FACTORS INFUENCING TRAIL USE INTO LAKES WITH TOURISM VALUES

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ABSTRACT

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Tourism establishments that are only accessible by float plane are a vital component to northern Ontario"s economy. The remote nature of the lakes where these establishments are located can be compromised through introduced all-terrain vehicle (ATV) trails that are developed from forest access roads. This study assesses the factors that influence ATV trail use into lakes with tourism establishments that are only accessible via float plane. The study was conducted across northern Ontario using TrafX traffic counters to monitor ATV trail use. Five factors were analyzed; Weekend and corresponding holiday traffic, Trail Length, Lake Size, Accessibility (distance to communities) and the presence Walleye *Sander vitreus.* It was discovered that trail length was negatively associated with trail use and weekend and corresponding holiday, lake size, and accessibility were positively associated with trail use. These results can help to identify lakes that are of high risk for ATV trail use and, thus, might require more management and enforcement efforts.

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INTRODUCTION

Forest operations in Ontario require the creation and maintenance of forest access roads. These roads help forest companies to access stands of timber and connect processing facilities to these stands. However, forest access roads also provide other benefits to the northern economy and many other social values such as opportunities to hunt and fish. Not only do forest access roads enhance economic and social values, they can create access into areas that are protected or restricted (OMNRF 2001). This type of access can result in consequences from forest operations such as creating access into lakes with tourism values, which can negatively impact revenues that tourism operators receive from their establishments (Hunt et al. 2005).

Resource-based tourism in Ontario is a large component of the northern economy. Hunt et al. (2008) estimated that in 2005 there were approximately 1137 resource-based tourism establishments in northern Ontario that together generate approximately $114 million per year. Resource-based tourism encompasses hunting, fishing, visiting provincial parks and conservation reserves, camping, canoeing, hiking, wildlife viewing and many other outdoor activities. However, most tourism establishments in northern Ontario cater to tourists who seek fishing and hunting experiences (Hunt et al. (2008).

Forest operations can affect resource-based tourism through access, visual and audible aesthetic impacts (OMNRF 2001). Visual aesthetic impacts occur when harvested areas or access roads, become visible to tourists as they conduct their activities. Audible aesthetic impacts occur when sounds from equipment or haul trucks, are heard and are interpreted negatively (i.e. noise) by tourists at resource-based tourism establishments or the waterbody where the establishment is located. These aesthetic disturbances can affect a tourists" experience and therefore, could influence future demand for tourism establishments.

Access impacts occur when land-based access to previously remote lakes or rivers is created from existing road networks such as forest access roads. Access can compromise the remote nature of the resource-based tourism experience, which can impact the most fundamental aspect to many tourists; the perception of remoteness. This impairment is especially true with fly-in fishing operations (Hunt et al. 2005). Fly-in accessible tourism establishments attract a high proportion of customers because of their ability to access lakes that are inaccessible by highway and off-highway vehicles. Anglers and tourists pay premium prices to fish waters without a high population of local angling (Hunt et al. 2005). This premium arises because anglers expect better quality fishing in terms of increased fish size and catch rates than would be expected for other lakes (OMNRF 2001).

Increased access can negatively affect fish and wildlife populations. Research into the impacts of forestry operations on fish and wildlife populations has discovered that roads affect terrestrial and aquatic animals in several ways such as increasing mortality from collision with vehicles, accelerating spread of exotic species, and increased alteration and use of habitats by humans (Frissel and Trombulak, 2000). For example, a study completed by Gunn and Sein (2000) assessed the effects of forestry roads and the exploitation of lake trout (*Salvelinus namaycush*). Although lake trout can tolerate substantial losses to their spawning habitat, natural populations, particularly in small lakes, must be protected from excessive angling harvest (exploitation) caused from the introduction of forest access roads. Specifically noted in the study were the rapid and severe effects that angling exploitation exerted on a lake trout population on a lake that saw improved access from the construction of a 12 km forest access road (Gunn and Sein 2000).

Currently in Ontario, there are steps in place during the forest management planning process to avoid and mitigate the negative impacts that forest activities can have on resource-based tourism values. As per the guidelines of the management planning process, letters are mailed to each resource-based tourism (RBT) operator in or adjacent to the management unit whose interests or uses may be affected by the production and implementation of forest management plans for an invitation to participate in the forest management planning process (OMNRF 2009). This allows the RBT operator to voice her/his concerns, and outline areas that they feel are at risk of exploitation or damage from forest operations. Many times, these concerns result in a no harvest reserve created around a lake to protect the values. No harvest reserves are areas of standing timber left in place near resource-based tourism values to minimise the visual impacts of forest operations. These buffers can also help with the mitigation of sound impacts and access impacts resulting from forest operations (OMNRF 2001). These processes are assessed through an independent forest audit, where the prevention, minimization or mitigation of site damage is stressed and held to a compliance level of 95% (KBM 2015). In areas containing resource-based tourism outfitters, an indicator for road density (km of road per km^2 of Crown production forest) is used to protect the values over time (KBM 2015)

Forest access roads can result in trails that individuals create between the road network and the point of attraction such as a lake (Hunt and Lester 2009). Recreationists use these trails with off-road vehicles such as all-terrain vehicles (ATVs) to access these lakes. While some information exists about factors that affect the development of these ATV trails into lakes (Hunt and Lester 2009), little is known about the use levels on these trails. Use is important to understand as the impacts from these trails in terms of harvest (exploitation) of fish and wildlife or the introduction of non-indigenous species are positively related to use (Frissel and Trombulak 2000). Given the lack of information about trail use and the strong evidence that use is related to recreational fishing, information and research on recreational fishing demand is used to develop hypotheses related to trail use.

The published research studies have identified many factors that affect fishing demand including: cost of accessing the site, fishing quality, environmental quality, facilities, regulations, and congestion (Hunt 2005). Other research suggests that use is affected by calendric and weather-related factors (Hunt and Dyck 2011).

The objective of this thesis is to investigate and determine the factors that influence ATV trail use into lakes with fly-in only accessible tourism establishments. The findings may assist resource managers with managing and preventing ATV trails. Additionally, the management of trails and prevention of ATV trail use can help to maintain the economic and social values for tourism operators.

The following hypotheses were developed that ATV trail use to lakes with fly-in only tourism establishments should be higher for:

H1: (Cost Factor) shorter length trails that separate the lake and the forest access road network;

H2: (Cost Factor) lakes that are close to areas where many people live;

H3: (Attraction – fishing quality) larger-sized lakes;

H4: (Human Behaviour - calendric) weekend days than week days; and

H5: (Attraction – fishing quality) lakes that contain desirable fish species.

Hypothesis 1 (H1) describes the cost factor of accessing the lake by analysing the length of the trail from the end of the road system to the lake it reaches. Hypothesis 2 (H2) describes another variant of the cost factor; this hypothesis assumes that the distance to the trail from locations where anglers reside influences the use of the trail. Hypothesis 3 (H3) is an attraction factor, describing that lake size could be an attractant for fishing, and thereby influencing the use of the trail system. Hypothesis 4 (H4) is related to constraints on behaviour of trail users. It assumes that weekend days should result in more trail use because of increased leisure time availability. Hypothesis 5 (H5) is based on another attractant variable. H5 assumes that the species of fish within the lake will influence the use of the trail system to the lake.

LITERATURE REVIEW

The review focuses on two key areas: road access management and recreational fishing demand. Road access management is an integral component of the forest management planning process. In particular, the literature reviewed provides an indication about how effective different access controls are at influencing traffic. The effectiveness of controls may serve as a delimitation of the study; meaning that access controls were not measured or accounted for when assessing ATV trail use here.

Studies related to recreational fishing demand provide the foundation for hypothesis development. As such, these studies are reviewed with an emphasis on support for the five described hypotheses.

Road Access Management

Managing roads is an essential part of forest operations as roads can impact the natural environment (Frissel and Trombulak, 2000). Road management includes not only the physical structure and placement of the road but attempts to modify vehicle use of roads using approaches such as gates, regulations posted on signs, the construction of berms and ditches as well as the removal of water crossings and roadbeds. There are three main types approaches used to modify road use: road decommissioning, road deactivation and road closure (Hunt & Hupf, 2014). Road decommissioning involves removing a road. It occurs when a road is permanently removed using techniques such as road ripping or road obliteration. Removed roads are altered extensively to make them completely unusable. This alteration is done to limit access into areas that were previously harvested to protect wildlife values or if the intent is not to maintain the road for public use (OMNRF 2009).

Road deactivation occurs when a road is "unplugged" from a larger road network. Unlike road decommissioning, a deactivated road is not completely destroyed. Instead, a berm is placed, or a water crossing is removed, in order to prevent use. The roadbed remains unaltered other than the berm or water crossing removal. This allows for a low-cost re-opening of the road for future forest operations (OMNRF 2009).

Road closures involve prohibiting individuals from using a road. These closures can focus on individuals pursuing specific activities, specific times of year, or trying to access specific areas. Techniques for road closures include signs and gates. A benefit of road closures is that the roads are still usable for authorized individuals and/or uses (Hunt & Hupf, 2014).

Some research has examined the effectiveness of deactivation and closure methods to reduce traffic on forest access roads in Ontario (Hunt & Hupf 2014). The authors found that roads that were closed temporarily through seasonal sign-based closures were as effective at reducing traffic (92%) as were combined deactivation and sign-based closure methods. The effectiveness of seasonal-based closures at reducing traffic was consistent with earlier reported results (Hunt & Hosegood, 2008).

Deactivations without closures were less effective at reducing traffic while permanent sign-based closures were the least effective approach, reducing less than 60% of traffic. Hunt and Hupf (2014) also found that the quality of the road influenced the level of use. Therefore, poorer quality ATV trails (or even longer ATV trails) should receive less use than better quality roads.

Demand for Recreational Fishing

Many factors may influence the demand for recreational fishing. The main factors known to influence angler demand are; costs, fishing quality, environmental quality, facility development, encounters with other anglers, and regulations (Hunt 2005). Additionally, it is known that anglers are more likely to fish on certain days and months (Hunt and Dyck 2011).

One important factor that was positively associated with traffic to northern Ontario lakes was the accessibility of the lake to areas where people lived (Hunt & Dyck 2011). This accessibility measure was based on a weighted average of the lakes proximity to human settlements and the size of these settlements. This research into accessibility assisted with developing H2. Because accessibility is associated with traffic on forest access roads to lakes in northern Ontario, it is suspected that accessibility is also positively related to ATV trail use at lakes with fly-in fishing establishments.

The availability of walleye and lake trout was found to be positively related to increased fishing activity at lakes (Hunt & Dyck 2009; Dabrowska et al. 2017). While a better measure of fishing quality is a catch rate (Hunt et al. 2007), availability is still an important driver of fishing demand. Consequently, availability was used to develop H5, specifically that walleye availability would be associated with increased ATV trail use.

Larger-sized lakes tend to have more traffic than smaller-sized lakes (Hunt and Dyck 2011). This increased activity at larger-sized lakes can occur because these lakes offer anglers more fishing opportunities due to their association with increased species diversity, abundance, and fish size (Braoudakis and Jackson 2016). The increased size and catch of fish is more attractive to anglers (Carlin et al. 2012; Melstrom and Lupi, 2013; Long & Melstrom 2016). Therefore, larger-sized lakes could increase ATV trail use.

The timing of fishing trips is influenced by weather, days of the week, and fuel costs (Hunt and Dyck 2009). Traffic to lakes was higher on warmer and drier days. Traffic counts were lower at sites on large lakes greater than 750 ha and when wind speeds were high (likely because winds on these large-sized lakes can create dangerous boating conditions). Traffic counts were highest on holidays and their associated weekend days, followed by weekend days and finally weekdays. This is likely because most anglers work during the week, and consequently, most are likely to plan a fishing trip on a weekend, where they have more leisure time. These findings led to the creation of H4, a human behaviour-based hypothesis. It was inferred that if the weekday influences use on recreational fishing lakes, it could have the same effect on ATV trail use. Days during the summer also had more traffic than days of other seasons, and finally, increases to fuel costs resulted in decreased in overall traffic (Hunt & Dyck 2011).

Cost negatively impacts demand for fishing (Hunt 2005; Hunt & Dyck 2011; Melstrom & Lupi 2013). Hypothesis 1 was developed around assessing the length and difficulty of accessing a site. As increasing trail length is a type of cost to anglers, H1 is consistent with past studies of recreational fishing. Likewise, the accessibility of a lake to places where people live measures reduced cost of accessing lakes. Therefore, H2 was developed with an expected positive effect on ATV trail use.

MATERIALS AND METHODS

Study Area

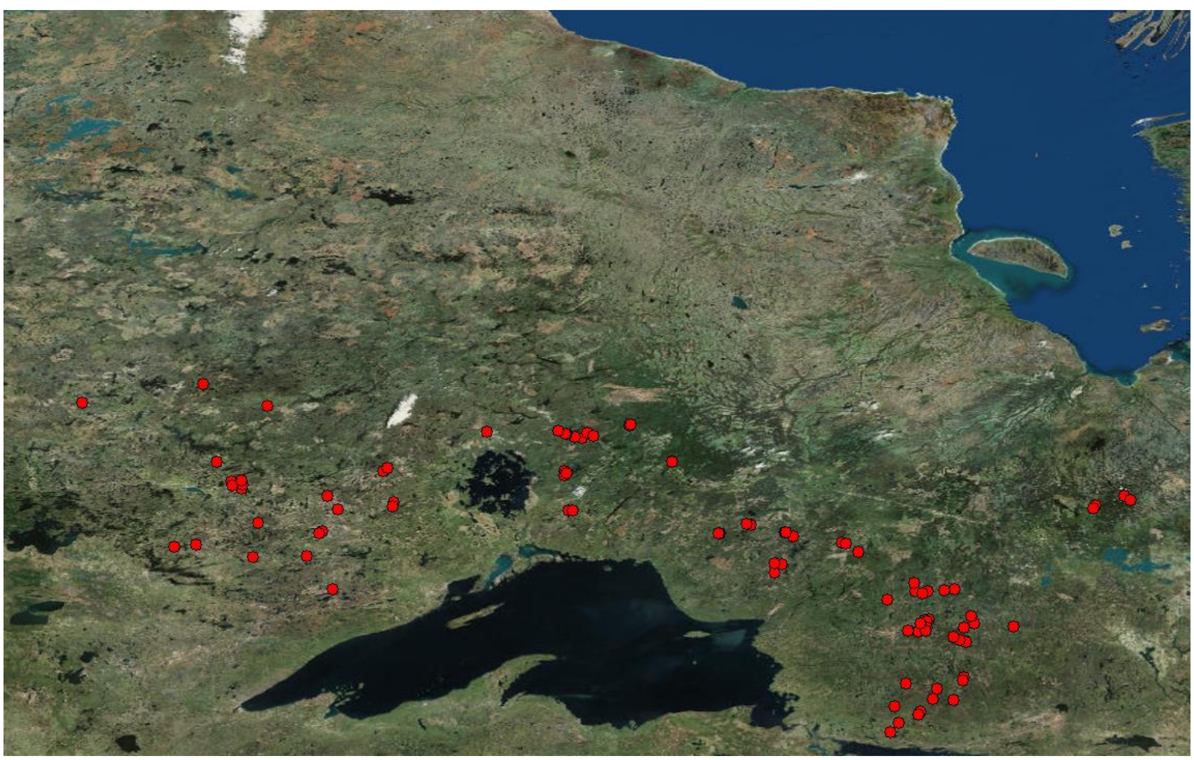

Figure 1. Sample area of the project, including each site location.

Between 2006-2017, the Center for Northern Forestry Ecosystem Research of the Ontario Ministry of Natural Resources and Forestry (OMNRF) conducted research into the access and ATV trail use to lakes with fly-in fishing only accessible tourism establishments. The sample for that research consisted of nearly all of northern Ontario, ranging from Cochrane to Kenora, and north of Lake Nipigon to the north shore of Lake Huron (Figure 1).

The sites with ATV trails were identified from leads provided by tourism operators, OMNRF staff, and others and were verified by field site inspections. All sites with leads were checked and those where ATV trails existed were assessed and traffic was monitored. In total, over 121 sites were sampled across northern Ontario and each site had a vehicle counter installed in order to monitor the data. However, only 93 sites were used in the final analysis because the data for some sites had not been retrieved while other sites contained problematic or corrupted data.

Survey Method

The research was completed using data sourced from Dr. Len Hunt at the Center for Northern Forest Ecosystem Research. The data collected for this undergraduate thesis was gathered between 2006-2017 by various research technicians spanning across northern Ontario. The data was collected with TrafX vehicle counters, which are a type of micro magnetometer. Micro magnetometers measure fluctuations in the Earth‟s magnetic field that are caused by ferrous metal passing through the detection zone of the unit, in the case of this study, ATVs and trucks (TrafX 2017). Each time a vehicle was detected, the TrafX unit recorded the date and time of the occurrence. The counters were used to collect data for a period of approximately 1 year. However, only the data from May 1st – September 30th was used for this project as this is the time of the year that fishing traffic would be dominant (Hunt and Dyck 20011)

The TrafX units were installed by digging a hole approximately 12 inches deep on the shoulder of the road or trail. This burial was conducted to prevent damage or vandalism to the unit. Site selection for the installation of the TrafX unit must be completed with care. The TrafX unit was not placed in areas where it is likely to be damaged, or parked upon, as this would have resulted in un-useable data.

The effectiveness of the TRafx Unit was tested by Hunt and Dyck (2011). Several tests were completed with varying vehicles and speeds (from trucks to ATVs) at different distances between the vehicle and the traffic counter. The TrafX counters provided very accurate results from these tests (Hunt & Dyck 2011).

Not every site was monitored as not all sites with leads could be located or verified that they reached the lake in question. Some sites had “grown in” to the extent that they could not verified without re-opening the trails. Therefore, these sites were not included in the sampling. The TrafX units must be retrieved in order to gather the data. Therefore, the units were placed in areas where they could be easily found and retrieved. Extensive notes and photos describing the location of the TrafX units were documented, including precise GPS locations.

Data Analysis

Daily counts of traffic data for each site were transferred to Microsoft Excel. In total, 17 470 counts occurred from May 1st – September 30th at all 93 sites. Using the date of recorded traffic occurrences at each site, sites were classified into weekday, weekend, and corresponding holidays. The weekday variable assesses the traffic on weekends including Friday and any corresponding statutory holiday (Friday/Monday) and compared to traffic on other days of the week. This variable comes from Hunt and Dyck (2011), who found that traffic counts were highest on holidays and their associated weekend days, followed by weekend days and finally weekdays.

The sites were separated, and columns were added to the database to assess the independent variables: Lake Size (ha), Trail Length (km), Walleye (Yes/No), and Accessibility. Lake size and trail length were measured using ArcGis. Trail length was measured along the identified access route, and lake size was found using the identify process on an OMNRF lakes GIS layer. The lake size measure is motivated from multiple sources that outline it as being a driver for site selection. Hunt and Dyck (2011) found that larger lakes had more traffic than smaller lakes, as did Dabrowksa et al. (2017) and Hunt, (2005). Trail length similarily had substantial amounts of literature supporting its impact on fishing demand. Specifically, Hunt (2005) described the cost of accessing the site as being a major driver of site selection.

For each of the 93 sites, OMNRF Fish Online (OMNRF 2018), a province-wide database for fish species was used to determine the types of fish species present in the waterbodies. This species data was inputted as (0/1) indicating the absence or presence of walleye. Walleye was used specifically as they are known to be major recreational species in northern Ontario (Hunt & Dyck 2011). Furthermore, Hunt (2005) and Dabrowksa et al. (2017) found that the species within the lake influenced the choice of a fishing site by anglers.

Finally, accessibility was measured from existing databases that were used for similar applications (Hunt and Dyck 2011). The accessibility measure represents a weighted average of the distances separating a lake from human settlements with the weight on the size of the settlement. The accessibility measure, however, did not contain an intuitive metric and therefore, it only indicated whether lakes are relatively closer or further from the human settlements. This variable was used by Hunt and Dyck (2011) where it was found to significantly and positively influence recreational fishing demand.

The completed raw data was transferred into Microsoft Access, where it was formatted for data analysis and then transferred to Microsoft Excel. Statistical analysis was conducted with the program LIMDEP (LIMDEP 2018). In LIMDEP, a negative binomial regression was estimated as this model accounts for the integer data (count data) for each trail. The results were processed and analyzed for trends and the results were discussed and compared to past literature on the subject. The negative binomial regression was estimated in place of a linear multiple regression because the dependent variable (trail use) was measured as an integer for this study. The negative binomial regression produces parameter estimates for each independent variable where the parameter estimates indicate the relationship between the independent variable and the dependent variable, such as accessibility and use. The parameter estimates relate to the relative increase or decrease in ATV trail use associated with a one-unit increase to the parameter estimate (i.e., the exponent of the parameter minus one multiplied by 100 indicates the predicted relative (percent) change to ATV trail use).

RESULTS

The full data consisted of 121 sites with a final set of 93. The average daily count was 0.46 for the final 93 sites analysed. The mean, standard deviation, minimum, and maximum for traffic count, trail length, lake size, walleye presence, and accessibility are illustrated below in Table 1.

Table 1. Mean, standard deviation, minimum, and maximum for traffic counts and the independent variables.

Variable	Mean	Standard Deviation	Minimum	Maximum
Traffic Count	0.46	1.95	0	40
Trail length (km)	1.80	1.60	0.11	7.05
Lake Size (ha)	1420.1	2422.8	38.3	12124.7
Walleye	1.0	0.0	1.0	1.0
Access	242.4811	144.0	60.3	1095.3

For all sites, the average daily traffic count was 0.46, with a maximum daily count of 40. The standard deviation of traffic counts was 1.96, meaning the daily traffic counts had a high degree of variability. Trail length had a slightly lower standard deviation with 1.6 with trail lengths ranging from 0.11 km to 7.05 km. Lake size was by far the most dispersed variable with a standard deviation of 2422.8. The mean lake size was 1420.1 hectares with the sizes ranging from 38.3 ha to 12124.7 ha. The mean walleye count was 1.0 with a standard deviation of 0.0. This means that every lake that was analyzed contained walleye. For this reason, walleye as an independent variable was eliminated from subsequent analyses. Accessibility was the final variable measured. The mean accessibility measure was 242.5, and the standard deviation was 144.0.

Figure 2 below illustrates a boxplot of trail length values for each site surveyed over the study.

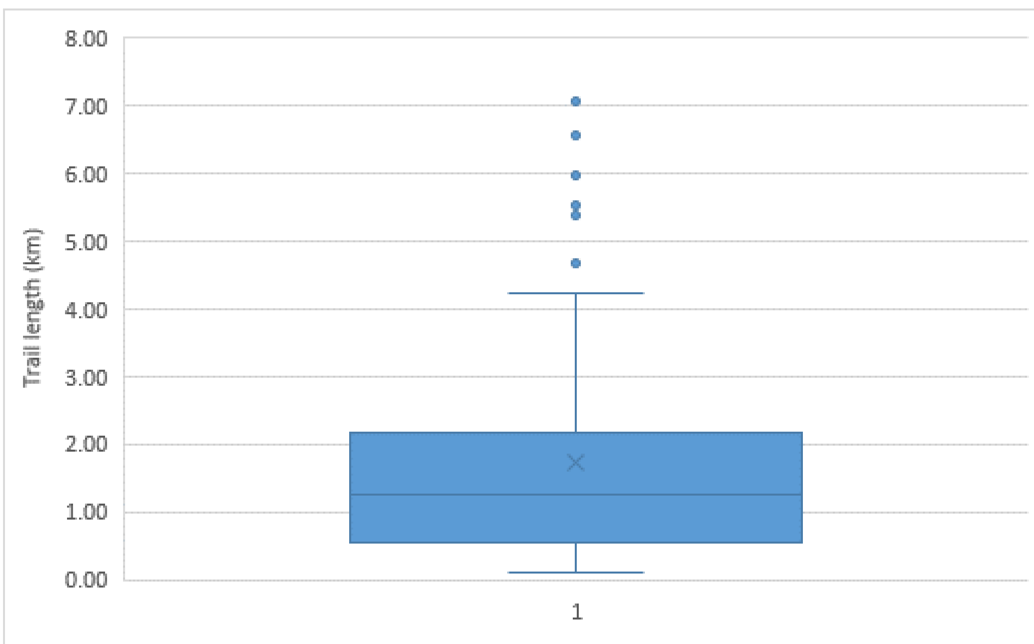

Figure 2. Boxplot illustrating the range of trail lengths (km) observed in the study.

This boxplot illustrates the range of trail lengths observed throughout the study. About 50% of the trails fell between 0.7 and 2.1 km. Six outliers were noted in trail length, all of which were above the upper whisker. This boxplot shows a greater variance in quartiles 2 and 3 than figure 2.

Lake size data is visualized below in Figure 3, with a boxplot diagram showing the recorded lake size for the sites monitored over the course of the study.

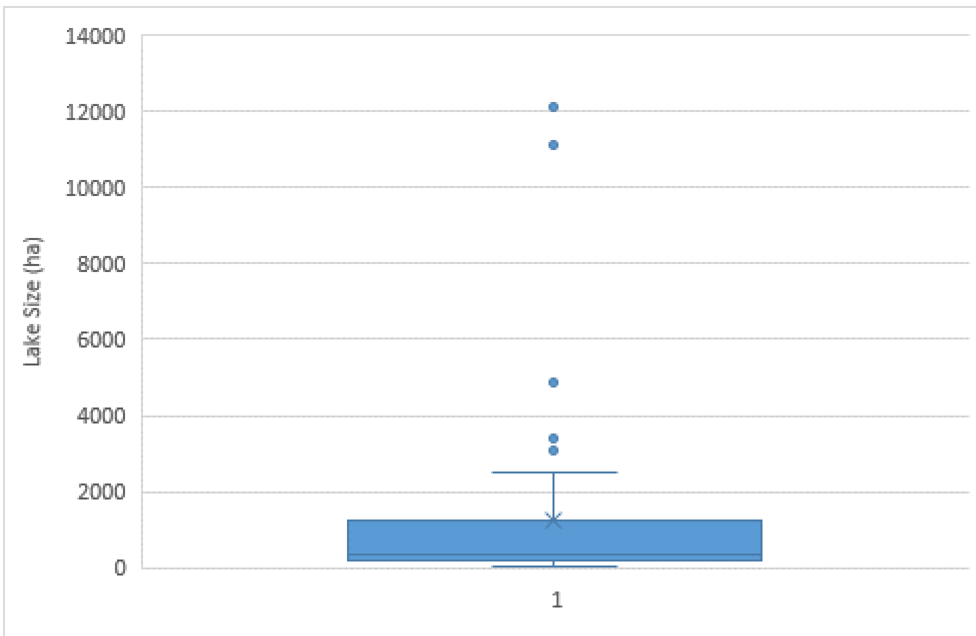

Figure 3. Boxplot illustrating the range of lake size (ha) observed in the study.

As illustrated above in Figure 3, the range of lake sizes in hectares observed throughout the study was noted by a very short boxplot, indicating that 50% of the recorded values fall within a small range. The median lake size was less than 500 ha. Five outliers were noted in lake size, all of which were above the upper whisker.

The negative binomial regression was estimated with a Pseudo R-squared of 0.53, which represents a very good fit to the data (IBM 2017). Multiple factors influenced trail use, as illustrated in Table 2. A positive and significant parameter estimate result illustrated a positive association between use and the independent variable while a negative and significant parameter estimates showed a negative association between use and variable.

All independent variables were statistically significantly different from zero ($p < 0.05$, Table 2). Trail use was positively associated with weekend and corresponding holiday data, lake size, and accessibility while trail length was negatively associated with use.

Traffic Count	Parameter Estimate	Standard Error	Z	Significance
Constant	-1.09097	0.9871	-11.05	<0.01
Weekend/Holiday	0.26071	0.05768	4.52	<0.01
Trail Length	-0.11443	0.02158	-5.3	<0.01
Lake Size	0.00011	0.9960D-05	10.93	<0.01
Accessibility	0.00085	0.00021	3.97	<0.01

Table 2.Negative binomial regression results including the parameter estimate, standard error „Z" value and significance of each independent variable.

To help readers understand the results, I present the relative effect of each parameter estimate on ATV trail use. As illustrated below in table 3, a change in the weekend and corresponding holiday variable showed the largest change, resulting in an estimate of increased use of 29.8%. A unit change of the trail length variable was associated with a decrease in use of 10.8%. Lake size had the smallest influence on a change in use with a calculated increase of 0.01%; although a one-unit change in lakes size is only 1 ha. Similarly, accessibility had a small relative impact on increased use, with a value of 0.09%.

Table 3. Relative effect of a one-unit change in each independent variable on trail use.

Independent variable	Relative impact on use
Weekend/Holiday	29.79
Trail Length	-10.81
Lake Size	0.01
Accessibility	0.09

DISCUSSION

This study assessed multiple factors that could potentially influence ATV trail use into lakes with fly-in only accessible tourism establishments. There is a strong relationship between trail use and factors that affect fishing demand. This result is consistent with the idea that these lakes with tourism establishments are lakes that are valued primarily for fishing. It is, therefore, safe to assume that most of the ATV traffic into the lakes during the study period was fishing based. Through a negative binomial regression analysis, it was determined that four factors influenced trail use into restricted access lakes with tourism values. Referring to the initial hypothesis:

H1: (Cost Factor) shorter length trails that separate the lake and the forest access road network

H2: (Cost Factor) Lakes that are close to areas where many people live.

H3: (Attraction – fishing quality) larger-sized lakes.

H4: (Human Behaviour - calendric) weekend days than week days.

H5: (Attraction – fishing quality) lakes that contain desirable fish species.

Analyzing the Hypotheses

Hypothesis 1 was accepted, as trail length was negatively associated with increased ATV trail use. It was estimated that the relative effect of a unit change in trail length (1 km) would result in a 10.81% reduction in the use of the trail.

The findings here support literature from fishing demand as the cost of accessing the lake weighs in the decision by anglers to select one lake over another. This result is consistent with Hunt and Dyck (2011) and Melstrom and Lupi (2013), as trail length adds substantially to the total travel time and cost, which in both studies negatively affected fishing demand.

Hypothesis 2 was also accepted as accessibility was positively associated with increased ATV trail use. This again supports Hunt (2005), Hunt and Dyck (2011), and Melstrom and Lupi (2013). Hunt and Dyck (2011) and Melstrom and Lupi (2013), both found that total travel cost and time were important factors that negatively affected fishing demand. Here, accessibility is the opposite of cost and thus, the sign of the relationship is positive. H1 and H2 are also closely related in this sense, as they both assess the willingness of a person to travel greater distance in order to reach a lake.

The third hypothesis was accepted as lake size was positively associated with increased ATV trail use. This result means that an increase in lake size could result in an increased ATV trail traffic to the site. This result supports Dabrowksa et al. (2017) and Hunt and Dyck (2011) in that lake size plays a significant and positive role on demand for fishing. It should be noted that in previous studies lake size was also positively correlated with increased catch rate and average fish size (Braoudakis and Jackson 2016). An increased catch rate will increase use (Carlin et al. 2012) as the attractiveness of the lake to anglers will increase (Hunt 2005).

Hypothesis 4 was accepted as weekend and corresponding holidays were positively associated with trail use. This result was expected as it seemed intuitive that traffic would increase on weekends and holidays due to these being the days that many people are less likely to work. This result is consistent with Hunt and Dyck (2011) who found traffic counts were highest on holidays and their associated weekend days, followed by weekend days and finally weekdays.

Finally, Hypothesis 5 was inconclusive. This result was due to lack of variability in the data. Lack of variation in walleye presence resulted in un-testable hypothesis.

It should be noted that this research did not consider all variables that could impact trail use. For example, Hunt and Dyck (2011) assessed the road quality as a potential influence of recreational fishing use. This was not taken into account for this study given the focus on ATV trails rather than roads. The study also lacked fishing data from the lakes (catch rate, average fish size) that could have affected trail use. Hunt and Hupf (2014) also assessed the effectiveness of various road access management controls on trail use. These variables were not addressed and are likely important at influencing trail use. Finally, this study only focused on the period between May 1st and September 30th as this season should have the most fishing activity. Trail use during other seasons might be influenced by different factors (e.g., fall use might be affected by attractiveness of areas for hunting).

Future Considerations

Extrapolating statistical results into practical real-world scenarios may at times be difficult. However, discovering the factors that play a role in ATV trail use could be implemented in various scenarios to preserve the value of the fisheries in which fly-in outfitters depend. Ensuring that tourists continue to return to tourism establishments can benefit the northern economy. Thus, identifying ways to prevent trails and trail use are important goals for forest management.

The results can be utilized in forest management and operations. By identifying lakes that may potentially be at higher risk of illegal access, the study can help to inform foresters about the needs to take protective measures. For example, forest managers can potentially design road systems further from higher risk lakes such as larger-sized lakes that are near communities. Forest managers can look at the results of this study, and design roads with qualities that would limit the chances of illegal access occurring, namely; the distance of trails to lakes. If these data are utilized throughout the forest management process, the remote nature of northern Ontario‟s fly-in fisheries might be maintained. The importance of protecting RBT values in northern Ontario cannot be understated. As previously mentioned, there were approximately 1137 resource-based tourism sites in northern Ontario, combining for total revenue of approximately $114 million (Hunt et al. 2008). Forest harvesting near lakes with known tourism values can negatively impact tourism revenues (Hunt et al. 2000)

Another area this research can be utilized is through enforcement; as previously mentioned, the results of this study can outline lakes that may be at a greater potential risk of having a trail introduced. Illegal access is a known issue in northern Ontario. Organizations such as OntOra (Ontario Outdoors Recreational Association) believe that it is their right to access, and fish any lake (Ontora 2017). The organization has caused problems for enforcement in Ontario by creating trails into lakes with fly-in tourism establishments. The factors that influence ATV use can assist with enforcement throughout northern Ontario by allowing conservation officers to better recognize areas that could be a potential issue, and areas that they could check regularly. Northern

Ontario is a vast, sparsely populated region. There are far too few conservation officers to constantly monitor all lakes with tourism establishment for unauthorized use. By utilizing the results from this study, conservation officers can effectively eliminate certain lakes based on their attributes such as distance to communities, trail length and lake size. This will allow for more effective enforcement of restrictions on lakes with tourism establishments.

The results indicate that several factors influence use of trails into lakes with tourism establishments. Namely, the trail length, the lake size, the distance to communities and the weekend days all can affect ATV trail use. An analysis on the relative impact of each parameter revealed that the weekday variable and trail length had the highest relative impact on use per unit change. It is important to understand what drives the use of ATV trails as RBT outfitters are large contributor to northern Ontario‟s economy. Forest operations can result in substantial implications in RBT values. Utilizing the findings of this research can result in the further protection of Ontario‟s unique resource-based tourism industry and help to preserve fish and wildlife species into the future.

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