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# KENAI PENINSULA MOOSE CALF MORTALITY STUDY



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PROGRESS REPORT (RESEARCH)

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Job No.: 1.33R Job Title: Kenai Peninsula Moose Calf Mortality Study

Period Covered: 1 July 1982 through 30 June 1983
(Includes limited data during May and June 1982)

SUMMARY

During spring 1982, 37 moose (*Alces alces*) calves were fitted with mortality mode radio transmitters to monitor causes of mortality in the 1969 Kenai Peninsula burn. Three calves were abandoned by their cows within 24 hours of capture, leaving 34 transmitting calves associated with their mothers for subsequent monitoring. Predators killed 15 of 34 (44%) bonded moose calves within 1 month of age. Black bears (*Ursus americanus*) killed 11 calves (32%), black or brown bears (*Ursus arctos*) killed 1 (3%), wolves (*Canis lupus*) killed 1 (3%), and unknown predation accounted for 2 (6%). Two calves died from natural abandonment (6%), and 1 calf died from causes unknown (3%). Total mortality of bonded calves was 18 (53%). Sex ratios of captured calves favored males (25 of 37, 68%). The twinning rate for cows was extremely high (66% for all cows observed with calves, 56% for all cows observed). No bias toward twin or male calves was detected from predation rates.

Key words: black bear, Kenai Peninsula, moose, mortality, 1969 burn, predation, radio transmitter, sex ratios, twinning rate.

CONTENTS



## BACKGROUND

Background information regarding the need to identify causes of moose (Alces alces) calf mortality was outlined (Franzmann and Peterson 1978, Franzmann and Schwartz 1979, Franzmann et al. 1980). Black bears (Ursus americanus) were a major cause of moose calf mortality during the 1st 6 weeks following birth in the Kenai Peninsula, Alaska 1947 burn area where 34% of the radio-collared calves were killed by this predator (Franzmann and Schwartz 1979, Franzmann et al. 1980). Black bear ecology studies in the 1947 Kenai Peninsula burn indicate that the area has a high density (1 bear/11 $km^2$) of black bears (Schwartz et al. 1982). Another finding from these studies was that black bears generally avoided nontimbered areas (Schwartz and Franzmann, In Press).

From these studies in the 1947 burn, a hypothesis was developed which stated black bear density was keyed to the food resource and this food resource was more abundant in older successional stages of forest. If this hypothesis were true, then bear numbers should be less in recently burned forests. The 1969 burn lies to the west of the 1947 burn separated by an unburned area of forest (Fig. 1). Descriptions of the areas appear in LeResche and Davis (1973), Oldemeyer et al. (1977), and Schwartz and Franzmann (In Press). If the hypothesis were true, then stage of plant succession in the 1947 burn (30-year-old forest) should have a high black bear density at the time of these studies (1977, 1978). An important assumption in this study is that bear density is important in the high rate of black bear predation on moose calves. Areas devoid of overstory cover, or in an earlier successional stage (such as the 1969 burn), would not favor black bears, and moose calf predation rates from black bears should be significantly reduced.

This study was designed to test this hypothesis and provide information on both black bear and moose ecology that should assist managers in decision making on certain management and habitat manipulation programs that may favor 1 species over the other. For example, if the hypothesis were substantiated then several options would be available to managers:

1. There should be an emphasis on moose management in early succession (6-25 years).

2. There should be an emphasis on black bear management in later succession (25-50 years).

3. Deviating from these courses would be confounded by limitation of the basic food resource for each, depending on successional time.

4. Habitat manipulation may be more judiciously pursued with a better understanding of potential effects upon these 2 species.

It was apparent to us that data on moose calf predation by black bears generated by the 1977 and 1978 Kenai Peninsula studies may be misrepresented if applied to other areas. This high rate of black bear predation was documented in an area where the successional state was believed to favor black bears. This high predation rate may not occur in other areas under different successional influence. The need was evident that this hypothesis should be tested.

## OBJECTIVE

To determine the extent and causes of moose calf mortality in the 1969 burn on the Kenai Peninsula.

## PROCEDURES

This study was conducted in the 33,500-ha 1969 burn located in the central lowlands of the Kenai Peninsula, Alaska (Fig. 1). Description of the physical aspects, vegetation, soils, and specific habitats of the Kenai Peninsula have been widely published (Spencer and Hakala 1964, Stephens 1967, Rausch and Bishop 1968, LeResche and Davis 1973, Bishop and Rausch 1974, LeResche et al. 1974, Oldemeyer et al. 1977, Sigman 1977, Bailey et al. 1978, Schwartz and Franzmann 1980, Oldemeyer 1981).

Calves were located by visual search from both fixed-wing aircraft (Piper Super Cub) and helicopter (Bell Jet Ranger) during the peak calving period (late May, early June), and captured when <72 hours old, generally within 24 hours of birth. Calves were captured by using the helicopter to force the cow away from the calf and landing nearby to allow the crew to disembark and physically catch the calf. The calf was sexed, and a radio transmitter applied. Initially, a 50-g radio transmitter equipped with a 27-cm antenna (Model S2BSETT, Telonics, Mesa, Ariz.) was attached to the ear. This was replaced with an expandable neck collar made from Ace bandage material in which a similar radio transmitter was sewn in place (Schwartz et al. 1983). In addition, some recovered expandable neck collars from a previous study were used.

The replacement was made due to problems associated with the time delay in attaching the ear tag transmitter and the weight of the transmitter pulling on the calf's ear. Previous studies (Ballard et al. 1979, Franzmann and Schwartz 1979) indicated that the time involved to collect physiologic data from the calf contributed to calf abandonment by the cow. Therefore, we did not handle the calf for additional data and discontinued use of the ear tag transmitter. The Ace bandage style expandable neck collar was constructed as outlined by Schwartz et al. (1983). As soon as the collar was placed on the calf, the crew departed via the helicopter; prior to leaving the area, we made sure the cow returned to the calf.

The transmitter pulsed at approximately 35 beats/min (slow mode) while the calf moved, and when movement ceased for 4 hours, the pulse doubled (fast or mortality mode). The frequencies of the transmitter ranged from 148.010 to 148.600 Mhz. Flights were made daily over the study area (until 20 June 1982) with fixed-wing aircraft (Piper Super Cub) equipped with antennas mounted on the struts. After 20 June, flights were made every other day until 1 July, then 2 times/week until 1 August, followed by weekly flights until early October.

When we detected a fast or mortality signal, the area was searched from the air until we located the calf and marked it on a map. When the monitoring flight was completed, a helicopter (Bell Jet Ranger) was used to go to the site and determine cause of mortality. The criteria used to determine cause of mortality were outlined by Franzmann and Bailey (1977), Franzmann and Schwartz (1978, 1979), and Franzmann and Peterson (1978).

## FINDINGS

Radio transmitters were placed on 37 calves (19 on 26 May 1982; 16 on 27 May 1982; and 2 on 1 June 1982)(Table 1). Three calves were abandoned by their cows within 24 hours of capture, leaving 34 transmitting calves associated with or bonded to their mothers for subsequent monitoring. This proportion of abandonment (8%) was a considerable improvement over previous studies when the calf was processed for physiologic data (20%, Ballard et al. 1979) and when the cow was immobilized and the calf then processed (29%, Franzmann and Schwartz 1979).

Predators killed 15 of 34 (44%) bonded moose calves before 24 June 1982 (within 1 month of birth). Black bears killed 11 calves (32%), a black or brown bear (Ursus arctos) killed 1 (3%), wolves (Canis lupus) killed 1 (3%), and unknown predation accounted for 2 (6%) (Table 2). Two calves died as result of natural abandonment (6%), and 1 calf died from causes unknown (3%). Total mortality of bonded calves was 18 (53%) (Table 1). Calves were monitored until October, but all mortalities occurred by 24 June 1982. However, due to failure of 4 transmitters as of 19 July, 24 July, 5 August, and 17 August, we have a gap in our data. Two of the 3 ear tag transmitters placed on the calves sloughed out of the ear and fell off. One fell off on 24 July, the other on 23 September (Table 1). Fortunately, the transmitters remained on the calves through the high mortality period. Ten transmitters were still functioning as of 4 October when we made our last monitoring flight (Table 1).

Visual coverage of the study area and a concurrent black bear radio collaring project in the area provided observations of 4 nonradioed calves being eaten by black bears on 29-30 May and 8, 15 June.

One thousand forty-nine radio signals were monitored during this study, and 303 aerial sightings of calves with radio transmitters were made. We were able to get to a calf mortality site within a few hours on 2 calves, within 24 hours on 10 calves, and on site of 3 calves while bears were still feeding. Of the 3 remaining mortalities, we were at 1 within 48 hours and the other 2 were within 72 hours. One of these latter calves had a transmitter that did not go on mortality mode, but we observed the dead calf from the air. We believe this procedure is an accurate method to assess moose calf mortality as has been concluded from other studies (Ballard et al. 1979, Franzmann et al. 1980).

The 3 calves (2 males, 1 female) that were abandoned during capture were each from a set of twins. No single calves were abandoned associated with capture. These calves did not rebond with their mothers; 2 died in 3 days and 1 died in 4 days. The calves were undisturbed for several days thereafter as was reported in other studies (Ballard et al. 1979, Franzmann et al. 1980).

Two female calves that rebonded after capture were later abandoned by the cow. Both calves were females. One was abandoned on 3 June and the other on 7 June, 7 and 11 days after capture, respectively. Both calves were visually located several times after it was determined that they had rebonded with their mothers. We do not believe that capture was a contributing factor in these 2 cases and concluded that we had witnessed natural abandonment of 1 calf of a set of twins in 2 instances.

Calf mortality studies in the 1947 burn on the Kenai Peninsula during 1977 and 1978 (Franzmann and Schwartz 1979) had resulted in finding sex ratios skewed in favor of male calves. Sex ratios from this study also favored males; 25 of 37 (68%) of calves were males (Table 3). The sex ratios in all the calf mortality studies on the Kenai Peninsula have been from 60 to 68% males.

Combined sex ratios provide a 64% ($N$ = 84) male component in the calf population (Table 3). The predation rate on sexes of calves was similar to their component in the population, so there did not appear to be a sex bias in predation.

During the calf capture segment of the study which entailed detailed coverage and search of the study area, all moose observed were tabulated (Table 4). The twinning rate from all cows in the area observed with calves was 66% (35 of 53 cows had twins). The twinning rate for all cows observed in the area, including those with no calves, was 56% (35 of 63 cows had twins). The twinning rate of 66% is more realistic because this early in the calving period some or most of the cows may yet produce calves. The twinning rate related to calves captured was 73% (27 of 37 calves captured were from cows with twin calves). We also observed a cow with newborn triplets which were still wet and "in the nest." These twinning rates are the highest that we have seen reported. Peterson (1955) summarized data from various regions and reported these twinning rates: Newfoundland (12.9%,), Ontario (22.7%), and Alaska (13.4%). For a total of 2,047 observations of cows with calves from these regions, the twinning rate was 15.4%. Our studies in the 1947 burn resulted in observed twinning rates of 22% (Franzmann et al. 1980). Lowest twinning rates reported were 4.5% in the Jackson Hole, Wyoming area in the early 1960's (Houston 1968). The highest rates we are aware of prior to this study were 44% from the Copper River Delta, Alaska in the mid-1970's (J. Reynolds, pers. commun.).

The high proportion of twins in this population provided an opportunity to determine mortality rate differences between single and twin calves. Of the 11 calves killed by black bears, 8 were twin calves (73%); of 15 calves killed by all predators, 10 were twins(67%); and of the total 18 calf mortalities, 13 were twins (72%). We captured 37 calves, and 27 were twins for a ratio of 75% (Table 4). It appears that mortality was not related to the number of calves produced; the percentage of twins sampled and percentage killed were essentially the same.

High twinning rates in moose were reported to be related to quality and quantity of range availability (Hosley 1949, Hatter 1950, Edwards and Ritcey 1958, Markgren 1969). The high twinning rate in this study would support that concept because the 1969 Kenai Peninsula burn is at present (1982) in its most productive browse-producing period. Spencer and Hakala (1964) reported that following the 1947 Kenai Peninsula burn winter forage progressively developed, and was attracting moose within 5 years following the burn. Heavy browse growth was reached in about 7 years with maximum growth in 15 years.

The 1969 burn had similar characteristics to the 1947 burn and occurred over similar habitats. We believe the same response is occurring in the 1969 burn as was reported for the 1947 burn (Spencer and Hakala 1964). Winters on the Kenai Peninsula since the mid-1970's have been relatively mild (Bangs and Bailey 1980), and browse availability was not thereby affected. All basic environmental conditions were such that moose in the 1969 burn could demonstrate a positive reproduction response, and they demonstrated this with the highest twinning rates ever reported.

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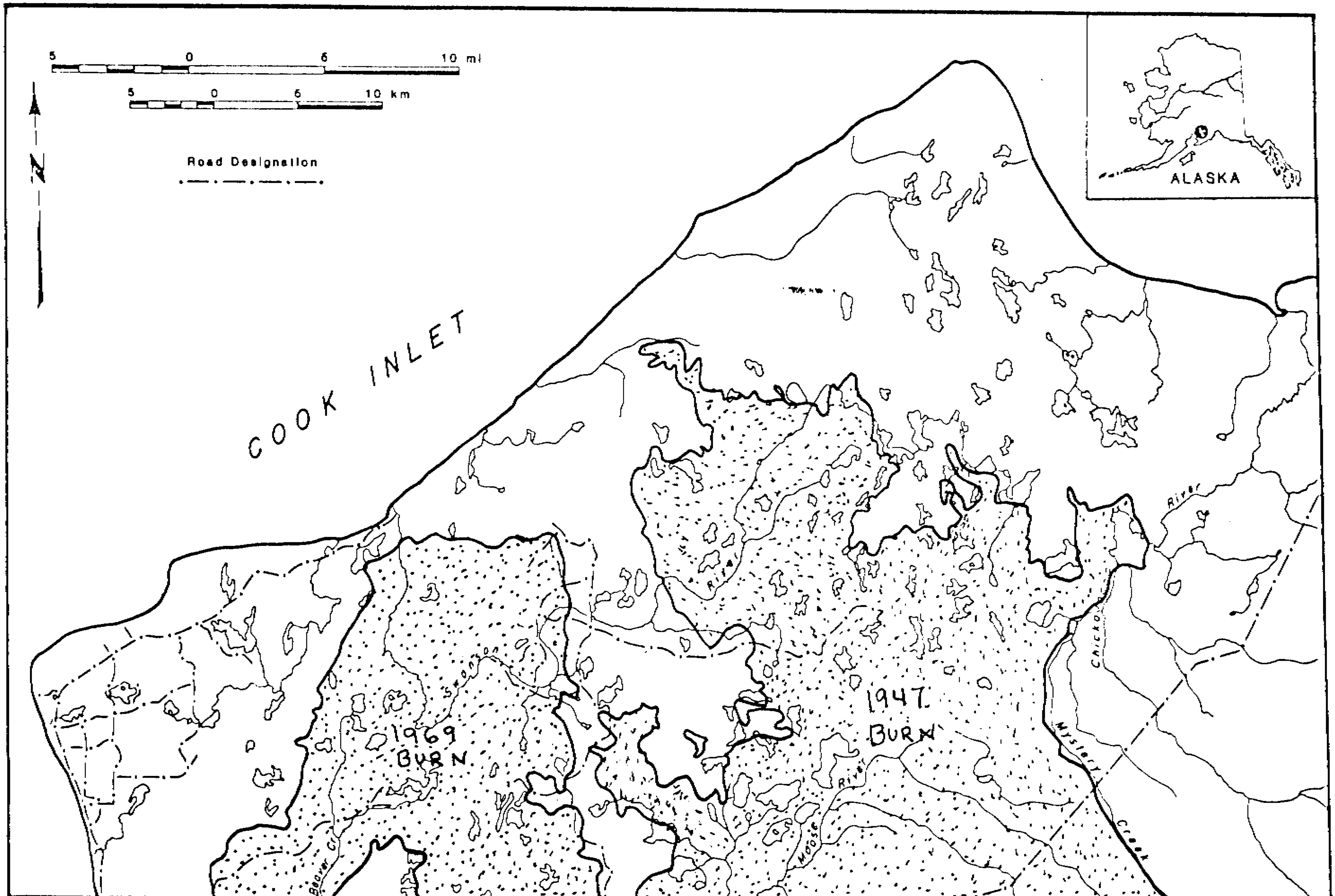


Fig. 1. Northern Kenai Peninsula 1947 and 1969 burns.

Table 1. Mortality data from moose calves captured in the 1969 burn, Kenai Peninsula, Alaska, 1982.

| Calf No. | Radio frequency (Mhz) | Single or twin calf | Sex | Bonded | Comment |
|---|---|---|---|---|---|
| 1 | 148.130 | Single | F | Yes | Ear tag transmitter fell off 23 Sep |
| 2 | 148.370 | Single | M | Yes | Transmitter last heard on 19 Jul |
| 3 | 148.420 | Twin | M | No | Capture abandonment |
| 4 | 148.020 | Twin | F | Yes | Alive and transmitter functioning 4 Oct |
| 5 | 148.080 | Single | F | Yes | Transmitter last heard 17 Aug |
| 6 | 148.580 | Single | M | Yes | Black bear predation 20 Jun |
| 7 | 148.090 | Twin | F | Yes | Alive and transmitter functioning 4 Oct |
| 8 | 148.210 | Twin | M | Yes | Black bear predation 9 Jun |
| 9 | 148.350 | Twin | M | No | Capture abandonment |
| 10 | 148.270 | Twin | M | Yes | Alive and transmitter functioning 4 Oct |
| 11 | 148.310 | Twin | F | Yes | Black bear predation 28 May |
| 12 | 148.260 | Twin | F | Yes | Black bear predation 11 Jun |
| 13 | 148.330 | Twin | M | Yes | Black bear predation 4 Jun |
| 14 | 148.060 | Twin | F | Yes | Black bear predation 12 Jun |
| 15 | 148.170 | Single | M | Yes | Black bear predation 16 Jun |
| 16 | 148.030 | Twin | M | Yes | Unknown predator 24 Jun |
| 17 | 148.050 | Twin | M | Yes | Black bear predation 29 May |
| 18 | 148.010 | Twin | M | Yes | Ear tag transmitter fell off 24 Jul |
| 19 | 148.440 | Twin | M | Yes | Transmitter last heard 24 Jul |
| 20 | 148.140 | Single | F | Yes | Black bear predation 30 May |
| 21 | 148.070 | Twin | F | Yes | Natural abandonment 7 Jun |
| 22 | 148.240 | Twin | M | Yes | Unknown mortality 16 Jun |
| 23 | 148.300 | Twin | M | Yes | Black bear predation 14 Jun |
| 24 | 148.360 | Twin | M | Yes | Alive and transmitter functioning 4 Oct |
| 25 | 148.220 | Twin | M | Yes | Black bear predation 5 Jun |
| 26 | 148.540 | Twin | M | Yes | Alive and transmitter functioning 4 Oct |
| 27 | 148.290 | Twin | F | No | Capture abandonment |
| 28 | 148.280 | Twin | M | Yes | Alive and transmitter functioning 4 Oct |
| 29 | 148.570 | Twin | M | Yes | Alive and transmitter functioning 4 Oct |
| 30 | 148.180 | Twin | F | Yes | Natural abandonment 3 Jun |
| 31 | 148.340 | Single | M | Yes | Alive and transmitter functioning 4 Oct |
| 32 | 148.040 | Twin | M | Yes | Alive and transmitter functioning 4 Oct |
| 33 | 148.560 | Twin | M | Yes | Unknown predator 9 Jun |
| 34 | 148.110 | Twin | M | Yes | Alive and transmitter functioning 4 Oct |
| 35 | 148.600 | Single | F | Yes | Unknown bear predation 12 Jun |
| 36 | 148.420 | Single | M | Yes | Wolf predation 7 Jun |
| 37 | 148.050 | Single | M | Yes | Transmitter last heard 17 Aug |

Table 2. Causes of mortality of radio-tagged moose calves during summer 1982 in the 1969 burn on the Kenai Peninsula, Alaska.

| Cause of death | Number killed | % of total ($\underline{N}$ = 34) |
|---|---|---|
| Black bear predation | 11 | 32 |
| Brown *or* black bear predation[a] | 1 | 3 |
| Wolf predation | 1 | 3 |
| Unknown predator | 2 | 6 |
| Total predator mortality | 15 | 44 |
| Natural abandonment | 2 | 6 |
| Unknown | 1 | 3 |
| Total mortality | 18 | 53 |

[a] Cause of death circumstantially favored brown bear.

Table 3. Sex ratios from Kenai Peninsula, Alaska, calf mortality studies.

| Kenai Peninsula calf mortality studies | No. of males | No. of females | % males in study | Total calves killed by predators | Males killed by predators | Females killed by predators | % males killed by predators |
|---|---|---|---|---|---|---|---|
| 1977 (_N_ = 15) | 9 | 6 | 60 | 9 | 5 | 4 | 56 |
| 1978 (_N_ = 32) | 20 | 12 | 63 | 14 | 9 | 5 | 64 |
| 1982 (_N_ = 34) | 25 | 12 | 68 | 14 | 9 | 5 | 64 |
| Total (_N_ = 81) | 54 | 30 | 64 | 37 | 23 | 14 | 62 |

Table 4. Moose observed during calf capture part of the calf mortality study in the 1969 burn, Kenai Peninsula, Alaska, (26-27 May, 1 Jun 1982).

| No. of calves | No. observed | % of cows with calves[a] | % of total cows observed | Status of cows | % of cows with calves captured |
|---|---|---|---|---|---|
| 1 | 17 | 32 | 27 | 10 | 27 |
| 2 | 35 | 66 | 56 | 27 | 73 |
| 3 | 1 | 2 | 1 | | |
| Total | 53 | 100 | 84 | 37 | 100 |
| 0 | 10 | 0 | 16 | 0 | 100 |
| Grand total | 63 | 100 | 100 | 37 | 100 |

[a] Cows with no calves were not used to calculate percentage (singles, twins, and triplets) because this early in the calving period some cows may yet produce calves.