Human Impact on Shipwrecks in Lake Winnipesaukee

Anthony H. Gilchrist

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HUMAN IMPACT ON SHIPWRECKS IN LAKE WINNIPESAUKEE

A Thesis
Submitted to the School of Graduate Studies and Research
in Partial Fulfillment of the
Requirements for the Degree
Master of Arts

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May 2019
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Shipwrecks are adversely affected by human activities. Some of the most common activities conducted by humans, include recreational SCUBA diving and fishing, have the potential to destroy the data and cultural integrity of these sites. Human interaction with shipwrecks requires additional research to find the best way to limit human impact on shipwrecks. This project’s primary goal was to measure the level of human impact on newly discovered shipwrecks one year after their locations were made publicly accessible. To achieve this goal six wrecks whose positions were unreleased until 2017 in Lake Winnipesaukee, New Hampshire were examined during the summer of 2018. The primary method was the comparison of pre-existing video data with video data collected in 2018. This analysis showed major impacts over the course of one year on two of the six shipwrecks examined. These damages appear to be the result of anchor damage and divers. As a result of this research the author recommends that a management system be put in place for the shipwrecks on Lake Winnipesaukee.
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I would like to thank Hans Hug Jr. for sharing with me the incredible work he has done finding shipwrecks. Without the data provided by Hans, this project would not have been possible. Hans is an extremely valuable resource for underwater archeology in the lakes region and I look forward to conducting more studies on the shipwrecks he has discovered.

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CHAPTER ONE

THE PROBLEM

Lake Winnipesaukee is the biggest freshwater lake in New Hampshire and contains a rich archaeological record. Its history began with the Native Americans who frequented it in canoes. Europeans first came to the lake in the early 1800s, accompanying the growing logging industry. They used a different type of vessel. These early ships were scow shaped sailboats that were designed to carry large loads of cargo. None of the remains of these boats are known to still exist on the bottom of the lake. The next type of ship to frequent the lake was the horse boat. A horse walking on a treadmill system connected to a paddle wheel powered these boats. There is one identified shipwreck of this type located next to Bear Island, the biggest island on the lake. Steamboats were the next ships to frequent the lake in great numbers. This era of tourist travel on the lake lasted from 1850 to the 1920s. There are many shipwrecks from this era that are known to exist in the lake. Some of the most popular shipwrecks at the lake for divers to visit include Belknap, Lady of the Lake, and three steamers in Wolfeboro Harbor. Lake Winnipesaukee also has shipwrecks that date up until the late 20th century.

There are many well-known shipwrecks on Lake Winnipesaukee. Hans Hug Jr identified many unknown shipwrecks using side scan sonar during the 2000s. In fact, he recorded upward of 300 man-made objects in Lake Winnipesaukee, many of them shipwrecks. In the summer of 2017, Hug released the coordinates for 24 of these shipwrecks on the Winnipesaukee Forum (https://www.winnipesaukee.com/forums/showthread.php?t=22174). Prior to releasing the site coordinates, Hug documented each shipwreck with video.
As it has been known over the years in Lake Winnipesaukee, many of the known shipwrecks have been looted. Thus, it is possible that over the course of one year (2017 to 2018) many of the shipwrecks, whose locations were released in 2017, may have been looted or damaged by local divers and fishermen. If after one dive season the shipwrecks whose locations were previously unreleased until 2017 have been noticeably disturbed, it will show that an effective management strategy for these shipwrecks will need to be implemented.

The problem of looting and the removal of artifacts on shipwrecks is not one that is isolated to Lake Winnipesaukee and the State of New Hampshire. All around the world shipwrecks are adversely affected by human activities. Some of the most common activities conducted by humans on water, such as recreational SCUBA diving, fishing, and dredging, adversely affect the cultural resources below. These activities have the potential to destroy the data and integrity of sites found underwater. The topic of human interaction with shipwrecks requires more research to find the best way to limit the human impact on shipwrecks.

**Problem Statement**

This project’s primary goal was to measure the level of human impact that newly discovered shipwrecks endured over the course of one year after their locations are made publicly accessible. To achieve this goal, a total of 9 shipwrecks in Lake Winnipesaukee, New Hampshire (6 with coordinates released in 2017) were examined.

**Primary Research Question and Hypothesis**

*What effect did releasing the location of shipwrecks in Lake Winnipesaukee to the public have on the condition of the shipwrecks within one year of the locations being released?*
It is hypothesized that between 2017 and 2018 many of the shipwrecks, whose locations were previously unknown, have been looted or damaged by local divers and fishermen.

**Secondary Research Questions and Hypotheses**

1) *What effect do divers have on these shipwrecks in Lake Winnipesaukee during one year?*

   It is hypothesized that with the lack of supervision over shipwrecks, some divers will loot the shipwrecks.

2) *What degree of anchor damage occurs on these shipwrecks in Lake Winnipesaukee during one season?*

   It is hypothesized that there will be damage due to the common method of anchoring on shipwrecks since the release of the location of these shipwrecks.

3) *What effect does fishing have on these shipwrecks in Lake Winnipesaukee over the course of one season?*

   It is hypothesized that the shipwrecks in water shallower than 30 feet will contain more light tackle debris, while the deeper shipwrecks will either contain or show signs of impact from downrigger weights or the heavier wire fishing lines used in deep-water lake fishing.

**Significance**

Understanding and quantifying human impact on shipwrecks is among the first steps to properly managing submerged cultural heritage. Once we discover the most common types of damage to shipwrecks and the potential cause of the damage, appropriate measures can be developed to mitigate future damage. This research is the
first of its kind on Lake Winnipesaukee and in the state of New Hampshire. What is learned from this investigation may hopefully be translatable to other freshwater lakes in the United States.

**Assumptions**

1) The coordinates for the newly released shipwreck locations are correct.
2) Recently released shipwreck locations were only known to Hans Hug prior to their release.

**Limitations**

1) The quality of some of the video and photographic data are less than optimal due to the water conditions and/or lack of light.
2) The sample size was limited to 9 total shipwrecks, which may influence the results.

**Summary**

This chapter presented the background and significance of the problem. It also included the research questions, hypotheses and limitations. Chapter Two is the review of relevant literature including the history of Lake Winnipesaukee and the development of boating on the lake. Chapter Three presents the methodology for the study and describes the procedure for data collection. Chapter Four presents the results of human impact on the nine boats that were examined. Chapter Five discusses the conclusions and implications of this study including recommendations for shipwreck preservation and for future research.
CHAPTER TWO
REVIEW OF RELATED LITERATURE

Introduction

This chapter presents the environmental and historical background of boating on Lake Winnipesaukee, including the growth of steamboats. This period of steamboats is followed by the growth of tourism and private boating. Finally, relevant legislation related to shipwrecks, side scan sonar’s use in archaeology, and previous research into the human impact on shipwrecks are presented.

Environmental Setting of Lake Winnipesaukee

As shown on the map on the following page, Lake Winnipesaukee is located in New England in the northeastern part of the United States (Figure 1). Formed by glacial movement during the last ice age, Lake Winnipesaukee is the largest freshwater lake in New Hampshire and one of the biggest lakes in New England (Figure 2). Lake Winnipesaukee covers 71 square miles and is 213 feet at its maximum depth. The lake has 288 miles of shoreline and 258 islands; most of which is privately owned (Bizer 2018). Multiple rivers including the Gunstock River and Red Hill River are its tributaries and its outlet is the Winnipesaukee River.

The amount of water discharged from the lake to the Winnipesaukee River is controlled by the Lakeport Dam in Lakeport, New Hampshire. The lake’s surface freezes almost every winter, but the subsurface water temperature past one meter remains a relatively constant 40 degrees Fahrenheit throughout the year. During the summer, the top layer of water can reach 70-80 degrees.
Figure 1. Location of Lake Winnipesaukee. (Google Earth.)

Figure 2. Satellite view of Lake Winnipesaukee with key locations labeled. (Google Earth.)
The underwater environment in Lake Winnipesaukee is very constant below a depth of 20 feet, with a sandy bottom that is littered with glacial boulders. The water is often murky in Lake Winnipesaukee due to boat activities and the mixing of different temperature waters throughout the year. In the shallower areas, some invasive plant species such as milfoil are found in abundance (Lyon 2004).

**Historical Background of Boating on Lake Winnipesaukee**

The first historically recorded boaters on Lake Winnipesaukee were the Winnipesaukee Indians. They had a large village on Lake Winnipesaukee, called Aquedoctan. Unfortunately, they were displaced in April of 1696 when the village was evacuated because of an anticipated raid by Colonial Militias. Some of their greatest contributions to the region were fishing weirs that were located in the narrows between Paugus bay and the main lake. Little is known about the Native Americans since a scarce amount of archeological research has been undertaken in the Lakes Region aside from several digs done at the Weirs. There is one dugout canoe that was found in the town Moultonborough on Lake Winnipesaukee during the early 20th century and currently resides at the Libby Museum in Tuftonboro, New Hampshire. There are also a few other examples of dugout canoes that have been found throughout New Hampshire. (Gallop 1969; Hodgson 2018; Starbuck 2006; Libby Museum 2018).

The history of Colonial boating in New Hampshire started in 1652, when Simon Willard and Captain Edward Johnson set out on an expedition to find the upper end of the Merrimack River. What they found was Lake Winnipesaukee or as it was known by the Native Americans, “the smile of the great spirit.” Although they did not explore Lake Winnipesaukee further, they left their mark on a rock in the Weirs that was rediscovered
around 1830. This rock known as Endicott rock resides in Weirs Beach as a tourist attraction (Heald 1984).

The region remained relatively untouched by Europeans until Alton was founded in 1710. In 1768, the New Hampshire Colonial Governor John Wentworth completed a road from Portsmouth, New Hampshire to his summer house in Wolfeboro, New Hampshire. This now provided a connection to the northern part of Lake Winnipesaukee, expanding settlement opportunities beyond Alton, the only place that was really settled. At that time, the only commercial boats on Lake Winnipesaukee were called gundalows: flat-bottomed sailing barges that could accommodate one or two sails and were steered with a long oar. These would remain the norm on Lake Winnipesaukee until a new form of travel, the horse boat (Blaisdell 1975; Crisman and Cohn 1998; Heald 1984).

The horse boat was next type of boat widely used on Lake Winnipesaukee. These boats were used from the 1830s until the 1880s. A model of one of these vessels is shown by Figure 3. These boats consisted of two horses placed at the stern on treadmills, which were then connected to paddle wheels on the side of the vessel. While horse boats were found on lakes across the United States, the Winnipesaukee horse boats had a unique design intended specifically for the conditions of Lake Winnipesaukee. The best estimates for the Winnipesaukee horse boat dimensions are 60 feet (18.2 meters) in overall length, 40 feet (12.2 meters) of length on the bottom, and a 11-foot maximum beam. This gave the ends of the boats a 10-foot (3 meter) overhang which made it possible to pull them onto almost any shore line of the lake. They were steered with large oars. The sides were three feet high and the forward part of the vessel was open while the aft portion of the vessel contained the machinery and crew quarters. These boats
were fairly effective at hauling raw materials such as firewood and bricks. The last horse boat recorded to be in use was retired in 1890 and was captained by Leander Lavelle (Crisman and Cohn 1998). The impact of these boats is still visible today with a horse boat sitting under 40 feet (12.2 meters) of water, which is a very popular diving attraction today. Although it is unknown why this shipwreck sank (It is located near a popular spot where people used to throw trash in Lake Winnipesaukee and therefore was probably scuttled), it serves as the only known example of this form of boating (Bizer 2018).

Figure 3. Horse boat model. (Image courtesy of the New Hampshire Boat Museum.)

**The Growth of Steamboats on Lake Winnipesaukee**

Lawyers Stephen C. Lyford and Ichabod Bartlett were the two individuals who envisioned steamboats as the future of travel on Lake Winnipesaukee. In 1833, they launched the 96-foot long *Belknap*. Although innovative for its time, Belknap was not an elegant vessel. Its hull was scow shaped with flat bottom and rounded front. The boiler
was set in brick and all the moving parts were exposed above the deck of the boat. It was only able to attain a speed of 5 or 6 miles per hour and was audible for miles away. Even with these shortcomings, it conducted regular passenger service between Alton Bay Lake Village, Center Harbor, and Meredith (Blaisdell 1975).

The construction of the Belknap coincided with the building of a dam in Lakeport New Hampshire in 1828 and the subsequent dredging of Paugus bay and the Weirs Channel in 1833. These events raised the lake level and made Lake Village accessible to the rest of Lake Winnipesaukee (Weirs Beach 2019). A much more substantial dam was built in 1851 by the Lake Company which raised lake levels even higher (Gallagher 2015).

There is some debate amongst experts as to whether Belknap was the first steamer on the Lake Winnipesaukee or if it was Jenny Lind. Jenny Lind was also a scow shaped steamer with an exposed engine above deck. Some argue that this boat was the first steamboat, but research by Dr. Bruce Heald found no data to indicate that to be true. Both Belknap and Jenny Lind were employed in the logging industry (Heald 1984). During this time numerous other scow steamers were constructed on Lake Winnipesaukee including Cork Leg (later known as Widow Dustin), Long Island, Dolly Dutton, Mayflower, Naugatuck, Seneca, and Winnipesaukee (Blaisdell 1975).

Regular passenger service on these early boats did not last long. One stormy day in October of 1841, the Belknap was caught by a sudden gale while pulling a large raft of logs. The raft dragged the boat into what is now known as Steamboat Island where it sank in shallow water. Its machinery was salvaged, and the rest of the hull left where it still rests today (Heald 1984).
The next steamboat to offer regular passenger service on Lake Winnipesaukee was *Lady of the Lake*. Built in 1851, it was at that time the largest ship on Lake Winnipesaukee. Its owners planned to link this service with the anticipated railroads. It would not only be the best mode of transportation to get to the northern end of Lake Winnipesaukee but would also connect to a train going to the White Mountains (Blaisdell 1975).

*Lady of the Lake*’s first captain was William Walker, one of the principal investors in the construction of the boat (Heald 1984). It was very prosperous for the next few years, having more success than nearly every major steamboat that was constructed in the years after it was launched. It became a symbol of tourism and Lake Winnipesaukee; offering special excursion rides to Diamond Island, where the Diamond Island House was situated. This hotel was known for its rowdy gamblers and even included a bowling alley. While vacationers were a great part of *Lady of the Lake*’s business, its main income came through transporting local passengers to and from their destinations across the Lake Winnipesaukee. In its glory days, to many, it was seen as the safest way to get to the northern end of Lake Winnipesaukee because of its sheer size and stability. After several years it was sold to the Boston, Concord, and Montreal Railroad. Under the control of the railroad, local historian, Dr. Bruce Heald, estimated it made $30,000 profit in its years of operation (1849-1893) (Heald 1984).

Although *Lady of the Lake* was built as a stable and trustworthy boat, it was rebuilt some 20 years into its life after it burned to the waterline at Wolfeboro Town Docks. The fire did not discourage the Boston, Concord, and Montreal Railroad’s plans for the boat, as it was promptly rebuilt and sent back into passenger service. It also
struck the Witches (a large group of exposed rocks outside of Meredith Bay) while carrying a private party on a nighttime excursion. Although this accident cost the company about $10,000, Lady of the Lake ceased passenger service for the remainder of that season. According to Bruce Heald Lady of the Lake did not experience a single fatality in its years of service (Heald 1984).

A summer 1865 schedule of the Boston and Concord and Montreal railroad refers to Lady of the Lake as the preferred steamer (Figure 4). This is the oldest identified example of an advertisement for Lady of the Lake and shows that at that time, tourism may have been a major source of revenue. The poster advertises trips from Boston north through Concord and Manchester to the Lakes Region and then farther north to the White Mountains. The boat met the trains when they came in and the railroads advertised that you could leave Boston at 7:30 or 8:00 am and be to Center Harbor (a small town in the northern part of Winnipesaukee) in time to climb Red Hill (a small mountain at the northern end of the Winnipesaukee with a view of the entire lake) the same day. Then passengers could stay at the Center House in Center Harbor and take a steamboat to Wolfeboro (large town in the northeastern part of the Winnipesaukee) in the morning. This poster may have been the impetus for these tourists to come to Lake Winnipesaukee. Having a poster with the beautiful art on the sides with scenes of Winnipesaukee and full transportation schedules may have made this a very popular excursion route. Other routes went to Wolfeboro and Long Island, where the larger steamboats would connect with smaller steamboats to get into the shallower parts of Lake Winnipesaukee, such as the waters surrounding Melvin Village and Lee’s Mills (in Moultonborough Bay at the most northern end of the Winnipesaukee) (Boston, Concord & Montreal Rail Road 1865).
Figure 4. 1865 Summer advertisement: Boston, Concord & Montreal Railroads. (Image courtesy of the Boston Athenaeum.)
In the summer of 1852, the Cocheco Railroad launched its own passenger boat known as *Dover*. This boat was poorly constructed and earned the reputation of an extremely leaky ship. At this same time, a smaller steamboat known as *Red Hill* reached a violent ending at Lee’s Mills in the northern end of Lake Winnipesaukee. On May 23, 1853, its boiler exploded just as the last passengers had disembarked. This clearly did not thwart people’s reliance on the steam industry as it was starting to expand exponentially at the time (Blaisdell 1975).

Between the 1850s and the 1870s numerous smaller steamboats were built. Some of these smaller vessels where privately owned and others were employed by the railroads to transport passengers into areas such as Moultonborough Bay where larger steamboats like *Lady of the Lake* could not safely navigate. One of these steamboats was *James Bell*, which started in private ownerships and was eventually purchased by the Boston and Maine railroad to service the Paugus Bay area and conduct private excursions (Blaisdell 1975). The first propeller driven steamboat was brought to Lake Winnipesaukee in 1875. It was named *Nellie*. Other smaller steamers built at this time are *Gazelle, Lamprey, Minneola, Maid of the Isles, and Belle of the Wave*. In 1880, one of the earlier scow steamers, *Winnipesaukee*, began to break up when traveling through the Broads (the central portion of Lake Winnipesaukee), fortunately the crew managed to beach the vessel before tragedy struck. This would lead to the first laws regarding the inspection to steamboats in New Hampshire to be enacted in 1881 (Blaisdell 1975).

Unsatisfied with the quality of *Dover* and how *Lady of the Lake* had continuously produced higher ticket sales, the Cocheco Railroad decided to expand *Dover* another twenty feet from its previous length of 100 feet. This rebuilt version was named
Chocorua. It remained very leaky and traveled considerably slower than Lady of the Lake. It is said that often the Lady of the Lake would pass the Dover when traveling through the Broads to show its superiority to the slower boat. Even more unfortunate for Chocorua, in 1866 the boat sank one morning, resting on the shallow bottom next to its dock in Meredith (Blaisdell 1975; Heald 1984).

The Cocheco Railroad was frustrated by the technically inferior Chocorua and its lack of revenue. In 1871 the Cocheco railroad began plans to build the largest steamboat ever be launched on Lake Winnipesaukee. This steamboat got its name from another mountain following the tradition that Chocorua had started: Mount Washington.

Mount Washington Steamboat

The Smith and Townsend firm from East Boston built Mount Washington. Construction took place at Alton Bay in the southern end of the Lake Winnipesaukee and Mount Washington launched in the spring of 1872 (Blaisdell 1975; Heald 1984). Its final construction cost came out to be more than anticipated, roughly $62,000 or $1.2 million in today’s dollars. Its length was 178 feet (54.3m) with a beam of 49 feet and 4 inches (15 meters) making it by far the largest ship ever to be launched in Lake Winnipesaukee at that time. Its walking beam engine consisted of a massive 33-foot low pressure boiler attached to a single cylinder engine with a bore of 42 inches and a stroke length of 10 feet. This massive engine gave Mount Washington the capability of running at 450 horse power when the engine was at full pressure (30-35 pounds normal operating pressure). This engine could do 24 rotations per minute. Its original weight was listed at 510 tons. No other boat of this size would be launched on Lake Winnipesaukee until the second Mount Washington was launched in the 1940s. It must have been a true spectacle for
people at the time to see such a major boat launched into Lake Winnipesaukee, when many of the local residents had probably never seen a boat of such size (Blackstone 1969; Blaisdell 1975; Morgan Friedman).

*Mount Washington*’s hull consisted of a lower deck with seating and guardrails along all sides of the boat. The top deck consisted of the pilot house, along with more seating towards the bow with a private cabin for the captain and purser. There also was a dining room aboard the boat with a large table. It was equipped with several 12-foot long metal flat-bottomed lifeboats in case of emergency (Blackstone 1969). Figure 5 shows *Mount Washington* steamboat.

![Mount Washington steamboat](Image courtesy of the New Hampshire Boat Museum.)

*Mount Washington* was immediately a symbol amongst the local citizens because of its enormous size. It started attracting tourists from more distant areas around New England and possibly outside of that region. Adding to the appeal of the boat was its
grand dining. Historians, such as Edward Blackstone, have described this food from accounts he collected as “second to none.” The crew maintained a family gathering while dining. Every crewmember ate at the same long table in the dining room (Blackstone 1969).

During the late 1800’s, the Mount Washington steamboat played an active part in the tourist industry on Lake Winnipesaukee. The first captain to assume command of this boat was Augustus Wiggin in 1872. He served as captain until he retired in 1896. The next captain was Henry L. Wentworth a native of Long Island, Lake Winnipesaukee. An example of Mount Washington schedule from Captain Wentworth’s time is shown in Figure 6.

![Figure 6. Newspaper advertisement 1905. (Image courtesy of the Winnipesaukee Museum.)](image)

This time schedule shows how busy Mount Washington was during that time. In the spring of 1908, tragedy struck when Captain Wentworth apparently committed suicide as he was last seen walking down the train tracks with a gun in his hand and later found with a gunshot wound to the head (Heald 1984).

Captain Wentworth’s replacement would become one of the most well-known names in New Hampshire at this time, Captain Herbert A. Blackstone. He remained captain of Mount Washington for 14 years. Captain Blackstone had a long history of boat building prior to becoming captain of the Mount Washington. He achieved his first major
break in 1881 when Arthur Lamprey hired him to design and build his ship, *The Belle of The Wave*. He then returned to Boston for several years until deciding to return to Lake Winnipesaukee where he built *Maid of the Isles*. This time another boat owner, Charles Brown, contacted him. He desired a boat approximately 60 feet (18.3 meters) long and asked Herbert Blackstone to approve his final design. Although Blackstone did not initially agree with the design of the boat, one can only deduce that he was motivated by money to build it, as he traveled from Boston to Melvin Village to build the ship. This was not the last boat he and his family would build for Arthur Lamprey. Soon after, they constructed *Montclair* and *Cyclone* (Blackstone 1969; Blaisdell 1975).

Captain Blackstone may have been one of the most well-known captains to work the waters of Lake Winnipesaukee due to the long length of time he operated on the lake. But he also saw the most significant accident *Mount Washington* had to endure. On an early season Thursday morning of dense fog in 1910, it was accidentally driven up on to the rocks near One Mile Island. This island is named One Mile Island because it is located one mile from Center Harbor. The problem is that this island and the land across from it, on Center Harbor Bay, create a bottleneck for big boats. When the markers are not carefully followed, boats can easily run aground. It is suggested that the fog on that day obscured the markers. Fortunately, the boat only sustained minor damages during this collision and managed to steam on (Blaisdell 1975).

*Lady of the Lake* was quickly surpassed by the technological superiority of *Mount Washington*. By 1894 *Lady of the Lake* was considered unprofitable for the railroad and was taken out of service. After this it was towed to Lakeport, NH and its machinery was disassembled and sold. It remained there until the following year when it was towed to
Glendale where a railroad tycoon was building a mansion overlooking the lake, which later became known as Kimball’s Castle. *Lady of the Lake* was then beached and used as housing for the stonemasons working on the castle. After completion of the castle, all the wood above the basic structure of the hull was removed and it was filled with rocks and towed out into Glendale Cove. Although they intended for this to cause it to sink the hull refused to do so. They then decided to drill holes in its side, which finally caused the boat to sink to the bottom of the lake. It remains to this day intact and is a popular diving attraction on Lake Winnipesaukee (Blaisdell 1975; Dive Winnipesaukee 2018).

With its competition scuttled, *Mount Washington* was now the dominate vessel in the Lake Winnipesaukee passenger service industry. It continued to conduct regular passenger service for the next 30 years. *Mount Washington* was under control of the railroad until 1922. In 1922, the railroad sold the boat to Captain Leander Lavelle (one of the major captains on the lake at the time). According to officials in the railroad’s official statements, lack of revenue was blamed. This appears to be a fallacy since all historians agree *Mount Washington* was taking on regular passengers and was as busy as ever (Blaisdell 1975; Heald 1984). This purchase was rumored to only have cost Captain Lavelle $3,000, a fraction of its original building cost. This purchase marked a change in *Mount Washington*’s career as a steam vessel. The railroad’s original focus, which was to move passengers and freight to the northern end of Lake Winnipesaukee, had almost fully been replaced by the tourist industry. The purchase of *Mount Washington* happened a year after the legislation to build Daniel Webster Highway had passed. This road made it much easier to travel to the lakes region and Lake Winnipesaukee’s northern end
without the use of railroads or steamboats. This may have been a major contributing factor in the railroad selling *Mount Washington* (Blaisdell 1975).

By examining pictures from the late 1920 to early 1930s, it appears that the depression really did not hurt the tourism and transportation industry on Lake Winnipesaukee (Collection of the New Hampshire Boat Museum). When one looks through old photos of the early 1930s, it is clear that the docks at the Weirs and other locations around Lake Winnipesaukee appear packed with passengers eager to ride *Mount Washington*. The passenger rate at that time also remained consistent with previous years with the rate of one dollar or around $18 in today’s currency (Friedman 2018). From this one can see that the rates for *Mount Washington* were not too high for local residents and tourists alike. During this time images show smaller private steamboats traveling around Lake Winnipesaukee indicating that the recreational boating industry was not affected either.

This era also is when most postcards about *Mount Washington* are dated to. The majority of these seem to picture Lavelle’s steamboats, especially *Mount Washington*. A small minority of these postcards also show smaller steamboats that were used to transport passengers to hotels and summer camps in the shallow coves of the lake. Unfortunately, the smaller boats from this era are not well documented. The postcards show especially compelling images of crowds of people boarding the *Mount Washington* and many majestic images of the steamboats travelling across the Lake. The sheer number of postcards that still exist today illustrate how many of postcards must have been sold and distributed. Many postcards had addresses indicating they were being sent from places around the Lake Winnipesaukee to Massachusetts and other parts of New
England. The earliest postcards that exist in the collections of the New Hampshire Boat Museum and the Lake Winnipesaukee Museum and date to around 1905. But postcards did not seem to become common until Lavelle purchased the boat in 1922. Postcards likely served to spread the fame of Mount Washington (Collection of The New Hampshire Boat Museum).

The season of 1939 was without incident and the original Mount Washington’s last passenger voyage before the winter was the Columbus Day foliage cruise. After that cruise, Mount Washington was moved to the Weirs for the winter. Here it came to rest on the bottom of the Lake Winnipesaukee because of the lower than normal lake levels (This was normal for big steamboats during the winter months as the dam at Lakeport purposely lowered the lake). This meant that it could not be moved from its dock next to the railroad track until the following spring when the snowmelt brought the lake level back to normal.

Unfortunately, Mount Washington did not survive that long. On December 23, 1939, just days before Christmas, a local hotel owner, Fred Moore, noticed that a stove had over heated in the railroad station next to the water starting a fire. He quickly notified the fire department and efforts were made to contain the fire, but to no avail. The crewmembers rushed to detach Mount Washington from the dock and break the one-inch of ice surrounding the boat. This did not work as its bottom was suck in the mud. By the morning, Mount Washington had burned to the water line (Blackstone 1969; Blaisdell 1975).

This tragedy attracted national attention to Lake Winnipesaukee as the New York Times stated:
THE WEIRS, N. H., Dec.23- The steamer Mount Washington which has plied the waters of Lake Winnipesaukee since 1872 and was estimated to have carried more than 200,000 passengers, burned to the waterline last night in a fire which destroyed the Boston & Maine Railroad station and a sea plane landing. (New York Times 1939)

The article goes on to explain that the damages at that time were estimated to be around $200,000 and that 1,500 feet of the boardwalk had also been burned in the fire. The tone of this article is melancholic as it stated, “the Mount Washington was known to three generations of summer visitors to Lake Winnipesaukee.” This shows how much Mount Washington and Lake Winnipesaukee were really sewn into the fabric of both New Hampshire and the nation.

The demise of Mount Washington did not stop Leander Lavelle. He immediately started making plans for the construction of a new boat. It did not take very long and by December 28 of that same year he had purchased a new steamboat in Burlington, Vermont. It was purchased for a mere $20,000, but it would cost much more to get it back to Lake Winnipesaukee and get it running as a passenger boat. It had an iron hull, which was the main difference from its predecessor. This also presented a special challenge on how to transport such a heavy vessel. Chateauguay, as it was known on Lake Champlain, had fallen to disrepair when automobiles took over the role of the steamboat and railroad in the 1920s. At that point, it was converted into a car ferry until Lavelle purchased it (Blackstone 1969; Heald 1971).

Transporting and rebuilding the boat was contracted to General Ship and Engine Works, a company from East Boston. On April 3, 1940, it was hauled out of the waters
of Lake Champlain and was cut into 20 sections in a manner that Edward Blackstone described as like “cutting a loaf of bread”. They then put these pieces on 18 separate train cars and transported it to Lakeport on the southern end of the Lake Winnipesaukee. These pieces were reattached and with an engine installed, it was launched in August of that same year. It was powered by three steam engines of a more modern design than its predecessors. In less than a year, on August 12, 1940, *Mount Washington II* was launched. At 230 feet (70 meters) long the newly rebuilt boat became, and remains, the largest vessel ever launched on the Lake Winnipesaukee (Blackstone 1969; Gallup 1969).

Unfortunately for Lavelle, he built his new boat at the brink of the Second World War. It also had multiple design flaws. The main problem was that the propellers had been installed too high up in the water, thus they did not provide proper thrust. This was fixed by putting plates over the area of water where the propellers were to make the thrust push the boat forward. This worked to limited success, but the remainder of the 1940 season did not produce much profit for the company. As the United States became more deeply involved in the World War II, it became harder for potential tourists to pay for the basic expenses needed for life, let alone a vacation (Blaisdell 1975). This caused a lull in the tourist industry, which would drive the company into bankruptcy in April 1940. This bankruptcy effectively ended Leander Lavelle’s steamboat business and arguably the entire steamboat era on Lake Winnipesaukee. Lavelle would die before the end of World War II, uncertain if his remake of this great steamboat would be a success. The U.S. Coast Guard took *Mount Washington’s* steam engines and it was hauled out of the water for the duration of the war. Its hull was sold to General Ship and Engine Works of Boston for $30,000 (Blackstone 1969; Gallup 1969; Heald 1971).
After the war, General Ship and Engine Works, the company that bought Mount Washington II, rebuilt it and added two 615 horsepower engines. Ending the steam era on Lake Winnipesaukee. By 1946, Mount Washington II was operational again and the owners built two additional passenger boats for their fleet, one of which, Sophie C, is still in operation today as the mail boat on the Lake Winnipesaukee. Captain Brian Avery took command of Mount Washington II and it has continued passenger service to this day. Although the boat had several renovations, the basic structure remains, with the diesel engine that have powered it since 1946 (Heald 1971).

**Growth of the Tourism Industry on Lake Winnipesaukee**

Tourism grew in the 1880s and it was an exciting time for excursionist on Lake Winnipesaukee. At that time, many locations like Diamond Island (an island in the central part of Lake Winnipesaukee near the Broads), had great importance to the region’s economy. In towns such as Wolfeboro, Center Harbor, and the Weirs, many new luxury hotels and resorts were built to meet the industry’s needs. One hotel worthy of more attention is the Diamond Island House, which was eventually disassembled and dragged across the ice with oxen to the Weirs where its structure was used to build the Weirs Hotel, one of the grandest at the time. The Weirs Hotel burned in 1924 and was never rebuilt (Blackstone 1969).

Some of the advertisements for these hotels still exist in modern times and likely served as catalyst for tourists to want to visit the Lakes Winnipesaukee. An excellent example of an advertisement for a hotel that would have needed to be accessed by a steamboat is the Wawbeek Hotel in Melvin Village (Moultonborough Bay). Their advertisement consisted of beautiful pictures of sailboats and tourists having fun. It also
advertised that the hotel has “True Yankee Hospitality” and homecooked meals. This advertisement was from the 29th season of the hotel’s operation, indicating that they must have had at least some degree of success because of the length of time they were in operation (Figure 7).

The early to mid-1880s show some of the first organized summer camps in the world were in the lakes region of New Hampshire and on Lake Winnipesaukee. The number of summer camps in the lakes region would expand over the next few decades with a total of 72 established lake region camps by the 1930s. Many of these camps were located on islands giving them a unique setting. An example is Camp Idlewild, which was founded in 1891 and ran for over 60 years. Camp Idlewild at Lake Winnipesaukee was located on Cow Island in Tuftonboro and was boys camp for ages 7-15. The time
that many of these campers spent on the lake made a big impression and some former campers came back to the lakes region and built summer homes (Heald 2001). Figure 8 shows an example of a Camp Idlewild advertisement.

Figure 8. Camp Idlewild advertisement. (Winnipesaukee Forum.)

**Growth of Private Boating and Other Activities on Lake Winnipesaukee**

In 1882, the first piece of boating legislation in New Hampshire’s lakes region came with the appointment of Colonel Drake as boiler inspector. This legislation was a direct result of the near tragedy on the steamboat *Winnipesaukee* in 1879 (Blaisdell 1975). It should be noted he was only to inspect the boilers of commercial vessels. By 1889, navigation on the lake was changed forever when New Hampshire’s legislature put forth $1,000 for navigational aids to be placed around Lake Winnipesaukee (Heald 2001). The vast majority of private boats on Lake Winnipesaukee before 1900 were scow rowboats, canoes and small steamers with upright boilers without awnings. In the early
1900’s, the open power launch was introduced to Lake Winnipesaukee. These boats were between 16 and 20 feet long and were powered by small marine engines. A well-known example of ones of these boats was *Silver*.

In 1915, the Public Service Commission of New Hampshire was granted permission to require registration for private vessels. The first year this legislation was enacted, approximately 1,500 boats were registered. This shows just how many boats were on NH lakes during the early 20th century (NH only has 17 miles of seacoast therefore the majority of private boats were on lakes) (Heald 2001).

The early 1920s brought v-bottom boats to Lake Winnipesaukee. This shape offered less resistance and therefore the speed of private boats increased dramatically. Multiple private owners began competing for fastest boat on the lake. By 1931, *Jayee III* owned by W. S. Corby was the fastest on the lake at 27 miles per hour (Blasdell 1975).

In 1931, the first lighted navigational markers were placed on Lake Winnipesaukee helping to improve safety during night time travel. By 1937, 776 spar buoys, 46 flashing light buoys and 30 steady light buoys had been placed in New Hampshire’s lakes, the majority being placed in Lake Winnipesaukee (Heald 2001).

While the demise of the original *Mount Washington* marked the end of the steam era on Lake Winnipesaukee, it coincided with the beginning of rapid expansion in private and recreational boating that continues to this day. During WWII, many private boat manufacturers stopped producing consumer boats and began exclusively building boats for the United States military. Private boats in the post-WWII era on the lake started to get smaller than their predecessors and more affordable to the average American (Kaiser and Sweet 2014). Small wooden power boats such as Chris-Craft became an everyday
appearance on Lake Winnipesaukee. This is reflected archeologically with multiple Chris-Craft shipwrecks along with other brands of power boats such as Higgins and Century found in the lake. It should be noted that during the early years of these recreational power boats, there were no environmental regulations preventing people from scuttling their power boats in the lake or requiring them to recover the powerboat after it had sunk, which may be why the lake contains more wooden than fiberglass powerboats (31 wooden, 2 fiberglass, 2 aluminum).

In recent years, new shipwrecks are not a common occurrence. This is not a result of people not sinking their boats, but because in the 1990s the State of New Hampshire passed environmental legislations requiring the owners of sunken vessels to remove them from the lake within 48 hours or face a $500 fine for every day the vessel is submerged (State of New Hampshire 2015). If a vessel was motorized, it also requires that the owner report the incident to the Department of Environment Services so that an environmental assessment of the site can be performed. While this legislation has led to less new shipwrecks on the lake, there are still people who intentionally or unintentionally sink their boats on the lake and do not report the incident to avoid paying salvage costs.

In 1960, the Department of Safety and Boating was created under the Department of Safety Services (police, fire) in New Hampshire. This effectively formed what is now known on New Hampshire lakes as the marine patrol. In 1961, there were 37,750 motorboats registered in New Hampshire. This is a much larger number than the 1,500 that were registered in 1915 and shows how much recreational boating on New Hampshire’s lakes was increasing. Just 4 years later in 1965, 40,790 privately owned
motor boats were registered in the New Hampshire (Heald 2001). By 1980, the marine patrol in New Hampshire had approximately 55 officers who patrolled over 200 lakes throughout the state. In 1984, 47,800 boats were registered in New Hampshire, which is an increase of almost 10,000 privately owned boats in two decades. Since 1980, this expansion in recreational boating and tourism on the lake has continued. Prices for lakeside properties have increased as well and the majority of the lake front is now privately owned (The Lakes Region Conservation Trust owns the majority of undeveloped islands and lake front properties). This increase in property value and the subsequent increase in local and state property taxes drove the majority of privately-owned summer camps bankrupt. Camp Idlewild was one of these unfortunate summer camps and was forced to close in the early 1970s. Now at least 2 camps on Lake Winnipesaukee are owned by the YMCA, since they have a tax-exempt status (Heald 2001).

Recreational Diving on Lake Winnipesaukee

Scuba diving has been popular on Lake Winnipesaukee since the 1980s and its popularity appears to have increased recently along with the rest of the United States’ recreational dive community. Almost all the diving done in the lake is shipwreck diving due to the absence of other interesting dive sites (Hans Hug, personal communication 2018). The very well-known shipwrecks listed on the Bizer (2018) map have been looted of all loose artifacts. Some of the shipwrecks even have places where pieces have been forcibly removed. For example, divers have removed the rudder from Lady of the Lake. Anchor damage is a major risk factor for the shipwrecks on Lake Winnipesaukee due to
the practice of dragging the anchor until it catches the shipwreck. This practice is not actively used by the recreational dive charter companies.

Currently there are only two companies running dive charters on Lake Winnipesaukee; Dive Winnipesaukee and Shark Bait Diving Adventures. These shops only run charters to commonly known dive sites; all of which are shown on the Bizer map of Lake Winnipesaukee (Dive Winnipesaukee 2018). If any of the lake’s shipwrecks show signs of diver related damage, it will most likely have been done by divers not on charter boat dives because charters will not allow passengers to take artifacts off shipwrecks. This leaves an unknown number of divers who go out on their own to explore the shipwrecks in Lake Winnipesaukee. Conditions on Lake Winnipesaukee are generally calm and small boats can be used for scuba diving, therefore one can trailer in a small a craft to the lake to dive the shipwrecks (Bizer 2018).

**Fishing Activities on Lake Winnipesaukee**

Fishing is one of the most popular recreational sports on the lake and occurs year-round. Lake Winnipesaukee’s waters contain a range of species from landlocked salmon to smallmouth bass. Deep-water fishing (fishing in over 20-30 feet of water) on Lake Winnipesaukee is dominated by the use of downriggers, a fishing system that uses a 20 to 40 pound lead weight to hold tackle at the desired depth and lead core line systems. Both systems use heavy tackle and wires that can easily ensnare shipwrecks while trolling. Shallower fishing involves monofilament line and lighter tackle. There is no commercial fishing on Lake Winnipesaukee. Commercial activities that have occurred (infrequently) on Lake Winnipesaukee include the dredging of some of better-known channels in the lake (Lyon 2004).
Relevant Shipwreck Legislation

The major legislation that covers the shipwrecks located in the waters of Lake Winnipesaukee is the Abandoned Shipwreck Act of 1988. The Abandoned Shipwreck Act of 1988 is a federal law protecting shipwrecks. The act essentially assigns ownership of abandoned ships or shipwrecks that have no rightful owner, to the respective states in whose waters they are located. The act also states that the owner of shipwrecks located on federal land or US territorial waters is the United States. The problem that this law is trying to address is primarily underwater salvage of archaeological sites. The main goal of this law is to give shipwreck management guidelines for individual states to adopt if they wish to do so. The “Abandoned Shipwrecks” that the act refers to are shipwrecks that have generally gone 30 days without being claimed. Because of modern environmental laws, most recent shipwrecks will not be abandoned because many states have laws requiring the owners of the boats to recover the vessel. If not recovered, the owner will face major fines from the damage modern boats do to the environment when they sink (NPS 1987).

In New Hampshire, the state historic preservation laws are codified in Chapter 227-C of Title XIX, which states that all submerged historic resources are property of the state. This makes all acts of looting of any shipwreck illegal under New Hampshire law. Although the law does provide a provision for artifacts to be removed from submerged cultural resources when a curation agreement is made with the State Historic preservation Office (NPS 1987). It should be noted that no one (including NH marine patrol) is actively enforcing laws regarding shipwrecks in Lake Winnipesaukee.
Archeology on Lake Winnipesaukee

Investigation of shipwrecks on Lake Winnipesaukee has been extremely limited. There has only been one survey conducted on the lake before this investigation for which a report can be found. This survey was conducted by Stephanie Laura Poole in 2013 on the *Lady of the Lake* shipwreck. This survey used a baseline to create an overall site plan of the top level of the shipwreck. This site plan shows where the top decking is missing and some of the damage the wreck has sustained over the time it has been in the water. During the survey, the shipwreck was extensively photographed and side scan sonar data was collected of the shipwreck site.

Side Scan Sonar and Archeology

Acoustic imaging is a very useful tool in underwater archeology. While a camera or any form of visual imaging has a limited range, acoustic imaging travels a greater distance, even in turbid water. In recent years, the quality of acoustic imaging systems has gotten to the point that the images achieved can be of an equivalent quality as photographs. These systems include typical fish finder systems and side scan sonar systems. The basic principle of sonar is that it sends out an acoustic signal and measures the strength of the echo’s return from the base of the water column to give a depiction of the topography of the interface between the base of the water column and the landscape below. Side scan sonar systems utilize twin fan shaped beams that image large areas of the sea floor on either side of the transducer (Adams, Mindell, and Foley 2000). The transducers of these systems are known as towfish and are a torpedo shaped tube that is towed behind the survey boat at a depth set by the operator to maximize the image quality. On fish finders the transducer is mounted to the hull of the boat. In shipwreck
discovery, they are used to find potential shipwrecks. This mainly consists of looking for boat shaped or non-natural objects (objects with symmetry/straight lines) and then the potential locations are surveyed using remotely operated underwater vehicle (ROVs) or scuba divers (Woods Hole 2018).

**Previous Research into Human Impact on Shipwrecks**

The problem of looting and the removal of artifacts on shipwrecks is not one that is isolated to Lake Winnipesaukee and the State of New Hampshire. All around the world, shipwrecks have been subjected to human damage. Joanne Edney and Dirk Spennemann wrote an article in 2015 about trying to reduce diver impact on shipwrecks by creating artificial reefs with modern ships that have been decommissioned. Their article focuses on shipwrecks around Australia. They present five primary effects recreational divers have on historic shipwrecks. “(1) Boat anchor and mooring damage (2) Intentional contacts with wrecks (e.g. holding onto, kneeling on, removing marine life from surfaces etc….. And vandalism) (3) Unintentional contact with wrecks (e.g. inadequate buoyancy control), all causing physical impact which leads to gradual weakening of the structure (4) The impairment of site integrity through disturbance to, removal, or addition of artifacts fittings as personal mementos or souvenirs, and for profit and memorialization (5) Exhaled air bubbles in confined spaces (during wreck penetration) which accelerates corrosion” (Edney and Spennemann 2015;142).

Edney and Spennemann suggest that artificial reef wrecks would be key in protecting historic shipwrecks by arguing that the presence of more artificial reef shipwrecks would also enhance the local dive sites in certain areas devoid of any dive sites other than shipwrecks. They surveyed the local recreational dive communities in
Australia asking whether the presence of artificial reefs for recreational diving as opposed to historic shipwrecks would adversely affect the dive community. Their study showed that many divers from the younger generations to the older generation in Australia would be fine with diving on artificial reefs instead of historic shipwrecks. Many of the younger divers, go scuba diving to explore the marine ecosystems and not for the purpose of exploring the wrecks. The one major group of divers that the article mentions that disagree with artificial reefs replacing historic shipwrecks are “Legacy Divers” or divers that began diving during the times when it was popular and widely accepted in the diving communities to remove artifacts from shipwrecks. They predict that by 2025, many of these legacy divers will be too old to dive and therefore will no longer be a major voice in the recreational diving communities (Edney and Spennemann 2015).

Gail Vander Stoep et al. (2014) wrote about the topic of shipwreck management as well. Her research was based in Michigan and consisted five parts “1. Review of relevant federal and state/provincial law, policy, and practice associated with Great Lakes shipwrecks 2. A mail survey of shipwreck discoverers 3. Two modified nominal group workshops with shipwreck discoverers 4. A workshop on assessment and monitoring, involving various stake holder groups 5. A telephone survey of Great Lakes shipwrecks resource managers (U.S. and Ontario)” (Vander Stoep et al. 2014;128). The most useful part of this research for the authors was the mail survey that was sent to the discoverers of shipwrecks. The goal of this survey was to solicit “1. Descriptive information about shipwreck discovery activity (past and current activity levels and locations, procedures and equipment used, types of resources sought). 2. Opinions about shipwreck discovery activity (constraints; recommendations for search, assessment, monitoring and protection
procedures; willingness to assist the state of Michigan in documenting, assessing and monitoring shipwrecks)” (Vander Stoep et al. 2014:135).

Vander Stoep and her team had 25 survey forms returned to them over the course of one year, giving them a response rate of 59 percent. Even with this relatively small sample size, there was a very diverse range of answers to the questions about what should be done with newly discovered shipwrecks. Some believe that their discovery should be shared with the entire dive community of the Great Lakes for recreational divers, while others do not wish to share their finds with anyone. The workshops conducted during their research were productive and had positive results for the discoverers of shipwrecks as to the understanding of what the proper course of action should be when they discover these shipwrecks. From their findings, the authors generated several ideas for improving the monitoring and stewardship of newly discovered shipwrecks in the Great Lakes. One is to institute various incentives to motivate the discoverers of shipwrecks to work with the various state governments. These incentives could include financial incentives such as waiving launch fees or tax deductions. The authors also suggest that implementing better education programs for the public and for the discoverers of shipwrecks to help mediate problems associated with the discovery of new shipwrecks (Vander Stoep et al. 2014).

In 2016, Joanne Edney wrote an article describing a framework for managing diver impact on shipwrecks. This framework was developed to assist cultural resource managers in deciding the best course of management actions for each individual shipwreck site. It first lists five major impacts that divers have on shipwrecks. These are identical to the ones listed in her previous article: boat anchor and mooring damage,
impairment of site integrity and stability, intentional contact with shipwrecks, unintentional contact with shipwrecks, and exhaled air bubbles. The article categorizes the management strategies for shipwrecks into two categories, regulatory and non-regulatory. Regulatory includes laws and regulations as well as permitting systems that could be put into place. It does mention that laws regarding shipwrecks will not be effective unless there is some amount of surveillance by law enforcement on sites to prevent certain off limit sites from being dove on and artifacts from being removed from sites where diving is allowed. Permitting systems could include requiring training for diving guides to prevent tourists from damaging sites. They could also implement limits on the number of divers at sites, requiring divers follow a code of conduct, requiring special certifications, and requiring every diver to be appropriately briefed before their dives. There is also the idea of using “sacrificial shipwrecks”, or ones of less cultural value, to be dove on by recreation divers as opposed the them diving on ships of major cultural significance. All of these provide very good options for trying to mediate the impact of divers on shipwrecks (Edney 2016).

In 2015, Della Scott-Ireton and Jennifer McKinnon proposed the idea of educating the public through shipwrecks being left open as underwater sanctuaries. They suggest using heritage trails to educate the public about shipwrecks and their unique biological and archeological value to better protect them from diver-inflicted damage. An example they give is the 1733 Spanish Galleon Trail in Florida. This trail’s purpose is to tell the story of the treasure fleet and its decline using booklets. They distributed these booklets to all the local fishing shops, dive shops, and visitor centers. The booklets emphasize the impact that divers have had on these wrecks while trying to recover
treasure. They also explain about the impact that these divers have had on the biological components of the sites, as they represent some of the oldest artificial reefs in the area. The use of this heritage trail has helped minimize the impact that divers have on these shipwrecks. Other examples of similar maritime heritage trails can be found in Cayman Islands and Saipan (Scott-Ireton and McKinnon 2015).

All these resources present good perspectives on what should be done to manage the impact that divers have on shipwrecks. There is a limited number of resources on the topic and these articles provide the best information currently available. The articles written by Joanne Edney (2015, 2016) provide a reasonable framework for different solutions to the problems associated with the recreational dive community on historical shipwrecks. The list of the different effects provided by Edney, provide a good basis of analysis when looking at the ways divers adversely affect historic shipwrecks regardless where the shipwreck is located. Unfortunately, in the case of Lake Winnipesaukee and of the rest of the lakes in New Hampshire, no efforts have been made to manage the recreational dive communities’ impact on shipwrecks or to measure the extent of this impact.
CHAPTER THREE

METHODS

This investigation involved examining nine shipwrecks located in Lake Winnipesaukee. The primary method used in this investigation was the comparison of video data collected by local diver, Hans Hug Jr., with video data collected in 2018 to determine if there are any noticeable changes in the conditions of six shipwrecks one year after their locations were published. These shipwrecks were also compared with two shipwrecks that are currently popular dive sites on Lake Winnipesaukee which were recorded during 2018. During the investigation an additional shipwreck that had not been released to the public was recorded. All the shipwrecks chosen are in depths recommended for the basic scuba certifications (shallower than 60 feet) and depths that cannot be reached by general snorkelers (greater than 20 feet) (Professional Association of Dive Instructors 2018b).

Preliminary Data

Video Data

Hans Hug Jr. is the owner-operator of Sonar Search and Recovery Located in southern New Hampshire. His company utilizes an Edgetech Model 4125-p side scan sonar that runs at frequencies of 400 and 900 KHz. This is used in conjunction with a Hummingbird model 1197 side scan sonar and chart plotter. In his spare time, Hug has made it his hobby to scan Lake Winnipesaukee in search of shipwrecks. He has been very successful at this and has located upwards of 300 man-made objects in the lake, many of them shipwrecks. He is an avid user of the Winnipesaukee Forum, the primary website used to spread information to Lake Winnipesaukee residents
(https://www.winnipesaukee.com/forums/) and in June 2017, he posted a list of shipwrecks he had found along with those which were already known to the public. Some 7,706 individuals have viewed the original post on the Lake Winnipesaukee Forum. Thus, his posting reached a large number of Lake Winnipesaukee residents.

Hans Hug Jr. found all these shipwrecks using a side scan sonar system. Once identified, he dove to them and video-recorded what he found with a GoPro HD camera. The quality of the videos varies due to the changing visibility conditions below the surface of Lake Winnipesaukee and at the depth of each of the shipwrecks. These videos were analyzed by the researcher to create an inventory of what was still intact on the shipwrecks when Hans Hug Jr. dove them (Appendix A). This inventory varied between the shipwrecks due to the differing designs and purposes of the original boat. Examples of items included in the inventory: engines and engine parts, steering wheels, brass parts, loose artifacts, propellers, light/bells/signaling devices, name/registration plates, rudders, etc. Existing anchor damage, fishing debris/damage (fishing lures, downrigger weights), diver debris/damages (guide lines, obvious damages from looting), and other obvious damages were also noted.

**Side Scan Sonar and GPS Data**

Every shipwreck found and dove by Hans Hug Jr. has been precisely recorded with his side scan sonar system. Their locations were recorded with his GPS system making finding them in the murky waters of Lake Winnipesaukee possible. The GPS was in a latitude/longitude coordinate system and the Datum used was NAD83. The sonar images also provide a rough measurement of the shipwrecks at the time that they were scanned. Figure 9 is an example of a side scan sonar image taken by Hans Hug Jr.
Summer 2018 Survey

Overview

The survey was conducted over the course of July and August of 2018. The survey was non-invasive and all appropriate steps were taken to avoid any damage to the shipwrecks. The New Hampshire division of historical resources was informed of the project as well (Appendix B). To avoid anchor damage, the dive boat was driven to the shipwreck site’s GPS coordinates and a dive flag buoy with a small weight attached as an anchor was dropped at the exact coordinates of the shipwreck to mark it. The dive boat was then anchored at a safe distance to avoid impacting the shipwreck. All participants in the survey were required to hold Advanced Open Water Certified or equivalent due to the inherit dangers of diving in murky waters and around shipwrecks (Professional Association of Dive Instructors 2018a). The survey crew included Juliann Gilchrist, Ian...
Gilchrist Jr., and Dat Tran. On the surface the primary danger to divers was from other boats. To help mitigate this danger, at least one person remained on the boat during the dives. The dive boat had a dive flag mounted on it as well.

Eleven dives (10 for investigational purposes) were conducted during the 2018 survey on 9 different shipwrecks (Table 1). Six shipwrecks (Meredith Steam Launch, Higgins Speed Boat, Chase Point Vessel, Little Bear Island Shipwreck, Paugus Bay Century Raven, Gilford Yacht Club Shipwreck) had their coordinates released in 2017, one shipwreck’s (New Wolfboro Steamer) coordinates have not been publicly released, and two shipwrecks (*Lady of the Lake, Scamp*) are popular dive sites. Transportation to and from the sites was provided by the Gilchrist family’s Boston Whaler 170 Montauk. Two of the shipwrecks had two dives preformed on them. The Paugus Bay Century Raven required two dives due to the large amount of the diver’s air supply being consumed to locate the shipwreck. The Little Bear Island Shipwreck had a measuring tape left on it by part of the diving team and an additional dive was required to recover it.

<table>
<thead>
<tr>
<th>Known Before 2017</th>
<th>Unreleased</th>
<th>Not Publicly Known Before 2017</th>
</tr>
</thead>
<tbody>
<tr>
<td>The Scamp</td>
<td>The Lady of The Lake</td>
<td>Gilford Yacht Club Shipwreck</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Chase Point Vessel</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Paugus Bay Century</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Meredith Steam Launch</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Higgins Speed Boat</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Little Bear Island Shipwreck</td>
</tr>
</tbody>
</table>

Table 1. Shipwrecks Surveyed During the Summer of 2018.
Video Data

Each shipwreck was documented with both video-recording and photographs. Each dive lasted approximately 30-40 minutes. During each dive, the whole shipwreck was recorded using a stick mounted GoPro Hero 5 video camera with image stabilization. Points of interest to the researcher and to the predetermined inventory made for each shipwreck, were thoroughly photographed using a Canon EOS M3 camera with an underwater housing and flash. If all the data could not be collected in one dive, another dive was conducted to complete the task. After the video data was collected it was reviewed and new inventory sheets were filled out for each shipwreck. A dive log was kept for each dive (Table 2).

<table>
<thead>
<tr>
<th>Shipwreck Name</th>
<th>Depth</th>
<th>Bottom Time</th>
<th>Starting Psi</th>
<th>Ending Psi</th>
<th>Number of Dives</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wolfeboro Steamer</td>
<td>20 Feet</td>
<td>26 Min</td>
<td>2,000</td>
<td>800</td>
<td>1</td>
</tr>
<tr>
<td>The Scamp</td>
<td>18 Feet</td>
<td>24 Min</td>
<td>3,000</td>
<td>2,000</td>
<td>1</td>
</tr>
<tr>
<td>The Lady of the Lake</td>
<td>30 Feet</td>
<td>42 Min</td>
<td>3,000</td>
<td>690</td>
<td>1</td>
</tr>
<tr>
<td>Paugus Century</td>
<td>33 Feet</td>
<td>45 Min 29 Min</td>
<td>3,000 3,000</td>
<td>900 1,500</td>
<td>2</td>
</tr>
<tr>
<td>Little Bear Island Wreck</td>
<td>30 Feet</td>
<td>35 Min 5 Min</td>
<td>3,000 1,100</td>
<td>900 800</td>
<td>2</td>
</tr>
<tr>
<td>Gilford Yacht Club Wreck</td>
<td>32 Feet</td>
<td>28 Min</td>
<td>3,000</td>
<td>1,400</td>
<td>1</td>
</tr>
<tr>
<td>Chase Point Vessel</td>
<td>33 Feet</td>
<td>21 Min</td>
<td>3,000</td>
<td>1,700</td>
<td>1</td>
</tr>
<tr>
<td>Higgins Speed Boat</td>
<td>40 Feet</td>
<td>35 Min</td>
<td>3,000</td>
<td>1,100</td>
<td>1</td>
</tr>
<tr>
<td>Meredith Steam Launch</td>
<td>36 Feet</td>
<td>25 Min</td>
<td>3,000</td>
<td>1,400</td>
<td>1</td>
</tr>
</tbody>
</table>

Table 2. Dive Log Data from Author.

Analysis

The analysis of these data consisted of comparing the status of the shipwrecks from when Hans Hug Jr. first recorded them to data collected during the summer of 2018.
Creating a “percent of inventory affected” accomplished this. For example, if there were 10 items inventoried on a shipwreck in the pre-2017 videos and 2 of those items were found to be damaged in 2018, it would mean that 20% of the shipwreck’s inventory had been affected. After this was completed, the shipwrecks that were known to the public before 2017 were compared to the ones with locations released in June 2017 to see if there were any noticeable differences in their condition. If the previously known shipwrecks show less impact than the ones that were unknown it could indicate that the known shipwrecks have been impacted to the point that there is not much left to be damaged aside from the basic hull of the shipwreck. It could also indicate that newer shipwrecks are more frequently targeted by looters. If the percent of any of the inventories of the shipwrecks has been affected by more than 30%, it will be considered a shipwreck that has been adversely affected and therefore at high risk to lose its cultural significance due to loss of data. This would also indicate that the locations of newly found shipwrecks should not be released to the public. If fishing and anchoring damage is found to be prevalent, it will show that sites on similar lakes could be affected in similar ways to the shipwrecks found on Lake Winnipesaukee.
CHAPTER FOUR

RESULTS

This chapter presents the results for each shipwreck. The map below shows the location of each of the shipwrecks except the New Wolfeboro Steamer, whose coordinates have not yet been released to the public (Figure 10).

Figure 10. Location of Shipwrecks surveyed in 2018. (The New Wolfeboro Steamer is not included as its coordinates are not yet public.)
The Meredith Steam Launch is a shipwreck that lies in approximately 30 feet (9.1 meters) of water. It is located in Meredith Bay about 80 feet from Church Landing in a channel that is frequented by motorboat traffic and fishermen. The bottom at the shipwreck’s location consists of approximately 2 feet of fine silt making visibility on the shipwreck poor. The shipwreck is approximately 25 feet (7.62 meters) long and is shaped in a style consistent with private steamboats of the early 20th century. The shipwreck itself rests on top of large logs, which may or may not be associated with the shipwreck. It should also be noted that the keel is intact on the vessel and there is a small wire reel attached to the top of the bow. Also, an unknown number of loose artifacts are scattered on the inside of the vessel. A side scan image of this shipwreck is shown in Figure 11.

Figure 11. Side scan sonar image of the Meredith Steam Launch. (Image courtesy of Hans Hug Jr.)
The preliminary data of the Meredith Steam Launch showed most of the vessel was intact. The completeness scores (1-10 based on condition) for the shipwreck are as follows: the overall completeness of the hull had a score of 6, the steering mechanism and helm had a score of 2, the metal components and hardware had a score of 4, the engines and motors had a score of 3. The items with numeric count on the preliminary data are as follows; 1 hole (possible downrigger strike) on the port side of the shipwreck approximately half way down the hull, 1 beer can (modern trash), and one beam (saw/ pry marks) that appeared to have been moved recently. This saw/pry mark was evident because the wood appeared to have been recently damaged.

The 2018 survey of the Meredith Steam Launch did not reveal any major differences in the condition of the Meredith Steam Launch. There was a 0% change in all the completeness scores (Figure 12). It should be noted that data collection on this shipwreck was hampered by the extremely poor visibility during the 2018 survey. Therefore, some possible data may have been lost.

Figure 12. 2017 and 2018 Meredith Steam Launch Completeness Scores.
The Higgins Speed Boat is located on the southeastern side of Welsh Island that faces the “Broads.” It rests in 40 feet (12.2 meters) of water making it the deepest shipwreck that was surveyed for this project. The cause of this boat sinking is unclear as no visible damage is seen in the preliminary data. Figure 13 shows a side scan image taken of the vessel by Hans Hug Jr.

Visibility on the shipwreck was approximately 25 feet (7.62 meters) making it the shipwreck with the best visibility in this project. It should be noted that, due to the shipwreck’s location next to the “Broads”, the surface conditions at the shipwreck site vary drastically from day to day. The bottom at the location has a very solid surface (non-silt), which has left the entire shipwreck unburied. The brand of the boat is apparent from the “Higgins” insignia on top of the gunnels (Figure 14). The Higgins Boat Company produced similar speed boats to this one during the late 1950s, meaning that this boat must have sunk sometime after the 1950s.
Overall, the preliminary data on the Higgins Speed Boat showed that it was the most intact shipwreck in the data set. The preliminary completeness scores for the Higgins Speed Boat are as follows: the hull score was 9, the steering mechanism and helm score was 8, the metal components and hardware score was 9, the engines and motor score was 9, the glass score was 10. The items on the shipwreck with numeric scores were: 1 cleat/tie down point, 1 steering wheel, 2 loose artifacts in the center console, 2 lights (1 at the bow, 1 at the stern).

The 2018 survey of the Higgins Speed Boat showed that significant changes occurred to the shipwreck. The most noticeable damage to the shipwreck is shown in the figures above. These damages included the windshield collapsing, the engine cover being torn off and the seat material being torn (Figure 15; 16). All these damages are
indicative of an anchor or down rigger strike. An anchor dragging over the shipwreck is probably the cause of the damage because the area in question is not ideal for downrigger fishing (it has a sandy bottom and is not on a slope). The area is also not a normal location that a recreational boater would anchor since it is facing the widest part of the lake and therefore one of the choppiest parts of the lake. For these reasons it can be assumed that this anchor strike was caused by recreational scuba divers not properly anchoring their boat over the shipwreck.

Figure 15. Pictures of the Higgins Speedboat engine compartment cover before (left) and after (right) its coordinates released to the public.

Figure 16. Pictures showing the windshield of the Higgins Speedboat before (left) and after (right) its coordinates released to the public.

The completeness scores for the Higgins Speed Boat lost a significant amount of points between the 2017 and 2018 data (Figure 17). The hull’s completeness score dropped by 4 points, which is a 34% decline. The steering mechanism and helm’s completeness score dropped by 4 points, which is a 50% decline. The metal components
and hardware dropped by two points and is a 23% decline. The glass components, which consisted entirely of the windshield, saw the largest drop in its completeness by dropping 6 points which is a 60% decline from its score in 2017. The only completeness category not effected was the engines and motors category. This is most likely due to the relatively high durability of these components.

Figure 17. 2017 and 2018 Higgins Speed Boat Completeness Scores.

Chase Point Vessel (GPS N 43 38.410 W 71 18.141)

This shipwreck is located off Chase Point in Moultonborough. The shipwreck lies in approximately 40 feet (12.2 meters) of water and is around 35 feet (10.6 meters) long. A side scan image of the shipwreck is shown by Figure 18.

The bottom of this area is rocky and consists of fine silt which made the visibility on the shipwreck poor. The wreck is sitting listing to its port side upright on the bottom. The hull of this shipwreck appears to have been burned, which is presumably the cause of its sinking. An internal combustion engine (Figure 19) and batteries are present inside of the
hull indicating the vessel is probably from middle to late 20th century. All gunnels and siding have been burned off the hull with the exception of portions of the transom and the bow, which rise up prominently from the shipwreck. The visibility at the site was low on the day it was visited with less than 5 feet (1.5 meters).

Figure 18. Side scan sonar image of the Chase Point Vessel. (Image courtesy of Hans Hug Jr.)

Figure 19. The internal combustion engine on the Chase Point Vessel. (Image taken by author.)
The preliminary data for this shipwreck showed it to be in relatively poor condition when compared to the other subject shipwrecks. The preliminary completeness scores are as follows: the hull score was 3, the steering mechanism and helm score was 4, the metal components and hardware score was 2, and the engine and motor had a score of 5. The items with numeric counts are as follows 1 modern flagpole.

The 2018 survey of the shipwreck found the shipwreck had not changed drastically from when it was originally documented by Hans Hug. The hull completeness score stayed the same. The steering mechanism and helm score dropped from 4 to 3, which is a 25% decline from its pre-2017 score. The metal components and hardware score stayed the same. The engine and motor score dropped from a 6 pre-2017 to a 5 in 2018, which is a 17% percent decline (Figure 20). It should be noted that the changes in the completeness scores of the shipwreck are most likely due to natural processes and not to human related activities. This is because it appears corrosion had separated several pieces of metal. Items with numeric counts increased by one piece of modern debris (a small rug), which was found directly behind the stern of the vessel.

Figure 20. 2017 and 2018 Chase Point Vessel Completeness Scores.
Little Bear Island Shipwreck (GPS N 43 38.448 W 71 19.850)

This shipwreck is located on the western side of Little Bear Island in the Moultonborough portion of Lake Winnipesaukee. The shipwreck is about 28 feet (8.53 meters) long and lies in 27 feet (8.2 meters) of water. A side scan image of the Little Bear Island shipwreck is show in Figure 21.

The hull is wooden with a very deep hold and is burned throughout. This gives the indication that the ship was sunk in some sort of accident. The bow portion of the stem (Figure 22) extends upwards approximately five feet off the bottom and the transom remains intact (Hug 2017). A propeller and rudder are present and exposed on the shipwreck. Due to the presence of an internal combustion engine on the vessel it seems to date to sometime in the 20th century.
The preliminary data for this shipwreck showed it to be in the poorest condition of all the shipwrecks, probably due to the cause of its sinking. The preliminary completeness scores are as follows: The hull score was 3, the steering mechanism and helm score was 4, the metal components and hardware score was 3, the engines and motor score was 5. The items with numeric counts are: 1 cleat/tie down point, 1 propeller, 1 rudder, and 1 piece of modern trash.

A 2018 survey of the shipwreck found it remained in the same condition as its pre-2017 data indicated with all its overall completeness scores staying the same. This is
a 0% change (Figure 23). The items with numeric counts on the shipwreck that were observed from the pre-2017 data remained on the shipwreck with the addition of one modern piece of trash (deflated children’s float inside of the hull), and a fishing lure.

![Little Bear Island Shipwreck Completeness Scores](image)

Figure 23. 2017 and 2018 Little Bear Island Shipwreck Completeness Scores.

**Paugus Bay Century Raven (GPS N 43 35.613 W 71 28.163)**

The Paugus Bay Century Raven shipwreck (side scan Figure 24) is in Paugus Bay near several known shipwrecks including the *Scamp* and three barges. This leaves the possibility that some divers may have accidently found this shipwreck when looking for the known ones in the general vicinity. The shipwreck lies in 26 feet (7.9 meters) of water and is 25 feet (7.6 meters) long. The bottom is comprised of a thin layer of slit giving the site relatively good visibility when compared to some of the other shipwrecks surveyed. The shipwreck itself is a speed boat style Century model Raven, which were manufactured between the 1960s and 1970s (Figure 25).
Hans Hug reported that the boat was fully intact the last time he dove on it (Hug 2017). The shipwreck is in such good condition that there is still leather on the seats. Another interesting feature of this shipwreck is that the cabin and bilge compartments contain multiple heavy rocks indicating that it may have been scuttled (Figure 26).
Overall, the Paugus Bay Century Raven was in excellent condition compared to many of the other shipwrecks surveyed during this project. The preliminary completeness scores for the Paugus Bay Century Raven: the hull score was 9, the steering mechanism and helm score was 8, the metal components and hardware score was 9, the engine and motor score was 9, the glass score was 10. The preliminary items with numeric counts: 2 Century logos (Name or Registration Plates), 1 front cabin hatch, 2 bow and stern hooks (cleats/tie down points), 1 steering wheel, 1 stern light in the cabin(loose artifact), 1 possible down rigger/ anchor strike in the stern, 2 engine vents (other items), and 4 signal devices (2 horns, 1 navigation light, and 1 spot light).

The 2018 survey of the Paugus Bay Century Raven showed that it remains in excellent condition. There were no noticeable differences between the condition of the Paugus Bay Century Raven between the pre-2017 video and the 2018 videos. There was
a 0% decline in all the completeness scores (Figure 27). This could be an indication that the shipwreck has not been dove on since Hans Hug originally took the video. It could also simply mean that any recreational divers that have visited the shipwreck have been respectful to the site. No fishing tackle was present on the shipwreck during the 2018 survey probably due to the fact the shipwreck’s location is not ideal for fishing because of the relatively flat featureless bottom. This also means that this shipwreck has a relatively low probability of being hit with a downrigger weight.

![Figure 27. 2017 and 2018 Paugus Bay Century Raven Completeness Scores.](image)

**Gilford Yacht Club Shipwreck (GPS N 43 35.038 W 71 24.291)**

The Gilford Yacht Club Shipwreck is in the waters directly off of the entrance to the Gilford Yacht Club. It lay within approximately 26 feet (7.9 meters) of water and the visibility is around 10 feet (3 meters). The bottom is comprised of a layer of fine silt. The wreck itself lies upright in the sand and is home to a large number of fish. It appears to be a speedboat of some kind and still has many of its metal components present. From
the boat’s design it can be assumed that it is a post-1950 vessel. It is approximately 25 feet (7.6 meters) long. A side scan sonar image of this shipwreck is shown by Figure 28.

![Figure 28. Side scan sonar image of the Gilford Yacht Club Shipwreck. (Image courtesy of Hans Hug Jr.)](image)

The preliminary data for Gilford Yacht Club Shipwreck show it to be in good condition with most of its hull intact. The preliminary completeness score for the shipwreck are as follows: the hull score was 5, the steering mechanism and helm score was 3, the metal components and hardware score was 7, and the engine and motor score was 5. The preliminary items with a numeric count are as follow: 3 cleats/ tie down points, 1 steering wheel, 2 possible anchor/ down rigger strikes, 1 piece of modern trash (solo cup near bow), and two signaling devices (port/starboard navigation lights).

The 2018 survey of the Gilford Yacht Club Shipwreck showed it to be the second most impacted site examined for this project. The most obvious damage was the engine cover, which was fully attached in the pre-2017 video appears to have been ripped from
its hinges by an impact of some type. The steering mechanism and helm appear to have also been damaged by this same catastrophic event (Figure 29). Several pieces of metal hardware also appear to have been damaged. Whether this shipwreck was damaged by recreational scuba divers, boaters, or fishermen is unknown. Because its location so close to the Gilford Yacht Club, damage to the site could be from an anchor strike caused a recreational boater anchoring their boat off the yacht club. The area in which the shipwreck is located is also a popular fishing spot giving the possibility that the shipwreck could have been damaged by a downrigger strike (this is unlikely due to the 26-foot depth of the shipwreck). Although the shipwreck did not have any fishing line or tackle found during the 2018 survey. It is also worth noting that the steering wheel of this shipwreck, which was visible during the pre-2017 video was no longer visible on the shipwreck. This either indicates that the steering wheel has been buried in the silt so deeply that it was not visible during the 2018 survey or more likely that it was looted off the wreck sometime before the 2018 survey of the shipwreck.

Figure 29. The Gilford Yacht Club Shipwreck’s engine compartment before and after its coordinates released to the public.
The 2018 completeness scores for the Gilford Yacht Club Shipwreck illustrate the second greatest decline of all the shipwrecks (Figure 30). The hull lost one point of its completeness score or a 25% decline. The steering mechanism and helm completeness score declined by 1 point or a 33% decline from its 2017 score. The metal components score was reduced by 3 points or a 29% decline from the 2017 score. The engine completeness score stayed the same as was seen in the Higgins Speed Boat.

![Diagram of Gilford Yacht Club Shipwreck Completeness Scores]

Figure 30. 2017 and 2018 Gilford Yacht Club Shipwreck Completeness Scores.

Shipwrecks Publicly Known Before 2017

**Lady of The Lake (GPS N 43 35.289 W 71 23.234)**

This steamboat was built in 1851 and served Lake Winnipesaukee as a passenger steamer until it was scuttled in 1898. Figure 31 shows a historic picture of *Lady of the Lake*. Before its sinking, it was stripped of its superstructure and engines. To sink the vessel, it was filled with heavy rocks and holes were drilled in the hull, which can still be seen on the shipwreck today. The shipwreck contains no apparent loose artifacts, as
divers removed them years ago. Most notably the massive rudder was salvaged from the shipwreck in the past 30 years and resides in the Winnipesaukee Museum in Weirs Beach, NH. This shipwreck is also the only one in Lake Winnipesaukee where penetration dives are possible. Therefore, the exhaled bubbles from divers’ regulators could be damaging the interior of the shipwreck (Bizer 2018; Heald 1984; Poole 2013).

Figure 31. Image of Lady of the Lake. (Courtesy of the New Hampshire Boat Museum.)

The 2018 investigation of this shipwreck revealed that the shipwreck showed definitive signs of human interference. A large amount of fishing tackle and line was found on the shipwreck. In at least one spot, the hull has been vandalized by divers carving into the wood with dive knifes (Figure 32). The inside of the hull has air bubbles on the ceiling indicating that the shipwreck was penetrated shortly before the 2018 survey was conducted. These air bubbles introduce oxygen to the wood making it decay faster (Edney and Spennemann 2015). No loose artifacts were identified during the 2018 survey. The results of the 2018 survey on the Lady of The Lake were not surprising given the long period of time and volume of divers that this shipwreck has been exposed to. Luckily this shipwreck is still very big and made of much stronger wood than some of the
other shipwrecks that were examined during this project. When compared to the other six shipwrecks in the study *Lady of The Lake* had significantly more noticeable impacts that can be specifically attributed to divers.

![Figure 32. Image of diver vandalism on the side of the *Lady of The Lake*'s hull (left), Image of stern of vessel with modern flag pole placed by recreational divers (right). (Images taken by author.)](image)

**Scamp (GPS N 43 35.264 W 71 28.216)**

*Scamp* is a 78-foot (23.8 meters) shipwreck located in Paugus Bay. This shipwreck, while not featured on the Bizer map until recently, has been known to local residents due to its relatively shallow depth (20 feet). The shipwreck is also located on a rocky sloping area of the lake making it a popular spot for fishing in the area. The *Scamp* is most likely a vessel scuttled by Irwin Marine using dynamite. This is evident by the stern section of the ship having the appearance of being blown apart by a strong force.

A 2018 survey of the shipwreck showed it to be in stable condition where it rests. Downrigger wires and fishing line were observed throughout the entire site, indicating that fishing activities have been affecting the shipwreck since it sank. Some of the more notable debris observed were two downrigger weights (Figure 33) located within 20 feet of the shipwreck and a mushroom shaped anchor wedged underneath a portion of the hull.
remains. A fishing lure was also located attached to the main hull of the shipwreck. A milk container was found affixed to the bow by a rope (most likely placed there by other divers or snorkelers to locate the shipwreck). All these factors show *Scamp* to be in more danger than the majority of other shipwrecks found on the lake due to the high level of fishing activity that has affected it and its relatively well-known location. No loose artifacts were observed during the 2018 survey indicating that any which were present on the shipwreck when it was scuttled have been looted.

Figure 33. 10 lb. Fish-shaped downrigger weight found on the *Scamp* during 2018 survey. (Image taken by author.)

In comparison with the six shipwrecks that had their locations released during the summer of 2017, *Scamp* shows much more evidence of human impact. This is due to the large amount of fishing debris found on the shipwreck during the survey. Structurally, how *Scamp* has changed over the course of its time underwater is unknown as there was no pre-2017 data with which to compare its condition. This means that no hull deterioration could be recorded on this shipwreck. Overall, *Scamp* should be considered an excellent example of a site that has been manipulated by human interactions over the
course of time. The amount of debris found on the site should serve as an indication of how much fishing tackle can pile up on top of a shipwreck over time. *Lady of The Lake* shows many more impacts that can be directly attributed to divers while the *Scamp* had much more fishing debris on it.

**Shipwreck with Unreleased Coordinates**

**The New Wolfeboro Steamer (GPS Coordinates Not Released)**

The New Wolfeboro Steamer is a shipwreck located near Wolfeboro Bay. This shipwreck’s location is still unknown to the general public and therefore the coordinates will not be provided in this report. It is unclear whether the shipwreck has been discovered before or not but the shallow depth (20 feet) means that it may be visible from the surface or by snorkelers during calm days. The shipwreck lies on its port side in an area of the bottom with a light layer of silt covering it. Visibility on the shipwreck is generally fair at about 10-15 feet (3-4.6 meters). The inside of the hull is littered with loose debris and artifacts. The shipwreck itself is approximately 35 feet (10.7 meters) long and has the shape of a private steamer of the early 20th century.

The New Wolfeboro Steamer showed little human impact on the site. Multiple pieces of modern debris were observed during the survey of the shipwreck. This debris included 1 plastic pole (may have been a piece of an oar), 1 red plastic cup, and a golf ball. No evidence of fishing or diver related human impacts were found during the 2018 survey (Figure 34).
Figure 34. Photograph of the bow of the New Wolfeboro Steamer. (Image taken by author.)
CHAPTER FIVE

CONCLUSIONS

In this chapter, a discussion of the results and conclusions are presented by research question and hypothesis. This is followed by a discussion of potential factors associated human impact on shipwrecks. Finally, recommendations for shipwreck protection and future research are presented.

Primary Research Question

What effect did releasing the location of shipwrecks in Lake Winnipesaukee to the public have on the condition of the shipwrecks within one year of the locations being released?

From the data collected during the survey, the shipwrecks faired reasonably well over the course of one season except for two of the newer shipwrecks (Higgins Speed Boat and the Gilford Yacht Club Shipwreck). This is more pronounced due to the fragile materials used in the construction of these speedboat type vessels and their high level of integrity when Hans Hug Jr. originally documented them.

Secondary Research Questions

1) What effect do divers have on these shipwrecks in Lake Winnipesaukee during one season?

The answer to this question was not clear from the data collected during this survey. Although two of the shipwrecks (Higgins Speed Boat and the Gilford Yacht Club Shipwreck) showed clear human impact, it is unknown whether these impacts were caused by scuba divers or fisherman.

2) What degree of anchor damage occurs on these shipwrecks in Lake Winnipesaukee during one season?
There is a high probability that the damage to the Higgins Speed Boat and the
Gilford Yacht Club Shipwreck was caused by anchors dragging across the shipwrecks.
Due to the absence of any downrigger weights or anchors found on the shipwrecks
released in 2017, one cannot be certain whether the damage was caused by a downrigger
weight or by an anchor.

3) What effect does fishing have on these shipwrecks in Lake Winnipesaukee over the
course of one season?

While many of the shipwrecks surveyed during the summer of 2018 (especially
Scamp) had fishing tackle, downrigger wires, and monofilament lines on them, clearly
indicating fishing activates occurring around these shipwrecks, neither of the two
shipwrecks (Higgins Speed Boat or Gilford Yacht Club Shipwreck) with significant
damage to them had fishing debris present. Due to the absence of such materials, the
damages to these shipwrecks appears to more likely be due to anchor strikes from dive
vessels rather than to downrigger weights striking them. The only confirmed downrigger
strikes appear to have happened to Scamp, which was a shipwreck known to the public
before 2017 (two downrigger weights were found on the shipwreck).

Data Trends

The overall data trends seem to show that a variety of factors affect whether a
shipwreck with newly released coordinates will be adversely affected by humans. These
factors included: location, depth, and age of the shipwreck. Figure 35 shows the percent
change on each shipwreck between its pre-2017 score and its 2018 score.
Figure 35. Overall Percent Change in Completeness Scores.

The location of the sites appears to be a major factor in which shipwrecks are affected by humans. The shipwrecks that were in waters that were ideal for fishing (around bottom structures and rocks) seemed to have more fishing debris and damage on them. Examples would be Scamp, Lady of the Lake, the Gilford Yacht Club Shipwreck and the Higgins Speed Boat. Scamp had by far the most fishing debris on it, with Lady of the Lake having the second most debris on it. These two shipwrecks were commonly known before 2017 and the amount of fishing debris before the 2018 survey and its rate of collection are unknown. The Gilford Yacht Club Shipwreck and the Higgins Speed Boat showed major signs of impact related damages, whether this was caused by downrigger weights or anchors is unknown. Also, shipwrecks that were in areas of high boat traffic, such as the Chase Point Vessel and the Meredith Steam Launch did not show
any major changes to them. This could be attributed to the fact that fishermen and scuba divers tend to avoid these areas for safety reasons.

Depth seems to be another major factor in determining how at risk a shipwreck is to human impact. It can be presumed that the shallower the water, the more likely it is for regular boaters to strike it with their anchor (as anchoring in shallower water tends to be easier). It is noted that the vast majority of recreational boater’s anchor in and around sandbars, which do not have any known shipwrecks near them. At around 15-20 feet of water fishermen start using downriggers, which present another risk for impact related damages to occur on shipwrecks. *Scamp* is the shipwreck most greatly effected by damage from downriggers, which would indicate they are more frequently being used at a depth of around 20 feet because all the other shipwrecks examined for this project were at depths greater than 20 feet of water. *Scamp* could have also been more vigorously affected by downriggers because it is located next to a drop off into deeper waters (where salmon can be caught). Although this project did not examine any shipwrecks in over 40 feet of water, it can be assumed that these shipwrecks have less of a likelihood of being impacted by human activities because they require more experience and equipment to dive on. Thus, less of the diving community can dive on them and fishermen are generally not fishing at deeper depths in the lake. The only risk that does not seem to be depth determined is improper anchoring occurring on shipwrecks by recreational divers. This is because recreational divers will not discriminate which shipwrecks they anchor on based on the depth of the water.

The age of the shipwreck and the style of shipwreck also seem to influence how much they are impacted by human activities. It seems that the larger and older
shipwrecks were made of sturdier materials than the more modern speed boat style shipwrecks. Half of the shipwrecks (Meredith Steam Launch, Little Bear Island Shipwreck, Chase Point Vessel) from the newly released group were older shipwrecks and none of them experienced any noticeable changes over one season. All these shipwrecks were also rather large compared with the rest of the newly released group. The older shipwrecks also were in worse condition when they were discovered by Hans Hug Jr. therefore, if any additional damage was done to the sites they may not have been noticed by the researcher. The older shipwrecks are probably all early 20th century and their heavy-duty construction suggests that they would be more resistant to anchor damage than the newer speed boat shipwrecks that are constructed of thinner and more fragile wood. Two out of the three speed boat style shipwrecks that were investigated showed most of the damage. The Paugus Bay Century Raven was the only shipwreck that was a speed boat style that showed little damage. It is likely that this shipwreck did not show damages simply because no other recreational divers had attempted to visit it or if they did, they were unable to find it (the research team spent an entire 40-minute dive locating the shipwreck). The Gilford Yacht Club Shipwreck and the Higgins Speed Boat both showed catastrophic damage, which was likely due to recreational divers attempting to visit them or from being struck with downrigger weights. Since both shipwrecks were not damaged in the years prior to their discovery by Hans Hug Jr. it can be assumed that they were both impacted by dive boat anchors that could cause more damage than a downrigger weight. Overall, it seems the speed boat style shipwrecks in the lake are the most at risk for damage from anchor and downrigger damage and should in the future have special consideration taken when their locations are released.
Recommendations for Preservation of Shipwrecks

On Lake Winnipesaukee, and all other lakes in New Hampshire, there is a lack of information available to recreational scuba divers on how to properly treat shipwrecks. To accomplish this, the easiest route would be to create educational pamphlets for the local dive shops and air fill stations to distribute to customers. These pamphlets would contain information on the laws protecting shipwrecks along with a description on how to properly anchor dive boats near shipwrecks and information on why it is important to keep New Hampshire shipwrecks in pristine condition. The marine patrol should also try to educate their officers on the laws regarding shipwrecks and possible strategies to enforce these laws.

It is also important for shipwreck discoverers in the future to carefully consider which shipwrecks locations they release to the general public. The data collected from this project suggests that the locations of newer speedboat style shipwrecks should be more carefully guarded than that of older shipwrecks that are not in excellent condition. However, if the older shipwrecks have a great historical significance or large number of commonly looted artifacts still intact, they should also be guarded. One way to make these shipwrecks available to the public and reduce the risk of them being damaged would be to only give the coordinates to guides that would be registered with the New Hampshire Division of Historical Resources or a local nonprofit such as a museum. That way if the shipwrecks were found to be damaged it would be more obvious who is at fault.

Another way to protect these shipwrecks would be to place anchor moorings at the location of the shipwreck so that dive boats do not have to anchor on the shipwreck
and can simply tie off on the mooring. This would not be possible on every shipwreck due to the large number of shipwrecks in the lake, but could be done with those that are most vulnerable. Placing moorings would also have to be done with the consent of the Marine Patrol and would require a funding source for the upkeep of the buoys and anchors. An example of an existing buoy system for historic shipwrecks is the Lake Champlain Underwater Historic Preserve which is run by the Vermont Division Of Historic Preservation and managed by the Lake Champlain Maritime Museum with help from local dive centers (LCMM 2019).

Another option to protect these shipwrecks would be to use some of currently known shipwrecks in Lake Winnipesaukee as “sacrificial shipwrecks.” Which is the idea of using shipwrecks of less cultural value to be dove on by recreation divers as opposed to them diving on shipwrecks of major cultural significance (Edney 2016). This would probably not be the best method because there is still a lot of potential data that can be recovered from these shipwrecks, but it would allow for a higher degree of protection for shipwrecks that are currently unknown to the public. This is problematic as there is a limited number of shipwrecks left to be discovered in the lake due to modern environmental laws that prevent new shipwrecks from being left on the bottom. An alternative to using existing shipwrecks for this purpose is intentionally scuttling a ship to act as a “sacrificial shipwreck.” This would probably not be possible due to the amount of pollution that this would bring to the lakes ecosystem unless it is cleaned of toxic materials.

Overall, the primary method of management for these shipwrecks should be to educate the community about how and why they should be protected. Other more
complicated systems of conservation could be implemented once there is a way to spread information about the protection of shipwrecks on New Hampshire’s lakes. These more complicated systems could include having a shipwreck preserve with moorings near the shipwrecks to protect them from anchor strikes or having a system of registered guides on the lake. Regardless of what system of conservation is chosen, it will greatly improve the probability of the shipwrecks lasting longer on the lake’s bottom. Currently there are no active protections for these shipwrecks and therefore any system that could be implemented would be better than the “none at all” approach.

**Recommendations for Future Research**

Currently, there have been only two brief archeological surveys with publicly available information preformed on Lake Winnipesaukee. This survey and the survey done by Poole on *Lady of The Lake* in 2013. Both projects were brief and only recovered data on the conditions of the shipwrecks in the lake and one produced a historical background on *Lady of The Lake*. The majority of shipwrecks in Lake Winnipesaukee that have not even had basic questions answered about them; such as their exact make and style, their name or owner’s name, and why they sank. These are valuable questions that would help to give the shipwrecks a greater historical context and integrity. The true archeological value of the newer speedboat style shipwrecks is unknown but may depend on the brand of speedboat and the availability of documentation on the design. Lesser known speedboat brands which are present in the lake could be archeologically valuable for the future.

To expand upon the research presented, the same group of shipwrecks from the 2018 survey should be examined every few years to see if any noticeable changes have
occurred. This would not only look at human impact but could examine how shipwrecks deteriorate due to natural processes as well. This research could also have benefited from a larger sample size and include more of the speed boat style shipwrecks, as they seem to be the most vulnerable type of shipwreck on Lake Winnipesaukee.

Another useful tool in expanding research on human impacts on shipwreck is photogrammetry. Photogrammetry can be used to create 3D models of shipwrecks and could be completed on shipwrecks periodically to try to diagnose any change. Photogrammetry works by using reference points placed on the shipwreck and taking a large number of overlapping photos of the site containing the reference points. Computer software is then used to stitch the photos together into a 3D model. To see changes in condition to the shipwrecks the models from different years could be overlaid on one another (Costa et al. 2016).
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Starbuck, David

Vander Stoep, Gail A., Kenneth J., Vrana, and Hawk Tolson

Weirs Beach
Woods Hole

Zimmerman, Karl
Appendix A

Inventory Sheet

<table>
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<tr>
<th>Shipwreck Name</th>
<th>Date of Dive</th>
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<td><strong>Items with Completeness Score (1-10)</strong></td>
<td></td>
</tr>
<tr>
<td>Hull</td>
<td></td>
</tr>
<tr>
<td>Steering mechanism and helm</td>
<td></td>
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<tr>
<td>Superstructure</td>
<td></td>
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<tr>
<td>Glass components</td>
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<tr>
<td>Metal components/Hardware</td>
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<tr>
<td>Engines/Motors</td>
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<tr>
<td><strong>Items with Numerical Counts</strong></td>
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<tr>
<td>Overall length</td>
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<tr>
<td>Name or registration plates</td>
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<tr>
<td>Portholes</td>
<td></td>
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<tr>
<td>Cleats/Tie down points</td>
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<tr>
<td>Anchors (original to the Wreck)</td>
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<tr>
<td>Modern anchors</td>
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<tr>
<td>Wheel</td>
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<tr>
<td>Propellers</td>
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<tr>
<td>Rudders</td>
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<tr>
<td>Loose artifacts</td>
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<td>Fishing tackle</td>
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<tr>
<td>Fishing line</td>
<td></td>
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<tr>
<td>Fishing net</td>
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<td>Downrigger/Anchor strikes</td>
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<td>Modern trash</td>
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<td>Saw or pry marks</td>
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<tr>
<td>Lights/Signaling devices</td>
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<tr>
<td>Other</td>
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</tr>
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</table>

The inventory sheet used by the researcher to score the shipwrecks using the pre-2017 and 2018 data.
Appendix B

Consent For Project

Email from the New Hampshire Division of Historical Resources expressing consent for the 2018 survey.

Hello Anthony,

I apologize for my delayed response to your email, as I have been in the field since early July and am just now catching up.

Thank you for providing the opportunity to read your research proposal. I think the evaluations you are making will provide important data that can hopefully be incorporated into a management plan for New Hampshire shipwrecks.

Having worked for several years for the National Park Service’s Park of theBattlegrounds Program, I have some interest in similar projects and would be very interested in any information you may be able to provide.

To answer your question regarding permits for the removal of objects from wrecks on the lakes, I am not aware of any being granted.

I wish you the best in your project and am very interested in what you find. I will be working in the coming months to update the Division’s marine archaeology program and will be looking for input from researchers such as you.

I hope your project is going well and the weather has been cooperating.

Sincerely,
David