THIRD PROGRESS REPORT ON THE

SAGEHEN CREEK PROJECT

by

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Introduction

The most significant development in 1953 in relation to the Sagehen Creek Project was the receipt of a generous Grant-in-Aid of $30,000 from the Max C. Fleischmann Foundation of Nevada in June, 1953. The University was granted full freedom in the use of the funds, a fact that made it possible to properly and carefully plan the best possible utilization of the grant in relation to thevarious facets of the research program under way and in relation to the badly needed facilities. As presently planned half of the grant will be expended for aid to graduate and other students in the research program there and half will be allotted for facilities.

Need For Project Leader

This step is deemed essential if the full research possibilities there are to be fully realized. Previously during the absence of the writer, the project had been under the direction of Mr. Albert C. Jones, a graduate student in fisheries. While this arrangement was wholly satisfactory when Mr. Jones was living at the project, his decision to seek a Ph.D. degree left us without a man to head up the work there. With an investment of over $56,000 in facilities and instruments and with the writer being able to spend only comparatively short periods of time there, it is evident that such an appointment is not only necessary but urgent. To date the writer, aided by various other faculty members and co-worker., has handled all details of design of both the research program and construction of facilities. The project has reached a stage now where it is a "going" concern and in order that it be properly administered the appointment of a full-time., skilled fisheries technician seems to offer the best solution to the problem. Such a man would handle all field, administrative details connected with operation of the project, details which by reason of numerous commitments in other activities, have not had sufficient attention simply because of lack of time on the part of the writer.

Interdepartmental Cooperation

Much aid on both administrative and research problems has been freely given by faculty members in Botany, Entomology and Parasitology, Museum of Vertebrate Zoology, Electrical Engineering, and Paleontology. This summer (1954) Entomology 49, a field course, is being held at the Sagehen Project. Since only seven students are enrolled in the course, it is a simple matter to house and feed this additional number. Housing has been provided by the purchase of extra tents from Army Surplus Depots and a cook is preparing the meals for a total of some twenty students and faculty members living and working at the project.

A temporary field laboratory will be set up in the garage for entomological work since work spaces for only eight students are available in the lab. This can easily be done on a temporary basis without disruption of any of the research in progress. The Department of Entomology and Parasitology has furnished extra tables, cooking gear, and field equipment to meet the increased demands of this program.

Dr. Herbert Mason of the Botany Department is much interested in a hanging bog that covers an area of around five acres and in which are found rich growths of the insectivorous plant, Drosera. Next September a meeting of the Biosystematist's group from the Stanford. Berkeley and Davis campuses will be held at the Sagehen Project when Dr. Mason will address the group on bog ecology.

Project Research

The winter of 1953-54 was the first in which, by reason of the increased facilities, it was possible to start the winter studies planned since the inception of the project. Sixteen thermocouple stations were established around the underwater observation tank, two of which were solar radiation stations, one was on air, and the remainder were placed at varying depths in the different habitats presented by the stream. Most of the underwater thermocouple stations could be viewed by the observer in the tank. Two graduate students, Mr. Albert Jones and Mr. Elbert Brock, conducted the observations aided by Mr. Ray Allen, Laboratory Helper. These studies dealt with micro-temperature measurements, using a Leeds and Northrup potentiometer No. 8662 and copper constantin thermocouples. Observations were made at all hours of the day and night and under all sorts of climatic conditions. Observations of the behavior of fishes seen outside the four windows of the tank were made simultaneously.

With respect to winter water temperatures, the most surprising finding was the effect of ground-water emerging from the stream bed. Surface water was usually at a temperature of 32° F at night while Station 13, which was located eight inches deep in a gravel riffle, usually ranged from 35° F to 37° F, depending upon conditions. Observations of anchor, frazil, and surface ice were also made concurrently. The effects of anchor ice on stream levels was especially pronounced during periods of cold weather. The damming effect of this ice would raise stream pool levels as high as 15 inches at night. The artificial effect on the water stage recorder in the gaging station was especially noticeable, giving an entirely false effect. Much less water, rather than more, was flowing at such times. Officials of the U.S. Geological Survey, Surface Water Branch, have expressed a deep interest in the winter flow records and sent several men into the project last winter to calibrate the Leupold-Stevens water stage recorder and to establish a rating curve for the Sagehen stream gaging station.

Fish Population Studies

The same ten sections of Sagehen Creek used last year were pumped and drained again this year. This is part of the long-range program of studies concerned with distribution and abundance of fishes. The results are being analyzed and summarized each season. No publication of these data is planned until a minimal period of five years has been covered. In an effort to determine the ecological mechanisms governing changes in abundance from year to year, correlations with weather, stream flows, temperatures, and other data will be made. A large amount of excellent ecological data is being accumulated which, over a period of time, should provide much new information on the cyclic nature and behavior of fish populations. This work is new, it duplicates no other work of its kind, and if the interest of students in the program is any criteria, many new and highly useful facts should come out of it that can be applied to fish stocking and management problems generally.

Student Research Projects

Mr. Glen Flittner completed his M.A. thesis, "The Composition and Distribution of Fish Populations in Sagehen Creek, Nevada-Sierra Counties, California," in September, 1953, and was called into the armed services shortly thereafter. For his thesis materials, Mr.

Flittner used the 1952 pumping and draining data from the ten sections of stream that are sampled annually.

At present four Ph.D. and two Masters Degree candidates are centering their field research at the Sagehen Creek Project. A list of these follows herewith:

Name	***Department: Problem***	***Major Professor: Degree***
Mr. Robert S. Hoffmann	*Museum of Vertebrate Zoology:* Cycles in blue grouse and microtine rodents	A. Starker Leopold: Ph.D.
Mr. Joseph G. Hall	*Museum of Vertebrate Zoology:* Behavior and utilization of food by beaver colonies in the Sagehen Creek basin	A. Starker Leopold: Ph.D.
Mr. Richard Gard	*Zoology:* Beaver-trout relationships in the Sagehen Creek basin	A. Starker Leopold: Ph.D.
Mr. Robert S. Rupp	*Zoology:* Natural propagation of trout in Sagehen Creek	Paul R. Needham: Ph.D.
Mr. Albert C. Jones	*Zoology:* Seasonal distribution and abundance of drift foods in relation to stream habitat	Paul R. Needham: Ph.D.
Mr. Elbert Brock	*Zoology:* Life history studies of Shironomids dwelling in Nostoc	Paul R. Needham, Robert L. Usinger, George F. Papenfuss: M.A.

Progress Reports on Individual Research Projects

1. Studies on cycles in blue grouse and microtine rodents by Mr. Robert Hoffman.

Investigations of population fluctuations in small mammals, particularly the meadow mouse (Microtus montanus) and in blue grouse (Dendragapus fulliginosus) were continued in 1954 in the Sagehen Creek basin. Meadow mouse populations had increased to a peak in the fall of 1953, and now show evidence of declining. Changes in the structure of the population are of special interest in that they may provide information on the mechanisms behind the periodic increase and decline in the population, shifts in sex and age ratios, and reproductive rates. The possible influence of changes in the nutritional value of foods has also been investigated, with samples of meadow vegetation being collected for analysis. This year, two of the smaller meadows were treated with 200 pounds of commercial fertilizers supplying nitrogen and phosphorus, leaving the rest of the meadow areas as controls. In this way, it will be possible to determine the effect of fertilization on the nutritive value of the meadow plants, and the influence of any changes in the food on the meadow mouse populations.

Concurrently with the mammal studies, the blue grouse population of to area further upstream has been followed by means of a spring census of the displaying male birds, and a count of winter roosting sites. This population has shown a steady decline since the

spring of 1952. Nutritional studies on this species include the analysis of samples of their sole winter food, the needles of white fir.

It is hoped that these studies, together with similar work on small mammal populations in the San Francisco Bay area, vdU provide information on the degree of Wwhrony in population fluctuations between different "cyclic'' species, and in different areas.

2. Beaver investigations by Mr. Joseph G. Hall.

A study of the beaver colonies on Sagehen Creek has now been in progress for just two years. This particular study, which centers mainly about the problems of the animals in relation to their food supply and the movements of individual animals along the streams, has been carried on principally during the years of 1952 and 1953 with periodic short visits being made to the area during the intervening seasons.

During the summer of 1952, a considerable amount of time was spent observing beaver activity in two of the three colonies being studied intensively. Also the program of marking and measuring the aspen trees cut by the animals was undertaken in an effort to determine the rate of use of this type of food by the beavers. In addition, mapping of the areas under investigation was begun for all three colonies being studied in detail.

Two Bailey live-traps, purchased by the Museum of Vertebrate Zoology, were available for use by the start of the 1953 summer season and were set out for approximately thirty trap-nights during this season. Considerable difficulty was encountered in getting traps moved about and in learning the best trapping techniques and this may have been partially responsible for the low catch; 6 animals of which one was found dead in the trap. The other 5 were marked by web-punching and released at the site of capture.
Marking for field identification was tried unsuccessfully with paint and stainless steel safety pins. Much time was spent in mapping, as during the previous summer, and the areas being studied were practically mapped completely by the end of the season. Marking and measuring aspen utilization was continued and a new system of sampling particular plots of aspen was started; these sample areas are being permanently marked to enable interested persons to follow the sequence of cutting in future years.

Plans for the 1954 summer include intensive live-trapping and marking, an activity which will be greatly facilitated by the use of two more Bailev live-traps which have been purchased as part of the Sagehen permanent equipment. An intensive willow-sampling program will be started in an endeavor to compare the use of this type of food in colonies whose aspen supplies are markedly different. The aspen marking will continue as before. Field-marking the beaver by branding the tail and perhaps also by fur painting and clipping will be accompanied by further observations of movements to study problems of territoriality, social organization of colonies and censusing of the colonies. In addition, cooperation with Mr. Richard Gard on investigations of the relationship between beaver and trout will be extremely valuable.

3. Age, growth and reproduction of sculpins in Sagehen Creek.

In June 1954, Mr. A. C. Jones completed his Master's thesis, "Age, growth, and reproduction of the sculpin, Cottus beldingi, in Sagehen Creek, Nevada-Sierra counties, California". Field research was begun in May, 1953, and concluded in January, 1954. This

study provides facts which can be used in an analysis of the ecological role of the sculpin in Sagehen Creek.

The sculpin is the most abundant fish in Sagehen Creek. In 1953 the population of the ten sample sections, representing 2,000 feet of stream, was approximately 4,600. Population estimates from 1951 to 1953 showed that a low occurred in the sculpin population in 1952 which was due to a virtual failure of the 1951 year-class, which appeared as yearlings in 1952. The severe winter of 1951-52 was probably responsible for the high mortality suffered by this year-class.

The reproductive potential of sculpins is considerably less than that of trout. The average number of eggs produced per female sculpin was 130. Trout usually produce at least 300 eggs per female. The greater abundance of sculpins over trout in Sagehen Creek may be due to the fact that sculpins provide parental care for the eggs and that the trout are subject to a heavy summer fishing mortality.

4. Beaver-trout relationships in Sagehen Creek.

This is a new project started in the spring of 1954 by Mr. Richard Gard. It is one that should work out nicely In cooperation with Mr. J. G. Hall, who has already spent two years studying the beaver colonies with the emphasis on rates of food consumption by beaver in the Sagehen Creek basin. The main objectives here will be to determine (a) ecological changes in stream habitat brought about by beaver dams, (b) productivity in terms of angling in the beaver ponds as compared to normal stream areas, and (c) the range and extent of blockage of trout from access to upstream spawning areas by the beaver dams. operation of two-way fish traps combined with tagging each fish caught, will be one of the techniques employed. Data from the creel census will provide estimates of the numbers, kinds and sizes of trout caught in the beaver ponds as compared to undammed stream sections.

5. Natural propagation of trout in Sagehen Creek.

This is another new study initiated in 1954. As is noted elsewhere here, since all stocking of hatchery trout was stopped in 1951, efforts under this project will be devoted mainly to determination of recruitment rates of trout and other fishes by natural propagation. More specifically, Mr. Rupp's work will center around determination of (a) the numbers of brown and brook surviving to spawn each fall following each angling season, (b) numbers of eggs laid and numbers surviving through eyeing and hatching, and (c) numbers surviving afterward or, conversely, the mortality rates of each year-class. Here too the use of the creel census data will prove essential. Ovarian counts will provide bases for estimates of total eggs spawned. Except for work done by K. Radway Allen and Derisley F. Hobbs in New Zealand, no really basic data has yet been produced bearing on the mortality rates of trout in the egg and fingerling stages.

6. Seasonal distribution and abundance of drift foods in relation to stream habitat.

Having completed his Master's thesis as noted above, Mr. Jones is undertaking a study of drift foods in Sagehen Creek for his Ph.D. problem. Drift foods supplied to fish in streams are those terrestrial forms which fall or are blown into the water by wind from adjacent vegetation. Part of it is also derived from those elements of aquatic faunas which by

reason of the action of floods, anchor and frazil ice or other causes, are broken loose from their normal niches in stream beds to be carried downstream. Very little has been done to date on this problem and it is one that is expected to produce much now and basic information.

7. Life history studies of Chironomids dwelling in the alga, Nostoc.

This problem is being attacked by Mr. Elbert Brock for his M.A. problem. It has long been known that the green nodules of Nostoc found in streams usually contain Chironomid (Diptera) larvae or pupae. Nothing is known, however, about how the animal gets into or out of the nodule, the time or stage when each step takes place or the manner in whch it occurs. Thus, there is a beautiful problem here for an original piece of research. Dr. George Pappenfuss and Dr. R. L. Usinger will aid in the direction of Mr. Brock's efforts.

1953 Creel census

Officials of the California Department of Fish and Game have agreed to employ the help of one student biologist on Dingell-Johnson funds at Sagehen each summer to assist in the creel census work. This aid is most welcome for it frees a parallel amount of funds in the Zoology-Fisheries budget for other purposes.

A creel census is most important for it gives a fairly accurate record of the species, rate of removal, and number of trout being taken annually by anglers. By mutual agreement, stocking of Sagehen Creek with hatchery-reared trout was stopped in 1951 in an effort to find out what a small stream of this type would produce without any aid whatsoever from planting trout. This plan will be followed for five years after which marked hatchery fish will be planted to determine their survival rates and actual contribution to the catch in relation to rearing and planting costs.

In 1953, an estimated 1050 anglers took a calculated total catch of 2,976 trout. The fishing could be said to be good for the average catch per angling hour was 1.19 trout. Eastern brook trout, Salvelinus fontinalis, dominated the catches, forming 68.0 per cent of all fish taken. Rainbow trout Salmo gairdneri, were second in importance, making up over 21.0 per cent, while brown trout, Salmo trutta, contributed only 212 fish, or 7.0 per cent. Species was not determinable in 83 fish or 4.0 per cent of the total catch because of various reasons but principally for the reason that some anglers had eaten their fish before being checked by the creel census workers.

Sampling Technique

As proven by creel census workers employed by the California Department of Fish and Game, only randomized creel census checks are necessary. At Sagehen Creek creels were checked three of the five working days a week (Monday through Friday) and three out of four weekends a month. The work days actually selected for sampling were chosen from tables of random numbers after numbering these days from 1 to 5. Recalculations were used to determine catches on days or weekends that were not sampled. It is believed that the estimates for total catches are fairly accurate, at least over 90 per cent. Sampling of creels was always done on the long, three-day weekends such as Memorial Day, Fourth of July and Labor Day.

The field data required is shown on the following page and Illustrates the type of information being obtained from the creel census.

Studies underway by graduate student Robert Rupp on numbers of surviving spawners each year and juvenile mortality rates should correlate nicely with the removal rates of breeding-age fish as demonstrated from the creel census.

Stream Sampling Project

Dr. R. L. Usinger and the writer undertook a joint research study on the microfauna of stream beds for the California Department of Fish and Game and the State Water Pollution Control Board under Standard Agreement No. ID-757. Prior approval of the proper University Authorities was obtained. Most of the field work was done at the Sagehen Creek Project. the problem attacked was that of developing a plan for taking periodic bottom samples in streams that might be used in analysis of pollution problems. The work required that a suitable plan be recommended for periodic sampling of streams and in order to do this a statistical study of the variates in bottom sampling was undertaken with the aid of Dr. Evelyn Fix of the Statistical Laboratory on the Berkeley Campus. Data was obtained from 100 bottom samples taken in a single riffle following the Latin Square experimental design. Analyses of these data were completed in the spring and a report was submitted to the California Department of Fish and Game on June 30, 1954. The title of this mimeographed report was “A Plan for the Biological Phases of the Periodic Stream Sampling Program," by Robert L. Usinger and Paul R. Needham.

Fish and Game Conference 1953

On August 20 and 21, 1953, over forty persons assembled at the project headquarters to discuss various fish and game problems. The first order of business was reports by students working there. Graduate students, Joseph G. Hall, Albert C. Jones, Elbert M. Brock, and Glenn Flittner spoke first, each on his own research problem, followed by undergraduates Don Weidlein and Tom Kearns who summarized the creel census. A lively discussion followed each talk and the meeting proved so successful that it was decided to make it an annual affair. Some eight representatives, both administrators and biologists of the California Department of Fish and Game attended. These included Mr. Robert Montgomery, District Fisheries Manager, Mr. Willis Evans, Supervising Fisheries Manager, Mr. Joe Wales, Chief, Trout Research, Mr. Bruce Kimsey, Chief, Warm-water Fish Research, Tom Bornamen, Warden, William Pollitt, and Mr. Alex Calhoun, Chief, Inland Fisheries Division.

Nevada was well represented by Mr. S. S. Wheeler, formerly Executive Officer for the Nevada Fish and Game Commission, Mr. Earl Branson, Secretary, Nevada Fish and Game Commission, and Mr. Tom Trelease, Chief of Fisheries for the same organization. Mr. Wheeler served as Chairman for the conference in 1953 and has agreed to serve in the same capacity at the 1954 meeting.

The U. S. Forest Service was represented by Mr. Ivan Sack, Supervisor of the Toiyabe National Forest, Mr. Guerdon Ellis, Supervisor of the Tahoe National Forest in which the Sagehen Project is located, and Mr. E. E. Boehm, District Ranger. Mr. Jim Thomas, sports writer for the Associated Press, and Mr. Grant Matthews, outdoor writer for the San Francisco Chronicle, also attended both publishing excellent accounts of the Sagehen work following the meeting.

The first day was devoted to discussion of problems of mutual interest and on the second day, a demonstration was given of the fish sampling technique of pumping and draining. A buffet lunch was served at cost each day.

The discussions were notably freer and more relaxed than one usually encounters in hotels or other city meeting places. Holding it out-of-doors on a beautiful, sunny day on a lovely mountain stream seemed to encourage clearer thinking and more fruitful discussions. Both students and faculty alike gained much from the free and open discussions.

Facilities Constructed in 1953

The following items were partially or wholly completed in 1953:

1. Field laboratory building, with work spaces for eight students, storage shelves for equipment, toilet, office, and large sink with hot and cold water.
2. Stream gaging station for measuring the flow of Sagehen Creek. The Leupold-Stevens water stage recorder installed there was provided by the U.S. Geological Survey as a part of a cooperative study of the flow characteristics of this stream.
3. Garage, workroom and darkroom. A three unit garage, 20 ft. x 40 ft., was completed to house the station TD-9 tractor, one pickup truck, and one automobile. Also this building contains two additional rooms, one for use as a workroom and a darkroom where students and faculty alike can do field photographic work.
4. Fuel Dump. Because of fire hazards with respect to fuels and buildings,this structure was a necessity. The single car garage that formerly housed the TD-9 tractor was moved to a suitable site and converted for this purpose.
5. Motor generator house. A two kilowatt Kohler generator was purchased and installed to supply electric lights. This has eliminated the use of gasoline lanterns which are hazardous, smelly, and hard on the eyes of those working at night.
6. Gravity water supply system. A three-inch steel pipeline, 2,850 ft. in length, was installed in October, 1953. The work was done under contract at a cost of approximately $1.05 per lineal foot. The line is buried 14 inches deep and supplies spring water at 44°F for both domestic and experimental uses. This line is an enormous improvement over the pumping system formerly used and likewise provides better protection in relation to fire hazards. The 1,000 gallon redwood tank formerly used now serves as storage for fire protection.
7. Grading and gravelling of project parking area. A new parking area was graded opposite the garage when some 600 yards of earth was moved for the garage site. This will provide ample space for parking of cars. In addition, 200 yards of gravel was spread over the grounds of the main project area to eliminate muddiness during inclement weather.
8. Underwater Observation Tank. This was fitted with a weatherproof top, rear entrance, walkway, and new rock racks to counteract buoyancy. In addition, a two-wire underground cable was installed over the some 400 ft. between the tank and the laboratory. This connects to a potentiometer in the latter building for making micro-measurements of water temperatures. Likewise, a single-wire, grounded phone line was installed between the tank and the laboratory to provide a means of

communication between the observer in the tank and the person recording for the observer in the laboratory. A 24-station selector switch in the tank permits operating 24 separate thermocouple stations in the air and water around the tank. This tank has now withstood two winters in the stream without harm.

9. Phone Line. In late fall 1953, bids were let for the construction of a phone line after a suitable agreement had been worked out between the University Authorities And Fibreboard Products, Incorporated. The latter concern own the Hobart Mills-Truckee phone line to which the Sagehen Project line is attached. The seven mile Sagehen line was completed before heavy winter storms began, and is rapidly paying for itself in auto mileage saved by elimination of trips to Truckee. A phone line is essential for protection of personnel at all times of year.

10. Weather Station and Instrumentation. A two-pen, spring-wound, 7-day, Bristol recording thermometer provides an accurate constant record of air and water temperatures at one location. Other standard weather instruments are used to record rainfall, snowfall, maximum and minimum temperatures, and wind velocity. A recording barograph keeps a constant record of atmospheric pressure. Through the cooperation of the Department of Electrical Engineering and the Standards Laboratory, solar radiation instruments have been installed in connection with studies dealing with the formation and dispersal of anchor ice in winter. The Standards Laboratory have calibrated various instruments used and aided materially in the various problems concerned.

It can be seen from the above list that vast progress was made in 1953 toward completion of items required both for the research program and in making the environment livable for personnel the year round. To these ends, the grant-in-aid received from the Max C. Fleischmann Foundation of Nevada was most timely and helpful.

Sheet No._____

Sagehen Creek Creel Census
1954 Season

Date:_____ No. of Anglers:_____ No. of hours fished _____

Angler's County of Residence:_____

Method of fishing: (check) Bait ____ Spinner ____ Fly ____ Plugs ____

Section of Stream Fished: (check) Upper ____ Middle ____ Lower ____

Catch: (total no.)_____ No. of scale samples taken _____

Rainbow		E.Brook		Brown Trout		Sp.Unknown	
Spec.No.	Total Lgth.	Spec.No.	Total Lgth.	Spec.No.	Total Lgth.	Spec. No.	Total Lgth.

Totals _____

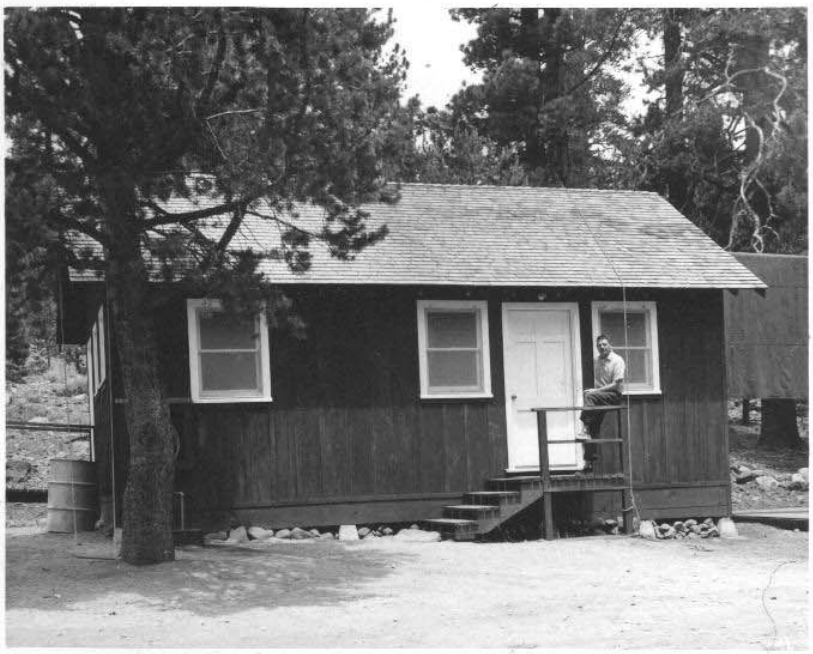
No. and species of marked fish: _____

No. and species from beaver ponds: _____

Remarks: (re weather, water, fish, or other)_____

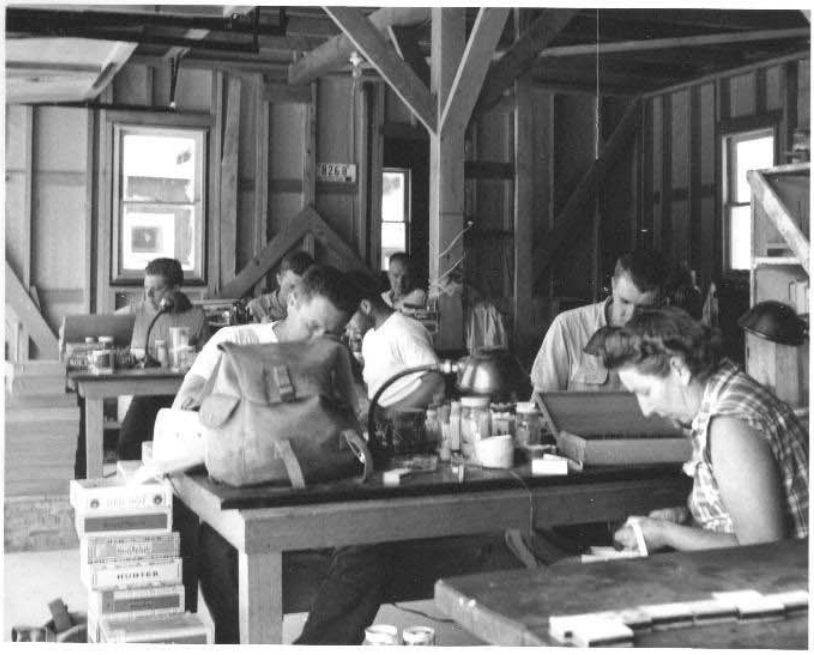
_____
Name of Surveyor

Sagehen Project. Mess Building



Laboratory Building providing work space for eight graduate students.

Three space garage. This houses a bulldozer, Project pickup truck, and one automobile. Included are generator and darkrooms. This is located on main road above the Project headquarters for easy accessibility in winter.



Laboratory set up in garage for students taking Entomology 49 in the summer of 1954.

Underwater Observation Tank as used in the winter of 1953-54. The wires leading from thermocouple stations placed at various positions in the stream bed, are seen just below the middle section of the top of the tank. Rock racks at each end counteract buoyancy.

Thermocouple Stations on south side of tank, used in the study of ice formation and dispersal and its concomitant effects on fish life.

Aquarium and Tank Building. This contains 12 small tanks for holding small lots of fish and a rack for 12, three foot aquaria. Also serves as a supplemental laboratory.

Typical catch of brook, brown and rainbow trout caught in Sagehen Creek