CHAPTER 2

# FEEDING THE FAMILY IN TIMES OF CHANGE

*Heather Myers* (University of Northern BC)
*Helen Fast* (Department of Fisheries and Oceans)
*Mina Kislalioglu Berkes* (University of Manitoba)
*Fikret Berkes* (University of Manitoba)

## INTRODUCTION

Northern peoples have traditionally depended on harvests of land and marine wildlife for their food, as well as for cultural definition and social connection. This tradition remains strong in some communities, while in others there appears to be a decline in harvest participation and production, raising questions about food security, nutrition, and health. Country foods have also been considered an important component of future economic development in the region, and could provide affordable, nutritious food for the region's residents. But changes are now occurring in Arctic communities, instigated by, among other influences, integration into the southern Canadian economy and incipient cultural colonialism regarding lifestyle choices. Added to these influences, Arctic residents are now receiving information about contaminant loads in Arctic wildlife and peoples, and about environmental change, usually generated by activities outside the Arctic. In addition, they are faced with economic development and conservation decisions that may affect how they can conduct traditional land-based pursuits. All of these new influences loop back to some fundamental questions of food security – a concept comprising access to acceptable, affordable, nutritious food: how will Arctic residents make choices regarding food sources in the future?

We will discuss a number of components that affect the future of food production and consumption in Arctic communities:

- a measure of domestic food production, consumption and sharing activities will provide a baseline for understanding the scope of traditional food use;

- an evaluation of the impacts of environmental change on the sustainability and utilization of marine resources will help to determine the capacity/limitations for future harvest;
- an analysis of community comprehension of contaminants in wildlife and humans, given a decade of information programs, will help to evaluate any consequent changes in behaviour and attitude;
- an assessment of economic development options and preferences regarding country foods will also measure changes in attitudes/opportunities.

An understanding of these components should contribute to policy development regarding Canada's Arctic oceans, as well as a research agenda to ensure ocean quality, resource management, use, and conservation.

## SUBSISTENCE FOOD PRODUCTION AND CONSUMPTION

The basis of understanding many issues about the Arctic lies in the importance of northern peoples' traditional food harvesting, consumption, and sharing. Hunting, fishing and gathering, and processing of food and other products of the harvest, are important components of social, cultural, and economic life in the North. Traditional self-reliance in food production and the ethics of sharing and reciprocity have been maintained over millennia, despite the introduction of imported foods in recent years. The terms domestic food, traditional food, and country food are used synonymously, in this chapter, to refer to foods that are available from local natural resources and which are culturally accepted. Subsistence refers to the practices of producing such foods and related by-products for use within the household or for exchange with other households.

Even though there have been many socio-economic changes, these foods have remained important and desirable for most northern peoples. Northern Aboriginal identity is partly defined in terms of living off the land and producing food from lands and waters. Having access to and consuming wild food is important for core cultural values, such as sharing. The distribution of subsistence harvests to relatives and neighbours remains a widespread practice. For example, among the Cree people of western James Bay, about 50 per cent of all respondents reported sharing their food with three or more households. Even in the relatively large communities of Moose Factory and Attawapiskat, sharing with three to six other households was common (Berkes *et al.* 1994).

Both land use and a traditional economy persist in the northern parts of Canada's provinces and territories. This land-based economy has remained a cornerstone of the mixed economies of many northern communities, and despite predictions to the contrary, it has not been replaced by the modern wage economy (George and Preston 1987). But much of the value of the traditional economy is "invisible" to conventional economic analysis. Hunting brings food to the table but little cash transaction to the economy. Since the products of



**Table 2.1**
**HARVEST ESTIMATES**

| *Year* | *Region* | *Harvest* | *Per capita production* |
|---|---|---|---|
| 1978–9 | E. James Bay, PQ | 809,181 kg | 115 kg/yr (7,022 people) |
| 1984–5 | Keewatin, NWT | 895,298 kg | 224 kg/yr (3,999 people) |
| 1980 | Northern Quebec | 1,100,179 kg | 285 kg/yr (3,857 people) |
| 1990 | W. James Bay, ON | 686,500 kg | 106 kg/yr (6,475 people) |

hunting seldom pass through the market, government statistics do not place any value on subsistence, and hunters are technically defined as "unemployed." Yet, subsistence hunting is obviously important for the economy of small northern communities, many of them Aboriginal.

In the Northwest Territories, Usher (1989) estimated that subsistence production and processing added about 10 per cent to total labour income, and an estimated 80 per cent of native households participated in the domestic economy. Even though harvesting was done on a part-time basis, the average Arctic hunter took 1,000 to 1,500 kg of meat and fish annually with a replacement value of $10,000 to $15,000 (Usher 1989). Later estimates maintain this level of participation: 73–79 per cent of Nunavut Inuit males in 1999; 60 per cent of NWT Inuit and Inuvialuit in 1998 (Conference Board of Canada 2002, 34–35).

Berkes and Fast (1996) compiled and standardized all available harvest estimates, mostly from the 1980s, by community and by region (see Table 2.1 below). The general finding is that many Inuit communities in the Arctic obtained in the order of 200 kg per person per year of meat, mostly from wildlife (including waterfowl and marine mammals) and from fish. Various indigenous groups living in the Subarctic harvested in the order of 100 kg per person per year (Berkes and Fast 1996).

The replacement value or income-in-kind from country food may be substantial in these small, semi-isolated indigenous communities. On a per-household basis, the yearly value of the subsistence harvest for the Western James Bay Cree (1,116 households) was about $7,030. If other subsistence products, such as fuelwood, berries, and medicinal plants were taken into account, the in-kind income increased to $8,400 per year per household or $9.4 million for the region (Berkes *et al.* 1994). Adjusted to constant 1991 dollars, the average value of subsistence harvests (not including plant products) were in the order of $15–17,000 per household per year in the Arctic, and $6–9,000 in the Subarctic (Berkes and Fast 1996). On a territorial basis, in Nunavut this harvest carries real significance, where the replacement cost of country food harvested is (conservatively) estimated at $30–50M per year (Conference Board of Canada 2002, 31).

Studies that have included data on both the traditional and the non-traditional economy, including wage income and transfer payments, have made it possible to calculate the relative value of traditional harvests in the overall economy (Berkes and Fast 1996, Usher 1989, Treseder *et al.* 1999). For example, in

western James Bay, the traditional economy comprised 25 per cent of the total economy. Across Canada, the range was from a high of 58 per cent in Sanikiluaq in Hudson Bay to a low of 11 per cent, excluding land-based commodities, in northern Manitoba (Berkes *et al.* 1994). Overall, the traditional harvest value was one-third that of the entire cash economy, easily exceeding the income from any other single source.

The above numbers may be considered to be indicative of the quantitative significance of the subsistence economy, but they should be treated with caution. They are based largely on questionnaire studies and are subject to the limitations of such studies (Usher and Wenzel 1987). Despite this, the major conclusion is that the traditional economy of many northern indigenous groups has remained alive and quantitatively significant. However, the amounts of country food harvested have declined perhaps in most areas.

Rankin Inlet youth models elegant sealskin wedding gown: new livelihood opportunities may be developed from traditional resources. Photo by Steve Newton, 2004.

A detailed comparison by Usher (2002) of Inuvialuit (western Arctic Inuit) harvests in the 1960s versus the 1990s provides insights into the nature of such changes. Using various data sources, Usher (2002) found that the total country food harvest declined from about 677,000 kg/yr in the 1960s to 333,000 kg/yr in the 1990s. The Inuvialuit population in the region nearly doubled during this time, while the total country food harvest declined by about one-half, so that per capita harvests in the 1990s were about one-third of those in the 1960s. Usher (2002) attributes most of this change to the decline of the dog team and the fur trade. Changes in the composition of the harvest support Usher's analysis. The harvest of the land animals is about the same, and caribou (a human food) has actually increased. Regarding the groups of species used partly for dog food in the 1960s, the harvest of marine fish is about one-quarter of what it was, and that of marine mammals is about one-half. Many of these shifts are accompanied by other changes.

There have been a number of transformations in the modes of production in the Arctic which have contributed to the changes in harvest and consumption of traditional foods since the 1960s, including such drastic changes as the collapse of fur markets in the 1980s (Wenzel 1991), the erosion of land-based knowledge (Ohmagari and Berkes 1997), and gradual and perhaps more positive changes such as the use of the living resources of the Arctic to underpin sustainable, culturally appropriate economic development options (Treseder *et al.* 1999). These changes are being compounded by new and continuing influences, some of which we will discuss below. Many of these changes have impacted not only the harvest and the local diet, but also the relationship of indigenous peoples to their environment.

## COUNTRY FOOD CONSUMPTION AND NUTRITION

The study of country food consumption has developed separately from the study of harvests. There is no direct way to convert harvest values into actual human food intakes, as the fraction of the harvest that becomes table food varies by area, by season, and by the proportion of desirable foods in the mix. A large number of studies since the 1970s has documented that traditional foods are important quantitatively – and even more important qualitatively. For example, among the Dene and Inuit of the Northwest Territories, Yukon, and Nunavut, only about one-third of the total food energy in the contemporary diet comes from traditional foods. But more than one-half of the protein comes from traditional foods (Kuhnlein *et al.* 2001). Thus, the question of the quality of the food is crucial.

Country foods are the most nutritious food available to northerners, providing protein, omega-3 fatty acids, key vitamins, and minerals. Imported foods are not only expensive, because they have to be transported into the northern communities, but also often a poor source of quality food. In northern indigenous communities characterized by high unemployment and low income, "affordable" imported foods, and the ones most commonly chosen, tend to be the less nutritious ones – high in refined carbohydrates, fats, sugars, and salt, but low in vitamins, fibre, and protein (Kuhnlein *et al.* 2001). Thus, it is easy for them to constitute a large proportion of the energy (or calories) consumed when imported foods form part of the diet. Indeed, Kuhnlein and Receveur (2003) have recently reported that, on the days that country foods are eaten, northerners' diets are high in various vitamins and minerals, as well as protein. On days that imported foods are eaten, their diets are high in sucrose, carbohydrates, and fats.

Work done at the Centre for Indigenous Peoples' Nutrition and Environment (CINE) has demonstrated that nutrient densities per 1,000 kcal of the traditional food portion of the diet are higher than those in the market food portion of the diet in seven of eight nutrient categories. As consumed by Inuit women of a Baffin Island community, there was more protein, iron, zinc, magnesium, vitamin A, and copper in the traditional portion of the diet and more calcium in the market food portion (Kuhnlein *et al.* 2001).

Thus, any decline in the consumption of these country foods is of concern from the point of view of dietary health. Worse, the switch from these foods to a diet of refined carbohydrates, high sugar intake and fats low in omega-3 fatty acids is a cause for concern with respect to increasing rates of heart disease,

diabetes, obesity, and other diet-related problems among northern indigenous peoples. Given this background of the importance of traditional foods in Arctic communities, we now move on to discuss the impacts of environmental and social change in the Arctic, how these changes are perceived and understood by northern residents, and the implications of change for future economic and development decisions.

## IMPACTS OF ENVIRONMENTAL CHANGE

The various factors of environmental change, and in particular the impact of contaminants, in raising concerns about traditional foods, should be considered in a historical context. The changes that indigenous peoples have had to deal with in the last two hundred or so years have been enormous. As summarized in Table 2.2, even in the last forty or so years, there have been many changes in the Arctic affecting the harvest and consumption of traditional foods and the relationship of indigenous peoples to the land. Other factors which could be added to the list of influences include the impacts of development, such as hydroelectric development in James Bay, oil and gas development in the western Arctic, and mining in Yukon and northern Manitoba (Berkes and Fast 1996), involvement in the wage economy (Kruse 1991; Myers 1982), climate change (Krupnik and Jolly 2002), and concerns over the health of the land due to contaminants in country foods (Jensen *et al.* 1997).

Concerns about pollution and contamination in the Arctic are not new. Food-chain accumulation of radioactive fallout from nuclear tests became an issue as early as the 1950s and the 1960s, and challenged the notion of the Arctic as a pristine environment. In the late 1960s and the 1970s, the contamination of northern aquatic ecosystems by methyl mercury became a major concern. This toxic form of mercury was found in fish harvested for commercial purposes and subsistence food, as a result of release of inorganic mercury into the environment from chlor-alkali plants in northern Ontario and Quebec, and as a consequence of the creation of hydroelectric reservoirs in northern Manitoba and Quebec (Berkes 1980).

By 1980, evidence began to accumulate of higher-than-expected values of persistent organic pollutants (POPs), such as pesticides and PCBs, in the Arctic. Although the initial reaction was to look for local sources, such as PCBs from DEW-line stations and pollution by the flow of Siberian rivers and the Mackenzie, attention soon shifted to the role of aerial transport as the main source. Cool temperatures in the Arctic favour the deposition of POPs from the atmosphere to land and water.

POPs are widely used in the South and can be transported long distances in the atmosphere. They bioaccumulate in the fatty tissues of organisms and they resist degradation. As in the radioactive fallout and mercury cases, species higher in the food chain tend to accumulate more POPs, resulting in widespread Arctic marine ecosystem contamination (Muir *et al.* 1992). The general conclusion is that colder temperatures result in degradation-resistant organic pollutants being deposited in northern regions, continuing to accumulate long after their use has been reduced or stopped elsewhere (Muir *et al.*1992; Jensen *et al.* 1997).

**Table 2.2**
**CHANGES IN MODES OF PRODUCTION RELATED TO HARVEST AND CONSUMPTION OF TRADITIONAL FOODS IN THE CANADIAN ARCTIC AND THE SUBARCTIC SINCE THE 1960S**

| | |
|---|---|
| *Centralized settlements instead of seasonal mobility* | Reduction of family involvement in harvesting, impacting the transmission of traditional environmental knowledge by reducing on-the-land learning |
| *Adoption of mechanized transportation in place of dog teams* | Decreased need for fish and marine mammals for dog food; increased need for cash income for purchase of equipment and fuel |
| *Individualized hunting in place of group cooperation* | Gradual abandonment of communal caribou drives, beluga hunts, and fish-trap fishing; loss of some social norms for appropriate behaviour on the land |
| *Commercialization or de-commercialization of resources* | Development of commercial hunts for some species; development of cultural tourism and ecotourism; loss of fur markets due to the animal rights lobby |
| *Involvement in formal economy jobs* | Responding to availability of non-traditional jobs (*e.g.,* mining; service industry employment) that provide cash incomes necessary for mechanized transportation and fuel |
| *Harvesting as part of a mixed economy* | Specialization of hunters; development of reciprocal arrangements between hunters and non-hunters within family groups; balancing of harvest costs/needs with job expectations and income; adjustment of traditional food sharing practices within the community |
| *Availability and accessibility of market foods* | Changes in tastes and values; acceptability of non-traditional foods as a result of media and schooling; adjustments to traditional food sharing practices |
| *New knowledge about contaminant levels in wildlife* | Adjusting modes of production to target foods with low contamination levels; minimizing those with high levels |
| *New knowledge about the continued desirability of country food consumption* | Reaffirming traditional wisdom about the desirability of country foods and the healthy influence of going on the land |
| *The need for sustainable income-generating economic options* | Searching for ways and incentives to develop options that can generate income, as well as being supportive of land-based activities |

Although the phenomenon of food chain accumulation was well known to ecologists, no data were available until the mid-1980s on contaminant intake through the diet of northern peoples and on levels of accumulation. A report by Dewailly *et al.* (1989) regarding high levels of PCBs in the breast milk of Inuit women from the Hudson Bay area came as a shock to many. In response to accumulating evidence on contaminants in country food, a project was carried out between 1985 and 1987 in the Inuit community of Broughton Island, Nunavut, known to have relatively high levels of traditional food harvests. The results showed that blood PCBs in many individuals, including two-thirds of

those under fifteen years of age, exceeded the tolerable levels set by Health and Welfare Canada (Kinloch *et al.* 1992).

Accumulating evidence of Arctic ecosystem contamination prompted government research and response, coordinated by an intergovernmental Technical Committee on Contaminants in the Northern Ecosystems and Native Diets. The work of this committee and the follow-up studies have generated a large database on organochlorines, radionuclides and heavy metals. The work included the Broughton Island study, but was nevertheless criticized for failure to address human health concerns and for lack of indigenous representation. As a result, in 1989 the technical committee was expanded to include five Aboriginal parties: the Council of Yukon First Nations, the Dene Nation, the Metis Nation-NWT, the Inuit Tapirisat of Canada, and the Inuit Circumpolar Conference.

The task of addressing Aboriginal health concerns involved, among other things, the participation of Aboriginal people to help identify research priorities. For example, the Dene people of the Mackenzie Valley region had been reporting changes in fish quality at least since the early 1980s. Liver of burbot (*Lota lota*) is traditionally consumed by the Dene, but Dene fishers reported that burbot livers were becoming small and dark in colour, and were unfit for consumption. Initially oil contamination from Norman Wells was suspected. Laboratory studies revealed that the change in appearance was associated with a low fat content. Only low levels of low-boiling aromatic hydrocarbons were found in the abnormal livers, similar to control fish. Thus, no clear connection could be established between the liver condition and petroleum contamination. Later, the livers were found to contain unexpectedly high concentrations of toxaphene (up to 5,000 ng/g wet weight) and other organochlorines (Lockhart *et al.* 1987), being deposited by global transport processes.

The revamped technical committee, now including indigenous representatives, developed a five-year (1991–97) Northern Contaminants Program (NCP). In 1997, NCP published the summary of the findings of the research programs it had funded, the Canadian Arctic Contaminants Assessment Report or CACAR I (Jensen *et al.* 1997); these focused on determining levels, geographic extent, and sources of contaminants in the Arctic environment and peoples. The program was renewed with a five-year mandate and funded a further five years of research, focusing on impacts and risks to human health, as well as temporal trends of contaminants of concern in key Arctic species. Benefit-risk communication is now undertaken by the Aboriginal partners and territorial health departments, and considers the amount of country food consumption as well as the benefits of such consumption. The NCP has put considerable time into careful information (Indian and Northern Affairs Canada 2003, x–xi), including development of school curricula; Regional Contaminants Coordinators (RCCs); training courses for front-line workers; community tours by RCCs, health experts, scientists and an Aboriginal partner; Elder-scientist retreats; one-on-one and small-group communications.



The history of the impacts of environmental change in the Arctic, especially those related to contaminants, has been one of rapid change, surprise, discovery, and re-discovery. The role of the indigenous peoples has changed from one of passive recipient to one of active participant. This change in role may be related to the emergence of Aboriginal land claims, the assertion of increasingly greater authority of indigenous peoples over their land, and the acquisition of a greater voice in resource management and other issues.

However, the communication of research results and advisories to the community has remained a problem. In earlier studies, including the one in Broughton Island, results were communicated by "experts" in ways that caused alarm and confusion in communities. Many people ceased to eat country foods altogether, which brought a set of more immediate health problems and undermined the very real health benefits still to be derived from a country food diet. The increasing involvement of Aboriginal representatives through the NCP has improved communication, both in the design of projects and in providing dietary advice to communities based on the results. Consumers of traditional foods are indeed being exposed to contaminant levels that are of concern, but in view of the importance of traditional foods, most health advisories in the 1990s sought to balance risks versus benefits, rather than aiming to ban consumption (Kuhnlein *et al.* 2001). The benefits include the nutrition, taste, social and cultural values, health effects, educational and physicalbenefits of being on the land, and economic considerations. The risks include the contaminants and their uncertain health effects.

The risk-benefit analysis also needs to consider the risk of *not* harvesting and consuming traditional food (Kuhnlein 2002). Given the various social and economic changes impacting northern peoples (*e.g.,* Table 2.2), the contaminants problem is only one factor among many. The connection between people and the land is under multiple stresses. However, the risk of losing the connection to the land would, in turn, have additional consequences for the well-being of both the people and the land. In the final analysis, it may be that the message about contaminants is still either confused, not getting through to northern peoples, or being ignored.

## COMMUNITY PERCEPTIONS OF CONTAMINANTS

The risks from contaminants in country foods are complicated to understand, even more so when one factors in language differences, conceptual differences, and cultural differences. Early lessons from the NCP showed the importance of communicating more carefully – listening to local observations of changes in fish and wildlife; understanding the likely behavioural responses to negative information and risk; balancing potential risks versus known benefits; and informing human subjects of study results and implications.

Northern residents' perceptions about contaminants have been influenced by early alarms, then assuaging messages, and more recently, a sort of confusing double message reflected in scientists, governments and Aboriginal organizations arguing before international audiences that the Arctic and its peoples are

Box 2.1

Synopsis of new knowledge from the NCP, 2003 regarding northern food supply.

Synopsis of some key findings from NCP II (from CACAR II Highlights, Indian and Northern Affairs Canada, 2003).

New findings have refined the understanding of pathways, regional differences in levels, and human contaminant intakes. Of interest are findings that levels of many POPs are decreasing (except for dieldrin and endosulfan), but there is uncertainty about what patterns characterize mercury levels in various environments. Some new contaminants are now being found. Mercury, heavy metals, and POPs levels in fish, wildlife, birds, and marine mammals show different patterns – between and within species and regions. For example, PCBs and dieldrins are dropping in beluga whales, but DDT and toxaphene are staying the same, and chlordane and endosulfan are increasing (Indian and Northern Affairs Canada, 2003, vi); mercury and cadmium levels in seal kidneys and livers are higher in some ringed seal populations than others (many are higher than guidelines set for fish consumption), but POPs in seal blubber are similar across the north and declining in some locations. Contaminants levels in marine invertebrates and fish and land mammals are relatively low, but in freshwater fish, mercury levels are rising – in some cases, exceeding subsistence consumption levels, but not commercial sale levels (Indian and Northern Affairs Canada, 2003, vi–vii).

Human health messages in NCPII have confirmed that nutritional, economic, social, and cultural benefits of eating country foods outweigh the currently known risks. There are many reasons that support the use of country foods: physical fitness, nutrition and disease prevention, social/cultural/spiritual benefits, economic benefits. Yet, in Kivalliq and Baffin communities, more than 25 per cent of the population is consuming more mercury than allowed for in the Total Daily Intake (TDI). Ten per cent of mothers in Baffin, and 16 per cent of those in Nunavik, have mercury blood levels in "increasing risk" levels, but blood levels of Inuit in Kivalliq and Kitikmeot, and those of Aboriginal peoples in other parts of the territories, are much lower, within the "acceptable" range (Indian and Northern Affairs Canada 2003, ix). POPs intakes are generally below TDIs, but in the Inuvialuit, Kitikmeot, Kivalliq, and Baffin regions, many people (25–50 per cent) are taking in more than the TDI for chlordane and toxaphene. In the Baffin region, PCB intakes are also higher than the TDI. Interestingly, there have been few studies of the health effects of contaminants on northern peoples, though one is underway in Nunavik on vulnerable groups – women of child-bearing age, pregnant women, fetuses, and children. Contradictory results exist about the effects of mercury on children's development, and early evidence suggests that some level of protection is offered by vitamin E, selenium, certain fatty acids, and fish protein. In Nunavik, some relationship has been suggested between mothers' PCB blood levels and birth size, infection rate/immune abilities, and between DDT and infection rates in children and infants.

being contaminated, then arguing at home that eating traditional foods is "still the best." People are definitely wondering if food is safe to eat, but the messages remain mixed and the nuances difficult to grasp. Animals in one region may have higher-than-tolerable levels of one contaminant, yet that species in another region will not; one species in an area may have higher levels of contaminants,



while another species in the same region will not (see inset Box 2.1). Food guidelines suggest that certain types of food should be avoided by certain groups of people (such as *muktuk* by women of child-bearing age, pregnant women, or young children). Having alarmed northern residents in the 1980s, and calmed (or nuanced!) them in the 1990s with information that country food is "still the best," the NCP reports released in March 2003 suggested that there may now be identifiable impacts of existing human contaminant levels (Dewailly *et al.* 2003). It is understandable that northern people may be confused or uncertain about contaminants.

Indeed, a recent survey in Nunavut and Labrador,[1] focusing on contaminants comprehension among three target population groups, showed that only about 30 per cent in Nunavut understood the concept of contaminants, as defined and communicated by the NCP, while slightly more people in Labrador knew about and understood the issue (Myers and Furgal, under review). Primarily, hunters tended to be the most informed, and elders to some extent, but women with children were relatively unaware of this issue. People tended to relate the word/concept to concrete items they could see (garbage on the land, rusted metals, development on the land), though some related the issue to environmental processes, pollution, viruses, or food poisoning. Many were certain that if an animal had contaminants, they would be able to see it, and either avoid it or cook it well enough to reduce the risk. This level of comprehension obviously has critical implications for food choices by Inuit, particularly for women with children who are making key diet choices for their families, affecting the growth and development of their children and the next generation.

Forty per cent of respondents in Nunavut said they had some concern about eating country food, but often defined the source of the concern as "skinny animals," sick animals, radio stories, bears at the dump, stomach ache, old meat. Very few specifically mentioned PCBs. Despite any concerns by respondents, all reported eating caribou and seal, with varying levels of consumption of other foods. Asked if there were country foods they did not eat, respondents mentioned all types of food, without pattern – reasons included availability, seasonality, taste preferences, "skinniness," and quota limitations – not contaminants. Regarding the nuanced information about different levels of contaminants in different species and foods, and the different susceptibilities of consumers (primarily women, children and fetuses), respondents did not reflect this understanding, and felt instead that they would *see* different levels of contamination and that everyone should eat country food because it is good for one (Myers and Furgal, under review).

Despite extensive public information efforts, comprising print and radio media, videos, school curriculum packages, public meetings, and community-based health committees, it is clear that information is not getting through to key parts of the population. A number of things may be contributing to this state of knowledge. Primarily, the obvious uncertainty about the science, especially reflected in the mixed messages, may have "turned off" the general listener. As

well, general knowledge of Western science, not to mention understandable Inuktitut terminology for scientific concepts, is limited. This may be exacerbated by the tension between Western science and traditional ecological knowledge.

Part of this difficulty may be explained by the basic differences between the Aboriginal worldview and the Western one. Conventional contaminant research is, by definition, analytical and reductionist in approach, and therefore a high degree of specificity is a desired end point. By contrast, Aboriginal knowledge of the environment is holistic, inclusive, and fluid. Toxicologists have often noted that there is no precise or accurate term for contaminants in Inuktitut. One word used has been *ulurianaqtuq* (Baker Lake), which may be translated as, "the product of something dangerous." This non-specific "dangerous something" could mean an oil spill, toxic chemicals, garbage, viruses, or other (Jensen *et al.* 1997).

Such translations of scientific terminology may be frustrating to a toxicologist who is trying to communicate specific information on the relationship between toxicant levels (or intakes) and undesirable effects. But it may well be considered an extension of a worldview that is less specific than the Western one, but broader and more inclusive. Omura (2002) points out that systematic generalizations are in general regarded negatively by the Inuit. Such statements are thought to be oversimplifying and generalizing complex phenomena, and therefore "childish," without much sense (*ihuma*). A similar attitude is adopted by the Yupik of Alaska (Morrow 1990). Such considerations put the translation and communication problem in a different light. If difficulties in contaminant research are partly a result of differences between the two worldviews in observing and understanding the environment, then more innovative methods of communication may be necessary.

On the other hand, a profound, culturally based commitment to country food, and the lack of affordable alternatives, may create a state of denial among some northerners. Finally, the evaluation of risk has been extremely difficult to communicate with any accuracy, coloured as it is by scientific uncertainty, trade-offs with culturally-held values, personal preferences/tolerances, and language difficulties. In Arctic communities, faced with a number of pressing social and economic issues, people may also simply be suffering from information overload.

Complicating these communications/comprehension problems is the fact that communications habits in northern communities are different than those assumed to exist by southern-based scientists and officials – for instance, making authoritative statements or directing peoples' behaviour is an uncomfortable task for young or middle-aged Inuit – acceptable communications styles tend to be more passive. This is further complicated by the very high degree of personnel turnover, so that, for instance, health committee representatives, or health professionals, or teachers may become somewhat knowledgeable, or attend a meeting or two, then change jobs or leave town – and all that training is gone, but assumed by the larger system to still exist.



Adding to the difficulties of adapting to a changing future are other intergenerational communication issues. It is apparent to many northerners that continuing to enjoy the benefits of the renewable resource economy depends on transferring to succeeding generations the extensive traditional environmental knowledge (*Inuit Qaujimajatuqangit* [IQ]) held by elders and others. This transfer of knowledge is not occurring at the level or rate needed to ensure it remains viable. In the Kivalliq Region of Nunavut, for example, David Alagalak, President of the Kivalliq Wildlife Board has stated that there remain only fifteen years to access much of the IQ of the Kivalliq Region. Beyond that, elders will have passed on and the knowledge will have been lost (Hudson Bay Ocean Working Group 2003). In the Inuvialuit Settlement Region in the western Arctic there is general agreement among community leaders, parents, and elders that Inuvialuit youth will not be ready to assume leadership responsibilities as the present generation retires. Youth share this sense of failure. They attribute their lack of capacity not to lack of interest, but rather to an experience of being abandoned and forgotten. Youth want to acquire the skills and knowledge by experiencing the land firsthand and learning from family and elders (Schlag and Fast, this volume).

The perceptions of the contaminants issue may reflect a tension between traditional knowledge ("country food is best") and Western science ("invisible contaminants are in the meat"). The invisibility and long-term nature of the effects make it hard to prove the existence of contaminants. Government officials regularly receive anecdotal information about fish with no eyes, seals with no fur or very thin, caribou with oddly shaped hooves, caribou with low fat content or poor quality coats (Fast *et al.* 2001; McDonald *et al.* 1997; Fisheries and Oceans Trip Report 2001). Respondents to the Contaminants Comprehension survey often said that if animals were contaminated they would "see it" (Myers and Furgal, under review), and indicators cited reflected those that have been used/referred to since before the contaminants issue was raised – "skinny animals," unusual behaviour, white spots in the meat. Faith in visible, concrete knowledge about the Arctic environment and wildlife, based on traditional knowledge, remains firm, in contrast to Western science transmitted by southern scientists in sometimes incomprehensible language and concepts.

Despite the messages they are receiving about contaminants, the Comprehension survey discovered that about 30% of Nunavut respondents "would change their food choices if they were found to be contaminated," but few respondents (about 10%) thought they had actually been exposed–and that they could avoid contaminants by food selection or cooking, for example (Myers and Furgal, under review).

There are a number of implications of both the contaminants issue and the state of knowledge among northern peoples. The existence of contamination in wildlife threatens northerners' accepted view of wildlife as a valued source of food, or as a never-ending/unquestioned component of the Arctic environment. Questions about the survival and health of certain species, such as polar bears and whales, strike at the very essence of traditional ecological identity and integrity, and threaten the spiritual and physical health of Arctic peoples.

In addition, on a practical level, hunters' roles in northern communities may be undermined – from a valued role in providing for the community, they may be cast in a questioned role as producers of "contaminated" food. Elders' dependence on country food produced by their families and the community may be undermined if hunters feel less confident or committed to such production. The sharing of food within extended families and communities, which reinforces important social and cultural values, may be undermined if country food is less available or desirable, though sharing of imported foods may replace it. Country food stores operated by some community-based organizations may be caught between less demand and less production, thus undermining a potentially important economic opportunity.

Income is potentially threatened by these food changes, since producers may be less able to earn cash income from their harvest and consumers will find it costly to purchase (nutritious) imported foods. Less measurable but equally important is the loss of confidence, pride, and identity associated with traditional production, processing and consumption of food.

### ASSESSMENT OF ECONOMIC OPTIONS AND PREFERENCES REGARDING COUNTRY FOOD

The uncertainty and lifestyle changes affecting northern peoples have serious impacts on options for both formal and informal incomes. Most residents of small remote Nunavut communities currently get, and expect to continue to get, a lot of their food from subsistence harvesting. Wage-paying work and cash-earning options remain limited, encouraging people to produce at least some of their own food (depending upon affordable costs for harvesting). This is encouraged by the Government of Nunavut and Nunavut Tunngavik Incorporated.

Subsistence provides a type of security which cannot be had from cash incomes or from wage employment. The Government of Nunavut is not expected to grow much more, meaning few new job opportunities in that sector. The Bathurst Mandate (Nunavut Visioning Exercise) encourages *Nunavummiut* to "build on their strengths": the arts and crafts economy, tourism, and harvesting of natural resources. Harvesting includes subsistence harvest; market harvest for local sale; organized community hunts where hunters are reimbursed for bringing country food into the community for distribution; and commercial harvest for large-scale resale in both domestic and export markets (Junkin 2002, 11).

The Nunavut Land Claims Agreement (1999) gives Inuit "security of tenure" to the wildlife and participation in its management with the territorial and federal governments through co-management boards (Junkin 2002, 9). This commitment is expected at the federal level as well. In community meetings in 2001–3, DFO was told that Canada's *Oceans Strategy* must also support Inuit efforts to maintain their culture and lifestyle. This includes rights to maintain harvesting activities and the need for a "coordinated, transparent and inclusive approach to the management of marine and ocean resources" (Terriplan 2003, 4–5).



Spring fishing is an important family event, an opportunity for subsistence harvesting and also for intergenerational training. Photo by Heather Myers.

The role of land and marine resources in the future of the Nunavut economy requires more detailed planning. Currently, the marine sector accounts for 5–10 per cent of the total NWT economy and more than 10 per cent of the Nunavut economy (G.S. Gislason & Associates Ltd. 2002). The critical questions are: what will people focus on as food and economic sources in the future? What problems, considerations and opportunities might affect these choices? Questions arise regarding regional understanding and decision-making about future domestic and commercial food production, and whether – or how – social expectations will need to be adjusted.

There is some concern that if all young Nunavummiut carry on the subsistence values of their parents, their increasing numbers might put a strain on carrying capacity of the marine resources. The future importance of domestic harvesting cannot be predicted: many point to changing lifestyles and increased use of store-bought food by young people, while others note that employment does not necessarily reduce harvest participation, and that reduced participation rates may only be related to youthfulness and may increase as youth mature and take on family/social obligations (Condon *et al.* 1995; Kruse 1991). Food Security surveys in Nunavut in 2000–2001 showed young respondents actively participating in harvesting and consumption of country food (Myers *et al.* in press). If low employment remains a condition in Nunavut communities, interest in self-reliant domestic food production is likely to continue. As an economic development opportunity, as well, there could be interest in commercial production of country food.

Commercial fisheries have been conducted for decades in Arctic communities, often on a small family- or community-based scale. More recently, some of these have been organized, with collector boats gathering the catch from dispersed fishers and transferring it to processing plants. Some larger freezer-packer boats and experimental fisheries have also been tried out, often encountering difficulties with equipment and transportation (Myers 2000). The experiences in fisheries suggest that small-scale ventures may be more sustainable in northern communities, whereas large-scale enterprises tend to bring with them serious problems in terms of transportation, cost, infrastructure, capacity in work skills and management, and marketing (Myers 2000). While serving local markets can help to diversify and develop the local economy, expanding into other markets, particularly beyond the territory, may be difficult for northern entrepreneurs in

**Table 2.3**
**VALUE OF THE MARINE ENVIRONMENT IN TERMS OF COMMERCIAL FISHERIES, ARTS & CRAFTS, AND SPORT USE**

| | | *GDP* | *Employment* | *Income* |
|---|---|---|---|---|
| *Commercial Fisheries* | Nunavut | $8M | 140 PYS | $3.5M |
| *Arts and Crafts* | NWT | $1.6M | 30 PYS | $1.2M |
| | Nunavut | $12M | 200 PYS | $10M |
| *Sports hunts/fishing* | NWT | $1M | 10 PYS | $0.6M |
| | Nunavut | $3.4M | 55 PYS | $2.0M |

terms of knowing and serving that "other" market. In Sanikiluaq, for example, a small scallop fishery has been initiated, which generates a break-even source of income for a few families, selling to the local market. Should they wish to expand into other markets, however, they will encounter barriers of high transportation costs, the high cost of building a commercial processing plant that meets federal standards, and federal testing (M. Fleming, pers. comm., 11 July 2003).

There is a clear desire to develop more commercial fisheries in Nunavut. Currently, there are no commercial marine fisheries in NWT, but in Nunavut there are commercial fisheries for char, clams, shrimp, and turbot. Char is the oldest commercial fishery in Nunavut, often taking place in small, dispersed fisheries by family-based or community-based groups. An estimated 90 tonnes was landed in 2001, with almost two hundred operators and hired hands working in this fishery. Of the turbot quota, 5,000 tonnes goes to Nunavut fishers, 2,500 tonnes to company quotas, and 1,500 tonnes to a competitive fishery involving southern Canadian companies. Some of the catch is processed in Pangnirtung (365 tonnes), but much of it goes south. There are seventeen offshore shrimp licences, most of which are leased to, and fished by, non-Nunavut companies in return for royalty payments plus employment and training opportunities. A commercial clam fishery is experimental, with less than 10 per cent of the 55,000-kg annual quota having been caught in recent years. It is sold to local people for $8.50 per kg, but cannot be exported because it cannot be tested without access to a bivalve testing facility. Overall, harvesting and processing of finfish and shellfish, as well as royalties, which are a significant component, provide an important input to the Nunavut GDP, employment, and income (see Table 2.3) (G.S. Gislason & Associates Ltd. 2002, 12–14). Between 1992 and 1995, $4.3 million was invested by various levels of government to support the Baffin Region fisheries, in order to locate commercial stocks, support pilot projects, explore new technologies, and improve marketing and lobbying on behalf of the industry (GNWT 1996).

Further value is derived from the marine-based economy in the form of non-food-related economic activities such as arts and crafts production and sports hunts/sport fishing (Table 2.3). Arts and crafts can provide a significant component of community economies, from products including carvings, sealskin products, prints, wall hangings, and tapestries. Relatively little information is available on the economic value of this sector since most artists work from home and StatsCan does not collect information. Marine tourism includes polar bear hunts, cruises, angling and sea kayaking, boat tours, wildlife viewing, and so on. Polar bear hunts are the largest of these activities in NWT and Nunavut, with an average hunt generating about $30,000 in northern revenues. Of this, $25,000 goes to the outfitter and the rest to related expenses. There are about forty polar bear hunts in the NWT and seventy-five in Nunavut, generating expenditures of $1.2 million and $2.25 million respectively. Sport fishing in Nunavut focuses on Arctic char, pike, grayling, cisco, and other species (G.S. Gislason & Associates Ltd. 2002).

The optimism about future development of marine resources, whether for subsistence or commercial purposes, must be tempered by consideration of several knowledge and management needs. Generally, marine fishery development in the Arctic faces obstacles of remoteness, ice conditions, expensive technology and related training needs, expensive transportation, quota regulations, and limited knowledge of Arctic fishery potentials. There is a need for clear procedures for issuing fishing licences, deciding quotas, and giving TEK its rightful place in establishing quotas and complementing scientific stock assessment numbers. These and other concerns have come out in community consultations with Nunavut communities and hunters and trappers organizations (Terriplan 2003):

**Management knowledge and capacity:** *The need for better research and information on harvesting data and inventories, and thus greater certainty in quotas and regulations; the use of Inuit Qaujimajatuqangit or TEK; the need for researchers to report back findings.* The lack of scientific information results in uncertainty with regard to setting quotas for a variety of inshore and offshore marine species and complicates developing community- or commercially-based experimental fisheries; there are only two technicians and one biologist for the region (J. Maurice, pers. comm., July 14, 2003). Communities on the other hand, are eager to explore the commercial potential of other species. Traditional knowledge and scientific knowledge of stocks are sometimes not in agreement (whether for fish or marine mammals), and this makes quota setting, harvest regulation, and the distribution of fishing licenses very difficult (Terriplan 2003, 15–16). In Arctic Bay, residents argued that quota systems encourage misuse of resources – traditional rules are better to maintain resources; they also wished for greater consultation before regulations are developed. On the other hand, employment participation in both inshore and offshore fisheries require skilled workers, which are lacking in Nunavut.

**Infrastructure and licensing:** *Adequate ports, harbours and processing plants are needed; more exploratory fisheries are needed for local economic development; fairer distribution of fishing licences; more visible DFO staff.*

There are currently no deepwater port facilities to support significant commercial harvesting activities in Nunavut, and only four registered processing plants. Several communities commented on confusing procedures for applying for/distributing commercial and exploratory fishing licences, and a lack of clarity regarding how narwhal quotas were established (Terriplan 2003, 17). Others were concerned with equity regarding non-Nunavut-based trawlers. Not one Nunavut fishing company owns its own offshore fishing vessel, and Nunavut fishers only have the options of selling or transferring their quota, leasing a southern vessel, or going into contracts with foreign vessels. Furthermore, Nunavut fishers have limited access to adjacent turbot and shrimp quotas, contributing to the challenges for expansion (J. Maurice, pers. comm., July 14, 2003). DFO presence was desired for research and more expeditious information transfer.

**Environmental quality and change:** *Evaluation of climate change implications on conditions such as ice break-up; protection of wildlife health, including waste and sewage management, water quality and health implications for some stocks* (*e.g., clams*) *harvested by local people*. Sewage treatment is a growing issue in Nunavut communities and becomes very pointed where local clam populations are affected. Many communities also want to see more research regarding contaminants and wildlife health. In Resolute and Arctic Bay, mine tailings are a local concern, and in Sanikiluaq, impacts of hydro development are a concern regarding marine ecosystem health. In many communities, people voiced concerns about climate change and the impacts of ship traffic or tourism on marine life.

**Impacts of industrial fishery development:** *Assessment of the impact of trawlers on the turbot fishery in Cumberland Sound*. There is concern about the impacts of large trawlers on the Cumberland Sound turbot fishery and implications for small-scale fishermen and species that feed on turbot, which include seal, beluga, and narwhal. The communities are unclear as to the roles of the HTOs, the NWMB and DFO in setting quotas (Terriplan 2003, 23).

### RESEARCH AND POLICY ISSUES REGARDING FOOD SECURITY

In summary, it is apparent that the influences bearing on the country food production systems of northerners are not only historical – they continue today. Despite the abiding value of country foods to northern peoples and economies, their relationship and dependence on those foods is being pressured to change. These changes affecting modes of production as well as consumption of traditional foods, both historical and more current, are summarized in Table 2.2.

Yet, despite these changes, and given Arctic peoples' location, environment, resources, culture, and economic circumstances, country foods remain an important subsistence and commercial resource. It is clear that these peoples must still find ways to feed their families. To the important subsistence harvest of food from the Arctic lands and oceans, there is added the potential for some degree of commercial development of these resources. While there may be unknowns regarding the future extent of fishery use and country food production, it does seem clear that country foods will continue to be very important for reasons of health, culture, and economy.

It is also clear that the changing Arctic environment may affect this sector of activity, though the evidence from Nunavut and Labrador suggests that peoples' valuation of country food is not (yet) much affected by the information they have received. Contaminant levels will likely have an effect on the potential for commercial development, however.

Finally, in terms of human management of resources and their use, it is clear that capacity lags behind need, for fishery knowledge and management, and for commercial development, particularly at larger scales, whether for population data, infrastructure, or skills.

Considering these changes leads the authors to some recommendations regarding both research and policy development, in the realms of northern oceans, resources, and economies. There are a number of questions and information needs arising from our survey of these issues, which affect the ability of northerners to feed themselves in either subsistence or commercial ways:[2]

*Research is needed to understand the nature of changes in country food consumption at both local and regional levels*. It is clear that traditional foods continue to be important quantitatively – but even more so qualitatively, in terms of nutrition and culture. Though total country food harvest has declined over the years, much of this change may be related to the decline of the dog team and the fur ban, rather than a decline of country food used for direct human consumption.

*Research and policy discussion are needed on the question of sustainable, culturally appropriate* (*formal and informal*) *economic options based on the land and country foods*. This should take into account community and local-level characteristics and needs. The message has not changed for decades: country food is important to northerners; its pursuit must be supported in ways that are appropriate to northerners.

*More public discussion and policy development are needed regarding the elements that should be included in the "new" risk-benefit approach to contaminants in country food, and the currency or currencies to be used*. For example, is mortality and morbidity the only relevant currency, or should there be an accounting of human satisfaction and cultural values of living off the land? Is the apparent "lack of awareness" by northern residents of the contaminants information essentially this – a re-weighting of risk factors? What factors do influence northern peoples' behaviour

in the face of new information like that about contaminants? And of course, there must be ongoing research into the levels and impacts of contaminants in the Arctic environment, wildlife, and peoples.

*Research and decisions are needed regarding what kinds of indicators* (*social sustainability indicators; human satisfaction indicators*) *should be used to track change*. These will need to draw on *Inuit Qaujimajatuqangit* as well as modern/southern values – those valued by young and old in Arctic communities. They will also need to blend values regarding environmental quality, domestic and commercial economies, social continuation and connection.

*More commitment and support is needed from* DFO *to develop commercial/economic opportunities for northern peoples, based on northern resources and values*. For example, policy, supporting legislation, and action are needed to assess Arctic commercial fishery quotas. This should assess the viability of commercial fisheries and the development of appropriate-scaled infrastructure. This would comprise the population dynamics of target fisheries and their ecosystems and the level of fishing pressure they can sustain; then an assessment of the size of fishery that can be sustained biologically and economically, the training of a workforce, and development of appropriate infrastructure for fishing and transportation.

*Given the size and capacities of northern communities and resources, measures of "success" need to be adapted to a scale which is appropriate, sufficient and sustainable in the north*. This will probably mean that smaller but longer-term activities are more acceptable, more locally meaningful, and more economically viable in the Arctic setting.

*Given the sweeping and rapid nature of changes, even in the last forty years* (*Table 2.2*)*, new ways are needed with which to anticipate and deal with change and surprise*. The experience of "feeding the family," as examined in this chapter, indicates a changing world in which surprise is likely. The conventional policy emphasis has been on managing the environment and resources. This has proven to be difficult to do in rapidly changing environments, such as the Arctic, where the future is unpredictable. Instead, perhaps the policy emphasis should be on building adaptive capacity, so that local institutions, and local people feeding their family, are better able to respond to surprises by learning to deal with change. This is the area of resilience thinking and the subject of the next section of the book.



## REFERENCES


Berkes, F. 1980. "The mercury problem: an examination of the scientific basis for policy-making." In *Resources and the environment*, edited by O.P. Dwivedi. Toronto: McClelland and Stewart, 269–87.

Berkes, F., P.J. George, R.J. Preston, A. Hughes, J. Turner, and B.D. Cummins. 1994. "Wildlife harvesting and sustainable regional native economy in the Hudson and James Bay Lowland, Ontario." *Arctic* 47: 350–60.

Berkes, F., and H. Fast. 1996. "Aboriginal peoples: The basis for policy-making towards sustainable development." In *Achieving Sustainable Development*, edited by A. Dale and J.B. Robinson. Vancouver: UBC Press, 204–64.

Condon R., P. Collings, and G. Wenzel. 1995. "The Best Part of Life: Subsistence Hunting, Ethnicity, and Economic Adaptation Among Young Adult Inuit Males." *Arctic* 48(1): 31–46.

Conference Board of Canada. 2002. *Innovation and traditional resource-based economies study, May 2002*. Ottawa: Conference Board of Canada.

Dewailly, E., A. Nantel, J.P. Weber, and F. Meyer. 1989. "High levels of PCB in breast milk of Inuit women from Arctic Quebec." *Bulletin of Environmental Contamination and Toxicology* 43: 641–46.

Dewailly, E., G. Muckle, C. Furgal, and P. Ayotte. 2003. "Regional, national and international risk management: how to deal with cohort study results." In *Canadian Arctic Contaminants Assessment Symposium, Ottawa, March 4–7, 2003, Abstracts*: O-H11.

Fast, H.B., S. Eddy and O. Banias, eds. 2001. *Charting a Coordinated Approach to Management of the Western Hudson Bay Region. Proceedings of the Western Hudson Bay Workshop, Winnipeg, MB, October 23–25, 2000*. Ottawa: Canadian Manuscript Report of Fisheries and Aquatic Science 2590.

Fisheries and Oceans Canada. Trip Report: Churchill, Kivalliq and Iqaluit Community Tour, March 7–19, 2001. Unpublished.

George, P. and R.J. Preston. 1987. "'Going in between': The impact of European technology on the work patterns of the West Main Cree of northern Ontario." *Journal of Economic History* 47: 447–60.

GNWT. 1996. Towards a Baffin Fisheries Strategy, Part I – Background Report. Department of Resources, Wildlife and Economic Development. Unpublished.

Government of Nunavut, Bathurst Mandate. *http://www.gov.nu.ca/Nunavut/English/departments/bathurst*

G.S. Gislason & Associates Ltd. 2002. The Marine-Related Economy of NWT and Nunavut. Draft report prepared for Fisheries and Oceans Canada. Unpublished.

Hudson Bay Ocean Working Group. 2003. Notes from Traditional Ecological Knowledge Focus Group, Winnipeg, June 25–26, 2003. *http://www.umanitoba.ca/academic/institutes/natural_resources/im-node/hudson_bay/index.shtml*

Indian and Northern Affairs Canada. 2003. *Canadian Arctic Contaminants Assessment Report II: Highlights*. Ottawa.

Jensen, J.K. Adare and R. Shearer, eds. 1997. *Canadian Arctic contaminants assessment report*. Ottawa: Indian and Northern Affairs Canada

Junkin, B. 2002. Economic Development Activities & their Orientation. Prepared for the Economic Development Committee of the Hudson Bay Oceans Integrated Management Group. Unpublished.

Kinloch, D., H.V. Kuhnlein and D.C.G. Muir. 1992. "Inuit foods and diet: A preliminary assessment of benefits and risks." *The Science of the Total Environment* 122: 247–78.
Krupnik, I. and D. Jolly, eds. 2002. *The Earth Is Faster Now: Indigenous Observations of Arctic Environmental Change*. Fairbanks: Arctic Research Consortium of the United States.
Kruse, J. 1991. "Alaska Inupiat Subsistence and Wage Employment Patterns: Understanding Individual Choice." *Human Organization* 50(4): 317–26.
Kuhnlein, H.V., O. Receveur, and H.M. Chan. 2001. "Traditional food systems research with Canadian indigenous peoples." *International Journal of Circumpolar Health* 60: 112–22.
Kuhnlein, H.V. 2002. Indigenous peoples' food systems: Perspectives on contaminant risks and nutrient benefits. Paper Presented at the Monbukagakusho International Symposium, National Museum of Ethnology, Osaka. Unpublished.
Kuhnlein, H.V., and O. Receveur. 2003. CINE Dietary exposure assessments of arctic indigenous peoples for risks and benefits, *Canadian Arctic Contaminants Assessment Symposium, Ottawa, March 4–7, 2003; Abstracts*. Ottawa: Indian and Northern Affairs Canada.
Lockhart, W.L., D.A. Metner, D.A.J. and D.C.G. Muir. 1987. "Hydrocarbons and complaints about fish quality in the Mackenzie River, Northwest Territories, Canada." *Water Pollution Research Journal of Canada* 22: 616–62.
McDonald, M.A., L. Arragutainaq and Z. Novalinga. 1997. *Voices from the Bay: Traditional Ecological Knowledge of Inuit and Cree in the Hudson Bay Bioregion*. Ottawa: Canadian Arctic Resources Committee.
Morrow, P. 1990. "Symbolic actions, indirect expressions: Limits to interpretations of Yupik society." *Etudes/Inuit/Studies* 14: 141–58.
Muir, D.C.G., R. Wagemann, B.T. Hargrave, D.J. Thomas, D.B. Peakall and R.J. Norstrom. 1992. "Arctic marine ecosystem contamination." *The Science of the Total Environment* 122: 75–134.
Myers, H. 1982. "Traditional and modern sources of income in the Lancaster Sound Region." *Polar Record* 21(130): 11–22.
——— . 2000. "Options for appropriate development in Nunavut communities." *Etudes/Inuit/Studies* 24(1): 25–40.
——— , and C. Furgal. Under review. Communicating about contaminants in Nunavut and Labrador.
——— , S. Powell, and G. Duhaime. In press. "Setting the table for food security: Policy impacts in Nunavut." *Canadian Journal of Native Studies.*
Nunavut Land Claims Agreement. 1999. Government of Canada. Ottawa: Queens Printer.
Ohmagari, K., and F. Berkes. 1997. "Transmission of indigenous knowledge and bush skills among the Western James Bay Cree women of subarctic Canada." *Human Ecology* 25: 197–22.
Omura, K. 2002. Problems on use of traditional ecological knowledge in resource management: A case from the Canadian Arctic. Paper Presented at the Monbukagakusho International Symposium, National Museum of Ethnology, Osaka. Unpublished.
Schlag, M., and H. Fast. This volume. Marine Stewardship and Canada's Oceans Agenda in the Western Canadian Arctic: A Role for Youth.



Treseder, L., J. Honda-McNeil, M. Berkes, F. Berkes, J. Dragon, C. Notzke, T. Schramm, and R.J. Hudson. 1999. *Northern Eden: Community-Based Wildlife Management in Canada*. London: International Institute for Environment and Development.
Terriplan Consultants Ltd. 2003. IER Planning, Research and Management and updated by J. Maurice. Toward Integrated Ocean Resource Management in the Baffin Island Region of Nunavut: Results of the Baffin Marine Issues Scan. Report prepared for Fisheries and Oceans Canada.
Usher, P.J. 1989. *Towards a strategy for supporting the domestic economy of the Northwest Territories*. Yellowknife: Background study prepared for the NWT Legislative Assembly's Special Committee on the Northern Economy.
——— . 2002. "Inuvialuit use of the Beaufort Sea and its resources, 1960–2000." *Arctic* 55 (suppl. 1): 18–28.
——— , and G. Wenzel. 1987. "Native harvest surveys and statistics: A critique of their construction and use." *Arctic* 40: 145–60.
Wenzel, G.W. 1991. *Animal Rights, Human Rights: Ecology, Economy and Ideology in the Canadian Arctic*. Toronto: University of Toronto Press.

NOTES

1 Awareness, comprehension and perception of contaminants issues in two regions of the Canadian north, funded by Northern Contaminants Program II.
2 In all of these examples, it is assumed that information will draw on both southern scientific, and northern traditional knowledge.