Black Bass Fishing in the U.S.

Report 91-4

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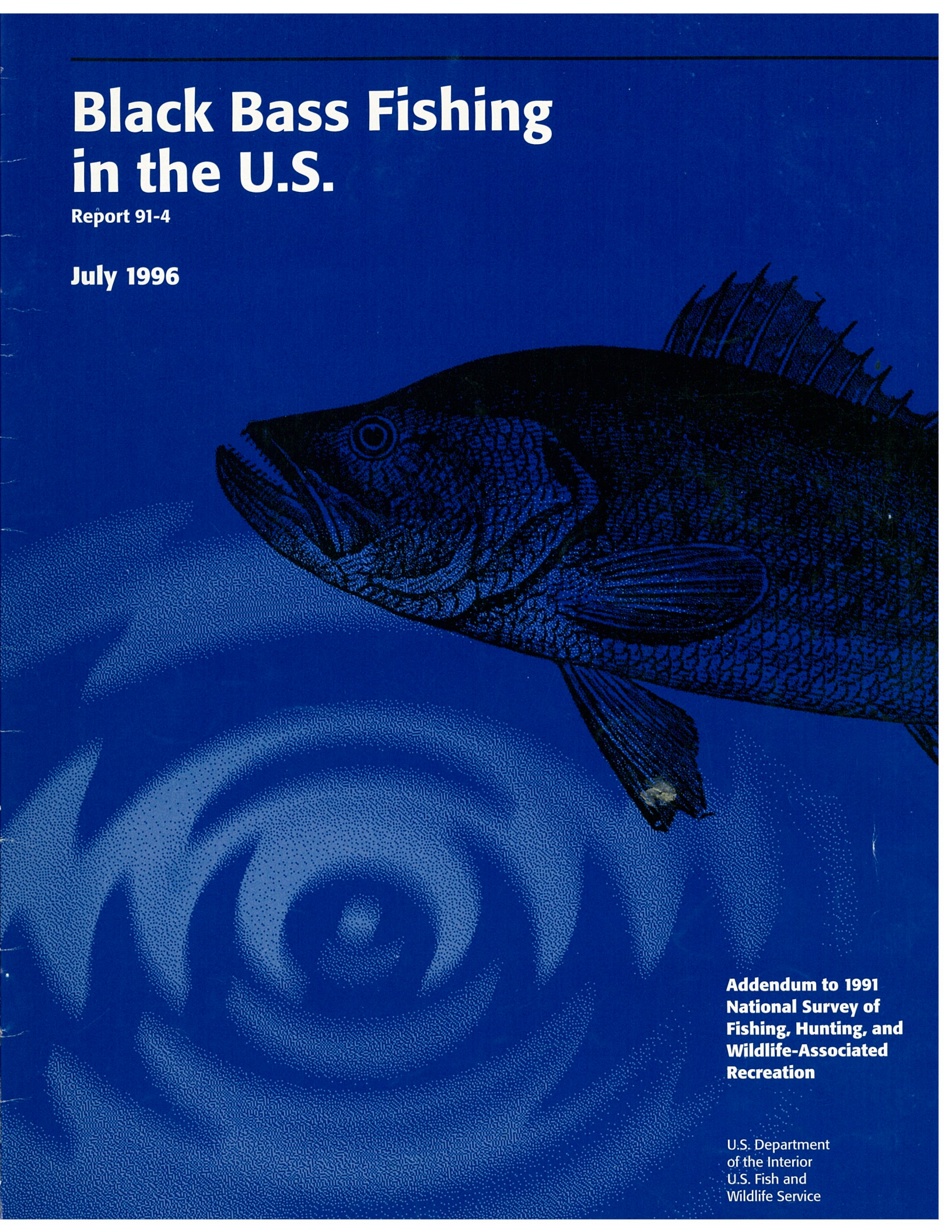

Addendum to 1991 National Survey of Fishing, Hunting, and Wildlife-Associated Recreation

U.S. Department of the Interior
U.S. Fish and Wildlife Service

Black Bass Fishing in the U.S.

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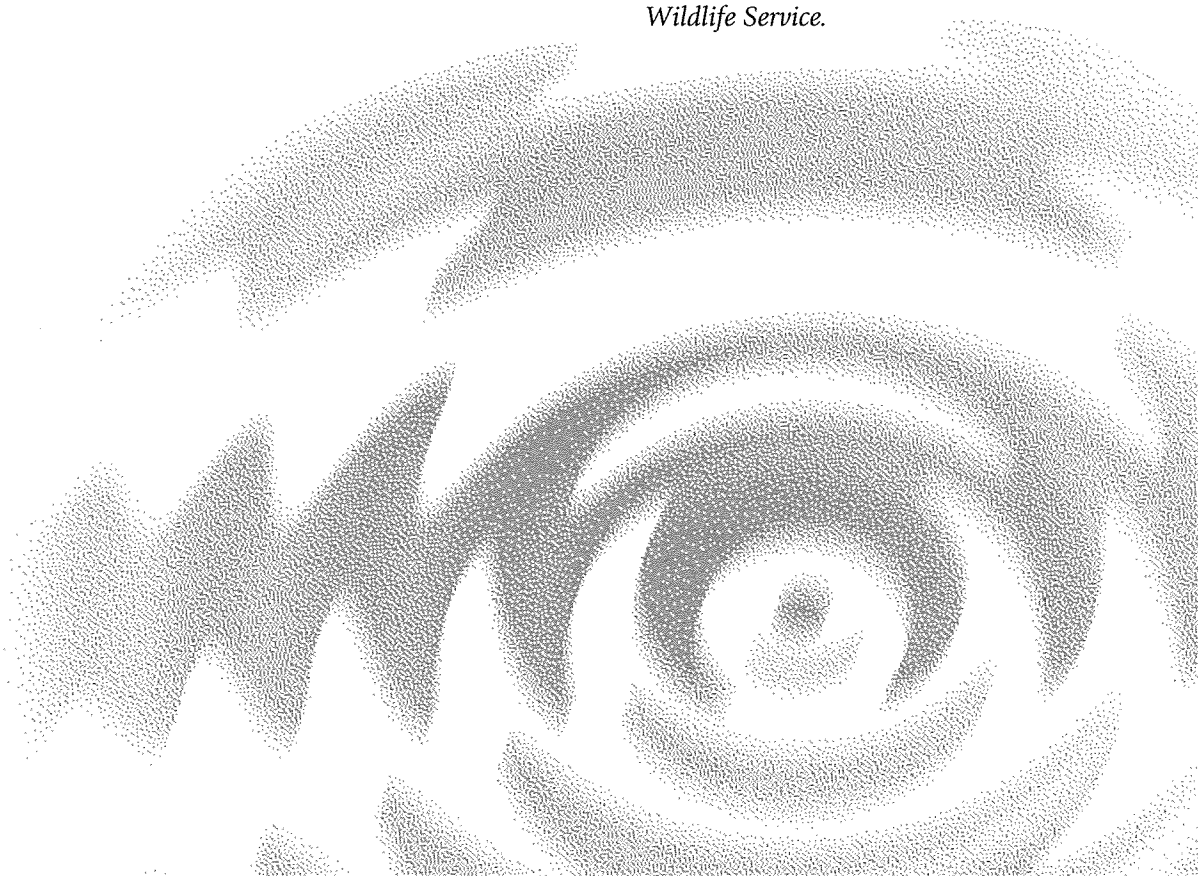
This report is intended to complement the National and State reports from the 1991 National Survey of Fishing, Hunting, and Wildlife-Associated Recreation. The conclusions are the authors and do not represent official positions of the U.S. Fish and Wildlife Service.



Introduction

Black bass fishing is the most popular type of fishing in the United States. In 1991 forty-three percent of all freshwater anglers in the United States fished for black bass. In this report we present and discuss black bass fishing in the United States and the characteristics of black bass anglers. The data used for this presentation come from the 1991 National Survey of Fishing, Hunting, and Wildlife-Associated Recreation (FHWAR). All data represent anglers 16 years of age and older who fished in the United States during 1991. A bass angler is defined as a person who said they fished for bass at least once during the survey year. They are not persons who fished exclusively for bass. In this report, bass refers only to black bass, including largemouth, smallmouth, spotted bass, etc. White bass, striped bass, striped bass hybrids, and rock bass are excluded. Also excluded is Great Lakes black bass fishing.

The remainder of this paper is divided into four sections. The first section deals with the level of participation in bass fishing in terms of participants and days of participation. This is presented for the nation and on a state-by-state basis. The second section deals with the demographic characteristics of bass anglers and how they compare to the U.S. population and freshwater anglers in total. In the third section we present a participation model that can be used to describe bass anglers and predict participation in bass fishing. The final section provides a summary.

Bass Fishing Participation Levels

Bass was the most sought after fish in the United States in 1991 when 12.9 million freshwater anglers fished for bass, 43 percent of all freshwater anglers (Table 1). In comparison, 10.1 million (34 percent) fished for panfish, 9.2 million (30 percent) fished for catfish and bullheads, 9.1 million (30 percent) fished for trout, and 8.3 million (28 percent) fished for crappie. Since anglers can fish for more than one species, summing the number of anglers by species will result in a number that is larger than the actual number of anglers.

Anglers fished for bass on more than 158 million days for an average of 12 days per angler. Keeping in mind that anglers can fish for more than one species in a day, bass were sought on 37 percent of all freshwater fishing days.

Tables 2, 3, and 4 contain state-by-state estimates of bass fishing. These estimates represent freshwater and bass fishing in each state by residents and nonresidents combined.

The percent of freshwater anglers that fish for black bass varied widely from less than 15 percent in low participation states such as Colorado, Idaho, and Oregon to more than 60 percent in Florida, Maryland, and Oklahoma (Table 2). Generally, the Southern and Eastern states had the highest level of participation in bass

TABLE 1.

Freshwater Anglers and Days of Fishing, by Type of Fish: 1991

(Population 16 years old 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	30,186	100	430,922	100	14
Black bass (largemouth, smallmouth, etc.)	12,857	43	158,226	37	12
Panfish	10,149	34	102,184	24	10
Catfish and bullheads	9,195	30	96,451	22	10
Trout	9,107	30	81,366	19	9
Crappie	8,327	28	90,940	21	11
White bass, striped bass and striped bass hybrids	6,408	21	63,181	15	10
Anything[1]	4,984	17	37,744	9	8
Walleye and sauger	3,278	11	37,302	9	11
Northern pike, pickerel, muskie and muskie hybrids	2,693	9	29,327	7	11
Other freshwater fish	2,550	8	21,452	5	8
Salmon	989	3	8,548	2	9
Steelhead	493	2	4,025	1	8

Note: Detail does not add to total because of multiple responses.

[1]Respondent identified "Anything" from a list of categories of fish.

TABLE 2.

Freshwater Anglers and Black Bass Anglers, by State Where Fishing Occurred: 1991

(Population 16 years old and older. Numbers in thousands. Excludes Great Lakes fishing.)

State	Freshwater Anglers	Bass Anglers	
		Number	Percent
United States	30,186	12,857	43
Alabama	831	451	54
Alaska	213	***	***
Arizona	480	180	38
Arkansas	769	398	52
California	2,118	499	24
Colorado	778	77	10
Connecticut	255	128	50
Delaware	45	25	56
Florida	1,311	823	63
Georgia	1,066	509	48
Hawaii	32	*12	*38
Idaho	365	42	12
Illinois	1,262	490	39
Indiana	928	450	48
Iowa	556	223	40
Kansas	453	202	45
Kentucky	766	412	54
Louisiana	785	408	52
Maine	361	118	33
Maryland	392	238	61
Massachusetts	373	208	56
Michigan	1,305	517	40
Minnesota	1,440	322	22
Mississippi	565	263	47
Missouri	1,329	650	49
Montana	342	*267	*78
Nebraska	252	96	38
Nevada	171	48	28
New Hampshire	267	126	47
New Jersey	411	185	45
New Mexico	281	53	19
New York	1,206	469	39
North Carolina	1,019	548	54
North Dakota	99	*7	*7
Ohio	1,206	565	47
Oklahoma	804	488	61
Oregon	605	87	14
Pennsylvania	1,379	638	46
Rhode Island	66	38	58
South Carolina	645	326	51
South Dakota	158	26	16
Tennessee	996	477	48
Texas	2,074	1,088	52
Utah	317	53	17
Vermont	181	52	29
Virginia	780	420	54
Washington	681	122	18
West Virginia	339	180	53
Wisconsin	1,339	489	37
Wyoming	301	*7	*2

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

TABLE 3.

Days of Fishing in Freshwater and for Bass, by State Where Fishing Occurred: 1991

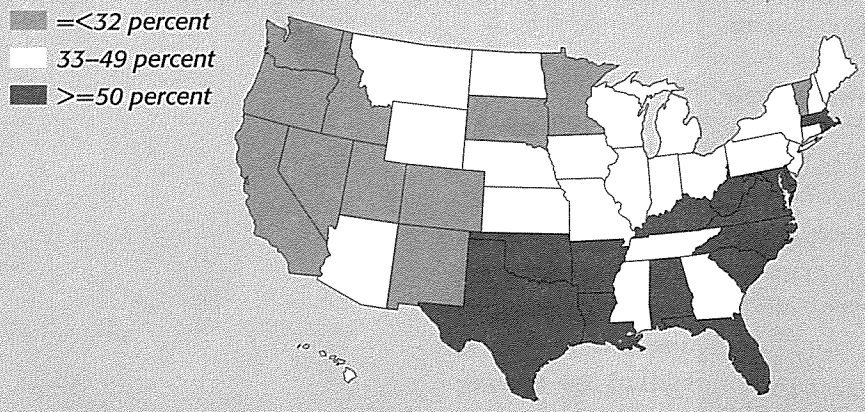
(Population 16 years old and older. Numbers in thousands. Excludes Great Lakes fishing.)

State	Days Fishing in Freshwater	Days of Bass Fishing	
		Number	Percent
United States	430,922	158,226	37
Alabama	11,215	5,600	50
Alaska	2,086	***	***
Arizona	4,074	1,460	36
Arkansas	11,002	5,817	53
California	18,712	3,764	20
Colorado	6,284	582	9
Connecticut	3,460	1,342	39
Delaware	569	307	54
Florida	15,465	9,760	63
Georgia	15,341	6,338	41
Hawaii	207	*76	*37
Idaho	3,157	321	10
Illinois	15,626	5,197	33
Indiana	11,793	5,512	47
Iowa	6,062	1,934	32
Kansas	4,981	1,980	40
Kentucky	9,861	4,323	44
Louisiana	12,026	5,422	45
Maine	3,960	854	22
Maryland	4,354	1,859	43
Massachusetts	6,011	2,923	49
Michigan	14,816	4,796	32
Minnesota	19,959	2,936	15
Mississippi	8,338	3,640	44
Missouri	15,136	6,873	45
Montana	3,156	*190	*6
Nebraska	2,734	907	33
Nevada	1,218	297	24
New Hampshire	2,720	1,096	40
New Jersey	5,911	2,306	39
New Mexico	1,943	356	18
New York	15,497	4,741	31
North Carolina	13,015	5,924	46
North Dakota	993	*26	*26
Ohio	14,450	6,292	44
Oklahoma	12,079	6,842	57
Oregon	6,490	610	9
Pennsylvania	23,792	7,186	30
Rhode Island	1,049	585	56
South Carolina	9,329	3,645	39
South Dakota	1,722	243	14
Tennessee	13,690	6,689	49
Texas	29,092	13,459	46
Utah	2,672	237	9
Vermont	2,258	381	17
Virginia	10,504	5,017	48
Washington	8,583	1,077	13
West Virginia	4,107	1,520	37
Wisconsin	19,003	4,903	26
Wyoming	2,348	*37	*2

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

FIGURE 1.

Percent of Anglers Who Sought Bass



fishing. Western and Northwestern states had the lowest levels of participation. This can be seen graphically in Figure 1 which shows the percent of anglers who fished for bass.

Columns one and two of Table 3 show the number of days spent fishing in freshwater and fishing for bass. The third column shows the share of all freshwater days that anglers spent fishing for bass. These days are not necessarily days spent exclusively bass fishing; the anglers could have sought more than one species of fish on a day of fishing. The pattern of days of fishing follows that of participants with Eastern states having more days than Western states. Three notable exceptions to the days and anglers comparisons are Maryland, Pennsylvania, and West Virginia. All three of these states showed a much lower percent of freshwater days fishing for bass than they showed for percent of freshwater anglers fishing for bass. This suggests that bass anglers in these states fished fewer days than other anglers or fewer days for bass than bass anglers in other states. That is, although many people fish for bass in these states, they spent more time pursuing other fish species.

Table 4 shows the average number of days of freshwater and bass fishing by state. Except for Arkansas, Florida, and Tennessee, all states had a lower average number of days bass fishing than all freshwater fishing. Arkansas, Florida, and Tennessee had slightly higher average days of fishing for bass than for all freshwater fish. This is noteworthy considering that a bass fishing day is also a freshwater fishing day. However, it can be explained by the fact that many avid anglers in these states fished exclusively for bass on many of their fishing days. This, combined with the fact that some freshwater anglers did not fish for bass at all, explains how the average days of bass fishing can be greater than the average days of all freshwater fishing.

The average number of days anglers spent fishing for bass, by state, is shown graphically in Figure 2. The lightly shaded areas show states where the average number of bass fishing days is less than or equal to eight. States with no shading represent average days greater than eight but less than twelve. The heavily shaded states are states where the average days of bass fishing are the highest, greater than or equal to twelve. The geographic distribution in Figure 2 is similar to Figure 1 which shows participation rates in bass fishing. This comparison shows that states with the highest level of participation tend also to be the states with the highest average days of bass fishing.

FIGURE 2.

Average Number of Bass Fishing Days

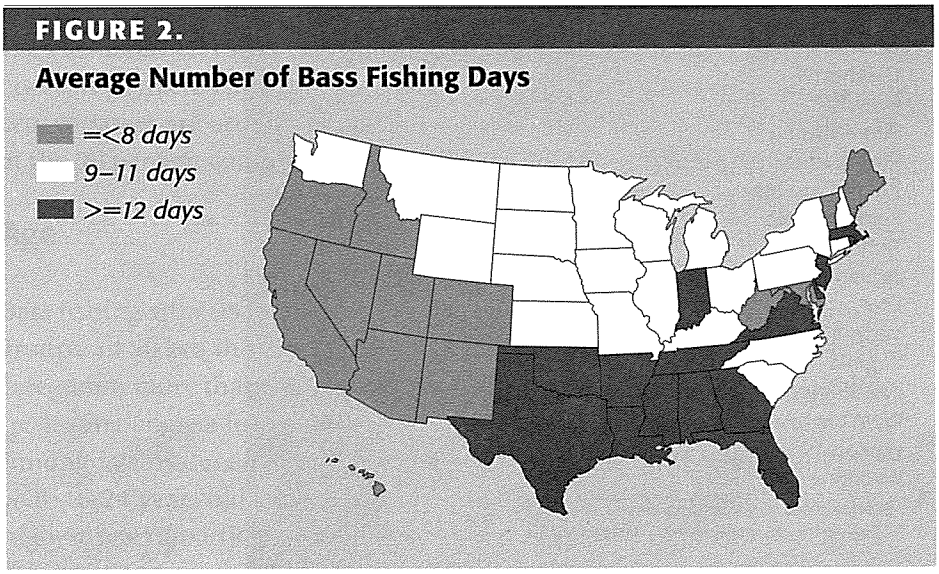


TABLE 4.

Average Days of Fishing in Freshwater and for Bass, by State Where Fishing Occurred: 1991

(Population 16 years old and older. Numbers in thousands. Excludes Great Lakes fishing.)

State	Average Days Freshwater	Average Days Bass
United States	14.3	12.3
Alabama	13.5	12.4
Alaska	9.8	***
Arizona	8.5	8.1
Arkansas	14.3	14.6
California	8.8	7.5
Colorado	8.1	7.6
Connecticut	13.6	10.5
Delaware	12.6	12.3
Florida	11.8	11.9
Georgia	14.4	12.5
Hawaii	6.5	*6.3
Idaho	8.6	7.6
Illinois	12.4	10.6
Indiana	12.7	12.2
Iowa	10.9	8.7
Kansas	11.0	9.8
Kentucky	12.9	10.5
Louisiana	15.3	13.3
Maine	11.0	7.2
Maryland	11.1	7.8
Massachusetts	16.1	14.1
Michigan	11.4	9.3
Minnesota	13.9	9.1
Mississippi	14.8	13.8
Missouri	11.4	10.6
Montana	9.2	*0.7
Nebraska	10.8	9.4
Nevada	7.1	6.2
New Hampshire	10.2	8.7
New Jersey	14.4	12.5
New Mexico	6.9	6.7
New York	12.8	10.1
North Carolina	12.8	10.8
North Dakota	10.0	*3.7
Ohio	12.0	11.1
Oklahoma	15.0	14.0
Oregon	10.7	7.0
Pennsylvania	17.3	11.3
Rhode Island	15.9	15.4
South Carolina	14.5	11.2
South Dakota	10.9	9.3
Tennessee	13.7	14.0
Texas	14.0	12.4
Utah	8.4	4.5
Vermont	12.5	7.3
Virginia	13.5	11.9
Washington	12.6	8.8
West Virginia	12.1	8.4
Wisconsin	14.2	10.0
Wyoming	7.8	*5.3

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

Characteristics of Black Bass Anglers

Freshwater fishing is a very popular activity with nearly 16 percent of the U.S. population over 16 years of age participating in 1991. Forty three percent of all freshwater anglers fished for black bass, nearly 7 percent of the U.S. population over 16 years of age. In the following pages we present a comparison of freshwater and bass 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 the activity for each category (e.g., what proportion of the 45-54 year old U.S. population participate in freshwater fishing and what proportion of 45-54 year old freshwater anglers fish for bass). 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 2 percent or larger are usually significant at the 90 percent confidence level.

Age

Bass fishing appeals to all age groups. In all but the oldest age categories, more than 40 percent of freshwater anglers fished for bass. Among freshwater anglers, those that were 18-24 years old showed the highest rate of participation in bass fishing, 47 percent (Table 5).

Comparing bass anglers to the U.S. population shows that bass anglers were younger. Fifty-three percent of bass anglers were between the ages of 25 and 44 while only 43 percent of the general population was in this age group. The percent of bass anglers over 55 years old (14 percent) was much lower than the percent of U.S. population in that category (27 percent). Bass anglers had a similar age distribution to other freshwater anglers. Sixteen percent of freshwater anglers were 55 and over while 14 percent of bass anglers fell into that age category.

Sex

Eighty percent of bass anglers were male. Table 6 shows this is disproportionately high compared to the U.S. population, where women were the majority at 52 percent. The percent of bass anglers that were male (80 percent) was also higher than the percent of male freshwater anglers (73 percent).

While many women participated in freshwater fishing (8.1 million), this was only 8 percent of the women in the U.S. Twenty-four percent of the male population over 16 years of age participated in freshwater fishing. In addition, female anglers were less likely to participate in bass fishing than male anglers. Female freshwater anglers participated in bass fishing at a rate of 32 percent whereas 46 percent of male freshwater anglers were bass anglers. As a result, women made up 27 percent of freshwater anglers and only 20 percent of bass anglers.

TABLE 5.

Age Distribution of the U.S. Population, Freshwater Anglers, and Bass Anglers: 1991

(Population 16 years old and older. Numbers in thousands. Excludes Great Lakes fishing.)

	U.S. Population		Freshwater Anglers			Bass Anglers		
Age	Number	Percent	Number	Percent	Percent of U.S. Population	Number	Percent	Percent of Freshwater Anglers
U.S. Total	189,964	100	30,186	100	16	12,857	100	43
16-17	6,530	3	1,285	4	20	523	4	41
18-24	23,023	12	3,989	13	17	1,888	15	47
25-34	42,931	23	8,521	28	20	3,647	28	43
35-44	38,341	20	7,303	24	19	3,241	25	44
45-54	27,021	14	4,067	13	15	1,756	14	43
55-64	21,085	11	2,778	9	13	1,071	8	39
65 and over	31,032	16	2,243	7	7	731	6	33

Education

Table 7 shows that about one out of every five Americans 16 years old or older (19 percent) had 11 or fewer years of education. Only 14 percent of bass anglers had not completed high school. Seventeen percent of all freshwater anglers fell into this category. Twenty-three percent of bass anglers had 1-3 years of college compared to 19 percent for the U.S. population. The proportion of freshwater and bass anglers with a college degree or more education was virtually identical to the U.S. population.

Freshwater anglers' participation in bass fishing increased with education level up to completion of college, from 37 to 45 percent.

Income

In 1991, the median household income for the U.S. was slightly more than $30,000. As shown in Table 8, 44 percent of the U.S. population 16 years or older lived in households with incomes less than $30,000. Freshwater anglers had somewhat higher incomes than the U.S. population. Only forty percent lived in households with annual income below $30,000. For bass anglers, an even lower proportion (38 percent) came from households with income below the U.S. median income. Households with incomes above the median accounted for 52 percent of freshwater anglers and 54 percent of bass anglers. Nine percent of freshwater anglers and 8 percent of bass anglers lived in households where the income was not reported.

At least 36 percent of all freshwater anglers in each income category fished for bass. The percent of freshwater anglers who fished for bass increased from 36 percent for the less than $10,000 income category up to 46 percent for the $25-29,900 income category. Participation declined slightly at the upper income levels to 43 percent for persons from households with incomes above $75,000. Freshwater anglers from homes not reporting their income participated in bass fishing at a rate of 39 percent. Fourteen percent of the FHWAR respondents did not report their household income.

Census Geographic Region

Table 9 shows the distribution of freshwater and bass fishing by Bureau of Census geographic region.

TABLE 6.

Sex Distribution of the U.S. Population, Freshwater Anglers, and Bass Anglers: 1991

(Population 16 years old and older. Numbers in thousands. Excludes Great Lakes fishing.)

	U.S. Population		Freshwater Anglers			Bass Anglers		
Sex	Number	Percent	Number	Percent	Percent of U.S. Population	Number	Percent	Percent of Freshwater Anglers
Total	189,964	100	30,186	100	16	12,857	100	43
Male	90,369	48	22,041	73	24	10,237	80	46
Female	99,595	52	8,145	27	8	2,620	20	32

TABLE 7.

Education Distribution of the U.S. Population, Freshwater Anglers, and Bass Anglers: 1991

(Population 16 years old and older. Numbers in thousands. Excludes Great Lakes fishing.)

	U.S. Population		Freshwater Anglers			Bass Anglers		
Education	Number	Percent	Number	Percent	Percent of U.S. Population	Number	Percent	Percent of Freshwater Anglers
Total	189,964	100	30,186	100	16	12,857	100	43
0-11 years	35,906	19	5,042	17	14	1,850	14	37
12 years	77,293	41	12,218	40	16	5,252	41	43
1-3 years college	36,725	19	6,507	22	18	2,898	23	45
4 or more years college	40,040	21	6,419	21	16	2,858	22	45

TABLE 8.

Income Distribution of the U.S. Population, Freshwater Anglers, and Bass Anglers: 1991

(Population 16 years old and older. Numbers in thousands. Excludes Great Lakes fishing.)

	U.S. Population		Freshwater Anglers			Bass Anglers		
Household Income	Number	Percent	Number	Percent	Percent of U.S. Population	Number	Percent	Percent of Freshwater Anglers
Total	189,964	100	30,186	100	16	12,856	100	43
Under $10,000	18,585	10	1,795	6	10	640	5	36
$10–$19,900	29,864	16	4,198	14	14	1,689	13	40
$20–$24,900	15,188	8	2,573	9	17	1,062	8	41
$25–$29,900	18,727	10	3,250	11	17	1,506	12	46
$30–$49,900	42,689	22	8,793	29	21	3,924	31	45
$50–$74,900	24,448	13	4,744	16	19	2,065	16	44
$75,000 or more	13,579	7	2,195	7	16	940	7	43
Not Reported	26,884	14	2,638	9	10	1,030	8	39

TABLE 9.

Geographic Distribution of the U.S. Population, Freshwater Anglers, and Bass Anglers: 1991

(Population 16 years old and older. Numbers in thousands. Excludes Great Lakes fishing.)

Region	U.S. Population		Freshwater Anglers			Bass Anglers		
	Number	Percent	Number	Percent	Percent of U.S. Population	Number	Percent	Percent of Freshwater Anglers
Total	189,964	100	30,186	100	16	12,856	100	43
New England	10,180	5	1,186	4	12	563	4	47
Middle Atlantic	29,216	15	2,820	9	10	1,277	10	45
E. North Central	32,188	17	5,553	18	17	2,394	19	43
W. North Central	13,504	7	3,626	12	27	1,315	10	36
South Atlantic	33,682	18	4,882	16	14	2,700	21	55
E. South Central	11,667	6	2,503	8	21	1,276	10	51
W. South Central	19,926	10	4,039	13	20	2,165	17	54
Mountain	10,092	5	2,025	7	20	371	3	18
Pacific	29,508	16	3,552	12	12	796	6	22

TABLE 10.

Population Density Distribution of the U.S. Population, Freshwater Anglers, and Bass Anglers: 1991

(Population 16 years old and older. Numbers in thousands. Excludes Great Lakes fishing.)

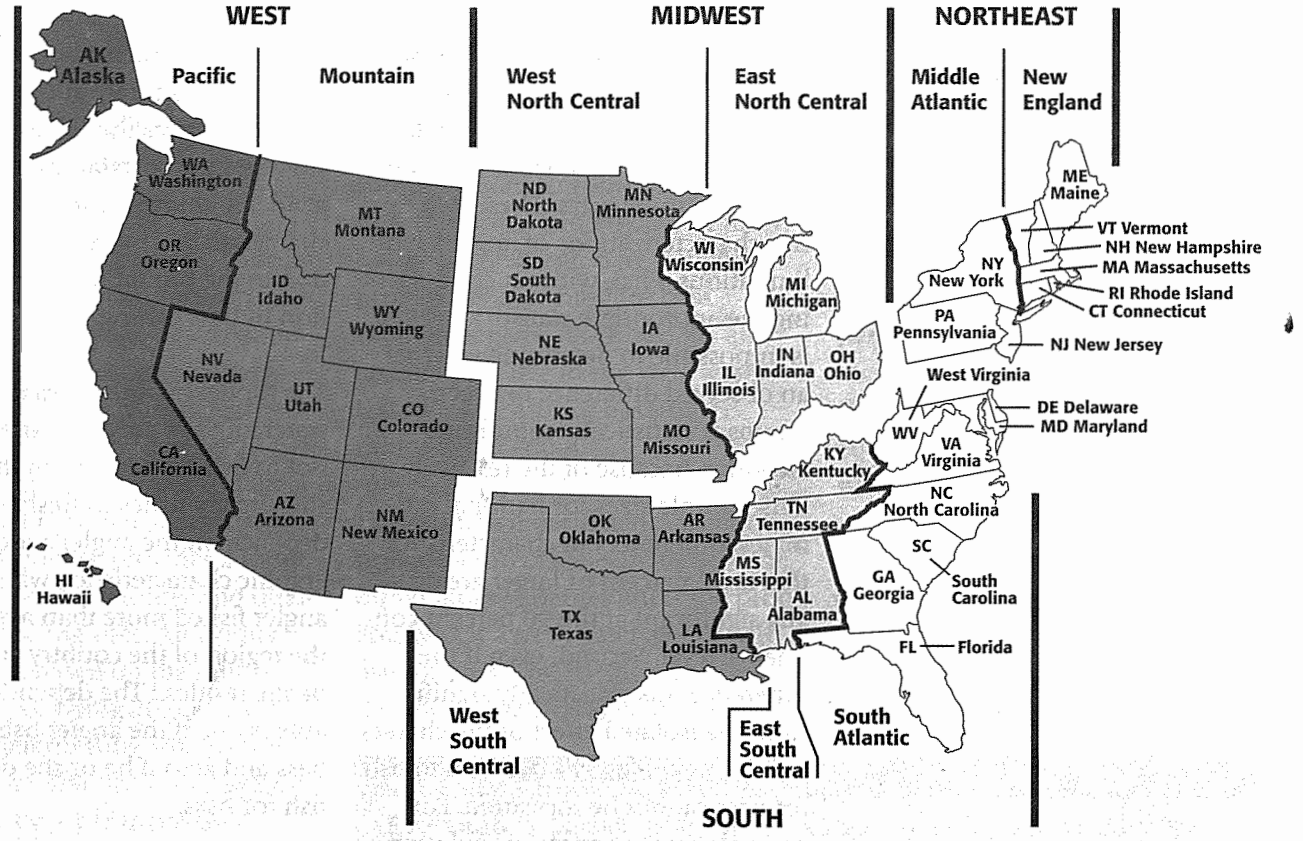
Density of Location	U.S. Population		Freshwater Anglers			Bass Anglers		
	Number	Percent	Number	Percent	Percent of U.S. Population	Number	Percent	Percent of Freshwater Anglers
Total	189,964	100	30,186	100	16	12,856	100	43
Big City/Urban	71,454	38	8,491	28	12	3,511	27	41
Small City/Town	77,405	41	12,533	42	16	5,404	42	43
Rural	39,110	21	9,036	30	23	3,884	30	43
No Response	1,997	1	125	0	6	58	0	46

Bureau of Census geographic regions are defined in Figure 3. As a percent of the U.S. population 16 years of age and over, the West North Central region had the highest participation rate in freshwater fishing with 27 percent. As a percent of total freshwater anglers, the East North Central and the South Atlantic regions had the highest level of participation, making up 18 and 16 percent of freshwater anglers, respectively. The pattern is similar with bass anglers. Twenty-one percent of all bass anglers lived in the South Atlantic region and 19 percent lived in the East North Central region. As the state-by-state analysis suggested, the regions with the lowest share of bass anglers were the New England, Mountain, and Pacific regions.

Overall, 43 percent of all freshwater anglers participated in bass fishing. The percent participating by region varied from a low of 18 percent in the Mountain region to a high of 55 percent in the South Atlantic region. The West South Central and the East South Central regions also had high levels of participation in black bass fishing by freshwater anglers at 54 and 51 percent, respectively.

FIGURE 3.

Map of the United States, Showing Bureau of Census Regions



As the participation rates suggest, the geographic distribution of bass anglers differs from the U.S. population and other freshwater anglers. For example, 15 percent of the U.S. population was from the Middle Atlantic region whereas only 9 percent of freshwater and 10 percent of bass anglers were from this region. The situation was similar in the Pacific region. Sixteen percent of the U.S. population lived in the Pacific region yet only 12 percent of the freshwater anglers and 6 percent of bass anglers lived there. This works in the opposite direction in other regions. Only 10 percent of the U.S. population lived in the West South Central region while 17 percent of bass anglers lived there.

Population Density of Residence

The 1991 FHWAR asked respondents whether they considered their place of residence to be in 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 respondent 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.

People in rural areas participated in fishing almost twice as much as urban residents, 23 percent participation versus 12 percent. Table 10 shows that participation in bass fishing by freshwater anglers was about the same for all population density levels, about 43 percent. As a result, the distribution of bass anglers among population density levels is similar to that of all freshwater anglers. This distribution shows that most bass anglers came from rural areas.

Participation Model

The descriptive statistics presented in the previous section show that bass anglers are different from 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 groups is statistically significant. However, because of the relatively large sample sizes for national estimates, differences in characteristics that are 2 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 bass cannot be measured. For example, in the general population, income level is correlated with gender. The previous section found participation in bass fishing is also correlated with gender. This raises the question: Were men more likely to have fished for bass 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 bass was estimated to predict what sort of angler was most likely to fish for bass 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 each characteristic's individual contribution to the probability of participation in bass fishing.

The model hypothesizes that a freshwater angler's decision whether or not to fish for bass, given that he or she already fishes in freshwater, depends on the angler's sociodemographic characteristics, whether the angler fished more than average, and the region of the country where he or she resides.[1] The dependent variable is one if the angler fishes for bass and zero if he or she does not fish for bass.

This type of yes or no response is modeled in terms of the logarithm of the odds that the individual fished for black bass. This is called the logit and appears on the left side of equation 1. Equation 1 shows the model estimated.

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

[1]*Attempts were made in earlier versions of this model to include a supply variable. Two things were considered, the number of boat ramps and the surface area of water in the respondent's state of residence. Neither of these provided additional predictive power to the model and thus were excluded.*

where:

P_i= Probability that the i-th individual fished for black bass

x_i = Vector of explanatory variables

α = Intercept to be estimated

β = Vector of coefficients to be estimated.

The explanatory variables, x, were a combination of binary and continuous variables. They are described in Table 11. The means of the binary variables repeat the percentages reported earlier. For example, 27 percent of anglers are women and 28 percent lived in urban areas. The region of residence provides a rough measure of the availability and quality of bass fishing sites. An avidity measure was based on the number of days fished. Using 20 days as the cutoff for determining whether an angler was avid or not was based on the average days per freshwater angler, as reported in the 1991 FHWAR. About 21 percent of freshwater anglers fished 20 days or more.

The model below was estimated from a nationwide sample of 16,395 freshwater anglers.

$$\ln \frac{P_i}{(1-P_i)} = -.292 + .004\text{INCOME} - .008\text{AGE} + .068\text{URBAN} - .316\text{BLACK} - .584\text{SEX} + 1.106\text{AVID} + .538\text{SOUTH} - .983\text{WEST}$$

All of the explanatory variables were significant at the 1 percent level. The likelihood ratio index can be interpreted in the same way as a multiple correlation coefficient in ordinary least squares regression. The index value of 0.121 indicates that the equation explains about 12 percent of the variation in the logit, which is typical of recreation models. The equation shows that the probability of fishing for bass increases with income and decreases with age, other things being equal. It also shows that anglers who say they live in urban areas, fish 20 days or more, or live in the South have a higher probability of fishing for bass. Women anglers, black people, and anglers who live in the West were less likely to fish for bass, other things being equal.

The estimated coefficients do not provide a direct measure of how the explanatory variables affect the probability that a freshwater angler will fish for bass. 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 explanatory variables with all dichotomous variables equal to zero to show how each variable affects the probability of fishing for bass. The derivatives shown in Table 12 can be used to make statements like "being a woman decreases the probability of fishing for bass by 14 percent," or "being an avid angler increases the probability of fishing for bass by 26 percent." The whole equation can also be reevaluated to make more complex comparisons. For example, a black, woman angler in the West has only a 9.1 percent chance of fishing for bass while a white, urban, avid fisherman in the South has a 78.5 percent chance of fishing for bass.

TABLE 11.

Explanatory Variables in the Black Bass Fishing Probability Model

Variable	Description	Mean
Income	Annual household income, in thousands of dollars	37.4
Age	Age of respondent, years	38.6
Urban	1 if respondent indicates urban residence 0 otherwise	0.28
Black	1 if respondent indicates race is black, 0 otherwise	0.05
Female	1 if respondent is female, 0 otherwise	0.27
Avid	1 if respondent fished 20 days or more, 0 otherwise	0.21
South	1 if respondent resided in the South,[1] 0 otherwise	0.38
West	1 if respondent resided in the West,[2] 0 otherwise	0.18

1. South includes the South Atlantic, East South Central, and West South Central regions as defined by the U.S. Census Bureau, see Figure 3.

2. West includes the Pacific and Mountain Census regions.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