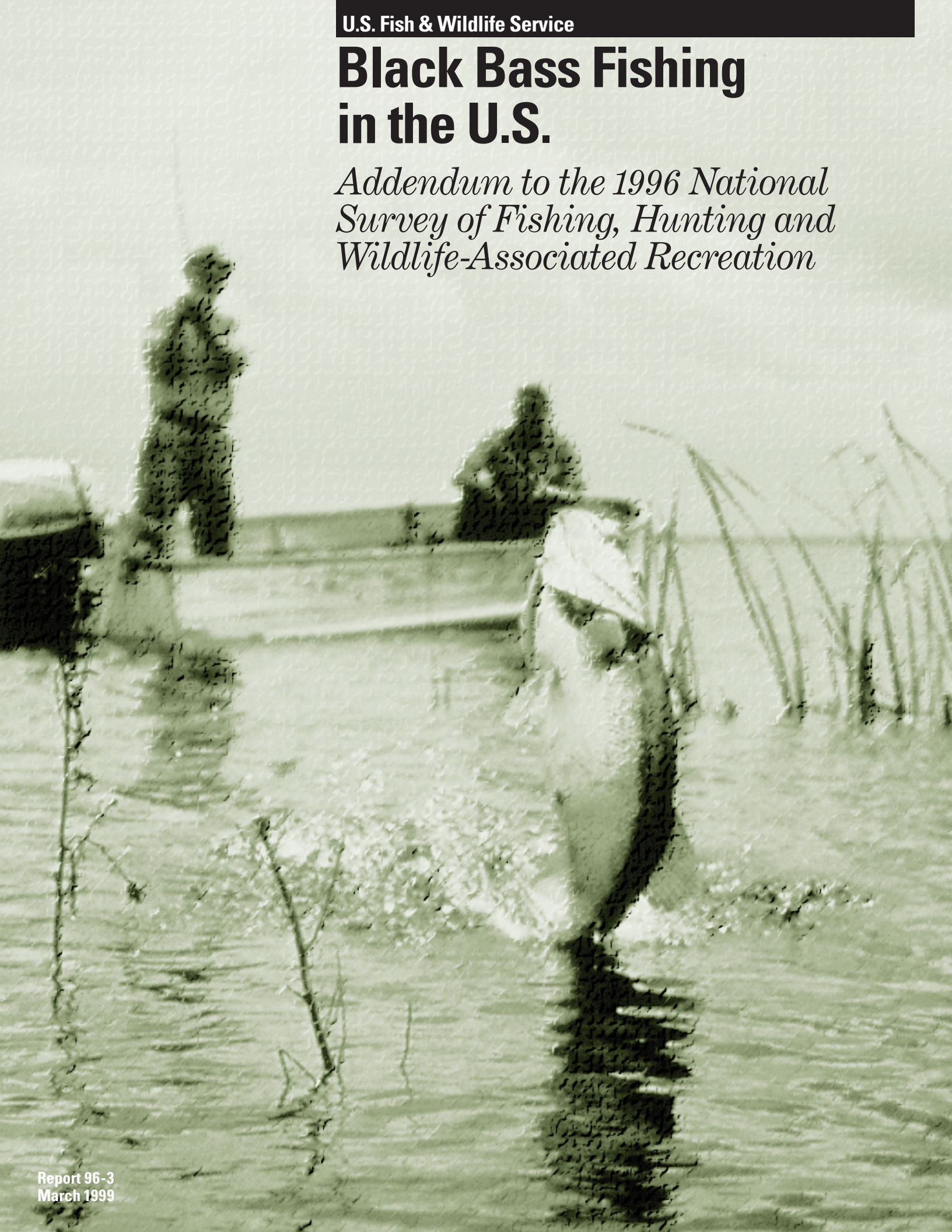
U.S. Fish & Wildlife Service

Black Bass Fishing in the U.S.

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



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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.

Front Cover — USFWS photo

Introduction

Black bass fishing is the most popular type of fishing in the United States. Black bass include largemouth, smallmouth, and spotted bass. In 1996, 44 percent of all freshwater anglers in the United States fished for black bass. This report uses information from the 1996 National Survey of Fishing, Hunting, and Wildlife-Associated Recreation (FHWAR) to describe black bass fishing in the United States and the characteristics of black bass anglers.

For this report, a bass angler is anyone 16 years of age and older who fished for black bass at least once during the year. They may have fished for other species too. White bass, striped bass, striped bass hybrids, and rock bass are not included in this definition. Great Lakes bass fishing raises some different issues so it is not included in this report.

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

USFWS photo

Bass Fishing Participation Levels

In 1996, black bass were the most sought after fish in the United States with 12.7 million freshwater bass anglers, 44 percent of all freshwater anglers (Table 1). In comparison, 9.0 million anglers (31 percent) fished for trout, 8.0 million (28 percent) fished for panfish, 7.4 million (26 percent) fished for catfish/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 bass on more than 191 million days for an average of 15 days per year. Keeping in mind that anglers can fish for more than one species in a day, bass were sought on 39 percent of all freshwater fishing days.

Tables 2, 3 and 4 contain state-by-state estimates of bass fishing. These estimates represent fishing in these states by residents and nonresidents combined. The percent of freshwater anglers that fish for bass ranged widely — from more than 60 percent in Rhode Island, Delaware and Texas to less than 15 percent in North Dakota, Oregon, Utah, and Colorado. Generally, the Southern and Eastern states had the highest level of 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 in each state.

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 do not represent fishing for bass exclusively; anglers may have sought more than one species a day of fishing.

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.)

	Anglers		*Days of Fishing*		*Average Days per Angler*
Type of fish	*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	1218	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.

The pattern of days of bass fishing is similar to angler participation; Eastern participants spend a greater share of freshwater fishing days bass fishing than Western participants. Notable exceptions to this pattern are Pennsylvania, Iowa, and Mississippi which have higher (45 percent or over) bass participation rates but relatively lower levels (less than 40 percent) of freshwater days 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 spend relatively more time pursuing other species.

Table 4 shows the average number of days freshwater and bass fishing by state. Nationally, anglers averaged 17 days of freshwater fishing and 15 days of bass fishing. The majority of states had a lower average number of days bass fishing than all freshwater fishing. Eleven states however, had slightly higher than 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. Several states have no marking in them. The sample size for these states was less than 30 so their average days are not judged reliable enough to include in this figure. The lightly shaded areas show states where the average number of bass fishing days is less than or equal to ten. States with moderate shading indicate average days greater than or equal to 11 but less than 15. The heavily shaded states are states where the average days of bass fishing are equal to or greater than fifteen.

Table 2. Freshwater and Black Bass Anglers, by State Where Fishing Occurred: 1996

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

State	Freshwater Anglers	Bass Anglers	
		Number	Percent
United States	28,921	12,708	44
Alabama	843	454	54
Alaska	313	**	**
Arizona	483	247	51
Arkansas	739	335	45
California	2,175	652	30
Colorado	787	84	11
Connecticut	318	131	41
Delaware	66	43	65
Florida	1,137	663	58
Georgia	967	496	51
Hawaii	22	*7	*32
Idaho	474	73	15
Illinois	1,123	602	54
Indiana	863	505	59
Iowa	477	218	46
Kansas	341	188	55
Kentucky	772	405	52
Louisiana	815	409	50
Maine	290	117	40
Maryland	319	146	46
Massachusetts	377	228	60
Michigan	1,311	494	38
Minnesota	1,421	428	30
Mississippi	487	246	51
Missouri	1,138	620	54
Montana	329	**	**
Nebraska	247	91	37
Nevada	219	52	24
New Hampshire	237	114	48
New Jersey	428	240	56
New Mexico	312	73	23
New York	1,111	548	49
North Carolina	1,009	495	49
North Dakota	90	*6	*6.7
Ohio	908	480	53
Oklahoma	891	325	36
Oregon	589	*73	*12
Pennsylvania	1,277	576	45
Rhode Island	72	49	68
South Carolina	716	407	57
South Dakota	213	49	23
Tennessee	767	399	52
Texas	2,147	1,315	61
Utah	397	*46	*12
Vermont	176	66	38
Virginia	761	446	59
Washington	768	150	20
West Virginia	323	151	47
Wisconsin	1,232	372	30
Wyoming	379	**	**

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

Table 3. Days Freshwater and Black Bass Fishing, by State Where Fishing Occurred: 1996

(Numbers in thousands. Excludes Great Lakes fishing.)

State	Days Fishing in Freshwater	Days of Bass Fishing	
		Number	Percent
United States	485,474	191,350	39
Alabama	14,256	5,906	41
Alaska	3,602	**	**
Arizona	4,689	2,440	52
Arkansas	9,661	4,275	44
California	28,987	7,162	25
Colorado	8,232	661	8
Connecticut	3,880	1,724	44
Delaware	980	678	69
Florida	18,409	12,647	69
Georgia	12,857	6,359	49
Hawaii	189	*58	*31
Idaho	4,411	498	11
Illinois	17,089	7,964	47
Indiana	13,456	6,567	49
Iowa	7,062	2,455	35
Kansas	6,355	4,442	70
Kentucky	9,631	4,633	48
Louisiana	18,493	8,276	45
Maine	4,107	1,351	33
Maryland	4,290	2,247	52
Massachusetts	6,746	3,524	52
Michigan	19,456	6,244	32
Minnesota	25,897	6,077	23
Mississippi	8,213	3,197	39
Missouri	14,682	8,368	57
Montana	2,617	**	**
Nebraska	3,004	1,025	34
Nevada	1,976	492	25
New Hampshire	3,139	1,352	43
New Jersey	6,021	3,018	50
New Mexico	2,836	482	17
New York	17,412	7,051	40
North Carolina	15,831	8,013	51
North Dakota	1,321	*131	*10
Ohio	12,878	6,237	48
Oklahoma	14,674	5,546	38
Oregon	7,117	*1,212	*17
Pennsylvania	18,635	5,444	29
Rhode Island	1,347	755	56
South Carolina	11,341	5,256	46
South Dakota	2,748	316	11
Tennessee	11,317	5,787	51
Texas	37,575	17,913	48
Utah	3,936	*301	*8
Vermont	1,951	583	30
Virginia	9,282	5,006	54
Washington	10,975	2,122	19
West Virginia	5,040	1,624	32
Wisconsin	14,398	3,733	26
Wyoming	2,415	**	**

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

Figure 1. Percent of Anglers Who Sought Bass

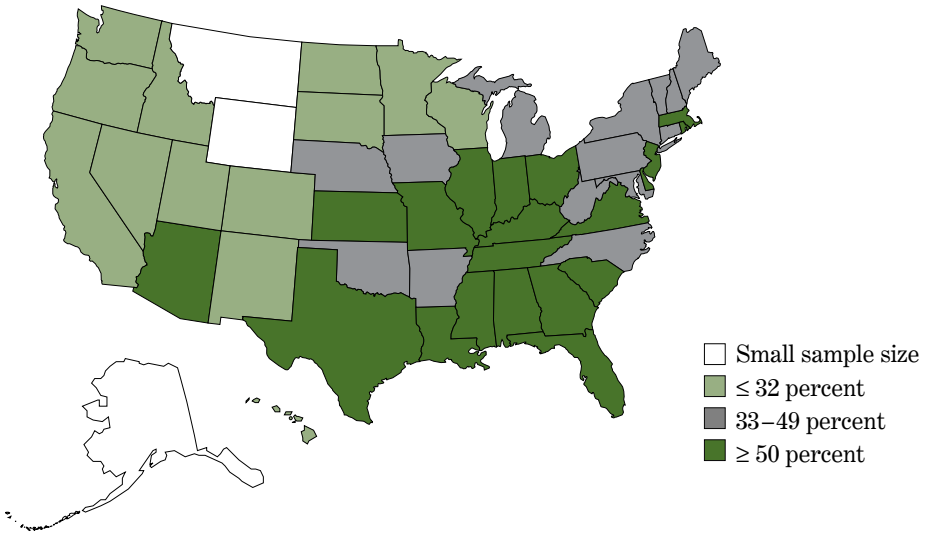
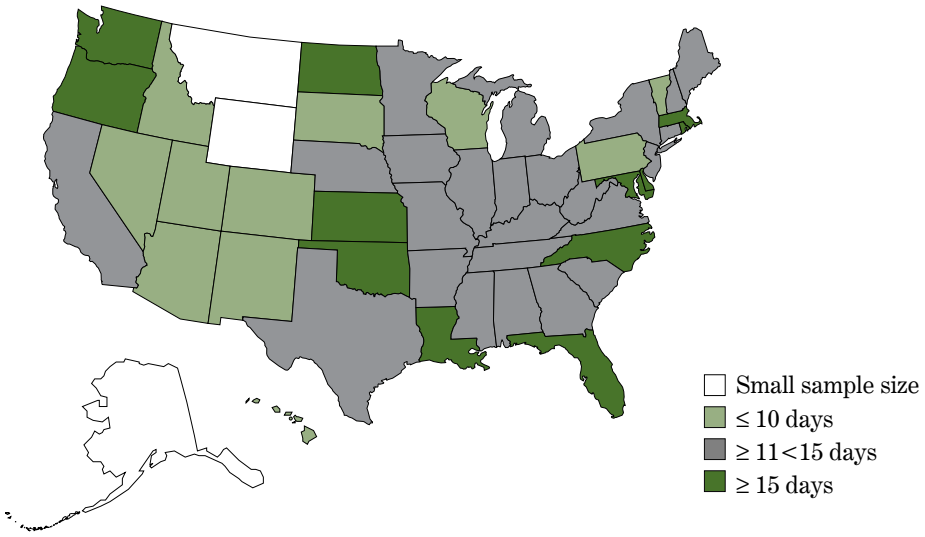


Figure 2. Average Number of Bass Fishing Days



The geographic distribution in Figure 2 is similar to that in Figure 1 which shows participation rates in bass fishing. This comparison shows that states with the highest levels of participation tend also to be the states with the highest average days of bass fishing. Exceptions to this generalization are Oregon and Washington which had high average days of bass fishing but low bass participation levels. This suggests that although there are only a relatively small number of bass anglers in these states, these bass anglers are avid and spend a greater than average time pursuing bass than bass anglers in other states.

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

State	*Average Days Freshwater*	*Average Days Bass*
United States	16.7	15
Alabama	16.9	13
Alaska	11.5	**
Arizona	9.7	9.9
Arkansas	13.1	12.9
California	13.3	11.1
Colorado	10.5	7.9
Connecticut	12.2	13.2
Delaware	14.8	15.9
Florida	16.2	19.1
Georgia	13.3	12.9
Hawaii	8.6	*8.6
Idaho	9.3	7
Illinois	15.2	13.2
Indiana	15.6	13.1
Iowa	14.8	11.5
Kansas	18.6	23.9
Kentucky	12.5	11.4
Louisiana	22.7	20.3
Maine	14.2	11.5
Maryland	13.4	15.4
Massachusetts	17.9	15.4
Michigan	14.8	12.6
Minnesota	18.2	14.2
Mississippi	16.9	13.1
Missouri	12.9	13.5
Montana	8	**
Nebraska	12.2	11.3
Nevada	9	9.7
New Hampshire	13.2	11.8
New Jersey	14.1	12.6
New Mexico	9.1	6.6
New York	15.7	13.1
North Carolina	15.7	16.5
North Dakota	14.7	*21.3
Ohio	14.2	13.1
Oklahoma	16.5	17.2
Oregon	12.1	*16.6
Pennsylvania	14.6	9.5
Rhode Island	18.7	15.4
South Carolina	15.8	13
South Dakota	12.9	6.5
Tennessee	14.8	14.6
Texas	17.5	13.6
Utah	9.9	6.6
Vermont	11.1	8.9
Virginia	12.2	11.2
Washington	14.3	15
West Virginia	15.6	11
Wisconsin	11.7	10.3
Wyoming	6.4	**

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

Characteristics of Black Bass Anglers

Freshwater fishing is a very popular activity with 14 percent of the U.S. population 16 years of age and older participating in 1996. Forty-four percent of all freshwater anglers fished for black bass, nearly 6 percent of the U.S. population 16 years of age and older. 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 each activity for each category (e.g., what proportion of the 45-54 year old U.S. population freshwater fishes and what proportion of the 45-54 year old anglers bass fish). The columns labeled "Percent" in tables 5 through 10 show the percent of participants who were 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 interval.[1]

Age

Bass fishing is popular with all age groups. In all but the oldest age category, more than 42 percent of freshwater anglers fished for bass (Table 5). Among freshwater anglers, equally high rates of participation were found for anglers that were 16-17 and 45-54 years old (47 percent) and for anglers 18-24 and 25-34 years old (46 percent).

Comparing bass anglers to the U.S. population shows that bass anglers were younger. Sixty-eight percent of all bass anglers were 25 to 54 years old, while only 57 percent of the U.S. population was in that age group. The percent of bass anglers 55 and older (17 percent) is much lower than the percent of the U.S. population (30 percent) in that age category. Bass anglers had a similar age distribution to other freshwater anglers.

Sex

Eighty-one 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 male bass anglers (81 percent) is also higher than the percent of male freshwater anglers (74 percent).

While many females 16 years of age and older participated in freshwater fishing

[1] This means that for 90 percent of all possible samples, percentage differences 3 percent or greater will still be different.

Table 5. Age Distribution of the U.S. Population, Freshwater Anglers, and Bass Anglers: 1996
(Population 16 years of age 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	201,472	100	28,921	100	14	12,708	100	44
16-17	7,080	4	1,200	4	17	560	4	47
18-24	20,423	10	2,840	10	14	1,301	10	46
25-34	34,973	17	6,015	21	17	2,761	22	46
35-44	44,376	22	7,950	27	18	3,334	26	42
45-54	35,867	18	5,524	19	15	2,571	20	47
55-64	23,311	12	2,868	10	12	1,241	10	43
65 Plus	35,442	18	2,524	9	7	940	7	37

Table 6. Sex Distribution of the U.S. Population, Freshwater Anglers, and Bass Anglers: 1996
(Population 16 years of age 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*
U.S. Total	201,472	100	28,921	100	14	12,708	100	44
Male	96,660	48	21,371	74	22	10,238	81	48
Female	104,812	52	7,550	26	7	2,470	19	33

(7.5 million), this was only 7 percent of the female population in the U.S. In comparison, 22 percent of the U.S. male population 16 years of age and older 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 33 percent while male freshwater anglers participated at a rate of 48 percent. As a result, women made up 26 percent of freshwater anglers and only 19 percent of bass anglers.

Education

Table 7 shows that 17 percent of Americans 16 years of age and older had 11 or fewer years of education. Only 13 percent of bass anglers had not completed high school. A slightly higher number of bass anglers had 4 or more years of college (27 percent) compared to the U.S. population (25 percent). Freshwater anglers' educational levels are virtually identical to those of bass anglers. Freshwater anglers' participation in bass fishing increased with an increase in the level of education — from 41 percent for anglers with less than a 12th grade education to 46 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. As shown in Table 8, 44 percent of the U.S. population 16 years and older lived in households with incomes greater than $35,000. Freshwater anglers had higher incomes than the U.S. population. Fifty-five percent lived in households with annual incomes greater than $35,000. For bass anglers, an even greater proportion (57 percent) came from households with incomes above the median income. Households with incomes below the national median accounted for 33 percent of freshwater anglers and 31 percent of bass anglers. Twelve percent of freshwater and bass anglers lived in households where income was not reported.

Freshwater anglers' participation in bass fishing increased with income up to the $30,000-34,900 income category. The percent of freshwater anglers who fished for bass increased from 30 percent for the less than $10,000 income category up to 47 percent for persons living in households with incomes greater than $30,000. Freshwater anglers from homes not reporting their incomes participated in bass fishing at a rate of 44 percent.

Census Geographic Division

Table 9 shows the distribution of the U.S. population, and of freshwater and bass anglers by Census Geographic Divisions. These geographic regions are defined in Figure 3. As a percent of the total regional population 16 years and older, the West North Central had the highest participation rate in freshwater fishing with 23 percent. As a percent of total freshwater anglers in the U.S., the East North Central and the South Atlantic regions had the highest level of participation, both making up 17 percent. The pattern is similar with bass anglers.

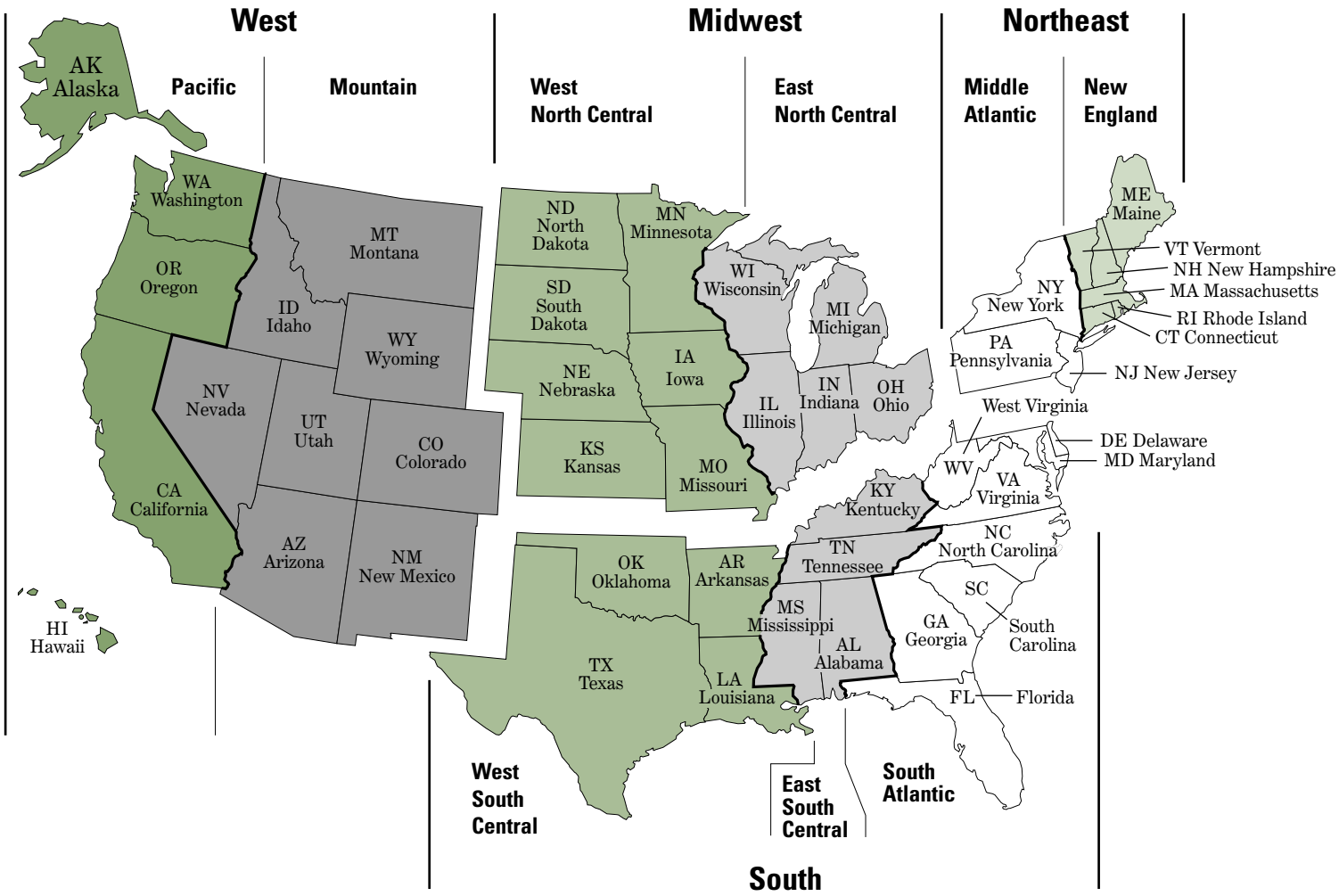
Table 7. Educational Distribution of the U.S. Population, Freshwater Anglers, and Bass Anglers: 1996
(Population 16 years of age and older. Numbers in thousands. Excludes Great Lakes fishing.)

	U.S. Population		*Freshwater Anglers*			*Bass Anglers*		
Education	*Number*	*Percent*	*Number*	*Percent*	*Percent of U.S. Population*	*Number*	*Percent*	*Percent of Freshwater Anglers*
U.S. Total	201,472	100	28,921	100	14	12,708	100	44
0-11 Years	33,743	17	3,959	14	21	1,630	13	41
12 Years	71,098	35	10,470	36	15	4,552	36	43
1-3 Years College	45,573	23	7,017	24	15	3,110	24	44
4+ Years College	51,057	25	7,474	26	29	3,415	27	46

Table 8. Income Distribution of the U.S. Population, Freshwater Anglers, and Bass Anglers: 1996
(Population 16 years of age 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*
U.S. Total	201,472	100	28,921	100	14	12,708	100	44
Under $10,000	15,043	7	1,164	4	8	346	3	30
$10-19,900	19,690	10	2,199	8	11	819	6	37
$20-24,900	13,080	6	1,852	6	14	740	6	40
$25-29,900	12,337	6	2,287	8	19	1,039	8	45
$30-34,900	12,572	6	2,054	7	16	969	8	47
$35-39,900	10,653	5	1,999	7	19	933	7	47
$40-49,900	18,274	9	3,581	12	20	1,496	12	42
$50-74,900	32,223	16	5,988	21	19	2,797	22	47
$75-99,900	28,835	7	2,444	8	16	1,147	9	47
$100,000 or More	13,756	7	1,968	7	14	926	7	47
Not Reported	38,774	19	3,394	12	9	1,495	12	44

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



Twenty percent of all bass anglers lived in the South Atlantic region and 18 percent lived in the East North Central region. As the state-by-state analysis suggests, the regions with the lowest share of bass anglers were the New England, Mountain, and Pacific regions.

Overall, 44 percent of freshwater anglers participated in black bass fishing. The percent participating by region varied from a low of 21 percent in the Mountain region to a high of 53 percent in the South Atlantic and East South Central regions. The West South Cental and Middle Atlantic regions also had high levels of participation in black bass fishing by freshwater anglers at 52 and 50 percent, respectively.

As the participation rates suggest, the geographic distribution of bass anglers differs from the U.S. population and other freshwater anglers. For example, 16 percent of the U.S. population lived in the Pacific region yet only 12 percent of freshwater anglers, and 7 percent of bass anglers lived there. Also of note is that 11 percent of the U.S. population lived in the West South Central region while 14 percent of freshwater anglers and 17 percent of bass anglers lived in that region.

Population Density of Residence

The 1996 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 to be 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 a big cities, 21 percent versus 11 percent. Table 10 shows that participation in bass fishing by freshwater anglers was about the same for all population density levels, between 42 and 45 percent. As a result, the distribution of bass anglers among population density levels is similar to that of all freshwater anglers. As a percent of total bass anglers, most bass anglers are from small cities and towns (42 percent).

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

	U.S. Population		Freshwater Anglers			Bass Anglers		
Region	*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	12,708	100	44
New England	10,306	5	1,143	4	11	547	4	48
Middle Atlantic	29,371	15	2,529	9	9	1,262	10	50
E. North Central	33,121	16	4,963	17	15	2,293	18	46
W. North Central	13,875	7	3,244	11	23	1,330	10	41
South Atlantic	36,776	18	4,774	17	13	2,555	20	53
E. South Central	12,459	6	2,339	8	19	1,247	10	53
W. South Central	21,811	11	4,046	14	19	2,093	17	52
Mountain	11,966	6	2,283	8	19	480	4	21
Pacific	31,787	16	3,599	12	11	900	7	25

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

	U.S. Population		Freshwater Anglers			Bass Anglers		
Density of Location	*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	12,708	100	44
Big City/Urban	73,480	36	8,013	28	11	3,396	27	42
Small City/Town	83,720	42	11,978	41	14	5,295	42	44
Rural	42,976	21	8,883	31	21	3,989	31	45
No Response	1,295	1	47	4	0	28	0	60

1991–1996 Comparison of Bass Fishing Activity

From 1991 to 1996 the number of freshwater anglers changed little — 30.2 million to 28.9 million. Similarly, the number of bass anglers remained almost the same — 12.9 million in 1991 and 12.7 million in 1996. Both of these changes are within the margin of error for this sample size at the 95 percent confidence level so we cannot be sure that the number of anglers actually changed.[2] However, fishing activity has increased. Freshwater fishing days rose 13 percent while bass fishing days increased 21 percent. Corresponding with this, the average fishing days per angler increased for freshwater anglers from 14.3 days in 1991 to 16.7 days in 1996, and for bass anglers from 12.3 days in 1991 to 15.0 days in 1996 (Table 12). This indicates that freshwater anglers and bass anglers are not increasing in numbers but they are becoming more avid — that is, they spend more time fishing.

A comparison of the average number of fishing days by state finds that the average days spent fishing increased a great deal for some states. (Table 12). In Kansas, for example, the average number of freshwater days increased from 11.0 days in 1991 to 18.6 days in 1996; days spent black bass fishing increased from 9.8 days in 1991 to 23.9 days in 1996. Other states which saw large increases (greater than 5 days) in average freshwater and/or black bass average days were Florida, Louisiana, Maryland, Minnesota, North Carolina, North Dakota, Oregon and Washington.[3]

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

[3] North Dakota's estimates for 1991 and 1996 and Oregon's estimates for 1996 are based on small sample sizes and may not be as reliable as estimates for other states.

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
Anglers, Bass	12,857	12,708	*–1
Days, All Freshwater	430,922	485,474	13
Days, Bass	158,226	191,350	21

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

* The difference is within the margin of error of the sample size 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 bass anglers in 1991 are not different from the estimate for 1996.

Table 12. 1991-1996 Comparison of Average Days of Fishing in Freshwater and for Bass by State Where Fishing Occurred.
(Excludes Great Lakes fishing.)

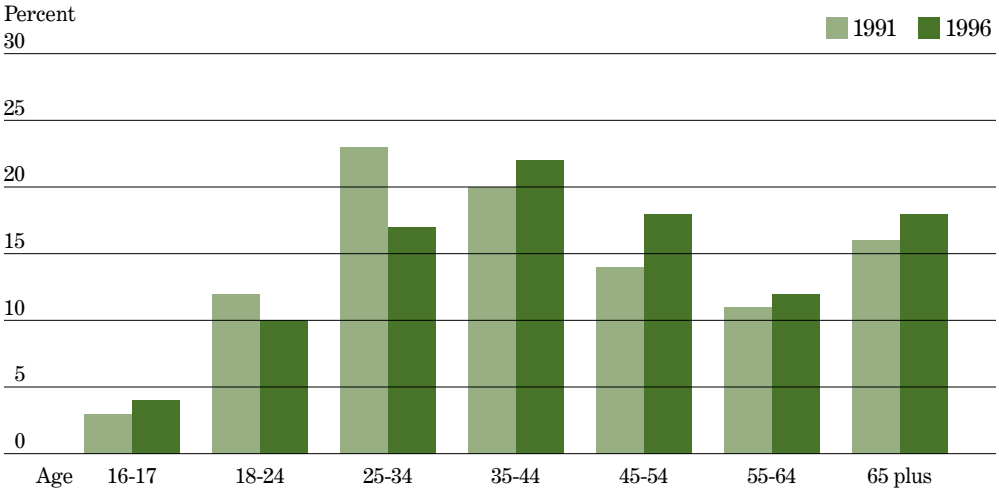
State	*1991 Freshwater Average Days*	*1996 Freshwater Average Days*	*1991 Bass Average Days*	*1996 Bass Average Days*
United States	14.3	16.7	12.3	15.0
Alabama	13.5	16.9	12.4	13.0
Alaska	9.8	11.5	**	**
Arizona	8.5	9.7	8.1	9.9
Arkansas	14.3	13.1	14.6	12.9
California	8.8	13.3	7.5	11.1
Colorado	8.1	10.5	7.6	7.9
Connecticut	13.6	12.2	10.5	13.2
Delaware	12.6	14.8	12.3	15.9
Florida	11.8	16.2	11.9	19.1
Georgia	14.4	13.3	12.5	12.9
Hawaii	6.5	8.6	*6.3	*8.6
Idaho	8.6	9.3	7.6	7.0
Illinois	12.4	15.2	10.6	13.2
Indiana	12.7	15.6	12.2	13.1
Iowa	10.9	14.8	8.7	11.5
Kansas	11.0	18.6	9.8	23.9
Kentucky	12.9	12.5	10.5	11.4
Louisiana	15.3	22.7	13.3	20.3
Maine	11.0	14.2	7.2	11.5
Maryland	11.1	13.4	7.8	15.4
Massachusetts	16.1	17.9	14.1	15.4
Michigan	11.4	14.8	9.3	12.6
Minnesota	13.9	18.2	9.1	14.2
Mississippi	14.8	16.9	13.8	13.1
Missouri	11.4	12.9	10.6	13.5
Montana	9.2	8.0	*0.7	**
Nebraska	10.8	12.2	9.4	11.3
Nevada	7.1	9.0	6.2	9.7
New Hampshire	10.2	13.2	8.7	11.8
New Jersey	14.4	14.1	12.5	12.6
New Mexico	6.9	9.1	6.7	6.6
New York	12.8	15.7	10.1	13.1
North Carolina	12.8	15.7	10.8	16.5
North Dakota	10.0	14.7	*3.7	*21.3
Ohio	12.0	14.2	11.1	13.1
Oklahoma	15.0	16.5	14.0	17.2
Oregon	10.7	12.1	7.0	*16.6
Pennsylvania	17.3	14.6	11.3	9.5
Rhode Island	15.9	18.7	15.4	15.4
South Carolina	14.5	15.8	11.2	13.0
South Dakota	10.9	12.9	9.3	6.5
Tennessee	13.7	14.8	14.0	14.6
Texas	14.0	17.5	12.4	13.6
Utah	8.4	9.9	4.5	6.6
Vermont	12.5	11.1	7.3	8.9
Virginia	13.5	12.2	11.9	11.2
Washington	12.6	14.3	8.8	15.0
West Virginia	12.1	15.6	8.4	11.0
Wisconsin	14.2	11.7	10.0	10.3
Wyoming	7.8	6.4	*5.3	**

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

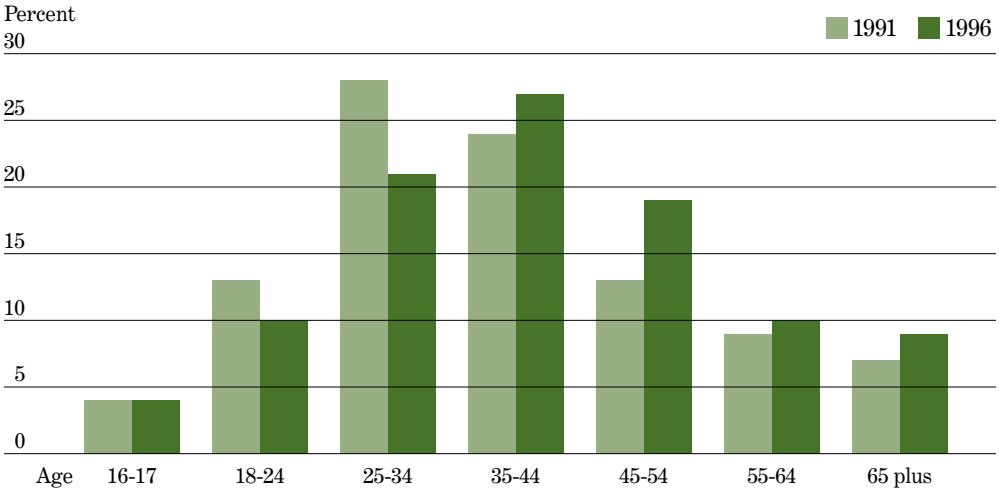
One explanation for the increase in the number of days is that anglers were older in 1996 than they were in 1991 and may have had more leisure time. As shown in Figure 5, the number of bass anglers 45 years of age and older increased from 28 percent in 1991 to 37 percent in 1996. Likewise, freshwater anglers 45 years of age and older increased from 29 percent in 1991 to 38 percent in 1996. The aging of anglers is related to the aging of the "Baby Boom" generation. The U.S. population over 45 increased from 41 percent in 1991 to 48 percent in 1996.

Figure 5. 1991-1996 Comparison of Age Distribution
(Population 16 years of age and older. Excludes Great Lakes fishing.)

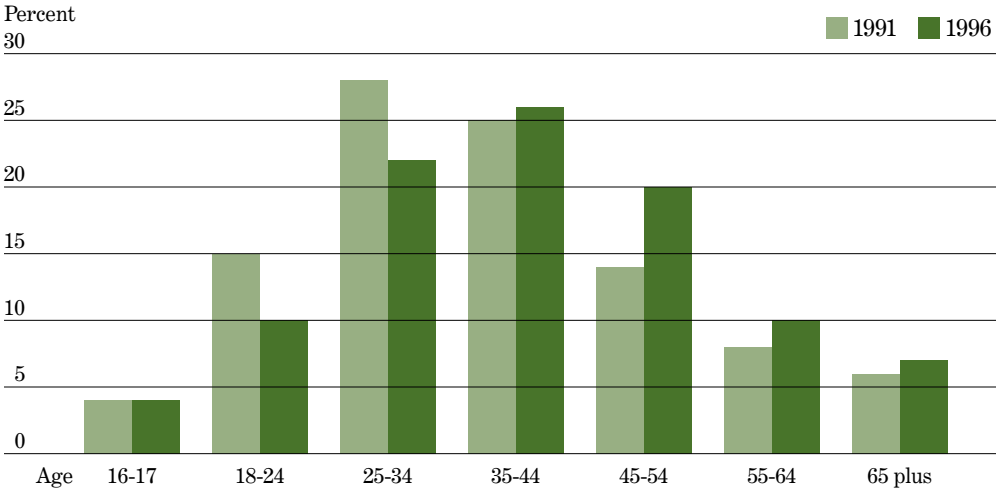
Percent of U.S. Population, by Age



Percent of Freshwater Anglers, by Age



Percent of Bass Anglers, by Age



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 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 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 how each characteristic contributes to 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, 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.[4]

The participation variable is one if the angler fished for bass and zero if he or she did not fish for bass. This type of yes or no response is modeled in the logarithm of the odds that the individual fished for black bass. 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 black bass

x_i = Vector of explanatory variables

α = Intercept to be estimated

β = Vector of coefficients to be estimated

The explanatory variables x_i were a combination of binary and continuous variables. They are described in Table 13. 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 bass fishing sites.

Table 14 shows the model estimated from a nationwide sample of 7,939 freshwater anglers. All variables were significant at the 1 percent level. Variables for age, Hispanic ethnicity, urban residence,

[4] 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 13. Explanatory Variables in the Black Bass Fishing Model

Variable	*Description*	*Mean*
Income	Annual household income, in thousands of dollars	49.5
Female	1 if respondent is female 0 otherwise	0.26
Avid	1 if respondent fished 20 days or more 0 otherwise	0.22
African-American	1 if respondent's ethnicity is African-American 0 otherwise	0.05
South	1 if respondent resided in the South[5] 0 otherwise	0.39
West	1 if respondent resided in the West[6] 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

[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

Table 14. Logit Equation Results for Black Bass Fishing Model

Variable	*Estimated Coefficient*	*Standard Error*	*Partial Derivative*
Intercept	–0.756	0.080	– – –
Income	0.005	0.001	0.0013
Female	–0.580	0.056	–0.1434
African-American	–0.457	0.116	–0.1129
Avid	1.019	0.058	0.2517
South	0.188	0.069	0.0463
West	–0.834	0.091	–0.2061
RiverWQ	0.005	0.001	0.0013

Pseudo $R^2 = 0.0859$
All variables significant at the 0.01 level.

retired anglers and water quality of lakes and ponds 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 0.0859 indicates that the equation explains about 9 percent of the variation in the logit.

The equation shows that the probability of fishing for bass increases with income, others things being equal. It also shows that avid freshwater anglers and anglers who live in the South have a higher probability of fishing for bass. Female anglers, African-American anglers and anglers who live in the West were less likely to fish for bass, other things being equal.

The equation also shows that the probability of anglers fishing for bass increases with the water quality of rivers. This result makes intuitive sense as bass 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 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 variables with all dichotomous choice variables equal to zero to show how each variable affects the probability of fishing for bass. These partial derivatives shown in Table 14 show a change from a base case of a non-African-American male, with average income who lives in a Northeastern or Midwestern state with average river water quality. The derivatives can be used to make statements like "being a woman decreases the probability of fishing by 14 percent." Or a 50 percent increase in water quality increases the probability of fishing by 7 percent.

The whole equation can also be reevaluated to make more complex comparisons. For example, a female, African-American angler residing in a Western state has a 16 percent chance of fishing for bass, while an avid, non-African-American male angler residing in the South has a 73 percent chance of fishing for bass. 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, income and water quality have significant impact on the probability of bass 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 only one-eighth of one percent (0.13 percent).

Note on Calculation Probabilities of Participation from the Bass Participation Model

Equation 1 (page 13) can be solved for the individual's probability of participation in bass fishing, P_i, as

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

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 avid, male, non-African-American angler from the South.

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 South and West 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 14.

3. Sum the results in the calculation in step 2. In this example, this sum is 0.990067. 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 2.691415 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, 0.7291 in this example.

The probability is interpreted as the probability that an angler with the characteristics described by the independent variables will be a bass angler. In this case, the probability that an avid, non-African-American male who resides in a southern state is a bass angler is 72.91 percent.

Table 15. Calculation of Bass Fishing for an Avid, Male, non-African-American Angler from the South

Variable	*Beta*	*Value*		*Beta X Value*
Intercept	–0.75550	1		–0.7555
Income	0.00509	49.5		0.251955
Female	–0.58030	0		0
African-American	–0.45670	0		0
Avid	1.01870	1		1.0187
South	0.18750	1		0.1875
West	–0.83400	0		0
RiverWQ	0.00516	55.7		0.287412
			Sum (α+βx)	0.990067
			$e^{(\alpha+\beta x)}$	2.691415
			Probability	0.7291

Summary

The 1996 National Survey of Fishing, Hunting, and Wildlife-Associated Recreation shows that fishing for black bass appealed to a large number of freshwater anglers. In fact, bass were pursued by more anglers than any other fish that the survey covered. A comparison of 1991 and 1996 FHWAR surveys finds that the average number of days fishing for bass increased although the number of bass anglers remained almost the same.

From a sociodemographic standpoint, there are some interesting differences between freshwater anglers overall and bass anglers. Bass anglers tend to be wealthier, more Southern and more male than other anglers. A probability of participation showed that sociodemographic characteristics and water quality had a significant impact on whether an angler sought bass or another species. Also of note is the finding that avid freshwater anglers are much more likely to fish for bass than non-avid freshwater anglers. This means that bass anglers tend to be more avid than freshwater anglers in general.

These findings from the 1996 FHWAR underscore the importance of bass for millions of freshwater anglers. Information about who these bass anglers are, their age, sex, race, where they live, and so on can be used by recreation managers and others to enhance the fishing experiences of many anglers.

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