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ABSTRACT

MICHIGAN DEPARTMENT OF CONSERVATION

(Institute for Fisheries Research Report No. 1510)

CREEL RETURNS AND SURVIVAL OF HATCHERY TROUT TRAINED BY PSYCHOLOGICAL RESEARCH SERVICES

D. S. Shetter and G. P. Cooper

April 24, 1957

Psychological Research Services (PRS) was employed by contract to conduct experiments for the Conservation Department on creel returns and survival of hatchery trout given special conditioning (training) for improved survival, and for better spread in the creel throughout a period of days after planting. PRS trained their trout at the Oden hatchery. The fish were planted in natural lakes and streams at research stations where complete creel returns were recorded by Institute personnel.

The experiments involved mostly brook trout, some rainbows and browns, and both fingerling and legal-size fish. PRS trained their trout at three levels: I fish were taught to feed off the bottom; II fish were taught bottom feeding and to avoid predators; III fish were trained for bottom feeding, avoidance of predators, and use of natural cover. Untrained hatchery fish were controls. Some experiments also involved wild trout collected from a natural stream. A typical experiment involved the planting of equal numbers (100 to 500) of control (C), I, II and III fish in a stream or lake where a complete daily creel record was obtained for all legal-size (over 7 inches) trout kept by anglers. Fish were identified as to training by fin clipping. Creel returns for trained and control lots were analyzed for significant differences in total return (by Chi-square) and in spread of catch over a period of days (by mean days out, and a rank test). Plantings of PRS fish were made during 1953-1955; creel returns through 1956 are summarized; there is good evidence of almost no survivors by the end of 1956 in the waters planted.

The experiments involved 23 plantings of legal-size trout (total of 12,405 fish) and 13 plantings of fingerlings (60,011 fish). For most plantings (except 6 during 1954), fish in experimental lots were comparable in length. Returns from different plantings were variable, so that conclusions must be generalizations based on averages for repeated experiments.

Training at the III level resulted in losses averaging about 15 to 20 percent of fish in the anglers creel, as compared to control fish. The III fish had a better spread in anglers' creels over a period of days than did the controls (averaging about 10% in terms of mean rank), but the improved spread was partly (probably largely) not a real gain; it was due to the loss

of fish from creels during the first few days after planting. Training at the I and II levels had less effect on creel returns and no apparent benefit.

Training of fingerling brook trout (III level) did not increase the returns to anglers. A single planting of fingerling rainbows gave returns of 1.04 percent for III (trained) fish and 0.47 percent for controls; the difference is significant statistically, but returns were low; the result would have more significance if it had been confirmed by repeated tests. One experiment with fingerling brown trout gave returns of 1.37 percent for III (trained) fish and 1.04 percent for controls; this difference is not statistically significant but is "suggestive."

PRS trout were planted for survival studies in certain streams closed to fishing. Electric shocker was used to count the numbers of trout surviving at periodic intervals. Checks by shocker and nets were made also to follow PRS trout in some of the waters open to angling. For brook trout, training increased the survival to some extent, but the improved survival did not last long enough to benefit angling. For rainbows, training improved survival to some degree over winter months, but this did not extend into the fishing season.

In a screened section of the Tobacco River, with known numbers of C, I, II, III and wild brook trout, intensive angling for 12 days removed C trout faster than III trout, and III's faster than wild trout.

It seems clear that psychological conditioning made legal-size trout less susceptible to capture by anglers during the first few days, but this had the ultimate effect of reducing total returns to anglers. Training of fingerling brook trout did not benefit anglers. Training of rainbow fingerlings might be beneficial, but more experiments would be needed to establish this point.

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CREEL RETURNS AND SURVIVAL OF HATCHERY TROUT TRAINED BY PSYCHOLOGICAL RESEARCH SERVICES

By D. S. Shetter and G. P. Cooper

The planting of legal-size hatchery trout would make a greater contribution to sport fishing if (1) a greater percentage of these fish were caught by anglers, and if (2) the catch were spread out over a longer period of time. Returns of legal-size fish in anglers' creels generally average something less than 50 percent of the numbers planted, and a large proportion of those which are creeled are taken within the first few days or, at best, the first few weeks after planting. The capture of hatchery fish by anglers would more closely simulate fishing for wild trout if the hatchery fish were less susceptible to immediate capture and if those not caught during the first few days had better survival thereafter.

The reasons why hatchery trout are caught readily after planting seem fairly obvious. We presume that hatchery trout, when planted in a stream, are caught more readily than native (wild) trout because they have grown up in raceways with hand feeding and have become conditioned to the presence of people on the banks. Possible reasons why hatchery trout (those not caught) do not survive longer are more obscure. Difficulties in adjusting to current, to natural feeding, avoidance of predators, etc., are possibilities.

In recognition of the desirability of obtaining a better spread of hatchery trout among more anglers and over a longer period of time, the Fish

Division for some time has made boat plantings of legal-size trout, scattering them along a section of stream, in contrast to the former method of spot planting a large number of fish in one pool. However, the one careful evaluation of scatter planting, which has been made in Michigan thus far, did not show an appreciable improvement in spread of catch among anglers or over a period of time[1].

Early in 1953, Messrs. J. L. Bingham, H. M. Adelman, and J. L. Maatch, graduate students in the Psychology Department at Michigan State University, formed the Psychological Research Services, Inc. (hereinafter referred to as PRS). Preliminary experiments by PRS at the State Fish Hatchery at Mattawan, Michigan, described by Dr. Justin W. Leonard to the Conservation Commission in May, 1953, suggested that hatchery trout might be "trained" by appropriate psychological techniques to act more like wild (native) trout. In July, 1953, the Conservation Commission approved a contract between the Fish Division and PRS, for experiments in the application of psychological techniques to trout culture and trout management.

The purposes of the PRS project were to determine the kind and amount of conditioning needed to make hatchery trout more successful in adapting to natural feeding, to the use of natural shelter, and in avoiding natural predators after planting; to evaluate the results of this conditioning (training); to prepare a manual of techniques; and to assist in instruction of key Fish Division personnel as to their methods. The original contract ran from July 12, 1953 to July 13, 1954; the contract was renewed by the Conservation Commission to July 14, 1955. During the second year only J. L. Bingham and H. M. Adelman were employed.

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[1] Cooper, E. L. 1953. Trans. Amer. Fish. Soc., Vol. 82, 1952, pp. 265-280.

For certain experiments conducted by PRS, the results have already been published (see appendix to this report). These experiments included studies on starvation of trout, comparative survival of hatchery trout and wild trout of legal size, and comparative learning ability of brook, brown and rainbow trout.

The present report is concerned primarily with returns to anglers of PRS trout from plantings made in waters open to public fishing, and to a lesser extent with survival of PRS trout from plantings in waters where no fishing was allowed. Most of the effort by PRS was in training of trout for the plantings in waters open to public fishing. The data on returns to anglers and on survival are presented in considerable detail in accompanying tables.

Methods

The general plan of the PRS experiments was to start with two to four lots of hatchery trout for different levels of training. These lots were taken at random from a common stock of fish, so that the fish in different lots were comparable in size, in fish-cultural history, and in other significant factors. One lot was kept as a control, while the fish in the remaining one to three lots were given "training" (conditioning) at one to three experimental levels. The fish in each lot were marked by a distinctive fin clip or by numbered jaw tags. Specified numbers of control fish and fish trained at different levels were then planted in a stream or lake, and this constituted a single planting experiment. At creel census stations, clerks kept daily records of test fish caught by anglers, and these fish were identified by their fin clip or tag number as to training level.

Training[2]

The PRS staff trained their trout in raceways at the Oden state fish hatchery. They worked mostly with brook trout, some with rainbows and browns;

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[2] The experimental methods employed by PRS are also described in other reports submitted to the Conservation Department.

and with both legal-size and fingerling fish. Training was directed towards teaching the fish to feed off the stream bottom rather than from the surface of the water, to flee from predators, and to utilize underwater "cover" as another means of escaping from predators and man. Training was at three levels, as follows:

Group I. Underwater feeding (trained to feed off the bottom).

Group II. Underwater feeding, plus training to avoid predators and man.

Group III. Underwater feeding, plus avoidance training, plus training in escape to underwater cover (hiding places).

Group C. Control fish, no training.

For training at the I level, the PRS staff installed mechanical underwater feeders in the hatchery raceways, which delivered food near the bottom of the stream. This method replaced the usual method of hand-scattering of food on the surface of the water by an attendant. The schedule of underwater feeding was gradually altered to feeding in early morning and evening, rather than during the middle of the day, and altered to feeding the fish a little at a time over extended periods.

For avoidance training at the II and III levels, mild electrical shock was administered to the fish at the appearance of some cue to danger. Cues included any violent disturbance of the surface of the water, presence of foreign objects under water, presence of potential predators such as a stuffed muskrat drawn through the water, shadows, and threatening sounds. The fish soon learned to associate a danger cue with the "unpleasant" experience of electrical shock, and would then flee to the end of the raceway or hide in cover as a reaction to the cue alone. Training was considered complete when this reaction to cue alone was spontaneous, and when fish trained at the II level would flee to the extreme end of the raceway, and

when all fish trained at the III level would take refuge in cover. Trout in Groups II or III were trained in underwater feeding, avoidance of predators, and refuge to cover, concurrently.

It required approximately two weeks to train individual lots of fish, in the raceways at Oden.

Marking

All test fish were marked for later recognition as to level of training. Most fish were fin clipped, some were given numbered jaw tags. When fin clipping was used, two (for one experiment, three) fins were removed. A different fin combination was used each year of planting, so that fish could be identified with planting dates. Fin-clip combinations for different levels of training were such that the lack of a particular fin would not handicap the fish in one lot more than in another. For example, in one year (1955) C fish had the anal and left pectoral fins removed, III fish had the anal and right pectoral removed.

Planting sites, waters open to fishing

The PRS staff trained their fish during 1953, 1954, and 1955, and hatchery personnel planted the fish in lakes or streams immediately after the fish were trained. The plantings were made in twelve lakes and in portions of five streams (Table 1); all are proven trout waters. In all, 23 plantings of legal-size trout were made (total of 12,405 fish), and 13 plantings of fingerling trout were made (total of 60,011 fish), with a breakdown by year and species as follows:

1953, legal-size brook trout, 3,350 fish, 8 localities, Table 2.
" , " rainbow " , 1,250 " , 2 " , Table 2.
1954, " brook " , 3,200 " , 5 " , Table 3.
" , " rainbow " , 725 " , 1 " , Table 3.

1955, legal-size brook trout, 1,280 fish, 4 localities, Table 4.
" , " rainbow " , 2,600 " , 3 " , Table 4.
1954, fingerling brook " , 41,035 " , 10 " , Table 5.
" , " rainbow " , 7,999 " , 1 " , Table 5.
" , " brown " , 10,977 " , 2 " , Table 5.

The actual dates of plantings are given in Tables 2-5.

At all lakes and streams which received test fish, the state-wide trout fishing regulations were in effect (open season from last Saturday in April through second Sunday in September, a 7-inch size limit, no restrictions on bait, daily creel limit of 5 trout from lakes or 10 trout from streams), with the following exceptions:

1. An extended fall season to November 30 on rainbow trout in Devoe and North lakes and in the East Branch Au Gres River, Iosco County, downstream from M-55 where certain of the experimental trout planted in Guiley Pond were recovered.
2. A 10-inch minimum size limit on East Fish Lake and Fuller Creek Pond.
3. Artificial flies only, for trout fishing in Ford Lake, 1955-1956.
4. No live fish to be used for bait on Fuller Creek Pond, and Swanzy, East Fish, Hemlock, Ford, Lost, West Lost, North Twin, and South Twin lakes.

Creel census methods

Most of the lakes and streams where PRS fish were planted are in one of three research areas where the Conservation Department operates fisheries research stations, namely, Hunt Creek, Pigeon River, and Rifle River. In these areas, fishing is under a permit system in which clerks obtained records on all angling. The two test waters not within the three research areas are Guiley Pond and Swanzy Lake. At Guiley Pond, Mr. Elmer Stensrud kept a

complete record of all angling for the Department[3/] and at Swamp Lake the Fish Division conducted an intensive census in which most anglers were contacted. Thus for the present report we have practically complete records on the returns of PRS trout to anglers.

Census clerks examined all angler's creels and kept daily records of all PRS trout, including notations of the level of training (C, I, II or III) determined from fin clips. These daily returns are listed in Tables 6-41. Much of the present report is based on an analysis of these returns. The returns are complete through the 1956 trout fishing season. Field checks by electric shocker, trap nets and weirs on Hunt Creek and East Fish, Ford and Hemlock lakes (see Table 51), and the pattern of daily distribution of creel returns, showed that by the end of the 1956 season there were practically none of the legal-size trout left in the test waters and an insignificant number of survivors from the fingerlings planted during 1954. We may need to make a slight revision of the present report after the 1957 fishing season is over, but it seems unlikely that conclusions given in the present report will have to be altered materially.

Statistical methods

The aim of PRS training was to obtain a greater return of hatchery trout to the creel and a better spread of these returns over a longer period of time. Thus the present analysis deals with total returns and with daily spread of the catch. The effect of the training is judged by comparing returns from trained fish (Groups I, II or III) with returns from untrained hatchery controls (Group C).

Chi-square is the statistical method used to compare total returns or survivals from two or more lots of fish. Chi-square (X^2 in tables) is

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[3/] A few recoveries of trout planted in Guiley Pond were obtained by Mr. E. Parker, from angling in and below the pond operated by More Trout, Inc.

necessarily based on an analysis of actual numbers of fish, not on percentage returns. It tells whether a difference in rate of return between two or more lots of fish could happen by chance alone. If the difference could not happen by chance (at betting odds, or confidence level, of 95%), and assuming that other variables are constant, one concludes that a significant difference resulted from the training.

The analysis of daily spread is more complicated. We are interested in the question "were the fish caught by a large number of anglers over an extended period of many days, in contrast to a less desirable situation where the fish were caught by fewer anglers within the first few days after planting?" We have chosen two statistics to answer that question: mean days out and mean rank. The two methods give results which correspond closely. The first, "mean days out," is the more meaningful figure. The second, "mean rank," provides a method of determining whether a difference in spread is statistically significant, in contrast to a difference which could happen purely by chance.

The statistic "days out" is derived from the date of capture by an angler as related to the planting date (see Table 6 as an illustration). Trout caught on the planting date were out one day, those caught the day after planting were out two days, etc. If one fish was caught on the 2nd day and one fish was caught on the 9th day, the "mean days out" for the 2 fish would be 5.5 days.

In computing "days out," only days of the open season on trout were included. The first PRS plantings were made on August 26, 1953 and there were 19 days left in the trout open season that year. Through 1956 the seasons were:

1953—first planting - September 13————19 days

1954--April 24 - September 12----------142 days

1955--April 30 - September 11----------135 "

1956--April 28 - September 9----------135 "

For those waters which were open in an extended fall season to November 30 on rainbow trout, the period from September to November 30 was included in days out. For the 1954 fingerling plantings, "days out" were calculated from the day on which the first experimental fish of legal size appeared in an angler's catch. Likewise for East Fish Lake, where a 10-inch size limit prevailed, "days out" were computed starting with the day on which the first 10-inch trout from an experimental group was captured. If the reader objects to this procedure (for fingerlings and for fish from East Fish Lake), he can readily derive corrected averages for mean days out from dates given in the accompanying tables.

The "rank test" is a non-parametric statistic in which one does not assume a normal distribution of variates. The procedure is described by Edwards (1954, Statistical methods for the Behavorial Sciences, pp. 417-433). Its computation is more involved than for mean days out. Where you have creel returns from two (or more) lots of fish, the returns are arranged in daily sequence. If a single fish is caught on the first day, it has a rank of 1; then if two fish are caught on the second day, these two fish share ranks 2 and 3 and each is assigned a rank of 2.5; if then four fish are caught on the third day, these four fish share ranks 4, 5, 6 and 7 and each is assigned a rank of 5.5; finally, if the two lots which you are ranking have a total of 100 returns, with a single fish caught on the last day, this fish has a rank of 100. The "mean rank" for the fish in any one experimental lot is the average of ranks for fish in that lot. Whether or not two mean ranks are significantly different is determined by a "z" test (see Edwards'

text); whether or not the collective difference among three or more mean ranks is greater than could be expected by chance is measured by the H test (see Edwards).

Thus we refer to the average "mean days out" for an understandable figure on the amount of time that trout remained in a stream before they were caught by anglers, and we refer to the analysis of mean rank in determining whether a difference in daily spread is significant.

We obtain the same results in the rank test, whether or not "days out" includes days from other than the open season on trout.

For a clear understanding of the analyses given on Tables 6-41, the reader should also note the page of footnotes preceding Table 6.

Experimental variability

Creel returns from the 36 plantings of PRS trout (Tables 6-41) were highly variable among the different lakes and streams—some returns were high, others low. The differences in returns between lots of trained fish and their controls were also variable—in some experiments trained fish gave better returns and spread, in other experiments the control fish did better; in some instances Group II fish did better than Group III; etc. This variability makes it more difficult to evaluate the effect of training, and the evaluation has to be based on averages for a number of plantings.

Some of the variability may have been due to experimental bias, in that important factors other than training were not kept constant. This was true of the plantings of legal-size fish made during 1954 (Table 3). Although the 1954 plantings are listed as legal-size fish, some fish in each lot were of sub-legal size (less than 7 inches in length), and relatively more of the trained fish than controls were of sub-legal size at time of planting. This may have had a considerable effect on the angler returns, from hooking mortality among the sub-legals before anglers could keep them, and from delay

in the dates on which surviving fish could be kept by anglers (while the fish were growing to legal size). The effect of this bias would be to reduce the numerical returns and increase the daily spread of the trained fish in contrast to the controls, independent of the effect of training. Reduced returns and improved spread did occur among the 1954 plantings of "legal-size" trout, and we do not know how much of this difference can be ascribed to training, how much to experimental bias. In plantings other than those of legal-size trout during 1954, fish in experimental lots were closely comparable in size (Tables 2, 4, 5), and experimental bias due to differences in length must have been small although not necessarily absent.

Another problem in the analysis of creel returns of PRS trout is that, for many of the plantings, trained fish gave lower numerical returns but a better daily spread. We must then evaluate a gain against a loss. See Tables 6 and 7, and the page of text following Table 6, for further information on this problem.

Results and Conclusions on Creel Returns From PRS Trout

Legal-size trout

Tables 6-41 give complete data on angler returns from individual plantings of PRS trout through 1956; an insignificant number of additional returns in subsequent years can be expected. Tables 6-41 also contain summary figures, by level of training, for total return, percentage return, gain or loss in return of trained fish over the controls, and the mathematical probability that the gain or loss is significant; and, under analysis of daily spread, summary figures for mean days out, mean rank, gain or loss in mean rank of trained fish, and probability that gain or loss in rank is significant. In these tables the probabilities tell whether there is significant difference in a collective sense among the several experimental lots (Groups C, I, II, III) in any given experiment.

Summaries of creel returns for individual plantings are grouped by year for direct comparison in tables as follows:

Table 42—legal-size trout planted during 1953.

Table 43— " " " " " 1954.

Table 44— " " " " " 1955.

Table 48—fingerling " " " 1954.

Finally, yearly summaries on returns are given in Tables 45 and 48, and summary analyses of mean rank are given in Tables 47 and 49.

Among the eight plantings of legal-size brook trout made during 1953, numerical returns of trained and control fish were significantly different from only three plantings (Table 42). In Hunt Creek the controls did better than fish trained at the I and III levels. In the Pigeon River, II fish did better than controls. In Ford Lake control fish did better than the III's. In daily spread of trout among anglers, trained brook trout did better than controls in Hunt Creek (Table 6) and Ford Lake (Table 10); for other tests the improvement in spread (generally the case for trained fish) was not significant as measured by the H test. For the eight plantings the general pattern was a greater return for control fish and a better spread for trained fish; from the standpoint of returns to the angler, the benefit in spread among trained fish was largely nullified by loss in returns (see text page preceding Table 7, and Table 7).

For the two 1953 plantings of legal-size rainbow trout the results were irregular. In Guiley Pond, the III's gave better returns than controls; in the Rifle River the controls did better than the III's (Table 42). Conversely, in daily spread, III fish in Guiley Pond had somewhat poorer spread, III fish in the Rifle had somewhat better spread, but differences were not significant (Tables 15 and 16).

The 1954 plantings of legal-size trout consistently gave higher returns of control fish (Table 43), but better spread of trained fish (Tables 17-22). The amount of improvement in spread of trained fish is closely matched by the loss in returns. The degree of poorer returns and better spread of trained fish was greater for the 1954 plantings than for the 1953 and 1955 plantings, probably due to the experimental bias (difference in size at time of planting) described above.

Among the 1955 plantings of legal-size brook and rainbow trout (Table 44), only the Rifle River planting of rainbows gave significant differences: here again, C fish gave greater returns, III fish gave better spread (Table 27).

If we look to the annual summaries for numerical returns (Table 45) and mean rank (Table 47), we see more clearly the trends mentioned above: a larger creel return of control fish than of III fish (the most highly trained), and a better spread of III fish than of controls. If we eliminate the 1954 results from consideration because of experimental bias, the figures for 1953 and 1955 still show the same results, although less strikingly. The conclusion that PRS training did retard the catchability of hatchery trout is strengthened by a separate study on the Tobacco River (see Table 54).

Fingerlings

PRS fingerling brook, rainbow, and brown trout were planted during the fall of 1954 at 12 sites (different sections of Hunt Creek considered as one site). Daily creel returns are given in Tables 30-41. For all plantings, numerical returns are summarized in Table 48, and mean ranks (daily spread) are summarized in Table 49.

Among the ten plantings of fingerling brook trout, trained fish gave better returns than controls in West Lost Lake (Table 36), control fish gave

better returns than trained fish in Hemlock Lake (Table 38), while trained and control fish gave equal returns in the remaining eight plantings. For all plantings combined, total returns were almost identical: 6.38 percent of 20,556 C fish, and 6.41 percent of 20,479 III fish (see Table 48). In daily spread, III fish were better than controls in Hemlock Lake (Table 38), but differences in spread for the other nine plantings were not significant (Table 49).

In the single planting of fingerling rainbows in Devoe Lake (Table 40), trained fish gave significantly higher returns than control fish. However, percentage returns were small—1.04 for trained, 0.47 for control. We could attach more significance to the better returns on fingerling rainbows if more than one planting had been involved, and if similar results had been obtained for brook trout and brown trout fingerlings. Since one of the ten plantings of brook trout gave significantly better returns of trained fish, one should allow for similar experimental variability with rainbows. Daily spread of returns from trained and control fish was similar.

The single planting of fingerling brown trout in the Rifle River gave slightly (but not significantly) better returns of trained fish, no difference in spread of catch (Table 41).

Survival of PRS trout, waters open to angling

We believe that the creel returns given above for PRS plantings are practically 100 percent complete; i.e., that there will be very few returns during 1957 and subsequently. We conclude this for two reasons: (1) In most instances creel returns diminished to nothing long before the end of the 1956 fishing season. (2) Population studies on Hunt Creek, East Fish Lake, Ford Lake, and Hemlock Lake showed that few or no fish were left by September of 1956 (Table 51).

Population estimates by electric shocker were made on Hunt Creek each September from 1953 to 1956. Each time the number of trout remaining in the stream at the end of the fishing season was estimated. Trap nets were used on East Fish, Ford, and Hemlock lakes for similar information.

The results at Hunt Creek (Table 51) show that (1) for legal-size brook trout there was a little better survival of III fish than controls at the end of the first angling season, (2) very few fish were caught during the second season, and (3) there were almost no survivors at the end of the second season. Results on the three lakes showed (1) no better survival of trained fish, and (2) almost no PRS trout remaining at the end of the 1956 fishing season.

Survival Studies, PRS Trout, Waters Closed to Angling

In addition to the numerous plantings of PRS trout in waters open to angling, a number of straight survival studies were made on plantings of fingerling and legal-size trout in enclosed stream areas which were closed to fishing (Tables 52 and 53). These tests were carried on in Diversions IIA and IIIA of Section C of Hunt Creek, and in a portion of Slagle Creek south of the county highway which passes through the State Fish Hatchery at Harrietta. The design of these tests was to liberate lots of trained and control trout (identified by marking) in screened sections of stream from which the fish could not escape, and to determine survival at regular intervals by recapturing all, or nearly all, fish with a D.C. electrical shocker. The shocker was operated two to four times throughout the stream section for each count. For most counts, conditions were favorable for operation of the shocker, and it is believed that the counts were at least 90 percent complete. Conditions at the two stream sites, pertinent to the design of the tests, were as follows:

Slagle Creek. A concrete dam at the upper end of the experimental section was a barrier to fish moving out of the section. The lower end of the section was blocked by a screen of vertical wooden slats with 1/2-inch spaces between; trout less than 5 inches in length could escape through the screen. From November, 1953 through August, 1956 high water frequently over-topped the downstream screen allowing experimental fish to escape; anglers reported that they caught test fish below the section, and 40 test fish were recaptured by shocker below the section. Hatchery rearing ponds located nearby may have attracted predators in abnormal numbers to the test section.

Hunt Creek. Fish-tight screens were present at the upper and lower ends of the experimental diversions. One flood over-topped these barriers for a 2-hour period, but few test fish escaped; one was caught in the fish trap at the lower end of Section Z, none was taken by anglers or by extensive operation of the electric shocker outside the diversions. Although anglers might have done some illegal fishing in the experimental diversions of Hunt Creek while these survival studies were going on, no test fish were found in their creels at the checking station.

We believe that the survival tests at Hunt Creek were more reliable than those at Slagle Creek, because of more escapement of test fish at Slagle Creek.

Survival, legal-size trout

One hundred legal-size brook trout of experimental groups I, III and C and 102 wild fish (obtained from the North Branch Au Sable River) were put in the Hunt Creek diversions on August 26, 1953. Monthly counts were made by shocker through April, 1954 when the raceways were drained and all surviving fish were recovered. The numbers of survivors each month for each

experimental group are tabulated in Table 52. Survivors in April, 1954 were 20 C's, 20 I's, 24 III's, and 52 wild fish. The greater survival of the wild fish is statistically significant; other differences are not significant.

The results from other plantings of legal-size trout (brooks and rainbows), in Hunt Creek and Slagle Creek, are also summarized in Table 52. For brook trout there is some indication of better survival of I and II fish (not of III fish) in Slagle Creek. For brook trout in Hunt Creek during 1954, there was no difference in survival. For rainbow planting made in Slagle Creek in August, 1953, there was better survival of I and II (trained) fish over the winter months; however, by April the survival rates were about the same—the better survival of II fish over C fish was not significant. The test on legal-size rainbows, started in April, 1954, showed no benefit from training.

Survival, fingerling trout

Trained and control fingerling brook trout were used for survival studies in Hunt Creek and Slagle Creek, and monthly checks by shocker were made on survivors (Table 53). The two tests at Hunt Creek and the 1953-54 test at Slagle Creek showed no benefit from training. In the 1955-56 test at Slagle Creek, survival of trained (III) fish was better than of controls for about the first 12 months, but by the end of 18 months the difference in survival between controls and trained fish was largely lost.

Controlled Fishing Tests, Tobacco River

From the legal-size brook trout trained for the 1954 PRS plantings, approximately equal numbers of C, I, II and III fish were planted in a screened raceway of the former Tobacco River Rearing Station 10 miles northwest of Clare, Michigan. Also, 132 wild trout from other streams were included for a fifth experimental lot. These fish were then fished over by a group of anglers selected by PRS. All trout caught were killed after

capture, and tallied as to level of training (fish were fin clipped) and date of capture. The purpose of this test was to determine if the trained fish were less susceptible than controls to immediate capture, and more susceptible than wild trout. At the end of twelve days of fishing, the raceway was drained and all surviving trout were recovered. The results of this test are summarized in Table 54. The creel returns and survival records were analyzed the same as for tests described in the first part of this report.

The Tobacco River test gave results similar to those with legal-size brook trout in waters open to public fishing. Anglers caught a significantly greater number of controls than of trout trained at the III level. Also, they caught a significantly greater number of trained fish than of wild fish.

The daily spread of creel returns, analyzed by a test of independence (Chi-square), was significantly different for training at a 99.9 percent confidence level. Rank tests further verified this conclusion. Significant differences in mean rank were found between controls and III's, and between III's and wild fish. Training at the III level made the fish less susceptible than controls to early capture, but the III fish were caught more readily than the wild fish.

Acknowledgments

The work of psychological conditioning of hatchery trout for better survival and improved spread of the catch was primarily a research project of Psychological Research Services (Messrs. J. L. Bingham, H. H. Adelman, and J. L. Maatch). The Institute for Fisheries Research was given the responsibility of tabulating creel returns at research stations, assisting PRS in much of the collecting by shocker of trout involved in survival studies, and, for the second contract year (1954-1955), acting in an advisory capacity in setting up the planting experiments.

The PRS staff were assisted in the training program at Oden by Mr. L. B. Hoodmaker and his staff. Other help came from C. T. Yoder, J. R. Hammond, and Joe Southwick and his staff at the Harrietta hatchery.

Creel records were obtained by Institute staff at Hunt Creek, Pigeon, and Rifle River research stations, and by personnel at the Marquette station. Cooperation from outside the Conservation Department was given by Mr. Elmer Stensrud in keeping creel records at Guiley Pond. Institute staff members at field stations and Ann Arbor contributed much time in the compilation and analysis of the records given in this report.

Appendix

Brief summary of other studies made and published by FRS

The staff of FRS conducted experiments at the State fish hatchery at Oden on the ability of hatchery-reared brook trout to survive long periods without food (Adelman, Bingham and Maatch, 1955)[1] Three groups of 40 fish each were utilized. The average sizes of fish were 3.5, 5.5 and 7.5 inches. Weight decreased noticeably during the first three months, and stayed relatively constant over the last four months. At the end of the 7-month period, survival amounted to 30 percent for the 3.5-inch fish, 90 percent for the 5.5-inch fish, and 75 percent for the 7.5-inch fish. At the end of seven months, half of the surviving fish were put on a "demand-feed" schedule (immediately fed all they would eat); the other half were fed small and increasing increments until a full daily ration was eaten. Those on demand feeding all died, those on slow feeding did not. The authors concluded that starvation, per se, was not an important factor causing low winter survival rates.

In a second paper, Adelman and Bingham (1955)[2] compared the survival in two enclosed natural stream areas, of untrained hatchery-reared brook trout with wild brook trout, all 7 inches or larger. In Hunt Creek, wild fish survived from late August to March at a rate about twice that of the hatchery fish. In Slagle Creek, hatchery brook trout survived the same

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[1] Adelman, Harvey M., Joseph L. Bingham, and Jack L. Maatch
1955. The effect of starvation upon brook trout of three sizes. The Prog. Fish-Cult., Vol. 17, No. 3, July, 1955, pp. 110-112.

[2] Adelman, Harvey M. and Joseph L. Bingham
1955. Winter survival of hatchery-reared and native brook trout. The Prog. Fish-Cult., Vol. 17, No. 4., Oct., 1955, pp. 177-180.

period about 1.7 times as well as the wild fish. The authors concluded that there was little or no difference between hatchery-reared and wild brook trout in ability to survive the winter months. Their data are included as a part of Table 52 of the present report.[3]

Adelman and Bingham (1956)[4] conducted tests at the State fish hatchery at Mattawan on the ability of brook, brown and rainbow trout to discriminate differences in size. They found that brown trout resolve stimulus differences more readily than either rainbow or brook trout. When the effect of learning the first discrimination upon the speed of learning a second discrimination was tested, it was found that brown trout underwent no change, rainbow trout learned the second discrimination more rapidly, the brook trout more slowly. These results give general support to the common observation that brook trout are the least "intelligent" of the three species of trout, and probably explain why they are the most readily captured by anglers under a wide variety of conditions.

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[3] The figures given by Adelman and Bingham in their P.F-C. article (Vol. 17, No. 4, page 179, Table 1) vary somewhat from field data in Institute files (given in Table 52 of the present report), but these differences would not alter general conclusions on survival to March of 1954. However, survival data for April, 1954 (see Table 52) were not included in the P.F-C. article which was prepared prior to the time of the April check. The figures for April do not change the conclusion for brook trout in Hunt Creek, namely: the wild fish had twice the survival of hatchery fish. For brook trout in Slagle Creek, the better survival of hatchery fish over wild fish (as concluded by Adelman and Bingham) was apparent in the figures for January to March (P.F-C. article, Table 1), but by April (Table 52) the survival rates of hatchery and wild fish were identical (47%). In view of the small number of wild trout involved in the Slagle Creek test, and the known escapement of test fish from the Slagle Creek experimental section, the P.F-C. authors had a weak case in concluding that hatchery trout survived as well as wild trout. The April survival data also tend to negate their conclusion. Furthermore we do not share the point of view of Adelman and Bingham that the Hunt Creek results should be discredited because of illegal fishing; this test ran for 8 months, the area was open to fishing for only the first 19 days, frequent checks by Hunt Creek employees failed to disclose any angling on the test section, and furthermore most of the differential mortality occurred after the fishing season was over.

[4] Adelman, Harvey M., and Joseph L. Bingham
1956. Size discrimination in the brook, brown and rainbow trout. The Prog. Fish-Cult., Vol. 18, No. 1, January, 1956, pp. 26-29.

INSTITUTE FOR FISHERIES RESEARCH

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Typed by: Anne E. Kruse

Tabular summary

of

Creel returns (through 1956) and survival of trout from experimental plantings of trout "trained" by Psychological Research Services (PRS), 1953-1956.

Data compiled and summarized by D. S. Shetter and G. P. Cooper, with assistance by other Institute staff.

For significant summaries, see Tables 1, 6, 45, 47, 48, 49, 51, 52, 53, and 54.

For an understanding of Tables 6-41, see page of footnotes preceding Table 6.

In addition to an evaluation of PRS training, the summaries give significant data on returns of hatchery trout to anglers.

Prepared by
Institute for Fisheries Research
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Table 1-5

Localities, planting dates, and species, numbers and size of fish in experimental plantings of PRS trout in waters open to public angling.

Level of PRS training

Group I -- Underwater feeding.

" II -- Underwater feeding and avoidance training.

" III -- Underwater feeding, avoidance training, and use of shelter.

" C -- Controls; no training.

Table 1

Localities where experimental plantings of PRS trained and control trout were made, 1953-55

Stream or lake	County	T.	R.	Sec.
Hunt Creek	Montmorency	29N	2E	25,35,36
East Fish Lake	"	29N	2E	34,35
Fuller Pond	"	29N	2E	34
Pigeon River	Otsego	32N	1W	9
Ford Lake	"	32N	1W	8
North Twin Lake	"	32N	1W	10
South Twin Lake	"	32N	1W	10
Lost Lake	"	32N	1W	3
West Lost Lake	"	32N	1W	3
Hemlock Lake	Cheboygan	33N	1W	34,35
Guiley Pond	Iosco	22N	6E	9
Rifle River	Ogemaw	23N	3E	11,14,22,23
Fontinalis Creek	"	23N	3E	2
Devoe Lake	"	23N	3E	11,12
North Lake	"	23N	3E	1
Gamble Creek	"	23N	3E	2
Swanzy Lake	Marquette	45N	25W	13

Table 2

PRS plantings of legal-size trout during 1953.
All plantings made on August 26

Stream or lake	Species of trout	Number of fish planted, by experimental group				Average length in inches[*]
		C	I	II	III	
Hunt Creek	Brook	200	100	...	100	8.1
East Fish L.	"	200	150	150	150	8.1
Pigeon River	"	200	100	100	100	8.1
Ford Lake	"	200	150	150	150	8.1
South Twin L.	"	100	100	...	...	8.1
West Lost L.	"	100	100	...	...	8.1
Hemlock L.	"	150	...	150	150	8.1
Guiley Pond	"	150	50	50	50	8.1
Guiley Pond	Rainbow	150	50	50	50	7.8
Rifle River	"	500	150	150	150	7.8

[*] From Department fish planting records.

Table 3

PRS plantings of legal-size trout during 1954

Stream or lake	Planting date: 1954	Species of trout	Number of fish and average weight in pounds			
			C	I	II	III
Hunt Creek	Apr. 22	Brook	100 (0.155)	100 (0.150)	100 (0.135)	100 (0.132)
East Fish L.	"	"	150 (0.159)	150 (0.141)	150 (0.132)	150 (0.122)
Pigeon River	"	"	200 (0.159)	200 (0.150)	200 (0.141)	200 (0.128)
Ford Lake	"	"	150 (0.163)	150 (0.143)	150 (0.139)	150 (0.127)
Guiley Pond	Apr. 26	"	200 (0.179)	200 (0.175)	200 (0.140)	200 (0.134)
Rifle River	"	Rainbow*	200 (0.166)	175 (0.143)	175 (0.144)	175 (0.138)

*These fish were jaw-tagged and measured individually. From the tabulation it can be shown that the following percentages of each group were less than 7.0 inches in length at planting: C, 8.5; I, 12.6; II, 16.0; III, 24.0.

Table 4

PRS plantings of legal-size trout during 1955

Stream or lake	Planting date: 1955	Species of trout	Number of fish and average length in inches	
			C	III
Hunt Creek	May 17	Brook	189 (7.2)	189 (7.1)
Pigeon River	"	"	200 (6.7)	200 (6.7)
Ford Lake	"	"	150 (6.8)	150 (6.7)
Fontinalis Cr.	May 16	"	102 (7.2)	100 (7.2)
Rifle River	"	Rainbow	300 (7.3)	300 (7.1)
Devoe Lake	May 16, 17	"	500 (7.1)	500 (6.8)
North Lake	"	"	500 (7.0)	500 (6.6)

Table 5

PRS plantings of fingerling trout during fall of 1954

Stream or lake	Planting date: 1954	Species of trout	Number of fish and average length in inches	
			Control	Trained
Hunt - Sec. D	Nov. 12	Brook	999 (4.3)	998 (4.2)
Hunt - ZABC	"	"	2,000 (4.4)	2,000 (4.2)
Fuller Pond	Oct. 14	"	2,198 (4.2)	2,168 (4.1)
East Fish L.	"	"	4,911 (4.2)	4,834 (4.1)
Ford Lake	Nov. 11	"	2,906 (4.3)	2,914 (4.2)
South Twin L.	"	"	1,065 (4.3)	1,070 (4.3)
North Twin L.	"	"	1,369 (4.2)	1,370 (4.2)
West Lost L.	"	"	998 (4.2)	994 (4.3)
Lost Lake	"	"	1,141 (4.3)	1,145 (4.3)
Hemlock L.	"	"	1,494 (4.3)	1,490 (4.2)
Swanzy L.	Nov. 12	"	1,475 (4.3)	1,496 (4.2)
Devoe Lake	Oct. 15	Rainbow	4,050 (4.1)	3,949 (4.2)
Rifle River	Sept. 16	Brown	4,992 (3.4)	4,985 (3.4)
Gamble Cr.	"	"	500 (3.4)	500 (3.4)

Tables 6-41

Creel returns from PRS experimental plantings made in waters open to public fishing, 1953-1956. Daily creel returns, analysis of total returns, and analysis of daily spread of catch, for individual experimental plantings.

Footnotes for tables 6-41

1/ Under "significant dates" are given, for each fishing season, only the earliest and latest dates when creel returns occurred.

2/ "Days out" includes only days of the regular open season on trout; not days from mid-September to late April, except where rainbow trout were caught during the extended fall rainbow season on certain waters (to Nov. 30).

3/ "Percentage gain or loss in returns" is computed using percentage returns for the C group as a base of 100%.

4/ "Probability that gain of loss is significant" is tested by Chi-square (X^2), and is based on numerical returns, not on percentages. Values for probabilities below 95% are approximations. Probabilities of less than 95% are generally not regarded as conclusive.

5/ "Percentage gain or loss in mean rank" is computed using the mean rank of the C group as a base.

6/ "Probability that gain or loss in mean rank" is significant is computed by the White z test for 2 groups, or the Kruskal-Wallis H test for 3 or more groups (see Edwards, 1954, Statistical methods for the behavorial sciences: 417-433). For z the two-tailed test was used. Where the H test was used, probabilities below 95% are approximations. Probabilities of less than 95% are generally not regarded as conclusive.

NOTE: In tables 6-41, under analysis of numerical returns is an item "probability that gain or loss is significant," and under analysis of daily spread of catch is an item "probability that gain or loss in mean rank is significant." In both cases probability of significant difference is concerned with the variation among all groups which are represented in the experiment. Probabilities of differences in pairing of two groups are given in later summary tables.

Table 6

Creel returns through 1956 from PRS experimental plantings of legal-size brook trout, Hunt Creek (experimental sections C and A), planted August 26, 1953

	Significant dates[1]	Days out[2]	Experimental group, and number planted C 200	I 100	III 100
Creel returns	8/27/53	2	52	15	17
	....	3	46	25	9
	....	4	26	7	7
	....	5	15	7	6
	....	6	6	5	4
	....	7	3	2	1
	....	8	6	1	4
	....	9	4	2	2
	....	10	..	..	1
	....	11	4	5	2
	....	12	..	1	1
	....	13	2	..	3
	....	16	..	2	..
	....	17	1	..	..
	9/13/53	19	2	1	..
	4/24/54	20	3	..	4
	....	21	3	..	1
	....	26	..	1	..
	....	28	..	..	1
	9/12/54	161	..	..	1
	5/12/56	311	1	..	..
	Totals	...	174	74	64
Analysis of numerical returns	Percentage return		87	74	64
	Percentage gain or loss in returns[3]		..	-15	-26
	Probability that gain or loss is significant[4]		For C-I-III Prob. = 99.9%+ X^2 = 21.8		
Analysis of daily spread of catch	Mean days out		6.44	5.16	8.95
	Mean rank		146.8	161.3	177.3
	Percentage of gain or loss in mean rank[5]		..	+10	+21
	Probability that gain or loss in mean rank is significant[6]		For C-I-III Prob. = 95% H = 5.83		
	Percentage of gain or loss in mean rank corrected to equal returns[*]		..	-2	+6

[*] See Table 7 for method.

The creel returns (Table 6) for legal-size brook trout in Hunt Creek, Aug. 26, 1953, showed a loss in total returns of the trained trout as compared to returns of control (C) trout (15% loss for fish trained at the I level, 26% loss for the III level), but a better daily spread of the trained trout (10% gain for the I level, 21% gain for the III). We may then logically ask the question: was improvement in spread of the trained fish a real gain, or was it largely the result of losing many of those fish which in the C group were caught during the first two or three days? In other words, if training resulted in anglers not catching some of the many fish which would otherwise have been caught during the first few days, and if more trained trout were not caught thereafter, has anything been gained at all? Thus, in Table 7, we correct the creel returns of the C and I groups to equal (in percentage) the returns for the III group. We do this by subtraction from the C and I groups for the first two days when larger numbers of C and I fish were caught. The rank test is then applied to the "corrected" creel returns. The conclusion is that the III group had an improvement in daily spread of only 6% over an equal number of fish in the C group. There was a loss of 26% in total returns to obtain a "real" improvement of 6% in daily spread.

This procedure of adjusting creel returns has been applied only to this one set of data; it has been done to show the importance of considering total returns and gain in mean rank together. The procedure of adjusting creel records to equal returns (on a percentage basis), for a comparison of spread of catch, is logical if one is interested only in the sum total result (returns plus spread) of these experimental plantings. On the other hand, the experimental training did make the trout less susceptible to capture by anglers during the first few days; this result, in itself, might have practical significance if these hatchery trout could be endowed, at the same time, with a better capacity for survival.

Table 7

Analysis of creel returns of legal-size brook trout from Hunt Creek, planted August 26, 1953.
Showing method of obtaining "percentage of gain or loss in mean rank corrected to equal returns"

Days out	Actual creel returns: Group, and number planted						Corrected creel returns: Group		
	C 200		I 100		III 100				
	Creel returns	Correction	Creel returns	Correction	Creel returns	Correction	C	I	III
2	52	-26	15	..	17	..	26	15	17
3	46	-20	25	-10	9	..	26	15	9
4	26	..	7	..	7	..	26	7	7
5	15	..	7	..	6	..	15	7	6
6	6	..	5	..	4	..	6	5	4
7	3	..	2	..	1	..	3	2	1
8	6	..	1	..	4	..	6	1	4
9	4	..	2	..	2	..	4	2	2
10	..	..	..	..	1	..	..	..	1
11	4	..	5	..	2	..	4	5	2
12	..	..	1	..	1	..	..	1	1
13	2	..	..	..	3	..	2	..	3
16	..	..	2	..	..	..	..	2	..
17	1	..	..	..	..	..	1	..	..
19	2	..	1	..	..	..	2	1	..
20	3	..	..	..	4	..	3	..	4
21	3	..	..	..	1	..	3	..	1
26	..	..	1	..	..	..	..	1	..
28	..	..	..	..	1	..	..	..	1
161	..	..	..	..	1	..	..	..	1
311	1	..	..	..	..	..	1	..	..
Returns:	174	..	74	..	64	..	..	..	64
Correction:		-46	..	-10	..	..	..	..	..
Corrected totals:		..	..	..	..	..	128	64	64
Mean rank, corrected:		..	..	..	..	..	127.3	124.7	134.8
Percentage gain or loss in mean rank, corrected to equal returns:							..	-2	+6

Table 8

Creel returns through 1956 from PRS experimental plantings of legal-size brook trout, East Fish Lake, planted August 26, 1953.
Planting size 7" - 8 1/2"; legal size limit at lake 10".
No early recoveries because of high size limit.

	Significant dates[1]	Days out[2]	Experimental group, and number planted			
			C 200	I 150	II 150	III 150
Creel returns	4/24/54	1	2	1	1	..
	....	4	..	1	..	..
	....	9	..	1	..	..
	....	23	..	..	1	..
	....	37	1	2	..	..
	....	57	1	4	..	..
	....	61	1	1	2	..
	....	62	..	..	1	1
	....	66	1	..	1	..
	....	67	1	..	..	1
	....	73	1	..	..	..
	....	79	..	..	1	..
	....	113	1	..	..	1
	....	114	..	..	..	1
	....	124	2	1	..	..
	....	141	..	1	..	..
	9/12/54	142	..	1	..	1
	4/30/55	143	1	2	..	2
	Totals	...	12	15	7	7
Analysis of numerical returns	Percentage return		6	10	5	5
	Percentage gain or loss in returns[3]		..	+67	-17	-17
	Probability that gain or loss is significant[4]		For C-I-II-III Prob. = 83% X^2 = 5.0			
Analysis of daily spread of catch	Mean days out		72.3	71.3	50.4	112.0
	Mean rank		20.8	18.7	16.4	31.0
	Percentage of gain or loss in mean rank[5]		..	-10	-21	+49
	Probability that gain or loss in mean rank is significant[6]		For C-I-II-III Prob. = 91% H = 6.5			

Table 9

Creel returns through 1956 from PRS experimental plantings of legal-size brook trout, Pigeon River, planted August 26, 1953

	Significant dates[1]	Days out[2]	Experimental group, and number planted			
			C 200	I 100	II 100	III 100
Creel returns	8/26/53	1	19	12	5	4
	....	2	41	16	23	11
	....	3	1	1	3	2
	....	4	13	11	6	9
	....	5	5	5	9	2
	....	6	2	1	2	4
	....	7	..	..	1	..
	....	8	3	3	5	..
	....	9	2	2	..	..
	....	10	1	..	..	..
	....	11	5	4	4	2
	....	12	2	..	1	2
	....	13	1	3	..	..
	....	14	1	1	1	..
	....	15	3	..	..	1
	....	16	..	..	..	1
	....	17	3	1	1	2
	....	18	10	3	6	5
	9/13/53	19	1	..	1	..
	4/24/54	20	1	..	1	2
	....	21	1	..	1	..
	....	28	..	..	1	..
	....	35	..	1	..	..
	....	42	2	..	..	..
	5/30/54	56	..	1	..	..
	Totals	..	117	65	71	47
Analysis of numerical returns	Percentage return		59	65	71	47
	Percentage gain or loss in returns[3]		..	+10	+20	-20
	Probability that gain or loss is significant[4]		For C-I-II-III Prob. = 99%+ $X^2 = 13.3$			
Analysis of daily spread of catch	Mean days out		6.59	6.51	6.63	7.30
	Mean rank		142.5	143.4	159.3	166.9
	Percentage of gain or loss in mean rank[5]		..	+1	+12	+17
	Probability that gain or loss in mean rank is significant[6]		For C-I-II-III Prob. = 74% H = 3.99			

Table 10

Creel returns through 1956 from PRS experimental plantings of legal-size brook trout, Ford Lake, planted August 26, 1953

	Significant dates[1]	Days out[2]	Experimental group, and number planted			
			C	I	II	III
			200	150	150	150
Creel returns	8/27/53	2	2	..	..	..
	....	4	4	3	1	1
	....	10	..	..	1	..
	....	11	9	6	14	3
	....	12	15	8	12	5
	....	13	18	12	14	13
	....	14	2	2	1	..
	....	17	..	..	..	1
	....	18	4	7	5	3
	9/13/53	19	14	9	11	4
	4/24/54	20	14	8	6	11
	....	21	30	24	17	14
	....	22	2	1	1	2
	....	24	..	2	..	..
	....	25	1	2	1	..
	....	26	1	2	1	1
	....	28	..	1	..	..
	....	34	..	..	1	..
	....	35	2	..	..	1
	....	41	1	..	..	..
	....	42	..	1	1	..
	....	48	..	..	..	1
	....	49	..	..	..	1
	....	57	..	1	..	..
	6/5/54	62	..	1	..	..
	5/8/55	170	..	..	1	..
	....	208	..	..	1	..
	8/5/55	259	..	..	..	1
	4/30/56	299	..	2	..	4
	....	303	..	2	..	1
	5/27/56	326	..	1	..	..
	Totals	...	119	95	89	67
Analysis of numerical returns	Percentage return		60	63	59	45
	Percentage gain or loss in returns[3]		..	+5	-2	-25
	Probability that gain or loss is significant[4]		For C-I-II-III Prob. = 99% X^2 = 12.6			
Analysis of daily spread of catch	Mean days out		16.93	33.79	20.35	43.09
	Mean rank		175.7	204.1	161.6	208.3
	Percentage of gain or loss in mean rank[5]		..	+16	-8	+19
	Probability that gain or loss in mean rank is significant[6]		For C-I-II-III Prob. = 99% H = 11.6			

Table 11

Creel returns through 1956 from PRS experimental plantings of legal-size brook trout, South Twin Lake, planted August 26, 1953

	Significant dates[1]	Days out[2]	Experimental group, and number planted C 100	I 100
Creel returns	9/4/53	10	..	2
	....	11	11	6
	....	12	4	2
	9/7/53	13	2	1
	4/24/54	20	36	34
	....	21	15	10
	....	24	1	..
	....	27	1	2
	....	28	2	3
	....	29	1	1
	....	30	1	2
	....	31	..	1
	....	34	1	1
	....	35	1	4
	....	42	..	1
	....	45	..	1
	....	47	..	1
	....	55	..	3
	....	56	3	3
	....	92	..	1
	....	93	1	1
	....	95	2	..
	....	125	1	..
	8/29/54	147	..	1
	Totals	...	83	81
Analysis of numerical returns	Percentage return		83	81
	Percentage gain or loss in returns[3]		..	-2
	Probability that gain or loss is significant[4]		Prob. <20% X^2 = 0.03	
Analysis of daily spread of catch	Mean days out		24.6	27.7
	Mean rank		77.0	88.2
	Percentage of gain or loss in mean rank[5]		..	+15
	Probability that gain or loss in mean rank is significant[6]		Prob. = 89% z = 1.58	

Table 12
Creel returns through 1956 from PRS experimental plantings of legal-size brook trout, West Lost Lake, planted August 26, 1953

	Significant dates[1]	Days out[2]	Experimental group, and number planted C 100	I 100
Creel returns	9/5/53	11	2	3
	4/24/54	20	40	37
	....	21	12	13
	....	22	..	1
	....	29	..	1
	....	41	4	..
	....	42	1	2
	....	55	1	2
	....	56	1	..
	....	63	1	..
	....	89	..	1
	....	115	1	..
	7/31/54	118	1	1
	Totals	...	64	61
Analysis of numerical returns	Percentage return		64	61
	Percentage gain or loss in returns[3]		..	-5
	Probability that gain or loss is significant[4]		Prob. <25% $X^2 = 0.09$	
Analysis of daily spread of catch	Mean days out		26.4	24.6
	Mean rank		63.6	62.3
	Percentage of gain or loss in mean rank[5]		..	-2
	Probability that gain or loss in mean rank is significant[6]		Prob. = 18% $z = 0.23$	

Table 13

Creel returns through 1956 from PRS experimental plantings of legal-size brook trout, Hemlock Lake, planted August 26, 1953.

No recoveries in 1953, 1955 or 1956

	Significant dates[1]	Days out[2]	Experimental group, and number planted		
			C 150	II 150	III 150
Creel returns	5/7/54	33	..	..	2
	....	34	..	..	2
	....	55	1	..	..
	5/30/54	56	..	..	1
	Totals	..	1	0	5
Analysis of returns and spread	Percentage return		0.7	0	3.3
	Returns not sufficient for further analyses				

Table 14

Creel returns through 1956 from PRS experimental plantings of legal-size brook trout, Guiley Pond, planted August 26, 1953

	Significant dates[1]	Days out[2]	Experimental group, and number planted			
			C 150	I 50	II 50	III 50
Creel returns	8/26/53	1	1	..	..	1
	....	2	8	6	2	1
	....	3	4	1	2	3
	....	4	10	3	5	4
	....	5	3	6	6	..
	....	6	3	3	2	2
	....	7	2	..	1	1
	....	8	4	..	2	..
	....	9	4	1	..	..
	....	10	2	..	..	..
	....	11	6	1	2	1
	....	12	2	..	..	1
	....	13	1	..	..	..
	....	14	1	..	1	..
	....	15	5	2	2	1
	....	16	..	..	..	1
	....	17	1	..	..	1
	....	18	1	..	..	..
	9/13/53	19	2	1	1	2
	4/28/54	24	1	..	1	..
	....	26	4	..	2	..
	....	31	1	..	..	..
	....	38	..	..	..	1
	5/22/54	48	..	..	1	..
	Totals	..	66	24	30	20
Analysis of numerical returns	Percentage return		44	48	60	40
	Percentage gain or loss in returns[3]		..	+9	+36	-9
	Probability that gain of loss is significant[4]		For C-I-II-III Prob. = 83% X^2 = 5.01			
Analysis of daily spread of catch	Mean days out		9.52	6.00	10.1	9.70
	Mean rank		74.4	55.1	73.9	71.1
	Percentage of gain or loss in mean rank[5]		..	-26	-1	-4
	Probability that gain or loss in mean rank is significant[6]		For C-I-II-III Prob. = 77% H = 4.27			

Table 15

Creel returns through 1956 from PRS experimental plantings of legal-size rainbow trout, Guiley Pond, planted August 26, 1953

	Significant dates[1]	Days out[2]	Experimental group, and number planted			
			C 150	I 50	II 50	III 50
Creel returns	8/26/53	1	..	..	..	1
	....	2	..	..	..	1
	....	3	..	..	2	1
	....	4	3	..	..	1
	....	5	4	1	3	..
	....	8	6	..	2	..
	....	9	1	..	..	..
	....	11	2	1	1	4
	....	12	2	1	..	1
	....	13	..	..	1	..
	....	14	..	..	..	2
	....	15	..	..	..	1
	9/13/53	19	1	..	1	..
	4/24/54	20	2	..	1	2
	....	36	..	1	..	..
	....	39	..	..	..	2
	....	41	3	1	..	1
	....	42	1	1	1	..
	....	43	1	..	..	..
	....	48	1	1	..	..
	....	55	..	2	..	..
	....	56	..	..	1	..
	....	57	1	..	..	1
	....	62	2	..	..	..
	....	66	1	..	..	..
	....	75	..	..	1	..
	....	90	..	1	..	..
	....	110	1	..	1	..
	....	121	1	..	..	..
	....	160	1	..	..	..
	10/9/54	188	..	..	..	1
	Totals	...	34	10	15	19
Analysis of numerical returns	Percentage return		23	20	30	38
	Percentage gain or loss in returns[3]		..	-13	+30	+65
	Probability that gain or loss is significant[4]		For C-I-II-III Prob. = 89% X^2 = 5.96			
Analysis of daily spread of catch	Mean days out		32.0	39.5	25.5	27.0
	Mean rank		39.9	50.9	34.9	36.5
	Percentage of gain or loss in mean rank[5]		..	+28	-13	-9
	Probability that gain or loss in mean rank is significant[6]		For C-I-II-III Prob. = 68% H = 3.51			

Table 16

Creel returns through 1956 from PRS experimental plantings of legal-size rainbow trout, Rifle River, planted August 26, 1953

Significant dates[1]	Days out[2]	Experimental group, and number planted C 500	I 150	II 150	III 150
Creel returns					
8/27/53	2	4	2	1	..
....	3	3	..	1	..
....	4	8	1	1	1
....	5	3	..	2	..
....	6	3	..	2	..
....	7	..	1	..	..
....	9	2	2	1	1
....	11	16	4	5	4
....	12	7	1	..	1
....	13	8	1	4	..
....	14	1	..	1	1
....	17	3	1	..	..
....	18	21	8	1	2
9/13/53	19	8	3	4	2
4/24/54	20	3	2	..	..
....	21	2	..	..	..
....	22	..	1	1	..

(Table continued)

Significant dates[1]	Days out[2]	Experimental group, C	I	II	III
Creel returns					
....	26	2	..	..	..
....	27	5	2	1	4
....	28	6	4	1	2
....	29	..	..	1	..
....	33	1	..	..	..
....	34	8	2	..	1
....	35	..	1	1	1
....	36	1	2	..	..
....	38	1	..	1	..
....	39	..	1	..	1
....	40	1	..	..	..
....	41	2	1	..	2
....	42	5	1	2	..
....	48	3	..	..	..
....	49	5	1	..	1
....	62	1	..	..	..
....	69	3	..	..	1
....	70	1	..	3	2
....	90	1	..	1	..
....	91	1	..	..	1
....	110	..	1	..	..
....	111	..	..	1	..
7/30/54	117	..	..	..	1
4/30/55	162	1	..	..	..
Totals	...	140	43	36	29
Analysis of numerical returns — Percentage return		28	29	24	19
Percentage gain or loss in returns[3]		..	+4	-14	-32
Probability that gain or loss is significant[4]		For C-I-II-III Prob. = 85% X^2 = 5.36			
Analysis of daily spread of catch — Mean days out		23.6	23.3	25.8	33.7
Mean rank		119.8	127.5	118.0	150.9
Percentage of gain or loss in mean rank[5]		..	+6	-2	+26
Probability that gain or loss in mean rank is significant[6]		For C-I-II-III Prob. = 82% H = 4.93			

Table 17

Creel returns through 1956 from PRS experimental plantings of legal-size brook trout, Hunt Creek (experimental sections C and A), planted April 22, 1954

Significant dates[1]	Days out[2]	Experimental group, and number planted C 100	I 100	II 100	III 100
Creel returns 4/24/54	1	22	13	7	3
....	2	13	15	11	3
....	3	1	1	..	..
....	5	..	1	..	..
....	6	..	1	..	1
....	7	2	2	1	1
....	8	2	..	..	..
....	9	5	1	1	..
....	13	1	..	1	..
....	19	1	..	1	..
....	21	..	..	1	2
....	22	1	3	4	2
....	23	1	5	4	2
....	25	..	..	1	..
....	26	4	2	..	..
....	28	..	1	..	..
....	29	4	2	..	3
....	30	1	2	5	2
....	32	..	..	2	2
....	33	..	..	..	1
....	35	1	..	..	..
....	36	3	6	1	..

(Table continued above)

(Table continued)

Significant dates[1]	Days out[2]	Experimental group C	I	II	III
Creel returns	37	4	3	1	1
....	38	1	..	..	..
....	39	..	1	..	..
....	40	2	..	..	..
....	41	..	..	1	1
....	44	2	..	..	1
....	47	1	..	..	2
....	50	1	..	..	4
....	51	1	..	1	..
....	54	1	..	1	..
....	58	..	2	2	3
....	59	..	..	2	1
....	65	1	..	..	..
....	70	..	1	..	..
....	71	..	..	..	1
....	73	1	..	..	1
....	86	1	..	..	..
....	95	..	..	1	..
....	96	1	..	..	..
....	99	..	..	1	1
....	117	1	..	..	..
....	125	..	..	1	..
....	133	1	..	..	..
....	134	..	1	..	..
9/12/54	142	..	..	1	..
4/30/55	143	..	..	..	2
Totals	...	81	63	52	40

Analysis of numerical returns	Percentage return	81	63	52	40
	Percentage gain or loss in returns[3]	..	-22	-36	-51
	Probability that gain or loss is significant[4]	For C-I-II-III Prob. = 99.9% X^2 = 37.6			
Analysis of daily spread of catch	Mean days out	21.3	18.2	27.5	39.4
	Mean rank	107.7	104.5	123.7	155.8
	Percentage of gain or loss in mean rank[5]	..	-3	+15	+45
	Probability that gain or loss in mean rank is significant[6]	For C-I-II-III Prob. = 99.9%+ H = 17.1			

Table 18

Creel returns through 1956 from PRS experimental plantings of legal-size brook trout, East Fish Lake, planted April 22, 1954.

Planting size 7" - 8 1/2"; legal size limit at lake 10"

	Significant dates[1]	Days out[2]	Experimental group, and number planted			
			C 150	I 150	II 150	III 150
Creel returns	5/30/54	1	1	..	..	..
	....	21	2	..	..	..
	....	67	1	..	..	..
	....	77	1	1	..	..
	....	78	4	3	..	..
	8/22/54	85	2	..	..	..
	4/30/55	107	2	6	5	2
	....	108	..	..	1	..
	....	128	1	..	..	..
	....	149	1	..	..	..
	7/8/55	176	1	..	..	..
	Totals	...	16	10	6	2
Analysis of numerical returns	Percentage return		11	7	4	1
	Percentage gain or loss in returns[3]		..	-36	-64	-91
	Probability that gain or loss is significant[4]		For C-I-II-III Prob. = 99%+ X^2 = 13.3			
Analysis of daily spread of catch	Mean days out		83.5	95.3	107.2	107.0
	Mean rank		14.3	17.4	24.3	23.0
	Percentage of gain or loss in mean rank[5]		..	+22	+70	+61
	Probability that gain or loss in mean rank is significant[6]		For C-I-II-III Prob. = 87% H = 5.57			

Table 19

Creel returns through 1956 from PRS experimental plantings of legal-size brook trout, Pigeon River, planted April 22, 1954

Significant dates[1]	Days out[2]	Experimental group, and number planted C 200	I 200	II 200	III 200
Creel returns 4/24/54	1	2	1	1	..
....	2	1	1	..	1
....	8	8	3	4	4
....	9	2	4	..	1
....	13	1	2	..	..
....	14	2	..	..	..
....	16	1	2	1	..
....	20	2	4	4	2
....	21	2	..	5	2
....	22	3	3	5	5
....	23	7	4	8	2
....	26	..	1	2	..
....	27	3	1	1	2
....	29	3	3	8	1
....	30	2	3	3	2
....	31	..	2	1	..
....	33	1	..	3	..
....	34	1	..	1	1
....	35	..	..	2	..
....	37	4	..	1	..
....	38	2	..	1	1
....	43	2	..	..	..
....	44	3	3	3	2
....	45	..	1	1	1
....	46	..	1	1	6
....	47	..	..	..	2
....	48	1	1	2	1
....	50	..	1	4	2
....	51	2	2	6	6
....	52	..	..	1	1

(Table continued above)

(Table continued)

Significant dates[1]	Days out[2]	Experimental group C	I	II	III
Creel returns	54	..	1	..	..
....	57	1	1	..	2
....	58	1	1	..	..
....	59	1	..	..	..
....	62	..	1	..	..
....	63	..	1	..	..
....	64	..	1	1	..
....	65	1	2	1	1
....	66	..	..	..	1
....	67	1	1	..	..
....	68	..	1	..	1
....	69	..	..	1	..
....	70	..	1	..	1
....	71	..	..	1	1
....	72	..	2	..	2
....	73	..	1	1	1
....	74	..	..	2	1
....	75	1	1	..	1
....	76	..	1	2	..
....	77	1	1	..	1
....	78	..	2	..	..
....	88	1	..	..	..
....	89	..	..	..	2
....	93	..	..	..	1
....	99	..	..	..	1
....	103	1	..	..	..
....	115	1	..	..	..
....	123	..	..	1	..
....	134	..	..	1	1
....	141	..	..	1	..
9/12/54	142	..	..	1	..
6/5/55	179	..	..	1	..
Totals	...	65	62	83	63
Analysis of numerical returns — Percentage return		33	31	42	32
Percentage gain or loss in returns[3]		..	-6	+27	-3
Probability that gain or loss is significant[4]		For C-I-II-III Prob. = 91% X^2 = 6.56			
Analysis of daily spread of catch — Mean days out		32.4	38.2	41.9	46.1
Mean rank		113.2	135.9	139.2	159.8
Percentage of gain or loss in mean rank[5]		..	+20	+23	+41
Probability that gain or loss in mean rank is significant[6]		For C-I-II-III Prob. = 99% H = 11.2			

Table 20

Creel returns through 1956 from PRS experimental plantings of legal-size brook trout, Ford Lake, planted April 22, 1954

Significant dates[1]	Days out[2]	Experimental group, and number planted C 150	I 150	II 150	III 150
Creel returns					
4/24/54	1	8	2	1	1
....	2	19	12	10	7
....	3	9	10	7	5
....	5	2	1	1	4
....	6	9	5	9	2
....	7	8	8	8	3
....	9	3	3	..	..
....	15	1	2	1	1
....	16	2	7	1	2
....	21	..	2	2	3
....	22	4	4	2	2
....	23	8	9	2	7
....	25	5	3	1	3
....	28	1	2	1	2
....	29	..	2	10	5
....	30	..	..	1	1
....	36	1	..	1	..
....	38	1	2	..	..
....	42	1	1	2	2
....	43	1	4	..	3
....	46	..	2	..	..
....	47	..	..	1	..
....	50	..	..	..	1
....	58	1	..	..	..
....	65	1	1	..	4
....	66	3	3	6	..
....	68	1	..	..	1
....	72	1	..	5	2
....	73	1	..	1	..
....	80	1	3	3	2
....	82	1	..	..	1
....	84	1	2	1	..
....	87	2	..	..	..
....	88	..	2	..	..
....	89	..	..	..	1
....	111	1	..	1	1
....	127	..	1	..	..
....	130	1	..	1	..
....	132	1	1	..	..
....	134	..	2	1	4
....	135	4	4	1	3
....	136	..	..	..	2
....	139	1	..	..	..
....	141	1	1	..	2
9/12/54	142	..	1	..	..
4/30/55	143	1	1	..	..
....	144	2	2	3	3
....	147	..	1	..	1
....	149	1	..	..	..
....	150	1	..	..	..
....	151	1	..	..	..
....	157	..	..	..	1
....	199	..	..	1	..
....	237	..	..	2	..
8/3/55	238	..	1	1	..
5/1/56	281	1	..	..	..
....	284	..	..	..	1
7/16/56	357	..	..	1	..
Totals	...	112	107	89	83
Analysis of numerical returns: Percentage return		75	71	59	55
Percentage gain or loss in returns[3]		..	-5	-21	-27
Probability that gain or loss is significant[4]		For C-I-II-III Prob. = 99.9%+ X^2 = 17.1			
Analysis of daily spread of catch: Mean days out		37.1	39.6	47.4	53.0
Mean rank		171.9	193.8	203.3	223.6
Percentage of gain or loss in mean rank[5]		..	+13	+18	+30
Probability that gain or loss in mean rank is significant[6]		For C-I-II-III Prob. = 98.5% H = 10.5			

Table 21

Creel returns through 1956 from PRS experimental plantings of legal-size brook trout, Guiley Pond, planted April 26, 1954

	Significant dates[1]	Days out[2]	Experimental group, and number planted			
			C 200	I 200	II 200	III 200
Creel returns	4/28/54	3	6	1	1	2
	....	4	3	3	..	..
	....	5	6	..	..	1
	....	6	1	..	2	..
	....	10	1	..	..	..
	....	11	1	2	..	..
	....	12	..	2	..	..
	....	14	3	..	..	..
	....	16	2	2	1	..
	....	27	2	1	..	..
	....	35	2	..	..	..
	....	45	1	..	..	..
	....	47	1	..	..	..
	....	48	..	1	1	..
	....	49	1	..	1	..
	....	52	..	..	3	..
	....	55	..	..	1	..
	....	56	..	1	1	..
	....	67	..	..	1	..
	....	70	..	1	1	..
	....	71	..	..	1	..
	....	98	1	..	..	..
	....	112	2	..	..	..
	9/12/54	140	1	..	..	..
	Totals	...	34	14	14	3
Analysis of numerical returns	Percentage return		17	7	7	2
	Percentage gain or loss in returns[3]		..	-59	-59	-88
	Probability that gain or loss is significant[4]		For C-I-II-III Prob. = 99.9%+ X^2 = 33.5			
Analysis of daily spread of catch	Mean days out		26.1	21.0	43.1	3.7
	Mean rank		30.1	32.1	45.8	10.3
	Percentage of gain or loss in mean rank[5]		..	+7	+52	-66
	Probability that gain or loss in mean rank is significant[6]		For C-I-II-III Prob. = 99%+ H = 11.7			

Table 22

Creel returns through 1956 from PRS experimental plantings of legal-size rainbow trout, Rifle River, planted April 26, 1954

Significant dates[1]	Days out[2]	Experimental group, and number planted C 200	I 175	II 175	III 175
Creel returns 4/30/54	5	1	..	..	..
....	6	1	6	1	4
....	7	1	4	..	..
....	10	1	1	..	..
....	11	2	1	..	..
....	13	..	1	..	..
....	14	2	2	1	1
....	17	..	1	..	..
....	18	5	1	2	..
....	19	6	3	..	2
....	20	3	4	3	1
....	21	5	1	1	2
....	24	1	..	1	..
....	25	2	..	..	1
....	26	..	1	..	..
....	27	2	8	..	1
....	28	..	2	..	1
....	29	..	1	..	..
....	35	1	..	..	..
....	41	1	..	1	2
....	42	1	1	..	..
....	43	..	..	..	1
....	44	1	2	..	..
....	46	..	..	..	1
....	47	4	..	1	1
....	48	6	6	3	3
....	49	11	5	3	3
....	52	2	1	2	1
....	54	..	2	..	1
....	55	8	6	3	6
....	56	1	1	1	3
....	68	5	3	2	7
....	69	2	2	2	2
....	70	6	..	10	1
....	71	2	1	..	..
....	72	2	2	..	1
....	73	..	..	1	1
....	74	..	..	..	1
....	76	3	1	2	1
....	77	1	1	..	1
....	81	..	..	2	..
....	84	1	..	..	..
....	90	1	..	..	1
....	93	..	..	1	..
....	95	..	1	..	..
....	98	..	..	..	1
....	101	2	..	..	3
....	104	..	..	..	2
....	105	..	..	1	2
....	118	1	1	..	1
....	119	..	..	..	1
....	139	1	..	..	..
9/12/54	140	1	2	2	..
4/30/55	141	..	1	..	..
....	148	..	..	1	..
5/27/55	168	..	..	..	1
Totals	...	96	76	47	62
Analysis of numerical returns: Percentage return		48	43	27	35
Percentage gain or loss in returns[3]		..	-10	-44	-27
Probability that gain or loss is significant[4]		For C-I-II-III Prob. = 99.9%+ X^2 = 20.1			
Analysis of daily spread of catch: Mean days out		48.1	42.1	60.7	59.7
Mean rank		133.9	113.9	169.9	163.4
Percentage of gain or loss in mean rank[5]		..	-15	+27	+22
Probability that gain or loss in mean rank is significant[6]		For C-I-II-III Prob. = 99.9%+ H = 19.9			

Table 23

Creel returns through 1956 from PRS experimental plantings of legal-size brook trout, Hunt Creek (experimental sections C and A), planted May 17, 1955

Significant dates[1]	Days out[2]	Experimental group and number planted C 189	III 189
Creel returns			
5/18/55	2	8	6
"	3	"	1
"	5	2	"
"	6	7	3
"	7	2	"
"	8	1	"
"	9	2	3
"	10	3	3
"	12	12	15
"	13	4	4
"	14	5	7
"	18	7	4
"	19	1	"
"	24	3	"
"	26	"	1
"	27	3	1
"	30	1	"
"	32	"	1
"	33	1	3
"	34	1	1
"	35	3	2
"	36	3	1
"	38	3	7
"	39	4	2
"	40	6	1
"	41	3	1
"	42	2	4
"	43	2	"
"	44	2	4
"	45	"	1
"	47	4	2
"	48	3	3
"	49	"	1
"	50	1	1
"	53	3	"
"	54	"	2
"	58	"	5
"	60	"	1
"	61	1	"
"	62	"	1
"	63	4	7
"	67	2	"
"	68	1	1
"	69	2	"
"	70	1	"
"	71	"	1
"	72	4	1
"	73	"	3
"	75	1	1
"	76	"	2
"	83	1	1
"	88	1	"
"	95	1	"
"	97	"	2
"	99	"	2
"	110	1	"
9/4/55	111	"	1
5/27/56	148	1	"
"	162	"	1
7/4/56	186	"	1
Totals	"	123	116
Analysis of numerical returns	Percentage return	65	61
	Percentage gain or loss in returns[3]	"	-6
	Probability that gain or loss is significant[4]	Prob. = 45% X^2 = 0.41	
Analysis of daily spread of catch	Mean days out	33.0	39.0
	Mean rank	113.9	126.5
	Percentage of gain or loss in mean rank[5]	"	+11
	Probability that gain or loss in mean rank is significant[6]	Prob. = 84% z = 1.41	

Table 24

Creel returns through 1956 from PRS experimental plantings of legal-size brook trout, Pigeon River, planted May 17, 1955.

	Significant dates[1]	Days out[2]	Experimental group, and number planted	
			C 200	III 200
Creel returns	5/17/55	1	1	..
	....	3	1	..
	....	20	1	..
	....	23	..	1
	....	24	1	1
	....	26	1	1
	....	31	1	..
	....	33	4	1
	....	35	1	1
	....	38	1	1
	....	40	1	..
	....	44	2	..
	....	45	1	..
	....	46	1	..
	....	47	..	1
	....	57	..	1
	7/23/55	68	..	1
	Totals	..	17	9
Analysis of numerical returns	Percentage return		9	5
	Percentage gain or loss in returns[3]		..	-44
	Probability that gain or loss is significant[4]		Prob. = 85% X^2 = 2.02	
Analysis of daily spread of catch	Mean days out		31.1	39.0
	Mean rank		12.6	15.2
	Percentage of gain or loss in mean rank[5]		..	+21
	Probability that gain or loss in mean rank is significant[6]		Prob. = 68% z = 0.81	

Table 25

Creel returns through 1956 from PRS experimental plantings of legal-size brook trout, Ford Lake, planted May 17, 1955.

	Significant dates[1]	Days out[2]	Experimental group, and number planted	
			C 150	III 150
Creel returns	5/21/55	5	1	3
	....	9	1	..
	....	77	2	..
	....	79	1	4
	....	81	..	4
	....	84	3	..
	....	87	..	1
	....	88	2	..
	....	94	1	3
	....	95	3	1
	....	99	1	..
	....	113	1	..
	9/8/55	115	2	6
	4/28/56	119	1	2
	....	120	2	..
	....	122	2	3
	....	123	5	..
	....	125	5	3
	....	126	2	1
	....	127	1	..
	....	128	5	..
	....	134	..	2
	....	139	..	1
	....	140	1	..
	....	141	1	..
	....	146	..	1
	....	148	1	4
	....	149	1	..
	....	151	..	1
	....	181	1	..
	....	198	3	1
	7/23/56	205	1	..
	Totals	...	50	41
Analysis of numerical returns	Percentage return		33	27
	Percentage gain or loss in returns[3]		..	-18
	Probability that gain or loss is significant[4]		Prob. = 70% X^2 = 1.0	
Analysis of daily spread of catch	Mean days out		118.3	107.5
	Mean rank		49.4	41.8
	Percentage of gain or loss in mean rank[5]		..	-15
	Probability that gain or loss in mean rank is significant[6]		Prob. = 83% z = 1.36	

Table 26

Creel returns through 1956 from PRS experimental plantings of legal-size brook trout, Fontinalis Creek, planted May 16, 1955

	Significant dates[1]	Days out[2]	Experimental group, and number planted	
			C 102	III 100
Creel returns	5/27/55	12	1	..
	....	28	..	1
	....	35	..	1
	....	36	1	..
	....	65	..	2
	....	77	1	..
	....	95	..	1
	....	101	2	1
	....	113	..	1
	9/11/55	119	4	..
	Totals	...	9	7
Analysis of returns and spread	Percentage return		9	7
	Mean days out		89.2	71.7
	Mean rank		10.0	6.6
	Returns not adequate for further analysis			

Table 27

Creel returns through 1956 from PRS experimental plantings of legal-size rainbow trout, Rifle River, planted May 16, 1955

Significant dates[1]	Days out[2]	Experimental group, and number planted C 300	III 300
Creel returns			
5/17/55	2	8	3
....	6	11	..
....	7	6	3
....	9	13	5
....	12	13	1
....	13	23	3
....	14	15	16
....	15	23	7
....	18	6	6
....	19	6	11
....	20	..	7
....	21	6	2
....	22	2	..
....	23	3	11
....	24	..	1
....	26	1	4
....	27	13	14
....	28	2	1
....	32	5	2
....	33	3	5
....	34	6	9
....	39	..	2
....	42	..	3
....	43	..	1
....	48	3	1
....	49	..	2
....	52	2	..
....	57	..	2
....	58	1	1
....	63	1	2
....	67	..	1
....	70	..	1
....	75	..	1
....	86	..	1
....	88	..	1
....	90	..	2
....	99	..	1
....	103	1	..
....	105	..	1
....	111	1	1
....	112	..	1
....	116	..	1
9/11/55	119	..	1
5/10/56	132	..	1
Totals	...	174	139
Analysis of numerical returns — Percentage return		58	46
Percentage gain or loss in returns[3]		..	-21
Probability that gain or loss is significant[4]		Prob. = 99%+ X^2 = 7.72	
Analysis of daily spread of catch — Mean days out		18.3	31.1
Mean rank		127.5	193.9
Percentage of gain or loss in mean rank[5]		..	+52
Probability that gain or loss in mean rank is significant[6]		Prob. = 99.9%+ z = 6.46	

(Table continued above)

(Table continued)

Table 28

Creel returns through 1956 from PRS experimental plantings of legal-size rainbow trout, Devoe Lake, planted May 16, 17, 1955

	Significant dates[1]	Days out[2]	Experimental group, and number planted	
			C (500)	III (500)
Creel returns	9/3/55	111	..	1
	....	113	..	1
	10/3/55	141	..	1
	5/20/56	222	1	..
	....	231	1	..
	8/18/56	312	1	..
	Totals	...	3	3

Returns not adequate for further analysis

Table 29

Creel returns through 1956 from PRS experimental plantings of legal-size rainbow trout, North Lake, planted May 16, 17, 1955

	Significant dates[1]	Days out[2]	Experimental group, and number planted	
			C (500)	III (500)
Creel returns	6/12/55	28	1	..

Returns not adequate for analysis

Table 30

Creel returns through 1956 from PRS experimental plantings of fingerling brook trout, Hunt Creek, planted November 12, 1954

Significant dates[1]	Days out[2]	Experimental group, and number planted	
		C	III
		2,999	2,998
Creel returns			
5/30/55	1	2	..
....	5	..	1
....	8	2	..
....	9	2	..
....	10	2	..
....	21	..	1
....	28	1	3
....	31	1	..
....	41	..	5
....	47	..	1
....	48	3	1
....	49	1	..
....	51	..	1
....	62	..	1
....	67	1	..
....	68	1	..
....	69	..	1
....	74	..	1
....	75	1	4
....	94	3	1
....	98	1	..
9/5/55	99	..	1
4/28/56	106	1	3
....	110	..	2
....	111	1	1
....	113	3	1
....	114	..	1
....	115	1	..
....	121	1	1
....	123	..	1
....	124	..	1
....	126	1	..
....	127	..	1
....	128	1	..
....	130	1	..
....	131	..	1
....	134	1	1
....	135	3	3
....	138	1	1
....	139	1	1
....	141	2	1
....	142	1	..

(Table continued above)

(Table continued)

Significant dates[1]	Days out[2]	Experimental group	
		C	III
Creel returns			
....	143	..	1
....	147	1	..
....	148	2	1
....	149	4	3
....	150	1	2
....	153	2	..
....	160	..	1
....	161	..	1
....	164	..	1
....	167	2	5
....	169	..	2
....	170	2	..
....	173	..	2
....	175	1	..
....	176	2	..
....	177	1	..
....	178	..	2

(Table continued above)

(Table continued)

Significant dates[1]	Days out[2]	Experimental group	
		C	III
Creel returns			
....	180	2	..
....	181	1	..
....	183	..	2
....	185	..	2
....	186	1	1
....	187	2	..
....	189	..	2
....	193	1	..
....	194	1	..
....	199	..	1
....	203	..	1
....	206	..	1
....	208	1	..
....	210	1	1
....	213	1	1
....	215	1	..
....	216	..	1
....	218	1	..
....	222	..	1
....	224	1	..
....	226	1	..
....	232	3	..
9/9/56	240	..	2
Totals	....	76	79
Analysis of numerical returns	Percentage return	2.53	2.64
	Percentage gain or loss in returns[3]	..	+4
	Probability that gain or loss is significant[4]	Prob. <20% $X^2 = 0.03$	
Analysis of daily spread of catch	Mean days out	130.1	129.9
	Mean rank	78.8	77.3
	Percentage of gain or loss in mean rank[5]	..	-2
	Probability that gain or loss in mean rank is significant[6]	Prob. = 16% $z = 0.20$	

Table 31

Creel returns through 1956 from PRS experimental plantings of fingerling brook trout, Fuller Creek Pond, planted October 14, 1954.

10" size limit--no recoveries in 1955

	Significant dates[1]	Days out[2]	Experimental group, and number planted	
			C 2,198	III 2,168
Creel returns	4/29/56	1	1	..
	....	7	1	..
	....	14	1	..
	....	50	1	..
	....	72	..	1
	....	81	1	1
	....	117	1	1
	....	129	..	1
	9/9/56	134	1	..
	Totals	...	7	4
Analysis of numerical returns and spread	Percentage return		0.32	0.18
	Mean rank		5.14	7.50

Returns not adequate for further analysis

Table 32

Creel returns through 1956 from PRS experimental plantings of fingerling brook trout, East Fish Lake, planted October 14, 1954

First creel return August 25, 1955

	Significant dates[1]	Days out[2]	Experimental group, and number planted C 4,911	III 4,834
Creel returns	8/25/55	1	3	4
	4/28/56	19	8	4
	....	20	..	2
	....	47	3	4
	....	48	1	..
	....	55	1	..
	....	61	12	8
	....	62	3	..
	....	67	1	..
	....	68	6	10
	....	69	7	2
	....	70	1	..
	....	71	6	4
	....	73	..	1
	....	76	2	2
	....	79	..	1
	....	81	2	..
	....	82	4	2
	....	83	2	2
	....	87	1	..
	....	89	1	..
	....	92	1	2
	....	93	..	1
	....	108	3	..
	....	127	..	2
	....	129	1	1
	....	130	2	1
	....	152	1	..
	9/9/56	153	..	2
	Totals	...	72	55
Analysis of numerical returns	Percentage return		1.47	1.14
	Percentage gain or loss in returns[3]		..	-22
	Probability that gain or loss is significant[4]		Prob. = 82% X^2 = 1.80	
Analysis of daily spread of catch	Mean days out		65.4	66.0
	Mean rank		64.1	63.9
	Percentage of gain or loss in mean rank[5]		..	-0.3
	Probability that gain or loss in mean rank is significant[6]		Prob. = 2% z = 0.03	

Table 33

Creel returns through 1956 from PRS experimental plantings of fingerling brook trout, Ford Lake, planted November 11, 1954.

First creel return on August 5, 1955

Significant dates[1]	Days out[2]	Experimental group, and number planted	
		C 2,906	III 2,914
Creel returns			
8/5/55	1	1	..
....	8	1	..
....	9	..	1
....	15	..	1
....	19	1	..
9/8/55	35	1	..
4/28/56	39	1	..
....	40	1	3
....	41	11	8
....	42	5	6
....	43	2	2
....	44	..	1
....	45	18	13
....	46	8	12
....	47	7	1
....	48	..	1
....	50	3	4
....	52	1	1
....	53	1	3
....	54	3	1
....	59	..	3
....	60	1	1
....	61	1	1
....	62	3	1
....	63	2	..
....	65	1	..
....	66	1	2
....	67	..	2
....	68	5	..
....	69	1	5
....	71	1	2
....	81	1	..
....	83	..	1
....	92	1	..
....	100	1	2
....	101	..	1
....	102	1	2
....	112	..	1
....	118	1	1
....	123	..	1
....	133	1	2
....	143	1	..
8/17/56	150	1	..
Totals	...	89	86
Analysis of numerical returns	Percentage returns	3.06	2.95
	Percentage gain or loss in returns[3]	..	-4
	Probability that gain or loss is significant[4]	Prob. = <20% X^2 = 0.03	
Analysis of daily spread of catch	Mean days out	53.7	56.6
	Mean rank	84.8	91.3
	Percentage of gain or loss in mean rank[5]	..	+8
	Probability that gain or loss in mean rank is significant[6]	Prob. = 61% z = 0.86	

Table 34

Creel returns through 1956 from PRS experimental plantings of fingerling brook trout, South Twin Lake, planted November 11, 1954.

First creel return June 13, 1955

Significant dates[1]	Days out[2]	Experimental group, and number planted C 1,065	III 1,070
Creel returns			
6/13/55	1	..	1
....	5	1	..
....	34	2	2
....	40	..	4
....	50	1	3
....	51	1	4
....	52	2	..
....	53	..	2
....	54	4	4
....	55	..	2
8/14/55	63	..	1
4/28/56	92	55	58
....	93	11	8
....	94	4	5
....	95	10	1
....	97	3	..
....	98	2	1
....	99	6	10

(Table continued above)

(Table continued)

Significant dates[1]	Days out[2]	Experimental group C	III
Creel returns			
....	100	2	1
....	104	5	7
....	106	4	10
....	113	4	5
....	114	4	1
....	119	6	3
....	121	..	1
....	124	5	2
....	126	1	2
....	127	1	2
....	128	1	..
....	149	1	..
....	190	2	..
....	207	1	..
....	210	2	1
....	211	2	1
....	212	1	2
....	216	1	1
....	220	..	2
....	221	2	1
....	223	..	2
9/7/56	224	1	2
Totals	...	148	152

Analysis of numerical returns	Percentage returns	13.9	14.2
	Percentage gain or loss in returns[3]	..	+2
	Probability that gain or loss is significant[4]	Prob. = <20% X^2 = 0.02	
Analysis of daily spread catch	Mean days out	104.2	100.2
	Mean rank	157.7	143.5
	Percentage of gain or loss in mean rank[5]	..	-9
	Probability that gain or loss in mean rank is significant[6]	Prob. = 86% z = 1.46	

Table 35

Creel returns through 1956 from PRS experimental plantings of fingerling brook trout, North Twin Lake, planted November 11, 1954.

First creel return September 2, 1955

Significant dates[1]	Days out[2]	Experimental group, and number planted	
		C	III
		1,369	1,370
Creel returns			
9/2/55	1	1	..
4/28/56	11	19	19
....	12	6	14
....	13	1	..
....	15	..	2
....	18	3	5
....	19	9	4
....	26	..	2
....	27	1	2
....	30	..	2
....	31	2	1
....	33	2	1
....	44	2	4
....	45	4	6
....	62	2	1
....	67	..	3

(Table continued above)

(Table continued)

Significant dates[1]	Days out[2]	Experimental group	
		C	III
Creel returns			
....	72	2	2
....	73	1	..
....	74	2	..
....	75	..	1
....	76	..	1
....	78	2	3
....	79	1	..
....	83	1	1
....	89	1	..
....	90	1	2
....	129	5	1
....	130	..	1
....	131	..	1
....	133	..	3
....	134	1	..
....	135	1	1
....	136	1	..
....	137	1	1
....	144	2	3
9/9/56	145	2	2
	Totals ...	76	89
Analysis of numerical returns	Percentage return	5.55	6.50
	Percentage gain or loss in returns[3]	..	+17
	Probability that gain or loss is significant[4]	Prob. = 65% X^2 = 0.92	
Analysis of daily spread of catch	Mean days out	48.6	45.9
	Mean rank	83.5	82.6
	Percentage of gain or loss in mean rank[5]	..	-1
	Probability that gain or loss in mean rank is significant[6]	Prob. = 9% z = 0.11	

Table 36

Creel returns through 1956 from PRS experimental plantings of fingerling brook trout, West Lost Lake, planted November 11, 1954

Significant dates[1]	Days out[2]	Experimental group, and number planted C 998	III 994
Creel returns			
7/3/55	1	2	..
....	43	6	4
....	53	3	2
....	57	4	6
....	65	1	2
....	69	3	2
....	70	3	2
9/11/55	71	3	4
4/28/56	72	80	108
....	73	41	49
....	74	8	11
....	76	4	6
....	77	2	3
....	78	9	2
....	79	30	30
....	80	10	25
....	82	2	4
....	83	5	4
....	84	3	1
....	86	7	1
....	87	4	5
....	88	4	11
....	91	2	2
....	92	6	9
....	93	8	10
....	94	3	4
....	100	3	2
....	101	4	7

(Table continued above)

(Table continued)

Significant dates[1]	Days out[2]	Experimental group C	III
Creel returns			
....	102	2	2
....	103	..	2
....	107	3	6
....	108	14	14
....	109	4	6
....	112	2	1
....	120	2	3
....	121	1	2
....	122	..	3
....	124	2	3
....	125	1	..
....	126	..	1
....	131	1	2
....	132	1	1
....	135	3	6
....	145	1	6
....	151	1	1
....	155	4	2
....	156	2	1
....	157	3	1
....	159	2	1
....	161	..	1
....	164	..	1
....	165	8	5
....	167	1	..
....	168	8	2
....	177	3	1
....	192	1	..
....	195	2	1
....	196	..	2
9/3/56	200	..	1
	Totals	...	332	394

Analysis of numerical returns	Percentage returns	33.3	39.6
	Percentage gain or loss in returns[3]	..	+19
	Probability that gain or loss is significant[4]	Prob. = 99%+ $X^2 = 8.45$	
Analysis of daily spread of catch	Mean days out	89.4	87.3
	Mean rank	366.8	360.7
	Percentage of gain or loss in mean rank[5]	..	-2
	Probability that gain or loss in mean rank is significant[6]	Prob. = 30% $z = 0.39$	

Table 37

Creel returns through 1956 from PRS experimental plantings of fingerling brook trout, Lost Lake, planted November 11, 1954.

No recoveries in 1955

	Significant dates[1]	Days out[2]	Experimental group, and number planted	
			C 1,141	III 1,145
Creel returns	4/28/56	1	15	12
	....	2	1	4
	....	3	5	2
	....	8	..	1
	....	11	2	3
	....	16	3	1
	....	31	1	..
	....	36	7	8
	....	38	1	..
	....	50	1	..
	....	56	..	1
	....	59	3	2
	....	65	2	..
	....	71	5	2
	....	72	..	1
	....	88	1	..
	....	91	3	1
	....	116	..	1
	9/2/56	128	1	1
	Totals	...	51	40
Analysis of numerical returns	Percentage returns		4.47	3.49
	Percentage gain or loss in returns[3]		..	-22
	Probability that gain or loss is significant[4]		Prob. = 74% X^2 = 1.19	
Analysis of daily spread of catch	Mean days out		31.8	27.4
	Mean rank		47.6	43.9
	Percentage of gain or loss in mean rank[5]		..	-8
	Probability that gain or loss in mean rank is significant[6]		Prob. = 50% z = 0.67	

Table 38

Creel returns through 1956 from PRS experimental plantings of fingerling brook trout, Hemlock Lake, planted November 11, 1954

Significant dates[1]	Days out[2]	Experimental group, and number planted: C 1,494	III 1,490
Creel returns			
5/19/55	1	..	1
....	43	3	1
....	46	6	..
....	47	2	..
....	49	..	1
....	65	..	1
....	68	2	1
....	69	5	3
....	75	6	4
....	82	1	..
....	83	6	4
....	86	7	13
....	87	26	14
....	91	1	..
....	98	6	3
....	100	7	7
....	101	5	9
....	102	3	3
....	104	9	1
....	105	3	2
....	108	10	1
....	109	7	4
....	110	2	3
....	113	3	1
....	115	11	1
9/11/55	116	3	1
4/28/56	117	104	88
....	118	50	40
....	119	14	14

(Table continued above)

(Table continued)

Significant dates[1]	Days out[2]	Experimental group: C	III
Creel returns			
....	122	5	5
....	123	10	15
....	124	2	..
....	125	1	5
....	126	3	6
....	129	..	4
....	131	7	3
....	132	6	5
....	133	2	1
....	136	3	4
....	141	..	3
....	145	6	6
....	149	6	6
....	151	4	1
....	159	..	1
....	161	1	2
....	168	..	3
....	170	..	2
....	172	..	1
....	179	..	2
....	193	1	..
....	205	1	..
....	210	..	1
....	213	..	1
....	217	..	1
....	218	..	2
....	225	1	..
....	238	..	1
....	243	1	..
....	247	..	1
....	250	1	..
9/9/56	251	1	..
Totals	...	364	303

Analysis of numerical returns	Percentage returns	24.4	20.3
	Percentage gain or loss in returns[3]	..	-17
	Probability that gain or loss is significant[4]	Prob. = 99% X^2 = 6.74	
Analysis of daily spread of catch	Mean days out	112.5	117.7
	Mean rank	312.2	360.2
	Percentage of gain or loss in mean rank[5]	..	+15
	Probability that gain or loss in mean rank is significant[6]	Prob. = 99.9 z = 3.25	

Table 39

Creel returns through 1956 from PRS experimental plantings of fingerling brook trout, Swanzy Lake, planted November 12, 1954.

	Significant dates[1]	Days out[2]	Experimental group, and number planted	
			C 1,475	III 1,496
Creel returns	5/7/55	1	1	..
	....	23	..	2
	....	29	..	2
	....	107	6	4
	....	122	1	1
	9/11/55	128	25	12
	4/28/56	129	30	44
	....	130	20	35
	....	131	2	7
	....	134	2	1
	....	135	4	2
	....	136	1	..
	....	146	1	..
	....	157	2	..
	5/30/56	160	1	..
	Totals	...	96	110
Analysis of numerical returns	Percentage return		6.51	7.35
	Percentage gain or loss in returns[3]		..	+13
	Probability that gain or loss is significant[4]		Prob. = 60% X^2 = 0.69	
Analysis of daily spread of catch	Mean days out		127.7	124.9
	Mean rank		98.2	108.2
	Percentage of gain or loss in mean rank[5]		..	+10
	Probability that gain or loss in mean rank is significant[6]		Prob. = 78% z = 1.24	

Table 40

Creel returns through 1956 from PRS experimental plantings of fingerling rainbow trout, Devoe Lake, planted October 15, 1954.

All recoveries from Rifle River downstream from Devoe Lake

Significant dates[1]	Days out[2]	Experimental group, and number planted C 4,050	III 3,949
Creel returns			
5/30/55	1	1	..
....	12	..	2
....	13	1	..
....	21	..	1
....	59	..	1
....	60	..	5
....	74	1	..
....	75	1	..
....	81	..	1
....	85	..	4
....	87	..	1
....	90	..	3
....	91	1	1
....	92	..	1
....	94	1	1
....	97	2	3
....	98	..	1
....	99	2	1
....	100	1	..
....	103	1	..
....	104	2	1
9/11/55	105	1	4
5/1/56	109	..	1
....	126	..	1
....	133	..	2
....	135	1	1
....	163	1	..
....	170	..	1
....	172	..	1
....	173	1	..
....	176	1	..
9/4/56	235	..	3
Totals	...	19	41
Analysis of numerical returns	Percentage return	0.47	1.04
	Percentage gain or loss in returns[3]	..	+121
	Probability that gain or loss is significant[4]	Prob. = 99%+ X^2 = 7.98	
Analysis of daily spread of catch	Mean days out	100.2	101.3
	Mean rank	33.0	29.4
	Percentage of gain or loss in mean rank[5]	..	-11
	Probability that gain or loss in mean rank is significant[6]	Prob. = 54% z = 0.74	

Table 41

Creel returns through 1956 from PRS experimental plantings of fingerling brown trout, Rifle River and Gamble Creek (combined returns), planted September 16, 1954.

First creel return June 8, 1955

Significant dates[1]	Days out[2]	Experimental group, and number planted	
		C 5,492	III 5,485
Creel returns			
6/8/55	1	1	..
....	8	1	1
....	9	..	3
....	26	2	1
....	42	..	4
....	43	2	2
....	47	1	1
....	49	1	..
....	51	3	4
....	60	..	3
....	61	..	2
....	64	..	1
....	67	6	1
....	68	..	1
....	74	..	1
....	75	..	2
....	78	1	..
....	81	..	1
....	82	4	2
....	83	1	..
....	85	1	..
....	88	2	2
....	89	7	..
....	90	1	4
....	92	1	..
....	93	1	..

(Table continued above)

(Table continued)

Significant dates[1]	Days out[2]	Experimental group C	Experimental group III
Creel returns			
....	95	..	2
9/11/55	96	1	6
4/28/56	97	4	2
....	100	1	..
....	104	2	..
....	105	..	3
....	109	..	1
....	111	1	3
....	115	..	1
....	118	..	1
....	119	..	3
....	121	..	1
....	122	1	1
....	124	..	1
....	125	1	2
....	126	2	3
....	129	..	2
....	131	..	1
....	133	..	1
....	134	1	..
....	136	1	..
....	139	..	1
....	140	..	2
....	157	2	..
....	161	1	..
....	163	..	1
....	166	1	..
....	182	..	1
....	184	1	..
7/29/56	189	1	..
Totals	...	57	75

Analysis of numerical returns	Percentage returns	1.04	1.37
	Percentage gain or loss in returns[3]	..	+32
	Probability that gain or loss is significant[4]	Prob. = 87%	X^2 = 2.24
Analysis of daily spread of catch	Mean days out	90.0	88.8
	Mean rank	65.3	67.4
	Percentage of gain or loss in mean rank[5]	..	+3
	Probability that gain or loss in mean rank is significant[6]	Prob. = 24%	z = 0.31

Tables 42-51

Compiled summaries of creel returns, daily spread of catch, and survival data from PRS experimental trout plantings made in waters open to public fishing, 1953 - 1956.

Table 42
Summary of returns and probability of significant difference between experimental groups.

PRS plantings of legal-size trout, 1953

Site	Species of trout	Experimental group	Number planted	Creel returns (to 9/9/56) Number	Creel returns (to 9/9/56) Percent	Chi-square, C versus group[1]	Probability that difference is significant[2]
Hunt Creek	Brook	C	200	174	87	...	...
		I	100	74	74	7.0	99%+
		III	100	64	64	20.1	99.9%+
East Fish L.	"	C	200	12	6	...	...
		I	150	15	10	1.4	76%
		II	150	7	5	0.09	<25%
		III	150	7	5	0.09	<25%
Pigeon River	"	C	200	117	59	...	...
		I	100	65	65	0.92	65%
		II	100	71	71	3.9	95%
		III	100	47	47	3.1	92%
Ford Lake	"	C	200	119	60	...	...
		I	150	95	63	0.38	40%
		II	150	89	59	0.01	<10%
		III	150	67	45	7.0	99%+
South Twin L.	"	C	100	83	83	...	...
		I	100	81	81	0.03	<20%
West Lost L.	"	C	100	64	64	...	...
		I	100	61	61	0.09	<25%
Hemlock L.	"	C	150	1	0.7	...	...
		II	150	0	0	...	...
		III	150	5	3.3	1.5	78%
Guiley Pond	"	C	150	66	44	...	...
		I	50	24	48	0.11	25%
		II	50	30	60	3.23	94%
		III	50	20	40	0.11	25%
Guiley Pond	Rainbow	C	150	34	23	...	...
		I	50	10	20	0.04	<20%
		II	50	15	30	0.73	60%
		III	50	19	38	3.8	94%
Rifle River	"	C	500	140	28	...	...
		I	150	43	29	0.00+	<10%
		II	150	36	24	0.75	58%
		III	150	29	19	4.1	95%

[1] Chi-square is a measure of the difference in returns from plantings and is based on numerical returns rather than on percentage returns.
[2] Probabilities of 95% or more are generally regarded as conclusive.

Table 43
Summary of returns and probability of significant difference between experimental groups.

PRS plantings of legal-size trout, 1954

Site	Species of trout	Experimental group	Number planted	Creel returns (to 9/9/56) Number	Creel returns (to 9/9/56) Percent	Chi-square, C versus group[1]	Probability that difference is significant[2]
Hunt Creek	Brook	C	100	81	81	...	...
		I	100	63	63	7.2	99%+
		II	100	52	52	17.6	99.9%+
		III	100	40	40	33.5	99.9%+
East Fish L.	"	C	150	16	11	...	...
		I	150	10	7	1.1	71%
		II	150	6	4	4.0	95%+
		III	150	2	1	10.0	99%+
Pigeon River	"	C	200	65	33	...	...
		I	200	62	31	0.05	<20%
		II	200	83	42	3.1	92%
		III	200	63	32	0.01	<10%
Ford Lake	"	C	150	112	75	...	...
		I	150	107	71	0.27	33%
		II	150	89	59	7.3	99%+
		III	150	83	55	11.5	99.9%+
Guiley Pond	"	C	200	34	17	...	...
		I	200	14	7	8.6	99%+
		II	200	14	7	8.6	99%+
		III	200	3	2	26.8	99.9%+
Rifle River	Rainbow	C	200	96	48	...	...
		I	175	76	43	0.61	53%
		II	175	47	27	16.8	99.9%+
		III	175	62	35	5.6	98%

[1] Chi-square is a measure of the difference in returns from plantings and is based on numerical returns rather than on percentage returns.
[2] Probabilities of 95% or more are generally regarded as conclusive.

Table 44
Summary of returns and probability of significant difference between experimental groups.

PRS plantings of legal-size trout, 1955

Site	Species of trout	Experimental group	Number planted	Creel returns (to 9/9/56) Number	Creel returns (to 9/9/56) Percent	Chi-square, C versus III group[1]	Probability that difference is significant[2]
Hunt Creek	Brook	C	189	123	65	...	...
		III	189	116	61	0.41	45%
Pigeon River	"	C	200	17	9	...	...
		III	200	9	5	2.0	85%
Ford Lake	"	C	150	50	33	...	...
		III	150	41	27	1.0	70%
Fontinalis Cr.	"	C	102	9	9	...	...
		III	100	7	7	0.05	<20%
Rifle River	Rainbow	C	300	174	58	...	...
		III	300	139	46	7.7	99%+
Devoe Lake	"	C	500	3	1	...	...
		III	500	3	1	...	...
North Lake	"	C	500	1	0	...	...
		III	500	0	0	...	...

[1] Chi-square is a measure of the difference in returns from plantings and is based on numerical returns rather than on percentage returns.
[2] Probabilities of 95% or more are generally regarded as conclusive.

Table 45

Annual summaries of creel returns from PRS plantings of legal-size trout for plantings where returns exceeded approximately 20% to 30%

Species of trout	Year	Number of separate plantings	Experimental group	Total trout planted	Creel returns (to 9/9/56) Number	Creel returns (to 9/9/56) Percent	Chi-square, C versus group [1]	Probability that difference is significant [2]
Brook	1953	6	C	950	623	66	...	...
			I	600	400	67	0.15	30%
			II	300	190	63	0.41	44%
			III	400	198	50	29.9	99.9%+
"	1954	3	C	450	258	57	...	...
			I	450	232	52	2.8	93%
			II	450	224	50	4.9	97%
			III	450	186	41	22.4	99.9%+
"	1955	2	C	339	173	51	...	...
			III	339	157	46	1.3	75%
"	1953-1955	11	C	1,739	1,054	61	...	...
			I	1,050	632	60	0.03	<20%
			II	750	414	55	6.1	98.6
			III	1,189	541	46	64.4	99.9%+
Rainbow	1953-1955	4	C	1,150	444	39	...	...
			I	375	129	34	2.0	84%
			II	375	98	26	18.7	99.9%+
			III	675	249	37	0.46	50%
Both species	1953-1955	15	C	2,889	1,498	52	...	...
			I	1,425	761	53	0.86	66%
			II	1,125	512	46	12.8	99.9%+
			III	1,864	790	42	40.3	99.9%+

[1] Chi-square is a measure of the difference in returns from plantings and is based on numerical returns rather than on percentage returns.

[2] Probabilities of 95% or more are generally regarded as conclusive.

Table 46

Summary of percentage of gain or loss in creel returns and percentage of gain or loss in mean rank, for creel returns from trained groups (I, II, III) compared with control group (C), for PRS plantings of legal-size trout where returns exceeded 20%.

Site	Species	Year	I		II		III	
			Returns	Rank	Returns	Rank	Returns	Rank
Hunt Cr.	Brook	1953	-15	+10	...	...	-26	+21
Pigeon R.	"	"	+10	+ 1	+20	+12	-20	+17
Ford L.	"	"	+ 5	+16	- 2	- 8	-25	+19
S. Twin L.	"	"	- 2	+15	...	...	...	...
W. Lost L.	"	"	- 5	- 2	...	...	...	...
Guiley P.	"	"	+ 9	-26	+36	- 1	- 9	- 4
Hunt Cr.	"	1954	-22	- 3	-36	+15	-51	+45
Pigeon R.	"	"	- 6	+20	+27	+23	- 3	+41
Ford L.	"	"	- 5	+13	-21	+18	-27	+30
Hunt Cr.	"	1955	...	...	...	...	- 6	+11
Ford L.	"	"	...	...	...	...	-18	-15
Guiley P.	Rainbow	1953	-13	+28	+30	-13	+65	- 9
Rifle R.	"	"	+ 4	+ 6	-14	- 2	-32	+26
Rifle R.	"	1954	-10	-15	-44	+27	-27	+22
Rifle R.	"	1955	...	...	...	...	-21	+52
Algebraic sums	Brook	1953	+ 2	+14	+54	+ 3	-80	+53
	"	1954	-33	+30	-30	+56	-81	+116
	"	1955	...	...	...	...	-24	- 4
	"	1953-55	-31	+44	+24	+59	-185	+165
	Rainbow	1953-55	-19	+19	-28	+12	-15	+91
	Both species	1953-55	-50	+63	- 4	+71	-200	+256

Table 47

Analysis of mean rank of creel returns from PRS plantings (1953-1955) of legal-size brook trout and rainbow trout, where creel returns exceeded 20%

Site	Year	Group, and mean rank				Number of fish	Ranks adjusted to N = 100			
		C	I	II	III		C	I	II	III
Brook trout										
Hunt Cr.	1953	146.8	161.3	...	177.3	312	47.1	51.7	...	56.8
Pigeon R.	"	142.5	143.4	159.3	166.9	300	47.5	47.8	53.1	55.6
Ford L.	"	175.7	204.1	161.6	208.3	370	47.5	55.2	43.7	56.3
S. Twin L.	"	77.0	88.1	...	...	164	47.0	53.7	...	...
W. Lost L.	"	63.6	62.3	...	...	125	50.9	49.8	...	...
Guiley P.	"	74.4	55.1	73.9	71.1	140	53.1	39.4	52.8	50.8
Hunt Cr.	1954	107.7	104.5	123.7	155.8	236	45.6	44.3	52.4	66.0
Pigeon R.	"	113.2	135.9	139.2	159.8	273	41.5	49.8	51.0	58.5
Ford L.	"	171.9	193.8	203.3	223.6	391	44.0	49.6	52.0	57.2
Hunt Cr.	1955	113.9	...	...	126.5	239	47.7	...	...	52.9
Ford L.	"	49.4	...	...	41.8	91	54.3	...	...	45.9
Rainbow trout										
Guiley P.	1953	39.9	50.9	34.9	36.5	78	51.2	65.3	44.7	46.8
Rifle R.	"	119.8	127.5	118.0	150.9	248	48.3	51.4	47.6	60.8
Rifle R.	1954	133.9	113.9	169.9	163.4	281	47.7	40.5	60.5	51.8
Rifle R.	1955	127.5	...	...	193.9	313	40.7	...	...	61.9
Brook trout Totals	1953	Mean					48.9	49.6	49.9	54.9
		Standard error of mean					1.04	2.31	3.08	1.38
	1954	Mean					43.7	47.9	51.8	60.6
		Standard error of mean					1.20	1.80	0.42	2.74
	1955	Mean					51.0	...	...	49.4
	1953-1955	Mean					47.8	49.0	50.8	55.6
		Standard error of mean					1.13	1.60	1.46	1.85
Rainbow trout Totals	1953-1955	Mean					47.0	52.4	50.9	56.9
		Standard error of mean					2.23	7.16	4.86	4.00

In the above, ranks are adjusted to equal numbers of returns for direct comparison. The figures (totals) generally show a higher mean rank for trained fish than for controls. The figures for brook trout planted during 1954 are undoubtedly somewhat misleading; proportionately more of the trained fish were under legal size when planted which would in itself delay the dates on which the fish could be creeled at legal size. Brook trout planted during 1953 were more comparable in length (between groups), and the figures for this year are apparently more reliable than for 1954.

The averages of mean ranks, given under totals above, were compared by the "t" test for the several possible combinations between any two groups. For legal brook trout planted during 1953, the only pair of averages for which the difference is statistically reliable at the 95% confidence level (or higher) is C versus III. For 1954 brook trout significant differences occur between C versus II, C versus III, I versus III, and II versus III; for all brook trout, C versus III, and I versus III; for all rainbows, no statistically significant differences.

Table 48
Summary of returns and probability of significant difference between experimental groups.

PRS fall plantings of fingerling trout, 1954

Site	Species of trout	Experimental group	Number planted	Creel returns (to 9/9/56) Number	Creel returns (to 9/9/56) Percent	Chi-square, C versus III group[1]	Probability that difference is significant[2]
Hunt Creek	Brook	C	2,999	76	2.53	...	...
		III	2,998	79	2.64	0.03	<20%
Fuller Pond	"	C	2,198	7	0.32	...	...
		III	2,168	4	0.18	0.34	40%
East Fish L.	"	C	4,911	72	1.47	...	...
		III	4,834	55	1.14	1.8	82%
Ford Lake	"	C	2,906	89	3.06	...	...
		III	2,914	86	2.95	0.03	<20%
South Twin L.	"	C	1,065	148	13.9	...	...
		III	1,070	152	14.2	0.02	<20%
North Twin L.	"	C	1,369	76	5.55	...	...
		III	1,370	89	6.50	0.92	65%
West Lost L.	"	C	998	332	33.3	...	...
		III	994	394	39.6	8.5	99%+
Lost Lake	"	C	1,141	51	4.47	...	...
		III	1,145	40	3.49	1.2	74%
Hemlock L.	"	C	1,494	364	24.4	...	...
		III	1,490	303	20.3	6.7	99%
Swanzy L.	"	C	1,475	96	6.51	...	...
		III	1,496	110	7.35	0.69	60%
Devoe Lake	Rainbow	C	4,050	19	0.47	...	...
		III	3,949	41	1.04	8.0	99%+
Rifle-Gamble R.	Brown	C	5,492	57	1.04	...	...
		III	5,485	75	1.37	2.2	87%
Totals	Brook (only)	C	20,556	1,311	6.38	...	...
		III	20,479	1,312	6.41	0.01	<10%
Totals	All species	C	30,098	1,387	4.61	...	...
		III	29,913	1,428	4.77	0.88	67%

[1] Chi-square is a measure of the difference in returns from plantings and is based on numerical returns rather than on percentage returns.
[2] Probabilities of 95% or more are generally regarded as conclusive.

Table 49

Analysis of mean rank of creel returns from PRS 1954 plantings of fingerling trout

Site	Species	Mean rank		Number of fish	Ranks adjusted to N = 100	
		C	III		C	III
Hunt Cr.	Brook	78.8	77.3	155	50.8	49.9
Fuller P.	"	5.1	7.5	11	46.4	68.2
E. Fish L.	"	64.1	63.9	127	50.5	50.3
Ford L.	"	84.8	91.3	175	48.5	52.2
S. Twin L.	"	157.7	143.5	300	52.6	47.8
N. Twin L.	"	83.5	82.6	165	50.6	50.1
W. Lost L.	"	366.8	360.7	726	50.5	49.7
Lost L.	"	47.6	43.9	91	52.3	48.2
Hemlock L.	"	312.2	360.2	667	46.8	54.0
Swanzy L.	"	98.2	108.2	206	47.7	52.5
Devoe L.	Rainbow	33.0	29.4	60	55.0	49.0
Rifle R.	Brown	65.3	67.4	132	49.5	51.1
Totals for brook trout						
	Mean				49.7	52.3
	Standard error of mean				0.69	1.87
Totals for all species						
	Mean				50.1	51.9
	Standard error of mean				0.72	1.57

In the above, ranks are adjusted to equal numbers of returns for direct comparison.

In the comparison of averages of mean ranks for C and III for all brook trout, $t = 1.31$; for the three species combined, $t = 1.04$. Neither t value is significant at a 95% confidence level.

Comparing mean ranks for C and III fish for the 12 individual plantings, control fish had a higher mean rank than trained fish in 7 of the 12 plantings.

The conclusion is that creel returns from the trained fingerling trout did not involve a greater spread over a longer period of time than creel returns from the controls.

Table 50

Graphic summary of comparison of creel returns from trained (T) and control (C) trout, PRS plantings of legal-size and fingerling fish.

C>T means that returns or spread of control trout was greater than of trained trout, etc. An X is used in the table where the comparison between C and I, II and III fish was the same. Where the trained groups (I, II, or III) differed in relation to C, the groups are entered in appropriate columns. The 95% confidence level for significant difference was used as the basis of division between difference and equality.

Year	Site	Species	Numerical returns			Daily spread		
			C>T	C=T	T>C	C>T	C=T	T>C
Legal-size trout								
1953	Hunt Cr.	Brook	X					X
"	E. Fish L.	"		X			X	
"	Pigeon R.	"		I, III	II		X	
"	Ford L.	"	III	I, II			II	I, III
"	S. Twin L.	"		X			X	
"	W. Lost L.	"		X			X	
"	Hemlock L.	"		X			X	
"	Guiley P.	"		X			X	
"	Guiley P.	Rainbow		X			X	
"	Rifle R.	"	III	I, II			I, II	III
1954	Hunt Cr.	Brook	X				I	II, III
"	E. Fish L.	"	II, III	I			X	
"	Pigeon R.	"		X				X
"	Ford L.	"	II, III	I				X
"	Guiley P.	"	X			III	I	II
"	Rifle R.	Rainbow	II, III	I			I	II, III
1955	Hunt Cr.	Brook		X			X	
"	Pigeon R.	"		X			X	
"	Ford L.	"		X			X	
"	Fontinalis Cr.	"		X			X	
"	Rifle R.	Rainbow	X					X
"	Devoe L.	"		X			X	
"	North L.	"	Few returns			Few returns		
Fingerlings								
1954	Hunt Cr.	Brook		X			X	
"	Fuller P.	"		X			X	
"	E. Fish L.	"		X			X	
"	Ford L.	"		X			X	
"	S. Twin L.	"		X			X	
"	N. Twin L.	"		X			X	
"	W. Lost L.	"			X		X	
"	Lost L.	"		X			X	
"	Hemlock L.	"	X					X
"	Swanzy L.	"		X			X	
"	Devoe L.	Rainbow			X		X	
"	Rifle R.	Brown		X			X	

Table 51

Summary of creel returns and fish survival by seasons, for PRS experimental plantings for which survival data are available.

Species, site, and planting date	Experimental group	Number planted	First season		Second season		Third and fourth seasons		% non-angling mortality
			Creel returns	Survivals*	Creel returns	Survivals*	Creel returns	Survivals*	
Legal-size brook trout									
Hunt Cr. 8/26/53	C	200	167	15	6	0	1	0	13
	I	100	73	15	1	1	0	0	26
	III	100	57	38	7	0	0	0	36
Hunt Cr. 4/22/54	C	100	81	1	0	0	0	0	19
	I	100	63	1	0	0	0	0	37
	II	100	52	1	0	0	0	0	48
	III	100	38	5	2	0	0	0	60
Hunt Cr. 5/17/55	C	189	122	11	1	0	..	..	35
	III	189	114	18	2	0	..	..	39
Fingerling brook trout									
Hunt Cr. 11/12/54	C	2,999	21	238	55	15	..	..	97.5
	III	2,998	22	237	57	8	..	..	97.4
E. Fish L. 10/14/54	C	4,911	3	692	69	2	..	..	98.5
	III	4,834	4	523	51	2	..	..	98.9
Ford L. 11/11/54	C	2,906	4	...	85	3	..	..	96.9
	III	2,914	2	...	84	5	..	..	97.0
Hemlock L. 11/11/54	C	1,494	134	...	230	6	..	..	76
	III	1,490	79	...	224	6	..	..	80

*Fish still present in the stream or lake at the end of the season, determined by shocker population estimates in Hunt Creek and trap net population estimates in lakes. Figures are estimates, not actual counts. The second-season survival figures for East Fish Lake represent fish picked up after a complete lake poisoning operation done in September, 1956.

Tables 52-54

Survival studies, 1953-1956, on PRS trained trout in streams not subjected to angling

and

PRS experiment at Tobacco River Rearing Station, 1954, results of intensive angling over known numbers of trout

Table 52

Survival studies[1], 1953-1954, on PRS legal-size[2] (approx. 7"-8") brook and rainbow trout in stream sections not subjected to angling. The streams were Diversions IIa and IIIa of Section C of Hunt Creek, and Slagle Creek. Given numbers of trout were introduced; stream sections were checked periodically by electric shocker; table gives actual counts of fish present. Experiments involve trained trout (I, II, III), hatchery controls (C), and wild trout (W).

Species and site:	Brook trout, Hunt Creek				Brook trout, Slagle Creek[3]					Rainbow trout, Slagle Creek[3]				
Group:	C	I	III	W	C	I	II	III	W	C	I	II	III	W
Planted Aug., 1953:	100	100	100	102	90	30	30	30	30	90	30	35	30	30
Sept., 1953	66	69	67	79	78	25	27	28	25	77	30	35	29	25
Oct., "	48	47	38	69	77	20	23	26	23	75	30	35	28	23
Nov., "	41	34	41	58	..	..	..	..	..	..	..	..	..	..
Dec., "	..	..	..	..	68	24	22	25	23	75	30	35	27	22
Jan., 1954	41	37	29	62	67	21	18	23	19	70	30	35	27	24
Feb., "	37	32	32	65	58	19	12	17	15	68	30	35	25	27
Mar., "	28	26	31	59	..	..	..	..	..	66	29	32	24	..
Apr., "	20	20	24	52	42	19	12	10	14	48	18	26	19	19

Species, and site:	Brook trout, Hunt Creek				Brook trout, Slagle Creek[2]					Rainbow trout, Slagle Creek[3]				
Group:	C	..	III	W	C	I	II	III	W	C	I	II	III	W
Planted Apr., 1954:	100	..	100	100	90	30	30	30	30	90	30	30	30	30
Sept., 1954	29	..	19	22	26	19	19	8	9	40	14	10	11	13

[1] The C, I, II and III rainbow trout put in Slagle Creek in August, 1953 carried numbered tags. By keeping records of tag numbers during the monthly counts of survivors, the fact that a particular fish had survived could be established by its recapture either during that monthly count or during any subsequent monthly count; and survivals were so determined. All rainbows put in Slagle Creek in April, 1954 were also tagged.

In the case of wild (W) rainbows put in Slagle Creek in August, 1953 and in the case of all lots of brook trout listed in this table, the fish were fin-clipped but not tagged. Thus no adjustment could be made for fish which might have been missed during one count but collected during a subsequent count. Because of this difference in procedure, it is not proper to compare the Slagle Creek rainbows (planted in August, 1953) with other test fish.

[2] In general, fish in experimental groups were closely comparable in size.

[3] Slagle Creek was subject to floods which over-topped the blocking screen at the lower end of the test section, and in the screen itself the vertical wooden slats were far enough apart to allow the escapment of trout 5 to 6 inches in length, and perhaps larger. Some test fish were picked up by shocker below the screen during both 1953 and 1954, so that there was experimental error due to escapement.

Table 53

Survival studies, 1953-1956, on PRS fingerlings[1] (approx. 4"-5") brook trout in stream sections not subjected to angling. The streams were Diversions IIa and IIIa of Section C of Hunt Creek, and Slagle Creek. Given numbers of trout were introduced; stream sections were checked periodically by electric shocker; table gives actual counts of fish present. Experiments involved trained trout (I, II and III levels) and hatchery controls (C).

Species, and site:	Brook trout, Hunt Creek				Brook trout Slagle Creek[2]			
Group:	C	I	II[3]	III[3]	C	I	II[3]	III[3]
Planted:	Oct., 1953				Aug., 1953			
Number:	50	50	50	50	100	100	100	100
Nov., 1953	45	42	42	40	..	..	..	..
Jan., 1954	49	32	41	40	..	..	..	..
Feb., "	43	33	40	43	..	..	..	..
Mar., "	35	29	43	42	..	..	..	..
Apr., "	30	27	30	34	8	8	4	9
Sept., "	7	8	7	13	..	..	..	..

Species, and site:	Brook trout, Hunt Creek		Brook trout Slagle Creek[2]	
Group:	C	III	C	III
Planted:	Nov., 1954		Nov., 1954	
Number:	493	499	500	500
Jan., 1955	410	404	208	246
Mar., "	322	310	64	80
May, "	217	215	99	148
Aug., "	116	107	..	..
Sept., "	..	..	93	124
Nov., "	70	80	..	..
Dec., "	..	..	61	94
Feb., 1956	57	61	47	69
Apr., "	..	..	50	63
May, "	42	41	20	29
Aug., "	24	27	Flooded out	
Oct., "	19	16	..	..

[1] In general, fish in experimental groups were closely comparable in size.

[2] Slagle Creek was subjected to floods, and a blocking screen at its lower end was not a barrier to trout less than about 5 inches long. Some test trout were found in the stream below, and there was experimental error due to escapement.

[3] Groups II and III fingerlings were transposed in original field notes; i.e., Group II had the highest level of training. In the present table, the fish which had the highest level of training are listed under Group III, for sake of uniformity.

Table 54

Creel returns from PRS experimental plantings of legal-size brook trout, Tobacco River. Fish planted in a 200-yard raceway of Tobacco River Rearing Station. Natural cover added to stream. The 132 wild trout were brought in from other streams. Planting date May 1, 1954. Intensive angling May 2-12, 1954. Remaining fish removed from raceway on May 12, by electric shocker and draining raceway.

	Experimental group and number planted*					
Days out[2]	C	I	II	III	Wild	Total
	144	149	154	166	132	745
1	75	68	60	54	18	275
2	5	8	6	8	3	30
3	18	23	20	27	16	104
4	15	20	31	9	10	85
5	8	8	6	10	11	43
6	3	7	5	6	7	28
7	1	..	1	4	2	8
8	3	3	..	3	5	14
9	2	1	..	1	3	7
10	8	5	6	13	16	48
11	..	1	4	8	5	18
12**	6	5	15	23	36	85
Totals	144	149	154	166	132	745

*Numbers planted do not include 6 fish which died as a result of planting operations.

**These remaining fish recovered by shocker and draining.

Analysis of daily spread of catch by test of independence in 5x7 fold table

Days	C	I	II	III	Wild
1	75	68	60	54	18
2,3	23	31	26	35	19
4	15	20	31	9	10
5	8	8	6	10	11
6,7,8	7	10	6	13	14
9,10,11	10	7	10	22	24
12	6	5	15	23	36

X^2 = 125. d.f. = 24. Probability of difference = 99.9%+

Analysis of numerical returns

Group	C	I	II	III	Wild
Number planted	144	149	154	166	132
Total creel returns (11 days)	138	144	139	143	96
Percentage return	96	97	90	86	73

Probability that total returns to anglers (11 days) are significantly different[4]

For all groups:
Prob. = 99.9%+. X^2 = 51.3
For C versus II:
Prob. = 90% X^2 = 2.73
For C versus III:
Prob. = 99%+. X^2 = 7.43
For III versus wild:
Prob. = 99%+ X^2 = 7.52

Analysis of daily spread of catch, including 12th day

Group	C	I	II	III	Wild
Mean days out	3.18	3.15	3.94	4.99	7.10
Mean rank	302	312	354	398	511
Percentage of gain or loss in mean rank[5]	..	+3	+17	+32	+69

Probability that difference in mean rank is significant[6]

For all 5 groups:
Prob. = 99.9%+. H = 89.9

For C versus III:
Prob. = 99.9%+. z = 4.03

For III versus wild:
Prob. = 99.9%+ z = 4.48

[2] For numbered footnotes, see page preceding Table 6.