Information regarding the current shellfish area closures in Massachusetts associated with Amnesic Shellfish Poisoning

On October 11 The Massachusetts Division of Marine Fisheries closed all waters south of Cape Cod to shellfishing due to a substantial bloom of a potentially toxic species of phytoplankton termed *Pseudo-nitzschia* . Certain species of *Pseudo-nitzschia* can produce the toxin domoic acid (DA). Filter-feeding shellfish can accumulate *Pseudo-nitzschia* during normal feeding. When shellfish with high levels of DA are consumed, the consumer is susceptible to Amnesic Shellfish Poisoning (ASP). It is important to note that this closure is precautionary; to-date there have been no reports of ASP associated with the consumption of Massachusetts shellfish.

Pseudo-nitzschia has been reported in Massachusetts waters for several decades and occurs throughout marine waters worldwide. However, these algae do not always produce domoic acid and *Pseudo-nitzschia* has rarely been documented in Massachusetts waters at concentrations which warrant a public health concern. Domoic acid toxin production varies by species, but toxicity in shellfish is usually observed when cell concentrations are above 50,000 to 100,000 cell/liter[1,3]. What triggers *Pseudo-nitzschia* to produce toxin is not completely understood. In situations where toxin production has been observed, it is when the *Pseudo-nitzschia* bloom stops its rapid growth phase and cell concentrations begin to decline[2]. This dynamic means that toxin levels may increase as *Pseudo-nitzschia* concentrations decrease, requiring constant bloom and toxin monitoring.

What testing resulted in the current ASP closure?

On October 7 The Division of Marine Fisheries closed shellfish growing areas in Buzzards Bay, Mount Hope Bay and Lackeys Bay due to the results of phytoplankton samples collected on October 6 as part of a long term plankton and water quality monitoring project in Buzzards Bay conducted by the Turner Lab at the U-Mass School for Marine Science and Technology. The samples showed extremely high concentrations of *Pseudo-nitzschia* throughout areas of Buzzards Bay. A similar closure was issued for adjacent areas in the State of Rhode Island based on *Pseudo-nitzschia* concentrations and the confirmed presence of DA toxin. Below are cell counts from the October 6 plankton samples.

Location	*PseudoNitzschia* Cells/L	Date
New Bedford Outer Harbor	56, 525 cells/L	10/6/2016
Mattapoisett Harbor	14,850 cell/L	10/6/2016
Cape Cod Canal West End Stakes	53,700 cells/L	10/6/2016
Megansett Harbor	209,650 cells/L	10/6/2016
Middle of Buzzards Bay at Cleveland Ledge Light House	497,800 cells/L	10/6/2016

Division of Marine Fisheries biologists collected additional samples between October 8 and October 11 that showed similarly high *Pseudo-nitzschia* concentrations across areas in Vineyard Sound and Nantucket Sound. These results led to the expansion of the closure on October 11. Samples collected from Cape Cod Bay and North Shore sites showed far fewer *Pseudo-nitzschia* concentrations. A subset of cell counts from DMF plankton samples are shown below.

Location	*Pseudo-nitzschia* Cells/L	Date
Woods Hole Channel	106,434	10/8/2016

Lackey's Bay	165,957	10/8/2016
Vineyard Sound off Menemsha	134,680	10/8/2016
Vineyard Sounds Middle Ground	51,712	10/8/2016
Canapitsit Channel	106,427	10/8/2016
Chatham Fish Pier	106,413	10/10/2016
Wellfleet Harbor	2,205	10/10/2016
Barnstable Harbor	3,257	10/10/2016
Town Cove	2,106	10/10/2016
Round Cove	5,713	10/10/2016
Annisquam River Gloucester Harbor	14	10/11/2016
Plum Island Sound	357	10/11/2016

Additional plankton sampling has been on-going by DMF staff and the NOAA Hazardous Algal Bloom Response Network, which conducted a plankton sample collection cruise aboard the *R/V Tioga* today (10/20/2016). Additional results will be made available following analysis.

Species Identification

Plankton samples collected on 10/11/2016 were sent to a partnering research laboratory for species identification. Identifying what species of *Pseudo-nitzschia* are primarily responsible for a bloom is important when determining if the observed bloom represents a public health risk. Massachusetts samples were dominated by *P. pungens* as well as the *P. pseudodelicatissima*-complex, which includes a number of toxic species known to occur in the Gulf of Maine. While most toxin samples analyzed to-date have been negative for DA, the presence of toxin forming species in the bloom means the bloom still has the potential to produce toxin and threaten shellfish safety, especially as the bloom subsides.

Domoic Acid Toxin Sampling

Division of Marine Fisheries biologists collected shellfish samples on October 10 from shellfish growing areas in Buzzards Bay, Vineyard Sound, Nantucket Sound and Cape Cod Bay to test for the presence of Domoic Acid (DA) in shellfish meats. These samples were sent to a third party laboratory for DA analysis via high-performance liquid chromatography (HPLC). All results from this round of shellfish samples came back negative for the presence of DA.

A second round of shellfish samples were collected by the Division of Marine Fisheries on October 19 and analyzed for DA at the Division's Gloucester Shellfish Laboratory on October 20. The presence of DA was confirmed in quahogs collected from Buzzards Bay; all other samples tested negative for DA. However, the continued presence of high *Pseudo-nitzschia* concentrations throughout Nantucket Sound and Vineyard Sound harvest areas warrants the continuation of the closure until additional analysis can be conducted.

What's Next

The Division of Marine Fisheries is continuing to monitor *Pseudo-nitzschia* cell concentrations across the state and will continue to process shellfish and plankton samples for DA toxin. As additional information becomes available it will be provided to the public. All shellfish growing areas South of Cape Cod will remain closed until further notice.

Additional Background information on *Pseudo-nitzschia* in the Gulf of Maine

- There are more than 14 *Pseudo-nitzschia* species confirmed in the Gulf of Maine; 7 are known to produce the neurotoxin domoic acid (DA).

- Toxic and non-toxic species share common morphological features and cannot be readily identified via light microscopy; species identification requires either electron microscopy or genetic methods to differentiate.

- The three most toxic species described for the Gulf of Maine include large- celled species *P. seriata* and *P. multseries*, and the smaller-celled species, *P. plurisecta.* Prior reports of DA production per cell varies across these species and environmental conditions.

- Different cell thresholds can be used for estimating potential for toxicity (generally 50,000 cells per L for large-celled spp., and 1,000,000 cell per liter for small-celled spp.) and to inform toxin testing. The State of Maine has reported toxicity in shellfish at cell counts as low as 10,000 cells per liter while Rhode Island has reported toxin in shellfish at cell counts below 4000 cells per liter.

Click here for an Amnesic Shellfish Poisoning (ASP) fact sheet.

1. *Bates et al. 1998. Bloom dynamics and physiology of domoic-acid-producing Pseudo-nitzschia species. Physiological Ecology of Harmfull Algal Blooms*
2. *Auro, et al. 2013. Nitrogen Utilization and Toxin Production by Two Diatoms of the Pseudo-nitzschia pseudodelicatissima Complex: P. cuspidata and P. fryxelliana. J. Phycology., 49: 156–169.*
3. *Fernandes et al. 2014. Diversity and toxicity of the diatom Pseudo-nitzschia Peragallo in the Gulf of Maine, Northwestern Atlantic Ocean. Deep Sea Res Part 2 Top Stud Oceanogr.*
4. *Trainer et al. 2012 Pseudo-nitzschia physiological ecology, phylogeny, toxicity, monitoring and impacts on ecosystem health. Harmful Algae.*