

THE IMPACT OF LICENSE FEES ON PENNSYLVANIA TROUT ANGLERS' PARTICIPATION

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Abstract: This paper examines a recent policy change by the Pennsylvania Fish and Boat Commission with serious implications for angling participation. Due to water quality problems at its fish culture stations, the Commission reduced the number of catchable-sized trout stocked in 2002 in the state by 28% relative to recent years. In addition, the Commission has proposed a package of changes to the set of fishing license and permits sold in the state that includes increases in the costs of both a fishing license and a trout/salmon stamp.

This paper uses two approaches to explore current knowledge about the potential impacts of these changes on angling participation in the state. First, previous research done both in Pennsylvania and in other states is reviewed. Second, data on license sales in Pennsylvania over the last 30 years are analyzed using econometric models to estimate relationships between the size of the trout stocking program and license sales, and between license and stamp prices and license sales.

Introduction

Two upcoming changes could have serious implications for angling participation in Pennsylvania. First, beginning in 2002, the Pennsylvania Fish and Boat Commission will reduce the number of catchable-sized trout stocked in the state by 28% relative to recent years. Second, the Commission has proposed a package of changes to the set of fishing license and permits sold in the state that includes increases in the costs of both a fishing license and a trout/salmon stamp.

This paper reviews current knowledge about the potential impacts of these changes on angling participation in the state, specifically focusing on the effects of price increases. Two approaches are followed. First, previous research done both in Pennsylvania and in other states is reviewed. Second, data on license sales in Pennsylvania over the last 30 years are analyzed using econometric models to estimate relationships between license and stamp prices and license sales.

Historical Background on Trout Management in Pennsylvania

The Pennsylvania Fish and Boat Commission (earlier the Pennsylvania Fish Commission) has propagated and stocked trout since 1873. Up until the late 1960's and early 1970's, the Commission managed the trout fishery primarily as a put-and-take fishery, with little attention paid to the wild trout resource (Snyder, 1995). Prior to the early 1970's, trout stocking decisions (which waters received trout, and how many) were largely political, with less consideration given to differences among waters in angling pressure, access, or the ability of the waters to support the stocked fish. Beginning in 1973, a county quota system allocated hatchery production to each county, based on license sales in the county, amount of accessible water, and the population of the county. This occurred at the same time that total hatchery production was increasing dramatically (from 2.8 million catchable trout in 1970 to 4.3 million in 1975).

To make better use of this increased production, the Commission changed from a county-based Allocation approach to a resource-based allocation approach. Beginning in the mid 1970's, extensive inventories of the physical, chemical and biological characteristics of Pennsylvania waters were

conducted. This information was used to form the basis of a classification system, based on the ability of each water body to support wild trout. In this classification, the best trout waters are classified as Class A wild trout waters. To capitalize on the natural productivity of these waters, and prevent between wild trout and hatchery-produced trout, stocking was discontinued on these waters. Waters with less wild trout productivity, but that meet minimum requirements for size, access and water quality, are eligible for trout stocking.

The objective of the stocking program has since been to “provide recreation in those waters where wild trout populations are inadequate to sustain the fishery at desired levels.” (PA FBC 1997). Beginning in 1983, trout management has been conducted following consistent statewide guidelines, so that similar waters are managed the same way, regardless of where they are located in the state. Trout are allocated to individual waters based on the size of the water, public access, angler use, and the ability of the water to sustain the trout until they are harvested. The goal of the stocking program is to generate one angler use day for each stocked trout.

Background On Angler Participation And Trout Stocking In Pennsylvania Angling Activity

Two independent estimates of trout angling activity in Pennsylvania are available. According to the most recent National Survey of Fishing, Hunting and Wildlife-Related Recreation (USFWS 1998), Pennsylvania anglers participated in 18,635,000 angling days in 1996 (excluding Great Lakes angling). Of these, 8,861,000 angling days, or 48% of the total, were for trout. Resident anglers accounted for 93% of the trout angling days in the state. The Coldwater Unit of the PA Fish and Boat Commission (PFBC) has assembled estimates of trout angling days for various classes of stocked waters, collected in . An additional 279,000 angler days occur on delayed harvest streams (spring and fall combined). Finally, 1,514,000 angler days are spent on trout-stocked lakes annually. The PFBC estimates do not include trout angling on waters that are not stocked.

License Sales

The total number of fishing licenses issued increased approximately 43% between 1970 and

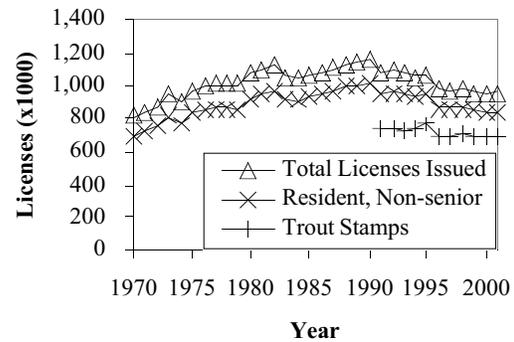


Figure 1. Annual Pennsylvania fishing license sales 1970-2000

1990, peaking at 1.164 million licenses in 1990 (Figure 1). Since 1990, issuances have declined 19% (216,000 licenses). Trout stamp sales have declined in a parallel manner, though the proportional decrease has been smaller. Much of the decline occurred in 1991 and 1996, years when license fees were increased. Over 70% of the decrease in sales since 1990 occurred in those two years. Senior lifetime licenses may also account for a significant portion of the decline. Senior annual license sales in 2000 were 66,000 fewer than in 1978, the year before senior lifetime licenses became available. Other potential factors, such as changes in the demographic makeup of Pennsylvania, do not help explain the decline in license sales (Ford 1997). For example, between 1990 and 2000, the age distribution of Pennsylvania residents has actually skewed toward the 35-54 year old age category, a range of ages at which Pennsylvanians tend to fish proportionately more.

License Prices and Fees

During the period 1970-2000, license prices and fees have increased five times. Figure 2 shows the total cost to purchase the regular license and stamp necessary to fish for trout, including license price and issuing fees. While the nominal (face-value) cost has increased four-fold, the real price (adjusted for inflation, and measured in year 2000 dollars) is actually 8% lower in 2000 than it was in 1970. Comparison of Figures 1 and 2 shows that fishing license issuances declined in every year that fishing license costs were increased. The average drop in license issuances in years of a cost increase was 7.1 percent.

License Revenues

Fishing license revenues, including all license types,

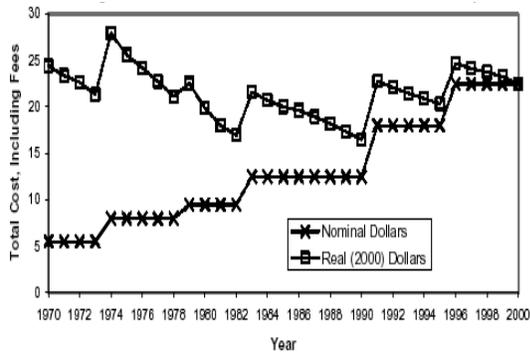


Figure 2. Total Cost of a Resident License and Trout Stamp

have increased steadily over the period 1970–2000 (Figure 3). Measured in real dollars, revenues have held fairly constant, with year-to-year fluctuations. Importantly, license revenues increased in every year that prices were increased.

Previous Studies of Angler Participation

A working hypothesis here is that the number of fish stocked in Pennsylvania waters will influence catch rates (or fishing success), and in turn influence angler satisfaction, and that this change in angler satisfaction will be reflected in a change in participation or license sales.

In a 1996 survey (Responsive Management, 1996b), Pennsylvania anglers expressed high levels of satisfaction with their fishing experiences. When asked about factors that took away from their satisfaction, 21% responded that “pollution or litter” detracted from their enjoyment, 18% responded “not enough game fish,” 18% said “interference from others,” and 16% reported “work obligations” kept them from enjoying fishing as much as they would have liked. Several other reasons were reported, but were attributed to smaller segments of the angler population.

Other studies indicate that angler satisfaction is due to several factors in addition to catch rate. Holland and Ditton (1992) examined fishing trip satisfaction in Texas. They narrowed their inventory of all dimensions of fishing trip satisfaction to six: 1) sense of freedom, 2) excitement, 3) competency, 4) relaxation, 5) enjoying the natural setting, and 6) reflection on past experience. They found that enjoyment of nature and sense of freedom were the two most important factors of satisfaction, followed by excitement and competency.

Hummon and Greene (1993) examined trout fishing in Pennsylvania. A random sample of 1600 anglers gave the following ranking of factors that are important to a satisfying fishing experience: 1) close to home, 2) nice environment, 3) special waters—clean water or good fishing holes, 4) uncrowded, 5) catch trout, and 6) stocked trout.

In 1997 survey (Heberling 1997), Pennsylvania anglers listed factors important to their choice of a fishing site. Nearly 60% of the respondents mentioned peace and quiet as a prominent factor. The next-most-often listed factors were (55%) an uncongested environment (55%), type of fish (45%), number of fish caught (39%) and nice scenery (35%).

A common finding, then, is that number of fish caught does contribute to fishing satisfaction, at least for some anglers, but is a less important determinant than other factors such as the physical setting of the fishing experience and social factors. It is still an open empirical question, however, whether fishing success impacts angler participation or license sales. Several studies, which are reviewed below, have investigated the factors that influence angler participation. Taken together, these studies suggest that license cost and the opportunity cost of time are more important determinants of angler participation than stocking rates or fishing success.

Two studies looked specifically for a link between stocking rates and aggregated license sales. Loomis (1999) found no statistical relationship between the two in an analysis of statewide license sales in California. Likewise, Loomis and Fix (1998) found no statistical relationship between statewide license sales and stocking levels in Colorado. Loomis and Fix did find, however, that intra-state regional differences in stocking levels were related to regional differences in fishing activity, as measured by angler days. Whether this relationship is the result of an inducement effect, where anglers in a region with higher stocking levels are induced to fish more frequently, by an attraction effect, where anglers travel to regions with highest stocking levels, or to a program delivery effect, where the state conservation agency stocks more heavily in areas where more fishing occurs, is unclear.

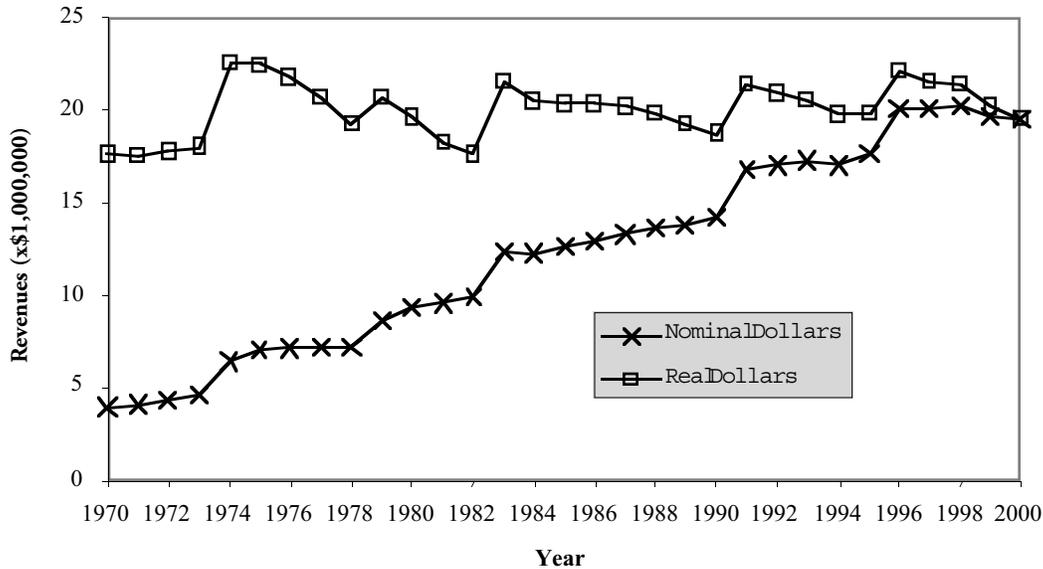


Figure 3. Fishing License Revenues

Two other studies have focused on the individual decisions made by active anglers whether to continue to fish. Fedler and Ditton (2001), in a survey of Texas anglers, found that while some half of the anglers surveyed fish consistently, year after year, the rest “drop in” and “drop out” over time. Most significantly, 25% of anglers who purchased a license in any given year were likely to not purchase a license within the next one or two subsequent years, with time constraints as the most-commonly cited reason for not participating.

In a 1996 survey, inactive anglers in Pennsylvania (anglers who had fished in 1995, but who did not buy a 1996 license) were asked their reasons for not buying a license (Responsive Management 1996a). Respondents were not prompted, and could list multiple reasons. The most common reason given was a lack of free time, due to work, family or other commitments. Only 8% of inactive anglers cited license cost as a reason for not buying a license. This even though the survey was conducted in the year following an increase in fishing license fees. Even fewer inactive anglers mentioned the quantity of fish (4%) or quality of fish (2%) as reasons for not buying a license.

A national survey conducted between 1993 and 1996 (Responsive Management 1996b) also asked inactive anglers their reasons for not buying a license. Here, anglers were read a list of potential

reasons, and asked how strongly each reason influenced their decision to not buy a license. Among inactive Pennsylvania anglers, the most commonly-cited factor was a loss of interest (62% said that loss of interest influenced their decision to no longer fish). Others in the top five reasons that respondents said influenced their decision included lack of free time, no one to fish with, and work and family obligations. Of particular interest to us is that 21% of the inactive anglers stated that the cost of licenses influenced their decision to no longer fish, while only 10% stated that the quantity of game fish available influenced their decision.

Finally, two studies looked specifically at the impact of license fees on angler participation. Teisl et al. (1999), in a study of anglers in New England, found that a one percent increase in the resident fishing license price will lead to a 0.05 percent decrease in resident license sales, while a one percent increase in nonresident fees will lead to a 2.83 percent decrease in sales. Sutton et al. (2001) found that an 18% increase in license price to a unique fishing spot in Texas will lead to a 10% drop in sales, implying a 0.55% drop per 1% increase in license price. This latter result must be interpreted with caution, since it involved purchase of a special permit to fish in one specific area, not a statewide license.

Analysis of Historical Participation

To determine the relationship between stocking rates and license sales, we analyzed license sales data from Pennsylvania over the last thirty-two years (1970-2001). The analysis was limited to resident, non-senior licenses, which consistently account for 87-89% of all license sales. Senior annual licenses are difficult to model because of the attrition process as anglers buy lifetime licenses. An analysis of non-resident license sales is complicated by the recent introduction of three- and 7- day tourist licenses.

To control for changes in population over the period, the number of licenses sold in each year was divided by the number of Pennsylvania residents between the ages of 16 and 64, generating a measure of licenses sold per capita. In 1970, the purchase rate was 9.7%. It peaked in 1990 at 13.4%, and has since declined to 10.7%.

Several factors were investigated to determine whether they influenced license sales, including license price, the unemployment rate (x100), per-capita personal income, and the number of adult trout stocked in Pennsylvania. License price includes issuing fees, as well as the cost of a trout stamp. While not all license holders purchase a trout stamp, the majority do. The unemployment rate was included as a measure of the opportunity cost of time, because anglers have reported that the amount of free time they have is an important determinant of participation in angling.

Tests showed that the license sales time series was non-stationary, meaning that an ordinary regression of license sales on the explanatory variables could lead to spurious results. Instead, regressions were conducted using first-differenced data. That means that the dependent variable in the regressions was the absolute change in per capita licenses sales (positive or negative) that occurred each year, relative to the year before. The explanatory variables were first-differenced as well (change in real price, change in unemployment, change in income, and change in stocking rate).

A second set of tests showed that the differenced data exhibited serial autocorrelation. A moving-average autoregressive model was therefore estimated. Regression results are shown in Table 1. The dependent variable is the annual absolute

change in resident licenses sold per capita. The regression R-square was 0.819. The regression standard error was 0.002123. The regression F statistic was 22.660.

The constant term and the trend term work together to determine the background level of change in license sales. The trend term is set so that it equals 1 in 1970. Thus, in the early part of the period 1970-2001, the background trend was positive—absent any change in price or unemployment, license sales tended to increase. In later years, the background trend turned negative.

Real per capita income was not a significant determinant of license sales, and was dropped from the regression.

Price is an important determinant of license sales. For each \$1 increase in the real price of a fishing license, resident license sales per capita dropped by 0.001709. In 2001, when the population of Pennsylvania between the ages of 16 and 64 was 7,770,000, this would translate into a decrease of 13,280 licenses. Expressed as a point elasticity, a 1% increase in the real price of a fishing license would result in a 0.36% decrease in resident licenses sales.

Table 1. — Regression results for Resident Licenses

Variable	Estimated Coefficient	Std. Error	t-Statistic
Constant	0.002166	0.001214	1.785
Trend	-0.000122	6.50E-05	-1.874
Trout Stocked	-9.90E-11	1.01E-09	-0.098
License Price	-0.001709	0.000139	-12.327
Unemployment	0.001036	0.000369	2.806
MA(1) Autoregr. coeff.	0.521108	0.184384	2.826

Unemployment was also a significant determinant of license sales, with higher unemployment leading to higher license sales. The magnitude of the effect was much less than for price changes. A one-point increase in the unemployment rate would result in an increase in resident license sales of 8,050, an increase of 1.0%.

The number of adult trout stocked was not a significant determinant of resident license sales.

This non-result held regardless of whether a trend variable was included in the regression, so it cannot be attributed to colinearity with the trend variable. Nor did the result change when the regression was run with longer lags, up to a four-year lag. Nor did the result change when biomass of fish stocked was used, instead of number of fish. From the 32 years of data used for the analysis, we have no statistical evidence that stocking rate influences license sales.

To summarize, the econometric analysis of historical license data showed that license price and the unemployment rate were significant determinants of license sales, but that the number of trout stocked each year was not. Still, for comparison purposes, we calculate the impact that a 1.4 million fish decrease in stocking would have on resident license sales. Because the estimated coefficient for trout stocked is negative, the expected impact of the stocking decrease is an increase in license sales per capita of 0.000138, which translates to an increase of 1072 licenses. The uncertainty associated with this estimate is high, however.

Conclusions

Two upcoming changes could have serious implications for angling participation in Pennsylvania. First, beginning in 2002, the Pennsylvania Fish and Boat Commission will reduce the number of catchable-sized trout stocked in the state by 28% relative to recent years. Second, the Commission has proposed a package of changes to the set of fishing license and permits sold in the state that includes increases in the costs of both a fishing license and a trout/salmon stamp. 2003. This paper reviews current knowledge about the potential impacts of potential price changes on angling participation in the state. Three sources of information are included. First, previous research done both in Pennsylvania and in other states is reviewed. Second, data on license sales in Pennsylvania over the last 30 years are analyzed using econometric models to estimate relationships between the size of the trout stocking program and license sales, and between license and stamp prices and license sales. Third, results from a survey of 611 resident trout anglers are presented.

Previous research on the impact of license price increases on angling participation (as measured by license sales) has given a consistent result. While an

increase in license price does reduce license sales, the sales reduction is proportionately small, so that revenues increase as a result of the license price increase. In contrast, previous research on the impact of trout stocking on angling participation has given a consistent non-result. No statistical relationship has been found between the quantity of trout stocked in a state and the number of resident fishing licenses sold in that state.

Pennsylvania data on license sales, license prices, and trout stocking levels from 1970 to 2000 were analyzed using econometric regression techniques. That analysis gave results that are consistent with previous research in other states. The analysis found no statistical relationship between the number of trout stocked in Pennsylvania and license sales, either resident or nonresident. The statistical precision of that result is low, however, due to limited data. Further, the analysis showed that a 1% increase in fishing license price results in a 0.36% to 0.37% decrease in license sales. We project that a \$10 increase in the price of a resident fishing license and trout stamp effective in 2003 would result in a decrease in the number of licenses sold in that year of 14%, but would result in an increase in license revenues of 26%.

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