Churn Baby Churn!
Impacts of Motorized Watercraft in New Hampshire's Lakes and Ponds

INTRODUCTION

New Hampshire has greater than 1,000 public lakes and ponds that provide both vacationers and residents with valuable resources. Not only are New Hampshire's water bodies an important economic and cultural resource, they also play an important role in the quality of life for those that choose to utilize them. The recreational opportunities that a lake provides are numerous. According to a 2002 study, recreational boating, fishing, swimming, and drinking water contribute an estimated $1.5 billion annually to the state's economy. Recreational boating activities are popular in New Hampshire waters. Motorized boat use is the most popular recreational boating activity in many state waterbodies. As motorized boating activities increase in popularity, boater education is essential to minimize water quality impacts.

Aerial photo of boat motor wake on Lake Monomonac, Rindge, N.H.

Research activities have studied the relationship between motorized watercraft and the interaction with the aquatic environment. These include releasing emissions into the water, physical contact with aquatic plants, organisms and the lake bottom from the boat or propeller, turbulence from propulsion systems, waves, noise and aesthetics. Operating motorized watercraft irresponsibly can lead to sediment re-suspension, nutrient loading, aquatic life disturbance, aquatic plant destruction, the spread of exotic plants and animals, as well as shoreline erosion. The problem becomes more prevalent in shallow lakes less than 15 feet in depth and in shallow shoreline areas (littoral zones).

WATER CLARITY

Motorized watercraft can increase lake and pond turbidity and decrease water clarity, typically in lakes and ponds less than 15 feet in depth. As the watercraft travel along the water's surface, the boat's propulsion system may churn up lake bottom sediments. The suspended sediments result in turbid water and decreased water clarity. Turbidity is a measure of the degree to which light is transmitted through the water. High turbidity results in less light penetration through the water column. Turbidity impacts the ability of fish to uptake

oxygen through their gills, limits sunlight penetration, decreases dissolved oxygen concentrations, and increases surface water temperatures.

Several studies have shown a relationship between the numbers of motorized watercraft to lake clarity. In fact, VLAP observed lower Secchi disk readings at lakes sampled during weekends (periods of increased watercraft activity) compared to weekdays. The level of disturbance to the lake bottom can vary based on watercraft size, engine type and horsepower. In addition to the water's depth, the speed at which motorized watercraft travel impacts waters. Motor angle and boat speed have a distinct role in suspending sediments. A slow boat plowing through shallow areas may re-suspend as much sediment as a boat speeding in the same area. The type of substrate that composes the lake bottom is also a factor in determining how motorized watercraft activity impacts water clarity. High flocculent organic substrates, fine silts and clays re-suspend much more easily and for longer periods of time than sandy and rocky bottom substrates.

WATER QUALITY

Water quality is very important when considering the health of an aquatic ecosystem, which is why motorized watercraft are a concern. Water quality influences species diversity, abundance, aquatic life and public health.

The suspension of lake bottom sediments and other decaying organic matter provide nutrients that stimulate cyanobacteria and algal production. Specifically, these sediments release phosphorus, a nutrient required for plant and algal growth, to the water column. The newly available phosphorus can then be utilized by cyanobacteria and algae to increase growth.

Certain species of cyanobacteria produce toxins that are released into the water column upon cell death. During cyanobacteria blooms (periods of increased cell growth), hundreds of thousands of cells may die, releasing high concentrations of toxins. These toxins can be potentially toxic to pets, livestock and humans. Upon death, these cells also drift to the lake bottom. Once cells reach the lake bottom, bacteria promote cell decomposition, increasing the organic bottom layer and reducing hypolimnetic dissolved oxygen. This lack of oxygen can be detrimental to fish and other aquatic life and will eventually result in internal phosphorus loading from the sediments.

Various studies have also demonstrated that exhaust and unburned fuel leakage from older two-stroke boat motors negatively impact aquatic ecosystems. New four-stroke and direct fuel injection systems are much cleaner to the air and water. Fortunately most motorized watercraft owners have replaced the old two-stroke engines with more efficient direct fuel injection or four-stroke engines, decreasing the amount of unburned fuel discharged to surface waters.

Boat maintenance processes, like oil changes, winterization, fueling, washing and hazardous waste storage, are also sources of water pollutants. Most of these activities are conducted at local marinas that are regulated by state and

federal governments. Marinas can no longer discharge pollutants to public waters and are utilizing best management practices for pollution prevention planning and operation.

SHORELINE EROSION

Shoreline erosion is a naturally occurring process, which can be manipulated through a series of factors that increase the erosion rate. Water movement at the shoreline results in the greatest erosion. Erosion rates depend on the shoreline's geological composition, watershed slopes and runoff rates, water level, shoreline currents, lake fetch, wind action, and vegetative buffers, among others.

Several types of boating contribute to the wave action around the lake and may have a significant affect on shoreline erosion. When a motorized watercraft moves through the water, it produces energy captured in a wake. The wake is responsible for the formation of waves that move in an outward fashion until they dissipate.

The waves created by motorized watercraft and their impact on shorelines vary depending on several factors including boat speed, watercraft type (speed boat, bass boat, jet ski, etc.), engine size, as well as the boat's distance from shore. This is why "no wake" zones, among other practices, are important to observe.

Ignoring safe boating practices encourages excessive erosion. Shoreline erosion de-stabilizes banks leading to sedimentation and loss of vegetative shoreline buffers. This process decreases water clarity and provide nutrients to encourage aquatic plant, cyanobacteria and algal growth. Shorefront property owners can lose valuable land and beach frontage, decreasing property values.

AQUATIC PLANTS

Aquatic plants are very beneficial to a lake ecosystem. Not only do they provide a safe habitat for fish and other wildlife, they also provide stabilization for bottom sediments and the shoreline, cycle nutrients, and provide food for many species. Several factors affect aquatic plant growth, including light availability, nutrient availability, wave action stress, lake sediment composition, and water level and temperature.

Motorized watercraft activity can impact aquatic plant communities through direct contact with either the boat propeller or the hull. Indirectly, boats produce waves that can damage aquatic plants particularly in shallow waters.

AQUATIC LIFE

Aquatic wildlife is a necessary component of any food chain. Aquatic wildlife includes many organisms within the aquatic ecosystem with the exception of fish and invertebrates. Examples of some common aquatic wildlife include

waterfowl, shorebirds, eagles, loons, turtles, and frogs. These species can be a sign of a healthy lake ecosystem.

Irresponsibly operated motorized watercraft can affect aquatic wildlife both directly and indirectly. Motorized watercraft can maim or kill wildlife through direct contact. Waves may disturb wildlife nests along the shoreline, leading the adults to abandon the nest. Habitat destruction and food resources are major concerns in the protection of many aquatic species.

FISH ASSEMBLAGES

Fish, like all other aquatic life, are an important part of the aquatic ecosystem. Species diversity and abundance are indicators of a healthy aquatic ecosystem. The presence of certain species and populations can be affected by the quality and quantity of food, climate, water quality, and the presence of suitable habitat.

Motorized watercraft can impact both individual and whole fish populations. Fish are particularly susceptible to toxic pollutants from the engine and the boat itself. The movements of motorized watercraft can also be responsible for disturbing fish nests, spawning and feeding activities. Increased levels of turbidity make oxygen uptake through the gills difficult and impact the success of fish eggs or spawning activities.

WHAT CAN WE DO TO MINIMIZE THE IMPACT OF MOTORIZED WATERCRAFT ON LAKES AND PONDS?

While boating is a popular recreational pastime, we must take responsibility for the damage that it may cause to our lakes and ponds. There are many ways in which we can minimize the impact of motorized watercraft, decreasing the amount of damage, and ultimately prolonging the healthy life of these aquatic ecosystems.

No-wake zone laws are one of the most important and effective solutions to minimizing the impact of motorized watercraft. Motorized watercraft are required to decrease their speed within these zones to avoid disturbing bottom sediments or create waves that could potentially erode the shoreline. In New Hampshire, boats are required to obey no-wake speeds within 150 feet of the shoreline.

Restrictions of motorized watercraft may be required in some cases. Many lakes and ponds restrict certain watercraft, speeds, or types of motors. This can be an important protective measure especially in small, shallow waterbodies or drinking water supplies. This process can be initiated through legislation and contact with the NH Department of Safety.

Reducing fuel and exhaust inputs, through cleaner technology, is also important in minimizing the impact of motorized watercraft on lakes and ponds. Older two stroke engines are very inefficient, releasing up to 30 percent of their

fuel unburned into the water. Switching to a four-stroke engine or a direct injection engine is more fuel efficient, quieter, easier to maintain, and most importantly, better for the environment.

Minimizing the impact of motorized watercraft ultimately becomes the responsibility of the boaters. Boater education and enforcement of existing rules and regulations may be most effective in protecting New Hampshire's lakes and ponds.

WHO TO CONTACT

For more information regarding water quality impacts contact the DES Watershed Management Bureau at (603) 271-2304.

For more information regarding boating rules and regulations or to report violations, please contact the NH Department of Safety, Marine Patrol Bureau at (603) 293-2037 or Boating Education at (603) 267-7256.

References

Asplund, T. R. 2000. The Effects of Motorized Watercraft on Aquatic Ecosystems. Wisconsin Department of Natural Resources, Bureau of Integrated Science Services. pp.1-21.

Asplund, T.R., Cook, C.M. March 1999. Can no-wake zones effectively protect littoral zone habitat from boating disturbance? *Lakeline Magazine*, pp.6-18, 48-52.

Marine Engines and the Environment: *Low Pollution Engines Reduce Air and Water Pollution*. ARD-31, DES Fact Sheet, (603) 271-3503 or http://des.nh.gov/organization/commissioner/pip/factsheets/ard/documents/ard-31.pdf.

Mosisch, T.D., Arthington, A.H. 1998. The Impacts of Power Boating and Water Skiing on Lakes and Reservoirs. *Lakes & Reservoirs: Research and Management*, (3) 1-17.

Wagner, K.J. 1991. Assessing Impacts of Motorized Watercraft on Lakes: Issue and Perceptions. pp 77-93. In: Proceedings of a National Conference on Enhancing States' Lake Management Programs, May 1990. Northeastern Illinois Planning Commission, Chicago Ill.

Yousef, Y.A., McLellon, W.M., and Zebuth, H.H. 1979. Changes in Phosphorus Concentrations Due to Mixing by Motorboats in Shallow Lakes. North American Lake Management Conference, April 16-18, 1979, Kellogg Center for Continuing Education, Michigan State University, Mich.