RELATIONSHIP BETWEEN FISHING HOURS AND NUMBER OF FISH HARVESTED FROM UPPER RED LAKE

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***Abstract*-Total hours fishermen spend fishing and total amount of fish harvested per year are some of the most important pieces of knowledge gained from creel surveys. They provide crucial information that assesses fisheries mortality and pressure. MN DNR uses their results from creel surveys to improve or impose regulations, and to maintain healthy fisheries. Based on results from similar studies, there is expected to be a positive relationship between hours fished and fish harvested. To determine the relationship between these two variables on Upper Red Lake, data from two years were selected when the variables were at their highest and lowest values, without regulation changes occurring. The results from this study were obtained using regression analysis on catch rates. The values from the catch rate analysis showed that fish per angler hour is dependent on the amount of effort put forth, but there are ultimately other variables influencing the overall outcome. This study could be expanded in the future to include questions regarding why anglers exhibit patterns of pressure in specific systems.**

I. INTRODUCTION

Walleyes are the most sought-after species on Upper Red Lake. Each year, during the creel open water survey, May-August, Upper Red Lake sees high fishing pressure. For example, anglers spent 142,126 hours fishing on Upper Red Lake in 2022. This was up approximately 12,000 hours from the previous year (2021). Almost all those fishing hours are spent targeting walleye. This pattern seems to be present regardless of if the fishing is good or bad (Kennedy 2022).

Harvest information from creel surveys is used to assess the health of recreational fisheries and inform fishery managers through interviews and counts of anglers. This allows managers to assess the effort, catch, and harvest of specific species in a system (Nieman et al. 2021). Over the years slot limits and size limits have changed as walleye size and number have increased. With increasing slot and size limits, more fishing hours are being spent on Red Lake (Kennedy 2022).

Using data from creel surveys, past studies have looked at the relationship between fish harvesting rates from anglers. One paper showed that harvest rates and time anglers spent fishing were correlated to anglers' decision to keep the fish that they kept. As an angler expends more energy and time fishing, the rate of harvest should decline (Hunt 2002). This coincides with the low fishing hours reported by creel surveys in early-late summer on Upper Red Lake.

Large lakes with high maximum sustainability yields are often viewed as being more resistant to overharvest. They can be overfished today due to anglers' ability to travel and take advantage of these situations (Parkinson 2004), especially during times of high catch rates. Upper Red Lake creel information shows that anglers travel and spend the most time fishing on the lake when harvest rates are thought to be, and typically are, the highest (Kennedy 2022). The reason anglers' hours reach such low rates towards the middle of the summer (June-Aug) on Upper Red Lake, is because catchability is at its lowest rate of the open-water season. So, anglers take advantage of better angling opportunities on lakes closer to the point of origin (Parkinson 2004).

The objective of this study is to test for a relationship between total hours fished and total rate of harvest, by using catch rate analysis from open-water creel surveys. As fishing pressure increases there seems to be an increase in the total amount of fish harvested, understanding this relationship better could help estimate fish harvest rates more accurately. Knowing more about the social responses by fisherman can benefit fishery managers by accounting for ecological dynamics and human dimensions in a system (Nieman et al. 2021). Is increased angling more of a sociological element or is it representative of actual higher harvest rates is the question this study is trying to answer.

II. METHODS

The Upper Red Lake area that falls under the jurisdiction of Minnesota is approximately 48,000

acres. The maximum depth on Upper Red Lake is 16 ft, with an average depth of 9 ft. East Upper Red Lake is managed by the Minnesota Department of Natural Resources, Division of Fisheries, in Bemidji, Minnesota (Kennedy 2022).

To examine for a correlation between total hours fished and amount of fish harvest from Upper Red Lake, data was retrieved from the Minnesota Department of Natural Resources (MN DNR). Creel survey reports were used from 2006-2015. 2015 was selected because it had the highest fishing hours and fish harvest without a regulation change. In 2006, fishing hours and harvest were the lowest without a regulation change occurring.

Creel surveys are done on Upper Red Lake each year to implement the Red Lake Fisheries Technical Committee's Harvest Plan (Kennedy 2023). The survey implements a two-stage completed trips interview done by a creel clerk, who inquiries about the total fish caught and asks to measure species kept. The total hours spent fishing is also obtained by the creel clerk during the interview. Fishing hours selected, ranged from sunrise to sunset in the months May-September. Fish length data and amounts are computed to report total fish harvest rates.

Regression analysis was used to test for a relationship between total fish harvest rates and hours fished. The data was displayed on three separate graphs, one representing total fish harvest rates in 2015 and 2006, another representing total hours fished in both sample years studied, and the last one showing log-transformed data. The total hours spent fishing, and total fish harvest rates were calculated by the MN DNR and published in the Upper Red Lake Creel Report.

III. Results

Catch rates varied from (C=0.12-1.8 fish/hr; Figure 1) in 2006, and (C=0.39-1.9 fish/hr; Figure 2) in 2015. The relationship between catch rate and fishing effort was tested using log-transformed data, which showed a significant relationship in 2006, but not in 2015 (Figure 3). The results showed inconsistent relationships between fish harvested and catch rates (Figure 3). Walleye harvests ranged from 898-17,450 fish per period (Figure 4). Fishing hours ranged from 2,713-81,141 (Figure 5) in 2006 and 2015.

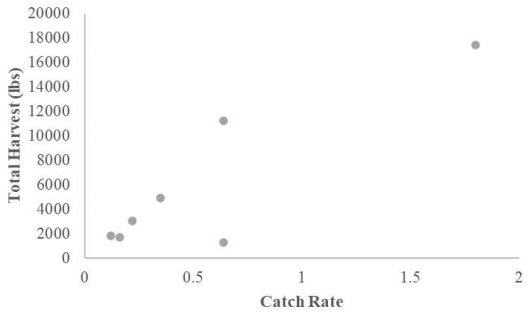

Fig. 1. Scatterplot of regression analysis figure between catch rates and number of walleyes harvested in 2006.

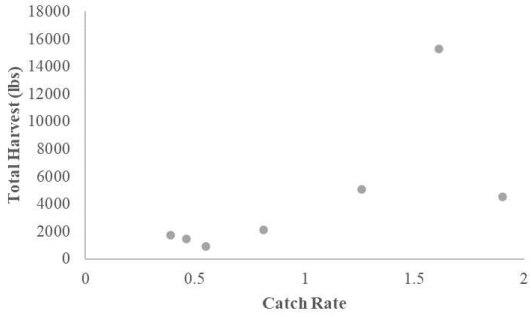

Fig. 2. Scatterplot of the regression analysis using catch rate and number of walleyes harvested in 2015.

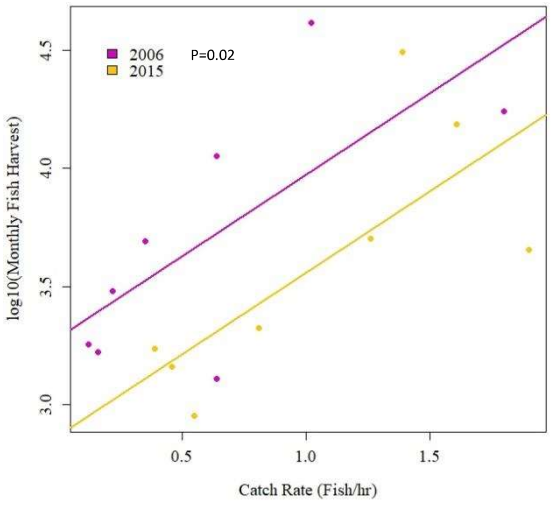

Fig. 3. Catch rate and fish harvest were log-transformed from regression analysis data, for the years 2006 and 2015.

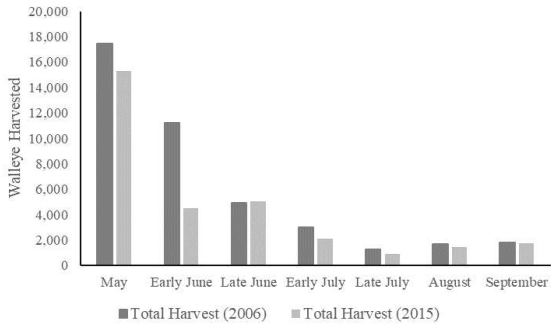

Fig. 4. Comparison of total walleye harvested on Upper Red Lake in 2006 and 2015

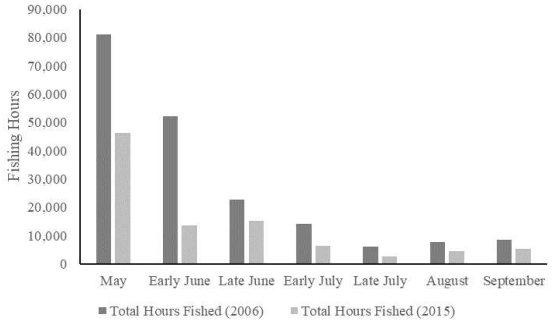

Fig. 5. Comparison of total fishing hours on Upper Red Lake in 2006 and 2015.

IV. Discussion

Recreational fisheries, such as Upper Red Lake, must be managed carefully because they are social-ecological systems. Understanding of how humans can impact fisheries is one of the most important aspects gained from creel survey (Nieman 2021). Harvest amounts and fishing effort are obtained which assist fishery managers decisions in establishing slot limits and size limits. Testing how greatly these two variables influence each other, showed that catch rate is greatly dependent on fishing effort exerted. Determining why the fishing effort varies so greatly, when the catch rate stays relatively stable, is an important socio-ecological question fishery management should be asking today (Hunt 2002).

Annual harvest information from creel surveys is currently used to implement Harvest Plans in recreational fisheries (Kennedy 2023). In a time where human-environmental interactions are at an all-time high, creel surveys are being slowly adapted to inquire why anglers make certain decisions. Some examples could include questions regarding anglers' decisions to keep certain fish, or why they chose to exert certain amounts of effort (Nieman 2021).

Further inquiry is required to sustain fisheries in the future. Research into why anglers are fishing in patterns would help expand fisheries knowledge on how to better manage heavily pressured lakes and predict fishing pressure during certain periods of time. Creel surveys need to be adapted and changed to better answer critical aspects of social-economic relationships today (Nieman 2021).

Acknowledgements

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