Economic Impact Analysis
of Wake Surf Boat Regulation in Vermont

Responsible Wakes for Vermont Lakes has petitioned the Vermont Agency of Natural Resources to adopt a rule to regulate wake surf activity on Vermont lakes. The rule would limit wake surf activity[1] to *wake sport zones* 1000 feet from shore, at least 20 feet deep, comprising at least 60 contiguous acres. This analysis estimates the economic impact of the proposed rule. It is intended to meet the requirements 3 V.S.A. § 838(b) on rulemaking procedures, examining the costs and benefits of the proposed wake surf boat rule for the government, businesses, and citizens of the state of Vermont.

Sailing, kayaking, and water-skiing on Lake Fairlee, courtesy of Tom Ward

Executive Summary

This analysis examines two scenarios, with and without wake boat regulation, ten years into the future. It shows that the economic benefits of regulation outweigh the costs by ten to one. The annual benefits — estimated at $93 million — include the preservation of water quality, the continuation of affordable small-scale recreational activities that form the core of Vermont's water-based recreation, and the protection of the tourist economy that depends on clean, clear, and safe lakes. The potential annual costs — about $8 million — accrue to limitations that this rule would place on the growth of the wake surf boat industry.

Wake surfing close to shore discourages the thousands of swimmers, kayakers, sailors, anglers, water-skiers, and other small-craft users who form the foundation of Vermont's substantial lake-based economic activity. Moreover, even a few wake surfers close to shore cause costly environmental damage, while contributing little to the state's economy.

Organization

As called for in the rulemaking statute, this analysis compares the economic impact of the proposed rule with the economic impact of having no rule on wake surfing.[2] The analysis is organized around two alternative scenarios:

- **Scenario 1:** the proposed rule ***is not*** adopted; Vermont adds ***no further regulation of wake surfing***.
- **Scenario 2:** the rule ***is*** adopted; Vermont ***regulates wake surfing*** as called for in the petition from *Responsible Wakes for Vermont Lakes.*

Under each scenario, we examine the anticipated costs and benefits for citizens, businesses, and government entities potentially affected by the rule. [3] Some of the impacts of the rule will take several years to be manifest, so we must rely not only on historical data, but also on plausible and common-sense estimations for the future.

Findings

This analysis is based on several findings documented by scientific research and documented reports.

- That the operation of wake surf boats near shore ***damages the lake*** bottom, shoreline, and shoreline structures. [4]
- That ballast tanks such as those used in wake surf boats can spread ***aquatic invasive species***. [5]
- That the operation of wake surf boats near shore reduces the ability of ***small craft and swimmers*** to operate safely. [6]
- That in the absence of this rule, the near-shore ***wake surf activity*** would increase on many Vermont lakes. [7]
- That the **value of lakefront property** on Vermont's lakes is highly influenced by clean, clear water, safe swimming, and safe operation of small craft. [8]

Any attempt to quantify the economic impact of a new rule involves projections based on available data and conditions. When preparing this analysis we have consistently selected its projections from the low end of the identified range. What is presented here is a conservative estimate of the effects of the proposed rule.

Scenario 1: No further regulation of wake surfing

If the rule is ***not*** adopted…

- **Wake surfing activity would increase on Vermont lakes.** Without regulation, we expect wake sports to be more popular in Vermont inland lakes in the coming decade. The wake surfing industry nationally is growing at an annual rate of 20% to 30%. [9] The Water Sports Industry Association and the National Marine Manufacturers Association report that on average 14 wake surf boats are currently sold in Vermont annually [10] and growing at 3% per year. At this rate the number of wake surf boats in Vermont would triple in ten years. This increase would benefit the manufacturers and sellers of wake boats and the small number of people who participate in the sport of wake surfing; These boats cost on average $150,000 today.[11] If sales of wake surf boats increase at the current rate, in ten tears we can expect 50 new wake boats will be sold each year in Vermont, with a potential annual gross revenue of **$7.5 million.** (Since none of the major manufacturers build wake boats in Vermont,[12] most of this revenue would be shipped out of state. A 10% commission on wake boat sales might total about $840,000 annually for Vermont dealers.[13]) The sales of these boats would also generate **$420,000** annually in state sales tax.

- **Environmental damage costs from wake surfing would increase.** Without the proposed rule, environmental damage from wake surf activity on the 69 inland lakes where wake surfing is allowed under current rules[14] would need to be repaired by the Department of Environmental Conservation, or the lakefront residents and their associations. This repair includes mitigation of: phosphorus raised by propellor wash; blue-green algal blooms (cyanobacteria) promoted by bottom sediment disturbance; the spread of aquatic invasive species from ballast tanks;[15] damage to shorelines, structures, and property caused by large wakes.

  In ten years, increased wake surfing activity could spread aquatic invasive species to 30 currently uninfected lakes,[16] requiring mitigation efforts of $35,000 per lake per year[17] and costing the State of Vermont and lake associations **$1 million**.[18] We estimate that half the 69 lakes in the list below will need to repair the effects of sediment raised by prop-wash from wake surfing, at $40,000 per lake, totaling **$1.2 million.**[19] In addition, lakefront property owners will need to ***repair damage*** to their shoreline structures and small craft caused by wake surfing. Half of the 7,674 lakefront property owners[20] on 69 lakes might incur $250[21] annually in such expenses, for a total of **$1 million.**

- **Small craft sales and rentals would eventually decrease.** Sales and service of small craft in Vermont — canoes, kayaks, paddle boards, pontoon boats, small motorboats, sailboats, fishing boats — along with outfitting and rental business that rely on safe and calm lakes, make up most of the water-based recreation activity in Vermont.[22] In the absence of the

proposed rule, more and more lakes will become less usable by small craft because of wake surfing close to shore, thus these businesses will gradually lose revenue.[23] We estimate that 50 such businesses might eventually each lose $10,000 in potential annual revenue, for a total of **$500,000.**[24] The existing 23,000 small craft on Vermont lakes will eventually become less valuable in the presence of wake surfing activity. If each lost an average of $150 in value the one-time cost to their owners would amount to **$3.4 million.**

- **Lake-related tourism would eventually decrease.** Outdoor recreation accounts for 4.1% of Vermont's GDP, putting us fourth in the nation.[25] Most of the water-based recreation in Vermont involves low-cost, low-impact swimming, fishing, canoeing, kayaking, paddling, sailing, and enjoying nature.[26] Few tourists visit for wake surfing. Tourists to Vermont account for $3 billion in annual spending on lodging, food, drink, goods, and services.[27] According to the Vermont Department of Tourism, 16% of these visitors come to the Green Mountain State for kayaking, canoeing, and other small-craft recreation,[28] thus accounting for approximately $480 million in spending. Vermont State Parks report that 41% of their visitors come for canoeing and kayaking.[29] Youth summer camps, many of which rely on small craft lake recreation, contribute $60 million annually to Vermont's economy.[30] As wake surfing increasingly drives out small craft and spoils water quality, we estimate that 69 of our lakes that allow wake-surfing will over time become less attractive to kayakers, anglers, campers, and swimmers.[31] Thus small craft-related tourist spending at Vermont businesses may eventually be reduced by 15%[32], or **$72 million.**[33] In addition, revenues from the 9% State Rooms and Meals Tax would over time drop by over **$6 million** annually.

- **Lakefront property and lake-town tax bases would eventually decrease.** The 69 lakes where wake surfing is currently allowed host 7674 camps, cottages, and homes.[34] Extensive research, in Vermont and elsewhere, has shown that a decrease in a lake's water quality decreases the value of lakefront properties. [35] Research has also found that wake surfing close to shore decreases water quality, as follows:

- Their deep-draft, downward-facing propellers stir up sediment on the bottom, which increases water turbidity and reactivates phosphorous, increasing the risk of harmful algae blooms. [36]
- Their propellers chop up existing milfoil and spread it throughout the lake. [37]
- Their ballast tanks can carry aquatic invasive species from one lake to another. [38]
- Their waves damage shoreline structures and cause shoreline erosion, leading to further phosphorous loading. [39]
- Their wakes make it difficult for small craft, swimmers, and anglers to use the lake.[40]

Based on studies of lakefront property values and water quality, we estimate this decrease in water quality could reduce the value of waterfront properties by 10%, [41] and cost lakefront property owners $115 million in reduced value over ten years, or **$11.5 million** annually.[42] If

lakefront properties lose this much in value, then lakeside towns and school districts will see their grand lists decrease by this amount. At an average tax rate of 1.6%, after ten years Vermont would lose annually about $1.8 million in property tax revenue, or **$180,000** per year.[43]

Thus for **Scenario 1**, in which the rule is ***not*** adopted, we estimate eventual annual costs to Vermont citizens, businesses, and the state government to amount to **$97.8 million,** while the benefits to wake boat dealers and state sales tax would total **$7.9 million**.

Item	Annual Cost ($ millions)	Annual Benefit ($ millions)
Wake Boat Sales + 6% Tax		7.9
Environmental Damage	3.2	
Small-Craft Owners & Businesses	3.9	
Lake-Related Tourism + 9% Tax	79.0	
Lakefront Property Values + 1% Tax	11.7	
Total	**97.8**	**7.9**

Scenario 2: Vermont regulates wake surfing

If the rule is adopted…

- **Wake surfing activity would be prohibited on 50 Vermont lakes, and restricted on 19[44].** Thus wake boat sales would diminish, to the detriment of manufacturers and sellers of wake boats. Instead of selling about 50 boats per year, as projected above, Vermont dealers might sell 20 wake surf boats per year, thus losing potential annual revenue of **$7.5 million**. The State would see sales tax revenue decrease annually by **$600,000**. The 100 existing wake boats would depreciate more quickly in a regulated environment, by perhaps 5% annually. We estimate this would cost $20,000 per boat, totaling a value loss of $2.0 million, or **$200,000 annually.**

- **Environmental and structural damage costs from wake surfing would be avoided.** This would, as explained above, save the State and lake associations **$3.2 million** annually in environmental damage repair.

- **Small-craftSmall-craft-based-based recreation would continue to grow at its current 15% rate.**[45] Many Vermont lakes would become more amenable to other forms of recreation.

Thousands of Vermonters as well as tourists will be able to enjoy these affordable, low-impact, non-damaging forms of recreation. Small-craft sales and rentals will continue to grow at their current pace, benefitting at least 50 Vermont small businesses with an annual increase of **$500,000.**[46]

- **Lake-dependent tourism would continue to grow at its current pace.** As explained above, small-craft tourism accounts for 16% of Vermont visitors; preserving this tourism will avoid the **$72 million** loss in annually revenue to Vermont businesses, and **$6 million** in rooms and meals taxes to the State.

- **Lakefront property and lake town tax bases** would remain steady, thus avoiding the **$11.5 million** potential annual decrease in property values caused by wake surfing, and the concomitant **$180,000** million loss of annual property tax revenue to lake towns.

Thus, for **Scenario 2**, in which the rule is adopted, we estimate eventual annual benefits to Vermont citizens, businesses, and the state government to total **$93.4 million,** while the costs to wake boat dealers and owners will total **$8.3 million**.

Item	Annual Cost ($ millions)	Annual Benefit ($ millions)
Wake Boat Sales + 6% Tax	8.3	
Environmental Damage		3.2
Small-Craft Owners & Businesses		0.5
Lake-Related Tourism + 9% Tax		78.0
Lakefront Property Values + 1.6% Tax		11.7
Total	**8.3**	**93.4**

Conclusion

The economic benefits of adopting the rule proposed by *Responsible Wakes for Vermont Lakes* outweigh the costs by ten to one. The rule will preserve the low-impact, affordable, water-based recreational activity and tourism that has been a key factor in Vermont's economic growth. Failure to adopt the rule will lead to a degradation of lake water quality and safety that will suppress this economic growth and require substantial expense to repair. This analysis demonstrates the clear net economic benefit of regulating wake surfing, and preventing our lakes from becoming damaged and overwhelmed by wake surfing activity in shallow and near-shore water. Our lakes' water quality, quiet, safety, and beauty support many businesses,

provide value to thousands of our citizens, and draw tourists from near and far. Keeping wake surf activity in deep water far from shore will make many vulnerable lakes more valuable to current and future users.

Photo courtesy of Rabbit Hill Inn, Waterford

This analysis was prepared by Responsible Wakes for Vermont Lakes. Comments, questions, or suggestions for improvement may be sent to webmaster@responsiblewakes.org

Appendix A: Lake List

These are the 69 lakes on which motorboating over five miles per hour is allowed under current rules. *Homes* refers to lakefront camps, cottages, cabins, and homes. *AIS* refers to Aquatic Invasive Species. A *Wake Sports Zone* would be allowed on certain lakes with 60 contiguous acres of water at least 20 feet deep and at least 1000 feet from shore.

	LAKE	ACRES	TOWN	HOMES	AIS	Wake Sports Zone
1	AMHERST LAKE	81	Plymouth	26		No
2	ARROWHEAD MOUNTAIN	760	Fairfax	79	√	Yes
3	BALD HILL POND	108	Westmore	20		No
4	BOMOSEEN LAKE	2360	Castleton	1000	√	Yes
5	BROWNINGTON POND	139	Brownington	27	√	No
6	CARMI LAKE	1402	Franklin	120	√	Yes
7	CASPIAN LAKE	789	Greensboro	191		Yes
8	CEDAR LAKE	123	Monkton	42	√	No
9	CENTER POND	79	Newark	30		No
10	CHIPMAN LAKE	79	Tinmouth	69	√	No
11	COLES POND	125	Walden	80		No
12	CRYSTAL LAKE	763	Barton	120	√	Yes
13	DERBY LAKE	207	Derby	7	√	No
14	DUNMORE LAKE	985	Leicester	444	√	Yes
15	EAST LONG POND	188	Woodbury	27		No
16	ECHO LAKE	104	Plymouth	87		No
17	ECHO LAKE	550	Charleston	112		Yes
18	EDEN LAKE	194	Eden	165		No
19	ELLIGO LAKE	174	Craftsbury	60	√	No
20	ELMORE LAKE	219	Elmore	87	√	No
21	FAIRFIELD POND	446	Fairfield	94	√	No
22	FAIRLEE LAKE	457	Fairlee	168	√	No
23	FOREST LAKE	133	Calais	50		No

24	GREAT AVERILL LAKE	828	Averill	102		Yes
25	GREAT HOSMER POND	140	Craftsbury	62	√	No
26	GREENWOOD LAKE	96	Woodbury	65		No
27	GROTON LAKE	422	Groton	175		No
28	HALLS LAKE	85	Newbury	76	√	No
29	HARRIMAN RESERVOIR	2040	Whitingham	0		Yes
30	HARVEYS LAKE	351	Barnet	227		No
31	HOLLAND POND	325	Holland	44		No
32	HORTONIA	479	Hubbardton	185	√	Yes
33	IROQUOIS LAKE	243	Hinesburg	98	√	No
34	ISLAND POND	626	Brighton	154		Yes
35	JOES POND	396	Danville	274		No
36	LAMOILLE LAKE	148	Morristown	21		No
37	LITTLE AVERILL	467	Averill	33		Yes
38	LITTLE LAKE	162	Wells	103	√	No
39	MAIDSTONE LAKE	745	Maidstone	202		Yes
40	MARTINS POND	82	Peacham	31		No
41	METCALF POND	81	Fletcher	41	√	No
42	MILES POND	215	Concord	104		No
43	MOLLYS FALLS RES	397	Cabot	5		No
44	MOREY LAKE	547	Fairlee	166	√	Yes
45	NEAL POND	185	Lunenberg	98		No
46	NEWARK POND	153	Newark	79		No
47	NORTON POND	583	Norton	67		Yes
48	PARKER LAKE	250	Glover	101		No
49	PEACHAM POND	340	Peacham	78		No
50	PENSIONER POND	173	Charleston	29		No
51	RAPONDA LAKE	121	Wilmington	71		No
52	RESCUE LAKE	184	Ludlow	208	√	No
53	RICKER POND	95	Groton	22		No
54	SABIN POND	142	Woodbury	105		No
55	SADAWGA POND	194	Whitingham	43	√	No

56	SALEM LAKE	764	Derby	167	√	Yes
57	SEYMOUR LAKE	1769	Morgan	306		Yes
58	SHADOW LAKE	128	Concord	76		No
59	SHADOW LAKE	210	Glover	116		No
60	SHELBURNE POND	452	Shelburne	0	√	No
61	SOUTH POND	103	Eden	29		No
62	SPECTACLE POND	103	Brighton	28		No
63	ST. CATHERINE LAKE	904	Poultney	313	√	Yes
64	SUNSET LAKE	202	Benson	76	√	No
65	VALLEY LAKE	88	Woodbury	25		No
66	WATERBURY RESERVOIR	839	Waterbury	0		Yes
67	WILLOUGHBY LAKE	1687	Westmore	302	√	Yes
68	WINONA LAKE	248	Bristol	59	√	No
69	WRIGHTSVILLE RES.	190	East Montpelier	0		No
	Total	**27087**		**7674**	**27**	**19**

Endnotes

[1] In the proposed rule, a wake boat is a powerboat with ballast tanks, hull design, or other devices that increase the displacement of the vessel so as to enhance its wake while under power. Wakesurfing is the activity of propelling a person forward on a board with a boat's wake. The rule does not regulate water skiing or wakeboarding behind a traditional boat. Boats without wake-enhancing ballast or other devices may be used on all lakes in the list above.

[2] See 3 V.S.A. § 838: *Proposed rules shall be filed with the Secretary of State in a format determined by the Secretary that includes the following information…(2) An analysis of economic impact. (3) An analysis of environmental impact…. The economic impact analysis shall analyze the anticipated costs and benefits to be expected from adoption of the rule. Specifically, each economic impact analysis shall, for each requirement in the rule: (A) list each category of people, enterprises, and government entities potentially affected and estimate for each the costs and benefits anticipated; and (B) compare the economic impact of the rule with the economic impact of other alternatives to the rule, including having no rule on the subject…*

[3] See note 1 above.

[4] See Review of Papers Addressing Wake boat Impact on Aquatic Environments; also Water Quality and Wave Impact Study,; See also Wake Boats, Safety and the Lake: "Wakeboard Boats with full ballast tanks create unnaturally large waves and a deeper prop wash than other types of boating activities. These large waves crash into the shoreline, battering habitats in the shallow areas of the lake where 90% of plants and aquatic organisms live. The resulting erosion releases nutrients into the water column, threatening water quality and increasing potential for cyanobacteria."; See also Ballast/Wake Boats: Specific Concerns About Aquatic Invasive Species & Water Quality, New Hampshire Department of Environmental Services, 2022

[5] See

- *Wake boat ballast bags can harbor invasive species,* Michigan State University;
  CONCERNS ABOUT BALLAST BOATS, INVASIVE SPECIES AND WATER QUALITY, Ossipee Lake Alliance;
- *Ballast/Wake Boats: Specific Concerns About Aquatic Invasive Species & Water Quality,* New Hampshire Department of Environmental Services;
- *New Hampshire Wake Boat Commission Final Report,* page 4;
- *Zebra mussels' best friend: wakeboard boats*, University of Minnesota.
- *Eurasian Water-Milfoil,* Ontario Invading Species Program, http://www.invadingspecies.com/invaders/aquatic-plants/eurasian-water-milfoil-2/;
- *Ballast Water Monitoring,* United States EPA, https://www3.epa.gov/npdes/pubs/vgp_ballast_water.pdf;
- *Protect Your Waters from Aquatic Invasive Species Clean. Drain. Dry*., New York Department of Environmental Conservation, https://www.dec.ny.gov/animals/48221.html;
- *Ballast Water Treatment: Eurasian Milfoil,* https://elinorelinorstapleforde0256831.blogspot.com/2021/10/ballast-water-treatment-plant-eurasian.html;
- *Invasive Species*, United States EPA, https://19january2017snapshot.epa.gov/greatlakes/invasive-species_.html; *Engineering Seminar: Defending the Great Lakes,* University of Wisconsin, https://uwpexponent.com/news/2022/11/09/engineering-seminar-defending-the-great-lakes/;
- *Ballast Water,* USDA National Invasive Species Information Center, https://www.invasivespeciesinfo.gov/subject/ballast-water;
- *Wake boat ballast bags can harbor invasive species,* Michigan State University, 2016, https://www.canr.msu.edu/news/wake_boat_ballast_bags_can_harbor_invasive_species;
- *Volume and contents of residual water in recreational watercraft ballast systems,* Management of Biological Invasions 7(3):281-286, January 2016, https://www.researchgate.net/publication 306920452_Volume_and_contents_of_residual_water_in_recreational_watercraft_ballast_systems;
- I*mpacts of Motorized Craft on New Hampshire's Waterbodies,* New Hampshire DES, https://www.des.nh.gov/sites/g/files/ehbemt341/files/documents/2020-01/wmb-25.pdf;
- *Low-Speed Boating . . .Managing the Wave,* by Doug Keller, Aquatic Habitat Program Manager with Indiana DNR – Division of Fish and Wildlife, North American Lakes Management Society, https://www.nalms.org/wp-content/uploads/2017/10/37-3-4.pdf;
- *Ballast/Wake Boats: Specific Concerns About Aquatic Invasive Species & Water Quality*, Amy P. Smagula, Limnologist;
- *Wake Boats, AIS, and Water Quality,* NH Department of Environmental Services, https://lmcd.org/wp-content/uploads/2022/06/Wake-Boats-AIS-and-Water-Quality_NHDES-Presentation.pdf;
- *Annual Losses to Great Lakes Region by Ship-borne Invasive Species at least $200 Million,* David Lodge, University of Notre Dame; David Finnoff, University of Wyoming , https://www.invasive.org/gist/products/library/lodge_factsheet.pdf

[6] See Water Quality and Wave Impact Study,; see also Evidence from Vermont Lakes, and *Indicators and standards of quality for paddling on Lake Champlain*, Journal of Great Lakes Research, Volume 38, Supplement 1

[7] "Sales of wake boats…are estimated to be up 20 percent to 13,000 units in 2020.", NMMA Newsletter, June 2021. "As an industry, the wake surf companies are growing very quickly. Wake-surfing year over year right now grows at about 30 or 35 percent, and that's on a per-unit basis." Star Tribune, ; "Wake-surf Boats Market Intelligence Report Offers Growth Prospects", Market Watch. According to the Water Sports Industry Association's comments to the Agency of Natural Resources, wake boat sales in 2021 were up 38% over 2020. Berkshire-Hathaway Business Wire reports that "Sales of wake sport boats—popular for wakesurfing, wakeboarding and skiing, attractive to new and active boaters—were up 22% to 13,600 units in 2020."

[7] See Water Quality Affects Property Prices: A Case Study of Selected Maine Lakes*; see also* Realtors Say Algae Blooms Hurt Waterfront Prices*; "*In Maine, New Hampshire, and Vermont, studies on the impact of water quality on lakefront property values demonstrate a significant loss in property value as water quality degrades. Lower property values represent a loss in town tax revenue*.",* Lake Wise Program, Vermont Department of Environmental Conservation; "Around the country, lakefront property is consistently valued at least 25% to 40% higher than inland comps.", Town of Georgia, Vermont; also see testimony of Bob Martin, lister at Woodbury Lake, who reports that "A slight downgrade of 10% [in lakefront property valuation] would cause a $650,000 annual loss of state education and town revenue."; See also Land Valuation Schedule for Listers, Vermont Department of Taxes, showing quality of water influencing valuation by a factor of 2.

[9] See note 6

[10] "Sales of wake boats in Vermont are very low, averaging 14 per year.", Letter from WSIA and NMMA to DEC, and testimony at public comment session July 29, 2022.

[11] "In general, you can expect to spend anywhere from $93,000 to $180,000 on a high-quality wake surf vessel with a good resale value.", Center for Surf Research, 2022

[12] None of the four largest U.S. manufacturers of wake surf boats, Malibu, MasterCraft, Nautica, and Tigé, has facilities or official dealers in Vermont.

[13] "Commissions are usually 10 percent, though that may vary depending on your boat and your location." boats.com, July, 2021

[14] Vermont has at least 800 lakes and ponds. Of these, 69 currently allow wake surfing under current rules. See the Lake List in Appendix A.

[15] See note 5 above. Also see "Cyanobacteria blooms begin annual reappearance in Vermont waterbodies," The Charlotte News, 2022; See also See Review of Papers Addressing Wake boat Impact on Aquatic Environments; also Water Quality and Wave Impact Study,; See also Wake Boats, Safety and the Lake: "Wakeboard Boats with full ballast tanks create unnaturally large waves and a deeper prop wash than other types of boating activities. These large waves crash into the shoreline, battering habitats in the shallow areas of the lake where 90% of plants and aquatic organisms live. The resulting erosion releases nutrients into the water column, threatening water quality and increasing potential for cyanobacteria."; See also Ballast/Wake Boats: Specific Concerns About Aquatic Invasive Species & Water Quality, New Hampshire Department of Environmental Services, 2022. See also *Economic impacts of invasive species,* Invasive Species Centre, Canada.

[16] See list of lakes in Appendix A. Currently, 3-4 new lakes become infested with AIS each year. Without this rule, the uninspectable and unemptyable ballast tanks of wake boats traveling from lake to lake will accelerate this infestation rate to 6 lakes per year.

[17] The annual cost to mitigate Eurasian watermilfoil alone on Lake Elmore, a typical 200-acre Vermont lake, amounts to over $30,000 per year. On Lake Fairlee it's over $60,000. The DEC receives requests amounting to more than $2 million each year to repair damage. To repair the effects of sediment disturbance, algal blooms, and other damage caused by prop wash and large wakes would at least double these amounts.

[18] See note 13 above.

[19] This estimate is based on a cost of at least $10 per acre to mitigate cyanobacteria and other harmful algae blooms that spoil lakes, for 69 lakes totaling 27,000 acres of area. See Cyanobacteria Mitigation Program, Lake Anna, Virginia. See also The High Cost of Algae Blooms in U.S. Waters, Environmental Working Group 2020. See also Cyanobacteria plagues Lake Carmi : "The DEC said if it determines the aeration system isn't enough it may consider doing what's called an alum treatment on Lake Carmi, which prevents phosphorous from releasing and, in turn, prevents algae blooms. Pierson said the treatment on Lake Carmi could cost millions of dollars, but residents like Rob Evans said it could be a logical next step to save the lake."

[20] See lake list in Appendix A

[21] The cost to replace a single 10' section of aluminum dock commonly used in Vermont lakes is about $1000. The cost to repair a waterfront stone wall ranges from $500-$2000. The cost to replace a damaged kayak is about $500.

[22] See note 17 above.

[23] See Boat Wake Impact Analysis, Water Environment Consultants Mount Pleasant, SC

[24] See Partial List of Vermont Small Craft Businesses. Cost estimate is based on each of 50 small-craft businesses selling or renting 50 fewer boats per year at $500 per boat.

[25] See Outdoor Recreation Statistics, US Bureau of Economic Statistics, 2022 See also GOVERNOR PHIL SCOTT CREATES VERMONT OUTDOOR RECREATION ECONOMIC COLLABORATIVE, Press Release 2017

[26] See *Vermont outdoor recreation sector stood tall as significant economic driver,* Vermont Agency of Natural Resources

[27] "Tourism is one of the largest industries in Vermont, as the state welcomes over 13 million visitors each year. These visitors account for $3.0 billion in annual spending on lodging, food and drink, goods and services." Vermont Department of Tourism, 2022. See also The Economic Impact of Vermont Tourism

[28] See Vermont Tourism and Recreation Survey, page 8, 2014

[29] See note 26.

[30] See *Youth Summer Camp Industry Has a Direct Economic Impact on the Northeast*

[31] See THE ECONOMIC IMPACT OF POTENTIAL DECLINE IN NEW HAMPSHIRE WATER QUALITY: THE LINK BETWEEN VISITOR PERCEPTIONS, USAGE AND SPENDING

[32] This estimate is derived from studies of the impact of water quality on tourism, which show that spoiled lakes are less attractive to tourists such as The Economic Impact of Water Quality on Property Values & Tourism, Protect Wisconsin Waterways; The Iowa Lakes Valuation Project: A Report to the Iowa Department of Natural Resources, 2014; Economic Benefits of Nitrogen Reductions in Iowa, Iowa State University 2018, Section 3.1.3; Nutrient Pollution: The Effects: Economy, United States Environmental Protection Agency, April 2022; Recreational demand for clean water: evidence from geotagged photographs by visitors to lakes, Frontiers in Ecology and the Environment, January 2015; and from studies of the impact of spoiled lakes on lakefront property values cited in note 38 below.

[33] While Vermont may welcome new tourists who come specifically for wake surfing, these will be small in number, since wake surf boats are expensive, and towing them to Vermont from out of state is neither simple nor in accord with Vermont law on the transport of aquatic invasive species.

[34] Extrapolated from Lake Elmore Boat Count 2022. Also see Appendix A, Lake List.

[35] A UVM Lake Champlain study (Voigt B., Lees J., et al., 2015) found that for every meter of reduced water clarity, property values fell 3% for year-round lakeside residences and 37% for seasonal dwellings. Studies in Maine (Holly M.J., Boyle K.J., et al., 1996) and Minnesota (Krysel C., Boyer E., et al., 2003) also found a decline in lakeshore property values of up to several hundred dollars per frontage foot for each meter of water clarity lost. For a 1000-acre lake with 90% of its perimeter developed, this could amount to a $10M decline of lakeshore property values and property tax base. In the case of repeated algal blooms, losses can be substantial. In Georgia, VT, such blooms were blamed for a $50,000 decline in the value of each of 37 lakefront properties on St. Albans Bay—a $1.85M devaluation in the total tax base (Dobbs T., 2015). A similar result was seen in an AIS study in Washington State, where the presence of Eurasian milfoil significantly lowered sale prices of properties by an average $94,385 . (Olden J.D. and Tamayo M., 2014) Also see note 6 above. A regional study in the Mississippi headwaters, Lakeshore Property Values and Water Quality, quantified this relationship using five years of property sales records.

[36] See Impact of lake navigation – sediment resuspension study: Lake Masson and Lac des Sables Case, University of Laval (Canada); The Effects of Motorized Watercraft on Aquatic Ecosystems, Timothy R. Asplund, Wisconsin Department of Natural Resources and University of Wisconsin – Madison, Water Chemistry Program;

[37] "Boat propellers will chop milfoil plants into small fragments. These fragments float on the water surface and are at the mercy of wind and lake currents. In a short time, roots form on these fragments. If washed into shallow areas, these plants will eventually take hold creating a new milfoil colony. This process will continue until every suitable area of the waterbody is clogged with these weeds.", Ever Heard of Milfoil?, New Hampshire Lakes; About Milfoil, Lake Iroquois Association Environmental Fact Sheet WD-BB-23; Eurasian milfoil, Nature Conservancy Canada; Variable milfoil, New Hampshire Department of Environmental Services.

[38] See *Wake boat ballast bags can harbor invasive species,* Michigan State University; *CONCERNS ABOUT BALLAST BOATS, INVASIVE SPECIES AND WATER QUALITY,* Ossipee Lake Alliance; *Ballast/Wake Boats: Specific Concerns About Aquatic Invasive Species & Water Quality,* New Hampshire Department of Environmental Services; *New Hampshire Wake Boat Commission Final Report,* page 4; *Zebra mussels' best friend: wakeboard boats*, University of Minnesota. *Eurasian Water-Milfoil,* Ontario Invading Species Program, http://www.invadingspecies.com/invaders/aquatic-plants/eurasian-water-milfoil-2/;

[39] Wake Boat Erosion, Living on the Bank; A Field Study of Maximum Wave Height, Total Wave Energy, and Maximum Wave Power Produced by Four Recreational Boats on a Freshwater Lake, University of Minnesota.

[40] See testimony from Vermont lake users.

[41] See "In Georgia, Water Pollution Has Devalued Lakeside Properties By $1.8M", Vermont Public Regional News. "The assessment for 37 properties on Ferrand Road went down $50,000 because of the problems in the bay, according to town officials, shrinking Georgia's grand list by $1.8 million…overall consensus was, in general, approximately 25 percent difference between a property that's not seeing a water pollution problem and those that are." See also *Economic Impact of Milfoil*

[42] The estimate in the report is based on an extrapolation of this rate to 7674 lakefront properties valued at $150,000 each losing 10% of their value.

[43] See https://www.propertytax101.org/vermont/propertytax

[44] See lake list in Appendix A.

[45] See *Number of kayaking participants in the United States from 2010 to 2021* , Statista Research

[46] See Partial List of Vermont Small Craft Businesses. Estimate is based on each of 50 small-craft businesses selling or renting 50 more boats per year at $500 per boat.