Importance of traditional foods for the food security of two First Nations communities in the Yukon, Canada

Roseanne C. Schuster¹, Eleanor E. Wein², Cindy Dickson³, Hing Man Chan¹

¹ Health Sciences Program, University of Northern British Columbia, Prince George, Canada
² Canadian Circumpolar Institute, University of Alberta, Edmonton, Canada
³ Council of Yukon First Nations, Whitehorse, Canada

Received 13 March 2010; Accepted 1 February 2011

ABSTRACT

Objectives. This study sought to evaluate food consumption patterns in the context of food security in two Yukon First Nations communities.

Study design. Twenty-nine members of Vuntut Gwitchin households in Old Crow and 33 members of Tlingit households in Teslin participated in individual interviews.

Methods. Food frequency questionnaires were used to quantify traditional food consumption throughout the spring 2007 and winter 2008 and to identify potential temporal trends through a comparison with data from the early 1990s. Additional questions, including the Health Canada Household Food Security Survey Module, sought to assess food security concerns in each community.

Results. Overall frequency of traditional food consumption did not change in either community from the 2 time-point analyses. There was, however, a difference in frequency of consumption of certain groups of foods, and this highlighted the degree to which environmental variability affects the availability of foods.

Conclusion. The importance of traditional foods in the diet of Yukon First Nations has not changed over the past 15 years. However, limited availability of food species, access to harvesting equipment and decrease in available time to go out on the land to harvest are food security challenges facing households today.

(Int J Circumpolar Health 2011; 70(3):286-300)

Keywords: traditional food use, food security, Yukon First Nations, environmental change, food frequency questionnaire, temporal change
INTRODUCTION

Traditional foods are central to the health and culture of the Aboriginal peoples of Canada and are widely recognized as contributing to physical, social and spiritual well-being (1,2). Harvesting and preparation activities bring individuals in the community together, helping to maintain social relationships, facilitate knowledge transfer and sustain spiritual connections with the land (1,3). Regular engagement in hunting, fishing, berry picking and plant harvesting contributes to fitness and overall health (1,4,5). Even when consumed in small quantities, traditional foods contribute large amounts of essential nutrients to the diet so that individuals have significantly higher micronutrient intakes on days when traditional foods are consumed than days where traditional foods are not part of the diet (2,4–11).

Food security has been defined as existing “when all people, at all times, have physical and economic access to sufficient, safe and nutritious food to meet their dietary needs and food preferences for an active and healthy life” (12), with availability, access and appropriate use considered to be the 3 pillars of food security (13). There are 2 aspects of food insecurity: moderate food insecurity involves not having the kinds and variety of foods that an individual wants, while severe food insecurity occurs when an individual does not have enough food to eat. A 2001 study identified that 10% of Yukon households were severely food insecure and another 11% were moderately food insecure for a total of 21% of households, which is significantly higher than the Canadian average of 15% (14).

With respect to the culturally specific role that foods play in Aboriginal communities, food security in a northern and First Nations context can be defined as “the continual and predict-
MATERIALS AND METHODS

Communities
Old Crow is the home of the Vuntut Gwitchin First Nation and is the northernmost community in the Yukon (Fig. 1), located 128 kilometres north of the Arctic Circle (19). Traditionally a nomadic people following the migrations of the Porcupine Caribou Herd, the Vuntut Gwitchin have occupied Crow Flats for centuries, and their permanent settlement on the banks of the Porcupine River since the 1950s has provided them with continuous access to the semi-annual migration of the Porcupine Caribou Herd (19,20). Old Crow is a fly-in community with a population of 253 (21).

The Tlingit community of Teslin is located in southern Yukon, 183 kilometres southeast of the territorial capital of Whitehorse along the Alaska Highway (22). The ancestors of the Teslin Tlingit moved inland from the Pacific coast in the eighteenth century (23). The settlement of Teslin began as a trading post in the early 1900s and became permanent after the completion of the Alaska Highway in 1942 (22). Teslin Village has a population of 297 (21).

Ethics and research agreements
The Canadian Institutes of Health Research Guidelines for Health Research Involving Aboriginal People (24) were followed, and ethical approval for the study was obtained through the University of Northern British Columbia’s Review Ethics Board. Individual informed consent was obtained from each participant.

Figure 1. First Nations traditional territory map of the Yukon (Wein & Freeman, 1995, p. 162. Reprinted with permission from the Arctic Institute of North America).
Data collection

Interviews were conducted in the spring (March–May) of 2008 in Old Crow and in the summer (June–August) of 2008 in Teslin by 3 research assistants from the respective communities. Thirty-three households representing about 30% of households in each community were randomly selected from a household list provided by the respective community governments, and 1 eligible male and 1 eligible female were invited to participate from each household. Eligibility criteria were age of 19 or older, written consent and membership in either a Vuntut Gwitchin household in Old Crow or a Tlingit household in Teslin. Due to difficulties in making contact with households in Teslin, as many of the occupants were not home during the data collection period, an additional 24 households were randomly selected for a total of 57 households in Teslin only. During the interviews the participants answered a food frequency questionnaire (FFQ) and additional questions on food security. The interviews were conducted in English and coded for confidentiality.

Food frequency questionnaires

The study methods were intended to yield food frequency data directly comparable to that collected for the fall 1991 through summer 1992 by Wein and Freeman (18). The FFQ utilized the same list of traditional foods developed by Yukon First Nations elders and leaders for the 1991–1992 study. The FFQ asked how often the participant consumed each of 78 foods from 5 groups (mammals, birds, fish, berries, other plants) in each of the 4 seasons in order to capture seasonal variability and inquired separately about muscle, liver and kidney for caribou and moose only. Colour photographs of each species were available to assist in participant recall. Participants were invited to add a food not listed. Seasons were divided into equal lengths of 90 days each. In addition to reporting frequency of food use, the FFQ asked participants for their average edible cooked portion size for each traditional food in order to calculate the quantity of foods consumed. Plastic food models of various shapes, sizes and thicknesses were used as a guide to standardize portion sizes. If consumed as a liquid infusion, plant quantity was reported for the amount of actual plant matter used for the infusion.

Food security

Participants were asked questions on their access to traditional foods. A multi-step coded question asked participants for their perceptions of their current traditional food consumption in comparison to 15 years ago. In the final section, participants were asked the 18 multiple choice questions of the Households Food Security Survey Module (HFSSM), which has been used in the Canadian Community Health Survey (14,25).

Data analysis

All data were entered into Epi Info v. 3.4.3 (Centers for Disease Control and Prevention; Atlanta, United States) data entry files and were then analyzed by the statistical software package SPSS v. 16.0 (SPSS, Inc., Chicago, United States). Grams per person per day (g/person/day) for each food was calculated by multiplying the individual's annual frequency of consumption by their average reported portion size and dividing it by 360 days. Descriptive statistics for g/person/day consumption were reported in terms of all participants surveyed as well as for consumers only. Participants that reported consuming a quantity of traditional foods in excess of three times the standard deviation of their respective community’s average of g/person/day were considered outliers, and 3 outliers from Old Crow and 1 from Teslin were excluded.
from the data analysis. When 2 individuals from 1 household participated, only the female’s responses were included in the analysis of the food security sections, in which participants were asked to speak on behalf of their entire household.

Frequency and quantity (g/person/day, all participants and consumers only) of consumption were compared for caribou muscle, liver and kidney, each of the 5 groups and total food consumption by age and gender. The non-parametric Kruskall-Wallis was used to compare these measures between age groups (19–40, 41–60, 61+), and the non-parametric Mann-Whitney U was used to compare gender (female, male). One male declined to give his age and is therefore not included in age-specific analyses. The comparison of frequency of food consumption between that reported in Wein and Freeman (18) and the collected data was performed using the Mann-Whitney U test. A p-value of 0.05 was used as the criteria for significance in all statistical tests performed.

RESULTS

Participants

Nearly one-third of First Nations households in each community participated in the study (Table I). Twenty-nine individuals (15 males, 14 females) and 33 individuals (19 males, 14 females) participated in the interviews. Participants from Old Crow were an average age of 49.7±16.0 years and had an average of 2.5±1.6 persons in the household (range 1–6). Teslin participants were an average of 43.7±17.6 years and had an average of 2.4±1.4 individuals in the household (range of 1–7).

Food frequency and quantity

Forty-five traditional foods were reported to be consumed in Old Crow (Table IIa) and 60 in Teslin (Table IIb). All participants in both communities reported consuming at least 1 food from the groups of wild game and fish during the year surveyed, and nearly all participants reported having berries. Caribou meat, blueberry, chinook (king, spring) salmon, salmonberry and low bush cranberry were the foods consumed in the largest quantities (g/person/day, all participants) in Vuntut Gwitchin households. Foods eaten in the largest quantities by participants in Tlingit households were moose meat, lake trout, caribou meat, chinook salmon and blackberry.

Comparison between 1991–1992 and 2007–2008

In 2008, members of Vuntut Gwitchin households reported consuming traditional foods a median of 582 times per year, not significantly different from the frequency of 443 times reported in 1992 (Table IIa). Caribou, Labrador tea, chinook salmon, blueberry and salmonberry were the most frequently consumed individual foods (median) in 2008,
| Traditional food | Consumers [n (%)] | Median Mean + SD (g/day – all) | Median Mean + SD (g/day – consumers) | Mean + SD (g/meal) |
|------------------|-------------------|---------------------------------|-------------------------------------|---------------------|
| **Total**        | 26 (100)          | 259 372 + 271                   | 259 372 + 271                       |                     |
| **Mammals**      |                   |                                 |                                     |                     |
| Caribou meat     | 26 (100)          | 90.7 124 + 99.9                 | 90.7 124 + 99.9                     | 204 + 185           |
| Moose meat       | 24 (92)           | 3.1 15.8 + 35.8                 | 3.2 16.5 + 35.5                     | 211 + 164           |
| Caribou kidney   | 19 (73)           | 3.1 6.6 + 8.6                   | 7.4 9.0 + 8.9                       | 130 + 143           |
| Rabbit           | 16 (62)           | 1.2 5.6 + 9.5                   | 5.4 9.0 + 10.8                      | 150 + 159           |
| Muskox           | 12 (46)           | 0.6 2.6 + 3.8                   | 5.1 5.7 + 3.8                       | 244 + 119           |
| **Birds**        |                   |                                 |                                     |                     |
| Duck             | 19 (73)           | 8.4 28.6 + 35.1                 | 24.6 39.1 + 35.8                    | 94.7                |
| Goose            | 17 (65)           | 5.9 15.3 + 22.8                 | 15.8 23.4 + 24.8                    | 335 + 172           |
| Grouse           | 14 (54)           | 1.0 8.3 + 13.5                  | 10.3 15.4 + 15.3                    | 278 + 169           |
| Ptarmigan        | 15 (57)           | 0.6 3.5 + 17.4                  | 1.0 3.0 + 8.9                       | 334 + 264           |
| Arctic ground squirrel | 6 (23) | 0.0 1.4 + 3.5                  | 4.6 6.1 + 5.0                       | 217 + 306           |
| **Fish**         |                   |                                 |                                     |                     |
| All salmon       | 26 (100)          | 72.6 112 + 109                  | 72.6 112 + 109                      |                     |
| Chinook (king)   | 26 (100)          | 38.1 56.6 + 52.1                | 38.1 56.6 + 52.1                    | 302 + 80.4          |
| Coho (silver)    | 18 (69)           | 3.6 12.5 + 19.9                 | 8.3 18.1 + 21.8                     | 207 + 87.9          |
| Chum (dog)       | 16 (62)           | 3.2 9.7 + 16.9                  | 8.6 15.8 + 19.2                     | 186 + 49.7          |
| Sockeye (red)    | 4 (15)            | 0.0 6.6 + 25.4                  | 21.7 42.7 + 57.6                    | 169 + 46.2          |
| Other fish       | 22 (84)           | 34.2 55.1 + 77.8                | 39.2 65.1 + 80.7                    |                     |
| Lake whitefish   | 15 (58)           | 3.7 12.1 + 20.6                 | 17.9 21.0 + 23.7                    | 160 + 62.5          |
| Fish eggs        | 19 (73)           | 3.5 11.9 + 17.9                 | 13.3 16.3 + 19.2                    | 154 + 99.2          |
| Burbot (ling cod)| 8 (31)            | 0.0 11.5 + 43.7                 | 6.6 37.3 + 75.6                     | 178 + 131           |
| Arctic grayling  | 15 (58)           | 1.4 7.8 + 12.1                  | 8.4 13.6 + 13.3                     | 189 + 95.1          |
| Fish liver       | 13 (50)           | 0.2 7.4 + 13.1                  | 10.3 14.8 + 15.4                    | 200 + 161           |
| Broad whitefish  | 5 (19)            | 0.0 2.2 + 8.6                   | 3.0 11.2 + 18.2                     | 254 + 226           |
| Round whitefish  | 3 (12)            | 0.0 1.5 + 5.9                   | 7.9 12.6 + 15.2                     | 118 + 0.0           |
| Inconnu          | 3 (12)            | 0.0 0.4 + 1.3                   | 2.6 3.1 + 2.8                       | 143 + 84.2          |
| Long nose sucker | 2 (8)             | 0.0 0.3 + 1.3                   | 4.3 4.3 + 2.8                       | 94.7 + 0.0          |
| Jackfish (N. pike) | 1 (4)  | 0.0 0.03 + 0.2                 | 0.8 0.8                             | 143                  |
| **Berries**      |                   |                                 |                                     |                     |
| Blueberry        | 25 (96)           | 64.8 81.0 + 85.0                | 71.0 84.3 + 85.1                    |                     |
| Salmonberry      | 24 (93)           | 18.7 27.9 + 27.9                | 21.7 30.3 + 27.8                    | 281 + 184           |
| Low bush cranberry | 18 (69) | 19.2 27.1 + 28.1                | 20.7 28.2 + 28.1                    | 269 + 186           |
| Rosehip          | 7 (27)            | 0.0 2.8 + 7.6                   | 12.2 10.4 + 12.2                    | 180 + 120           |
| Strawberry       | 1 (4)             | 0.0 0.3 + 1.7                   | 8.9 8.9                             | 118                  |
| Raspberry        | 2 (8)             | 0.0 0.3 + 1.3                   | 4.4 4.4 + 2.1                      | 237 + 167           |
| Black currant    | 2 (8)             | 0.0 0.2 + 0.9                   | 3.2 3.2 + 1.7                       | 118 + 83.6          |
| Red currant      | 3 (12)            | 0.0 0.1 + 0.4                   | 0.5 1.0 + 0.9                       | 138 + 68.3          |
| **Other plants** |                   |                                 |                                     |                     |
| Arctic dock (Old Crow rhubarb) | 24 (92) | 12.0 22.2 + 31.8                | 12.0 24.0 + 32.5                    |                     |
| Wild onion       | 18 (69)           | 6.9 12.9 + 24.0                 | 11.8 18.6 + 28.0                    | 335 + 141           |
| Labrador teaa   | 9 (35)            | 0.0 4.2 + 12.6                  | 3.9 12.1 + 19.8                     | 97.2 + 63.7         |
| Spruce           | 24 (92)           | 2.0 3.6 + 4.8                   | 2.0 3.9 + 4.9                       | 188 + 11.6          |
| Mushroom         | 13 (50)           | 0.0 1.2 + 2.4                   | 1.1 2.4 + 3.0                       | 158 + 11.0          |
| Willow           | 2 (8)             | 0.0 0.2 + 0.7                   | 2.5 2.5 + 0.7                      | 148 + 41.8          |
| Balsam fir       | 1 (4)             | 0.0 0.00 + 0.0                  | 0.1 0.1                             | 2.0                 |

*a Quantity calculations reported for dried tea leaves.
## Table Ib. Quantity of traditional foods consumed by adults in Teslin Tlingit households (n=32).

| Traditional food          | Consumers [n (%)] | Median Mean ± SD (g/day – all) | Median Mean ± SD (g/day – consumers) | Mean ± SD (g/meal) |
|---------------------------|-------------------|-------------------------------|--------------------------------------|-------------------|
| **All traditional foods** |                   |                               |                                      |                   |
| Mammals                   | 32 (100)          | 182                      | 185 ± 105                            | 182 ± 105         |
| Moose meat                | 32 (100)          | 82.2                      | 104 ± 79.8                           | 82.2 ± 79.8       |
| Caribou meat              | 20 (63)           | 77.0                      | 87.6 ± 64.5                          | 76.9 ± 64.5       |
| Moose kidney              | 23 (72)           | 0.8                       | 1.2 ± 1.8                            | 1.1 ± 2.0         |
| Mountain sheep            | 13 (41)           | 0.0                       | 1.1 ± 2.2                            | 1.3 ± 2.8         |
| Beaver                    | 22 (69)           | 0.0                       | 0.9 ± 1.1                            | 0.7 ± 1.0         |
| Beaver liver              | 10 (31)           | 0.0                       | 0.6 ± 0.7                            | 0.3 ± 1.1         |
| Black bear                | 6 (19)            | 0.0                       | 0.4 ± 1.4                            | 0.2 ± 2.1         |
| Porcupine                 | 14 (44)           | 0.4                       | 0.0 ± 0.6                            | 0.5 ± 0.7         |
| Groundhog                 | 10 (31)           | 0.0                       | 0.4 ± 0.6                            | 1.0 ± 1.2         |
| Rabbit                    | 10 (31)           | 0.0                       | 0.3 ± 0.7                            | 0.7 ± 1.1         |
| Caribou kidney            | 5 (16)            | 0.0                       | 0.1 ± 0.3                            | 0.7 ± 0.8         |
| Caribou liver             | 5 (16)            | 0.0                       | 0.1 ± 0.3                            | 0.7 ± 0.4         |
| Muskrat                   | 2 (6)             | 0.0                       | 0.0 ± 0.4                            | 1.2 ± 1.2         |
| Arctic ground squirrel    | 5 (16)            | 0.0                       | 0.1 ± 0.4                            | 1.3 ± 0.9         |
| Elk                       | 1 (3)             | 0.0                       | 0.1 ± 0.2                            | 2.0 ± 2.0         |
| Deer                      | 2 (6)             | 0.0                       | 0.1 ± 0.2                            | 0.9 ± 0.3         |
| Lynx                      | 1 (3)             | 0.0                       | 0.0 ± 0.2                            | 1.3 ± 1.3         |
| **Birds**                 |                   |                               |                                      |                   |
| Duck                      | 27 (84)           | 1.0                       | 4.6 ± 10.4                           | 5.4 ± 11.2        |
| Geese                     | 19 (59)           | 0.5                       | 2.6 ± 6.8                            | 4.3 ± 8.5         |
| Grouse                    | 19 (59)           | 0.2                       | 1.3 ± 4.0                            | 1.5 ± 6.4         |
| Ptarmigan                 | 4 (13)            | 0.0                       | 0.1 ± 0.5                            | 1.2 ± 1.2         |
| Caribou eggs              | 1 (3)             | 0.0                       | 0.0 ± 0.0                            | 0.1 ± 0.1         |
| **Fish**                  |                   |                               |                                      |                   |
| Salmon                    | 27 (84)           | 4.1                       | 10.2 ± 13.0                          | 12.1 ± 13.4       |
| Chinook                   | 22 (69)           | 2.0                       | 7.8 ± 12.3                           | 2.3 ± 11.3        |
| Sockeye                   | 8 (25)            | 0.0                       | 1.6 ± 4.6                            | 4.2 ± 6.5         |
| Chum                      | 10 (31)           | 0.0                       | 0.7 ± 1.5                            | 1.7 ± 2.2         |
| Coho                      | 4 (13)            | 0.0                       | 0.1 ± 0.4                            | 0.5 ± 0.8         |
| **Other fish**            | 32 (100)          | 11.4                      | 32.0 ± 38.2                          | 32.0 ± 38.2       |
| Lake trout                | 32 (100)          | 6.6                       | 16.8 ± 26.3                          | 6.6 ± 26.3        |
| Lake whitefish            | 20 (63)           | 2.0                       | 5.5 ± 10.0                           | 2.8 ± 8.8         |
| Fish eggs                 | 23 (72)           | 0.6                       | 5.2 ± 13.7                           | 1.0 ± 7.2         |
| Arctic grayling           | 17 (53)           | 0.2                       | 1.2 ± 3.1                            | 0.7 ± 2.3         |
| Broad whitefish           | 10 (31)           | 0.0                       | 0.9 ± 2.2                            | 2.0 ± 2.9         |
| Inconnu                   | 14 (44)           | 0.0                       | 0.5 ± 0.9                            | 0.7 ± 1.2         |
| Dolly varden              | 5 (16)            | 0.0                       | 0.5 ± 2.8                            | 8.1 ± 10.9        |
| Burbot                    | 5 (16)            | 0.0                       | 0.5 ± 1.5                            | 3.9 ± 2.2         |
| Fish liver                | 7 (22)            | 0.0                       | 0.3 ± 1.1                            | 0.5 ± 1.2         |
| Round whitefish           | 3 (9)             | 0.0                       | 0.2 ± 0.6                            | 2.0 ± 2.0         |
| Jackfish                  | 5 (16)            | 0.0                       | 0.2 ± 0.7                            | 2.0 ± 1.5         |
| Rainbow trout             | 4 (13)            | 0.0                       | 0.1 ± 0.3                            | 0.7 ± 0.8         |
| Arctic char               | 1 (3)             | 0.0                       | 0.0 ± 0.1                            | 0.7 ± 0.1         |
| Halibut                   | 1 (3)             | 0.0                       | 0.0 ± 0.1                            | 0.3 ± 0.3         |
| **Berries**               |                   |                               |                                      |                   |
| Blackberry                | 30 (94)           | 1.6                       | 33.1 ± 43.3                          | 16.7 ± 35.3       |
| Raspberry                 | 27 (84)           | 2.3                       | 7.6 ± 13.1                           | 3.0 ± 9.0         |
| Low bush cranberry        | 18 (56)           | 0.2                       | 5.2 ± 13.4                           | 1.8 ± 6.1         |
| Strawberry                | 22 (69)           | 0.2                       | 4.5 ± 10.4                           | 1.0 ± 6.5         |
| High bush cranberry       | 16 (50)           | 0.0                       | 4.2 ± 8.3                            | 4.2 ± 8.4         |
| Blueberry                 | 15 (47)           | 0.0                       | 3.2 ± 6.5                            | 4.9 ± 8.8         |
| Soapberry                 | 19 (59)           | 0.4                       | 2.1 ± 3.0                            | 3.0 ± 3.5         |
| Saskatoon                 | 6 (19)            | 0.0                       | 0.7 ± 1.6                            | 3.8 ± 3.5         |
| Rosehip                   | 7 (22)            | 0.0                       | 0.5 ± 1.5                            | 1.4 ± 2.2         |
| Red currant               | 2 (6)             | 0.0                       | 0.2 ± 0.7                            | 2.5 ± 2.5         |
| Black currant             | 3 (9)             | 0.0                       | 0.1 ± 0.3                            | 0.7 ± 0.7         |
| **Other plants**          |                   |                               |                                      |                   |
| Wild rhubarb              | 21 (66)           | 0.1                       | 2.0 ± 4.5                            | 0.8 ± 2.9         |
| Labrador tea*             | 6 (19)            | 0.0                       | 1.2 ± 4.1                            | 3.1 ± 6.6         |
| Balsam fir                | 16 (50)           | 0.0                       | 0.1 ± 0.2                            | 0.0 ± 0.3         |
| Mushroom                  | 5 (16)            | 0.0                       | 0.1 ± 0.5                            | 0.7 ± 1.1         |
| Spruce                    | 4 (13)            | 0.0                       | 0.0 ± 0.2                            | 0.3 ± 0.3         |
| Pine                      | 3 (9)             | 0.0                       | 0.0 ± 0.2                            | 0.6 ± 0.5         |
| Bear root                 | 2 (6)             | 0.0                       | 0.0 ± 0.1                            | 1.0 ± 1.0         |
| Birch                     | 1 (3)             | 0.0                       | 0.0 ± 0.0                            | 0.0 ± 0.0         |

*Quantity calculations reported for dried tea leaves.
Table IIIa. Frequency of food use by adults in Vuntut Gwitchin households in 1992 and in 2008.

| Traditional food          | 1992 Annual frequency | 2008 Annual frequency | Mann-Whitney U |
|---------------------------|------------------------|------------------------|----------------|
|                           | Median | Mean + SD | Median | Mean + SD |       |
| All traditional foods     | 443    | 529.2 + 345 | 582    | 749 + 558 | 315.5 |
| Mammals                   |         |           |         |           |       |
| Caribou                   | 285    | 298 + 186  | 193    | 245 + 160 | 330.0 |
| Moose                     | 264    | 241 + 136  | 162    | 204 + 136 | 328.5 |
| Muskrat                   | 12.0   | 29.3 + 41.8| 10.5   | 31.7 + 49.0| 403.0 |
| Rabbit*                   | 6.0    | 18 + 35.3  | 1.0    | 4.2 + 5.7 | 236.5 |
| Birds                     |         |           |         |           |       |
| Duck                      | 12.0   | 26.6 + 31.8| 15.0   | 31.9 + 43.0| 391.0 |
| Goose                     | 6.0    | 14.3 + 16.7| 8.0    | 15.7 + 21.5| 379.0 |
| All fish**                | 45.0   | 83.1 + 96.4| 138    | 200 + 174 | 207.0 |
| All salmon**              | 24.0   | 28.1 + 35.6| 67.5   | 90.4 + 77.1| 134.0 |
| Chum                      | 3.0    | 7.0 + 8.6  | 7.5    | 19.8 + 26.9| 315.0 |
| Chum                      | 2.0    | 4.4 + 6.5  | 6.0    | 19.2 + 30.1| 307.0 |
| Other fish                | 24.0   | 55.0 + 83.5| 66.5   | 110 + 118 | 284.5 |
| Lake whitefish**          | 0.0    | 0.8 + 2.0  | 6.0    | 26.3 + 37.8| 200.5 |
| Fish eggs                 | 3.0    | 13.7 + 25.4| 15.0   | 26.2 + 28.5| 287.5 |
| Fish liver                | 3.0    | 9.0 + 15.7 | 0.5    | 18.8 + 34.8| 394.5 |
| Arctic grayling           | 0.0    | 4.0 + 9.5  | 3.0    | 16.5 + 22.8| 290.5 |
| Broad whitefish**         | 6.0    | 20.2 + 32.8| 0.0    | 2.0 + 5.6 | 84.5  |
| Berries**                 | 39.0   | 50.2 + 48.5| 87.0   | 138 + 156 | 218.0 |
| Blueberry                 | 24.0   | 23.1 + 21.0| 36.0   | 44.8 + 49.3| 285.0 |
| Salmonberry**             | 3.0    | 6.8 + 12.5 | 36.0   | 44.6 + 49.4| 124.0 |
| Low bush cranberry        | 6.0    | 16.5 + 19.4| 16.5   | 37.4 + 52.5| 379.5 |
| Other plants*             | 24.0   | 71.4 + 111 | 93.0   | 134 + 184 | 266.0 |
| Labrador tea*             | 6.0    | 57.9 + 107 | 46.5   | 71.3 + 82.4| 246.0 |
| Spruce**                  | 0.0    | 0.7 + 2.3  | 0.5    | 32.2 + 80.8| 277.0 |
| Arctic dock               | 3.0    | 7.4 + 9.4  | 7.5    | 13.3 + 19.6| 348.5 |

* Only results where median frequencies are greater than zero for at least one timepoint are shown.
**Significant difference, p<0.05, Mann-Whitney U.
***Significant difference, p<0.01, Mann-Whitney U.
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Table IIIb. Frequency of traditional food use by adults in Teslin Tlingit households between 1992 and 2008.

| Traditional food | 1992 Annual frequency | 2008 Annual frequency | Mann-Whitney U |
|------------------|------------------------|------------------------|----------------|
|                  | Median     | Mean + SD          | Median     | Mean + SD          |                  |
| Total            | 498        | 593 + 452          | 386        | 496 + 490          | 336.0           |
| Mammals          |            |                      |            |                      |                  |
| Moose            | 217        | 233 + 158          | 165        | 170 + 95.9          | 322.0           |
| Caribou          | 186        | 202 + 123          | 150        | 148 + 79.5          | 318.0           |
| Beaver           | 0.0        | 5.7 + 13.4         | 1.0        | 14.2 + 28.9         | 310.5           |
| Rabbit**         | 2.0        | 7.9 + 24.0         | 1.0        | 1.7 + 2.2           | 325.5           |
| Birds            | 1.0        | 4.6 + 10.6         | 0.0        | 0.5 + 0.9           | 245.0           |
| Birds            | 4.0        | 13.3 + 26.4        | 2.0        | 5.0 + 7.6           | 341.0           |
| Duck             | 1.0        | 6.3 + 18.0         | 1.0        | 2.8 + 6.6           | 357.5           |
| Grouse           | 1.0        | 3.2 + 5.6          | 1.0        | 1.1 + 1.5           | 304.5           |
| Mammals          | 101        | 123 + 106          | 49.5       | 72.6 + 83.1         | 245.5           |
| Salmon**         | 27.0       | 38.4 + 32.1        | 10.0       | 20.6 + 30.5         | 238.5           |
| Chnook**         | 24.0       | 32.7 + 28.8        | 4.0        | 15.3 + 28.3         | 194.0           |
| Other fish*      | 58.0       | 84.7 + 89.2        | 22.0       | 52.0 + 63.1         | 245.5           |
| Lake trout       | 15.0       | 19.7 + 20.3        | 9.5        | 23.7 + 35.7         | 365.5           |
| Lake whitefish*  | 9.00       | 22.6 + 42.3        | 3.00       | 8.7 + 16.4          | 279.5           |
| Fish eggs        | 6.00       | 8.4 + 8.9          | 2.00       | 8.3 + 17.0          | 284.0           |
| Arctic grayling**| 3.0        | 5.4 + 5.9          | 1.0        | 1.9 + 2.8           | 229.5           |
| Burbot**         | 1.0        | 2.1 + 2.3          | 0.0        | 1.4 + 5.6           | 216.5           |
| Rainbow trout    | 0.0        | 1.2 + 4.8          | 1.0        | 0.2 + 0.8           | 368.5           |
| Berries          | 70.0       | 166 + 242          | 149        | 162 + 185           | 353.0           |
| Low bush cranberry| 0.0       | 27.9 + 76.9        | 4.0        | 33.7 + 62.9         | 343.0           |
| High bush cranberry| 3.0      | 15.6 + 30.3        | 0.5        | 27.5 + 61.1         | 371.5           |
| Raspberry        | 2.0        | 24.8 + 38.6        | 7.5        | 27.3 + 42.7         | 321.5           |
| Strawberry       | 3.0        | 14.0 + 26.0        | 2.5        | 25.2 + 50.6         | 378.0           |
| Blackberry*      | 24.0       | 28.6 + 28.5        | 10.0       | 13.7 + 14.8         | 249.0           |
| Soapberry        | 4.0        | 18.8 + 50.0        | 2.5        | 6.5 + 8.3           | 370.0           |
| Other plants*    | 12.0       | 57.1 + 123         | 5.0        | 86.8 + 299          | 257.0           |
| Balsam fir       | 0.0        | 31.4 + 101         | 0.5        | 29.0 + 88.2         | 365.0           |
| Spruce**         | 1.0        | 6.1 + 20.0         | 0.0        | 22.7 + 88.5         | 241.5           |
| Wild rhubarb**   | 1.0        | 8.7 + 20.4         | 0.0        | 1.8 + 5.2           | 228.5           |

* Only results where median frequencies are greater than zero for at least one timepoint are shown.
** Significant difference, p<0.05, Mann-Whitney U.
*** Significant difference, p<0.01, Mann-Whitney U.

Table IV. Median, mean and standard deviation g/day of traditional food consumption for adults in Old Crow and Teslin.

| Gender/Age | Old Crow (g/day) | Teslin (g/day) |
|------------|------------------|----------------|
|            | n    | Median | Mean + SD | n    | Median | Mean + SD |
| Women      |      |        |           |      |        |           |
| 19–40      | 5    | 172    | 259 + 229 | 7    | 210    | 198 + 84.2 |
| 40–60      | 3    | 399    | 334 + 153 | 3    | 169    | 165 + 72.2 |
| 61+        | 6    | 479    | 479 + 340 | 4    | 142    | 159 + 114 |
| Men        |      |        |           |      |        |           |
| 19–40      | 3    | 254    | 482 + 483 | 10   | 163    | 196 + 127 |
| 40–60      | 5    | 133    | 240 + 232 | 5    | 257    | 188 + 153 |
| 61+        | 3    | 492    | 490 + 6.3 | 3    | 187    | 172 + 51  |
| Total      | 26+  | 259    | 367 + 271 | 32   | 182    | 185 + 105 |

* One male from Old Crow declined to give his age and therefore is only included in the total analysis.
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with caribou, blueberry, moose, Labrador tea and broad whitefish the most frequently consumed in 1992. Frequency in the consumption of salmon, all fish, berries and other plants was shown to significantly increase in Old Crow between 1992 and 2008. There was a decrease in the consumption of broad whitefish but an increase in the consumption of lake whitefish and chinook salmon, which led to an increase in the overall frequency of fish use. Statistically significant increases in salmonberry, spruce and Labrador tea contributed to the increases in the categories of berries and other plants.

In 2008, members of Tlingit households consumed traditional foods a median of 386 times per year, with moose muscle meat, lake trout, blackberry, raspberry and low bush cranberry the most frequently consumed foods (Table IIIb). The annual frequency did not differ significantly from the 1992 median of 498, when moose, chinook salmon, blackberry, lake trout and lake whitefish were the most frequently consumed traditional foods. Frequency of consumption decreased between 1992 and 2008 within the categories of salmon, other fish and all fish, marked by decreases in consumption of chinook salmon, lake whitefish, arctic grayling, and burbot, round whitefish, jackfish and least cisco. Other plants as a group were consumed less frequently, marked by decreases in rhubarb, bear root, wild onion and willow. Frequency in the consumption of rabbit, bird eggs, blackberry and red currant decreased but there was no statistically significant change in the categories of mammals, birds and berries.

**Age and gender**

There was no statistically significant difference in overall quantity of consumption (g/person/day) of traditional foods by age and gender in either community (Table IV); however, Old Crow median and mean consumption for men and women aged 61+ and mean consumption for men 19–40 is substantial at over 1 pound per day. Annual frequency of consumption of birds in Old Crow was the only category shown to differ significantly with both age and gender, with frequency increasing with age within each gender (data not shown). A statistically significant difference was found between genders for frequency and quantity (g/person/day, all participants) of caribou liver consumption, with Vuntut Gwitchin men consuming more than women. Frequency of bird consumption, g/person/day bird consumption (all participants) and g/person/day plant consumption (all participants) were shown to increase with age in Old Crow. In Teslin, men consumed significantly more birds (g/person/day, consumers only) than women. Women consumed berries more frequently and in greater quantities (g/person/day, consumers only). There was a statistically significant difference in age-related consumption of birds, with those aged 41–60 consuming more than those 19–40 and those 61+ consuming the least amount.

**Food security**

When asked for their perceptions of their own consumption of traditional foods over the past 15 years, the majority of households in Old Crow and Teslin reported consuming the same amount of mammals, ducks and geese, fish, berries and barks and saps between spring 2007 and winter 2008 as they did 15 years ago (data not shown). The percentage of households that reported consuming less traditional foods than they did 15 years ago was generally greater than the percentage that reported consuming more in both communities. When decreases in consumption of a group of traditional foods were reported, the main reason given in each community was the decreased availability or unavailability of that food. When many
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participants reported not eating wild greens, bark and sap, roots and mushrooms, the reasons given were not liking the foods, never having tried it and, for mushrooms, uncertainty about which types were safe.

Eighty-five percent of Vuntut Gwitchin households reported that their traditional foods came from within their household or immediate family, while 15% reported others in the community were their main source of traditional foods. In Teslin, all households reported providing their own traditional foods, with half (52%) also receiving traditional foods from other households in the community and 15% purchasing traditional foods, specifically salmon, from an outfitter or another First Nation.

Seventy-four percent of households in both communities reported obtaining all the traditional foods that their households wanted. Of the other 26% of households in Old Crow, all wanted more caribou. When participants in Old Crow were asked what prevented their households from obtaining all the traditional foods that they wanted, two responded not having money for equipment and one reported not having money to hire someone to hunt for them. In Teslin, four households responded that they had no time to harvest, two that harvesting was too strenuous and one that harvesting restrictions were obstacles.

Results from the HFSSM identified only half (52%) of participating Vuntut Gwitchin households in Old Crow as food secure, with 37% shown to be experiencing moderate food insecurity and 11% experiencing severe food insecurity. Eight households in Teslin declined to answer enough questions of the HFSSM for their level of food security to be assessed. Out of the nineteen households that did complete this section, 95% were identified to be food secure and 5% moderately food insecure.

DISCUSSION

Validity of comparison
The percentage of First Nations households interviewed in Teslin and in Old Crow was comparable to the percentage interviewed by Wein and Freeman (18). The phrasing of the FFQ question to establish frequency per season in this study was “How often did you eat [each traditional food per each season]?” The phrasing of the question in the Wein and Freeman (1995) study was “How often does anyone in your household eat [each traditional food per each season]?”— which was intended to obtain the maximum frequency of any individual in the household. This introduces limitations with the comparison, as it may be difficult to recall another person’s food consumption. However, the respondent may likely have answered with details about his/her own food use, making the information directly comparable.

Limitations
The exclusion criterion of exceeding three times the standard deviation for total g/person/day traditional food consumption may artificially eliminate high-end consumers of traditional foods; however, this criterion was employed as the best method to protect against the biases presented by self-reporting and by use of the food models. Reporting bias in traditional food studies tends towards an overestimation of frequency (26). Food models were only to represent the cooked edible portions and not the bones; however, it is interesting to note that participants reported larger portions (g/meal) for small animals such as rabbit, groundhog, muskrat and various birds in comparison with caribou and moose (Tables IIa and IIb). This may be indicative of a bias towards overestima-
tion due to difficulty estimating size without bones, the form in which they are normally consumed.

Because of logistics variations, data sampling were collected in different seasons in the 2 communities when the abundance of wild food varied. The effects of this seasonal variability on household food security status could have the potential to influence the FFQ results. However, the design of our FFQ questions specifically asked the respondents about the frequency of their food use in each of the 4 seasons. This bias may not be very significant.

Teslin interviews were conducted in the summer season, which may have contributed to the difficulties in contacting initially selected households (messages not returned, individuals out of town). Summer in Teslin is a busy time for a variety of reasons, including harvesting, non-harvesting travelling and seasonal employment due to increased tourism, so some participants were reached on the second or third contact. In both communities there was no reason to believe that the households sampled were different from those who did not participate, and thus the 29–30% of participating households from each community is considered to be a representative sample.

Frequency of food use

There was no decline in the frequency of traditional food use in Old Crow; rather, the frequency of consumption of certain categories was shown to increase. Consumption of traditional foods is generally higher in more remote communities such as Old Crow that have maintained a traditional lifestyle (18,27). Market foods in Old Crow are two and a half to three times the price as in the Yukon capital of Whitehorse (28–29), which may be one factor in the maintenance of traditional foods in the diet. At the community meeting in Old Crow, the frequency for mammals and birds were confirmed, but differing views were expressed on the apparent increase in the frequency of consumption of fish and berries.

The overall frequency of traditional food use in Teslin did not change; however, frequency of consumption of all fish, salmon, other fish and other plants did decrease. Individuals at the community meeting emphasized the community’s concerns about declining salmon populations. The increasing community concern was manifested in the Teslin Tlingit Council’s implementation of 48-hour net closures in 1994 and some community members voluntarily reducing their annual catch (K. Melton, TTC Fish and Wildlife Officer, personal communication, 28 April 2009). These may be factors in the decreased frequency of consumption of chinook salmon between 1991–1992 and 2007–2008 as well as why 15% of households reported obtaining salmon from outfitters or other First Nations. The results of the FFQ were confirmed at the community meeting in Teslin.

Frequency of traditional food use has been found to be higher among males and increases with age in both genders (7–8,30), although clear trends have not been found when evaluating age and gender together. This study identified a few age- and gender-related differences in traditional food consumption but did not find general trends for either age or gender.

One theme that emerged from the community meetings, particularly in Old Crow, was the importance of recognizing the variability in environmental conditions that affects the availability of traditional food sources. This variability is even more pronounced in northern communities such as of Old Crow, where less
species are available than in more southerly communities such as Teslin. The Porcupine Caribou Herd has been the principal cultural and dietary resource of the Vuntut Gwitchin, and the herd’s irregular 2007 fall migration left families without their usual stock of caribou for the winter of 2008. As a result, some families reported turning towards fish as a main protein source, which supports the increase in frequency of fish consumption identified. Community members emphasized that this was an anomaly and is not a general trend towards increased fish use; during the following summer of 2008 there was a Yukon-wide restriction on the First Nations subsistence harvest of chinook salmon due to low populations. In fact, the Vuntut Gwitchin Government bought and distributed chinook salmon to community members in order to supplement the meager 7 fish that had been caught as a result of the abnormally low run and high water levels (S. Graupe, VGG Director of Natural Resources, personal communication, 31 March 2009). Community members also noted that higher than average precipitation levels resulted in more berries than usual in 2007, and naturally people will harvest foods that are readily available.

Food security
Twenty-six percent of household in both Teslin and Old Crow reported not getting all the traditional foods that they wanted, which is a manifestation of moderate food insecurity. The 48% of Vuntut Gwitchin households identified as food insecure by the HFSSM is well above both the 2001 Yukon-wide average of 21% (14) and the 2004 data for Aboriginals off-reserve of 33% (25). The overall food insecurity level in Old Crow is comparable to that experienced in Nunavut (56%) (14), as these remote Arctic communities face similar environmental and socio-economic challenges to traditional lifestyles. Only 1 household in Teslin was identified as moderately food insecure by the HFSSM; however, the 8 households that declined to answer the HFSSM section may have done so because they were experiencing food insecurity and found it difficult to discuss. Had they answered, the reported percentage of Tlingit households experiencing food insecurity in Teslin may be higher. The food security results for both Old Crow and Teslin were validated at their respective community meeting.

Food security in Aboriginal communities hinges on the vulnerability of traditional and market food systems, which are affected by their exposure and sensitivity to rapidly occurring environmental and socio-economic pressures and their capacity to adapt to these challenges (31–32). Climate change, contaminants, mining and drilling for oil are environmental issues challenging Athapaskan and Tlingit communities, and with the globalization of markets, now even remote Arctic communities feel the impacts of global food markets (2,33–35). Incorporating market foods into the diet can be an adaptation to traditional food insecurity; however, reliance on market foods introduces new vulnerabilities based on price, supply and quality, which can be very challenging in northern communities (36). The differing availability and accessibility of wage employment and market foods may be reflected in the food security results for Old Crow and Teslin. Teslin’s location on the Alaska Highway en route to the Yukon capital of Whitehorse offers more opportunities for wage employment as well as both a lower cost and greater variety of market foods than the fly-in community of Old Crow (28–29). Not having enough time to harvest
was mentioned by 15% of Teslin participants as an obstacle to obtaining all the traditional foods that they wanted, which is an issue in communities where many members participate in some form of a wage economy, as the work week limits harvesters’ ability to get out on the land (37–38). Thus, an increased ability to supplement with market foods likely contributes to Teslin’s higher reported levels of food security. Still, Teslin and Old Crow are both actively pursuing culturally specific adaptations, including youth education and engagement to address the challenges to traditional food insecurity.

**Conclusion**

Traditional foods continue to be a vital component of the diet for Yukon First Nations communities. As environmental and socio-economic changes continually challenge northern First Nations communities, the availability of traditional foods is critical to maintaining their food security. Additional research is needed in order to identify trends in traditional food use, particularly as yearly environmental variability plays a large role in which foods are available and accessible.

**Acknowledgements**

This work would not have been possible without the support of the communities of Old Crow and Teslin, the Teslin Tlingit Council and the Vuntut Gwitchin Government, particularly Megan Williams and Jennifer Lee. Special thanks are extended to the research assistants: Tracy Kapuschak, Bertha Frost, Edna Kyikavichik and Lorraine Peter (community coordinator) of Old Crow and Santana Jules, Brittany Desjarlais and Marianne Keenan (community coordinator) of Teslin. The research in Old Crow was funded by the Natural Science and Engineering Research Council of Canada through the International Polar Year Program and an UNBC/Michael Smith Health Research Award and in Teslin by a Team Grant from the Canadian Institute of Health Research. The first author was supported by a Fulbright Fellowship from the U.S. Department of State.

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