

Skagit Wildlife Research Grant Program

Final Report

Period Covered: 1 March 2003 - 31 December 2005

Project Title: Mountain Goat Habitat Relations in the North Cascades, Washington
Grant Number: 2003-02

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I. Project description

The purpose of this project is to provide a rigorous study of habitat distribution and use for mountain goats in the North Cascades, Washington. This involves capturing at least 20 mountain goats and fitting them with global positioning system (GPS) tracking collars which will be used to study their movements in detail. These movements will be analyzed with reference to geographic and ecological variables in the North Cascade Mountains to evaluate the extent of real and potential habitat and gain an understanding of requirements and choices for mountain goats in meeting their daily requirements on a seasonal basis. In addition, collared mountain goats will be used in the refinement of survey protocols for this species.

II. Results

Of the 50 mountain goats captured to date on this project, 22 were in the North Cascades (Table 1, Fig. 1). As expected, all collars did not function correctly, and 2 were replaced (on 018MPF and 016MBF). Many continue to function and to lengthen their utility (by reducing battery drain), the schedule of fixes for these collars has been changed from 8 to 2 fix attempts per day for collars that have been in the field for more than 2 years. This applies to the 12 currently functioning collars (Table 1). Another 8 collars are in the field but apparently not working at present, and 2 were on mountain goats that died (023WCF and 033GPF – 2 of 22 mortalities in well within expected natural mortality rates). Altogether, we have location information covering 10,492 days consisting of 55,424 fixes.

Movements of these collared mountain goats have been very informative about their space use. For animals for which we have fixes for at least 300

Table 1. Summary of 22 North Cascades mountain goats captured and fitted with GPS collars for habitat studies.

| Mountain Goat ^a | First Fix | Last Fix | Days | Fixes | sq km | Daily Mean Elev. (m) | | Status ^b |
|----------------------------|-----------|----------|-------|-------|-------|----------------------|------|---------------------|
| | | | | | | Min | Max | |
| 008SHF | 09Aug03 | 24Aug05 | 732 | 4837 | 8.5 | 474 | 1867 | OK |
| 010MBM | 03Sep03 | 21Apr05 | 589 | 2897 | 27.0 | 884 | 2095 | NC |
| 011MBM | 03Sep03 | 31Oct03 | 59 | 400 | 10.1 | 667 | 1746 | NC |
| 012MBM | 05Sep03 | 31Oct03 | 57 | 368 | 5.6 | 1287 | 2063 | NC |
| 013MBF | 03Sep03 | 22Feb05 | 516 | 2901 | 8.9 | 1043 | 2116 | NC |
| 014MBF | 04Sep03 | 05Aug05 | 666 | 3352 | 14.9 | 783 | 2084 | OK |
| 015MBF | 03Sep03 | 04Apr05 | 559 | 2744 | 14.6 | 797 | 1837 | NC |
| 016MBF | 04Sep03 | 21Apr05 | 348 | 1609 | 8.6 | 1119 | 1930 | NC |
| 017CMF | 04Sep03 | 18Oct05 | 775 | 5111 | 5.7 | 1099 | 1842 | OK |
| 018MPF | 04Sep03 | 15Aug05 | 399 | 2466 | 13.1 | 1061 | 2010 | OK |
| 019MBF | 04Sep03 | 13Sep04 | 307 | 1465 | 14.7 | 511 | 1859 | NC |
| 020WHM | 14Sep03 | 12Nov05 | 772 | 4274 | 25.0 | 712 | 1663 | OK |
| 021WHF | 04Sep03 | 10Aug05 | 643 | 3015 | 12.3 | 426 | 1865 | OK |
| 022TFF | 05Sep03 | 09Nov05 | 763 | 3456 | 8.6 | 372 | 1783 | OK |
| 023WCF | 05Sep03 | 16Nov03 | 73 | 422 | 4.6 | 866 | 1855 | Mortality |
| 026RLF | 15Sep03 | 17Jul05 | 644 | 2522 | 8.7 | 814 | 1929 | OK |
| 027FCF | 15Sep03 | 15Nov05 | 759 | 4000 | 5.0 | 709 | 1659 | OK |
| 028SHF | 16Sep03 | 23Jul05 | 616 | 3308 | 12.7 | 516 | 1541 | OK |
| 029MBM | 16Sep03 | 11Feb04 | 124 | 394 | 3.4 | 693 | 1250 | NC |
| 033GPF | 09Jul04 | 22May05 | 318 | 1940 | 13.1 | 1316 | 2379 | Mortality |
| 034GPF | 09Jul04 | 23Aug05 | 404 | 1969 | 17.7 | 957 | 2184 | OK |
| 047LMF | 27Oct04 | 31Oct05 | 369 | 1974 | 10.8 | 717 | 1630 | OK |
| Total | | | 10492 | 55424 | | | | 22 |

^aThe last letter of the mountain goat designation indicates its sex.

^bOK = functioning, NC = no contact at last attempt.

days, the difference between maximum and minimum daily mean elevation was as small as 744 m (017CMF) and as great as 1400 m (021WHF and 022TFF), showing quite a large difference in response to winter movements to lower elevations. Elevation range was strongly related to minimum elevation but not to maximum elevation. Further analysis of the responses of mountain goats to winter conditions is planned.

For animals for which we have fixes for at least 300 days, males ranged over larger areas (25 and 27 km²) than most females, which covered an average of 11 km² (range 5 – 18 km²).

Apart from general movements within seasonal ranges, these mountain goats have exhibited 2 types of movements of particular interest: seasonal shifts apparently in response to winter weather and excursions from seasonal ranges.

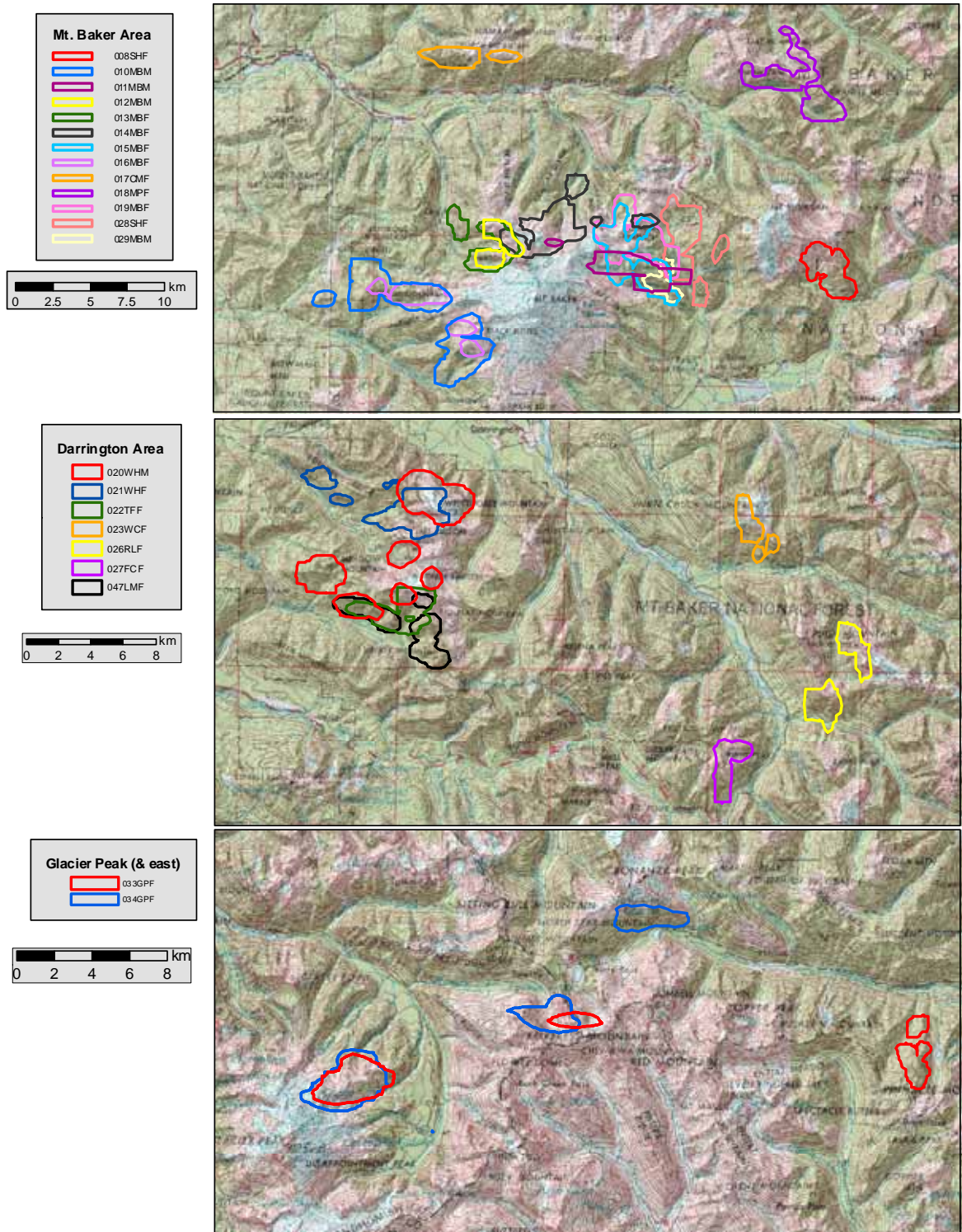


Figure 1. Range of North Cascades Mountain Goats determined by GPS tracking.

As shown by the elevation data, seasonal shifts varied considerably among individuals. For season shifts, some individuals shown a marked shift in

range. For instance, 014MBF moved from Handley Peak down the Bar Creek valley about 3.5 km, 019MBF moved from the Coleman Pinnacle area about 3.5 km to the bottom of Swift Creek, and 022TFF moved from the south side of Three Fingers about 3 km to the slopes above the South Fork of Canyon Creek (Fig. 1). In contrast, the seasonal use of area by 017CMF was virtually the same summer and winter, with only a moderate elevation shift (Fig. 1, Table 1).

Several mountain goats showed short-term movements out of their usual range. For example, 014MBF made three excursions from Hadley Peak to the southeast slopes of Ptarmigan Ridge (6 km), and 017CMF made one excursion of 6 km from Church Mountain beyond Excelsior Pass. Judging from similar movements by mountain goats in other parts of the state, 014MBF's movements were probably to a mineral lick below Ptarmigan Ridge. This seems a less likely explanation for 017CMF's excursion because there is no defined cluster of locations at the end of the excursion and it took place in mid-August, while most excursions to mineral licks have taken place in June or July.

The most noteworthy movements of this type were by 033GPF and 034GPF. These are two of the 50 or so animals that congregate on Gamma Ridge on the northeast side of Glacier Peak early every summer. In marked contrast to seasonal movements, these animals disperse from that area by late summer. It appears most likely that these movements are to take advantage of the natural mineral lick between Gamma Peak and Dusty Creek. 034GPF left Gamma Ridge on 27Jun04 and with a brief pause on Fortress mountain, moved 17 km to the northeast to the south side of Bonanza Peak (Fig. 1) where she remained until she returned to Gamma Ridge on 10Jun05. She stayed on Gamma Ridge until 05Aug05, when she returned to Bonanza Peak where she still is. 033GPF left Gamma Ridge in 2004 on 10Aug, traveling 30 km to Pinnacle Peak above Lake Chelan. She died there in the spring of 2005. Although it was known that mountain goats deserted Gamma Ridge during the summer, it is evident that they travel a considerable distance. We currently plan to collar additional mountain goats on Gamma Ridge in 2006 to better understand this phenomenon.

To gain a formal understanding of the habitat requirements of mountain goats in the Cascade Range, locations obtained from tracked mountain goats will be modeled with landscape characteristics to produce an evaluation of mountain goat habitat. This work is being carried out by Adam Wells, a graduate student at Western Washington University, with supervision by Professor David Wallin.

A necessary preliminary to a habitat model is a model of GPS across the landscape. This needs to be done because the GPS fixes obtained from collared mountain goats is biased toward locations favorable for GPS fix

acquisition. By modeling fix acquisition probability, habitat analysis can be corrected for this bias (at least partially) by weighting each fix by the inverse of its probability of acquisition. To provide the data for the development of the fix acquisition probability model, collars were placed for 24 or more hours at 543 strategically selected locations throughout the Cascade Range. The acquisition rates are currently being modeled according to the physical and vegetative landscape characteristics.

The mountain goat habitat model developed for another partner in the project (Sauk-Suiattle Tribe) will be developed this spring, but a preliminary model showed that our approach is viable (Fig. 2).

III. Financial information

Expenditures grant funds during the last period of the grant were:

| Category | Item | Expenditures |
|-------------------|-----------------------------|---------------------|
| Personal Services | Technician/Graduate Student | 1,003.92 |
| | Total | 1,003.92 |

IV. Partnerships

Expenditures by partners toward this project during the last period of the grant were approximately as follows:

| Agency | Goods and | | Total |
|---------------------------------|------------------|-----------------|--------------|
| | In Kind | Services | |
| Department of Fish and Wildlife | 17,286 | 0 | 17,286 |
| Western Washington University | 2,500 | 0 | 2,500 |
| U.S. Forest Service | 1,500 | 0 | 1,500 |
| Sauk-Suiattle Tribe | 11,716 | 0 | 11,716 |
| Total | 33,002 | 0 | 33,002 |

V. Publications

A manuscript on the GPS acquisition probability model has been prepared and will be submitted once final analysis has been completed. This and the mountain goat habitat model will constitute Adam Wells' master's thesis.

VI. General evaluative statement on the project

Progress on the mountain goat habitat studies project has been good. We captured and tracked 22 mountain goats in the North Cascades and monitored 5 of them for more than 2 years, 10 of them for 1-2 years, and 7 of them for less than 1 year. Although the uneven representation due to failing collars is less than optimum, our sample is sufficient for the analysis we intend, especially when combined with data from other parts of the state.

Extensive testing of GPS collars at specified field sites will provide the basis for adjusting the analysis for the inherent bias in tracking with GPS collars.

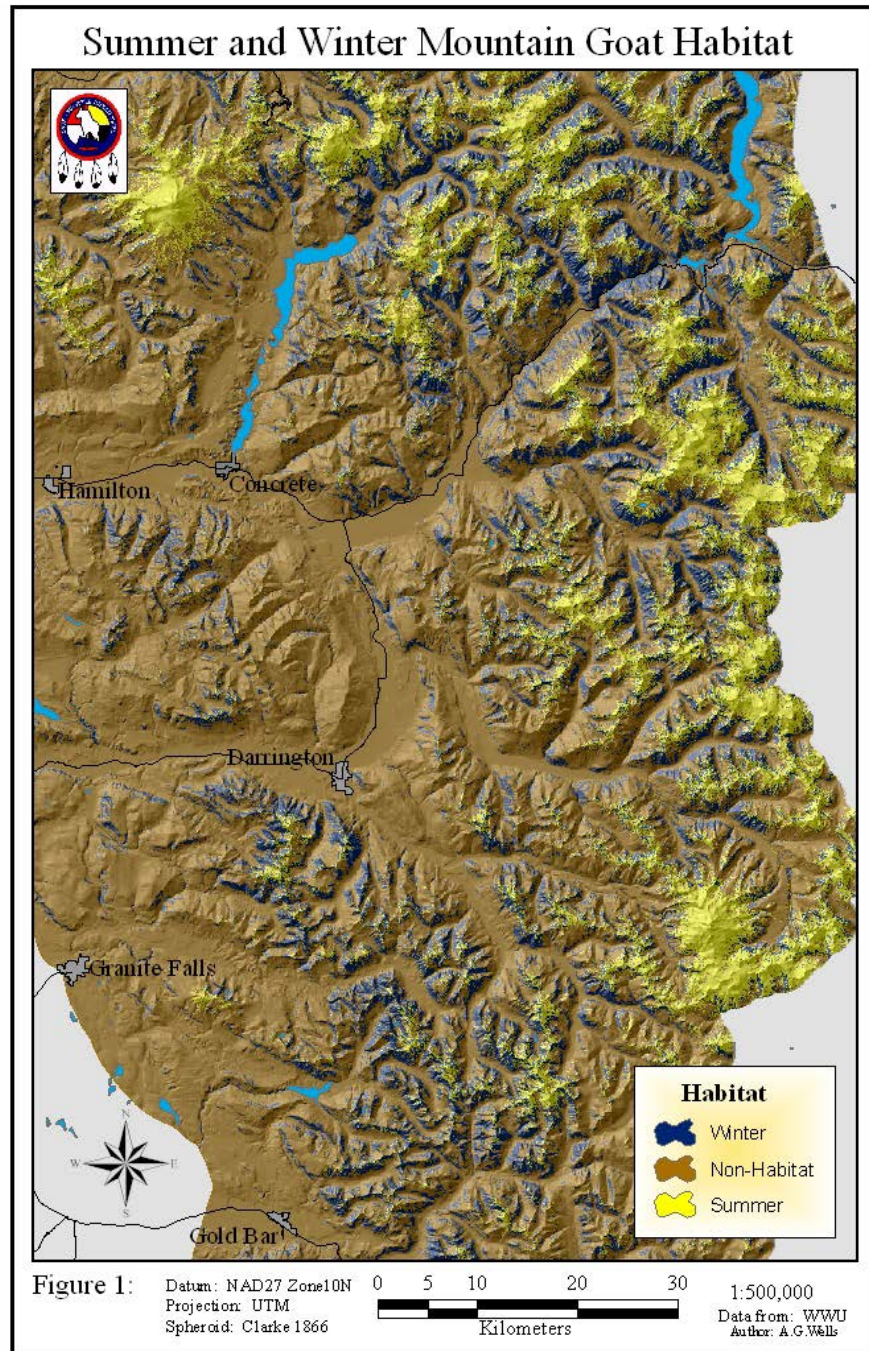


Figure 2. Preliminary mountain goat habitat map (from Wells, A.G. and Wallin, D.O. undated. Seasonal habitat analysis of mountain goats (*Oreamnos americanus*) in the North Cascades of Washington state. Report to the Sauk-Suiattle Indian Tribe. 6 pp).

This work is nearing completion, which will set the stage for the development of the habitat model to take place in spring 2006.