HUNTING AND FISHING TRENDS IN THE U.S.[1]

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Abstract.--Trends in hunting and fishing participation are evaluated on the basis of responses to a telephone survey of the U.S. population conducted as a part of the 1975 National Hunting and Fishing Survey. Probability of participation in hunting and fishing is a function of the respondent's age, sex, income, place of residence, and a number of supply characteristics. The availability of forested acres and total public recreation acres in a participant's state are also significantly related to the probability of hunting and fishing. The probability of non-participation is also evaluated. The impact of future changes in population parameters and pertinent supply characteristics upon hunting and fishing trends and the related policy implications are discussed.

Introduction

This paper will review hunting and fishing participation data to determine if any trends can be estimated and, to the extent possible, what causal factors influence these trends. In the traditional sense, a comprehensive analysis of hunting and fishing trends has not been undertaken. The scarcity of comparable time-series data is one probable cause for the paucity of trend analyses along with the small degree of success achieved by those who have tried. Another factor is that the underlying causal relationships which explain participation in hunting and fishing for the nation are just now being examined in a systematic way by Kellert at Yale in his study of American Attitudes Toward Animals. The fitting of a line through data points does not get the resource management information necessary for decision making. We must look beyond the trend line to the causal relationships and especially those that have some degree of public control. This research area, which calls for a multidisciplinary approach, will be where answers are found to help decision makers in the management of wildlife resources for the future benefit of society.

This paper is divided into three sections. First, a review of the existing data from past recreational surveys and state license data will be undertaken; second, an analysis of the data to determine causal relationships that could provide some insights into future trends; and third, an analysis of the causal variables with conclusions regarding the future participation rates of hunters and fishermen.

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Hunting and Fishing Participation Data

The most complete time series data on hunters and fishermen are the state license figures. Excluding saltwater anglers, these numbers are available on a state by state basis back to the year 1932. However, these figures are representative of all sportsmen who acquired a license to hunt or fish and do not include those categories of people who are exempt (e.g., for reason of age both young and old), those who hunt or fish on their own land, etc. Each of the 50 states has its own laws pertaining to exemptions from licenses. Figures 1 and 2 show the number of fishing and hunting license holders from 1955 to 1978. Projecting the number of license holders to the future would give us an estimate of participation rates but these figures would not include participation by the legally unlicensed group. The actual size of this latter group has not been estimated, but it most likely varies from state to state and may account for a considerable percent of partication in some parts of the country. For purposes of this paper, estimates of illegal hunting and fishing will not be included as it is unlikely it could be estimated from survey data.

A second source of statistics on hunters and fishermen comes from National Surveys. Since 1955 Hunting and Fishing surveys have been conducted by the Fish and Wildlife Service at 5 year intervals. Figure 3 shows the estimated total hunters and fishermen from 1955 to 1975. These figures represent participation by sportsmen 12 years of age and older. The upward trend evidenced by both hunting participation rates shows that increasing numbers of people are hunting and fishing. However, measured as a percent of population, the increased participation becomes a decreasing percentage of the U.S. population. This indicates that the relative popularity of fishing and hunting are declining. However, the relative popularity of any recreation is affected by changing preferences and trends in complementary activities and therefore may show up as some form of cyclical behavior over time. The difference between license holder trends and the national survey figures has not been completely reconciled. The National Surveys have not been designed in the past for direct comparability. License figures are a simple tally of sportsmen while the hunting and fishing survey estimates are based on population samples that are not restricted to that segment of the population that is required to have a license to hunt or fish. Therefore, it is expected that the survey estimates will be larger than the license figures. The expected magnitude of difference is unknown. Until such time as we fully

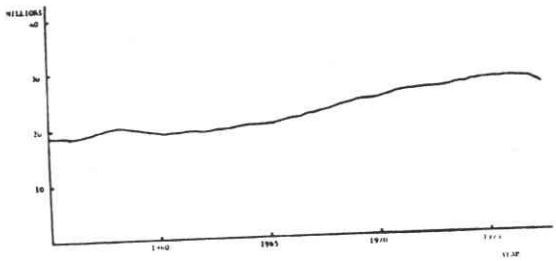

Figure 1.--Number of fishing license holders 1955-1978

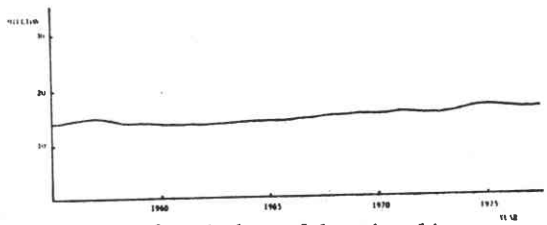

Figure 2.--Number of hunting license holders 1955-1978

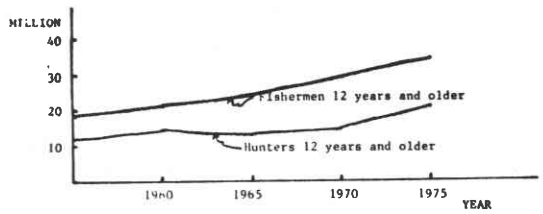

Figure 3.--Estimated number of fishermen and hunters in the U.S. 1955-1975

understand what is being measured by the National Surveys there is a reluctance to predict the future with this data base. This conclusion holds for the other national surveys as well.

A third source of hunting and fishing participation data comes from a screening survey used in the 1975 National Survey of Hunting and Fishing. Using random digit dialing the population sampled was asked if they hunted or fished in 1975, and if they had not in 1975 they were asked if they had done so in 1972, 1973, or 1974. Table 1 presents the findings from a 10 percent sample of the screening questionnaire.

Table 1

A Comparison of Hunters and Fishermen who discontinued Hunting and Fishing in 1975

	Hunted in 1975	Hunted in 1972, 1973, or 1974 but not in 1975	Fished in 1975	Fished in 1972, 1973, or 1974 but not in 1975
Head of household	61.9	62.1	41.8	41.8
Spouse	9.4	20.6	20.0	27.5
Children	28.7	17.3	38.2	30.7

In order to analyze these data the probability of not participating was estimated for both hunting and fishing in 1975. Data from sportsmen who had participated in the years 1972, 1973, or 1974 but not in 1975 and those who had participated in 1975 were used to estimate the probability that sportsmen would discontinue hunting or fishing. The independent variables used in the equation consisted of social, demographic and measures of availability of opportunity in the state that sportsmen lived in. This equation was estimated with cross-section data using ordinary least squares regression. The equation, estimated for hunters and fisherment separtely, was:

$$\text{Non-Participants} = f(\underset{+}{\text{AGE}}, \underset{-}{\text{AGE}^2}, \underset{-}{\text{SEX}}, \underset{+}{\text{INCOME}}, \underset{+}{\text{METRO}}, \underset{+}{\text{HEAD}}, \underset{-}{\text{WATER}}, \underset{-}{\text{COAST}}, \underset{-}{\text{FOR}}, \underset{+}{\text{TREC}})$$

Where: Non-participants = 1 for those who did not go in 1975 but did go in 1972, 1973, or 1974.

Non-participants = 0 for those who went hunting (fishing) in 1975.

AGE - the respondents age
AGE^2 - the respondents age squared
SEX - the respondents sex, 0=female 1=male
INCOME - the respondents family income before taxes
METRO - 1 if the respondent lived in a metropolitan area
0 if the respondent lived in a non-metropolitan area
HEAD - 1 if the respondent is the head of the household and 0 otherwise
WATER - the square miles of surface water in the state
COAST - the coastal miles in the state of residence
FOR - the forested acres in the state, in millions
TREC - total acres of publicly-owned recreation land in the respondent's state, in thousands

The a priori expectation on the signs of the variables are given below the variables. The estimated coefficients are in table 2. The age of maximum probability of non-participation is 55 for fishermen. Without the age square term being significantly different from zero the age of maximum probability was not computed for hunters. Interpreted this means that with other factors held constant a fisherman's probability of discontinuing fishing decreases after age 55. The lack of a maximum probability for hunters is most likely due to a greater commitment that hunters included in the sample may have to their sport. Therefore, there was not a specific age group where most hunters were discontinuing hunting.

Table 2

Estimated Non-Participation functions for Hunting and Fishing

	(1)		(2)	
	Fishing	(t-value)	Hunting	(t-value)
Intercept	.1980	(12.4)	.3538	(9.1)
AGE	.0035	(4.2)	.0042	(2.2)
AGE^2	$-.00003$	(3.1)	$-.00002$	(.8)
SEX	$-.0999$	(10.7)	$-.2455$	(12.2)
INCOME	$-.4 \times 10^{-7}$	(.2)	$.3 \times 10^{-7}$	(.1)
METRO	.0175	(2.3)	.0483	(3.8)
HEAD	.0079	(.7)	.0019	(.1)
WATER	$-.44 \times 10^{-5}$	(1.2)		
COAST	$-.61 \times 10^{-5}$	(.3)		
FOR	$-.0014$	(2.6)	$-.0035$	(4.6)
TREC			$.13 \times 10^{-5}$	(1.9)
F-ratio	25.9		38.7	
$\bar{R}^2$	.0195		.0546	
N	11,738		5,373	
Age of Maximum Probability	55			

The probability of discontinuing fishing (equation (1) in table 2) indicates the influence of being male is negative and living in a metropolitan area is positive. Both of these findings are consistent with other research results. Income and being head of the household had no apparent influence on discontinuing participation. Looking at the influence of surface water availability it is not surprising that those states with more square miles of surface water have a lower probability of non-participation once a fisherman had been fishing in the past. The influence is not strong with a relatively high standard error but nevertheless it is present. The presence of forested acres also decreased the probability of non-participation. This is most likely due to the high correlation between forest acres and watersheds.

The influence of the social and demographic variables on the probability of non-participation in hunting (equation 2) was somewhat stronger than for fishing with approximately 5.5 percent of the variation explained. The influence of residence in a metropolitan area increased the probability of discontinuing hunting with other factors held constant. It can be interpreted that from a cross-section of hunters the probability of discontinuing hunting is increased if the sportman lives in a metropolitan area. A likely cause of this result is that hunting requires more

travel time and cost for metropolitan residents than for non-metropolitan residents and therefore they may feel less committed to hunting as the costs rise over time.

As a measure of the availability of other outdoor recreation activities the variable TREC was included. Its positive coefficient indicates that hunters from states that have relative abundance of public recreation areas are more likely to discontinue hunting than hunters who live in areas where public recreation lands are less abundant. From the cross section of hunters in the sample it appears that income did not influence their decision about participation. It must be remembered that this data set contains only hunters and fishermen and the results only pertain to those who are already hunting or fishing and the factors that may influence their decision to continue in the future.

Looking to the future of participation in hunting and fishing activities the analysis shows that for fishermen the loss of currently available sites should increase the probability of non-participation. While the same is true for hunters, an increase in public recreation areas would further increase the probability of discontinuing hunting.

A Model for Determining Trends in Hunting and Fishing

The traditional models for extrapolating trend lines to the future do not capture the underlying relationships that cause trends to shift. Of particular interest are variables subject to policy manipulation by land management agencies. Specifically, it would be desirable to estimate the relationship between the availability of hunting and fishing opportunities and the probability of the general population becoming hunters or fishermen. To do a thorough analysis requires both cross-sectional and time series data on participants and non-participants, their social and demographic characteristics, the location of the hunting or fishing activity and a series of quantitative and qualitative variables describing both the sites used and others available nearby. Even though such a complete data base is not available to test hypotheses concerning determinants of fishing and hunting, this analysis will give insights into the practicality of pursuing this area of research.

The telephone screening survey used to determine participation for the 1975 National Survey of Hunting, Fishing and Wildlife Associated Recreation contains over 322,000 individual observations from 106,000 households. The screening questionnaire contains social and demographic characteristics of participants as well as non-participants in hunting and fishing. The sample includes approximately 2,000 households per state. A 10 percent sub-sample taken randomly from the telephone screening survey was used to test a limited set of hypotheses concerning the influence of policy variables on the probability that an individual would participate in hunting or fishing. Future projections of the significant variables in a probability equation will give an indication as to the expected direction of the trend for hunting and fishing.

The Model

It is hypothesized that the probability of an individual going hunting or fishing is associated with their social and demographic characteristics and the abundance of the areas where hunting and fishing take place in the individual's state of residence. A model for fishing and hunting is specified to account for the difference in hunting and fishing opportunities. Each equation is given below with the expected sign of the coefficients to be estimated.

$$\underset{\quad +}{\text{Fish}} = f(\underset{+}{\text{AGE}}, \underset{-}{\text{AGE}}^{2}, \underset{+}{\text{SEX}}, \underset{+}{\text{INC}}, \underset{-}{\text{METRO}}, \underset{+}{\text{HEAD}}, \underset{+}{\text{WATER}}, \underset{+}{\text{COAST}}, \underset{+}{\text{FOR}})$$

$$\underset{\quad +}{\text{Hunt}} = f(\underset{+}{\text{AGE}}, \underset{-}{\text{AGE}}^{2}, \underset{+}{\text{SEX}}, \underset{+}{\text{INC}}, \underset{-}{\text{METRO}}, \underset{+}{\text{HEAD}}, \underset{+}{\text{TREC}}, \underset{+}{\text{FOR}})$$

Where: Fish - the probability of going fishing in 1975, 1 for fishermen and 0 for non-fishermen

Hunt - the probability of going hunting in 1975, 1 for hunters, and 0 for non-hunters

The factors influencing the decision to either hunt or fish may not be fully captured by this limited set of variables. However, those variable that have policy significance (i.e., surface water, forested acres, recreation acres) are of the most interest from a management viewpoint. Table 3 contains the results of the estimation of the hunting and fishing equations. The equations were estimated with ordinary least squares. The dichotomous dependent variable violates the assumption of homoskedasticity of the error term ordinary least squares but the large sample size makes the cost of estimating the equations with probit or logit extremely expensive. The large sample size will minimize the OLS bias and for practical purposes the coefficients are not significantly different between OLS and logit

or probit. The findings of significance for the policy variables and the signs of the coefficients are of major interest at this stage in the analysis.

Table 3

The Probability of Fishing and Hunting in 1975

	(3)		(4)	
	Fishing	(t-value)	Hunting	(t-value)
Intercept	.098	(10.6)	-.067	(10.3)
AGE	.0089	(19.0)	.0087	(26.5)
AGE^2	-.00013	(23.2)	-.00012	(30.7)
SEX	.2204	(35.8)	.1886	(43.4)
INC	$-.29x10^{-6}$	(2.2)	$-.14x10^{-6}$	(1.5)
METRO	-.0479	(9.1)	-.0808	(21.8)
HEAD	.0155	(2.0)	.0758	(13.9)
WATER	.00003	(11.9)		
COAST	-.00012	(8.4)		
TREC			$.16x10^{-5}$	(6.8)
FOR	.0014	(3.7)	.0015	(6.2)
F-ratio	325.6		720.5	
$\bar{R}^2$	.0888		.1609	
N	30,072		30,072	
Age of Maximum Probability	33		35	

The results in table 3 indicate that the probability of going fishing is at a maximum at age 33. That is, the probability increases until age 33 and then decreases as indicated by the negative sign on the age-squared variable. The probability is increased for males and for residents of non-metropolitan areas. Also, for those who indicated they were the head of the household the probability of being a fisherman increased. The results for hunting are the same as for fishing up to this point except the age of maximum probability is 35. Income had a negative sign for both hunters and fishermen. It appears that from a cross-section of respondents to the telephone interview the probability of going hunting or fishing decreased with increasing income levels.

The probability of fishing was positively related to the square miles of surface water in the respondents state and the quantity of forested acres. The forested acres variable was included as a proxy variable for other outdoor activities that may substitute for fishing. The positive sign on FOR indicates that states with a relative abundance of forest lands have an increased probability of fishing activity. The COAST variable was significant with a negative sign indicating that for this cross section of respondents those from states with considerable coastline had a lower probability of going fishing. All other variables held constant, the probability of a Rhode Island resident going fishing is higher than for a resident of Maine.

Interpreting the results for hunting, the expected positive sign for FOR was statistically significant indicating that increased forest acreage increased the probability of hunting activities. However, the sign on TREC is also positive indicating that an increase in public recreation acreage increases the probability of hunting. This result may be related to the fact that many areas are managed for multiple use and the increase in acreage for public use may also serve as wildlife habitat for game species thereby increasing the probability of hunting.

Future Participation in Hunting and Fishing

The participation rates estimated for 1975 were 31.6 percent of the U.S. population for fishing and 13.5 percent for hunting. An analysis of some of key variables used in the participation equation will give some insights to future participation rates. Even though precision is not possible at this time at least a determination can be made as to the direction of the trend for the future. The variables used for this determination are AGE, METRO, WATER, FOR, AND TREC.

AGE

The median age of the U.S. population is gradually increasing. After the post WWII baby boom the birth rate began to slow down in the U.S. With increases in life expectancy the median age of the population in 1975 increased to approximately 29 years. For each 1 percent increase in the median age of the population the probability of going fishing will increase by .865 percent and hunting by 1.99 percent.

METRO

In recent years there has been a shift in the population growth rates of the metropolitan and non-metropolitan areas. The metropolitan areas have grown at a rate of 3.4 percent from 1970 to 1974 while non-metropolitan areas grew 5.5 percent during the same time period. This is a reversal in trend from the 1960's to 1970's that is expected to continue to the 1980's. For each 1 percent increase in non-metropolitan area population the probability of going fishing will increase by .046 percent and .252 percent for hunting.

WATER

The square miles of surface water for most

states varies only slightly over time. However, projects such as dams, canals, reservoirs, and man-made lakes are constantly being built. Most often such alterations of the landscape are a trade-off for running water at only a small net gain in surface acreage. For each 1 percent of net gain there is an increase in the probability of participation of .122 percent.

FOR

The trend in forested acreage across the country has been fairly constant for the past 10 years. Future demand for forest products may cause an increase in timber cutting. Increase in timber cutting and the shifting of private forest lands to other types of agricultural production may cause a decline in forested acres in the future. For each 1 percent loss of forest land the probability of going hunting will decrease by .117 percent. For fishing the probability will decrease by .047 percent.

TREC

The total acreage in publicly owned recreation lands which contains fish and game areas and natural wilderness that provide habitat for game species, is increasing over time. For each 1 percent increase in publicly owned recreation levels the probability of going hunting increases by .068 percent.

Summary

Over the next decade the U.S. population pyramid will show an increase in the number of U.S. residents in the age categories where participaution in hunting or fishing is a maximum. Also, the population growth of non-metropolitan areas is expected to continue, therefore there should be an increase in the number of U.S. residents that have the highest probability of going hunting or fishing. The factors that ultimately influence the actual participation are only partially captured by the changing availability of the activity in the individuals state of residence. Such factors as square miles of surface water, forested acerage and public recreation areas, which include fish and game areas and wildnerness areas, will contribute to increasing the participation in hunting and fishing in the future. However, the number of acres or miles of surface water, forests, or public recreation areas necessary to augment the current stock of these resources by 1 percent is not likely to have much impact on hunting or fishing over the next decade. The coefficients on these variables are trends only in an aggregate sense. However, if the specificity of these supply variables could be increased i.e., surface water of a specific type or quality and forested acres that are the habitats for specific game species, perhaps the coefficients would show a larger impact and affect trends for the future in a more discernable way.

The usefullness of adding policy variables that can be affected by resource management agencies has been shown to be a promising tool to aid in predicting the future of hunting and fishing activities. Further refinement of the model specified and more precise policy variables awaits the results of the 1980 National Survey of Fishing, Hunting, and Wildlife Associated Recreation. The use of 1980 Survey data will enable us to test the robustness of the model and any change over time in the structural parameters. This study is in the developmental stage and clearly more work needs to be done before reliable projections can be made.