Yukon

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Results of an analysis of recent wolverine (*Gulo gulo*) harvest in the Yukon (2015-2021)

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Government of Yukon
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Executive Summary

- Wolverine are a species of special management interest because they are a valued furbearer and listed as a species of Special Concern in the federal *Species at Risk Act*.
- Fur trapping in Yukon is spatially regulated by Registered Trapping Concessions (RTCs), where the concession holder and assistant trappers have exclusive rights to trap. Wolverine trapping is regulated seasonally with open harvest extending from 1 November to 28 February. There is no quota, but trappers must report harvest via mandatory fur sealing.
- We provide an analysis of wolverine harvest trends for the 2015–2021 trapping seasons. We used wolverine pelt sealing records and trapper-submitted carcasses to obtain data on annual harvest and sex-age structure.
- The annual wolverine harvest fluctuated from 102 to 221 wolverines per season in 2015-2021. The annual harvest increased from an average of 132 wolverines during 1988–2014, to 155 during 2015–2021. The highest annual wolverine harvest ever recorded in the Yukon was 221 animals in 2020.
- Wolverine harvest in Yukon is biased toward young males, which is desirable because population growth rates are sensitive to changes in adult female survival. The proportion of adult females in the harvest ranged between 7% and 13%.
- In 2019, the harvest season was shortened from 10 March to 28 February. This change reduced the number of wolverines harvested, but some wolverine were still harvested in March despite the regulation change.
- The sustainable harvest rate for wolverine has been estimated at ≤ 8%. Based on this threshold, the wolverine harvest is likely sustainable in much of the Yukon, but we estimated harvest rates in southwestern Yukon that greatly exceeded 8%.
- Further harvest monitoring would help determine regions where populations are possibly being overharvested. Reliable density estimates, harvest quotas or refugia, increased communication and stewardship, or a combination thereof, may be necessary in regions where harvest rates may be unsustainable, such as in southwestern Yukon.

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Introduction

Wolverine (*Gulo gulo*; **Figure 1**) are a species of special management interest because they are both a valued furbearer and listed as a species of Special Concern in the federal *Species at Risk Act*. Yet, the density of wolverine and their population trends are largely unknown across much of Canada, including the Yukon. Management of harvested wolverine populations is important because they may be susceptible to over-harvest (Weaver et al. 1996) due to their naturally low density and low reproductive output (Magoun 1985; Persson et al. 2006). Thus, management of harvested wolverine populations must balance harvest with conservation.

Few wolverine populations have been assessed for harvest sustainability (Lofroth and Ott 2007; Dalerum et al. 2008; Mowat et al. 2019), particularly at the spatial and temporal scales needed to inform management. This is especially true in remote areas, where much of the landscape remains wilderness and monitoring wildlife is costly. The sustainable harvest rate for wolverine has been consistently estimated as ≤ 8% annually for studied wolverine populations in western Canada (Weaver et al. 1996, Banci and Proulx 1999, Krebs et al. 2004, Mowat et al. 2019). Previous studies in the Yukon have indicated low to medium harvest rates (1–5%) in eastern and central regions, but high harvest rates (≥ 8%) in southwestern Yukon (Kukka et al. 2022).

In the absence of population data in Yukon, management of wolverine harvest is informed, in part, by data from harvested individuals or through analyses of spatiotemporal patterns of harvest. Regular harvest monitoring is important for identifying temporal and regional trends, particularly in the absence of quotas. While an assessment of harvest sustainability without reliable population data may be problematic, descriptive examinations using available harvest data can identify areas of concern, direct limited resources to areas that may warrant further investigation and inform the need for potential management interventions (Kukka et al. 2022). Recently, Kukka et al. (2017, 2022) assessed wolverine harvest demographics and harvest trends for 1990–2014. Here, we provide an updated analysis using data for the years 2015–2021.

Figure 1. Wolverine (*Gulo gulo*). Photo credit: D Power.

Methods

We obtained wolverine harvest data for 2015–2021 from two sources: 1) fur sealing records, and 2) biological samples from fur trappers. The former is mandatory for harvested wolverine pelts, while the latter is a voluntary program with trappers compensated $50 for each carcass or skull submitted (Kukka et al. 2017). Our data for each animal consisted of kill date, trapping concession (RTC) ID, and sex. Where available, sex was confirmed via necropsy of carcasses; otherwise, trapper-reported sex was used in the analyses. The accuracy of trapper-reported sex for wolverine is high based on our previous studies (Jung et al. 2020). We obtained age data from the animals submitted by trappers. Age was determined via cementum analysis of a premolar tooth at a commercial laboratory (Matson's Laboratory LLC, Milltown, Montana). Wolverine ≥ 2 years old were considered adults, and younger animals were categorized as young.

We examined spatiotemporal harvest trends at two spatial scales: territorial (all of the Yukon) and regional (ecoregions). Ecoregions are ecologically distinctive areas that take into account climatic and biophysical conditions at a regional scale (Ecological Stratification Working Group 1996). The Yukon is comprised of 25 ecoregions that range in size from approximately 1,000 km^2 to 50,000 km^2 (Smith et al. 2004; Environment Yukon 2016), with each ecoregion including a mean of 21 ± 19 (SD) RTCs (range = 0–75; **Figure 2**). One RTC (RTC 405 in central Yukon) was treated as a region because of its exceptionally large size (~35,000 km^2) and it functions as a community trapping area used by multiple trappers. We did not include northernmost Yukon in our analysis of harvest trends, because reliable harvest data are not available.

For each year and ecoregion, we calculated the mean annual harvest density (number of wolverine harvested/1,000 km^2). We defined five harvest density classes for the mean annual wolverine harvest: very high (≥1 wolverine harvested/1000 km^2), high (0.60–0.99 wolverine harvested/1,000 km^2), medium (0.30–0.59 wolverine harvested/1,000 km^2), low (0.01–0.29 wolverine harvested/1,000 km^2) and none (0 wolverine harvested/1,000 km^2). We based these harvest density classes on previously estimated wolverine population densities from the Yukon (5.6–9.7 wolverines/1,000 km^2; Banci 1987, Golden et al. 2007b, Slough 2007). Harvest densities that were high or very high were likely unsustainable, while those that were medium or low were likely sustainable.

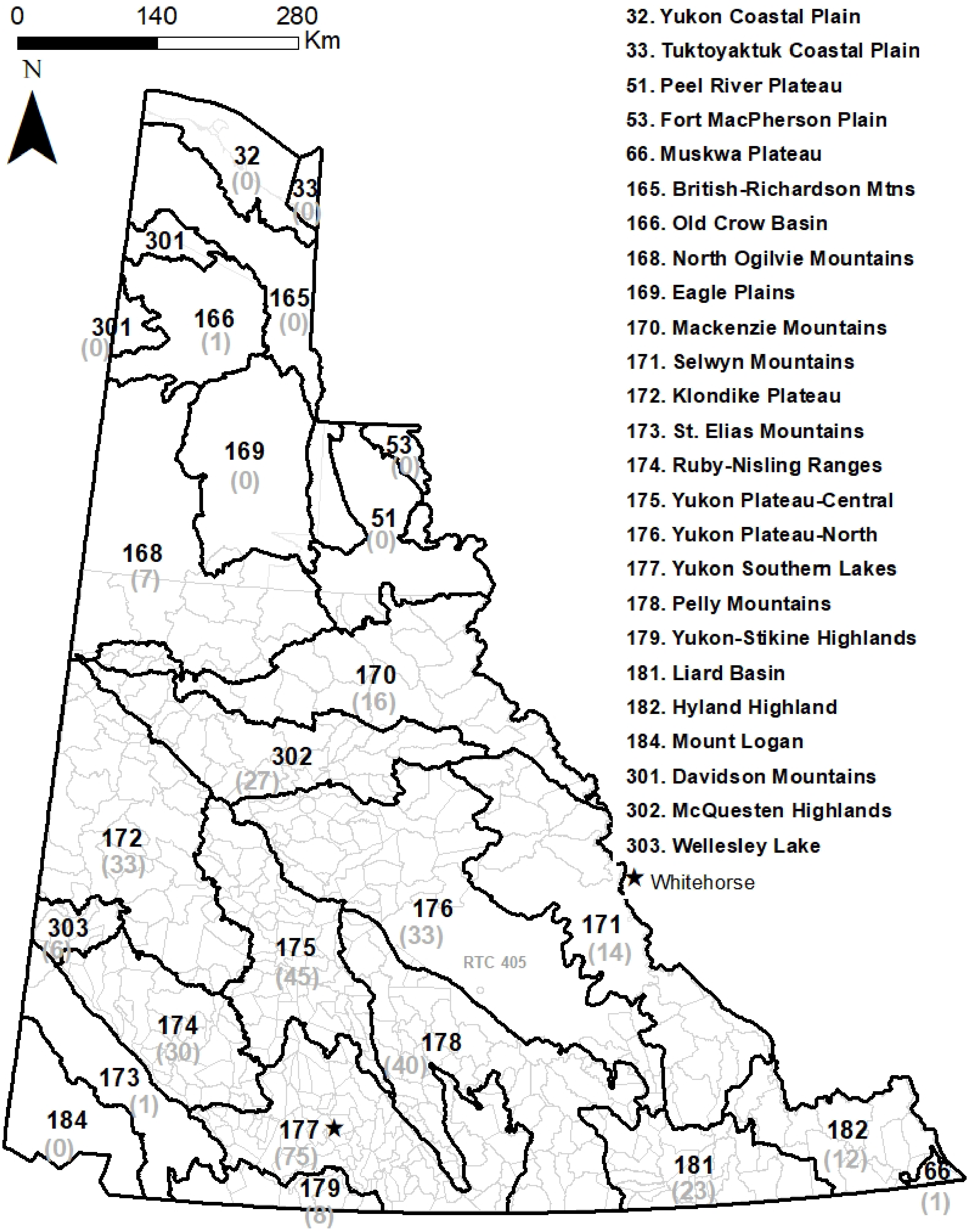

Figure 2. Map of Yukon, Canada, showing registered trapping concessions (light gray) within ecoregions (bold black). The city of Whitehorse is indicated with a star. Light gray numbers in brackets indicate the number of registered trapping concessions in each ecoregion.

Results

Spatiotemporal harvest trends

Between 2015 and 2021, 1,088 wolverines were harvested in the Yukon. The mean annual harvest was 155 ± 34 (SD) wolverines (range = 102–221). Although harvest varied annually, there was no significant trend over time. Previous study of wolverine harvest in the Yukon during 1988–2014 reported a mean annual harvest of 132 ± 31 (SD; range = 65–201; Kukka et al. 2022). In 2020, the harvest was 221 (**Figure 3**), which is the highest annual harvest of wolverine ever recorded in the Yukon.

In RTCs where harvest occurred, a mean of 2.1 ± 1.5 (SD) wolverines per RTC were trapped annually. A mean of 66 ± 11 (SD) RTCs reported wolverine harvest in a given year (18% of all RTCs [**Figure 3**]). Wolverine harvest was not evenly distributed across the territory. More wolverines were harvested in southwestern Yukon than other areas. The largest number of wolverines harvested (*n* = 474; 44%) were from the Southern Lakes and Ruby-Nisling ecoregions, which also translated to very high harvest density (wolverines harvested / 1,000km^2) in these ecoregions. Harvest density was low in the eastern areas of the territory (**Figure 4**).

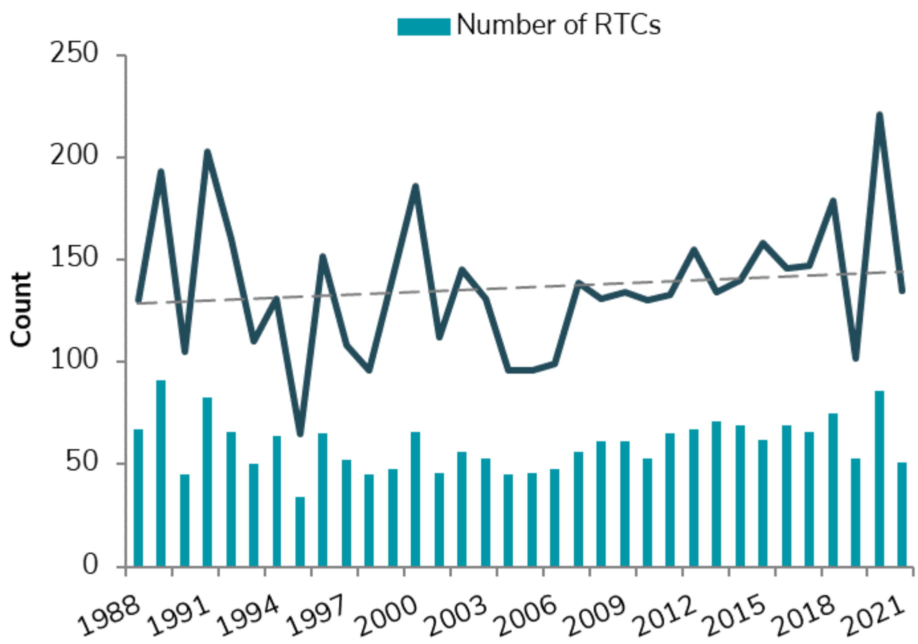

Figure 3. Annual wolverine (*Gulo gulo*) harvest and the number of registered trapping concessions (RTCs) reporting wolverine harvest in the Yukon during 1988–2021.

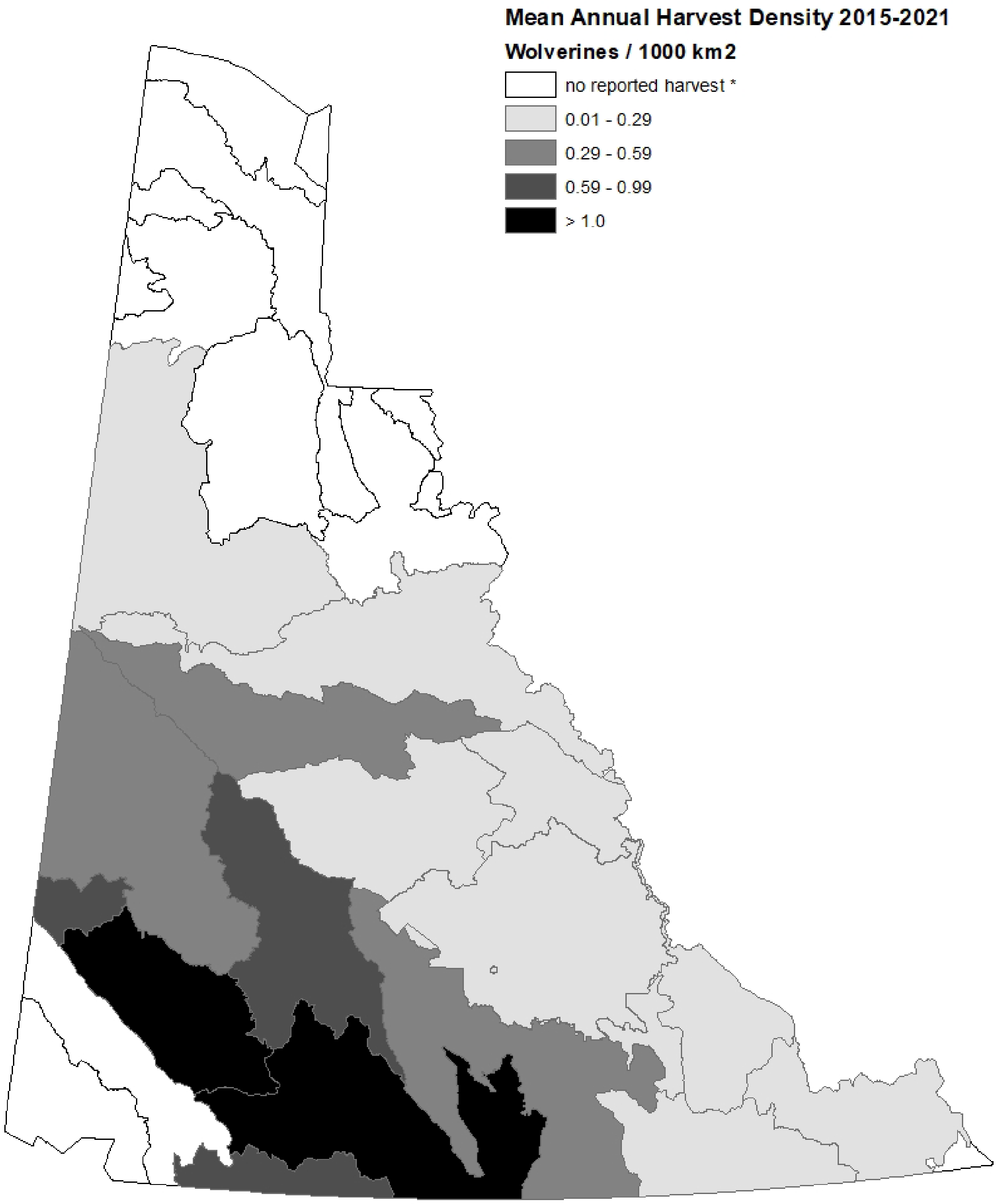

Figure 4. Mean annual wolverine (*Gulo gulo*) harvest density during 2015–2021 in ecoregions of the Yukon, Canada. Note that wolverine harvest likely occurs annually in northern Yukon, but reporting is not reliable.

Harvest sustainability

We estimated harvest rates to be mostly sustainable in ecoregions in much of central and eastern Yukon during 2015–2021. The lowest harvest rates (<1 to ≤5 %) were estimated for eastern ecoregions, such as Hyland Highland, Liard Basin, MacKenzie Mountains, Selwyn Mountains and Yukon Plateau North. In contrast, very high annual harvest rates were estimated for ecoregions in southwestern Yukon, including Wellesley Lake, Yukon Plateau Central, Yukon Stikine Highlands, Ruby-Nisling Ranges and Southern Lakes. Harvest rates were estimated to be particularly high in Ruby-Nisling Ranges Ecoregion in southwestern Yukon (Table 1).

Table 1. Estimated annual harvest rates for wolverine (*Gulo gulo*) by ecoregion, during 2015–2021, in Yukon, Canada. Values in shaded cells indicate years when estimated harvest rates included >8%, the estimated harvest rate that exceeds sustainability.

Ecoregion	Estimated wolverine population[a]	Estimated harvest rate (% of estimated population range)						
		2015	2016	2017	2018	2019	2020	2021
Hyland Highland	99–172	4–7	<1–1	<1	2–3	<1–1	1–2	1–2
Klondike Plateau	207–359	2–4	4–6	3–5	**6–10**	4–7	5–8	3–6
Liard Basin	82–142	2–4	2–4	<1–1	<1–1	1–2	3–5	<1–1
MacKenzie Mountains	188–325	<1–1	<1	<1	3–5	<1	<1	<1–1
McQuesten Highlands	143–247	4–6	5–8	3–6	4–6	1–2	4–6	5–8
Pelly Mountains	194–336	2–4	4–7	4–7	3–5	5–8	**7–13**	4–6
RTC 405	198–343	1 - 2	2 - 3	1 - 2	1 - 2	<1	4 - 8	2 – 3
Ruby-Nisling Ranges	107–185	**23 - 40**	**17 - 30**	**13 - 23**	**24 - 41**	**8 - 14**	**24 - 41**	**18 – 32**
Selwyn Mountains	135–233	2–3	2–4	<1	2–4	3–5	2–3	3–6

Wellesley Lake	24–42	**12–21**	2–4	**14–25**	2–4	**12–21**	**7–12**	<1
Yukon Plateau-Central	116–201	5–8	3–4	**14–24**	**9–15**	3–4	**13–22**	4–7
Yukon Plateau-North	162–281	3–4	<1	3–6	2–3	1–3	1–3	<1
Southern Lakes	163–283	**10–17**	**12–21**	**9 –16**	**12–20**	**10–17**	**22–37**	**10–18**
Yukon-Stikine Highlands	37–65	3–5	**17–30**	**6–11**	**8–13**	<1	**8–13**	**11–19**

[a] The estimated population size was based on wolverine population densities in the Yukon ranging between 5.6–9.7 wolverines/1,000 km^2 (Banci 1987, Golden et al. 2007b, Slough 2007).

Biological sample submissions

During 2015–2021, Yukon trappers submitted a total of 577 wolverine carcasses or skulls. Trappers reported the sex of the animal for 98% of these samples. We determined age for 98% of the wolverine samples submitted (*n* = 567).

Harvest sex-age structure

Young animals (<2 years old) constituted the majority of the harvest (66%; Figure 5). The overall sex ratio favoured males (1.9:1.0 males: females). Adult females are the most valuable demographic of wolverine population, so we examined the harvest of adult females specifically. The annual harvest of adult females ranged from 7% to 13% during 2015–2021 (Figure 6), which is similar to previous years.

The majority of the harvest took place in mid-winter, in January and February, followed by December, March and November. This pattern was similar for both adults and young animals (Figure 7).

Prior to 2019, wolverine harvest closed on 10 March, but subsequently the season was shortened to 28 February in order to protect denning females. However, wolverines were harvested in March after the season was shortened in 2019, likely as by-catch in traps set up for wolves (*Canis lupus*), whose season closed on 31 March. Regardless, the number of wolverines harvested in March, on a yearly basis, was lower after 2019, (Figure 8), indicating that the regulation change was having an effect.

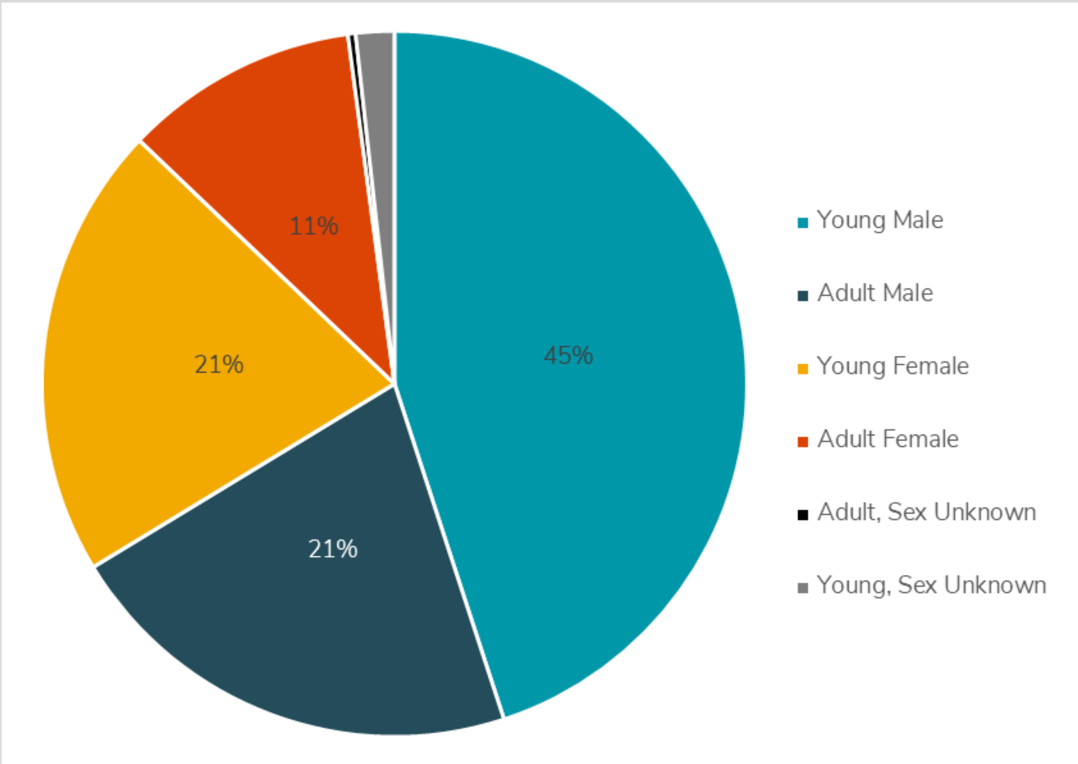

Figure 5. The percent sex and age structure of harvested wolverines (*Gulo gulo*) during 2015-2021 in the Yukon.

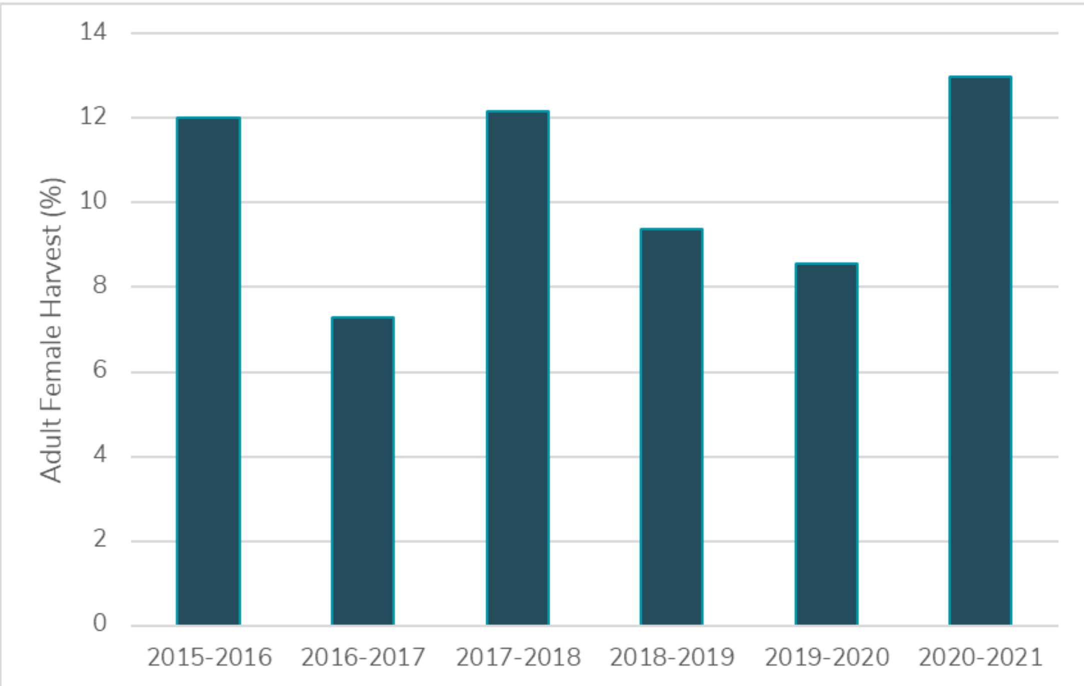

Figure 6. Percent of adult females in the wolverine (*Gulo gulo*) harvest during 2015–2021 in the Yukon.

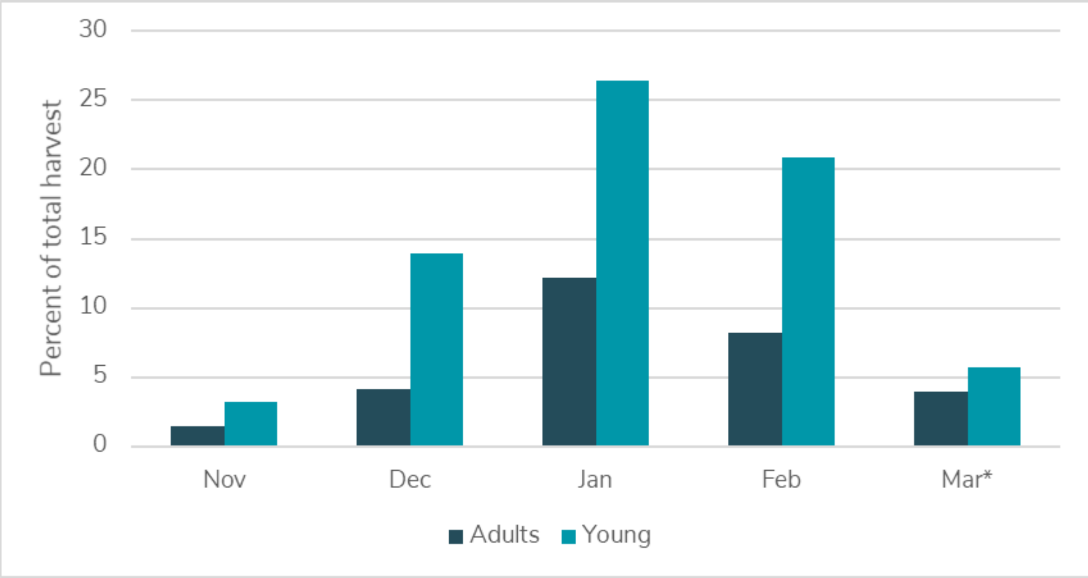

Figure 7. Distribution of wolverine (*Gulo gulo*) harvest based on age class during 2015–2021. The wolverine harvest season was shortened to 28 February beginning in 2019.

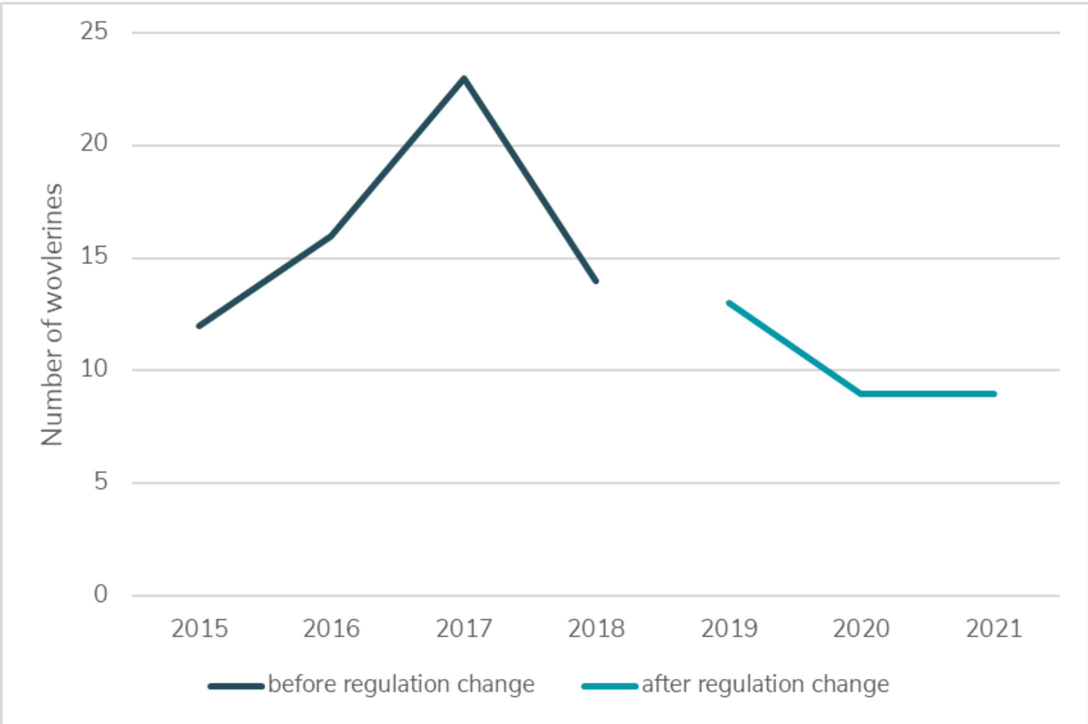

Figure 8. The harvest of wolverine (*Gulo gulo*) during the month of March before regulation change (season ended on 10 March before 2019), and after regulation change (season ended on 28 February beginning in 2019).

Discussion

The mean annual wolverine harvest during 2015–2021 was higher than reported by Kukka et al. (2022) for 1988–2014. However, it fluctuated annually from 102 wolverines harvested in 2019 to 221 in 2020, which marked the highest annual wolverine harvest ever recorded in the Yukon. Reasons for such large variation in annual harvest is unknown but likely related to trapper effort.

The spatial distribution of wolverine harvest has remained similar over time. Harvest was concentrated in southwestern Yukon, which has a higher human population and more infrastructure than elsewhere in Yukon. Wolverine harvest concentration in regions with human settlements is consistent with findings in Alaska (Golden et al. 2007a). As such, maintaining large wilderness areas with no to low wolverine trapping is likely the most important action for ensuring sustainable harvest (Kukka et al. 2022).

Wolverine harvest is likely sustainable in eastern Yukon, where we estimated harvest rates well below 8%, which is considered the maximum sustainable harvest rate for wolverine (Weaver et al. 1996, Banci and Proulx 1999, Krebs et al. 2004, Mowat et al. 2019). However, harvest rates in southwestern Yukon were estimated as very high (≥10-40%) in all years. We also estimated very high harvest rates for southwestern Yukon in 1988–2014 (Kukka et al. 2022). It is likely that high harvest rates are sustained by dispersing wolverines from unharvested areas, which includes a combination of protected areas and trapping concessions without wolverine harvest. These areas without harvest provide refugia and a source of wolverines to active trapping areas (Kukka et al. 2022). Alternatively, wolverine populations in southwestern Yukon may be higher than our density estimates, and a combination of high local abundance and a consistent source of immigration from refugia may have supported the high number of wolverine harvest in southwestern Yukon. A key caveat to our analyses of harvest sustainability is that population density was unknown; rather, we used two older estimates of density specific to the Kluane and Old Crow Flats areas. These may not be representative of all areas of the Yukon.

Trapper behaviour results in high local harvest. One strategy likely used by some focal wolverine trappers is to trap an area intensively, and then leave it untrapped for subsequent years, presumably to let it “fill up” again. This strategy likely depletes the local population, and recovery depends on immigration from adjacent areas. Thus, putative harvest refugia are important for sustaining populations in a quota-free system, and they are likely critical in sustaining harvest in southwestern Yukon.

The wolverine harvest season extended to 10 March until 2019, when it was shortened to 28 February. While wolverine harvest in March declined after the regulation change, some animals were still being harvested, likely as by-catch in wolf traps (wolf trapping extends to 31 March). Wolverine harvest in March is an ethical concern because pregnant female wolverines are likely in advanced stages of gestation or are already in dens with kits (Kukka et al. 2017). Increased outreach and training to trappers to avoid wolverine by-catch in wolf snares in late winter is recommended.

In conclusion, in the absence of quotas, wolverine harvest in the Yukon likely relies on harvest refugia. Further monitoring of wolverine harvest would help determine where populations are possibly being overharvested. Reliable density estimates, increased communication and stewardship, and additional regulations (e.g. harvest quotas or refugia) may be necessary in regions where harvest rates may be unsustainable, such as in southwestern Yukon.

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