WPOA LAKE ADVISORY COMMITTEE

August 2023

Wake Boat Report
Executive Summary

Introduction

Wake boats are powerboats specially designed to increase wave height for watersports. The hull is shaped to achieve maximum wake, 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 in the stern of the boat and create larger waves. While wake boarding, a rider is towed with a rope, usually at a speed of 20–23 mph. They use the wake of the boat to perform jumps and tricks. Wake surfing involves a person trailing behind a boat on a short surfboard and surfing on the boat's wake without being attached to the boat by a rope. Wake surfing generally occurs at speeds of 9–11 mph. Many wake boats can operate in modes to support wake surfing or wake boarding and have the ability to maximize wave height through ballast and wave shapers at the required speed for the respective activity. Wake boats can produce waves with 1.7–17 times the energy of other comparable-sized powerboats.

Wake boats and their propellers generate enough turbulence to resuspend bottom sediments in water up to 33 feet deep. The large waves generated by wake boats take between 225–950 feet to dissipate to heights and wave energies observed 100–200 feet away from similar boats operating at cruising speed.

As a result of the large waves and increased bottom scour caused by these vessels, public boating safety and environmental concerns have been raised not only in Ohio but in many states across the country.

Ohio and Lake Waynoka current boating laws and regulations are intended to promote public safety and prevent damage to aquatic resources, shorelines and personal property but many were created prior to the commercialization and popularization of wake boats in the early 2000s.

Recently, there has been an increase in the popularity of wake boats[3] which use ballast, wave shapers, and other hull designs to produce waves that are substantially larger and more powerful than those generated by the typical powerboat. For example, Macfarlane[4] found that wave energy from ballasted wake-surfing craft was 5–17 times higher than a benchmark speedboat and Marr et al.[5] found that waves produced by wake boats were 2–3 times higher, had 3–9 times more energy, and were 6–12 times more powerful than a typical motorboat. When comparing[6] wave energies produced by a wake boat operated in wake surfing (10 mph, one ballast tank filled), wake boarding (20 mph, both ballast tanks filled), and cruising (30 mph, empty ballast tanks) modes it was discovered wave energies were significantly different between operating modes at a distance of 328 feet. The waves created in wake-surfing mode were on average 1.7 times higher than those created in cruising mode. The energy created by such large waves requires a substantial distance to dissipate; it has been estimated[6] that the distance required for wake surfing-generated waves to dissipate completely is approximately 984 feet and determined[7] that waves from a wake boat in wake-surfing mode would need a distance of 950 feet, to dissipate to the wave heights observed 100 feet from the same boat in cruising mode.

ENVIRONMENTAL EFFECTS OF WAKE SURFING

The environmental effects of powerboating have been well documented. Waves from powerboats can increase shoreline erosion, decrease water clarity, and plant abundance, and increase phosphorus in the water column[2].

Shoreline Erosion

Shoreline erosion can lead to degradation of fish habitat and water quality due to physical disruption of rooted plants and resuspension of sediment and nutrients and is a concern for lakefront property owners because it results in a loss of property and can damage infrastructure. The main factors that influence shoreline erosion are wave energy, aquatic plants, the slope of the nearshore and bank areas, and characteristics of the bank material. Recreational boating activity can exacerbate erosion by increasing the wave energy that reaches the shoreline[10 11]. Studies[7] comparing wave energy from wake boats to the monthly maximum wave energy from wind to wake boats passing 100 feet from shore, the wave energy produced in wakeboarding and wake-surfing modes was 553% and 2,546% higher, respectively, than the monthly maximum energy from wind-driven waves. Wake-boat-induced wave energy was 679% higher for wake-surfing mode, compared to wind-driven wave energy, when the wake boats passed 500 feet from shore. It would take 950 feet (wake-surfing mode) for waves to decrease to the 0.8-foot wave height typically observed 100 feet from a cruising wake boat. Even though these distances would allow the waves to decrease to similar heights, the waves from wake-surfing modes had longer wave periods, and therefore more energy, than the cruising mode wake. Wake boats are designed to create larger wakes than traditional watercraft, therefore the greater energy of waves created by wake boats operating in wakeboarding or wake-surfing mode are likely to exacerbate boat wave induced erosion.

Sediment Resuspension

Sediment resuspension decreases water clarity in lakes, subsequently reducing the ability of fish to find food, the depth to which aquatic plants can grow, and the dissolved oxygen content within the water column[12 13 14 15] In addition, as sediments are resuspended and nutrients become available in the water column, excessive algae growth can occur. Boat wakes resuspend sediments, especially fine substrates such as silt or sand, in shallow waters[16] and this resuspension increases with wave energy. Existing studies have shown that resuspended sediments caused by powerboats increase turbidity and phosphorus concentrations in rivers, lakes, and shallow experimental ponds[2 10 16]. Wake boats have greater potential to exacerbate sediment resuspension through increased wave energy and propeller turbulence. It has been determined[6] sediment resuspension was significantly higher than background conditions up to 492 feet from wake boats operating in wake-surfing mode and was highest when wake boats were operated in wake-surfing mode at a speed of 10 mph. Previous studies of typical powerboats indicated that propellers from outboard engines create turbulence that can reach as deep as 10 feet[17 18]. Field testing has found[19] that wake boat propellers generated water velocities with the capacity to resuspend unconsolidated sand, silt, and smaller organic materials at a depth of 15 feet while the boat was in wakeboarding or wake-surfing modes. Other studies[20] have estimated that modern wake boats can cause sediment resuspension in water up to 33 feet deep.

Aquatic Invasive Species

Aquatic invasive species (AIS) are non-native organisms that cause significant negative effects when introduced to inland lakes and other aquatic ecosystems. To prevent accidental AIS introductions to Lake Waynoka, our boating regulations already require that watercraft bilges and live wells be purged prior to entering the community. While this regulation has been observed to rarely be enforced, it is worth noting that this risk may be greatly increased by wake boats due to

ENVIRONMENTAL EFFECTS OF WAKE SURFING (continued)

the presence of large ballast tanks that can be filled from or emptied directly into the water body they are operating on. For example, research[21] has shown that ballast tanks from wake boats operated on a lake infested with the Zebra Mussel typically carried 247 Zebra Mussel veligers per sample, which was much greater than stern drive motor compartments (13 veligers per sample), outboard motor lower units (1 veliger per sample), live wells, or bilges. Although wake boat ballast tanks are typically emptied before trailering, they are rarely ever completely dry which increases the survival time for invasive species potentially trapped inside. Transportation of other invasive species and fish pathogens is also possible, and the greater propeller turbulence and increased scouring caused by wake boats may result in fragmentation and proliferation of aquatic invasive plants[18].

TOPOGRAPHICAL CONSIDERATIONS

The 332-acre topography of Lake Waynoka includes depths at normal pool of 35 feet to less than a foot in some of the coves. The lake's main channel is narrow and extends approximately 2.3* miles in a general east to west direction. All coves and a portion of the upper end where Straight Creek feeds the lake, are designated no wake zones. This provides for an approximately 1.5 mile long, 90-acre waterway with no speed or wake restrictions. Within this speed zone the width of the lake varies from approximately 183 feet to a maximum shore to shore distance of about 541 feet, averaging 372 feet wide. Depths within this speed zone area vary greatly from a maximum of 35 feet to a minimum of 3 feet at normal pool. Average depth in the middle of the speed zone channel is approximately 15 or less measured on a straight line and approximately 20 feet along the winding unmarked main channel.

*As measured by Google Maps

BOATING TRAFFIC AND OTHER CONSIDERATIONS

Each Lake Waynoka property owner has an inherent right to use and enjoy the boating, fishing, and swimming recreational opportunities within our lake-oriented community. At the same time, it is equally important not to risk public safety or to cause environmental harm. Balance is needed when managing the use of our most important resource. Recreational boating on Lake Waynoka includes a wide variety of powered and non-powered watercraft. Our existing local and State boating regulations have correctly been constructed primarily to preserve public safety on the water but have not been updated to address current issues. On Lake Waynoka, for instance, along with the introduction of wake boats and other watercraft designed for larger bodies of water, Lake Waynoka's boating population has almost doubled since 2006 (464 registrations) to 816 registrations in 2022.

As an example of the potential safety risks this presents on a small body of water, consider that the Ohio Department of Natural Resources' recommended acreage per watercraft needed for safe boating is 7.5 acres of water per boat in operation. Applying this standard to Lake Waynoka's 332 acres of navigable water would allow no more than 44 power boats to be operated at the same time. In addition, the risks are significantly increased within the speed zones on Lake Waynoka which currently only comprise approximately 90 acres of our waterways.

CONSIDERING POTENTIAL SOLUTIONS

The negative effects of a wake boat decline as the boat travels farther away from the shoreline. Increasing the minimum distance that boats are allowed to operate at greater-than-no-wake speed near docks and shoreline would allow more time for wave energy to dissipate and increase protection of nearshore areas. Other jurisdictions have changed or are considering increased buffer distances in response to wake boats. For example, the Oregon Marine Board banned wake boats in three of five zones of the Willamette River and requires that boats maintain extended distances from docks, boathouses, or moorages when operating for the purpose of wake boarding (200 feet) or wake surfing (300 feet)[22]. Lake Waynoka only presents a small area that could provide a similar buffer zone for wave dissipation. Shallow water also increases the likelihood that turbulence from wake boat propellers can scour the bottom, disrupt aquatic plants, and resuspend sediment. Many states are considering a minimum lake size for wake boats. For example, Indiana law restricts operation of a boat at a speed greater than 10 mph on a lake less than 300 surface acres in size. Other measures such as requiring a minimum water depth for wake boat operation could provide additional protection of aquatic resources. The Michigan DNR recommends that wake boats operating in wake-surfing or wake-boarding mode do so in water that is at least 15 feet.

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NOTE: This document was created based on a report filed by the Michigan State Department of Natural Resources September 2022