# REPORT ON THE ACTIVITIES

# OF THE

# JACKSON HOLE BIOLOGICAL RESEARCH STATION

# SUMMER 1955

L. Floyd Clarke, Director

## IMPROVEMENT OF PHYSICAL FACILITIES

Our plans for improvement of physical facilities of the Station continued during the summer. The most noteworthy of these were:

1. Installation of Rural Electrification which replaces the old power plant. This required considerable rewiring of the Station and made possible the provision of electricity at all times as well as the use of additional electrical appliances for research and living facilities.

2. Establishment of a central propane storage tank. This replaces the small propane bottles which had been set up previously to provide fuel for the Station. A 500 gallon propane tank was installed, enclosed by a seven foot wire mesh fence to meet Park Service specifications. The installation required trenching and laying of a considerable amount of pipeline. This will eliminate the necessity of considerable waste of time and money in going to Jackson to refill the small propane bottles.

3. Providing two additional cabins and a tent for research workers. This was made possible by partitioning off the power house so that the shower, water pump, and hot water tanks were separated from the rest of the cabin which then was remodelled as a living unit. This required laying new floor and new ceiling over the shower room. This was a very satisfactory living unit except for the noise of the water pump. It may be necessary to sound-proof the pump room next year.

   Also, the building originally used as a library was remodelled to provide living accommodations. This required the remodelling of one of the storerooms in the lab. to provide shelving for books and periodicals most frequently used as well as building library shelves in the director's home for the remainder of the books and periodicals. Both of the above living units were provided with stoves, shelving, tables, electricity, etc.

   A surplus Army mobile unit X-ray tent was remodelled (building windows and doors) and provided an additional living unit.

4. Cinder block foundation replaced the wooden supports under the director's house.

5. The laboratory was improved by the installation of a large heating stove which makes it possible for research workers to work in the lab. at any time. Without heat the lab. was too cold for comfort especially during the mornings and evenings as well as stormy periods. Two old tables at the Station were repaired and covered to accommodate the increase in number of research workers at the Station. Other improvements in the lab. included some rewiring, additional desk lamps, construction of shelving, and other changes of a minor nature. Plumbing and other repairs were also made.

6. The general care and upkeep and improvements including items too numerous to mention required the constant attention of the director. All of the labor for improvements mentioned above was provided by Station personnel.

   A series of regulations were drawn up and given to the research workers concerning the general care and improvement of the Station

PROJECTED IMPROVEMENTS

1. To continue to replace the wooden supports with cinder blocks under the various buildings at the Station.

2. To pour a cement floor and foundation for the shop.

3. To oil treat the logs in all buildings at the Station.

4. To provide two additional living units plus one unit to be used for storage and additional laboratory space. It is hoped that some of the living units of the Jackson Hole Preserve now located at Moran can be obtained and moved to the Station. The year to year increase in the demand resulting from more and more research workers applying is far in excess of the facilities available.

A Study of Social Behavior Patterns in Moose of Wyoming

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Project Number 77

The project in its first summer was carried out as planned from June 10 to September 10, 1955 at the Jackson Hole Biological Research Station, Moran, Wyoming. The results were highly satisfactory. Ample material on moose behavior could be secured and examined.

In the initial phases of the three-year project a survey of suitable habitats and moose locations was undertaken. Most important goal of this summer's work was to get repeated observations on the same moose group(s) and a standardization of field notes for detailed evaluation. Marking and identification of individual moose was partially accomplished, but needs much further experimentation and development.

Besides regularly spaced moose observations in the areas accessible from the Station by automobile, eight major packtrips into the Teton Forest Wilderness areas and into Yellowstone and Grand Teton National Parks areas were undertaken to gather observations. From the moose calving season (June) to the onset of the rutting season (Sept.) behavioral changes were closely observed and recorded.

The location and character of the Research Station proved to be very suitable for this kind of project. Frequently moose came right into the pasture and yard of the Station, grazing and browsing on the banks of the Snake River, so that additional observations could be made at the doorstep of the laboratory.

While the majority of the findings will have to be carefully evaluated and exposed to well-planned checkups and repetitions, a few facts appear quite clearly to stand out as characteristics of moose behavior. For example the delayed reaction to a disturbance: The moose (both sexes) upon noticing a disturbance, i.e. a person appearing, will not like the elk or deer immediately react, but seems in most cases to ignore the incident at first. After a delay of 50 to 150 seconds the moose will retreat or deflect the course often so quietly that it is hard to notice the direction or place of refuge. Contrary to popular belief and legend, no cases of aggression toward the observers were noted in the hundreds of encounters with moose at close quarters during this summer's work.

Summarizing this brief report it can be stated: The research project has been conducted according to the planned schedule. Moose behavior patterns were successfully studied throughout the summer. Methods were adapted and improved, evaluation of results is in progress.

(Grant from National Science Foundation.)

# Ecology and Social Behavior of the Yellow-Bellied Marmot (*Marmota flaventris*)

Kenneth B. Armitage
University of Wisconsin at Green Bay
Project Number 82

## Social Behavior

A colony of marmots was located inside the south entrance of Yellowstone on the east side of the Snake River just south of the junction of the Lewis and Snake Rivers. The colony lies in a north-south direction on an old terrace of the Snake River at an elevation of about 6680 feet. The burrows are along the old river bank and in the alluvial flat bordering the present stream bottom. The vegetation is primarily clover and timothy. A hot stream flows along the base of the bank, but does not serve as a barrier as young marmots crossed it frequently. All of the colony was not studied; that part along the bank and north of the phone line was omitted.

First observations were made on June 17. On that day young were observed at a number of the burrows. An observation tower was built and the colony mapped prior to the beginning of regular observations. Trapping was started July 5 and continued irregularly until August 15. Seven adult females, two adult males, and thirty-six young were trapped, ear tagged, and color marked. Adults were tagged in the left ear and young in the right ear. The pattern of trapping is indicated in Table 1. Twelve were retrapped once, one was retrapped twice, four, three times; one, four times; and two, five times. One adult and 25 young were retrapped. Trap success was considerably lower than hoped for. Of 350 set traps, only 95 resulted in captures including recaptures, or about 27%. A number of baits were tried, peanut butter, raisins, apples, carrots, honey, and oats. The latter seems to offer the best promise of success. Part of the lack of success is probably a result of the rich food supply available.

Since all animals were not trapped, an accurate census of the population is not possible. However, a close count can be achieved by counting adults under different situations, such as appearance at a burrow in the morning, number of adults appearing at various burrows during an alarm, etc. The adults in the study area numbered 17-20 and the young numbered 45-50. Of the adults, nine were identified as females and three as males. It seems that the sex ratio will show many more females than males unless it should develop that females are more susceptible to being trapped than males.

Activity of the animals was studied at various periods during the day. This was correlated with weather conditions. The peak of activity was from 7-10 A.M. with a possible second peak after 4 P.M. until the animals entered the burrows for the night. However this latter peak seems to occur only early in the summer when temperatures are cooler.

Activity drops by about 40% when the temperature is above 21°C. The drop is really greater than this indicates for many of the animals are at the burrows during the high temperatures whereas they were out feeding or playing during the cooler hours. All of the animals enter their burrows when a rain ensues, but a few may remain at the burrow entrance during a drizzle. By a half hour after sunset, all the animals have entered their burrows.

The detailed behavior of an individual animal was followed to determine the percentage of time spent in various activities. Feeding utilized more time (34.4%) than any other observed activity. Feeding was primarily on clover. During the period of blooming of the yellow monkey flower the young were observed feeding on the flowers. Some grasses were eaten and late in the summer young were seen eating the timothy heads.

The play activity of both young and adults was noted. Nearly all play occurred before 10 A. M., but some play might take place anytime during the day.

Each animal had a home burrow and most had auxilliary burrows in addition. The burrow systems seem to be so laid out that an animal is rarely ever more than 20-30 feet from a burrow. The auxilliary burrows function primarily as a refuge in case of danger.

The home range of a number of adults was noted. This varies considerably for different individuals. One old adult rarely went over 20 or 30 feet while others ranged up to 480 feet. Each animal tended to go to the same area for feeding. Whenever a marmot traveled from one part of the colony to another part, it used the trail system. The dependence upon trails can be well illustrated by the reaction to an alarm. On alarm marmots will use the most direct trail system to the home burrow if possible. Only when the trail to the home burrow is blocked will the marmot use a trail to an auxilliary burrow.

There was no evidence that any marmot acted as a sentinel. There always were some marmots lying near their burrows or feeding. The marmot that first detected an intruder gave the alarm whistle. This whistle alerted other marmots nearby who in turn might start whistling. Never was the entire colony seen to react to an intruder, but only that part of the colony nearest the intruder. On some occasions marmots distant from the scene of intrusion might stand up and look around for a few seconds, then go on with their activity. The alarm reaction was typified by a running to the burrow, entering, or sitting at the burrow and watching the intruder and often whistling. Alarm reactions were given to moose, deer, horses, coyotes, and people.

The alarm whistle was shrill and sharp. There were at least four other sounds in addition. One which was similar to the alarm whistle I have labelled the "curiosity" whistle. This call was given in situations similar to the alarm call, but did not precipitate the alarm reaction.

There were sounds given by the young at play, shrieks emitted by an animal being molested by another, and growls which could be heard in the burrows.

Since only about half the adults could be recognized as individuals, it was not possible to gather much material about interactions between individuals. One series of observations revealed that two females and a male made up a harem or part of a harem. The male was dominant and had free range over the harem burrow system. The females were probably dominant only at their own burrow and only to the other female.

By the first week of August, many of the animals had their full winter coat. By the second week of August the adults were disappearing and on August 20th only two adults could be found. Nineteen young were counted the same day. The adults definitely go into hibernation before there is a marked change in environmental conditions and while there is still an ample supply of food. Hibernation is evidently brought about by internal changes, such as amount of fat, type of fat, or some other internal factor. This is further substantiated by the fact that the young go into hibernation later than the adults, and marmots go into hibernation later at higher elevations.

## Habitat Selection

Nine marmot colonies were located during the course of the summer. Although marmots are found under a variety of conditions, the optimal habitat is a grassy meadow with the trees and shrubs at a considerable distance from the burrows. Something to burrow under seems to be a necessity. A colony at the south end of Jenny Lake in Teton National Park shows signs of dying out. Trees and shrubs are growing over the area and old burrows, now grown over with vegetation, can be found. Mr. Jepson, Park Naturalist, reports that population has dropped since 1945. The reasons why a colony dies out when the area is invaded by trees and shrubs is not fully understood. Since the animals seem to rely strongly on sight to detect intruders, it may be that predators are able to operate more successfully.

## Melanism

It was not possible to determine the incidence of black marmots. Activity was limited to gathering reports from others who claimed to have seen these animals. The authenticity of the reports will have to be checked at a future time. Nine locations were reported ranging from the Bechler country to the Snake River Canyon south of Hoback, Wyoming. The colony at the south end of Jenny Lake referred to above was one of these. An adult and young were found there and the young was photographed.

Not included here, but contained in the original report are a detailed map of the study area and tables on trapping and play activity.

(Grant from the New York Zoological Society.)

# A PRELIMINARY REPORT OF A STUDY OF SWAN LAKE, GRAND TETON NATIONAL PARK, TETON COUNTY, WYOMING

George T. Baxter and L. Floyd Clarke
University of Wyoming
Project Number 75

A study was made of Swan Lake, Grand Teton National Park, Wyoming from mid-June through August, 1955. Swan lake is an elongate, 33.5 acre lake with maximum depth 10 feet, minimum depth 4.9 feet, and volume 164 acre feet. The basin is of glacial origin situated on a rolling morainal plain just east of Jackson lake in Range 115 W, Township 45 N of the Grand Teton quadrangle, U.S.G.S. 1899. The water supply is from a single small intermittant stream, possible underground seepage and primarily water which backs in from Third Creek which flows past the south end of the lake.

The light penetration averaged about 5.5 feet during 1955; the water was colored dark brown persumably by humic materials. No thermal stratification occurred in 1955. The maximum surface temperature was 71° F on July 21, maximum bottom temperature 69° F on July 21. The mean of the surface and bottom temperatures rose from 61.0° F on June 17 to 68.5° F on July 21 and then decreased to 65.0° F by August 25. Dissolved oxygen content was relatively low, varying between 41% and 87% saturated at the two sampling stations. $O_2$ was relatively higher (average 74.5% saturated) at the south end than at the north end (56% saturated), probably because of the effect of fresh water backing in from Third Creek. Free $CO_2$ varied between 3.2 and 1.1 ppm., total alkalinity between 51 and 66 ppm., and the pH from 6.8 to 7.4. On June 17 the conductivity of the water was 40 reciprocal megohms at 25° C, the total phosphates .04 ppm.

A relatively dense and quite stable plankton population existed during the summer of 1955. *Ceratium*, *Dinobryon* and, later in the summer, *Mallomonas* were the conspicuous unicellular organisms. *Bosmina longirostris* and *Cyclops bicuspidatus* were two of the more conspicuous Crustacean plankters. Quantitative enumeration of the plankton has not been completed at the present time. The benthos averaged 216.6 organisms per square foot at the south end of the lake (six samples) and 138.4 per square foot at the north end (five samples). Benthos included midge larvae (Tendipedidae), bristle-worms (Oligochaeta), phantom midge larvae (*Chaoborus*), and molluscs (Planorbidae and Sphaeridae), of which the bristle-worms were predominant, making up, on the average, about 50% of the number of organisms in the samples.

An overnight set of a 200 foot gill net in the lake caught 98 Utah chubs, 44 rosyside suckers, and one brook trout at the south end of the lake on August, 16-17. A similar set the next night at the north end of the lake caught 14 Utah chubs and one rosyside sucker. The distribution of the fish was apparently related to the oxygen content of the water. A variety of invertebrate animals and a large number of rooted aquatic plants were collected and preserved. Their identification has not yet been completed.

(Grant from New York Zoological Society and appropriation from University of Wyoming.)

Sagebrush-Grass Competition
Dr. Alan Beetle
University of Wyoming
Project Number 64

Approximately three weeks were spent at the Station and in the vicinity. During the second year of this work an attempt was made to define the sagebrush communities in terms of specific identity of the sagebrush dominants, and their site preferences. It was found that *Artemisia cana*, *A. tripartita*, and *A. arbuscula* occupy distinct sites and at present are specifically segregated from *A. tridentata*. *A. tridentata* exhibits the greatest morphological variation and areas which it occupies will have to be subdivided in many different sites defined on some other basis than the presence of big sagebrush.

Land and Freshwater Molluscs of Jackson Hole
Mrs. Dorothy Beetle
University of Wyoming
Project Number 72

Collections of terrestrial and freshwater mollusca were made at 15 localities in the Grand Teton National Park during a six day period. The material is still being identified but to date 13 new records have been established for the county. One species not previously reported south of Canada has been found at Jackson Lake.

## Metabolic Differences Associated with Altitude

Dr. Garth Kennington
Lawrence College, Appleton, Wisconsin
Project Number 79

The purpose of this project was to begin an investigation of certain physiological aspects of altitude, particularly those concerned with animal metabolism and possible metabolic differences associated with altitude. Of the ways in which this could be studied, two seemed to lend themselves best to the problem, (1) exposure of the same animal or group of animals to various altitudes and (2) measurements on different populations of the same or closely related species of animals which are distributed over a range of altitudes.

One of the major tasks of the summer was the location of suitable sites and animal subjects for study and a considerable amount of time was consumed in exploring various possibilities. It was necessary to find elevations of appropriate height and accessibility. Equipment had to be made which was sufficiently sturdy and reliable to withstand rough roads and pack trips. Probably most important was the location of experimental animals which fulfilled the requirements of the project, namely, that they be present in sufficiently large numbers to provide adequate replication and in a distribution pattern where the same species or very closely related species occur at different elevations. Before discussing the work of the summer it should be mentioned that a culture of flour beetles (Tribolium) proved of particular value and interest. They were brought from Appleton, Wisconsin and were originally from the same stock that provided material for work on simulated altitude. For this reason, a good deal is known about the response of these beetles at lower altitudes and in simulated altitudes, a fact which makes them especially valuable for comparisons to be discussed later.

The choice of animals to be used as possible experimental subjects rapidly narrowed down to two groups, mammals and arthropods. Of the mammals two rodents, the picket pin squirrel and the pocket gopher were present in adequate numbers and suitable locations. Several squirrels were collected during the first few weeks of the summer from altitudes of 6,700 to 8,500 feet, and tests were made on the dehydrogenase activity of various tissues using Thunberg's methylene blue technique. No clear-cut differences were observed on animals from different altitudes and this approach to the problem was postponed until more precise equipment became available. Unfortunately there was not enough time to begin work on the pocket gopher although its tendency to "stay put" in a given habitat and its wider altitudinal distribution (up to at least 11,000 feet) make it probably the most promising mammalian material for an investigation of this type.

The most productive work of the summer centered around metabolism tests on two groups of arthropods, the flour beetles already mentioned and various species of ants, particularly the carpenter ant Camponotus sp., which seemed to be present in almost all areas. Metabolism determinations were made using a modification of the Gerard-Hartline tissue respiration technique.

Camponotus from biological station altitude (6,750 feet) were transported to the top of Two Ocean mountain in Togwotee Pass (10,600 feet) and paired tests were run against Camponotus collected in Togwotee Pass area (it was necessary to run paired tests in all cases away from the laboratory because temperature could not be controlled). Similarly Camponotus from the Togwotee Pass area were brought down to the station laboratory for comparison with Camponotus collected in the station area. The major findings from this series of experiments can be summarized as follows:

1. At a given temperature Camponotus native to the station altitude (6,750 feet) used less (approximately $\frac{1}{4}$ to $\frac{1}{2}$ as much) oxygen per unit weight (cc. $O_2$/gm./hr.) than Camponotus native to Togwotee Pass area altitudes (10,000 to 10,600 feet).

2. Oxygen consumption in the station Camponotus was reduced by about half (61% in a representative series) when they were tested at Togwotee altitude. No doubt part of this occurs as a result of the lower average temperature (about 17 degrees C. as compared with around 25 degrees C. at the station) but more than temperature must be involved since the Camponotus from Togwotee area actually showed a slight decrease (8%) in oxygen use when brought to the higher oxygen tension and temperature of the station, rather than an increase which might be expected. Speculation on these results would be premature since they need to be more fully documented but they suggest a difference associated with altitude.

Results obtained with Tribolium are essentially an extension of those with Camponotus, with the addition of data taken using simulated altitudes. An apparatus was constructed in which it was possible to simulate altitudes from about 3,000 to 14,000 feet. It was used at the station altitude to simulate both lower and higher altitudes and at 10,600 feet to simulate lower altitudes. It served as a useful check on observations made in the open and provided additional data outside the range of natural altitudes in the Jackson Hole area. The most important results using Tribolium are as follows:

1. With temperature constant, Tribolium confusum used more oxygen per individual adult per hour as the altitude (both simulated and real) increased. The range of altitudes studied extended from that of Appleton, Wisconsin (about 600 feet) to 10,600 feet on Two Ocean mountain in Wyoming. It should be mentioned that experiments carried out in Appleton at Lawrence College the previous winter provided data for the lower altitudes.

2. A culture of T. confusum was left for 18 days at the top of Two Ocean mountain and at the end of that time was compared with a second culture kept at the biological station. There was virtually no difference between the two suggesting that little or no acclimatization took place in that time.

These results are presented with the understanding that they are tentative and need extension and documentation.

(Grant from the New York Zoological Society.)

# An Investigation of Modes of Reproduction in Grasses

Dr. Charles LaMotte
A. and M. College of Texas
Project Number 78

## Objectives

1. To determine in some degree the prevalence of apomixis among species and biotypes (strains) of Poa (the bluegrasses) and Calamagrostis (the reedgrasses) in Jackson Hole--Teton Mountain area.

2. To investigate the embryological details of all agamospermic apomicts discovered, in an effort to determine the exact type of apomixis involved in each instance and the modes of origin of embryo and endosperm.

## Status of the Problem

Many investigators have determined that certain grasses are able to reproduce sexually as well as apomictically. Many hybrid forms showing a wide range of chromosome variability are able to reproduce themselves agamospermically (by seeds formed without fertilization). Some of these local races would seem to have a very special advantage in their struggle for life.

Much remains to be done. As many as possible of the American species and biotypes of Poa and Calamagrostis - and other genera, in fact - should be examined for evidences of apomixis and their modes of reproduction accurately determined. Then it should be possible to evaluate the role of apomixis, facultative and otherwise, in the adaptation of biotypes to the particular environmental niches in which they are found, and in view of the fact that apomixis is being discovered in an ever-increasing number of species, we should eventually be able to incorporate the advantages of apomictic reproduction into many of our experimental grass improvement programs.

The possible advantages are obvious. It is well known that hybrids are often better adapted to "disturbed" or modified habitat than either of the parental species in the region involved, and it is also well known that hybrids may be more vigorous vegetatively and/or reproductively than either parent. Ordinarily, however, segregation occurs in the $F_2$ and succeeding generations and the advantages of hybridity are soon greatly diluted or lost. If, on the other hand, the crosses have occurred in such manner as to include genetic tendencies toward apomictic reproduction it is quite possible that the hybridity of the $F_1$ will be retained in succeeding generations of at least some of the "families". That this does happen in the wild and that it plays an important part in the adaptation of many biotypes to a multitude of micro-environmental conditions is, to say the least, quite probable. Since apomixis is already known to be rather common among species and biotypes of Poa and Calamagrostis further studies within these genera may be expected with confidence to yield

important basic information that may in turn prove to be of great practical value in the development of better forage grasses of many kinds for artificially improved pastures and range lands.

## Procedures

So far, attempts have been made to determine:

(1) Whether any pollen at all is produced.

(2) The percentage of undeveloped or abnormal pollen grains among those that are produced.

(3) The range of variation in sizes of pollen grains. (Great variation in size may suggest meiotic irregularities.)

(4) Whether there are lagging chromosomes or other common irregularities in the meiotic behavior of pollen mother cells that may indicate apomictic reproduction.

(5) Whether there is variation in chromosome numbers among apparently closely related clones.

(6) Whether there is an unusual number of seeds having multiple embryos. (Multiple embryogeny suggests that there is at least some apomixis involved.)

And finally, through embryological studies it should be possible to determine:

(7) Whether the embryo sacs are developed aposporously or otherwise, whether facultative apomixis is at all likely to be occurring, and whether triple fusion is essential to endosperm development.

Ideally, these observations should be combined with genetic studies of nursery-grown material, as is being done in Sweeden, at Stanford, California, and perhaps in a few other places; but that is something that calls for funds in considerable amounts and the co-ordinated efforts of a team of workers.

## Accomplishments during the Summer of 1955

(1) All collections of early-flowering biotypes of Poa nervosa examined before or during anthesis had abortive anthers, and the plants that were left undisturbed in the field did produce seeds, although usually in only a small proportion of the florets of each spikelet. Mature panicles were collected for further examination and for seed viability tests.

Ovaries in various stages of development prior to and following anthesis were preserved for future embryological examination.

(2) Many collections of Poa pratensis material, presumably representing several different biotypes, were made for cytological and embryological studies. All were found to produce pollen, but several collections showed considerable variation in percentages of good pollen (as determined by the application of iodine) and others showed variation in sizes of pollen grains and/or variation in number of chromosomes in PMCs. Seeds were also collected for viability tests and for seedlings from which to obtain root tips for chromosome counts.

(3) Several lots of cytological and embryological material of Poa palustris were preserved for future study. Whether there is likely to be any apomictic material in these collections was not determined.

(4) Some collections of Calamagrostis canadensis had abortive anthers that apparently never open, other collections had anthers which contained some pollen grains that appeared to be good and which did dehisce during anthesis, and still others seemed to have anthers well filled with good pollen.

(5) Collections of Poa fendleri obtained from around Lake Solitude and at Togwotee Pass on the Continental Divide had abortive anthers in all panicles examined, but the earlier critical stages of development were missed and no embryological material was preserved; so additional collections will have to be made before the reproductive details can be worked out.

(6) Miscellaneous lots of cytological and embryological material of species of Bromus, Agropyron, Elymus, and certain others, were preserved, primarily for use in graduate course work at the Agricultural and Mechanical College of Texas.

(7) Several hundred herbarium species of grasses and other angiosperms were collected during the summer for teaching use, and duplicate grass specimens were left to be used in expanding the herbarium of the Jackson Hole Research Laboratory.

Comment

From the limited observations thus far made, it would seem that the Jackson Hole area is rich in apomictic forms of grasses and should prove to be an ideal place for combining a study of the details of apomictic reproduction with observations on the special adaptive features of apomictic biotypes that seem to fit them peculiarly for their particular environmental niches. Much of fundamental and practical importance might be revealed by such investigations carried on there. I am not yet aware of a better place for a program of this kind.

(The literature pertaining to this problem is reviewed and a list of the most important references cited.)

Population Densities of Small Mammals in Representative Vegetation Types and Procurement of Experimental Red-backed Mice

James Opsahl
University of Illinois

Project Number 73

The primary objective of this year's research was to obtain live red-backed mice (Clethrionomys gapperi galei), and other microtine mice if possible, for use in metabolism experiments at the University of Illinois. The short time available precluded any population density studies. However, for purposes of comparison of fluctuations, the first trapping was done in an area of lodgepole pine forest near Turpin Meadow Ranch which had been studied in 1953 and again trapped in 1954. The results follow:

| Year | Month | Nights trapped | Red-backed Mice |
|---|---|---|---|
| 1953 | October | 3 | 23 |
| 1954 | August | 2 | 0 |
| 1955 | August | 3 | 2 |

Three other areas were trapped. All were beside the highway up to Togwotee Pass; one was about one mile down from the Pass, and the other two were adjacent areas 1½ miles up from the Turpin Meadow turnoff.

Greater success in obtaining red-backed mice was achieved than might otherwise have been expected by making two variations in the procedure used in previous years. The first of these was the inspection of traps after dark as well as in the morning. This was done at the suggestion of Dr. Olwen Williams. It is thought that this is more important on cold nights and results in saving animals which, caught early, might not survive the night in the traps. The other practice resorted to was that of transporting all white-footed mice (Peromyscus maniculatus) captured to points several miles away, thus leaving traps available to red-backed mice. When this was done, the number of red-backed mice taken the third and fourth nights was greater than would otherwise be expected. In all, 22 live red-backed mice were taken to Illinois. No other microtines were trapped.

It is thought that the mice obtained this year will be sufficient to provide the remaining data necessary for completion of the metabolism studies.

The information collected this summer together with the results of studies previously made are to be submitted soon to the University of Illinois in partial fulfillment for the Ph. D. degree.

# Ecology and Social Behavior of the Mule Deer

James Ruos
Gettysburg College
Project Number 85

During the summer of 1955 between the dates of June 16 and August 20, a secondary study was made on the species of mule deer, Odocoileus hemionus. Three objectives were kept in the foreground throughout this study: 1) to study the ecology of the mule deer in its natural, unrestricted habitat; 2) to observe the social behavior patterns found in this species; and 3) to familiarize the reader, as well as the writer, with the typical habitats and activities of the mule deer. The areas studied were combined into one term, the Teton Wilderness Area, for simplicity.

## Description of Habitat Types

Due to the fact that there was much variation of moose habitats it was found necessary to label these units according to types.

1) Spruce-Fir Forest--is classified generally as the climax species for the Teton mountain area. Deer were found to be most frequent in this type of forest habitat. These deer were discovered to be equally distributed in both the closed and open canopies. The open canopy areas offered excellent grazing conditions. This habitat is common at higher elevations.

2) Mixed Forest--are those forested areas common to the occurring change of climax, that is, Lodgepole supplemented by Spruce-Fir. This habitat is commonly found at moderately high elevations (7000 to 8500 feet). Deer were least found in this habitat type of the three major forest units. A solid preference was revealed for the closed canopy areas.

3) Lodgepole Forest--the predominate conifer forest of the lower elevations in the wilderness area. Mule deer were found to be quite common in both the open and closed canopies. These extensive Lodgepole forests often bordered on the larger "Willow-Grass" swamps.

4) Willow-Grass Swamps--the most typical of the moose habitats. Grazing deer were quite common in this habitat. There was a definite preference of the deer to utilize the drier borders of the swamps. The higher willows were used for cover and perhaps occasional browsing, and the swamp grasses for food. Deer beds were not uncommon in this type of locale.

5) Grass-Sage Meadows--are generally classified as hillside meadows found at higher elevations (8000 to 10,000 feet) although some were found below 6500 feet. This habitat is not to be confused with the dry-plains grass-sage habitat. This "Type 5" was found to be a common feeding ground for mule deer. It would be justifiable to state that the Grass-Sage Meadow of the higher altitudes would be the complement of the Willow-Grass Swamp of the lower elevations.

6) Burned Forest--although several burned areas were visited, no mule deer were observed. These areas occurred at higher elevations of approximately 8500 feet. Lush grasses were plentiful. Late June elk herds were observed on one of these areas. Due to the fact that a limited time was spent on these habitats, no conclusion should be made.

In conclusion--mule deer of the Teton Wilderness Area have adapted themselves to most ecological habitats common to the moose and in general terms, common to the entire area, an exception being mainly the deeply flooded swamps.

## Mule Deer Group Associations

During the summer pre-rutting season it was clearly observed that mule deer groups fall into two distinct categories which are listed as the following: 1) Mature Bucks
a-individual
b-groups of two
c-groups of three

2) Does
a-mature individuals; with yearlings
b-mature individuals; with fawns
c-groups of two mature individuals

In no case was a mixed sex group observed during the season.

These groups seemed to be influenced by three principal factors:

1) Sex
2) Time
3) Elevation

## Activity of Mule Deer

Activity depends upon five major factors:

a-season
b-time of day
c-atmospheric weather conditions
d-ground condition
e-physiological make-up of the individual deer

General conclusions:
a-sex plays little importance in "factor activity"
b-elevation is not assumed to be a direct factor, but acts as an element in that in a higher elevation there exists a colder climate and therfore deer tend to become most active at a respectively later time than those deer found at lower altitudes.
c-deer are most active during mornings and evenings
d-bedding down generally occurs after 10:-- A.M. in the morning and is assumed to occur after 8:30 P.M. in the evening.

Range of Activity

It was also concluded that mature buck deer tend to be found at higher altitudes during the summer migration than the mature does without fawns. Does with fawns are assumed to migrate to a lesser extent and are expected to be found in the lower elevations of the range. It was also noted that the maximum elevation attained by migrating deer during the mid-June to mid-August season was found to occur in mid-August.

## Special Types of Behavior

Included in the category of special types of behavior are observations of unusual, yet normal, reactions of mule deer in uncommon and common circumstances. Insects including mosquitoes and flies are probably responsible for altitudinal migration. The deer were not greatly disturbed by man. Domestic animals do not produce flight, but deer will yeild to their intrusion. Deer and moose are frequently found together, but apparently deer and elk do not share the same area.

A Comparison of Ant Communities at Increasing Altitudes

Dr. Gerald Scherba
Chico State College
Chico, California

Project Number 80

Objectives: The overall goal of this study is a comparison of the structure and composition of the ant communities at different altitudes in Western Wyoming. In doing this we hope to establish some of the basic characteristics of ant communities in general, and to arrive at a picture of the ant fauna of the Jackson Hole region. This kind of a study should lead to an increased understanding of animal communities and of biotic communities in montane regions.

Methods: Operationally this investigation has been partitioned into three phases:

1. Ecological reconnaissance--in which the ant fauna of distinct plant communities has been intensively collected, and observations made on nesting habits, relative abundance and behavior. Particular attention has been given to the relationships between ant species, and to the reciprocal influences of the ant community on the plants and other animals.

2. Statistical comparisons--testing the significance of observed differences in relative species frequency, density, nesting preferences, distribution patterns and associations in a series of selected communities.

3. Community integration and dynamics--where laboratory observations are made on relationships between ant species in order to check field observations. In the field the relationship between activity pattern and the microclimate is compared for different species within the community.

Results: At the present writing phase 1 has been completed. The ant fauna of over 40 plant communities has been investigated. These can be grouped as follows:

1. 6500-7000 feet
   Big Sagebrush Community
   Aspen Forest
   Lodgepole Pine Forest

2. 8500-9000 feet
   Big Sagebrush Community
   Aspen Forest
   various Conifer Forests

3. 10,000-11,000 feet
   Whitebark Pine Forest
   Wind Timber Zone
   Tundra

In each case several stations were selected, being as careful as possible to choose areas that were ungrazed and untimbered and in a mature condition, or in the same stage of succession. Numerous observations

concerning the relationships within the several communities have been made, and a considerable quantity of preserved material has been collected for determination during the coming year. When these observations are connected with the taxonomic data a cohesive picture of the ant community at each area should begin to emerge.

In addition, preliminary observations have begun on the succession of ant communities in lodgepole pine forests in which datable fires have occurred extending from 1 to 25 years ago. The effect of cattle grazing on the sagebrush ant fauna has also been investigated in a preliminary way by using island communities in Jackson Lake and a series of mammal exclosures established by the Forest Service in the Hoback River region.

(Grant from the New York Zoological Society.)

Swan Lake Research and Flora of Jackson Hole Area
W. G. Solheim
University of Wyoming
Projects Number 75 and 81

Swan Lake Research Project: A detailed study of the flora of this lake was carried on from the middle of June through the first week in August. During this period plankton algae samples were taken weekly. These samples were secured with the cooperation of Drs. L. Floyd Clarke, George Baxter, and other personnel at the Research Station. In addition frequent and numerous samples were also secured of the algae attached to other aquatic plants and the bottom. Specimens of macroscopic flowering plants were secured as they matured sufficiently for identification. The taking of plankton samples was continued through the month of August by Drs. Clarke and Baxter.

The collections will be studied in detail as time permits. It is hoped that identification of all the specimens may be completed by the end of the 1955-56 academic year. Since the University of Wyoming does not have the literature necessary for the identification of the algae these will have to be sent to specialists for study.

Flora of the Jackson Hole Area: During the period from the middle of June through the first week in August collections were made throughout most of the Jackson Hole area including the Grand Teton National Park. The major effort was centered in the collection of fleshy and parasitic fungi. Collections were, however, also made of liverworts, mosses, ferns and phanerogams. These were collected in quantity sufficient to make three specimens. These, when identified, will be deposited in the Herbarium at the Research Station, the Grand Teton National Park Herbarium and Rocky Mountain Herbarium at the University of Wyoming in Laramie.

Most of the fleshy fungi will be sent to Dr. Alexander H. Smith of the University of Michigan for study. The remainder of the fungi will be studied and identified by the author and occasionally by specialists to whom a few will be sent.

The total number of specimens collected exclusive of the algae is 628. This is a considerable number but much field work must still be done in order to give an adequate picture of the flora of the area.

(Supported by University of Wyoming.)

Influence of Nerves on the Regeneration and Regression
of Limbs in Amphibia

Dr. Charles Thornton
Kenyon College, Gambier, Ohio

Project Number 68

Two problems were investigated, both involving the use of Amblystoma tigrinum larvae collected in a pond near Pacific Creek.

I. In order to investigate further the influence of nerves on the formation of the apical epidermal cap in limb regeneration, limbs of larval tiger salamanders, along with 5 mm. sections of spinal cord, were transplanted to the back fin of host larvae. After establishment the grafted limbs were amputated. The intracentral nerve fibers of the spinal cord deplants grew into the limb deplants, induced formation of apical caps and thus supported regeneration. It is concluded that foreign nerve fibers not normally associated with muscles and skin can thus stimulate regeneration. Control limb deplants with no spinal cord deplant failed to regenerate except for 6 (out of 38) which showed indications of small pointed blastemata when local nerves succeeded in innervationg the limb deplant.

II. The influence of the apical epidermal cap on limb regeneration was tested by mechanically removing the cap daily as it formed on the limb stump. Regeneration was inhibited. Similar amounts of epidermis removed daily from the lateral surface of the limb stump tip did not inhibit regeneration.

(Grant from National Science Foundation.)

The Food Habits of Small Mammals

Dr. Olwen Williams
University of Colorado

Project Number 84

Snap-traps were set in a variety of habitats in Teton National Forest for a total of 815 trap-nights during the first three weeks of August 1955. These habitats included a whitebark pine forest, a spruce-fir forest, a subalpine meadow, and a lodgepole pine forest. During the trapping period 149 animals were caught, mainly Peromyscus maniculatus artemisiae, providing 131 stomachs the contents of which could be satisfactorily examined. In each case the examination was restricted to a rapid qualitative survey of the items present. A careful quantitative re-examination of each stomach will be made this winter. A collection of seeds and fruits was taken from each area where necessary to help in the recognition of unfamiliar items.

The initial results seem to verify previous observations. Peromyscus maniculatus, in this part of North America at least, is an opportunist utilizing within certain limits any foods that are abundantly available. Little was learned about the food habits of the other mice caught because of the small number of specimens taken.

Since the trapping technique used to secure most of the specimens used in the food habit study was one that we have used many times in the past to secure relative population figures, some information was obtained concerning the population levels of mice in the different habitats studied. In comparison to similar situations studied in Colorado Peromyscus populations appeared to be fairly high while Microtus populations were very low.

The study constituted a small part of a larger study we are making concerning the causative factors underlying small mammal distribution in the Rocky Mountain area.

## PROJECTS FOR 1956

Margaret Altmann - A study of social behavior patterns in moose of Wyoming.

Kenneth B. Armitage - Ecology and social behavior of the yellow-bellied marmot.

George T. Baxter and L. Floyd Clarke - Study of effects of pollution on Swan Lake.

Alan Beetle - Study of range condition sponsored by Wyoming Natural Resources Board.

Dorothy Beetle - Collection of land and freshwater molluscs.

Garth Kennington - Metabolic differences associated with the altitude.

James Opsahl - New project.

Gerald Scherba - A comparison of ant communities at increasing altitudes.

Charles Thornton - Influence of nerves on the regeneration and regression of limbs in amphibia.

Olwen Williams - Food habits of small mammals.

Other research workers have also indicated a desire to come to the Station next summer.

## SEMINARS

An outstanding series of seminars was held during the summer with the following people participating. These seminars were held in the director's house. Slides and other visual aids were presented. Refreshments were served during the informal discussion periods which followed the lectures. This contributed to the informality of the occasion.

Margaret Altmann - Comparative aspects of behavior of big game animals.
Charles Thornton - Regeneration in amphibians.
W. G. Solheim - Plant distribution and ecology of Wyoming especially Jackson Hole.
Charles LaMotte - Plant reproduction and genetics with special emphasis on development of grasses.
Paul Pirlot - Research programs in biology at the Institute of Scientific Research in the Belgian Congo, illustrated with slides.
Gerald Scherba - Distribution of ant colonies.
Garth Kennington - Differences in metabolism in various altitudes.
David Love - Geology of Jackson Hole area.
Kenneth Armitage - Ecology of marmots and trip to Central America.
Alan Beetle - Origin and evolution of grass plains and problems in connection with study of sagebrush-grass competition.

Slides of wildlife and scenery were projected on several occasions for the enjoyment of the families of research workers. Informal conferences on station problems of mutual concern were held with station personnel. Campfire sings and picnics were held about once each week in which all participated.

## LIBRARY

The reorganisation of the library described above under physical facilities increased the utilization of books and periodicals because of the more ready access of the volumes to the investigators. Although some delay was encountered in obtaining subscription renewals, all the journals for which the University has subscribed were coming regularly to the Station during the past summer.

Reprints continue to come in from research workers of previous years. These are made available as needed. A list of the reprints from publications which we have available on research conducted at the Station is attached. Other papers are now in the process of being published. Duplicate copies of all reports of research workers during the past two summers are being prepared for use by the personnel at the Station. One copy is kept on file in the Department of Zoology at the University.

## COOPERATION WITH OTHER AGENCIES

Research workers at the Station cooperated with the Park Service, Forest Service, and Wyoming State Game and Fish Department exchanging ideas and mutually assisting each other to the benefit of all concerned. The Park Service personnel utilized the station laboratory including the museum for study. The relations with all these agencies were most friendly and helpful. We especially appreciate the cooperation of Mr. Frank Oberhansley, superintendent of Grand Teton National Park, Mr. Jepson, chief naturalist, and Mr. Arthur Buckingham, supervisor of the Forest Service.

## IMPORTANT VISITORS

President Humphrey and the Board of Trustees made an official visit. The director of the Station met with them and explained the operation of the Station.

Dr. Paul Pirlot, Institute of Scientific Research in Central Africa, Belgian Congo. Interested in research projects in progress. Was accompanied by his family.

Dr. Mark Keith and wife, Duluth Center of the University of Minnesota. Specialist on leeches; was consulted in identification of leeches in Swan Lake and other areas. Made collections.

Dr. Roy F. Cain, Department of Botany, University of Toronto. Collected fungi and consulted with Dr. Solheim on herbarium collection.

Dr. Ralph Ames, Head of Department of Botany, Utah State, mycologist, made collections and worked with Dr. Solheim on taxonomy of plants in area.

Mr. Eugene Cronin, Botanist with U.S.D.A. in Utah, made collections.

Dr. Kent H. McKnight, Professor of Botany, Brigham Young University. Aided in identification of museum specimens.

Dr. B. H. Willier, Head of Division of Biological Sciences, Johns Hopkins. Interested in general program of research. Accompanied by his family.

Dr. Walter Wilde, physiologist at Tulane Medical School. Interested in high altitude physiology work. Accompanied by his family.

Dr. Howard Holtzer and wife, Department of Anatomy, University of Pennsylvania School of Medicine. Special interest in regeneration studies, consulted with Thornton.

Dr. William Longhurst, wildlife conservationist, University of California. Made observations on ecology of area.

Dr. Murray Buell, Department of Botany, Rutgers, president of Ecological Society of America. Made observations of opportunities for ecological study in the area.

Dr. Gordon Alexander, head department of Zoology, University of Colorado. Accompanied by his son, made study of birds in area.

Dr. David Barry, State Teachers College, Mankato, Minnesota with a group of students on a field natural history trip.

Members of the Biology Teacher's Institute being held on campus on three different occasions. They were interested in the various research projects underway.

Numerous visitors who were in the area for the meeting of the Western Association of State Game and Fish Commissioners.

# INANCIAL REPORT

1954-1955
(November 1, 1945-June 30, 1955)

| Item | Budgeted Amount | Expended Amount | Unexpended Amount |
|---|---|---|---|
| Part-time Assistants ..... | $ 400.00 | $ 400.00 | |
| Equipment ..... | 577.14 | 225.85 | |
| For cabins and laboratory | | 351.29* | |
| Supplies ..... | 236.63 | 97.11 | $ 2.52 |
| | | 137.00* | |
| Contractual ..... | 257.28 | 154.75 | 2.53 |
| | | 100.00* | |
| Materials ..... | 149.68 | 27.56 | .12 |
| | | 122.00* | |
| Travel ..... | 162.40 | 162.27 | .13 |
| Total ..... | $1,783.13 | $1,777.83 | $ 5.30 |

1955-1956
(July 1, 1955-October 1, 1955)

| | | | |
|---|---|---|---|
| Part-time Assistants ..... | $1,000.00 | $ 150.00 | $ 850.00 |
| Equipment ..... | 470.00 | 319.69 | 150.31 |
| Supplies ..... | 677.00 | 368.23 | 308.77 |
| Contractual ..... | 1,122.00 | 416.32 | 705.68 |
| Travelling ..... | 300.00 | 130.00 | 170.00 |
| Capital Outlay ..... | 773.00 | | 773.00 |
| Total ..... | $ 4,342.00 | $ 1,384.24 | $ 2,957.76 |

*These amounts were transferred into the next year's budgeted amount. Materials was transferred to Contractual.

$528.39 received for lodging at the Station was placed in the General Fund of the University.
The New York Zoological Society contributed $500 toward the Director's salary in the form of an honorarium.
Grants-in-aid in the amount of $1500 were given by the New York Zoological Society.