

In many regions of Nova Scotia, smoking fish is a popular activity. There are several federally approved processing facilities and food establishments that smoke fish for commercial sale. Whether these fish products are prepared for personal or commercial use, significant food safety issues can arise if improper food safety practices occur prior to, during, or after the smoking process.

The specific risk factors covered in this factsheet are based on the science of the survival, growth, and toxin production of disease-causing (pathogenic) microbes that can cause foodborne illness.

The following will discuss regionally popular methods of fish smoking, the risks associated with the methods, and how to reduce these risks through specific food safety controls.

There are many methods of smoking fish, depending on the fish itself, the smoking agent used, and the desired characteristics of the end product. The methods described usually involve introduction of smoke to the food surface via burning untreated sawdust, chips, sticks/ logs, or vapourizing liquid smoke, depending on the style of the smoker unit.

Smoking can have some adverse effect on the growth of microbes, but the extent is usually minimal or too variable to be considered a primary food safety control factor.

General Risks and Controls

Risk # 1 - Incoming fish have moderate to high microbial loads. Some of these microbes can lead to foodborne illness.



- **Control the risk** – Avoid cross-contamination when handling fish prior to smoking; use appropriate cleaning and sanitizing methods for both raw and ready-to-eat (cooked) food contact surfaces; practice frequent and thorough hand washing.
- **Control the risk** – Cook the product to the proper final temperature as found in the **NS Retail and Food Services Code**; verify temperature with a calibrated probe thermometer; ensure the smoking unit has the capability to maintain consistent temperatures throughout the process.

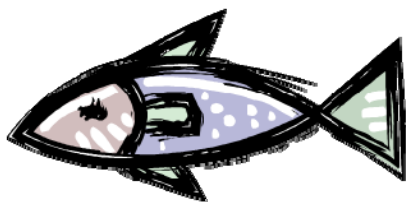
Risk # 2 –Smoking product at very high temperatures in the absence of, or in very low humidity environments can dry the product out before it reaches a high enough temperature to

kill some microbes. Therefore, the process intended to destroy the microbes only dries them out. If the food product is exposed to humidity at the processing level after smoking, or at the consumer level, these dried microbes can become viable and grow/ reproduce in the food, causing foodborne illness.

- **Control the risk** – Ensure your smoker unit has the ability to control levels of humidity during the hot smoke/ cook; verify the levels of relative humidity present during the cooking/ smoking process using wet and dry bulb temperature measurements; ensure your relative humidity levels are supported by reputable scientific sources, and verified as effective in destroying microbes of concern.

Risk # 3 – Improper handling of smoked product in its ready-to-eat form prior to packaging could contaminate food intended to be eaten without further microbial destruction steps (i.e., cooking).

- **Control the risk** – Practice frequent and thorough hand washing; have a dedicated area (separate from raw fish handling areas) for cooling, handling, and packaging ready-to-eat fish; consider approved post-production interventions to destroy microbes, such as post production pasteurization or additives approved for use in fish to reduce microbial activity in food.



Risk # 4 – Storage of packaged ready-to-eat products at room temperatures, or inconsistent refrigeration.

- **Control of Risk** – Any ready-to-eat fish product without shelf stability testing and verification must be kept at a controlled temperature of 4C (40F) or colder.

Hot Smoked Fish Concerns

In addition to Risks # 1, 2, 3, and 4, there are some additional food safety risks for products made in this manner.

Examples: smoked alewife (a.k.a., kiack or gaspereau) smoked eel, hot smoked haddock, smoked mackerel

Risks and Risk Controls

Risk # 5 – Naturally occurring bacteria on fish and bacteria introduced to the fish surface can produce biogenic amine (e.g., histamine) if fish are left at temperatures over 10C (50F) for extended periods of time.

- **Control the risk** – If sourcing your own fish, cool quickly using ice in coolers; use good personal hygiene practices (hand washing prior to handling fish); if sourcing from a supplier, ensure that the product has remained consistently at temperatures 4C (40F) or colder.

Risk # 6 – Fish may not be gutted prior to smoking. This could pose increased food safety risk associated with the bacteria *C. botulinum* and production of the toxin *C. botulinum* type E. This issue has prompted government agencies

in some countries to prohibit the practice of using un-eviscerated fish at the commercial level.

- **Control the risk** – Gut fish prior to smoking; develop and scientifically verify a process that prevents the development of C. botulinum type E production using other control factors such as salt, temperature control, and shelf life. Note that gutting fish will not completely eliminate the risk of C. botulinum presence in/ on the fish.

Risk # 7 – Fish may be vacuum packaged, or packaged in a low oxygen container; if C. botulinum organisms are present, it could provide an environment for C. botulinum toxin production, since this toxin can be produced at refrigeration temperatures.

- **Control the risk** – Freeze any vacuum packaged or reduced oxygen smoked fish product; ensure labels are present for consumers instructing them to open the package prior to defrosting at refrigeration temperatures (4C (40F) or colder).

Cold Smoked Fish Concerns

This method involves smoking fish without cooking it. The slow smoking process (ranging from 6 to 24 hours) serves to flavour the product, with temperatures rarely exceeding 30C (86F).

All the above risks, with the exception of Risk # 2, apply to the cold smoking process for fish, but there are additional factors associated with the process:

Examples: cold smoked salmon, herring, halibut, cod, haddock, arctic char

Risk # 8 – Cold smoked fish does not typically reach temperatures high enough to destroy the organism, Listeria monocytogenes. Salted cold smoked fish also does not have salt levels high enough to inhibit the growth of this specific bacteria.

- **Reduce the risk** – There is no known control measure to eliminate L. monocytogenes on cold smoked product, unless it is cooked prior to eating, by the consumer. This is not a popular practice. There are some practices that may reduce these bacterial numbers such as using scientifically verified cold smoking time/ temperature procedures that do not exceed 24 hours; relying on well-established and verified environmental cleaning and sanitation controls; high staff hygiene standards; using approved additives to inhibit Listeria growth.

Risk # 9 – Cold smoked fish does not reach temperatures high enough to destroy parasites common to raw fish (roundworms, tapeworms, and flukes).

- **Control the risk** – Freeze fish prior to cold smoking using the temperatures outlined in the **NS Retail and Food Services Code**.

For more information on food safety, contact your local Food Safety Specialist, or visit the Department of Agriculture's food safety website at <http://www.gov.ns.ca/agri/foodsafety>