FISHERIES SESSION

THE EFFECT OF TROUT STOCKING ON THE RATE OF CATCH

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Proc. Annu. Conf. Southeast. Assoc. Game & Fish Comm. 5:467-472

During the 1950 trout fishing season, an effort was made to gather data that would more closely indicate just what the fishing success was on the streams of the various Cooperative Wildlife Management Areas in western North Carolina. In years past, most of the data collected were used to make the annual creel report, which tended to be a record of the relationship between the numbers of fish stocked and the numbers caught. Stocking practices were altered very little from year to year. The individual streams were stocked periodically, and the creel reports indicated that an approximately equivalent number of fish were caught somewhere in the area.

The streams that produced better than others were not really known. We do know that there is a difference in the productivity of fish food and of fish in the various streams, and that many fish may migrate to better adapted waters. The extent of the productivity or migration cannot be determined from a total creel report for an entire area. A creel report of the situations on the individual streams would seem to be necessary. To make an intensive investigation which would supply exact information on an individual stream basis, much money and labor would be needed. However, a relative report made by the individual fishermen is a good indication of what might be occurring on the streams, and on this basis the 1950 trout creel census surveys were conducted.

In attempting to make a report of the individual streams, a part of the information was asked of the fishermen. Stocking was carried out as it had been practiced in the past. The streams were stocked prior to the opening date, and at intervals thereafter when it was believed necessary. The individual creels were recorded by species, numbers, and weight as the fishermen left the area. The fishermen were asked in what particular stream the fish were caught, and how long they had fished. This information gave the catch information for the individual streams, as well as the fishing intensity on the streams. From these reports, the catch per man hour of effort was computed. It is believed that the figures presented include a minimum of error since they are totals and are not based on samples. All fishermen pass through the checking stations on entering and leaving the areas.

To get a visual idea of the fishing by monthly intervals, graphs were made for three of the management areas. These graphs indicate depletion of the trout population in each area as it occurred. The average catch per man, the number of fishermen each month, and the catch per man hour of effort is recorded to show the relationships as they occurred. A zero axis is placed to show the point below which depletion of the normal population occurs. Since the graphed points show

the difference between the numbers stocked and the numbers caught, any point below the zero axis must indicate that depletion is from the normal population of the streams. Catches will consist of both stocked fish and fish from the native population of the streams, but for a better understanding of the graphs we should assume that the depletion below the zero axis is from the native population. The number of stocked fish that can be taken by hook and line fishing has been found to be about 70% as a maximum. Therefore, the depletion of the normal population is undoubtedly greater than the graphs indicate.

In the Mount Mitchell Cooperative Wildlife Management Area, the trout waters of approximately 37 miles are comprised of the South Toe River and its tributaries. Table 1 shows that prior to the opening of the fishing season 3,900 trout were stocked. During the first month of fishing 5,037 trout were removed from the streams, resulting in a depletion of the native population of 1,137 trout even if a 100% catch of stocked trout is assumed. The fishing pressure was very heavy. The 1,519 fisherman trips resulted in an average catch of 3.3 fish at the rate of 0.76 fish per man hour of effort. During the next month there was about two-thirds reduction in fishing pressure. Only 543 men fished the streams for an average of 4.0 fish and a slightly lower (0.73) catch per man hour of effort. During this month the stocking was about equal to the catch, and little actual depletion occurred. During the third month, approximately the same number of men fished as in the previous month. Stocking was slight but the catches held at 4.0 per man average. Fish were somewhat harder to catch as the catch per man hour of effort of 0.69 indicates. The depletion of trout on the area was greatest during this month. By the end of the month a total of 3,000 more trout had been taken than had been stocked. During the last month of fishing the number of fishermen was reduced to some 50% of the two preceding months. Only 258 men fished for an increased average catch of 5.2 fish and an increased return of 1.1 fish per man hour of effort.

Table 1. Stocking and catch of trout on the Mount Mitchell area.

	Month				
	May	June	July	Aug.	Total
Fishermen	1,519	543	521	258	2,841
Catch/man hour	0.76	0.73	0.69	1.10	0.77
$\overline{X}$ catch	3.30	4.00	4.00	5.20	3.74
Total catch	5,037	2,184	2,084	1,347	10,652
Total stock	3,900	2,135	250	1,950	8,235
Difference	1,137	49	1,830	603	2,417

By glancing at Table 1 with the assumed zero axis, we can now see that the stocked fish theoretically carried most of the fishing during the first month when the fishing pressure was greatest. After the first month, the graphed points remain below the native population line, or zero axis, for the remainder of the fishing season, even though stockings were made to minimize the depletion. At one time in July the streams had been depleted of about 3,000 trout in addition to those stocked. Should we assume that a maximum of 70% of the stocked fish were caught, then further depletion of the normal population would be indicated. Since 8,235 trout were stocked, and an estimated 30% were not caught, then the native

population compensated for 2,471 of the stocked trout. Adding this figure to the indicated depletion of 3,000 native trout, we arrive at a total catch of at least 5,500 trout from the native population.

The return per unit of effort is the recognizd basis for determining the quality of fishing. The above figures are of particular significance when it is observed that the catch per man hour of 0.76 fish during the first month increased to 1.1 fish during the last month, in spite of the fact that the streams were carrying nearly 7,000 fewer fish. It may be further observed that the 1,519 fishermen of the first month were reduced by five-sixths to 258 during the last month. It appears that the catch rate is much more greatly affected by the number of fishermen on the stream than by the number of fish in the stream.

Table 2 is the catch and stock record for the individual streams of the Mount Mitchell Area. The catch record was given by the fishermen as their creels were checked. The stocking record was made by the hatchery personnel.

Table 2. Catch and stock report by streams in Mount Mitchell Area.

Stream	Catch	Stock	Men	Av. C.	CPMH [a]
South Toe River	4,311	2,050	1,239	3.50	0.68
Neal Creek	579	450	221	2.60	0.55
Hemphill Creek	174	550	23	7.60	1.00
Lower Creek	248	350	45	5.50	1.10
Upper Creek	500	700	84	6.00	1.00
Rock Creek	627	388	115	5.50	0.71
Middle Creek	85	100	13	6.50	1.10
Lost Cove Creek	102		23	4.40	0.93
North Fork Creek		150			
Left Fork Creek		150			
Curtis Creek	2,186	1,500	544	4.20	0.95
Newberry Creek	1,261	1,100	320	3.90	0.86
Mackey Creek	578	750	214	2.70	0.97
TOTAL	10,652	8,235	2,841	3.74	0.77

[a] Catch per man hour of fishing.

Those streams with the least fishing intensity had the better catch records. The time required to catch fish on these streams was less than on the larger and more easily fished streams, where there were no fishermen. Some migration may have occurred, but it did not seem to injure the fishing on the small streams. It is noteworthy that in the South Toe River the catch exceeded the stocking by more than 100%, yet the catch per man hour remained as high as 0.68 This is to be contrasted with streams such as Hemphill Creek, Lower Creek, and Upper Creek, where the total catch was less than the number of stocked fish. Here the highest average catch per man hour was 1.1 fish. It appears, then, that an average catch of 1.1 fish per man hour by all fishermen and under all circumstances is the best that can be obtained in these streams; even by excessive stocking.

Furthermore, Lost Cove Creek, which received no stocking, had a catch per man hour of 0.93 fish. Admittedly, the population of this stream may have been affected by migration from other heavily stocked streams of the area, but this rate of catch for an unstocked stream is not inconsistent with the records from the

North Fork of the French Broad. The North Fork of the French Broad is a small, remote stream visited by less than 100 men per month. It was not stocked with hatchery fish, yet it produced over 2,000 fish from its native population for an average creel of 5.4 fish. The catch in this fine stream was exceeded only on the Santeetlah Area, and shows again that catch depends less on stocking than on the numbers of fishermen.

The records of the Mount Mitchell Area, then, might be summarized by saying that excessive stocking produced a return of 1.1 fish per man hour of effort; a native population without stocking but subjected to relatively light fishing pressure maintained an average catch per man hour of 0.93 fish; and extreme depletion under very heavy pressure, where the catch was more than 100% greater than the stocking, experienced a drop in the average catch per man hour to only 0.68 fish. That is, the difference in the rate of return between situations of excessive stocking and extreme depletion was a maximum of 38%. This raises a legitimate question as to whether or not the practice of indiscriminate stocking of trout streams has a commensurate value in relation to the cost, or whether the value of trout stream stocking is largely psychological so far as the fishermen are concerned.

The West Fork of Pigeon River within the Sherwood Refuge consists of three lesser forks which might possibly contain 25 miles of trout water. The Left Fork is richest of the three, with Middle Fork second, and Right Fork almost barren of bottom food (Chamberlain 1942). The area streams were stocked with 1,612 trout previous to the opening of the fishing season. During the first month of fishing 5,072 trout were removed by 1,073 men for an average catch of 5.1 fish at the rate of 1.08 fish per hour of effort. A depletion of 3,460 trout from the native population materialized during the first month. In June only 337 men fished for an average catch of 5.3 fish per man and a catch per man hour average of 0.97 fish. The depletion totalled 3,935 trout at the end of June. In July the fishing pressure increased by about 100 men over the previous month, and the average rate of catch dropped to 0.92 fish per man hour of effort. The total depletion at the end of July was 5,221 trout. In August 240 men fished the area. This was about one-fifth the number of fishermen on the streams during the first month. The average catch increased to 4.9 fish per man and the catch per man hour increased to 1.0 fish. The total depletion at the end of the season was at least 5,650 native trout in addition to the 4,279 stocked trout, even if we consider that 100% of the stocked fish were taken during the season.

At this point it might be well to compare the population curves for the Mount Mitchell and Sherwood areas, since they are extremely similar in most respects. Stocked fish carry the fishing load only during part of the first month. Both areas were subjected to extremely heavy fishing pressure during the first month, and only about one-third as much during the two succeeding months. In the fourth month of the season the fishing pressure was reduced to 20% or less of that at the beginning of the season. This greatly decreased fishing pressure presumably accounted for the increased catch rate at the end of the season, even though the fish populations at the time were very greatly reduced. It might reasonably be observed from the Mount Mitchell Area records that the increased catch rate in August was the result of an excessive stocking during that month. However, this thought is refuted by the records from the Sherwood Area in which the catch rate increased during August under very light fishing pressure, even though the total

population of the stream continued to diminish. This indicates that the lack of fishing pressure rather than stream population has the greater effect on the catch rate.

About 40 miles of water are present in the Santeetlah Cooperative Wildlife Management Area, Station 1. Table 3 shows that a total of 3,300 trout were stocked preceding the opening date. Data on this area are presented to contrast with the two previous ones because the fishing pressure was very even throughout the season. Under constant and rather light fishing pressure, the catch rate remained constant at 1.3 fish per man hour during the first two months. In June an unusually heavy stocking was made in anticipation of heavy holiday fishing pressure. The catch rate increased to 1.7 fish per man hour in June, dropped to 1.5 fish in July, and returned to the original 1.3 fish in August, when the trout population was 5½ thousand fish below its opening day level.

Table 3. Stocking and catch of trout on the Santeetlah Area, Station 1.

	Month					
	April	May	June	July	Aug.	Total
Fishermen	333	331	324	506	379	1,891
Catch/man hour	1.3	1.3	1.7	1.5	1.3	1.4
$\overline{X}$ catch	6.1	6.9	6.6	5.5	5.3	6.0
Total catch	2,020	2,290	2,134	2,776	2,096	11,316
Total stock	3,300	1,200	3,000	0	1,600	9,100
Difference	1,280	1,090	866	2,776	496	2,216

There are several significant factors to be observed from the data and the population curve for this area. Over 11,000 fish were caught. The fishing pressure was relatively light and the catch rate was high. The pressure was exceptionally constant throughout the season, and so was the catch rate. Even assuming all stocked fish to be caught from the beginning of the season to the end, the trout population suffered a net depletion of over 5.5 thousand fish. The catch per man hour was exactly the same in the last month of the season as in the first. Since the catch rate was entirely unaffected by the decreased population, we must conclude that the number of fish in the stream was not a limiting factor on fishing success. Reasonably, we must further conclude that at least some part of the stocking was excess to maximum fishing success and consequently was wasted.

CONCLUSIONS

There are many factors that affect the "catchability" of trout beside the number of fish present in the streams. The differences in the ability of fishermen is averaged out by using results obtained by a large number of fishermen, and consequently finding an "Average Fisherman." Other variables are not so easily controlled. Climatic conditions affect the tendency of fish to feed. The difference between April temperatures and August temperatures probably affect catchability. Certainly rainfall, or lack of it, producing high or low water stages in the streams, affect fishing results. Large numbers of fishermen tramping beside or in a stream tend to reduce the catchability of trout by frightening them. Water levels are lower in August than in May. In spite of these variables, several important conclusions are indicated from the data.

1. Creel reports for an entire area or watershed may be misleading if applied to any one stream. Management should be on a basis of individual stream records.
2. The catch per man hour of effort is a better criterion for evaluating the quality of fishing than is the average catch, because fishermen tend to fish longer per fishing trip in June.
3. The smaller streams are neglected for the larger and more easily fished ones, yet the fishing results are often better in the smaller streams where there are fewer fishermen.
4. In water which produces a native trout population, heavy stocking before the opening of the season need not be considered essential for a good catch return if the fishing intensity is not excessive.
5. The normal population of trout producing waters usually supports a large part of the total catch.
6. In a stream carrying a normal trout population, the addition of fish has relatively little effect on the *rate* of catch. Apparently, other limiting factors apply. Streams seem to have a more or less definite maximum return per unit of effort which cannot be increased to any appreciable extent by increasing the number of fish present.
7. Fishing intensity, when heavy, will tend to lower the catch rate, presumably due to the disturbance in the trout habitat by the fishermen.
8. The accepted aim of trout stream management is to provide the shortest time between bites. It appears that management plans must include, as a primary objective, some effort to distribute the fishing pressure as thinly as possible over all the available waters and over the whole length of the fishing season. The data presented support the belief that this factor is more important in fishing success than is heavy stocking resulting in high populations.

LITERATURE CITED

Chamberlain, T. K. 1942. Stream Management in the Pisgah National Forest.