings for analysis, a balance needed to be struck between the detail of templates used and the speed of analysis; recording analysis with detailed templates would take much longer. Attention was also paid to the duration and frequency bandwidth chosen for each template. To reduce analysis time to a practical order of magnitude, a two-step process of analysis was required.

In the first step, a limited number of low-resolution templates were used to discover candidate calls of the target species, recognizing that there would be many false positives. These candidate calls were extracted as two-second sound clips with each clip starting one second prior to the centre of the call detection and running to one second after the centre of the call. Datasets were also created at this step that included clip file name and statistics about the candidate clip. A clip spectrogram was created for each clip that was useful for validation. By the second step, the volume of data had been greatly reduced and only clips were processed. These could then be analyzed at high resolution to remove most false positives.

Classification of clips involved setting a threshold for target and off-target calls and calculating a difference between the two. A viewing system for validation was developed to allow experts to view each call (clip) as a spectrogram along with its classification and to listen to it by simply clicking on the spectrogram. Summary statistics were created for all detections to aid in validation.

Distance and Direction Estimation

Sound pressure level in decibels (SPL), which humans perceive as ‘sound volume’, has been shown to provide a good estimate of distance to a calling bird (Yip et al. 2017)[5]. Direction can be estimated using the equivalent of Interaural Level Difference (ILD); from a human perspective this would be equivalent to using sound volume as a cue about direction (Nelson and Suthers 2004)[6]. Although many automated direction estimation algorithms use Interaural Time Difference (ITD), humans do not use this for frequencies high frequencies (Roman et al. 2003)[7]. There were several

[5] Yip, D.A., Leston, L., Bayne, E.M., Sólymos, P., and Grover, A. 2017. Experimentally derived detection distances from audio recordings and human observers enable integrated analysis of point count data. Avian Conservation and Ecology 12(1):11. https://doi.org/10.5751/ACE-00997-120111.
[6] Nelson, B.S. and Suthers, R.A. 2004. Sound localization in a small passerine bird: discrimination of azimuth as a function of head orientation and sound frequency. The Journal of Experimental Biology 207: 4121–4133.
[7] Roman, N., Wang, D., and Brown, G. 2003. Speech segregation based on sound localization. The Journal of the Acoustical Society of America 114: 2236–2252. https://doi.org /10.1121/1.1610463.

reasons why we were concerned that ITD might be unreliable in our studies. Some include: low signal to noise ratios (SNR), reverberation, environmental noise like wind, etc. In addition, our recording hardware was expected to have small differences that would be more pronounced at the high frequencies of bird calls. Microphones and circuits were identical by design, but tolerances in components were not and phase errors were expected. Exact synchronization of the two stereo recordings was problematic, even with the synchronization click that was used. We concluded that ILD was the best choice.

In order to calculate distance and direction to a singing bird recorded by the four-channel recorders, it was necessary to calibrate the system using bird songs recorded at varying distances. When a singing olive-sided flycatcher or rusty blackbird was observed, the observer would record the calls using a handheld recorder (Tascam DR100-MKII). The distance of the bird from the observer was estimated using a rangefinder or waypoints taken at the observer's location and the bird's perch after it moved. Recordings were taken at approximately 20 m increasing increments until the bird could no longer be heard. Several dozen examples were collected using these techniques.

An algorithm was devised to find the peak root mean square (RMS) amplitude within each clip and convert it to a decibel value with an accurate time stamp. The four peak values were then used to triangulate the direction of the call; it was assumed that the calling bird was in the horizontal plane of the microphone array.

In the final data set, distance of the calling bird was estimated using decibel-distance curves created with field calibration recordings. Using the sound clips, distances were estimated by choosing the largest decibel value measured by the four microphones.

APPENDIX 2:
AUTOMATED RECORDER UNITS
2016, 2017, AND 2019

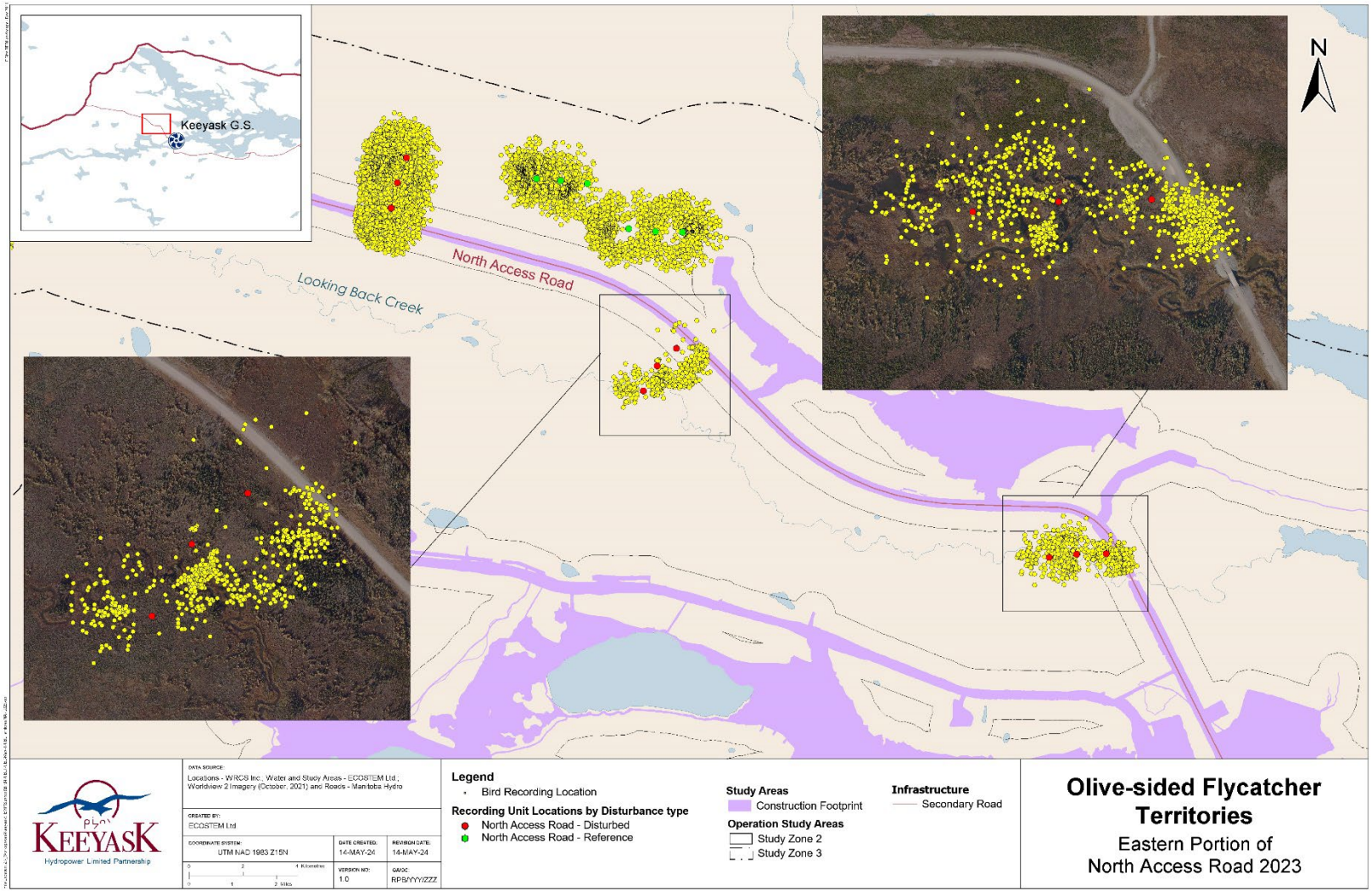
Table 2-1: Number of Territories with Olive-sided Flycatcher Recordings, 2016, 2017, and 2019

Year	Disturbance Source	Disturbed Sites			Reference Sites		
		Number of Territories	Number of Recording Days	Number of Recordings	Number of Territories	Number of Recording Days	Number of Recordings
2016	NAR	9	88	5,808	7	68	4,488
	SAR	1	10	660	1	10	660
	PR 280	8	79	5,214	4	40	2,640
	Total	18	177	11,682	12	118	7,788
2017	NAR	7	70	4,620	7	67	4,422
	SAR	0	0	0	0	0	0
	PR 280	3	30	1,980	2	20	1,320
	Total	10	100	6,600	9	87	5,742
2019	NAR	5	49	3,234	3	30	1980
	SAR	1	10	660	1	10	660
	PR 280	3	30	1,980	3	30	1,980
	Total	9	89	5,874	7	70	4,620

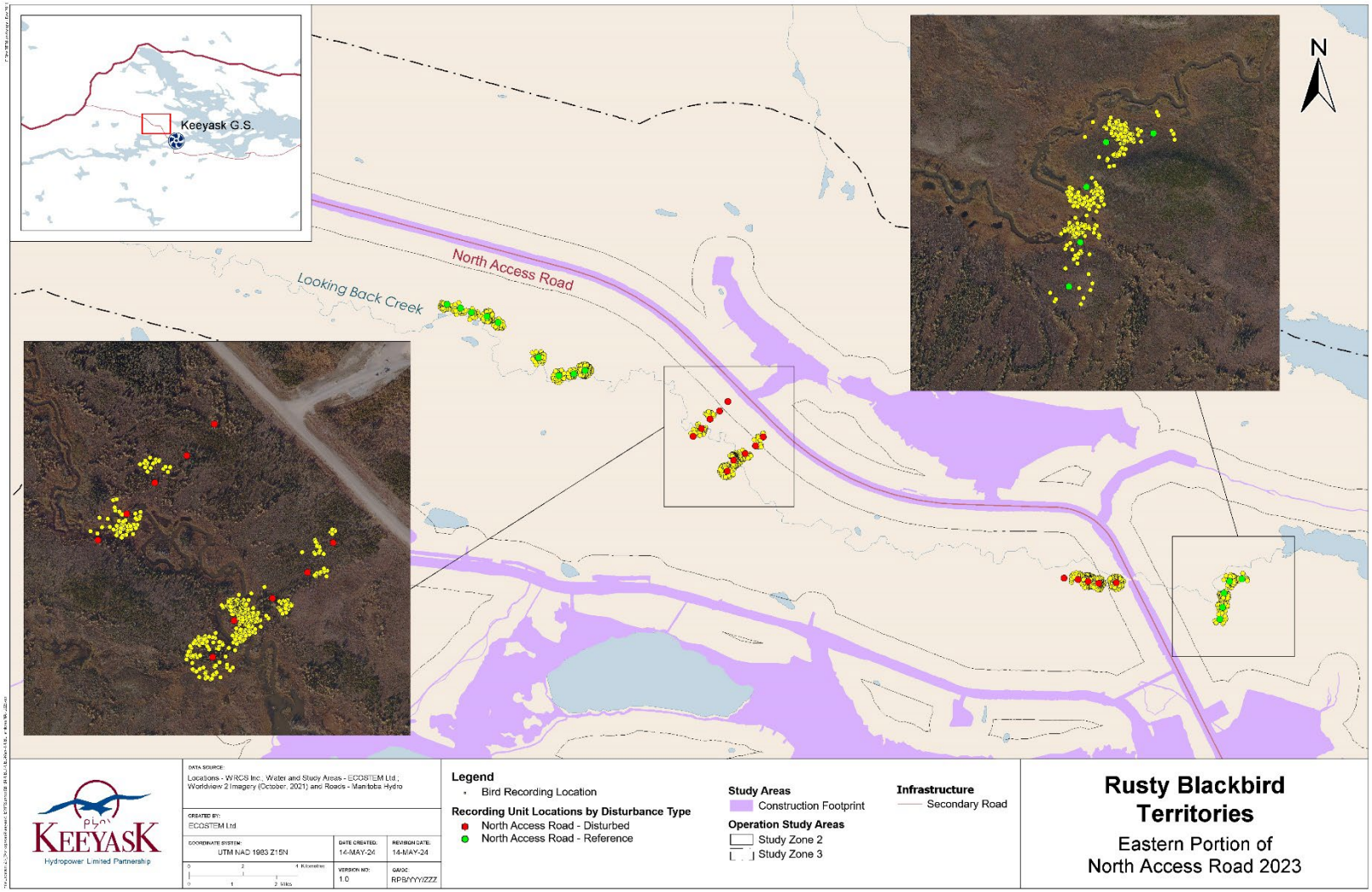
Table 2-2: Number of Territories with Rusty Blackbird Recordings, 2016, 2017, and 2019

Year	Disturbance Source	Disturbed Sites			Reference Sites		
		Number of Territories	Number of Recording Days	Number of Recordings	Number of Territories	Number of Recording Days	Number of Recordings
2016	NAR	7	70	4,620	4	40	2,640
	SAR	1	10	660	2	20	1,320
	PR 280	5	50	3,300	5	50	3,300
	Total	13	130	8,580	11	110	7,260
2017	NAR	12	120	7,920	11	110	7,260
	SAR	3	30	1,980	3	30	1,980
	PR 280	3	28	1,848	2	20	1,320
	Total	18	178	11,748	16	160	10,560
2019	NAR	9	49	5,940	9	90	5,940
	SAR	1	10	660	1	10	660
	PR 280	2	30	1,320	2	19	1,254
	Total	12	89	7,920	12	119	7,854

APPENDIX 3:
OLIVE-SIDED FLYCATCHER AND RUSTY BLACKBIRD TERRITORIES 2023



Map 3-1: Olive-sided Flycatcher Territories at the North Access Road, 2023



Map 3-2: Rusty Blackbird Territories at the North Access Road, 2023