# A Second Progress Report on the Sagehen Creek Experimental Wildlife and Fisheries Project, 1952

by

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The year 1952 was most productive both from the standpoint of the research work being centered at the Sagehen Creek Project and by reason of additional facilities that were completed. One of the most significant results of initiating this project has been the large amount if interest that has been developed in the program there as shown by students, faculty members, State and Federal wildlife and fishery workers. Evidently the plan for developing a high mountain biological project to serve as a field center for basic, long-term research on fish and wildlife problems, has had a broad appeal.

Details of the location of the project and the method of its operation under a cooperative agreement between the Regents of the University and the U.S. Forest Service were described in the 1951 Progress Report and will not be repeated here.

## Research

Sampling of stream fish populations was expanded and intensified considerably during the past season. In the summer of 1951 only four stream sections were sampled while in 1952, ten were sampled. Each of the latter was spaced about a mile apart, providing one sampling station for each mile of the ten-mile length of Sagehen Creek. The same technique as was used in 1951, namely, diversion of the main flow of the stream and pumping the pools dry with a light, portable pump.

## Methods

Total weights of each species were recorded. All trout were weighed and measured individually while with other species, average lengths and weights were determined from random samples from each collection. All fish were returned alive to the same stream section from which they were originally taken. Scale samples for age and growth analyses were taken from all trout. In a number of instances sculpins, trout and other fishes were marked by removal of fins before release. This was done so that they would be recognized when caught in later population samples and to provide information on the extent of their movements either up or down stream when they might be taken in the two-way fish traps.

## Fish Population Studies - 1952

During the months of July, August, and September, a total of 3,275 fish of all species were collected from the ten sample sections in Sagehen Creek. In obtaining, this total, 2,014 feet of stream were pumped dry. Five families and nine species were represent-ed in the sampling data. These were:

(1) Salmonidae

Eastern brook trout (Salvelinus fontinalis)
Rainbow trout (Salmo gairdneri)
Brown trout (Salmo trutta)

(2) Coregonidae

Rocky Mountain Whitefish (Prosopium williamsoni)

(3) Catostomidae

Tahoe sucker (Catostomus tahoensis)
Lahontan mountain sucker (Pantosteus lahontan)
C. tahoensis X P. lahontan hybrids

(4) Cyprinidae

Red-sided shiner (Richarsonius egregious)
Lahontan speckled dace (Rhinichthys rubilus robustus)

(5) Cottidae

Mountain Baird sculpin (Cottus beldingi)

It is interesting to note that the native Lahontan cutthroat trout, Salmo clarki henshawi, originally the only trout in the basin, was not represented in these sampling data. Only one hybrid trout was taken which appeared t o possess some of the characteristics of both cutthroat and the rainbow. The non-native rainbow, brown, and eastern brook trout have almost completely replaced the native cutthroat in the Truckee River, of which Sagehen Creek is a tributary.

Numbers and Ages of Trout

The following Table 1 summarizes the number of each species collected in 1953 in relation to age as determined from scale readings.

Table 1. Numbers of each species of trout taken in ten sampling stations in relation to age.

| Age[1] | O | I | II | III | IV |
|---|---|---|---|---|---|
| Eastern brook trout | 463 | 61 | 30 | 2 | 0 |
| Rainbow trout | 66 | 111 | 19 | 4 | 0 |
| Brown trout | 24 | 32 | 3 | 2 | 1 |
| Totals | 553 | 204 | 52 | 8 | 1 |

[1] "O", less than 1 yr. old; I, passed first birthday and in 2nd year; II, in 3rd year; III, in 4th year, etc.

The following list embodies the actual numbers and weights of each species of fish taken in the 2,014 feet of stream sampled:

| Species | Total Number[1] | Total Weight (in lbs.)[1] |
|---|---|---|
| Eastern brook trout | 560 | 8.58 |
| Rainbow trout | 200 | 6.38 |
| Brown trout | 62 | 5.97 |
| | Total for all trout… | 20.93 |
| Sculpins | 1696 | 20.85 |
| Lahontan speckled dace | 449 | 2.5 |
| Lahontan red-sided shiner | 177 | 1.62 |
| Suckers (plus hybrids) | 121 | 2.16 |
| Rocky Mountain whitefish | 5 | 0.067 |
| | Total for all "rough" fish… | 27.19 |
| | Total weight of all species… | 48.12 |

[1] Figures tentative and subject to revision.

Total numbers of fish were calculated from each stream sample section in order to obtain an estimate of the relative size of the fish population inhabiting Sagehen Creek. This was accomplished by calculating the numbers of each fish species present in each of the estimated ten miles of stream actually occupied by fish life. Since ten stream samples were taken, each sample was used as the basis for the assumption that in that particular mile of stream, the stream sample in question more nearly represented the true population than did an average for all ten sample sections. For example, the uppermost section of Sagehen Creek, where it is much colder and smaller in size, would be expected to support a smaller population of fishes than that of one of the lower stream sections. In terms of pounds of fish per mile of stream, Section I, the uppermost in the basin, produced an average of only 30.6 lbs. per mile, while Section IX, next to the lowermost, gave an average of 276.9 lbs. per mile. Section I contained only eastern brook trout while Section IX had all the nine species of fishes that are present in the basin. The latter section is located at the lower end of Sagehen Creek close to the point were it flows into the Little Truckee River. Here the stream averages around 10 ft. in width, is much warmer in temperature than Section I, and well lighted where the stream meanders through sage brush flats with scattered clumps of heavily-grazed willows on its banks. The distribution, weight and numbers of fishes in Sagehen Creek offer many highly interesting and puzzling ecological problems. As one proceeds upstream from its mouth depending upon distance, water temperatures, and general habitat conditions, first one fish species and then another disappears from the fauna. In the area of the project headquarters only sculpins and trout are present, while close to its headwaters, the single cold-water-loving, eastern brook trout occurs. Just what causal factors are involved here and how they operate constitutes One of the special studies under attack by graduate student Glenn A. Flittner.

The following data present an estimate of the total biomass in numbers and weight of all species of fishes inhabiting Sagehen Creek. These are based on recalculations of data taken from each of the ten sampling sections.

| Species | Calculated Number[1] | Calculated Weight in lbs.[1] |
|---|---|---|
| Eastern brook trout | 17,205 | 262.3 |
| Rainbow trout | 5,092 | 131.2 |
| Brown trout | 1,722 | 181.3 |
| | 24,019 | 574.8 |
| Sculpins | 41,989 | 493.5 |
| Speckled dace | 14,717 | 73.1 |
| Red-sided shiner | 6,374 | 58.9 |
| All suckers | 3,308 | 76.5 |
| Rocky Mountain whitefish | 222 | 3.1 |
| **Totals** | 90,629 | 705.1 |
| **Grand total** | | 1,279.9 |

[1] Figures tentative and subject to revision.

From the above data, it is evident that the non-game fish outnumber and outweigh the trout. Of the total number of trout present in 1953, only approximately 1,737 fish were larger than 150 mm in to total length (approximately 6 inches). This figure then, represents the number of fish of "catchable" size available to anglers at the time of sampling and while the stream was undergoing, normal angling pressure.

Undoubtedly, more fish of catchable size would have been present in the population samples, had they been taken prior to the opening of the angling season. In 1953, a creel census will be conducted to determine the numbers, sizes, species, and age of fish removed from the stream by angling. Since it is necessary that all possible causes of mortality be adequately assessed, an accurate estimate of removals by anglers is most important in relation to the overall attack on problems relating to survival and migrations of fishes. The California Department of Fish and Game has agreed to furnish one man to the Project for sampling anglers' catches in 1953.

The data taken in 1951 and 1952 have been worked up in summary form and our main effort now is to correlate fluctuations in populations from season to season and year to year with ecological factors. It is quite unlikely that any major printed research contribution will be produced from this work before five or six years have elapsed. The research program is definitely long-term, cooperative, and at least this amount of time will be required to produce sufficiently solid results to warrant publication.

## Competition for Food Between Sculpins and Trout

Mr. Eli Dietsch, a graduate student, completed examination of 432 sculpin stomachs and 36 eastern brook trout stomachs. His material was presented in thesis form and contained the conclusion that eastern brook trout and sculpins apparently occupy different niches within the stream environment. Lacking air bladders, sculpins are sedentary bottom dwellers. Trout, on the other hand, aided by the hydrostatic function of an air bladder, are more mobile and live in the planes between the surface and the substrate. He found that sculpins appear to prefer extensive areas of bottom rubble containing both boulders and large gravel, materials which usually form the bottoms of swift riffles. Larger trout, on the other hand, prefer wide, deep pools with extensive shelter areas where they can hide under cut banks, overhanging vegetation, stumps or logs. Fingerling trout less than a year old prefer shallow riffles where they are constantly on the go seeking current-born food particles.

The sculpins had fed principally on aquatic insects, eating many of the same forms that were consumed by the brook trout. This indicates that these fish offer competition for the same foods with trout. Mr. Dietsch made extensive comparisons of the food eaten at the different seasons of the year and by different size groups of fishes. No evidence was found for assuming that sculpin destroy large numbers of trout eggs and his observations offered no proof that sculpin even prey on trout eggs. No evidence was found during the period of study that sculpins consumed fingerling trout to any extent and the latter. being stronger swimmers, avoid capture by them.

Because of extensive snowfall in the winter of 1951-52, it was impossible to collect sculpin stomachs during the spring when young eastern brook fry normally emerge from their gravel nests. It is not unlikely that predation by sculpin on trout could be serious at such times and further work will be necessary to obtain more information during this critical period.

## Beaver-Trout Study

This work is being conducted by Mr. J. G. Hall, a graduate student working under the direction of Dr. A. Starker Leopold. The beaver in the Sagehen Creek drainage were under observation from late June until the middle of September. The summer's work consisted mainly of preliminary mapping and observations on colony size, location, relation to local food supplies and behavior of the animals themselves.

All of the beaver now inhabiting this stream have presumably been descended from four animals planted there in 1945 by the Forest Service from a stock of Idaho animals. A cursory examination and aging of stumps by a noding method did not, however, turn up any stumps cut prior to 1948. Since the time of their introduction they have broken up into at least four thriving colonies. One of the most extensive colonies may actually be two adjacent ones. The highest colony is a little over five miles by stream from the lowest one and each of the others is separated by at least a mile from its neighbors. Except for the second-highest colony, all are located in areas of plentiful aspen and some aspen is available even to this colony.

Over 1400 aspen in the uppermost colony were marked and measured so that a detailed study of aspen-use could be started. Although aspen-use is the most obvious sign of beaver activity, observation of the animals actually feeding indicates that willow is at least as important an item in the diet.

It was not possible to trap and mark beaver during the season but this work is planned for 1953. Until this has been done, no accurate figure can be given for the population size. However, the season’s observations would indicate a total population of from 20 to 30 individuals on Sagehen Creek.

In the summer of 1953, special effort will be made to determine how beaver dams may affect trout population levels in the stream areas in which they are built. Evidence to date indicates that new dams may greatly expand trout habitat. Whether or not they are harmful or beneficial may possibly depend upon the age of the dams in relation to stream flow, siltation rates and other factors.

## Blue Grouse and Meadow Vole Study

A study of population cycles in the blue grouse (Dendragapus) and meadow vole (Microtus) is being carried out by Mr. Robert Hoffmann, another graduate student working under Dr. Leopold. Of major importance is a census of these two species to determine the level of the

population from year to year, and to see whether or not there is a correlation between the population cycles in both species. Two techniques are employed in the grouse census; counting the sexually displaying ("hooting") male birds in the spring, and measuring the amount of droppings accumulated during the winter at the special roosting sites. For voles a standardized trap-line is used to sample the population. This also provides specimens from which corpora lutea, placental scar, and embryo counts, and other data can be obtained to give an idea of reproductive activity and sex-age composition in the population. Such analysis of population structure is more difficult for grouse but some information may be gained from the determination of the distribution of various size classes of grouse droppings on the wintering roost sites.

Together with the census work, a study of the food habits of both species is under way. It is known that the grouse are restricted during the winter to a single food type, coniferous needles, of which white and red fir are by far the most important. Samples of these needles have been collected monthly, and will be analyzed for their nutritive value with respect to such items as protein, calcium and phosphorus. In this way, it may be possible to demonstrate a suspected fluctuation in the nutritive value of the grouse food and to correlate this with fluctuations in the level of the grouse population. Analysis of the vole foods is more difficult in that the species composition of the more complex diet is not known. This must first be determined before a nutritive analysis of the food can be carried out, and experiments are now in progress to determine the feasibility of certain microscopic identification techniques. Once the diet is determined, it will be possible to determine any correlations that may exist between the food value and the vole population and perhaps also between the nutrition of both grouse and voles and their respective population cycles.

## Winter Studies

The heavy winter of 1951-52 left a snow pack approximately 8 to 12 feet and for this reason, it was not possible to open the project until early June, 1952. While plans were made to conduct winter studies over the winter of 1952-53, heavy, early snowfall prevented installation of the necessary instruments and winter operation had to be temporarily abandoned.

An underwater observation tank was finally installed in early December 1952, after many unavoidable delays. This tank is made of sheet metal and is 6' long, 4' wide and 5' deep. Four plate glass windows, 15" x 24", are installed 6" above the bottom on the sides close to each corner. Rocks on racks at each end counteract buoyancy. The observer sits inside and can view directly from the windows, either fish behavior or occurrences in the stream environment under observation. It is surprising how clearly one can see through the water from the tank. Objects under cut banks or trees are clearly visible at distances up to five or six feet. To avoid chilling of the observer, a wood platform is built over the floor of the tank and on this an air mattress is used. In addition, an effort is being made to secure an electrically heated flying suit from army surplus for winter use. Students have aptly termed this the "deepfreeze".

Thermocouples will be mounted at selected stations outside the windows where they can be observed directly during periods of ice formation and dispersal. Through the use of a sensitive potentiometer, accurate water temperatures may be recorded during the various phases of this process. For protection of personnel and instruments, two men will always work together; one in the tank making the observations and one in the field laboratory recording observations through voice communication between the tank and laboratory. The research emphasis here will be an attempt to measure the effects of' the formation and

dispersal of stream ice on fish populations in relation to stream temperatures, and flows, solar radiation, and other ecological factors.

## Facilities Completed in 1952

1. A 1,000 gallon redwood water tank to provide a gravity water supply at the station headquarters.
2. Insulation of water system against freezing in winter.
3. Building to house the water pump that supplies water to the 1,000 gallon tank and a motor generator for electricity.
4. Concrete floor and walls under the equipment cabin.
5. Addition of one 8′ x 14′ room and 14′ x 12′ porch on the station headquarters building. The latter serves as an outdoor dining area in the summer.
6. One single unit garage to house the TD-9 International Tractor in winter.
7. New driveway from main road to the station headquarters.
8. Underwater observation tank discussed above.
9. Miscellaneous: shelter to house various weather instruments, rack for fuel drums, repairs to tent frames, etc.

Both lack of time and funds in 1952 prevented conduction of additional fish traps, laboratory and small fish hatchery. As noted elsewhere here, the first two items will be completed in 1953 if present plans mature. The greatest need now is for a laboratory building where instruments may be housed and where suitable protection will be provided for indoor work at all seasons of the year. This will reduce crowding in the main cabin in winter by removing laboratory operations and gear to a separate building.

## Construction Program - 1953

Lack of time and money did not permit completion of all items planned for the summer *of* 1952, though excellent progress was made as illustrated by the above list. In the summer of 1953, and assuming that funds are available, the following items will be completed:

(1) Purchase, installation and calibration of instruments for measuring air and water temperatures and other ecological conditions, (2) stream gaging station for accurate measurement of stream flows, (3) construction of a small field laboratory (unless funds are secured for a more adequate structure), (4) completion of miscellaneous items such as fencing of special experimental areas and installation of additional two-way fish traps.

In order to expedite the research work planned, it is going to be necessary eventually to secure somewhat better living and laboratory accommodations for the Sagehen Project. Such items as an adequate field laboratory for both winter and summer use, a garage and workshop, pipeline for a gravity water supply, a small fish hatchery, bunkhouse, one residence, fencing and road improvements are badly needed. None of these items would duplicate structures or other facilities already available and, if granted, would make the field job much easier and at the same time, further the cooperative aspects of the program by providing better housing and laboratory facilities

or those who will be assisting on various problems in the area. Somewhat more commodious facilities would greatly accelerate the field program and eliminate considerable dilution of the research effort by reason of the necessity for working and living under rigorous environmental conditions between November and May.

## Acknowledgements

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