

Figure 1. Survey transects in the Bullen Point to Staines River and Badami study areas, Alaska, 1999.

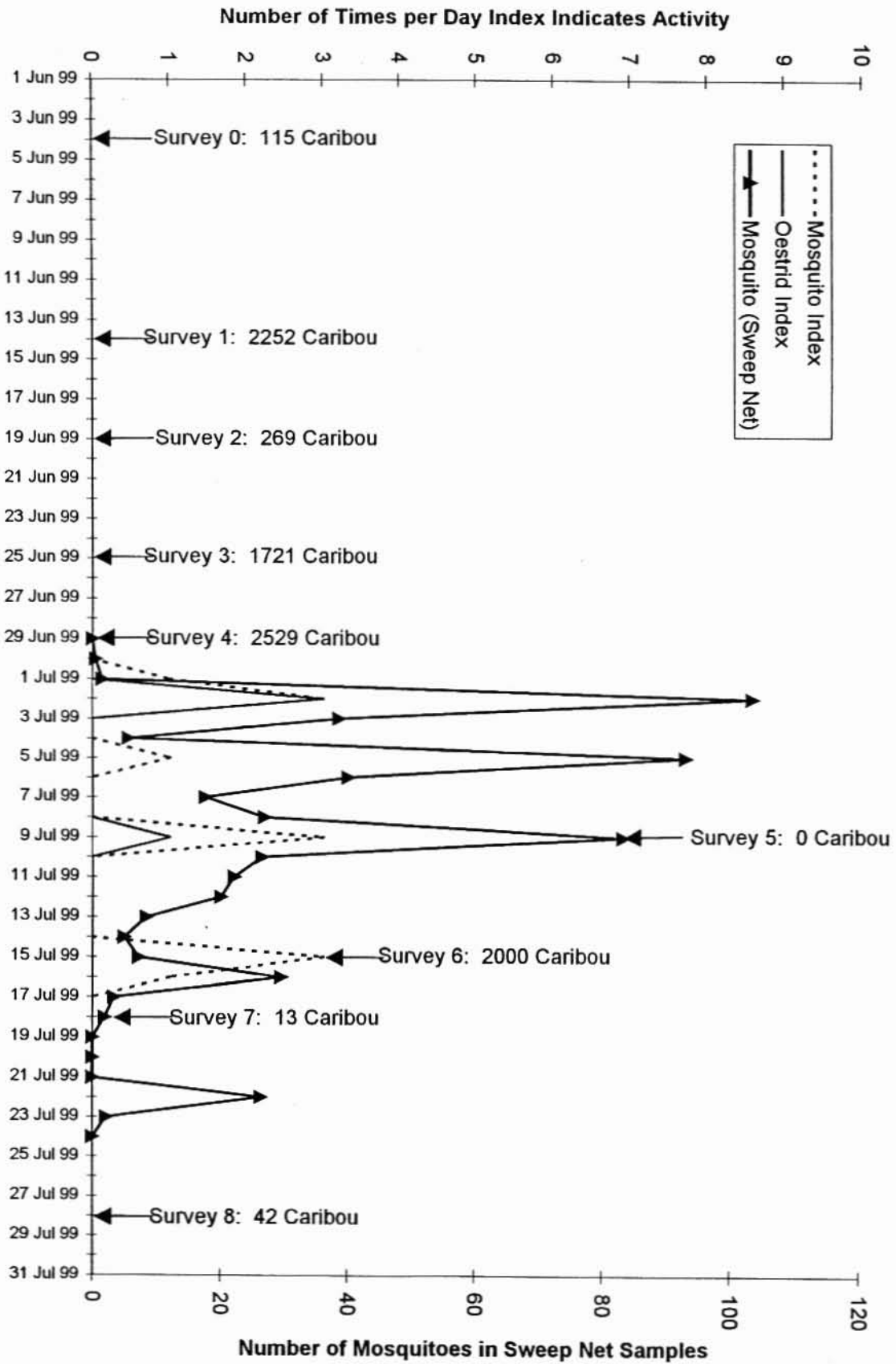


Figure 2. Mosquito and oestrid activity indices based on hourly weather data collected at the Deadhorse Weather Station and 1999 aerial caribou survey dates, Bullen Point to Staines River study area, Alaska, 1999.

1999 DISTRIBUTION OF CARIBOU CALVES DURING THE CALVING PERIOD

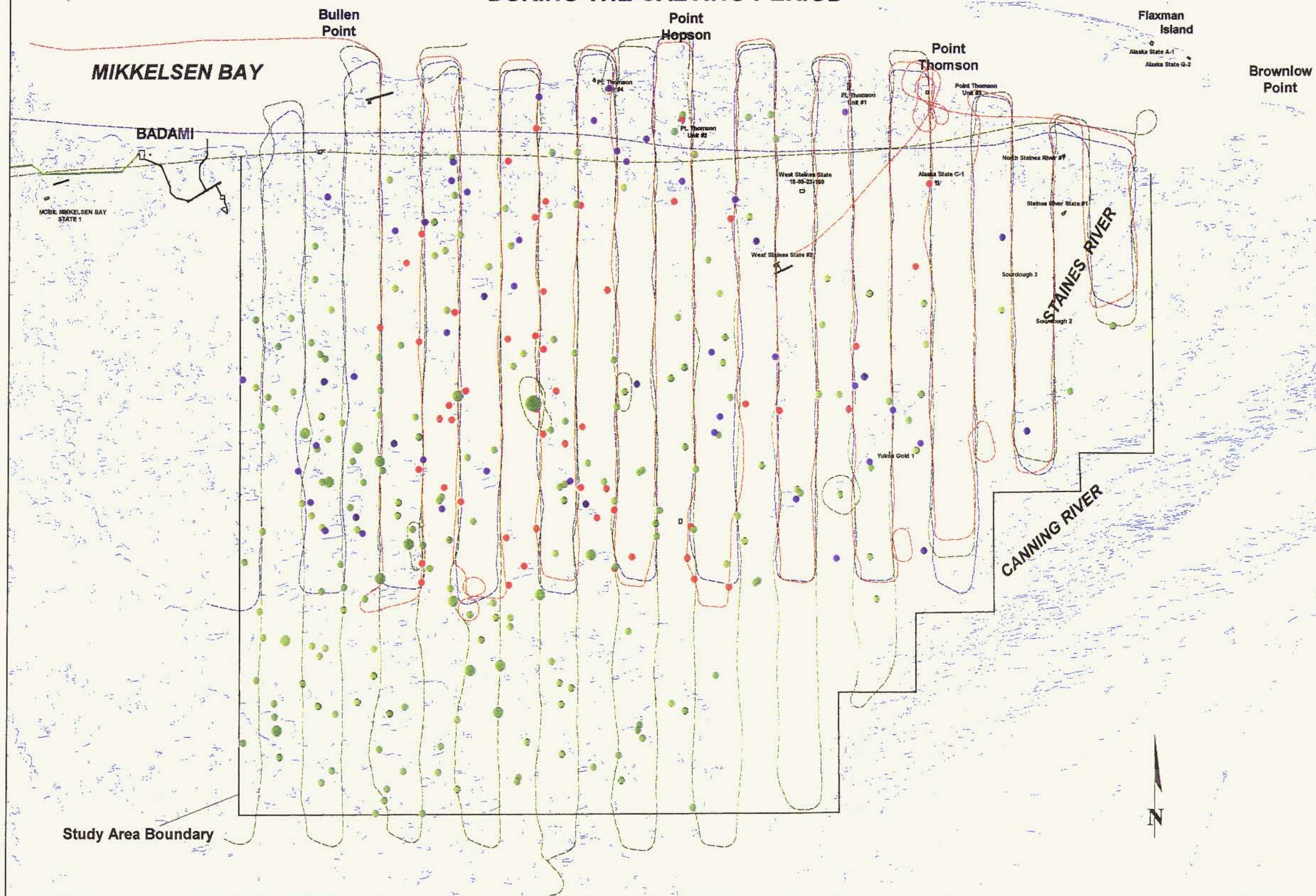


Figure 3

Distribution of caribou calves in the Bullen Point to Staines River study area, Alaska, during calving period surveys on 4, 14, and 19 June 1999.

Caribou Group Size

| 4 June 1999 | | Groups |
|-----------------------|------------------|--------|
| ● (Small Red) | Less than 10 | 52 |
| ● (Medium Red) | 10 to 50 | 0 |
| ● (Large Red) | 51 to 100 | 0 |
| ● (Very Large Red) | Greater than 100 | 0 |
| 14 June 1999 | | Groups |
| ● (Small Green) | Less than 10 | 192 |
| ● (Medium Green) | 10 to 50 | 15 |
| ● (Large Green) | 51 to 100 | 1 |
| ● (Very Large Green) | Greater than 100 | 0 |
| 19 June 1999 | | Groups |
| ● (Small Purple) | Less than 10 | 50 |
| ● (Medium Purple) | 10 to 50 | 0 |
| ● (Large Purple) | 51 to 100 | 0 |
| ● (Very Large Purple) | Greater than 100 | 0 |

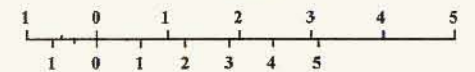
Aerial Coverage

| | | |
|------------------|---------------------|------|
| — (Red Dashed) | Survey Line 4 June | 64% |
| — (Black Dashed) | Survey Line 14 June | 100% |
| — (Blue Dashed) | Survey Line 19 June | 75% |

Pipelines

Oil Production and Service Facilities

Miles



Kilometers

Map Projection: UTM Zone 6

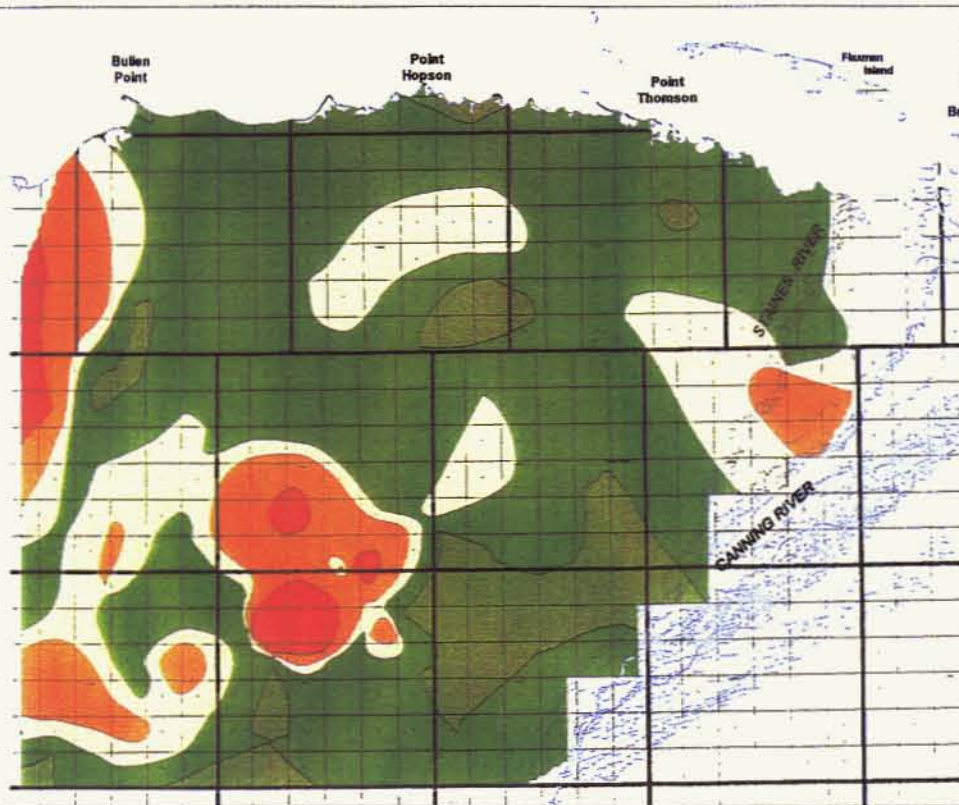
Datum: NAD 27

View Scale: 1:170,000

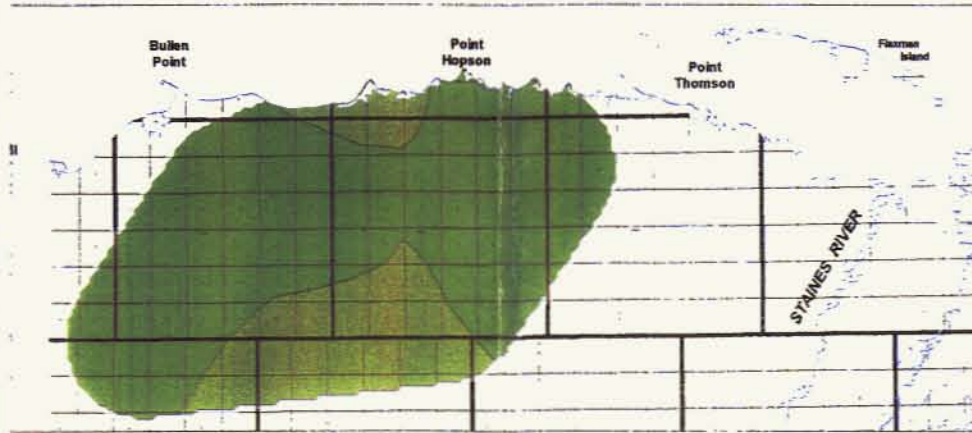
Mapping Scale: 1:63,360

Prepared by: LGL Alaska Research Associates

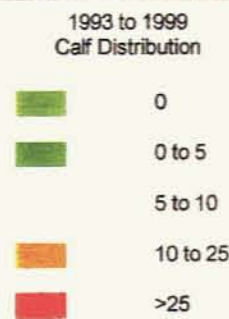
File: 99sd_fig3.wor



1993 Calving Period (1 survey)



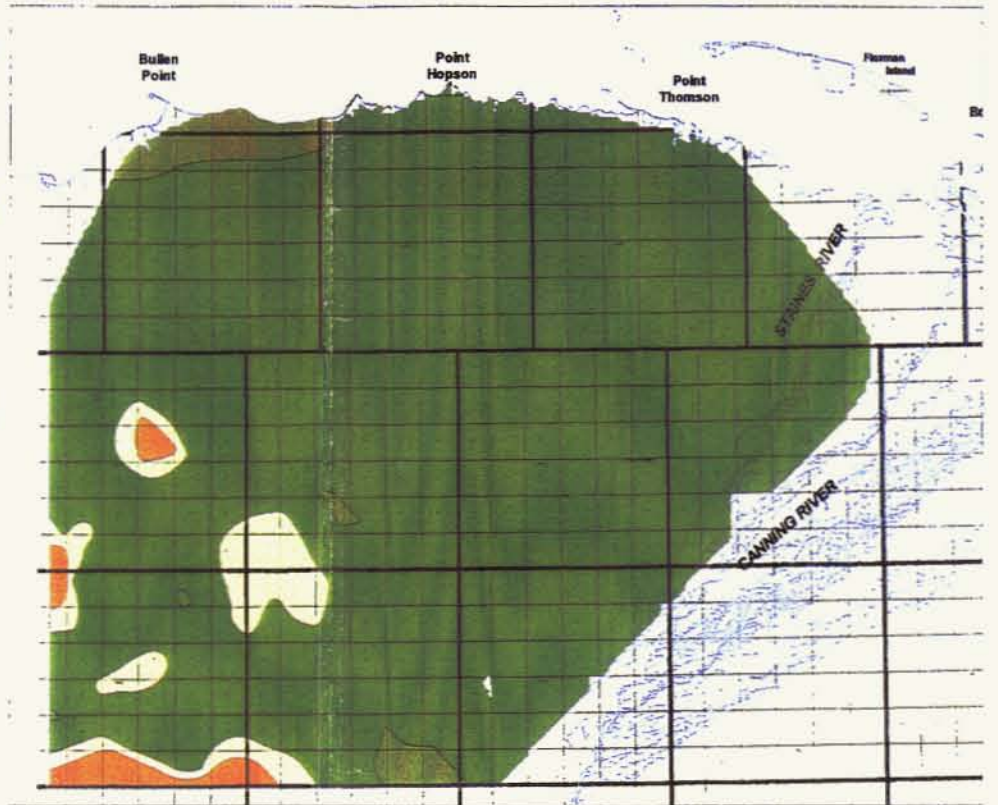
1995 Calving Period (1 survey)



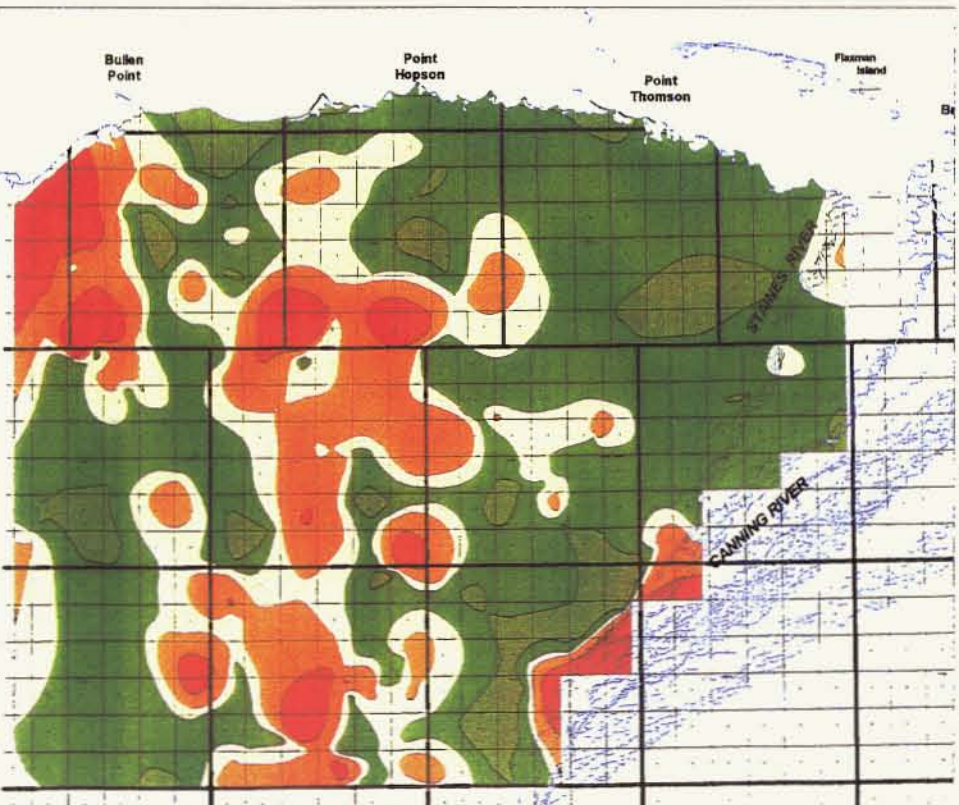
Projection: UTM Zone 6
Datum: NAD 27
View Scale 1:335,000
Mapping Scale: 1:63,360
File: Fig4_99.wor

Figure 4

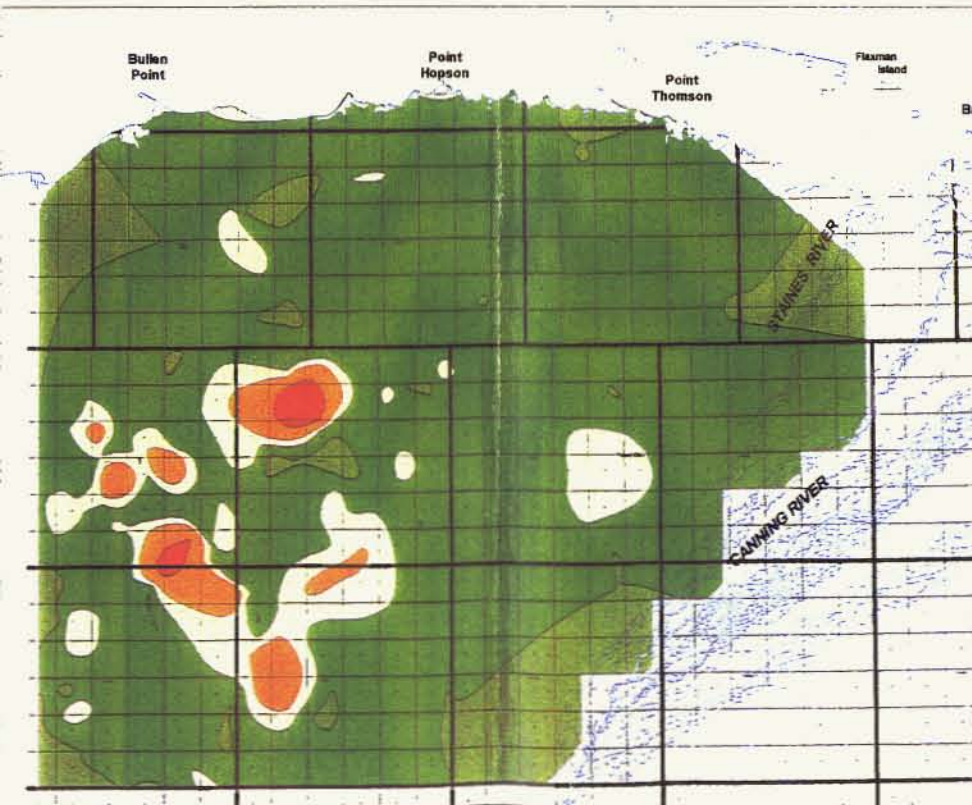
Distribution of calves during the calving period (before 20 June) as contours of the total number of calves by year and for combined 1993 to 1999 distributions (7 surveys), in the Bullen Point to Staines River study area, Alaska.



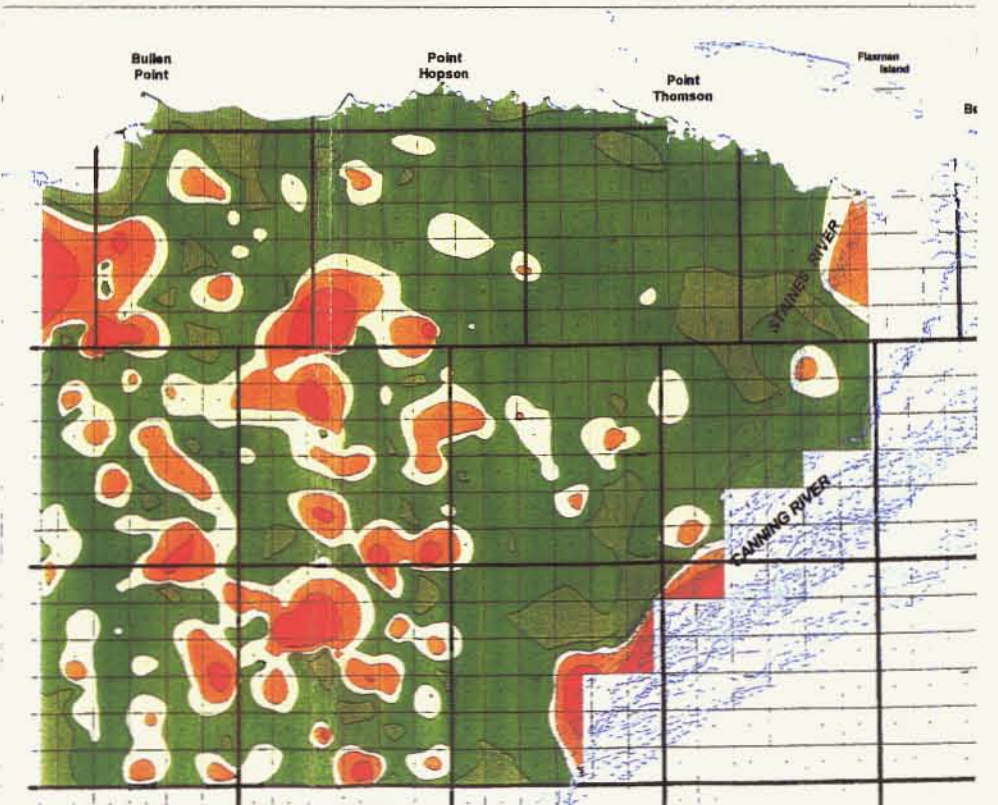
1997 Calving Period (1 survey)



1998 Calving Period (2 surveys)



1999 Calving Period (2 surveys)



1993 to 1999 Calving Period Surveys (7 surveys)

1999 DISTRIBUTION OF CARIBOU DURING THE POST-CALVING PERIOD

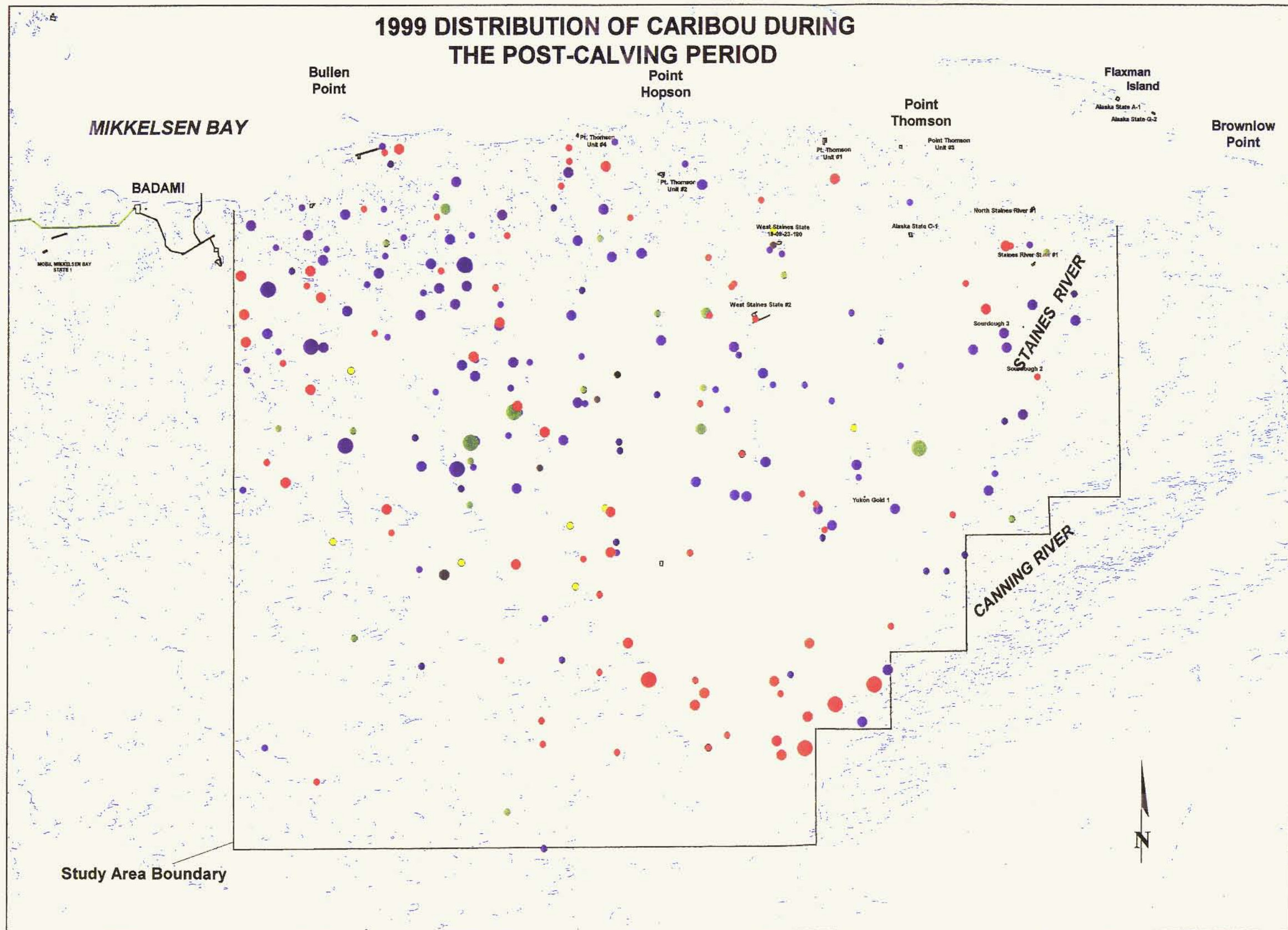


Figure 5

Distribution of caribou in the Bullen Point to Staines River study area, Alaska, during post-calving surveys 25 and 29 June, 9, 15, 18, and 28 July 1999

| Caribou Group Size | | | |
|--------------------|------|----------------|------|
| 25 June 1999 | | 29 June 1999 | |
| ● <10 | (44) | ● <10 | (66) |
| ● 10 to 100 | (28) | ● 10 to 100 | (53) |
| ● >100 | (4) | ● >100 | (5) |
| 15 July 1999 | | 18 July 1999 a | |
| ● <10 | (14) | ● <10 | (8) |
| ● 10 to 100 | (3) | ● 10 to 100 | (0) |
| ● >100 | (3) | ● >100 | (0) |
| 28 July 1999 b | | | |
| ● <10 | (4) | | |
| ● 10 to 100 | (1) | | |
| ● >100 | (0) | | |

() Number of Groups

a= 78% coverage b= 76% coverage

No caribou were observed during the 9 July survey 1999.

— Pipelines
 Oil Production and Service Facilities

Miles: 1 0 1 2 3 4 5
 Kilometers: 1 0 1 2 3 4 5

Map Projection: UTM Zone 6
 Datum: NAD 27
 View Scale: 1:175,000
 Mapping Scale: 1:63,360
 Prepared by: LGL Alaska Research Associates
 File: SD99_Fig.5.wor



**1993 to 1999
Coastal Caribou Concentrations**

| | |
|--------------|---------------|
| 0 | 14.2253 sq km |
| 0 to 5 | 19.9848 sq km |
| 5 to 100 | 41.6637 sq km |
| 100 to 500 | 13.0525 sq km |
| 500 to 1000 | 0.0044 sq km |
| 1000 to 2500 | 0.0 sq km |

**Caribou Group Size
(Number of Groups)**

| | |
|--------------|------|
| ◊ < 10 | (48) |
| ● 10 to 100 | (16) |
| ● 101 to 250 | (2) |
| ● > 250 | (9) |

Figure 6. Coastal post-calving period (after 20 June) distribution as contours of the total number of caribou within 2 km of the coast for combined 1993 to 1999 caribou distributions (25 surveys), in the Bullen Point to Staines River study area, Alaska

Contours created from interpolation grid.
Interpolation type: Natural Neighbors, Forward Step
Aggregation Distance 200 m, Sum of Total Caribou
Method-Slope, Skew=1, Weight=2, Exponent=2
Grid: Convex Hull, 200m cell

Projection: UTM Alaska Zone 6
Datum: NAD 1927
Scale: 1:160,000

Table 1. Sex and age classification for caribou observed during systematic aerial surveys in the Bullen Point to Staines River study area, Alaska, 4 June to 28 July 1999.

| Flight | Date | Number of Caribou | | | | Total | Number Of Groups | Mean Group Size | Study Area Coverage |
|----------------|-----------|-------------------|-------|--------|--------------|-------|------------------------|-----------------------|------------------------|
| | | Bulls | Cows | Calves | Unclassified | | | | |
| 0 ^a | 4 Jun 99 | 0 | 84 | 31 | | 115 | 51 | 2.3 | 64% |
| 1 | 14 Jun 99 | 2 | 1,462 | 702 | 86 | 2,252 | 208 | 10.8 | 100% |
| 2 ^b | 19 Jun 99 | 3 | 145 | 70 | 51 | 269 | 50 | 5.4 | 75% |
| 3 | 25 Jun 99 | 2 | 932 | 487 | 300 | 1,721 | 76 | 22.6 | 100% |
| 4 | 29 Jun 99 | 9 | 1,426 | 644 | 450 | 2,529 | 123 | 20.6 | 100% |
| 5 | 9 Jul 99 | 0 | 0 | 0 | 0 | 0 | 0 | | 100% |
| 6 | 15 Jul 99 | 409 | 997 | 293 | 301 | 2,000 | 20 | 100.0 | 100% |
| 7 ^b | 18 Jul 99 | 2 | 4 | 1 | 6 | 13 | 8 | 1.6 | 78% |
| 8 ^b | 28 Jul 99 | 0 | 20 | 12 | 10 | 42 | 5 | 8.4 | 76% |

^aSurvey purpose was to identify arctic fox den sites, caribou sightings were recorded during this flight over a reduced survey area (Fig. A-1.)

^bGround fog prevented surveying portions of transects south of 70°00' north latitude (see Figures A-3, A-7 and A-8).

Table 2. Caribou group movements recorded on systematic strip-transect aerial surveys during the calving and post-calving periods in the Bullen Point to Staines River study area, Alaska, 14 June to 15 July 1999.

| Date | Direction | | | | | Total | Wind Direction |
|---|-----------|----|---|---|---|-------|----------------|
| | N | NE | S | E | W | | |
| Calving Period (1 to 20 June) | | | | | | | |
| 14 Jun 99 | 0 | 1 | 1 | 0 | 2 | 4 | NW |
| 19 Jun 99 | 0 | 0 | 2 | 0 | 0 | 2 | NW |
| Total | 0 | 1 | 3 | 0 | 2 | 6 | |
| Post-calving Period (21 June to 15 August) | | | | | | | |
| 25 Jun 99 | 2 | 2 | 0 | 3 | 0 | 7 | ENE |
| 15 Jul 99 | 2 | 4 | 0 | 1 | 1 | 8 | E |
| Total | 4 | 6 | 0 | 4 | 1 | 15 | |

Table 3. Caribou activity by group size recorded during systematic strip-transect aerial surveys during the calving and post-calving periods in the Bullen Point to Staines River study area, Alaska, 14 June to 28 July 1999.

| Group Size | Activity | | | | | | | |
|------------------|--|-------|------|------|------|-----|------|-------|
| | Calving Period (1 to 20 June) | | | | | | | |
| | Rest | Stand | Feed | Walk | Trot | Run | Move | Total |
| Groups <10 | 29 | 1 | 28 | 6 | 1 | 0 | 2 | 67 |
| Groups 10 to 100 | 10 | 1 | 19 | 1 | 0 | 0 | 0 | 31 |
| Groups >100 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| All Groups | 40 | 2 | 47 | 7 | 1 | 0 | 2 | 99 |
| | Post-Calving Period (21 June to 15 August) | | | | | | | |
| | Rest | Stand | Feed | Walk | Trot | Run | Move | Total |
| Groups <10 | 10 | 2 | 39 | 2 | 0 | 2 | 4 | 59 |
| Groups 10 to 100 | 2 | 2 | 20 | 1 | 0 | 1 | 4 | 30 |
| Groups >100 | 0 | 0 | 6 | 0 | 0 | 0 | 1 | 7 |
| All Groups | 12 | 4 | 65 | 3 | 0 | 3 | 9 | 96 |

Table 4. Caribou group sightings by activity and habitat types (Walker 1983, see Table A-3) recorded during systematic strip-transect aerial surveys during the calving and post-calving periods in the Bullen Point to Staines River study area, Alaska, 14 June to 28 July 1999.

| Activity | Wet Sedge/Moist Sedge, Dwarf Shrub Tundra Complex IIIId | Wet Sedge/Moist Sedge/Barren Complex IIIe | Moist/Wet Sedge Complex IVa | Moist Sedge, Dwarf Shrub Tundra Va | Moist Tussock Sedge, Dwarf Shrub Tundra Vb | Dry, Dwarf Shrub, Crustose Lichen Tundra Vc | Moist Graminoid, Dwarf Shrub Tundra/Barren Complex Ve | River Gravels Xa | Gravel Roads and Pads Xe | Total |
|---|--|--|--------------------------------|---------------------------------------|---|--|--|---------------------|-----------------------------|-------|
| Calving Period (1 June to 20 June) | | | | | | | | | | |
| Rest | 2 | 1 | 1 | 25 | 2 | 4 | 5 | 0 | 0 | 40 |
| Stand | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 2 |
| Feed | 2 | 5 | 6 | 25 | 3 | 0 | 6 | 0 | 0 | 47 |
| Move | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 2 |
| Walk | 4 | 0 | 1 | 2 | 0 | 0 | 0 | 0 | 0 | 7 |
| Trot | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 |
| Run | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Total | 9 | 6 | 8 | 54 | 6 | 4 | 12 | 0 | 0 | 99 |
| Post-calving Period (21 June to 15 August) | | | | | | | | | | |
| Rest | 0 | 0 | 0 | 5 | 1 | 2 | 1 | 1 | 1 | 11 |
| Stand | 0 | 1 | 0 | 2 | 0 | 0 | 0 | 1 | 0 | 4 |
| Feed | 3 | 0 | 1 | 36 | 3 | 12 | 9 | 1 | 0 | 65 |
| Move | 0 | 0 | 0 | 4 | 0 | 2 | 1 | 0 | 0 | 7 |
| Walk | 0 | 1 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 3 |
| Trot | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Run | 0 | 0 | 0 | 2 | 0 | 1 | 0 | 0 | 0 | 3 |
| Total | 3 | 2 | 1 | 51 | 4 | 17 | 11 | 3 | 1 | 93 |

Table 5. Caribou group location by habitat type as mapped for the Point Thomson Unit Area (Noel and Funk 1999) based on point locations recorded during aerial strip-transect surveys in the Bullen Point to Staines River study area, Alaska, 1993 to 1999.

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| Survey Year | Water Ia | Aquatic Graminoid Tundra IIb | Water/Tundra Complex IIId | Wet Sedge Tundra IIIa | Wet Sedge Tundra/Water Complex IIIc | Wet Sedge/Moist Sedge, Dwarf Shrub Tundra Complex IIId | Moist/Wet Sedge Complex IVa | Moist Sedge, Dwarf Shrub Tundra Va | Dry, Dwarf Shrub, Crustose Lichen Tundra Vc | Moist Graminoid, Dwarf Shrub Tundra/Barren Complex Ve | River Gravels Xa | Gravel Roads and Pads Xe | Wet Mud XIa | Total |
|-------------------|-------------|---------------------------------|------------------------------|--------------------------|---|--|--------------------------------|--|---|---|---------------------|-----------------------------|----------------|-------|
| 1993 | 2 | 0 | 0 | 2 | 0 | 3 | 0 | 6 | 0 | 2 | 1 | 1 | 1 | 18 |
| 1997 | 12 | 0 | 0 | 0 | 0 | 3 | 0 | 0 | 1 | 1 | 1 | 0 | 0 | 18 |
| 1998 | 1 | 0 | 1 | 1 | 0 | 5 | 4 | 5 | 1 | 0 | 0 | 0 | 1 | 19 |
| 1999 ^a | 1 | 1 | 0 | 1 | 1 | 3 | 3 | 5 | 0 | 2 | 0 | 0 | 0 | 17 |
| Total | 16 | 1 | 1 | 4 | 1 | 14 | 7 | 16 | 2 | 5 | 2 | 1 | 2 | 72 |

^a For nine records with observer classified habitat within the landcover map area:
 Five of seven Va observer classes matched map class for 71% accuracy.
 Two Va observer classes were mapped as IIIa and IIIc.
 Two Vc observer classes were mapped as Ve for 0% accuracy.

Table 6. Hierarchical vegetation categories for the Point Thomson Area Vegetation/Land Cover Map, based on Walker's (1983) vegetation classification. Vegetation types were mapped and labeled at Level C.

| LEVEL A SMALL- SCALE UNITS | LEVEL B LANDSAT- SCALE UNITS | LEVEL C PHOTO-INTERPRETED MAP UNITS | LEVEL D TYPICAL PLANT COMMUNITIES | |
|-------------------------------------|------------------------------------|--|---|--|
| A. Water | I. Water | Ia. Water (ponds, lakes, rivers, streams, saltwater) | No vegetation | |
| B. Wet Tundra | II. Very Wet Tundra | IIb. Aquatic Graminoid Tundra (emergent vegetation) | Aquatic <i>Arctophila fulva</i> Grass Tundra Aquatic <i>Carex aquatilis</i> Sedge Tundra | |
| | | IIc. Water/Tundra Complex (pond complex with emergent vegetation) | Typical communities listed in IIb, IIIa, and Va | |
| | | IIIa. Wet Sedge Tundra | Wet <i>Carex aquatilis</i> , <i>Scorpidium scorpioides</i> Sedge Tundra (wettest facies of wet alkaline tundra) Wet <i>Carex aquatilis</i> , <i>Eriophorum angustifolium</i> , <i>Pedicularis sudetica</i> , <i>Drepanocladus brevifolius</i> Sedge Tundra (wet alkaline tundra) Wet <i>Eriophorum angustifolium</i> , <i>Dupontia fisheri</i> , <i>Campylium stellatum</i> Graminoid Tundra (wet acidic tundra, coastal areas) | |
| | III. Wet Tundra | IIIb. Wet Graminoid Tundra (wet saline tundra, saltmarsh) | Wet <i>Carex subspathacea</i> , <i>Puccinellia phryganodes</i> , <i>Stellaria humifusa</i> , <i>Cochlearia officinalis</i> Sedge Tundra | |
| | | IIIc. Wet Sedge Tundra/Water Complex (pond complex, no emergent vegetation) | Typical communities listed in IIIa and Va | |
| | | IIId. Wet Sedge/Moist Sedge, Dwarf Shrub Tundra Complex (wet patterned-ground complex) | Typical communities listed in IIIa and Va, and sometimes IIb | |
| | | IIIe. Wet Sedge/Moist Sedge/Barren complex (wet frost-scar tundra complex) | Typical communities listed in IIIa, Va and Ve | |
| | | IV. Moist/Wet Tundra Complex | IVa. Moist Sedge, Dwarf Shrub/Wet Graminoid Tundra Complex (moist patterned ground complex) | Typical communities listed in IIIa and Va |
| | | | V. Moist or Dry Tundra | Va. Moist Sedge, Dwarf Shrub Tundra Moist <i>Carex bigelowii</i> , <i>Eriophorum angustifolium</i> , <i>Dryas integrifolia</i> , <i>Salix reticulata</i> , <i>Tomenthypnum nitens</i> , <i>Thamnia subuliformis</i> Sedge, Dwarf Shrub Tundra (moist alkaline tundra) Moist <i>Luzula arctica</i> , <i>Poa arctica</i> , <i>Saxifraga cernua</i> , <i>Salix planifolia</i> , <i>Dicranum elongatum</i> , <i>Ochrolechia frigida</i> Graminoid, Dwarf Shrub, Crustose Lichen Tundra (moist acidic tundra) |

Table 6. Continued

| LEVEL A SMALL- SCALE UNITS | LEVEL B LANDSAT- SCALE UNITS | LEVEL C PHOTO-INTERPRETED MAP UNITS | LEVEL D TYPICAL PLANT COMMUNITIES |
|---|--|---|--|
| C. Moist Tundra (continued) | V. Moist or Dry Tundra (continued) | Va. Moist Sedge, Dwarf Shrub Tundra (continued) | Moist <i>Carex aquatilis</i> , <i>Eriophorum angustifolium</i> , <i>Salix planifolia</i> , <i>Campylium stellatum</i> Sedge, Dwarf Shrub Tundra (moist acidic tundra, wetter facies) |
| | | Vc. Dry, Dwarf Shrub, Crustose Lichen Tundra (<i>Dryas</i> tundra, pingos, river bars) | Dry <i>Dryas integrifolia</i> , <i>Carex rupestris</i> , <i>Oxytropis nigrescens</i> , <i>Salix reticulata</i> , <i>Ditrichum flexicaule</i> , <i>Lecanora epibyron</i> Dwarf Shrub, Forb, Crustose Lichen Tundra (<i>Dryas</i> tundra, pingos) |
| | | | Dry <i>Dryas integrifolia</i> , <i>Astragalus alpinus</i> , <i>Oxytropis borealis</i> , <i>Salix reticulata</i> , <i>Distichium capillaceum</i> , <i>Lecanora epibyron</i> Dwarf Shrub, Forb, Crustose Lichen Tundra (<i>Dryas</i> tundra, river bars) |
| | | Vd. Dry, Dwarf Shrub, Fruticose Lichen Tundra (dry acidic tundra) | Dry <i>Salix rotundifolia</i> , <i>Pedicularis kanei</i> , <i>Luzula arctica</i> , <i>Polytrichum</i> sp., <i>Alectoria nigricans</i> , <i>Cetraria islandica</i> Dwarf Shrub, Fruticose Lichen Tundra (dry acidic tundra near coast) |
| | | Ve. Moist Graminoid, Dwarf Shrub Tundra/Barren Complex (frost-scar tundra complex) | Typical communities listed in Va plus either completely barren frost scars or communities such as: Dry <i>Saxifraga oppositifolia</i> , <i>Dryas integrifolia</i> , <i>Chrysanthemum integrifolium</i> , <i>Juncus biglumis</i> , <i>Arctagrostis latifolia</i> , <i>Ochrolechia frigida</i> Barren (alkaline frost scars) |
| E. Partially Vegetated and Barren | IX. Partially Vegetated | IXb. Dry Barren/Dwarf Shrub, Forb Grass Complex (forb rich river bars) | Typical communities listed in Vc, and mixed forb, grass and dwarf shrub communities such as: Dry <i>Bromus pumpehianus</i> , <i>Festuca rubra</i> , <i>Astragalus alpinus</i> , <i>Androsace chamaejasme</i> , <i>Salix ovalifolia</i> Grass, Forb, Dwarf Shrub Tundra (forb rich river bars) Dry <i>Dryas integrifolia</i> , <i>Artemisia borealis</i> , <i>A. glomerata</i> , <i>Salix ovalifolia</i> , <i>Androsace chamaejasme</i> Dwarf Shrub, Forb Tundra (<i>Dryas</i> river bars near arctic coast) |
| | | IXe. Dry Barren/Grass Complex (coastal sand dune grassland) | Dry <i>Elymus arenarius</i> Grass Tundra (coastal sand dune grassland) |
| | | IXf. Dry Barren/Dwarf Shrub Grass complex (sand dune steppe) | Dry <i>Artemisia borealis</i> , <i>A. glomerata</i> , <i>Deschampsia caespitosa</i> , <i>Trisetum spicatum</i> Dwarf Shrub, Grass Tundra (sand dune steppe) |
| | | IXh. Wet Barren/Wet Sedge Tundra Complex (barren/saline tundra complex, saltmarsh) | Typical communities listed in IIIb |

Table 6. Continued

| LEVEL A SMALL- SCALE UNITS | LEVEL B LANDSAT- SCALE UNITS | LEVEL C PHOTO-INTERPRETED MAP UNITS | LEVEL D TYPICAL PLANT COMMUNITIES |
|---|---|---|---|
| E. Partially Vegetated and Barren (continued) | IX. Partially Vegetated (continued) | IXi. Dry Barren/Forb, Graminoid Complex (coastal barrens) | Dry <i>Cochlearia officinalis</i> , <i>Stellaria humifusa</i> , <i>Puccinellia phryganodes</i> , <i>P. andersonii</i> , <i>Salix ovalifolia</i> , <i>Potentilla pulchella</i> Forb, Graminoid Tundra (coastal saline barrens) |
| | X. Light- colored Barrens (ground cover <30%) | Xa. River Gravels | Completely barren or with communities listed under IXb and IXc. |
| | | Xc. Barren Gravel Outcrops | Typical communities listed under Vd or IXe or the following among many others; <i>Dry Dryas octopetala</i> , <i>Lupinus arcticus</i> , <i>Potentilla biflora</i> , <i>Smelowski calycina</i> , <i>Saxifraga tricusoidata</i> , <i>Salix phlebophylla</i> , <i>Silene acaulis</i> Dwarf Shrub Barren (gravel outcrops) |
| | | Xe. Gravel Roads and Pads | Completely barren or partially vegetated with communities similar to IXb and IXc. |
| | XI. Dark-colored Barrens (ground cover <30%) | XIa. Wet Mud (drained lakes and ponds) | Completely barren or occasionally with colonizing species such as <i>Deschampsia caespitosa</i> and <i>Senecio congestus</i> . |
| XIc. Bare Peat (mostly barren coastal areas caused by storm surges) | | Completely barren or with sparse communities similar to IIIa, Va, and IXi. | |