



Northern Alaska Subsistence Food Research

Contaminant and Nutrient Ecology in Coastal Marine Mammals and Fish



How do contaminants get to the North Slope?

Contaminants are produced and released all over the world. On the North Slope, there are many local sources. Military sites, industrial development, and landfills are all local sources of contaminants. In addition, contaminants can be carried around the world in air and water. Contaminants found on the North Slope may have been released in the lower 48, in Asia, or in Europe.

Once they are in the air and water, they can travel thousands of miles. Some contaminants tend to concentrate in the Arctic. They are carried here in the air, and settle where it is cold. They may be taken up in plants or animals. Once they are in the food web, they are hard to get rid of.

The North Slope is fortunate that major contaminant transport pathways tend to lead elsewhere, which is not the case in other Arctic regions.

The eastern Canadian Arctic and West Greenland, for example, have higher levels of many contaminants. These contaminants come from the eastern United States and Europe, carried by air and water to that part of the Arctic. The North Slope receives some pollution from Asia, but levels are still relatively low.

What do contaminants do to animals and people?

Contaminants cause concern because they can be harmful. The many different types of contaminants can cause many different effects in animals and people. The same contaminant can also cause different effects depending on how much is present and how the person or animal is exposed to it.

Organochlorines can disrupt bodily functions. When present, some can cause cancer. Others may affect the ability to reproduce or damage nerves and the brain. At high levels, organochlorines can produce major effects, including death. This kind of *acute exposure* is rare, usually from an industrial accident. On the North Slope, exposures would be more likely to be *chronic*, meaning that they would occur in small amounts over a long time.

Consumers of subsistence-harvested foods from the North Slope are fortunate that the scientific analyses have shown very low levels of organochlorines to be present in many of the subsistence foods that they eat, at levels that are below levels of public health concern.

Heavy metals also disrupt bodily functions. Mercury can hurt the brain and nerves. Cadmium can harm kidneys and liver. Lead has the potential to cause nerve and brain damage, also. As with organochlorines, exposures can be acute or chronic. On the North Slope, the main concern is about chronic exposures.



Contaminants do not always produce effects. Sometimes, the concentrations are low enough that no harm is caused. Some elements such as zinc are necessary for the body in small amounts, but can become harmful in higher doses. It is important to study the concentrations of contaminants, not just whether they are present. Everyone in the world has been exposed to some types of contaminants, but most exposures are too low to have any effect.

How nutritious are our subsistence-harvested foods?

For Iñupiat, *niq̄pīaq* has always been a source of physical, mental, social, and cultural health. Many people say they simply feel better when they can eat traditional foods. Sharing brings people together, which also feels good, and is a key part of the Iñupiat value system.

Analyzing nutrients in various traditional foods confirms that they are healthy. In fact, many are better for you than even the healthiest food at the store. One way of showing how nutritious foods are is to see how much of the recommended daily allowance (RDA) of nutrients they provide. The RDA is the percentage shown on food labels. As this study shows, our *niq̄pīaq* is an excellent source of many nutrients.



For a number of years, scientists of the North Slope Borough Department of Wildlife Management, along with visiting scientists and graduate students, have collected tissues from various subsistence species from Alaska's North Slope through the cooperation of Alaskan Native hunters.

Many locally caught marine mammals, terrestrial mammals and marine and freshwater fish were tested for organochlorines (like PCBs and DDT), heavy metals (mercury, lead), and radionuclides (radioactive particles).

Results of these studies show that most contaminant levels in northern Alaska animals are low, in comparison to the rest of the Arctic. The levels of these contaminants are considered to be below levels of health concern for people. This is all good news, documenting that traditional foods are healthy.

Subsistence foods are good for you.

Bowhead Whale Nutritional Values

As for most tissues studied, epidermis ("skin") represents a good source for protein (42%), dietary fiber (21%), vitamin E (1.2%), and many elements, but is a poor source of carbohydrates (<5%) and sugars, vitamin C, and beta carotene.



Blubber is rarely eaten alone and is a very good source of polyunsaturated fatty acids (PUFAs - See next column) (1.89%) and many elements. It also offers 8% of needed vitamin A, 10% protein and little carbohydrate (<4%). Maktak is considered the outer skin and a small amount of underlying blubber.



Skeletal muscle (meat) provides approximately 45% of needed protein and > 10% for some of the Vitamin B compounds and many elements. It is a poor (<5%) source of fat, PUFAs, dietary fiber, and carbohydrate.



Bowhead Whale Nutritional Values

Kidney is a good source of fat (11%) and protein (28%) but not carbohydrate (2%). Kidney provides nearly 16% of the needed PUFAs and is an excellent source of many elements (Cr, Cu, Fe, Na, Mo, P, and Zn).



Heart is a good source of protein (40%) and many elements (Cu, Fe, Na, K, Zn, and P).

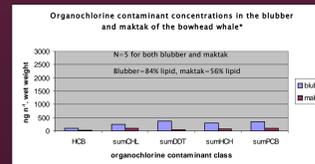
Tongue is a good source of fat (82%), PUFAs (161%), protein (27%), calories (30%), vitamin A (16%), and some elements (Cr, Cu, Na, and Fe).

Intestinal tissue is a good source of protein (37%) and many elements (Cu, Na, K, Fe, P and Zn).

The most remarkable observation is that these whales are much less contaminated than many other cetaceans with respect to metals (i.e., mercury and lead), radionuclides, and organochlorine contaminants (i.e. PCB, DDT).

Organochlorine levels measured were highest in blubber and maktak (because these tissues contain fat which is associated with organochlorine contaminants). However, these levels are still over 10 times lower than those found in northern right whales, a species that feeds in ways similar to the bowhead whale.

As compared with terrestrial arctic wildlife, like caribou, the levels of Cs-137 (a radionuclide) are 100 to a 1,000 times lower in bowhead whale tissues.



Blubber has a higher organochlorine concentration than maktak because of the higher amount of fat (lipid) present. Organochlorines are "lipophilic", which means that they like to concentrate in fat.

*Adapted from Hoekstra et al., 2005

What Are Polyunsaturated Fatty Acids (PUFAs) ?

Polyunsaturated fatty acids (PUFA) are part of the family of dietary fats. Like all fats, they provide energy for the body, are components in cell membranes, and help to transport many fat-soluble vitamins to their destination in the body. There are two types of PUFA: omega-3 and omega-6. Some fatty acids are essential for healthy growth and body maintenance. These fatty acids cannot be made within our bodies and must be obtained through dietary sources. PUFAs are involved in immune system health and the regulation of blood clotting and inflammatory processes.

Many important essential fatty acids (omega-3 class) are present in bowhead whale tissues. These are known to be important in prevention of heart disease, diabetes and many other diseases and are essential for neonatal development. These data indicate that important nutrients are provided by bowhead whale tissues (raw) to human consumers.

PUFAs and Healthy Hearts The roles of different types of fat in the diet has been closely linked to cardiovascular (heart) health. Past studies emphasized saturated fat as the primary culprit in many types of heart disease. As a result, diets low in fat (especially saturated) were recommended for heart health. More recent studies are finding that PUFAs are strongly protective against heart disease. To cut these types of fats out of the diet would raise the risk for cardiovascular disease. Doctors and researchers now believe that the type of fat that you eat is as or more important for heart health than the amount of fat you eat. Recent research on PUFAs confirms this concept.

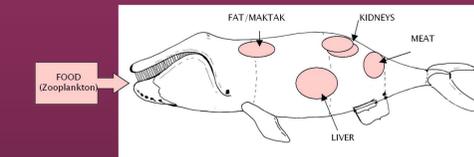
Bowhead Whale Research

Almost everything we eat has contaminants present in it. However, their levels vary by the type of food, where it comes from and often the amount of fat it has in it.

Bowhead whale does have contaminants present, but they have been shown to be present in VERY LOW levels in comparison to both store bought foods and other subsistence foods.

Bowhead whale is a healthy subsistence food high in omega fatty acids and is highly recommended for continued consumption!

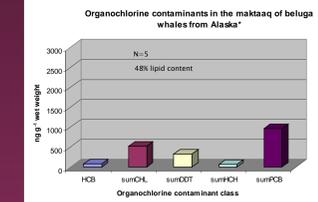
Where do we LOOK for contaminants in bowhead whales?



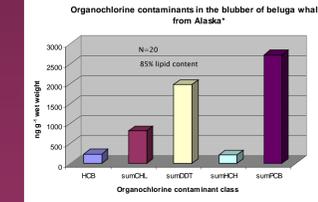
Essential and non-essential elements analyzed in bowhead whale tissues were generally low and of no concern. Of the 12 elements studied (arsenic, cadmium, cobalt, copper, lead, magnesium, manganese, mercury, molybdenum, selenium, silver, and zinc) in the bowhead whale, the element of possible minor concern from a subsistence perspective is cadmium in the kidney. However, because people usually do not eat very much kidney, it is unlikely to pose a significant health risk. Most of the cadmium present in the bowhead whale and other arctic animals is thought to be from natural sources rather than from human-caused pollution. Other arctic species have elevated cadmium levels and this has probably always been the case.



Beluga Whale Research



Blubber has a higher organochlorine concentration than maktak because of the higher amount of fat (lipid) present. Organochlorines are "lipophilic", which means that they like to concentrate in fat.



When compared with store-bought food, there was little difference found in organochlorine (OC) concentrations in beluga whale tissues, with the exception of blubber and maktak (which contains blubber). There was no store-bought food that could compare to blubber/maktak, so this comparison could not be made.

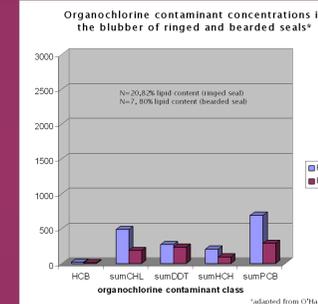
We emphasize that switching from non-blubber tissues to store-bought food will not eliminate organochlorine exposure. This switch is likely to result in the consumption of less healthy, nutrient-poor products and the elimination of important, healthy, socio-cultural practices.

*Adapted from Hoekstra et al., 2005

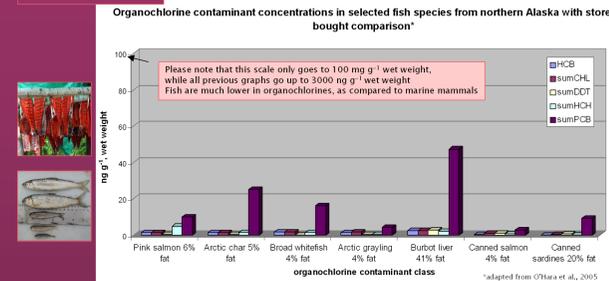
Seal and Walrus Research

We realize how important these species are to many villages. Future DWM research plans include additional studies on the nutrients and contaminants present in seal and walrus.

Though contaminants are present in seal blubber, when considering the risks associated with contaminant exposure relative to the known benefits of eating subsistence foods, as well as the risks associated with eating poor replacement foods (store-bought food), the consumption of these subsistence foods should be maintained and encouraged.



Fish Research



All fish above had their fillets analyzed with the exception of the burbot, which had only the liver analyzed. The burbot livers are much higher in fat (lipid) than the fillets from the other fish, and likewise are higher in organochlorine contaminants, though these levels are much lower than those seen in the blubber of marine mammals found higher in the food chain. In many cases, the subsistence fish analyzed had lower concentrations of organochlorines than the store-bought foods that were examined. It is also important to note that these samples were analyzed raw. Previous studies have noted a reduction of total PCBs and other organochlorines in fish due to cooking.

Caribou Research

Currently, there is a caribou health assessment in progress that will evaluate both the health of the animals and some of the nutrients present in their tissues. Data are still preliminary, but will be made available to the public when the project is completed. The NSB-DWM is actively pursuing additional funding for studies that will investigate the nutritive value of this subsistence food to consumers living in northern Alaska. Through this work we hope to document contaminant levels, as well as basic human nutritional parameters.



Assisting the DWM with the collection of these data will aid us immeasurably in getting this research completed and providing the answers our communities need with respect to this food resource. This includes providing samples from hunter-collected carcasses, as well as providing us with information on what parts of the animal you eat, how you prepare it, the amount you consume and how often you eat it.

