

REPORT ON THE ACTIVITIES
OF THE
JACKSON HOLE BIOLOGICAL RESEARCH STATION
SUMMER 1962

L. Floyd Clarke, Director

PHYSICAL FACILITIES

During the past year some improvements were made in the physical facilities of the Research Station. A new 1,000 gallon septic tank together with the sewage drainage system was installed. This is essential to maintain adequate sanitary conditions at the Station. New laboratory tables were installed in both the zoology and botany laboratories. Additional equipment was purchased as needed to meet the needs of research workers. The Station is now in relatively good position in the standpoint of available equipment.

The second year of operation with the new highway coming close to the Station proved that this condition did not result in as much disturbance to our operation as had been previously anticipated. All roadways within the Station grounds were eliminated with the exception of a central driveway with the result that the areas previously used by vehicles are beginning to become revegetated. This results in a decrease in the amount of dust and improves the appearance of the Station grounds.

The Station is still in need of two major improvements, neither of which will necessarily increase the total number of investigators, but will provide for improved operation and convenience. The first of these is the construction of a seminar-library building to eliminate the necessity of holding the seminars in the living room of the director's house and also to provide adequate space for books and periodicals which the Station is building up. Currently the library is housed in the zoology laboratory, but this is seriously hampering space for laboratory use. A budgeted item has been included in the 1963-65 University of Wyoming budget to provide some funds to help out with this construction. One of the serious handicaps to obtaining funds for construction is the short-term contract which is now in effect between the Park Service and the New York Zoological Society and the University of Wyoming. Our attempts to obtain a long-term agreement recently received a temporary set back when we were informed by the Park Service that they felt it was desirable to continue on a short-term basis until their own research program had been definitely crystallized. We trust this is only a temporary cut back, since most Park officials with whom we have had contact seemed to favor a longer term agreement.

The second major construction item is living quarters for investigators who come to the Station without families. The present dilapidated building being used for this purpose will be torn down as soon as adequate quarters can be provided.

SUMMARIES OF RESEARCH PROJECTS CARRIED OUT IN 1962

The Social Role of the Aging Ungulate
Margaret Altmann
University of Colorado
Project Number 77

The research on the Social Role of the Aging Ungulates, sponsored by the National Institutes of Health through the University of Colorado, was carried out according to plan during the 1962 field work period. Evaluation and interpretation of data and observational materials are still in progress and shall yield extensive reports later on.

Some of the findings shed light on the differential role of the sexes as to behavioral pattern in old age. For instance, aged females in elk and bison occupy frequently a social position within the herd or group. This position permits the aged elk or bison to participate to an extent in the shielding, warning and defense activities of the herd. Participation in the care of the calves is also part of this pattern. Only during the stress period of the fall rutting season have we observed occasional cases in which aged elk cows drop out of a group and live alone or are joined by a few yearlings. Aged bison cows were never found in solitary positions.

In contrast to these behavior patterns in females we found that aged bison bulls show any of the following behavior types:

- 1) The bison which stays on in the herd in prominent position despite old age.
- 2) The aged bison which leaves the herd and lives a solitary life.
- 3) The aged bison yielding to threat or combat to stronger and younger bulls moves into marginal position to the herd, he lives as "outrigger". "Outrigger" position means that the bison herd is within scenting, hearing or visual distance and that the aged bull shares the movements of the herd. Temporary rejoining and leaving of the herd have been noticed in this type.
- 4) The aged bison which forms an outside small bull band or takes a single younger bison as a living partner.

In aged bull elk a tendency to solitary living and early migration to winter habitats has been observed.

Related research activities during the 1962 season concerned the writing of a book chapter on Naturalistic Observations on Maternal Behavior in Moose and Elk, a contribution to the Handbook on Maternal Behavior in Mammals edited by H. Rheingold, published by John Wiley & Sons (in Press).

Among the interested visitors to our research project during this summer and fall were: Professor John Emlen, University of Wisconsin; Professor W. C. Young, University of Kansas; Professor Erickson, University of Illinois;

Dr. S. Barron, N.I.H., Bethesda, Maryland; Professor K. Armitage, University of Kansas. These visitors precipitated many stimulating discussions and some were taken into the research areas for first-hand observations.

Assisted by John McLeod and Steve Martin, University of Wisconsin. Supported by Grant No. M2599, National Institute of Mental Health.

Trends of Vegetation in the Near Six Elk Enclosures
on the Northern Yellowstone Wildlife Winter Range
Robert C. Bergstrom
University of Wyoming
Project Number 121

Four vegetation sampling methods used by Walter Kittams and Gail B. Denton in 1958 and duplicated and extended this year by the writer and William Barmore are listed below:

1. The Parker 3-step line transect.
2. 32" square quadrat.
3. Belt transect (50 and 100 ft.).
4. Photography (on all the above sampling methods).

At Junction Butte a new elk enclosure was located and erected during the summer and all of the above listed sampling techniques were used in setting up a permanent type sampling in the area. Conclusions drawn by the writer are summarized in the report submitted to Yellowstone National Park authorities for each of the six elk enclosures and similar vegetation near each enclosure. The more pertinent trends shown by the study are summarized below:

1. Grass species show little change since 1958. Apparently too much topsoil (1-3 inches) has been lost in the Gardiner-Stevens Creek area for good production on the most heavily used sites in or outside the enclosures.
2. Willow (several species of Salix) and aspen are being severely decreased in density in the Lamar-Horseshoe and in much of the northern elk range.
3. Big sage (Artemisia tridentata) is slowly, in most areas, but rapidly in the Gardiner-Stevens Creek area, being eliminated.
4. Other browse plants such as Lonicera sp., Prunus sp., Vaccinium sp., Chrysothamnus viscidiflorus, and Tetradymia canescens are less heavily damaged but are threatened in local areas.
5. Willow and Aspen are showing spectacular gains in height and diameter inside the elk enclosures.
6. On many small areas such as knolls and upper portions of south facing slopes, much of the total plant density consists of undesirable forage species such as Phlox multiflora and P. hoodii, Chrysothamnus sp., Antennaria sp., and Artemisia frigida. Increase of these species with loss of Agropyron spicatum and Festuca idahoensis is, of course, undesirable.

Recommendations for future work in the Lamar Horseshoe and along the Yellowstone River to the Gardiner area are listed:

1. Reread grassland quadrats and line transects at 5-10 year intervals.
2. Reread only "outside" aspen, willow and sage belt transects at 2-5 year intervals. Trend inside the exclosures on these species is already well established.
3. Use denuded areas inside exclosures for a plant-succession study. One plot of this type is located about 40 feet south of 0'.0" stake of the C₁-T₂ inside transect on the older (1958) elk exclosure. Soil is sandy-loam and erosion pavement. Bare area is about 15'x 6'. Invading plants now present are Camelina microcarpa, Agropyron spicatum, Erigeron corymbosus, Sedum stenopetalum, Astragalus miser.
4. Establish study on wildlife summer range to see if this high altitude is as good as previously assumed.
5. Check source of heavy sheet erosion along Cache and Miller Creeks.
6. In future studies allow two weeks at the culmination of study for analysis of vegetation trends.

Worked with William Barmore, Assistant Management Biologist, Yellowstone National Park, on this project.

Supported by a grant from Yellowstone National Park.

Limnological Studies on Swan Lake and Third Creek
L. Floyd Clarke and George T. Baxter
University of Wyoming
Project Numbers 74 and 108

The most significant new research done on the Third Creek study involved a detailed study of the insect fauna. Dr. Gordon Edwards assisted in this study and was responsible for the classification of these insects. A summary of this work appears elsewhere in this report under his project.

In connection with the age-growth study of brook trout in the beaver ponds of Third Creek, 110 brook trout were collected, lengths and weights taken, scale samples collected, and stomachs preserved for future study. Re-examination of the ecology of the five study Stations on Third Creek was carried out. During the summer of 1961 three Stations, I, IV, and V were stocked with 930 fingerling brook trout each. None of these Stations had trout in them previously. These three Stations were examined during the 1962 summer season and no fish were recovered from any of the three Stations, suggesting that they are unable to support a brook trout population. Up to the present time the reason for this inability to support brook trout has not been definitely determined, however, since all other factors are quite comparable to ponds in which brook trout are present, it is suspected that the lack of O₂ during winter months when these ponds are frozen over could be

responsible. Oxygen determinations during the winter months will be necessary in order to determine this.

Studies were continued on a restricted basis on the ecology of Swan Lake. General ecological conditions were noted and plankton and bottom samples collected. These studies will be compared with studies from previous summers to determine what important changes were taking place in the Lake as a result of the continuous addition of the effluent from the Colter Bay sewage. It is quite evident from the studies made up to this point that the Lake is serving effectively as a sewage lagoon. Undoubtedly the use of the Lake for this purpose only during the summer months with approximately a nine months period for recovery each year allows it to recover so that the rate of deterioration is not rapid.

Supported by the University of Wyoming.

Some Aspects of Plant and Animal Distribution
as Affected by Geologic Formations
Kenneth L. Diem and Garth S. Kennington
University of Wyoming
Project Number 112

Research carried on in the summer of 1962 was a continuation of a three year study initiated in 1961. The study will attempt to evaluate and correlate quantitative and qualitative differences of various plant and animal populations occurring on five different geological formations. Study areas were located in Yellowstone National Park on Pitchstone Plateau, 8,800 feet, and on Two Ocean Plateau, 9,200 feet. In the Teton National Forest study areas were located on Big Game Ridge, 9,400 feet, and on Huckleberry Ridge, 9,200 feet. The Moran study area, 6,800 feet, was located in Grand Teton National Park, adjacent to the Biological Research Station. Geological formations represented by these study areas are Middle Pliocene pitchstone or rhyolitic glass; Oligocene pyroclastic andesitic conglomerate from the Wiggins formation; Cretaceous freshwater sedimentary sequence of sandstones, conglomerates, claystones and shales from the Harebell formation; Late Jurassic marine sandstone sediments from the Sundance formation; and sediments of fluvial and glacial origin, respectively.

Field work on the subalpine meadow study areas did not commence until the middle of July because of a late snow melt. From the middle of July until Labor Day a total of 71 mountain pocket gophers (Thomomys talpoides) were collected and frozen for analytical work. Measurements were taken of burrow cross sections on each area. The flowers, stems and leaves and roots of Agoseris, Lupinus, Achillea, and Erigeron were collected and frozen for analytical work. Ectoparasites were collected from each specimen. Two quart soil samples were taken at each area for use in quantitative and qualitative plant growth studies in plant growth chambers. A count of new pocket gopher mound diggings was made on each study area in late August to develop a comparative pocket gopher density index.

Research will be continued at the University of Wyoming concerning radiation and isotope accumulation, fat analysis, trace element analysis, complete elemental analysis of the parent rock strata, and chromatography analysis of various plant and animal tissues.

Assisted by Ralph Dimmick, University of Wyoming, and Allen G. Smith

Supported by the New York Zoological Society and the National Park Service. Cooperators were Grand Teton National Park, Teton National Forest, Yellowstone National Park, and the U.S. Geological Survey.

Population Study of Canada Geese in Jackson Hole, Wyoming
Ralph W. Dimmick
University of Wyoming
Project Number 113

General Objectives:

1. To determine the seasonal distribution, size, and productivity of the Canada goose population in Jackson Hole.
2. To evaluate the various factors influencing Canada goose habitat and productivity, i.e., variable stream flow, proposed water impoundments, hunter concentrations, etc.
3. To formulate a management plan suitable for protection of the habitat, optimum productivity, and wise harvest of the Canada goose population in Jackson Hole, Wyoming.

Results

Periodic censuses of the Canada goose population in Jackson Hole were made during the year. In 1961 the peak population occurred in late August and early September, when 733 geese were observed. The peak population was observed during September 10-14 when 855 geese were located. The goose population was lowest during the breeding season when 198 were counted on the study area. Approximately 44 per cent of the birds present on the study area during the period of nest site selection and incubation were actually engaged in the production of young.

A total of 40 Canada goose nests was located during the 1962 nesting season. The first nest was initiated April 4, with the peak of nest initiation occurring during April 11-20. The peak of hatching occurred May 16-30; the last clutch hatched June 15. The length of the nesting season was 73 days. Nest success was 62.5 per cent, with 29 nests hatching at least one egg. Mean clutch size for 34 nests believed to be complete was 5.5 eggs, and mean brood size was 4.8 goslings for 38 broods observed during a brood census.

Patterns of water releases from Jackson Lake Dam were examined to detect the influence of the dam upon goose production and movements. During the period 1956-62, these releases were believed to be not detrimental to Canada

goose production. No nest destruction on the Snake River could be attributed to flooding in 1962.

Returns from 1381 geese banded while moulting during the period 1955-1960 indicated a mean annual mortality of 8.6 per cent among adult geese. Of 284 returns from geese banded at Turbid Lake and Jackson Lake, 183 (64.4 per cent) were from birds harvested in Wyoming.

Of the climatological data examined, snow cover appeared to have the most effect upon the goose population. Locations of goose concentrations in Jackson Hole are directly related to food availability, and the covering of terrestrial food supplies forces the birds to utilize the aquatic food or to emigrate. The major wintering area for that portion of the flock which does emigrate is Roosevelt Lake, Arizona; 46 per cent of 101 foreign recoveries were from this area. The remainder were scattered along the route of migration.

Supported by the Wyoming Game and Fish Department.

The Ecology, Taxonomy, and Bionomics of Insects in the Grand Teton Area
J. Gordon Edwards
San Jose State College
Project Number 117

Several hundred insect specimens were collected and identified to Order and Family, and most were also keyed to the correct Genus and Species. These specimens will be left at the Research Station to serve as a reference collection to aid in the identification of additional local material in the future. Several interesting specimens were found including tremendous numbers of Mud-loving Beetles (Heterocerus) in certain mud-banks, two common kinds of Crawling Water Beetles (Haliphus) in almost every pond, an unusual caddis-fly larva of Family Hydroptilidae, and many interesting kinds of Coleoptera and Diptera larvae. Part of the study involved a cooperative program with Dr. Clarke involving collection and identification of insects from a series of beaver ponds in the Third Creek area. The identifications included the following:

Coleoptera

Dytiscidae, 12 genera with several different species identified under many of these genera.

Gyrinidae, 1 genus.

Halipilidae, 1 genus, 2 species.

Heteroceridae, 1 genus.

Hydraenidae, 1 genus.

Hydrophilidae, 5 genera.

Diptera

Chaobridae, 1 genus.

Chironomidae, 7 genera.

Culicidae, 3 genera.

Dixidae, 1 genus.

Ephydriidae, 1 genus.

Heleidae, 2 genera.

Tipulidae, 2 genera.

Ephemeroptera

Baetidae, 2 genera.

Caenidae, 1 genus.

Hemiptera

Corixidae, 2 genera.

Gerridae, 2 genera.

Notonectidae, 1 genus.

Saldidae, 1 genus.

Odonata

Aeschnidae, 3 species of genus Aeschna.

Agrionidae, 5 genera with more than one species under some.

Lestidae, 1 genus, 3 species.

Trichoptera

Hydroptilidae, 1 genus.

Limnephilidae, 1 genus, 2 species.

A few trout stomachs from these ponds were also analyzed, and the entomological contents were identified, but lack of time prevented completion of that aspect of the Third Creek research project.

In addition to the work on aquatic insects, a few field trips were taken into the alpine regions to supplement the work of the previous two summers. High altitude insects were collected above Togwotee Pass (at about 10,500 ft. elevation), and on top of Symmetry Crags (10,650 feet), Static Peak (11,294 feet), South Teton (12,505 feet), and Prospectors' Mtn. (11,231 feet). Generally speaking, the high altitude insects were scarce this summer, probably because of the abundance of cold and rainy weather, but several new records were established and a few interesting additions to our knowledge of alpine ecology resulted.

The maximum-minimum thermometer that had been left overwinter beneath a rock slab on top of Static Peak registered only minus 8° F. compared with minus 54° F. in the valley 5,000 vertical feet below. This once again indicates a relatively great stability of temperature in such microhabitats and helps to explain how insects and spiders are able to survive winter conditions high above timberline in our western mountains.

A trip to Grasshopper Glacier near Cooke City, Montana revealed no complete bodies of grasshoppers in the ice, however, numerous grasshopper parts were still in evidence. This is due no doubt to the rapid melting of the glacier during recent years. The huge ice cliff described as rising abruptly above the melt-pond ten years ago has disappeared.

Brief collecting trips were also made to the Beartooth Plateau (elevation 10,900 feet) and to the Bighorn Mountains, seeking to establish correlations between their insect fauna and that of the Tetons.

Incidental to the insect studies made on the Tetons was an observation of two bands of Mountain Sheep on Prospectors' Mountain. Two different bands, one of 11 ewes and the other of five ewes, but no lambs were observed.

The specimens collected during the summer are now being labeled, and will soon be undergoing generic and specific identification, after which it is presumed that certain new ecological, biological, taxonomic, and zoogeographic findings will be available for the use of other biologists.

Supported by the New York Zoological Society.

Effect of Visitors on Alpine Ecosystems in the High Tetons
Charles C. Laing
University of Nebraska
Project Number 97

Work was continued on this project started in 1958.

Assisted by Paul Sebesta, University of Iowa.

Study of Spiders of the Family Lycosidae in Jackson Hole
Donald C. Lowrie
Los Angeles State College
Project Number 119

An analysis of the family Lycosidae was made to determine the distribution, especially with regard to the ecological habitat, of the 23 species already recorded from this area. This was accomplished with regard to the common species which could be collected frequently enough to determine the general type of habitat for each. However, about ten of the seventeen Pardosas, for example, were insufficiently common to make any certain statements about where they would be found. Likewise, with regard to their tolerances for humidity. Enough data are available for only six species to clearly indicate their humidity preferences. Four species of lycosids not collected previously were found based on over 400 specimens collected at over thirty different localities from the valley floor to over 11,000 feet. It seems that much further work is necessary to get any idea of the ecological habitats of over half of the lycosids of the area. Additional data were collected on all species of the area, but further study is needed.

Exploratory work with the squash technique for preparation of cells for study of chromosomes was carried out and over seventy-five slides of spider eggs prepared for study this winter.

Data on food habits were almost completely unobtainable. Only two specimens were collected in the process of feeding. Laboratory feeding indicated that this was probably due to the fact that prey was fed upon and the dead and mashed body discarded usually within an hour. For future work it would seem practical to try laboratory feeding of various insects to determine which would be accepted; field observations are too few to be of much use.

Assisted by Mrs. Jackie Bonquet.
Supported by the New York Zoological Society.

Ecological Studies of the Amphitheater and Surprise Lakes
in the Teton Mountains
John Merkle
Flint Junior College
Project Number 120

The summer of 1962 was spent obtaining quantitative and qualitative data on the vegetation of the forested and non-forested areas around these two lakes. Since visitors, hiking and horseback, use this area the National Park Service asked for a comparison of used and non-used areas if possible.

The data were obtained by quadrats, 1 square meter for herbaceous plants and 2 x 5 meters for shrubs and trees less than 4.0 inches diameter breast height. This included frequency for all species and cover for the most important species. Tree data were obtained by a combination of the Bitterlich method for basal area and the 1/10 acre plot for frequency and abundance.

Three trips were taken to the study area, July 9-14, July 31- August 5, and August 22. The first two trips were utilized in collecting data and plants. The last was a one day final reconnaissance and to collect some species not in flower during the early trips. The number of daily visitors was also recorded for the above dates.

A complete report on this work is soon to be completed and turned in to the National Park Service for their use. Recommendations are to be made concerning future development and use of the area.

Supported by Grand Teton National Park.

Some Aspects of the Blood Physiology
of Amblystoma tigrinum melanosticum
Paul G. Roofe
University of Kansas
Project Number 116

Forced hemopoiesis within the cartilage skeleton.

Twenty splenectomies were performed on Amblystoma larvae (90-100 mm.) and placed back in the pond near the Moran turnoff. These were left in a wire cage, 20" x 20" x 8", submerged (3 inches from the mud on the bottom) for a period of 17 days. Twenty pseudosplenectomies (body wall completely opened but spleen left intact) were treated in a like manner on the same sized individuals. Twenty normal (untreated) larvae were handled in the same fashion.

Only one of the splenectomized animals failed to survive. The wounds in all cases healed perfectly to the point in many cases it was impossible to tell where the incision was placed.

Comparisons of the hemopoietic activity throughout the entire reticulo-endothelial system will now be undertaken to determine whether cartilage

and liver have the innate ability to respond to this type of forced hemopoiesis.

Samples.

Stomach content of Amblystoma larvae was taken from 20 specimens. Only the contents of one showed the following:

126 Pseudochironomus larvae
3 Procladius larvae

No tubifex larvae were found in the stomach, but were numerous in the mud on the bottom.

Changes in weights of organs and linear measurements from larvae to adult stages in Amblystoma tigrinum melanosticum.

Linear measurements consist of the following: total length; nose-anal length; difference between eyes; fore limb length; hind limb length; jaw length; jaw width; width of the pelvic girdle; width of the pectoral girdle; the width of the belly midway from an antero-posterior position.

The weights of all viscera will be compared and analyzed. Sixty adults were measured and fixed in 10% formalin. One hundred larvae were measured and fixed in 10% formalin. These were all held in the laboratory. However, on August 15, 3 weeks after the removal of the above, measurements on freshly removed 10 adult and 10 larvae specimens compared quite favorably with the laboratory specimens.

A total of 260 animals were carefully considered out of a total of 510 removed from the Moran Pond. This pond should be carefully considered for an all over ecological study. It could easily furnish rich and valuable data for the production of live weight (protein) of Amblystoma because of its circumscribed geographical position and readily measurable physical and biological parameters.

Supported by the National Institutes of Health.

The Breeding Behavior of the White Pelican
George B. Schaller
University of Wisconsin
Project Number 118

Between June 3 and August 22, 1962, I spent a total of 58 days in the southeast arm of Yellowstone Lake in observing the breeding behavior of the pelicans on the Molly Islands. The birds were watched from a canoe anchored near the colonies. In addition, I visited pelicans at their feeding and loafing areas away from the breeding grounds on 11 days. The following data give an indication of the information obtained.

Breeding behavior. The pelicans began to lay on about May 10 when the lake was still frozen and snow covered the ground. The first young hatched on June 8. The pelicans were divided into 8 distinct colonies on the two Molly Islands. Each colony tended to contain birds in the same stage of the

reproductive cycle, and a difference of 3 weeks existed between the most and least advanced colony.

Both adults incubate. Nest relief during incubation occurs once every two days, and during brooding once each day. The young are brooded constantly for about the first two weeks of their life; by the age of 3 weeks the unattended young begin to crowd together into groups or "pods." Small young are fed several times daily by both adults. Young in the pod receive only one large feeding per day, usually around noon. The parents are recognized visually by their young; conversely, parents also recognize and feed only their own young. The young begin to fly at the age of $2\frac{1}{2}$ months.

Displays. Pelicans exhibit several conspicuous displays. For example, their mating display consists of a strutting walk, given by both male and female, in which the crest on the head, the horn on the bill, and the yellow on the chest are prominently shown. Birds greet each other with raised head and extended pouch, and they show their submissiveness by pointing the bill to the ground and averting their heads. The latter two gestures are combined during the nest relief ceremony.

Population dynamics. About 600 breeding adults were present during early June. Juveniles apparently do not return to the islands until they reach adulthood. Censuses of the colonies showed a steady decline in the number of eggs and young throughout the season:

June 5	500+ eggs
June 22	300+ eggs and young
July 4	180+ eggs and young
July 20	143 young
August 11	117 young
August 21	117 young

This drastic decline was due to two principal causes: 1) during June the water of the lake rose 3 feet, wiping out about 80 of the 290 nests present; and 2) California gulls break open any eggs and devour any small young left briefly uncovered by the adults.

Supported by the New York Zoological Society.

Social Organization among Colonies
in the Ant, Formica opaciventris
Gerald Scherba
San Bernardino-Riverside State College
Project Number 80

Work this summer has involved an attempt to describe a pattern of social organization believed to exist between individual colonies of a species of Western mound-building ant. The population under study is located on Moose Island, in the ox-bow of the Snake River and has been under surveillance since 1957.

Results gathered this year indicate that:

1. Population size has remained stable over the 5 year period at approximately 400 mounds. These mounds can be classified into size and activity classes and their reproductive condition determined. Of the total population of mounds, 78% produced a brood in 1962, the remainder were broodless.
2. Workers visit between mounds up to a distance of 82 feet. Visiting rate is low, approximately 1%, but increases for bud nests recently founded. Workers from one nest visit at several nests and individual nests are visited by workers from more than one nest. The rate at which workers from one nest will visit other nests differs; one heavily visited nest has recently become less active and broodless. This single finding opens further possibilities for exploring and understanding the pattern of visiting which occurs.
3. An unexpected finding was that of a rodent, probably the Meadow Vole, Microtus montanus, that nests within the ant mounds. Laboratory observations indicate that the ants do not avoid the voles and that neither newborn nor adult voles are insensitive to the ant bites. Presumably the voles adjust their entry and departure from the ant mounds so that they do not coincide with the periods of greatest ant activity, but this is conjecture.

Supported by a three year grant from the National Science Foundation.
Assisted by Norman Heryford, University of Kansas.

SEMINARS

As in previous years seminars were held each Thursday evening at 7:30 in the home of the director. These were all well attended and furnished an excellent opportunity for all of the investigators to become better acquainted with research projects underway as well as to provide valuable suggestions to the investigators on their research program. The seminars continue to serve a very important function in the unification and stimulation of the research efforts at the Research Station.

The following is a list of seminars presented.

Margaret Altmann - Age and Social Role in Wild Ungulates.
George B. Schaller - Behavior of Mountain Gorilla.
Charles C. Laing - Effect of Human Use on Wild Lands in the Tetons.
Donald C. Lowrie - Competitive Exclusion Principle.
Gerald Scherba - Social Organization among Colonies of the Mound Building Ant.
J. Gordon Edwards - Ecology, Taxonomy, and Bionomics of Insects in Grand Teton Area.
John Merkle - Misconceptions in Plant Ecology.
Ralph Dimmick - Canada Goose Population Study in Jackson Hole.
Kenneth L. Diem - Influence of Geological Formation on Dependent Plant and Animal Populations.

LIBRARY

Periodicals previously subscribed were continued but no new ones added. The current periodicals were made available to the research workers before being filed in the stacks. We continue to receive reprints from research workers of previous years. The total number of the titles of published data resulting from work at the Station is currently well in excess of 100. Current National Park Service and Forest Service publications and information are made available to investigators. Reports on research projects, Annual Reports and other information related to the Station operation are made available. A list of the reprints of publications which we have available on research conducted at the Station is included as an appendix to this Report.

COOPERATION WITH OTHER AGENCIES AND INDIVIDUALS

The cooperation with Grand Teton National Park during the past year was better than any other previous season. This was due to increased interest of Park Service personnel in Research Station operations. Worthy of special mention was the very great interest which Mr. Willard E. Dilley, Chief Park Naturalist, showed in our operation. No Park Service representative with whom we have been in contact the past years has demonstrated the cooperation which Mr. Dilley has shown. As a result of discussions with Mr. Dilley relations of the Research Station with the National Park Service were re-evaluated. Participating in these discussions were Kenneth L. Diem, L. Floyd Clarke, and Willard E. Dilley. The following is a brief summary of the results of these discussions as prepared by Mr. Dilley.

1. Need for permanency to be attained by an agreement for no less than twenty years.
 - (a) The fiscal department of the University of Wyoming is of the opinion that the type of buildings used at the Research Station cannot be amortized in a period less than twenty years. New building construction could not be authorized for a shorter period.
 - (b) A long term agreement makes planning of the operations of the Research Station less difficult. Various contracts can be entered into by the University without the shadow of termination affecting the agreement.
 - (c) A long term agreement creates a more favorable situation when grants for research are sought from various foundations.
2. The staff of the Research Station believes that the present location is satisfactory and ideal in many respects. Geographically it is centrally located to most of the field work which researchers engage in. Pack horses and saddle horses can be obtained nearby. It is not too inaccessible for use during the winter season. Occasionally some projects require field work during the winter. Dr. Clarke and Dr. Diem felt that it would be very difficult to convince the Directors of the University of the justification for a move to another location.
3. Extent of facilities at the Research Station. The Director of the Research Station plans to keep the Station at about its present size. If a long term agreement is forthcoming, they plan to remove one bunk house and build a library-seminar building of about the same size. They would expect to replace all tents, trailers, etc., with adequate quarters. Any construction would be in the nature of upgrading their present facilities.
4. Pasturage for horses is not essential or even desirable. It is considered more economical to rent saddle and pack animals, with the outfitter furnishing all needed equipment.
5. It was felt that it would be desirable to state in any agreement, a few matters of policy as to the nature of research performed and the objectives of the Research Station. Most of the ideas discussed have been a policy of the Station as far as practice is concerned, but they were matters which had not been put in writing.
 - (a) The primary objective of the operation is to perform research which has local application or research which can best be done here because of some unique

feature of this area. This statement is not intended to confine research to the exact and artificial boundaries in the park.

- (b) All applicants who apply for permission to work from the Station facilities will be treated equally, giving no regard to the school or other institution with which they might be affiliated.
- (c) To avoid continuous use of the Station quarters and facilities by any one researcher to the exclusion of other qualified persons, projects are approved for no more than three years. In instances where a project is not completed within the three year period, the investigator may apply for an extension of one year. The board of directors may review the petition and decide if an extension is justified.

The pocket gopher study initiated in the summer of 1961 in cooperation with the Park Service was continued. Dr. Kenneth L. Diem is in charge of this project. Personnel of Grand Teton National Park, Teton National Forest and others continued their helpful advice on this project.

A new project was initiated in cooperation with the Park Service dealing with the study of alpine ecology. Dr. John Merkle was in charge of this project. Mr. Glen Cole, the Park Biologist, and Mr. Willard E. Dilley, Chief Naturalist, were especially helpful to Dr. Merkle in the initiation of this research program.

The cooperation of the Wyoming Game and Fish Department is also appreciated. The personnel of the Department, especially Mr. George Wrakestraw, assisted Mr. Ralph Dimmick in a Canada goose study. The Wyoming Game and Fish Commission also provided financial support for this project. They were also cooperative in providing the necessary permits for collection and study of game species in the area.

As in previous years investigators at the Research Station were available for advice on biological problems. Both private agencies and individuals and public agencies including the Park Service, Forest Service, and the Game and Fish Department were assisted by Research Station personnel.

Many scientists of national and international repute were visitors at the Station during the past summer. These and other people interested in our operation too numerous to list in this report were welcomed to the Station and had opportunity to visit the various investigators.

Again this year Dr. and Mrs. Fairfield Osborn and some of their guests visited at the Station. Dr. Osborn is President of the New York Zoological Society, which has so effectively cooperated with the Research Station in its development. We always appreciate his cooperation, advice and counsel.

Included in last year's Annual Report was a report dealing with cooperation with the Park Service for developing a plan of research in national parks, prepared by Dr. L. Floyd Clarke and Dr. Kenneth L. Diem with the advice and counsel of Dr. David Love of the U. S. Geological Survey, and various Park Service representatives. This was well received. During the past year and a half, at least, the Park Service has increased its interest in research very greatly. It has recognized the opportunity which national parks can provide for research of significance to the Park Service itself and other fields of biology.

STUDENT TRAINING PROGRAM

The Research Station of the past years has not only attempted to furnish opportunity for experienced investigators to develop significant research in which the area provides opportunity, but has also established programs in which students interested in biological research have been given the opportunity to work with experienced investigators. These students have received valuable information on methods and procedures in biological research. For the past several years the Station has cooperated with the National Parks Association and the National Park Service in a Student Conservation Program in which two or three students under this program worked on research projects at the Station. This program was discontinued during 1962, however, it is hoped that the Park Service will be able to continue this program in the future. However, the Station continued to provide opportunities for young investigators. Two biology majors from the University of Wisconsin, John McLeod and Steve Martin assisted Dr. Margaret Altmann in her study of ungulate behavior. Paul Sebesta, graduate student from the University of Iowa, was an assistant to Dr. Charles Laing on the study of effects of visitor use on the wild lands in the Tetons. Ralph Dimmick, graduate student from the University of Wyoming, in addition to study on his own project, assisted Dr. L. Floyd Clarke on a limnological study and Dr. Kenneth L. Diem on an ecological study of the elk summer range. Barton Baldwin, a biology student from New York, assisted Dr. Paul G. Roofe on his salamander studies and Dr. L. Floyd Clarke on the limnological study. Norman Heryford, graduate student at the University of Kansas, assisted Dr. Gerald Scherba on his study of ant ecology. Mrs. Jackie Bonquet, graduate student at Los Angeles State College, assisted Dr. Donald Lowrie on his study of spiders. All of these students had an opportunity to become acquainted with research activities of all the investigators at the Station.

Additional graduate students from the University of Wyoming had opportunity to come to the Station for short periods of time. All of these young investigators felt that the experience they received would prove very valuable in connection with their plans for continuing study and research in fields of biology.

FINANCIAL REPORT
1961-1962

November 16, 1961 - June 30, 1962

<u>Item</u>	<u>Budgeted</u>	<u>Expended</u>	<u>Carried Over To Next Year's Budget</u>
Part-time Assistants	\$ 200.00	\$ 200.00	\$
Equipment	1,245.61	131.67	1,113.94
Supplies	671.54	123.69	547.85
Contractual	1,325.05	64.15	1,260.90
Travel	356.40	15.75	262.40
Fixed Charges	36.00	36.00	
Extraordinary Expense	102.78		102.78
	<u>\$3,937.38</u>	<u>\$ 571.26</u>	<u>\$3,287.87</u>

July 1, 1962 - October 15, 1962

<u>Item</u>	<u>Budgeted*</u>	<u>Expended</u>	<u>Unexpended</u>
Research Projects	\$ 877.50	\$ 877.50	\$
Part-time Assistants	1,600.00	1,400.00	200.00
Equipment	1,293.94	419.10	874.84
Supplies	1,147.85	381.39	766.46
Contractual	2,103.90	681.51	1,422.39
Travel	484.40	257.84	226.56
Fixed Charges	36.00		36.00
Extraordinary Expense	177.78	124.12	53.66
	<u>\$7,721.37</u>	<u>\$4,141.46</u>	<u>\$3,579.91</u>

*Includes money carried over from previous year, therefore, does not indicate amounts appropriated for one year.

Rent received in the amount of \$757.70 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 \$1890.00 were given by the New York Zoological Society.

Yellowstone National Park grant - \$1500.

Grand Teton National Park grant - \$1000.

National Park Service grant - \$1000.

Other projects not included here were supported by grants from various sources as indicated after project summaries.

LIST OF PUBLICATIONS ON RESEARCH
AT
JACKSON HOLE BIOLOGICAL RESEARCH STATION

University of Wyoming
and
New York Zoological Society

Altmann, Margaret

- 1951 Patterns of herd structure in free-ranging elk. Abstr. Anat. Rec., 3(3):74.
- 1952 Social behavior of elk, Cervus canadensis nelsoni, in the Jackson Hole area of Wyoming, Behavior 4(2).
- 1953 Social graces in elk society. Bul. N.Y. Zool. Soc. Animal Kingdom, 56(3):66-72.
- 1956 Patterns of herd behavior in free-ranging elk of Wyoming, Cervus canadensis nelsoni. Zoologica, 41(2):65-71.
- Two marking devices for large land mammals. Jour. of Wildl. Mgt., 20(4):464. With Richard D. Taber and Anton de Vos.
- 1958 The flight distance in free-ranging big game. Jour. of Wildl. Mgt., 22(2):207-209.
- Social integration of the moose calf. Animal Behaviour, Vol. VI, Nos. 3 & 4, pp. 155-159.
- 1959 Group dynamics in Wyoming moose during the rutting season. Jour. of Mammal., 40(3):420-424.
- 1960 Moose runs from Sandhill Crane. J. of Mammal., 41(4):525.
- The role of juvenile elk and moose in the social dynamics of their species. Zoologica 45, Pt. 1:35-39.
- 1961 "Teen-age" problems in the wilderness. Animal Kingdom, 64(2):41-44.

Armitage, Kenneth B.

- 1959 Behavior patterns of juvenile yellow-bellied marmots (Marmota flaviventris nosophora Howell). Anat. Rec., 134(3):529.
- 1961 Frequency of melanism in the golden-mantled marmot. J. of Mammal., 42(1):100-101.

Bangham, Ralph

- 1951 Parasites of fish in the Upper Snake River drainage and in Yellowstone Lake, Wyoming. Zoologica, 36 (III).

Bangham, Ralph

- 1953 Studies on monogenetic trematodes: Dactylogyridae from Alaska, Wisconsin and Wyoming. *Am. Mid. Nat.*, 50(1):206-217. Published by John D. Mizelle and Francis O. Webb using Bangham's material.

Hypocaryophyllaeus gilae n. sp. (Cestoda: Caryophyllaeidae) from the Utah chub, Gila atraria, in Wyoming. *Proc. Helm. Soc. Wash.*, 20(2):113-117. Published by Jacob H. Fischthal using Bangham's material.

Baxter, John W.

- 1960 Aquatic Hyphomycetes from Wyoming. *Mycologia*, 52(4):654-655.

Beetle, Alan A.

- 1957 A study of range condition classes in the Jackson Hole region of Wyoming. Wyoming Range Management Issue No. 104. (Mimeographed.)

1960 A Study of Sagebrush. Bulletin 368, University of Wyoming Agricultural Experiment Station, June.

1961 Range Survey in Teton County, Wyoming. Part I. Ecology of Range Resources. Bulletin 376, University of Wyoming Agricultural Experiment Station, March.

Beetle, Dorothy E.

- 1956 Habitats of terrestrial Mollusca in Jackson Hole, Wyoming. *Jour. Colo.-Wyo. Acad. Sci.*, 55(8):43.

1957 The Mollusca of Teton County, Wyoming. *The Nautilus*, 71(1):12-22.

1960 Noteworthy records of Wyoming mollusca. *The Nautilus*, 73(4):155-157.

A checklist of Wyoming recent mollusca. *Sterkiana*, No. 3.

Bliss, L. C.

- 1956 A comparison of plant development in microenvironments of arctic and alpine tundras. *Ecol. Mon.* 26:303-337.

Carpenter, Charles

- 1953 Aggregation behavior of tadpoles of Rana p. pretiosa. *Herpetologica*, 9:77-78.

An ecological survey of the herpetofauna of the Grand Teton-Jackson Hole area of Wyoming. *Copeia*, 3:170-174.

Trapping technique for aquatic salamanders. *Herpetologica*, 8:183.

- 1954 A study of amphibian movement in the Jackson Hole Wildlife Park. *Copeia*, 3:197-200.

- Craighead, Frank C.
1951 A biological and economic evaluation of coyote predation.
N.Y. Zool. Soc. and the Conservation Found. July (booklet)
- Craighead, John J.
1952 A biological and economic appraisal of the Jackson Hole elk herd.
N.Y. Zool. Soc. and the Conservation Found. November (booklet)
- Craighead, Frank C. and John J. Craighead
1949 Nesting Canada geese on the Upper Snake River. Jour. Wildl.
Mgt., 13(1):51-64.

1950 The ecology of raptor predation. Trans. 15th No. Amer. Wildl.
Conf., pp. 209-223.
- Cummins, George B. and John W. Baxter
1962 Nomenclature, life histories, and records of North American
Uredinales. Madrono, 16(6):201-203
- Denniston, R. H.
1948 Certain aspects of the behavior of the Wyoming moose.
Jour. Colo.-Wyo. Acad. of Sci., 3(6):55.

1949 The development of a calf moose. Jour. Colo.-Wyo. Acad. of
Sci., 4(1):58.

Certain aspects of the development and behavior of the Wyoming
moose. Anat. Rec., 105(3).

1956 Ecology, behavior and population dynamics of the Wyoming or
Rocky Mountain moose, Alces alces shirasi. Zoologica, 41(3):
105-118.
- Emlen, John T.
1952 Social behavior in nesting cliff swallows. The Condor, 54:
177-199.

1954 Territory, nest building, and pair formation in the cliff
swallow. The Auk, Vol. 71.
- Findley, James S.
1951 Habitat preferences of four species of Microtus in Jackson
Hole, Wyoming. Jour. Mammal., 32(1):118-120.

A record of moose speed. Jour. Mammal., 32(1):116.

A tame red fox cub. Jour. Mammal., 32(1):117.

1954 Reproduction in two species of Myotis in Jackson Hole, Wyoming.
Jour. Mammal., 35(3):434.
- French, Norman R.
1955 Foraging behavior and predation by Clark Nutcracker.
The Condor, 57(1):61-62.

1959 Life history of the Black Rosy Finch. The Auk, 76(2):159-180.

French, Norman R.

- 1959 Distribution and migration of the Black Rosy Finch. The Condor, 61(1):18-29.

Gilligan, James P.

- 1954 Wildlife values in western wilderness area management. Jour. Wildl. Mgt., 18(4).

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- 1957 Comparative rates of survival of normal and deformed chub, Gila atraria Girard, in Two Ocean Lake, Teton County, Wyoming. Proc. Pa. Acad. of Science, 31:77-82.
- 1959 Ecology of the chub, Gila atraria with special emphasis on vertebral curvatures in Two Ocean Lake, Teton National Park, Wyoming. Ecology 40(4):564-571.

Kennington, Garth S.

- 1957 Influence of altitude and temperature upon rate of oxygen consumption of Tribolium confusum Duval and Camponotus pennsylvanicus modoc Wheeler. Physiol. Zool., 39(4):305-314.
- 1961 The influence of temperature and atmospheric pressure on the rate of oxygen uptake in Tribolium confusum. Ecology, 42(1):212-215.

Laycock, William

- 1953 Ecological notes on the pocket gopher in Wyoming. Jour. Colo.-Wyo. Acad. of Sci. 4(5):41.
- 1957 Seasonal periods of surface inactivity of the pocket gopher. Jour. of Mammal., 38(1):132-133.
- 1958 The initial pattern of revegetation of pocket gopher mounds. Ecology, 39(2):346-351

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- 1951 Report on a collection of spiders and harvestmen from Wyoming and neighboring states. Zoologica, 36(LV):219-237.
- A report on land snails of the Jackson Hole region, Wyoming. The Nautilus, 65(2):60-65.

Lowrie, Donald C. and Willis J. Gertsch

- 1955 A list of the spiders of the Grand Teton Park area, with descriptions of some new North American spiders. Amer. Museum Novitates, No. 1736.

McHugh, Tom

- 1958 Social behavior of the American buffalo (Bison bison bison). Zoologica, 43, Pt. 1, No. 1, April 4, 1958.

Miller, Dwight D.

- 1955 A study of sex combs in Drosophila affinis and Drosophila athabasca. Trans. of the Amer. Microscop. Soc., 74(2): 191-197.

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- 1950 A survey of Pasteurella tularensis infection in the animals of the Jackson Hole area. Zoologica, 35(II):129-131.

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- 1950 Breeding of three-year-old females in the Jackson Hole Wildlife Park buffalo herd. Jour. of Mammal., 31(4):463.

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- 1959 Mammals of Jackson Hole, Wyoming. Jour. of Mammal., 40(3):371-381. With James S. Findley.

Noble, Glenn A.

- 1953 An intestinal amoeba from the prong-horned antelope. Trans. of the Amer. Microscop. Soc., 72(3):249-252.

- 1958 Coprozoic protozoa from Wyoming mammals. J. Protozool., 5(1):69-74.

- 1961 Stress and Parasitism. I. A preliminary investigation of the effects of stress on ground squirrels and their parasites. Exper. Parasit., 11(1):63-67.

Patterson, Robert L.

- 1952 Sage Grouse in Wyoming. Sage Books, Denver, Colorado.

Rausch, Robert

- 1949 Paradilepis simoni n. sp., a cestode parasitic on the osprey. Zoologica, 34(1).

Rausch, Robert and Everett Schiller

- 1949 A contribution to the study of North American cestodes of the genus Paruterina Fuhrmann, 1906. Zoologica, 34(1).

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- 1948 Botanical investigations in the Jackson Hole Wildlife Park. Jour. Colo.-Wyo. Acad. of Sci., 3(6):40.

- 1950 The meadows of the Jackson Hole Wildlife Park. Jour. Colo.-Wyo. Acad. of Sci., 4(2):53.

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- 1961 Weights and linear measurements of the body and of some organs of the Tiger Salamander. Anat. Rec., 141(1):35-44. (With Homer B. Latimer and Lily S. Feng.)

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- 1957 An analysis of avifaunas in the Teton Mountains and Jackson Hole, Wyoming. The Condor, 59(6):373-393.

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- 1961 Nest structure and reproduction in the mound-building ant Formica opaciventris Emery in Wyoming. J. of the N. Y. Ent. Soc., 69:71-87.

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- The American elk or wapiti. Wildlife Series No. 1, Jackson Hole Wildlife Park.
- The Wyoming or Yellowstone moose. Wildlife Series No. 2, Jackson Hole Wildlife Park.

Smith, Dixie R.

- 1959 Changes in interspecific associations as related to grazing pressures. Jour. Range Mgt., 12(6):309-311.
- 1960 Description and response to elk use of two mesic grassland and shrub communities in the Jackson Hole region of Wyoming. Northwest Science, 34(1):25-36.
- 1961 Competition between cattle and game on elk winter range. Wyo. Ag. Exp. Sta. Bull. 377, 16 pp.

Solheim, W. G.

- 1960 Mycoflora Saximontanensis Exsiccata. Centum XI and XII. U. of Wyoming Publ. 24(3 & 4):22-33; 34-55.

Spencer, Warren P.

- 1950 The Drosophila of Jackson Hole, Wyoming--a taxonomic and ecological survey. Am. Mid. Nat., 43(1):79-87.

Thornton, Charles Stead

- 1956 Epidermal modifications in regenerating and in non-regenerating limbs of anuran larvae. Jour. Exp. Zool., 131(2): 373-394.

The relation of epidermal innervation to the regeneration of limb deplants in Amblystoma larvae. Jour. Exp. Zool., 133(2): 281-300.

- 1957 The effect of apical cap removal on limb regeneration in Amblystoma larvae. Jour. Exp. Zool., 134(2):357-382.

- 1958 The inhibition of limb regeneration in urodele larvae by localized irradiation with ultra-violet light. Jour. Exp. Zool., 137(1):153-180.

- 1960 Influence of an eccentric epidermal cap on limb regeneration in Amblystoma larvae. Dev. Biol. 2(6):551-569.

Regeneration of sensory limbs of Amblystoma larvae. Copeia, No. 4, pp. 371-373, Dec. 30.

Tiner, Jack D.

- 1951 Observations on larval carnivore ascarids in rodents. Jour. Parasit., 37(Sup.):21-22.

- 1952 Speciation in the genus Ascaris: Additional experimental and morphological criteria. Jour. Parasit. 38(Sup.):57.

- 1953 The migration, distribution in the brain, and growth of ascarid larvae in rodents. Jour. Infect. Dis., 92:105-113.

Fatalities in rodents caused by larval Ascaris in the central nervous system. Jour. Mammal., 34:153-167.

Williams, Olwen

- 1959 Food habits of the deer mouse. Jour. of Mammal., 40(3): 415-419.