

## Importance factors affecting trout and salmon sport fishing's demand and their elasticities Ely region Minnesota.

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### Abstract

The purposes of this study were to 1. Study the factors that impact on trout and salmon sport fishing's demand in Ely region and their elasticities, and 2. Study sensitivity of these factors that impact demand of fishing of this region. Recreational fishing is an important sport and outdoor activity that creates a lot of jobs and income for the local community. Ely, Minnesota is the most famous area for fishing. Even though sport fishing provides high revenues to Minnesota but little information regarding specific type of fish for sport fishing such as trout and salmon is limited. The research questions for this study are why do anglers continue to choose this? What are important factors for them to return to this site? This study is quantitative study that includes mean, standard deviation, t-test and the sensitivity or elasticity is derived from the estimated coefficient of a double natural logarithmic demand function. The sample size of 1083 had been collected by mail for those who have fishing license. The result for purpose one shows that there are four factors that are statistically significant at  $p < 0.05$ : travel cost (coefficient of -0.29 and t-value of -7.28), age (coefficient of -1.06 and t-value of -4.86), household size (coefficient of -0.23 and t-value of -1.96) and trout fishing experience (coefficient of 0.40 and t-value of 4.69). The result for purpose 2 shows that elasticity of travel cost ( $E = -0.29$ ), household size ( $E = -0.23$ ), age ( $E = -1.06$ ) and trout fishing experience ( $E = 0.40$ ). Among these factors, only age is elastic, with an elasticity of -1.06. This information benefits the local community, local businesses, the local government, and the state by providing better policy and marketing strategies in order to increase tourist demand.

**Key words:** Tourism, Demand Function, Elasticity, Fishing

### Introduction

Recreational fishing is considered to be one of the most important outdoor activities in the United States, accounting for billions of dollars in revenue each year. In Minnesota, recreational fishing plays an especially important economic role. The Sport Fishing Association has ranked Minnesota as number four in the nation for overall economic impact from freshwater fishing (Gartner, 2002). Furthermore, freshwater fishing accounts for 42,293 jobs in Minnesota, which yield a total of \$148 million in wages and salaries. (Gartner, 2002).

Although the Minnesota DNR data establish the general economic significance of sport fishing in the state, there are few figures available on specific fish especially trout and salmon. Furthermore, to be able to improve

the fishing site community's quality of life, and increase local government's revenue, it is important to collect crucial information especially sensitivity of important factors such as travel cost, income, experience, and socio-economic variables.

With this context in mind, this research paper will focus on consumer behavior, employing demand theory to explain the cases of anglers' consumption at the recreation site for Region II (Ely as the center), which is the place that visitors visit the most which is 37% total visitors for fishing for the whole state (Gartner, 2002). Since the resources are limited, it is important to consider this location as the priority to study. The paper will address the following question: Other than the travel cost and the price of goods, what are the other factors that affect the demand of anglers for visiting the site?

### Purpose

1. To describe what factors visitors, take into account in making decisions to fish at Ely region.
2. To describe how sensitivity of these factors to demand of fishing in Ely region.

### Methodology

Demand Theory and Travel Cost (Parkin, 2019) The theory of consumer choice is used to estimate the economic value of outdoor recreation and the policies for it. Policies should be based on the theory of consumer choice, the preferences of visitors, and the economic constraints that impact consumer choice. Consumers make their choices in order to achieve their maximum utility or satisfaction (Ward & Beal, 2000).

Demand Curves (Parkin, 2019) A demand curve is the relation of demanded quantity and price. The demand function may be estimated by regression analysis. If the algebraic form is linear, the model may be formed as follows

$$Q_x = \beta_0 + \beta_1 P_x + \dots + \beta_n N + \varepsilon$$

From the regression process, the estimated coefficient ( $\beta$ ) will represent the change in  $Q_x$  (Demanded quantity) caused by price, income.

#### Elasticity of Demand

Elasticity is the sensitivity of demand of visiting to a small change in its independent variables that affect the demand for visiting recreation sites.

Price Elasticity (Parkin, 2019) Price elasticity is the responsiveness of quantity demanded to a small change in price.

$$E_P = \frac{[\% \Delta Q]}{[\% \Delta P]}, E_P = \frac{\Delta Q}{\Delta P} \times \frac{P}{Q}$$

Income Elasticity (Parkin, 2019)

The formula follows the same format as explained with price elasticity. Income elasticity is equal to  $\frac{[\% \Delta Q]}{[\% \Delta I]}$  when I is income. The estimated values for income elasticity may be either positive (normal goods) or negative (inferior goods).

### Other Elasticity

Other elasticity includes the elasticity of socio-economic variables, and the formula for computing elasticity across variables all have the same form:

$$\frac{\% \Delta Q}{\% \Delta Socio} \text{ or } \left[ \frac{\Delta Q}{\Delta Socio} \right] \times \left[ \frac{Socio}{Q} \right] \text{ when Socio = socio-economic variables.}$$

### Methods

To be able to create the demand function and calculate the sensitivity or elasticity, it is important to calculate the travel cost, which represents the price of the product (that is, travel visits) in the travel demand function.

Travel cost calculation First, it is necessary to find the travel cost, which is the main independent variable in the demand function. When calculating the round-trip travel distance and time to the site for each individual, each individual will have an increasing travel time and distance. For most situations, travel cost per party from original "I" has two parts, which are travel cost and time cost = [round trip variable cost of operating an automobile from original "i"] + [opportunity cost of travel time per party from original "i"] (Feather & Shaw, 1999; Philips & Silberman, 1985). And Step 2 To create the demand model, socio-economic data and travel cost for each individual are used to construct the demand function. The original function is  $Visits = \beta_0 + \beta_1(\text{travel cost}) + \text{socio-economic variables (age, education, income, fishing experience)}$ . The natural log is then taken to transform it into a double-logarithmic equation, which is as follows: (Alston, Chalfant & Piggott, 2002; Bowker et al., 1996).

$$\ln Visits = \beta_0 + \beta_1 \ln(\text{travel cost}) + \beta_2 \ln(\text{socio-economic variables include age, education, income, fishing experience}) + \epsilon \quad (1)$$

The elasticity calculation from model (1) can be calculated as follows:

$$\text{Elasticity } \eta = \frac{\left( \frac{\partial Y}{Y} \right)}{\left( \frac{\partial X_n}{X_n} \right)} = \frac{\partial \ln Y}{\partial X_n} = \beta_n.$$

The elasticity can be derived from the estimated coefficient of each independent variable from model (1) (Plourde & Ryan, 1985).

### Results

Table 1 shows the results of the estimate coefficient for the double-logarithmic demand function. Travel Cost's the estimated coefficient is -0.29 with a t-stat of 7.28. It is statistically significant at  $p < 0.05$  and the sign is negative. Family Size's estimated coefficient for family size is -0.23, and it is statistically significant at  $p < 0.05$  (the t-stat is 1.96). This means that when the family size is larger, the number of visits will decrease. Age's estimated coefficient is -1.06, and it is statistically significant at  $p < 0.05$  (the t-stat is 4.86 and Trout Fishing Experience's the estimated coefficient is 0.40, which is statistically significant at  $p < 0.05$  (t-stat = 4.69). This indicates that, when anglers gain more trout fishing experience they will fish more.

**Table 1** Results from the double-log function for Region II

Variable	Coefficient	Std. Err.	t-value	P-value	Expected sign based on previous studies
Constant	6.30	0.75	8.40	0.00	None
Ln (travel cost)	-0.29	0.04	-7.28	0.00	- Lothrop et al. (2014)
Ln (household size)	-0.23	0.11	-1.96	0.05	- Walsh, Johnson & McKean (1988).
Ln (age)	-1.06	0.21	-4.86	0.00	- Walsh, Johnson & McKean (1988)
Ln (income)	-0.02	0.11	-0.22	0.82	+ Walsh, Johnson & McKean (1988)
Ln (education)	0.05	0.12	0.40	0.68	- Ojumu et al. (2009)
Ln (trout fishing experience)	0.40	0.08	4.69	0.00	+ Woodall et al. (2002).
Ln (salmon fishing experience)	-0.06	0.08	-0.76	0.44	+ Woodall et al. (2002).

## Conclusion

This research shows that fishing is famous sport in Minnesota that creates a lot of income and jobs in local communities. The Ely region is the most famous area for fishing in Minnesota especially for trout and salmon fishing. Using double natural logarithmic demand function along with travel cost model has provided crucial information regarding correlation of independent variables of travel cost, income and socioeconomic factors and dependent variable (number of visits). Furthermore, this transformation demand function also provides the sensitivity (elasticity) of these independent variables to demand of fishing (dependent variable). Moreover, travel cost(price) was derived by calculating opportunity cost of time that anglers spent on the trip and time not working during the trip. This would provide accurate price (travel cost) for fishing demand function. Result show that there are four factors that have an impact on the demand of visiting, which are travel cost, age, trout fishing experience, and family size. a Besides, the sign of estimated coefficient that represents their affects to demand of fishing but the absolute value of estimated coefficient for each variable is also important because it represents elasticity or sensitivity of these factors. Among four factors, only age that has elastic of elasticity which shows the high sensitivity of age to demend of fishing. Recommendation of providing and supporting the older age would have crucial impact on their decision to visit the site. On the other hand, elasticities of other variables do not show the elastic sign so that the changes of these variables negatively will not have the great impact on the number of visitings. Non-sensitive factors would be factos that policy makers and managers should use to target their marketing because changes of these factors do not negatively change the revenue dramatically. On the other hand, very sensitive factors would affect the demand greatly which can be decreasing and increasing but more information is needed. As policies makers, stable and increasing

revenue is better goal that they want to achieve so that less sensitive factors to demand of fishing are more important factors for trout and salmon sport fishing in Ely region..

## Discussion

Travel cost has negative relation with fishing's demand with low elasticity. That means once the travel cost increases greatly but the demand of visiting will slightly decrease. This means the total revenue from fishing will not decrease much. Eventually, the total revenue is still profitable. Local government should consider to increase the price of license, entry fee or any tax which eventually increase the revenue for their community. Furthermore, specific areas of inland lake fishing for trout and salmon fishing are located in Ely region so that this would explain the reason why price elasticity is inelastic because of less competitiveness of same specific type of lakes in the market. Anglers do not have choices of the same specific lakes for trout and salmon fishing so that they could not fishing anywhere else even though the travel cost (price) increases.

Age is another factor that is significantly related to visiting demand, with a high elasticity of -1.06. This means that once the age of the angler becomes higher, the demand of visiting will drop a lot more. Fishing is an activity that requires much physical exertion, which would have negative health impacts on older anglers. It is important to provide the facilities, services, accommodations, and food that would benefit these types of middle-aged anglers (Ojumu et al., 2009).

Since family size would impact on demand but it is not elastic. In this case, demand of fishing is not greatly impacted by family size much because its elasticity is considered low. The reason is that sport fishing is considered male sport and it is not family sport.

Based on the result of fishing experience, another group for planners to focus on are anglers with less fishing experience. The planners can provide special promotions for this group, with lower costs, and provide training programs so that they would enjoy this kind of sport and gain more fishing experience. Furthermore, the discount or promotion focus on high experience of fishing would increase the demand for fishing. Moreover, Ojumu(2009) recommended that managers and policy makers should focus on the younger anglers to maintain good revenue. If younger anglers are targeted, they would have had longer years of experience by the time they get older and would have positive impact on the demand for fishing days in the state.

Based on study of Ojumu(2009), he recommended that managers and policy makers need to target their marketing to respondents that are less sensitive of price changes or the socioeconomic factors with less sensitivity but fishing experience years. The negatively changes of these factors will have smaller impact on decreasing of demand which means the local community and state still maintain their good revenue. From the discussion of the relationship between socio-economic factors and the demand for visiting of recreation sites, it is evident that there are many factors besides price of product (travel cost) and income for standard demand function which normally focuses on price and income. This study provides more information regarding demand function that socioeconomic factors of anglers in the market area will influence fishing demand.

## Suggestions

Important factors and their elasticities information can be used for better business strategy and policy to increase demand of fishing in this recreation.

It would benefit for local government to consider to use this information to calculate for economic value this recreation. The model transformation can be semi-logarithmic model for demand function and using consumer surplus concept to calculate for economic value or willingness to pay. Willingness to pay is important information for many future projects which helps the policy makers to set the price, tax, and fee .based on this willingness to pay of consumers

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