STUDY PERFORMANCE REPORT

State: Michigan **Project No.:** F-35-R-23

Study No.: 673 **Title:** Evaluation of on-site angler survey methods

Period Covered: April 1, 1997 to March 31, 1998

Study Objective: Determine if mean-of-ratios estimator provides an unbiased estimate of angler catch rate for Michigan angler surveys utilizing roving interviews and determine if angling effort may be accurately estimated from access interview distribution of angler activity.

Summary: Michigan conducts access and roving angler surveys to estimate angling effort and catch. Access surveys use angler interviews from completed angler trips while roving surveys use interviews from incompleted angler trips. Catch rates are calculated using a ratio-of-means estimator for completed-trip interviews and a mean-of-ratios estimator for incompleted-trip interviews (Lockwood 1997, Jones et al. 1995). Access interviews may be recorded by angling party or by individual angler while catch information from roving interviews are recorded by individual angler to avoid angler party size bias (Lockwood 1997). When roving interviews are collected, anglers are interviewed prior to completion of their angling trip. Minimum fishing time for each roving interview is 0.5 h (Pollock et al. 1997). Pollock et al. (1997) shows that accuracy of roving interview catch rates may be affected by bag limits. Comparisons of catch rates from Michigan angler survey data bases were made to determine if roving catch rates accurately represented access catch rates.

Job 1. Title: Select catch rate data sets.

Findings: Data sets from Michigan angler surveys were selected to evaluate potential biases associated with roving interview catch rates. Two paired data sets existed for each survey, an access and a roving interview data set. These data were not collected in conjunction with this study, but were collected during previous management or research studies. Thirty-four paired data sets contained catch rates from interviews with only one angler per interview. Sixty-six paired data sets were from angler party interviews with one or more (multiple) anglers per party. To correct for party size bias, catch from roving interview angling parties with more than one angler was divided amongst that party's anglers and an interview record was created for each angler. No individual fish were split between anglers and catch was divided as evenly as possible. For example: if two anglers caught two fish they each received one fish and two interviews were created; if three anglers caught five fish one angler received one fish, the remaining two anglers each received two fish and three interview records were created. Similarly, when no fish were caught an angler interview record reflecting a catch of zero was created for each angler in that party. Access interviews were not divided, catch information by party was used. Each of the surveys then contained paired roving and access interviews with catch by species. Catch was harvest for some surveys and catch-and-release for others. Minimum length of fishing trip for roving and access interviews was 0.5 h.

Job 2. Title: <u>Compare catch rates.</u>

Findings: Catch rates from roving surveys use the mean-of-ratios estimator which averages catch rates across anglers (further descriptions in Lockwood et al., in press). Resulting mean catch rate does not reflect any variation in trip length by individual anglers. For example, if there are two angler catch rates in a data set, and one angler fished 1.0 h with a catch per hour of 1.00, while the second angler fished 8.5 h with a catch per hour of 0.12, the resulting mean-of-ratios catch per hour would be the average or 0.56. Catch rates from roving interviews are calculated in this manner to correct for differing interview probabilities. Anglers that fish longer have a greater probability of being interviewed than anglers with shorter trip lengths.

Pollock et al. (1997) has shown that when bag limits are easily attained, more skilled anglers with greater catch per hour, and consequently shorter trips, are less likely to be interviewed Catch rates from roving interviews in this situation would underestimate the catch per hour. Fierstine et al. (1978) showed no significant difference between 84 angling parties interviewed twice during their fishing trip, once while fishing and, second time as they completed their fishing trip.

Appropriate catch rate estimators to use with access and roving methods are only recently understood (Lockwood 1997, Jones et al. 1995). Prior evaluations of access and roving interview methods often failed to correctly calculate catch per hour for each method and did not always account for angler party size bias associated with roving methods. Lockwood (1984) compared access and roving catch rates using mean-of-ratios catch rate estimator and did not compensate for party size. Conversely, Malvestuto et al. (1978) compared access and roving catch rates using daily ratio-of-means estimators. Crone and Malvestuto (1991) compared catch rate precision (measured by the coefficient of variation) for five methods using roving interviews. Their assumption that catch rate and trip length are independent may have accounted for differences they observed between mean party estimator (party mean-of-ratios) and total ratio estimator (ratio-of-means).

Simulation of roving survey ¾ An important assumption of roving interviews is the consistency of catch rate throughout any given angling trip. If catch per hour is consistently greater or lesser toward the end of fishing trips, roving methods would give a biased estimate of catch rate. To demonstrate this, a data set with 14 access interviews was selected. Catch per hour (using the ratio-of-means estimator) for the data set was 0.3023 (Table 1). Start time and end time for each angler was included in the data set. Two simulated roving surveys were done. First for a fishery with catch rates being consistent throughout each angler's fishing trip; and second for a fishery with catch rates increasing from the beginning to the ending of each fishing trip. For the first simulation, the trip catch rate for a given interview was assigned to every hour that angler fished. In the second simulation, the catch per hour increased from 0.00 during the first hour to the trip catch rate during the last hour fished for a given interview.

To simulate a roving survey, various times of the day were selected to sample anglers. Mean-of-ratios catch rates for consistent and increasing catch rates were calculated for each angler present during a randomly selected time, the catch rates were stored and this process was repeated 10,000 times. Similar to a roving survey, anglers that fished longer had a greater probability of being sampled. For the simulation with consistent catch rates, the resulting estimate of catch per hour was 0.2959, almost identical to the actual catch per hour of 0.3023 (Table 1). However, for the second simulation with increasing catch rates the catch per hour of 0.1810 substantially

underestimated actual catch per hour. It is relatively easy to imagine a situation with decreasing catch rates and the resulting overestimation of actual catch per hour.

*Evaluation of survey data sets¾*Access and roving interview catch rates from angler surveys were compared. Both types of interviews were collected from each survey and catch rates were directly comparable. Bootstrapping techniques with 10,000 replications were used to calculate estimated difference in catch rates. The percentile method for detecting differences in catch rate was used and differences were considered significant when 0.0000 was not included in the central 95% bootstrap differences (Efron and Tibshirani 1993). Ten thousand replications has been shown adequate to overcome severe deviations from normality in data sets and correctly represent confidence limits (Buckland 1984).

For the 34 one angler-per-party data sets, catch rates from access interviews were significantly greater (α=0.05) than those from roving interviews 4 times, or 11.8%, and significantly less 6 times, or 17.6% (Tables 2-6) . For the 66 multiple angler-per-party data sets, access interviews were significantly greater 2 times, or 3.0%, and significantly less 9 times, or 13.6% (Tables 7-13).

Shape of bootstrap differences was evaluated to further assess accuracy of percentile confidence limits. Efron and Tibshirani (1993) measured shape as:

$$\text{shape} = \frac{\hat{\Theta}_{up} - \hat{\Theta}}{\hat{\Theta} - \hat{\Theta}_{lo}}, \qquad (1)$$

where, $\hat{\Theta}$ is the estimated difference between access and roving interview catch rates, and $\hat{\Theta}_{up}$ and $\hat{\Theta}_{lo}$ are the upper and lower 95% limits. Shape >1.00 indicates a greater distance between $\hat{\Theta}_{up}$ and $\hat{\Theta}$ than between $\hat{\Theta}_{lo}$ and $\hat{\Theta}$. However, Efron and Tibshirani (1993) note that exact intervals are usually asymmetrical. For the estimated differences of 34 one angler-per-party data sets, a right skew was evident for 16 and a left skew for 18. Similarly, for the estimated differences of 66 multiple angler-per-party data sets, a right skew was evident for 29 and a left skew for 37. For these catch rate data sets, calculating exact (symmetrical) intervals would tend to underestimate upper limits about 45% of the time and lower limits about 55% of the time. Shape of difference distributions is noted in Tables 2-13.

Ratio-of-means catch per hour for access interviews and mean-of-ratios catch per hour for roving interviews were calculated, appropriately, for each data set. Calculated catch rates of each data set were compared using Wilcoxon signed ranks test for paired data. Mean catch per hour for the 34 one angler-per-party interviews was 0.3268 for access interviews and 0.2301 for roving interviews. Mean catch per hour for the 66 multiple anglers per party interviews was 0.2271 for access interviews and 0.2331 for roving interviews. No significant differences were detected for the one angler-per-party paired values (P=0.86) nor for the multiple angler-per-party paired values (P=0.26).

Access interview catch rates were significantly less than roving interview catch rates more often than they were greater than roving interview catch rates and more frequent than would be expected by chance. This suggests catch rates decline near the end of an angling trip. However this trend was not evident for all data sets. Additional data sets are to be evaluated to more adequately detect direction of potential bias.

Literature Cited:

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Table 1.—Simulated catch rates for constant or increasing catch per hour within each angling record. Catch rates for constant or increasing catch per hour were based on 10,000 replications of the data set. Sample times were randomly selected for each record and the probability of a record being sampled was based on reported beginning and ending angling time for each record.

Data set		Constant rate of catch	Increasing rate of catch		
Records	Catch per Hour	$\bar{\bar{R}}$	$\bar{\bar{R}}$	Δ	Percent Δ
14	0.3023	0.2959	0.1810	0.1149	38.83

Table 2.—Catch rates of coho salmon from completed trip interviews and incompleted trip interviews. Interviews are from Platte River shore anglers in 1990. Only interviews from fishing parties with one angler were used. Confidence limits (α=0.05) are given in parenthesis and result from 10,000 bootstrap differences in catch rates. Differences are considered significant and noted with an "*" when 0.0000 falls outside the central 95% bootstrap difference values.

Site/ Month/ Day type	Completed trip Records	$\hat{R}$	Incompleted trip Records	$\bar{R}$	Δ	95% limits Minimum	Maximum	Shape
Site 1								
September								
Weekend	14	0.3026	27	0.1579	0.1447	-0.0947	0.4175	1.08
October								
Week	48	0.2319	8	0.5000	-0.2681	-0.7722	0.1404	0.80
Weekend	26	0.2166	8	0.6984	-0.4818*	-0.9202	-0.0943	0.90
Site 2								
September								
Weekend	27	0.5345	16	0.0625	0.4720*	0.2221	0.7368	1.04
October								
Week	30	0.3855	10	0.0000	0.3855*	0.1667	0.6139	1.08
Weekend	28	0.1916	5	0.3333	-0.1417	-0.4256	0.2023	1.16

Table 3.—Catch rates by species of shore and wading anglers fishing section 302 of the Rogue River, 1994. Only interviews from fishing parties with one angler were used. Confidence limits (α=0.05) are given in parenthesis and result from 10,000 bootstrap differences in catch rates. Differences are considered significant and noted with an "*" when 0.0000 falls outside the central 95% bootstrap difference values.

Month/ Day type/ Species/	Completed trip Records	$\hat{R}$	Incompleted trip Records	$\overline{R}$	Δ	95% limits Minimum	Maximum	Shape
May								
Weekend								
RLK[1]	7	0.1053	36	0.0000	0.1053	0.0000	0.3750	2.39
BRN[2]	7	0.1053	36	0.0000	0.1053	0.0000	0.3750	2.39
RSR[3]	7	0.4737	36	0.2426	0.2311	-0.1943	0.7667	1.19
BNCSR[4]	7	0.6842	36	1.1316	-0.4474	-1.2054	0.2455	0.95

[1]Legal size rainbow trout kept.
[2]Legal size brown trout kept, no fin clip.
[3]Sublegal size rainbow trout released.
[4]Sublegal size brown trout released, no fin clip.

Table 4.—Catch rates by species of shore and wading anglers fishing section 303 of the Rogue River, 1994. Only interviews from fishing parties with one angler were used. Confidence limits (α=0.05) are given in parenthesis and result from 10,000 bootstrap differences in catch rates. Differences are considered significant and noted with an "*" when 0.0000 falls outside the central 95% bootstrap difference values.

Month/ Day type/ Species/	Completed trip Records	$\hat{R}$	Incompleted trip Records	$\overline{R}$	Δ	95% limits Minimum	Maximum	Shape
May								
Weekend								
RLK[1]	5	0.0000	29	0.1468	-0.1468*	-0.3192	-0.0138	0.77
BRN[2]	5	0.0000	29	0.1100	-0.1100*	-0.2085	-0.0322	0.79
RLR[3]	5	0.1333	29	0.0719	0.0614	-0.1340	0.3114	1.31
RSR[4]	5	0.0000	29	0.3264	-0.3264*	-0.6897	-0.0690	0.71
BNCLR[5]	5	0.0000	29	0.2988	-0.2988*	-0.5452	-0.0920	0.83
BNCSR[6]	5	0.0000	29	0.2529	-0.2529*	-0.4828	-0.0690	0.80

[1]Legal size rainbow trout kept.
[2]Legal size brown trout kept, no fin clip.
[3]Legal size rainbow trout released.
[4]Sublegal size rainbow trout released.
[5]Legal size brown trout released, no fin clip.
[6]Sublegal size brown trout released, no fin clip.

Table 5.—Catch rates by species of shore and wading anglers fishing section 301 of the Rogue River, 1995. Only interviews from fishing parties with one angler were used. Confidence limits (α=0.05) are given in parenthesis and result from 10,000 bootstrap differences in catch rates. Differences are considered significant and noted with an "*" when 0.0000 falls outside the central 95% bootstrap difference values.

Month/ Day type/ Species/	Completed trip Records	$\hat{R}$	Incompleted trip Records	$\overline{R}$	Δ	95% limits Minimum	Maximum	Shape
April								
Weekend								
RLK[1]	4	0.0000	15	0.0667	-0.0667	-0.2000	0.0000	0.50
BRN[2]	4	0.0000	15	0.0083	-0.0083	-0.0250	0.0000	0.50
RLR[3]	4	0.0000	15	0.4444	-0.4444	-1.0667	0.0000	0.72
RSR[4]	4	0.1538	15	0.6333	-0.4795	-0.9000	0.0445	1.14
BNCLR[5]	4	0.0000	15	0.0444	-0.0444	-0.1333	0.0000	0.50
BNCSR[6]	4	1.8462	15	0.4944	1.3518	-0.9444	4.3611	1.38
May								
Weekend								
RLK[1]	7	0.0000	15	0.0611	-0.0611	-0.1667	0.0000	0.58
BRN[2]	7	0.2069	15	0.1556	0.0513	-0.2722	0.5151	1.41
RLR[3]	7	0.5517	15	0.0500	0.5017	0.0000	0.9155	0.92
RSR[4]	7	1.7241	15	0.4570	1.2671	-0.8733	3.8370	1.36
BNCLR[5]	7	0.1379	15	0.0167	0.1212	-0.0333	0.4706	2.09
BNCSR[6]	7	0.2759	15	0.4400	-0.1641	-0.6978	0.5043	1.24

[1]Legal size rainbow trout kept.
[2]Legal size brown trout kept, no fin clip.
[3]Legal size rainbow trout released.
[4]Sublegal size rainbow trout released.
[5]Legal size brown trout released, no fin clip.
[6]Sublegal size brown trout released, no fin clip.

Table 6.—Catch rates by species of shore and wading anglers fishing section 302 of the Rogue River, 1995. Only interviews from fishing parties with one angler were used. Confidence limits (α=0.05) are given in parenthesis and result from 10,000 bootstrap differences in catch rates. Differences are considered significant and noted with an "*" when 0.0000 falls outside the central 95% bootstrap difference values.

Month/ Day type/ Species/	Complete trip Records	$\hat{R}$	Incomplete trip Records	$\overline{R}$	Δ	95% limits Minimum	Maximum	Shape
May								
Weekend								
RLK[1]	10	0.0000	13	0.1436	-0.1436	-0.3692	0.0000	0.63
BRN[2]	10	0.0370	13	0.0513	-0.0143	-0.1539	0.0889	0.76
RLR[3]	10	0.1111	13	0.1026	0.0085	-0.2308	0.2500	1.06
RSR[4]	10	1.4074	13	0.2692	1.1382*	0.0085	2.0328	0.86
BNCLR[5]	10	0.1852	13	0.0000	0.1852	0.0000	0.3871	1.08
BNCSR[6]	10	1.1111	13	0.0513	1.0598*	0.1592	1.8461	0.94

[1]Legal size rainbow trout kept.
[2]Legal size brown trout kept, no fin clip.
[3]Legal size rainbow trout released.
[4]Sublegal size rainbow trout released.
[5]Legal size brown trout released, no fin clip.
[6]Sublegal size brown trout released, no fin clip.

Table 7.—Catch rates of coho salmon from completed trip interviews and incompleted trip interviews. Interviews are from Platte River shore anglers in 1990. Results reflect individual angler catch rates from fishing parties with one or more anglers. Confidence limits (α=0.05) are given in parenthesis and result from 10,000 bootstrap differences in catch rates. Differences are considered significant and noted with an "*" when 0.0000 falls outside the central 95% bootstrap difference values.

Site/ Month/ Day type	Complete trip Records	$\hat{R}$	Incomplete trip Records	$\overline{R}$	Δ	95% limits Minimum	Maximum	Shape
Site 1								
September								
Weekend	66	0.2136	39	0.1670	0.0466	-0.1336	0.1977	0.84
October								
Week	120	0.1634	18	0.4012	-0.2378*	-0.5189	-0.0013	0.84
Weekend	85	0.1395	19	0.5362	-0.3967*	-0.6322	-0.1777	0.92
Site 2								
September								
Weekend	66	0.1940	27	0.1852	0.0088	-0.2901	0.2185	0.70
October								
Week	66	0.1687	23	0.5217	-0.3530*	-0.7294	-0.0016	0.92
Weekend	47	0.1184	9	0.1926	-0.0742	-0.2631	0.1198	0.97

Table 8.—Catch rates by species of shore and wading anglers fishing section 301 of the Rogue River, 1994. Results reflect individual angler catch rates from fishing parties with one or more anglers. Confidence limits (α=0.05) are given in parenthesis and result from 10,000 bootstrap differences in catch rates. Differences are considered significant and noted with an "*" when 0.0000 falls outside the central 95% bootstrap difference values.

Month/ Day type/ Species/	Complete trip Records	$\hat{R}$	Incomplete trip Records	$\overline{R}$	Δ	95% limits Minimum	Maximum	Shape
May								
Weekday								
RLK[1]	7	0.1000	27	0.0778	0.0222	-0.1778	0.2016	0.99
BRN[2]	7	0.5000	27	0.3056	0.1944	-0.2720	0.6193	0.87
RLR[3]	7	0.0333	27	0.1111	-0.0778	-0.2593	0.0582	0.74
RSR[4]	7	0.0333	27	0.1111	-0.0778	-0.2593	0.0666	0.77
BNCLR[5]	7	0.1667	27	1.5383	-1.3716*	-2.8662	-0.2569	0.75
BNCSR[6]	7	0.1667	27	0.8053	-0.6386	-1.5490	0.0814	0.77
Weekend								
RLK[1]	10	0.1481	61	0.0621	0.0860	-0.0792	0.2474	1.07
BRN[2]	10	0.3210	61	0.1890	0.1320	-0.1785	0.6157	1.40
RLR[3]	10	0.0988	61	0.1399	-0.0411	-0.2342	0.2042	1.19
RSR[4]	10	0.7901	61	0.2065	0.5836	-0.1855	1.2428	1.04
BNCLR[5]	10	0.3457	61	0.1686	0.1771	-0.1736	0.6485	1.22
BNCSR[6]	10	0.0741	61	0.2986	-0.2245	-0.4874	0.0663	1.04

[1]Legal size rainbow trout kept.
[2]Legal size brown trout kept, no fin clip.
[3]Legal size rainbow trout released.
[4]Sublegal size rainbow trout released.
[5]Legal size brown trout released, no fin clip.
[6]Sublegal size brown trout released, no fin clip.

Table 9.—Catch rates by species of shore and wading anglers fishing section 302 of the Rogue River, 1994. Results reflect individual angler catch rates from fishing parties with one or more anglers. Confidence limits (α=0.05) are given in parenthesis and result from 10,000 bootstrap differences in catch rates. Differences are considered significant and noted with an "*" when 0.0000 falls outside the central 95% bootstrap difference values.

Month/ Day type/ Species/	Complete trip Records	$\hat{R}$	Incomplete trip Records	$\overline{R}$	Δ	95% limits Minimum	Maximum	Shape
May								
Weekend								
RLK[1]	11	0.0482	74	0.0000	0.0482	0.0000	0.1818	2.56
BRN[2]	11	0.0482	74	0.0000	0.0482	0.0000	0.1791	2.49
RSR[3]	11	0.4096	74	0.2832	0.1264	-0.1499	0.4096	1.03
BNCSR[4]	11	0.6024	74	1.0937	-0.4913*	-0.9915	-0.0271	0.95
July								
Weekend								
RLR[5]	4	0.0000	31	0.0215	-0.0215	-0.0645	0.0000	0.50
RSR[3]	4	0.0741	31	0.0667	0.0074	-0.0074	0.0509	3.60
BNCLR[6]	4	0.0000	31	0.0161	-0.0161	-0.0484	0.0000	0.50
BNCSR[4]	4	0.5926	31	0.8140	-0.2214	-0.7644	0.2892	0.90

[1]Legal size rainbow trout kept.
[2]Legal size brown trout kept, no fin clip.
[3]Sublegal size rainbow trout released.
[4]Sublegal size brown trout released, no fin clip.
[5]Legal size rainbow trout released.
[6]Legal size brown trout released, no fin clip.

Table 10.—Catch rates by species of shore and wading anglers fishing section 303 of the Rogue River, 1994. Results reflect individual angler catch rates from fishing parties with one or more anglers. Confidence limits (α=0.05) are given in parenthesis and result from 10,000 bootstrap differences in catch rates. Differences are considered significant and noted with an "*" when 0.0000 falls outside the central 95% bootstrap difference values.

Month/ Day type/ Species/	Complete trip Records	$\hat{R}$	Incomplete trip Records	$\overline{R}$	Δ	95% limits Minimum	Maximum	Shape
May								
Weekday								
RLK[1]	8	0.0000	23	0.0725	-0.0725	-0.1884	0.0000	0.63
BRN[2]	8	0.3571	23	0.1594	0.1977	-0.1369	0.5755	1.09
RLR[3]	8	0.0000	23	0.0435	-0.0435	-0.1304	0.0000	0.49
RSR[4]	8	0.2500	23	0.2609	-0.0109	-0.4348	0.7391	1.63
BNCLR[5]	8	0.0000	23	0.0870	-0.0870	-0.2609	0.0000	0.50
BNCSR[6]	8	0.1786	23	0.2319	-0.0533	-0.4638	0.4493	1.18
May								
Weekend								
RLK[1]	9	0.0000	62	0.0940	-0.0940*	-0.1857	-0.0230	0.78
BRN[2]	9	0.0000	62	0.1045	-0.1045*	-0.1727	-0.0463	0.84
RLR[3]	9	0.0263	62	0.0820	-0.0557	-0.1514	0.0660	1.14
RSR[4]	9	0.0263	62	0.1665	-0.1402	-0.3195	0.0050	0.79
BNCLR[5]	9	0.2368	62	0.1444	0.0924	-0.2074	0.3663	1.07
BNCSR[6]	9	0.2105	62	0.1229	0.0876	-0.1585	0.5447	1.65
BLVK[7]	9	0.0263	62	0.0081	0.0182	-0.0242	0.0627	1.14

[1]Legal size rainbow trout kept.
[2]Legal size brown trout kept, no fin clip.
[3]Legal size rainbow trout released.
[4]Sublegal size rainbow trout released.
[5]Legal size brown trout released, no fin clip.
[6]Sublegal size brown trout released, no fin clip.
[7]Legal size brown trout kept, left ventral fin clip.

Table 11.—Catch rates by species of shore and wading anglers fishing section 301 of the Rogue River, 1995. Results reflect individual angler catch rates from fishing parties with one or more anglers. Confidence limits (α=0.05) are given in parenthesis and result from 10,000 bootstrap differences in catch rates. Differences are considered significant and noted with an "*" when 0.0000 falls outside the central 95% bootstrap difference values.

Month/ Day type/ Species/	Complete trip Records	$\hat{R}$	Incomplete trip Records	$\overline{R}$	Δ	95% limits Minimum	Maximum	Shape
April								
Weekend								
RLK[1]	4	0.0000	28	0.0714	-0.0714	-0.1667	0.0000	0.75
BRN[2]	4	0.0000	28	0.0164	-0.0164	-0.0446	000000	0.58
RLR[3]	4	0.0000	28	0.2619	-0.2619*	-0.6191	-0.0238	0.67
RSR[4]	4	0.1538	28	0.4464	-0.2926	-0.6369	0.1969	1.30
BNCLR[5]	4	0.0000	28	0.0238	-0.0238	-0.0714	0.0000	0.49
BNCSR[6]	4	1.8462	28	0.3720	1.4742	-0.6518	4.5120	1.51
May								
Weekend								
RLK[1]	7	0.0000	56	0.0640	-0.0640*	-0.1161	-0.0164	0.90
BRN[2]	7	0.2069	56	0.0417	0.1652	-0.0759	0.6206	1.86
RLR[3]	7	0.5517	56	0.0908	0.4609	-0.0437	0.8801	0.93
RSR[4]	7	1.7241	56	0.3665	1.3576	-0.5159	3.8790	1.54
BNCLR[5]	7	0.1379	56	0.0164	0.1215	-0.0357	0.4661	2.07
BNCSR[6]	7	0.2759	56	0.4691	-0.1932	-0.6238	0.4341	1.45

[1]Legal size rainbow trout kept.
[2]Legal size brown trout kept, no fin clip.
[3]Legal size rainbow trout released.
[4]Sublegal size rainbow trout released.
[5]Legal size brown trout released, no fin clip.
[6]Sublegal size brown trout released, no fin clip.

Table 12. Catch rates by species of shore and wading anglers fishing section 302 of the Rogue River, May 1995.—Results reflect individual angler catch rates from fishing parties with one or more anglers. Confidence limits (α=0.05) are given in parenthesis and result from 10,000 bootstrap differences in catch rates. Differences are considered significant and noted with an "*" when 0.0000 falls outside the central 95% bootstrap difference values.

Day type/	Complete trip		Incomplete trip			95% limits		
Species/	Records	$\hat{R}$	Records	$\overline{R}$	Δ	Minimum	Maximum	Shape
Week								
RLR[3]	4	0.0000	17	0.4510	-0.4510	-1.0980	0.0000	0.71
RSR[4]	4	0.8824	17	0.7059	0.1765	-0.6373	1.2981	1.29
BNCLR[5]	4	0.0000	17	0.0588	-0.0588	-0.1765	0.0000	0.50
BNCSR[6]	4	0.2941	17	0.6324	-0.3383	-0.8823	0.1569	0.92
Weekend								
RLK[1]	13	0.0408	34	0.0549	-0.0141	-0.1098	0.0750	0.91
BRN[2]	13	0.0204	34	0.0196	0.0008	-0.0588	0.0588	0.95
RLR[3]	13	0.0612	34	0.0686	-0.0074	-0.1196	0.1488	1.37
RSR[4]	13	0.8980	34	0.1814	0.7166*	0.0405	1.6540	1.27
BNCLR[5]	13	0.1020	34	0.0000	0.1020	0.0000	0.2588	1.39
BNCSR[6]	13	0.6531	34	0.0784	0.5747*	0.0327	1.3111	1.29

[1]Legal size rainbow trout kept.
[2]Legal size brown trout kept, no fin clip.
[3]Legal size rainbow trout released.
[4]Sublegal size rainbow trout released.
[5]Legal size brown trout released, no fin clip.
[6]Sublegal size brown trout released, no fin clip.

Table 13.—Catch rates by species of shore and wading anglers fishing section 302 of the Rogue River, 1995. Results reflect individual angler catch rates from fishing parties with one or more anglers. Confidence limits (α=0.05) are given in parenthesis and result from 10,000 bootstrap differences in catch rates. Differences are considered significant and noted with an "*" when 0.0000 falls outside the central 95% bootstrap difference values.

Month/ Day type/ Species/	Complete trip Records	$\hat{R}$	Incomplete trip Records	$\overline{R}$	Δ	95% limits Minimum	Maximum	Shape
June								
Weekend								
RSR[1]	5	0.0784	13	0.1154	-0.0370	-0.1897	0.1077	0.93
BNCSR[2]	5	0.1961	13	0.1282	0.0679	-0.2043	0.4268	1.56
September								
Weekend								
RSR[1]	4	0.0000	9	0.3175	-0.3175	-0.7619	0.0000	0.73
BNCLR[3]	4	0.0000	9	0.1111	-0.1111	-0.3333	0.0000	0.51
BNCSR[2]	4	0.0000	9	0.3333	-0.3333	-0.8413	0.0000	0.66

[1]Sublegal size rainbow trout released.
[2]Sublegal size brown trout released, no fin clip.
[3]Legal size brown trout released, no fin clip.