"Wakesurfing? That's a Whole New Story" (Additional Details and Sources for Infographic)

How is wakesurfing different from water skiing?

- Water ski boats are designed and operated to make the smallest wake possible, to provide a smooth ski.
- Surf boats are designed and operated to make the largest wake possible, so someone can surf, like in the ocean.
- Skiers use a long rope and go ~25 mph. Surfers use rope only to start, then surf ~15 ft behind the boat at ~11 mph.

How big are the wakes? They can be 3 to 4 feet high or more where the surfer is [1]. As the wake moves away from the boat's path it breaks, losing roughly half of its height and energy [2]. But because it started out so big, even after traveling 200 ft toward shore the wake is still 16" high, compared to 7" for the very same boat operated in cruise/ski mode, based on a study paid for by the boating industry [2]. That study also shows that only the most exposed shores of the largest lakes ever experience wind waves as big and powerful as the 16" waves coming ashore from surfing 200 ft away. A shore that overlooks 2 miles of open water (2-mile "fetch") would experience 16" waves only if the wind was at least 30 mph for at least 45 minutes, an extremely rare occurrence [3]. Most lakes have never seen such waves, but enhanced wakes for surfing impact even the most sheltered shores. The underwater energy in the surf wake moving toward shore also extends deeper, so it's not only the shoreline being damaged; lakebed sediment and vegetation are churned and damaged. Fish and wildlife that nest in sheltered areas are suddenly exposed to powerful wave energy. Loon eggs can be toppled or chilled [11] and fish eggs are tossed or smothered with silt.

What about the safety of other boaters? Other boaters are blindsided by huge waves, still over a foot high from a surfboat that never came within a football field of them (300 ft) [2]. Fishermen are particularly vulnerable; they are often standing to cast, facing shore, anchored, unaware that a huge wake is about to hit the side of their boat. Even people in large boats who see the wake coming in time to turn into it have been tossed, injured, and soaked, and their boats damaged. Waves lose very little energy as they travel over deep water. Surfboat operators are often unaware that their wakes are still dangerous for others two football fields away; by the time the wake hits them the surf boat is far away. Unfortunately, the boating industry's "Wake Responsibly" campaign is silent about protecting others [4].

How do they make that huge wake?

- While surfing, the boat maintains "transition speed", that inefficient bow-high plowing speed not quite "on plane". This makes a much bigger wake than going faster, like a planing cruiser or ski boat.
- Surfboats have ballast tanks that fill with about 2000 to 5000 pounds or more of lake water to force the boat deeper in the water to further increase the wake. That's like putting a car on top of the boat.
- Wedges and fins can be deployed to further increase and shape the wake.

Why does the propeller wash extend so deep? The boat stays in bow-high plowing mode the entire time someone is surfing, so the propeller is angled down about 30 degrees below horizontal (boat angle plus propeller shaft angle). A powerful 350-600 hp motor is needed due to the heavy ballast and very inefficient plowing mode. The impact is over 20' deep, far deeper than for other activities on inland lakes [5]. Sediment and pollutants like phosphorus and mercury that remained harmlessly entombed in deep sediment for decades can be reintroduced into the water and food web. [10]

Does the bow-high position impair forward visibility? Check out photos and videos, even on manufacturers' websites.

How do ballast systems spread invasive species? Ballast systems don't drain completely, and several gallons of lake water can remain in the tanks, piping, pumps, etc. When ballast is filled and emptied in a different lake, that residual water and any invasives (zebra mussel larvae, spiny waterfleas, bits of invasive plants, etc.) are transferred. Some invasives can survive many days because closed ballast systems don't dry out [6]. They are often inaccessible, under the boat's deck, so they cannot be inspected and are difficult and expensive to decontaminate, requiring lots of hot water and a trained operator. See a typical ballast system [7]. Manufacturers know they cannot be fully drained as evidenced by the fact that the owners' manuals say to add several gallons of antifreeze in winter to prevent the residual water from freezing and causing damage [8]. **Failure to empty all ballast water when leaving a lake violates state law [9].**

Sources:

[1] Per this video sponsored by Malibu, the wakes, where surfing, are 2'-5" to 4'-5" https://www.guinnpartners.com/boat-testing/
[2] Page iv and Table 7 of the 2015 study by Goudey and Girod, paid for by the Water Sports Industry Association, on their website. Data is for their deeper lake. For their shallow lake data, the boat was in water only 8'-10' deep (p 2, 4) and shows interactions with the lakebed under the boat (p 18) and much greater friction with the lakebed as the wake moves toward shore (p iii, 14, 18 and 25). Surfers say they only surf in deeper water. https://www.wsia.net/wp-content/uploads/2020/03/WSIA_draft_report_Rev_II.pdf
[3] Fig 28 of [2] (2 typos: "1.2 s" is "1.25 ft" and "50 ft" is "1.50 ft" per rev. VDOT). Madison airport reports wind speeds hourly, more in storms. Only 4 measurements over 25 mph in all of 2023, only 1 over 30 mph, wunderground/history (gusts are less than 20 sec).
[4] See videos and posters at WSIA.net and WakeResponsibly.com
[5] See p 10 at https://nlmddotorg.files.wordpress.com/2022/07/nlmd-phase-2-study-report-july-20-2022-with-appendices.pdf
[6] See p 5 at https://lmcd.org/wp-content/uploads/2022/06/Residual-water-in-ballast-bags-study-WI.pdf
[7] See p 4-7 at https://nautique.blob.core.windows.net/boat-manuals/2023/2023-G-Series-Manual.pdf
[8] Various manuals such as p 245 at https://www.mastercraft.com/media/ywxbltjn/mastercraft_my2022_ownersmanual.pdf
[9] See Wisconsin Statutes NR 19.055 and NR 40.
[10] See [5] and https://www.sciencedirect.com/science/article/abs/pii/0043135480902651?via%3Dihub
[11] https://maineaudubon.org/projects/loons/your-loon-questions-answered/
Many more sources can be found at https://mymlsa.org/wp-content/uploads/2023/07/Fisheries-Report-37-Wake-Boat-Study-Official-Version-Released-on-7.28.2023.pdf

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