Cyst Abundance for the Gulf of Maine *Alexandrium catenella* Bloom in October 2023

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Summary

The cyst abundance in the October 2023 survey was relatively low, and this may lead to a low-moderate *Alexandrium catenella* bloom year in spring 2024.

Cyst map. We performed gulf-wide cyst survey PI-23-04 onboard of NOAA ship RV PISCES. On October 12-23, sediment cores at top 1-cm were collected containing *A. catenella* cysts at 57 stations both western and eastern Gulf of Maine, including some extra stations out of historical, 'legacy' stations (Fig.1). The observed cysts were then extrapolated into gulf-wide, repetitive 'Legacy' stations to generate a reconstructed cyst map (Fig.2), following methodology of Solow et al. (2014).

Interannual variability of cyst abundance. Fig.3 and the following table summarize the cyst abundance in the western Gulf of Maine (WGOM), eastern Gulf (EGOM), Bay of Fundy (BoF), and Gulf-wide (All), using the extrapolated cyst map as described above. The gulf-wide bloom magnitude for fall 2022 ranks 19th out of 21 years of sampling. This suggests a potential for a low to moderate *A. catenella* bloom in 2024, continuing the low to moderate bloom pattern as in the past years. Actual timing of the bloom will depend on the actual hydrodynamic conditions in the Gulf. The hotspot of cysts that was present for most other years off the southwest entrance to Penobscot Bay (Fig.1) was also present in the fall 2023 cyst survey. Compared to fall 2022, cyst abundance is slightly elevated in the western WGOM/bloom (Fig.2 & Fig.4).

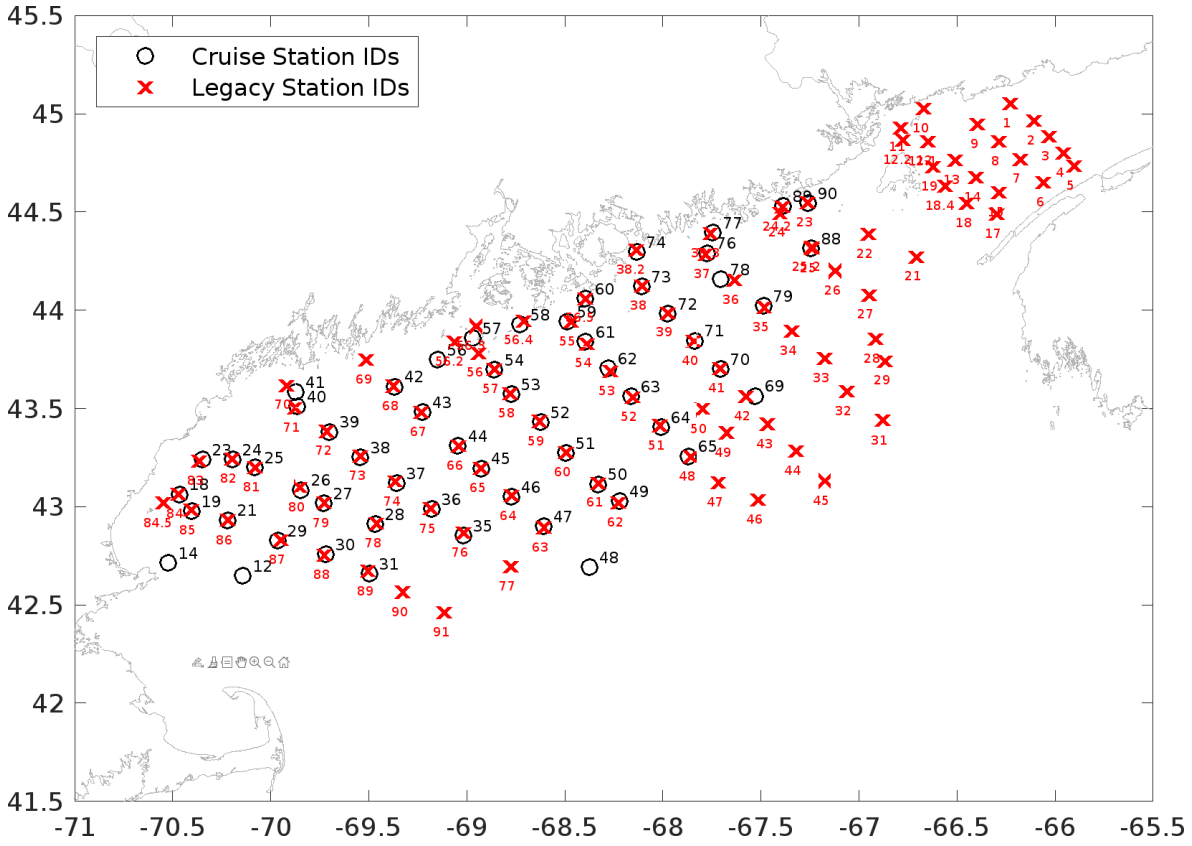

Fig.1: Sediment Sampling Stations in the Gulf of Maine and the actual cruise track for October 2022 Gulf of Maine Cyst Mapping Cruise aboard the Henry Bigelow. Actual cruise stations are shown in open circles, and ‘legacy’ stations are shown in red crosses.

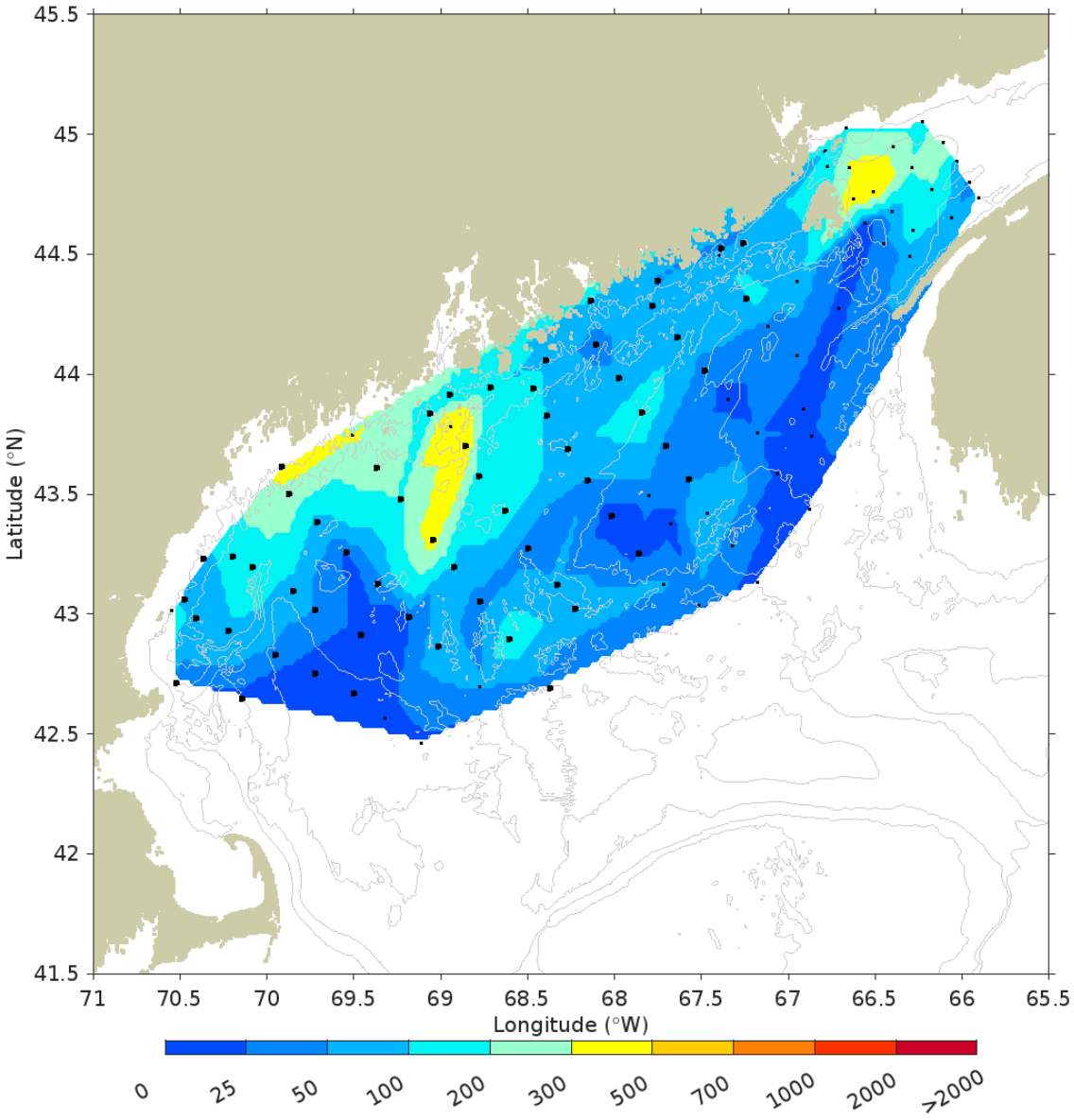

Fig.2. Cyst abundance for the top 1-cm sediment layer, extrapolated following Solow et al. (2014):

Solow, A. R., Beet, A. R., Keafer, B. A., & Anderson, D. M. (2014). Testing for simple structure in a spatial time series with an application to the distribution of *Alexandrium* resting cysts in the Gulf of Maine. *Marine Ecology Progress Series*, *501*, 291-296.

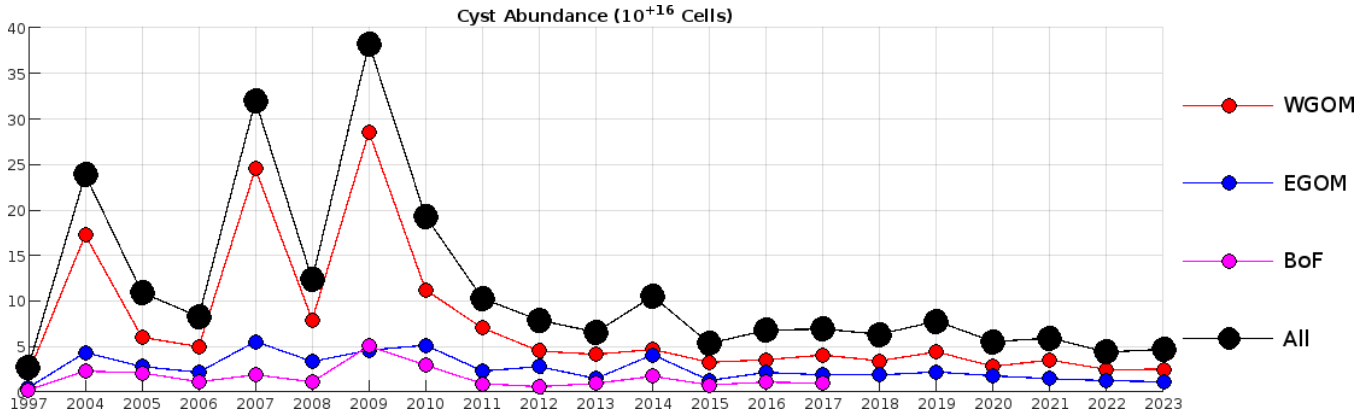

Fig.3. Cyst abundance estimated by extrapolated data from the fall cyst survey during past years. Because the Bay of Fundy has not been sampled since 2013, the corresponding cyst abundance were not shown.

Year	WGOM	% of Mean WGOM	EGOM	% of Mean EGOM	BOF	% of Mean BOF	Total	% of Mean Total	Rank order
1997	2.4	28	0.6	19	0.22	16	2.8	24	21
2004	17.2	237	4.4	169	2.3	164	23.9	212	3
2005	6	83	2.8	109	2.1	151	10.9	97	6
2006	5	69	2.2	84	1.1	81	8.3	74	9
2007	24.5	337	5.6	215	1.9	136	32	284	2
2008	7.9	109	3.4	130	1.1	80	12.4	110	5
2009	28.5	393	4.6	178	5.1	362	38.2	340	1
2010	11.2	154	5.1	200	3	212	19.3	172	4
2011	7	97	2.3	90	0.9	66	10.3	91	7
2012	4.5	62	2.8	108	0.6	43	7.9	70	10
2013	4.1	57	1.5	58	1	68	6.6	58	14
2014	4.4	61	4	154	1.4	102	9.8	87	8
2015	3.3	45	1.3	50	0.8	56	5.3	48	18
2016	3.6	49	2.2	83	1.1	79	6.8	60	13
2017	4.1	56	1.9	74	0.96	69	6.9	62	12
2018	3.4	47	1.9	73	1.05	75	6.3	56	15
2019	4.4	61	2.2	86	1.15	83	7.8	69	11
2020	2.8	39	1.8	69	0.94	67	5.5	49	17
2021	3.5	48	1.5	57	0.94	67	5.9	53	16
2022	2.47	34	1.25	49	0.65	47	4.38	39	20
2023	2.51	34	1.13	44	1.07	77	4.71	42	19
Mean	7.3	100	2.7	100	1.4	100	11.6	100	

Table 1. Top 1-cm cyst abundance (10^{16}) projected to for the WGOM, the EGOM, the Bay of Fundy (BoF), and the entire Gulf.

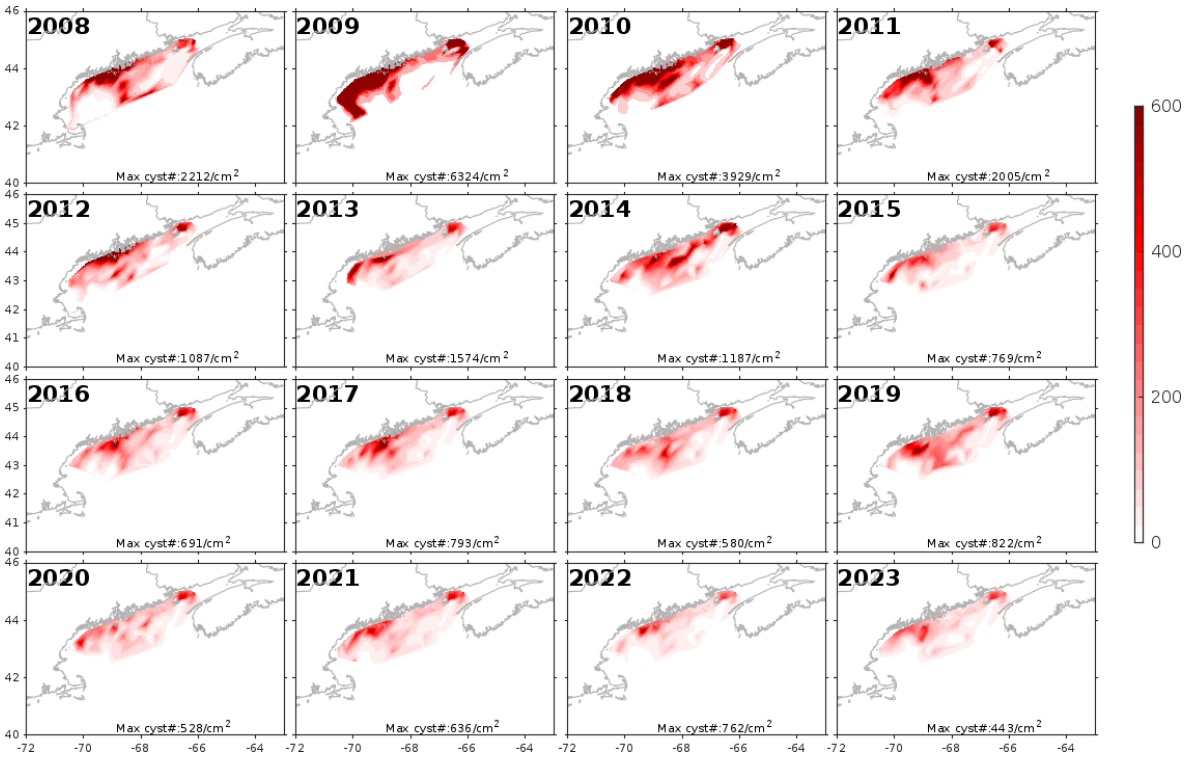

Fig.4. Cyst abundance of top 1 cm sediment layer (cm^2) during fall cyst survey of each year during 2007-2023.