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US FISH & WILDLIFE SERVICE--ALASKA

WATERFOWL UTILIZATION STUDY ON YUKON-KUSKOKWIM
DELTA

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US FISH & WILDLIFE SERVICE--ALASKA

Regional Director, Bureau of Sport
Fisheries and Wildlife, Portland, Oregon

April 10, 1964

Wildlife Administrator, Bureau of Sport
Fisheries and Wildlife, Juneau, Alaska

Waterfowl Utilization Study on Yukon-Kuskokwim Delta

The attached outline for a detailed study of waterfowl utilization by Eskimos of western Alaska has been developed jointly by personnel of this office and Dr. Klein. It is proposed that the study be financed, initially at least, from this office.

With your concurrence we would like to start the study this month so that one of the investigators can be present on the Delta before waterfowl start to arrive in the vicinity of native villages. I will plan to call either you or Mr. Griffith on Monday, April 13, to discuss this project and solicit any additional thoughts you may have on the matter.

Ray Woolford

Attachment

cc: Klein
King ✓

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United States Department of the Interior
Fish and Wildlife Service
Bureau of Sport Fisheries and Wildlife
Juneau, Alaska

Project Plan

SPRING AND SUMMER UTILIZATION OF MIGRATORY WATERFOWL
IN WESTERN ALASKA

Location

The area of primary concern is the Yukon-Kuskokwim delta. It may be described as the drainages of the Yukon and Kuskokwim Rivers west of a line between the villages of Chogasut and Kulakag. Western extremities are the coastal fringes between Carter Spit on the south and Chamiliut on the north.

Objectives

1. Determine the timing of spring migrations of waterfowl into the area; abundance and seasonal variations in numbers; and species composition of bird populations.
2. Determine the extent of utilization by species by residents during (1) spring migration; (2) nesting (egg gathering); and (3) moult (drives).
3. Study economic, social and ethnic features of individual and organized groups of residents to determine what extent these factors contribute to the degree and pattern of utilization.

Justification

The inhabitants of the Yukon-Kuskokwim delta are preponderantly Eskimos. Ancestrally they have killed ducks and geese for food without regard to the time of year or other restriction. Initially the harvest was accomplished by egg gathering during the nesting period, by the clubbing of flightless birds during the moult, and by taking on the wing with the crudest of aboriginal devices. The introduction of firearms to natives of Alaska began in the late 1800's and after the turn of the century increased rapidly. Today the Eskimo hunter is well equipped with modern firearms and a supply of ammunition limited only by his ability to pay. Available to him are methods and means of transportation giving him greater mobility than ever before.

Treaties between the United States, Canada and Mexico provide that there shall be a closed season on migratory waterfowl during the interval between March 15 and September 1 of each year. Modest efforts within the past four

years to limit spring hunting in this area have met with resistance. The opinion has been expressed that the spring take of birds is insignificant and is of little consequence to management. Data to support this allegation, or the reverse, are lacking.

Previous Work

Some background information is available from various sources. Ethnological studies of the Eskimo people of the Yukon-Euskokaim delta region have been conducted by Osvelt (1960, 1962-63, and 1963); Van Stone and Osvelt (1960) and Lentis (1959) and these furnish an insight into the social and ethnic characteristics of these native groups.

The problem of evaluation of the significance of native use of waterfowl in the study area has been approached in the past by biologists working in the area (Scott 1948, Olson 1951, Lensink 1953, RPS Prog. Reports II and IV 1957) and by administrators attempting to estimate total native utilization of wildlife throughout Alaska (Scott 1951 and Hansen 1957). Unfortunately, these efforts, within the study area, have been incidental to broader investigations and have yielded only the most cursory information on native utilization of waterfowl. These reports do, however, provide a base of information useful in planning this more intensive investigation.

Procedure

1. Information relative to the timing of spring migrations of waterfowl into the area; abundance and seasonal variations in numbers; species and composition of bird populations can be obtained from the following sources:
 - (a) Reports of previous biological studies in the area (Scott 1948, Olson 1951, Adams 1952, Lensink 1953, Williamson 1957, and Shepherd 1963).
 - (b) Field notes of USFWS biologists, game management agents and refuge personnel working in the area.
 - (c) Through the cooperation of Bureau of Indian Affairs village teachers.
 - (d) Through direct observation of the investigators and refuge personnel while working within the area.
2. The extent of utilization of waterfowl by species by residents during (1) spring migration; (2) nesting (egg gathering); and (3) molt (drives) can be obtained through synthesis of data from several sources:
 - (a) Data available from published literature and reports from previous studies in area.

- (b) Bureau of Indian Affairs reports of native use of wildlife.
 - (c) Direct contact will be made with EIA school teachers in the various villages throughout the area to enlist their cooperation in recording data on native utilization of waterfowl.
 - (d) Similar contact will be made with native village councils throughout the area to solicit their cooperation in the study. A well-educated native of the area will be employed to act as interpreter and interviewer to assist in making contacts with the village councils and to aid in interviews with natives.
 - (e) Trading posts throughout the area will be visited and information relative to ammunition sales will be sought.
 - (f) The principal investigator and assistant will spend time traveling through the area during the periods of spring migration, nesting and molt to obtain first hand observations on native utilization to enable realistic synthesis of the data from all sources.
3. Investigation into the economic, social, and ethnic features of individual and organized groups of residents to determine what extent these factors contribute to the degree and pattern of utilization will be accomplished as follows:
- (a) Historical information on the ethnology, ecology, and economics of the area will be obtained from published literature.
 - (b) Population data and recent and present statistics on the economy of the area will be obtained from Bureau of the Census reports (1960), Bureau of Indian Affairs reports, State and Federal welfare program summaries and church records.
 - (c) Income from the fur harvest can be calculated from data contained in the MS thesis by John Darns (1964, Mink Management Studies in the Yukon-Kuskokwim Delta Region, Univ. of Alaska).
 - (d) The Alaska Dept. of Labor will be contacted for information relative to employment status within the area, the size of the labor pool, unemployment compensation, wage earnings in area, etc.
 - (e) Income from commercial and personal use fisheries will be obtained from reports of the Alaska Department of Fish and Game and the Bureau of Commercial Fisheries.
 - (f) Religious influence on the people of the area is available in several published reports (Oswalt, 1963; Tilarion 1861-1863, and Lantis, 1959).

- (3) The principal investigator and assistant will gather supplemental information on all of the above facets of the study while in the area as well as seeking additional knowledge of the attitudes of the people toward conservation, legal restrictions on wildlife utilization and law enforcement as a result of white influence through education, cultural contact, the state and federal game law enforcement programs, etc.

Probable Duration

Phase I:

April 20 (approx.) - May 15, 1964

Principal investigator in the field to make initial contacts, line up native assistant, contact school teachers and village councils and observe spring arrival of waterfowl and utilization.

June 1 - June 30, 1964

Principal investigator and/or assistant in field to follow up contacts with school teachers and village councils and visit trading posts. Observation of utilization of waterfowl eggs.

July 1 - August 20, 1964

Assistant in field to observe utilization of molting waterfowl and to follow up contacts with school teachers and village councils.

Sept. 1 - Oct. 31, 1964

Native assistant to complete interviews with village councils to obtain yearly utilization data.

Nov. 1 - Nov. 30, 1964

Preparation of Phase I report.

Phase II:

1965 season - collection of supplemental information where 1964 data is insufficient.

Personnel

Principal investigator:

Dr. David R. Klein
Leader, Alaska Cooperative Wildlife Research Unit

Assistant (Native):

To be selected

Assistant (Graduate student):

To be selected

Supervision

The project will be under the direct supervision of Dr. David R. Klein. Dr. Klein will coordinate activities with the Alaska Wildlife Administrator in Juneau and Bureau of Sport Fisheries and Wildlife personnel familiar with the area. Additionally, Ray Woolford, Alaska Wildlife Administrator, will serve in the capacity of advisor and cooperator.

Cost

Salaries

Principal investigator (2 months-field work, supervision and report preparation) included in Coop. Unit budget.

Native assistant (2 months)

to June 30 668.00

July 1 - Oct. 31 668.00

Graduate assistant (3 months)

to June 30 668.00

July 1 - Sept. 1 1,336.00

\$3,348.00

Per Diem

Principal investigator

to June 30 225.00

July 1 - Aug. 20 125.00

Assistants (COLA included above)

\$350.00

Travel

Commercial airlines, to area

to June 30 300.00

July 1 - Oct. 31 180.00

Air charter within area

to June 30 1,500.00

July 1 - Oct. 31 1,700.00

Boat rental

to June 30 200.00

July 1 - Aug. 20 200.00

\$3,380.00

Supplies and Miscellaneous

Field supplies for graduate assistant
to June 30
July 1 - Aug. 23

153.00
100.00

Other (maps, printing, etc.)
to June 30
July 1 - Nov. 30

50.00
75.00
\$375.00

Total to June 30
Total July 1 - Nov. 30

3,761.00
4,384.00

Grand total

\$8,145.00

Literature and Reports Cited

- Adams, Paul. 1952. Waterfowl Reports. FR Reports 3-R-7. Alaska Game Comm.
- Hansen, H. A. 1957. Utilization of Wildlife by Alaska Natives. Annual Waterfowl Rep. Alaska. USFWS.
- Illarion, Hieromonk. 1861-1868. Journals of Hieromonk Illarion, Russian Orthodox Church Missionary. Alaska Church Col. of U. S. Nat. Archives.
- Lantis, Margaret. 1959. Folk Medicine and Hygiene of the Lower Kuskokwim and Nunivak-Nelson Island Areas. Anthropol. Papers of the U. of Alaska. 8:1-76.
- Lensink, Calvin J. 1953. Waterfowl Reports FR Reports 3-R-5. Alaska Game Comm.
- Olsen, Sigurd T. 1951. Waterfowl Reports FR Reports 3-R-6. Alaska Game Comm.
- Oswalt, Wendell H. 1960. Eskimos and Indians of Western Alaska. Anthropol. Papers of U. of Alaska 8:101-118.
- _____. 1962. Historical Populations in Western Alaska and Migration Theory. Anthropol. Papers of U. of Alaska. 11:1-14.
- _____. 1963. Mission of Change in Alaska. Huntington Library. San Marino, Calif. 170 p.
- River Basin Survey Reports. 1957. Fish and Wildlife Resources of the Lower Yukon. USFWS.
- Scott, R. P. 1948. Waterfowl Reports. FR Reports 3-R-2. Alaska Game Comm.
- _____. 1951. Wildlife in the Economy of Alaska Natives. 16th N. A. Wildlife Conf.
- Shepherd, F. E. K. 1963. Waterfowl Reports. FR Reports W-6-R-3. Alaska Dept. of Fish & Game.
- Van Stone, J. W. and W. H. Oswalt. 1960. Three Eskimo Communities. Anthropol. Papers of U. of Alaska 9:12-56.
- Williamson, F. S. L. 1957. Ecological Distribution of Birds in the Napaskiak Area of the Kuskokwim River Delta, Alaska. Condor 59:317-338.

Report to:

Department of the Interior
Fish and Wildlife Service
Bureau of Sport Fisheries and Wildlife
Portland, Oregon

AVAILABILITY AND UTILIZATION OF MIGRATORY WATERFOWL
IN WESTERN ALASKA

David R. Klein and Darwin E. Seim

Contract No. 14-16-0001-2097

Alaska Cooperative Wildlife Research Unit
University of Alaska, College

Submitted by:

David R. Klein
Unit Leader

Date:

April 5, 1965

AVAILABILITY AND UTILIZATION OF MIGRATORY WATERFOWL IN WESTERN ALASKA

David R. Klein and Darwin E. Seim

The inhabitants of the Yukon-Kuskokwim Delta are preponderantly Eskimos. Ancestrally they have killed ducks and geese for food without regard to the time of year or other restriction. Initially the harvest was accomplished by egg gathering during the nesting period, by the clubbing of flightless birds during the molt, and by taking on the wing with the crudest of aboriginal devices. The introduction of firearms to natives of Alaska began in the late 1800's and after the turn of the century increased rapidly. Today the Eskimo hunter is well equipped with modern firearms and a supply of ammunition limited only by his ability to pay. Available to him are methods and means of transportation giving him greater mobility than ever before.

In May of 1961, in the Yukon-Kuskokwim Delta region, attempts were made by U. S. Fish and Wildlife Service agents to enforce the stipulations of the Migratory Bird Treaties with Canada and Mexico, which prohibit the taking of waterfowl between March 10 and September 1. These enforcement attempts were met with an outcry of indignation from the Eskimo people of the area who had been in the habit of hunting waterfowl whenever they were available, and in one case, a Fish and Wildlife Service aircraft and personnel were fired upon by natives resisting attempts to apprehend them in the act of hunting. As the controversy developed, both state and national political figures became involved in the issue. Although there was much heated debate and discussion of the problem, and general condemnation of both the action of the federal government and the anarchistic attitude of the natives, no satisfactory solution to the problem resulted. In fact, the entire controversy, as reported by the press, was characterized by a general lack of knowledge of the magnitude of the problem of native use of waterfowl from the standpoint of the effect on the waterfowl resource and the significance of seasonal use of waterfowl to the Eskimos themselves.

This study was undertaken with the broad objective of providing basic information necessary for an objective appraisal of the problem of seasonal use of waterfowl by Eskimos in the Yukon-Kuskokwim Delta (Figure 1). Specific objectives are as follows:

1. To determine the timing of spring migrations of waterfowl into the area; abundance and seasonal variation in numbers; and species composition of bird populations.
2. To determine the extent of utilization by species by residents during spring migration; nesting (egg gathering); molt (drives); and fall hunting.
3. To study economic, social and ethnic features of individual and organized groups of residents to determine to what extent these factors contribute to the degree and pattern of utilization.

The first objective, that of determining the timing of spring migrations of

waterfowl, abundance, seasonal variations in numbers and species composition, was undertaken in the study area by Darwin E. Seim, a graduate assistant at the Alaska Cooperative Wildlife Research Unit. Mr. Seim spent the spring and summer of 1964 traveling in the study area, recording observations on distribution and abundance of waterfowl by species, and conducting quantitative investigations of nesting densities of waterfowl and concentrations of molting adult birds. Mr. Seim's report on his summer's investigations is included as Part II of this report.

PART I

ESKIMO UTILIZATION OF WATERFOWL ON THE YUKON-KUSKOKWIM DELTA

David R. Klein

The utilization studies were conducted by the principal investigator during April, May and June of 1964 and during February 1965. Preliminary contact was made by correspondence with each village council within the study area, explaining the nature of our study and requesting the cooperation of the men of the village in the interest of providing a basis for a realistic appraisal of the problem. The letters to the village councils explained that I would visit the villages shortly after the spring hunting period and would inquire of them at that time information about the use they make of waterfowl throughout the entire year.

Travel to the villages was accomplished through the use of chartered aircraft. Mr. Ray Christiansen, who operates an air charter service out of Bethel, flew me to most of the villages surveyed. Mr. Christiansen is an Eskimo as well as a representative in the state legislature and he acted as interpreter in many of the villages. His personal friendship with natives in the villages and the fact that he is himself an Eskimo were of considerable value in enabling the establishment of a degree of rapport with the men of the villages during the interviews. I flew to the remainder of the villages visited with Samuelson Flying Service of Bethel, which is owned and operated by an Eskimo and which employs Eskimo pilots almost exclusively.

Upon arriving at a village, the village council president (chief) or other council member was contacted and arrangements were made to meet with the men of the village. The usual meeting place was the National Guard armory, although meetings were also held in trading posts, school and church buildings, community houses, and out of doors. Although the meetings were held on short notice, generally 20 to 30 men were in attendance. Actual attendance varied from eight at Akiak to 45 at Hooper Bay. Meetings were held in 25 different villages. The general procedure during the meetings was to explain the nature and justification of the study, pointing out the advantage to everyone involved of the availability of factual information so that an objective appraisal of the problem would be possible. Specific questions were then asked to ascertain the

numbers by species of waterfowl obtained by the average hunter during the spring and fall shooting periods and these values were then related to the average take per household. The number of eggs gathered per household and the primary species involved was also sought as well as the number and species of birds caught in summer drives of flightless adults. The men were also questioned as to the use made of the birds; the numbers eaten fresh and the amount preserved and methods employed; trends in recent years in the take and use of waterfowl; the types and amounts of other wildlife resources available to the people, such as fish, marine mammals, moose, fur bearers and small game.

Generally, the cooperation and response of the people in the villages was excellent. In one instance, in response to my preliminary letter, each hunter in the village had reported his daily take of waterfowl during the spring hunt to the scribe of the local Alaska Scout platoon. The scribe in turn tallied the total take for each man in the village. This record was then presented to me when I visited the village. In another area, where the people had physically resisted enforcement attempts by Fish and Wildlife Service agents in 1961, the men were extremely cautious about divulging information about their use of waterfowl. Generally, however, the people freely provided the information I requested about their spring and fall harvest of geese and ducks. This is substantiated by comparison of these data for villages on the lower Yukon with similar data collected by Branch of River Basin Studies personnel during 1956 (Progress Report No. IV. Fish & Wildlife Resources of the Lower Yukon River. U.S.F.W.S. Juneau, Alaska. 1957). In an attempt to gain the confidence of the people in the villages surveyed, the BRBS personnel delayed their interviews until after they had been in the area for some time. Their data reflects greater harvests of waterfowl than had been previously estimated. While I was unable to have the obvious advantage of familiarity with the people, the fact that I used an interpreter and that he was an Eskimo and was well known to the people, and further, that I was not identified with the U.S. Fish & Wildlife Service, undoubtedly contributed to the reliability of the data I collected. It is noteworthy that data from this study and the BRBS study for Emmonak and Mountain Village, where BRBS personnel spent considerable time, are quite similar while the data for Pilot Station, where BRBS personnel had very limited contact, show wide differences. These comparisons of average waterfowl harvest per household are as follows:

	<u>Total Geese Reported Taken</u>		<u>Total Ducks Reported Taken</u>	
	<u>Klein</u>	<u>BRBS</u>	<u>Klein</u>	<u>BRBS</u>
Emmonak	30	22.5	15	5
Mountain Village	38	21.6	12	12
Pilot Station	170	22.8	75	11

Because the Eskimos of the Yukon-Kuskokwim Delta region feel strongly about their need and "right" to hunt geese and ducks in the spring, they generally were not reluctant to speak of their spring waterfowl harvest and they apparently feel justified in this defiance of the migratory waterfowl regulations. However, Eskimos appear to feel less secure in justifying the spring hunting of swans and cranes, egg gathering, and summer drives of molting flightless waterfowl. This is presumably because they cannot usually justify these activities on the basis of need, and they harbor some concern about the possible harmful

effects of these activities on the waterfowl populations. Consequently, Eskimos were at times somewhat reluctant to give specific information about their take of swans and cranes and to talk about egg gathering and drives of flightless birds. The data obtained relative to these activities is, therefore, of a less reliable nature than the goose and duck harvest data.

Population and economic data for the study area have been obtained from various published and mimeographed reports which are cited in the text. Of particular value in this respect is Mr. Lado A. Kozely's "Overall economic development plan relating to the Yukon-Kuskokwim River basins", Bethel District Office, Bureau of Indian Affairs. 1964.

Ethnological and historical information about the Eskimo people of the area was obtained from the literature. More detailed descriptions of the cultural changes taking place in the area, the roots of origin and historical cultures of the people, and the ethnography of the Eskimo can be obtained by reading Oswalt's "Mission of change in Alaska" and "Napaskiak", Illarion's "Journals of Hiermonk Illarion, Russian Orthodox Church Missionary", and Nelson's "The Eskimo about Bering Strait".

This report deals primarily with the seasonal utilization of waterfowl by Eskimos on the Yukon-Kuskokwim Delta. Demographic, economic, sociologic, and ethnographic information is presented only in so far as it may relate to the problem of native use of waterfowl. Secondarily, knowledge of the abundance and distribution of waterfowl by species which resulted from Mr. Seim's field work is also included in Part II of this report.

The People:

The Yukon-Kuskokwim Delta area has an average population density of about one person per three square miles. With the exception of less than 25 people living in isolated locations, the entire population of the area, estimated at 9,521 in 1963, lives in 35 villages and the town of Bethel. The population of Bethel in 1963 was 1,538 and the other villages ranged in size from 31 to 531. In 1963 only three villages had a population less than 100, thirteen were in the 100-200 range, eleven in the 200-300 range, seven in the 300-400 range and only Hooper Bay had a population in excess of 500 people.

Since the introduction of aspects of Western culture and economy into the area, there has been a general abandonment of the smaller villages where subsistence hunting and fishing were the only economy. The Eskimo people have in turn concentrated in the larger villages along the Kuskokwim and Yukon Rivers, and on the coast of the Bering Sea where schools, churches, and stores are available. Kozely (1964) lists over fifty villages within the study area that have been abandoned during the past three decades. Many of these now abandoned villages were located on the tundra of the Delta at some distance from the two main rivers. As a result of this shift in population distribution, vast areas of the Delta which were previously spotted with small villages are now completely unpopulated.

The Yukon-Kuskokwim Delta area supports the largest concentration of Eskimo people existing today. Eskimos constitute over 97 percent of the total human

population of the area. With the exception of white school teachers in most of the villages, and white missionaries and traders in some of the villages, the major portion of the white segment of the population is in Bethel, where in 1962 whites numbered 281. The ratio of whites to Eskimos is presently decreasing due to a faster rate of increase among the Eskimos. Children under 14 years of age made up 49 percent of the population of the study area in 1963. The average annual rate of increase in the area is 4.18 percent. This compares to 1.4 percent for the entire United States and rates of two percent for India and 3.5 percent for Mexico.

In a U. S. Public Health Service study of a sample of ten villages in the Yukon-Kuskokwim Delta area, including 420 housing units, it was found that 86 percent of the houses had only one room, ten percent had two rooms, and four percent had three rooms. The typical family consisted of eight persons; the mother's age was 25 to 29, she had five living children, and 40 percent of the mothers studied had tuberculosis.

The Eskimos of the Yukon-Kuskokwim Delta regions are all members of the Bering Sea Eskimo sub-group. This group is further broken down into the following tribes within the study area: Chnagmiut - the lower Yukon including the Delta; Ikogmiut - the Yukon River above Marshall and historically as far up river as Paimiut; Magemiut - the coastal area from the mouth of the Yukon to Cape Romanzof; Kaialigmiut - the coastal area and adjacent tundra from Cape Romanzof to the mouth of the Kuskokwim; Kuskwogmiut - the Kuskokwim River upstream to Aniak. In addition, the Eskimos of Goodnews Bay are derived from the Nushagamiut of the Nushagak River in Bristol Bay (Collins, 1954). All of these people speak the same basic Yuk dialect which is one of the three dialects of Western Eskimo.

Patterns of Waterfowl Use:

Prior to the coming of the first whites to the Yukon-Kuskokwim Delta, and before the introduction of firearms, Eskimos relied upon primitive weapons and techniques to take waterfowl. Although their bow with blunt-tipped arrow and the throwing bola, which were used for taking waterfowl, were relatively inefficient in contrast to the shotgun, a much greater effort was expended in the pursuit of waterfowl over a longer duration of time than is presently the case. Egg gathering and drives of flightless adult birds in the summer are still undertaken in essentially the same manner as they were in the past, although the use of outboard motors has added to the mobility of the Eskimo and motor powered boats are a definite asset in conducting drives on large lakes or lake systems. The patterns of waterfowl use by the Eskimos of the Delta region vary considerably from the coastal areas to the up-river regions where the tundra intergrades with the shrub type and spruce forests.

The coastal Eskimos, which include the people of the villages of Scammon Bay, Hooper Bay, Tanunak, Nightmute, Newtok, Kipnuk, Chefornek, Kwigillingok, Kwinhagak, and Goodnews Bay, derive much of their subsistence economy from the sea, although they are not oriented toward the sea to as great an extent as Eskimos on the islands of the Bering Sea or those on the Arctic Ocean coast of Alaska. Fish, primarily tomcod, and seals are the resources of the sea upon which they draw most heavily. Other marine mammals, such as walrus and beluga whales, are not abundant in this region. Seal hunting is an important winter

occupation and continues into the spring and early summer until the sea ice leaves the coastal areas. A few men from the villages on the Yukon Delta, the villages of Chevak, Tuntatuliak and Eek, and as far up the Kuskokwim as Napaskiak, travel by dog sled to the coastal areas to hunt seals.

It is during the early spring (late April and early May, see Table 1) that large numbers of northward migrating eider ducks become available to seal hunters. The eiders come in almost continuous flocks of a few to several hundred birds each and fly low over the open leads adjacent to the shore ice. Their date of arrival and availability is governed to a large extent by the ice conditions and occurrence of open water. Seal hunters shoot the eiders as they pass over them while they are lying in wait for seals. Seal hunters are reluctant to shoot eiders when seals are present in the area because they feel their shooting will frighten the seals; however, the eiders are readily taken during periods when seals may be temporarily unavailable. The eiders are an important food source for the seal hunters, who may remain afield for several days at a time, and they are also taken back to the villages for food when they can be killed in sufficient quantity. Because the eiders are among the first waterfowl available after a long winter of living on fish and seal, they are looked forward to by the people as a pleasant variation to their diet. In those years when fish stored for winter use are depleted before spring and fresh fish and seals are not abundant, eiders become an important supplementary source of food.

While firearms have enabled seal hunters to take larger numbers of eiders on a given hunt than was the case with aboriginal techniques, in recent years the presence of a cash economy has resulted in increased dependence on purchased foods with a corresponding reduction in the effort expended in seal hunting. Even with a substantial increase in the cash value of raw seal hides, only an average of about 20 percent of the men of the coastal villages continue to hunt seals. Seal hunting is of greatest importance in the villages of Scammon Bay, Hooper Bay and Tanunak.

As the spring progresses in the coastal areas, other early arriving species become available (Tables 1, 2, 3 and 4). The Cackling and White-fronted Geese arrive in abundance in early May, although a few birds generally arrive by late April. The Emperor Goose is generally a little later in arriving with the exception of the Goodnews Bay area where Emperors congregate in large numbers in late April. The Emperor Goose is taken in greater numbers than any other goose in all of the coastal villages from Goodnews Bay to Newktok. In Chevak, Hooper Bay, and Scammon Bay, the Cackling and White-fronted Geese constitute the larger portion of the spring take.

Pintail ducks are also taken in large numbers throughout the coastal area (Table 3). Although they are not as eagerly sought as geese, because each duck represents a smaller amount of meat than does a goose, they are more readily obtainable than geese after the tundra ponds and lakes become free of ice. Mallards are not as abundant in the coastal tundra as they are in the areas further back from the coast and they, therefore, are not taken in appreciable numbers by Eskimos in the coastal villages.

During the early spring immediately after the birds first start arriving on the tundra, the hunting is most intensive. At this time the people are eager for a

change of diet, other food is in as short supply as at any other time of the year, and after a winter of unemployment, financial reserves are at a yearly low. There is no question but that the need is greater at this time for the birds than at any other time of the year. The men generally travel 10 to 20 miles daily by dog team to favored hunting locations where pass shooting is possible or where exposed mud bars are favored by geese as resting sites. Blinds of snow and ice or dead vegetation are used as well as decoys of mud and sticks or dead birds.

Further in from the coast and on the lower Yukon and Kuskokwim Rivers, the pattern of spring hunting is quite similar to that on the coast. Species composition, however, shows more variation from area to area. On the Kuskokwim River, including the tundra villages of Nunapichuk and Kasigluk, the Canada goose varieties (Cackling and Lesser Canada Geese) and to a slightly lesser extent the White-fronted Goose, are the only geese taken in numbers during the spring hunt (Table 2). Although among the ducks, Pintails are taken in greatest number, Mallards assume increasing importance in the upriver areas. Most of the early spring hunting is done along the Kuskokwim River itself, which is an important flight-way for migrating geese and ducks. Bluffs and high cutbanks are favored locations for pass shooting and exposed river bars, which are used as resting areas by the birds before any open water is available, are also good hunting locations.

The species of waterfowl taken during the spring hunting period on the Yukon River vary considerably more from area to area than is the case on the Kuskokwim River. At Russian Mission, the Canada geese varieties are taken in greatest numbers while hunters from Marshall and Pilot Station take more brant and lesser numbers of White-fronted and Canada geese. At Andraefsky, White-fronted Geese predominate in the bag; and at Mountain Village, Snow Geese and White-fronted Geese are taken in almost equal numbers, with brant and the Canada varieties being of lesser importance. Pintails and Mallards are taken in equal numbers on the Yukon from Russian Mission to the mouth.

Without doubt, the importance to the Eskimo of spring hunting on the Yukon-Kuskokwim Delta, and the take of waterfowl associated with it, have increased substantially since the introduction of modern firearms into the area. Because of the increased human population throughout the entire Delta area and the concentration of these people in relatively few villages, instead of being dispersed as they were before the advent of schools, churches and stores, a greater pressure is exerted upon the land resources available from any one village. Consequently, although the resources of the land are less efficiently utilized in the more remote areas than was the case in the past, those areas adjacent to the villages are not able to provide the abundance of subsistence foods that is necessary to feed the village populations without pronounced seasonal shortages. Since the period of the year during which food shortages are most likely to occur coincides with the spring arrival of waterfowl, it is understandable that use of these birds is greatest at this time.

The intensity of spring hunting is greatest immediately after the birds first arrive and until thaw conditions render travel by dog team on the rivers, sloughs, and tundra no longer possible. During the breakup of ice in the rivers (early May on the Kuskokwim and late May on the Yukon) and until the ice ceases to flow in the rivers, travel is greatly restricted and hunting effort is naturally curtailed. Only a few years ago it was the custom of virtually all of the Eskimos

of the river and tundra villages to leave the villages before spring breakup and travel as family units to individual hunting camps which were dispersed throughout the tundra of the Delta. At these camps, muskrat hunting was the primary occupation, although waterfowl were shot for food. The families generally stayed at the spring hunting camps until salmon were beginning to run in the rivers and travel back to the villages was possible by boat. During recent years there has been decreased interest in muskrat hunting because of the reduced prices offered for their pelts; and, in addition, parents have become more reluctant to take their children out of school during this period. As a result, there are presently only a few families in each village who continue to make the annual move to the spring hunting camps. This trend has accordingly reduced the late spring hunting pressure on waterfowl which is of a more dispersed nature than the early spring hunting. In addition, the waterfowl hunting associated with muskrat hunting results in the take of birds that may have already begun nesting.

During the summer an occasional bird may be shot for food throughout the Delta region, but generally the abundance of fresh fish does not allow for any shortage of food and the people are usually occupied at this time with the many activities associated with the catching and preservation of fish. Also in recent years, increasing numbers of men in the lower Yukon and Kuskokwim River areas have become engaged in commercial fishing activities and many men from the villages of the coast near the mouth of the Kuskokwim each year travel to the Bristol Bay area to be employed in salmon canneries. These cash-yielding occupations, which are important to the economy of the villages, obviously take precedence over subsistence hunting.

The gathering of eggs from the nests of waterfowl has traditionally been practiced throughout the Delta region; however, it has been of greatest importance in the coastal tundra where nesting densities are highest (Table 4). It seems likely that in spite of the increased human population, fewer eggs are gathered presently each season than was the case in the past. With the people concentrated in the villages and fewer people dispersed over the tundra, the total area presently searched for eggs is much less than was previously the case, and egg gathering is mainly restricted to the areas adjacent to the tundra and coastal villages. There is no significant amount of waterfowl nesting in the shrub and forest zones adjacent to the upriver villages on both the Yukon and Kuskokwim Rivers, consequently, egg gathering by the Eskimos in these villages is only practiced by those families who travel to spring hunting camps on the tundra. As mentioned above, the proportion of families in the upriver villages that go to the spring hunting camps is quite small.

Egg gathering is done primarily by the women and children of the coastal and tundra villages. Although the eggs obtained are important as food, there is undoubtedly additional incentive for egg gathering associated with its traditional significance in the culture of the people and the recreation obtained from such group outings. While most of the egg gathering is done adjacent to these villages, it is not uncommon in favorable weather for groups of women and children to be transported several miles by boat for a day of egg gathering in more productive habitat. In the spring hunting camps of the upriver Eskimos, eggs are gathered by the men in association with their muskrat hunting excursions as well as in the vicinity of the camps by the women and children.

The larger the egg the greater its value as food, consequently, the eggs of the various species of geese nesting throughout the region are preferred although any eggs encountered are usually utilized, down to and including the smallest eggs of passerine species. In the coastal fringe of tundra from Scammon Bay to Kwinhagak, the eggs of Emperor Geese are readily available and constitute the major proportion of eggs taken. The eggs of Cackling Geese are also fairly abundant throughout this same region and at Chevak and possibly Newktok, they are most frequently taken. The eggs of sea gulls comprise a significant part of the total eggs taken and at Scammon Bay, Tanunak, Tiksik Bay (new site of Nightmute), and Goodnews Bay, the eggs of murres, puffins, and other sea birds are available and are gathered. In the tundra areas of the Delta further back from the coast, eggs collected represent a more random assortment of species.

An important method of taking waterfowl in the past has been that of staging drives of flightless birds in mid-summer when adults are molting their flight feathers and before juveniles have attained flight. These drives have involved large numbers of people (usually all those in a village who were physically able) and were usually conducted among the lake systems where the ducks and geese concentrate during the molt. In recent years the drives have lost much of their significance to the economy of the villages and each year sees a reduction in the total number of drives made throughout the area.

The drives require considerable organization and advance planning within the village. Boats must be committed to transport the people to the drive area and to be used in the actual drive on the lakes. The birds are herded into one large flock on the lakes through the use of boats and kayaks and then are forced onto the land where additional people drive them ahead of them into fish nets in which they become entangled or through a line of waiting people who kill the birds with clubs. The social aspect of the drives, the thrill of the chase, and the general excitement all contribute to make them a pleasant diversion from the summer's fishing activities. The number of birds taken in a single drive, of course, varies with the habitat in which the drive is conducted as well as with the efficiency of the drive in terms of numbers of people and boats and general organization. Generally, in order to be worthwhile, a drive involving most of the people of a village would have to yield at least several hundred birds. From reports of the distribution of birds per family resulting from drives, the average take per drive quite likely falls between one and two thousand birds. Additionally, small drives may occasionally be undertaken by several men with boats when they are afield in the summer and conditions are favorable. Such drives generally yield from 20 to 100 birds.

Traditionally, at least one drive was conducted by the people in each of the villages of the coastal, tundra and downriver areas. Drives were not generally undertaken by the people in the upriver regions because it was necessary to travel too great distances from the summer fish camps on the rivers to reach suitable areas for drives. The social and recreational aspects of drives have perhaps always been of nearly equal significance to the actual need for food at a time when other food is quite abundant. With the increase in wage employment in recent years, the demands of commercial and subsistence fishing, and the more frequent absence of men from the villages during the summer months, there is less opportunity and incentive to organize village drives. Also, the Eskimo people realize this activity is in violation of federal laws, and because they cannot

justify it in their own minds on the basis of need for food, there is increasing hesitation among them to undertake a drive which requires advance decisions and planning. It is always more difficult to rationalize a questionable action before than after the fact. Further, there is concern by the people that they may be apprehended by federal agents while they are in the act of making a drive and they realize that an organized drive on the treeless tundra involving several boats and dozens of people is readily visible from a plane flying over the area.

Organized village drives during 1963 were apparently restricted to a few coastal villages including Scammon Bay and Chefnak and possibly others, the two tundra villages of Kasigluk and Nunapichuk, and Napaskiak. The estimated total take in the Scammon Bay drive was 2,500 birds, while the estimated take from a drive at Napaskiak in 1961 was 1,400 birds. The Chefnak drive, on the other hand, apparently involved less than 200 birds, mostly Emperor Geese. Other organized drives may have taken place during 1963, but we are not aware of them. In the coastal areas, Emperor Geese are the birds taken most frequently in the drives while in the tundra villages and at Napaskiak, ducks (Pintail, Canvasback, and Mallard) apparently predominate with some Lesser Canada Geese also being taken.

Fall hunting of waterfowl is of considerably lesser importance throughout most of the Delta region than is spring hunting (Tables 2 and 3). The exceptions are the Yukon River villages of Marshall, Pilot Station, and Andraefsky, where fall hunting results in a greater take of birds than does spring hunting, and the coastal villages of Scammon Bay and Hooper Bay where fall and spring hunting are about equal. There are several reasons for the general reduced take of waterfowl in the fall which include the availability and abundance of other food at this time, the demands of other activities such as subsistence fishing and fish preservation, moose hunting in upriver areas, the high cost of salt for preservation of birds for winter use, the greater wariness of the birds than in the spring, and the absence of well defined flightways in the fall.

Geese are not as readily available for hunting in the fall as in the spring. Consequently, there is a much greater reduction in the number of geese taken during the fall than is the case among ducks. This characteristic of the fall take is most pronounced in the villages of the Kuskokwim River above Bethel. The take of swans and cranes during the fall is relatively insignificant in contrast to the spring take.

There are a few individuals in some of the villages who preserve birds shot in the fall for use during the winter period, although most of the birds taken during the fall throughout the area are used as they become available as food. Because of the damp rainy weather, which is common during the fall, birds cannot usually be preserved by drying as is sometimes done in the spring, and cold storage facilities are not available. Instead, it is necessary to use salt as a preservative and the salted carcasses are stored in wooden barrels. The salt and barrels necessary for preservation of birds in this manner are quite expensive in these remote villages; consequently, only the occasional, more affluent Eskimo can afford to preserve for winter use birds which are shot in the fall.

Traditionally, in addition to the meat of waterfowl as food, use was made of the bird skins, with feathers left on, for the construction of parkas; goose and eider.

down was used to a limited extent as insulation in garments; showy feathers were used as decoration on mammal skin parkas and for ornamentation on masks, fans, and other ceremonial objects; and needles and other implements and tools were made from bird bones. Bird-skin parkas were common throughout the Yukon-Kuskokwim Delta area as recent as 30 to 20 years ago. They were most frequently made from the ventral surface skins of geese, brant, and eider ducks; and while extremely warm, these parkas do not wear as well as most mammal-skin parkas. Bird-skin parkas are now extremely rare throughout the area. Feathers are still used to some extent for decoration on parkas and in the construction of ceremonial fans and masks which are exported for sale to tourists. Metal implements and tools have completely replaced the uses previously made of bird bone.

Economic Status of Area:

The basic economy of the entire Yukon-Kuskokwim Delta area is that of subsistence hunting, fishing, and gathering. The major portion of the food consumed by the people and their dogs comes from the wildlife resources of the area, virtually all of the fuel for cooking and heating is locally obtained wood or seal oil, and much of the Eskimo clothing is made from hides of the marine and land mammals of the area.

By far the most important single item in the subsistence economy of the area is salmon. Virtually all of the villages, with the exception of those in the coastal areas, are dependent for their primary food source upon the annual migratory runs of salmon up the Yukon and Kuskokwim Rivers. Large quantities of salmon are caught in gill nets as they move up the rivers and are sun dried on racks and stored for winter use for human consumption and for food for dogs, which are essential as draft animals. On the upriver portions of the Yukon and Kuskokwim Rivers, above tidal effects, fish wheels are occasionally used to take salmon. When drying weather is poor in late summer and early fall, the fish racks may be covered and fires used to hasten drying or the salmon may be placed in pits lined with sedges or other vegetation and covered until ready for use in late fall or early winter. With the beginning of the fish runs, the people disperse from the villages to fishing camps along the rivers. These are traditionally used fishing sites occupied by one to a few families each, and with permanent fish drying racks and storage sheds. Tents are used for summer living. People at the villages of Kasigluk and Nunapichuk, where salmon are not available, annually travel down the Johnson River to its confluence with the Kuskokwim where they fish for salmon.

Among the salmon, the kings are of primary importance to both the subsistence and commercial fisheries. Chum salmon are very abundant and are caught and preserved in large numbers primarily for dog food. Chums are fished commercially and are also caught for personal use. Red salmon are only available in numbers on the Kuskokwim, and are caught for subsistence purposes in the fall. In addition to salmon, other fish available seasonally throughout the area include sheefish, smelt, blackfish, whitefish, pike, lush (ling cod), and in the coastal areas needle fish, tomcod, herring, flounder, and trout.

Other food resources of the area, in addition to fish and waterfowl, include marine mammals, moose, ptarmigan, snowshoe and arctic hare, carcasses of mammals taken for their pelts (such as muskrat and mink), berries and greens from wild

plants, and limited production of leaf and root crops in home gardens.

The cash economy of the area is supplemental to the subsistence economy which meets many of the basic needs of the people. Nevertheless, cash is essential to purchase the many staple food items introduced into the Eskimo diet by whites, such as tea, coffee, salt, flour, milk and sugar; it is also required for clothing, outboard motors and fuel, fish nets, rifles and ammunition, household items, etc. Less basic to the needs of the people, but important to their psychological well being, are such things as food delicacies from the trading post, dress clothing, radios, occasional air transportation, movie attendance money, and religious items and offerings.

Sources and amounts of cash income for 10 villages in the Yukon-Kuskokwim Delta area are presented in Table 6. Wages are derived mainly from cannery or saltery work, National Guard participation, work for the local village traders and Bureau of Indian Affairs, school facilities, and longshoring. Commercial fishing is an important source of income on the Kuskokwim River downstream from Kwethluk, and on the Yukon River from St. Marys to the sea. King, silver, and chum salmon are the three species of fish upon which the commercial fisheries is based. There is no commercial fishery in the coastal areas south of the Yukon Delta.

Hunting and trapping income is derived from the shooting of muskrats and trapping of mink for their pelts, and the sale of seal hides. Mink trapping has been by far the most important activity of this nature and averages annually 15,000 to 20,000 mink valued at between \$375,000 and \$500,000 (Burns, 1963). Mink from the Yukon-Kuskokwim Delta are considered the largest and the best quality mink in North America, and they command premium prices at fur auctions. Oswalt (1963) indicates that \$250 to \$375 was the average value of mink to each trapper in 1956 at Napaskiak. In the past two years the harvest has been considerably below these levels due to poor weather conditions during the trapping season and a pronounced reduction in the value of mink on the market. Hair seal pelts have increased in value in the last few years and now bring prices of \$20 to \$30 per pelt. Muskrats have yielded reduced income from trapping in recent years due to low value of pelts and the general decreased interest in spring rat hunting discussed earlier. Oswalt states that during 1956, which was a poor year with local prices of \$.40 to \$.35 per pelt, the range in income by Napaskiak muskrat hunters was \$20 to \$200. Other fur bearers of lower abundance and frequently only locally available throughout the area, but which contribute to the overall income from trapping, are weasel, beaver, marten, river otter, snowshoe hare, lynx, wolf, and fox.

Income from arts and crafts involves the sale of items of women's handicraft such as baskets of grasses, sedges, and roots; parkas and mukluks; dolls and beadwork. In some of the coastal villages, men do limited ivory and wood carving. Utilitarian articles constructed for local sale by some men with special craft abilities include river boats, kayaks, and dog sleds.

Total personal income within the study area can only be estimated from the incomplete data available; however, it exceeds \$4 million annually. Earned income constitutes approximately 35 percent of the total income of the area, the remainder being welfare income from state and federal sources (Table 7). Welfare money is available mainly under the following categories: old age assistance,

aid to dependent children, aid to the blind, unemployment compensation, social security, and direct Bureau of Indian Affairs and State of Alaska payments to individuals without other sources of income and unable to subsist from the land. Of the total welfare monies coming into the area, approximately 80 percent are from the State of Alaska, and most of the remainder is through the Bureau of Indian Affairs. It is interesting that the distribution of welfare money to the villages appears to be correlated with the proximity of the village to the town of Bethel, where the district welfare agency offices are located. For example, the village of Napaskiak, which is only seven miles from Bethel, has a per capita income \$17 above the average for the area and 30.2 percent of its income is derived from welfare. While Pilot Station, approximately 90 miles from Bethel and on the Yukon River, has a per capita income \$106 below the area average, yet only 9.1 percent of its income is from welfare. In addition to direct welfare payments, those individuals with Eskimo blood are also given free medical care through the auspices of the U. S. Public Health Service, which has a large staffed hospital in Bethel and sends nurse and doctor teams on frequent visits to the villages.

The per capita cash income for the area is obviously among the lowest in the nation. The average per capita income of \$432 for the villages, for which complete data is available, compares to the 1963 averages of \$2,839 for all of Alaska, \$2,500 for all 50 states and \$1,390 for Mississippi which has the lowest average in the nation. The contrast is obviously great and is reflected in the standard of living of the Eskimo people. However, a direct comparison of cash income of this nature does not take into consideration the value of the subsistence commodities that the Yukon-Kuskokwim Delta produces and the extent to which these commodities supplant the need for cash expenditures. The importance of the fish, wildlife, and plant resources of the area to the Eskimo people is further appreciated when it is realized that the extremely high costs of any imported items renders the buying power of the dollar less than one half of what it is in Seattle or other West coast cities.

The Waterfowl Populations:

Waterfowl population data for the Yukon-Kuskokwim Delta area are sketchy. For those species which, for the most part, nest only in this area, such as the Emperor and Cackling Geese, population estimates are available based on counts of birds in their wintering areas or based on aerial or ground counts of breeding pairs on the nesting grounds. For more cosmopolitan nesters, such as the Lesser Canada and White-fronted Geese, estimates of the Yukon-Kuskokwim component of their populations are either lacking or are empirical guesses by workers familiar with the particular species. Available population estimates for waterfowl species which are taken by Eskimo hunters in the Yukon-Kuskokwim Delta area are listed in Table 8 in comparison with the Eskimo harvest.

Cackling Geese and White-fronted Geese receive greater hunting pressure than any other waterfowl species on the Delta area. The spring take by Eskimos may approach 15 percent of the total spring population of each species. Lesser Canada Geese, which are included with Cackling Geese in the utilization data, apparently are considerably less numerous throughout the Delta area than Cackling Geese, and therefore represent the smaller component of the Canada goose varieties reported taken. Black Brant, Emperor and Snow Geese are only locally available

throughout the Delta area and harvests of these species are accordingly lower than for Canadas and White-fronts which are more widely distributed during the spring migration. Although species populations of Brant, Emperor and Snow Geese resident in, or passing through, the Delta area are comparable to the White-fronted and Cackling Geese populations, the portions of their populations harvested by Eskimos are considerably less than is the case for the White-fronts and Cacklers. This is apparently directly related to their more restricted local availability. Probably not more than two to three percent of the total spring population of Black Brant is taken by Eskimo hunters each year, while the fall harvest is perhaps three percent. The maximum spring harvest of Emperor Geese by Eskimos would not likely exceed six percent of the spring population of these birds, while the fall harvest accounts for about one percent of the population at that time of the year. Snow Geese do not nest on the Delta, but are available during spring migration along the coast and on the Yukon Delta. These birds apparently are destined for nesting areas on Wrangell Island and the northeast coastal areas of the Chukchi Peninsula of Siberia and constitute about 300,000 geese (Cooch 1964). On the basis of this population estimate, the spring harvest by Eskimos on the Yukon-Kuskokwim Delta amounts to approximately one to two percent of this segment of the total Lesser Snow Goose population.

No population estimates are available for the species of ducks involved in the harvest. Eiders, which are taken in significant numbers only in early spring, represent a very small percentage of the total number of eiders which migrate northward along the coast each spring. Pintails and Mallards, while taken in greater numbers than eiders, are not as eagerly sought by the Eskimos as geese. Their harvest is both a product of availability and hunting effort. The take of over twice as many Pintails as Mallards is the direct result of the relative abundance of these two species throughout the Delta area. Because the hunting effort on ducks is considerably less than on geese, it is doubtful if the harvest of any species of duck approaches five percent of the spring population.

Most of the Eskimo harvest of swans on the Yukon-Kuskokwim Delta takes place during the spring. As far as is known, only Whistling Swans are taken, as Trumpeters apparently do not occur in the area. This harvest accounts for approximately six to eight percent of the total Whistling Swan population in North America.

References Cited - Part I

- Banko, W. E. and R. H. Mackay. 1964. Our native swans. Waterfowl Tomorrow. Ed. J. P. Linduska. U.S. Fish & Wildlife Ser. p. 155-164.
- Barry, T. W. 1964. Brant, Ross' Goose, and Emperor Goose. Waterfowl Tomorrow. Ed. J. P. Linduska. U.S. Fish & Wildlife Ser. p. 145-154.
- Burns, J. J. 1964. The ecology, economics and management of mink in the Yukon-Kuskokwim Delta, Alaska. Unpub. M.S. thesis, Univ. of Alaska, 114 p.
- Collins, H. B. 1954. Arctic area. Program of the History of America. Instituto Pan Americano de Geografia e Historia. Commision de Historia. Mexico. 152 p.
- Cooch, F. G. 1964. Snows and Blues. Waterfowl Tomorrow. Ed. J. P. Linduska. U.S. Fish & Wildlife Ser. p. 125-133.
- Dzubin, A., H. W. Miller and G. V. Schildman. 1964. White-fronts. Waterfowl Tomorrow. Ed. J. P. Linduska. U.S. Fish & Wildlife Ser. p. 135-143.
- Gabrielson, I. N. and F. C. Lincoln. 1959. The birds of Alaska. Stackpole Co., Harrisburg. 922 p.
- Hansen, H. A. and U. C. Nelson. 1957. Brant of the Bering Sea - migration and mortality. North Am. Wildl. Conf. 22:237-256.
- Illarion, H. 1861-1863. Journals of Hiermonk Illarion, Russian Orthodox Church Missionary. Alaska Church Collection of U.S. Nat. Archives.
- Kozely, L. A. 1964. Overall economic development plan, the Yukon-Kuskokwim River Basins. U.S. Bureau of Indian Affairs, Bethel Dist. Off. 220 p.
- Nelson, E. W. 1900. The Eskimo about Bering Strait. Govt. Print. Off., Wash. D. C. 518 p.
- Nelson, U. C. and H. A. Hansen. 1959. The Cackling Goose - its migration and management. North Am. Wildl. Conf. 24:174-187.
- Oswalt, W. H. 1963. Mission of change in Alaska. Huntington Library, San Marino, Calif. 170 p.
- _____. 1963. Napaskiak; an Alaskan Eskimo community. Univ. of Arizona Press, Tucson. 178 p.
- U.S. Bureau of Census. 1962. U.S. census of population: 1960. Detailed characteristics. Alaska. U.S. Govt. Print. Off., Wash. D. C.

Table 1. Earliest Dates of Arrival of Waterfowl Species in the Yukon-Kuskokwim Delta Region (data from Gabrielson and Lincoln, 1959)

Species	Dates	Locations
Cackling Goose	Apr. 24 Apr. 29	Bethel Mt. Village
Lesser Canada Goose	Apr. 17	Bethel
Emperor Goose	May 15	Hooper Bay
White-fronted Goose	Apr. 17 Apr. 17 Apr. 25	Bethel Chevak Mt. Village
Black Brant	May 5 May 20 May 25	St. Michael Hooper Bay Mt. Village
Snow Goose	Apr. 29	Mt. Village
Mallard	Apr. 13 Apr. 16 Apr. 23	Bethel Mt. Village Pilot Station
Pintail	Apr. 14 Apr. 19 Apr. 20 May 8	Marshall Eek St. Michael Hooper Bay
Whistling Swan	Mid-April Apr. 21 May 7	St. Michael Mt. Village Bethel
Lesser Sandhill Crane	Apr. 29 May 2	Mt. Village St. Michael
Pacific Eider	May 4	Hooper Bay
King Eider	May 4	Hooper Bay
Spectacled Eider	May 2 May 5 May 6	Cape Romanzof Hooper Bay St. Michael

Table 2. Take of Geese and Brant by Eskimos on the Yukon-Kuskokwim Delta

Village	Spring						Fall							
	Total/ Village	Total/ Household	Relative Importance					Total/ Village	Total/ Household	Relative Importance				
			Canada	Whitefront	Emperor	Snow	Black Brant			Canada	Whitefront	Emperor	Snow	Black Brant
<u>Yukon River</u>														
Russian Mission	240	12	1					120	6	1				
Marshall	1120	35		2			1	1600	50	3	2		1	
Pilot Station	2640	60	3	2			1	4840	110	3	2		1	
*Andraefsky	1892	43	3	1		4	2	2728	62	2	1		3	
Mountain Village	1650	25	3	1		1	4	858	13	2	1			
*Hamilton	92	23	3	2		1		36	9	2	1			
*Kotlik	414	23	3	2		1		162	9	2	1			
*Cheneliak	161	23	3	2		1		72	9	2	1			
*Pastolik	23	23	3	2		1		9	9	2	1			
*Bill Moore Slough	46	23	3	2		1		18	9	2	1			
*Akers Slough	23	23	3	2		1		9	9	2	1			
Emmonak (Kwiguk)	1260	20	3	2		1		630	10	2	1			
Alukanuk	1500	25	3	2		1		480	8	1	2		3	
<u>Kuskokwim River</u>														
*Upper Kalskag	520	20	1	1				130	5	1				
Lower Kalskag	620	20	1	1				155	5	1				
Tuluksak	750	25	2	1				390	13	2	1			
Akiak	870	30	1	2				232	8	1	2			
Akiachak	2250	50	1	2				450	10	1	2			
*Kwethluk	2520	40	1	2				567	9	1	2			
*Bethel	812	4	1	2				406	2	1	2			
*Oscarville	250	25	1					100	10	1				
*Napaskiak	875	25	1					350	10	1				
Napakiak	1075	25	1					430	10	1				
*Tuntatuliak	480	20	1					120	5	1				
Eek	780	20	1	1				195	5	1				
Kwigillingok	1250	25	2		1			500	10					
Kwinhagak	810	18	2		1	3		135	3			1		
*Nunapichuk	4960	30	1	2				3720	60	1	2			
*Kasigluk	3120	30	1	2				2340	60	1	2			
<u>Bering Sea</u>														
Sheldon Point	330	15	3	1		2		110	5	2	1			
Scammon Bay	2600	100	1	3	2	4	5	2600	100	1	3	2		
Hooper Bay	6480	90	1	2	4		3	7200	100	1	2	4	3	
Chevak	1134	13	1	2	3	4		319	13	1	2	3	4	

Table 2. Take of Geese and Brant by Eskimos on the Yukon-Kuskokwim Delta (Cont'd)

Village	Spring							Fall						
	Total/ Village	Total/ Household	Relative Importance					Total/ Village	Total/ Household	Relative Importance				
			Canada	Whitefront	Emperor	Snow	Black Brant			Canada	Whitefront	Emperor	Snow	Black Brant
<u>Bering Sea (cont'd)</u>														
*Newktok	420	21	2		1			240	12	1				
Tanunak	900	25			1			540	15	1				
*Nightmute	937	21	2		1			564	12	1				
Chefornak	450	15	2	3	1			240	8	1	2			
Kipnuk	1125	25	2		1			675	15	1				
Goodnews Bay (Mumtrak)	429	13			1		2	165	5	1				
Total	47858							34935						
Approx. take by species			20000	13500	6500	5400	2500			18200	9100	1700	400	5500
Average per hunter		31							23					

*Basis for extrapolating data between ecologically similar villages to obtain estimates for those villages which were not visited is as follows:

Andraefsky = average of Pilot Station and Mountain Village

Hamilton)
 Kotlik)
 Cheneliak) = average of Emmonak and Alukanuk
 Pastolik)
 Bill Moore Slough)
 Akers Slough)

Upper Kalskag = Lower Kalskag

Kwethluk = average of Akiak and Akiachak

Bethel (native) = estimate based on FWS, BIA, and other reports

Oscarville)
 Napaskiak) = Napakiak

Tuntatuliak = Eek

Kasigluk = Nunapichuk

Nightmute)
 Newktok) = average of Chefornak, Tanunak, and Kipnuk

Table 3. Take of Ducks by Eskimos on the Yukon-Kuskokwim Delta

Village	Spring					Fall			
	Total/ Village	Total/ Household	Relative Importance			Total/ Village	Total/ Household	Relative Importance	
			Mallard	Pintail	Eider			Mallard	Pintail
<u>Yukon River</u>									
Russian Mission	540	27	2	1		260	13	2	1
Marshall	320	10	1	2		160	5	1	2
Pilot Station	1100	25	2	1		2200	50	2	1
*Andreafsky	704	16	2	1		1188	27	2	1
Mountain Village	462	7	1	2		330	5	1	2
*Hamilton	24	6	2	1		48	12	1	1
*Kotlik	103	6	2	1		216	12	2	1
*Cheneliak	42	6	2	1		84	12	2	1
*Pastolik	6	6	2	1		12	12	2	1
*Bill Moore Slough	12	6	2	1		24	12	2	1
*Akers Slough	6	6	2	1		12	12	2	1
Emmonak (Kwiguk)	315	5	1			630	10	1	
Alukanuk	420	7	2	1		900	15	2	1
<u>Kuskokwim River</u>									
*Upper Kalskag	260	10	1	2		130	5	1	2
Lower Kalskag	310	10	1	2		155	5	1	2
Tuluksak	300	10	2	1		210	7	2	1
Akiak	870	30	2	1		493	17	2	1
Akiachak	315	7	2	1		675	15	2	1
*Kwethluk	1134	10	2	1		1003	16	2	1
*Bethel	609	3	2	1		203	1	2	1
*Oscarville	150	15		1		30	3		1
*Napaskiak	525	15		1		105	3		1
Napakiak	645	15		1		129	3		1
*Tuntatuliak	288	12		1		72	3		1
Eek	468	12		1		117	3		1
Kwigillingok	750	15	3	2	1	250	5	2	1
Kwinhagak	450	10		1	2	225	5		1
Nunapichuk	1060	30	2	1		930	15	2	1
Kasigluk	1170	30	2	1		585	15	2	1
<u>Bering Sea</u>									
Sheldon Point	110	5		1		286	13	2	1
Scammon Bay	650	25	3	2	1	520	20	2	1
Hooper Bay	1080	15		1	2	364	12		1
Chevak	504	3		1	2	945	15		1
*Newktok	540	27		2	1	200	10		1

Table 3. Take of Ducks by Eskimos on the Yukon-Kuskokwim Delta (Cont'd)

Village	Spring					Fall			
	Total/ Village	Total/ Household	Relative Importance			Total/ Village	Total/ Household	Relative Importance	
			Mallard	Pintail	Eider			Mallard	Pintail
<u>Bering Sea</u> (cont'd)									
Tanunak	720	20		2	1	468	13		
*Nightmute	1269	27		2	1	470	10		1
Chefornak	600	20	3	2	1	390	13	2	1
Kipnuk	1800	40			1	225	5		1
Goodnews Bay (Mumtrak)	264	8			1	66	2		1
Total	21700					15015			
Approx. take by species			4700	12000	3300			4300	10500
Average per hunter		14					10		

*Data calculated from ecologically similar villages. See footnote Table 1.

Table 4. Take of Swans, Cranes, and Bird Eggs by Eskimos on the Yukon-Kuskokwim Delta

Village	Swans		Cranes		Eggs	
	Total/ Village	Total/ Household	Total/ Village	Total/ Household	Total/ Village	Total/ Household
<u>Yukon River</u>						
Russian Mission	60	3	5		n.s.	
Marshall	123	4	10		240	
Pilot Station	352	3	30		90	
Andraefsky	303	7	30		225	
Mountain Village	330	5	30		n.s.	
*Hamilton	12	3	2		26	
*Kotlik	54	3	7		119	
*Cheneliak	21	3	3		46	
*Pastolik	3	3	n.s.		7	
*Bill Moore Slough	6	3	n.s.		13	
*Akers Slough	3	3	n.s.		7	
Emmonak (Kwiguk)	252	4	30		500	
Alukanuk	120	2	20		310	
<u>Kuskokwim River</u>						
*Upper Kalskag	52	2	5		n.s.	
Lower Kalskag	62	2	5		n.s.	
Tuluksak	30	1	10		144	24
Akiak	116	4	3		120	24
Akiachak	450	10	135	3	312	24
Kwethluk	441	7	126	2	336	
*Bethel	40		10		n.s.	
*Oscarville	20	2	2		48	
*Napaskiak	70	2	6		192	
Napakia	33	2	3		216	
*Tuntatuliak	96	4	25		364	36
Eek	156	4	30		1404	36
*Kwigillingok	200	4	45		1300	36
*Kwinhagak	130	4	42		1620	36
Nunapichuk	620	10	136	3	2976	48
Kasigluk	390	10	117	3	1372	48
<u>Bering Sea</u>						
Sheldon Point	110	5	22	1	100	
*Scammon Bay	78	3	10		1243	48
Hooper Bay	216	3	15		7200	100
*Chevak	139	3	13		3780	60
*Newtok	60	3	5		1200	60

Table 4. Take of Swans, Cranes, and Bird Eggs by Eskimos on the Yukon-Kuskokwim Delta (Cont'd)

Village	Swans		Cranes		Eggs	
	Total/ Village	Total/ Household	Total/ Village	Total/ Household	Total/ Village	Total/ Household
<u>Bering Sea (cont'd)</u>						
Tanunak	72	2	10		3600	100
*Nightmute	94	2	13		2820	60
Chefornak	10		5		3000	100
*Kipnuk	90	2	13		2700	60
Goodnews Bay (Mumtrak)	8		n.s.		660	20
Totals	5535		1033		39795	

*Data calculated from ecologically similar villages. See footnote Table 1.

n.s. - amount taken not significant

Table 5. Yukon-Kuskokwim Delta Village Populations (Data from U. S. Bureau of the Census 1962 and Kozely 1964. Overall economic development plan, Yukon-Kuskokwim River basins.)

Village	U.S. Census 1960	BIA Village Census			No. Households 1962
		1961	1962	1963	
<u>Yukon River</u>					
Russian Mission	102			123*	20**
Marshall	166			201*	32**
Pilot Station	219	248	247	251	44
Andraefsky	225			272*	44**
Mountain Village	300	316	325	351	66
Hamilton	35	31	31	32	4
Kotlik	57	119	123	165	18
Cheneliak	97	22	23	31	7
Pastolik		16		10	1***
Bill Moore Slough		32		4	2***
Akers Slough		12		5	1***
Emmonak (Kwiguk)	358	393	384	388	63**
Alukanuk	278	332	343	362	60
<u>Kuskokwim River</u>					
Upper Kalskag	147	155	151	121	26
Lower Kalskag	122	140	140	148*	31
Tuluksak	137	146	155	165*	30
Akiak	187	180	184	194	29
Akiachak	229	237	252	277*	45
Kwethluk	325	345	356	366	63
Bethel	1258			1538	203**
Oscarville	51			61*	10**
Napaskiak	154	168	163	186*	35
Napakiak	190	244	246	254	43
Tuntatuliak	144	152	160	169	24
Eek	154	209	216	212	39
Kwigillingok	344	310	299	318	50
Kwinhagak	228	252	264	280	45**
Nunapichuk	327	368	387	392	62
Kasigluk	244	253	345	229	39
<u>Bering Sea</u>					
Sheldon Point	125			138*	22**
Scammon Bay	115	155	163	169	26
Hooper Bay	460	402	509	531	72
Chevak	315	348	358	372	63
Newktok	129	148	146	144	20
Tanunak	183	204	215	232	36

Table 5. Yukon-Kuskokwim Delta Village Populations (Data from U. S. Bureau of the Census 1962 and Kozely 1964. Overall economic development plan, Yukon-Kuskokwim River basins.) (Cont'd)

Village	U.S.	BIA Village Census			No.
	Census 1960	1961	1962	1963	Households 1962
<u>Bering Sea</u> (cont'd)					
Nightmute	237	246	262	253	47
Chefornak	133	133	143	139	30
Kipnuk	221	256	265	274	45
Goodnews Bay (Mumtrak)	154	153	167	159	33****
Total				9521	1530

*Estimates based on average population change of other villages.

**Estimates based on average household size of 6.2; in the case of Bethel, it includes only the Eskimo population.

***1963

****1961

Table 6. Sources and Amounts of Earned Income Within Villages on the Yukon-Kuskokwim Delta, 1962 (Data from Kozely 1964. Overall economic development plan, Yukon-Kuskokwim River basins.)

Village	Wages	Fishing	Hunting & Trapping	Arts & Crafts	Other Activities	Private Business	Total
<u>Yukon River</u>							
Pilot Station	32,993	6,250	16,115	2,990	340	8,500	67,188
Mountain Village	37,000	150,000	15,700	770	1,600	-	205,070
Kotlik	19,500	5,000	10,500	1,400	-	-	36,400
Alukanuk	124,000	25,000	16,800	3,200	220	5,000	174,220
<u>Kuskokwim River</u>							
Kwethluk	21,000	40,000	21,660	21,500	3,200	1,000	108,360
Napaskiak	20,500	15,000	18,050	3,700	1,050	-	58,300
Napakiak	39,895	12,000	12,242	3,372	1,200	-	68,709
Tuntatuliak	21,035	13,090	13,641	3,611	3,268	1,900	56,545
Kwigillingok	46,225	30,000	19,310	3,090	8,970	3,000	111,095
Kasigluk	15,000	61,000	25,500	5,000	7,000	10,000	123,500
<u>Bering Sea</u>							
Scammon Bay	18,800	13,500	11,035	6,500	1,200	7,000	58,085
Hooper Bay	28,000	10,000	28,470	1,400	3,000	3,000	73,870
Newtok	19,700	-	5,512	1,670	575	-	27,457
Tanunak	70,000	6,020	15,200	5,175	1,020	7,000	104,415
Nightmute	19,900	1,600	8,150	11,100	1,500	8,500	50,750
Chefornak	26,500	12,500	22,650	2,790	700	1,000	66,140
Kipnuk	98,000	7,500	32,200	5,700	7,150	6,000	156,550
Goodnews Bay (Mumtrak)	100,000	4,400	3,360	1,620	75	400	110,355
Percent of Total	45.7	24.9	17.9	5.1	2.5	3.8	

Table 7. Total Cash Income Within Villages on the Yukon-Kuskokwim Delta (Data from Kozely 1964. Overall economic development plan, Yukon-Kuskokwim River basins.)

Village	1963 Welfare		1962 Total Earned Income	Per Capita Income	Income Per House- hold
	BIA	State			
<u>Yukon River</u>					
Pilot Station	1,425	13,296	67,188	326	1,862
Mountain Village	256	20,312	205,070	643	3,419
Kotlik	-	6,765	36,400	262	2,398
Cheneliak	639	2,340			
Emmonak (Kwiguk)		13,840			
Atukanuk	798	28,552	174,220	562	3,393
<u>Kuskokwim River</u>					
Upper Kalskag	2,444	10,712			
Lower Kalskag	4,054				
Tuluksak	983				
Akiak	2,529	9,920			
Akiachak	34	17,603			
Kwethluk	1,983	14,344	108,360	341	1,979
Napasikiak	344	24,936	58,300	449	2,388
Napakiak	1,693	16,452	68,709	342	2,020
Tuntatuliak	480	13,752	56,545	419	2,958
Eek	666	10,572			
Kwigillingok	468		111,095		
Kwinhagak	1,517	3,296			
Nunapichuk		9,081			
Kasigluk	8,828	12,568	123,500	633	3,715
<u>Bering Sea</u>					
Scammon Bay	511	9,636	58,085	404	2,624
Hooper Bay	6,191	21,412	73,870	191	1,409
Chevak	1,280	17,468			
Newktok	580	6,144	27,457	237	1,709
Tanunak	3,543	10,228	104,415	509	3,283
Nightmute	134	10,492	50,750	238	1,306
Chefornak	68	12,696	66,140	568	2,630
Kipnuk	2,842	20,428	156,550	656	3,996
Goodnews Bay (Mumtrak)	857	11,720	110,355	773	3,725
Average				432	2,611

Table 3. Comparison of waterfowl population estimates for the Yukon-Kuskokwim Delta with the estimated take by Eskimos

Species	Source	Waterfowl Population	<u>Take by Eskimos</u>		
			Spring	Fall	Total
Cackling Geese	Nelson&Hansen 1959	(spring) 80,000 (fall) 250,000	20,000	18,200	38,200
White-fronted Geese	Dzubin et al. 1964	200,000	13,500	9,100	22,600
Black Brant	Hansen&Nelson 1957 Barry 1964	100-200,000 100-175,000	2,500	5,500	8,000
Emperor Geese	Barry 1964	200,000	6,500	1,700	8,200
Snow Geese	Cooch 1964	300,000	5,400	400	5,800
Whistling Swans	Banko & Mackay 1964	70-90,000			5,535

PART II
DISTRIBUTION AND COMPOSITION OF
WATERFOWL ON THE YUKON-KUSKOKWIM DELTA

Darwin E. Seim

Summer 1964

Introduction:

This general study includes a survey of species distribution, production, and also limited information pertaining to native utilization of waterfowl in the Yukon-Kuskokwim Delta regions. The areas studied include the Yukon River area from Marshall to the mouth, fanning across the Delta from Sheldon Point to Kotlik. Kuskokwim area observations include the tundra expanse southeast of Bethel from the Kwethluk River to the Eek River, the Johnson (Tundra) River southwest of Bethel to Kasigluk and the area from Kasigluk to Nunavakpak Lake.

The study was conducted by the author with Paul Panuyak, an Eskimo from Chevak, as field assistant. Field observations on the Yukon River area began on June 20 and continued to July 26 while Kuskokwim area observations began on July 28 and terminated on August 26.

In late June and early July, an attempt was made to find nesting areas and determine nesting success by walking random transects. This was complicated somewhat by the late breakup and persistent high waters. After the nesting season, field time was devoted to observing broods and concentrations of molting birds. It should be emphasized that field time was divided between the Yukon and Kuskokwim areas, therefore, prohibiting concentrated observations in any particular area.

Methods:

Observations in the Yukon River area were made from a 16-foot plywood riverboat powered by an 10 horsepower Evinrude outboard motor. While the small size of the boat prohibited traveling in rough water, it did allow passage through most of the smaller sloughs and lakes.

During the early part of the summer, random transects were walked to determine nesting density and success. An attempt was made to observe all the different types of habitat to determine any effects late breakup and floods had on waterfowl populations. Areas walked included open meadows between willows and brush on the upper part of the Yukon Delta and the swampy and tundra expanses nearer the coast of the Bering Sea. A limited number of nests were found in the willows, but it is believed that more nesting occurred a greater distance from the sloughs and river due to the high water levels.

Observations were made to determine if any renesting occurred in the wettest areas. Eggs were candled in different types of habitat to determine and compare approximate phenological stages.

Kuskokwim area observations were made from a 22-foot plank riverboat powered by the same 10 horsepower outboard motor. The larger boat proved to be quite satisfactory as a considerable amount of rough water can be expected on the Kuskokwim River during the month of August. Large quantities of gasoline had to be transported because it could not be obtained in several of the villages.

In most cases, brood counts were made while the young were in the water. Number of broods, age and species were recorded whenever possible. In those instances where it was not possible to record accurately the brood size, species and approximate age were recorded.

During the month of August, weeds prohibited travel in many of the lakes and smaller sloughs. It is believed that a larger area could be covered more efficiently with the use of a canoe.

Habitat Conditions:

The habitat conditions were abnormal this year due to a late breakup followed by persistent high waters. Flood conditions produced obvious adverse effects on the breeding population in certain areas. Residents living in these areas reported that at the normal time for arrival of waterfowl, most of the lakes and ponds were still frozen. It is possible that there was considerable reshuffling of waterfowl concentrations because suitable habitat was unavailable.

Islands in the Yukon River from below Mountain Village to Alakanuk, reportedly had only the tops of willows above water. According to natives in the area, these islands are "stopping off" places for spring waterfowl and some are also utilized for nesting.

The "driftwood line" showed that waterlevels extended considerable distances into the open areas along the Yukon River. Evidence of destroyed nests due to flooding was found in some of these areas. Judging from concentrations of ducks and geese flying in and out of these areas, it is believed that the wettest areas are utilized for feeding rather than nesting.

Waterfowl concentrations were observed on visible sandbars, however, high water levels covered the majority of these. As previously mentioned, lack of suitable habitat probably caused larger concentrations to occur in the limited areas available. This correlates with statements by the natives that in certain areas larger concentrations of waterfowl were observed, while in other areas previously utilized there were only a few or no waterfowl.

Population Composition:

From the large size of the area covered, it was found that abundance and composition by species varied according to the local habitat. It is also believed that species composition varies in an area during different parts of the summer due to activities of the birds, such as nesting, molting and congregation prior to migration.

Adult birds were recorded where accurate counts could be made and population composition percentages were calculated from these observations. This method proved rather satisfactory for the smaller sloughs and lakes where the waterfowl concentrations were smaller. In those areas where it was not possible to get accurate counts on individual birds, the approximate percentages were estimated by observing the flock composition. It was easier to get counts on individual birds in the sloughs of the Yukon Delta during the early part of the summer, however, Kuskokwim observations were made during the peak of the molt and shortly after, making it more difficult to estimate population composition in that area.

The various species are discussed to provide a more detailed picture of distribution according to the existing habitat conditions throughout the area. Tables 1, 2, 3, 4 and 5 show the approximate population composition for these areas. The species composition tables were calculated largely from counts of individual birds within areas. In some areas, however, not all birds could be counted in this manner. For the most part, the upper Yukon Delta supports dense willow growth which makes observation of waterfowl difficult. Individual birds could be counted as we traveled through the sloughs. Since all birds in the area could not be counted, our figures are useful as a basis for comparison of relative numbers of waterfowl between areas rather than as total counts.

Some of the islands in the Yukon and Kuskokwim Rivers contained large numbers of waterfowl. Islands on the Yukon River worthy of mention include: Hills Island near Pilot Station and the unnamed islands between Mountain Village and Acres Fish Saltery on Middle Mouth. On June 20, approximately 500-700 ducks were observed on Hills Island, however, one week later there were only about 200. Most islands in the Yukon River were flooded but numerous waterfowl were flushed from the partially submerged willows when traveling by. Natives reported that spring waterfowl could not utilize these islands because of the flood conditions, however, prior to fall migration large numbers of waterfowl are reported to congregate there.

The areas where greatest densities of waterfowl on the Yukon Delta were observed include the coastal areas, particularly the area from Sheldon Point south toward Black River and also the area between Middle Mouth and Pastolik River. There is less human activity in these areas as there are fewer fish camps and villages than elsewhere on the Delta.

In the Kuskokwim River area, greatest densities were observed in the lake

area southeast of Fowler Island, the Eenayarak River area and the tundra expanse between Kasigluk and Nunavakpuk Lake. As mentioned earlier, progressively more waterfowl were seen during the month of August. By the end of the month, large flocks were forming on the larger lakes southwest of Bethel and on the islands in the river, particularly Fowler and Eek Islands.

The most common and abundant species over almost the entire area was the Pintail. In general, the greatest concentrations of this species were found in the more open grass-covered areas where there were numerous tundra pools and shallow lakes. During travel on the main Yukon and Kuskokwim Rivers, Pintails were the most commonly observed species. Along some of the heavily willowed sloughs below Mountain Village and around Marshall on the Yukon River, however, American Widgeon were almost or more abundant than Pintails. On some of the larger lakes in the more open areas nearer the Bering Sea, Scaup were equally abundant.

The distribution of American Widgeon seemed to follow the heavily willowed slough areas with the greatest concentrations occurring in the Yukon Delta below Mountain Village in the thirty mile slough (Tunurokpak Channel) area and around Marshall. During the early part of the summer, large numbers of this species were observed on the visible sandbars and smaller lakes in these areas. Lesser concentrations were observed in the St. Marys and Andreafsky River area of the Yukon Delta and in the slough and lake country southeast of Bethel on the Kuskokwim River. The lower regions of both the Yukon and Kuskokwim Deltas contained only thin scatterings of Widgeon with no major areas of concentration.

Scaup were most commonly observed in the areas where there were larger bodies of water interspersed with open areas of grass and sedge. Although this species did not occur in as great numbers as the Pintail, they were rather evenly distributed on the main rivers with greatest concentrations in areas adjacent to the rivers nearer the coast of the Bering Sea.

Mallards were thinly but rather evenly scattered over the entire area and were usually observed in small numbers. During the early part of the summer, pairs were observed along the "slow" side of the main Yukon River where there were log jams or other irregularities in the riverbank causing "quiet" water. In the smaller lakes and ponds around Hamilton on the Yukon River, more Mallards were observed than in any other area. This perhaps was unusual judging from comments of natives living in the area who said that during past years they had not seen as many Mallards in the immediate vicinity.

Green Winged Teal were observed throughout the area with greatest numbers occurring in the grassy or swampy areas between dense willow growth. They were commonly associated with Widgeon on sandbars along some of the smaller sloughs but were more widely distributed. In a few areas, Green Winged Teal were considered to have approximate equal abundance as the Mallard, but were usually observed in slightly larger flock sizes.

The greatest portion of the Shoveler population was seen during June and July. They are of lesser importance in the species composition than the species already discussed but were represented in small numbers over the greater part of the Yukon Delta. Only a few Shovelers were observed in the Kuskokwim area during the month of August.

Oldsquaw were restricted to the largest bodies of water, primarily those

nearest the Bering Sea. They were observed most frequently in the areas adjacent to Kwemeluk Pass south of Sheldon Point and the coastal areas across the lower Yukon Delta to Hamilton. Some of the largest lakes between the Kwethluk and Eek Rivers, and also in the area around Nunavakpuk Lake in the Kuskokwim region contained smaller numbers of this species.

Species rarely observed in these areas included Canvasback and American Goldeneye. The upper parts of the Yukon Delta where there were larger wooded areas was the only place where Goldeneyes were observed. A few Canvasbacks were seen in the tundra area between Kasigluk and Nunavakpuk Lake.

It was more difficult to get accurate estimates of the composition of the goose population because they were usually observed in larger flock sizes. The greatest part of the goose population on the Yukon Delta was observed in the flat swampy coastal areas with fewer numbers occurring in the Nanvaranak Slough and lake area east of New Fort Hamilton. The molting geese in particular seemed to follow the tides rather closely, feeding on the mud flats when the tide was out and then going back out into the shallow coastal waters when the tide was in.

The largest numbers of geese in the Kuskokwim area were observed on the tundra expanses around the Eek and Eenayarak Rivers and the larger islands in the Kuskokwim River, particularly Eek Island. Increasingly larger numbers were seen during the latter part of August when the molt was finished and flocks were forming prior to migration.

Both the Lesser Canada and Cackling Goose were present throughout the study areas. The Lesser Canada Goose was the most common of these two geese on the Yukon River above the Delta and in the Kuskokwim study area; moving down the Yukon Delta to the coast, the Lesser Canada Goose became less common while the Cackling Goose was the most prevalent form in the coastal fringes. Differentiation of the two species in the field was difficult under the best of conditions and often not possible when the birds were in flight at some distance. Consequently, both Lesser Canada and Cackling Geese are listed under the general heading Canada in the accompanying tables.

Two species that are apparently on the increase in the Yukon-Kuskokwim Delta include Whistling Swans and Lesser Sand Hill Cranes. This is based on information from people who have lived in the region for several years and also from the frequency that these birds were observed.

Whistling Swans had a wider distribution throughout the area while Lesser Sand Hill Cranes were most numerous in the open tundra areas. Even though cranes are a very wary bird, they were very frequently observed throughout all the tundra habitat.

Nesting:

A limited amount of information on nesting was obtained in the Yukon Delta. As field work started on June 20, and the first broods were observed on July 4, the observation time was rather short. This time was spent in walking areas to find nests and to determine the effects of late breakup and high water levels on phenology and production. Eggs were candled to compare phenology from wet and dry nesting sites to determine if renesting occurred.

Nests that had been destroyed by floods were found in the open areas along the Yukon River below Alakanuk and also along the Alakanuk, Kwiguk and Kakachtoli Passes. Eggs that had never been incubated and had been washed out of nests were also found throughout these areas. Eskimos in several of the fish camps along the Yukon River, and in particular the ones at the end of Kwiguk Pass, reported that they frequently found eggs scattered around when they set up fish camps early this spring.

In certain areas renesting occurred judging from comparisons of phenological stages of eggs in wet and dry areas. In the dryer areas, eggs were hatching while eggs found in the flooded areas were in early stages of development. Clutch sizes were usually smaller in these late developing nests causing the average clutch sizes to be somewhat smaller than one might expect under normal conditions.

Although the number of nests found is rather small to yield significant data on nesting densities, Table 5 gives some information on the number of nests and average clutch size for the various species. The majority of nests were found in the coastal tundra areas. In these areas nests were found very close to the edge of shallow pools (usually less than 10 inches) and also on the tiny islands in these pools. A few nests were found in the willow areas on the upper Yukon Delta but not a significant number to reflect density. In the coastal areas south of Sheldon Point and also around Kwiguk and Kangokakli Passes, one or less nests could be found in an hours walking. In other areas nests were more difficult to find because of water conditions and dense willow growth. Throughout the nesting areas a total of 17 empty nests were found.

Broods:

The first young were observed on July 4 in the Kwemeluk Pass area south of Sheldon Point. Soon after the hatch occurs the young and the female leave the nesting grounds and go to the sloughs and lakes. Almost all of the duck broods were observed swimming in the sloughs while young geese were observed primarily in the coastal areas, particularly on the mud flats caused by tidal action.

Tables 7, 8 and 9 show the average brood sizes for the different areas. Other investigators have reported a decrease in brood sizes as the season progresses, however, in this investigation observations could not be made in the same areas for extended periods of time. Although these tables do show a slight decrease for most species, it should be pointed out that they represent different areas which may be exposed to different environmental conditions.

Different developmental stages were represented within each particular species. This is perhaps due in part to renesting and also the time factor caused by availability of nesting sites early this spring. Green Winged Teal were more advanced than the other species, however, by August 25 when field work terminated, hardly any were well developed enough to fly. At this time, young of the year were beginning to congregate into small groups.

Molting:

The first indication of molting was observed between July 2 and July 7. At this time, however, only single or small numbers of molting birds were seen. Adult males were grouping up in the small lakes adjacent to Kwemeluk Pass and

as continued observations were made across the Yukon Delta, larger numbers of molting birds were seen. Numerous flocks of molting Pintails, between 10 and 30 birds per flock, were seen on the sloughs in the coastal area between Apoon and Okahokwewhik Passes. In this same area flocks of molting White-front and Canada geese were observed. As previously mentioned, these molting geese followed the tides rather closely. The molting geese formed larger flocks than did the molting duck species.

Kuskokwim observations started shortly after the peak of the molt. Although large flocks of molting birds were reported for some of the lakes in the area, most of these were beginning to disperse during and shortly after the first week in August. By August 20, adult birds were beginning to concentrate into large flights.

Predation:

Avian predation was noted in several areas on the Yukon Delta. On almost all of the coastal nesting grounds investigated, several eggs were found that had been destroyed by gulls or jaegers. The Eskimos seem to think that the jaegers destroy more waterfowl than other predatory species. This may be justified in part because gulls probably destroy equally as many.

On separate occasions Glaucous Gulls were observed taking young Pintails and young geese. On one occasion, a Glaucous Gull was seen taking two young Pintails from a brood swimming in the Yukon River. Young geese seemed to be more vulnerable to gull attacks when they are separated from the rest of the brood. This was observed on the tidal mud flats near Apoon Pass on the Yukon Delta.

Native Utilization:

Eskimos and whites living in the areas were very helpful throughout the summer. They often gave advice on travel in unfamiliar areas and information about trading posts where supplies and gasoline could be purchased. Comments from these people pertaining to utilization of waterfowl and economy of the area were recorded and some of these seem worthy of mention. Information concerning egg hunting, spring hunting and molting drives was recorded whenever possible. During the past several years, the economic structure of many of the villages has changed with the onset of King Salmon fishing starting early in the spring and also from monies of various welfare sources.

For the most part, the natives are busily engaged in King Salmon fishing soon after spring breakup. This has apparently cut down the amount of egg gathering in most of these areas. Natives living around Acres Fish Saltery on Middle Mouth said that they pick a "few" eggs in the spring, but this probably occurs mostly in the areas nearest the fish camps. Another factor that reduces the number of eggs taken in this area is the fact that there are no gregarious nesting species and nests are rather thinly scattered. Eggs of species other than ducks and geese are also taken, particularly loon and Lesser Sand Hill Cranes. Egg hunting reportedly occurs between May 18-20 when the ground is still frozen and walking is easy. The female is most readily seen on the nest early in the morning at this time.

There are 130 natives living at Acres Fish Saltery during the fishing season, and this spring they reportedly took 275-300 geese. Most of this hunting was said to occur in the Middle Mouth area of the Yukon River. Because of the

late breakup delaying the fishing season, some villages were very low on food this spring. When waterfowl arrived in the Eek area for example, a heavy kill was reported. Unfortunately a definite number on kill could not be obtained.

Molting drives are not known to occur on the Yukon Delta. People living here say that molting waterfowl do not congregate in large flocks as they do in other areas. However, this observer did see rather large numbers of molting Pintails and geese near the coast of the Bering Sea. Molting drives do occur in the Kuskokwim area. The village of Napaiskak had a drive on or about August 1. Unfortunately the number of waterfowl taken was not learned, but in a drive that took place in 1961, approximately 1,400 birds were taken. The villages of Eek and Kasigluk were reported to have separate drives prior to August 1. These drives took place before our field work started on the Kuskokwim, therefore, only limited information about the drives was received after they took place.

Natives were occasionally seen taking waterfowl throughout the summer, particularly near their fish and berry camps. They started hunting geese in the Kuskokwim River area about the middle of August. Trading posts reported an increase in the sale of shotgun shells at this time.

TABLE 1. Approximate waterfowl population composition of the area between Marshall and the Fish Village slough area north of Mountain Village (Area 1). Figured from observations of 2,723 birds.

<u>Species</u>	<u>Percentage of Population</u>
Pintail	39
Widgeon	33
Green Winged Teal	13
Scaup	12
Mallard	2
Shoveler	1
	<u>100</u>

TABLE 2. Approximate waterfowl population composition of the area between Mountain Village, including thirty mile slough (Tunurokpak Channel), to Alakanuk (Area 2). Figured from observations of 501 birds.

<u>Species</u>	<u>Percentage of Population</u>
Pintail	30
Widgeon	43
Scaup	21
Green Winged Teal	4
Mallard	1
Shoveler	1
	<u>100</u>

TABLE 3. Approximate waterfowl population composition of the area from Alakanuk to Sheldon Point, including Kwemeluk Pass and Nioklakowik Slough (Area 3). Figured from observations on 1,394 birds.

<u>Species</u>	<u>Percentage of Population</u>
Pintail	40
Scaup	36
Oldsquaw	14
Green Winged Teal	4
Mallard	3
Shoveler	2
Widgeon	<u>1</u>
	100

Figured from approximately 550 geese.

<u>Species (Geese)</u>	<u>Percentage of Population</u>
White-front	55
Canada	<u>45</u>
	100

TABLE 4. Approximate waterfowl population composition of the Yukon Delta from Alakanuk to Hamilton including: Alakanuk, Akagowik, Kwiguk, Kangokakli, Aproka, Kwipak, Kawanak, and Apoon Passes (Area 4). Figured from observations on 1,734 birds.

<u>Species</u>	<u>Percentage of Population</u>
Pintail	45
Scaup	31
Oldsquaw	10
Widgeon	4
Mallard	4
Green Winged Teal	4
Shoveler	<u>2</u>
	100

Figured from approximately 2,500 geese observed on mud flats and shallow coastal water between Okshokwewhik and Okwega Passes.

<u>Species (Geese)</u>	<u>Percentage of Population</u>
White-front	60
Canada	<u>40</u>
	100

TABLE 5. Approximate waterfowl population composition of the Kuskoikwim area southeast of Bethel between the Kwethluk and Eek Rivers and also the Tundra (Johnson) River to Kasigluk and Nunavakpuik Lake (Area 5). Figured from observations on approximately 3,000 birds.

<u>Species</u>	<u>Percentage of Population</u>
Pintail	45
Scaup	20
Green Winged Teal	15
Oldsquaw	10
Widgeon, Mallard, Shoveler	<u>10</u>
	100

Figured from approximately 900 geese.

<u>Species (Geese)</u>	<u>Percentage of Population</u>
White-front	65
Canada	<u>35</u>
	100

TABLE 6. Average clutch sizes of nests found on the Yukon Delta.

<u>Species</u>	<u>Total Nests</u>	<u>Total Eggs</u>	<u>Average Clutch Size</u>
Pintail	15	110	7.3
Scaup	9	59	6.5
Green Winged Teal	7	64	9.1
Oldsquaw	6	30	5.0
Widgeon	5	36	7.2
Shoveler	5	41	8.2
Mallard	4	34	8.5
White-front Goose	3	16	5.3
Canada Goose	2	9	4.5

TABLE 7. Brood sizes for the Yukon Delta from Kwemeluk Pass to Apoon Pass. July 4 to July 25.

<u>Species</u>	<u>Total Broods</u>	<u>Total Young</u>	<u>Average Size</u>
Pintail	14	93	6.64
Green Winged Teal	8	63	7.5
Shoveler	7	49	7.0
Scaup	5	32	6.4
Mallard	4	27	6.75
Oldsquaw	3	14	4.66
White-front Goose	14	30	5.7
Canada Goose	12	66	5.5

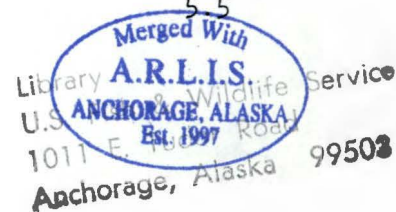


TABLE 8. Brood sizes for the Kuskokwim Delta for the Tundra (Johnson) River area to Kasigluk and the slough and lake region from Kasigluk to Nunavakpuik Lake. August 1-4.

<u>Species</u>	<u>Total Broods</u>	<u>Total Young</u>	<u>Average Size</u>
Green Winged Teal	26	202	7.77
Pintail	21	136	6.43
Scaup	4	27	6.75
Oldsquaw	3	18	6.0
Mallard	2	14	7.0
Shoveler	2	14	7.0
Canvasback	2	9	4.5
White-front Goose	4	17	4.25
Canada Goose	3	15	5.0

TABLE 9. Brood sizes for the Kuskokwim Delta between the Kwethluk and Eek Rivers. August 5-25.

<u>Species</u>	<u>Total Broods</u>	<u>Total Young</u>	<u>Average Size</u>
Pintail	23	117	5.08
Green Winged Teal	15	39	5.93
Scaup	5	30	6.3
Mallard	4	24	6.0
Oldsquaw	4	23	5.75
Shoveler	2	13	6.5
White-front Goose	5	30	5.0
Canada Goose	6	20	4.66

