BCTOX's Marine Biotoxins Surveillance System in BC – Data from CFIA

Shifting pattern of biotoxins in West Coast Canada

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Public health surveillance is "the continuous, systematic collection, analysis and interpretation of health-related data needed for the planning, implementation, and evaluation of public health practice" according to WHO.

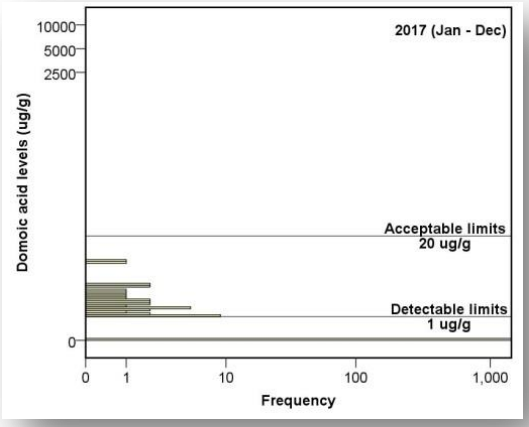
BCTOX is hopeful that this initiative will draw attention of public health professionals to changing pattern of marine biotoxins that may cause shellfish poisoning. The graphs could be predictive indices for what are going to come next month!

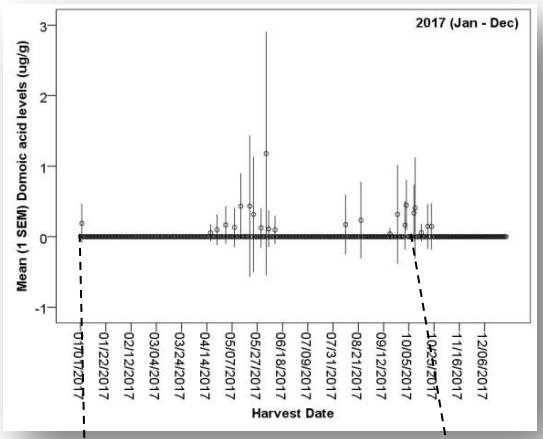
Frequency **Mean (1 SEM) concentrations**

1. Domoic acid

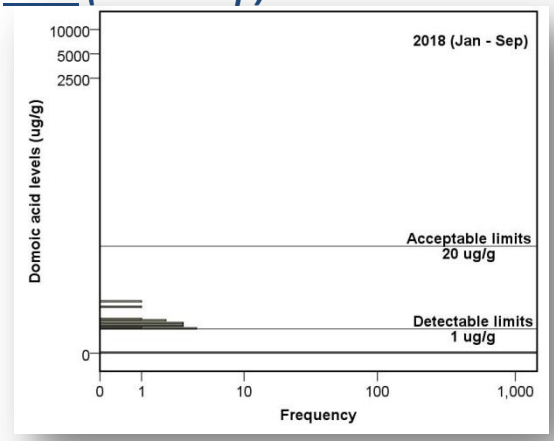
Domoic acid (ug/g) (Amnesic shellfish poisoning (ASP)) among detected shellfish samples in BC (January to December 2017) (n=2 positive cases out of 1088 samples) [These graphs are prepared to imply the trend, and it should be interpreted with caution]

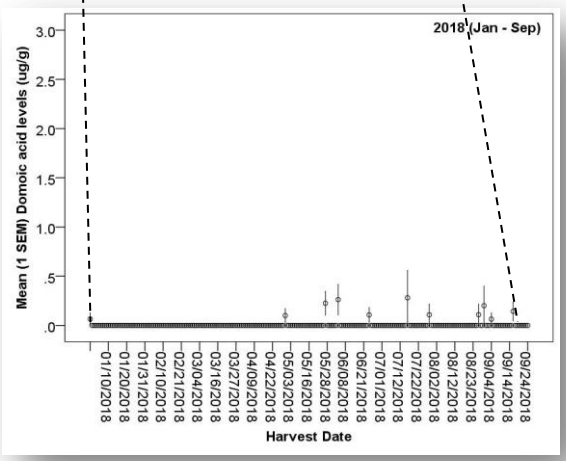
2017 (Jan to Dec)





2018 (Jan to Sep)





Bi weekly marine bio-toxin monitoring in West Coast BC from Jan to Sep 2018

- ***Below*** regulatory limits Domoic acid [Amnesic Shellfish Poisoning] are rarely reported. No cases of above regulatory limits were reported. As compared to Jan to Sep 2017, the values seem to be lower.

BCTOX's Marine Biotoxins Surveillance System in BC – Data from CFIA

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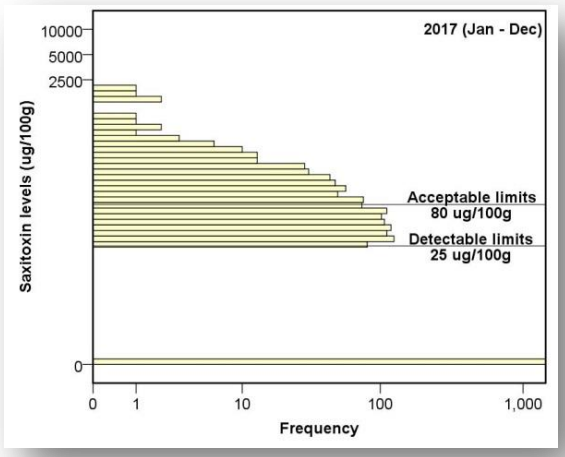
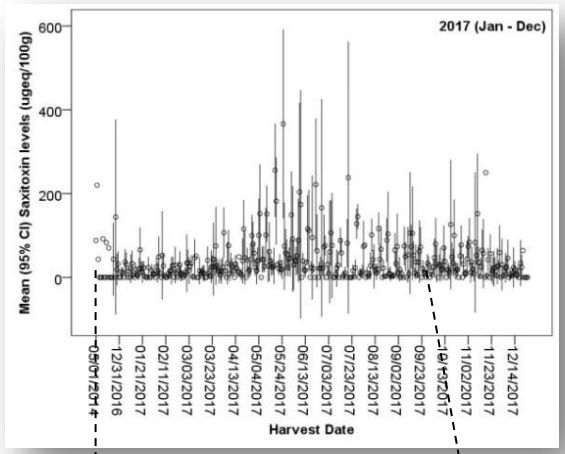
Frequency **Mean (1 SEM) concentrations**

2. Saxitoxin

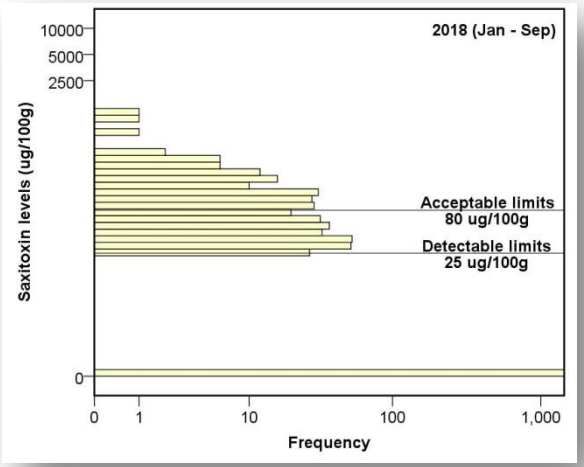
Saxitoxin (ug/100g) (Paralytic shellfish poisoning (PSP) among detected shellfish samples in BC (January to December 2017) (n=154 detected and 20 above the regulatory limit out of 1181 samples) [These graphs are prepared to imply the trend, and it should be interpreted with caution]

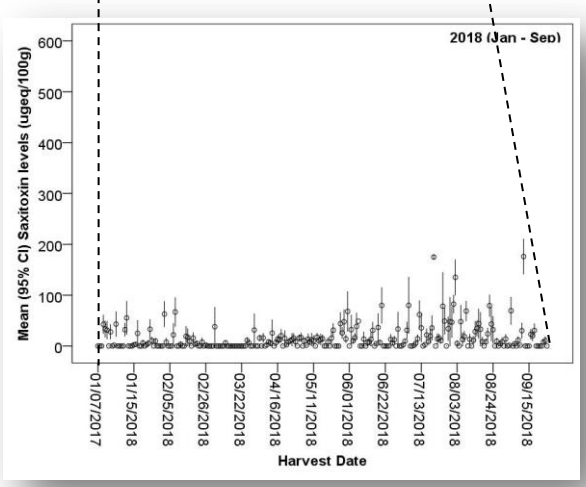
2017 (Jan to Dec)





2018 (Jan to Sep)





Bi weekly marine bio-toxin monitoring in West Coast BC from Jan to Sep 2018

✓ ***Above*** regulatory limits of Saxitoxin [Paralytic shellfish poisoning] concentrations were reported in 2018. The extent of the problem seems to be lower than 2017.

BCTOX's Marine Biotoxins Surveillance System in BC – Data from CFIA

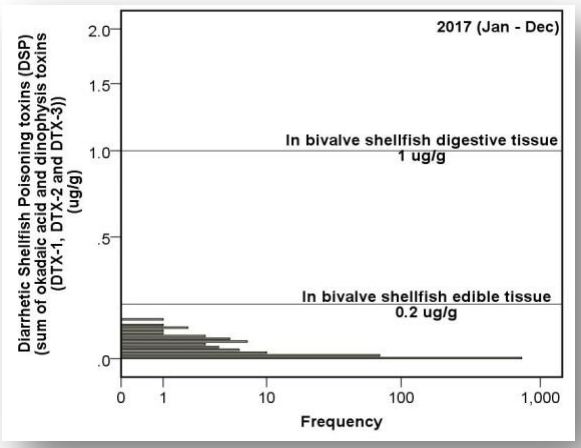
Shifting pattern of biotoxins in west coast Canada

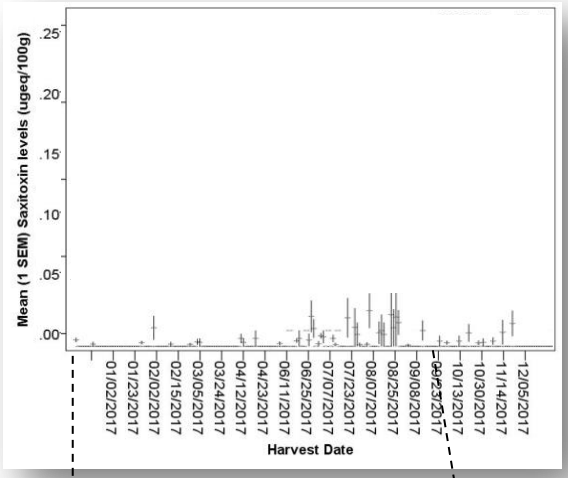
Frequency **Mean (1 SEM) concentrations**

3. Okadaic acid

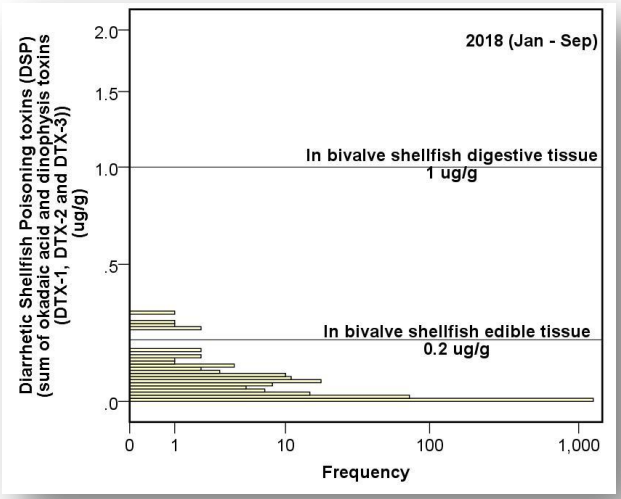
Okadaic acid (sum of okadaic acid and dinophysis toxins (DTX-1, DTX-2 and DTX-3) (Diarrhetic Shellfish Poisoning toxins (DSP)) among shellfish samples in BC (January to December 2017) (n=114 detected out of 735 sample) [These graphs are prepared to imply the trend, and it should be interpreted with caution]

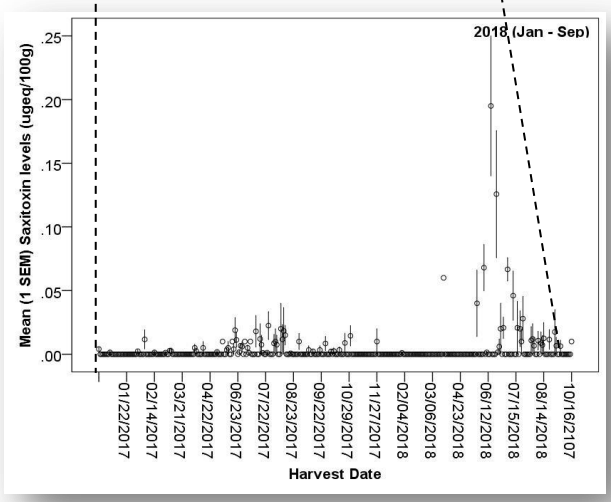
2017 (Jan to Dec)





2018 (Jan to Sep)





Bi weekly marine bio-toxin monitoring in West Coast BC from Jan to Sep 2018

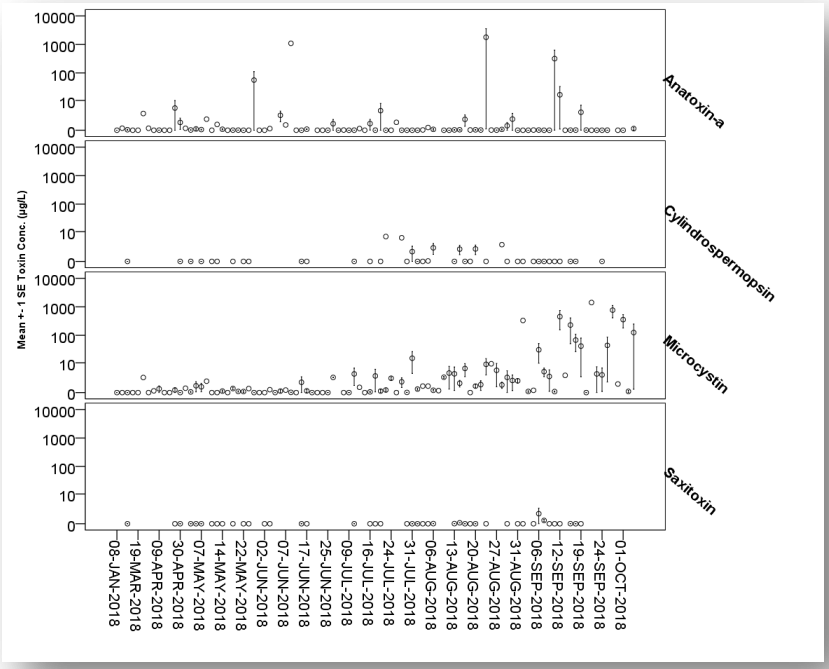
✓ ***Above*** regulatory limits of Okadaic acid and dinophysis toxins [Diarrhetic Shellfish Poisoning] were reported a couple of times. The extent is clearly higher than the last year.

BCTOX's Marine Biotoxins Surveillance System in WASHINGTON STATE –
Data from WASHINGTON STATE Toxic Algae - Shifting pattern of biotoxins

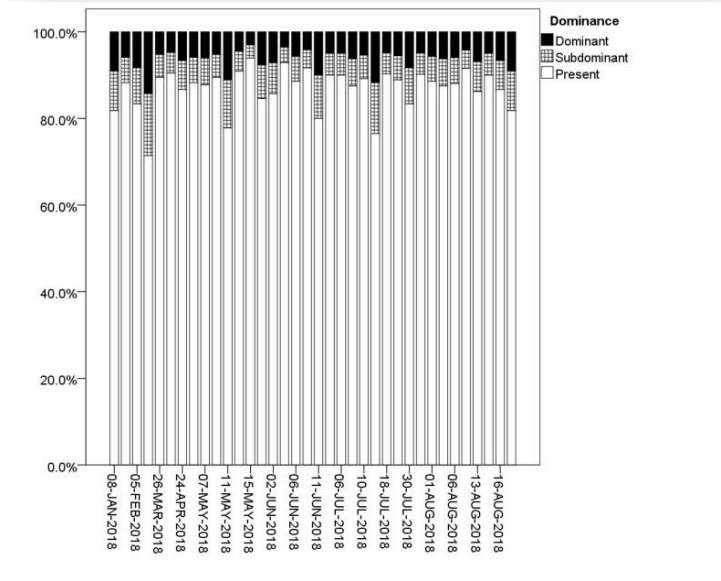
Frequency **Mean (1 SEM) concentrations**

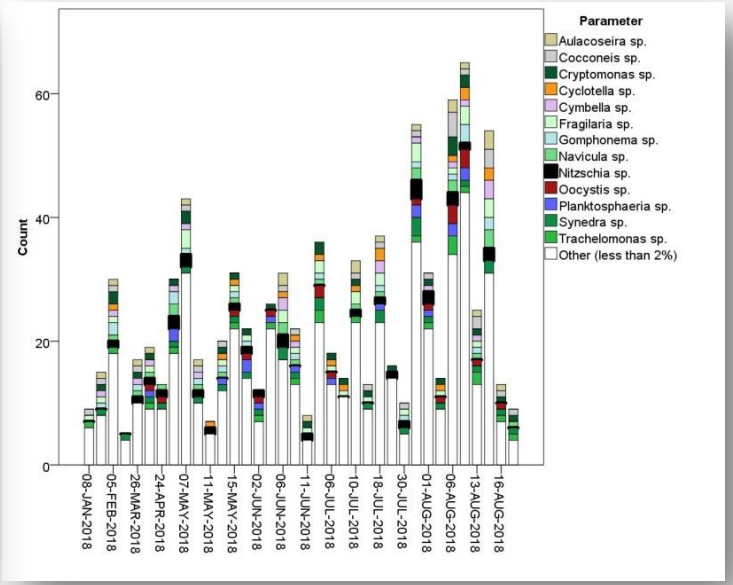
4. *Biotoxins*- WASHINGTON STATE *(2018 Jan to Sep)*

Four types of biotoxins are monitored in Washington State Anatoxin-a, Cylindrospermopsin, Microcystin and Saxitoxin. The pattern is showed below. These data/information for BC were not available.



5. *Phytoplankton's -* WASHINGTON STATE *(2018 Jan to Sep)*[n= 995]





BCTOX's Marine Biotoxins Surveillance System in BC – Data from CFIA

Shifting pattern of biotoxins in west coast Canada

Frequency **Mean (1 SEM) concentrations**

6. Other Marine Miotoxins

1- ***Algae bloom*** are simple plants that do not have ordinary leaves or roots. True algae (*green* algae) start to grow bloom in late spring and early summer in rather colder areas in or near water. --- They are the result of excess nutrients, particularly phosphates originates from fertilizers. Also excess carbon and nitrogen and catalyst residual sodium carbonate. --- Algal is short-lived, and decaying dead organic matter consumes dissolved oxygen in the water, resulting in hypoxic and die off of plants and animals in large numbers.

2- ***Harmful algae bloom*** (or ***red tide***); involves toxic phytoplankton such as dinoflagellates of the genus Alexandrium and Karenia, or diatoms of the genus Pseudo-nitzschia. Such blooms often take on a red or brown hue. They produce natural toxins.

2-1- ***Saxitoxin***

Dinoflagellate Alexandrium fundyense produces Saxitoxin that causes paralytic shellfish poisoning

2-2- ***Domoic acid***

Pseudo-nitzschia diatom produces Domoic acid that causes amnesic shellfish poisoning.

2-3- ***Okadaic acid***

--- Dinoflagellates Dinophysis produce Okadaic acid (sum of okadaic acid and dinophysis toxins (DTX-1, DTX-2 and DTX-3) that causes Diarrhetic Shellfish Poisoning (DSP)

2-4- ***Azaspiracid***

Dinoflagellate Azadinium spinosum produces Azaspiracid (is a phycotoxin) and analogues. Azaspiracid can result in severe acute symptoms that include nausea, vomiting, diarrhea, and stomach cramps.

EU and FDA regulatory limit is 160 µg/kg (reports from Europe).

--- No information is available online from BC

2-5- ***Brevetoxin***

Karenia brevis dinoflagellate produces brevetoxin that causes neurotoxic shellfish poisoning. (Common in Florida and Gulf of Mexico). NSP is diagnosed with gastrointestinal and neurological symptoms: nausea and vomiting, paresthesias of the mouth, lips and tongue as well as distal paresthesias, ataxia, slurred speech and dizziness. Neurological symptoms can progress to partial paralysis and respiratory distress.[1]

--- No information is available online from BC

2-6- ***Cyclic imines***

"The dinoflagellates Karenia selliformis and Alexandrium ostenfeldii / A. peruvianum have been implicated in the biosynthesis of gymnodimines and spirolides, while Vulcanodinium rugosum is the producer of pinnatoxins and portimine."[2]
[3]

--- No information is available online from BC

2-7- ***Palytoxin and analogues*** (No information is available online from BC)

"Most incidents of palytoxin poisoning have manifested after oral intake of contaminated seafood. Poisonings in humans have also been noted after inhalation, cutaneous/systemic exposures with direct contact of aerosolized seawater during Ostreopsis blooms and/or through maintaining aquaria containing Cnidarian zoanthids."[4]

"Common symptoms include numbness, paraesthesia and swelling around the site of exposure (cutaneous exposure), rhinorrhea, cough, dyspnea (inhalational exposure), perioral paraesthesia, dysgeusia (oral exposure) and eye irritation (ocular exposure)"[5]

--- No information is available online from BC

2-8- ***Pectenotoxin***

--- No information is available online from BC

--- No information is available online from BC

2-10- *Yessotoxin and analogues*

Lingulodinium polyedrum and Gonyaulax spinifera Dinoflagellates produced Yessotoxins that are related to ciguatoxins. Yessotoxins causes diarrhetic shellfish poisoning. [6]

EU regulatory limit is 1 µg of YTXs per g (1 mg/kg).

--- No information is available online from BC

2-9- *Tetrodotoxin and analogues*

After ingestion of puffer fish. The flesh of the puffer fish (ie, fugu) is considered a delicacy in Japan.

Image adopted from MedScape

"Paresthesias initially affect the tongue, lips, and mouth and progress to involvement of the extremities. Gastrointestinal symptoms may be seen and include nausea, vomiting, and less often, diarrhea. Muscle weakness, headache, ataxia, dizziness, urinary retention, floating sensations, and feelings of doom may occur. An ascending flaccid paralysis can also develop. Other reported effects include diaphoresis, pleuritic chest pain, fixed dilated pupils, dysphagia, aphonia, seizures, bradycardia, hypotension, and heart block. Death can occur within hours secondary to respiratory muscle paralysis or dysrhythmias. Clinical effects in the mildest of cases resolve within hours, whereas the more severe cases may not resolve for days. Treatment is supportive; there is no specific antitoxin. Patients who have progressed to having generalized paresthesias, extremity weakness, pupillary dilation, or reflex changes should be admitted to the hospital for observation until peak effects have passed. Those with respiratory failure should be intubated and placed on mechanical ventilation. Vasopressor support may be necessary for hypotension refractory to intravenous fluids. Atropine has been used for symptomatic bradycardia."[7]

Ciguatoxin

Ciguatera fish poisoning (CFP)

Ciguatera is caused by eating contaminated reef fish. Symptoms include diarrhea, vomiting, numbness, itchiness, sensitivity to hot and cold, dizziness, and weakness. Onset from half an hour to up to two days. Diarrhea may last four days. Certain symptoms typically remain for a few weeks to months. Heart difficulties such as a slow heart rate and low blood pressure may occur.[8] --- Recreational exposure to cyanobacteria can cause GI, pruritic skin rashes and hay fever. [9]

Scombroid Fish Poisoning: Histamine Poisoning

3- *Cyanobacteria (blue green algae)*

Cyanobacteria are aquatic and photosynthetic bacteria that live in the water, and can manufacture their own food.

Cyanobacterial toxins

Cyanotoxin – is not related to cyanide – contain neurotoxins, hepatotoxins, cytotoxins, and endotoxins. It causes rapid death by respiratory failure.

--- No information is available online from BC.??

Anatoxin-a

It is produced by cyanobacters and causes loss of coordination, muscular fasciculations, convulsions and death by respiratory paralysis.

Cylindrospermopsin

Microcystin

BCTOXScope (CYANOscope)

BCTOX publishes your pictures of cyanobacteria found in BC your sample with your name.

Take and email your image(s) to BCTOX@yahoo.com

--- If not sure that it is cyanobacteria, it is ok, upload it please!

Make sure to write date, geographical area and other relevant information.

Examples

Photo

Photo

--- Algae gallery by Washington State Toxic Alga is publicly accessible!

Decision Tree for Drinking Water: Cyanobacterial Toxins – Step Descriptions (No information is available online from BC)

STEP A: STEP A: Initial screening for suspected blooms: Examine the water for one or more of total nitrogen and phosphorus. Check for bloom formation.

STEP B: If yes to any of: nitrogen (N)>658 µg/L; phosphorus (P)> 26µg/L; an N:P ratio < 23; changes in secchi depth; or blooms observed, go to Step C. If no, return to Step A.

STEP C: Sample the raw water. Use a portable field kit to test for the presence of microcystins.

STEP D: If the presence of microcystins is detected (>1.0µg/L) with a field test kit, go to step E, and alert the health authority of a potential issue. If microcystins are absent, return to step A.

STEP E: Use a portable test kit to test the treated water supply for microcystins.

STEP F: If the portable test kit indicates microcystins are present (>1.0µg/L) in the treated water, send a sample to the lab for confirmation and immediately notify the health authority.

STEP G: If the lab results indicate the seasonal MAC of 1.5µg/L has been exceeded, immediately contact the health authority for consultation and decision making.

4- Others

Coral

--- Toxic coral in aquarium sends Quebec family to hospital - Zoanthid corals can be toxic, be aware when handling them. (Global News)[10]

Zoanthid coral, the green type seen in this photo, is a common feature of saltwater aquariums. But these organisms can also contain palytoxin, which a Gatineau, Que., family blame for a sudden wave of illness that swept their home on the weekend. (Stu Mills) (Picture adopted from CBCNews)[11]

References:

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4. Patocka J, Gupta RC, Wu QH, et al. Toxic potential of palytoxin. J Huazhong Univ Sci Technolog Med Sci 2015;**35**(5):773-80.
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7. Lawrence D, McLinskey N, Huff JS, et al. CHAPTER 4 - Toxin-Induced Neurologic Emergencies. In: Dobbs MR, ed. Clinical Neurotoxicology. Philadelphia: W.B. Saunders, 2009:30-46.
8. Stewart I, Seawright AA, Shaw GR. Cyanobacterial poisoning in livestock, wild mammals and birds--an overview. Adv Exp Med Biol 2008;**619**:613-37.
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11. CBCNews-2018-04-25. Toxic coral in home aquarium blamed for making Gatineau family sick. http://www.cbc.ca/news/canada/ottawa/toxic-coral-blamed-for-sickening-gatineau-family-1.4633810.