SPRING 1987 WATERFOWL HARVEST

NEAR TUKTOYAKTUK, NWT

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SUMMARY

Direct observations of the location, sex and age composition, breeding status and size of the spring waterfowl harvest were conducted near Tuktoyaktuk from 26 May to 10 June 1987. Hunters were interviewed to determine total birds harvested, location and timing of the kill, and socioeconomic factors relating to the hunt. The latter included age and employment status of hunters, age and type of hunting equipment and hunting effort (number of shotgun shells, days on the land, and days hunted).

An estimate of the minimum number of each species harvested to 10 June was 2420 Lesser Snow Geese (LSG), 1603 White-fronted Geese (WFG), 428 Black Brant (Brant), 158 Tundra swans (TS) and 64 Canada Geese (CG). Few yearlings were killed of all species except WFG, reflecting the poor reproductive success of 1986. Age ratios, yearlings per adult, of WFG were exceptionally high. sex ratios of birds killed were near 1:1, except for adult WFG (1.9M:1F) and TS (0.3M:1F). The proportion of adult female WFG in the harvest increased as the season progressed. Also, the proportion of adults in the WFG harvest increased as the season progressed. Of geese with adult plumage, 81% of LSG, 80% of WFG, and 82% of Brant were potential breeders in 1987, based upon development of ovarian follicles.

The hunt began at inland sites near the Anderson River, Kugalluk River and Husky Lakes in early May. As the season progressed and travel conditions deteriorated, hunters concentrated their efforts on the coast of the Tuk Peninsula, to the southwest and northeast of Tuk. As the hunt came to a close, hunters were camped close to Tuk largely to the northeast of town along the coast.

Hunters (n=57)were an average of 34 years of age. Most had part time employment (67%) although many had just been layed off from the oil industry after several years of full-time employment. Hunters generally used 12 ga shotguns and carried an average of 8 boxes of shells to the hunt. They were on the land an average of 11 days and hunted an average of 6 days. Snow machines were an average of 3 years old.

Hunting continued beyond 10 June, when the survey ended. Total harvest estimates are therefore minimums, particularly for Brant and TS. There was good agreement between direct observations of the harvest, and hunter interviews. However, a possible reluctance to report swans was noted, and the disjunct distribution of Canada Geese may have caused inaccurate harvest estimates.

The minimum harvest estimate represents over 8300 kg of edible meat with an economic value of over $50,000. The nutritional value of wild meat over domestic meat raises the estimated value considerably.

If harvest patterns observed in 1987 are repeated in subsequent years, and regulations are eventually required, some management implications are apparent. Area closures, late season harvest regulation, and protection of "resident" versus migratory species are measures discussed for continued investigation.

The hunters were much better informed about the study in 1987 than during the feasibility study in 1986. The support and hospitality of the hunters and their families added considerably to the success of the 1987 work.

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INTRODUCTION

The spring take of waterfowl other than seaters by northern residents is illegal, as defined by the Migratory Birds Convention Act of 1918. Nevertheless, the drafting of an international protocol between the United States and Canada to legalize a spring hunt demonstrates recognition of the legitimacy of spring hunts, and an intent to entrench such recognition in law. Meanwhile, residents have continued their traditional spring waterfowl hunt while bearing the knowledge that, strictly speaking, their actions are illegal. At the same time, waterfowl of the Northwest Territories have sustained a largely unmanaged harvest.

In the 1980s, cooperative efforts by the Department of Renewable Resources, GNWT (DRR), the Canadian Wildlife Service (CWS), and other cooperators were conducted to measure the waterfowl take in the Baffin, Keewatin, Kitikmeot and Inuvik regions. To date, harvest measurement has taken the form of regular interviews of hunters, with extrapolation of information to provide an estimate of total harvest. Such data are sufficient for small, unmanaged harvests, but insufficient if harvests are large relative to the size of populations being harvested.

In 1986, DRR conducted a pilot study of the spring harvest of waterfowl in the Tuk Peninsula-Liverpool Bay area (Bromley, unpub. data). Objectives were to determine the feasibility of the project, and to begin collecting data on the species composition, sex, age and breeding status of birds being

shot. Data such as these are required for assessment of the impact of spring hunts on waterfowl populations, and to provide a basis for the eventual cooperative development of spring hunting regulations in consultation with hunters, should restrictions become necessary.

At present the continental waterfowl resource is managed according to the size, sex, age and species composition of the fall harvest (McCabe 1987), with little regard for the spring harvest. By determining the characteristics of the spring harvest we can incorporate both data sets to provide a more realistic picture of the continental harvest, and more effective international management of the resource. To that end, we initiated a 3-year study of the characteristics of the spring waterfowl harvest in the Tuktoyaktuk area. This report summarizes our findings during spring 1987.

OBJECTIVES

Our long term goal is to develop an understanding of the spring hunt that will permit us to: 1) predict characteristics of the harvest based on measurement of a few variables; 2) evaluate the impact of the harvest on waterfowl populations; and 3) recommend effective regulations as needed to protect the resource while permitting a spring hunt to continue. Specific objectives of this project were to determine:

1) the sex, age, breeding status and species composition of the waterfowl harvest;
2) the chronology of the spring hunt, in terms of hunter effort and harvest of species; and
3) the socioeconomic profile of hunters for comparison with future years.

STUDY AREA

The study area in northwestern NWT comprises Husky Lakes, the Tuktoyaktuk Peninsula from Kitigazuit to Hutchinson Bay, and Liverpool Bay, including the mouths of Kugalluk, Miner, Moose, smoke and Mason rivers and a stretch of the Anderson River above the Anderson River Delta Bird Sanctuary (Fig. 1). This area encompasses major breeding and stop-over areas for geese and swans, typically arriving in mid- to late May and persisting through the summer months (Barry 1966, Smyth et al. 1986). The area is above the tree line, except for the upper Kugalluk and Anderson rivers and parts of the Husky Lakes complex (Fig.1).

Lesser Snow Geese (LSG) of the Western Arctic Population migrate through and stage in the study area, with nearby breeding and summering concentrations at Banks Island (215,354 geese)} Anderson River Delta (9,235 geese) and Kendall Island (1,153 geese) (Kerbes 1986). Geese arrive in mid- to late May and move through the region until mid-June. Black Brant migrating in from the Pacific along the Beaufort coast have been estimated at 26,000 birds (T. Barry in PFTC1978). Brant arrive in late May, some to establish nesting territories by mid-June, but most to continue east and northeast to remote breeding sites.

White-fronted Geese (WFG) of the Mid-continent Population, Canada Geese (CG) of the Shortgrass Prairie Population and Tundra Swans (TS) of the Eastern Population, nest in low densities throughout the region (Barry et al. 1981). WFG are one

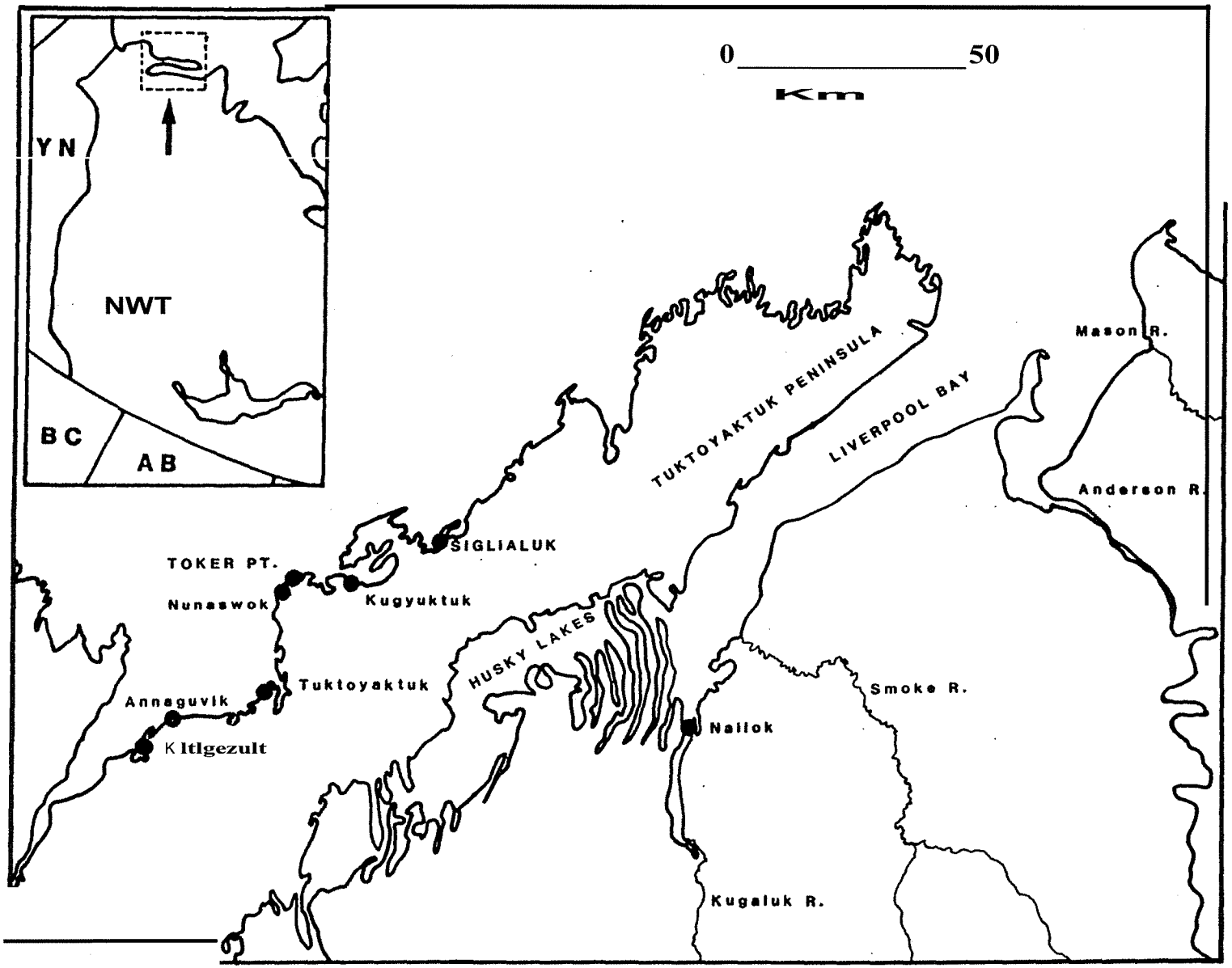

Figure 1. Map of the Tuktoyaktuk study area.

of the earliest migrants to arrive in spring, often being present on the study area in early May. Swans arrive about mid- to late May, as do CG. Significant proportions of each of these species' populations reside in the study area (McCormick et. al. 1984).

METHODS

Two approaches for the collection of data were undertaken. First, we collected information by travelling and camping with hunters, and by visiting their camps. Second, we visited hunters in the community, shortly after they had returned from a hunt. Data were also collected in two formats; one was a compilation of information based upon our direct observations of birds shot, and the other was a compilation of information provided by hunters during interviews.

For direct observations, we determined the sex of birds by cloacal examination; age was based upon plumage (Bellrose 1980) and was classified to yearling or adult. CG could not be aged on the basis of plumage characteristics. Breeding status was determined for a sample of female geese and swans, by examining the stage of development of ovarian follicles. Birds with adult plumage and an ovarian follicle of 10 mm or less in diameter were classified as non-breeding. Yearlings were assumed to be non-breeding also. Birds with 1 or more ovarian follicles greater than 10 mm were classified as breeding birds.

We attempted to examine all birds in each camp we visited, but often this was not possible. If the hunter was absent and we did not have his prior approval, birds were not examined. If hunters were present but chose not to permit us to examine birds taken, we did not force the issue. Also, due to time restrictions in camps with large numbers of birds, we could not examine the

entire take. In these situations, however, we recorded the number, species and sometimes age and sex of the kill.

For birds which we did examine, we recorded the species, sex, age, weight (kg), wing flat, total and diagonal tarsus, total bill length and width at gape, hunter identification number, geographic location where the bird was shot and the date and approximate time it was shot. Morphological measurements were in mm, taken with calipers and a "wing board". Individual hunters were provided with a hunter number to provide anonymity. The approximate time of death of birds will help to interpret body weight, which, in combination with morphological measurements, may provide an estimate of condition of birds (i.e. fat content). This, however, is beyond the scope of the present report.

Besides direct examination of hunters' birds, we attempted to interview every hunter we encountered, to determine their spring hunting effort and success to date. To describe the socio-economic profile of hunters we asked questions regarding their transportation, hunting equipment and employment status. Notes on hunting technique and number of people benefitting from the hunt were also recorded. A blank interview form is appended (Appendix A).

We travelled through the region by snowmobile in one to two teams, each accompanied by a local guide/interpreter. Typically, we would camp near hunting areas, sometimes in hunting camps. Often meals were shared with hunters and their families. After a

period of getting acquainted, we would explain the project, and ask if we could interview the hunter(s). Interviews usually required 10 - 20 minutes. As time permitted, we returned to camps to follow the season take of individual hunters by doing a short follow-up interview, asking about the number and species of birds shot since our previous visit. Several hunter interviews were conducted in town, particularly towards the end of the season. Such interviews were done both at houses and at offices when individuals were encountered.

Throughout the project, we attempted to consult with hunters and gain their support and cooperation. We attended meetings of the Tuktoyaktuk Hunters' and Trappers' Committee, soliciting comments on our data forms, methods and objectives. We also requested comments during our interviews and other informal opportunities to talk with residents.

By recording daily observations of waterfowl and their habitat condition we developed a subjective feeling for the presence and availability of birds, and for access to them by hunters.

RESULTS

Chronology of the Hunt

Waterfowl hunting emerged gradually from other spring activities as geese began to arrive. A typical pattern for the spring hunt in the Tuktoyaktuk area, based on both 1986 and 1987, was ~~as~~ follows.

As mild spring weather and long days of April and early May arrived, many people left Tuk to be on the land. People with full time employment often took annual leave at this time. Individual hunters and families usually had favorite or traditional areas for their spring camps, including Husky Lakes, Kugalluk River, Anderson River (Crossley Lakes, Husky Bend) and on the coast near the Mason River (Fig. 1). At camps they fished or relaxed, only opportunistically shooting geese and swans while engaged in other activity. If and when large numbers of waterfowl appeared, hunters switched to hunting waterfowl exclusively.

The spring hunt hinged upon travel conditions as much as upon any other factor. The earliest waterfowl, typically WFG, arrived when travelling conditions were still fine. As spring commenced, however, the snow softened and water accumulated on the lakes and sea ice. Hunters responded by moving from the Husky Lakes area to the coast near Kitigazuit and just west of Tuk. Very soon after, hunters from the rivers of Liverpool Bay also moved to the north coast of the Tuk Peninsula, largely to the east of Tuk. As conditions continued to deteriorate and travel became miserable,

hunters moved their camps closer to Tuk. from both directions. By this time, about June 6-8, families were out more for the enjoyment of camping or for a "picnic", and had largely given up any major effort to hunt waterfowl. Once the ice lifted and water drained off, a few days of excellent travel conditions allowed a short but potentially intensive hunt. Hunting stopped once snow machines could not travel between shore and sea ice.

A concomitant, though less distinct, pattern was apparent in the waterfowl migration. WFG were the earliest to arrive in significant numbers. They were dispersed and in small flocks. Small groups of swans arrived shortly after. The snow goose migration through the region was massive and occurred largely in brief, intense spurts of 2 or 3 days with slow trickles of geese in between times. Early in the season, LSG moved through and staged in the southeastern portion of the study area in particular. Later they migrated along the north coast of the Tuk. Peninsula. Adult swans were usually on or near their nesting ponds in the southern portions of the study area by late May to early June. Brant began to move through the south coast river deltas of Liverpool Bay in late May and along the north coast of the Peninsula in early June.

Species Composition of the Harvest

Based upon both hunter interviews (n=57) and direct observations of birds bagged, LSG and WFG accounted for the majority of the harvest (39% to 52% and 34 to 37% respectively,

Table 1). These were followed by Brant (9-17%), TS (3%) and CG (1-4%). Three Ross' Geese (RG) were also observed in the kill, both this year and in 1986 (Bromley, unpub. data).

Data were consistent between the two sources, interviews and direct observations. The interviews provided more complete information on the harvest occurring prior to 27 May, of which there is little in the direct observation category.

Age and Sex of Kill

The age composition of the kill varied widely between species (Table 2). Yearlings comprised only 4% and 7% of the LSG and Brant harvest, respectively. Yearlings, however, comprised 39% of the WFG harvest.

Sex ratios of birds in the harvest were near 1:1, with the exception of adult ~~white-fronts~~ and swans (Table 2). Adult male WFG were almost twice as numerous in the bag as females.

The proportion of adult female WFG in the kill varied over time. During early spring (prior to 1 June), females accounted for 28% of the adults harvested (2.6M:1F), while during late spring (1 June and later) 47% of the kill was female (1.2M:1F). Also, adult WFG were more prominent late in the season (74% of the kill) than they were earlier (57%), relative to yearling WFG. Thus, as the season progressed, the adult female class of WFG was a proportionately increasing component of the WFG harvest.

The second exception was that of TS based upon a relatively

Table 1. Species composition of the spring waterfowl harvest at Tuktoyaktuk, as determined by direct observations in the field, and by hunter interviews, 1987.

Source	Species					
	LSG n %	WFG n %	Brant n %	TS n %	CG n %	RG n %
Direct	259	250	113	22	24	3
Observations	39	37	17	3	4	<1
Hunter	798	528	141	52	21	3
Interviews	52	34	9	3	1	<1

Table 2. Sex and age composition of waterfowl in the spring harvest at Tuktoyaktuk in 1987, as determined by direct observations.

Age & Sex		Species				
		LSG	WFG	Brant	TS	CG*
Adult Male	n	129	96	52	4	6
	%	50	40	49	22	40
Adult Female	n	120	50	48	13	9
	%	46	21	45	72	60
Adult Sex Ratio	M:F	1.1	1.9	1.1	0.3	0.7
Yearling Male	n	3	41	3	0	
	%	1	17	3	-	
Yearling Female	n	7	53	4	1	
	%	3	22	4	6	
Age Ratio (Immature:Adult)		0.04	0.64	0.07	0.06	
Yearling Sex Ratio M:F		0.4	0.8	0.8	-	

* Canada Geese were not aged.

small sample (n = 17, Table 2), females were taken three times as frequently as males.

Harvest by location

The waterfowl harvest was dispersed throughout the Tuktoyaktuk area, but some variation in the geographical location of the kill among species was apparent (Tables 3 and 4). Thirty-three percent of LSG were harvested at inland locations, while 67% were taken at coastal sites. WFG were harvested equally at coastal and inland locations, while Brant were shot exclusively at coastal camps. Seventy-four percent of the Brant harvest occurred northeast of Tuk along the Northwest coast of the peninsula. Most (68%) of the swans were shot at inland locations.

People tended to camp at traditional family locations that were also known for the availability of particular species; thus the harvest reflected the distribution of the resource to a large degree. The Mason River coast, upper Anderson River and north coast of the Tuk Peninsula were known as excellent areas to hunt LSG. The coast northeast of Tuk and the Smoke River Delta were hunted specifically for Brant. Changing access to areas as snowmelt ensued influenced the take, however. For example, Brant remained available on the Smoke River Delta long after hunters had to leave due to deteriorating travel conditions. Similarly WFG and TS were widely available on the Kugalluk River when hunters had to abandon camps due to break-up.

Table 3. The number of birds shot, by location, during spring 1987 near Tuktoyaktuk, based upon interviews of hunters.

Location	Species									
	LSG		WFG		Brant		TS		CG	
	n	(%)	n	(%)	n	(%)	n	(%)	n	(%)
Mason River Coast	151	(19)	16	(3)	15	(11)	0	-	0	-
Anderson River* (Husky Bend to Crossley Lakes)	221	(28)	83	(16)	0	-	4	(8)	3	(14)
Smoke River Delta	10	(1)	87	(17)	18	(13)	3	(6)	4	(18)
Kugalluk* River	13	(2)	105	(21)	0	-	23	(44)	13	(59)
Siglialuk	69	(9)	92	(18)	43	(31)	2	(4)	0	-
Kugyuktok	78	(10)	12	(2)	25	(18)	4	(8)	1	(5)
Corrals & Warren Pt.	20	(3)	9	(2)	3	(2)	1	(2)	1	(5)
Toker Pt., Nunaswok & Kinoksik	126	(16)	41	(8)	32	(23)	4	(8)	0	-
Tuk.*	18	(2)	26	(5)	0	-	4	(8)	0	-
Annaguvik Whitefish Sta.	77	(10)	22	(4)	1	(1)	6	(12)	0	-
Husky Lakes *	4	(1)	16	(3)	0		1	(2)	0	-

* = Inland locations, the remainder are coastal sites.

Table 4. The number of birds examined by location of kill during spring 1987 near Tuktoyaktuk.

Location	Species				
	LSG	WFG	Brant	TS	CG
Mason River Coast	15	9	3	0	0
Anderson River (Husky Bend)	7	5	0	0	0
Smoke River Delta	24	120	18	1	13
Kugalluk River	10	64	0	18	10
Siglialuk	33	23	43	0	0
Kugyoktok	84	14	24	2	1
Toker Pt, Nunaswok	4	1	8	0	0
Annaguvik	97	17	17	1	0

Two leg-banded Brant in the harvest had been banded at Fairplay Point on Bathurst Island in July 1986 as adults.

Breeding Status of Birds Retrieved

A 13% sample of adult female LSG (16 of 120 birds) was examined for development of ovarian follicles (Figure 2a). Eighty-one percent (13 of 16 birds examined) of birds with adult plumage were potential breeders. Of these, two, or 13 percent exhibited signs of follicle resorption (extensive vascularization and darkening of the follicle wall) or ovulation of mature follicles. Thus we estimated that 19 to 31% of the adult female LSG population did not nest during 1987.

A 20% sample (10 of 50) of adult plumaged female white-fronts (Figure 2b) was examined, of which 80% (n = 8) were considered breeding birds. Two of these geese displayed signs of follicle resorption, but other ovarian follicles were enlarged so their potential as breeders was unchanged. Thus 20% (2 of 10 geese examined) of the adult WFG population was composed of non-breeding birds.

A 46% sample (22 of 48 adult females) of Brant was examined (Figure 2c), of which 18, or 82 percent were potential breeders.

Two birds had follicles with signs of resorption. Four Brant, or 18%, displayed little follicle development and represented non-breeding birds.

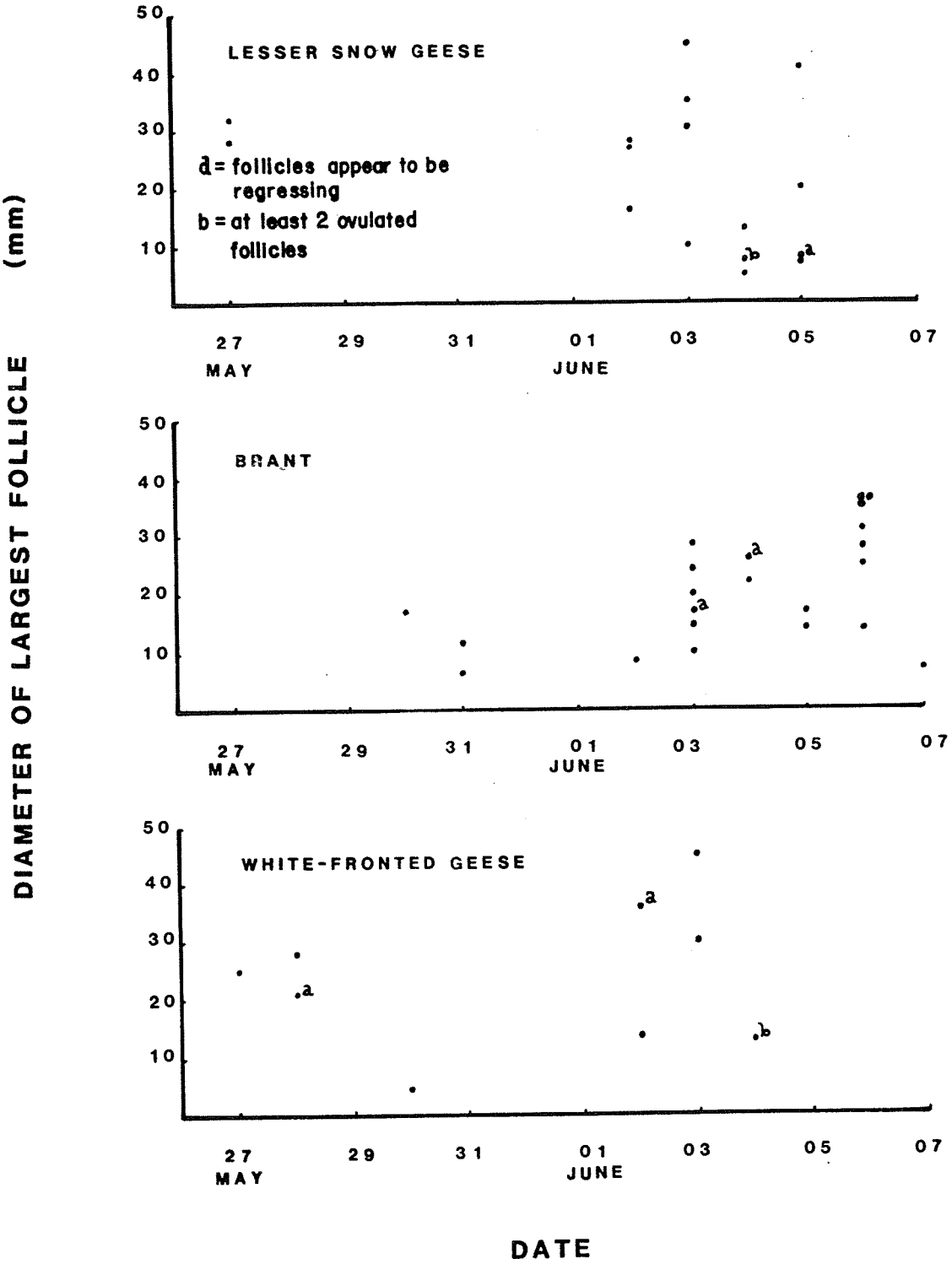

Figure 2. The diameter of largest ovarian follicles plotted by date for Lesser Snow Geese, Brant and White-fronted Geese near Tuktoyaktuk, 27 May to 7 June, 1987.

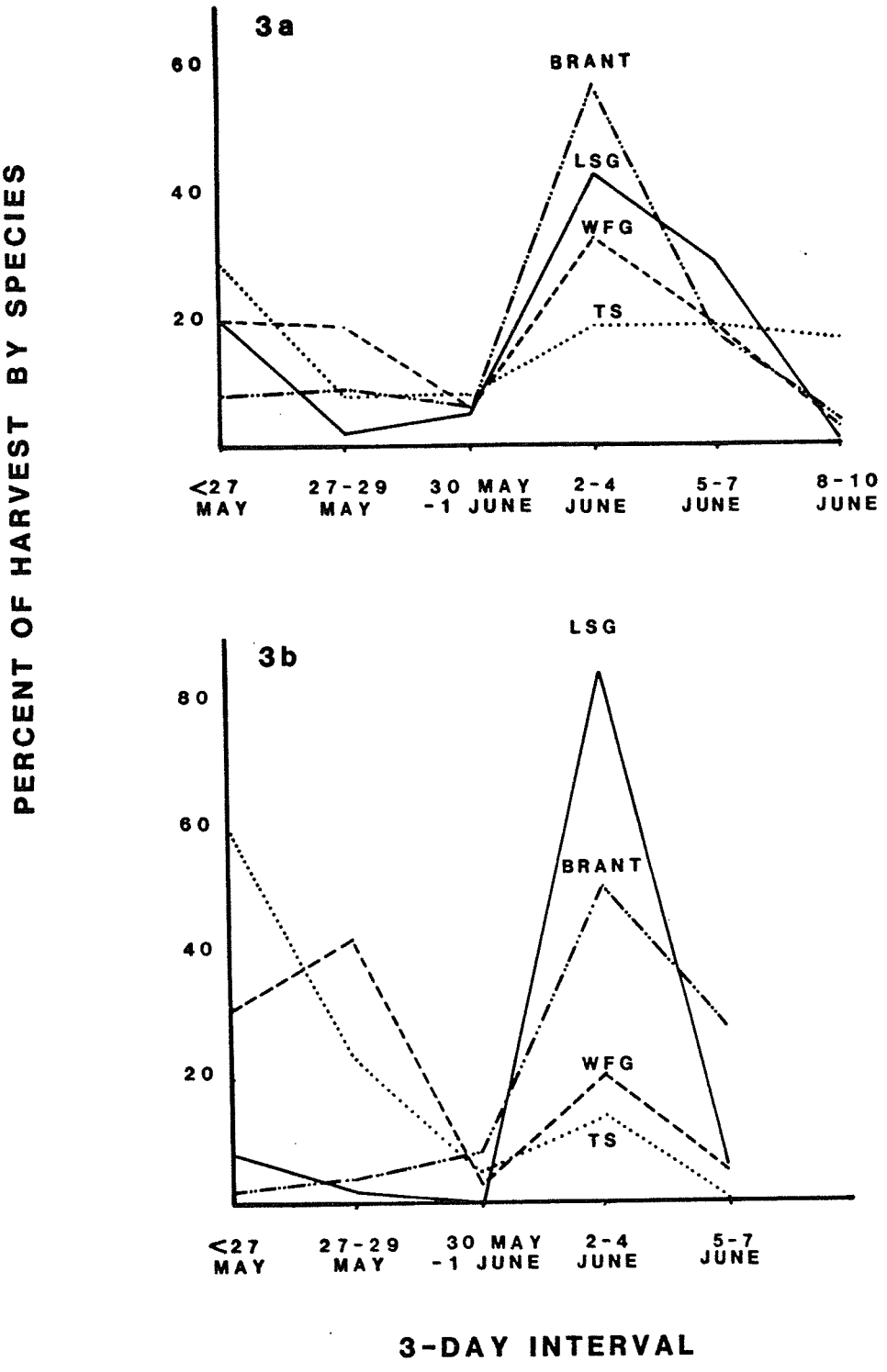

Figure 3. The percent of the total spring harvest of waterfowl by 3-day intervals near Tuktoyaktuk in 1987, based upon a) hunter interviews and b) direct observations.

Changes in Species Composition Through the Season

Based upon hunter interviews, take of ~~the~~ 3 major species of geese ~~all~~ peaked during the period 2-4 June (Figure 3a). TS were taken in small numbers throughout the spring, with no definite peak observed. Direct observations (Figure 3b) indicated similar results for LSG and Brant, but indicated that peaks in the WFG and TS harvest occurred during or before 27-29 May. These two species were well dispersed through the region and may have received more attention from hunters during periods when LSG and Brant were less available. Peaks in the proportion of WFG and TS harvested were lower than were those of LSG and Brant for both data sets (Figures 3a and 3b).

Weights and Measurements

Morphological measurements of birds are presented but not analyzed (Table 5). Weights are given (Table 5), and plotted for adult female LSG (Figure 4). Weights did not vary over the season for adult female WFG ($r = 0.09$, $p > 0.5$), but increased in adult female LSG ($r = 0.23$, $p = 0.01$).

Socioeconomic Factors

The age and employment status of hunters, hunter effort (days on the land, days hunting, and number of shotgun shells carried to the field), and age of equipment were determined for comparison in future years (Table 6). General comments of hunters interviewed focused upon the change in waterfowl distribution resulting from

Table 5. Weights (kg) and measurements (mm) by sex, age and species of birds harvested during spring 1987 near Tuktoyaktuk.

Measure	LSG		WFG				Brant		TS	
	AM	AF	AM	AF	YM	YF	AM	AF	AM	AF
n	129	119	85	37	38	44	50	46	4	12
Weight	2.5	2.5	2.5	2.5	2.4	2.0	1.4	1.5	7.3	6.5
Culmen	56.5	53.2	54.1	51.4	53.8	50.1	34.0	33.1	105	102
Bill Width	25.4	24.2	25.7	24.4	25.1	24.1	18.4	18.3	33.7	32.8
Total Tarsus	96.0	91.8	90.0	85.3	90.1	85.2	71.8	70.6	138	132
Diagonal Tarsus	81.1	76.7	74.8	70.3	75.4	71.0	60.4	60.9	113	110
Total Length	718	681	727	694	731	660	600	591	1265	1254
Wing Flat	437	423	438	419	424	398	349	339	565	548

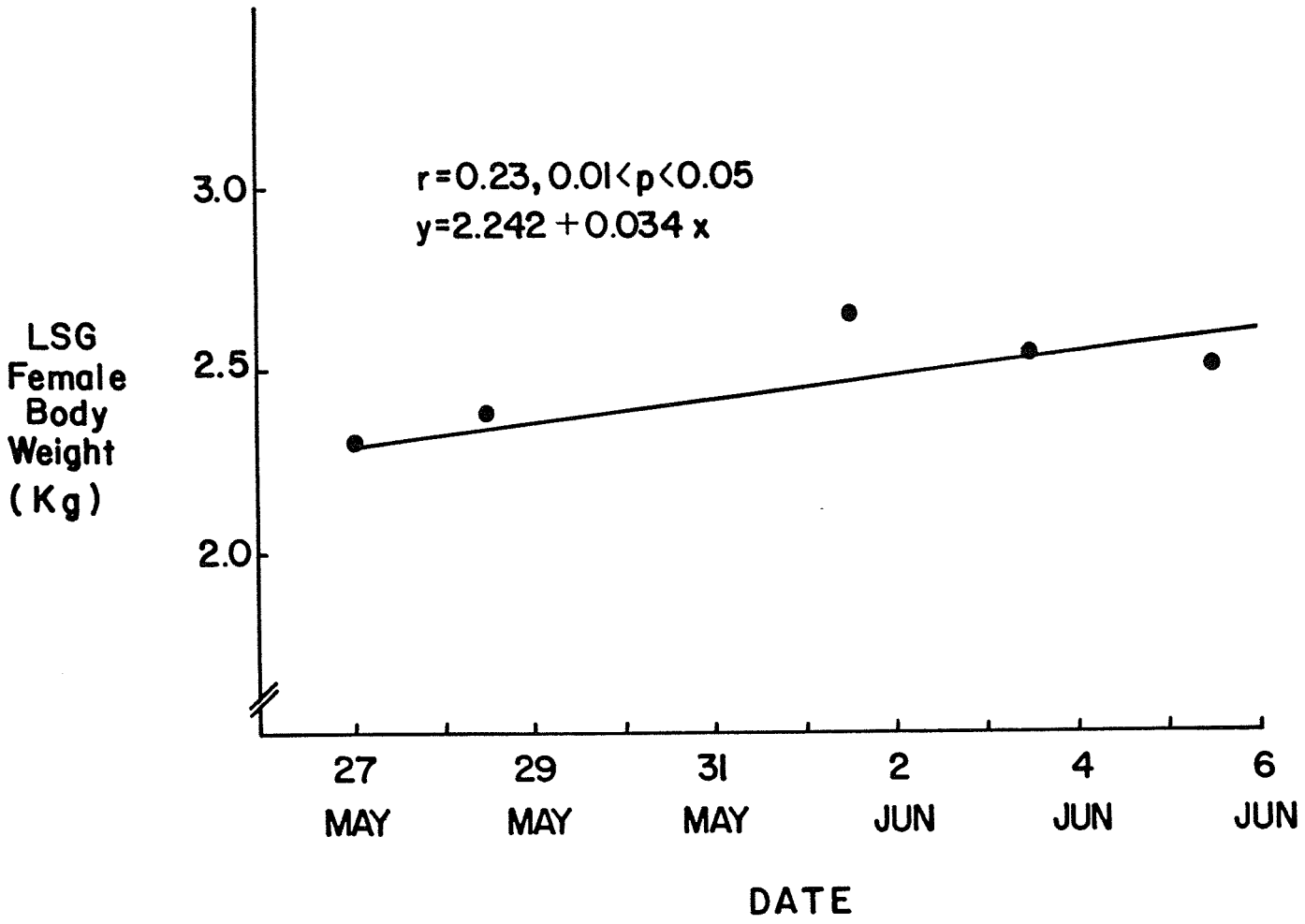

Figure 4. Regression of adult female body weight by date of kill for Lesser Snow Geese shot near Tuktoyaktuk from 27 May to 6 June, 1987.

Table 6. Socioeconomic factors determined for spring waterfowl hunters near Tuktoyaktuk in 1987.

Factor	Mean ± S.D. (years)	Range	n
Hunter's Age	34.3 ± 14.0	12 to 75	48
Age of Snow Machine	3.0 ± 2.7	13 to 0	53
Age of Shotgun	7.0 ± 5.4	24 to 0	56
Age of Rifle	4.0 ± 3.1	9 to 0	14

Employment status determined for 45 hunters:

Employed part-time = 30 (67%)
Employed full-time = 8 (18%)
Not employed = 7 (16%)

Days on the land = 656 days, n = 57 hunters

Days hunted = 360 days, n = 57 hunters

Number of people an individual hunted for = 7, n = 48 hunters

Use of 12 ga shotguns = 40 hunters

Use of small rifles = 14 of 57 hunters, for killing wounded birds

The average hunter shooting 16 ga and 12 ga guns bought 8 boxes (25/box) of shotgun shells.

Hunters shooting 16 ga guns bought 10 boxes of shotgun shells.

increased local aircraft traffic. Such statements primarily referred to LSG, which hunters suggested had shifted their spring migration eastward to east of the Tuk Peninsula.

Several hunters indicated that they had not participated in the spring harvest for several years because they were employed full-time with oil companies. Since the recession and extensive lay-offs occurred several months before, they had more opportunity for being on the land. Many individuals with no or part-time employment had enjoyed full-time employment for several years prior to this spring. Hunters considered that they had part-time employment if they worked off and on throughout the year, e.g. for 2 months full-time out of the year.

Other hunters were still employed full-time, usually by government, and hunted only on weekends or took annual leave for the spring hunt.

The spring hunt was often a highly social occasion. Camps varied in size from one to eight tents. Extended families, including women, children of all ages, and the elderly, participated in camp life. Most participated in caring for birds brought back to camp, or retrieving birds shot from camp. This was particularly true as the spring progressed and travel became difficult; more time was spent socializing than hunting. Visiting and card-playing lasted many hours, often from the evening through to the next morning.

Early in the spring, birds were stored by laying them flat on

their backs in the snow, and covering them with tarps. Later, they were frequently stored in deep pits dug in the snow on the sea ice near shore. For camps close to town, frequent snow machine trips were made to store the birds in freezers.

No incidents of wastage of geese or swans were observed, although ducks were noted either left behind or discarded on several occasions. Geese and swans were a major part of the diet in camps and were of obvious nutritional value. One elderly couple were eating ground squirrels until they were able to shoot some geese. Waterfowl carcasses were very thoroughly consumed and enjoyed.

Total Harvest Estimates

We used the total number of birds shot, total number of hunters interviewed, and number of days hunted to calculate the average number of each species shot per hunter-day (Table 7). A 15% random sample (n=35) of the DRR li t of General Hunting Licence holders in Tuktoyaktuk (n=233) were contacted to determine whether or not they hunted waterfowl in spring 1987. Twenty-six, or 74.3% of the sampled hunters did hunt waterfowl, so we estimated 173 hunters (0.743 x 233 GHL's) from Tuk actively hunted in 1987. Assuming that their effort and success was similar to the 57 hunters we interviewed, we calculated the total harvest by species as 2420 LSG, 1603 WFG, 428 Brant, 158 TS and 64 CG (Table 7), for a total of 4673 birds.

Table 7.- Estimate of total harvest by species during spring 1987 near Tuktoyaktuk.

Number of hunters interviewed = 57

Number of days hunted = 360

Average number of days hunted/hunter = 6.3

Number of birds of each species harvested by 57 hunters:

798	LSG
528	WFG
141	Brant
52	TS
21	CG

From a 15% sample of the 233 Tuk. GHL's, 74.3% or 173 hunters hunted waterfowl in spring 1987.

Thus: $\left(\frac{\text{total hunters}}{\text{interviewed hunters}} \times \text{reported harvest}\right) = \text{total harvest}$

1. 173/57 x 798 = 2422 LSG
2. 173/57 x 528 = 1603 WFG
3. 173/57 x 141 = 428 Brant
4. 173/57 x 52 = 158 TS
5. 173/57 x 27 = 64 CG

Total = 4,675 birds

DISCUSSION

Sources of Error

Our largest source of error for sex and age composition and total harvest estimates derives from our absence on the study area prior to 27 May and after 10 June. By not being present early in the season, we were not able to document the chronology of arrival and migration for waterfowl. We believe, however, that this gap was addressed by information provided by hunters and other biologists working in the area. A second concern during the early season was the sex and age composition of the harvest. This data was of particular interest for WFG and TS, for which a relatively large proportion of the harvest occurred prior to 27 May (Figures 3a and 3b). We were unable to resolve this problem.

Our absence during late spring prevented us from estimating the total harvest of all species for the entire spring hunt. There were at least several days of hunting along the coast of the Tuk Peninsula after our departure. Hunters noted that after the ice drained of melt water and travel improved, they sometimes had a movement of Brant through the area. Our information collected up to 10 June, 1987 indicated that the Brant and TS harvests were continuing at a significant rate (Figures 3a and 3b). WFG were also available along the coast when we departed. We cannot estimate what the late spring harvest is, but studies will be extended to include harvest during that period in 1988 and 1989.

Because we did not interview hunters at the very end of their spring hunting season, our estimates of total harvest per hunter and hunter effort (days on the land, days hunted) are minimums. Future interviews will be conducted at the end of the season as well as during the season while on the land.

Most known sources of error lead to underestimates of hunter effort and harvest. Thus estimates of total harvest are probably minimums. One possibility that could lead to an overestimate of harvest, is the greater likelihood of encountering hunters who were out on the land more frequently than others. Presumably, the more active hunters would account for a relatively large harvest of waterfowl. If they were over represented in our sample of interviews, a bias towards overestimating the harvest would occur.

Hunter interviews provided data which we felt were reliable for all species except TS and CG. We were confident in the data because it was reasonable and comparable with our direct observations of the harvest. However, several hunters, when asked how many TS were bagged, responded that it was illegal to hunt swans. A few hunters were suspicious, suspecting that we were trying to entrap them with the question. Also, we found that the few hunters with whom we were best acquainted accounted for a large proportion of the swan take. Possibly our lack of comment prompted them to take more swans than normal or other hunters were simply reluctant to report their swans. Most hunters, however, were enthusiastic about the taste of swans, so it was obvious that

the desire to shoot swans was great. Some hunters limit their take of swans because swans require too much freezer space and they are too hard to pluck (P. Voudrach, pers. comm.). As the population of hunters become more familiar and relaxed with the study, this concern should diminish.

CG were uncommon in the study area and sporadically distributed. The number we observed in the bag was more than reported in interviews, so total harvest is clearly underestimated. However, even if the CG harvest is doubled, it would only account for 128 birds. In spring, CG typically are found along rivers where travel conditions deteriorate early. Thus they are not widely available to hunters (P. Voudrach, pers. comm.)

We are unable to estimate loss of birds due to crippling. During direct observations, we did see some crippling loss occurring. The crippling loss of TS may be quite high, because swans were often repeatedly shot at without noticeable effect other than a gradual loss of altitude until they were out of sight. Nieman et al. (1987) observed an average crippling loss of 32% for goose hunting in southern Canada, but noted that loss varied according to hunting method, habitat and hunter expertise. Most spring hunting occurred in open habitat with good conditions for seeing and retrieving downed birds. Assuming a conservative loss of 20% due to crippling, an additional 935 birds were killed during the harvest.

Importance of the Harvest

A retrieved harvest of 4673 birds is roughly equivalent to 8350 kg of edible meat, assuming 75% of body weight is edible. With a value equivalent to that of chicken at a local grocery store, about $7.50/kg, the harvest is worth just over $50,000. Given that the harvest estimate is a minimum figure, the value of the harvest as food is also worth more.

Nutritionally, wild meat has almost double the protein and considerably less potentially harmful fat then does the meat of domesticated animals (Schaefer and Steckle 1980). Thus, the arrival of waterfowl in spring provides not only a welcome change in diet from winter fare, but also an energy and vitamin rich food. For a human population of 926 (Statistics Canada 1987), the spring waterfowl harvest is considered both economically and nutritionally significant.

Management Implications

It would be unwise to suggest management recommendations on the basis of one year's data, particularly since regulations may not yet be required. It is not too early, however, to identify possible patterns and anomalies in our findings to date which may be worthy of further investigation.

Of possible importance is the harvest of resident versus migrating birds. For most WFG and TS, the Tuk area is the end of migration, so arriving birds are essentially local residents. LSG

and Brant, on the other hand, are largely passing through the area enroute to distant nesting grounds. Thus, while the harvest of migrants is dispersed amongst different breeding segments of the populations, the harvest of resident birds may be relatively concentrated. If this is so, there is a potential for local suppression of nesting WFG and TS.

Production of LSG and Brant was low in 1986 (T. Barry, per. comm.), and this was reflected in the proportion of young in the spring harvest at Tuk. There was 6.8% young in the fall population of Western Arctic LSG (A. Dzubin, pers. comm.), compared to 4% in the spring take. Unlike LSG, however, yearlings accounted for 39% of the WFG spring harvest. Western mid-continent WFG had only 7.6% young in fall 1986, representing the lowest reproductive success ever measured for this population (A. Dzubin, pers. comm.). Similarly, age ratios in the fall harvest of mid-continent WFG in Canada and the U.S. were 0.50 (immature:adult) (Canadian National Harvest Statistics, Ottawa) and 0.44 (Sorensen et al. 1987) respectively, some of the lowest ever recorded. In comparison, the age ratio in the spring harvest was 0.64. Although low relative to other years, these relatively high age ratios during a year with less than 10% young in the population may be indicative of the vulnerability of immature WFG to spring hunting. Another possible explanation of the high age ratio in spring is that there may have been better production

locally in the Tuk⊕ area than in the whole of the population's nesting range in 1986.

With their exceptionally high vulnerability, immature WFG may tend to buffer adults, at least early in the season. During the last half of our study period, the proportion of adults in the harvest increased from about one quarter to one half. This phenomenon is similar to that which occurs in the fall harvest of geese (eg. Chapman et al. 1969) and may have concomitant ramifications for harvest regulations. That is, by limiting a late spring hunt, additional protection is provided to the adult segment of the population.

We have little data on sex ratios within the WFG population to explain the distorted sex ratio in the harvest. The distorted sex ratio in our sample of swans is also perplexing. During direct observations, many more swans were shot at than were killed, indicating that the ability to kill swans in spring with the present use of firearms is marginal. The smaller size of female swans may render them more vulnerable to shooting and retrieval than are males. Also, the female members of territorial swans hunted on or near their nesting ponds may be heavy with developing eggs and thus slower to gain flight than males.

If the pattern of use by location recurs over years, such predictability could have obvious value for the development of regulations. Area closures and closed windows of time within hunting seasons are effective regulatory tools.

The two leg-banded Brant in the harvest underscore an important potential benefit of intensive spring harvest studies. It may be necessary to determine nesting origins of migrating birds harvested at particular locations during spring. Extensive banding programs, in concert with harvest monitoring and a public education campaign to increase returns, can provide this knowledge.

The harvest of Brant banded on Bathurst Island provides an important connection between the Tuk. area and a population segment of birds which winters largely in Ireland. Some of these Brant are known to winter in Puget Sound, Washington. Apparently the Puget Sound Brant migrate along the Tuk. Peninsula in early June.

Comparison of 1987 with 1967 and 1968

The human population of Tuktoyaktuk has increased by 125% from 1967 (pop. = 412; Barry, unpub. rep.) to 1986 (pop. = 929; Statistics Canada 1987). The harvest of geese and swans has also increased, although less dramatically. Estimated harvests in 1967 and 1968 were 3807 (n =51 hunters interviewed) and 6029 (n = 41), respectively (Barry, unpub. rep.). With a minimum harvest estimate of 4673 geese and swans in 1987, harvests have apparently changed little over the past 20 years. However, with the exception of Brant, geese and swan populations have increased considerably.

The species composition of the harvest has changed, from 57% and 72% LSG in the 1960s to 52% in 1987, from 9 - 15% WFG to 34%,

and from 18 - 27% Brant to 9% (our calculations from Barry, unpub. rep.; and this study). Whether these changes are a result of differences in the populations of birds available, changing migration patterns, new hunting practices or some other reasons is unknown at this time.

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APPENDIX A

*** HUNTER QUESTIONNAIRE ***

DATE _____

HUNTER IDENTIFICATION _____

AGE _____

COMMUNITY _____

NUMBER OF YOUR IMMEDIATE FAMILY IN CAMP _____

NUMBER OF FAMILY HUNTERS IN CAMP _____

NUMBER OF PEOPLE YOU HUNT FOR _____

IS WATERFOWL HUNTING YOUR MAIN ACTIVITY THIS WEEK? _____

WHAT ARE YOUR OTHER ACTIVITIES THIS WEEK? _____

HOW MANY DAYS WILL YOU BE ON THE LAND THIS TRIP? _____

NUMBER OF TENTS IN CAMP _____

DO YOU WORK IN TOWN: Full Time _____
Part Time _____

EQUIPMENT:

	SNOW MACHINE	SHOTGUN	RIFLE
Make	_____	_____	_____
Model	_____	_____	_____
Year	_____	_____	_____

SHOTGUN SHELLS: Shot Size _____

Gauge _____

Length _____

Quantity _____

HUNTING METHODS IN PAST WEEK (NUMBER FROM MOST FREQUENT (1) TO LEAST FREQUENT (5):

Pass Shooting _____

Decoy/Blind _____

Jump Shooting _____

From Camp _____

Other (Specify) _____

HUNTING IN PAST WEEK:

	1	2	3	4
DATE				
LOCATION				
SPECIES (a)				
(b)				
(c)				

HAVE YOU RECOVERED ANY BIRD BANDS, OR SEEN ANY NECK COLLARED GEESE?

_____

COMMENTS _____

_____

_____