

INITIAL OBSERVATIONS ON A TAGGED MOUNTAIN GOAT POPULATION  
IN THE OLYMPIC MOUNTAINS

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INTRODUCTION

The perspective on goats in Olympic National Park is contrary to that of many goat range managers. The Park has too many. In a National Park, one individual of a non-native species is theoretically too many, and mountain goats are a non-native species. By an accident of history, goats did not invade the Olympic Mountains. In 1926, in an effort to correct that oversight, state and federal officials introduced four individuals from the Selkirks in Alberta. During the next four years goats obtained from Alaska, in exchange for Roosevelt elk calves, provided animals for two more introductions, approximately 11. The hopes of establishing another big game species on the peninsula for hunting purposes were damped by the establishment of Olympic National Park in 1933 on at least 95% of the potential goat habitat.

In the 50 years since the introductions the goats have dispersed throughout the mountainous interior and eastern portion of the peninsula and the total population has grown to an estimated 1,000 individuals (Moorhead 1977, Figure 1). A few of these find their way out of the park each fall and there is a legal hunting season on the periphery. Of the 20 archery permits allotted each year, 3 to 8 goats are taken.

The Park Service has initiated the present study to assess the immediate and potential impact of goat use on the ecosystem. Their man-

agement policies state that "control or eradication of exotic species will be undertaken when their presence threatens the perpetuation of significant scientific features, ecological communities and native species ...." (Olympic National Park 1973). Of particular concern is the handful of endemic plants and their relationship with the goats with whom they now share their mountainous habitat. One species, Senecio newwebsterii has already been documented as goat forage (Olmsted 1977).

#### METHODS AND MATERIALS

Effective control is based on a sound understanding of the dynamics of the population and its habitat requirements. To begin an assessment of the former, a tagging operation was initiated in June, 1977, and by September, 1977, 68 animals were tagged with individually identifiable ear tags. The data collected to date is being used to monitor movements and to estimate population parameters.

The major focus during 1977 was on the largest, densest and most accessible herd in the park. Its range is the area on and around Mt. Angeles and Klahhane Ridge in the northeast section of the park. From 1972 to 1976 the Park Service and the Game Department cooperated on a tagging operation in this area. A total of 34 animals were tagged with colored ear ribbons of which 14 are estimated to be still in the population. Most of these tags are not individually identifiable. Last summer we tagged 54 goats on Klahhane Ridge with numbered tags that can be identified at approximately half a mile with a 60 x power scope. The remaining 14 were tagged in the Lake Constance area in the east-central area of the park. The goats on Klahhane Ridge were captured primarily by snaring at an artificial salt lick which was established several years

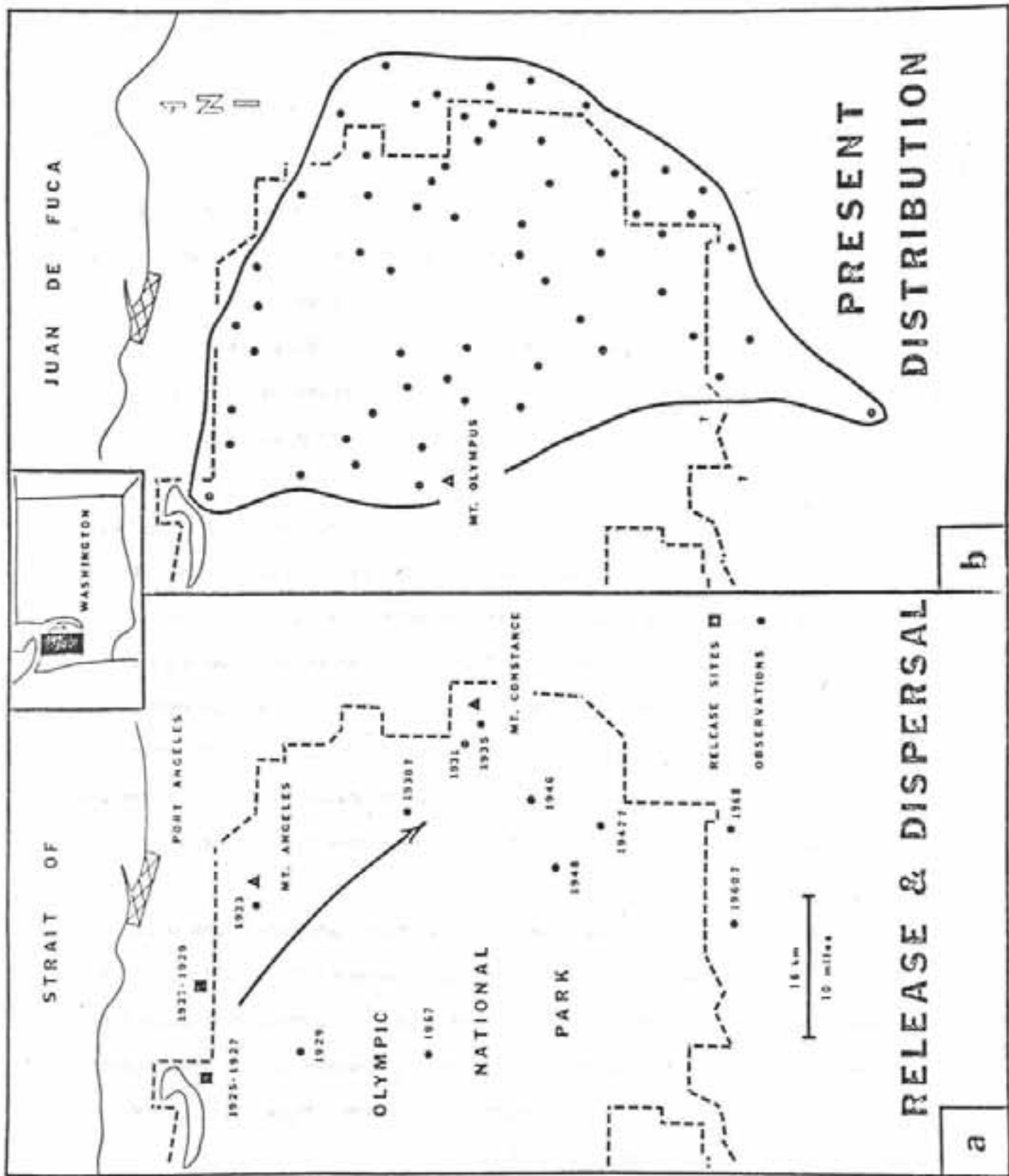


FIGURE 1. Distribution of mountain goats in Olympic National Park.

ago by the Park Service. The salting practice has been abandoned by the park, but the lick area is still sought by the goats in the spring and summer.

## RESULTS

### Population Parameters:

The composition of the newly tagged population on Klahhane Ridge is 61% adult females, 9% adult males, 13% yearling females, 7% yearling males, 6% female kids and 4% male kids. The animals were aged by horn annuli. The presence of a known number of tagged individuals has permitted census estimates. From 16 to 60% of the estimated total population has been observed from the ground each month from September through March with the exception of November when weather precluded any observations. From a cumulative record of these censuses, the per cent of each cohort that is tagged was calculated to be 54% adult females, 15% adult males, 44% yearling females, 15% yearling males and 7% kids. The same data was used to estimate the adult male/female ratio at 56 males per 100 females. Due to the small percentage of males seen during the winter months, the confidence interval is large for the adult male estimate. The estimates for adult males and therefore the ratio of males to females will presumably be more accurate after the censuses of the spring and summer of 1978.

Total population of Klahhane Ridge has been estimated each month using Bailey's modification of the Petersen estimate (Seber, 1973). Estimates have ranged from 100 to 221. By using the cumulative data since September, 1977, and calculating each cohort separately, the assumption of equal catchability is more closely met, and the estimate is 256 with a 95% confidence interval of 164 to 344.

The first goat was seen in the Klahhane Ridge area in 1933. In the 45 years since that time the intrinsic rate of growth has been 11% based on a population estimate of 256. Caughley (1977) noted that in growing populations the age of fecundity is sometimes lower than in populations with no growth. Reports (Hibbs 1966, Hjeljord 1971, Rideout 1974) indicate that mountain goats usually begin breeding at 3½ and have their first kid at 4 years although they are capable of breeding at 2½ and kidding at 3. In the Olympic population we did not observe a single 3 year old without a kid and occasionally a 2 year old had a kid. Another indication of a healthy, growing population is the twinning rate. Last summer the twinning rate was 6% among the tagged adult females, which in part was responsible for the exceptionally high overall reproductive rate. Twinning is a rare occurrence in a native or long-established population. (Chackwick 1973, Rideout 1974). In September there were 97 kids per 100 adult females, an adult female being 2 years or older. This high rate was in spite of at least 2 kid deaths that were known prior to the date of the September census.

Another important aspect of population growth is kid survival during the first year. We have tried to monitor that aspect closely each month and have developed three regression lines based on different combinations of data (Figure 2). The first line is computed from the kid/nanny ratio each month using the tagged and untagged sample and estimates a mortality of 33% from September - March. The second line is computed from the ratio of kids to nannies using only the tagged nannies and estimates a kid loss of 26% from September to March. The third line was included only to show minimum known loss. It was computed from the known losses of the tagged adult females and shows a minimum loss of 15% from Sept-

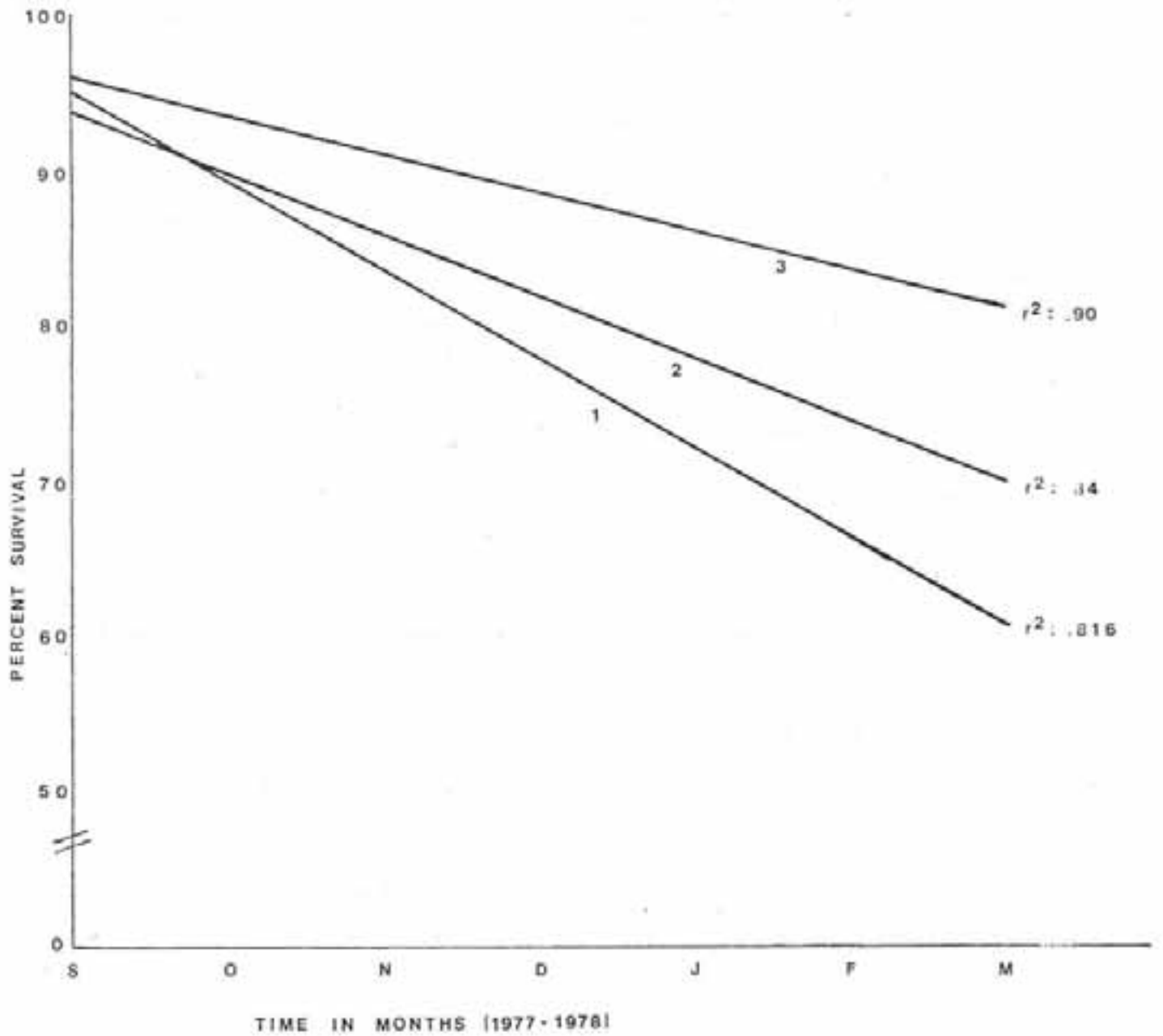


FIGURE 2. Regression of kid survival computed 1. using all individuals sampled, 2. using only tagged sample, 3. using cumulative known deaths.

ember to March.

Causes of kid mortality are rarely known. The remnants of one kid were found in mid-summer after being partially devoured by what appeared to be a bobcat. It was not known if the bobcat killed the kid or found it dead. Of the 6 tagged nannies that have lost kids, all were 3 or 4 years or younger and therefore could have been inexperienced and physiologically ill-prepared to support their offspring. In fact, of the tagged nannies that have been seen since September, 25% of those in the 4 year or younger group have lost kids as opposed to 12.5% in the older age group. This difference was significant at the 95% level. Growth and maturity of the nanny appears to be related to kid survival. Weight data collected by the park biologist suggests that full growth is not attained until at least 4 years. Of the three losses in the older age group, one was a twin and therefore had less parental investment than would a single kid.

#### Movements:

Social and spatial dynamics both within and between groups are also of importance to managers. With 20% of the population on Klahhane Ridge tagged, patterns of association and movement are developing. Close association appears to be limited to nanny and kid pairs, but fidelity to a winter home range was very apparent. The area sampled can be divided into three discrete portions. The goats within any one portion tend to be the same from month to month in spite of the fact that travel between areas does occur. It is significant that goats tagged during the same day are more likely to be in the same geographical area during the winter in spite of the opportunity to randomize during the summer. Since we

used consecutively numbered tags and tagged in order, series of numbers in the same area indicate some group cohesion from summer to winter.

During the years of data collection the only difference that we have been able to detect was that adult females in the lower area around the tunnels are losing large patches of hair as early as February. Last year one animal with an acute example of this condition was found dead on the summer range. To date, we have not been able to diagnose the affliction. A difference in forage quality between the tunnels and the other areas is one possible reason for the geographical isolation of this condition, but it has not yet been tested.

The last thing to mention is our new ability to see dispersal with a large percentage of tagged animals. Until last summer, no tagged goats were ever seen outside of the Mt. Angeles - Klahhane Ridge area except for one reported sighting on the opposite boundary of the park which was discounted by the park biologist because of what seemed to be an impossible distance to cover in a matter of weeks. Last summer we had 4 sightings of tagged animals, all males, at least halfway across the park. One of these goats, a 2 year old billy, was tagged 3 weeks earlier on Klahhane Ridge. He had travelled approximately 35 airline kilometers by the next time he was observed. This billy stayed in the new area for approximately a week and then moved on and has not been reported since.

This type of movement has not been observed in the other cohorts. Only 6% of the tagged adult females have disappeared from the Klahhane Ridge area since September as opposed to 60% of the adult males. We would venture to guess that the majority of those not seen are either dead or are wintering in an unsampled area near Klahhane and will be back on the



ridge in the summer.

The ease with which these goats can be individually marked and observed makes possible an analysis of movement, grouping and population dynamics not possible in most herds. It is anticipated that we will tag at least another 20% of the herd this summer and with careful and consistent observation will soon have an excellent opportunity to analyze fecundity and mortality by age class; kid and yearling survival related to the condition of the nanny; relatedness of individuals on a home range; productivity by home range and dispersal rate by age and sex class.

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