

WATERFOWL IN THE ECONOMY OF THE ESKIMOS ON THE YUKON-KUSKOKWIM DELTA, ALASKA

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ABSTRACT. Use of waterfowl by Eskimos on the Yukon-Kuskokwim Delta amounts to approximately 83,000 geese and brant and 38,000 ducks annually with the greatest take occurring during the spring hunting period. About 5,500 swans and 1,000 cranes are also taken throughout the area and 40,000 eggs are gathered for use as food. Egg gathering and village drives of molting, flightless adult birds have decreased in importance in recent years, but spring hunting of waterfowl continues to be important as it coincides with the period of greatest need for food by the Eskimos.

RÉSUMÉ. *Les Oiseaux aquatiques dans l'économie des Esquimaux du Delta du Yukon et du Kuskokwim, Alaska.* Chaque année, les Esquimaux du delta du Yukon et du Kuskokwim tuent environ 83,000 oies et bernaches, 38,000 canards, environ 5,500 cygnes et 1,000 grues et récoltent 40,000 œufs pour la nourriture. Les collectes d'œufs et la chasse aux oiseaux adultes en mue ont perdu de l'importance ces dernières années ; mais la chasse des oiseaux aquatiques au printemps continue d'être importante, car elle coïncide avec la période des plus grands besoins alimentaires des Esquimaux.

АБСТРАКТ. ВОДЯНЫЕ ПТИЦЫ В ХОЗЯЙСТВЕ ЭСКИМОСОВ ЮКОН-КУСКОКВИМ ДЕЛЬТЫ В АЛЯСКЕ. Добыча водной птицы эскимосами Юкон-Кускоквим дельты достигает приблизительно 83.000 гусей и казарок и 38.000 уток в год, главным образом в весенний период охоты. Около 5.500 лебедей и 1.000 журавлей добывается также в этой местности, и 40.000 яиц собираются на пищу. Значение сбора яиц и облавы деревней на линяющую и не способную летать взрослую птицу уменьшилось за последние годы, но весенняя охота на водную птицу сохраняет свое значение, так как она совпадает с периодом самой большой нужды эскимосов в пищевых продуктах.

MOST OF THE INHABITANTS of the Yukon-Kuskokwim Delta (Fig. 1) are Eskimos who traditionally have killed ducks and geese for food without regard to the time of year or other restriction. Historically, the harvest was accomplished by egg gathering during the nesting period, by clubbing flightless birds during the molt, and by taking on the wing with bolas and bird spears. The introduction of firearms to this region began in the early nineteenth century and today the Eskimo hunter is well equipped with modern arms and ammunition limited only by his ability to pay. Available to him are methods and means of transportation giving him greater mobility than ever before.

This study was undertaken from April to June 1964 and during February 1965 to provide basic information for an objective appraisal of the problem of seasonal use of waterfowl by Eskimos in the Yukon-Kuskokwim Delta. Letters were written in advance to each village council within the study area, explaining the nature of the study and asking their cooperation when I visited the villages shortly after the spring hunting period.

Mr. Ray Christiansen, who operates an air charter service out of Bethel and is a representative in the Alaska State Legislature, flew me to most of the villages. He was of great help for, being an Eskimo, he acted as interpreter, and the fact that many of the people in the villages were his personal friends established a rapport that otherwise would not have been possible. Samuelson Flying Service

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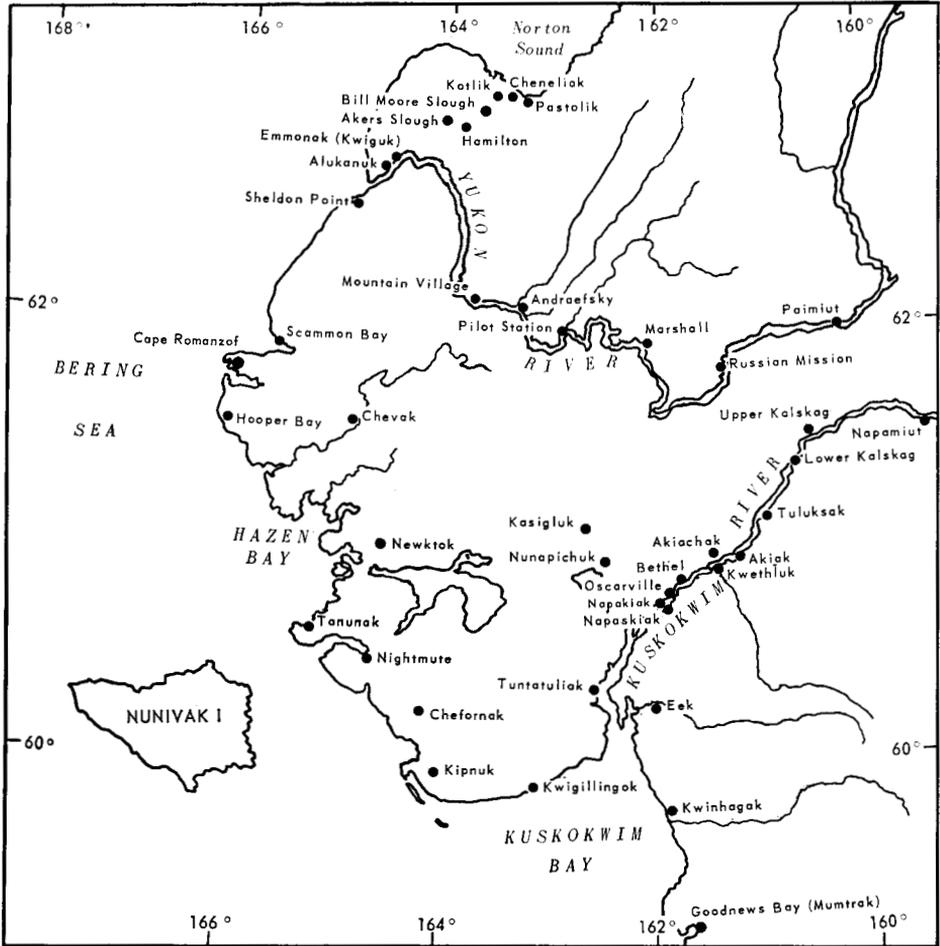


Fig. 1. The Yukon-Kuskokwim Delta area of Alaska.

of Bethel, which is owned, operated, and almost exclusively staffed by Eskimos, flew me to the other villages.

Upon arriving at a community, the village council president (chief) or other council member was contacted and arrangements were made to meet the men of the village, usually at the National Guard armory, but sometimes in trading posts, school and church buildings, community houses, or out-of-doors. Although the meetings were held at short notice, generally 20 to 30 men attended. Actual attendance varied from 8 at Akiak to 45 at Hooper Bay. At the meetings, which were held in 23 different villages (see footnote, Table 5), the reason for the study was explained; it was pointed out that everyone would benefit from an objective appraisal of the problem based on facts. Specific questions were then asked about 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. Information on 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.

The cooperation of the people in the villages was excellent. In one instance, in response to my preliminary letter, each hunter in the village reported his daily take of waterfowl during the spring hunt to the scribe of the local National Guard platoon. The scribe in turn tallied the total take for each man and presented the record to me when I visited the village. In another area, where the people had physically resisted enforcement attempts by U.S. Fish and Wildlife Service agents in the spring of 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 (BRBS) personnel during 1956 (U.S. Fish and Wildlife Service 1957). The fact that I used an interpreter who was an Eskimo, well known to the people, and further, that I was not identified with the U.S. Fish and 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 similar, whereas 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:

	Total geese reported taken		Total ducks reported taken	
	This study	BRBS	This study	BRBS
Emmonak	30	23	15	5
Mountain Village	38	22	12	12
Pilot Station	170	23	75	11

The Eskimos of the Yukon-Kuskokwim Delta region feel strongly about their need and *right* to hunt geese and ducks in the spring, but they feel less justified in their 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 harbour some concern about the possible harmful effects on the waterfowl populations. The data on the latter are therefore less reliable than the data on the goose and duck harvest.

Population and economic data for the study area have been obtained from the various published and mimeographed reports cited in the text; Kozely's work (1964) has been of particular value.

Ethnological and historical information about the Eskimo people of the area was obtained from the literature. Oswalt (1963a and b) gives detailed descriptions of the cultural changes taking place, the roots of origin and historical cultures of the people, and the ethnography of the Eskimo.

This report deals primarily with the seasonal use of waterfowl by Eskimos on the Yukon-Kuskokwim Delta, and the demographic, economic, sociologic, and ethnographic information presented is only that related to the problem.

The People

The Yukon-Kuskokwim Delta area has an average population density of about one person per 3 square miles; 97 per cent are Eskimos. The area supports the largest concentration of Eskimo people existing in the world today. With the exception of less than 25 people living in 3 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 6 villages had a population of less than 100, whereas 13 were in the 100-200 range, 11 in the 200-300 range, 7 in the 300-400 range, and only Hooper Bay had a population in excess of 500 people (Table 1). The average annual crude rate of natural increase in the area was 4.18 per cent in 1964. This compares with 1.4 per cent for the entire United States and rates of 2 per cent for India and 3.5 per cent for Mexico during the current decade.

Table 1. Yukon-Kuskokwim Delta village populations (data from U.S. Bureau of the Census 1962, U.S. Bureau of Indian Affairs (BIA), and Kozely 1964).

VILLAGE	U.S.	BIA VILLAGE CENSUS			NO.
	CENSUS 1960	1961	1962	1963	HOUSEHOLDS 1962
<i>Yukon River</i>					
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	31	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
<i>Kuskokwim River</i>					
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
Aklachak	229	237	252	277*	45
Kwethluk	325	345	356	366	63
Bethel	1,258			1,538	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
<i>Bering Sea</i>					
Sheldon Point	125			138*	22**
Scammon Bay	115	155	163	169	26
Hooper Bay	460	482	509	531	72
Chevak	315	348	358	372	63
Newktok	129	148	146	144	20
Tanunak	183	204	215	232	36
Nightmute	237	246	262	258	47
Chefnak	133	133	143	139	30
Kipnuk	221	256	265	274	45
Goodnews Bay (Mumtrak)	154	153	167	159	33****
TOTAL				9,521	1,530

*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

Since the introduction of aspects of Western culture and economy there has been a general abandonment of the smaller villages where subsistence hunting and fishing were the only means of livelihood. Kozely (1964) lists over 50 villages within the study area that have been abandoned during the past 3 decades; many of these villages were on the tundra of the Delta at some distance from the 2 main rivers. As a result vast areas are now unpopulated, and the Eskimo people are now concentrated in the larger villages along the Kuskokwim and Yukon Rivers, and on the coast of the Bering Sea where there are schools, churches, and stores.

In a U.S. Public Health Service study (from Kozely 1964) of a sample of 10 villages in the Yukon-Kuskokwim Delta area, including 420 housing units, it was found that 86 per cent of the houses had only 1 room, 10 per cent had 2 rooms, and 4 per cent had 3 rooms. The typical family consisted of 8 persons; the mother's age was 25 to 29, she had 5 living children; and 40 per cent of the mothers studied had tuberculosis.

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 wildlife resources; virtually all 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 is salmon. 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. 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 each occupied by one or several families, and with permanent fish drying racks and storage sheds. People at Kasigluk and Nunapichuk annually travel down the Johnson River to its confluence with the Kuskokwim where they fish for salmon. Other fish are also available seasonally throughout the area.

The people of the coastal villages of Scammon Bay, Hooper Bay, Tanunak, Nightmute, Newtok, Kipnuk, Cheforak, Kwigillingok, Kwinhagak, and Goodnews Bay (Fig. 1), derive much of their subsistence from the sea, although not to the same extent as the Eskimos on the islands of the Bering Sea or those on the Arctic coast of Alaska. Fish, primarily tomcod (*Microgadus proximus*), and seals (primarily *Phoca vitulina*) are the resources on which they draw most heavily. Other marine mammals, such as walrus (*Odobenus divergens*) and beluga whales (*Delphinapterus leucas*) are taken when available but they are not abundant in this region. Normally, 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 (Fig. 1.), travel by dog sled to the coastal areas to hunt seals. Seal hunting is an important winter activity and continues into the spring and early summer until the sea ice leaves the coastal areas.

Other food resources of the area include moose (*Alces alces*), ptarmigan (*Lagopus lagopus*), snowshoe and arctic hare (*Lepus americanus* and *L. othus*), carcasses of mammals taken for their pelts (such as muskrat, *Ondatra zibethica*

and mink *Mustela vison*), berries and greens from wild plants, and the limited produce of leaf and root crops in home gardens.

The cash economy of the area is supplementary 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 such as tea, coffee, salt, flour, milk and sugar introduced into the Eskimo diet by whites; 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 to be worn at church and social events, radios, occasional air transportation, money for movies, and religious items and offerings.

Sources and amounts of cash income for 18 villages in the Yukon-Kuskokwim Delta area are presented in Table 2. Wages are derived mainly from fish-processing work, National Guard participation, work for the local village traders, maintenance work for U.S. Bureau of Indian Affairs and State 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 Andraefsky 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 between the Yukon Delta and the Kuskokwim River.

Income is derived from the shooting of muskrats and trapping of mink for their pelts, and from 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 1964). Mink from the Yukon-Kuskokwim Delta are among the largest and of the best quality in North America, and they command premium prices at fur auctions. Oswalt (1963b) 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 owing to poor weather conditions during the trapping season and

Table 2. Sources and amounts of earned income within villages on the Yukon-Kuskokwim Delta, 1962 (data from Kozely 1964).

VILLAGE	WAGES	FISHING	HUNTING & TRAPPING	ARTS & CRAFTS	OTHER ACTIVITIES	PRIVATE BUSINESS	TOTAL
<i>Yukon River</i>							
Pilot Station	32,993	6,250	16,115	2,900	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
<i>Kuskokwim River</i>							
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
Napaklak	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	19,810	3,090	8,970	3,000	111,095
Kasigluk	15,000	61,000	25,500	5,000	7,000	10,000	123,500
<i>Bering Sea</i>							
Scammon Bay	18,800	13,500	11,085	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
Tanana	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
Cheforak	26,500	12,500	22,650	2,790	700	1,000	66,140
Kipruk	98,000	7,500	32,200	5,700	7,150	6,000	156,550
Goodnews Bay (Mumtrak)	100,000	4,400	3,860	1,620	75	400	110,355
PERCENTAGE OF TOTAL	45.7	24.9	17.9	5.1	2.5	3.8	

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 a reduced income in recent years due to low value of pelts and the consequent decreased interest in spring rat hunting. Oswalt states that during 1956, which was a poor year with local prices of only \$0.40 to \$0.85 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 is derived from the sale 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 85 per cent of the total income of the area, the remainder being welfare income from state and federal sources (Table 3). Welfare money is available mainly in 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.

Table 3. Total cash income within villages on the Yukon-Kuskokwim Delta (data from Kozely 1964).

VILLAGE	1963 WELFARE		1962 TOTAL EARNED INCOME	PER CAPITA INCOME	INCOME PER HOUSE- HOLD
	BIA	STATE			
<i>Yukon River</i>					
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			
Alukanuk	798	28,552	174,220	562	3,393
<i>Kuskokwim River</i>					
Upper Kalskag	2,444	10,712			
Lower Kalskag	4,054				
Tuluksak	988				
Akiak	2,529	9,920			
Akiachak	84	17,608			
Kwethluk	1,983	14,344	108,360	341	1,979
Napaskiak	344	24,936	58,300	449	2,388
Napaklak	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
<i>Bering Sea</i>					
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

Of the total welfare moneys coming into the area, approximately 80 per cent 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 7 miles from Bethel, has a per capita income \$17 above the average for the area and 30.2 per cent 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 per cent of its income is from welfare. In addition to direct welfare payments, those individuals with Eskimo blood are also given 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 one of the lowest in the nation. The average per capita income of \$432 for the villages, for which complete data is available, can be compared 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 fish, wildlife, and plant resources of the area are all the more important to the Eskimo people because of the high cost of imported items which reduces the buying power of the dollar to less than one half of what it is in Seattle or other West Coast cities.

Patterns of Waterfowl Use

Although the bow with blunt-tipped arrow, bird spear, and bolas, once used by the Eskimos for taking waterfowl on the wing, 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 at present. 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 upriver regions where the tundra intergrades with the shrub type and spruce forests. Aboriginal techniques of hunting waterfowl show remarkably little variation throughout the arctic and subarctic tundra regions. In this respect, Chard's (1963) description of methods of hunting waterfowl employed by the Nganasan of the Taimyr Peninsula of Siberia is also applicable to the Eskimos of the Yukon-Kuskokwim Delta.

SPRING HUNTING

During early spring (late April and early May, see Table 4), large numbers of northward-migrating eider ducks become available to seal hunters. The birds come in almost continuous flocks of a few to several hundred each and fly low over the open leads adjacent to the shore ice. Seal hunters are reluctant to shoot

Table 4. 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	Bethel
	Apr. 29	Mt. Village
Lesser Canada goose	Apr. 17	Bethel
Emperor goose	May 15	Hooper Bay
White-fronted goose	Apr. 17	Bethel
	Apr. 17	Chevak
	Apr. 25	Mt. Village
Black brant	May 5	St. Michael*
	May 20	Hooper Bay
	May 25	Mt. Village
Snow goose	Apr. 29	Mt. Village
Mallard	Apr. 13	Bethel
	Apr. 16	Mt. Village
	Apr. 23	Pilot Station
Pintail	Apr. 14	Marshall
	Apr. 19	Eek
	Apr. 20	St. Michael*
	May 8	Hooper Bay
Whistling swan	Mid-April	St. Michael*
	Apr. 21	Mt. Village
	May 7	Bethel
Lesser sandhill crane	Apr. 29	Mt. Village
	May 2	St. Michael*
Pacific eider	May 4	Hooper Bay
King eider	May 4	Hooper Bay
Spectacled eider	May 2	Cape Romanzof
	May 5	Hooper Bay
	May 6	St. Michael*

*Not included in Fig. 1 as at 63°29' N., 162°03' W.

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. They are an important source of food for seal hunters in the field and are also taken back to the villages when the birds 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, their arrival is welcomed by the people as a pleasant diet variation, and in those years when winter stores are becoming depleted they are an important supplementary food.

Whereas firearms have enabled seal hunters to take larger numbers of eiders on any one hunt than was possible before, in recent years the cash economy has resulted in increased dependence on purchased foods with a corresponding reduction in the effort expended on seal hunting. Even with a substantial increase in the cash value of raw seal hides, only an average of about 20 per cent 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 4, 5, 6, and 7). The cackling (*Branta canadensis minima*) and white-fronted geese (*Anser albifrons frontalis*) arrive in abundance in early May, but a few birds may be seen in late April. The emperor goose (*Philacta canagica*) usually comes a little later except to the Goodnews Bay area where they 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 Newtok. In Chevak, Hooper Bay, and Scammon Bay, the cackling and white-fronted geese constitute the larger portion of the spring take.

WATERFOWL IN THE ECONOMY OF THE ESKIMOS

Table 5. Take of geese and brant by Eskimos on the Yukon-Kuskokwim Delta.

VILLAGE	SPRING						FALL						
	Relative Importance						Relative Importance						
	TOTAL VILLAGE	TOTAL HOUSEHOLD	CANADA	WHITEFRONT	EMPEROR	SNOW	TOTAL VILLAGE	TOTAL HOUSEHOLD	CANADA	WHITEFRONT	EMPEROR	SNOW	BLACK BRANT
<i>Yukon River</i>													
Russian Mission	240	12	1				120	6	1				
Marshall	1,120	35		2			1,600	50	3	2			
Pilot Station	2,640	60	3	2		1	4,840	110	3	2			1
*Andraefsky	1,892	43	3	1		4	2,728	62	2	1			1
Mountain Village	1,650	25	3	1		1	858	13	2	1			3
*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)	1,260	20	3	2		1	630	10	2	1			
Alukanuk	1,500	25	3	2		1	480	8	1	2			3
<i>Kuskokwim River</i>													
*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	2,250	50	1	2			450	10	1	2			
*Kwethluk	2,520	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	1,075	25	1				430	10	1				
*Tuntatuliak	480	20	1				120	5	1				
Eek	780	20	1	1			195	5	1				
Kwigillingok	1,250	25	2		1		500	10					
Kwinhagak	810	18	2		1	3	135	3				1	
Nunapichuk	4,960	80	1	2			3,720	60	1	2			
*Kasigluk	3,120	80	1	2			2,340	60	1	2			
<i>Bering Sea</i>													
Sheldon Point	330	15	3	1		2	110	5	2	1			
Scammon Bay	2,600	100	1	3	2	4	2,600	100	1	3	2		
Hooper Bay	6,480	90	1	2	4	3	7,200	100	1	2	4		3
Chevak	1,134	18	1	2	3	4	819	13	1	2	3	4	
*Newtkok	420	21	2		1		240	12	1				
Tanunak	900	25			1		540	15	1				
*Nightmute	987	21	2		1		564	12	1				
Chefornak	450	15	2	3	1		240	8	1	2			
*Kipnuk	1,125	25	2		1		675	15	1				
Goodnews Bay (Mumtrak)	429	13			1		165	5	1				
TOTAL	47,858						34,935						
APPROX. TAKE BY SPECIES		20,000	13,500	6,500	5,400	2,500		18,200	9,100	1,700	400	5,500	
AVERAGE PER HUNTER		31						23					

* Villages not visited; the basis for extrapolating data between ecologically similar villages to obtain estimates for those villages which were not visited was as follows:

- Andraefsky = average of Pilot Station and Mountain Village
- Hamilton
- Kotlik
- Cheneliak
- 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
- Napaskiak }
- Tuntatuliak = Eek
- Kasigluk = Nunapichuk
- Nightmute } = average of Chefornak, Tanunak, and Kipnuk
- Newtkok }

Pintail ducks (*Anas acuta*) are also taken in large numbers throughout the coastal area (Table 6). They are not as eagerly sought as geese, because they represent less meat but they are the easier bird to obtain after the tundra ponds and lakes are free of ice. Mallards (*Anas platyrhynchos platyrhynchos*) are not taken in appreciable numbers by Eskimos in the coastal villages, but they are more plentiful in the areas further back from the coast.

During the early spring immediately after the birds first start arriving on the tundra, hunting is most intensive. At this time, the people are eager for a change of diet, other food is in shorter supply than at any other time of the year, and after a winter of unemployment, financial reserves are at a yearly low. The men generally travel 10 to 20 miles daily by dog team to bluffs and high cutbanks

Table 6. Take of ducks by Eskimos on the Yukon-Kuskokwim Delta.

VILLAGE	SPRING					FALL			
	TOTAL VILLAGE	TOTAL HOUSEHOLD	MALLARD	PINTAIL	EIDER	TOTAL VILLAGE	TOTAL HOUSEHOLD	MALLARD	PINTAIL
<i>Yukon River</i>									
Russian Mission	540	27	2	1		260	13	2	1
Marshall	320	10	1	2		160	5	1	2
Pilot Station	1,100	25	2	1		2,200	50	2	1
*Andreafsky	704	16	2	1		1,188	27	2	1
Mountain Village	462	7	1	2		330	5	1	2
*Hamilton	24	6	2	1		48	12	1	1
*Kotlik	108	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		
Alukanuk	420	7	2	1		900	15	2	1
<i>Kuskokwim River</i>									
*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	1,134	18	2	1		1,008	16	2	1
*Bethel	609	3	2	1		203	1	2	1
*Oscarville	150	15	1	1		30	3	1	1
*Napaskiak	525	15	1	1		105	3	1	1
Napaskiak	645	15	1	1		129	3	1	1
*Tuntatuliak	288	12	1	1		72	3	1	1
Eek	468	12	1	2		117	3	1	1
Kwiggilingok	750	15	3	2	1	250	5	2	1
Kwinhagak	450	10	1	1	2	225	5	1	1
Nunapichuk	1,860	30	2	1		930	15	2	1
*Kasigluk	1,170	30	2	1		585	15	2	1
<i>Bering Sea</i>									
Sheldon Point	110	5		1		286	13	2	1
Scammon Bay	650	25	3	2	1	520	20	2	1
Hooper Bay	1,080	15		1	2	864	12		1
Chevak	504	8		1	2	945	15		1
*Newktok	540	27		2	1	200	10		1
Tanunak	720	20		2	1	468	13		
*Nightmute	1,269	27		2	1	470	10		1
Chefornak	600	20	3	2	1	390	13	2	1
*Kipnuk	1,800	40		1	1	225	5		1
Goodnews Bay(Mumtrak)	264	8		1	1	66	2		1
TOTAL	21,700					15,815			
APPROX. TAKE BY SPECIES			4,700	12,000	3,300			4,800	10,500
AVERAGE PER HUNTER		14					10		

*Data calculated from ecologically similar villages. See footnote Table 5.

where shooting in flight is possible or to exposed mud bars where the geese rest before open water is available. 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 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, *Branta canadensis leucopareia*), and to a slightly lesser extent the white-fronted goose, are the only geese taken in numbers during the spring hunt (Table 5). Although among the ducks, pintails are taken in greatest number, mallards assume increasing importance in the up-river areas. Most of the early spring hunting is done along the Kuskokwim River itself, which is an important flightway for migrating geese and ducks.

The species of waterfowl taken during the spring hunting period on the

Table 7. 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
<i>Yukon River</i>						
Russian Mission	60	3	5		n.s.	
Marshall	128	4	10		240	
Pilot Station	352	8	30		90	
*Andraefsky	308	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	
<i>Kuskokwim River</i>						
*Upper Kalskag	52	2	5		n.s.	
Lower Kalskag	62	2	5		n.s.	
Tuluksak	30	1	10		144	24
Akiak	116	4	8		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	
Napaskiak	86	2	8		216	
*Tuntatuliak	96	4	25		864	36
Eek	156	4	30		1,404	36
*Kwigillingok	200	4	45		1,800	36
*Kwinhagak	180	4	42		1,620	36
Nunapichuk	620	10	186	3	2,976	48
*Kasigluk	390	10	117	3	1,872	48
<i>Bering Sea</i>						
Sheldon Point	110	5	22	1	100	
Scammon Bay	78	3	10		1,248	48
Hooper Bay	216	3	15		7,200	100
Chevak	189	3	13		3,780	60
Newktok	60	3	5		1,200	60
Tanunak	72	2	10		3,600	100
*Nightmute	94	2	13		2,820	60
Chefornak	10		5		3,000	100
*Kipruk	90	2	13		2,700	60
Goodnews Bay (Mumtrak)	8		n.s.		660	20
TOTALS	5,585		1,033		39,795	

*Data calculated from ecologically similar villages. See footnote Table 5.
n.s. — amount taken not significant

Yukon River vary considerably more from area to area than 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 (*Branta nigricans*) and fewer white-fronted and Canada geese. At Andraefsky, white-fronted geese predominate in the bag; and at Mountain Village, snow geese (*Chen hyperborea hyperborea*) 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. Because of the increased human population throughout the entire Delta and its concentration in relatively few villages, a greater pressure is exerted upon the land resources available to any one village. Consequently, although the resources of the land in the more remote areas are not exploited as they were in the past, land in the vicinity of the villages cannot provide the abundance of subsistence foods necessary to feed the population throughout the year. As food shortages are most likely to coincide with the spring arrival of waterfowl, it is understandable that use of the birds is greatest at that time.

The most intense spring hunting is 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 (early May on the Kuskokwim and late May on the Yukon) and until it ceases to flow in the rivers, travel is greatly restricted and hunting 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 before spring breakup and travel as family units to individual hunting camps 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 there until salmon were beginning to run in the rivers, and travel back to the villages was possible by boat. Now, because of the decreased interest in muskrat hunting and the reluctance of parents to take their children out of school, there are at present 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 of waterfowl, which has in the past been dispersed over a wider area than the early spring shooting, and results in the taking of birds that may have already begun nesting.

During the summer, an occasional bird may be shot for food in the Delta region, but generally the abundance of fresh fish prevents any shortage of food and the people are usually occupied 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 and many travel annually from the villages of the coast near the mouth of the Kuskokwim 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.

EGG GATHERING

The gathering of eggs from the nests of waterfowl has traditionally been practised throughout the Delta region; however, it has been of greatest im-

portance in the coastal tundra where nesting densities are highest (Table 7). It seems likely that in spite of the increased human population, fewer eggs are gathered now than in the past; for with most of the people concentrated in the villages, the total area searched is much less. There is no significant amount of waterfowl nesting in the shrub and forest zones adjacent to the upriver villages on the Yukon and Kuskokwim rivers, consequently, egg gathering is practised only by the few Eskimos who travel to spring hunting camps on the tundra.

Egg-gathering is undertaken primarily by the women and children of the coastal and tundra villages. Although the eggs are important as food, the traditional significance in the culture of the people and the recreational aspect of egg-gathering undoubtedly add incentive. While most of the eggs are gathered in the vicinity of these villages, it is not uncommon in favourable weather for groups of women and children to be transported several miles by boat for a day of egg-gathering in a more productive habitat. In the spring hunting camps of upriver Eskimos, eggs are also gathered by the men during their muskrat hunting excursions. The eggs of the various species of geese nesting throughout the region are preferred because of their size, but even the smallest eggs of passerine species are acceptable. 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 Newtok, they are most frequently taken. Those of sea gulls (*Larus* spp.) 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 (*Uria* spp.), puffins (*Fratercula corniculata* and *Lunda cirrhata*), and other sea birds may be available in limited numbers. In the tundra areas of the Delta further back from the coast, eggs collected represent a more random assortment of species.

DRIVES OF FLIGHTLESS BIRDS

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

Drives require considerable organization and advance planning within the village. Boats must be committed to transport the people to the area chosen and to be used in the actual operations on the lakes. The birds are herded into one large flock by boats and kayaks and are then forced onto the land where additional people frighten the birds 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 making 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 it is conducted as well as with the number of people and boats involved and the efficiency of the organization. Generally, 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, the average take per drive very likely falls between one and two thousand birds. Small drives yielding from 20 to 100 birds may also occasionally be undertaken by several men with boats when they are afield in the summer and conditions are favourable.

Traditionally, at least one drive was conducted annually by the people in each of the villages of the coastal, tundra and downriver areas, but they were not generally undertaken by the people in the upriver regions because suitable areas were at too great a distance. The social and recreational aspects of drives have perhaps always been of a significance nearly equal 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 village during the summer months, there is less opportunity and incentive to organize village drives. Also, the Eskimos 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 decision and planning. It is always more difficult to rationalize a questionable action before than after the fact. Furthermore, there is concern by the people that they may be apprehended by Federal agents, because 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 Chefornek, the two tundra villages of Kasigluk and Nunapichuk, and Napaskiak. The estimated total take in the Scammon Bay drive was 2,500 birds, whereas the estimated take from that at Napaskiak in 1961 was 1,400 birds. The Chefornek drive, on the other hand, appeared to involve 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, while in the tundra villages and at Napaskiak, ducks (greater scaup [*Nyroca marila*] and old squaw [*Clangula hyemalis*]) apparently predominate with some lesser Canada geese also being taken.

FALL HUNTING

Fall hunting of waterfowl is of considerably lesser importance throughout most of the Delta region than is spring hunting (Tables 5 and 6). 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 reduction in take of waterfowl in the fall, including the availability and abundance of other food at that 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, 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 of ducks; particularly in the villages of the Kuskokwim River

above Bethel. The take of swans (*Olor columbianus*) and cranes (*Grus canadensis canadensis*) 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 for use during the winter, but most of the birds taken are for immediate consumption. Because of the damp rainy autumn weather, birds usually cannot be preserved by drying as is sometimes done in the spring, and cold storage facilities are not available. Instead, salt is used as a preservative and the carcasses are stored in wooden barrels. As the required salt and barrels are quite expensive in these remote villages, only the occasional, more affluent Eskimo can afford to preserve for winter use birds that are shot in the autumn.

In the past, in addition to the meat of waterfowl, use was made of unplucked bird skins for making parkas; goose and eider down was used to a limited extent as insulation in garments; showy feathers were used to decorate mammal-skin parkas as well as fans and other ceremonial objects; and needles and other implements were made from bird bones. Bird-skin parkas were common throughout the Yukon-Kuskokwim Delta area as recently 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, they did not wear as well as most mammal-skin parkas. Bird-skin parkas are now very rare throughout the area. Feathers are still used to some extent for decoration on parkas and in the making of ceremonial fans and masks which are exported for sale to tourists. Metal implements have completely replaced those previously made of bird bone.

The Waterfowl Populations

Waterfowl population data for the Yukon-Kuskokwim Delta area are sketchy. For species such as the emperor and cackling geese that for the most part nest only in this area, population estimates are available based on counts of birds in their wintering areas or 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 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. The spring take by Eskimos may approach 15 per cent of the total spring population of each species. Lesser

Table 8. Comparison of waterfowl population estimates for the Yukon-Kuskokwim Delta with the estimated take by Eskimos.

SPECIES	SOURCE	WATERFOWL POPULATION	TAKE BY ESKIMOS		
			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			5,585

Canada geese, which are included with cackling geese in the utilization data, apparently are considerably less numerous throughout the Delta 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 in 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 inhabiting or passing through the Delta area are comparable to the white-fronted and cackling geese populations, the numbers harvested by Eskimos are considerably less than those of the white-fronts and cacklers. This is apparently directly related to their more restricted local availability. Probably not more than 2 to 3 per cent of the total spring population of black brant is taken by Eskimo hunters each year, while the fall harvest is perhaps 3 per cent. The maximum spring harvest of emperor geese by Eskimos would not be likely to exceed 6 per cent of the spring population of these birds, whereas the fall harvest accounts for about 1 per cent of the population at that time of the year. Snow geese do not nest on the Delta, but about 300,000 migrate in the spring along the coast and across the Yukon Delta to nesting areas on Wrangell Island and the north-east coast of the Chukchi Peninsula of Siberia (Cooch 1964). On the basis of this population estimate, the spring harvest by Eskimos on the Yukon-Kuskokwim Delta amounts to approximately 1 to 2 per cent 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 the eiders that migrate northward along the coast each spring. Pintails and mallards, although taken in greater numbers than eiders, are not as eagerly sought 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 there is considerably less hunting of ducks than of geese, it is doubtful if the harvest of any species of duck approaches 5 per cent of the spring population.

Most of the harvesting of swans by Eskimos on the Yukon-Kuskokwim Delta is in the spring. As far as is known, only whistling swans are taken, as apparently there are no trumpeters (*Olor buccinator*) in the area. This harvest accounts for approximately 6 to 8 per cent of the total whistling swan population in North America.

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