A METHOD FOR ESTIMATING FISHING EFFORT FROM TRAFFIC COUNTS

By Liter E. Spence Jr.
Montana Fish & Game Department

Introduction

The collection of reliable data on fishing pressure and harvest of fishing waters is a necessary fish management tool. Creel censuses at the field level are generally used to obtain such data. In most cases it is impossible to obtain complete coverage of waters because of lack of time, personnel, or funds for the job, and the researcher must conduct a partial creel census at whatever level resources will permit. Data collected in a partial census are often expanded by some means so as to provide estimates for the days of the season which were not censused. Estimates of fishing pressure and harvest can then be obtained for the entire fishing season being investigated.

A method which is frequently used to estimate fishing pressure requires the counting of cars, boats, or fishermen during pre-scheduled randomized periods. By using these data in conjunction with collected creel data and various fishing season information (such as number of days in the season, hours of legal fishing, etc.) estimates of pressure and harvest can be made for the entire season.

Methods

A method we have successfully used in a creel census to obtain fishing pressure and harvest information for non-census days relied on the use of hourly-recording traffic counters to record automobile traffic passing a given point. Traffic counts were obtained for each day of the fishing

season whether or not a census technician was on duty. A regression analysis was made using traffic counts and creel data obtained on census days to determine the relationships between car counts and the variables of interest (fishing pressure and harvest). This relationship was then used to estimate creel data for non-census days from car counts data. The regression estimates, plus the known data give total fishing effort and pressure for the season.

Rock Creek, near Missoula, Montana was utilized in a 10-year creel census study to determine the effects of stocking hatchery trout in a wild trout stream. Traffic counters were used during eight years of this study to determine total fishing effort and harvest.

Access to the 40-mile length of stream used in the study is limited to two points - one at the lower boundary, or mouth of the stream, and the other at the upper boundary of the study area. This arrangement greatly facilitated the use of traffic counters since fishermen entering and leaving the study area had to pass by one of the two access points. One traffic counter was installed at each of the access points. A creel census check station was also established at each access point. Fishermen leaving the area were requested to stop at the checking stations and be inteviewed as to their fishing effort and success. The census technicians were responsible for maintaining the traffic counters and keeping a daily record of the traffic counts.

The traffic counters used were manufactured by the Streeter-Amet Company of Grayslake, Illinois[1/]. The counting mechanism is powered by a 6-volt automobile battery. The counter mechanism is activated by a change in air pressure which results when wheels pass over a rubber hose stretched across

[1/] No endorsement of the product is intended.

the road. Each ~~axel~~ axle which crosses the road tube counts as ½ a car, so that each 2-axel vehicle is counted as one car. An eight-day mechanical clock triggers a printing mechanism which prints on a paper tape, each hour, the preceding hour's car count. Car counts were made over a 24-hour period.

Results

The effectiveness of using the counters to estimate fishing effort and harvest for non-census days can be shown best by results from the study (Table 1). These data show the precision of the regression estimates of total fishermen, hours fished, and fish caught with confidence intervals at the 95 percent probability level. These estimates are only for station 1, which received the most creel data.

A further example of the accuracy of the regression estimates can be shown by adding known creel data (for example ...) to the regression estimates. These data are shown in Table 2.

The greater precision found in the confidence limits between Table 1 and Table 2 is the result of adding known creel data to the estimated creel data. The known data have a confidence limit of zero, since there are no variances associated with them. The variance of the sum of the known data and regression estimate data is the sum of their variances. Since the variance is needed to determine the standard error and finally the confidence limits themselves, the confidence limit interval is narrower with the known data added than without it.

TABLE 1. Regression estimates of fishing effort and harvest and their 95% confidence limits for Rock Creek, Station 1, 1960-1967.

Year		Regression Estimate	95% confidence limits	%
1960	Fishermen	4676	± 399	8
	Hours fished	16114	± 1617	10
	Fish caught	13394	± 1287	10
1961	Fishermen	4421	± 440	10
	Hours fished	12637	± 1550	12
	Fish caught	8863	± 907	10
1962	Fishermen	6164	± 326	5
	Hours fished	17775	± 1645	9
	Fish caught	11401	± 1069	9
1963	Fishermen	3802	± 236	6
	Hours fished	12276	± 985	8
	Fish caught	7040	± 658	9
1964	Fishermen	3611	± 322	9
	Hours fished	13586	± 1226	9
	Fish caught	7184	± 839	12
1965	Fishermen	4432	± 399	9
	Hours fished	15195	± 1635	11
	Fish caught	9743	± 1152	12
1966	Fishermen	4125	± 506	12
	Hours fished	15066	± 2231	15
	Fish caught	9084	± 1880	21
1967	Fishermen	2315	± 458	20
	Hours fished	8326	± 1819	22
	Fish caught	7357	± 1297	18

TABLE 2. Total estimates of fishing effort and harvest and their 95% confidence limits for Rock Creek, Station 1, 1960-1967.

Year		Estimate	95% confidence limits	Rounded %
1960	Fishermen	11,513	± 452	4
	Hours fished	40,129	± 1770	4
	Fish caught	34,996	± 1685	5
1961	Fishermen	9,489	± 500	5
	Hours fished	27,829	± 1734	6
	Fish caught	20,482	± 1428	7
1962	Fishermen	10,936	± 503	4
	Hours fished	32,101	± 2060	6
	Fish caught	22,122	± 1576	7
1963	Fishermen	9,042	± 402	4
	Hours fished	28,915	± 1370	5
	Fish caught	18,210	± 1185	6
1964	Fishermen	8,651	± 404	5
	Hours fished	32,741	± 1709	5
	Fish caught	18,946	± 1757	9
1965	Fishermen	8,914	± 399	4
	Hours fished	30,850	± 1635	5
	Fish caught	19,961	± 1152	6
1966	Fishermen	8,956	± 506	6
	Hours fished	33,150	± 2231	7
	Fish caught	20,578	± 1880	9
1967	Fishermen	6,516	± 485	7
	Hours fished	25,033	± 1945	8
	Fish caught	19,426	± 1375	7

The accuracy of the regression estimates are determined by the degree of relationship between car counts and each of the other variables - fishermen, hours fished, and fish caught. The poorer this relationship the less accuracy is obtained in making estimates of each item. The degrees of relationship between car counts and these variables is measured by their correlation coefficients and these statistics were calculated for each year of the study from 1960-1967. Since regression estimates were made separately for each checking station's data, correlation coefficients were also derived separately for each station. Table 3 shows the correlation coefficients (r) obtained for each station. The closer (r) is to 1.000 the better is the relationship between car counts and each of the variables.

TABLE 3. Correlation Coefficients (r) between car count and the variables measured at each station on Rock Creek, 1960-1967.

	Fishermen	Hours fished	Fish caught
Station 1			
1960	.93076	.91812	.91745
1961	.90090	.87912	.89163
1962	.94600	.84778	.85177
1963	.92629	.89515	.86068
1964	.87893	.87316	.81133
1965	.87471	.82421	.79919
1966	.87746	.85057	.79716
1967	.87734	.89490	.85657
[illegible]	[illegible]	[illegible]	[illegible]
Station 2			
1960	.87458	.86152	.82525
1961	.90689	.89401	.79379
1962	.90822	.88857	.82505
1963	.77027	.73777	.56770
1964	.64199	.49449	.52266
1965	.69212	.60420	.59692
1966	.86823	.75828	.56713
1967	.61264	.63368	.49202

Correlations were highest between car counts and fishermen, followed by hours fished and fish caught. It is apparent that the relationship between car counts and the other three variables was less at station 2 than at station 1, particularly in later years. For instance the (r) for fishermen ranged from .87734 to .94600 at station 1, and from .61264 to .90822 at station 2.

The probable reason for the higher correlations at station 1 is that a larger percentage of the cars counted contained fishermen. At station 2 there is considerable traffic from sources other than fishermen, i.e. farm vehicles and logging trucks. For instance, a loaded logging truck with five axels will count as $2\frac{1}{2}$ vehicles on the traffic counter. Several of these vehicles being counted every day add considerably to the car count even though none of them were cars containing fishermen. On some of these days no fishermen at all were contacted at station 2, so it can be seen that correlations would not be as good as desired. There was some farm vehicle and local resident traffic at station 1, but a good share of the traffic count was due to fishermen.

Discussion and Conclusions

Traffic counters were not infallible in their operation. Occasionally mechanical difficulties did occur despite efforts to maintain them in working condition. When breakdowns occurred and either no counts or erratic oounts were obtained, estimates had to be made for the hours or days missed. These estimates were necessary to obtain some form of car count data to use in the regression analysis. Although the estimates were not as reliable

as the actual car counts obtained, it was felt that the estimates were reliable enough to be included in the regression analyses.

In spite of occasional mechanical failure of the traffic counters it is felt that they are an efficient tool for creel census work under the conditions stated herein. It is felt that they could be used under any circumstance where access to a lake or stream is limited or can be so controlled. If several checking stations were needed to adequately sample fishermen, a traffic counter could be used at each station effectively. They would not be very useful in situations where fishermen could enter or leave the fishing area at points other than established check points.

Traffic counters can be used to reduce the cost and time involved in creel census work without sacrificing and still maintain the accuracy needed when estimating fishing pressure and harvest on a body of water.