Chapter 2

The Nuxalk Food and Nutrition Program, coastal British Columbia, Canada: 1981–2006

● NANCY J. TURNER, PH.D.[1] ● THELMA HARVEY[2] ● SANDY BURGESS[2]

● HARRIET V. KUHNLEIN, PH.D.[3]

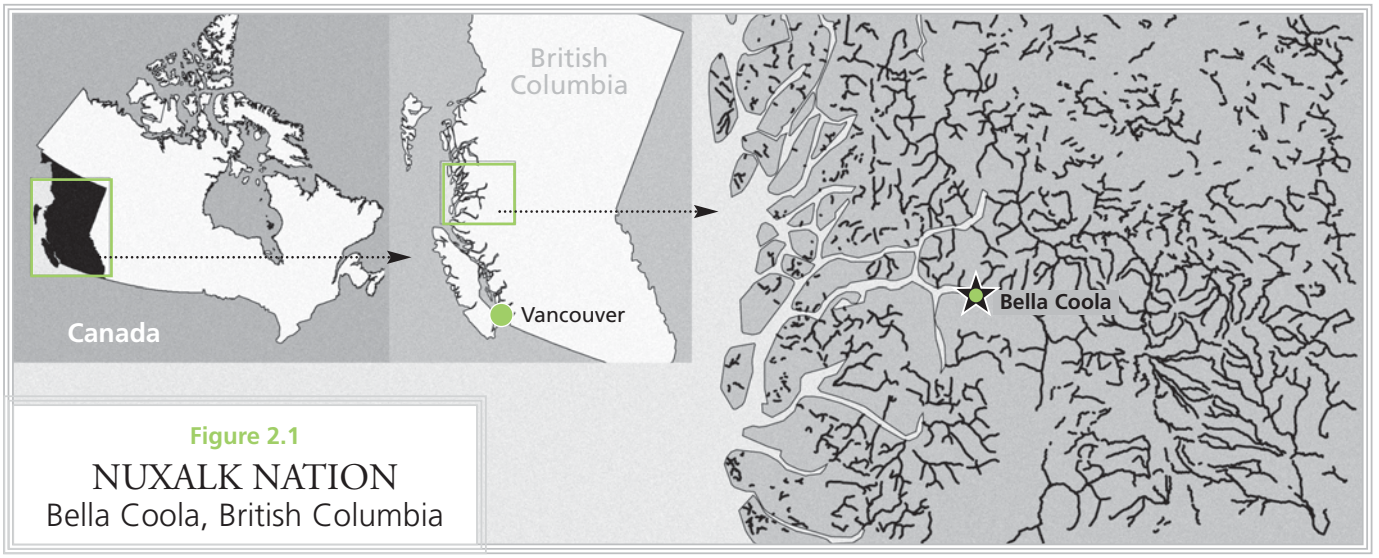

Figure 2.1

NUXALK NATION
Bella Coola, British Columbia

Data from ESRI Global GIS, 2006.
Walter Hitschfield
Geographic Information Centre,
McGill University Library.

1
School of Environmental
Studies,
University of Victoria,
Victoria, B.C., Canada

2
Nuxalk Nation,
Bella Coola, B.C., Canada

3
Centre for Indigenous
Peoples' Nutrition
and Environment (CINE)
and School of Dietetics
and Human Nutrition,
McGill University,
Montreal,
Quebec, Canada

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"The old foods are the new foods!"

Dr Margaret Siwallace, Nuxalk Elder

Abstract

The Nuxalk have occupied their home territory along the rugged British Columbia coast for an unknown amount of time – certainly thousands of years. For many generations, the people relied on a diversity of fish, game, berries, roots and other nutritious food. However, within the past 50 years or so, their traditional food resources have been eroded, salmon runs and other aquatic resources have been depleted, and lifestyle changes have decreased the time available for hunting, fishing and berry picking. As with many other indigenous communities, the Nuxalk experienced a dramatic dietary shift towards consumption of less nutritious, processed and packaged foods higher in calories and unhealthy fats. Younger people have been most susceptible to this dietary change.

The Nuxalk Food and Nutrition Program, originating in 1980, was a collaborative effort to document past and contemporary Nuxalk diet, assess nutritional values of traditional food, determine overall health status, and promote healthy traditional food. With Elders' advice and knowledge, a multi-faceted programme began with emphasis on documenting the food system: nutrient analysis of fish, berries and other foods, and dietary and health assessments. This led to education programmes aimed at raising awareness and knowledge of harvesting and preparing traditional food, as well as workshops and community meetings to promote healthy lifestyles and diet. The publication of a Nuxalk Food and Nutrition Handbook and a companion recipe book, *Kanusyam a Snknic*, were very popular. Many publications have been produced documenting various aspects of the overall programme. Over twenty years on, the positive effects of the Nuxalk Food and Nutrition Program are still evident, and it stands as an example for other initiatives to promote traditional food systems in indigenous communities. This chapter describes the Nuxalk food system and nutritional status, the ecological setting, and the background for establishing an intervention initiative by Nuxalk leaders in partnership with their academic colleagues.

Introduction

The Nuxalk ('Noo-halk') Indigenous People have occupied their traditional territory for thousands of years, living from the bounty of the land, river and ocean. Bella Coola, the home community of the Nuxalk, is situated at the mouth of the Bella Coola River within a steep-sided scenic valley on the central coast of British Columbia. Over centuries, they developed an immense base of knowledge and skills to enable them to harvest and process their food efficiently, effectively and sustainably generation after generation. However, as with many indigenous communities, the traditional food system of the Nuxalk has been eroded – especially over the past 50 or 60 years – and their diet has become less healthy. It is within this context of concern for dietary change and its effects on health that the Nuxalk Food and Nutrition Program was established.

In the early 1980s, a study of Nuxalk food and nutrition was initiated in collaboration with local and regional Nuxalk leaders. A constellation of related health and nutrition studies was initiated, involving the community health centre, Band Council, as well as Elders and Nuxalk youth. This was a pioneering venture – the first of its kind in Canada at this level of engagement between academic researchers and an entire indigenous community. The goals of the programme were to promote health through traditional food use, using traditional food as a venue and pathway for understanding and promoting good health.

Research as community-based and participatory

The Nuxalk Food and Nutrition Program began officially in January 1983, but it was preceded by background research on food system documentation and planning. Prior to the initial study in 1980 the Union of British Columbia Indian Chiefs identified the Nuxalk Nation as being interested in participating in research on indigenous food use and community health. Agreement was reached between the research leader and the Band Council outlining how initial studies would proceed, budgeting and planning of activities. Initial studies focused on ooligan (*Thaleichthys pacificus*), a traditionally

important small fish used in many cultural ways. In 1983, the research group obtained a major grant to begin health promotion activities, with an ethics review by the University of British Columbia. The Nuxalk community health nurse and community health representative worked in close collaboration with the researchers with guidance by Elders and Band Council members. Individuals who were interviewed were informed about the project and its goals and how the information they provided would be used. Throughout the entire programme, Nuxalk community researchers and health promotion staff were hired to undertake the interviewing and health promotion activities, including various activities in the schools and the health centre.

Throughout the research protocols, the confidentiality and anonymity of respondents were maintained. All papers and publications derived from the project were shared and reviewed by the Nuxalk Nation. A primary outcome was the production of two books for community households: one a reference guide to Nuxalk traditional food and its processing and production, and the second a popular recipe book for preparing healthy meals (Nuxalk Food and Nutrition Program Staff 1984, 1985). These books were well received and were found to be in use in schools and community centres as resource materials more than 20 years later.

The people of the Nuxalk Nation in historical and ecological setting

The Nuxalk language is classed in the Salish language family. However, the Nuxalk are geographically and linguistically isolated from other Salishan peoples, and their language forms a separate division, indicating a relatively long period of separation from other Salishan-speaking peoples. The Nuxalk territory is bordered by Wakashan-speaking peoples (Haisla and Hanaksiala, Heiltsuk, and Kwakwaka'wakw) on the north, west and south sides respectively, and by the Ulkatcho Dakelh (Carrier) Athapaskan-speaking people to the east. Culturally, the Nuxalk are closely aligned with their western neighbours, the Heiltsuk, and this similarity is reflected in their rich and complex ceremonial traditions, including elaborate winter dances, feasts and potlatches. Nuxalk trade with the Heiltsuk and other coastal groups provided food from the outer coast, such as dried seaweed, edible mussels and clams. In exchange, the Nuxalk facilitated trade from inland groups, the Ulkatcho and Tsilhqut'in (Chilcotin), providing outer-coast peoples with some interior resources. Although the Nuxalk traded and intermarried with their various neighbours, they also are known to have historically engaged in war with them on occasion (Kennedy and Bouchard, 1990).

At the time of the first contact with Europeans in the late-eighteenth century, the Nuxalk Nation peoples occupied a number – as many as 30 – of permanent villages situated along the major waterways of the Bella Coola Valley, North and South Bentinck Arms, Dean Channel and Kwatna Inlet. These last two regions were shared with the Heiltsuk (or Bella Bella) people – for a map of the original settlements in the Nuxalk territory, see Kennedy and Bouchard (1990). From this time, and especially as they endured waves of disease epidemics during the trade and colonial periods, the Nuxalk began to abandon their villages, and by the early 1900s almost all had moved to a village called *7alhqlaxlh*, at the mouth of the Bella Coola River, on the north shore. A major flood in 1936 forced relocation to the south side of the river, to the present village of Bella Coola. A newer subdivision about 8 km east and up the valley was developed in the 1980s and many Nuxalk reside there today (see Figure 2.1).

The Nuxalk traditional territory covers a diverse landscape and geographic region, ranging from deep ocean inlets, valley bottoms and rugged mountainous terrain, with many rivers and fast moving streams, ponds, marshes, rocky slopes and dense forested areas. These lands and waters provide a range of habitats for a wealth of traditional foods. The ocean inlets are very significant for food resources – various sea mammals (seal, sea lion, etc.), and many types of fish and shellfish have always been available. The rivers provide spawning and rearing habitat for all five common species of Pacific salmon, as well as steelhead. In past years, the rivers, especially the Bella Coola, served as a major spawning destination for ooligan (also eulachon), a type of smelt that spawns in the lower reaches of coastal rivers. The ooligan was second only to salmon in importance to

the Nuxalk (Kennedy and Bouchard, 1990), and the grease rendered from ooligan has been a key food and condiment (Kuhnlein *et al.*, 1996).

The estuarine tidal marshes are host to a number of different root vegetables that people traditionally harvested, as well as areas of prime hunting for ducks, geese, deer and bear. Various food resources are found in the low valley bottoms – huckleberries, blueberries, red elderberries, salmonberry, thimbleberry, cow parsnip and fireweed (for green shoots), wood fern (rootstocks), and black cottonwood (inner bark) – as well as a wide range of different medicinal and material plant resources. Most notably, western red cedar provided wood for canoes, houses and food storage and cooking boxes, and inner bark for mats, clothing and baskets. More types of berries and other food plants grow on the lower slopes of the mountains, as well as material and medicine plants, and game animals like mule deer and black-tailed deer. At the head of the valley are soapberries, black mountain huckleberries and other types of berries that are not available lower in the valley. On the upper slopes, mountain goat continue to be hunted for meat and fat, as well as for their skins. Lepofsky, Turner and Kuhnlein (1985) describe the main resource harvesting zones of the Nuxalk, while Pojar and Mackinnon (1994) provide a good general reference on coastal vegetation, including that of the Nuxalk territory.

To access food and other resources, the Nuxalk historically employed different types of dugout canoes, including a long, narrow river canoe and four types of sea-going canoes. Sometimes they used sails for these canoes, and paddles were often made from red alder. Snowshoes of two main designs were used for winter hunting. A variety of containers, especially cedarwood bent boxes and cedarbark baskets, were used to transport and store the foods they relied on. In recent times these have given way to burlap sacks, metal pots, and glass jars, and more recently plastic buckets, plastic bags and useable salvage.

Demographic characteristics

Population estimates vary for the Nuxalk, with pre-contact numbers around 2 000 or possibly more (McIlwraith, 1948). Diseases, such as smallpox, took a heavy toll on all First Nations communities in the region, and Boyd (1990) noted that the smallpox epidemic of 1836–1837 caused a 46 percent loss for the Nuxalk, with their population falling from 1 940 to 1 056 in a single year. The population has increased, however, and in 2000, there were approximately 1 200 Nuxalk Band members, of whom around 980 lived in the Bella Coola Valley. During the research period in the 1980s, there were 675 residents in 125 households on the Bella Coola Reserve, with another 200 members living in the valley or in urban areas of the province.

During the study period, census data revealed that about half of the adult population attained a Grade 9 education, and unemployment was at about 20 percent, with an average family income at about half that of the provincial average, typical of First Nation communities at the time. An average of 5.3 persons occupied homes, many of which had only two rooms. Two food stores operated in the community that provided an array of market food, but with limited fresh food availability (dependent on season and time of the week). There was a once-weekly delivery of food supplied to the Co-op food store overland on an unpaved road from Williams Lake (500 km distant), and minor supplies of fresh beef, chicken, milk and eggs and some produce from valley farmers (Kuhnlein, 1984).

A community health centre has been maintained on the reserve, including services for Elders, pregnant women, infants and toddlers and diabetics. A hospital in the Bella Coola community has a staff of three physicians, several nurses and a diagnostic laboratory.

Nuxalk culture

The household is the prime unit of the Nuxalk social structure. Traditionally, high-ranking individuals maintained their position and status through generosity to their family members; the more they were able to provide for their family, the larger the extended family group they attracted to their household. A high position carried with it the responsibility of sharing and distributing resources. The social organization of the Nuxalk is based to some extent on the region of origin

of one's lineage. People strongly identified with their ancestral villages, which were founded by one or more mythical ancestors, as described by McIlwraith (1948). Each lineage claimed its own private origin stories, considered private property, which were validated and perpetuated by ceremonial enactments during the winter dance season. These traditions are still maintained to some degree, although the amalgamation of the villages along with subsequent lifestyle changes have resulted in an erosion of cultural traditions, particularly by the 1970s. However, some of these are being renewed and revived today.

General ethnographic references for the Nuxalk (formerly known as Bella Coola) include Boas (1898), McIlwraith (1948), and Kennedy and Bouchard (1990). Smith (1928) and Edwards (1980) provide information specifically on Nuxalk medicines, and Turner (1973, 1995) describes Nuxalk ethnobotany. A detailed article by Edwards (1979) describes a traditionally important root vegetable, springbank clover, now little used anywhere on the coast (Turner and Kuhnlein, 1982).

General description of the Nuxalk food system and health

The dietary intake of the Nuxalk follows the general trend for Indigenous Peoples of Canada. The approach of Canadian Indigenous Peoples towards their traditional food is as relevant for the Nuxalk as for others:

> The traditional diet consisted mainly of meat or fish supplemented by berries, wild greens, roots, bulbs, nuts and seeds. As long as supplies were plentiful, people were able to maintain a healthy diet. The native people learned, through experience, to select those foods in proper amounts to supply the body with the nutrients it needs. Respect for the land, and the food it provided, led to the wise use of animals, fish and plants. Very little was wasted. Food was considered sacred.
>
> *(Health and Welfare Canada, 1985, p. 7)*

As noted previously, the Nuxalk traditional food system is a healthy one. When local foods were the only dietary source for sustenance and survival, the food system required physical work and a great deal of skill and knowledge applied at all stages of food production, from harvesting to processing, storage and serving. Traditionally, Nuxalk families moved from location to location throughout their traditional territory over the course of the seasons to harvest and process different food as it became available. The harvested food was carefully preserved – usually by dehydration, but also by smoking, and in some cases fermenting or storing fresh in cache pits and containers. This lifestyle kept people active and fit, as they often travelled long distances by foot or canoe, working outdoors, particularly during the growing season. Winters were more sedentary, but people remained active with household activities, special ceremonies and social activities.

During the period of this study, the generally recognized health problems with nutritional implications were alcoholism, poor dental health, obesity, diabetes and those associated with high-risk infants. Before the initiation of this study, there were no reports of dietary intake or adequacy for the Nuxalk.

As well as the ethnographic and ethnobotanical references mentioned previously, a number of publications relating to Nuxalk foods and nutrition resulting, in whole or in part, from the Nuxalk food and Nutrition Program, provide information on specific Nuxalk foods, and are cited in the references: Kuhnlein (1989b, 1990); Kuhnlein, Turner and Kluckner (1982); Kuhnlein and Turner (1986); Turner and Kuhnlein (1982, 1983); Turner *et al.* (1992). A description of traditional and contemporary Nuxalk foods was reported in Kuhnlein (1984). The two community books (Nuxalk Food and Nutrition Program Staff 1984, 1985) also provide important information on Nuxalk food. Lepofsky, Turner and Kuhnlein (1985) provide specific habitat information for 42 plant species, including harvesting efficiency tests for 14 of the 20 most readily available species. Two more general publications that incorporate Nuxalk food are Kuhnlein and Turner's *Traditional Plant Foods of Canadian Indigenous Peoples* (1991) and Turner's *Food Plants of Coastal First Peoples* (1995). Other articles by Kuhnlein (1984, 1989a, 1992) and Kuhnlein and colleagues (Barr and Kuhnlein, 1985; Kuhnlein and Moody, 1989; Kuhnlein and Burgess, 1997) discuss how the Nuxalk diet has changed over time.

Methodology

The Nuxalk Nation Council approved and encouraged the Nuxalk Food and Nutrition Program from its inception. The protocols for interviewing, recording, photography and health assessments followed the dual approval requirements of the University of British Columbia's ethics regulations and those established for the work by the Nuxalk Nation in consultation with the researchers. The programme serves, even 25 years later, as a model for community-based collaborative research, one on which much of the subsequent research from CINE, and its Indigenous Peoples' Food Systems for Health Program, is based.

A number of methods for collecting and analysing data were applied for different aspects of the research:

1. Community Interviews on Food Use, Dietary Intake and Change: Elders' meetings (1980–1982), family interviews (1981, 1985) and grandmother-mother-daughter interviews (1982 to 1983).
2. Food Availability Assessment (1982).
3. Traditional Food Nutritional Quality Assessments (1980–1986).
4. Health Status Assessments (1983, 1986).
5. Health Promotion Activities (1983–1986): Use of traditional Nuxalk foods, use of available marketed foods of good quality, enhancing healthful lifestyle habits and educational programmes.
6. Revisiting the Nuxalk Food and Nutrition Program (2006).

Community interviews on food use, dietary intake and change

The initial requirements of the programme were to establish foods the Nuxalk used in the past, those which current residents still have a working knowledge, and how people's diets have changed over the years. Information from existing literature (McIlwraith, 1948; Turner, 1973) needed elaboration and confirmation through interviews with contemporary Nuxalk community members. From 1980 to 1982, in a series of meetings organized by the research team, Elders were consulted about what traditional foods they had eaten, which foods were considered to be important, which were still being used, and how these foods were traditionally harvested, processed and prepared. The format enabled discussions and comparisons among Elders, as well as helped to directly inform younger community members about Nuxalk food traditions. Meetings were informal and social occasions, and were usually accompanied by serving traditional food.

In 1981, two community residents interviewed Nuxalk households, both on their reserve and in urban centres, about overall dietary intake and food use. Family members (mainly women) who actually did the food shopping and cooking were asked about their use of traditional foods in general, as well as what foods, store-bought and traditional, were eaten on the day of the interview. Analyses of the diet reports were compared to Canadian Recommended Nutrient Intakes at the time (Kuhnlein, 1984). Frequency and quantity of traditional foods were also asked about during the 1981 survey, and repeated in 1985 (Kuhnlein and Moody, 1989).

In 1982–1983, an interview study intended to track and document dietary change and food-use frequency was conducted with grandmothers, mothers and daughters of the same families living on the Nuxalk reserve. In 1983 and 1985, interviews on dietary intake were undertaken as part of the health assessment process.

Food-availability assessments

In 1982, an ecological study with Nuxalk student assistants evaluated the availability of traditional Nuxalk plant foods within the traditional territory as well as people's accessibility to berries and other traditional food resources, including fish and game. Forty-two plant species were included in the study, and standard ecological survey techniques were applied in measuring their abundance, frequency and cover. Twelve cover-types based on the type of vegetation predominating were identified and, within each, randomly placed quadrats were used to facilitate estimates of cover for various species (Lepofsky, Turner and Kuhnlein, 1985). In addition, harvesting efficiency data were gathered for several of the plant foods; the time required to harvest 250 ml of food by one person, and the area

needed to collect this amount, were recorded, as well as the traditional harvesting sites and seasons for each type of food.

Traditional food nutrient composition

Throughout the programme, nutrient analyses were undertaken on traditional Nuxalk foods to determine key nutrients, which could then be matched with dietary intake information to determine any risks or deficiencies that people might be incurring. Standard practices for sample collection and nutrient analysis were applied (Kuhnlein, 1986). Several Nuxalk salmon and ooligan grease preparations were described and analysed (Kennelly, 1986; Kuhnlein *et al.*, 1982; Kuhnlein *et al.*, 1996). Wild berries and wild greens, as well as some of the root vegetables, were also analysed (Kuhnlein, Turner and Kluckner, 1982; Turner and Kuhnlein, 1983; Kuhnlein and Turner, 1987; Kuhnlein, 1989b).

Health status assessments

In May 1983, the programme ran a health assessment clinic, which was free to all Nuxalk Band members and relatives. In total, 370 people – from infants to Elders – took advantage of the clinic, with sessions of approximately one hour that included several measurements. Interviews were made on diet and physical activity, general fitness level assessed by riding a stationary bicycle and skinfold thickness, blood pressure, and examinations for dental health, hearing and vision. Height and weight measurements were found, using a stadiometer and beam balance, and body mass index (BMI) was calculated as kg/m^2.

Approximately 30 ml of non-fasting venous blood from 199 Nuxalk participants (teens ≥13 years and adults) was portioned, frozen, shipped to the laboratory and frozen at -70° C until analysis, which was within three months of collection. Successful analysis of all measures was completed for 187 samples. Serum ferritin was determined using an ELISA assay (New England Immunology Associates, Cambridge MA). Hemoglobin and hematocrit were measured in the Nuxalk clinic prior to shipment using the cyanomethaemoblobin and electronic reading and centrifugation in capillary tubes. Red cell folate (RBC folate) was determined by microbiological assay using L. *casei*, with ascorbate as preservative. Plasma retinol and carotene were determined by a micromethod, and carotene was determined to reflect dietary sources of provitamin A and antioxidant protection. Serum cholesterol and HDL cholesterol were determined with enzymatic procedures (Barr and Kuhnlein, 1985). The Statistical Package for the Social Sciences (SPSS) was used for Pearson correlation analysis and partial correlations of BMI and HDL cholesterol (Kuhnlein and Burgess, 1997; Barr and Kuhnlein, 1985).

In 1986, follow-up assessments of many of these measures took place to determine impact of the health promotion activities. This report emphasizes anthropometry and blood results from the pre-intervention assessments; a following publication will report the health promotion intervention activities led by Nuxalk health staff, Elders and Council, and evaluation of the programme.

Revisiting the Nuxalk Food and Nutrition Program

In July 2006, the community and several original programme participants were revisited, with discussion including many of the original Nuxalk participants. The objective of discussions with Elders and leaders was to obtain information on the use of key traditional foods 20 years following the programme, and to document elements of the project on film.

Results and discussion

Community interviews on food use, dietary intake and change

The Elders' meetings and household interviews yielded important baseline information on which the main programme was based. They provided an extensive list of traditional foods being used, many which were noted in the literature reviewed earlier, and which became the focus of the research. These foods included all types

of salmon and salmon roe, steelhead, trout, cod, herring, ooligans, sea urchins, crab, clams, seal, abalone, sea cucumbers and mussels. Game animals included moose, duck, grouse, mountain goat, deer and rabbit. Tree foods used were cottonwood inner-bark, hemlock inner-bark and crabapples. Many kinds of berries were used, plus rose hips, silverweed roots, clover roots, cow-parsnip, seaweed, young stinging nettles, and the shoots of fireweed, thimbleberry and salmonberry. Labrador tea and salmonberry bark tea were also used (Nuxalk Food and Nutrition Program Staff, 1985).

Table 2.1 lists 67 species of foods known and used traditionally by the Nuxalk. It is derived from earlier ethnographies and from key informant interviews conducted with Elders during 1980–1984. It presents the scientific names, common names, local names in linguistic terminology, season of use, food preparation and an appreciation score. Seasonality and appreciation scores are from Kuhnlein (1992).

Interviews determined that all household members of the Nuxalk community took most of their dietary energy from store-bought food, and that, except for fish, very little traditional food was being consumed (cf. Kuhnlein, 1984). The Nuxalk families on the reserve were much more likely to use traditional food than those off the reserve. All on-reserve families interviewed used fish, and their use was five times more than that of the city families; on-reserve families (average household size of 5.3 individuals) consumed an average of 428 pounds of salmon and an additional 150 pounds of other fish and shellfish during the 1981 survey year. Of other traditional food, 65 percent of on-reserve families and 57 percent of off-reserve families used berries, 46 percent of on-reserve families and 21 percent of off-reserve families used game foods, and 35 percent of on-reserve and 29 percent of off-reserve families used other traditional foods (Nuxalk Food and Nutrition Program Staff, 1985). Only 51 percent of the on-reserve adults interviewed and 31 percent of the off-reserve adults had eaten fruit or juice on the day of the interview and, other than potatoes, only 39 percent of on-reserve adults and 56 percent of city adults had eaten vegetables.

In general, reserve families were consuming limited amounts of iron, vitamin A and folic acid, as well as low calcium, vitamin E, vitamin D, vitamin C and fibre (Kuhnlein, 1984; Kuhnlein and Moody, 1989). In contrast, intakes of phosphorus and sodium were high and exceeded recommended balance with calcium and potassium. Women in their childbearing years and pregnant women were seen to be particularly at risk. The identified foods that could provide these nutrients included fruits and vegetables (vitamin C, A, E and folic acid) and ooligan grease (vitamins A and E). Preserved salmon and other fish with bone and skin were recommended foods containing calcium, while meat, fish and shellfish were obvious sources of iron. At the time of the interviews, diabetes was emerging in this population, but this research study had not yet identified it as a major health problem. Locally available and cost-efficient foods could supply all of the nutrients that were seen as sufficient, and could provide people with a complete and healthy diet (Nuxalk Food and Nutrition Program Staff, 1985).

Fifty-four foods were discussed in the grandmother, mother and daughter interviews, including game, fish, shellfish, teas, berries, roots and greens. Of these, 34 species (mostly fish and seafood, berries and some game) were still being used by women of all three generations, but there was a general decline over time in frequency of use, as well as in the total numbers of foods being used. Of all the foods, several fish species accessed from the Bella Coola River were maintained as those most frequently harvested and used, and most highly appreciated for taste appeal. Decline in use of traditional food took place in the early twentieth century, as indicated by the frequency of use of each traditional food across the three generations of women. The research also showed that taste appreciation was linked to declining traditional food use, in that when a particular food was not consumed frequently women did not have as high an appreciation of its taste. It also showed not surprisingly that loss of easy access (proximity and time for harvest) to traditional food was a factor in its declining use. Factors influencing this change were noted as legislation restricting use of traditional food increasing pressure on local resources by increasing population, availability of new foods – and acceptability of these – by gardening and food markets; employment

Table 2.1 Nuxalk traditional food *(67 species)*

	Scientific name	*English / common name*	*Local name*	*Seasonality*	*Preparation*	*Appreciation Women*[1] *Score 1 – 5*[2] *(5 = highest)*
	Fish and seafood					
1	*Clupea pallasi*	Herring and roe	klkl;at	February–April	Boiled, canned, pickled	4.4
2	*Haliotis* spp.	Abalone	plxani	January–December	Fried, canned	4.1
3	*Mytilus edulis*	Mussels, blue	smiks	January–December	Steamed, fried, baked	3.8
4	*Neptunes* sp.	Crab	k'inacw	January–December	Steamed, boiled, smoked	4.5
5	*Ophiodon elongatus*	Ling cod	nalhm	January–December	Deep fried, smoked	3.9
6	*Oncorhynchus gorbuscha*	Hump salmon (pink)	kap'y	June–July	Dried, poached, barbequed, sluq	3.6
7	*Oncorhynchus keta*	Chum salmon (dog)	t'li	July–September	Canned, salted, smoked	3.7
8	*Oncorhynchus kisutch*	Coho salmon (silver)	ways	August–October	K'num, sluq, boiled, fried, baked, smoked	4.1
9	*Oncorhynchus nerka*	Sockeye salmon	samlh	June–July	Steak, canned, barbequed	4.5
10	*Oncorhynchus tshawytscha*	Spring salmon (Chinook)	amlh	April–June	Dried, baked, smoked, canned	4.3
11	*Parastichopus californicus*	Sea cucumber	7lats	January–December	Pickled, boiled	4.0
12	*Phoca* sp.	Seal, hair	ascw	January–December	Boiled, baked	3.4
13	*Platichthys stellatus*	Flounder, starry	pays, nukakals	January–December	Baked, boiled, smoked, fried, salted	3.6
14	*Salmo gairdneri*	Steelhead	k'lat	October–April	Smoked, baked, boiled, fried, salted	4.1
15	*Salmo* sp.	Trout	tutup	January–December	Baked, boiled, fried, smoked, salted	3.8
16	*Sebastes ruberrimus*	Red cod, snapper	lc7iixw	January–December	Fried, baked	4.0
17	Several genera	Clams	ts'ikwa	May–February	Fresh, fried, steamed, cooked, boiled	4.1
18	*Strongylocentrotus* sp.	Sea urchin	mtm	October–January	Raw, dried	4.2
19	*Thaleichthys pacificus*	Ooligan, Eulachon	sputc	March–April	Baked, boiled, fried, grease	4.2
	Game					
1	*Alces alces*	Moose	skma	September–December	Roasted, smoked, dried, canned	3.9
2	*Anas* sp.	Duck	naxnx	September–December	Smoked, dried, steamed	4.1
3	*Canachites* spp.	Grouse (ruffed) (blue)	takws, ,mucwmukwt	September–December	Smoked, dried, steamed	3.7
4	*Odocoileus* spp.	Deer	scwpanilh	September–February	Smoked, dried, steamed	4.3
5	*Oreamnos americanus*	Mountain goat	yaki, qwwaax	September–February	Smoked, dried, steamed	4.1
6	*Sylvilagus* sp.	Rabbit	qax	January–December	Fried, baked, steamed, cooked	3.8
	Berries					
1	*Amelanchier alnifolia*	Saskatoon berry	sq'sk	August–September	Dried, jam	3.9
2	*Arctostaphylos uva-ursi*	Kinnikinnick berry	milicw	July–September	Dried, cooked	3.5
3	*Cornus canadensis*	Bunchberry	p'xwlht	June–August	Jam	3.7
4	*Crataegus douglasii*	Black hawthorn	q'ay	July–August	Boiled, jam	3.6
5	*Empetrum nigrum*	Crowberry	–	July–August	Jam	–
6	*Fragaria vesca, F. virginiana*	Wild strawberry	qululuuxu	June–July	Fresh	4.2
7	*Ribes bracteosum*	Stink currant	q'is	July–August	Fresh, frozen, jam	4.0
8	*Ribes divaricatum*	Wild black gooseberry	atl'anulh	June–August	Fresh, jam	3.6
9	*Ribes divaricatum*	Wild green gooseberry and leaves	atl'anulh	June–August	Cooked	3.6

Continued

Table 2.1 *(continued)* **Nuxalk traditional food** *(67 species)*

	Scientific name	English / common name	Local name	Seasonality	Preparation	Appreciation Women[1] Score 1 – 5[2] (5 = highest)
10	*Ribes lacustre*	Swamp gooseberry	mnmntsa	June–August	Fresh, dried	3.5
11	*Ribes laxiflorum*	Wild blue currant	ts'ipscili	June–August	Fresh, cooked	3.8
12	*Ribes parviflorus*	Thimbleberry	snutatiiqw/sxtsi	June–August	Fresh, dried, jam	4.0
13	*Rosa nutkana*	Rosehip	skupik	August–October	Fresh, dried for tea, jam	3.6
14	*Rubus idaeus*	Wild raspberry	qalhqa	June–July	Fresh, dried, jam	4.3
15	*Rubus leucodermis*	Blackcap raspberry	usukw'ltlh	June–August	Fresh, dried, jam	4.5
16	*Rubus spectabilis*	Salmonberry	qaax	February–April	Fresh, dried, jam	4.3
17	*Sambucus racemosa*	Red elderberry	k'ipt	July–September	Fresh, cooked, jam	3.6
18	*Shepherdia canadensis*	Soapberry	nuxwski	July–September	Dried, canned, fresh	4.2
19	*Vaccinium alaskense*	Watery blueberry	snuqlxlayk	July–September	Fresh, dried, jam	4.1
20	*Vaccinium membranaceum*	Mountain bilberry	sqaluts	June–August	Fresh, dried, jam	4.3
21	*Vaccinium ovalifolium*	Oval-leaved blueberry	spuuxaltswa	June–August	Fresh, dried, jam	4.1
22	*Vaccinium parvifolium*	Red huckleberry	sqala	July–August	Fresh, dried, jam	4.1
23	*Vaccinium uliginosum*	Bog blueberry	–	July–August	Fresh, dried, jam	–
24	*Viburnum edule*	Highbush cranberry	st'ls	July–October	Cooked	3.9
	Greens, roots and other plants					
1	*Chenopodium album*	Lambsquarters	ts'icts'ikmlhp	February–April	Raw, steamed	4.0
2	*Dryopteris expansa*	Spiny wood fern	sqw'alm	September–February	Cooked	4.3
3	*Epilobium angustifolium*	Fireweed shoots	ts'ayxlhp	March–May	Peeled shoots, raw	4.0
4	*Fritillaria camschatcensis*	Rice roots	ilk	September–February	Boiled, mashed	3.8
5	*Heracleum lanatum*	Cow parsnip stems	xwiq'	February–April	Raw, peeled stems	3.6
6	*Ledum groenlandicum*	Labrador tea leaves	pu7yaas	October–February	Boiled for tea	4.0
7	*Lupinus nootkatensis*	Lupine root	q'akwtsnk	–	Cooked	–
8	*Populus balsamifera* spp. *trichocarpa*	Black cottonwood	aq'miixalhp	June–July	Raw scraped inner bark	4.3
9	*Polypodium glycyrrhiza*	Licorice fern root	k'tsaatsay	–	Raw	3.8
10	*Porphyra abbottiae* *Porphyra perforate*	Seaweed (laver)	ihaq's	January–December	Dried, cooked	4.4
11	*Potentilla pacifica*	Silverweed root	uq'al	October–February	Cooked	4.2
12	*Pteridium aquilinum*	Bracken fern	sacsakwmlhpnk	–	Cooked	3.5
13	*Pyrus fusca*	Pacific crabapple	p'c	September–October	Cooked	3.8
14	*Rubus parviflorus*	Thimbleberry shoots	sxtsi	February–April	Raw, peeled shoots, tea	4.0
15	*Rubus spectabilis*	Salmonberry shoots	qaxalxlhpsxts'	February–April	Raw, peeled shoots, tea	4.0
16	*Rumex acetosella*	Sheep sorrel	yumyumalcwlhp	February–April	Raw, cooked	3.7
17	*Trifolium wormskioldii*	Springbank clover rhizomes	t'xwsus	October–March	Cooked	4.3
18	*Urtica dioica*	Stinging nettle	tsna	February–April	Boiled	3.9

[1] Total number of women in the study was 61.
[2] Taste scores were recorded by women who used the foods (i.e. use frequency >1).
– No data.

and concerns for time, money and personal energy for harvesting and preparation activities; and interruption of knowledge transfer to younger generations about food harvest and use (Kuhnlein, 1989a, 1992).

These interviews showed that there was a marked change in the foods used by Nuxalk women and families over the three generations. The grandmother generation remembered using a number of foods but, as of 1983, many of them were rarely or no longer being eaten by their daughters and granddaughters. These included: gray currants and trailing currants, red elderberries, highbush cranberries, salal berries, wild gooseberries, bunchberries, wild crabapples, cottonwood inner bark, hemlock inner bark, clover roots, silverweed roots, salmonberry shoots, herring sea urchin, abalone, mussels, seal, mountain goat and rabbit. Grandmothers remembered liking all foods that they had eaten in former times. Foods still being used by the younger generations included all the salmon, steelhead, trout, herring, ooligans, cod species, salmon eggs, crab, clams, some of the berries (e.g. blackcaps, wild raspberries, salmonberries, soapberries), thimbleberry shoots, seaweed, Labrador tea, cow-parsnip, deer, moose, duck and grouse.

Nuxalk foods were harvested throughout the year, and each month produced important components of the diet, although most of the plant foods in particular were harvested in the spring, summer or autumn. Many of the fish and shellfish, including steelhead, trout, ling cod, flounder, mussels, sea urchin and crabs, were available during the winter months, and some of these could be harvested year-round. The herring spawning and ooligan spawning season marked the times when herring roe and ooligans could be obtained, and this was generally in early spring, around February and March. The greens – nettles, cow parsnip, fireweed and thimbleberry and salmonberry shoots – are tender and good to eat only for a few weeks in the spring, and seaweed, obtained from the Heiltsuk on the outer coast, was harvested usually in the month of May. From May onwards, the berries ripen in succession: salmonberries, wild strawberries, red elderberries, huckleberries and blueberries, currants and gooseberries, thimbleberries, raspberries and blackcaps, and finally, in late summer and autumn, wild crabapples and highbush cranberries. The salmon species each have their spawning season. In July, for example, people netted the last runs of spring salmon, as well as pink (hump) salmon, sockeye salmon and dog salmon. Dog salmon and coho salmon predominate in the autumn. Root vegetables were generally harvested in the autumn, after the leaves started to die back but while they were still visible; they could also be harvested through the winter until they start to sprout in spring. In earlier days, entire families would travel to harvesting locations within their territories to take advantage of the different resources as they became ready. Often the men hunted and fished, while the women picked berries and other plant foods, and processed the food for winter.

The traditional ways of preserving food included: dehydrating (in the sun or over a fire) for berries, salmon, halibut and some other food; smoking (for some of the salmon and salmon eggs, clams and some meat); storing in cedarwood boxes under water or in ooligan grease (e.g. crabapples and highbush cranberries); and fermenting (used for some salmon roe). Cedarwood frames were used to support a surface layer of skunk cabbage leaves or other large leaves, and the berries were mashed, cooked to a jam-like consistency and dried in large cakes, first on one side and then turned over and dried on the other. Dried berry cakes could be rolled up and stored in openwork baskets or in cedarwood boxes in a dry place, and, to use, were simply reconstituted in water overnight. After sugar was introduced in the late-ninetenth century, many people learned to prepare jam and jelly from wild berries. Canning and jarring technologies allowed people to store many types of food more conveniently. Many people started partially smoking their fish and then jarring it. Finally, during the 1950s home freezers were introduced and first used, often with vacuum packing, to retain the maximum freshness for fish and seafood, as well for berries and other foods. Some people debone their salmon and make it into patties, then jar it with their own homemade salsa; others marinate salmon with demerara sugar and salt before barbecuing or adding other flavourings. Of all the types of traditional food, as of 2006, salmon was still the most popular in Nuxalk households.

Shortages and lack of accessibility to some traditional Nuxalk foods meant that fewer were being used regularly, but most were still remembered in the community and there was interest in them among the current generations of youth and young adults. The inner bark of trees and root vegetables were traditional plant foods scarcely used.

Food availability assessments

The results of the 1983–1984 ecological study on food availability and accessibility showed that all of the salmon species, steelhead and ooligan were still available and could be harvested in the Bella Coola River. Other fish (e.g. cod, flounder and halibut) and shellfish were available on a more limited scale, mostly brought home by Nuxalk fishers from the outer coast. Herring eggs and seaweed, brought in from Bella Bella on the outer coast area, were sometimes in limited supply. Game, including deer and moose, were still used, but mountain goat and duck were little used, and game in general were seen to have become scarcer than in previous times. Plant foods still readily available included some fruits (Pacific crabapple, Saskatoon berries, wild gooseberries, rose hips, wild raspberries, thimbleberries, salmonberries, red elderberries, oval-leaved blueberries, highbush cranberries, bunchberries); inner bark (black cottonwood, western hemlock); greens (fireweed, cow-parsnip); root vegetables (springbank clover, Pacific silverweed); and Labrador tea (Nuxalk Food and Nutrition Program Staff, 1984; Kuhnlein, 1989a, 1989b; Kuhnlein *et al.*, 1982; Lepofsky, 1985; Lepofsky, Turner and Kuhnlein, 1985).

At least 18 plant foods of a total of 42 were identified that were readily available to the Nuxalk within the Bella Coola area. These included several types of berries, greens, and root vegetables, as well as the trees from which the inner bark can be harvested. It was noted that the berries were harder to find because many of the places where people used to pick them (blueberries, huckleberries, gray currants and others) have grown over and, although the bushes still grew there, the berries tended to be small and unproductive. The fish and shellfish available in the 1980s included all the salmon, steelhead, ooligans, as well as the shellfish, cod, flounder, and halibut. Of game foods, deer and moose were the most commonly used, with mountain goat and duck hunted rarely, and seal was infrequently used (Lepofsky, Turner and Kuhnlein, 1985).

Traditional food nutrient composition

Analysis of ooligan grease (Kuhnlein, Turner and Kluckner, 1982; Kuhnlein *et al.*, 1996) showed that this culturally valued product contained more vitamin A and vitamin E than other fats commonly used for cooking on the reserve. It was also noted that it contained a good balance of fats, with about 65 percent monounsaturated fat, 33 percent saturated fat, and the rest polyunsaturated fat, as well as meaningful amounts of protein, calcium, and vitamin K. Ooligan grease was also documented to contain several organochlorine contaminants (Chan *et al.*, 1996). Of the berries, thimbleberries and salal berries had higher vitamin C and calcium than store-bought strawberries and blueberries. Salmonberries and soapberries were good sources of calcium, with salmonberries being found to be a source of carotene (Nuxalk Food and Nutrition Program Staff, 1984; see also Kuhnlein, 1989b, 1990). Most analyses included levels of protein, fat, total calories, and dietary fibre, as well as selected minerals and vitamins. Nutrients from traditional plant foods are summarized in the appendices in Kuhnlein and Turner (1991). Table 2.2 shows selected nutrient composition data for Nuxalk food.

The nutrient analyses from the programme confirmed that the traditional Nuxalk foods provided the full complement of nutrients required for good health. Table 2.3 summarizes key nutrients, including micronutrients, and traditional foods and food groups known to provide them.

Health status assessments

The 1983 assessment results showed several health measures influenced by nutrition. Table 2.4 demonstrates that women aged 20 to 60, in particular, and some younger men, were iron deficient. In addition, many

Table 2.2 **Nutrient composition of Nuxalk traditional foods** *(per 100 g of edible portion)*

Food items	*Moisture* g		*Energy* kJ	*Protein* g	*Fat* g	*CHO* g	*Fiber* g	*Ash* g	*SAFA* g	*MUFA* g	*PUFA* g	*Retinol* µg	*ß Carotene* µg
Fish and Seafood													
Abalone, flour coated, fried[a]	60.1	148	619	19.6	2.8	11.1	0	1.8	1.7	2.7	1.5	2	0
Abalone, raw[a]	74.6	100	418	17.1	0.8	6	0	1.6	0.15	0.11	0.1	2	0
Blue mussels, raw[a]	80.6	82	343	11.9	2.2	3.7	–	1.6	0.43	0.51	0.61	48	0
Blue mussels, steamed, boiled[a]	61.2	165	690	23.8	4.5	7.4	0	3.2	0.85	1.01	1.21	91	1
Chum salmon (dog), poached[b]	70.6	113	472	22.3	2.6	0	0	2	0.7	0.92	0.88	5	0
Chum salmon (dog), raw[b]	73.3	126	527	23.1	3.7	0	0	1.3	0.94	1.3	1.3	30	0
Clams, boiled, steamed[a]	63.6	101	422	15.6	2	5.1	0	3.7	0.19	0.17	0.55	171	0
Clams, raw[a]	81.8	71	297	12.8	1	2.6	0	1.9	0.094	0.08	0.28	90	0
Coho salmon (silver), K'num[b]	45	267	1 116	29	11	13	–	2	–	–	–	103	–
Coho salmon (silver), fillet, raw[b]	75	105	439	23	1	1	–	2	–	–	–	67	–
Coho salmon (silver), raw[b]	65	172	719	18	8	7	–	1	–	–	–	26	–
Coho, salmon (silver), Sluq[b]	26	295	1 233	60	3	7	–	7	–	–	–	74	–
Crab, raw[a]	79.6	79	330	18.3	0.6	0		1.8	0.09	0.08	0.13	7	1
Flounder, baked[a]	73.2	110	460	24.2	1.5	0	0	1.5	0.36	0.28	0.65	13	0
Flounder, raw[a]	79.1	86	359	18.8	1.2	0	0	1.2	0.28	0.23	0.33	10	0
Herring roe, raw[a]	81.2	74	309	9.6	1.9	4.5	–	2.8	0.43	0.42	0.71	–	–
Hump salmon (pink), poached[b]	69.2	144	602	24.1	5.3	0	0	1.5	1.3	1.9	1.8	21	0
Hump salmon (pink), raw[b]	71.5	142	594	20.4	6.7	0	0	1.4	1.7	2.4	2.3	35	0
Ooligan, dried[c]	69.6	197	823	–	15.5		–	–	–	–	–	2 021	–
Ooligan, grease[c]	1.4	882	3 687	–	98	–	–	–	19	36	–	2 400	–
Ooligan, raw[c]	72.2	140	585	–	16.7	–	–	–	–	–	–	3 196	–
Ooligan, smoked[c]	59.2	882	3 687	–	21.9	–	–	–	27.1	54.8	–	4 439	–
Red cod snapper, baked[a]	70.4	121	506	26.3	1.7	0	0	1.4	0.37	0.32	0.59	35	0
Red cod snapper, raw[a]	76.9	94	393	20.5	1.3	0	0	1.3	0.29	0.25	0.46	30	0
Sockeye salmon, BBQ, canned[b]	55	208	869	28	8	6	–	3	–	–	–	146	–
Sockeye salmon, BBQ[b]	60	173	723	28	5	4	–	3	–	–	–	120	–
Sockeye salmon, canned[b]	66	158	660	20	6	6	–	3	–	–	–	70	–
Sockeye salmon, raw[b]	70	137	573	20	5	3	–	2	–	–	–	50	–
Spring chinook (King), baked[b]	65.6	223	932	25.7	13.4	0	0	1.8	3.2	5.74	2.66	149	0
Spring chinook (King), raw[b]	71.6	173	723	19.9	10.4	0	0	1.3	3.1	4.4	2.8	136	0
Spring chinook (King), smoked[b]	72	112	468	18.3	4.3	0	0	2.6	0.93	2	1	26	0
Trout, baked[a]	63.4	183	765	26.6	8.5	0	0	1.5	1.5	4.2	1.9	19	0
Trout, raw[a]	71.4	143	598	20.8	6.6	0	0	1.2	1.15	3.25	1.5	17	0
Game													
Deer[a]	75	111	464	21.5	2.7	0.2	–	0.6	0.63	0.34	0.35	–	–
Duck, flesh, skin, raw[a]	66.5	206	861	17.4	15.2	0	0	1.2	5.04	6.8	2.02	26	1
Moose, cooked[a]	61	152	635	35	1.3	0	0	0.6	0.29	0.2	0.31	0	0
Moose, raw[a]	73	115	481	22	3	0	0	0.7	0.22	0.15	0.24	2	0
Rabbit, cooked[a]	67.5	135	564	29	2.1	0	0	1	2	1.1	1.3	0	0
Rabbit, raw[a]	75.5	96	401	21.5	1.1	0	0	1.1	0.5	0.2	0.2	0	0

Vitamin A RE_µg	Vitamin A RAE_µg	Thiamine mg	Riboflavin mg	Niacin (NE) mg	Folic Acid (DFE) µg	Folate µg	Vitamin B_{12} µg	Zinc mg	Iron mg	Calcium mg	Phosphorous mg	Sodium mg	Magnesium mg	Copper µg	Manganese mg	Selenium µg
2	2	0.22	0.13	5.6	20	5	0.69	0.95	3.8	37	217	591	56	228	0.07	51.8
2	2	0.19	0.1	4.7	5	5	0.73	0.82	3.2	31	190	301	48	196	0.04	44.8
48	48	0.16	0.05	3.8	42	42	12	1.6	4	26	197	286	34	94	3.4	44.8
91	91	0.3	0.42	3.5	76	76	24	2.64	6.7	33	285	369	37	150	6.8	89.6
5	5	0.08	0.1	20.9	4	4	2	0.61	0.7	50	742	79	32	61	0.02	–
30	30	0.09	0.1	15.4	4	4	3.3	0.58	0.7	44	724	93	31	63	0.02	36.5
171	171	0.15	0.43	8.1	29	29	99	2.73	28	92	338	112	18	690	1	64
90	90	0.08	0.213	4.2	16	16	49.4	1.37	14	46	169	56	9	344	0.5	24.3
103	103	0.09	0.29	5.4	15	15	–	1	0.7	128	407	89	42	158	0.05	–
67	67	0.35	0.1	4.1	5	5	–	0.4	0.4	8	250	35	29	271	0.01	–
26	26	0.77	0.22	3.1	6	6	–	0.7	0.6	66	217	53	24	364	0.02	–
74	74	0.05	0.25	11.6	9	9	–	0.9	0.9	21	687	197	84	490	0.07	–
7	7	0.043	0.043	5.4	44	44	9	5.95	0.6	46	219	836	49	920	0.04	36.4
13	13	0.08	0.114	6.7	9	9	2.5	0.63	0.3	18	289	105	58	26	0.02	58.2
10	10	0.09	0.076	6.4	8	8	1.5	0.45	0.36	18	184	81	31	32	0.02	32.7
–	–	0.1	0.12	3.6	–	–	–	–	2.7	19	61	–	–	–	–	–
21	21	0.15	0.1	22.3	4	4	3.5	0.67	0.8	30	779	58	35	90	0.02	–
35	35	0.17	0.1	19.2	4	4	3.2	0.67	0.8	29	754	68	32	80	0.02	–
2 021	2 021	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
2 400	2 400	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
3 196	3 196	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
4 439	4 439	–	–	–	–	–	–	2.2	1.8	405	–	–	–	–	–	–
35	35	0.053	0.004	5.3	6	6	3.5	0.44	0.24	40	201	57	37	46	0.02	49
30	30	0.046	0.003	4.1	5	5	3	0.36	0.18	32	198	64	32	30	0.01	38.2
146	146	0.03	0.43	6.1	7	7	–	1	0.9	70	325	438	33	624	0.07	–
120	120	0.19	0.54	6.4	14	14	–	1.3	1.3	81	361	270	36	1 390	0.07	–
70	70	0.14	0.16	4.6	6	6	–	0.6	0.3	59	238	783	20	166	0.01	–
50	50	0.4	0.28	4.6	7	7	–	0.9	0.8	52	216	58	25	665	0.02	–
149	149	0.044	0.154	14.9	35	35	2.9	0.56	0.9	28	371	60	0.56	53	0.02	46.8
136	136	0.054	0.113	8.4	30	30	1.3	0.44	0.3	26	289	47	95	41	0.02	36.5
26	26	0.023	0.1	8.1	2	2	3.3	0.31	0.85	11	164	784	18	230	0.02	32.4
19	19	0.43	0.42	10.7	15	15	7.5	0.85	1.9	55	314	67	28	240	1.09	16.2
17	17	0.35	0.33	8.4	13	13	7.8	0.66	1.5	43	245	52	22	190	0.85	12.6
–	–	0.2	0.36	10.5	–	–	–	–	2.9	7	–	–	–	–		–
–	–	0.2	0.3	7.3	21	21	0.65	0.77	4.2	5	168	56	20	310	0.02	12.8
26	26	0.35	0.34	11.7	4	4	6.31	7.5	5	5	250	50	30	200	0.02	12.8
0	0	0.05	0.27	9	–	–	–	5	3	6	158	65	33	100	0.02	3
2	2	0.06	0.07	13.6	8	8	6.5	2.8	5.8	33	209	52	28	220	0.04	15.2
0	0	0.02	0.06	11.3	–	–	–	0.5	3.4	33	30	40	3	200	0.01	10

Continued

Table 2.2 *(continued)* **Nutrient composition of Nuxalk traditional foods** *(per 100 g of edible portion)*

Food Items	*Moisture* *g*	*Energy* *kcal*	*kJ*	*Protein* *g*	*Fat* *g*	*CHO* *g*	*Fiber* *g*	*Ash* *g*	*Thiamine* *mg*
Green Roots and other Plants									
Black cottonwood[d]	92	31	130	0.2	0.5	6.3	1.5	0.77	–
Bracken fern[d]	–	–	–	–	–	–	–	–	–
Cow parsnip stems[d]	95	20	84	0.2	0.3	4	0.9	0.51	T
Fireweed shoots[d]	92	30	125	0.3	0.4	6.4	0.8	0.56	–
Labrador tea leaves[d]	42	–	–	–	0.7	–	–	–	0.01
Lambsquarters[d]	88	41	171	3.3	0.6	5.7	1.5	2.3	T
Licorice fern root[d]	70	141	589	0.9	4.6	24	8.2	0.89	–
Lupine root[d]	82	73	305	2	0.4	15.4	7.38	0.78	0.04
Pacific crabapple[d]	79	90	376	1.2	1.6	17.7	6	0.79	0.03
Rice roots[d]	74	102	426	2.9	0.3	21.8	1.9	0.95	0.04
Salmonberry shoots[d]	93	31	130	0.5	0.6	5.8	1	0.28	0.05
Seaweed, laver[d]	10	303	1 267	24.4	1.4	48.2	25	16	–
Sheep sorrel[d]	88	48	201	1.1	0.6	9.6	1.1	0.86	0.02
Silverweed or cinquefoil[d]	66	136	568	3.1	0.6	29.5	9.5	0.9	0.01
Spiny wood fern[d]	68	128	535	2.5	1	27.3	3.7	0.76	–
Springbank clover rhizomes[d]	81	73	305	0.7	0.5	16.5	6.5	1	0.06
Stinging nettle[d]	89	44	184	1.8	0.6	7.9	1.4	1.2	0.08
Thimbleberry shoots[d]	93	28	117	0.6	0.4	5.5	1	0.63	0.01
Wild Berries									
Black hawthorn[e]	84	73	305	0.3	1.4	14.9	2.6	0.68	–
Blackcap raspberry[e]	79	87	364	1.2	1.4	17.5	11.5	0.46	0.01
Bog blueberry[e]	88	51	213	0.7	0.6	10.6	3.3	0.23	–
Bunchberry[e]	81	76	318	0.6	0.8	16.6	5.2	0.5	0.01
Crowberry[e]	89	45	188	0.2	0.7	9.5	5.9	0.71	0
Grey blueberry[e]	87	54	226	1.1	0.5	11.3	3.3	0.23	0
Highbush cranberry[e]	89	42	176	0.1	0.4	9.4	3.8	0.53	–
Kinnikinnick berry[e]	75	102	426	0.7	1.1	22.4	14.8	0.64	–
Mountain bilberry[e]	86	59	247	0.6	0.5	13.1	2	0.14	–
Red elderberry, cooked[e]	78	110	460	2.9	4.8	13.9	8.2	0.73	–
Red elderberry, fresh[e]	78	113	472	1.1	5.6	14.6	9.3	0.94	–
Red huckleberry[e]	87	56	234	0.8	0.5	12	3.9	0.13	0.02
Rosehip[e]	79	82	343	1.6	0.6	17.6	4.4	1.4	–
Salmonberry[e]	88	52	217	1.4	0.8	9.9	2.6	0.16	0.04
Saskatoon berry[e]	76	99	414	0.7	1.2	21.4	6.4	0.65	T
Soapberry[e]	81	80	334	1.8	0.7	16.6	5.3	0.35	0.01
Stink currant[e]	83	70	293	0.8	1.2	13.9	4.4	0.82	–
Swamp gooseberry[e]	86	66	276	1.5	2.3	9.7	3.5	0.9	0.04
Thimbleberry[e]	74	110	460	1.7	1.2	23	11.9	0.62	0.03

Riboflavin mg	*Niacin (NE)* mg	*Vitamin C* mg	*Folic Acid (DFE)* µg	*Zinc* mg	*Iron* mg	*Calcium* mg	*Phosphorous* mg	*Sodium* mg	*Magnesium* mg	*Copper* µg	*Manganese* mg
–	–	–	68.5	0.4	0.3	10	39		8	400	0.07
–	–	–	–	–	–	–	–	–	–	–	
T	0.26	3.5	16.1	0.4	0.2	29	16	0.7	11	100	0.06
–	–	–	–	0.7	0.5	32	31	0.6	20	700	0.18
0.39	92	98	–	2.4	184	215	93	3.7	73	2 400	45.4
0.02	T	70	–	2.3	1.8	246	49	0.8	41	2 300	0.63
–	–	–	–	0.7	4.4	84	37	1.6	53	700	2.62
0.05	T	–	–	0.2	10	31	33	123	78	200	0.53
0.01	1.9	–	–	0.2	0.6	29	33	21.2	28	500	0.33
0.04	0.02	29	36.5	0.7	2.2	10	61	18.4	23	200	0.44
0.02	0.22	7.5	–	0.2	0.3	8	27	2.5	17	100	0.73
–	–	–	–	1.7	2.9	230	474	3 300	623	1 700	1.61
0.12	0.43	33.5	–	1.2	2.3	57	45	2.3	31	1 200	0.92
0.01	2.4	–	–	1.1	3.5	37	109	65	60	1 100	0.84
–	–	–	–	1.5	0.8	56	63	1.4	44	1500	3.19
0.04	0.64	–	–	0.3	4.5	34	38	–	68	300	0.32
0.22	0.27	1.5	–	1.9	1	236	73	0.8	63	1 900	0.74
0.09	0.29	5.9	–	0.4	0.4	24	26	1	29	400	0.17
–	–	9.5	–	0.2	0.5	31	12	6.9	12	300	0.2
0	0.01	6.5	20.9	0.6	0.7	38	40	0.8	28	200	0.3
–	–	–	–	0.3	0.2	19	13	–	8	200	2.7
0.03	0.5	2.1	10.5	0.1	0.6	52	19	0.4	12	100	0.1
0	0.1	16.4	–	0.1	0.4	9	11	2.5	4	1 000	0.4
0	0.4	6.2	7.4	0.2	0.4	16	21	0.9	9	600	1.3
–	–	13.4	–	0.1	0.3	24	23	0.6	11	100	0.1
–	–	–	–	0.5	0.7	37	35	0.5	17	1 300	0.2
–	–	6.6	–	0.1	0.2	14	17	0.4	8	100	2.5
–	–	30.9	–	0.7	1	89	77	1.9	40	500	0.6
–	–	36.7	68.3	0.5	1.1	98	84	1.3	44	800	1
0.01	0.5	6.2	2.8	0.2	0.3	22	16	0.8	7	400	4.5
–	–	414	–	0.2	0.3	77	37	1.8	26	T	0.9
0	0.5	14.4	16.5	0.2	0.6	15	24	2.6	16	500	0.7
0	0.3	10.9	–	0.4	0.5	69	40	0.6	26	400	2.2
0.1	0.2	165.6	–	1.4	0.5	16	21	0.5	8	300	0.2
–	–	27.5	–	0.8	0.8	98	47	1.8	19	700	0.6
T	T	58.2	–	0.2	0.4	68	47	0.6	22	100	0.3
T	T	63.6	–	0.4	0.7	89	62	0.8	44	200	1.8

Continued

Table 2.2 *(continued)* **Nutrient composition of Nuxalk traditional foods** *(per 100 g of edible portion)*

Food Items	*Moisture* g	*Energy* kcal	*Energy* kJ	*Protein* g	*Fat* g	*CHO* g	*Fiber* g	*Ash* g	*Thiamine* mg
Wild Berries *(continued)*									
Watery blueberry[e]	82	74	309	0.9	0.6	16.2	2.8	0.86	0.02
Wild black gooseberry[e]	82	77	322	1.1	1.5	14.7	4.6	0.87	0.02
Wild blue currant[e]	84	65	272	0.7	0.6	14.2	5.2	0.52	0
Wild green gooseberry and leaves[e]	85	65	272	1.7	0.9	12.5	4.3	0.2	0.01
Wild raspberry[e]	83	73	305	0.6	0.8	15.8	4.5	0.34	0.01
Wild strawberry[e]	85	61	255	0.6	0.9	12.5	2.9	0.63	0.01

[a] Canadian Nutrient File, 2005.
[b] Kennelly, A.C. 1986.
[c] Kuhnlein, H.V. *et al.* 1996.
[d] Kuhnlein, H.V. 1990.
[e] Kuhnlein, H.V. 1989.
T Trace value.
– No data.

adults, both male and female, were low in blood folic acid and vitamin A as both retinol and ß-carotene. Of 187 persons evaluated, those at risk for deficiency of retinol, iron (ferritin) and folic acid were 27 percent, 18 percent, and 26 percent, respectively. Deficiencies in these essential nutrients put people at risk of poor vision, unhealthy pregnancy, various infections and poor dental health. As a result of the health assessments, several individuals were referred for dental care, hearing aids and glasses.

Table 2.3 Key nutrient-rich Nuxalk traditional foods

Nutrient	*Sources in traditional diet*
Vitamin A	Wild greens, wild berries (e.g. salmonberries), fish and shellfish
Vitamin D	Fish and shellfish
Vitamin E	Fish and shellfish, especially eulachon grease
Vitamin C	Wild greens, wild berries (e.g. strawberries, huckleberries)
Thiamin (B_1)	Fish and shellfish
Riboflavin (B_2)	Fish and shellfish
Niacin (B_3)	Fish and shellfish, seaweed
Folic acid	Wild greens and wild berries
Calcium	Wild greens, wild berries, hemlock inner bark, fish (cooked with the bones)
Iron	Wild greens (e.g. stinging nettles), wild berries, hemlock inner bark; fish and shellfish
Magnesium	Wild greens, wild berries, fish and shellfish
Carbohydrate	Greens, roots, berries
Fat	Fish and shellfish, particularly eulachon grease; also seal oil, deer fat, bear fat
Protein	Fish, meat and shellfish (e.g. salmon is an excellent source)

Adapted from Nuxalk Food and Nutrition Handbook, 1984, pp. 86-87; see also Kuhnlein, 1980, 1990; Kuhnlein *et al.*, 1982 (ooligan grease); Kuhnlein *et al.*, 1982 (clover and silverweed); Kuhnlein and Turner, 1982; Turner and Kuhnlein, 1982, 1983; Turner *et al.*, 1992.

As shown in Table 2.5, all age and gender categories demonstrated obesity expressed as a proportion of the population exceeding the Nutrition Canada Survey 95th percentile of weight for height (boys and girls) or high body mass index (BMI) (Demirjian, 1980). Adults and teens tended to have poor diets and to develop overweight or obesity, although teens were the most active and fit. Regular physical activity, combined with better diets and less dietary energy, was recognized as the best remedy (Kuhnlein and Moody, 1989; Barr and Kuhnlein, 1985; Nuxalk Food and Nutrition Program Staff, 1984).

As expected, cholesterol levels were positively correlated with age and BMI, and total cholesterol was higher than Caucasian values reported in the Nutrition Canada National Survey of 1975. HDL cholesterol was negatively correlated with BMI, and was not different by gender.

Health promotion activities

Following the 1983 health assessments, efforts were made within the programme to improve traditional

Riboflavin mg	Niacin (NE) mg	Vitamin C mg	Folic Acid (DFE) µg	Zinc mg	Iron mg	Calcium mg	Phosphorous mg	Sodium mg	Magnesium mg	Copper µ g	Manganese mg
0	0.4	3.3	4.9	0.2	0.5	24	21	1	9	300	0.1
0	1	40.2	19.9	0.2	0.7	111	53	0.6	23	400	0.5
T	T	61.5	–	0.4	0.6	51	23	1.8	18	100	1.2
0.01	0.5	12.6	–	0.4	0.9	124	46	1.1	26	400	0.4
0	0.4	30.7	61.8	0.4	0.7	36	38	0.4	17	600	0.4
0.03	T	23.8	–	0.2	0.4	64	35	0.6	54	800	0.8

Note: See original publications for n of samples, sample size and analytical methods.

food use and use of quality market foods. Attention was given to improving physical activity for the entire community and focusing on improving nutrient intakes of iron, folate and vitamin A i terms of general dietary improvements. Two community assistants worked under the guidance of the community health nurse and community health representative to conduct a broad range of programme activities (Kuhnlein and Moody, 1989).

In summary, intervention activities included promotion of traditional Nuxalk foods through food-gathering outings and expeditions, and through luncheons and feasts featuring healthy traditional foods. Often, younger researchers and participants gathered and prepared the food under the advice and direction of Elders, with the Elders hosted by the youth when the food was served. The project participants made ooligan grease each year in 1983, 1984 and 1985, and also cut, smoked and barbecued salmon. Other activities included: classes promoting traditional foods, good nutrition and healthful lifestyle habits for school children and adults; fitness classes from Bogie's Fitness (a Vancouver consultant) – including sessions at the school for those who were overweight as well as the general public; designing and installing a demonstration traditional food garden in the yard of the health centre; displays,

Table 2.4 Summary of Nuxalk nutritional status for ß-carotene, retinol, ferritin, haemoglobin and folate, 1983

Age	Gender	n	ß-carotene µg/dl	Retinol µg/dl	Ferritin µg/ml	RBC Folate ng/ml	Hb g/dl
13–19	F	13	42.3 ± 3.9	26.9 ± 6.9	16.3 ± 3.6	185 ± 15	12.6 ± 0.3
	M	18	40.4 ± 2.2	24.5 ±1.2	19.4 ± 3.6	211 ± 17	14.6 ± 0.3
20–40	F	41	37.0 ± 2.4	21.6 ± 0.07	25.4 ± 4.5	252 ± 20	12.8 ± 0.2
	M	51	40.1 ± 1.5	24.8 ± 0.7	58.2 ± 5.8	227 ± 9	14.7 ± 0.2
41–60	F	24	33.3 ± 3.0	25.1 ± 1.1	34.8 ± 8.2	212 ± 20	12.4 ± 0.4
	M	22	35.7 ± 3.2	24.4 ± 1.8	69.4 ± 10.5	185 ± 16	14.6 ± 0.3
> 60	F	11	36.1 ± 3.0	22.4 ± 2.1	53.1 ± 11.1	186 ± 44	13.2 ± 0.5
	M	7	32.1 ± 4.5	21.9 ± 1.3	63.6 ± 11.5	197 ± 44	14.1 ± 0.5

Normal values were assumed to be: ß-carotene > 40 µg/dl; Retinol > 20 µg/dl; Ferritin > 10 ng/ml; Red cell folate > 60 ng/ml;
Female haemoglobin > 11.5 g/dl if < 17 yr and >12 g/dl if >17 yr; Male haemoglobin > 13 g/dl if < 17 yr and >14 g/dl if >17 yr (Adapted from Kuhnlein and Burgess, 1997).

Table 2.5 Nuxalk children and adults at health risk for obesity, 1983

	Age	Total (n)	#	%	Mean BMI ± SD
Children					
Girls	1–5	24	8	33	–
	6–12	57	13	23	–
	13–19	32	8	25	–
Boys	1–5	19	7	27	–
	6–12	52	12	23	–
	13–19	31	7	23	–
Adults					
Women	20–40	47	10	21	28 ± 61
	41–60	22	10	46	33 ± 4.1
	> 60	13	5	39	33 ± 7.3
Men	20–40	55	9	26	28 ± 4.6
	41–60	22	6	27	29 ± 3.7
	> 60	7	4	57	31 ± 4.4

Note: ≥ 95% of Nutrition Canada Survey of Weight for Height and Adult BMI > 30 (Demirjian, 1980).
– Not applicable.

posters, flyers and pamphlets on good nutrition; publication of the two books by the Nuxalk Food and Nutrition Program Staff (1984, 1985); nutrition classes for pregnant women and mothers; dental health classes; workshops for diabetics; and classes for children and adults on healthy lifestyles and disease prevention. These activities of the intervention programme will be discussed in more detail in a future publication.

Revisiting the Nuxalk Food and Nutrition Program

Discussion with Nuxalk leaders in 2006 reaffirmed continued use of programme materials, particularly the community handbooks used in local schools and the recipe books used by families. Use of fish from the Bella Coola River was still the most important traditional food activity, employing traditional preservation and processing methods of drying and smoking with alder wood.

Council members and former leaders of the programme expressed concern with increasing diabetes and related health problems, as well as continuing interest in preserving their traditional food practices for the nutritional and cultural benefits provided. A recent update of incidence of chronic disease among residents in the Bella Coola Valley was made using a mail-in survey by Thommasen and Zhang (2006). They confirmed that chronic disease, including obesity and diabetes, were serious problems for valley residents, with *diabetes mellitus* documented at 7 percent. However, this survey of valley residents included less than 50 percent aboriginal people, most of whom were Nuxalk.

Major environmental deterioration resulted in the decline and disappearance of several important Nuxalk cultural food resources. For example, ooligan from the Bella Coola River declined to the extent that during the 2002–2006 period it was not possible to net enough fish to make ooligan grease. Further, Nuxalk residents reported some salmon, particularly the favored sockeye, becoming rare in the Bella Coola River. Abalone harvesting has been banned after it declined drastically following the opening of a commercial harvest. Commercial harvesting of herring and herring roe was believed to greatly reduce the availability of herring. Finally, the tidal flats were reported to have become so polluted from village sewage that residents were advised not to harvest traditional root foods from the area.

Conclusion

This documentation of the Nuxalk traditional food system included extensive data collection and measurement, giving important information on food use, food quality and health status of the Nuxalk. The knowledge of unique and diverse species in the Nuxalk food system in the coastal rain forest environment of British Columbia, Canada, is extensive, including many species of fish, plants and wild animal foods. Nutrient-rich foods contained in the Nuxalk food system include ooligan fat, salmon and shellfish, all excellent sources of fat-soluble vitamins and omega-3 fats; and several species of berries, roots and greens. As expected, the amount of traditional food consumed by reserve-residents was much greater than by those living in urban areas, but reserve families each consumed

an average of about 570 lbs of fish and shellfish, particularly salmon. This extent of use may have contributed to the high levels of healthy HDL cholesterol among adults in the 1980s. Overweight and obesity among children and adults were present, and there were lower than desirable levels of ß-carotene, retinol, ferritin, hemoglobin and red cell folate in blood, which followed from dietary reports of limited vitamin A, iron and folate.

All data derived from the programme were shared widely in the community, which led to Nuxalk community leaders expressing great enthusiasm for development of an education-based intervention to improve nutrition and health emphasizing traditional food knowledge. This led to funding for activities to promote greater use of local traditional foods and improving quality of locally available market foods and active lifestyles. Discussions held by researchers in the community in 2006, 20 years after completing the intervention, revealed that enthusiasm for traditional Nuxalk foods remained high, and continued to be promoted through the Band Council, the health clinics, and in health classes in the local schools. The intervention, its success, and its evaluation will be presented in a future publication.

Unfortunately, despite these successes, obesity and diabetes – in both Nuxalk and non-Nuxalk – became prominent in the valley in the intervening years, raising concerns about an increase in related chronic diseases. Simultaneously, environmental shifts created declining availability of some key Nuxalk foods, particularly ooligan, salmon and herring, which are excellent nutrient sources. It is hoped that attention to this threat of losing key environmental treasures will lead to more effective environmental protection programmes within the Nuxalk territory and in surrounding areas affecting the food system.

The loss of practice of local food traditions reflects a general, global trend among indigenous and local peoples, with increasingly more of the food that is produced, processed and marketed at a global scale being readily available and purchased in low-income areas. For many indigenous communities in North America this creates diets high in energy density but poor in nutrient quality, leading to obesity and other global lifestyle and health concerns (Kuhnlein *et al.*, 2006; Pelto and Vargus, 1992; Turner and Turner, 2006; Popkin, 2007).

Further research to build on the results of the Nuxalk Food and Nutrition Program could improve understanding of the forces driving negative environmental change that is decreasing availability of key food resources, and how to reverse these trends with local, regional and national policies. Understanding how to improve food choices, particularly among young reserve residents, of both traditional and purchased foods with education and other incentives is greatly needed in low-income First Nations areas.

The Nuxalk food system and active practice and use of it in Bella Coola clearly have many excellent health benefits. Combining these benefits with cultural activities that promote fitness and social events can serve the Nuxalk well. Most importantly, protection of the land and sea environments that produce the Nuxalk traditional food system will add immeasurably to the overall picture of health determinants for the Nuxalk, as it will for all citizens in the coastal region of British Columbia ●

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> Comments to: harriet.kuhnlein@mcgill.ca

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