Otsego Lake Association
2022 annual meeting

Otsego Lake Science Update

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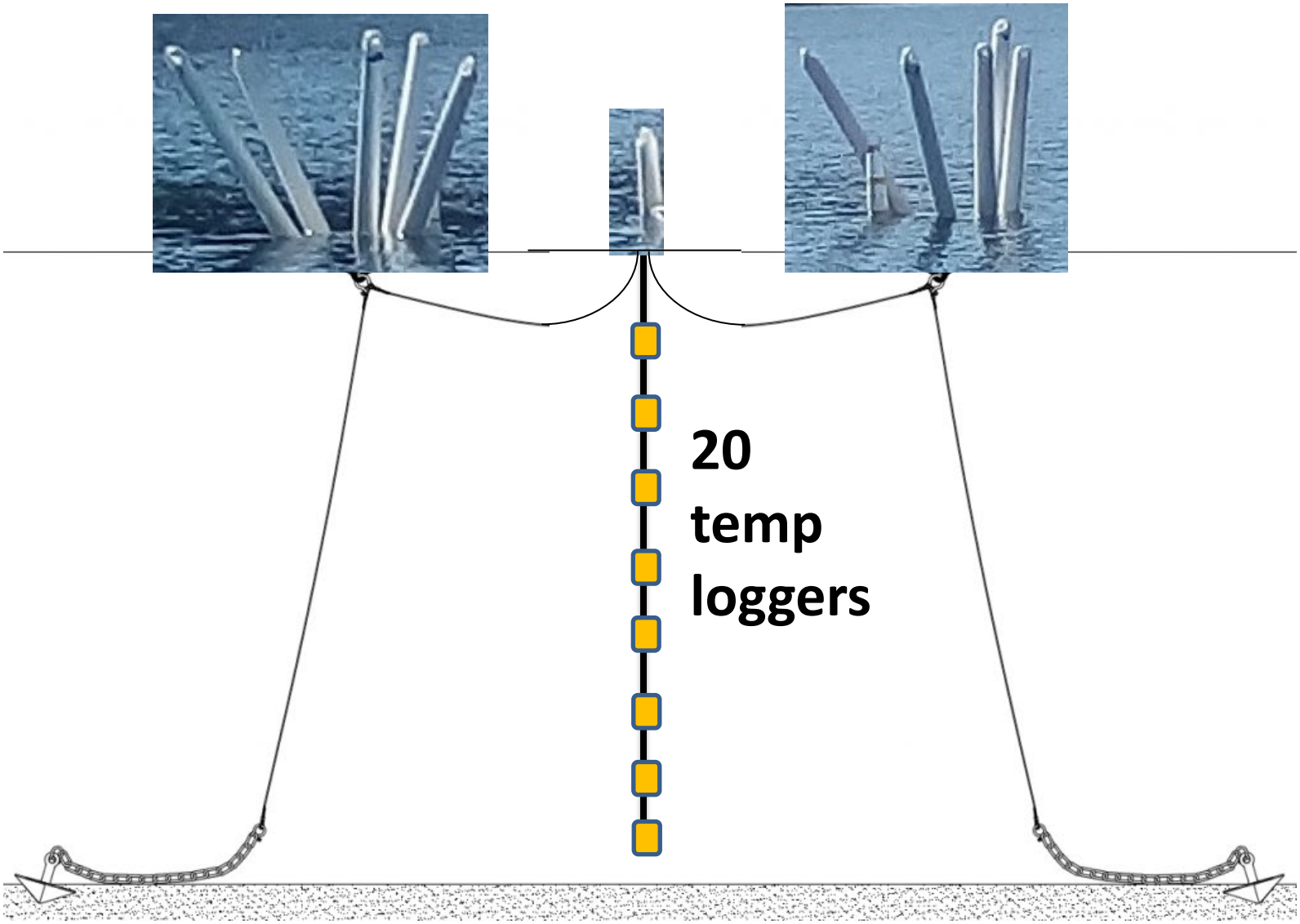
Continuous Lake Monitoring Buoy (CLMB)
Usually April - Dec

Winter setup (December – April)

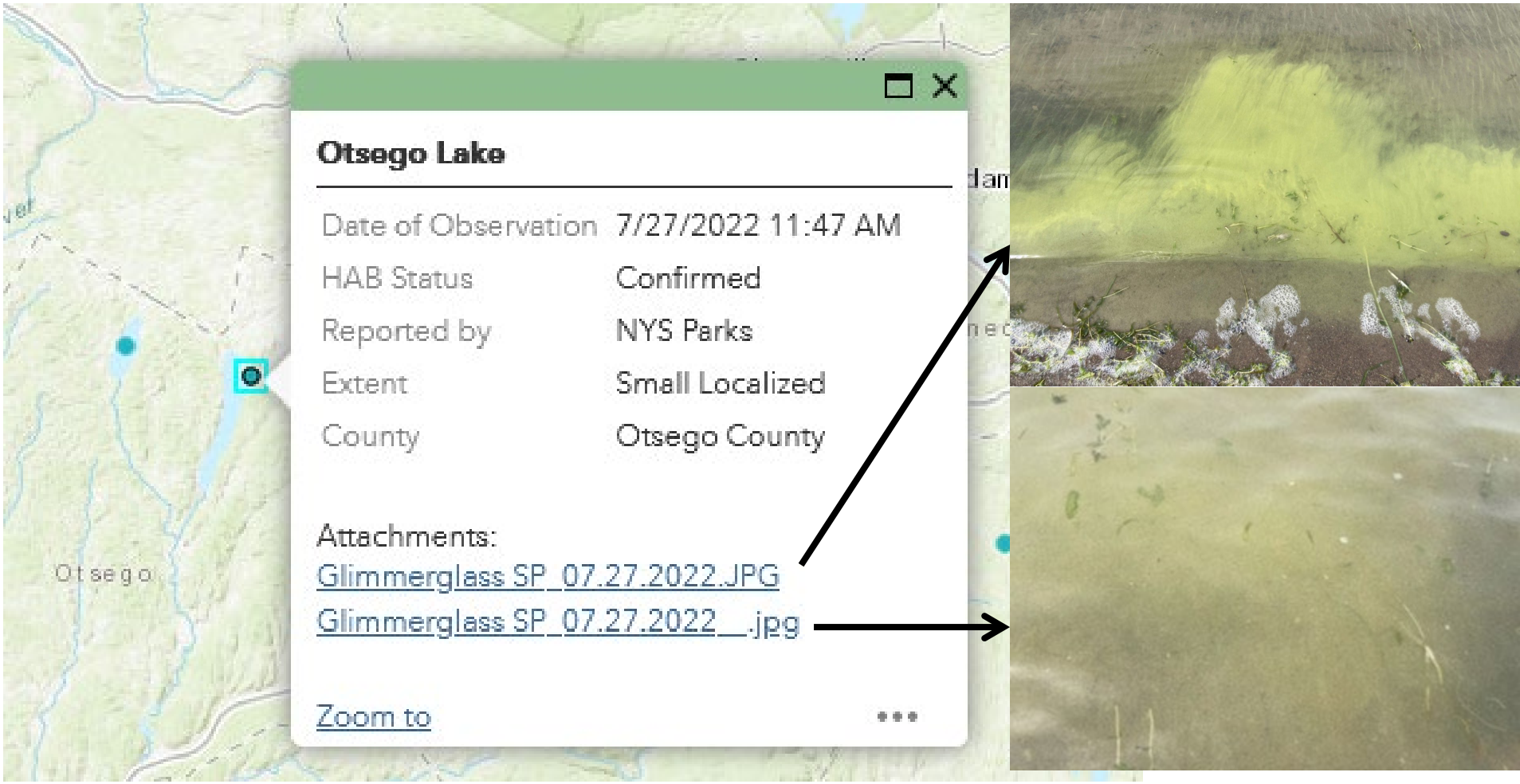


Modified from http://www.nexsens.com/wp-content/uploads/2013/02/Two-Point-Mooring-Setup-1024x669.png

1. **Over 1” (30 mm) of rain overnight, 24-25 July**
2. ***E. coli* exceedance in 25 July sample → Glimmerglass State Park beach closed**

Central							
Chenango Valley SP	7/19/2022	=	21.3	Open Daily	Open		1
Delta Lake SP	7/20/2022	=	140	Open Daily	Open	Clear after resample	1
Gilbert Lake SP	7/25/2022	=	3.1	Open Daily	Open		1
Glimmerglass SP	7/25/2022	=	579.4	Open Daily	Open with Advisory	Exceedance	1
Green Lakes SP - Center Swim Area	7/19/2022	=	10	Open Daily	Open		1
Green Lakes SP - East Swim Area	7/19/2022	<	10	Open Daily	Open		1
Green Lakes SP - West Swim Area	7/19/2022	=	50	Open Daily	Open		1
Sandy Island Beach SP	7/19/2022	=	90	Open Daily	Open		1
Selkirk Shores SP (2)	7/20/2022	=	410	Open Weekends/Holidays	Closed	Exceedance	1
Selkirk Shores SP Beach	7/19/2022	=	130	Open Daily	Open		2
Verona Beach SP	7/19/2022	=	130	Open Daily	Open		1

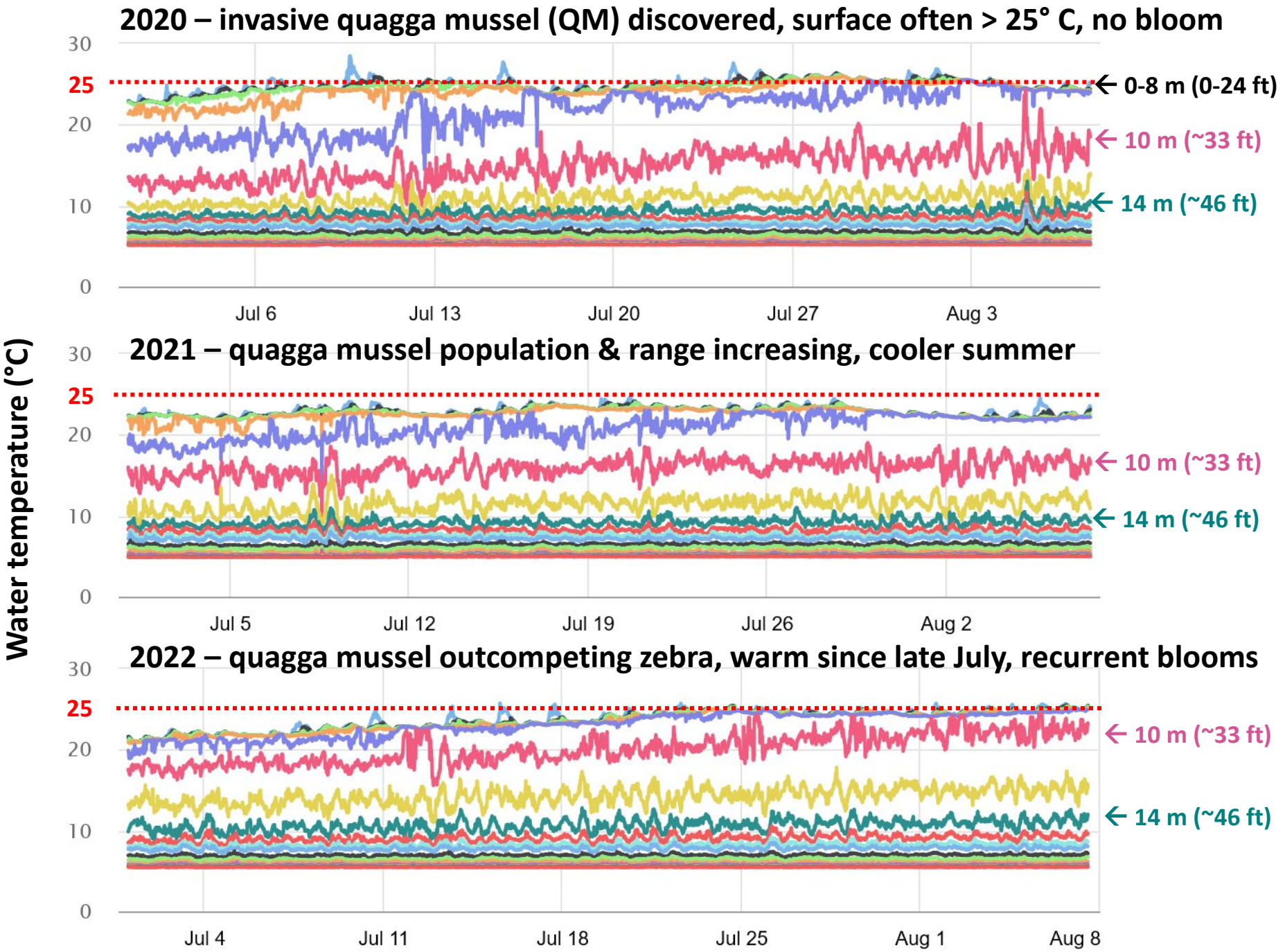
https://parks.ny.gov/recreation/swimming/beach-results/



Source: NYHABS (type in the URL box in a browser to be redirected to the NYSDEC HAB web page)

GSP beach closed again on 27 July for HAB

Reopened on 3 Aug, closed again on 5 Aug for another HAB


2020 – invasive quagga mussel (QM) discovered, surface often > 25° C, no bloom
2021 – quagga mussel population & range increasing, cooler summer
2022 – quagga mussel outcompeting zebra, warm since late July, recurrent blooms
Water temperature (°C)
30
25
20
10
0
← 0-8 m (0-24 ft)
← 10 m (~33 ft)
← 14 m (~46 ft)
Jul 6
Jul 13
Jul 20
Jul 27
Aug 3
Jul 5
Jul 12
Jul 19
Jul 26
Aug 2
Jul 4
Jul 11
Jul 18
Jul 25
Aug 1
Aug 8

Otsego Lake Association

Buoy Data

Real Time

Real Time

Otsego Lake Buoy

Otsego Lake, NY, USA

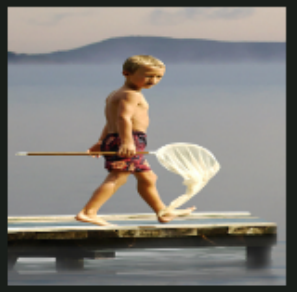
at 07-29-2020 10:30:00

Temp_0m	25.54	C
Temp_2m	25.53	C
Temp_4m	25.53	C
Temp_6m	25.46	C
Temp_8m	22.95	C
Temp_10m	19.36	C
Temp_12m	12.32	C
Temp_14m	9.63	C
Temp_16m	8.42	C
Temp_18m	7.83	C

Powered By WQData LIVE

Quick reference table

Temp		Wind speed	
°C	°F	m/s	mph
-40	-40	0	0
-35	-31	5	11



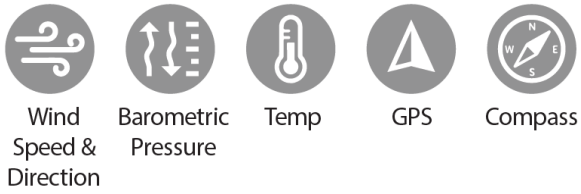
Otsego Lake Buoy

Temp_35m	6.16	C
Temp_40m	5.78	C
Temp_42m	5.62	C
Temp_44m	5.55	C
Temp_46m	5.52	C
Temp_48m	5.47	C
AirTemp	40.40	C
RH	75	%
Rel. BP	0.0	hPa
WindSp	5.8	m/s
Max WindSp	8.6	m/s
WindDir	3277	Degree

Powered By WQData LIVE

Barometric pressure sensor and directional compass not working in the current CLMB weather station

- replaced in early 2020 for failed precipitation sensor
- Brand new unit costs $4K+, more with extended warranty



This WATERPROOF unit (~$2K) can be added to the CLMB to restore the missing measurements.

- Humidity sensor cannot be waterproof
- NOAA uses this double weather station setup for offshore buoys for redundancy

OTL is high in total nitrogen (TN)

INLAND WATERS
https://doi.org/10.1080/20442041.2019.1664233

Prevalence of phytoplankton limitation by both nitrogen and phosphorus related to nutrient stoichiometry, land use, and primary producer biomass across the northeastern United States

Abigail S. L. Lewis [a], Brian S. Kim [b], Hailee L. Edwards [c], Heather L. Wander [c], Claire M. Garfield [d], Heather E. Murphy [e], Noah D. Poulin [f], Sarah D. Princiotta [g], Kevin C. Rose [h], Alex E. Taylor [i], Kathleen C. Weathers [j], Courtney R. Wigdahl-Perry [k], Kiyoko Yokota [l], David C. Richardson [c], and Denise A. Bruesewitz [b]

Table 1. Lake characteristics, sorted by latitude (Lat), including longitude (Long), elevation above sea level (Elev), mean lake depth (Depth), surface area (SA), total nitrogen (TN), total phosphorus (TP), chlorophyll *a* (Chl-*a*), and percentage of phytoplankton cells identified as chlorophyta (Chloro) and cyanobacteria (Cyano). TN, TP, and Chl-*a* data are reported as mean values for samples collected between pre (late June) and post (early July) experiment.

Late June-early July 2017 (at time of experiment)

Lake	State	Lat (°N)	Long (°W)	Elev (m)	Depth (m)	SA (ha)	TN (µg L^{-1})	TP (µg L^{-1})	Chl-*a* (µg L^{-1})	Chloro (%)	Cyano (%)
East	ME	44.610	69.785	80	5.5	695	280	15.7	2.7	71	1
Great	ME	44.530	69.900	76	6.4	3450	210	32.9	3.3	82	4
Long	ME	44.497	69.915	72	10.7	1035	100	9.4	3.7	58	18
Snow	ME	44.471	69.733	71	10.1	1494	200	8.8	6.7	59	20
High	VT	43.753	73.153	315	7.9	8	170	3.7	3.2	77	0
Otsego	NY	42.756	74.896	363	25.0	1637	550	7.3	9.0	58	0
Moe	NY	42.430	74.560	497	1.8	16	365	23.1	5.8	20	70
Cassadaga	NY	42.356	79.326	400	3.4	93	150	9.0	6.8	76	21
Bear	NY	42.347	79.385	399	4.6	46	250	13.0	10.4	44	34
Chautauqua	NY	42.162	79.414	399	7.6	2860	190	19.0	4.4	22	77
Mohonk	NY	41.766	74.158	379	6.0	7	190	13.6	2.7	54	18
Minnewaska	NY	41.726	74.235	503	5.7	14	160	4.3	2.8	83	0
Awosting	NY	41.706	74.290	568	5.0	39	88	3.9	1.9	70	0
Waynewood	PA	41.395	75.210	421	6.0	28	650	34.8	47.0	23	75
Lacawac	PA	41.382	75.293	439	5.2	21	100	4.5	4.8	12	86
Giles	PA	41.376	75.050	428	10.1	48	135	2.0	3.2	84	9

OTL 2021 mean TN = 700 µg L^{-1} (Waterfield & Albright 2021 – BFS annual report)

Received: 9 April 2021 | Revised: 8 June 2021 | Accepted: 18 June 2021

DOI: 10.1111/fwb.13791

REVIEW

Freshwater Biology WILEY

Cyanobacterial blooms in oligotrophic lakes: Shifting the high-nutrient paradigm

Kaitlin L. Reinl[1] | Justin D. Brookes[2] | Cayelan C. Carey[3] | Ted D. Harris[4] | Bas W. Ibelings[5] | Ana M. Morales-Williams[6] | Lisette N. De Senerpont Domis[7] | Karen S. Atkins[8] | Peter D. F. Isles[9] | Jorrit P. Mesman[5,10] | Rebecca L. North[11] | Lars G. Rudstam[12] | Julio A. A. Stelzer[5,13,14] | Jason J. Venkiteswaran[15] | Kiyoko Yokota[16] | Qing Zhan[7]

Microcystis **colony (5 Aug 2022, sampled at NW end of OTL)**

TABLE 1 Summary of cyanobacteria genera, traits, and Morpho Functional Groups (MFGs)[a] for documented blooms in oligotrophic systems in Table S1

Taxa	Traits summary	MFG (from Salmaso & Padisák, 2007)	
Aphanizomenon gracile	Thick filaments, produce akinetes, can regulate buoyancy	Nostocales (5e)	Can fix N_2
Dolichospermum sp. (formerly *Anabaena* sp.)	Thick filaments, produce akinetes, can regulate buoyancy **Was dominant in a localized diffuse bloom in 2018**	Nostocales (5e)	
Gloeotrichia echinulata	Thick filaments, forms large colonies, produce akinetes, can regulate buoyancy	Nostocales (5e)	
Microcystis sp.	Large vacuolated colonies, can regulate buoyancy, large surface area:volume allows slower sinking from surface, over-wintering dormant cells	LargeVacC (5b)	Cannot fix N_2
Planktothrix agardhii	Thin filaments, can regulate buoyancy, over-wintering dormant cells	FilaCyano (5a)	

High N in OTL is promoting non-N_2 fixing *Microcystis*?

Pencil tip for size reference

Microcystis colonies have various shapes – this is just an example

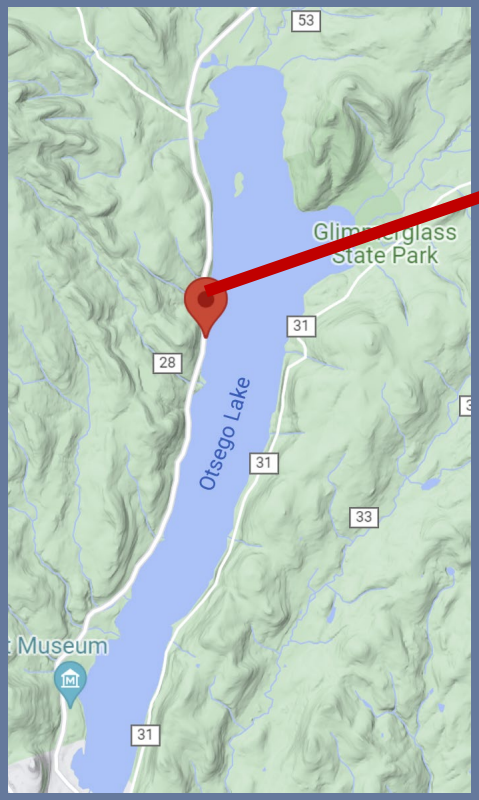
Invasive, non-native mussels in OTL altering habitat structure, biogeochemical cycling and food web

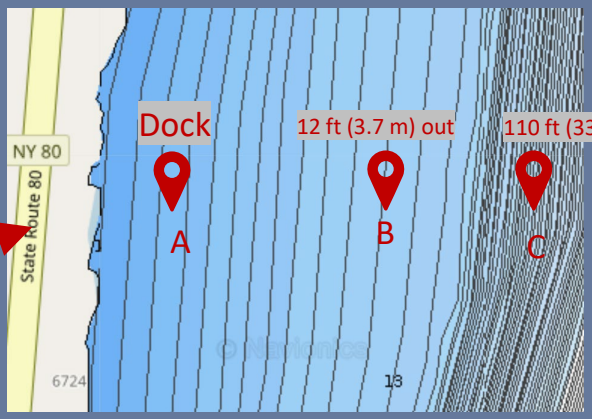
Zebra mussel (2007-)

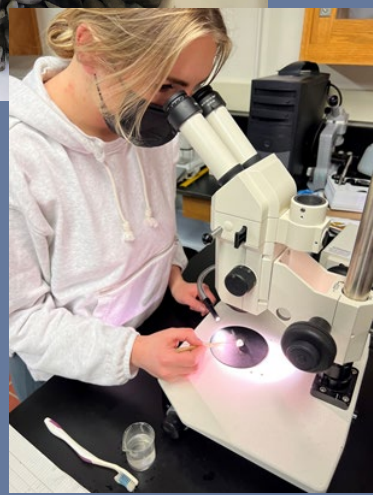
Quagga mussel (2018/20-)

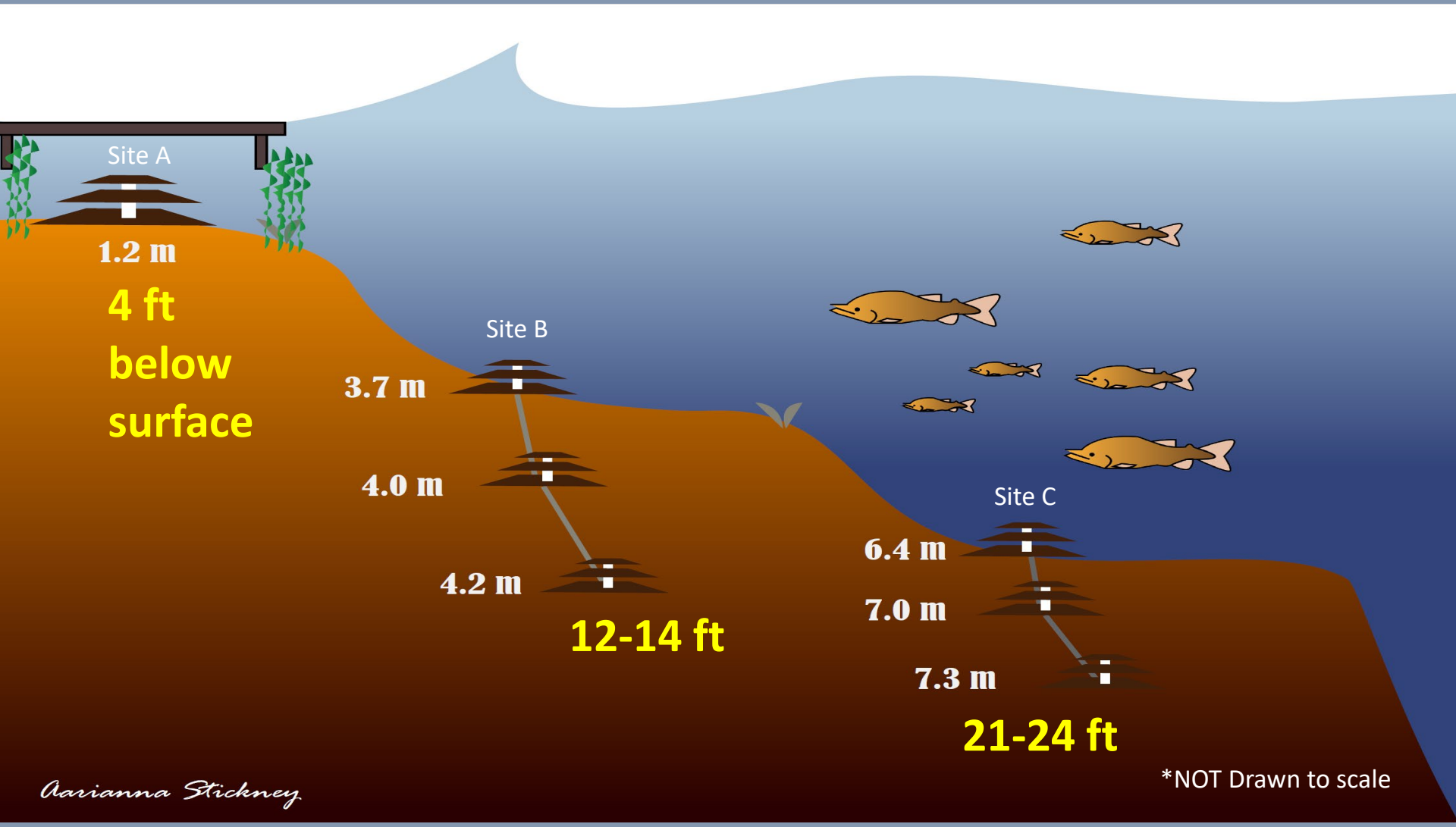
- in water ~80 days
- February 28th - May 19th 2021

Slides modified from NYSFOLA presentation by Stickney, Smith, Minissale, Lord and Yokota (2022)


53
Glimmerglass State Park
31
28
Otsego Lake
31
33
Museum
31

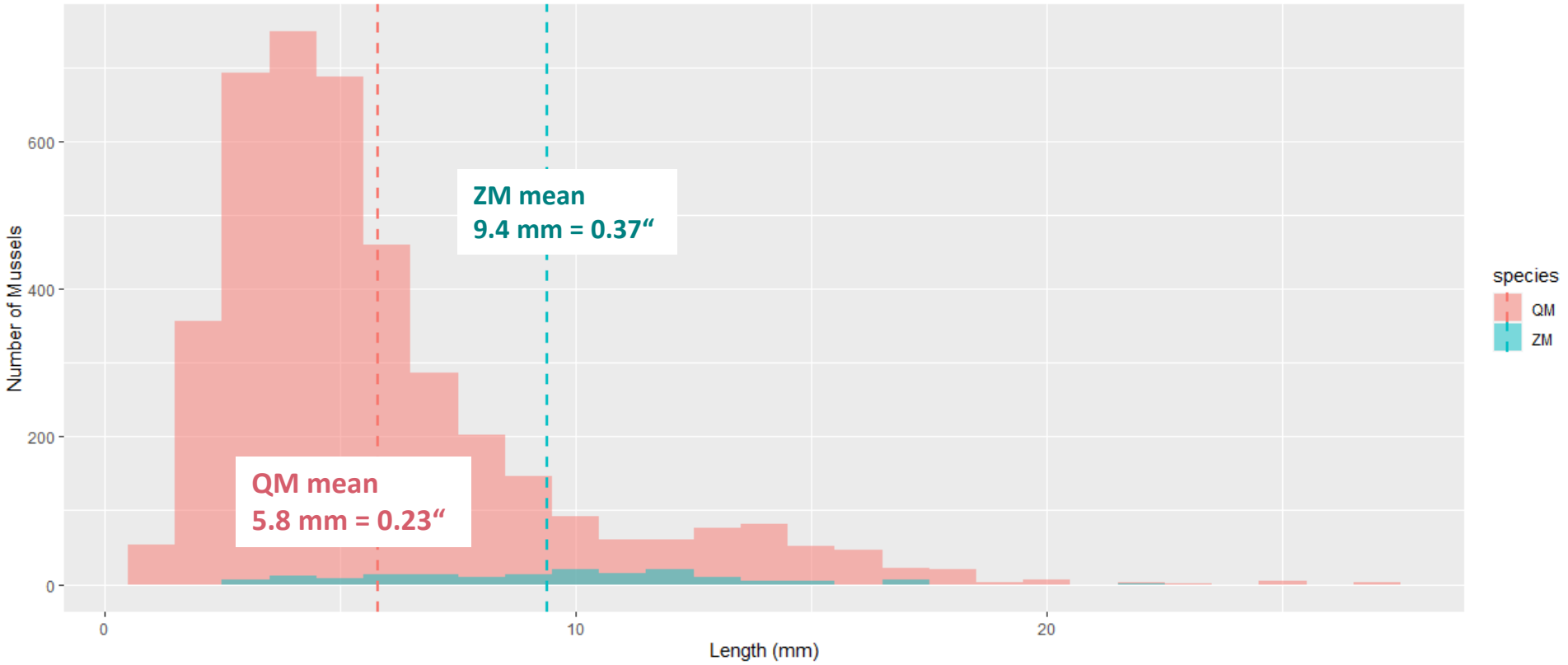

Dock
12 ft (3.7 m) out
110 ft (33.5 m) out
NY 80
State Route 80
A
B
C
6724
18




Site A
1.2 m
4 ft
below
surface
Site B
3.7 m
4.0 m
4.2 m
12-14 ft
Site C
6.4 m
7.0 m
7.3 m
21-24 ft
*NOT Drawn to scale
Aarianna Stickney

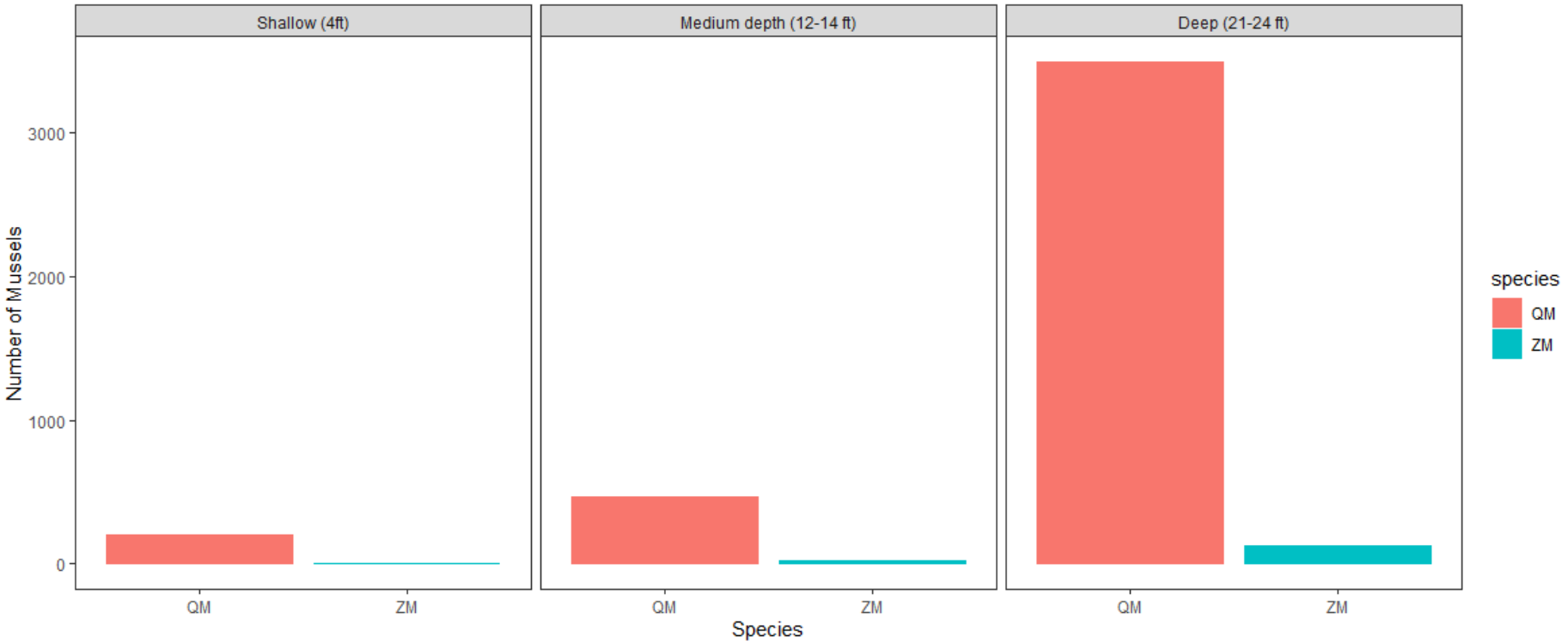
QM: Quagga mussel

ZM: Zebra mussel



		Median	Mean:
Quagga mussel (QM): 4161 individuals	96% of total	6.1 mm	5.8 mm
Zebra mussel (ZM): 160 individuals	4% of total	9.6 mm	9.4 mm

Shallow (4 ft) **Medium (12-14 ft)** **Deep (21-24 ft)**

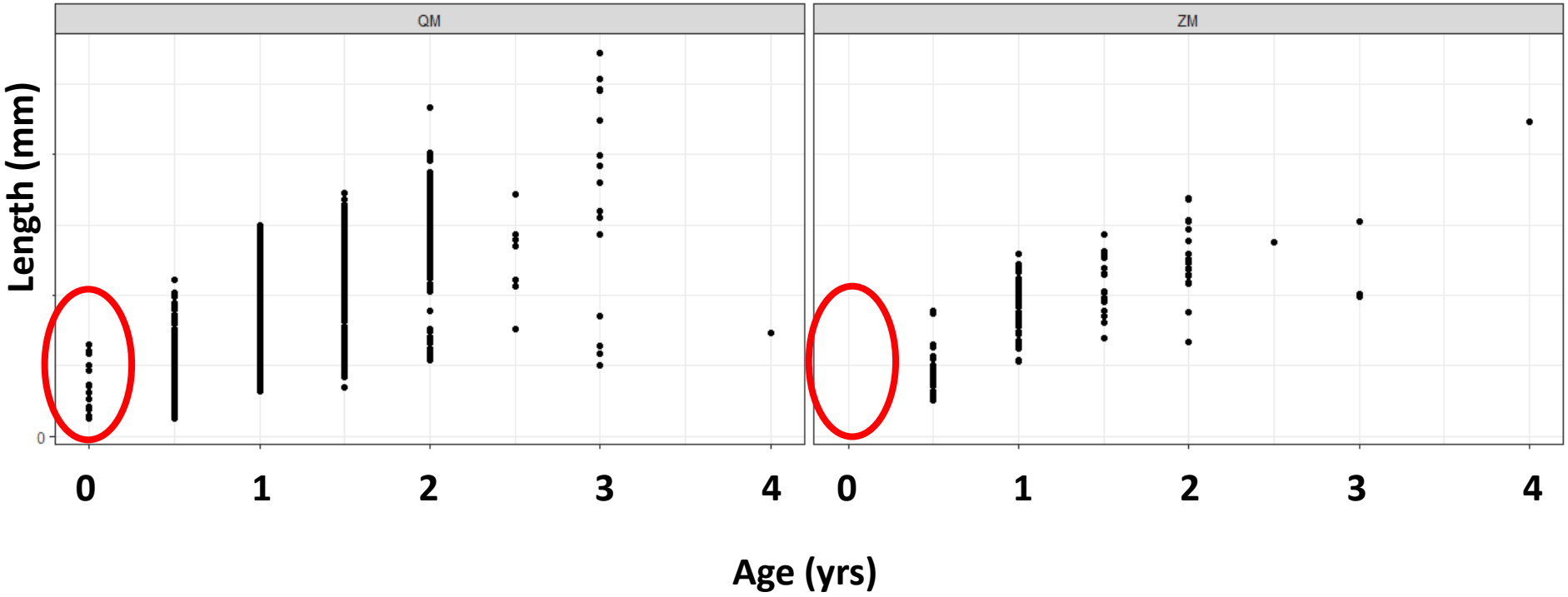


QM: Quagga mussel

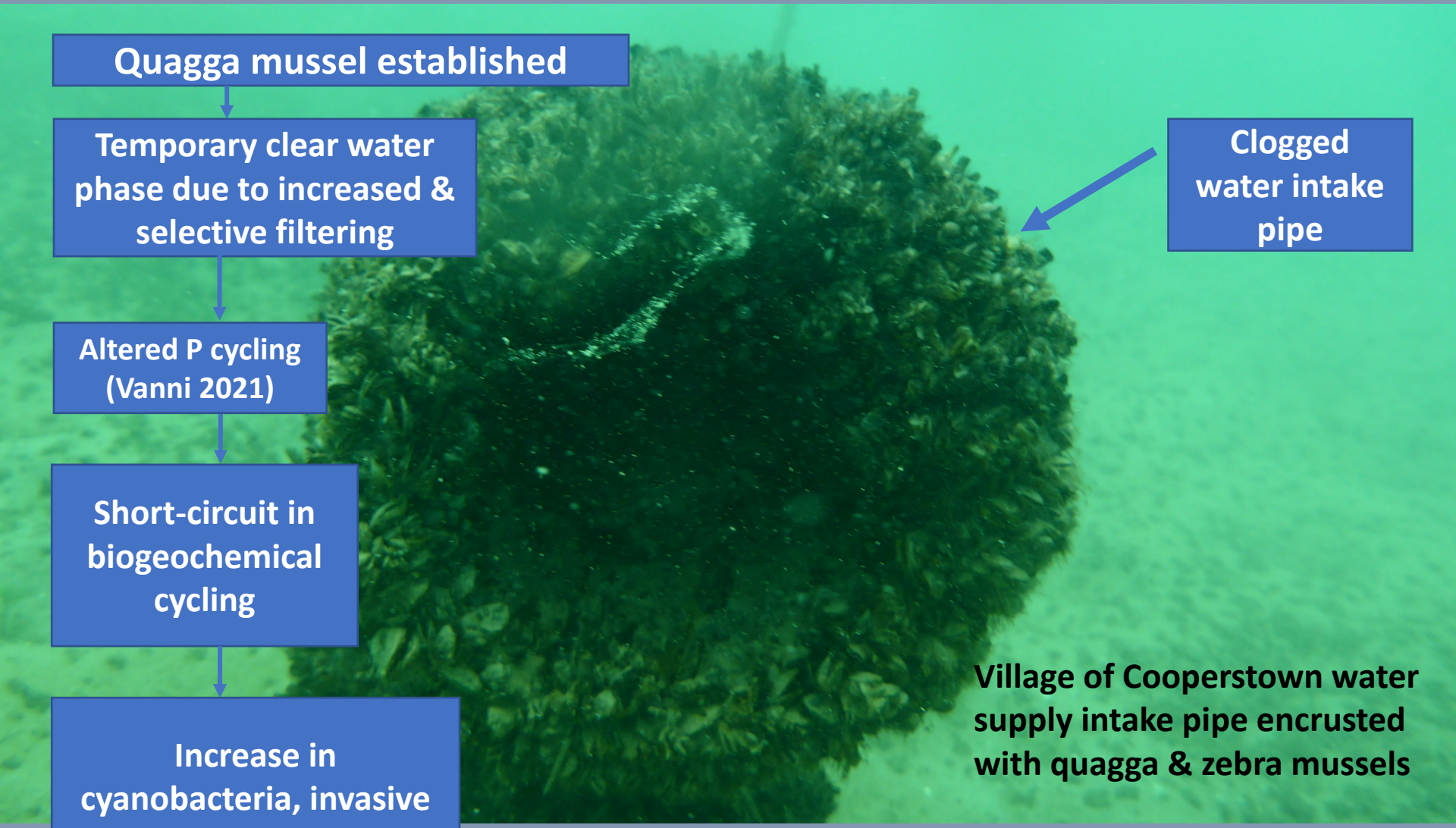
ZM: Zebra mussel

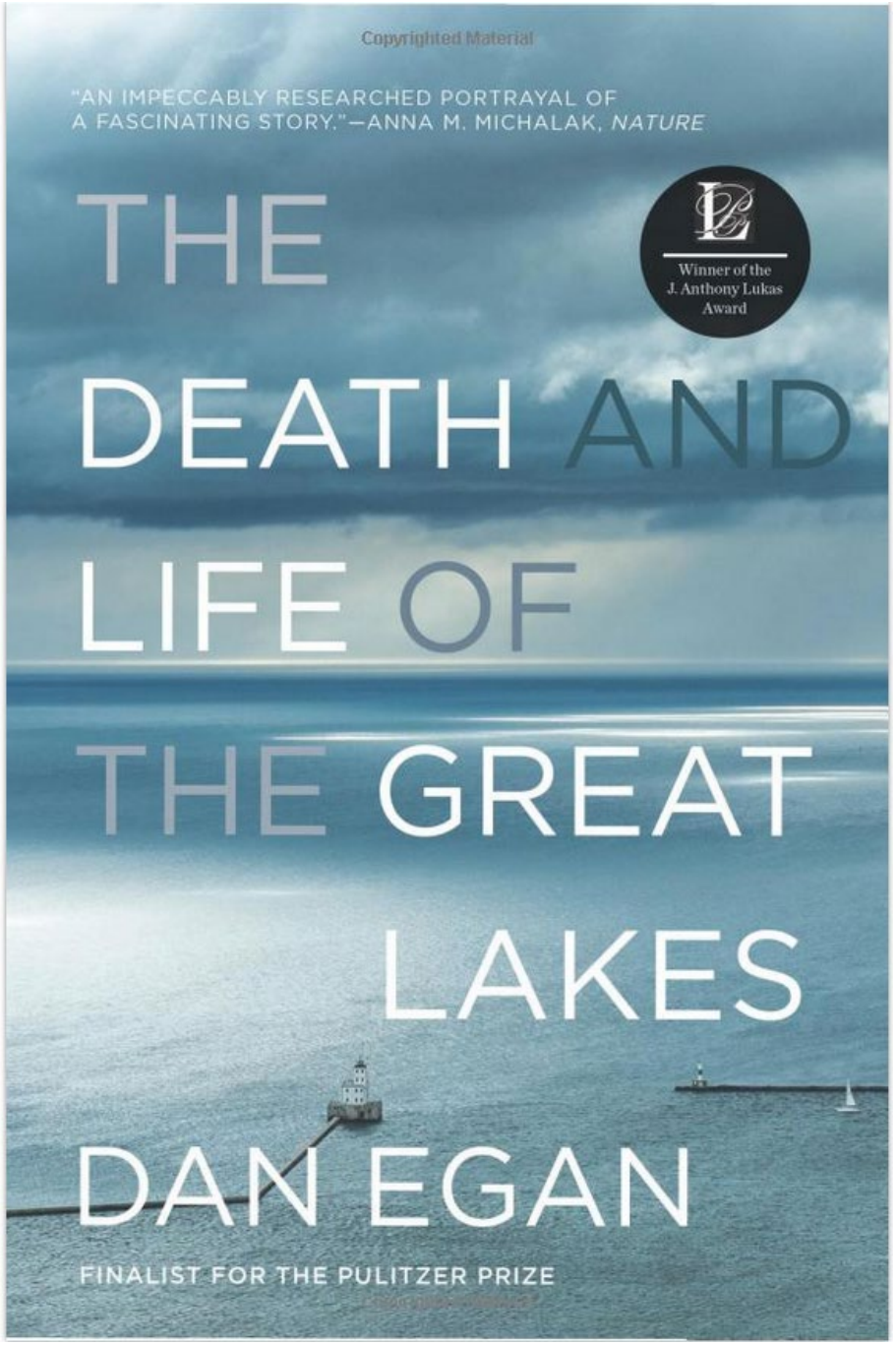
QM: Quagga mussel

ZM: Zebra mussel



- **QM juveniles successfully colonized new surfaces in late Feb – mid-May**
- **QM larger than ZM at the same age**
- **QM is outcompeting ZM both horizontally and vertically in OTL**


Quagga mussel established
Temporary clear water phase due to increased & selective filtering
Altered P cycling (Vanni 2021)
Short-circuit in biogeochemical cycling
Increase in cyanobacteria, invasive plants & algae, other nonnatives & pathogens
Clogged water intake pipe
Village of Cooperstown water supply intake pipe encrusted with quagga & zebra mussels



The Death and Life of the Great Lakes

By Dan Egan

Available as an audiobook (~12 hrs), too

Also an excellent video (27 min) on YouTube on this topic – search for "mussel pains Great Lakes"

New York Safe Boating Education Program

Covers NYS aquatic invasive species control regulations!

Boating Safety Certificates

Source: https://parks.ny.gov/recreation/boating/education.aspx

Who needs a boating safety certificate?

Anyone operating a Personal Watercraft (JetSki™, Wave Runner™, etc.) must have a boating safety certificate, and be at least 14 years of age or older.

Under a new law, known as Brianna's Law, all motor boat operators:

If you were born on or after:	You will need a boating safety certificate when operating a motorized vessel in:
January 1, 1988	2022
January 1, 1983	2023
January 1, 1978	2024
All operators of motorized vessels, regardless of age, will need a boating safety certificate by January 1, 2025	

NY Safe Boating Course (8 hrs, classroom instruction) OR
One of the NYS-approved online courses (3+ hours)
Children can take a course as long as they are 10 years old on the first day of course.

Tips:

- **If you complete an online course and lose your certificate, you must work with the online course vendor to get a replacement (not NYS Parks or DMV). Getting a NYS Adventure License will get your online course completion recorded in the DMV system.**
- **If you are planning to become a NY Safe Boating Instructor, you must have completed a classroom course with another NY Safe Boating Instructor. Online courses do not count. Other eligibility requirements apply.**

Acknowledgement

- **Otsego Lake Association – volunteer hours, ice-resistant steering system for 2 BFS boats, other supplies, PR support**
- Otsego Lake technical assistance: Holly Waterfield, Matt Albright, Edward Irwin
- SUNY Oneonta BFS Volunteer Dive Team
- National Science Foundation
- School of Sciences & Biological Field Station, SUNY Oneonta
- Logistical support/approval from: Otsego County Conservation Association; Glimmerglass Condominium Homeowners' Association; Otsego County Sheriff's Office; NYS Parks, Recreation & Historic Preservation; Belmonte-Flynn Family, VanHeusen Family, collaborators from the SUNY Lakes Ecological Observatory Network (SUNY LEON), Global Lake Ecological Observatory Network (GLEON), and Northeast GLEON (NE GLEON); SUNY BFS Summer Interns

Thank you for your interest and support
for Otsego Lake research!
OLA supports the CLMB project and live data streaming.

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