Gulfwatch Mussel Sample Archive: Sample Access Policy

Background

Gulfwatch was a transboundary chemical contaminants monitoring program organized and administered by the Gulf of Maine Council on the Marine Environment (GOMC). The program ran formally between 1993 and 2012, and involved the collection of blue mussels (*Mytilus edulis*) at rotating sites in all jurisdictions around the Gulf of Maine (i.e., Nova Scotia, New Brunswick, Maine, New Hampshire, and Massachusetts). Following mussel collection, scientific laboratories analyzed whole tissues for toxic chemicals formally designated by the United States Environmental Protection Agency; these included polycyclic aromatic hydrocarbons (PAHs), polychlorinated biphenyls (PCBs), chlorinated pesticides, and metals (see Appendix A for Gulfwatch data reports). Though the Program's analyses ended in 2012, researchers continued to sample opportunistically at Gulfwatch sites until 2014. Most recently, the National Oceanic and Atmospheric Administration (NOAA) Mussel Watch Program collaborated with Gulfwatch to assess the presence, distribution, and concentrations of contaminants of emerging concern (CECs) in *M. edulis* collected at various sites in 2015 and 2016 (see Apeti et al. [2021] in Appendix B for results).

Archived mussel samples from Gulfwatch, both extracts and whole tissues, are currently stored and maintained at the Huntsman Marine Science Centre in St. Andrews, New Brunswick, with funding support from Fisheries and Oceans Canada's (DFO) Marine Environmental Quality Program. The utility of mussel tissue analysis has been previously compared to that of surface sediments as indicators of environmental coastal contamination (see Elskus et al. [2020] in Appendix B); although both indicators were found to provide information on the spatial and temporal distribution of chemical contaminants in coastal waters, it was concluded that mussel tissue provides the important additional information on each contaminant's bioavailability. The GOMC and DFO are therefore making these unique samples available to the scientific community to:

- Determine levels of previously unmeasured environmental contaminants of concern as a time series;
- Assess for the presence of environmental CECs (e.g., dioxins and furans, polychlorinated bornanes, organobromines, perfluorinated compounds, organophosphate flame retardants, pyrethroids, microplastics, pharmaceuticals and personal care products, etc.); and/or
- Describe trends and timescales of newly discovered environmental contaminants.

The existence and preservation of these samples presents an invaluable opportunity to gain a regional perspective on the distribution and concentrations of toxic contaminants, establish a

baseline reference for future monitoring efforts, and improve our understanding of issues that threaten the overall environmental quality of coastal waters and those of the Gulf of Maine and Bay of Fundy in particular.

Sample Inventory and Storage Description

All information related to the contents of the Gulfwatch archive is maintained in the digital inventory, and instructions for navigating the inventory are available in Appendix C. The inventory contains data relating to the location and date of sample collection, type of sample (i.e., processed vs. unprocessed), and associated data reports with the results of chemical analyses previously performed on the sample, if applicable. A map of the Gulfwatch approximate site locations is also available, with instructions for its use (Appendix D).

Samples are being stored in freezers maintained at -20°C at the Huntsman Marine Science Centre in St. Andrews, New Brunswick. Processed samples are stored in glass jars with tightly closed lids and unprocessed samples are stored in plastic Ziploc bags.

Sample Request Procedure

1. Applicants must submit a research proposal to the Gulfwatch Archive Steering Committee (contact information provided below). The proposal must be completed using the Sample Request Form. The following information is required:

    a. Name, title, affiliation, and contact information of the Principal Investigator;
    b. Freezer number and container ID of the requested samples, using the information in the publicly available inventory;
    c. A statement of the proposed use of the requested samples, including a description and justification of contaminant(s) of interest, study objectives, and a brief description of methods and proposed approach;
    d. Declaration of funding source(s) available to carry out the proposed research;
    e. Indication of project timeline;
    f. Agreement that an acknowledgement must be given to the Gulf of Maine Council on the Marine Environment's Gulfwatch Contaminants Monitoring Program, Huntsman Marine Science Centre, and Fisheries and Oceans Canada's Marine Environmental Quality Program in any publication or presentation that presents data generated from the use of Gulfwatch samples; and
    g. Agreement that data and findings generated from the use of Gulfwatch samples must be shared with the Steering Committee and made publicly available, preferably as a published document. At minimum, data and interpretation must be uploaded to an open database. A copy of any final publication should be forwarded to the Steering Committee so that it can be posted to the GOMC's Gulfwatch webpage.

2. The following evaluation criteria will be applied by the Steering Committee to the research proposals:

    - Does the proposed project use the valuable temporal aspect and/or geographic coverage of these collections?
    - Does the project have potential to contribute meaningful information to our understanding of the status and trends of contaminants in coastal waters and those of the Gulf of Maine and Bay of Fundy?
    - Are all of the above required elements included in the research proposal?
    - Does the project address existing knowledge gaps?
    - Does the applicant have sufficient funding to carry out the project, and are the proposed methods for analysis appropriate?

3. If one or more of the above criteria are not met, or the proposed use of the samples is not deemed appropriate by the Steering Committee, the request will be denied. If a sample request is approved, the applicant will be contacted and the samples will be shipped at the expense of the recipient[1]. Any residual sample material will need to be discarded after the study is complete, thus highlighting the importance of ensuring meaningful use.

    [1] All charges associated with shipping, including specialized packaging, customs, duties, fees, or taxes, are the responsibility of the sample requestor. The requestor will be dealing directly with the Huntsman Marine Science Centre for shipping details.

Proposal Submission and Contact Information

Please submit proposals and direct any questions to DFO.MARMEQ-QMMMAR.MPO@dfo-mpo.gc.ca.

Disclaimer

GOMC, DFO, and Huntsman Marine Science Centre cannot guarantee the quality or suitability of the samples for further analysis. While all reasonable effort has been made to maintain the quality of the samples in the archive, it is solely the responsibility of the requestor to consult the available information (e.g. annual data reports, publications, etc.) and use their discretion to determine the suitability of the samples for the proposed use. The sample requestor is responsible for all costs associated with sample shipment and analysis.

APPENDIX A. Links to relevant Gulfwatch materials

• Gulfwatch Mussel Sample Archive Inventory (*user guide available in Appendix C)*	https://docs.google.com/spreadsheets/d/1zNEsw9NImXydIk7JhMjKpogfLPDo7BFVJ3zdkhuoyno/edit?usp=sharing
• Gulfwatch data reports (1992-2010) and other relevant data	https://www.gulfofmaine.org/public/gulfwatch-contaminants-monitoring/data-reports/
• Gulfwatch Contaminants Monitoring Program website	http://www.gulfofmaine.org/public/gulfwatch-contaminants-monitoring/
• Map of Gulfwatch sites (*user guide available in Appendix D*)	https://www.google.com/maps/d/edit?mid=16w5mWqjqxuitf0S7y1ufgoaa1RgA7Ms&usp=sharing
• Sample Request Form	https://docs.google.com/document/d/1F3_AZhLxaRvbzgtz8Ghs9J7OjhsHOtEzaJq2sm9KIdM/edit?usp=sharing

APPENDIX B. List of select Gulfwatch publications, compiled by GOMC and Gulfwatch committee member, Dr. Peter Wells

Apeti, D., Ride, M., Jones, S., Wirth, E., and Regan, S. 2021. National Status and Trends, Mussel Watch program. An Assessment of Contaminants of Emerging Concern in the Gulf of Maine. NOAA Technical Memorandum NOS NCCOS 291, March 2021. 118p.

Chamberlain**, S.**D., Wells, P.G., and MacDonald, B.H. 2018. The Gulfwatch contaminants monitoring program in the Gulf of Maine: Are its data being used for ocean protection, with special reference to Nova Scotia, Canada? Marine Pollution Bulletin 127: 781-787.

Chase, M.E., S.H. Jones, P. Hennigar, J. Sowles, G.C.H. Harding, K. Freeman, P.G.Wells, C. Krahforst, K. Coombs, R. Crawford, J. Pederson and D. Taylor. 2001. Gulfwatch: Monitoring spatial and temporal patterns of trace metal and organic contaminants in the Gulf of Maine (1991-1997) with the blue mussel, *Mytilus edulis* L. Mar. Pollut. Bull. 42(6): 491-505.

Elskus, A.A., LeBlanc, L.A., Latimer, J.S., Page, D.S., Harding, G.C.H., and Wells, P.G. 2020. Monitoring chemical contaminants in the Gulf of Maine, using sediments and mussels (*Mytilus edulis*): An evaluation. Marine Pollution Bulletin 153 (2020):110956.

Fried, S. 1999. Gulfwatch. Putting a little mussel into Gulf of Maine marine monitoring. Fundy Issues #12. Bay of Fundy Ecosystem Partnership. www.bofep.org/publications

Gulf of Maine Council on the Marine Environment. 2003. Gulfwatch. Monitoring chemical contaminants in Gulf of Maine coastal waters. GOMC fact Sheet, 4p. GOMC and NOAA.

Hall-Arber, M., Pederson, J., & Wells, P. G. 2012. Anthropogenic and external influences on the Gulf of Maine: Workshop Summary. In: *Advancing an Ecosystem Approach in the Gulf of Maine*. Proceedings of the Symposium " Gulf of Maine Symposium: Advancing Ecosystem Research for the Future of the Gulf. Held in St Andrews, NB, Canada, Oct.4-9, 2009. *Amer. Fish. Soc*. Sympos. 79. Pp. 235-241.

Harding, G., S. Jones, P.Wells, J. Aube, G.Brun, P. Hennigar, C. Krahforst, N. Landry, J. Schwartz, J. Stahlnecker, D. taylor, B. Thorpe, L. White, and P. Vass. 2005. Blue Mussels: Canaries of the Sea. Pages 50-52 in Bedford Institute of Oceanography, 2004 in Review, Annual Report, Fisheries and Oceans Canada, Dartmouth, NS.

Hennigar, P., S. Jones, M. Chase, J. Sowles, P.G. Wells, G. Harding, R. Crawford, C. Krahforst, K. Coombs, D. Taylor, K. Freeman, W. Robinson, and J. Pederson. 1999. Gulfwatch: monitoring toxic contaminants in mussels from the Gulf of Maine. Poster and poster abstract, 3rd BOFEP Bay of Fundy Science Workshop, April 1999, In Ollerhead, J. et al. (1999).

Hennigar, P., M. Chase, G. Harding, S. Jones, J. Sowles, and P.G. Wells. 2001. Dioxins/furans and chlorophenyls in *Mytilus edulis* from the Gulf of Maine. Abstract. Page 138 in Chopin, T. and P.G. Wells. (Eds.). 2001. *Opportunities and Challenges for Protecting, Restoring and Enhancing Coastal Habitats in the Bay of Fundy*. Proceedings of the 4th Bay of Fundy Science Workshop, Saint John, New Brunswick, Sept. 19-21, 2000. Environment Canada, Atlantic Region Occasional Report No. 17, Environment Canada, Dartmouth, NS and Sackville, NB.

Jones, S.H., M. Chase, J. Sowles, P. Hennigar, N. Landry, P.G.Wells, G.C.H. Harding, C. Krahhforst, and G.L. Brun. 2001. Monitoring for toxic contaminants in *Mytilus edulis* from New Hampshire and the Gulf of Maine. J. Shellfish Res. 20(3): 1203-1214.

Jones, S.H. and P.G. Wells. 2002. Gulf of Maine Environmental Quality Monitoring Workshop: Summary Report. Gulf of Maine Council on the Marine Environment. www.gulfofmaine.org/gulfwatch

Jones, S., L. White, P. Hennigar, P. Wells, C. Krahforst, G. Harding, J. Aube, G. Brun, J. Swartz, M. Chase, P. Vass, N. Landry and J. Stahlnecker. 2006. Spatial and temporal trends of chemical contaminants in tissues of the blue mussel, *Mytilus edulis* L., in the Gulf of Maine: 1993-2001. Proceedings of the 5th International Conference on Molluscan Shellfish Safety, Galway, Ireland, June 14-18th, 2004. Henshilwood, B., Deegan, T. et al, (Eds). The Marine Institute, Rinville, Oranmore, Galway, Ireland. Oct 2006. p 373-385.

Jones SH, Krahforst C, White L, Klassen G, Schwartz J, Wells P, Harding GCH, Brun GL, Hennigar P, Page D, Shaw SD, Trowbridge P, Taylor D and Aube J. 2010. The Gulfwatch Program 1993-2008. A review of scientific results. Final report. Gulf of Maine Council on the marine environment. http://www.gulfofmaine.org/council/publications/

Jones S, Krahforst C and Harding G. 2010. Distribution of mercury and trace metals in shellfish and sediments in the Gulf of Maine. Pp 308-315. In: Proceedings of the 7th International Conference on Molluscan Shellfish Safety. Lassus, P. (Ed.) June 14-19, 2009. Nantes, France, Quae Publishing, Versailles, France.

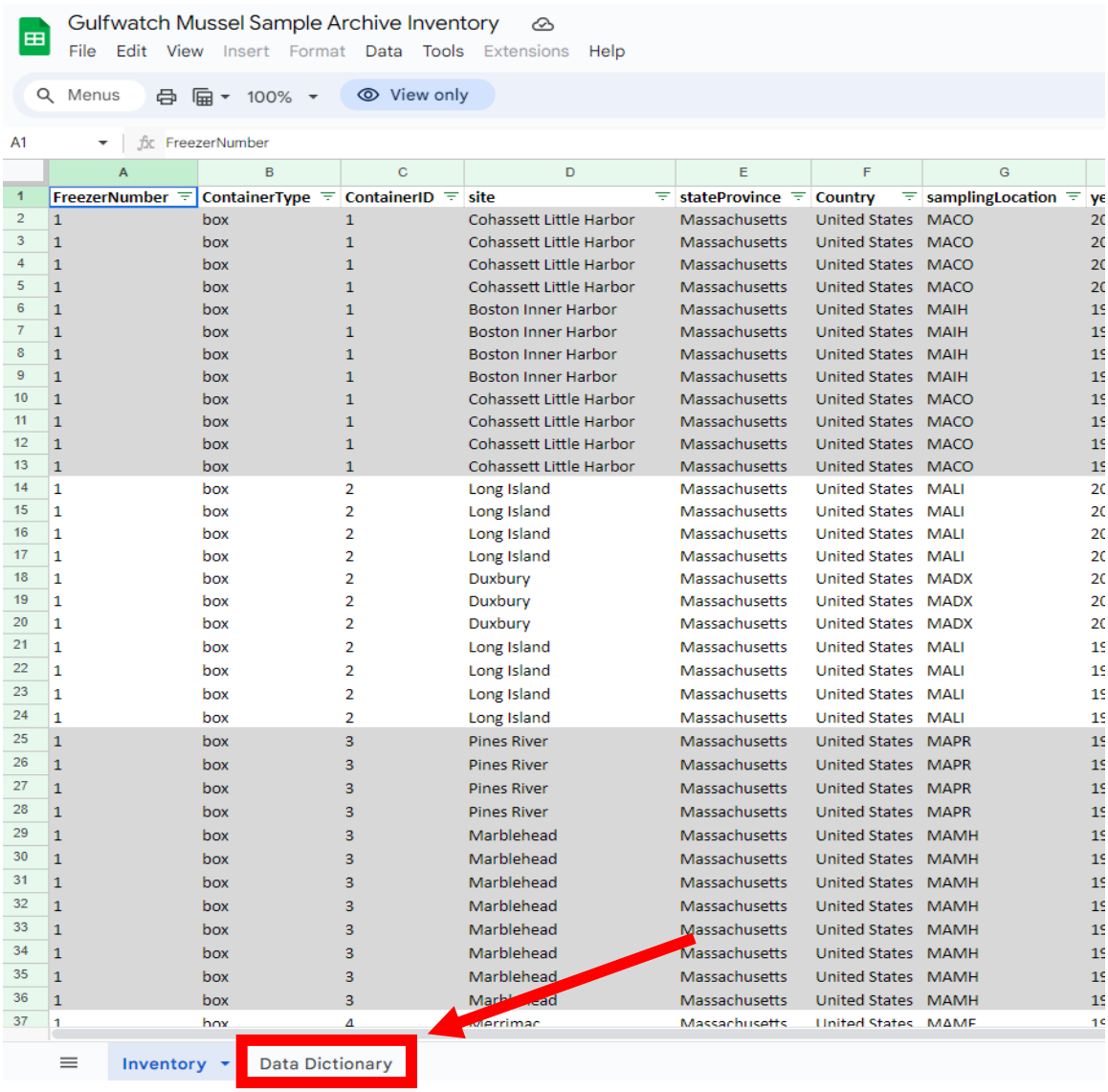
Pesch, G.G. and P.G.Wells. (Eds.). 2004. *Tides of Change Across the Gulf. An Environmental Report on the Gulf of Maine and Bay of Fundy*. Gulf of Maine Council on the Marine Environment, Augusta, ME. 81p. (peer-reviewed book)

Swam, L.M., D.A. Apeti, M.M. Rider, S. Jones, and L A Reed. 2023. National status and trends, Mussel Watch Program : A 2015/2016 assessment of legacy organic contaminants and trace metals in the Gulf of Maine. NOAA Technical Memorandum. https://doi.org/10.25923/atf4-1t66

Wells, P.G. 2004. Chapters 1, 7, 8 in Pesch, G.G. and P.G.Wells. (Eds.). 2004. *Tides of Change Across the Gulf. An Environmental Report on the Gulf of Maine and Bay of Fundy.* Gulf of Maine Council on the Marine Environment, Augusta, ME. 81p. (peer-reviewed book)

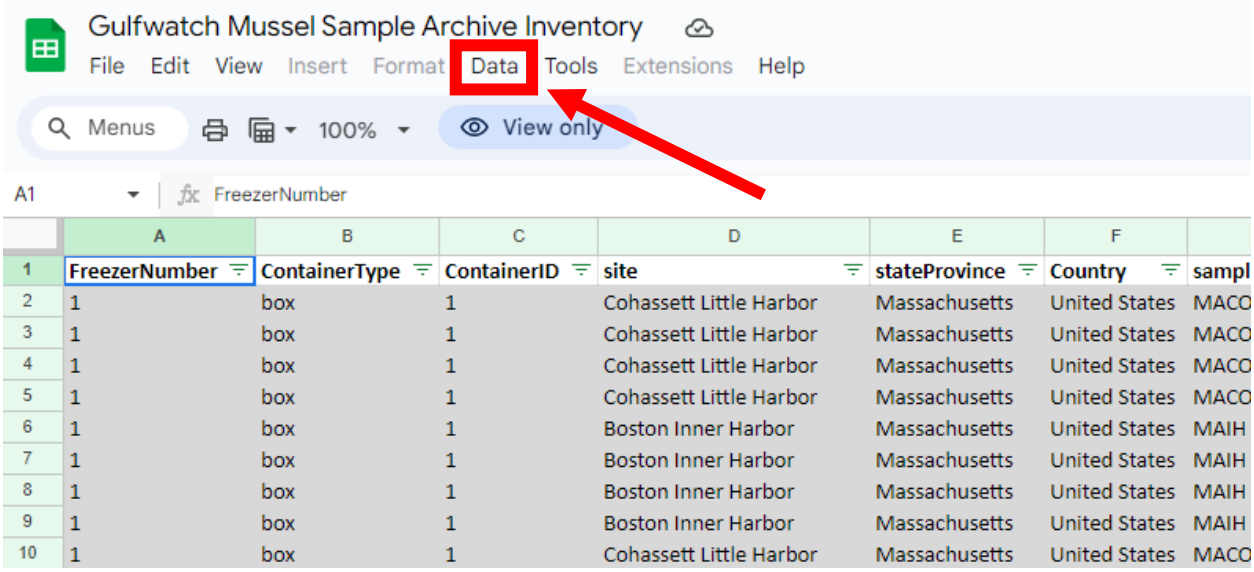
APPENDIX C. Instructions for navigating the Gulfwatch Mussel Sample Archive Inventory

1. A data dictionary describing the contents of each column is available in the second tab of the Google Sheet.



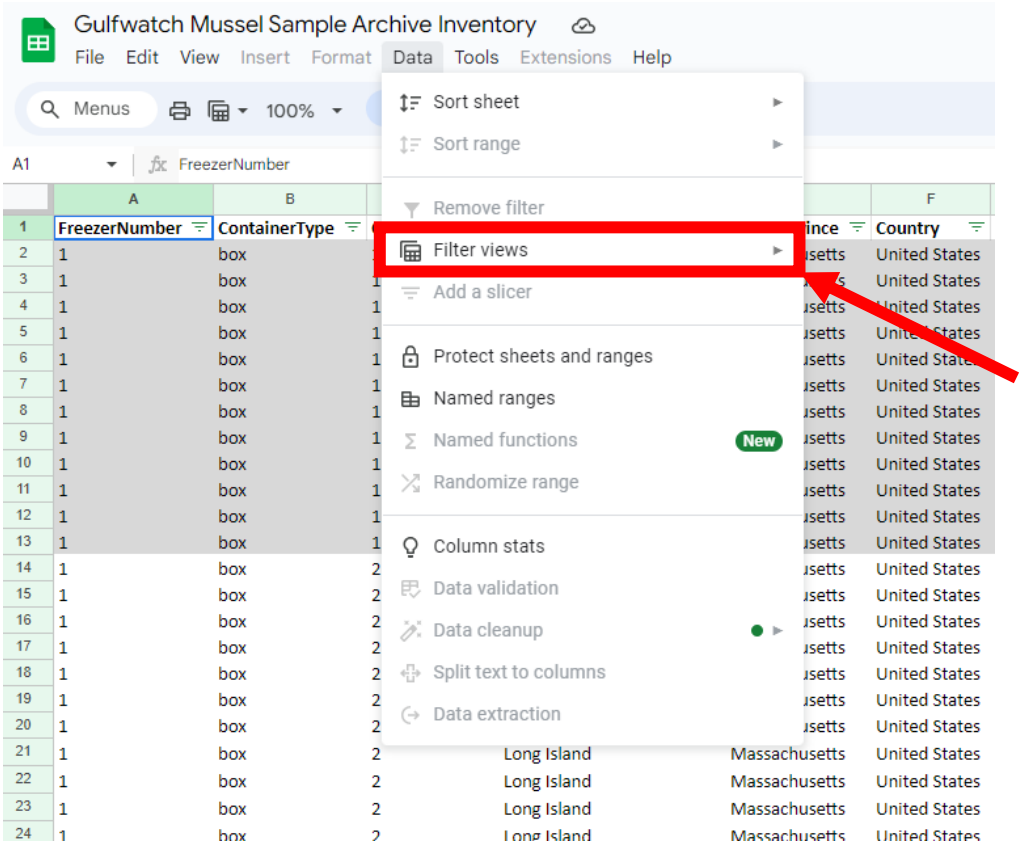
	A	B	C	D	E	F	G	
1	FreezerNumber	ContainerType	ContainerID	site	stateProvince	Country	samplingLocation	ye
2	1	box	1	Cohassett Little Harbor	Massachusetts	United States	MACO	20
3	1	box	1	Cohassett Little Harbor	Massachusetts	United States	MACO	20
4	1	box	1	Cohassett Little Harbor	Massachusetts	United States	MACO	20
5	1	box	1	Cohassett Little Harbor	Massachusetts	United States	MACO	20
6	1	box	1	Boston Inner Harbor	Massachusetts	United States	MAIH	19
7	1	box	1	Boston Inner Harbor	Massachusetts	United States	MAIH	19
8	1	box	1	Boston Inner Harbor	Massachusetts	United States	MAIH	19
9	1	box	1	Boston Inner Harbor	Massachusetts	United States	MAIH	19
10	1	box	1	Cohassett Little Harbor	Massachusetts	United States	MACO	19
11	1	box	1	Cohassett Little Harbor	Massachusetts	United States	MACO	19
12	1	box	1	Cohassett Little Harbor	Massachusetts	United States	MACO	19
13	1	box	1	Cohassett Little Harbor	Massachusetts	United States	MACO	19
14	1	box	2	Long Island	Massachusetts	United States	MALI	20
15	1	box	2	Long Island	Massachusetts	United States	MALI	20
16	1	box	2	Long Island	Massachusetts	United States	MALI	20
17	1	box	2	Long Island	Massachusetts	United States	MALI	20
18	1	box	2	Duxbury	Massachusetts	United States	MADX	20
19	1	box	2	Duxbury	Massachusetts	United States	MADX	20
20	1	box	2	Duxbury	Massachusetts	United States	MADX	20
21	1	box	2	Long Island	Massachusetts	United States	MALI	19
22	1	box	2	Long Island	Massachusetts	United States	MALI	19
23	1	box	2	Long Island	Massachusetts	United States	MALI	19
24	1	box	2	Long Island	Massachusetts	United States	MALI	19
25	1	box	3	Pines River	Massachusetts	United States	MAPR	19
26	1	box	3	Pines River	Massachusetts	United States	MAPR	19
27	1	box	3	Pines River	Massachusetts	United States	MAPR	19
28	1	box	3	Pines River	Massachusetts	United States	MAPR	19
29	1	box	3	Marblehead	Massachusetts	United States	MAMH	19
30	1	box	3	Marblehead	Massachusetts	United States	MAMH	19
31	1	box	3	Marblehead	Massachusetts	United States	MAMH	19
32	1	box	3	Marblehead	Massachusetts	United States	MAMH	19
33	1	box	3	Marblehead	Massachusetts	United States	MAMH	19
34	1	box	3	Marblehead	Massachusetts	United States	MAMH	19
35	1	box	3	Marblehead	Massachusetts	United States	MAMH	19
36	1	box	3	Marblehead	Massachusetts	United States	MAMH	19
37	1	box	4	Merrimac	Massachusetts	United States	MAMF	19

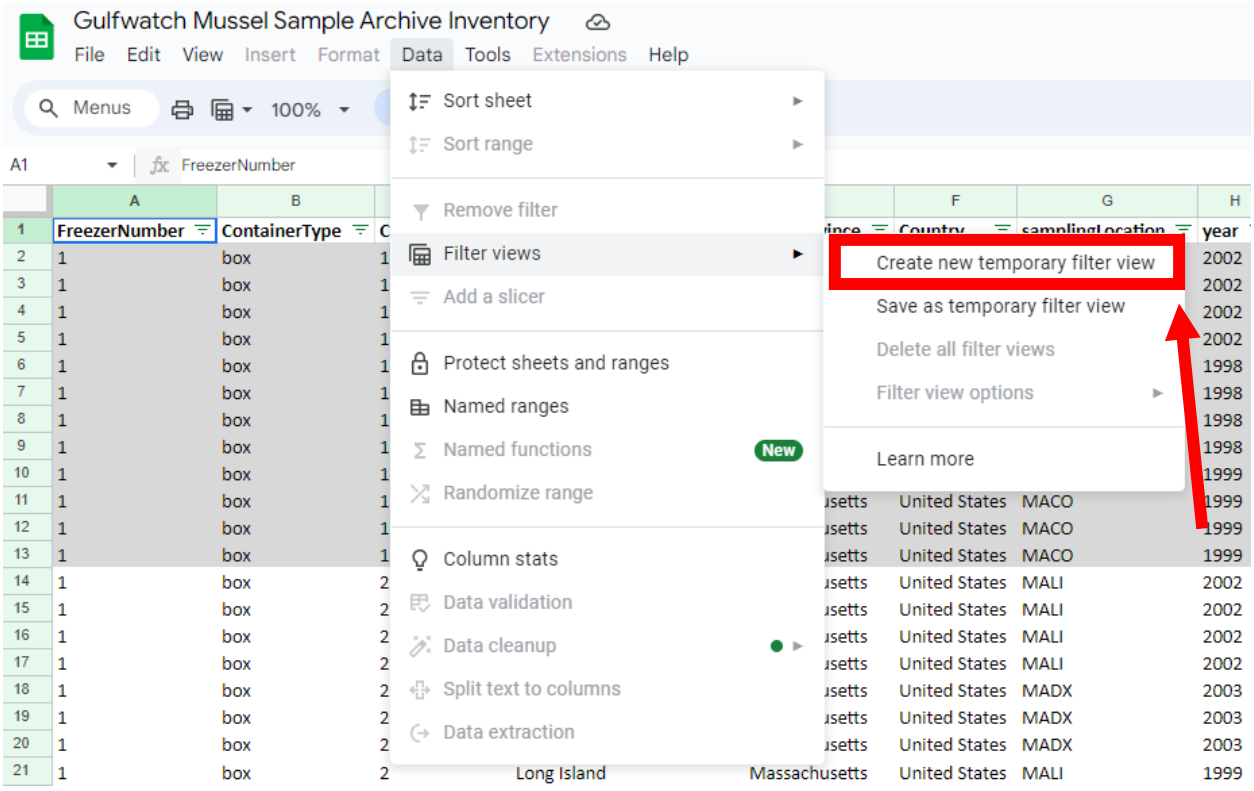
2. To filter the inventory by a parameter of interest (e.g. site), select Data in the top left bar.



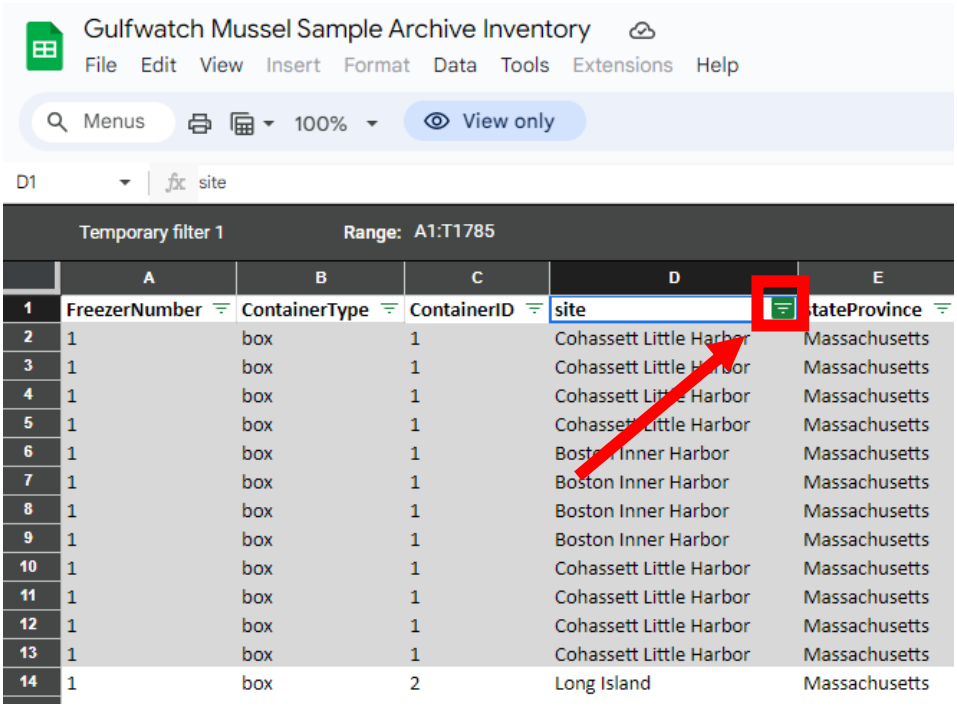
	A	B	C	D	E	F	
1	FreezerNumber	ContainerType	ContainerID	site	stateProvince	Country	sampl
2	1	box	1	Cohassett Little Harbor	Massachusetts	United States	MACO
3	1	box	1	Cohassett Little Harbor	Massachusetts	United States	MACO
4	1	box	1	Cohassett Little Harbor	Massachusetts	United States	MACO
5	1	box	1	Cohassett Little Harbor	Massachusetts	United States	MACO
6	1	box	1	Boston Inner Harbor	Massachusetts	United States	MAIH
7	1	box	1	Boston Inner Harbor	Massachusetts	United States	MAIH
8	1	box	1	Boston Inner Harbor	Massachusetts	United States	MAIH
9	1	box	1	Boston Inner Harbor	Massachusetts	United States	MAIH
10	1	box	1	Cohassett Little Harbor	Massachusetts	United States	MACO

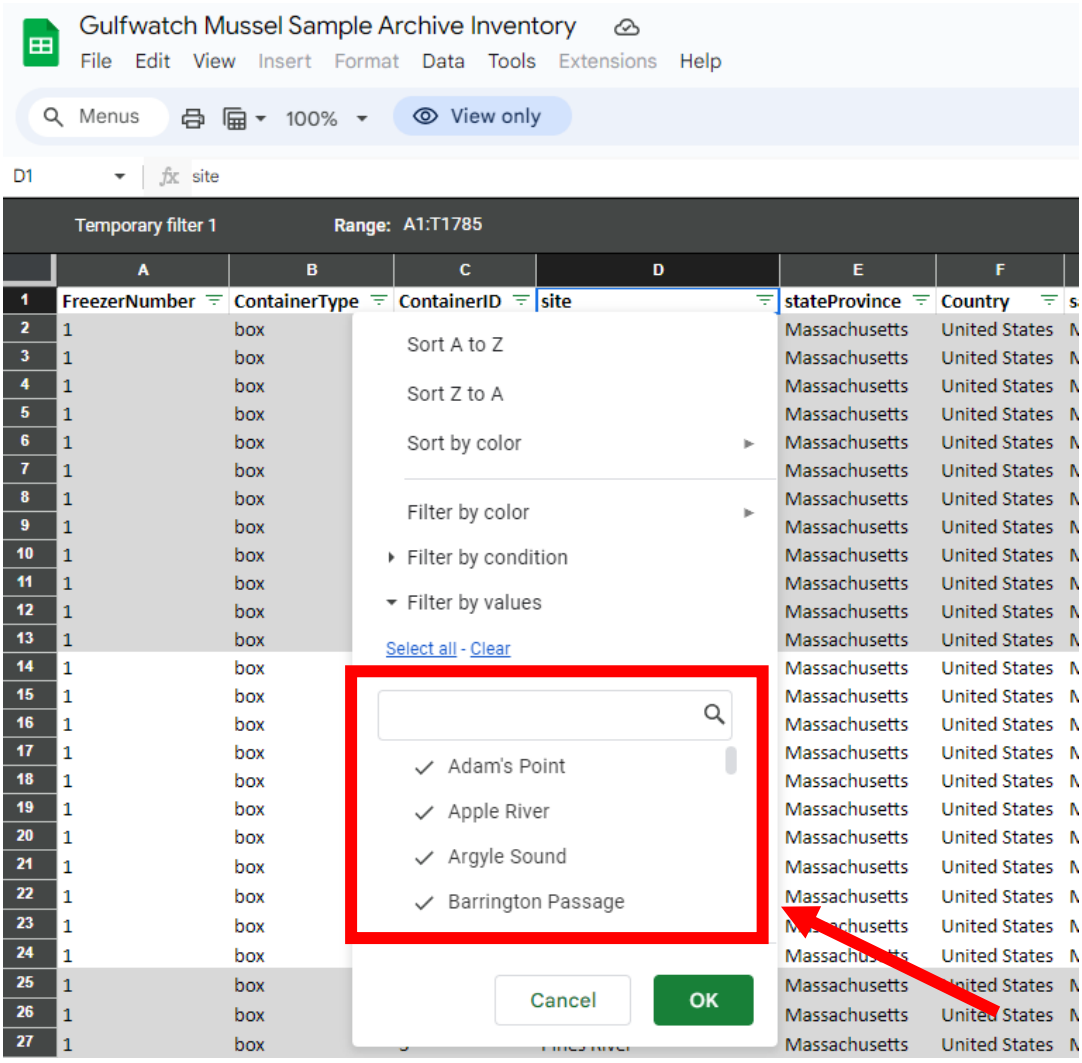
3. From the drop-down menu, select “Filter views”, and then “Create new temporary filter view”.





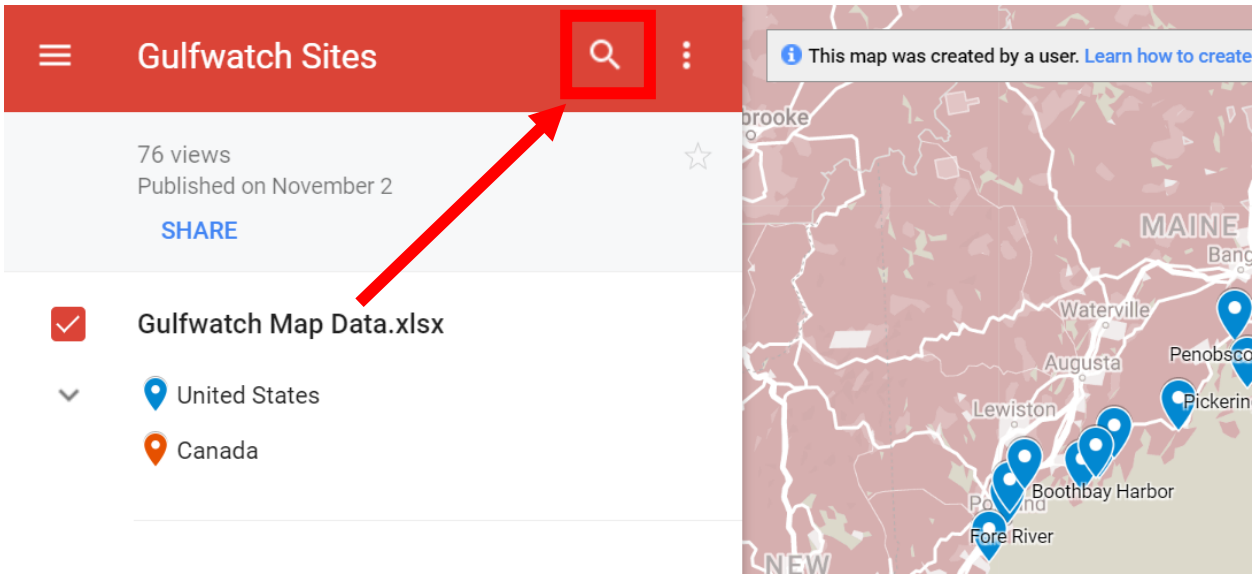
4. Now, any column of interest can be filtered by clicking on the three green lines beside the column title.




Gulfwatch Mussel Sample Archive Inventory
File Edit View Insert Format Data Tools Extensions Help
Menus
100%
View only
D1
site
Temporary filter 1
Range: A1:T1785
FreezerNumber
ContainerType
ContainerID
site
stateProvince
Country
Sort A to Z
Sort Z to A
Sort by color
Filter by color
Filter by condition
Filter by values
Select all - Clear
Adam's Point
Apple River
Argyle Sound
Barrington Passage
Cancel
OK

APPENDIX D. Instructions for navigating the Gulfwatch Site Map

1. To search for a particular site, select the magnifying glass icon in the top left corner.



2. Specific sites can then be searched using either the name of the location (e.g. Apple River) or by the sampling location code (e.g. NSAR).