U.S. Fish & Wildlife Service

# Trout Fishing in the U.S.

## *Addendum to the 1996 National Survey of Fishing, Hunting and Wildlife-Associated Recreation*

Report 96-4

# Trout Fishing in the U.S.

## *Addendum to the 1996 National Survey of Fishing, Hunting and Wildlife-Associated Recreation*

**Report 96-4**

**May 1999**

Genevieve Pullis
Division of Federal Aid
U.S. Fish and Wildlife Service
Washington, D.C.

and

Andrew Laughland
Division of Economics
U.S. Fish and Wildlife Service
Washington, D.C.

Division of Federal Aid
U.S. Fish and Wildlife Service
Washington, D.C. 20240
Director, Jamie Clark
Chief, Division of Federal Aid, Bob Lange

*This report is intended to complement the National and State reports from the 1996 National Survey of Fishing, Hunting, and Wildlife-Associated Recreation. The conclusions are the authors and do not represent official positions of the U.S. Fish and Wildlife Service.*

# Introduction

Trout fishing is one of the most popular types of fishing in the United States. In 1996, 31 percent of all freshwater anglers in the United States fished for trout. This report uses information from the 1996 National Survey of Fishing, Hunting and Wildlife-Associated Recreation (FHWAR) to describe trout fishing in the United States and the characteristics of trout anglers. For this report a trout angler is anyone 16 years of age and older who fished for trout at least once during the year. They may have fished for other species too. In this report, trout refers to all trout, including rainbow, brown, brook, lake, and so forth. Great Lakes trout fishing raises some different issues so it is not included in this report.

This report has five sections. The first section deals with the extent of participation in trout fishing. It presents the number of trout anglers and fishing days for the nation and by state. The second section discusses the demographic characteristics of trout anglers and compares them to other freshwater anglers and the overall U.S. population. The third section considers changes in trout fishing participation through time by comparing results for the 1991 and 1996 surveys. The fourth section develops a statistical model of trout fishing participation which predicts whether or not a freshwater angler will fish for trout or not, based on the person's demographic characteristics and residency. The final section summarizes the report.

*USFWS photo*

# Trout Fishing Participation Levels

As one of the most popular sport fish in the United States in 1996, trout were sought by 9 million freshwater anglers, 31 percent of all freshwater anglers (Table 1). In comparison, 12.7 million anglers (44 percent) fished for black bass, 8 million (28 percent) fished for panfish, 7.4 million (26 percent) fished for catfish and bullheads, and 6.4 million (22 percent) fished for crappie. Since anglers can fish for more than one species, the sum of the number of anglers by species is larger than the total number of anglers.

Anglers fished for trout on 94 million days for an average of 10 days per angler. Keeping in mind that anglers can fish for more than one species in a day, trout were sought on 19 percent of all freshwater fishing days.

Tables 2, 3, and 4 contain state-by-state estimates of trout fishing. These tables present fishing estimates in each state by residents and nonresidents combined.

The percent of freshwater anglers that fish for trout varied widely by state — from less than 6 percent in low participation states such as Alabama, Kentucky, Louisiana, Minnesota, and South Carolina to greater than 80 percent in Colorado, Idaho, Montana, Utah, Washington and Wyoming (Table 2). Generally, the Northeastern and Western states had the highest levels of participation in trout fishing. Southern and Midwestern states had the lowest levels of participation. An exception to this is West Virginia which has a relatively high participation rate (54 percent). This can be seen graphically in Figure 1 which shows the percent of anglers who fished for trout by state.

**Table 1. Freshwater Anglers and Days of Fishing by Type of Fish: 1996**
*(Population 16 years of age and older. Numbers in thousands. Excludes Great Lakes fishing.)*

| *Type of fish* | *Anglers* | | *Days of Fishing* | | *Average Days per Angler* |
|---|---|---|---|---|---|
| | *Number* | *Percent* | *Number* | *Percent* | |
| Total, all types of fish | 28,921 | 100 | 485,474 | 100 | 17 |
| Black bass (largemouth, smallmouth, etc.) | 12,708 | 44 | 191,350 | 39 | 15 |
| Trout | 8,974 | 31 | 93,566 | 19 | 10 |
| Panfish | 7,961 | 28 | 103,041 | 21 | 13 |
| Catfish and bullheads | 7,430 | 26 | 91,498 | 19 | 12 |
| Crappie | 6,363 | 22 | 91,031 | 19 | 14 |
| White bass, striped bass and striped bass hybrids | 4,756 | 16 | 61,386 | 13 | 13 |
| Anything | 4,218 | 15 | 39,035 | 8 | 9 |
| Another type of freshwater fish | 3,729 | 13 | 44,401 | 9 | 12 |
| Walleye and sauger | 3,276 | 11 | 48,726 | 10 | 15 |
| Salmon | 1,218 | 4 | 11,742 | 2 | 10 |
| Steelhead | 470 | 2 | 6,699 | 1 | 14 |

Note: Detail does not add to total because of multiple responses. Respondent identified “anything” from a list of categories of fish.

Columns one and two of Table 3 show the number of days spent freshwater fishing and fishing for trout. The third column shows the share of all freshwater days that anglers spent fishing for trout. These days do not represent fishing for trout exclusively; the anglers could have sought more than one species of fish on a day of fishing. The pattern of days trout fishing follows that of trout participation; anglers in Northeastern and Western states spend more days trout fishing than anglers in Southern and Midwestern states.

Table 4 shows the average number of days of freshwater and trout fishing by state. Nationally, anglers averaged 17 days of freshwater fishing and 10 days of trout fishing. States with the highest average days of trout fishing tended to be states in the Northeast where trout fishing is popular, such as Connecticut, New Jersey, Massachusetts and Rhode Island.

The average number of days anglers spent fishing for trout, by state, is shown graphically in Figure 2. Several states have no marking on them. The FHWAR Survey's sample sizes for these states were less than 10 so their average days are not judged reliable enough to include in the figure. The heavily shaded areas show states where the average number of trout fishing days is greater than or equal to 11. Moderate shading represents average days greater than or equal to 8 and less than or equal to 10. The lightly shaded states are states where the average days are less than or equal to 7.

**Table 2. Freshwater and Trout Anglers, by State Where Fishing Occurred: 1996**
*(Population 16 years of age and older. Numbers in thousands. Excludes Great Lakes fishing.)*

| State | Freshwater Anglers | Trout Anglers | |
|---|---|---|---|
| | | Number | Percent |
| United States | 28,921 | 8,974 | 31 |
| Alabama | 843 | *30 | *4 |
| Alaska | 313 | 111 | 35 |
| Arizona | 483 | 218 | 45 |
| Arkansas | 739 | 152 | 21 |
| California | 2,175 | 1,525 | 70 |
| Colorado | 787 | 699 | 89 |
| Connecticut | 318 | 168 | 53 |
| Delaware | 66 | *9 | *14 |
| Florida | 1,137 | ** | ** |
| Georgia | 967 | 160 | 17 |
| Hawaii | 22 | *6 | *27 |
| Idaho | 474 | 409 | 86 |
| Illinois | 1,123 | 74 | 7 |
| Indiana | 863 | ** | ** |
| Iowa | 477 | *48 | *10 |
| Kansas | 341 | ** | ** |
| Kentucky | 772 | *39 | *5 |
| Louisiana | 815 | *39 | *5 |
| Maine | 290 | 185 | 64 |
| Maryland | 319 | 89 | 28 |
| Massachusetts | 377 | 179 | 47 |
| Michigan | 1,311 | 204 | 16 |
| Minnesota | 1,421 | *72 | *5 |
| Mississippi | 487 | ** | ** |
| Missouri | 1,138 | 255 | 22 |
| Montana | 329 | 266 | 81 |
| Nebraska | 247 | 27 | 11 |
| Nevada | 219 | 159 | 73 |
| New Hampshire | 237 | 131 | 55 |
| New Jersey | 428 | 195 | 46 |
| New Mexico | 312 | 237 | 76 |
| New York | 1,111 | 468 | 42 |
| North Carolina | 1,009 | 197 | 20 |
| North Dakota | 90 | *6 | *7 |
| Ohio | 908 | *64 | *7 |
| Oklahoma | 891 | ** | ** |
| Oregon | 589 | 395 | 67 |
| Pennsylvania | 1,277 | 745 | 58 |
| Rhode Island | 72 | 39 | 54 |
| South Carolina | 716 | *38 | *5 |
| South Dakota | 213 | 42 | 20 |
| Tennessee | 767 | 120 | 16 |
| Texas | 2,147 | *141 | *7 |
| Utah | 397 | 341 | 86 |
| Vermont | 176 | 107 | 61 |
| Virginia | 761 | 239 | 31 |
| Washington | 768 | 628 | 82 |
| West Virginia | 323 | 174 | 54 |
| Wisconsin | 1,232 | *77 | *6 |
| Wyoming | 379 | 357 | 94 |

*Estimate based on small sample size.
**Sample size too small to report data reliably.

**Table 3. Days Freshwater and Trout Fishing, by State Where Fishing Occurred: 1996**
*(Excludes Great Lakes fishing.)*

| State | Days Fishing in Freshwater | Days of Trout Fishing | |
|---|---|---|---|
| | | Number | Percent |
| United States | 485,474 | 93,566 | 19 |
| Alabama | 14,256 | *101 | *1 |
| Alaska | 3,602 | 1,151 | 32 |
| Arizona | 4,689 | 1,579 | 34 |
| Arkansas | 9,661 | 635 | 7 |
| California | 28,987 | 16,291 | 56 |
| Colorado | 8,232 | 6,811 | 83 |
| Connecticut | 3,880 | 2,101 | 54 |
| Delaware | 980 | *114 | *12 |
| Florida | 18,409 | ** | ** |
| Georgia | 12,857 | 1,605 | 12 |
| Hawaii | 189 | *26 | *14 |
| Idaho | 4,411 | 3,324 | 75 |
| Illinois | 17,089 | 422 | 2 |
| Indiana | 13,456 | ** | ** |
| Iowa | 7,062 | *490 | *7 |
| Kansas | 6,355 | ** | ** |
| Kentucky | 9,631 | *413 | *4 |
| Louisiana | 18,493 | *259 | *1 |
| Maine | 4,107 | 2,149 | 52 |
| Maryland | 4,290 | 967 | 23 |
| Massachusetts | 6,746 | 2,891 | 43 |
| Michigan | 19,456 | 1,102 | 6 |
| Minnesota | 25,897 | *465 | *2 |
| Mississippi | 8,213 | ** | ** |
| Missouri | 14,682 | 2,052 | 14 |
| Montana | 2,617 | 2,100 | 80 |
| Nebraska | 3,004 | 219 | 7 |
| Nevada | 1,976 | 1,162 | 59 |
| New Hampshire | 3,139 | 1,412 | 45 |
| New Jersey | 6,021 | 2,476 | 41 |
| New Mexico | 2,836 | 2,046 | 72 |
| New York | 17,412 | 3,161 | 18 |
| North Carolina | 15,831 | 1,906 | 12 |
| North Dakota | 1,321 | *87 | *7 |
| Ohio | 12,878 | *220 | *2 |
| Oklahoma | 14,674 | ** | ** |
| Oregon | 7,117 | 3,524 | 50 |
| Pennsylvania | 18,635 | 8,861 | 48 |
| Rhode Island | 1,347 | 683 | 51 |
| South Carolina | 11,341 | *150 | *1 |
| South Dakota | 2,748 | 380 | 14 |
| Tennessee | 11,317 | 1,083 | 10 |
| Texas | 37,575 | *503 | *1 |
| Utah | 3,936 | 3,084 | 78 |
| Vermont | 1,951 | 888 | 46 |
| Virginia | 9,282 | 1,931 | 21 |
| Washington | 10,975 | 7,168 | 65 |
| West Virginia | 5,040 | 1,881 | 37 |
| Wisconsin | 14,398 | *658 | *5 |
| Wyoming | 2,415 | 2,118 | 88 |

*Estimate based on small sample size.
**Sample size too small to report data reliably.

**Figure 1. Percent of Freshwater Anglers Who Sought Trout**

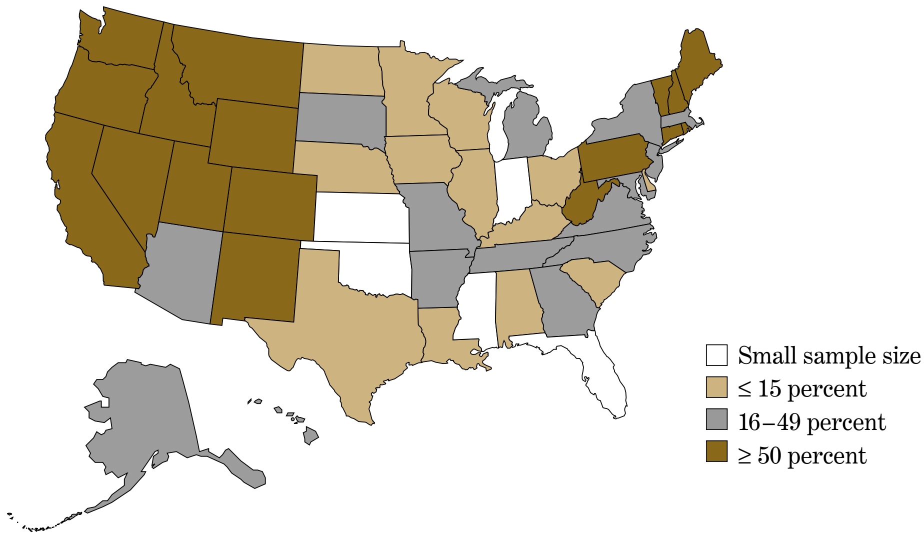
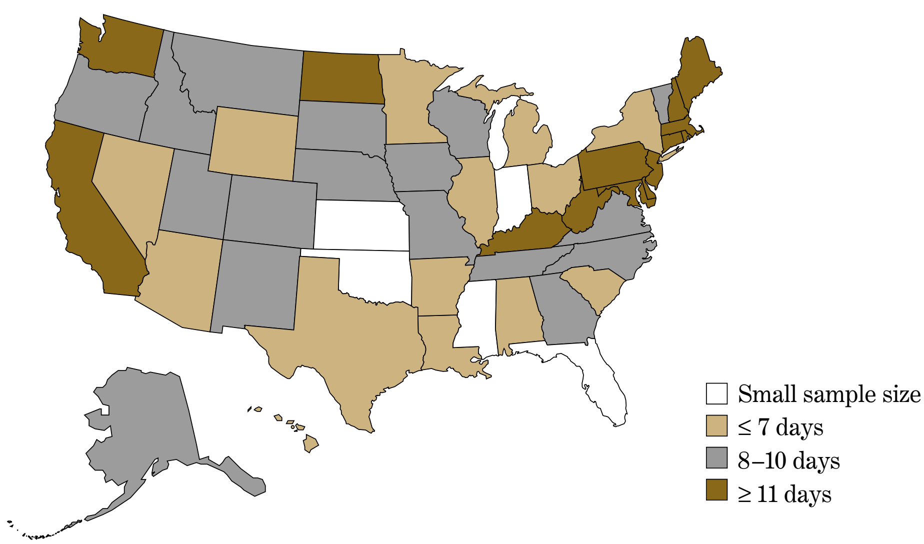



**Figure 2. Average Number of Trout Fishing Days**




The geographic distribution in Figure 2 (the average number of days anglers spent fishing for trout) is somewhat similar to Figure 1 which shows freshwater participation rates in trout fishing. In general, the comparison shows that states with the highest levels of trout days also tend to be the states with the highest levels of trout fishing participants. However, some Western states with high levels of participation had low average days of participation. For example, Wyoming had a low average day of trout fishing (6 days) yet the highest level of trout participation by freshwater anglers (94 percent). One explanation may be that anglers in these states are not avid anglers and therefore the number of days they fish for trout is low. This would lower the average for the state. Average days for all freshwater fishing is also low for Western states indicating that non-avidity is not confined to trout fishing but is true for freshwater fishing in general in some Western states.

Some states such as North Dakota and Delaware had high average days but low levels of angler participation. However, the sample sizes for these states are less than 25 which brings into question the reliability of those estimates.

**Table 4. Average Days Freshwater and Trout Fishing, by State Where Fishing Occurred: 1996**
*(Excludes Great Lakes fishing.)*

| *State* | *Average Days Freshwater* | *Average Days Trout* |
|---|---|---|
| United States | 16.7 | 10.5 |
| Alabama | 16.9 | *3.4 |
| Alaska | 11.5 | 10.4 |
| Arizona | 9.7 | 7.3 |
| Arkansas | 13.1 | 4.2 |
| California | 13.3 | 10.7 |
| Colorado | 10.5 | 9.8 |
| Connecticut | 12.2 | 12.6 |
| Delaware | 14.8 | *12.7 |
| Florida | 16.2 | ** |
| Georgia | 13.3 | 10.1 |
| Hawaii | 8.6 | *4.4 |
| Idaho | 9.3 | 8.2 |
| Illinois | 15.2 | 5.8 |
| Indiana | 15.6 | ** |
| Iowa | 14.8 | *10.3 |
| Kansas | 18.6 | ** |
| Kentucky | 12.5 | *10.6 |
| Louisiana | 22.7 | *6.7 |
| Maine | 14.2 | 11.7 |
| Maryland | 13.4 | 10.9 |
| Massachusetts | 17.9 | 16.2 |
| Michigan | 14.8 | 5.5 |
| Minnesota | 18.2 | *6.5 |
| Mississippi | 16.9 | ** |
| Missouri | 12.9 | 8.1 |
| Montana | 8.0 | 7.9 |
| Nebraska | 12.2 | 8.2 |
| Nevada | 9.0 | 7.4 |
| New Hampshire | 13.2 | 10.8 |
| New Jersey | 14.1 | 12.7 |
| New Mexico | 9.1 | 8.7 |
| New York | 15.7 | 6.8 |
| North Carolina | 15.7 | 9.7 |
| North Dakota | 14.7 | *14.5 |
| Ohio | 14.2 | *3.5 |
| Oklahoma | 16.5 | ** |
| Oregon | 12.1 | 9.0 |
| Pennsylvania | 14.6 | 11.9 |
| Rhode Island | 18.7 | 17.6 |
| South Carolina | 15.8 | *4.0 |
| South Dakota | 12.9 | 9.1 |
| Tennessee | 14.8 | 9.1 |
| Texas | 17.5 | *3.6 |
| Utah | 9.9 | 9.1 |
| Vermont | 11.1 | 8.3 |
| Virginia | 12.2 | 8.1 |
| Washington | 14.3 | 11.5 |
| West Virginia | 15.6 | 10.9 |
| Wisconsin | 11.7 | *8.6 |
| Wyoming | 6.4 | 6.0 |

*Estimate based on small sample size.
**Sample size too small to report data reliably.

# Characteristics of Trout Anglers

Freshwater fishing is a very popular activity with nearly 14 percent of the U.S. population 16 years of age and older participating in 1996. Thirty-one percent of all freshwater anglers fished for trout, nearly 4 percent of the U.S. population 16 years of age and older. In the following pages we present a comparison of freshwater anglers and trout anglers to the U.S. population by age, sex, education, income, geographic region, and population density of residence.

Tables 5 through 10 show the proportion of the population that participates in each activity for each category (e.g., what proportion of the 45-54-year-old U.S. population fishes in freshwater and what proportion of the 45-54-year-old freshwater anglers trout fishes). The columns labeled "Percent" in tables 5 through 10 show the percent of participants in each activity by category (e.g., what percent of all freshwater anglers were 45-54 years old). Because of the relatively large sample sizes for national estimates, differences in characteristics that are 3 percent or larger are usually significant at the 90 percent confidence level.[1]

**Age**

Trout fishing appeals to all age groups. At least 29 percent of all freshwater anglers in all age categories fished for trout (Table 5). However, most trout anglers fall between the ages of 25 and 54 (68 percent) with people between the ages of 35 and 44 (27 percent) comprising the single largest cohort of trout anglers.

Comparing trout anglers to the U.S. population shows that trout anglers were younger than the general population. Fifty percent of trout anglers were between 25 and 44 while only 41 percent of the general population were in this age group. The percent of trout anglers 55 and older (17 percent) is lower than that of the U.S. population in that category (28 percent). Trout anglers and freshwater anglers had a similar age distribution.

**Sex**

Seventy-eight percent of trout anglers were male. This is disproportionately high compared to the U.S. population, where women were the majority at 52 percent (Table 6). The percent of male trout anglers (78 percent) was also higher than the percent of all male freshwater anglers (74 percent).

While many females 16 years of age and older participated in freshwater fishing (7.6 million), this was only 7 percent of

[1] This means that for 90 percent of all possible samples, percentage differences 3 percent or greater are reliable indicators of differences.

**Table 5. Age Distribution of the U.S. Population, Freshwater Anglers, and Trout Anglers: 1996**
*(Population 16 years of age and older. Numbers in thousands. Excludes Great Lakes fishing.)*

| | *U.S. Population* | | *Freshwater Anglers* | | | *Trout Anglers* | | |
|---|---|---|---|---|---|---|---|---|
| *Age* | *Number* | *Percent* | *Number* | *Percent* | *Percent of U.S. Population* | *Number* | *Percent* | *Percent of Freshwater Anglers* |
| U.S. Total | 201,472 | 100 | 28,921 | 100 | 14 | 8,974 | 100 | 31 |
| 16-17 | 7,222 | 4 | 1,224 | 4 | 17 | 369 | 4 | 31 |
| 18-24 | 25,120 | 12 | 3,493 | 12 | 14 | 1,014 | 11 | 29 |
| 25-34 | 40,918 | 20 | 7,037 | 24 | 17 | 2,047 | 23 | 29 |
| 35-44 | 42,600 | 21 | 7,632 | 26 | 18 | 2,443 | 27 | 32 |
| 45-54 | 31,204 | 15 | 4,806 | 17 | 15 | 1,579 | 18 | 33 |
| 55-64 | 21,213 | 11 | 2,610 | 9 | 12 | 831 | 9 | 32 |
| 65+ | 33,670 | 17 | 2,399 | 8 | 7 | 716 | 8 | 30 |

Note: Data may differ from previous reports due to ratio adjustments of age cohorts. Detail does not add to total due to rounding.

**Table 6. Sex Distribution of the U.S. Population, Freshwater Anglers, and Trout Anglers: 1996**
*(Population 16 years of age and older. Numbers in thousands. Excludes Great Lakes fishing.)*

| | *U.S. Population* | | *Freshwater Anglers* | | | *Trout Anglers* | | |
|---|---|---|---|---|---|---|---|---|
| *Sex* | *Number* | *Percent* | *Number* | *Percent* | *Percent of U.S. Population* | *Number* | *Percent* | *Percent of Freshwater Anglers* |
| U.S. Total | 201,472 | 100 | 28,921 | 100 | 14 | 8,974 | 100 | 31 |
| Male | 96,660 | 48 | 21,371 | 74 | 22 | 7,045 | 78 | 33 |
| Female | 104,812 | 52 | 7,550 | 26 | 7 | 1,929 | 22 | 26 |

the female population in the United States. In comparison, 22 percent of the male population 16 years of age and older participated in freshwater fishing. In addition, female anglers were less likely to participate in trout fishing than male anglers. Female freshwater anglers participated in trout fishing at a rate of 26 percent while male freshwater anglers participated at a rate of 33 percent. As a result, females made up 26 percent of freshwater anglers and 22 percent of trout anglers.

**Education**

People of all educational levels participated in trout fishing although trout anglers tend to have completed more years of education than the U.S. population and than all freshwater anglers. Table 7 shows that 17 percent of Americans 16 years of age and older had not completed high school. Only 11 percent of trout anglers had not completed high school. Fourteen percent of all freshwater anglers fell into this category. A higher proportion of trout anglers had 4 years or more of college (31 percent) compared to the U.S. population (25 percent). Twenty-six percent of all freshwater anglers had 4 years or more of college.

Freshwater anglers' participation in trout fishing increased with a rise in the level of education — from 25 percent for anglers with less than 12 years of education to 37 percent for anglers with 4 or more years of college.

**Income**

In 1996, the median household income for the U.S. was slightly more than $35,000. Freshwater anglers had higher incomes than the U.S. population. Fifty-five percent lived in households with annual incomes $35,000 and greater (Table 8). For trout anglers, an even greater proportion (59 percent) came from households with incomes above the national median income. Households with incomes below the median accounted for 33 percent of all freshwater anglers and 30 percent of trout anglers. Twelve percent of all freshwater anglers and 11 percent of trout anglers lived in households where income was not reported.

At least 25 percent of all freshwater anglers in each income category fished for trout. Freshwater anglers from households earning less than $10,000 a year participated in trout fishing at a rate of 25 percent. Freshwater anglers from households earning more than $100,000 had the highest participation rate, 38 percent. The next highest participation rate for trout fishing by freshwater anglers is the $75,000-$99,900 income category with 36 percent. Freshwater anglers from homes not reporting their income participated in trout fishing at a rate of 29 percent. Nineteen percent of all respondents did not report their household income.

**Table 7. Educational Distribution of the U.S. Population, Freshwater Anglers, and Trout Anglers: 1996**

*(Population 16 years of age and older. Numbers in thousands. Excludes Great Lakes fishing).*

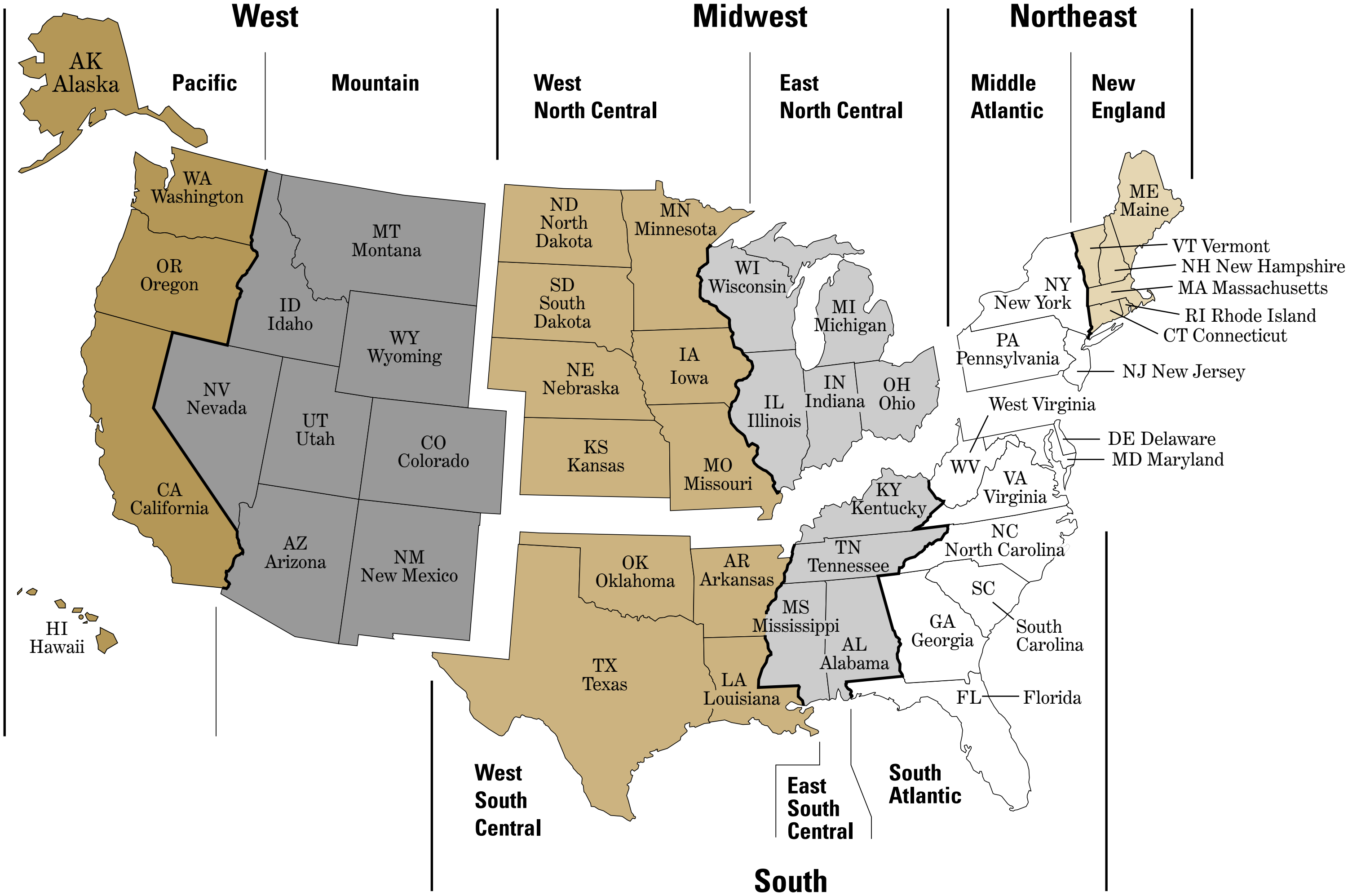
| | U.S. Population | | Freshwater Anglers | | | Trout Anglers | | |
|---|---|---|---|---|---|---|---|---|
| *Education* | *Number* | *Percent* | *Number* | *Percent* | *Percent of U.S. Population* | *Number* | *Percent* | *Percent of Freshwater Anglers* |
| U.S. Total | 201,472 | 100 | 28,921 | 100 | 14 | 8,974 | 100 | 31 |
| 0-11 Years | 33,743 | 17 | 3,959 | 14 | 21 | 981 | 11 | 25 |
| 12 Years | 71,098 | 35 | 10,470 | 36 | 15 | 3,079 | 34 | 29 |
| 1-3 Years College | 45,573 | 23 | 7,017 | 24 | 15 | 2,144 | 24 | 31 |
| 4+ Years College | 51,057 | 25 | 7,474 | 26 | 29 | 2,770 | 31 | 37 |

**Table 8. Income Distribution of the U.S. Population, Freshwater Anglers, and Trout Anglers: 1996**

*(Population 16 years of age and older. Numbers in thousands. Excludes Great Lakes fishing).*

| | U.S. Population | | Freshwater Anglers | | | Trout Anglers | | |
|---|---|---|---|---|---|---|---|---|
| *Household Income* | *Number* | *Percent* | *Number* | *Percent* | *Percent of U.S. Population* | *Number* | *Percent* | *Percent of Freshwater Anglers* |
| U.S. Total | 201,472 | 100 | 28,921 | 100 | 14 | 8,974 | 100 | 31 |
| Under $10,000 | 15,043 | 7 | 1,164 | 4 | 8 | 291 | 3 | 25 |
| $10-19,900 | 19,690 | 10 | 2,199 | 8 | 11 | 602 | 7 | 27 |
| $20-24,900 | 13,080 | 6 | 1,852 | 6 | 14 | 521 | 6 | 28 |
| $25-29,900 | 12,337 | 6 | 2,287 | 8 | 19 | 591 | 7 | 26 |
| $30-34,900 | 12,572 | 6 | 2,054 | 7 | 16 | 616 | 7 | 30 |
| $35-39,900 | 10,653 | 5 | 1,999 | 7 | 19 | 587 | 6 | 29 |
| $40-49,900 | 18,274 | 9 | 3,581 | 12 | 20 | 1,150 | 13 | 32 |
| $50-74,900 | 32,223 | 16 | 5,988 | 21 | 19 | 1,997 | 22 | 33 |
| $75-99,900 | 28,835 | 7 | 2,444 | 8 | 16 | 868 | 10 | 36 |
| $100,000 or More | 13,756 | 7 | 1,968 | 7 | 14 | 756 | 8 | 38 |
| Not Reported | 38,774 | 19 | 3,394 | 12 | 9 | 994 | 11 | 29 |

**Figure 3. Map of U.S. Showing Bureau of Census Regions**




**Census Geographic Region**
Table 9 shows the distribution of all freshwater and trout anglers by Census Geographic Divisions. These geographic regions are defined in Figure 3. As the state-by-state analysis suggests, the regions with the greatest share of trout anglers are the Mountain (21 percent) and Pacific (29 percent) regions. This geographical distribution is quite different from that of total freshwater anglers. Only 8 percent of total freshwater anglers live in the Mountain region and 12 percent in the Pacific. Also, although the East North Central region has one of the largest shares of freshwater anglers (17 percent), only 6 percent of trout anglers live in this region.

Overall, 31 percent of all freshwater anglers fished for trout. The percentage of freshwater anglers participating in trout fishing by region varied from a low of 9 percent in the East South Central to highs of 81 and 72 percent in the Mountain and Pacific regions respectively. The New England and Middle Atlantic regions also had high levels of participation (61 and 51 percent, respectively).

**Population Density of Residence**
The 1996 FHWAR asked respondents whether they considered their place of residence to be a big city or urban area, a small city or town, or a rural area. These categories were *not* defined for the respondent (e.g., by big city we mean “a city with a population of 500,000 or more”). Consequently, one respondent may consider an area to be a small city while another resident may consider the same area a big city. Therefore, the results discussed below should be viewed from the perspective of where the respondents classified themselves as living and not some generally assigned definition for the size of a big city, small city or rural area.

As a percent of the U.S. population, people in rural areas participated in freshwater fishing almost twice as much as residents of big cities, 21 percent versus 11 percent (Table 10). As a percent of total freshwater anglers, the largest number of participants are residents of small cities and towns (41 percent). Similarly, as a percent of total trout anglers, most trout anglers are from small cities and towns (42 percent).

**Table 9. Geographic Distribution of the U.S. Population, Freshwater Anglers, and Trout Anglers: 1996**
*(Population 16 years of age and older. Numbers in thousands. Excludes Great Lakes fishing.)*

| Region | U.S. Population | | Freshwater Anglers | | | Trout Anglers | | |
|---|---|---|---|---|---|---|---|---|
| | Number | Percent | Number | Percent | Percent of U.S. Population | Number | Percent | Percent of Freshwater Anglers |
| U.S. Total | 201,472 | 100 | 28,921 | 100 | 14 | 8,974 | 100 | 31 |
| New England | 10,306 | 5 | 1,143 | 4 | 11 | 694 | 8 | 61 |
| Middle Atlantic | 29,371 | 15 | 2,529 | 9 | 9 | 1,289 | 14 | 51 |
| E. North Central | 33,121 | 16 | 4,963 | 17 | 15 | 531 | 6 | 11 |
| W. North Central | 13,875 | 7 | 3,244 | 11 | 23 | 464 | 5 | 14 |
| South Atlantic | 36,776 | 18 | 4,774 | 17 | 13 | 942 | 10 | 20 |
| E. South Central | 12,459 | 6 | 2,339 | 8 | 19 | 199 | 2 | 9 |
| W. South Central | 21,811 | 11 | 4,046 | 14 | 19 | 417 | 5 | 10 |
| Mountain | 11,966 | 6 | 2,283 | 8 | 19 | 1,854 | 21 | 81 |
| Pacific | 31,787 | 16 | 3,599 | 12 | 11 | 2,584 | 29 | 72 |

**Table 10. Population Density Distribution of the U.S. Population, Freshwater Anglers, and Trout Anglers: 1996**
*(Population 16 years of age and older. Numbers in thousands. Excludes Great Lakes fishing.)*

| Density of Location | U.S. Population | | Freshwater Anglers | | | Trout Anglers | | |
|---|---|---|---|---|---|---|---|---|
| | Number | Percent | Number | Percent | Percent of U.S. Population | Number | Percent | Percent of Freshwater Anglers |
| U.S. Total | 201,472 | 100 | 28,921 | 100 | 14 | 8,974 | 100 | 31 |
| Big City/Urban | 73,480 | 36 | 8,013 | 28 | 11 | 2,680 | 30 | 33 |
| Small City/Town | 83,720 | 42 | 11,978 | 41 | 14 | 3,736 | 42 | 31 |
| Rural | 42,976 | 21 | 8,883 | 31 | 21 | 2,555 | 28 | 29 |
| No Response | 1,295 | 1 | 47 | 0 | 4 | 3 | 0 | 6 |

# 1991–1996 Comparison of Trout Fishing Activity

From 1991 to 1996 the estimated number of freshwater anglers changed slightly from 30.2 million to 28.9 million. Similarly, the number of trout anglers remained almost the same — 9.1 million in 1991 and 9.0 million in 1996. Both of these changes are within the margin of error for the estimates at the 95 percent confidence level so we cannot be sure that the number of anglers actually decreased.[2] However, fishing activity as measured by fishing days has increased. All freshwater fishing days rose 13 percent and trout fishing days increased 7 percent. Corresponding with this, the average fishing days per angler increased for all freshwater anglers from 14 days in 1991 to 17 days in 1996, and for trout anglers from 9 days in 1991 to 10 days in 1996. This indicates that all freshwater and trout anglers are not increasing in number of participants but that they are more avid, that is, they spend more time fishing per person.

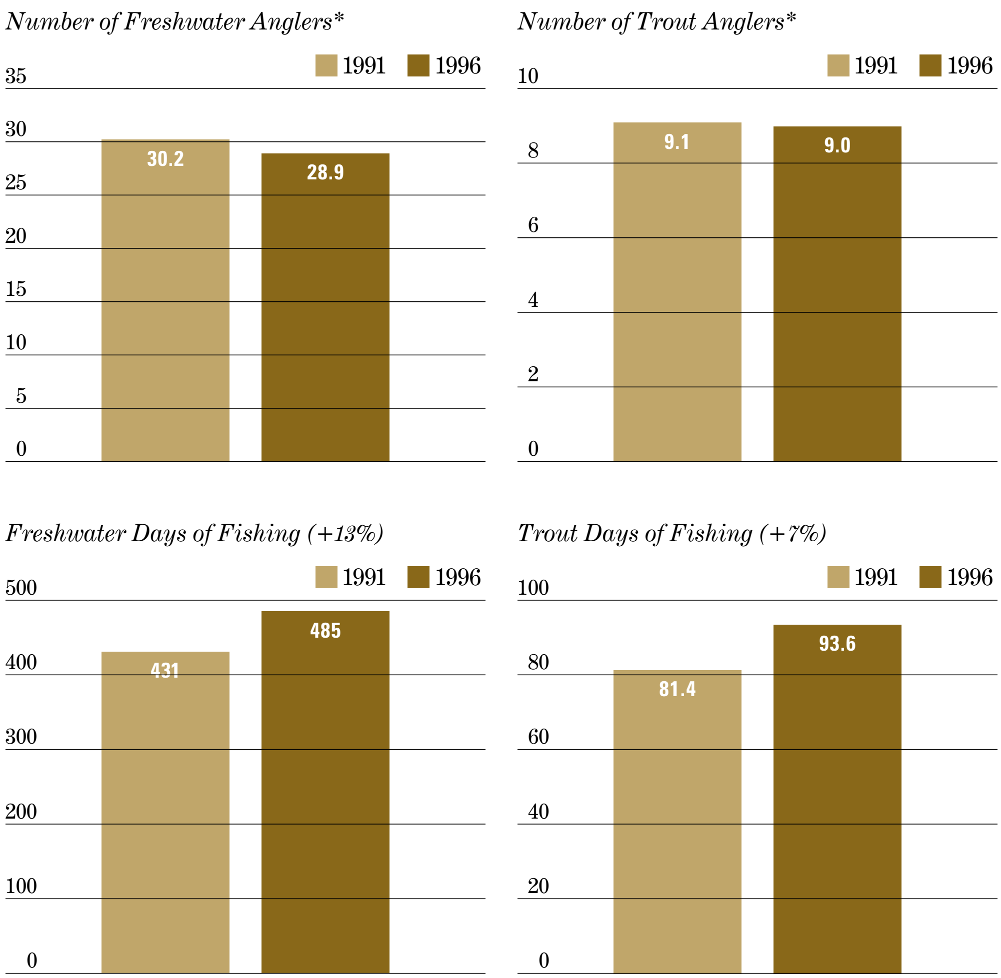
One explanation for the increase in the number of days is that the average angler was older in 1996 than he was in 1991 and consequently may have had more leisure time. As shown in Figure 5, the numbers of all freshwater anglers between the ages of 35 and 54 increased from 36 percent in 1991 to 43 percent in 1996. Trout anglers between these ages increased from 37 percent in 1991 to 45 percent in 1996. The aging of anglers is related to the aging of the "Baby Boom" generation. The U.S. population between the ages of 35 and 54 increased from 33 percent in 1991 to 37 percent in 1996.

[2] This means that for 95 percent of all possible samples, the estimates for the number of all freshwater and trout anglers in 1991 are not different from the estimates for 1996.

**Table 11. 1991-1996 Comparison of Activity: Participants and Days of Fishing**
*(Population 16 years of age and older. Numbers in thousands. Excludes Great Lakes fishing.)*

| *Participants and Days* | *1991 Number* | *1996 Number* | *Percent Change* |
|---|---|---|---|
| Anglers, All Freshwater | 30,186 | 28,921 | * – 4.0 |
| Anglers, Trout | 9,107 | 8,974 | * – 1.5 |
| Days, All Freshwater | 430,922 | 485,474 | 13.0 |
| Days, Trout | 81,366 | 93,566 | 7.0 |

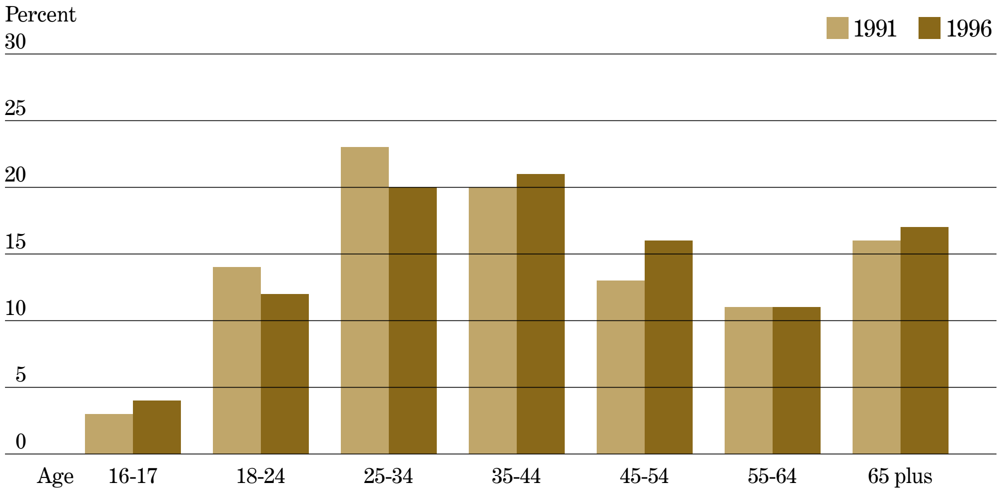
**Figure 4. 1991-1996 Participants and Days**
*(In millions)*



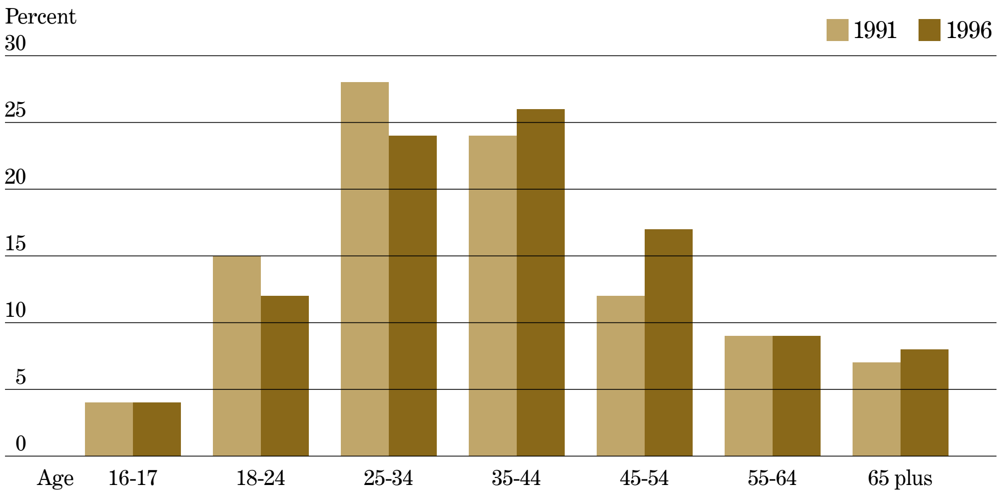

* The difference is within the margin of error of the estimates at the 0.05 level of significance. This means that for 95 percent of all possible samples, the estimates for the number of freshwater and trout anglers in 1991 are not different from the respective estimates for 1996.

**Figure 5. 1991-1996 Comparison of Age Distribution of the U.S. Population, Freshwater Anglers and Trout Anglers**
*(Population 16 years of age and older. Excludes Great Lakes fishing.)*

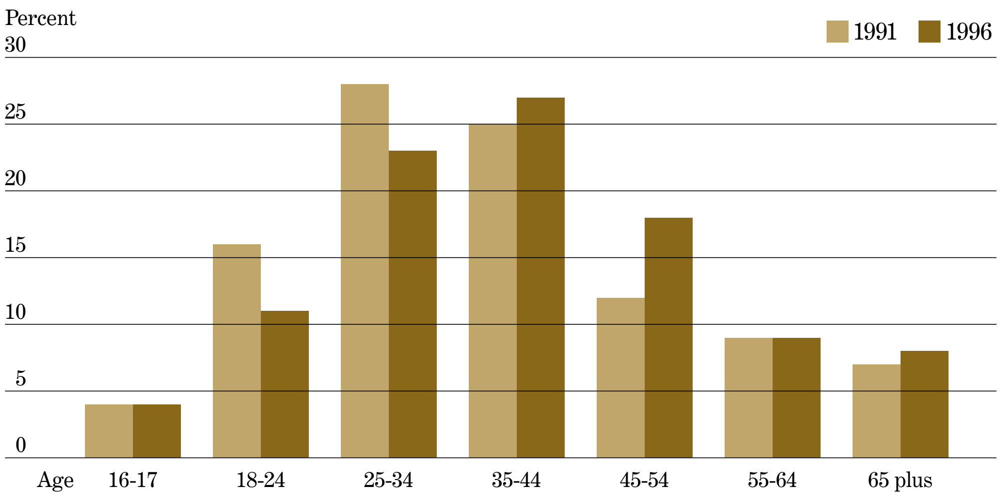
*Percent of U.S. Population, by Age*




*Percent of Freshwater Anglers, by Age*




*Percent of Trout Anglers, by Age*




Note: Data may differ from previous reports due to ratio adjustments for age cohorts.
Detail does not add to total due to rounding.

# Participation Model

The descriptive statistics presented in the previous section show that trout anglers are different from all freshwater anglers in some ways. These descriptive characterizations of anglers have limitations. First, without conducting the appropriate statistical test, it is impossible to determine whether an observed difference between two groups is statistically significant. However, because of the relatively large sample sizes for national estimates, differences in characteristics that are 3 percent or larger are usually significant at the 90 percent confidence level. Second, even if the difference was statistically significant, the isolated effect of the characteristic on an angler's decision to fish for trout cannot be measured. For example, in the general population, income level is correlated with gender. The previous section found participation in trout fishing is also correlated with gender. This raises the question: Were men more likely to have fished for trout because of their gender or because they were more likely than women to come from households with higher income levels? A participation model may be used to analyze this type of question.

The probability of fishing for trout was estimated to predict what sort of angler was most likely to fish for trout and to evaluate the isolated effects of sociodemographic and other factors on that decision. In participation models, the effect of a particular characteristic is calculated in an "other things being equal" context. In the example above, this procedure removes the confounding effects of the correlation between gender and income to show how each characteristic contributes to participation in trout fishing.

The model hypothesizes that a freshwater angler's decision whether or not to fish for trout, given that he or she already fishes in freshwater, depends on the angler's sociodemographic characteristics, whether the angler fished more than average, the region of the country where he or she resides, and the water quality (WQ) of rivers and streams in the respondent's state of residence. The RiverWQ variable represents the percentage of river and stream shore miles described by the EPA as "good water quality that fully supports aquatic life uses." Data for this variable were taken from the Environmental Protection Agency's 1996 National Water Quality Inventory biennial report to Congress. These data are based on information collected and evaluated by the states in 1994 and 1995.[3]

The participation variable is one if the angler fished for trout and zero if he or she did not fish for trout. This type of yes or no response is modeled in the logarithm of the odds that the individual fished for trout. This is called the logit equation and appears on the left side of equation 1. Equation 1 shows the model estimated.

$$\ln \frac{P_i}{(1-P_i)} = \alpha + \beta x_i \qquad (1)$$

where:

$P_i$ = Probability that the i-th individual fished for trout

$x_i$ = Vector of explanatory variables

$\alpha$ = Intercept to be estimated

$\beta$ = Vector of coefficients to be estimated

The explanatory variables, $x_i$, were a combination of binary and continuous

[3] States do not use identical survey methods and criteria to rate their water quality. There are no data available for Alaska, Oregon and Idaho.

**Table 12. Explanatory Variables in the Trout Fishing Model**

| *Variable* | *Description* | *Mean* |
|---|---|---|
| Income | Annual household income, in thousands of dollars | 49.5 |
| Urban | 1 if respondent indicates urban residence<br>0 otherwise | 0.28 |
| Female | 1 if respondent is female<br>0 otherwise | 0.26 |
| Avid | 1 if respondent fished 20 days or more<br>0 otherwise | 0.22 |
| African-American | 1 if respondent's ethnicity is African-American<br>0 otherwise | 0.05 |
| Hispanic | 1 if respondent's ethnicity is Hispanic<br>0 otherwise | 0.03 |
| Northeast | 1 if respondent resided in the Northeast[4]<br>0 otherwise | 0.39 |
| South | 1 if respondent resided in the South[5]<br>0 otherwise | 0.39 |
| West | 1 if respondent resided in the West[6]<br>0 otherwise | 0.20 |
| RiverWQ | Percent of river and stream miles reported to have good water quality that fully supports aquatic life.[7] | 55.7 |

[4] Northeast includes Middle Atlantic and New England regions as defined by the U.S. Census Bureau. See Figure 3.

[5] South includes the West South Central, East South Central, and South Atlantic regions as defined by the U.S. Census Bureau. See Figure 3.

[6] West includes Mountain and Pacific regions as defined by the U.S. Census Bureau. See Figure 3.

[7] Data from EPA's National Water Quality Inventory: 1996 Report to Congress.

variables. They are described in Table 12. The means of the binary variables repeat some of the percentages reported earlier. For example, 26 percent of freshwater anglers are women. The region of residence provides a rough indicator of the availability and quality of trout fishing sites.

Table 13 shows the model estimated from a nationwide sample of 7,984 freshwater anglers. All variables were significant at the 1 percent level except income which was significant at the 5 percent level. Variables for age and retired anglers initially included in the model were excluded after chi-square likelihood ratio tests determined that their coefficients were not significantly different from zero and therefore did not provide additional predictive power to the model.

The likelihood ratio index can be interpreted in a similar way as a multiple correlation coefficient ($R^2$) in ordinary least squares regression. The index value of 0.15 indicates that the equation explains about 15 percent of variation in the logit, which is typical of recreation models. The equation shows that the probability of fishing for trout increases with income and urban residence, other things being equal. It also shows that anglers who fish 20 days or more, or who live in the West or Northeast, have a higher probability of fishing for trout. Hispanic anglers are more likely to trout fish. Female anglers, African-American anglers and anglers who live in the South were less likely to fish for trout, other things being equal.

The equation also shows that the probability of anglers fishing for trout increases with the water quality of rivers. This result makes intuitive sense as trout fishing would be more desirable when water quality is good.

The estimated coefficients do not provide a direct measure of how the explanatory variables affect the probability that a freshwater angler will fish for trout. The coefficients show the effect of the variable on the logarithm of the odds ratio. To get around this, partial derivatives were calculated at the means of the continuous variables with all dichotomous choice variables equal to zero to show how each variable affects the probability of fishing for trout. The partial derivatives shown in Table 13 can be used to make statements like "being a resident of a Western state increases the probability of fishing by 40 percent." The partial derivatives in Table 14 show a change from a base case of a non-African-American, non-Hispanic male, with average income who lives in a Midwestern state with average river water quality.

The whole equation can also be reevaluated to make more complex comparisons. For example, a non-urban, male, African-American angler residing in a Southern state has a 3 percent chance of fishing for trout, while an urban, avid, Hispanic male angler residing in the West has a 91 percent chance of fishing for trout. Because the model predicts the log of the odds ratio, the calculation of these probabilities is rather involved. A note at the end of this document explains the calculation.

The results show that gender, race, region of residence, avidity, income and water quality have significant impacts on the probability of trout fishing. The effects of income and water quality are not as strong as the other explanatory variables. For example, a $1,000 increase in income or a 1 percent increase in river water quality increased the probability of participation by less than one percent.

**Table 13. Logit Equation Results for Trout Fishing Model**

| *Variable* | *Estimated Coefficient* | *Standard Error* | *Partial Derivative* |
|---|---|---|---|
| Intercept | –1.635 | 0.095 | — |
| Income* | 0.002 | 0.001 | 0.0004 |
| Urban | 0.236 | 0.061 | 0.0417 |
| Female | –0.220 | 0.064 | –0.0389 |
| African-American | –1.067 | 0.165 | –0.1889 |
| Hispanic | 0.729 | 0.159 | 0.1290 |
| Avid | 0.311 | 0.064 | 0.0551 |
| South | –1.170 | 0.107 | –0.2071 |
| West | 2.236 | 0.091 | 0.3958 |
| Northeast | 1.152 | 0.087 | 0.2040 |
| RiverWQ | 0.006 | 0.001 | 0.0010 |

Pseudo $R^2$ = 0.153

All variables significant at the 0.01 level.

* in thousands

### Note on Calculation Probabilities of Participation from the Trout Participation Model

Equation 1 (page 12) can be solved for the individual's probability of participation in trout fishing, $P_i$, as

$$P_i = \frac{e^{\alpha + \beta x_i}}{(1+e^{\alpha + \beta x_i})} \quad (2)$$

As they appear in both the numerator and the denominator of this equation, the interpretation of the coefficients (or "Betas") shown in equation 2 is not direct. An individual's probability of participation can be calculated using the coefficients in equation 2 and a scientific calculator or a spreadsheet. Table 15 illustrates the process for an urban, avid, male, Hispanic angler from the West.

1. First, determine the values you wish to use for each independent variable. The intercept is α and is constant. For the example, we assume average income, 49.5 (in thousands) and average water quality of rivers (55.7 percent). The rest of the variables are dichotomous, i.e., equal to one if the statement is true and 0 if it is false. Notice that Northeast – South – West, and African-American – Hispanic are mutually exclusive, if one is true the other cannot be true.

2. Multiply each value by the beta for that variable. The betas are the estimated coefficients in Table 13.

3. Sum the results in the calculation in step 2. In this example, the sum is 2.2026. This is the α+βx term from equation 2.

4. Take the antilog of the sum. On most calculators this is the $e^x$ function. In most spreadsheets it is the @EXP (.) function. This is 10.0002 in this example.

5. Calculate $P_i$ as the result of step 4 divided by the sum of 1 and the result of step 4 as shown in equation 2, 0.9091 in this example.

The probability is interpreted as the probability that an angler with the characteristics described by the independent variables will be a trout angler. In this case, the probability is 90.91 percent that an urban, avid, Hispanic male who resides in a western state is a trout angler.

**Table 14. Calculation of Trout Fishing for an Urban, Avid, Male, Hispanic Angler from the West**

| *Variable* | *Beta* | *Value* | *Beta X Value* |
|---|---|---|---|
| Intercept | –1.6347 | 1 | –1.6347 |
| Income* | 0.00231 | 49.5 | 0.11434 |
| Urban | 0.236 | 1 | 0.2358 |
| Female | –0.2196 | 0 | 0 |
| African-American | –1.0668 | 0 | 0 |
| Hispanic | 0.7289 | 1 | 0.7289 |
| Avid | 0.3111 | 1 | 0.3111 |
| South | –1.1696 | 0 | 0 |
| West | 2.2358 | 1 | 2.2358 |
| Northeast | 1.1522 | 0 | 0 |
| RiverWQ | 0.00559 | 55.7 | 0.311363 |
| | | Sum (α+βx) | 2.2026 |
| | | $e^{(\alpha+\beta x)}$ | 10.0002 |
| | | Probability | 0.9091 |

* in thousands

# Summary

The 1996 National Survey of Fishing, Hunting, and Wildlife-Associated Recreation shows that fishing for trout appealed to a large number of freshwater anglers. From a sociodemographic standpoint, there are some interesting differences between freshwater anglers overall and trout anglers. Trout anglers tend to be male, have higher incomes, and live in Western or Northeastern regions. A trout fishing probability of participation model showed that income, region of residence, population density of residence, gender, race and water quality had significant impacts on whether an angler sought trout or another species. Also of note is the finding that avid freshwater anglers are more likely to fish for trout than non-avid freshwater anglers. This means that trout anglers tend to be more avid than freshwater anglers in general.

These findings from the 1996 FHWAR underscore the importance of trout for millions of freshwater anglers. Information about whom these trout anglers are, their age, sex, race, where they live, and so on can be used by recreation managers and others to develop and refine fishing management programs so that anglers' fishing experiences can be enhanced.

*© PhotoDisc*

**U.S. Department of the Interior**
**U.S. Fish & Wildlife Service**
**Division of Economics**
**Arlington, Virginia**

**www.fws.gov**