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A Comparison of A Creel Census to Modeled Access-Point Creel Surveys on Two Small Lakes Managed as Put-and-Take Rainbow Trout Fisheries

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Abstract

Access-point creel surveys are assumed to represent actual angler harvest, pressure, and other parameters. A full creel census was conducted on two small lakes managed as put and-take Rainbow Trout (*Oncorhynchus mykiss*) fisheries to evaluate this assumption. Modeled results based on standard methods from full (40 h/week), one-half (20 h/week), and one-third (12 h/week) surveys, were compared to actual census values. The confidence intervals for angling pressure in all survey scenarios included the actual census values, with the exception of the full survey in one lake. Confidence intervals for total catch also included the census values, except for the full and one-third survey in one lake. In all cases, both Rainbow Trout catch and harvest point estimates were not significantly different among any of the scenarios and census. Census values for party size were not included in the confidence intervals in the one-third surveys at both lakes, and the one-half survey at one lake. Trip length confidence intervals included the actual census value only in the full survey for one lake; all other point estimates of trip length in the other survey scenarios were significantly different from the census values. In general, confidence limits increased as the simulated survey efforts decreased. Using standard access-point creel survey methods, managers of small water bodies stocked with catchable trout should be able to achieve relatively reliable creel survey estimates of angling pressure, catch, and harvest with considerably less effort than a full survey.

Keywords: Creel census; Creel survey; Rainbow Trout *Oncorhynchus mykiss*; Angling pressure; Trout catch; Trout harvest

Introduction

Creel surveys are a traditional fisheries management tool used for estimating angler use and monitoring the status of recreational fisheries [1-4]. They have been conducted to evaluate management changes [5-7], determine angler preferences [8,9], and estimate other angler activities [10-13]. In contrast to roving-type creel surveys where the creel clerk travels to the anglers, an access-point survey uses a stationary creel clerk to interview the anglers when they have completed fishing [14]. Access-point surveys are preferred when there is only one, or are just a few locations, that the fishery can be accessed, and when the survey is focused on angler catch, angling pressure, and fish harvest [15].

Newman et al. [16] strongly advocated for the evaluation of creel surveys to ensure the accuracy of the data collected. Creel survey data has been verified by calculating catch rates [17], studying angler reporting [18,19], and examining the definition of angling time [20]. A full creel census, where every angler is interviewed, has also been conducted, albeit rarely [16,20,21]. A nearly-full creel census or "virtually-complete" census was done to evaluate creel survey methodologies by Johnson and Wroblewski [22]. These studies focused on the use of creel surveys in larger water bodies (greater than 40 ha), particularly with cool and warm water fishes.

Access-point surveys of small lakes (less than 5 ha), particularly those managed as put-and-take catchable trout fisheries, are rarely conducted due to cost, the relative unimportance of the fisheries compared to larger waters, and the perception that such survey results may be unreliable because of inconsistent fishing pressure [23-25]. Creel surveys are commonly conducted on larger water bodies [26,27] and survey techniques have been standardized to a large degree [15]. This study was conducted because of the need to evaluate trout stocking programs [28], particularly in small lakes and ponds. The objective of this study was to determine the accuracy, and potential management use, of three different creel survey efforts on two small lakes managed as put-and-take fisheries with the stocking of catchable-sized (28 cm total length) Rainbow Trout (*Oncorhynchus mykiss*) using a creel census.

Materials and Methods

Study site

This study was conducted at the Mirror Lakes Game Production Area, rural Spearfish,South Dakota. The area encompasses two small lakes, Mirror Lakes #1 (2 ha) and #2 (1.1 ha), which can only be accessed by a single entrance road. The road also acts as a boundary for McNenny State Fish Hatchery and the associated hatchery housing. The close proximity of the hatchery to the access road and lakes allowed for the observation of the all vehicle traffic, and limited foot traffic, by hatchery staff at all hours. Both Mirror Lakes are managed as put-and-take fisheries for public use, and are stocked from March through October with catchable-sized (28 cm) Shasta strain Rainbow Trout. They also contain overly-abundant Green Sunfish (*Lepomis cyanellus*) populations.

Creel census

An angler census was conducted for both lakes from sunrise to sunset seven days a week beginning on May 21, 2006 and continuing until August 16, 2006. All anglers entering the area were stopped by a creel clerk and informed that there would be a mandatory interview

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upon departure. Angler entry and exit times on the single access road were noted for all vehicles. Upon leaving the area, all anglers were interviewed by at least one creel clerk, who collected trout catch, trout harvest, party size, trip length, and sunfish catch data. Because angling activity was suspected to differ between the lakes, data was collected separately by location (Mirror Lake #1 or #2) during the angler interviews. It was assumed that there was no angling pressure at night. In a few instances, people at the lakes at night were interviewed, and in all cases they were engaged in activities other than angling. In addition, hatchery employees living in the adjacent hatchery residences did not observe any night fishing activity. If night fishing did occur, it was likely negligible and would not have affected the results of the census.

Creel survey modeling

Using the creel census data, three creel survey scenarios were modeled using Creel Application Software (CAS) [15]. These scenarios included a "full" creel survey which assumed 40 hours per week of survey effort, a "one-half" creel survey (24 hours per week), and a "one-third" survey (16 hours per week). Because of non-uniform angling pressure, survey scenarios were also stratified to include interviews on weekends and holidays so as to avoid bias [29]. Each model was based on creel clerks working either a daily AM (8 a.m. to 3 p.m.) or PM (12 p.m. to 7 p.m.) shift.

Based on standard creel practices [29], the full survey model assumed that the creel clerk would work on both weekend days (Saturday and Sunday) or one weekend day and a holiday, and three randomly selected days during the week. The shifts (AM or PM) worked each day were randomly selected. For the one-half survey model, data was assumed to be collected on only one weekend day (either Saturday or Sunday) or holiday, and two days during the rest of the week. The shifts worked each day (AM or PM) were also randomly selected. The one-third creel survey model was similar to the one-half, with one of the weekdays eliminated; only one non-weekend or holiday day was assumed to be creeled. The subsampling used in all of the creel scenarios gave preference to the weekends and holidays and randomized AM and PM shifts. Each modelling scenario was evaluated with two randomized pressure counts per shift. One simulation was run for each of the modeled creel surveys.

Data for the survey simulations was based on those anglers that would have been interviewed by the clerk during the simulated survey period. Within CAS, the summary of catch, harvest and release were done with the following calculation:

$$\widehat{R}_{sx} = \sum_{y} R_{sxy}$$

Where R is the point estimate of the catch, harvest, or release number, s is the fish species, x is the work period (month) and day type (weekend/holiday or weekday) and y is the type of fishing strata (shore or boat fishing). Strata were summarized on a monthly interval by CAS.

To obtain pressure estimates, instantaneous counts were derived from the starting and ending times of angling trips in the census, as well as enumeration of the number of people shore-fishing. Instantaneous pressure counts were modeled for each survey scenario using the following formula:

$$P_{xy} = \frac{\sum_{z=1}^{n_x} (P_{xyz})}{n_x}$$

Where P is the mean angling pressure, x is the average daily pressure for the strata, y is the type of angling (shore or boat fishing), z is the day, and n_x is the number of days sampled in the strata.

In each scenario, total fishing pressure, total catch, Rainbow Trout catch, total harvest, Rainbow Trout harvest, party size, and completed trip length, were compared between the actual census value and the simulated surveys based on 95% confidence intervals.

Results

Over 1,000 parties were interviewed during the creel census (Table 1). Sample sizes (simulated interviews) for the full, one-half, and one-third creel surveys were 150, 132, and 62 interviews for Mirror Lake #1 and 188, 154, and 70 for Mirror Lake #2.

There was no significant difference between the point estimates for angling pressure in all survey scenarios (full, one-half, one-third) compared to the actual census values in both lakes, with the exception of the full survey in Mirror Lake #1. Total catch (Rainbow Trout and Green Sunfish) point estimates were also not significantly different than the census value for the survey scenarios, except for the full and one-third survey in Mirror Lake #1. In all cases, both Rainbow Trout catch and harvest estimates were not significantly different among any of the scenarios and census, but confidence intervals increased with decreasing survey effort.

Party size (number of anglers fishing together as a group) point estimates were generally very close to census values in all of the survey scenarios. However, the actual census value was not included in the confidence intervals of the one-half and one-third surveys at Mirror Lake #1 and the one-third survey at Mirror Lake #2. Trip length confidence intervals only included the actual census value only in the full survey for Mirror Lake #2. Point estimates for all of the other survey scenarios were significantly different from the census values. In general, confidence intervals for all parameters, except party size and trip length, increased as simulated survey effort decreased from a full to one-third survey.

Discussion

Hartzler [23] stated that only a small percentage of waters managed as put-and-take fisheries using catchable-sized Rainbow Trout are evaluated. This may be because the cost of hatchery-produced fish, particularly the small numbers of fish stocked in small lakes and ponds, is often less than the cost of a creel survey [24]. The results from the current study indicate that an access point creel survey consisting of only 12 hours per week of effort may provide relatively reliable pressure, catch, and harvest information, although surveys of greater than 12 hours per week may be needed to improve the precision of the point estimates. In addition, a full creel survey may be required to obtain accurate and precise party size and trip length estimates on small ponds.

Few creel censuses have been conducted. Those that have been done have focused primarily on larger reservoirs and non-salmonid fisheries [16,21,22,30]. Even though the current study focused on Rainbow Trout in a small impoundment, the results were similar to earlier studies [16,21,22,30]. Johnson and Wroblewski [22] noted that at 95% confidence limits, a creel survey effort similar to the one-half survey creel in the current study produced angling pressure point estimates within 13% of census values and total catch point estimates within 17%. Newman et al. [16] observed that creel survey point estimates for angling pressure were within 7% of census values. In their study, Newman et al. [16] observed that the confidence limits for some of the survey harvest estimates did not include the actual harvest value, just as was observed in the current study.

Lake	Census	Full	One-half	One-third
Mirror #1				
Interviews	1,014	150 ± 19	132 ± 37	62 ± 11
Party size	2.45	2.47 ± 0.03	2.71 ± 0.09	2.49 ± 0.01
Trip length	1.99	2.66 ± 0.45	2.81 ± 0.77	2.65 ± 0.45
Pressure	2,181	2,833 ± 644	2,914 ± 907	2,017 ± 543
Troutcatch	853	1,114 ± 389	1,218 ± 609	1,386 ± 630
Trout harvest	576	788 ± 316	932 ± 932	1,054 ± 684
Overall catch	3,535	3,716 ± 160	3,679 ± 352	4,762 ± 815
Mirror #2				
Interviews	1,014	188 ± 35	154 ± 47	70 ± 7
Party size	2.30	2.36 ± 0.06	2.40 ± 0.13	2.91 ± 0.29
Trip length	1.89	2.12 ± 0.66	2.58 ± 0.43	2.79 ± 0.56
Pressure	2,280	2,406 ± 671	2,818 ± 1,206	2,821 ± 1,206
Trout catch	888	787 ± 463	1,031 ± 927	1,026 ± 923
Trout harvest	495	562 ± 355	697 ± 668	694 ± 673
Overall catch	4,170	3,876 ± 552	4,040 ± 573	4,131 ± 744

Table 1: Actual creel census data and modeled mean (± 95% CI) results for a full (40 h/week), one-half (20 h/week), and one-third (12 h/week) creel surveys.

Jones et al. [31] recommended a minimum of 100 interviews for a reliable creel survey, particularly when angler catch rates are highly variable. While the full and one-half survey simulations exceeded this number, the one-third surveys had only 70 and 62 interviews for each lake respectively. Despite this small number, and the highly-variable catch rates at each of the lakes, the results from the one-third surveys were generally representative of true census values. However, confidence limits were sometimes much greater than that observed in the full or one-half surveys. This is not unexpected, because sample size and variance are often negatively related [32]. Newman et al. [16] also noted that sample creel survey sample sizes led to large variances and wide confidence limits. Large confidence limits may also be due in part to the inherent nature of creel surveys [17].

The modeling results observed in this study did not take into account potential errors during data collection. Angler reporting errors, potentially due to mistakes in recall, rounding, prestige, or fish species misidentification, would likely influence real-world results [18,33]. In addition, the models did not take into account data recording and entry errors [29].

Although VanDeValk et al. [19] suggest that in angling parties containing more than one individual, catch data should be collected from each individual angler. This did not occur in the present study. However, VanDeValk et al. [19] also observed a negative correlation between party size and harvest, which did not occur in this study. If party size or trip length did differ between the lakes or from year-to-year however, the lack of individual angler interviews may make it difficult to compare angler catch rates [19].

As defined by Polluck et al. [29], results from all of the creel survey simulations were largely accurate, or at least likely accurate enough in relation to the size and economics of the fishery. Parkinson et al. [24] noted the difficulties in collecting cost-efficient fisheries information on small lakes, where the cost of a typical creel survey can exceed the value of the fishery. The results of the current study indicate that a creel survey of as little as 12 hours per week could provide fisheries managers with enough information to effectively manage small ponds, particularly those stocked with catchable sized Rainbow Trout.

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