

Are There Toxic Chemicals in the Tissues of Casco Bay Blue Mussels?

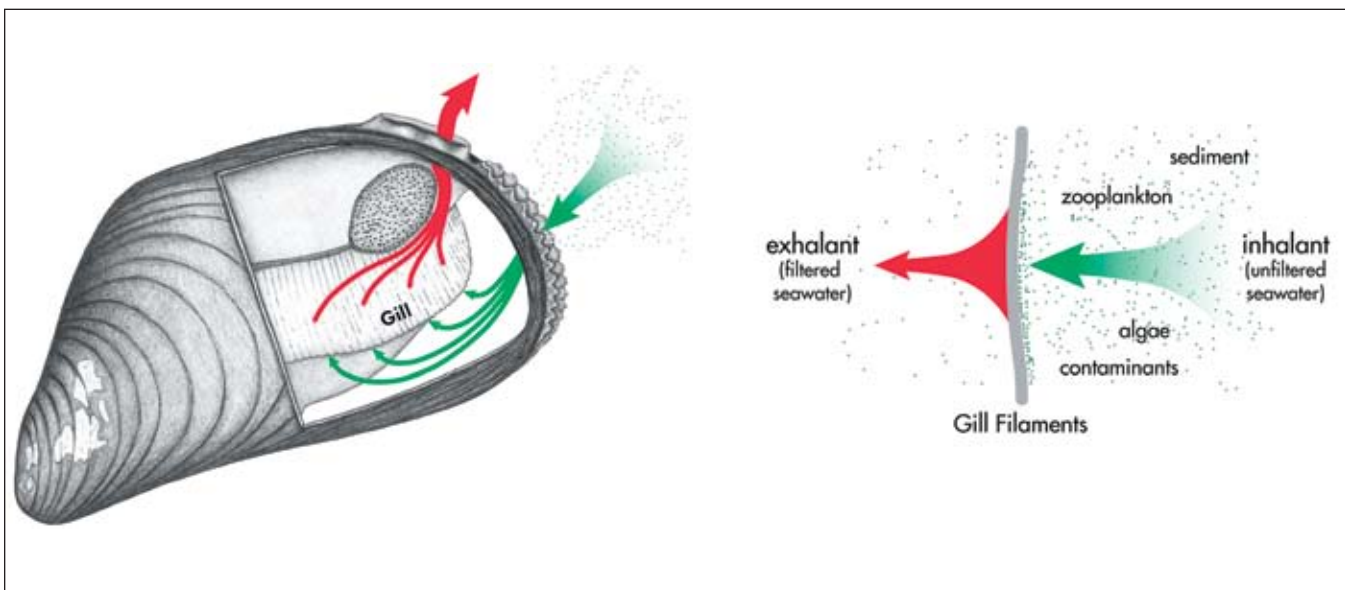
Answer: Yes. While mussels from most sites in the bay do not have elevated levels of toxics, there are some sites where metals and organics are elevated above the Maine coastal norm.

Why Is it Important to Monitor the Levels of Toxic Chemicals in Blue Mussels in Casco Bay?

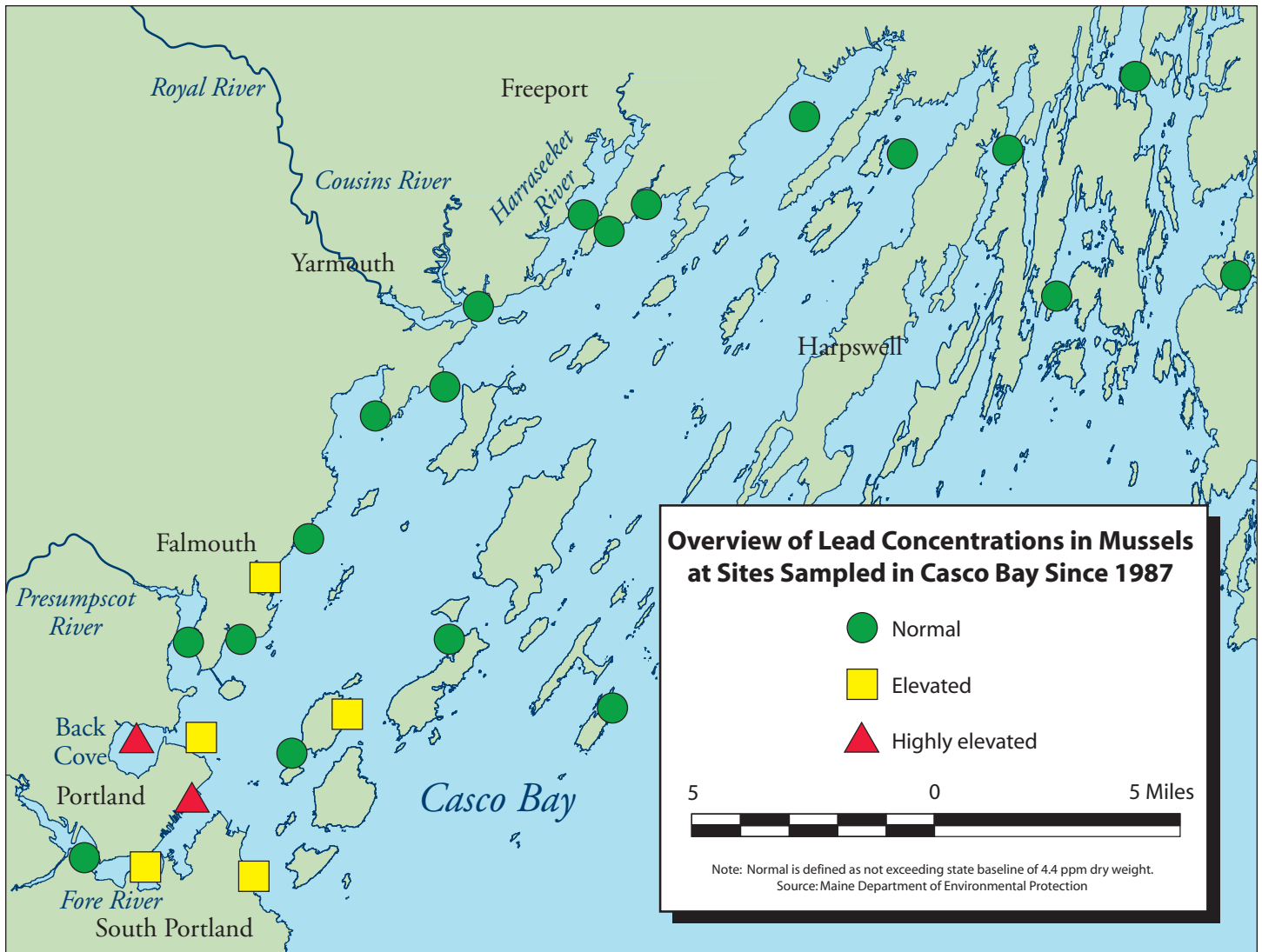
The common blue mussel, *Mytilus edulis*, is an ideal species to indicate the contaminant levels in an ecosystem. It is sedentary as an adult and is long-lived, accumulating local contaminants through feeding and surface contact. It is common throughout Gulf of Maine coastal areas and is thus useful as a “sentinel” species for Casco Bay and the broader Gulf. In Maine, blue mussels are found in densely populated beds in the intertidal zone (the zone between high and low tide). Casco Bay is one of the most productive areas in Maine for wild mussels. Because blue mussels are primary consumers at the base of the food chain, elevated levels of contaminants in mussel tissues suggest that top level consumers, including fish and humans, may be at risk from contaminants in the ecosystem.

Monitoring Blue Mussels in Maine’s Coastal Waters

In 1987, Maine Department of Environmental Protection (DEP) began a major long-term monitoring program to assess the levels and locations of toxic contaminants along the coast, using the common blue mussel *Mytilus edulis* as the indicator species. The goals of DEP’s blue mussel sampling program included defining background or baseline levels of toxic chemicals in Maine mussels (based on “reference sites” thought to be relatively free of pollution) and determining what levels pose a health risk to humans and/or marine life. Blue mussel soft tissue has now been analyzed from approximately 65 sites along the Maine coast over the past 18 years. Since 1996, CBEP has supplemented the DEP blue mussel monitoring program by periodically collecting samples at additional sites in Casco Bay. Selection of sites for testing takes into consideration the results of sediment contamination studies, the intensity of local land use, and past history of pollution, focusing on areas where the mussels might be exposed to elevated concentrations of toxics.



The common blue mussel serves as an excellent indicator of environmental contamination. As the mussel breathes and feeds, its gill filters out and retains particles, including contaminants, which can be digested and assimilated into its tissues.



Long-term monitoring of mussels in Casco Bay indicates that elevated levels of metals (such as lead) tend to be found in areas where human activity is concentrated.

Key Findings

DEP and CBEP have sampled blue mussels for the metals aluminum (Al), arsenic (As), cadmium (Cd), copper (Cu), iron (Fe), nickel (Ni), lead (Pb), zinc (Zn), silver (Ag) and mercury (Hg) as well as pesticides, dioxins and furans, PAHs and PCBs at multiple sites in Casco Bay. The map above provides an overview of the results of lead sampling at sites in the bay.

CBEP sampling in 1996 and 1998 indicated elevated toxic chemicals at the following sites:

- 🌀 Lead levels were elevated in Back Cove mussels while dioxins and furans were elevated at sites in Freeport, New Meadows, Jewell Island, Back Cove and the Harraseeket River; total PCBs were elevated in samples from Back Cove, Quahog Bay and somewhat elevated in samples from Falmouth;
- 🌀 Arsenic was elevated at Falmouth and Jewell Island.

For samples collected by CBEP and DEP from 2001 to 2003, the table on page 35 indicates sites where metals were elevated above the state norm. For other toxic chemicals, areas where elevated levels were detected are summarized as follows:

- 🌀 PAHs were at baseline levels or below at all sites except the inner Fore River where they were highly elevated.
- 🌀 PCBs and pesticides were at baseline or below at all other sites except the inner Fore River site, where PCBs were approaching elevated.

Field studies conducted by CBEP in 2001 indicate that recreational mussel harvesting is taking place in beds where pollutant levels are elevated in mussel tissue. Further studies will be needed to determine whether local harvesters and their families are consuming mussels frequently enough to face a health risk.

Metals Elevated Above Maine Normal Baseline Values Found in Mussels from Sampling Sites in Casco Bay 2001-2003

	Al	Cd	Cr	Cu	Ni	Pb	Zn	Ag	Hg
Great Diamond Island (Cocktail Cove)	X					X		X	
Long Island					X				
Mare Brook	X								
Inner Fore River						X	X		X
Maquoit Bay	X								
East End Beach						X	X		
Spring Point						X	X		
Mill Creek						X			
Outer Fore River						X			

Source: Maine Department of Environmental Protection

What Can We Conclude From Our Study of Blue Mussels in Maine and Casco Bay?

Most areas in Maine and Casco Bay that are away from human activity, past and present, contain background/baseline concentrations of toxic chemicals. Based on the blue mussel as an indicator, elevated levels of toxic contaminants tend to be present in areas with a “dirty history” (e.g., past manufacturing), in harbors, commercial ports, the mouths of river watersheds and in locations adjacent to population centers. This is also confirmed by regional mussel sampling conducted by the Gulf of Maine Council on the Marine Environment Gulfwatch program (see website in Reference below). The geographic distribution of sediment contamination in the bay (Indicator 10) is generally confirmed by the analysis of mussel tissue by the DEP, CBEP and Gulfwatch monitoring programs. Increases in concentrations of toxic chemicals in Casco Bay over time have been seen in areas with increased development and expansion of impervious surface, leading to increased loading of pollutants.

Changes in Lead Concentrations in Mussels from Casco Bay Sampling Sites Over Time



Note: Concentrations above 4.4 ppm dry weight are considered to be elevated based on reference conditions for Maine

Sampling at the same locations several years apart allows us to look at the way concentrations of contaminants are changing over time. Six of the sites noted in the table were also sampled for metals in 1988. Increases in lead levels were seen at four of the sites (Inner Fore River, Great Diamond Island, Mill Creek and East End Beach in Portland). The increases are all likely related to increased development and impervious surface.



Reference

Gulf of Maine Council on the Marine Environment, *Gulfwatch Contaminants Monitoring Program*, May 2005, <http://www.gulfofmaine.org/gulfwatch/mussels.asp> (May 18, 2005).