WAKE BOATS: A THREAT TO THE HEALTH OF OUR LAKES

ISSUE. *Save the Lakes ("STL")*, a non-profit organized to promote the health of Rhode Island's lake ecosystems, looks to the Rhode Island legislature for help in protecting these lakes and ensuring the sustainability of its natural resources [1]. Rhode Island is blessed with hundreds of freshwater waterbodies, named as lakes, ponds or reservoirs ("lakes"). The Rhode Island DEM Office of Water Resources currently tracks water quality condition of 237 lakes covering 18,845 acres; *STL* was able to track information on 140 of these lakes. Most of the lakes are considered small - 70% are 50 acres or less with only four lakes exceeding 500 acres. These water bodies offer critical elements of Rhode Island's environment and its biodiversity, including drinking water, habitats for aquatic life, flood and drought management and recreation.

STL has studied available research, reviewed publications and consulted with riparian owners and other Rhode Island residents regarding wake boats use on lakes. It is clear to STL that wake boat use on Rhode Island's smaller lakes raises profound ecological issues adversely impacting the health of these lakes and their ecosystems. Existing state or local restrictions on certain Rhode Island lakes are protected from wake boat use [2]. Other lakes are too small for wake boat use. The operation of wake boats on the remaining twenty-six (26) of the 140 lakes within STL's purview, however, is unrestricted. These lakes, and other potential lakes that STL did not identify, run the risk of profound negative environmental impacts. Prompt adoption by the Rhode Island Legislature of reasonable restrictions on wake boat use operating on these thirty (30) lakes is imperative to ensure the water quality and health of these lake ecosystems. In support of STL's recommendation below, please see Exhibit A. Data pertaining to the RI lakes/ponds/reservoirs that were reviewed by STL are displayed in Exhibit B.

RECOMMENDATIONS. Finding a balanced solution that meets competing demands surrounding wake boats on lakes is complex and challenging. Not all wake boat waves are equal, and no two lakes are the same. A myriad of factors, including, but not limited to, water depth, the lake's natural buffers, water quality, sunlight and sequestered contaminations, wave distance from shore, boat type, speed, and water temperature and wind play a role in determining how a boat wake will impact an aquatic ecosystem on any one lake. The solution is elusive [3].

Despite such challenges, reasonable state regulation on the operation of wake boats on Lake Rhode Island is necessary and ought to be adopted now. It is intended that the restrictions posited by STL be viewed as minimum restrictions existing alongside local municipalities' right to enact or maintain different restrictions provided such local restrictions are stricter than the regulations adopted by the state. *STL* proposes the following restrictions:

- No wake boat use on lakes that have less than 50 contiguous acres.
- Wake boats must operate 200 feet or more from shorelines and docks [4]; and
- Wake boats must only operate in waters 20 feet or more deep.

In addition:

- ·Wake boats must not traverse between lakes without the bottom of the boat being cleaned and its ballast being emptied of all water and cleaned inside, as required by RIDEM:
- The adopted regulations should require RIDEM to educate RI residents on the need for, and provide enforcement of, these requirements.

Several states, including three of Rhode Island's neighbors, have adopted legislation in recent years to ensure that wake boat use aligns with the characteristics of the particular lake on which it operates, barring wake boats where use threatens the lake environment or safety of lake users. Such legislation aims to balance recreational activities with environmental protection. For a description of other states' legislation, we attach Exhibit C.

WHO IS AFFECTED. Of the total 140 lakes in Rhode Island tracked by *STL*:

- 74 lakes are less than 50 acres – too small for wake boat use, and in some cases, no wake-boat use;
- 35 lakes are protected from wake boat use by existing use restrictions;
- 5 meet the proposed requirements for wake boat use, given their size and water depth; and
- 26 lakes – each with less than 50 contiguous acres but arguably big enough for wake boat use - run the risk of experiencing profound adverse environmental impacts by permitting wake boat use.

CONCLUSION. Now is the time to regulate wake boats on our lakes. The longer we wait, the more difficult and costly it will be to remediate the lakes and ensure clean water and healthy biosystems. Please see research studies in support of our position cited in Exhibit D. Increasingly, lake recreation in Rhode Island is halted for weeks each summer due to the dangers of cyanobacteria [5]. In addition, lakes face other new but significant environmental threats. We can no longer continue to remediate, on a hit or miss basis, after a lake has deteriorated. Remediation for a lake must be tailored to that lake's conditions and part of a long-term management plan. Such remediation is costly, complex and continuing – an endeavor that is often outside the reach of most riparian owners.

Allowing the continued operation of wake boats without restriction in lakes will undermine any efforts taken to date to restore the health and enjoyment of these lakes. Doing nothing will result in a rising need for remediation efforts that could be prohibitive and ineffective. Permitting wake boat recreation on Rhode Island lakes that are larger and deeper while adopting reasonable restrictions on our smaller lakes, balances competing interests associated with lake life, while assisting Rhode Island in ensuring water quality and the overall health of its beautiful lakes and aquatic life. Please help us save the lakes.

February 5, 2025

Exhibit A

IN SUPPORT OF *SAVE THE LAKES - RECOMMENDED* WAKE BOAT REGULATIONS

NOT JUST ANOTHER POWERBOAT. Wake boats are specialized power boats specifically designed to create large and powerful waves for recreational purposes (e.g., wake-surfing, water boarding). Wake boats have been found to produce waves up to 17 times the energy of other comparable-sized powerboats and their propellers generate enough turbulence to resuspend bottom sediments in water up to 33 feet[6] A wake boat's hull is shaped to achieve significantly increased wakes, and many have a hydrofoil device that lowers the stern when the boat is under power. Most wake boats also have built-in ballast tanks that can be filled with lake water to increase the weight of the stern, thereby creating larger waves. With heavy ballast (2,000-6,000 lbs.) and typically V-shaped hulls, wake boats sit lower than other boats, displacing more water, generating significant "prop wash" and creating large powerful waves with "wave energy" 4-7 times greater than a typical ski boat.[7]

WAKE BOATS' PROFOUND IMPACT ON THE HEALTH OF LAKE ECOSYSTEMS. The operation of a wake boat can cause the same negative environmental effects that a 'non-wake" powerboat can cause but with significantly more profound environmental impact. These negative environmental effects include more frequent toxic algae blooms, increased loss of fish and other aquatic habitats, increased shoreline erosion, decreased water clarity, decreased native plant abundance, increased phosphorus and other nutrients in the water column, an increase risk to property damage and personal safety and a significantly raised risk that aquatic invasive species will spread from lake to lake.

The negative environmental impact of wake boats is more fully summarized as follows:

A. Increased Sediment Resuspension. Sediment resuspension occurs in lakes when turbulence (whether caused by strong winds or motorized boats) disturbs the lake bottom and causes its sediment particles to lift and remain in the water column. Research has found that turbulence caused by wake boats can occur deeper under water close to or on the lake bottom than other powerboats and can result in significantly more sediment resuspension, with more profound negative effects on the health of the lake's ecosystems. The negative effects of sediment resuspension are cascading and complex:

The relationship between sediment suspension and its impacts on algae growth and aquatic habitats is complex and context dependent. There are a myriad of factors to consider including, for example, the size and depth of the lake, its light and nutrient availability and the presence of nutrients from water runoff and physical disturbance, For reasons discussed in this paper and based on our research and observational findings, we believe that the operation of wake boats, given their potential negative impact on the lake environments, should be regulated using parameters based on the size and depth of the lake.

- Water Turbidity. Increased sediment suspension results in increased water turbidity (cloudiness), which in turn reduces light penetration, limits photosynthesis and inhibits growth of microscopic life and algae, an important food source and habitat for fish and aquatic life at the lake's bottom. Unable to see, birds, fish and other suspension feeders find it difficult to find food. Suspension feeders help maintain water quality by filtering particles. reducing turbidity, increasing nutrient recycling through excretion and increasing light penetration for algae plant development. Numerous studies indicate that decreases in water quality can stress or kill fish.

- Algae Growth Blooms. Sediment resuspension, particularly at the bottom of a lake, releases nutrients (e.g., nitrogen and phosphorus) that were previously stored and

inaccessible on the lake bottom into the water column. As these nutrients are released into the water column they function as fertilizer for accelerated algae growth. Accelerated algae growth consumes dissolved water oxygen in the lake's water column, allowing the blooms to grow massive in size and preventing sunlight from reaching the bottom. The sensitive balance of nutrients, sunlight and oxygen is disturbed, increasing the risk of harmful and toxic algae blooms. In addition to creating harmful algae blooms, such disturbance reduces vegetation growth and the depth to which aquatic plants can grow, further degrading the aquatic habitat structure. The number and timing of 'no-contact" advisories issued to the public for the state's waterbodies by the Rhode Island Health demonstrate a steady rise in the frequency and severity of well-documented blue-green algae blooms, The cause of such increase in algae blooms is complex and the result of many variable conditions, including, for example, stormwater runoff, steadily rising temperatures and amount of available sunlight. Blue-green algae thrive in warm, shallow, nutrient rich surface waters.

B. Physical Damage to Lake Ecosystems. Direct damage from the deep hulls and propellers of wake boats scouring the lake's bottom and uprooting roots of mass vegetation, can disturb and destroy aquatic plant communities and increase the risk of harm to aquatic habitats, including habitats of near-shore nesting birds, fish and beavers. The energy of wake boats can warm the lake's water and, especially when coupled with the resuspended sediments (e.g., nitrogen, phosphorus), make the lake ecosystem less habitable for native flora and fauna to flourish, increasing the risk of harmful algae blooms. It has been documented that waves produced by wake boats can be 2-3 times higher, generate 3-9 times more energy and be 6-12 times more powerful than a typical powerboat. Energy of waves produced by wake boats operating in wake-surfing or wake-boarding mode have been found to be significantly higher than those produced by the same vessel operating in cruising mode. It has been documented that wake boats operating in wake-surfing mode produced the largest waves, with maximum wave energy approximately four times that of waves generated in wake-boarding mode.

C. Increased Spread of Aquatic Invasive Species. It is acknowledged that Rhode Island prohibits the transport of aquatic invasive species between waterbodies and requires the cleaning of boats, motors and trailers to remove invasive species prior to entering a different waterbody, Existing regulations, however, do not address nor specifically prohibit the transport of aquatic species contained in wake ballasts or bilges. Wake boats can retain up to 23 gallons in ballasts and bilge after being drained. The transport of this retained water by wake boats between water bodies results in a dramatic increase in risk for transporting aquatic invasive species and pathogens among water bodies.

D. Property Damage; Shoreline Erosion. Wake boats can produce waves with 1.7-17 times the energy of other comparable-sized powerboats and their propellers can generate enough turbulence to resuspend bottom sediments in water up to 33 feet deep. This power raises the risk of damage to property along the shoreline. The large, powerful waves generated by wake boats take between 400-1023 feet to dissipate to heights and wave energies observed 100-200 feet away from typical boats operating at cruising speed. The result is a significant increase in shoreline erosion. Shoreline erosion can lead to degradation of fish habitat and water quality due to the physical disruption of rooted plants and resuspension of sediment and nutrients. Shoreline erosion is also a concern for lakefront property owners and potential damage to infrastructure.

E. Shoreline Anchoring. It has been observed that shoreline anchoring is a typical response to erosion caused by wake boats. This response of hardening shorelines, as opposed to proactively reducing the erosive factors at the shoreline caused by wake boats, can result in wave wakes returning to the lake to do further damage. Hardening shorelines is often very costly financially and has other high environmental costs, reducing biodiversity and habitat quality, exacerbating aquatic invasive species growth, increasing the risk of algae blooms and increasing storm runoff and resultant pollutants into the lake.

F. Compromised Safety. The increased energy of waves caused by wake boats raises the risk of personal harm to swimmers and watercraft operators (jet skis, kayaks and other boats), as well as to other lake

recreation participants. While acknowledging the increased risk to personal safety, further discussion is outside the scope of this paper.

Exhibit B

RI LAKES INFORMATION

A) Lakes at risk from wake boats	Size in Acres	Max. Depth in feet	Mean Depth in feet	City/Town
Arnold Pond	73	9	NA	Coventry, w. Greenwich
Bowdish Lake	219	11	6	Glocester
Carr Pond	81	36	14	N. Kings./W. Green.
Flat River Res/Johnson's Pond	648	18	9	Coventry, w. Greenwich
Georgiaville Pond	97	21	13	Smithfield
Keech Pond	129	14	4.5	Glocester
Locustville Pond	82	12	8	Hopkinton
Loutitt Pond	56	12	5	W. Greenwich
Lower Simmons Res.	58	8	2.5	Johnston
Lower Slatersville Res.	72	16	9	N. Smithfield
Mashapaug Pond	69	17	7	Cranston, Providence
Mishnock Pond	48	18	8	W. Greenwich

Oak Swamp Reservoir	109	10	5	Johnston, Scituate
Pascoag Res/Echo L.	349	15	8	Glocester
Pausacaco Pond	68	22	8	Portsmouth
Sachem Pond	72	13	6	New Shoreham
Slacks Reservoir	137	15	9	Smithfield
Slatersville Reservoir	219	16	9	Burrillville, N. Smithfield
Smith & Sayles/Sand Dam Reservoir	173	11	5	Glocester
Sucker Pond	57	23	10	Burrillville
Upper Slatersville Reservoir	138	23	8	N. Smithfield
Waterman Lake Res.	106	15	9	Smithfield, Glocester
Wenscott Res./Twin Rivers	78	11	7	Lincoln
Wilson Reservoir	112	13	7	Burrillville
Worden Pond	1051	7	4	SK
Wincheck	133	24	7	Hopkinton
26 Lakes/Ponds in this group				

B) Lakes that Meet Proposed Parameters: 50 acres+ ; sufficient 20' depths areas; 200' from shorelines	Size in Acres	Max. Depth in Feet	Mean Depth in feet	City/Town

Beach Pond	419	65	30	Exeter
Hundred Acre Pond	84	36	18	S. Kingstown
Stafford Pond	476	22	10	Tiverton
Wallum Lake	322	74	28	Burrillville
Watchaug Pond	573	36	8	Charlestown
5 Lakes/Ponds in this group				

Lakes already protected from wake boats (various statutes & regulations)	Size in acres	Max. Depth in feet	Mean Depth in feet	City/Town
Arnold Mills Pond	252	30	12	Cumberland
Barden Pond	240	28	13	Foster
Belleville Pond	159	8	5	Exeter
Blue Pond	94	24	8	Hopkinton
Brickyard Pond	102	11	8	Barrington
Browning Mill/Arcadia P.	50	6	4	Exeter, Richmond
Burlingame Reservoir	67	36	8	Glocester
Chapman Pond	173	4	3	Westerly
Coventry Res/Stump P	168	75	12	Coventry

Diamond Hills Res	358	NA	NA	Cumberland
Great Grass Pond		NA	NA	Coventry
Indian Lake	265	9	7	W. Kingstown
Moswansicut Pond/Res	281	45	NA	Johnston, Scituate
Oak Swamp Reservoir	105	NA	10	Johnston,
Olney Pond	122	15	8	Lincoln
Pasquiset Pond	68	22	8	Charlestown
Ponagansett Res.	220	31	12	Glocester
Quidneck Reservoir	171	36	11.5	Coventry
Regulating Reservoir	214	32	NA	Scituate
Roger Wms. Park Ponds	114	NA	4.3	Providence
Scituate Reservoir	3277	NA	NA	Scituate
Schoolhouse Pond	83	28	10	Charlestown
Sisson Pond	69	NA	NA	Portsmouth
Sneech Pond	99	NA	NA	Cumberland
Spring Lake/Herring Pond	95	21	10	Burrilville
St. Mary's Pond	112	NA	NA	Portsmouth
Tiogue Lake/Res	215	11	6	Coventry

Turner Res. & Pond	215	NA	NA	E. Providence
Tucker Pond	23	32	11	Warwick
Wakefield Pond	72	21	6	Burrillville
Warwick Pond	83	26	14	Warwick
Westconnaug Reservoir	174	NA		Foster
Woonasquatucet Stump Pond	304	15	11	Burrillville
Woonsocket Reservoir	248	23	17	Smithfield
Yawgoo Pond	136	37	9	Exeter, W. Gr.

35 Lakes/Ponds/Reservoirs in this group

Other lakes reviewed are less than 50 acres in total.

Exhibit C

STATES INFORMATION

STATE	Legislation	Designated Zones	Mln. Ft	Min. Ft.	Min. Dist.	Related Requirements

			Wide	Depth	from Shore	
Maine	**Yes**			**15'**	**300': 200' from shore must be headway speed**	**Must report to legislature within 3 years re: enforcement.** **Boat dealers must provide info about boater safety & ed courses**
NH	**No Proposed but defeated in 2024**					**Senate Bill 431 would have limited wake surfing to water bodies of at least 50 acres. It would have also pushed wake surfers farther offshore, but disagreements over the distance – 200 or 300 feet**
VT	**Yes**	**At least 50 acres needed to be designated an allowable wake boat zone**	**200**	**20**	**500"**	***A HOME LAKE:*** **Wake Boats must be designated to one lake for a year, w/decal to so designate** **Must be decontaminated before moving to a different lake; & clean or decontaminate ballast tanks**
MA	**Proposed 2026**			**15"**	**300'**	**SD.3462 (Section 9G)**
Georgia	**Yes**				**200"**	**No wakeboarding or surfing within 200 feet of any moored vessel; any wharf, dock, pier, piling, or bridge structure or abutment; or any shoreline adjacent to a full-time or part-time residence, public park, public beach, public swimming area, marina, restaurant, or other public use area."**

						None of above between sunset & sunrise
S. Carolina	Yes					At least 200 feet from docks & other anchored craft & swimmers
Michigan	Proposed in 2024			20"	500"	Min. of 500" from the shoreline or a dock, a raft, a buoy or occupied bathing area, or a vessel moored or at anchor. Strong opposition by the Michigan Boating Industries Association, noting a negative impact on business, industry & jobs
Minnesota	Yes, pertaining to Caribou Lake			20"	500"	Cook County Ordinance that bans wake surfing & wake boats from artificially enhancing wakes; requires 20' depth and minimum of 500' from shoreline or another craft
Tennessee	Yes	50 acres min, lake size	400'		200"	Min. of 200' from a shoreline or a dock, pier, boathouse, or other structure located completely or partly on the water". Prohibited between sunset & sunrise

Wisconsin	No (2024) (proposed leg. Did not reach hearing stage); neighbors pitted against neighbors... No (2026) Wisconsin Lakes is proposing legislation			20'	500'	To limit the spread of aquatic invasive species (AIS), exterior surfaces and internal ballast systems of wake boats should be sanitized with hot water (≥140°F) before accessing other lakes. a. Inspections for AIS and aquatic plants must include internal and external ballasts. Consider restricting the timing of wake boat access to lakes until after fish spawning. 1.) A distance that does not harm natural shorelines and the investments made by riparian owners in docks and lifts. 2.) A distance that allows a safe navigation buffer for recreational users to travel along shorelines. 3.) A distance that allows riparian owners to enjoy their properties and safely access the interior waters of lakes. 4.) A distance that recognizes the reality that wake boats are getting larger, heavier, and able to create ever larger waves. Looking to "future-proof" a lake and recognize these realities: 700 feet from shore meets these requirements!

WAKE SURFING STUDIES - Lake Bottom Sediment Disturbances & Other Negative Impacts

Name of Study	Date	Focus	Findings
Analyzing Threats to Water Quality from Lake Bottom Disturbances on Payette Lake, Idaho	2020	Addresses impact of prop wash on lake bottom sediments for boats with downwardly angled props	Sediments are disturbed & phosphorus resuspended in water depths of 33 feet
Lake Kezar Study, Maine	2021	Wake surfing & its Impacts on shorelines & lake bottoms	Wake surfing should occur no less than 500' shore & no less than 20' water depth
A Phased Study of the Water Quality & Wave Propagation Dynamics Currently Impacting a Small Southeast Wisconsin Freshwater Lake: Waukesha	2022	Considerations in assessing shoreline & near shore impacts of wind-driven waves vs. motorboat waves in North Lake, Wisconsin	The preliminary data show: Clear differences between the wave heights, frequencies & duration as well as both surface & subsurface depths of wave energy produced by different types of powered vessels; Development of sedimentation "plumes" from wave-enhancing vessels which impact the shoreline; Sedimentation elements which have potential for impacting plant growth for selected species of plants on North Lake; Variability in water clarity & dissolved oxygen levels in selected portions of the lake...

Wisconsin's Green Fire Study, updated	**2024**	**Examine the effects of wake boats on lake ecosystem health with** **This updated literature review based on peer-reviewed research, published reports, and personal communications with topical experts.** **Research on wake boats has primarily focused on** **the effects of waves on shorelines, deep-reaching propeller turbulence, and the spread of** **aquatic invasive species.** **Throughout this document, wakes generated for recreational activities** **such as wakeboarding or wake surfing will be referred to as "recreational wakes."**	**Summary of the current research findings:** **While all motorized boats can impact lake ecosystems, our work suggests that wake boats are causing profound ecological issues for lakes.** **Focused findings follow.** ***1) Aquatic Invasive Species (AIS)*** **• Wake boats can retain up to 23 gallons of water inside ballasts and bilge after** **being drained with electric pumps. The transport of this water spreads AIS (e.g., Eurasian watermilfoil, spiny water flea, zebra mussel) between water bodies.** ***2) Shoreline Erosion*** **• Wake boats can produce wakes that are 2–3 times larger than motorized non-wake boats and transfer up to 12 times more power to shorelines, requiring more than 600 ft to dissipate.** **• Armoring shorelines with riprap to repair or reduce erosion have high environmental & financial costs, reducing biodiversity habitat quality, exacerbating** **AIS issues & increasing nutrient runoff into lakes.** ***3) Aquatic Plants*** **• Recreational wakes, propeller turbulence, and direct damage from deep hulls & propellers can disturb & destroy aquatic plant communities, worsening erosion and habitat loss.**

- **Native aquatic plants help secure shorelines and lake bottoms and are essential cornerstones of food webs. Manoomin (wild rice) is especially susceptible to intense turbulence and is of serious concern because of its cultural significance.**

4) Sediment Resuspension

- **Wake boats can resuspend lake sediments at deeper depths than other watercraft, reducing water quality & clarity. The resuspension of lake sediment**

can also reintroduce stored and previously inaccessible phosphorus back into the water column, fueling algal growth.

5) Birds and Fish

- **Enhanced wakes, noise levels, and turbulence can negatively impact wildlife, including near-shore nesting birds (e.g., common loons), and fish.**

It is noted in this report that it does not address the critical topic of human safety regarding wake boats.

UMN (Univ. of MN)	**2023**	**Study of waves created by recreational boats**	**Boats operating in wake-surfing mode or wake-boarding mode, during which boat speed, wave shapers, and/or ballast are used to increase wave height, are recommended to operate at least 500 feet from docks or the shoreline, regardless of water depth.** **Boats operating in wake-surfing or wake-boarding modes are recommended to operate in water at least 15 feet deep.** **Ballast tanks should be completely drained prior to transporting the watercraft over land.**
Laval (Quebec) University Study	**2015**	**Study of prop wash effects**	**Wake surfing disturbs sediment up to 16' below the surface, increasing various forms of phosphorus into the water column, potentially inducing cyanobacteria blooms & accelerating eutrophication of the lake.**

REFERENCES

Bilkovicet al, Review of Boat Wake Wave Impacts on Shoreline Erosion and Potential Solutions for the Chesapeake Bay, College of William and Mary (2017)

https://cdalakepoa.com/uploads/3/6/4/3/36431208/technical_summary_finalpdf.pdf

Cox, G, On Wave Decay, Australian Naval Architect (May 2002).

Environmental Protection Agency Factsheet on Water Quality Parameters Factsheet on Water https://www.epa.gov/system/files/documents/2021-07/parameter-factsheet_turbidity.pdf Changes in turbidity negatively affect aquatic health as well as affect other water parameters (e.g. higher temperature, reduced dissolved oxygen and associated decrease in photosynthesis by aquatic plants, increased nutrient concentrations).

Fonseca and Malhorta, New Wave Forecasting Tool, studies for US Army Corps of Engineers (2012)

MacFarlane, Gregor, National Centre for Maritime Engineering & Hydrodynamics, Australian Maritime College, University of Tasmania, 2019 communication with S. Stiger

Mercier-Blaisand Prairie, Impact of Wake boat Waves on the Shore of Lakes. Universidad Quebec a Montreal

Ruprecht et al. Wake surfing: Some Wakes are More Equal than Others, Proceedings of the Australasians

Coasts & Ports Conference, Aukland, NZ (2015)

PLOS One The Influence of Macrophytes on Sediment Resuspension and the Effect of Associated Nutrients in a Shallow and Large Lake (Lake Taihu, China. https:// journals.plos.org/plosone/article/d+10.1371/journal.pone.0127915 Research to examine sediment resuspension was conducted in large, shallow, eutrophic Lake Tahu, China to investigate the influence of vegetation on sediment resuspension and its nutrient effects found that sediment resuspension may be one of the most important factors delaying remediation of the lake.

Shuster et al, Characteristics of Recreational Boat Wakes, University of Alabama (2017)

Stoker, JJ, Water Waves.

US Army Corps of Engineers, S. Demerbilekand L. Vincent, Water Wave Mechanics

University of -Madison, Cener for Limnology, Wisconsin's Greenfire Voices for Conservation, The Effects of Wake Boats on Lake Ecosystem Health: A Literature Review May, 2024 David Ortiz, Michael Meyer. Terry Daulton. Bob Kovar Summary of current research findings and suggesting that wake boats are causing profound ecological issues for lakes.

University of Rhode Island Watershed Watch; What's the appropriate distance from shore to regulate enhanced wakes?

University of Rhode Island; Watershed Watch; Hot Topics: Cyanobacteria

Watch Your Wake: Boat Wake Research Underway in the Region, by the Wake Boat Subcommittee of the Waters and Wetlands Stewards, North Star Chapter of the Sierra Club posted Feb, 21, 2023,

Zabawa and Ostrom, Final Report on the Role of Boat Wakes in Shore Erosion in Anne Arundel County, MD

https://cdalakepoa.com/uploads/3/6/4/3/36431208/technical_summary_finalpdf.pdf

Fonseca and Malhorta, New Wave Forecasting Tool, studies for US Army Corps of Engineers (2012)

MacFarlane, Gregor, National Centre for Maritime Engineering & Hydrodynamics, Australian Maritime

College, University of Tasmania, 2019 communication with S. Stiger

Mercier-Blaisand Prairie, Impact of WakeboatWaves on the Shore of Lakes. Universidad Quebec a Montreal

Ruprecht et al. Wakesurfing: Some Wakes are More Equal than Others, Proceedings of the Australasians

Coasts & Ports Conference, Aukland, NZ (2015)

PLOS One The Influence of Macrophytes on Sediment Resuspension and the Effect of Associated Nutrients in a Shallow and Large Lake (Lake Taihu, China. https://

journals.plos.org/plosone/article/d+10.1371/journal.pone.0127915 Research to examine sediment resuspension was conducted in large, shallow, eutrophic Lake Tahu, China to investigate the influence of vegetation on sediment resuspension and its nutrient effects found that sediment resuspension may be one of the most important factors delaying remediation of the lake.

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[1] Save the Bay and STL are independent, member supported nonprofits championing policies that protect and improve RI's environment. Save the Bay has been instrumental in advocating for several notable pieces of legislation in RI, particularly focusing on environmental protection of Narragansett Bay and resource management in RI.

[2] Examples of such use restrictions include the use of watercraft motors limited to electric motors only, weight restrictions on watercraft using boat ramps.

[3] Watch Your Wake: Boat Wake Research Underway in the Region, by the Wake Boat Subcommittee of the Waters and Wetlands Stewards, North Star Chapter of the Sierra Club posted Feb, 21, 2023. As a simple example, vegetation acts as a natural buffer against the energy of boat wakes. The greater the width of the natural vegetation buffer, the more energy can be attenuated. Some shorelines are naturally hardened and able to withstand wake boats operating nearby. Other shorelines may be so sensitive that 1,000 feet may not be enough to protect them. Some lakes have lots of contaminants sequestered or are too shallow to allow wake boats at all. Some lakes are deep with rocky bottoms where prop wash will have little effect. The solution is elusive.

[4] URI Watershed Watch; What's the appropriate distance from shore to regulate enhanced wakes?

An appropriate distance from the shoreline should be a distance that (i) does not harm the natural shoreline and other structures such as docks and lifts and walls; (ii) allow for a safe navigation buffer for recreational users (paddle sports, fishing and swimmers) to travel; and (iii) allow riparian owners to enjoy their properties and restrictions are intended to safely access and use the interior waters of the lake.

[5] URI Watershed Watch; Hot Topics: Cyanobacteria. Cyanobacteria (aka blue-green algae) are naturally found in many freshwater systems. Blooms of "excess cyanobacteria occur in waterbodies when excess nutrients, sunlight and high temperatures create perfect conditions. Potential impacts include skin irritations, illness, loss of plant and animal life, loss of aesthetic appeal, recreational opportunities and even reduction in property values. During cyanobacteria bloom, people and pets are advised to stay clear out of the water to avoid potential toxins.

[6] Fisheries Division State of Michigan Department of Natural Resources www.michigan.gov/dnr/Fisheries Report 37 FR37 July 2023 A literature Review of Wake Boat Effects on Aquatic Habitats James Francis, Joel Nohner, John Bauman, and Brian Gunderman.https://cdalakepoa.com/uploads/3/6/4/3/36431208/technical_summary_finalpdf.pdf, The Scientific Evidence Regarding Enhanced Boat Wakes is Compelling.

[7]Fisheries Division State of Michigan Department of Natural Resources www.michigan.gov/dnr/Fisheries Report 37 FR37 July 2023 A Review of Wake Boat Effects on Aquatic Habitats James Francis, Joel Nohner, John Bauman, and Brian Gunderman. The energy of a boat wake increases exponentially with wave height, meaning even those small in wave height result in disproportionately higher energy levels. Studies have shown that the maximum wave energy produced by wake boats can be an order of magnitude (approximately 10 times) greater than that of conventional boats operating at higher speeds. The large waves generated by wake boats take considerable distances—between 400 to 1,023 feet—to dissipate to levels comparable to those of typical boats. This prolonged energy retention contributes to shoreline erosion, sediment resuspension, and degradation of water clarity.