

# Inuvialuit Use of the Beaufort Sea and its Resources, 1960–2000

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**ABSTRACT.** Comprehensive, census-type surveys of Inuvialuit harvesters were conducted in the Inuvialuit Settlement Region (ISR) in the 1960s (Area Economic Surveys) and 1970s (Inuit Land Use and Occupancy Project) and in the 1990s (Inuvialuit Harvest Study). These surveys, supplemented by other case studies, provide a basis for comparing Inuvialuit use of the Beaufort Sea and its resources in the 1960s and the 1990s. The geographic extent of harvesting was about the same in both decades. The number of harvesters grew, although by less than the rate of population growth. Mean annual harvest of country food per hunter declined from 2083 kg/yr to 707 kg/yr. The chief reason for the decline in harvest was the near-abandonment of dogs for transport. If we take into account the share of country food likely consumed by dogs, the per capita harvest of country food for human consumption may not have changed significantly between the two decades. What has changed, however, is the composition of the harvest: the ratio (by weight) of country foods from marine and terrestrial sources was 75:25 in the 1960s, but 45:55 in the 1990s. Available country food amounted to 115.2 kg/capita/yr in the 1990s, a significant contribution to the household economy. Thus, contrary to many predictions in the 1960s, subsistence harvesting persists as a significant economic as well as cultural preoccupation in the lives of Inuvialuit today. The results of this study suggest that the measurement of subsistence and commercial harvesting in terms of location, participation, inputs, and outputs is of continuing importance for fish and wildlife management and for economic planning.

**Key words:** Inuvialuit, Northwest Territories, land use, harvesting, country food, subsistence

**RÉSUMÉ.** Des enquêtes par recensement détaillées portant sur les exploitants pêcheurs ont été menées dans la Région désignée des Inuvialuit (RDI) au cours des années 1960 (Enquêtes économiques dans le secteur), des années 1970 (Projet d'utilisation et d'occupation du territoire par les Inuits) et des années 1990 (Étude sur les prélèvements par les Inuvialuit). Ces enquêtes, complétées par d'autres études de cas, offrent une base de comparaison à l'utilisation qu'ont faite les Inuvialuit de la mer de Beaufort et de ses ressources dans les années 1960 et 1990. L'étendue géographique des prélèvements était à peu près la même au cours des deux décennies. Le nombre d'exploitants a augmenté, bien qu'il soit resté inférieur au taux de croissance démographique. La moyenne annuelle par chasseur des prélèvements de nourriture traditionnelle a baissé de 2083 kg/an à 707 kg/an. Ce déclin est dû en grande partie au fait que les chiens ont cessé d'être utilisés pour le transport. Si l'on tient compte de la part de nourriture traditionnelle qui était probablement consommée par les chiens, la quantité d'aliments traditionnels prélevés par personne pour la consommation humaine pourrait ne pas avoir changé de façon notable d'une décennie à l'autre. Ce qui est différent, en revanche, c'est la composition de la récolte: le rapport (pondéral) entre les aliments traditionnels provenant de sources marines et ceux de sources terrestres était de 75 pour 25 dans les années 1960, mais de 45 pour 55 dans les années 1990. La nourriture traditionnelle disponible se montait à 115,2 kg/personne/an dans les années 1990, ce qui représentait un apport majeur à l'économie domestique. Ainsi, contrairement à de nombreuses prédictions faites dans les années 60, la récolte de subsistance reste une préoccupation économique et culturelle capitale dans la vie contemporaine des Inuvialuit. Les résultats de cette étude suggèrent que la mesure des prélèvements de subsistance et commerciaux en termes de lieu, de participation, d'intrants et extrants continue d'avoir de l'importance pour la gestion de la faune aquatique et terrestre et pour la planification économique.

**Mots clés:** Inuvialuit, Territoires du Nord-Ouest, utilisation du territoire, prélèvement, nourriture traditionnelle, subsistance

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## INTRODUCTION

The Inuvialuit of Canada's Western Arctic have experienced substantial economic, social, and political change since the early 1960s. Wage employment was then only just becoming widespread because of the construction of the DEW line and the new town of Inuvik, and most Inuvialuit were only beginning to adjust to a settlement-

based way of life. Most still relied on hunting, trapping, and fishing for the major part of their livelihood.

Around 1970, the snowmobile replaced the dog team as the primary method of winter transport. During the 1970s and early 1980s, accelerated oil and gas exploration resulted in significant changes to employment and income patterns. In 1984, the Inuvialuit and Canada signed the Inuvialuit Final Agreement (IFA), a comprehensive land-

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claim agreement that provided the Inuvialuit with surface title to about 30% of their traditional land base; exclusive harvesting rights for some wildlife species and preferential harvesting rights for the remainder; co-management of wildlife, fisheries, and the environment; and a cash and institutional basis for Inuvialuit-controlled economic development (Canada, 1984). By the 1990s, the Inuvialuit population had doubled, although the relative sizes of the six communities did not change much over the period. Five of the communities continue to be predominantly Inuvialuit. Only Inuvik has a substantial non-aboriginal population, and some Gwich'in reside in Inuvik and Aklavik; these facts have not changed over the period.

What have these changes meant for the harvesting and use of wildlife and fishery resources in Canada's Western Arctic, and what are the implications for resource management and economic life?

#### SOURCES AND METHODS

The Inuvialuit Settlement Region (ISR) has been the subject of much socioeconomic research since the 1960s, frequently including quantitative surveys of resource harvesting and household economics. Implementation of the IFA has required the maintenance of detailed fish and wildlife harvest statistics. Consequently, a substantial body of data is available, especially from the 1960s and 1990s, for comparative purposes. Research programs providing data for this analysis include the following:

- 1) The Area Economic Survey Program conducted by Canada's Northern Administration Branch during the early to mid-1960s (Lotz, 1976). These surveys were conducted in Tuktoyaktuk and Paulatuk in 1962 (Abrahamson, 1963), in Holman in 1963 (Abrahamson, 1964; Usher, 1965), in Sachs Harbour in 1965 (Usher, 1966), and in Aklavik and Inuvik in 1966 (Bissett, 1967). Each survey took three to four months and included interviews with virtually every household in the community that covered a range of economic matters, including harvesting activities and production. Interview data were supplemented by wildlife administrative and monitoring data maintained at that time by the NWT Game Management Service and by local RCMP detachments (Usher, 1975). The data are approximate, and for some species, incomplete. Cautions regarding the use and interpretation of such data, as outlined in Usher (1975), and Usher and Wenzel (1987), apply. In general, the source data tend to underestimate the harvests of furbearers (because of domestic retention of some furs, which are hence not recorded in trade data) and small game species (which are either unrecorded or under-reported).
- 2) My own research on the economy of Banks Island (Usher, 1971), done in the mid-1960s, which combined frequent and systematic surveys of every household with observations of harvesting activities and examination of wildlife monitoring data.
- 3) Baseline research and documentation in connection with the proposed Mackenzie Valley gas pipeline in the early 1970s (e.g., Bissett, 1974; Jessop et al., 1974), which combined hunter interviews and fish and wildlife administrative and monitoring data.
- 4) The land use and occupancy research for the Inuvialuit land claim, done in 1973–74 (Farquharson, 1976; Usher, 1976a). The chief research method was map biography surveys, consisting of systematic map interviews covering 81% of all households (Anon., 1976). The objective of the mapping project was to document the total extent, but not the relative intensity, of Inuvialuit land use. As all major land users were interviewed, the unsurveyed portion of the population would have added nothing to the areal extent of land use, as portrayed in Figure 1. Land-use activities were grouped by three historical periods. The most recent (i.e., up to 1974) covered the period of "sedentarization," in which people moved from the seasonal camps to permanent residence in communities, especially Inuvik, Aklavik, and Tuktoyaktuk, in response to the employment opportunities and government services they provided. This period began in the various communities at different times, ranging from the mid 1950s to the early 1960s. Data from this period have been used to approximate the territorial extent of harvesting and travel in the 1960s. The outer limit of 1960s use is based on harvesting for all species.
- 5) Inuvialuit Harvest Study (IHS) data, 1988–97 (Fabijan, 1991–98; Usher and Wendt, 1999; Fabijan and Usher, in press). The IHS involves systematic monthly surveys of harvesters, and the overall response rate in eight of the ten years reported here exceeded 90%. The survey records the number and location of all animals harvested by Inuvialuit, by month and community. The IHS is designed to quantify subsistence harvest levels. Consequently, commercial meat and fish harvests, which are in any event a small proportion of the total and for the most part exported from the ISR, are not included. Total monthly harvests are estimated from reported harvests, using a projection formula based on the hunter response rate. Since it is assumed that there is no difference between respondents and non-respondents, respondents are treated as a simple random sample of the hunter population. Each month is treated as a separate survey, and the total annual harvest for each community is estimated as the sum of the monthly estimates. Annual estimates for most species (and especially large mammals) are within 10% at the community level—and for almost all species within 5% or less at the regional level—19 times out of 20. Measurement error is thought to be insignificant.

- 6) Harvest data from polar bear monitoring programs conducted by the NWT Department of Resources, Wildlife, and Economic Development (Branigan and Nagy, 1998) and beluga monitoring by the Department of Fisheries and Oceans in cooperation with the Fisheries Joint Management Committee (Harwood et al., 2002).
- 7) Standard edible weight estimates for each species harvested in the ISR (Usher, 2000). This study was based on available but mostly unpublished body-weight data sets for almost all species harvested in the ISR. Data were obtained, where available, for whole body weights (total body mass), carcass weight, and edible weight, in some cases as directly comparable sets, and in others, as standard conversion indices. Priority was given to data sets from the ISR, from the same season when Inuvialuit hunting normally occurs, and from a subsistence hunt (in preference to a commercial or scientific harvest). Where data were available by sex and age-class, weights were determined for those categories (the IHS collects sex and age-class data for large mammals).
- 8) Census of Canada data (Statistics Canada, 1994) on population by aboriginal origin and by census subdivision (CSD). Each community in the region is a separate CSD.

Data sources (1), (2), and (3) were used to estimate Inuvialuit harvest levels for the 1960s. Where possible, these estimates are based on the five-year mean of reported harvests (1960–65); otherwise, they are as given in the original data sources.

Data sources (5) and (6) were used to construct a ten-year mean of Inuvialuit harvests (1988–97), which is taken to represent 1990s harvesting levels.

Data sources (4) and (6) were used to identify harvesting areas, and data sources (1) and (8) were used to establish approximate Inuvialuit population levels, during each time period. Data source (7) was used to develop country food harvest estimates by species by weight.

Survey data reliability has generally improved over time, as survey research methods themselves have improved and as these have been applied more rigorously and consistently in the Western Arctic. Survey research methods were only introduced in the North in the 1960s and were at first applied relatively informally and inconsistently (data sources 1, 2, 3). Nonetheless, all estimates used here are believed to be sufficiently reliable for the purposes of this analysis, although the domestic fishery estimates are the least exact. The first large-scale survey in the region applied in a consistent manner was the land use and occupancy study (data source 4). Contemporary harvest studies produce highly reliable data for most species, and especially for the most frequently harvested ones, and the IHS (data source 5) meets the highest contemporary standards of reliability for harvest surveys (Usher and Wenzel, 1987; Usher and Wendt, 1999). The methods and reliability of the

national census (data source 8) have also improved over the 40-year period.

All information refers to the Inuvialuit Settlement Region (ISR), as created by the Inuvialuit Final Agreement of 1984 (Fig. 1), and to the Inuvialuit population there only.

I have had the opportunity to observe the evolution of harvesting and its place in the economy and society of the Western Arctic over 40 years, including several years of field work in the ISR in the 1960s and 1970s and frequent sojourns to the region since (as recently as 2001).

## RESULTS

### *Geographic Extent of Inuvialuit Harvesting Activity*

Figure 1 shows that about one-third of the Inuvialuit harvesting area in the 1960s was on water or sea ice. The seaward limit of harvesting for Aklavik, Inuvik, Tuktoyaktuk, and Sachs Harbour is associated with the normal maximum extent of the fast ice (eastern Amundsen Gulf was more likely to freeze over entirely). At that time, it was common for people to travel to the floe edge for seal hunting and polar bear hunting, and sometimes also to set traps for arctic fox. Whaling, a key open water activity, was and is concentrated around the mouth of the Mackenzie River, and seal hunting occurred closer to shore in the open water season than in winter. The maximum seaward extent of use is therefore associated with sea ice cover rather than open water.

Similar (but not identical) data for the 1990s can be derived from the Inuvialuit Harvest Study, which records kill locations. No comprehensive map has been produced for all species for the 10-year period, however. As both fox trapping and winter seal hunting have declined since the 1960s, the best single indicator of sea ice use is the location of polar bear kills. These data are included in Figure 1. They suggest that the extent of sea ice use in recent years is about the same as it was in the 1960s. The kill location data in Figure 1 also indicate that much terrestrial wildlife harvesting occurs near the coast, for ease of transport and accessibility.

### *Participation in Harvesting*

There were ca. 1580 Inuvialuit in the Inuvialuit Settlement Region in the mid-1960s. Of these, about 325 were males of age 15–64, which is taken to approximate the number of harvesters, as this was a near-universal activity among that sector of the population at that time. These data are derived from the Area Economic Surveys, which recorded the Inuvialuit population of each community by age and sex, but did not record the actual number of persons engaged in harvesting. Published data from the 1966 Census of Canada are not sufficiently disaggregated to make this estimate.

The 1991 Census of Canada indicates that there were 2890 Inuvialuit in the ISR (single- and multiple-origins).

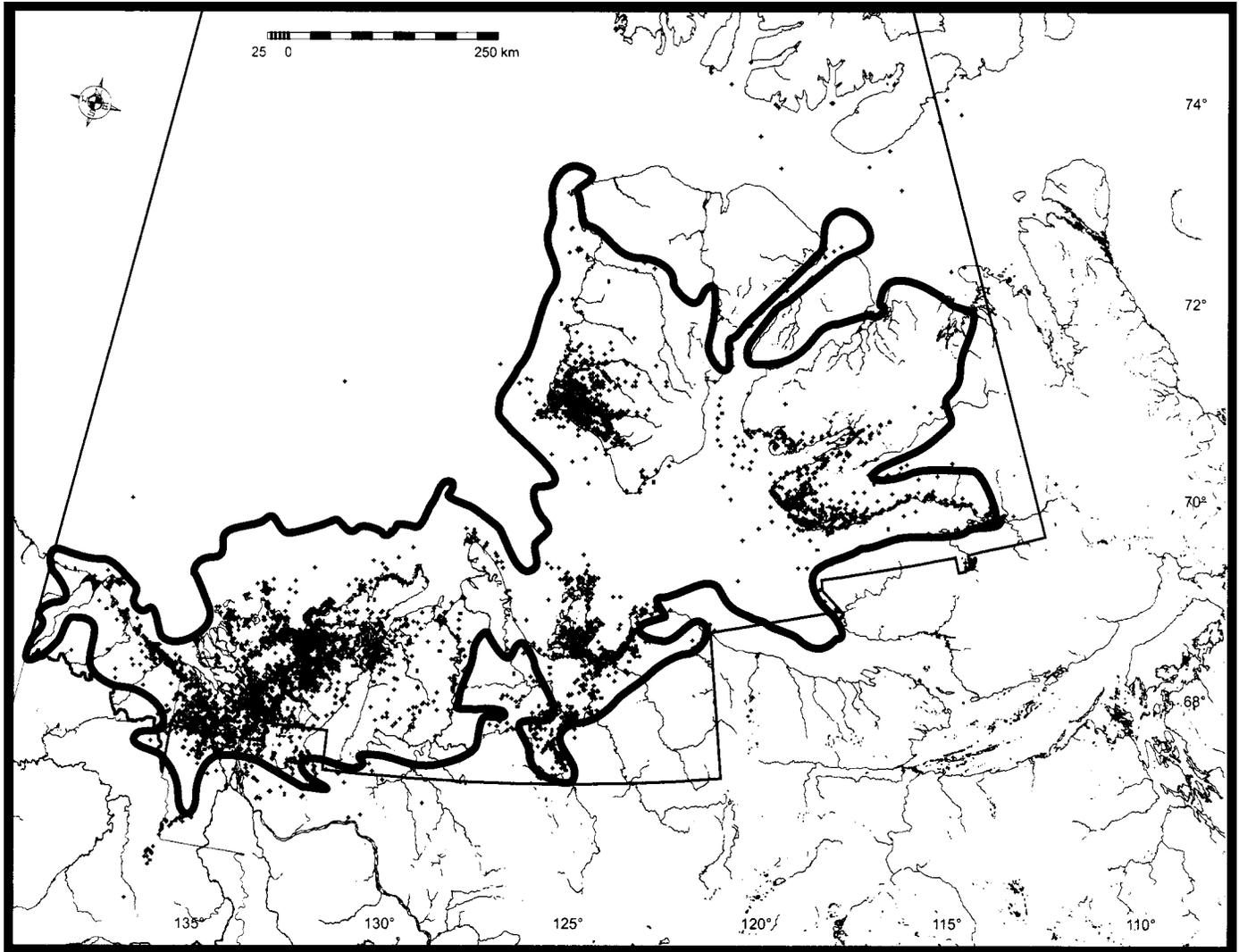


FIG. 1. Inuvialuit use of land and sea in the Inuvialuit Settlement Region, 1960s and 1990s. The thick line shows land and sea use in the 1960s: it represents the outer limit of Inuvialuit harvesting from the mid-1950s to the mid-1970s, as documented by the Inuit Land Use and Occupancy project. The dots, showing land and sea use in the 1990s, are based on actual kill locations (polar bears and terrestrial mammals only) in 1988–97, as documented by the Inuvialuit Harvest Study. Each dot shows the location of at least one kill. The thin line indicates the boundary of the Inuvialuit Settlement Region. Sources: Usher, 1976a: Plates 3, 4, 7, 8, 11, 12, 16, 20; Farquharson, 1976: Plates 43–44; IHS.

responses combined) (Statistics Canada, 1994:96–99). According to the records of the IHS, 471 Inuvialuit engaged in harvesting that year.

These data are not entirely comparable, chiefly because dissimilar methods were used to estimate the number of harvesters. However, it should be expected that the number of harvesters would be a declining proportion of the Inuvialuit population in view of the very substantial growth in wage employment over the period. The data appear to show that the Inuvialuit population grew by 83% in just over 25 years, and the number of harvesters grew by 45%. Harvesters as a proportion of the population thus declined from 20.5% to 16.3%. Although harvesting effort indices were not uniformly measured in either period, a key difference is that in the 1960s, most Inuvialuit men were full-time harvesters, while today the great majority are part-time harvesters and also earn significant cash income from

regular or casual employment (Smith and Wright, 1989; Condon et al., 1995).

Figure 2 provides the breakdown of the harvester population by community, as recorded by the IHS annually from 1988 to 1997. It shows the number of individuals who reported harvesting fish and wildlife in each community. There has been an apparent decline in the number of persons harvesting since 1992, especially in Inuvik and Aklavik, although preliminary analysis suggests this may be due at least in part to a declining rate of response to the survey (Usher and Wendt, 1999).

#### *Harvest Levels*

Table 1 compares the Inuvialuit harvest of key economic species in the 1960s and the 1990s. The period 1960–65 is taken to be representative of the 1960s, and

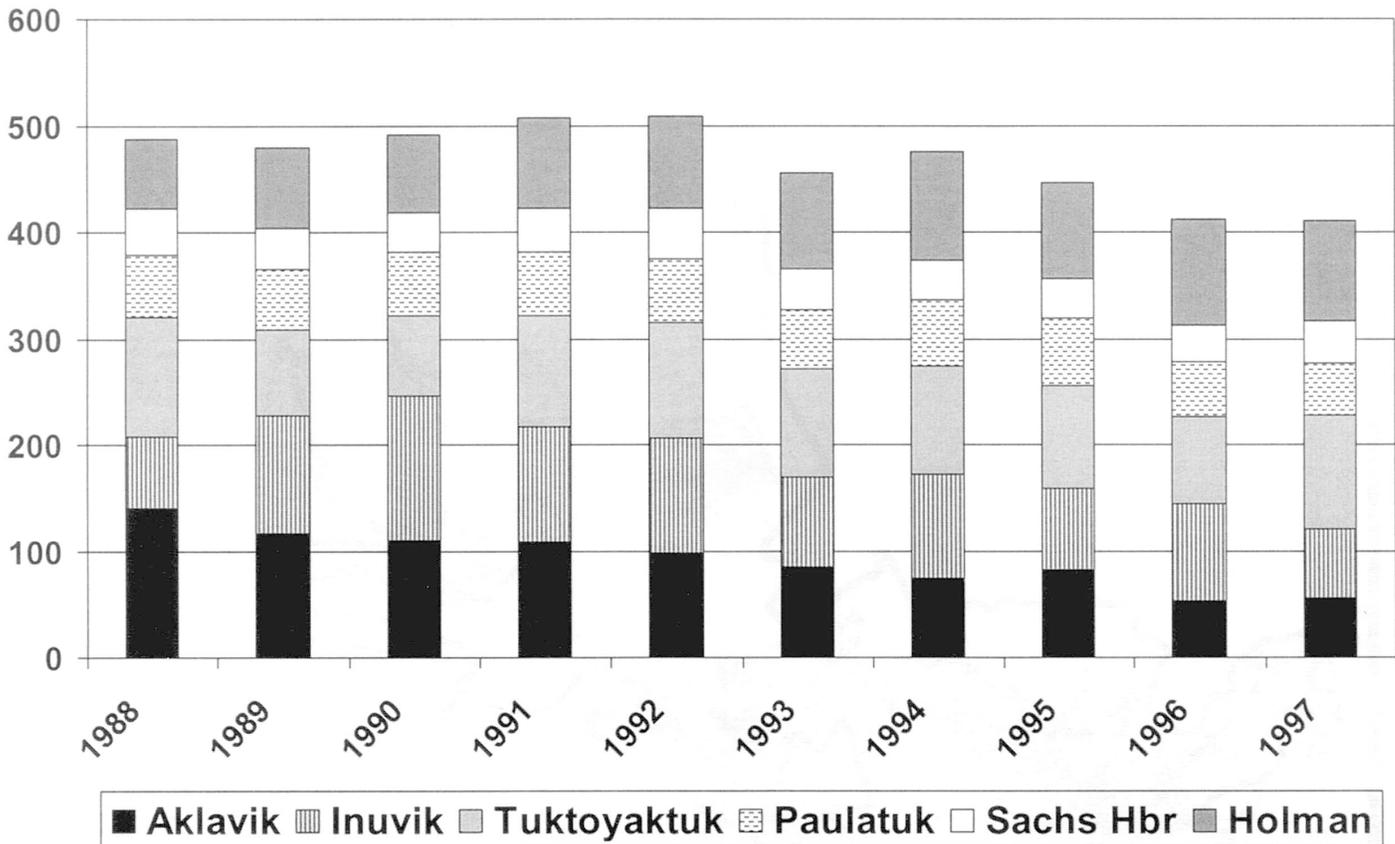


FIG. 2. Harvesters by community, Inuvialuit Settlement Region, 1988–97.

1988–97, of the 1990s. The chief uncertainty for the 1960s is the estimate for marine and anadromous fish, because these species were not subject to any administrative or monitoring recording at the time and, without specifically designed survey protocols, are the most subject to recall error in casual surveys. Nonetheless, the estimate of 400 000 kg/year is if anything conservative in light of Treble's (1996) thorough review of historical data for the Mackenzie Delta.

A key factor in the difference between harvest levels in the 1960s and the 1990s is the near-disappearance of dog teams as the mode of winter transport (Usher, 1972). This is the chief reason for reduced harvests of both seals and the various species of whitefish, which were the primary sources of dog feed at that time. A secondary factor in reduced seal harvests is the decline in pelt price due to European and American import bans, although only the community of Holman had a significant commercial seal harvest. However, beluga harvests are now nearly 50% higher than in the 1960s. The 1990s data do not include the bowhead whales taken in 1991 and 1996, which would have had a noticeable spike effect on available food from marine mammals in those years. Large ungulates now account for most of the food harvest, and both caribou and muskox are more abundant in the region now than they were in the 1960s (at which time muskox hunting was prohibited). Caribou harvests have more than doubled.

TABLE 1. Mean annual Inuvialuit harvest of selected species, 1960–65 and 1988–97. Data for 1960–65 have been estimated and rounded, except those for beluga and polar bears, which are based on exact counts from existing records.

Species	1960–65	1988–97
<b>Marine Mammals</b>		
beluga	83	117
ringed seal	4900	1085
polar bear	68	56
<b>Terrestrial Mammals</b>		
caribou	1300	3114
muskox	0	327
moose	60	28
muskrat	98 000	10 019
arctic fox	5300	1384
Marine and anadromous fish (kg)	400 000	92 034
Freshwater fish (kg)	40 000	17 450

<sup>1</sup> Sources: 1960–65 harvests: Abrahamson, 1963, 1964; Usher, 1965, 1966, 1975; Bissett, 1967; Jessop et al., 1974; Hunt, 1979; Treble, 1996. 1988–97 harvests: M. Branigan and J. Nagy, pers. comm. 1999; Harwood et al., 2000; Fabijan and Usher, in press.

Commercial trapping has declined substantially: both key regional species, muskrat and arctic fox, are now taken in only a fraction of their former numbers. Declining fur prices due to anti-fur campaigns in Europe and North

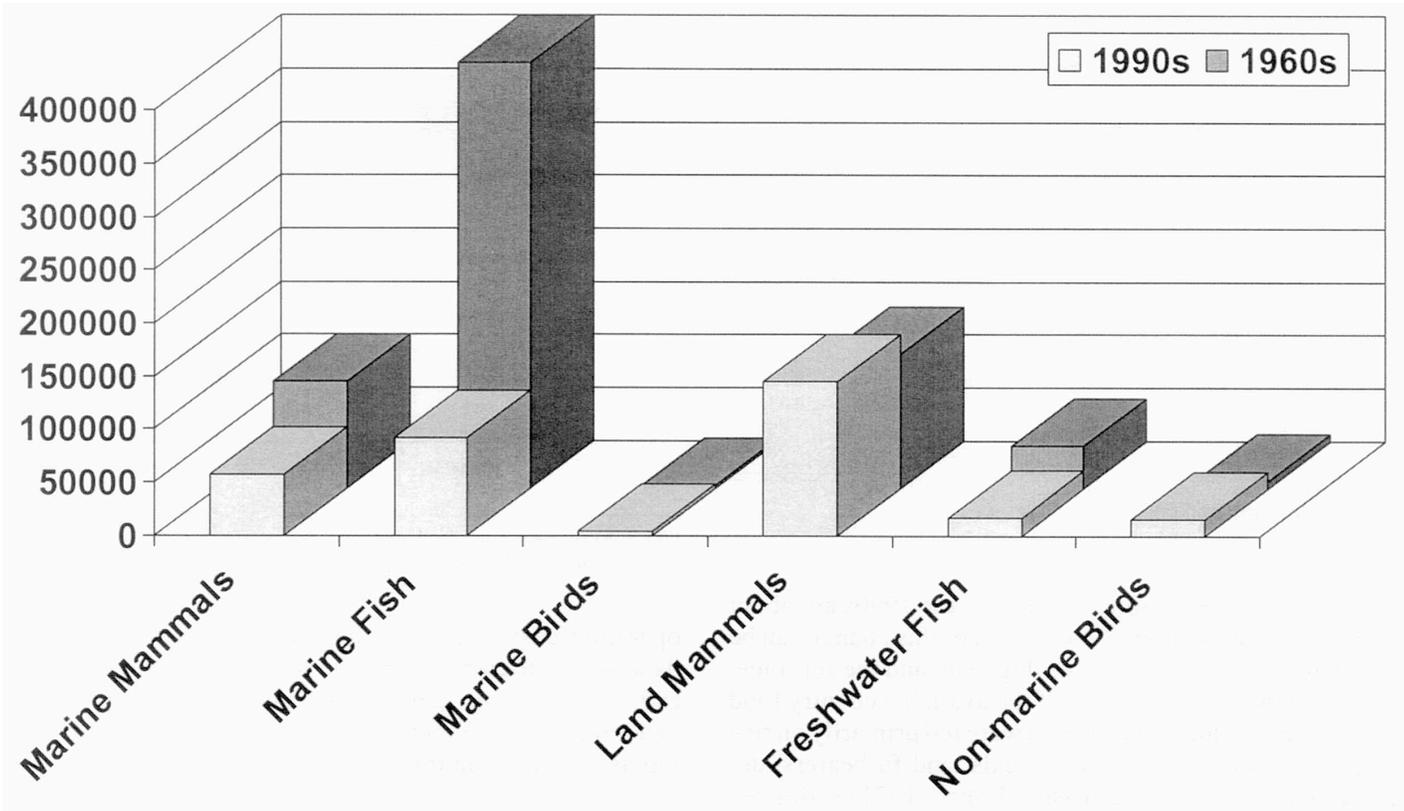


FIG. 3. Estimated edible weight of country food harvest (kg/year), Inuvialuit Settlement Region, 1960s and 1990s.

America are again a key factor, although both fox and muskrat harvests were already lower in the early 1960s than they had been in previous decades. Polar bear harvests have been limited by quota in the Northwest Territories since 1968.

To compare country food production between the 1960s and 1990s more directly, in Figure 3 all harvests have been converted to edible weight (Usher, 2000) and classified by marine and terrestrial (or freshwater) species. Anadromous species are included in the marine fish category, polar bears are included in the marine mammals category, and the marine birds category consists of sea ducks. The following comparison is subject to caution: the reliability of fish harvest estimates for the 1960s is uncertain and, since fish constituted a large component of the total 1960s harvest, the comparative analysis is sensitive to any significant error in those estimates.

#### Harvest Composition

Over 100 species of fish, mammals, and birds are harvested by Inuvialuit, of which about 40 are harvested regularly and account for about 99% (by weight) of total available country food. Of these 40, 18 are marine species (Usher, 2000; Fabijan and Usher, in press). During the period 1988–97, caribou was the most important species, accounting for 33.3% of the total country food harvest by weight. The top five species accounted for 69.8% of the harvest by weight, and the top ten (of which seven were marine) accounted for 86.5% (Table 2). Not all species are

equally available throughout the ISR. While many of the remaining species are harvested only in small numbers (and a few fur-bearing species are regarded as inedible), they are valued nonetheless for the variety they provide to the local diet (Wein and Freeman, 1992).

The key food sources during both periods were terrestrial mammals, marine fish, and marine mammals. The total country food harvest declined from approximately 677 000 kg/year to 333 000 kg/year. Mean annual country food production per harvester was approximately 2083 kg in the 1960s, and 707 kg in the 1990s. However, the composition of the harvest changed markedly. The harvest of terrestrial mammals has declined only slightly, although in the 1960s, 54% consisted of muskrat, of which the greater part was used for dog food. In the 1990s, 76% consisted of caribou, virtually all of which is eaten by humans. The caribou harvest appears to have more than doubled between the two periods, with a far higher proportion of hunters engaged in this activity than in pursuit of any other single species (Table 2). Caribou meat is the preferred food in most communities, and caribou were more abundant and available in the 1990s than in the 1960s. The harvest of marine fish is about one-quarter of what it was, and the harvest of marine mammals is somewhat over half.

In the 1960s, marine and terrestrial sources contributed to total available country food in a ratio of ca. 75:25. In the 1990s, that ratio was about 45:55. The Inuvialuit population in the ISR nearly doubled between the 1960s and the 1990s, while the total country food harvest declined by

TABLE 2. Top ten species by participation and production, 1988–97, from IHS data. Estimates are based on mean annual percentage of hunters (N = 466) harvesting the species, and mean annual production (kg edible weight).

Rank	Participation	(%)	Production	(kg)
1	caribou	62.9	caribou	110730
2	snow goose	35.4	beluga	43215
3	lake trout	31.3	broad whitefish	38254
4	white-fronted goose	26.0	muskox	22563
5	arctic char	24.2	arctic char	17553
6	broad whitefish	18.9	ringed seal	14105
7	Canada goose	18.2	inconnu	13602
8	beluga	15.9	lake whitefish	10161
9	ringed seal	14.8	snow goose	9981
10	eider duck <sup>1</sup>	14.6	cisco <sup>2</sup>	7897

<sup>1</sup> Includes king and common eiders.

<sup>2</sup> Includes arctic and least cisco.

about one-half. Per capita harvests in the 1990s are about one-third of those of the 1960s. Most of this change can be attributed to the decline of the dog team and the fur trade. In the 1960s, the greater part of the available country food supply went to dog teams, which were fed primarily on fish (especially whitefish species), seals, and furbearers, depending on location and season. Usher (1971) estimated that 75% of all country food obtained at Sachs Harbour was fed to dogs, and Jessop et al. (1974) estimated that 75% of the fish catch in the Mackenzie Delta was fed to dogs. Now, almost all country food is consumed by humans. Consequently, although Figure 4 suggests a dramatic decline in available country food per capita (429.5 to 115.2 kg), the availability of food intended specifically for human consumption may well have remained more or less constant over the period, and indeed the mix of terrestrial and marine sources of human food may also not have changed much.

Actual consumption of country food is always somewhat less than the amount apparently available, because some loss, spoilage, and waste are inevitable. The exact disparity is not thought to be large, but it has not been documented at the regional or community levels. Nonetheless, it is obvious that both the land and the sea in the ISR provide large amounts of nutritious country food to the Inuvialuit population. Per capita availability of country food in the ISR (115.8 kg/yr) is higher than per capita meat and fish availability for Canada as a whole (103.3 kg/yr; Statistics Canada, 1999). This suggests a much more substantial reliance on meat in the local diet, keeping in mind that Inuvialuit also consume locally purchased red meat, poultry, and fish from southern sources.

### Harvesting Costs

A few estimates of harvesting costs at particular locales exist for both the earlier and later periods (e.g., Usher, 1972; Smith and Wright, 1989), and the methods for censusing both capital costs (including depreciation) and

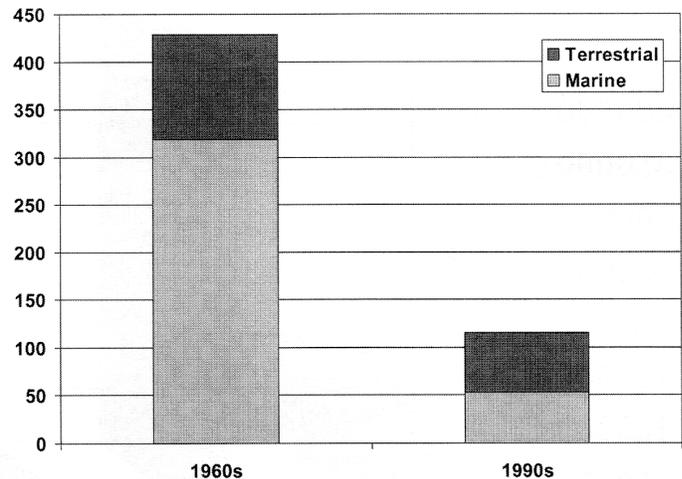


FIG. 4. Available country food per capita (kg/year) from marine and terrestrial sources, Inuvialuit Settlement Region, 1960s and 1990s.

operating costs are well established. However, existing data are insufficient to generate standardized, region-wide estimates for either period, and it is therefore difficult to generalize about either cost levels or the relationship of inputs to outputs in the harvesting sector.

### HARVESTING IN THE INUVIALUIT ECONOMY

Most Inuvialuit households in the smaller communities, and many in Inuvik, depend for part of their income on the subsistence and cash values generated by fish and wildlife. The economy can be described as a mixed, subsistence-based economy (Walker and Wolfe, 1987; Usher and Weinstein, 1991), with the household functioning as a unit of production as well as one of consumption.

The cash or market economy generates household income from wages, transfers, and commodity sales. The household generates and utilizes these income streams as a unit of production by combining the factors of production at its disposal according to household needs. These factors of production include land (wildlife resources, to which all Inuvialuit have access); labour (the skills, knowledge, and capacity of the household members, who at various times may act as wage earners, harvesters, and processors, or provide other support services to harvesting); and capital (the productive goods such as snowmobiles, boats, nets, and firearms). Most of the total income so generated is spent on consumption goods, but some of it is reinvested as productive capital. Cash from other market sectors is essential to achieve sufficient capitalization of modern harvesting. Within the community, households are linked through sharing, exchange, and partnership. This model applies generally in a circumpolar context and over time, although the amounts of income flowing through each category vary greatly (see, for example, Quigley and McBride, 1987; Smith and Wright, 1989; Usher et al., in press).

Harvesting activities generate both household income in the form of cash from commodity production, and in-kind or subsistence values in the form of food on the table (and other products such as hides, pelts, down, and bone). The flow of household income from harvesting has varied substantially over time and by specific source. For example, Banks Island was the white fox capital of the world from the 1930s to the 1970s. Fox abundance is typically cyclic, but peak years provided some trappers with cash incomes substantially higher than the average industrial wage in Canada in those days (Usher, 1971). Similarly, the Mackenzie Delta was a major source of Canadian muskrat pelts, with production valued at up to \$1 million annually in the 1940s and 1950s. Trapping is now only a minor source of cash income in the ISR, but it has been partially replaced by guided sport hunts for big game. In the case of polar bears, for example, sport hunts currently account for about half of the total harvest, and bring about \$400 000 annually to local hunters, mainly in Sachs Harbour, Holman, Paulatuk, and Tuktoyaktuk. Occasional commercial harvesting of fish and game for food occurred during both periods but did not provide substantial income at the regional level.

Using an approximate, and possibly conservative, figure of \$10/kg imputed value of the replacement cost of country food (i.e., what people would have to pay for equivalent meat supplies in local food stores; Usher, 1976b), country food provides a non-cash or in-kind benefit in the amount of about \$3.35 million annually to the ISR as a whole, or ca. \$1150 per capita. A typical household thus produces several thousand dollars' worth of food that it does not have to buy at the store. These are gross values; production costs, which can amount to several thousand dollars, have not been deducted. However, it appears nonetheless that harvesting produces a substantial net economic benefit (Usher, 1971; Smith and Wright, 1989).

## DISCUSSION

The resources of the Beaufort Sea and the adjacent lands are varied and abundant, and they provide for both cash and subsistence needs of the Inuvialuit. They do this today, as they have always done, even though a growing proportion of the population is not directly involved in harvesting and the share of household income provided by harvesting is declining. Important social, cultural, and nutritional needs, as well as economic ones, continue to be met, and harvesting continues to be a widespread and valued activity among Inuvialuit. This was not widely predicted in the 1960s by either social scientists or policy-makers (Usher, 1993).

The total area used by Inuvialuit for harvesting has not changed much. However, many particular harvesting patterns have changed. The following observations apply to the ISR as a whole and may not apply equally to each community, although the IHS provides a database that would enable such analysis.

The number of Inuvialuit who harvest has increased, although not by as much as the population as a whole. Harvesters, defined as anyone who harvests, have declined only slightly as a proportion of the total population, but the major change (not directly measured by any available survey data) has been a shift from full-time to part-time harvesting. To some extent, this has been made possible by the shift from dogs to snowmobiles, as well as the increased speed afforded by more modern technology, which harvesters have generally used to reduce the time required to harvest a targeted amount, rather than to increase harvest levels (Usher, 1972; Condon et al., 1995).

Perhaps more significantly, the focus and intensity of harvesting have changed. While there are no directly comparable figures on species-specific harvesting success from the 1960s, the 1990s data (Table 2) suggest that there may be increasing separation between major food producers or "super-harvesters" (Wolfe, 1987) and casual or "recreational" harvesters. The importance of caribou, beluga, whitefish, and arctic char as food sources is approximately matched by the proportions of hunters who harvest those species, but there are also some significant disparities. Over one-third of Inuvialuit harvesters hunt snow geese, but that species accounts for only 3% of the total harvest by weight. Three other species of waterfowl and sea ducks are in the top 10 species by participation but account for an even smaller proportion of food production. Similarly, lake trout are fished by nearly one-third of the harvesters, but account for only 2% (by weight) of the total harvest. It would appear that some of the major economic species (for both cash and food), such as polar bear and muskox, are taken by relatively few hunters. This has partly to do with their distribution within the ISR, as these species are effectively unavailable to some communities.

While the overall shift in reliance from marine to terrestrial food sources can be attributed largely to the near-disappearance of the dog team, it may also reflect that, to the extent that a distinctly "recreational" category of Inuvialuit hunters exists, those hunters target birds and fish that can be obtained on land or in fresh water. The Beaufort Sea, whether frozen or unfrozen, is a demanding and unforgiving environment. Harvesting its resources requires a level of knowledge and skill that not all harvesters have, and in some cases also a higher level of cooperation and organization and more costly harvesting equipment (Condon et al., 1995). Again, Table 2 is suggestive in this regard. While 63% of Inuvialuit harvesters obtain caribou, only 16% obtain beluga, which, at 8th place, is the highest-ranked true marine species. This picture is also consistent with findings from southwest Alaska that the benefits of household capital assets are maximized by directing investment to the food species with the lowest average unit costs, by weight (Wolfe, 1986).

While the total amount of country food produced has declined, the amount destined for human consumption has increased, and per capita availability on an edible weight basis appears to have remained relatively constant. It may

also be that the relative proportions of country food for human consumption from marine and terrestrial sources have not changed much.

A fact meriting some comment is that Inuvialuit subsistence and commercial harvesting, while largely unrestricted by quotas and continuing to meet the needs of a growing population, have not resulted in resource depletion. At least three factors appear to be promoting conservation and sustainable use: the Inuvialuit interest in conservation, current resource use and management practices, and the incentives of the mixed, subsistence-based economy.

As a result of their dependence on fish and wildlife for both subsistence and commerce, the Inuvialuit have a strong interest and a large stake in species and habitat conservation. These resources provide a healthy and preferred diet at relatively low cost, and the harvesting, processing, and sharing of country food provide an important basis of cultural continuity. The subsistence priority maintains and promotes interest in a broad spectrum of wildlife resources, rather than narrow reliance on a few "cash crops." Thus cultural preference, economic incentives, and Inuvialuit harvesting rights under the land-claim agreement converge to promote a strong interest in maintaining habitat for biodiversity, in contrast to modifying habitat to optimize the production of one or a few key species.

The sustainable use of wildlife promotes wildlife and habitat conservation in the ISR by creating a local constituency that gives priority to these objectives over other land uses, such as industrial development, to the extent that they are incompatible. It promotes concern with animal health and the quality of the food supply and a reliance on local resources instead of imported ones. It promotes a willingness to live with wildlife in circumstances where animals could otherwise be regarded as dangerous predators or competitors. The combination of subsistence and commercial harvesting tends to broaden the desired components of the harvest, hence working against excessive selectivity that could adversely affect population dynamics and genetic diversity (Freese and Ewins, 1998).

With a broad range of species and harvesting options available, and great seasonal and even interannual variability, there is both need and opportunity for flexibility and adaptability. These characteristics are in fact the hallmarks of successful households in a mixed, subsistence-based economy. People are prepared to take the supply of wildlife as nature provides it, rather than seeking to control it. Temporary local scarcities can be met by shifting effort to other resources. Food security is thus enhanced by reliance on a variety of species. This system is dependent on equal access by all households to large communal harvesting territories, as is provided by the Inuvialuit Final Agreement.

Harvesting in the ISR, whether subsistence or commercial, does not involve ecosystem simplification or loss of biodiversity through habitat modification or intensive

culture. These are both impractical and culturally unacceptable. In some cases (bears, some fish) there are stated harvest objectives, but the chief management tools to achieve them are habitat maintenance and harvest controls. Predator control is rarely practiced, and culls are considered unacceptable if there is no local use or external market for the product. No species is regarded or managed as a pest.

The fact that the economy is not totally reliant on harvesting is a benefit, as this reduces economic imperatives to over-harvest. It also facilitates voluntary self-regulation, which has occurred locally in several instances in recent years (Bailey et al., 1995), chiefly because there are alternative sources of income; because with mechanized transport, people are highly mobile and can harvest at alternative sites; and because Inuvialuit rely on a wide range of species for subsistence and can substitute plentiful ones for scarce ones.

Precisely because the Inuvialuit do not rely on a purely subsistence or "traditional" economy, but are part of a modern, mixed economy, the prospects for the conservation of species and habitat are actually enhanced. Incentives for over-harvesting are reduced, while those for habitat conservation are increased. While some species (polar bears, for example) are harvested at or close to maximum sustainable yield, the ISR is not dependent on a single resource. The regional harvesting sector is thus not highly exposed to market or environmental causes of failure, and it does not require environmental modification to enhance its success.

These circumstances have important management implications. The continued health and abundance of a diversity of species and of the marine and terrestrial environments that support them is as important to Inuvialuit now as it has always been. It would therefore be inappropriate to manage any particular species or environment in isolation, without reference to the effects on overall environmental health and on species and habitat diversity. Resource management must be highly adaptive, and that is what the wildlife and environmental co-management system established by the IFA provides.

The resources of the Beaufort Sea and the adjacent lands continue to meet fundamental needs of the Inuvialuit in many and diverse ways today, as in the past. None of these resources is currently at risk because of local harvesting practices or management. Nor have recent industrial development activities such as oil, gas, and mineral exploration in the region adversely affected environment or habitat in any significant way, at least as practiced and managed to date. It may be that the major risks will be those associated with global environmental change. Ensuring that the current favourable situation, at least at the regional level, continues—a fundamental objective of the Inuvialuit Final Agreement—will require continued vigilance with respect to industrial development activities, a sensitive and holistic approach to resource co-management, and the maintenance of traditional Inuvialuit values and practices. The

IFA requires environmental assessment of all developments that could have a significant negative effect on present or future wildlife harvesting, as well as compensation for wildlife harvesting losses. The results of this study suggest that continued documentation of the location, participation levels, harvest levels, and costs of harvesting activities by reliable, proven, and up-to-date methods is important for fish and wildlife management, economic planning, and environmental impact assessment.

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