



CLIMATE CHANGE IMPACT ON SEAFOOD SAFETY

SUMMARY

Seafood is an important part of income, nutrition and social enrichment for many Canadians. Climate change will impact the pillars of seafood security: availability, access, stability, and utilization. Food-borne pathogens, biotoxins and chemical contaminants are expected to increase due to climate change. The level of surveillance of wild fish and aquatic wildlife is poor in relation to terrestrial species, suggesting public health may be less able to anticipate the next threat compared to terrestrial food systems. However, signals of important changes are being seen in wildlife and fish, suggesting opportunities for public health to anticipate risks from climate change and develop proactive seafood safety strategies.

BACKGROUND

Seafood is an essential industry and source of food for Canadians. Local fish are high in demand for export as well as domestic consumption. Fisheries and aquaculture are expected to face significant challenges from climate change. Climate change will affect species movements and interactions; affecting pathogen transmission and environmental persistence. Climate change will increase water temperatures, changes to current flow, increase ocean acidity and decrease oxygen levels in water. These will all affect the immunocompetence of aquatic organisms –hosts, pathogens and parasites – affecting epidemiologic cycles. Northward movement of species with warmer waters will introduce new parasites and pathogens and affect their persistence. Climate change will shift the aquatic and marine distribution of contaminate due to coastal erosion, terrestrial flooding and ice and permafrost melt. Warming waters will increase the risk of algal toxins. Climate change will affect the availability and sustainability of fisheries by affecting the distribution, abundance and survival of important commercial species.

Fish and wildlife surveillance is already detecting signals of changing risk to seafood safety. Increasing reports of dead marine mammals due to marine toxins, such as domoic acid, and expansion of the season for toxic blooms to a year-round event at salmon farms signal changing ocean disease dynamics. Increased reports of marine birds and mammals affected by terrestrial parasites, such as *Toxoplasma* in sea otters or norovirus in porpoises, suggested increased upland flows of hazards into the marine food web. Rising sea-levels and increased floods and storms may further alter this pattern of pathogen and contaminant traffic. Canadian Killer Whales and Beluga Whales are now some of the most chemically contaminated animals in the world; each with food chains that directly overlap ours.

The capacity to predict which changes we can expect is limited due to the complexity of environmental, social and ecological variables that affect the interactions of fish, people and their shared environment. Investment in understanding and monitoring seafood and aquatic food systems lags behind activities and knowledge in terrestrial food systems. The diversity of routes through which Canadians acquire seafood (purchase from stores, from neighbours, or by personal harvesting) presents unique challenges in relying on food inspection systems. Fisheries surveillance programs tend to focus on disease of regulatory concern, which emphasize infectious and parasitic diseases. Programs to regularly monitoring and investigate emerging disease concerns in wild fish and shellfish lags behind what is done for aquaculture and for terrestrial food animals. Dialogue between public health and the seafood sector is less common than with the terrestrial food network.

CLIMATE CHANGE AND SEAFOOD SAFETY

1. *Biological concerns*: proliferation of food-borne pathogens - Warmer temperatures (in air and water), provide favorable conditions for pathogens such as bacteria to grow, allowing them to become more prevalent and expand to waters that previously unsuitable. For example, in 2004, a large *Vibrio parahaemolyticus* outbreak involving raw oysters occurred in Prince William Sound, Alaska. More recently, the BC oyster industry has been linked to norovirus infections across Canada and into the USA, not only causing hardship to those made ill but also affecting the viability of rural community aquaculture farms.
2. *Biotoxin concerns*: harmful algal blooms - Eutrophication (nutrient enrichment of water body) and stratification because of anthropogenic activity, combined with warmer conditions have allowed harmful algae blooms (HAB) to occur more frequently, expand in geographic scope and extend in duration. For example, in 2008, a large HAB in St. Lawrence Estuary resulted in the deaths of many seals, birds and Beluga whales in Quebec. This case has dramatic implications, as shell-fish can bioaccumulate the toxin posing serious health risk for consumers. This is further complicated because most HAB toxins can be tasteless, odorless and heat stable, therefore food preparation steps do not eliminate the risk.
3. *Chemical contaminants* – Rise in water levels, changes in water flow patterns and flooding events cause agricultural run-offs or introduce chemical contaminants (e.g. heavy metals, PCBs) into the aquatic environment. This increased chemical contaminant burden can reside in the environment or taken up directly, eventually bioaccumulating in the seafood chain. Links between elevated cancers rates in St. Lawrence Belugas and polycyclic aromatic hydrocarbon exposure has been well documented for example. Warmer temperatures, changing salinity and hypoxia will each affect the metabolic uptake of these contaminants in aquatic wildlife and food species.



PUBLIC HEALTH CONSIDERATIONS

Surveillance of aquatic wildlife and fish is more complicated and less common compared to terrestrial species. However, surveillance signals are being generated that suggest the need for proactive strategies to ensure ongoing access to the benefits of seafood without undue food safety risks. This is important not only for rural and aboriginal peoples who rely on seafood for nutritional, cultural and economic reasons, but also for all Canadians as seafood is a quickly growing contribution to our protein intake. New and sustained dialogue with seafood producers and aquatic health specialists may help identify critical points for surveillance and interventions to provide seafood safety and sustainability advice to the Canadian public.

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