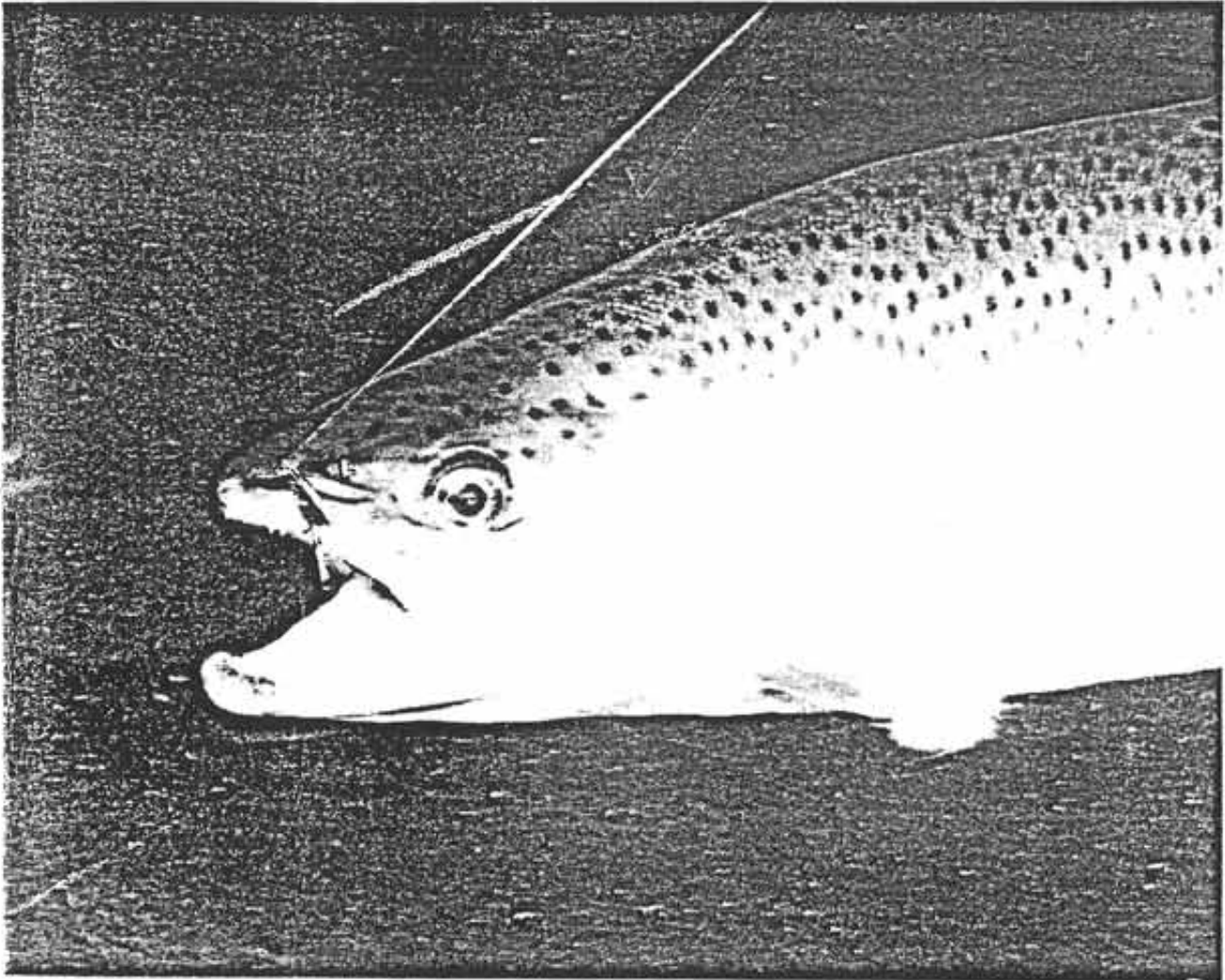


**Statewide
Fishery Management Survey
1986
Postal Census**



Dingell-Johnson Project No. F-43-R-7-9

**State of Utah
Department of Natural Resources
Division of Wildlife Resources**

William H. Geer, Director

STATEWIDE
FISHERY MANAGEMENT SURVEY

1986
POSTAL CENSUS
COMPLETION REPORT

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Dingell Johnson Project Number F-43-R-7-9
October 1988

Utah State Division of Wildlife Resources
An Equal Opportunity Employer

William H. Geer, Director

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STATEWIDE FISHERIES MANAGEMENT SURVEY

1986 Completion Report

INTRODUCTION

Statewide sportfishing postal surveys have been conducted in Utah in 1967, 1968, 1973, 1977, 1981 and 1986. These surveys are used to assess trends in angler use and harvest, information that can be useful in program planning and budget allocation, in assessing state fishery management program success, and in evaluating impacts of increased population and economic development. Past surveys have documented substantial increases in the number of anglers and the number of angler days on Utah's waters. Sportfish harvest has generally kept in pace with the increases in angling pressure, probably due to construction of sportfishing waters and improvement in fisheries management and culture technologies. The 1986 survey was conducted for the purpose of updating the trend information of the earlier surveys.

Since there are no estimates of response bias of Utah postal surveys, the information can only be used for assessing trends, with the assumption that any response biases have remained fairly constant from year to year.

METHODS

Samples of fishermen were selected at random from the 1985 purchasers of the various types of fishing licenses. Questionnaires were mailed to 2.5% of buyers of resident combination and annual fishing permits, and to 5.0% of purchasers of all other types of fishing permits.

A total of 12,820 individuals was selected and these people were sent a letter in May of 1986, to request that they keep a record of their catch during 1986. A form for recording their fishing activity was provided with this letter (for examples of the letters and forms employed, see Appendix). A second letter and the survey questionnaire were mailed during January-February, 1987.

Responses were coded and "keypunched" onto tape to permit summarization of the responses by computer. Expansions of the survey summary statistics were completed for each license type and then combined to produce total estimates. Since 1981, use indices have been made for individual waters with sample sizes (number of respondents reporting use) greater than 35. These lakes and streams with the most reported use were ranked according to their expanded use indices and compared to their use levels in 1981.

To estimate angler hours, angler day indices were simply multiplied by four hours per angler day, a figure used in the prior postal surveys which also fairly closely approximated the length of most angler days on Utah waters.

Indices for stamp purchasers on Lake Powell and Flaming Gorge, Idaho resident use of Bear Lake, and the specialized cisco fishery at Bear Lake were not made from postal return data. Cisco harvest is usually assessed by field surveys but these were not carried out in 1986. Thus, cisco harvest and angler days directed at cisco are not reflected by this survey. Idaho residents are permitted to fish the entirety of Bear Lake on Idaho resident permits. The postal data for Bear Lake was corrected for Idaho resident use by multiplying the postal data for that fishery by a correction factor (1.242) determined from the Bear Lake Cutthroat Trout Restoration research projects' creel census. Residents of Wyoming and Arizona may fish Utah waters of Flaming Gorge and Lake Powell, respectively, with purchase of special stamps. No records are kept by permit vendors of names or addresses of stamp purchasers and accounting for fishing activities of stamp purchasers for these two waters, therefore, cannot be accomplished with any level of certainty. It was estimated purchasers of Utah stamps from Arizona fished Lake Powell an average of 6 days in 1986, based upon estimates from Arizona's 1981 creel survey (personal communication, Erik Swanson, Flagstaff). Use of Flaming Gorge by Wyoming residents with Utah stamps was also estimated to be 6 angling days per stamp holder, the same as for Arizona stamp holders on Lake Powell in 1981 and similar to the 6.55 trips per Flaming Gorge angler used for the 1977 survey (Bangertter and Archer 1978, Johnson 1983). No estimates of fishing pressure on Lake Powell or Flaming Gorge were made for those Arizona or Wyoming residents who did not purchase Utah stamps (and therefore presumably did not fish Utah portions of these waters).

An angling day has been defined for these surveys as a reported instance of fishing a specific water. Since more than one water could be fished in a single day, it was possible for respondents to log more than one angler day in a single day of fishing. Because one-day licenses can be renewed by purchase of a stamp, purchasers of such licenses often reported several "days" of fishing.

RESULTS AND DISCUSSION

Statewide Summary

From 12,820 questionnaires mailed, 2,175 responses were received, of which 804 reported no fishing activity and 39 were unusable. The sample size for the estimation of use and harvest was 1,330, the number of usable responses which reported angling activity. The total number of usable responses was 16.7% of the number of questionnaires mailed. The response rate in terms of those reporting angling activity in 1986 was 10.4%.

This response rate represents a considerable decline from the 1981 survey. The usable responses and percent responding with information on angling activity were 35.8% and 26.7% respectively in 1981 (Johnson 1983). The decline in response was probably an indication of poor acceptance of one-piece bulk mailing forms and letters, which were tried for the first time with the 1986 survey. All previous surveys employed much more costly envelopes and personalized letters. Based upon the poor response rate in 1986, the bulk mailing approach produced no savings in terms of mailing costs per usable return and may have introduced a change in the survey's response bias.

The estimate of the number of anglers of all ages or license types, including unlicensed children and purchasers of Arizona and Wyoming stamps who fished Utah's waters in 1986, was 614,085, compared to 565,191 in 1981, 611,929 in 1977, and 533,869 in 1973 (Table 1). Problems encountered with juvenile harvest and effort responses in the 1977 survey (Bangerter and Archer 1978) almost certainly caused inflation of the 1977

juvenile estimates. In 1980, license fees were increased and the increase was especially steep for nonresident licenses. A sharp decline in nonresident use accounts for a 5% decline in total angler use in 1981. License costs for residents increased sharply in 1985. Resident license sales declined 10%, although total sales were only slightly less (1 percent) in 1986 than in 1981 (Table 2). Taking these factors into consideration, angler use increased from 1967-1977, when license fees were stable and Utah's population and numbers of fishing reservoirs were growing rapidly. License sales and angler use both have declined somewhat since the 1977 peak, perhaps due to increases in license fees.

The average number of days spent fishing per angler has changed little from 1977 (Table 2).

Although considerable effort has been expended during each of the last five surveys attempting to produce comprehensive statistics for licensed and unlicensed anglers on all Utah waters, the results appear to be subject to question. The comprehensive use-harvest statistics of Table 1 are highly variable from year to year and few trend lines are apparent. This variability is perhaps partly a function of changing methodologies. Questionnaire design and methods of interpreting juvenile use-harvest data have varied over the years. Non-response bias has not been measured for this survey, but changing response rates could alter results considerably. For the purpose of trend analysis, use of only those data pertaining to licensed anglers seems to be more reliable than the comprehensive indices. Methodologies for tracking use and harvest of licensed anglers have changed very little over the last five surveys.

Table 1. Angler use, harvest and success for all anglers on Utah waters in 1967, 1968, 1973, 1977, 1981 and 1986.

Year	Estimated number of license buyers who fished	Estimated number of licensed and unlicensed anglers ^b	Angling days ^b			Angling hours ^{a,b}			Harvest ^b			Creel ^{a,b} Rate
			Lake and reservoir	Stream	Total	Lake and reservoir	Stream	Total	Coldwater	Warmwater	Total	
1967	258,422	409,023	2,840,455	1,070,076	3,910,531	11,361,820	4,280,304	15,642,124	8,903,938	1,504,628	10,408,566	0.67
1968	268,512	417,204	2,769,146	1,049,256	3,808,402	11,076,584	4,197,024	15,273,608	8,586,825	1,519,262	10,106,087	0.66
1973	352,397	533,869	3,440,227	1,261,806	4,702,033	13,760,908	5,047,224	18,808,132	8,887,165	3,759,346	12,646,511	0.67
1977	403,617	611,929	3,356,879	1,438,478	4,795,357	13,427,516	5,753,912	19,181,428	8,248,792	3,575,377	11,824,169	0.62
1981	376,501	565,191	2,852,987	1,065,914	3,918,901	11,411,948	4,263,656	15,675,604	8,392,022	3,311,818	11,703,840	0.75
1986 ^c	368,665	614,085	2,878,672	956,284	3,834,956	11,514,686	3,825,136	15,339,822	8,178,684	2,897,837	11,076,521	0.72

^aAll estimates based upon a four-hour angling day.

^bIncluding Arizona and Wyoming purchasers of stamps to fish Flaming Gorge and Lake Powell, respectively. Use of Bear Lake by Idaho residents not included.

^cNot including Bonneville cisco fishery at Bear Lake.

Table 2. Comparison of license costs, sales and fishing activity by license category, 1977, 1981 and 1986.

License Type	Cost			Permit Sales			Average number days fished per angler		
	1977	1981	1986	1977	1981	1986	1977	1981	1986
Resident combination	18.00	23.00	35.00	74,570	83,486	67,436	11.4	12.1	12.5
Resident fishing	8.00	10.50	18.00	146,292	155,775	140,567	12.6	9.4	10.2
Resident 12-15 year old	3.50	4.50	8.00	36,644	36,462	36,291	11.4	12.1	9.8
Resident fishing 65 years and older ^a	4.00	5.00	9.00	14,870	18,045	18,225	9.9	10.3	9.7
Resident short-term ^b									
12-15 yr old	--	2.00	4.00		843	855			*
Adult	--	5.00	9.00	--	5,236	5,150	--	9.7	*
65 & Older	--	4.50	--		146	--			
Nonresident one-day (including one-day stamp in 1986,	2.00	5.00	5.00	96,781	54,040 70,495	75,322	1.4	1.8	2.9
Nonresident five-day	7.50	15.00	15.00	52,885	46,524	53,374	5.5	4.5	5.7
Nonresident season	25.00	35.00	40.00	4,834	9,115	7,869	16.5	13.7	16.7
Resident totals	--	--	--	275,376	299,993	268,524	11.8	10.5	10.5
Nonresident totals	--	--	--	154,500	109,679 124,114	136,565	3.3	3.9	4.8
Totals	--	--	--	429,876	409,672 424,107	405,089	8.8	8.7	8.5

^aFor simplicity, disabled permit sales are also included in this category.^bThis permit type was not implemented until 1980.

*Inadequate sample size.

Using the licensed angler data, it is apparent that there was a sharp increase in angler use and harvest from 1967 through 1977, which was accompanied by a decline in success rate (Table 3 and Figure 1). Since 1977, use has declined about 8%. Success rate in 1981 and 1986 rebounded somewhat, perhaps as the result of lower angling pressure on the state's sportfisheries.

Harvest of coldwater fish has not changed noticeably since 1967. The majority of Utah's coldwater fisheries are not self sustaining and require regular stocking. A significant increase could not be expected in coldwater success without major expansion of the state's hatchery system and/or the number of trout supporting streams and reservoirs.

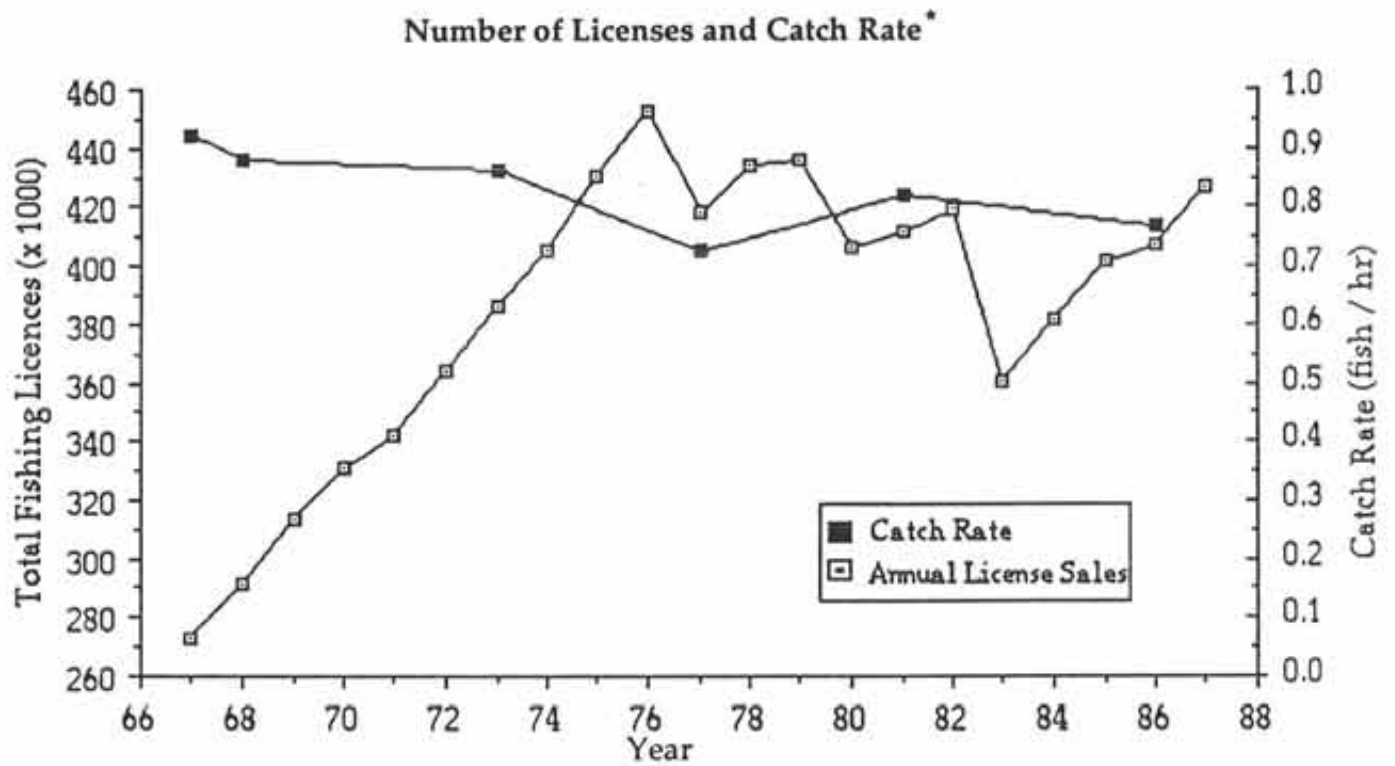
In spite of the static condition of Utah's coldwater fisheries, total harvest increased from 1967-1978 and the Utah sportfishery has been able to accommodate increases in the number of fishermen. This has been due to a nearly four-fold increase in harvest of warmwater fish since 1967, largely owing to the development of the Willard Reservoir and Lake Powell fisheries between 1968 and 1973. Lake Powell is currently the leading fishery in Utah in terms of use and harvest, based upon the 1981 and 1986 postal responses.

Unlike lakes and reservoirs, which have experienced increasing use in recent surveys, angling effort on streams has declined 30% since 1977 (Table 3). The 1977 peak in stream use seems exceptionally high. Low flows prevailed in 1977 and it is likely that stream use was higher than usual in response to improved fishing conditions during the runoff period. Extremely heavy runoff in 1983 and 1984 probably led to the decline in stream use in 1986. In response to flooding problems, many

Table 3. Use, harvest and success for anglers with Utah licenses, 1967, 1968, 1973, 1977, 1981 and 1986 on Utah waters. Percentages are given in parenthesis.

Year	Estimated number of license buyers who fished	Angling days			Angling hours			Harvest			Creel Rate (fish/hr)
		Lake and reservoir	Stream	Total	Lake and reservoir	Stream	Total	Coldwater	Warmwater	Total	
1967	258,422	1,622,195	710,303	2,332,498	6,488,780 (69.3)	2,841,212 (30.7)	9,329,992	7,871,413 (91.5)	731,224 (8.5)	8,602,637	0.92
1968	268,512	1,563,586	695,508	2,259,094	6,254,344 (68.6)	2,782,032 (31.3)	9,036,376	7,228,640 (91.0)	749,890 (9.0)	7,978,530	0.88
1973	352,397	1,949,692	845,286	2,794,978	7,798,768 (68.5)	3,381,144 (31.5)	11,179,912	7,501,685 (78.0)	2,102,245 (22.0)	9,603,930	0.86
1977	403,617	2,361,416	1,155,758	3,517,174	9,445,664 (67.1)	4,623,032 (32.9)	14,068,696	7,337,658 (71.3)	2,950,105 (28.7)	10,287,763	0.73
1981	376,501	2,345,362	896,764	3,242,126	9,381,448 (72.3)	3,587,356 (27.7)	12,968,504	7,738,873 (73.0)	2,866,711 (27.0)	10,605,584	0.82
1986	368,665	2,424,618	799,601	3,224,219	9,698,472 (75.2)	3,198,404 (24.8)	12,896,876	7,485,743 (75.2)	2,464,535 (24.8)	9,950,278	0.77

^aAngler hour estimates based upon a four-hour angling day.



* Catch rates are based upon statewide postal survey data from 1967, 1968, 1973, 1977, 1981, and 1986.

Figure 1. Trends in statewide catch rate and annual sales of fishing licenses, 1966-1988.

streams were channelized without regard to fish habitat needs. Particularly hard hit were the Weber, Blacksmith Fork and Provo Rivers (see "individual waters" below).

Given the finite nature of the state's water resources, other major resource developments and improvements will be required to meet anticipated future demands for sportfishing. The only options readily apparent of the magnitude required would be development of a major sportfishery in Utah Lake, improved stabilization and sportfishery management of Yuba Reservoir, a major acceleration in reservoir construction, stream habitat improvement and access acquisition, and/or major expansions of the state's hatchery system.

Use Indices for Individual Waters

Use indices were derived for individual waters using only data for licensed respondents and stamp purchasers. The indices derived from this analysis, when compared to creel surveys conducted in the field, are generally higher, to varying degrees, depending on the water considered (Johnson 1983). The utility of the postal results for individual waters may, therefore, be primarily valuable for detecting major changes in angler habits, such as response to development of major new fisheries.

Use indices for individual waters for which 35 or more respondents reported fishing activity are given in Tables 4 and 5. This information must be considered with the reservation that there have not been estimates of standard error provided and there are no means of correcting for any response biases inherent in this effort. The sample size of 35 respondents was intuitively selected. Use data provided do not include

juvenile statistics. Use indices of stamp purchasers at Flaming Gorge and Lake Powell have been included in the nonresident estimates for those waters and the Bear Lake use index has been corrected to account for use by Idaho residents fishing under reciprocal agreements.

Lake Powell appears to be the state's leading reservoir and the Provo the most important river in terms of angler use. Larger reservoirs tend to be the most popular, with the exceptions of Utah and Bear Lakes, which are Utah's second and third largest fresh waters but rank only tenth and eighteenth, respectively, according to use index. As would be expected, nonresident use is highest in waters of southern Utah and at Flaming Gorge and relatively low near the Wasatch Front.

Although Strawberry Reservoir experienced a decline of more than 10% since 1981, it still leads the state in use by residents of Utah (Table 4).

Thirty-five percent of the angler use of Lake Powell is from nonresidents (Table 4). The 1986 survey coincided with one of Lake Powell's peak years of popularity. Use and harvest may have been highest in 1985, when approximately 1.5 million pounds of fish, mostly striped bass, were harvested. Declines in Lake Powell's forage base since 1985 can be expected to result in reduced use in future surveys.

The greatest single increase in use of any water occurred at Flaming Gorge Reservoir, where use increased 56% since 1981 (Table 4 and Figure 2). This trend is paralleled by increases in Wyoming and Utah reciprocal use stamp sales over the same period, and may be due to the reservoir's growing reputation as a trophy lake trout fishery. Kokanee and rainbow trout catch rates were also unusually high in 1986

Table 4. Angler use indices for lakes and reservoirs for which at least 35 respondents reported activity in 1986, with comparison with 1981 survey results.

Use Level Ranking	Water Name	Angler use index (days)			Difference from 1981	Surface Acreage	Use Per Acre
		Resident ^a	Nonresident	Total			
1	Lake Powell	220,039	121,362	341,280	+57,267	185,000 ^b	1.8
2	Strawberry/ Soldier Cr. Res.	294,601	5,215	298,524	-34,347	14,000	21.4
3	Flaming Gorge	192,794	23,105	215,306	+77,205	40,000 ^b	5.4
4	Otter Creek Res.	69,944	35,858	105,517	+45,098	2,521	42.0
5	Scofield Res.	96,104	2,016	97,707	-35,023	2,815	34.9
6	Deer Creek Res.	72,718	4,154	76,558	-14,293	2,965	25.9
7	Panguitch Lake	11,432	59,640	70,996	-15,205	1,234	57.6
8	Utah Lake	69,752	620	70,252	+3,373	96,900	0.7
9	Pineview Res.	49,969	2,722	52,684	-44,318	2,874	18.3
10	Fish Lake	36,693	15,863	52,435	+20,914	2,500	21.0
11	Trail/Mirror Area Complex	36,387	10,403	46,670	-6,411	430	108.8
12	East Canyon	43,175	278	43,168	-4,677	684	63.5
13	Willard Bay Res.	41,830	171	41,941	-75,540	10,000	4.2
14	Bear Lake	34,431	1,439	35,870	+4,173	69,760 ^b	0.4
15	Steinaker Res.	24,078	7,617	31,695	+20,989	820	38.7
16	Minersville Res.	19,816	8,282	28,098	-20,270	990	28.4
17	Rockport Res.	24,147	278	24,305	-34,135	1,077	22.7
18	Lost Creek Res.	23,391	257	23,648	-13,254	415	57.0

^aIncluding Arizona/Wyoming residents who purchased Utah stamps, but not including use by Arizona/Wyoming residents that did not purchase stamps to fish the Utah portions of Lake Powell or Flaming Gorge, respectively. Includes use of Idaho residents fishing Bear Lake under reciprocal agreement.

^bIncluding border waters in adjacent states.

Table 5. Angler use indices for streams for which at least 30 respondents reported activity in 1986, with comparisons with 1981 survey results.

Use Level Ranking	Water Name	Angler use index (days)			Difference from 1981
		Resident	Nonresident	Total	
1	Provo River	105,878	4,046	109,623	+14,361
2	Weber River	63,848	920	64,640	-55,855
3	Ogden River	41,818	0	41,721	+3,848
4	Logan River	40,891	0	40,861	+5,516
5	Green River	26,518	13,521	40,009	+9,727
6	Sevier River	9,953	11,404	21,312	+12,699
7	Bear River (cold)	15,265	855	16,097	+1,281
8	Mammoth Creek	2,193	11,202	13,388	+3,957

Otter Creek Reservoir and Fish Lake also experienced significant increases in use. These increases followed changes in management and stocking strategies which produced much higher survival rates of stocked trout.

Harvest at Steinaker Reservoir was composed of 56% warm and 44% coldwater species, suggesting either/or both types of fishing may have contributed to the apparent increase in use there.

Use of Willard Reservoir declined by over 35% since 1981, probably due to the disappearance of its crappie. The fishery is now dominated by walleye and catch rates are undoubtedly lower now than in previous

Change in use from 1981 creel in angler days (x 1000)

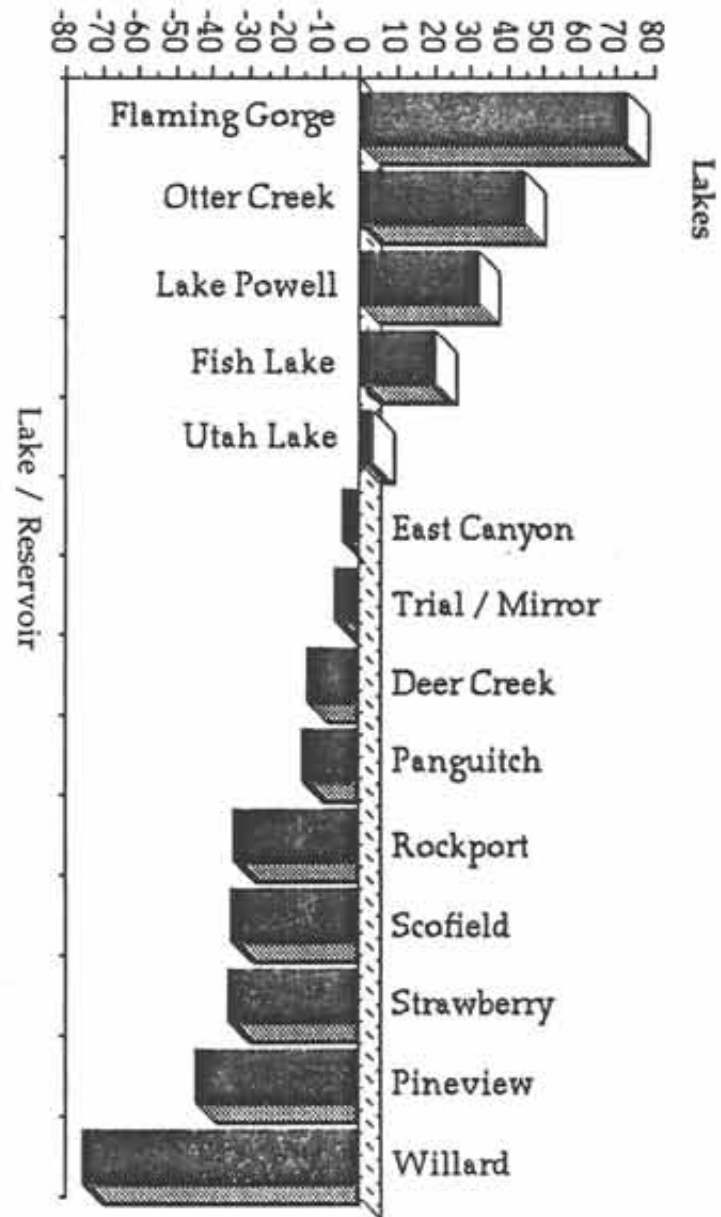


Figure 2. Change in angler use on the most heavily used lakes and reservoirs between the 1981 and 1986 postal surveys.

years. Pineview and Rockport reservoirs also experienced serious declines and these are thought to be related to water quality, competition and other problems complicating management of their fisheries. The apparent decline in fishing at Scofield was temporary because 1987 was an exceptionally good year for fishing quality there.

Use of streams declined in 1986 (see Statewide Summary, above and Table 3). The decline was led by a 46% reduction in pressure on the Weber River (Figure 3). The Weber River was, by far, the most heavily utilized stream in the 1981 survey and, in spite of the decline in use, remains the state's second most heavily used stream resource (Table 5). The Blacksmith Fork declined from a number 3 ranking, with 55,000 angler days use in 1981, to below eighth in the 1986 ranking. Although sample size for the Blacksmith dropped too low to permit meaningful estimation of its use index, use probably declined more than 30,000 angler days.

Both the Weber and Blacksmith Fork were heavily impacted by dredging and channelization projects which followed record runoff in 1983. Almost the entire length of the Weber River was affected by channel alterations. Stream angling days were valued by the U.S. Bureau of Reclamation in 1987 at \$17.60 per 4 hour angling day (U.S. Bureau of Reclamation 1987). Using this value, the economic loss in stream fishing from the Weber River is estimated to be \$927,719 annually.

The Blacksmith Fork was impacted by more than channel alterations. High water destabilized a small hydroelectric dam, necessitating draining of the reservoir, which resulted in scouring of sediment from the reservoir bed. Elevated turbidity from this and from the extremely high runoff in 1983 may have caused serious declines in water quality and

Change in use from 1981 creel in angler days (x 1000)

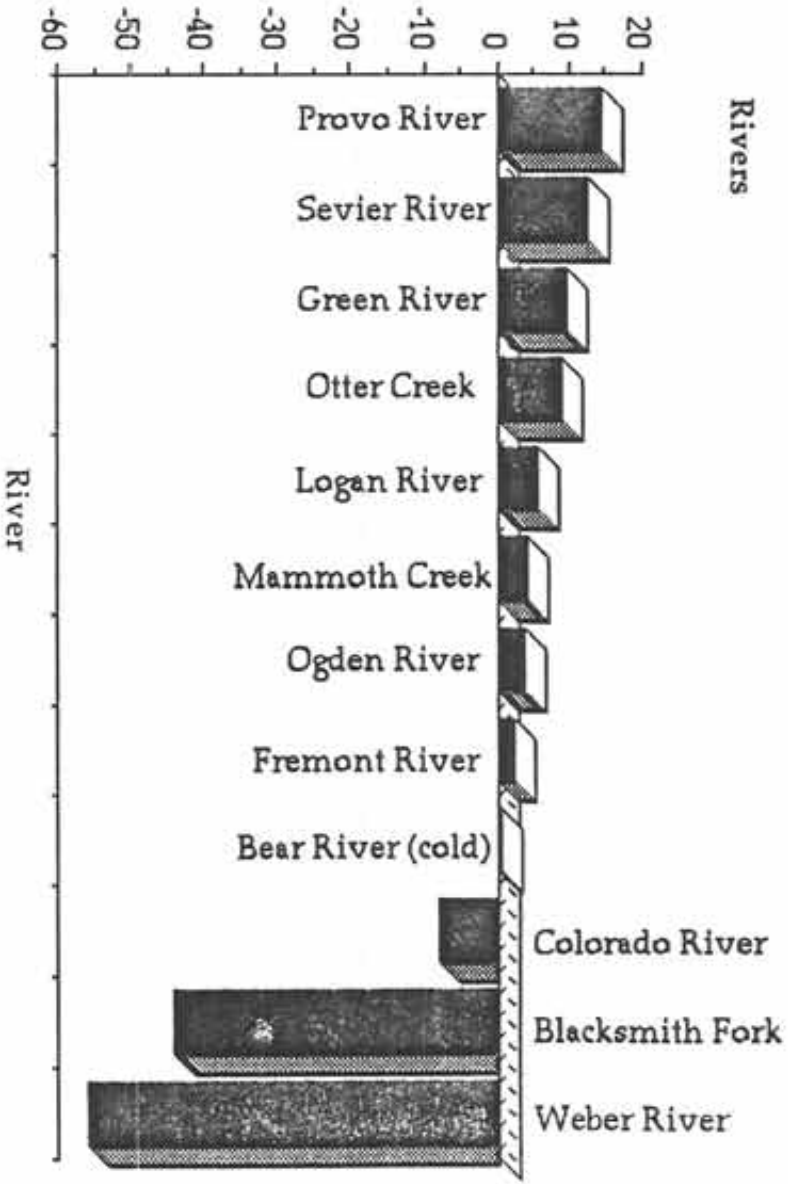


Figure 3. Change in angler use on the most heavily used streams between the 1981 and 1986 postal surveys.

lasting degradation of habitat. In addition, angling regulations have become more restrictive. Such regulations can be expected to suppress use until the fish population responds favorably to the protection. A favorable population response could not be expected following 1983 if habitat conditions have become a limiting factor to the fishery.

The decline in stream fishing, thus appears to be the result of resource degradation. Recent surveys suggest this decline may be a sustained trend. If, as appears to be the case, stream fisheries are utilized in proportion to their quality and availability, continued degradation of Utah's stream resources jeopardizes this one element of the quality of human living conditions in Utah. Because stream resources are finite and irreplaceable, the only recourse is a more vigilant approach to stream habitat protection and enhancement.

Angler pressure, expressed as use per acre (Table 4), is an important planning tool. Waters with low angler densities can be identified as resources available for meeting increasing angler use; those with use levels above about 50 trips per acre are probably producing at or above their capacities. In terms of use per acre of water, the Trial/Mirror complex of lakes (along the Mirror Lake highway east of Salt Lake City) are the most heavily used waters in Utah. East Canyon, Lost Creek and Panguitch Reservoirs are also being used at or above their production capacities. Lake Powell, Flaming Gorge, Utah Lake, Willard Bay, and Bear Lake are all resources that should be capable of accommodating major increases in use. Because of their proximities to the Salt Lake Valley, Utah Lake and Willard Bay are of exceptionally high strategic value in meeting future demand. Other waters, for which sufficient sample sizes

were not obtained but that are probably also fished far below their capacities, are Starvation and Yuba reservoirs.

Results by License Category

As in the 1981 survey, the most successful angler categories in terms of average number of fish caught for the season, were resident combination and season nonresident license buyers. The highest catch rates (fish/hour) were recorded for combination and 65-year old and older permit buyers (Table 6). Sample sizes for resident five-day permit buyers were insufficient to permit estimation of their harvest and catch rates. Nonresident purchasers of one- and five-day permits generally reported the lowest number of fish harvested per angler, due to the restricted number of angling days provided by the short-term permits and a relatively low catch rate for the one-day nonresident category. Nonresident one-day, five-day and adult resident five-day purchasers reported the highest percentages of warmwater fish in their catches. Senior citizen (65 and older) permit buyers targeted coldwater fish almost exclusively.

Nonresident anglers account for a very small portion of the harvest, relative to the number of nonresident permits sold. Harvest by nonresidents was only 18.2% of the 1981 total, although 31.0% of all permits were sold to nonresidents (Table 2).

Table 6. Angling use and success by license category, Utah, 1986.

License Type	Number of licenses sold	Estimated number that fished	Angling days			Estimate of Harvest			Creel rate (fish/hr)	Average number of fish per license buyer
			Lakes and reservoir	Stream	Total	Coldwater	Warmwater	Total		
Resident combination	67,436	57,321	526,018	190,345	716,363	2,049,357 (79.1)	541,217 (20.9)	2,590,574	0.90	38.4
Resident annual fishing	140,567	133,539	998,489	362,317	1,360,806	2,961,914 (75.2)	977,476 (24.8)	3,939,390	0.72	28.0
Resident annual fishing 12-15 yr old	36,291	34,476	249,042	89,233	338,275	694,802 (72.1)	168,510 (27.9)	963,312	0.71	26.5
Resident annual fishing 65 yr and older and disabled permits	18,225	16,403	119,327	39,971	159,298	481,098 (93.1)	35,710 (6.9)	516,808	0.81	28.4
Resident 5-day 12-15 yr old ^a	855	855	15,105	3,705	18,810	35,055 (70.7)	14,535 (29.3)	49,590	—	—
Resident 5-day Adult ^a	5,150	5,150	23,175	858	24,033	43,775 (53.7)	37,767 (46.3)	81,542	—	—
Nonresident one-day	59,678 ^b	59,678	152,735	18,207	170,942	304,459 (67.2)	148,689 (32.8)	453,148	0.66	7.6
Nonresident five-day	53,374 ^b	53,374	240,739	63,660	304,399	631,315 (65.7)	329,696 (34.3)	961,011	0.79	18.0
Nonresident season	7,869	7,869	99,988	31,305	131,293	283,968 (71.9)	110,935 (28.1)	394,903	0.75	50.2

Table 6. Continued

License Type	Number of licenses sold	Estimated number that fished	Angling days			Estimate of Harvest			Creel rate (fish/hr)	Average number of fish per license buyer
			Lakes and reservoir	Stream	Total	Coldwater	Warmwater	Total		
Resident Totals	268,524	247,744	1,931,156	686,429	2,617,585	6,266,001 (77.0)	1,875,215 (23.0)	8,141,216	0.78	30.3
Nonresident Totals	120,921	120,921	493,462	113,172	606,634	1,219,742 (67.4)	549,320 (32.6)	1,809,062	0.75	15.0
Grand Totals	389,445	368,665	2,424,618	799,601	3,224,219	7,485,743 (75.2)	2,464,535 (24.8)	9,950,258	0.77	25.5

^aSample size near zero.^bIn addition, 15,644 one-day stamps were sold, extending the terms of one and five-day nonresident licenses.

RECOMMENDATIONS

Survey Design

Some purchasers of fishing and combination licenses do not fish. Based upon previous surveys, 5-10% of license buyers fail to participate in the sport. Nonparticipation by license buyers was inadvertently left off this year's questionnaire, necessitating the use of nonparticipation rates derived from the 1981 survey. The question regarding nonparticipation by license buyers should be reinstated in future questionnaires.

The use of bulk mailing technology, although far less costly per parcel than traditional mailings, resulted in a serious reduction in returns and probably produced no net savings in cost per usable return. The change in response rate could also have affected a change in response bias. For these surveys to be considered comparable between years, non response biases and other forms of survey bias must remain consistent. For these reasons, traditional mailings, composed of letters of instruction to each fisherman sampled, printed on Department of Natural Resources Stationary and signed by the Director of Wildlife Resources, along with return addressed envelopes should be used in future surveys.

Currently, license buyers names and addresses are not available for the year of survey. Mailing lists must be prepared from license sale records the year prior to the survey and even these were not available until March 1986. Many license buyers do not buy licenses regularly and this is especially true of nonresident one- and five-day license buyers. Thus, many respondents report they did not buy licenses and many others

in the sample probably failed to respond for the reason that they did not fish in the year of the survey. If the survey sample could be selected from those buying licenses in the year of survey, response rates would probably increase markedly, especially among nonresidents. This, in turn, could permit a reduction in number of mailings required, thus reducing the cost of the survey.

Name and addresses of Wyoming and Arizona purchasers of stamps should be recorded by license vendors so that stamp purchasers can be sampled in the surveys.

Use of the Jordan River is apparently substantial, based upon the responses received in 1986. This was somewhat unexpected and a stream code was not assigned to the Jordan; thus, use of this river was not computed for 1986. Use of the Jordan River will be coded in future surveys, however.

Fishery Management Programs and Planning

Lake Powell and Strawberry Reservoir are the state's leading waters in terms of total angling use. Approximately one angling trip in five was spent on one of these two waters in 1986, and one nonresident trip in five was on Lake Powell alone. However, based on more recent field surveys, the catch rate at Strawberry in 1988 was only about half that of 1986 and the striped bass fishery has declined considerably in quality at Lake Powell. Unless the causes of these problems can be corrected, anglers could respond by reducing their participation in the sport in Utah or by relocating to other Utah waters, many of which are currently experiencing capacity use.

A steady decline in use of streams appears to be emerging. Again, unless measures are taken to reverse this trend, stream anglers could reduce their angling participation in Utah.

Several large lakes and reservoirs are being fished at rates far below their capacities, most notably Utah Lake, Yuba Reservoir, Starvation Reservoir, and Bear Lake. Utah Lake, located in the state's Wasatch Front population center, is easily capable of sustaining an additional 1,000,000 angling days per year if it's fish forage base shortage could be corrected. These waters, and Utah Lake in particular, are capable of sustaining anticipated increases in angling pressure, if problems that presently limit their fisheries can be corrected. They should, therefore, be given priority attention.

LITERATURE CITED

- Bangerter, A. and D. Archer. 1978. Statewide Fisheries Management Survey, 1977. Dingell-Johnson Project Number F-22-R-4. Publication Number 78-13. Utah Division of Wildlife Resources, Salt Lake City. 58 pp.
- Johnson, J. 1983. Statewide Fisheries Management Survey, 1981 postal census. Dingell-Johnson Project Number F-22-R-6. Publication Number 83-7. Utah Division of Wildlife Resources, Salt Lake City. 34 pp.
- U.S. Bureau of Reclamation. 1987. Supplement to final environmental assessment for the recreation master plan, Strawberry Reservoir enlargement. U.S. Department of the Interior, Bureau of Reclamation, Upper Colorado Region Office, Salt Lake City, Utah.

APPENDIX

Letters and forms employed in 1986
Postal Creel Survey



STATE OF UTAH
NATURAL RESOURCES
Wildlife Resources

Norman H. Bangerter, Governor
Dee C. Hansen, Executive Director
William H. Geer, Division Director

1596 West North Temple • Salt Lake City, UT 84116-3154 • 801-533-9333

May 1986

Dear Sportsman:

You have been selected from the list of people who purchased fishing or combination hunting and fishing licenses during 1985 to participate in a fish harvest study. We hope that you will assist us in the study, the results of which will help us in developing sound fisheries programs for the future.

The information needed is outlined on the form printed on the back of this letter. Please carry the form with you and record the fish you personally catch during 1986. We have found that if you keep a record of your fishing, it is much easier to recall at year's end all of your fishing activity. If you have children in your immediate family who did not purchase a license because they were not yet twelve years old, please record their catches during 1986 in the area provided on the lower portion of the form. If more than one member of your family receives this questionnaire, please arrange to keep only one catch record of the children in your family. (Do not include cisco or cisco trips in this report.)

We recognize that a growing proportion of Utah's anglers prefer to release a part or all of their catch. Record the release of only those gamefish (not carp, suckers, chubs, etc.) that were large enough to keep -- do not record fish that were returned because they were too small. You can begin assisting this study now by listing those fishing trips you have already undertaken during 1986 on the back of this letter.

Next January 1987 you will receive a follow-up letter requesting your data. Another form will be attached for the summarization of your catch and fishing trips.

We wish to thank you at this time for your interest and assistance in collecting this information which will help us to assure continued good fishing for you and your family in the future.

Sincerely,

William H. Geer
Director

1. One day of fishing is one fishing trip to a specific water -- no matter how long you fished.
2. For released fish, record only gamefish that were big enough to keep but you chose to release anyway.

Name of Water	No. days fished ^{1.}	Number coldwater fish		Number Warmwater fish	
		Kept	Released ^{2.}	Kept	Released ^{2.}
Totals					

**BULK RATE
U.S. POSTAGE
PAID
S.L.C. UTAH
PERMIT NO. 899**

Children 6-12 years of age
(list each child's fishing seperately)

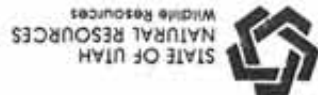
[illegible]STATE OF UTAH
NATURAL RESOURCES
Wildlife Resources

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1596 West North Temple - Salt Lake City, UT 84116



Norman H. Bangerter, Governor
Dee C. Hansen, Executive Director
William H. Geer, Division Director

1596 West North Temple • Salt Lake City, UT 84116-3154 • 801-533-9333

December 19, 1987

Dear Sportsman:

Last spring you were contacted by letter and requested to participate in a fish harvest survey for 1986. At that time, you were asked to keep a record of your fishing trips and fish creeled.

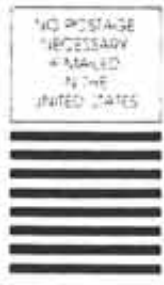
We are now requesting this information. Please complete the questionnaire on the back of this letter. (Do not return the form we sent you last spring. That form was only to assist you in keeping track of your fishing activities.) If you did not keep a written record please go ahead and complete the questionnaire from memory. Upon completion, simply fold, tape, and mail the questionnaire. Follow the instructions below. We have provided postage paid for your convenience.

The information you provide is important in assessing fishing quality in Utah and where improvements need to be directed. I very much appreciate your cooperation.

Sincerely,

William H. Geer
William H. Geer
Director

FROM _____



UTAH DIVISION OF WILDLIFE RESOURCES
1596 WEST NORTH TEMPLE
SALT LAKE CITY, UT 84116-9989



INSTRUCTIONS

1. One angler day = One day during which you fished a certain water (no matter for how long you fished there). If you fished more than one water in a single day, record each water as a separate angler day.

2. Released fish - Please record only gamefish (not carp, chubs, or suckers) that were big enough to keep. Do not record fish that were returned because they were small.

TO RETURN THIS QUESTIONNAIRE

1. Cut or tear off this panel along dashed line.

2. Fold so that return postage (Business Reply message) is on outside.

3. Tape flap closed. Do not staple.

4. Deposit your completed questionnaire in the mail.

1986 FISH HARVEST QUESTIONNAIRE

A. Did you fish in Utah during 1986? Yes ☐ No ☐
(If your answer is "No", you have completed the survey - please drop questionnaire in mail).

B. Type of Utah license purchased (for yourself) in 1986:

Resident Annual

- ☐ Combination (\$35.00)
☐ Fishing (\$18.00)
☐ 12-15 yr. old (\$8.00)
☐ 65 & older (\$9.00)

Resident Five-Day

- ☐ Adult (\$9.00)
☐ 12-15 yr. old (\$4.00)

Nonresident

- ☐ Annual (\$40.00)
☐ Five-Day (\$15.00)
☐ One-Day (\$5.00)

C. How many unlicensed children, 6-12 years old, in your immediate family fished in Utah? _____. (If more than one member of your family receives this questionnaire, please include the children on one reporting form only.)

1. How many days did these children spend stream fishing? _____. Lake and reservoir fishing? _____.

2. How many coldwater fish were caught by these children during 1986? _____. How many warmwater fish? _____.

(Coldwater fish are trout, kokanee, whitefish, and cisco; Warmwater fish are perch, bluegill, bass, catfish, walleye, pike, etc.)

D. Fishing record--Please list, to the best of your memory, names of all waters you fished, type of water (lake or stream), number of days you fished each water, and number of fish you caught. Please include only your catch. (Do not forget to include those experiences when you caught no fish!) Please do not include cisco taken while dip-netting at Bear Lake.

	Name of Water	Lake or Stream?	No. Days Fished	Catch - Record "Fish Kept" and "Keepers" you released.	
				No. Coldwater	No. Warmwater
1.					
2.					
3.					
4.					
5.					
6.					
7.					
8.					
9.					
10.					
11.					
12.					
13.					
14.					

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