

NATIONAL PARK SERVICE  
ALASKA REGION  
ANCHORAGE, ALASKA

UNIT 22D MOOSE SURVEY

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Natural Resources Survey and Inventory Report AR-88/10

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## BACKGROUND

Historical records show moose were absent from Unit 22 (Seward Peninsula) prior to 1930. Immigrants, presumably from the east and north were thought to have begun populating the area during the 1940's and 1950's. By the late 1960's, moose had expanded into most areas of suitable habitat. During the next two decades, numbers increased dramatically and currently may be at or near winter range carrying capacity in some areas.

Interest in harvesting moose in Unit 22 began in the late 1960's (Table 1). Much of the Unit's harvest traditionally occurs within drainages of Subunits 22B and 22D (Figure 1) where access is easiest because of the availability of roads and navigable rivers. Last year, a census was conducted within a portion of Subunit 22B using methods developed by Gasaway et al. (1986). The technique was designed primarily for conditions applicable to Interior Alaska and it was not known whether it would even work in this part of Alaska. Major climatological differences, primarily snow conditions, exist between coastal and interior regions of Alaska. The techniques specified were followed closely and surprisingly good results were obtained. Twice as many moose as previously estimated were found to inhabit the area. Short yearling percentages however, were similar to those estimates derived from surveys of previous years.

Because of high harvest, particularly along road corridors, and a slightly declining short yearling percentage, the decision was made to conduct, during March 1988 in portions of Subunit 22D, a census similar to that in 22B. Subunit 22D encompasses an area of approximately 5,200 square miles and includes as major drainages the Noxapaga, Kougarok, Kuzitrin, Pilgrim, American, and Agiupuk Rivers.

Objectives of doing a comprehensive moose census within Subunit 22D were as follows: 1) establish an overall density of moose to compare with previous estimates, 2) determine a percentage of short yearlings to compare with past survey data, 3) develop a sound data base for determining future changes in population structure and densities.

## METHODS

Techniques used in the 22D census again followed methods outlined by Gasaway et al. (1986). Because of the large size of the Subunit and anticipated differences in moose densities, two discrete census areas were defined. The Kuzitrin census area included portions of 22D draining into the Pilgrim, Kuzitrin, Kougarok, and Noxapaga Rivers (1,456 sq. mi.); and, the American census area included portions

of 22D draining into the American and Agiapuk Rivers (1,041 sq. mi.).

Sample units, approximately 12 square miles in size, were drawn on USGS topographical maps (1:63,360). Approximate size of each sample unit was determined while drawing boundaries by estimating the total number of one mile squares within each unit. Major rivers and creeks could not be used as boundaries because moose tend to use these areas as primary winter habitat. Care also had to be taken while drawing boundaries to assure these boundaries could be found from the air during the census. Prior knowledge and reconnaissance flights showed that moose were generally absent above the 1,000 foot contour during late winter. Much of the area above 1,000 feet was therefore eliminated before drawing sample unit boundaries.

Two sets of topographical maps with boundary lines were drawn. One set was assembled, placed on a wall, covered with clear mylar, and designated as the main work map. The other set was backed with cardboard and used during the stratification flight. Preceding the census, the main work map was taken to Anchorage where all sample units were accurately measured using a digitizing board.

Prior to conducting the actual censuses, stratification flights were flown by 4 persons in a C-185 aircraft. Based on the number of moose and/or tracks observed, sample units were assigned a density estimate of either high, medium, or low. Sample units to be counted were then randomly selected each day and assigned to the survey aircraft (supercub-type planes). Observers in these survey aircraft copied boundaries of their assigned units onto maps which they took with them on the census.

Once the survey aircraft reached their assigned sample unit, the parameter was flown and pilot and observer decided which was the best way to survey the area. Depending on the amount and type of cover, approximately 2 to 6 minutes per square mile were spent searching for moose. To determine a sightability correction factor (SCR), an area within the sample unit (estimated 2 sq mi in size) was selected and flown at approximately 6 to 10 minutes per square mile. All data were recorded on pre-printed data sheets. At days end data were combined, a rough population estimate with confidence intervals was determined and, except for the last day, new sample units to be flown the following day were randomly selected and assigned. Upon completion of the census, all data sheets were carefully reviewed and a final population estimate was derived.

## RESULTS

### KUZITRIN CENSUS AREA

The Kuzitrin Census Area, approximately 1,456 sq. mi. in size, was divided into 119 sample units. Based on stratification flight results, this area contained 51 low density units (608 sq miles), 39 medium density units (487 sq miles), and 29 units high density (361 sq miles). During the census, 41 sample units equaling 512 sq miles were actually surveyed. Of these, 8 were of low density strata (92 sq mi), 9 of medium density strata (113 sq mi), and 24 of high density strata (307 sq mi).

The expanded population estimate for the Kuzitrin Census Area was 1,951 moose. Confidence intervals surrounding this population estimate were as follows: at the 80% confidence interval (+/- 9.6%), 1,763-2,139 moose; at the 90% confidence interval (+/- 12.5%), 1,707-2,195 moose; and, at the 95% confidence interval (+/- 15.0%), 1,658-2,244 moose. Estimated percentage of short yearlings within this area was 14.2%. Confidence intervals surrounding this percentage were as follows: at the 80% level (+/- 9.1%), 12.9 -15.5%; at the 90% confidence interval (+/- 11.8%), 12.5-15.9%; and, at the 95% confidence interval (+/- 14.3%), 12.-16.3 %. Tables 2 & 4 provide a more comprehensive breakdown and analysis of these data.

### AMERICAN CENSUS AREA

The American Census Area approximately 1,041 sq mi in size was divided into 88 sample units. Based on stratification flight results, 43 sample units were of low density strata (505 sq. mi.), 26 sample units (309 sq. mi.) were of medium density strata, and 19 sample units (227 sq. mi.) of high density strata. During the census, 31 sample units (363 sq. mi.) were actually surveyed. Of these, 8 (89 sq. mi.) were of low density strata, 8 (91 sq. mi.) were of medium density, and 15 (183 sq. mi.) were of high density.

The expanded population estimate for the American Census Area was 941 moose. Confidence intervals surrounding this estimate were as follows: at the 80% confidence interval (+/- 8.7%), 859-1022 moose; at the 90% confidence interval (+/- 11.3%), 834-1047 moose; and, at the 95% confidence interval (+/- 13.7%), 812-1070 moose. Estimated percentage of short yearlings within this census area was 16.9%. Confidence intervals surrounding this percentage were as follows: at the 80% level (+/- 15.7%), 14.2-19.5%; at the 90% confidence interval (+/- 20.1%), 13.4-20.3%; and, at the 95% confidence interval (+/- 24.8%), 12.7-21.1%. Tables

3 & 5 provide a more comprehensive breakdown and analysis of these data.

#### DISCUSSION AND RECOMMENDATIONS

Most objectives of a Subunit 22D moose census have been met. A moose density was calculated and found to be approximately two times higher than previously estimated. Short yearling percentages however, were found to be similar to those percentages previously obtained from spring and fall surveys.

Because some doubt still exists on whether trend count areas are meaningful, none were established within Subunit 22D at this time. I have elected to wait until statisticians come up with a meaningful way to use these data. Although probably not the best approach, it appears that traditional spring and fall surveys in those areas of high moose concentrations will suffice for now.

Six aircraft ( 3 PA-18's, 1 PA-12, 1 C-185, and 1 Arctic Tern) were used in both censuses. A total of 14 people participated. The estimated costs of these censuses excluding salaries was \$17,000 (Table 6). Six full days were required to complete both censuses and 154.9 hours were flown by the aforementioned aircraft.

As was observed during the previous Subunit 22B census, coastal weather is quite variable and it is difficult to get more than a week at a time of what can be termed "optimal weather conditions". This year was no exception as we were forced to "break-off" the census for several days while waiting for a major storm front to pass.

Snow conditions continued to present problems, particularly during stratification. Prevailing northeasterly winter winds commonly found on the Seward Peninsula tend to pack the snow in some areas making it difficult to observe moose tracks. Much of this area borders on what may be commonly called desert conditions (i.e., less than 10" of precipitation annually) and getting a combination of fresh snow followed by good weather in March is difficult.

Although coastal conditions, weather and snow, on the Seward Peninsula were not ideal, the two censuses conducted this year were very successful. Data obtained and resultant confidence intervals surrounding those data proved to be among the best obtained statewide.

In summation, data gathered from censuses conducted during the past 2 years coupled with past survey data, harvest information, and hopefully an upcoming moose census in

Subunit 22A will allow us to develop a meaningful population model and subsequently a meaningful management plan for moose in Unit 22.

Special thanks go to the U. S. National Park Service and the U. S. Bureau of Land Management for aircraft and personnel provided during this census. Their assistance contributed directly to the success of this project. I look forward to working again with both agencies in future endeavors.

#### LITERATURE CITED

Gasaway, W. C., S. D. Du Bois, D. J. Reed, and S. J. Harbo. 1986. Estimating moose population parameters from aerial surveys. Biol. Pap. Univ. Alaska. No. 22. 108pp.

Table 1. Unit 22 historical moose harvest, 1969-87.

| Regulatory<br>Year | Males | Females | Unknown<br>Sex | Total<br>Harvest | (1)<br>Hunters | Percent<br>success |
|--------------------|-------|---------|----------------|------------------|----------------|--------------------|
| 1969               | 69    | 1       | 2              | 72               | 182            | 40                 |
| 1970               | 70    | 0       | 1              | 71               | 139            | 51                 |
| 1971               | 59    | 0       | 1              | 60               | 168            | 36                 |
| 1972               | 44    | 0       | 0              | 44               | 99             | 44                 |
| 1973               | 103   | 32      | 1              | 136              | 317            | 43                 |
| 1974               | 149   | 72      | 1              | 222              | 479            | 46                 |
| 1975               | 136   | 0       | 2              | 138              | 389            | 35                 |
| 1976               | 186   | 51      | 3              | 240              | 611            | 39                 |
| 1977               | 151   | 88      | 5              | 244              | 457            | 53                 |
| 1978               | 198   | 97      | 2              | 297              | 596            | 50                 |
| 1979               | 193   | 75      | 2              | 270              | 760            | 36                 |
| 1980               | 156   | 71      | 1              | 228              | 492            | 46                 |
| 1981               | 225   | 72      | 1              | 298              | 696            | 43                 |
| 1982               | 244   | 100     | 0              | 344              | 904            | 38                 |
| 1983               | 291   | 82      | 32             | 405              | 1292           | 31                 |
| 1984               | 298   | 91      | 6              | 395              | 1086           | 36                 |
| 1985               | 279   | 92      | 3              | 374              | 876            | 43                 |
| 1986               | 306   | 101     | 1              | 408              | 892            | 46                 |
| 1987               | 285   | 20      | 4              | 309              | 775            | 40                 |

(1) Minimum known number of hunters.

Table 2. Data obtained from Kuzitrin portion of 1988 Subunit 22D census.

Estimated total moose numbers and surrounding parameters.

| PAR/STRAT  | LOW    | MEDIUM  | HIGH    | TOTAL    |
|------------|--------|---------|---------|----------|
| N          | 51     | 39      | 29      | 119      |
| TOTAL AREA | 607.55 | 487.24  | 361.29  | 1456.08  |
| n          | 8      | 9       | 24      | 41       |
| AREA SUR.  | 92.08  | 113.20  | 306.89  | 512.17   |
| # SEEN     | 18     | 109     | 1065    | 1192     |
| DENSITY    | 0.1955 | 0.9629  | 3.4703  | 1.2648   |
| To         | 118.8  | 469.2   | 1253.8  | 1841.7   |
| V(To)      | 337.88 | 5601.91 | 8204.60 | 14144.38 |
| df         | 7      | 8       | 23      | 29       |

SCFo= 1.05948      V(SCFo)= 0.0013803612      df(SCFo)= 29  
Te= 1951.3      V(Te)= 20539.66      df(Te)= 29  
80% CI around Te = (1763.4- 2139.2) is +/- 9.63%  
90% CI around Te = (1707.8- 2194.8) is +/- 12.48%  
95% CI around Te = (1658.2- 2244.3) is +/- 15.02%

Estimated short yearling numbers and surrounding parameters.

| PAR/STRAT  | LOW    | MEDIUM | HIGH   | TOTAL   |
|------------|--------|--------|--------|---------|
| N          | 51     | 39     | 29     | 119     |
| TOTAL AREA | 607.55 | 487.24 | 361.29 | 1456.08 |
| n          | 8      | 9      | 24     | 41      |
| AREA SUR.  | 92.08  | 113.20 | 306.89 | 512.17  |
| # SEEN     | 1      | 15     | 162    | 178     |
| DENSITY    | 0.0109 | 0.1325 | 0.5279 | 0.1799  |
| Wno        | 6.6    | 64.6   | 190.7  | 261.9   |
| V(Wno)     | 35.12  | 228.60 | 211.28 | 475.00  |
| df         | 7      | 8      | 23     | 26      |

SCFo= 1.05948      V(SCFo)= 0.0013803612      df(SCFo)= 29  
Wne= 277.5      V(Wne)= 627.20      df(Wne)= 26  
80% CI around Wne= (244.5 - 310.4) is +/- 11.87%  
90% CI around Wne= (234.7 - 320.2) is +/- 15.40%  
95% CI around Wne= (226.0 - 328.9) is +/- 18.56%

Estimated percentage short yearlings and confidence intervals surrounding that percentage.

p= 0.1422      V(p)= 0.00009729      df(p)= 26  
80% CI around p= (0.1292-0.1552) is +/- 9.12%  
90% CI around p= (0.1254-0.1590) is +/- 11.83%  
95% CI around p= (0.1219-0.1625) is +/- 14.26%

Table 3. Data obtained from American portion of 1988 Subunit 22D census.

Estimated total moose numbers and surrounding parameters.

| PAR/STRAT  | LOW     | MEDIUM  | HIGH   | TOTAL   |
|------------|---------|---------|--------|---------|
| N          | 43      | 26      | 19     | 88      |
| TOTAL AREA | 504.80  | 309.40  | 226.80 | 1041.00 |
| n          | 8       | 8       | 15     | 31      |
| AREA SUR.  | 89.27   | 91.39   | 182.51 | 363.17  |
| # SEEN     | 19      | 81      | 430    | 530     |
| DENSITY    | 0.2128  | 0.8863  | 2.3560 | 0.8799  |
| To         | 107.4   | 274.2   | 534.3  | 916.0   |
| V(To)      | 1558.58 | 1242.97 | 554.10 | 3355.66 |
| df         | 7       | 7       | 14     | 19      |

SCFo= 1.02705      V(SCFo)= 0.0002885977      df(SCFo)= 21  
Te= 940.8      V(Te)= 3780.84      df(Te)= 19  
80% CI around Te = (859.1 - 1022.4) is +/- 8.68%  
90% CI around Te = (834.5 - 1047.1) is +/- 11.30%  
95% CI around Te = (812.1 - 1069.5) is +/- 13.68%

Estimated short yearling numbers and surrounding parameters.

| PAR/STRAT  | LOW    | MEDIUM | HIGH   | TOTAL   |
|------------|--------|--------|--------|---------|
| N          | 43     | 26     | 19     | 88      |
| TOTAL AREA | 504.80 | 309.40 | 226.80 | 1041.00 |
| n          | 8      | 8      | 15     | 31      |
| AREA SUR.  | 89.27  | 91.39  | 182.51 | 363.17  |
| # SEEN     | 4      | 14     | 68     | 86      |
| DENSITY    | 0.0448 | 0.1532 | 0.3726 | 0.1484  |
| Wno        | 22.6   | 47.4   | 84.5   | 154.5   |
| V(Wno)     | 231.54 | 184.35 | 53.24  | 469.14  |
| df         | 7      | 7      | 14     | 17      |

SCFo= 1.02705      V(SCFo)= 0.0002885977      df(SCFo)= 21  
Wne= 158.7      V(Wne)= 501.61      df(Wne)= 17  
80% CI around Te = (128.8 - 188.6) is +/- 18.81%  
90% CI around Te = (119.7 - 197.7) is +/- 24.56%  
95% CI around Te = (111.4 - 206.0) is +/- 29.78%

Estimated percentage short yearlings and confidence intervals surrounding that percentage.

p= 0.1687      V(p)= 0.00039397      df(p)= 17  
80% CI around p= (0.1422-0.1951) is +/- 15.69%  
90% CI around p= (0.1341-0.2032) is +/- 20.47%  
95% CI around p= (0.1268-0.2106) is +/- 24.83%

Table 4. Subunit 22D - Kuzitrin Census Data 1988.

| SUID   | ST | AREA  | CW1 | CW2 | LCF | UNK | TOT  | S | REG |
|--------|----|-------|-----|-----|-----|-----|------|---|-----|
| 15     | M  | 11.25 | 4   | 0   | 0   | 17  | 25   |   | 0   |
| 16     | H  | 10.23 | 8   | 0   | 0   | 10  | 26   | S | 16  |
| 17     | H  | 11.75 | 13  | 0   | 0   | 18  | 44   | S | 10  |
| 18     | L  | 11.73 | 0   | 0   | 0   | 2   | 2    | S | 0   |
| 19     | H  | 11.38 | 5   | 0   | 0   | 11  | 21   | S | 13  |
| 26     | H  | 11.05 | 13  | 0   | 0   | 38  | 64   | S | 10  |
| 27     | H  | 11.29 | 11  | 0   | 0   | 20  | 42   | S | 7   |
| 28     | H  | 12.66 | 0   | 0   | 0   | 22  | 22   | S | 22  |
| 32     | H  | 12.53 | 2   | 0   | 0   | 19  | 23   | S | 0   |
| 34     | H  | 12.62 | 0   | 0   | 0   | 19  | 19   | S | 19  |
| 36     | L  | 9.43  | 0   | 0   | 0   | 1   | 1    |   |     |
| 38     | L  | 13.32 | 1   | 0   | 0   | 2   | 4    |   |     |
| 43     | L  | 13.08 | 0   | 0   | 0   | 3   | 3    | S | 3   |
| 48     | H  | 13.76 | 8   | 0   | 0   | 20  | 36   | S | 9   |
| 49     | H  | 14.15 | 8   | 1   | 0   | 31  | 50   |   | 0   |
| 50     | H  | 14.57 | 0   | 0   | 9   | 138 | 147  | S | 7   |
| 67     | H  | 13.95 | 1   | 0   | 0   | 8   | 10   | S | 0   |
| 68     | L  | 11.90 | 0   | 0   | 0   | 4   | 4    |   |     |
| 71     | H  | 12.52 | 21  | 0   | 0   | 77  | 119  | S | 14  |
| 72     | H  | 15.18 | 2   | 0   | 0   | 16  | 20   | S | 0   |
| 73     | M  | 12.20 | 2   | 0   | 0   | 7   | 11   |   | 0   |
| 84     | M  | 11.51 | 2   | 0   | 0   | 10  | 14   | S | 8   |
| 87     | H  | 12.75 | 4   | 1   | 0   | 25  | 36   | S | 5   |
| 89     | M  | 15.71 | 3   | 0   | 0   | 4   | 10   |   | 0   |
| 96     | M  | 12.67 | 0   | 0   | 0   | 10  | 10   | S | 5   |
| 97     | L  | 11.67 | 0   | 0   | 0   | 2   | 2    | S | 2   |
| 99     | H  | 13.08 | 0   | 0   | 0   | 2   | 2    | S | 1   |
| 100    | H  | 13.28 | 0   | 0   | 3   | 49  | 52   | S | 5   |
| 104    | L  | 9.79  | 0   | 0   | 0   | 1   | 1    |   | 0   |
| 113    | H  | 12.87 | 3   | 1   | 0   | 10  | 19   | S | 19  |
| 114    | H  | 11.69 | 0   | 0   | 6   | 109 | 115  | S | 37  |
| 115    | M  | 10.34 | 0   | 0   | 0   | 14  | 14   | S | 14  |
| 116    | H  | 11.20 | 5   | 1   | 0   | 22  | 35   | S | 8   |
| 120    | H  | 13.49 | 16  | 2   | 0   | 56  | 94   | S | 56  |
| 122    | H  | 12.27 | 2   | 0   | 0   | 11  | 15   | S | 10  |
| 126    | M  | 12.47 | 2   | 0   | 0   | 7   | 11   | S | 5   |
| 132    | M  | 10.36 | 0   | 0   | 0   | 7   | 7    |   | 0   |
| 135    | M  | 16.69 | 2   | 0   | 0   | 3   | 7    |   | 0   |
| 137    | H  | 14.68 | 6   | 2   | 0   | 24  | 42   | S | 4   |
| 221    | H  | 13.94 | 0   | 0   | 0   | 12  | 12   | S | 10  |
| 242    | L  | 11.16 | 0   | 0   | 0   | 1   | 1    |   |     |
| 512.17 |    |       | 144 | 8   | 18  | 862 | 1192 |   |     |

Table 5. Subunit 22D - American Census Data 1988.

| SUID   | ST | AREA  | CW1 | CW2 | LCF | UNK | TOT | S | REG | INT |
|--------|----|-------|-----|-----|-----|-----|-----|---|-----|-----|
| 183    | L  | 12.08 | 0   | 0   | 0   | 0   | 0   |   |     |     |
| 184    | M  | 13.16 | 3   | 1   | 0   | 2   | 11  | S | 0   | 0   |
| 190    | L  | 10.16 | 1   | 0   | 0   | 1   | 3   |   |     |     |
| 194    | L  | 10.16 | 0   | 0   | 0   | 0   | 0   |   |     |     |
| 195    | H  | 11.46 | 5   | 0   | 0   | 32  | 42  | S | 3   | 4   |
| 197    | H  | 13.35 | 8   | 0   | 0   | 20  | 36  | S | 14  | 14  |
| 200    | L  | 12.51 | 3   | 0   | 0   | 2   | 8   |   |     |     |
| 203    | H  | 14.55 | 2   | 0   | 0   | 15  | 19  | S | 15  | 15  |
| 208    | M  | 9.95  | 1   | 0   | 0   | 16  | 18  | S | 14  | 14  |
| 215    | H  | 10.45 | 2   | 0   | 0   | 11  | 15  | S | 10  | 10  |
| 216    | H  | 10.60 | 2   | 0   | 0   | 11  | 15  | S | 2   | 2   |
| 217    | H  | 13.97 | 3   | 0   | 0   | 23  | 29  | S | 12  | 14  |
| 219    | H  | 10.11 | 5   | 0   | 0   | 22  | 32  | S | 20  | 20  |
| 226    | H  | 11.00 | 3   | 0   | 0   | 10  | 16  | S | 7   | 7   |
| 231    | M  | 9.72  | 0   | 0   | 0   | 5   | 5   |   |     |     |
| 233    | H  | 13.41 | 1   | 1   | 0   | 23  | 28  | S | 10  | 10  |
| 234    | M  | 12.54 | 4   | 0   | 0   | 4   | 12  | S | 3   | 3   |
| 266    | M  | 12.45 | 0   | 0   | 0   | 12  | 12  | S | 4   | 4   |
| 271    | M  | 11.67 | 0   | 0   | 1   | 5   | 6   |   |     |     |
| 272    | M  | 10.17 | 1   | 0   | 0   | 3   | 5   | S | 1   | 1   |
| 275    | H  | 14.37 | 7   | 0   | 0   | 35  | 49  | S | 15  | 15  |
| 277    | H  | 12.69 | 9   | 2   | 0   | 21  | 45  | S | 5   | 5   |
| 279    | M  | 11.73 | 2   | 0   | 0   | 8   | 12  | S | 2   | 2   |
| 281    | H  | 10.84 | 3   | 0   | 0   | 14  | 20  | S | 0   | 0   |
| 282    | H  | 11.86 | 2   | 0   | 0   | 23  | 27  | S | 3   | 4   |
| 285    | H  | 14.31 | 10  | 0   | 0   | 25  | 45  | S | 2   | 2   |
| 287    | H  | 9.54  | 0   | 0   | 0   | 12  | 12  | S | 0   | 0   |
| 290    | L  | 8.82  | 0   | 0   | 0   | 2   | 2   |   |     |     |
| 309    | L  | 10.49 | 0   | 0   | 0   | 3   | 3   | S | 1   | 1   |
| 311    | L  | 9.83  | 0   | 0   | 0   | 3   | 3   |   |     |     |
| 313    | L  | 15.22 | 0   | 0   | 0   | 0   | 0   |   |     |     |
| 363.17 |    |       | 77  | 4   | 1   | 363 | 530 |   |     |     |

TABLE 6. SUBUNIT 22D MOOSE CENSUS, 1988. A BREAKDOWN OF COSTS.

|                       | HRS   | CHARTER<br>COSTS | FUEL<br>COSTS | AIR<br>FARE | PER<br>DIEM | OTHER<br>EXPENSES |
|-----------------------|-------|------------------|---------------|-------------|-------------|-------------------|
| BERING AIR            |       | \$231.00         |               |             |             |                   |
| KEN TAYLOR            |       |                  |               | \$440.00    | \$155.00    |                   |
| STEVE DU BOIS         |       |                  |               | \$470.00    | \$279.00    |                   |
| DAN REED              |       |                  |               | \$470.00    | \$279.00    |                   |
| TIM OSBORNE           |       |                  |               |             | \$217.00    |                   |
| JOHN HARMON           |       |                  |               |             | \$195.00    |                   |
| PARK SERVICE PILOT    |       |                  |               |             | \$1,000.00  |                   |
| BOB NELSON (DIGITIZE) |       |                  |               |             | \$220.00    |                   |
| F&WP PA-18 (HARMON)   | 24.9  | \$1,500.00       |               |             |             |                   |
| F&WP PA-18 (KNUDSEN)  | 19.9  | \$850.00         |               |             |             |                   |
| C-185                 | 34.9  | \$3,211.00       |               |             |             |                   |
| NOME PA-12*           | 28.9  | \$1,936.00       |               |             |             |                   |
| PARK SERVICE TERN     | 40.8  | \$2,000.00       |               |             |             |                   |
| BLM PA-18             | 5.5   | \$770.00         |               |             |             |                   |
| USGS (MAPS)           |       |                  |               |             |             | \$418.00          |
| PACIFIC ALASKA FUEL   |       |                  | \$2,350.00    |             |             |                   |
|                       | 154.9 | \$10,498.00      | \$2,350.00    | \$1,380.00  | \$2,345.00  | \$418.00          |

\$16,991.00

\* DOLLAR FIGURE WAS DERRIVED USING AN ESTIMATED COSTS OF \$67/HR.

**FIGURE 1. UNIT 22 WITH SUBUNIT BOUNDARIES**

The map displays the Seward Peninsula, Alaska, with subunit boundaries for Unit 22. The subunits are labeled as follows:

- 22A**: Located in the southeast, including Norton Bay and the area around Cape Dook.
- 22B**: Located in the east-central part, including the area around Cape Dook and the mouth of the Yukon River.
- 22C**: Located in the south-central part, including the area around Cape Dook and the mouth of the Yukon River.
- 22D**: Located in the west-central part, including the area around Cape Dook and the mouth of the Yukon River.
- 22E**: Located in the northwest, including the area around Cape Eganberg and Goodhope Bay.

The map also shows various geographical features such as Cape Eganberg, Goodhope Bay, Eschscholtz Bay, Selawik Lake, and Norton Bay. It includes numerous mountains, rivers, and coastal features. The map is overlaid with a grid system.