The Utility of a Blue Mussel Cage for Paralytic Shellfish Toxin Monitoring

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Introduction


Fig. 1

Fig.1: A photo of blue mussels on a rock.

The ocean and climate are inseparable. The effects of climate change threaten coastal and marine ecosystems through changes in ocean temperature (Ben-Hasan et al., 2019) (Brierley et al., 2009). One of the impact of this is harmful algal blooms (HABs) (Griffith et al., 2020). Blue Mussels (Mytilus edulis) are great bioindicators for assessing the quality of coastal waters (Farrington et al., 2016).

Hypothesis

Controlled deployments of a mussel cage is an effective method to monitor marine ecosystems for potential accumulation of paralytic shellfish toxins (PSTs).

Fig. 2

A locator map of Baranof Island showing the study site.

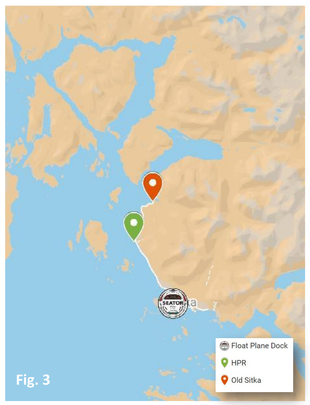


Fig. 3

A map of Sitka showing the harvesting sites of blue mussels, and the site of deployment of the mussel cage (float plane dock).

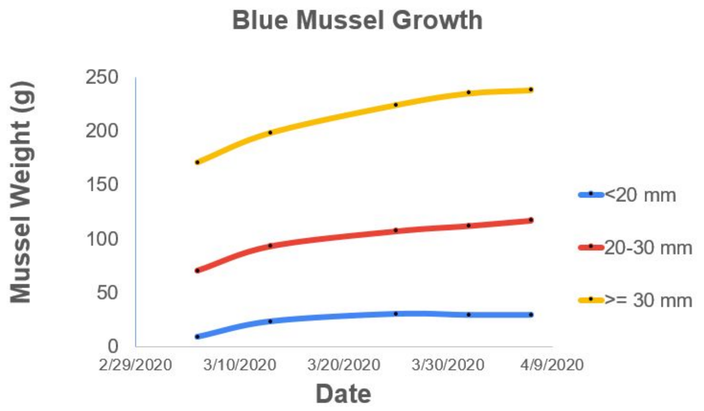

Fig. 4

The modified blue mussel cage at the float plane dock next to the SEATOR dock, Sitka.

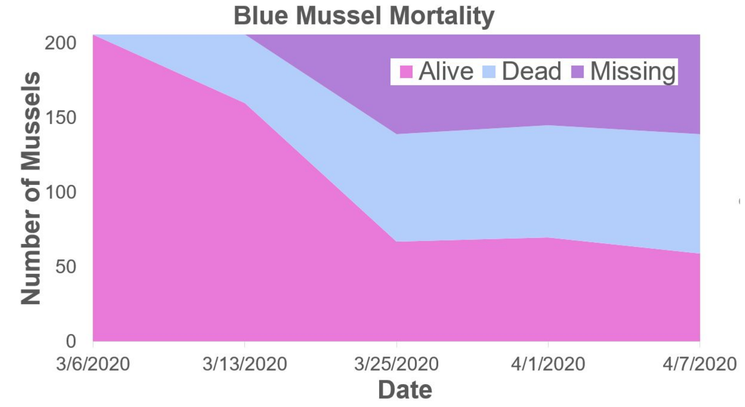
Methods

- The blue mussels were collected from two beaches in Sitka (see Fig. 2).
- They were put into three bins based on their initial length (<20 mm, 20 mm-30 mm, >30mm). An initial weight was recorded for each bin.
- The mussels were placed in the artificial mussel cage (as shown in Fig. 3).
- The weight and the length of the same specimen were measured each week for five weeks starting March 6th.
- The mortality was determined by the mussel being open and the lack of an adductor muscle.
- At the end of the five weeks a receptor binding assay was used to determine the level of paralytic shellfish toxins in the remaining mussels.
- Mussels were collected during the same week from Starrigavan Beach and our mussel cages. The samples were then shucked, homogenized, and prepped for RBA (Receptor Binding Assay).

Results



Note: The Mussel Length was measured during the first sample



STAERL ID	Date Collected	Location	Sample Site	Species	PSP Result* (µg/100g)	Sample Type
200245	4/7/2020	Sitka	Float Plane Dock (Cage 1)	Blue Mussel	21	whole
200246	4/7/2020	Sitka	Float Plane Dock (Cage 2)	Blue Mussel	32	whole
200247	4/7/2020	Sitka	Starrigavan North	Blue Mussel	12	whole

Discussion

Our data suggest that a controlled deployment of the blue mussel cage is an effective way to monitor marine ecosystems for levels of paralytic shellfish toxins. At least 100 g of mussel tissue were required to perform the receptor binding assay. There was sufficient mussel tissue to run the assay twice. The mussels in the cage had more mass per individual than beach-harvested mussels for this area.

This added weight could be because the cage was constantly submerged, and this gave the mussels 24-hour access to food. In the wild typically they would be exposed during low tide twice a day. The PST levels in mussels from the cage were higher than found at Starrigavan beach. Both testing sites were below the 80 µg/100 g the FDA action level for human consumption.

The cage attracted other marine life that may have contributed to the mortality of the mussels. For two weeks in a row, we observed a crab associated with the cage. During one recovery each, we observed one sea cucumber and one sculpin. At the end we did have a significant amount of fouling on the cage from being in the ocean. One third of our mussels went missing probably due to predators and the gage of the netting. another observation is that the cage attracted alge.

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