MEMORANDUM

State of Alaska

Department of Fish and Game
Division of Wildlife Conservation

TO:	Tom Schumacher Regional Supervisor Division of Wildlife Conservation Douglas	DATE: TELEPHONE: FAX:	12 January 2023 465-4265 465-4272
FROM:	Ross Dorendorf Area Management Biologist Division of Wildlife Conservation Ketchikan	SUBJECT:	GMU 2 Wolf Population Estimate and Management Update

Since 2013, the Alaska Department of Fish and Game (ADF&G) has estimated the size of the fall Game Management Unit (GMU) 2 wolf population (Fig. 1) using a DNA-based mark-recapture technique (Roffler 2016, 2017, 2018; Roffler et al. 2016, Roffler et al. 2019). Each fall we collect wolf hair using an array of scented hair traps distributed throughout northcentral Prince of Wales Island (POW). Individual wolves are identified by genotyping DNA extracted from follicles of hair trapped on hair boards. Those individual IDs along with dates and locations where individual wolves were detected or harvested are used to calculate a population estimate using a spatially-explicit capture-recapture model (SECR; Efford et al. 2004). This method requires detecting some individual wolves more than once in different locations (Fig. 2). Since 2016 the Hydaburg Cooperative Association (HCA) has collaborated with ADF&G and the U. S. Forest Service (USFS) to operate their own network of hair traps (Fig. 1).

Fieldwork, lab analysis, and calculating an estimate takes 8-10 months, so each year's estimate is used to inform harvest management in the following year. For example, the estimate from fall 2021 is the most recent estimate and was used to inform GMU 2 wolf harvest management during the fall 2022 hunting and trapping seasons. Trapping and hunting season lengths are set to allow sufficient harvest opportunity to maintain the fall GMU 2 wolf population within the objective range of 150-200 wolves as set by the Alaska Board of Game. However, since that population objective was set, new information on low genetic diversity, a greater than expected potential for inbreeding depression, and potential bias in population estimates used to set the population objective has emerged. To ensure sustainability of the GMU 2 wolf population, ADF&G is conducting research and analyses on these topics and managing for a fall population greater than the current objective range.

Fall 2021 Wolf Density Estimate

In fall 2021 we established an array of 83 nodes with 5 hair boards each for a total of 415 scented hair boards, throughout a large north-central POW sampling area (Fig. 1). Nodes were monitored weekly 28 September–11 December 2021 by ADF&G and USFS staff. HCA established 29 nodes with a total of

145 hair boards in the same area monitored 2016–2020 south of the ADF&G study area (Fig. 1). HCA monitored nodes weekly 7 October–8 December 2021.

During fall 2021 ADF&G and HCA collected a total of 1,317 hair samples (Table 1). After removing 513 samples from species other than canids, we tested 804 samples for individual identification using a panel of 15 microsatellite loci. Of the 804 samples analyzed, 367 produced genotypes identifying individual wolves, 197 samples were mixtures of two or more individuals, and 240 failed to produce a genotype. Mixed samples (hairs from two or more individuals) cannot be genotyped to individuals. When initial testing indicates a mixed sample, the lab selects single hairs for DNA extraction. Of 121 single hair extractions 36 produced genotypes identifying individual wolves. In addition to hair, we also collected tissue samples from 64 wolves harvested and sealed in GMU 2. All produced individual identifications. In total during fall 2021 we detected 107 individual wolves a total of 245 times (Table 1). The fall 2021 GMU 2 wolf population estimate was calculated using those data.

Unusually heavy snow during late November and early December 2021 hindered access to study areas and reduced the effectiveness of hair boards. ADF&G and HCA staff clear snow from hair boards during weekly checks, but between checks snow can accumulate. Wolves detect and roll on hair boards under snow, but snow can interfere with the board's ability to collect hair. During the final week of hair board checks, ADF&G staff could not access over half of our hair board nodes. HCA was also unable to access portions of their lines during the final two weeks, and due to staffing issues, was unable to run three of their normal six hair board lines. Despite these challenges, we collected about the same number of canid hair samples as in 2020. However, the number of individual wolves identified from hair samples in 2021 was lower than in 2019 or 2020 (Table 1).

We used SECR models to estimate the density and size of the wolf population in our area of analysis (7,684 km^2, 85% of GMU 2) and in GMU 2 (Fig. 1). The fall 2021 density estimate produced by the top-ranked SECR model was 29.9 ± 3.3 wolves/1,000 km^2, 95% CI [26.6–33.2 wolves/1,000 km^2], CV = 0.11. Using this density estimate to predict the number of wolves in the area of analysis resulted in an estimate of 235.4 ± 25.9 wolves, 95% CI [189.9–291.8], and a fall 2021 population estimate for GMU 2 of 268.0 ± 29.5 wolves, 95% CI [216.2–332.3] (Table 2, Fig. 3). The fall 2020 density estimate was 44.0 ± 4.8 wolves/1,000 km^2, 95% CI [35.5–54.5 wolves/1,000 km^2], which produced an estimated GMU 2 population size of 385.6 wolves, 95% CI [320.7.0–471.6] (Table 2, Fig. 3). The fall 2020 and fall 2021 population estimates are statistically different, however, the 2019 and 2021 estimates are indistinguishable suggesting that the GMU 2 wolf population may be stable.

Interpreting Estimates and Harvest Management

For fall 2021 ADF&G estimated the GMU 2 population to be within the range of 216 to 332 wolves (95% confidence interval) with a point estimate of 268 wolves. Within that range of plausible values, ADF&G bases harvest management on the point estimate because that is the value most likely to be correct given the data collected that year. However, that is an estimate, and the true number of wolves is likely to be somewhat higher or lower than the point estimate, so ADF&G encourages the public to focus on long-term trends in abundance and harvest, rather than on year-to-year changes. Those trends indicate the population is stable and that harvest is sustainably managed.

Although ADF&G's GMU 2 wolf population estimates have always been reasonable and consistent with the DNA collected, a recent analysis suggested some of the earlier estimates may have been biased low, underestimating the true population size. That analysis also indicated that expanding the area sampled [ADF&G study area expanded in 2015, HCA's study area added in 2016 (Fig. 1)] and greater availability of samples from harvested wolves since 2019 all contributed to increases in total samples available and estimates of population size.

When sampling is representative, an increase in samples should have a small effect on the estimate and a greater effect on the precision of the estimate. However, the substantial increases in population estimates in 2016 and 2019 (Fig. 3) suggest that the expanded study area is more representative of GMU 2 and that sampling at hair boards is less representative than originally thought with some subset of wolves (e.g., sex or age class, social hierarchy, pack association, etc.) less likely to be detected at hair boards than other wolves. If hair boards are biased in detecting a certain group of wolves, those wolves will be under-represented in the population estimate biasing estimates low. Samples from harvested wolves help offset any bias in hair board samples and contribute toward more accurate population estimates. ADF&G is continually investigating ways to improve sampling and account for bias.

When setting the current fall population objective (150–200 wolves) the Alaska Board of Game referenced population estimates from 2014-2017. If those estimates were biased low, the population objective in regulation may be set too low. The department is evaluating whether new information indicates the population objective should be changed. That may include conducting a population viability analysis (PVA) and continued research on the genomics of GMU 2 wolves.

Ongoing and Future Research

<u>Genetics</u>

A department-sponsored graduate student found that wolves in GMU 2 are largely reproductively isolated from wolves in neighboring GMUs and that wolves in the GMU 2 breeding population are closely related to each other (Zarn 2019). Breeding among closely related individuals can lead to inbreeding depression, a condition where unfavorable genetic traits are more likely to be expressed in offspring because both parents are more likely to carry genes for the unfavorable trait. Inbreeding depression can lead to population declines. Zarn (2019) found that wolves in Unit 2 are inbred at levels similar to wolves on Isle Royale National Park, an island in Lake Superior. Wolves colonized Isle Royale in 1948 by crossing an ice bridge from Canada. The population grew to about 50 individuals but as a result of inbreeding depression declined to 2 wolves and became functionally extinct by 2016 (Robinson et al. 2019). Wolves in GMU 2 are likely less vulnerable to inbreeding depression because GMU 2 has a larger land area and wolf population than Isle Royale. Further, no signs of inbreeding depression have been detected in GMU 2. However, to ensure sustainable management, additional investigation into population structuring, trends in genetic diversity, and rates at which immigrants from outside GMU 2 join the GMU 2 breeding population is required. The department in coordination with our collaborators at the National Genomics Center for Wildlife and Fish Conservation will conduct an in-depth analysis on the genomics of wolves throughout the region with a focus on GMU 2. Initial findings are expected in about two years.

<u>Camera-Based Wolf Population Estimate</u>

A department sponsored graduate student from the University of Alaska Fairbanks began a project to estimate the density of wolves in Unit 2 using camera-based approaches (e.g., Moeller et al. 2018). Cameras were deployed in 2021 and 2022 as a part of a multi-year study. That student left the program in 2022 and the university has recruited a new student to continue the project. Camera methods have the potential to simultaneously estimate density and trend of multiple species including wolves, deer, and black bears. The focus of this effort is to evaluate camera methods for wolves. If successful, camera methods could complement or replace the genetic capture-recapture method currently used. Upon selection of a new student, the department anticipates results from this study in 2027.

<u>Population Viability Analyses</u>

PVAs are a modeling tool used to identify information needs and for evaluating management scenarios. Like all modeling exercises, the outcome of a PVA is heavily reliant on the quality of available information, validity of the assumptions made, and model design. Therefore, choices over which data and assumptions to include influence the outcome. Because PVAs are reliant on the choices of data and assumptions, a PVA should not be the only source of information used when setting a population objective for GMU 2 wolves. A PVA used within the department’s current adaptive management strategy may provide useful new insight for Unit 2 wolf management (Boyce 1992). Department staff are best positioned to conduct an informed PVA and likely will engage in that process over the next few years.

Figure 1. The wolf population area of analysis (6,843 km^2) and hair trap nodes (5 hair boards per node) used during fall 2021 in Game Management Unit 2.

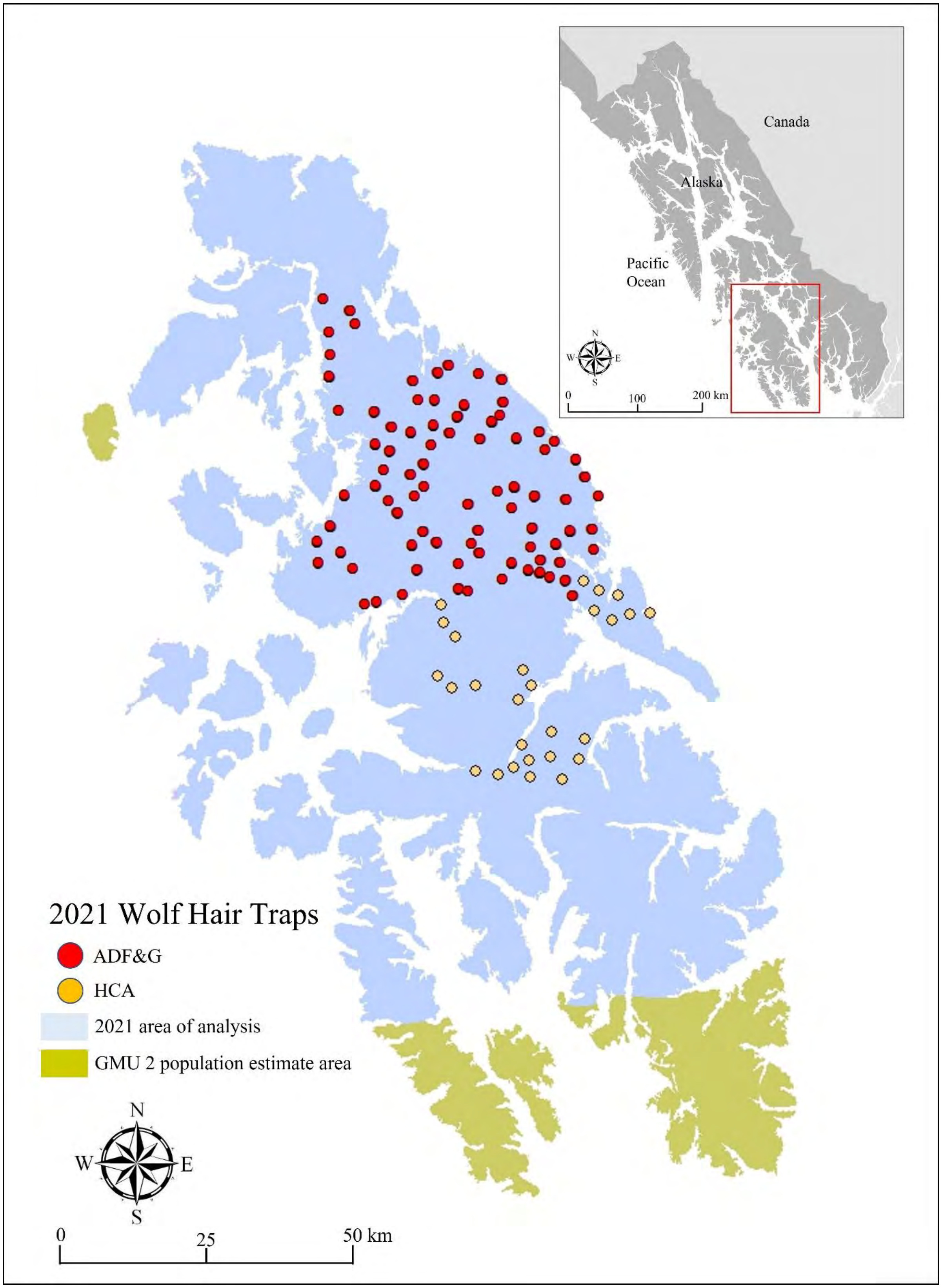
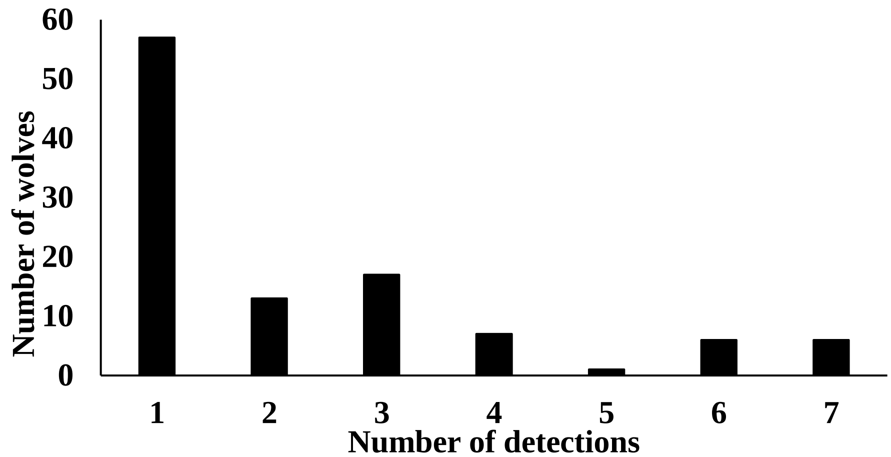


Figure 2. Number of times an individual wolf was detected at either a hair board or from harvest during fall 2021 in Game Management Unit 2. For example, 57 wolves were detected once, 13 wolves twice, and so on.



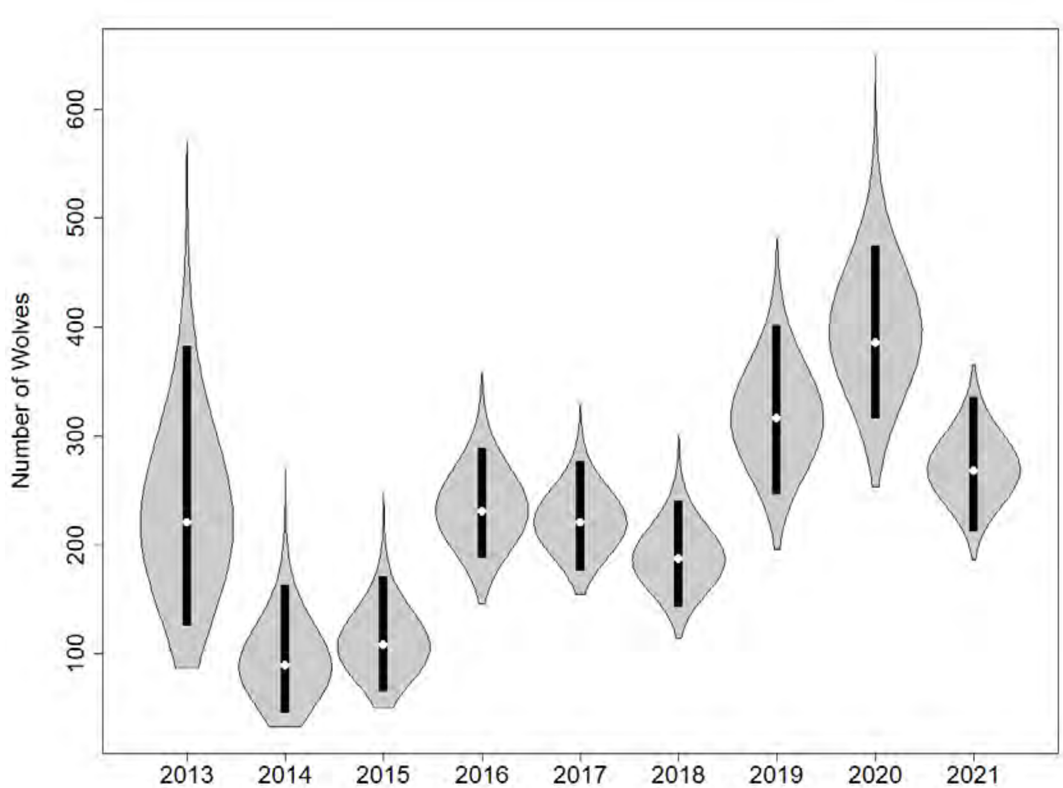


Figure 3. Violin plot of fall wolf population estimates during 2013–2021 for Game Management Unit 2. White dots represent the point estimates used for managing harvest, black bars represent the 95% confidence intervals, and violin plots (grey shapes) represent the probability density of the population estimates. Wider horizontal ranges are associated with more likely values of the population estimate. The point estimates for each year are located at the widest portion of their respective violin plot.

Table 1. Samples collected and genotyped for fall 2019, 2020, and 2021 Game Management Unit 2 wolf population estimates.

Samples	2019	2020	2021
Hair collected from hair boards	807	1,010	1,317
Hair identified as canid	584	827	804
Hair successfully genotyped	385	398	435
Individual wolves identified from hair	93	86	70
Tissue collected from individual harvested wolves	164	64	64
Individual genotypes identified from harvested wolves	163	64	64
New wolves detected through harvest	129	48	37
Total individual wolves detected	222	134	107

Table 2. Fall wolf population estimate and 95% confidence intervals (CIs) during 2013–2021 for Game Management Unit 2.

Year	Population estimate	95% CIs
2013	221	130–378
2014	89	50–159
2015	108	69–167
2016	231	192–285
2017	225	198–264
2018	187	147–236
2019	316	250–398
2020	386	321–472
2021	268	216–332

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This and earlier GMU 2 wolf survey memos can be found on ADF&G's website at: https://www.adfg.alaska.gov/index.cfm?adfg=wolf.resources