Interim Summary Report, 1984.

An Evaluation of Arctic nesting geese productivity and mortality on the Yukon Delta National Wildlife Refuge, Alaska

by

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and

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Key Words:

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Executive Summary

Ten field crews documented the nesting chronology, sources and magnitude of predation, and productivity of arctic nesting geese on the Yukon-Kuskokwim delta. The primary objectives of this study were to monitor the impact of human and animal predation and to determine net goose productivity on the delta.

Nesting chronology during this season was within the "typical" range, yet four to five days later than in 1983. Clutch sizes for all species (brant: $x=3.6$, $n=106$; cacklers: $x=5.1$, $n=97$; emperors: $x=5.9$, $n=31$; and white-fronts: $x=5.1$, $n=9$) were within the normal range when compared to the 15-year average. Nesting success this year was lower than observed in previous years for brant, emperors and white-fronts. Cacklers did poorer when compared to 1983 and better when compared to 1982; nonetheless, cackler productivity was mediocre to poor. Thus, overall nesting success was poor for brant, mediocre to poor for cacklers; mediocre to fair for emperors; and white-fronts exhibited a fair to good year despite an apparent decrease in numbers of geese on the various study plots.

Preliminary analysis of the delta study areas show that nesting failure was due in large measure to mammalian and avian predators. The number of mammalian predators appeared to be high this spring. We believe that the relatively mild environmental conditions observed during the 1983-1984 winter contributed significantly to the total amount of predator activity. Further, much of the observed depredation on the study plots occurred prior to the first surveys conducted by the field crews. Some egging of brant and cacklers was documented, but no jump shooting was reported this year. The general impression was a reduction in the volume of spring subsistence harvest.

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Introduction

Ten field crews distributed throughout the Yukon-Kuskokwim delta (Figure 1) documented the nesting chronology, predation and productivity of four species of arctic nesting geese from April 25th through July 20th 1984. The primary objectives of this study are to monitor both the sources and magnitude of animal and human predation and to determine net productivity of goose populations on the delta (Garrett, Butler and Wege 1983). This report is a preliminary assessment of these data available as of July 13th. Specifically, this report presents a preliminary assessment of weather conditions, temporal and spatial aspects of migration, nesting chronology, depredation and net productivity of Pacific black brant, cackling Canada geese, emperor geese and Pacific white-fronted geese.

Methodologies

Data gathering methodologies are similar to those described elsewhere (Garrett et al. 1983). While some adjustments were instituted for the 1984 field season, none of these changes disrupted the continuity of data gathering and will be described in the 1984 Summary Report.

Results

The 1983-84 winter was characterized by moderate temperatures and little snow accumulation. Unseasonably warm temperatures during early April further reduced the snow cover. Cold temperatures in early May allowed snow machine travel to continue until about May 15th and boat travel began about June 1st. The chronology of the 1984 breakup was several days later than 1983 and appeared to be an "average" year. Therefore, the reproductive effort was not hampered by environmental conditions, i.e. extreme temperatures and wind tides.

Pacific Black Brant:

The chronology of brant nesting as ascertained by field observers is shown in Table 1. In general, the nesting chronology was about four to five days later than during 1983 and 10-15 days "ahead" of 1982. Chronologically and environmentally, conditions were "average" and tended to support a prognosis of "favorable productivity". Basic production data also support this notion; namely, average clutch size was 3.6 eggs per clutch compared to the 15-year average of 3.7 eggs per clutch (Garrett 1983).

Despite favorable conditions, two factors contributed to poor brant productivity. First, the total number of brant nesting on the delta has decreased markedly over the past four years (Table 5), perhaps as much as 76% or more. This year's population was approximately half the number observed on the delta in 1983 -- from 33,000 to 16,248 brant or from 16,500 pairs to fewer than 8,124 pairs (Clark and Garrett 1984). Clearly, however, it is possible that some brant which have typically nested on the delta have moved off the refuge to more northerly molting or nesting areas. Second, brant exhibited a major nesting failure throughout the delta. Approximately 87% of the nesting attempts failed this spring (i.e. nesting success was 13% compared to 53% in 1983, Table 6). Most nesting failure is attributed to "animal predation" during the early stages of the nesting cycle. Both mammalian and avian predators -- specifically: fox, mink, gulls and jaegers -- appeared to be sharply focused upon brant. The types of predators at any one location, however, appears to have been different between colonies; thus, the general or functional category -- "predator assemblage" -- more accurately describes both the breadth and extent of predator activity. The salient point is that predator activity was sharply focused upon brant at the onset of nesting and that several kinds of predators were involved. Additionally, some spring subsistence egging occurred at Kokechik Bay and Kigigak Island monitoring areas, but in contrast with observations made during 1982 and 1983, field observers did not witness jump shooting of nesting brant. The general impression is that subsistence activity was less intense and of lower volume this year as compared with previous years.

Although many brant pairs failed to successfully produce goslings, the average brood size from a limited sample of Class I broods (3.0 goslings, n=34) shows an increase in size when compared with 1983 (2.8 goslings per brood, n=1454). This small increase in the number of goslings per brood, nonetheless, is overshadowed by the magnitude of the general nesting failure.

Cackling Canada Geese:

Five Canada geese (probably cacklers) were observed flying from Nunivak Island toward the mainland on April 4th (Jack Williams, personal communication). Migration-arrival for cacklers on the mainland (Manokinak) was April 27th (Table 2). Despite a five to six day delay in nesting chronology, average clutch size (5.1 eggs per clutch, n=97) was similar to 1983 (5.0 eggs per clutch, n=213) and supported the impression that favorable conditions for productivity occurred.

As was the case for brant, however, two factors resulted in poor cackler productivity on the delta. First, comparable data for 1983 and 1984 show that nesting attempts decreased by 35 percent. In addition, long-term data from the "cackler plots" support the observation of a continued numerical decline in nesting cacklers on the delta (Butler 1984). Second, there was a significant decline in nesting success (64%

compared to 46%) between 1983 and 1984 (Table 6). As with brant, nesting failure occurred primarily during the early stages of the nesting cycle. Both mammalian and avian predators, however, were active throughout incubation; additionally, some spring subsistence egging occurred on a few "cackler plots" at about the same level or slightly less than in previous years.

Many cackler pairs, upwards to 50%, failed to successfully produce goslings; furthermore, average brood size from a limited sample of Class I broods (4.1 goslings, n=114) was smaller this year compared to 1983 (5.0 goslings per bood, n=46), and contributed to the poor cackler production observed delta-wide this year.

Emperor Geese:

The chronology of events for emperor geese is shown in Table 3. The delay in migration-arrival and nesting between 1983 and 1984 was slightly less for emperors (three to four days) than for brant and cacklers. Our preliminary assessment is that environmental conditions were suitable for good emperor production.

In 1984, despite a slight increase in clutch size (5.9 eggs, n=31 compared to 5.4 eggs, n=121) and Class I brood size (3.8 goslings, n=152 compared to 3.7 goslings, n=52), comparable data show that nesting attempts decreased by 34% from 1983. Furthermore, nesting success dropped from 73% in 1983 to 63% in 1984 (Table 6); the result was, at best, mediocre emperor production on the delta.

Pacific White-fronted Geese:

The first white-fronts were observed at Manokinak field camp on April 26th. Subsequent observations at other field camps are reported in Table 4 along with nesting chronology data. As with the three other goose species, white-fronts exhibited a delayed nesting season. Nest initiation was three to four days later this year when compared to 1983; although, the general chronology appears to be about "average" for white-fronts (Mickelson 1975, Ely 1979).

This season only 123 nesting attempts were observed as compared to 327 in 1983. This is explicable on two counts: there were fewer birds on the field plots and the white-front survey was less intensive this season. Based upon the population trends of other arctic nesting geese on the delta (Jarvis and Bartonek 1979, Derksen 1983, Garrett et al. 1983) there is a strong tendency to infer that the white-front population may be continuing to decline also; our data sets are not strong enough to say one way or the other. Nesting success, while less this year (79%) than observed in 1983 (88%), is fair to good (Table 6). The number of eggs per clutch and the number of young per brood were not markedly different from previous years (Table 4); thus, overall, white-fronts appear to have had a fairly productive season despite lower production compared with previous years.

Conclusions

In general, net productivity is down from 1983 for four species of Yukon Delta NWR nesting geese. While clutch size and brood size were about "average", the survivorship (to hatch) of initiated clutches was dramatically reduced, particularly for brant (Table 6). Cacklers, emperors and white-fronts exhibited progressively better success, 46%, 63% and 79% respectively, but collectively they tended to be lower than in previous years (Table 6). In large measure this year's lowered net productivity is attributed to predator activity in the nesting areas. It appears that mild winter conditions promoted surivorship of terrestrial predators such as fox and mink; thus, fox in particular were noticeably abundant in some brant areas prior to the field crews' initial surveys. It should be noted that much of the total depredation occurred prior to the field crews entering the survey plots. In addition to terrestial predators, avian predators were very active -- both gulls and jaegers. We found this "predator assemblage" both effective and relatively abundant; nonetheless, the total impact this year may be magnified since small mammal numbers were particularly low at the various study areas. Thus, the combination of low returning numbers of breeding pairs, reasonably abundant numbers of mammalian and avian predators and favorable enviromental conditions appears to have triggered a substantial switching to vulnerable prey species -- specifically nesting geese and their eggs. Additionally there was some spring subsistence activity, but unlike 1982 and 1983 when both egging and jump shooting of nesting birds were observed, we observed only egging at Kigigak Island, Kokechik Bay and on several cackler plots. It appears that spring hunting and the volume of harvest this year was somewhat less than in 1983.

In summary, 1984 brant production was poor and cackler production was poor to mediocre. Emperors exhibited a mediocre to fair level of productivity, yet 10% below the past three years' average production. White-fronts appear to have had a fair to good year but clearly below the 1983 level. The principal factors contributing to lower than desired net productivity are fewer returning nesting pairs and loss of eggs to both "predators" and "humans". While all the data sets have not been analyzed at this writing, it appears that brant sustained the greatest level of predation followed by cacklers, emperors and white-fronts. While cacklers sustained a moderate level of egging, it appears that egging pressure was again greatest on brant but reduced from previous years. Emperors and white-fronts sustained less hunting and egging pressure than other goose species presummably because they are generally less accessible.

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Table 1. Chronology of Pacific black brant nesting on the Yukon Delta NWR, 1984.

Entry	Kokechik West	Tutakoke	Kigigak Inland	Old Chevak	Manokinak	South Nelson Inland	Cackler Flats	Whitefront Survey
Initial arrival	5/13	5/11	5/7	5/16	5/13	5/11	-	-
Peak arrival	5/27-5/29(1)	5/19-5/21	5/13-5/16	5/17-5/19	5/19-5/20	5/11-5/14	-	-
Nest initiation	5/22	5/20	5/18	-	5/22	-	-	-
Peak nest initiation	5/28-5/31	5/25-5/30	5/27	-	5/22-5/24	-	-	-
Initiation of incubation	5/26	5/26	5/23	-	5/28	-	-	-
Peak initiation of incubation	5/30-6/1	5/29-6/1	5/29	-	5/28	-	-	-
First clutch to hatch	6/17	6/18	6/17	-	6/20	-	-	-
Peak of hatch	6/19-6/22	6/18-6/19	6/20	-	6/21	-	-	-
Nesting attempts	1,106	480	274	0	8	0	66	0
Nests for which no eggs were laid	18	0	1	-	0	-	-	-
Nests for which no eggs hatched	657	474	241	-	5	-	49	-
Nests for which one or more eggs hatched	160	5	32	-	3	-	8	-
Nest status undetermined	271	1	0	-	0	-	9	-
"Complete" clutch size	3.9 (n=30)	3.4 (n=21)	3.5 (n=55)	-	-	-	-	-
"Incomplete" clutch size	2.6 (n=651)	3.0 (n=74)	1.0 (n=64)	-	3.8 (n=5)	-	3.9 (n=16)	-
Class I brood size	3.0 (n=20)	1.8 (n=5)	3.5 (n=9)	-	-	-	-	-

1 Three distinct brant migration waves were observed. Few, if any, brant landed on Kokechik Bay between May 13th-16th but some landed in the area between May 19th-24th, even though the bay was filled with ice. Most brant landed in the area during the final wave (May 27th-29th) which coincided with break-up.

Table 2. Chronology of cackling Canada geese nesting on the Yukon Delta NWR, 1984.

Entry	Kokechik West	Tutakoke	Kigigak Island	Old Chevak	Manokinak	South Nelson Island	Cackler Plots	Whitefront Survey
Initial arrival	5/7	5/9	4/28-4/30	5/7	4/27	4/25	-	-
Peak arrival	5/11-5/14	5/11	5/13-5/16	5/10-5/12	5/13-5/15	5/12-5/17	-	-
Nest initiation	5/22	5/21	5/21	5/23	5/21	5/24	-	-
Peak nest initiation	5/28-5/31	5/22-5/24	5/26	-	5/22-5/29(1)	5/24	-	-
Initiation of incubation	5/25	5/25	5/26	-	5/26	5/29	-	-
Peak initiation of incubation	5/29-6/1	5/27-5/31	5/30	-	5/27-6/2(2)	5/29	-	-
First clutch to hatch	6/20	6/22	6/19	6/26	6/19	6/24	-	-
Peak of hatch	6/22-6/26	6/22-6/25	6/24	-	6/25-6/26	6/24	-	-
Nesting attempts	79	23	100	52	37	6	386	6
Nests for which no eggs were laid	0	0	0	0	0	0	-	0
Nests for which no eggs hatched	22	4	59	43	26	5	150	2
Nests for which one or more eggs hatched	51	12	40	9	11	1	133	3
Nest status undetermined	6	7	1	0	0	0	103	1
"Complete" clutch size	-	5.8 (n=8)	5.0 (n=49)	-	5.0 (n=38)	5.0 (n=2)	-	-
"Incomplete" clutch size	4.6 (n=65)	5.1 (n=11)	2.0 (n=16)	2.7 (n=9)	4.5 (n=10)	5.5 (n=4)	5.1 (n=198)	5.8 (n=4)
Class I brood size	3.5 (n=8)	4.8 (n=14)	3.5 (n=31)	2.7 (n=16)	4.9 (n=44)	3.0 (n=1)	-	-

1 Nest initiation had two peaks: May 22th-25th and May 28th-29th.
2 Initiation of incubation had two peaks: May 27th-28th and June 1st- 2nd.

Table 3. Chronology of emperor geese nesting on the Yukon Delta NWR, 1984.

Entry	Eokechik Went	Tutakoke	Kigigak Inland	Manokinak	Old Chevak	South Nelson Island	Cackler Plots	Whitefront Survey
Initial arrival	5/26	5/11	Prior to 4/28	4/28	Prior to 4/30	4/28	-	-
Peak arrival	5/14-5/17	5/13	5/11-5/13	5/13-5/15	5/11-5/13	5/5-5/13(1)	-	-
Nest initiation	-	-	5/18	5/17	5/19	5/13	-	-
Peak nest initiation	-	-	5/23	5/24-5/27	-	5/21	-	-
Initiation of incubation	-	-	5/27	5/25	5/25	5/20	-	-
Peak initiation of incubation	-	-	5/28	5/28-6/1	-	5/24	-	-
First clutch to hatch	-	-	6/16	6/17	6/18	6/13	-	-
Peak of hatch	-	-	6/19	6/20-6/24	-	6/15	-	-
Nesting attempts	32	5	27	42	21	17	148	9
Nests for which no eggs were laid	0	0	1	0	0	0	-	-
Nests for which no eggs hatched	4	2	3	18	10	8	25	2
Nests for which one or more eggs hatched	27	1	9	20	11	9	63	6
Nest status undetermined	1	2	1	4(2)	0	0	60	1
"Complete" clutch size	-	-	5.5 (n=15)	7.2 (n=9)	5.3 (n=6)	4.0 (n=1)	-	-
"Incomplete" clutch size	5.9 (n=31)	5.7 (n=3)	3.6 (n=3)	3.7 (n=21)	3.5 (n=4)	4.9 (n=16)	5.6 (n=105)	7.1 (n=7)
Class I brood size	3.8 (n=18)	4.1 (n=34)	3.8 (n=9)	4.3 (n=18)	3.5 (n=41)	3.4 (n=32)	-	-

1 Two peaks of arrival: May 5th-6th and May 11th-13th.
2 Includes three nests active as of July 1st.

Table 4. Chronology of white-fronted geese nesting on the Yukon Delta NWR, 1984.

Entry	Kokechik West	Tutakoke	Kigigak Island	Old Chevak	Manokinak	South Nelson Island	Cackler Plots	Whitefront Survey
Initial arrival	5/6	5/4	Prior to 4/28	Prior to 4/30	Prior to 4/26	4/25	-	-
Peak arrival	5/11-5/16	5/13	5/13-5/18	5/10-5/12	5/13-5/16	5/6-5/15[1]	-	-
Nest initiation	-	-	5/19-5/26[2]	5/18	5/20	5/15	-	-
Peak nest initiation	-	-	-	-	5/23	5/19	-	-
Initiation of incubation	-	-	5/25-5/28[3]	5/24	5/25	5/19	-	-
Peak initiation of incubation	-	-	-	-	5/27	5/23	-	-
First clutch to hatch	-	-	-	6/19	6/18	6/14	-	-
Peak of hatch	-	-	-	-	6/20	6/17	-	-
Nesting attempts	2	2	2	17	7	26	45	22
Nests for which no eggs were laid	0	0	1	0	0	0	-	-
Nests for which no eggs hatched	0	-	0	3	1	6	1	6
Nests for which one or more eggs hatched	1	-	0	14	6	20	15	13
Nest status undetermined	1	2	1	0	0	0	29	3
"Complete" clutch size	-	-	-	5.4 (n=5)	4 0 (n=1)	5.0 (n=3)	-	-
"Incomplete" clutch size	6.0 (n=2)	6.5 (n=2)	3	4.0 (n=5)	4.6 (n=5)	4.5 (n=23)	4.5 (n=42)	4.1 (n=22)
Class I brood size	-	-	3.5 (n=2)	6.0 (n=1)	4.0 (n=1)	3.5 (n=6)	-	-

1 Two peaks of arrival: May 6th and May 11th-15th.
2 Nest initiation occurred in two waves: May 19th and May 26th.
3 Nest incubation occurred in two waves: May 25th and May 28th.

Table 5. Estimated numbers of Pacific black brant nesting on the Yukon Delta NWR, 1981-1984.

Year	Total brant nesting at three major colonies[1]	Total brant nesting on the Yukon Delta NWR[2]
1981	45,301	67,783
1982	24,005 (-47%)[3]	44,700 (-34%)
1983	22,508 (-06%)	33,000 (-26%)
1984	8,736 (-61%)	16,267 (-51%)

1 The three major brant nesting colonies are located at Kokechik Bay, Tutakoke River and Kigigak Island. The total number of birds estimated for these three colonies was determined by ground surveys.

2 The total number of brant nesting on the Yukon Delta NWR is the sum of ground surveys at the three major nesting colonies and the sum of aerial surveys for the remaining colonies.

3 Percentage decline from previous year.

Table 6. Nesting success estimates[1] of geese on the Yukon Delta NWR, 1981-1984.

Year	Species			
	Brant[2]	Cacklers	Emperors[3]	White-fronts
1981	58% (n=1,016)	61% (n=196)	78% (n=90)	NA
1982	36% (n=4,080)	25% (n=586)	70% (n=178)	NA
1983	53% (n=3,914)	64% (n=724)	73% (n=397)	88% (n=282)
1984	13% (n=1,653)	46% (n=571)	63% (n=369)	79% (n=87)

1 Nesting success equals the number of nests for which one or more eggs hatched divided by the number of nests for which productivity status was determined.

2 Kokechik Bay West contains 19% of the total known brant nesting area, and Tutakoke River and Kigigak Island contain 10% and 26%, respectively. The remaining 45% are areas that sustain colonies ranging between 50-1,000 birds.

3 Includes data from Kokechik Bay East (Petersen 1983 and 1984).

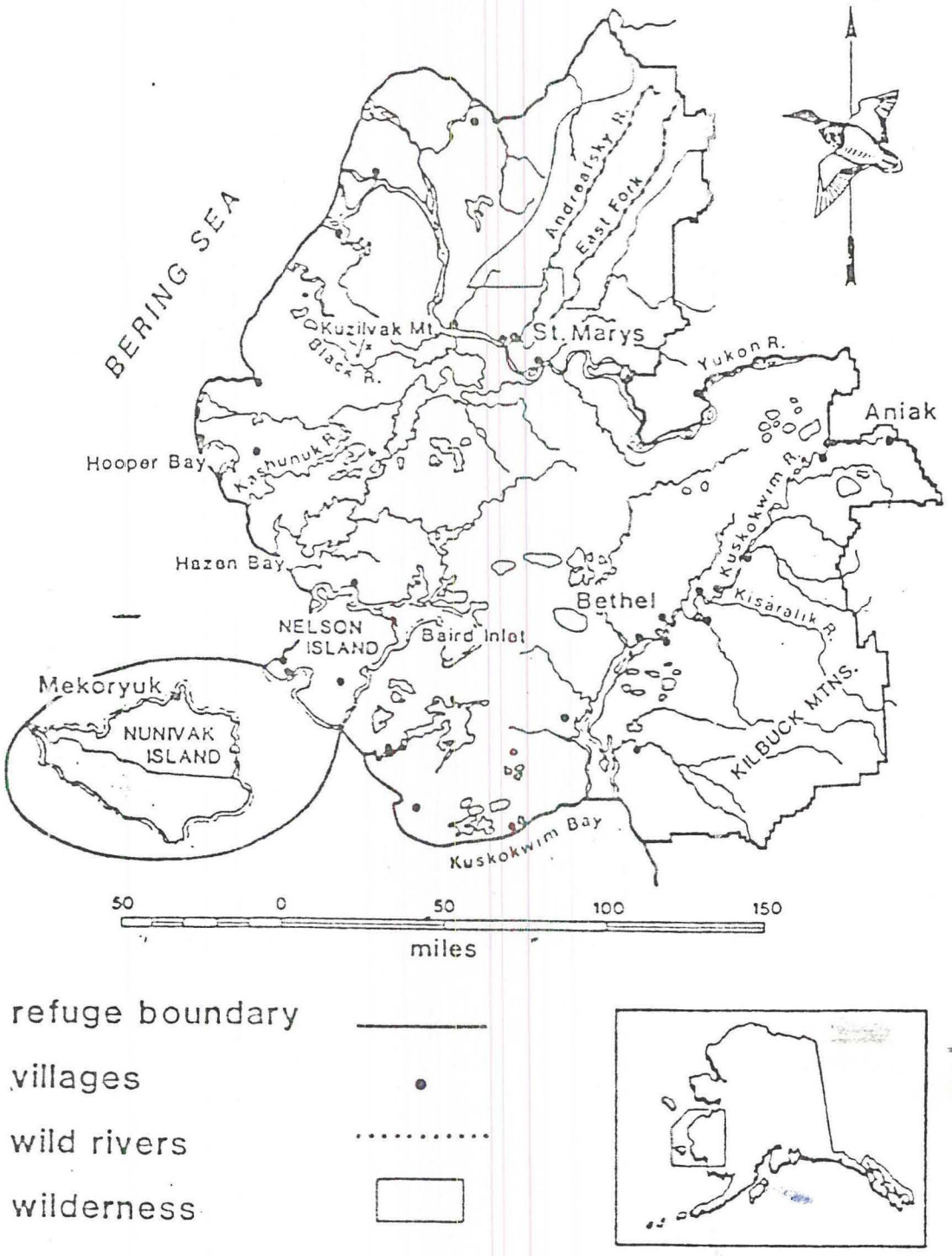

Figure 1. Location of Yukon Delta National Wildlife Refuge