

REPORT ON THE ACTIVITIES  
OF THE  
JACKSON HOLE BIOLOGICAL RESEARCH STATION  
SUMMER 1963

L. Floyd Clarke, Director

## PHYSICAL FACILITIES

During the past year two major improvements were made in the physical facilities of the Research Station. Both of these were financed and carried out by the Grand Teton National Park. The first of these involved the establishment of a sewage drainage system from the large septic tank installed the previous year. This drainage system carries the effluent to an area outside of the Research Station boundary and allows for drainage through a system of cross pipes. This results in the elimination of any possible surface sewage waste material in the area. The second project involved a complete rewiring of all outside electrical connections together with the installation of new fuse boxes for the Station as a whole and for each of the cabins. Some additional work still remains involving inside wiring, which we hope to have completed early next year.

Additional gravel was added to the driveway, and general Station improvements were effected.

The Station is still in need of the two major improvements referred to in last year's report.

1. A seminar-library building which will serve effectively as a study room for research workers and will increase the space available for seminars as well as result in greater convenience for those attending. The seminars are held in the director's home. The University of Wyoming 1963-65 budget contains funds for this construction, however, with the short-term lease now in effect between the Grand Teton National Park and the University of Wyoming and New York Zoological Society, we are reluctant to proceed with this construction especially since the Park Service has been considering plans for moving the Station to a new location.

2. We should also like to proceed with the elimination of our present bunkhouse and replacement by a more adequate building.

The Research Station staff would prefer to remain at the present location under a long-term lease and continue with the construction and improvement of facilities.

## SUMMARIES OF RESEARCH PROJECTS CARRIED OUT IN 1963

A Comparative Study of Interspecies Communications  
Margaret Altman  
University of Colorado  
Project Number 124

This project initiated this summer is to continue through May 1966. The project, a comparative analysis of interspecies communications and social interactions in wild free-ranging ungulates, aims to extend and correlate our previous research. The group of hoofed mammals has been strangely neglected in respect to behavioral research although it provides a wide variety of social patterns and interaction systems. Subprimate behavior-theory and ecology can expect to be greatly strengthened by recognition of these patterns.

From the standpoint of comparative group dynamics in "non-restrained" animals this research forms a logical next step in our long-range investigation of group behavior in wild ungulates. The particular emphasis in the proposed research is centered on an analysis of the signals, vocalizations, gestures and postures and olfactory cues which transmit understanding, between different species within the ecological web.

An application of the findings will also have some bearing on the field of human, non-verbal communications, child development, and on the field of comparative animal behavior, and of environmental biology.

Based on the experiences of the initial and recent studies of behavior patterns in free-ranging wild ungulates, we feel certain that thorough observation and analysis of behavior in wild, free-moving animal groups is possible, although the difficulties and hardships involved are considerably greater than those in work with confined laboratory animals.

In the course of our previous ungulate investigations we have found that the free-living animals have a large number of gross and subtle postures, vocalizations, and gestures which serve in communications within and between species groups. Our recent observations in the field have strengthened our conviction that the significance of the subtle communications in their effect and in their limitations deserve further study and analysis by an experienced investigator.

The average human observer is oblivious to a majority of the communications thus exchanged within and between wild animal groups. In some cases special recording methods may have to be developed, as for example, in the European work by Zippelius-Bonn, on supersonic calls in small-rodent communications. This project deals with a survey of the communications proper and attempts to describe the effects and limitations of such communications among and within the ungulate groups.

There are five main types of signal methods in the wild ungulates:

1. By posture (example: caribou warning)
2. By gesture (example: moose-threat - ears folded back)
3. By sound (example: elk cow-calf calls)
4. By position effect (example: detour elk yearling as sign of submission)
5. By olfactory means.

The observations on all five categories of communications shall shed some light on the differences in "carrying power" of signals and in understanding between species within an ecological web.

The species of wild ungulates selected for our proposed research are the Wapiti elk (Cervus canadensis), the Wyoming moose (Alces alces) and the bison (Bison bison). The animals will be observed in normal undisturbed condition and also in periods of stress and social change. Stress situations are used by us as an experimental device to reveal group structure and behaviors not readily revealed under other conditions. As a by-product of this project we expect to secure some longitudinal case histories of typical and deviate wild ungulates under observation.

Extension of the field research into the fall months will provide a definite advantage over the limited usual summer research periods by permitting the observation of the most crucial period of interaction, the ungulate mating season.

Assisted by Steve Martin, University of Wisconsin.  
Supported by National Science Foundation Grant.

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 conducted in the summer of 1963 was a continuation of a three year study initiated in 1961. The study areas have been described in the 1962 Biological Research Station report.

From the last of July until the end of August a total of 67 northern pocket gophers (Thomomys talpoides) were collected and frozen for analytical work. The flowers, leaves, stems and roots of Agoseris, Lupinus, Achillea, and Erigeron were collected and frozen for laboratory analysis. Five quarts of soil were collected on each area for soil analysis and plant growth experiments. Four rock samples were taken from each area to determine elemental composition of the parent rock strata. The comparative results of pocket gopher mound census for 1962-63 are given in the following table.

Northern Pocket Gopher, Thomomys talpoides, Population Densities  
in Soils of Five Geological Formations, 1962-63

Area and Formation	Gophers per Acre	
	1962 27 Aug.-2 Sept.	1963 22 Aug.-30 Aug.
Huckleberry Ridge	149	85
Huckleberry Exclosure (Cloverly-Morrison)	150	67
Big Game Ridge	102	101
Big Game Exclosure (Harebell)	56	90
Two Ocean Plateau (Wiggins)	104	96
Pitchstone Plateau (Rhyolite)	20	22
Moran (Glacial-Alluvial)	131	119

Research will be continued at the University of Wyoming concerning radiation and isotope accumulation, fat analysis, true element analysis, and chromatography analysis of various plant and animal tissues.

Assisted by Robert Casebeer, Teton National Forest; Allen Mebane Grand Teton National Park; and Allen G. Smith, U.S. Fish and Wildlife Service. Supported by the New York Zoological Society, the National Park Service, and the Research Council, University of Wyoming. 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

Censuses of the Canada goose population in Jackson Hole were made several times during the period September 1, 1962 and August 31, 1963. The greatest numbers of geese were present in September (855) and August (813). The population was lowest in mid-winter when 252 geese were located (February census).

An estimated 355 geese were present in the breeding population, of which 47 per cent were adults. Fifty nests were located; 46 per cent were successful in producing goslings. The mean number of eggs per completed clutch was 4.9 and the mean brood size was 4.5 goslings. Islands were selected most frequently for nest sites (64 per cent). Specific cover types utilized for nesting were shrubby (30 per cent) and driftwood (26 per cent). The first nest was initiated March 23, with the peak of nest initiation occurring during April 1-15. The peak of hatching occurred May 1-20 and the last active nest was destroyed June 21. In that portion of the study area from Jackson Lake southward the length of the nesting period was 91 days.

An experiment to develop a field technique for estimating the incubation stage of goose eggs was conducted. The technique was moderately reliable when combined with field observations at the nest site. Goslings obtained from the incubation experiment were reared at the Biological Research Station and photographed at weekly intervals. Age-specific characters were recorded in an attempt to develop a technique for aging goslings in the field.

Patterns of water release from Jackson Lake were compared with data concerning inflow of water into the lake. During most years since 1954, the dam delayed and/or decreased the flood crest in the Snake River below Jackson Lake.

Life tables were constructed for Canada geese banded at Turbid Lake in Yellowstone Park. Additional banding was done at Turbid Lake, and 284 geese were color-marked, sexed and aged.

Several observations were made of neck-banded geese in Jackson Hole during August. These observations were utilized in a Lincoln Index estimation of the population migrating through Jackson Hole during autumn (2292 geese). This result compared favorably with the result from a method which utilized the ratio of non-breeding to breeding geese combined with reproductive data (2618 geese).

Supported by the Wyoming Game and Fish Department.

A Study of the Plant Ecology of the Willow Flats  
William C. Edwards  
University of Nebraska  
Project Number 121

This was the initial summer of a proposed three summer research project on the Willow Flats area west of the Research Station on Second Creek. The majority of the work consisted of field observation, collecting specimens, and identification of specimens.

The literature at the Station was reviewed and much valuable information was obtained from papers written by Dr. John Craighead and Dr. Frank Craighead, Neil Bassett, and Dr. John Reed on the plant ecology of the area. Willows of Wyoming by Dr. George Argus was used especially for identification of the willows. Flora of Idaho by Dr. Ray J. Davis and Flora of Colorado by Dr. H. D. Harrington were used.

Some work was done at the Yellowstone Park Herbarium and the Grand Teton Park Herbarium. A four day trip was made to the Rocky Mountain Herbarium where positive identification was made of some of the specimens collected. Three trips were taken to the subalpine and alpine areas to collect willows.

Twenty-five willows, most of them different species, were permanently tagged with aluminum tags and with a red tag for quick location. Several collections were made from each specimen through the summer and collections will continue next summer. One hundred thirty specimens were collected representing twenty-eight plant families with concentration of collecting on the Willow Flats and of the willows themselves.

Tentative sites for an intensive ecological plant study were selected in the Willow Flats, and next summer these sites will be studied intensively.

Assisted by Warren Schimpff and Michael Kersten, SCP students.  
Supported by a grant from the New York Zoological Society.

An Ecological-Physiological Study of Moose  
Douglas B. Houston  
University of Wyoming  
Project Number 125

An ecological-physiological study of the Shiras moose population in the Jackson Hole area was initiated in August of 1963. Moose population dynamics will be one phase of the study, and will involve calculations of population productivity, sex and age structure of the population, and factors regulating population numbers and success. Measurements of physiological condition of the population as related to forage conditions, sex and age, and behavior will be attempted. Other phases of the study involve moose-habitat relationships and spatial distribution and mobility of the population.

A Study of Forty Big Game and Livestock  
Exclosures in Northwestern Wyoming  
Webster B. Jones  
University of Wyoming  
Project Number 126

A one year study of forty big game and livestock exclosures on the Bridger, Targhee, Teton and Shoshone National Forests was started in June of 1963. The exclosures involved in the study are listed below.

Greys River Boundary (2)	Crystal Creek (1)
Squaw Flats (2)	Little Bald Ridge (2)
Meadows (2)	Big Creek (1)
Station Creek (2)	Wall Creek (1)
Camp Creek (1)	Boulder Creek (2)
Bryan Flatts (1)	Elk Fork (2)
National Elk Refuge (4)	Cougar Creek (1)
Miller Butte (1)	Horse Creek (1)
Goosewing (2)	Pickett Creek (2)
Upper Slide Lake (1)	Alkali Basin (2)
Coalmine Draw (1)	Button Draw (2)

The objectives of the study are:

1. To inventory the exclosures.
2. To compare changes along their fencelines.
  - a. To relate changes to age of the exclosure.
  - b. To relate changes to distribution of livestock and wildlife.

The methods and procedures used are as follows:

1. Inventory will follow the methods used previously at a given exclosure, if practical, in order to get the best readings on trend. However, for speed and ease the University of Wyoming square-foot-ground cover estimates will be used except where Parker-three-step or other point methods will give more easily interpreted data.
2. In so far as possible similar data will be gathered at each exclosure, including frequency, cover and composition both within the exclosures and outside.
3. Composition effects of livestock and wildlife will be intensively studied through comparison of paired exclosures.
4. Previous data will be processed and used for comparison when it is available.

Funds were provided by the Wyoming Natural Resource Board and was supported by the Wyoming Agricultural Experiment Station.

A Vegetative Study of Point Island  
Michael Kersten and Warren Schimpff  
Central State College  
Stevens Point, Wisconsin  
Student Conservation Project

This project was concerned with an analysis of the ecology of Point Island. This is an island of trees standing isolated from other trees in a moist willow flat area found along Second Creek in the area adjacent to Jackson Lake. This area was selected because of the ecological changes occurring in it which consists of a gradual disappearance of trees associated with an increase in the willows of the area. The vegetative study included a determination of the plant species present, a collection and preservation of representative species, a study of the various cover types within the area, an analysis of growth rates of the trees as compared with growth rates of the same species in other forest areas, a quantitative analysis of trees present, and an attempt to determine the causes of the ecological changes taking place.

A large amount of quantitative data was obtained including a vegetative map of the area together with a species identification of the vegetative cover. Also included was a study of the animal species present. Age-growth studies were made by the use of tree borings.

The preliminary conclusion from this study was that because of the increased amount of moisture in the area the number of aspen was decreasing and the growth rate of aspen was very much slower than in normal aspen forest areas. One of the major contributing factors to this condition was due to extensive beaver activity. This study was preliminary in nature only and will make a contribution to a larger study underway on the willow flats areas.

Supported by Olympic Natural History Association and National Park Service.

Ecological Investigations at Holly Lake, Teton Mountains  
John Merkle  
Flint Junior College  
Project Number 127

The summer of 1963 was spent gathering ecological data at Holly Lake, Teton Mountains, Wyoming. The project is sponsored by the National Park Service and is to obtain data to show any effects of visitor use on the subalpine and alpine areas. The data and observations result in recommendations for the best possible management of the area to maintain the scenic beauty. Holly Lake is in a cirque and is surrounded by slopes with various exposures--east, north, and south. Some of the slopes are quite steep and some are gentle. The vegetative cover is meadow and trees. Quadrat data were taken to determine the most important species in the vegetative cover of all types present. Pictures were taken to illustrate the various habitats and vegetative types.

Supported by National Park Service.

Stress and Parasitism  
 Glenn A. Noble  
 California State Polytechnic College  
 Project Number 103

Purpose. To continue a study of the effect that stress on an animal has upon its parasites.

General Plan. To subject ground squirrels (*Citellus armatus*) to the stress of cold and crowding and to study subsequent variations in numbers of cecal pinworms (Syphacia sp.).

Procedure. Forty-three squirrels were live-trapped at various times during the summer, kept in cages in the laboratory, and supplied with food and water but without bedding. Lack of bedding meant lower ambient temperatures at night; thus they were cold stressed. They were kept in groups of 2, 5, and 10 so crowding was an additional stress factor. The squirrels were sacrificed at intervals of from 10 to 41 days and examined for worms. Adrenal glands were removed and preserved.

Thirty-eight squirrels were maintained and examined as were the stressed groups but bedding was furnished. These groups were the caged controls. Caging itself, however, is a stress factor.

Seventy-five squirrels were sacrificed in the field as soon as they were trapped and the ceca and adrenal glands taken to the laboratory for examination. These animals were trapped throughout the summer, almost every day, to determine the normal fluctuations in numbers of cecal worms.

The cecum of each animal was opened and the entire contents washed repeatedly in physiological saline and allowed to settle until the supernatent fluid was clear. Small amounts of the sediment were poured into petri dishes and examined under a wide-field microscope for pinworms. A total of 5175 worms were collected and those from each animal were weighed as a group. The adrenal glands of each major group were weighed together at the end of the summer. All animals were weighed when trapped and again when sacrificed.

Results.

	<u>Field</u>	<u>Stressed</u>	<u>Control</u>
Number of squirrels .....	75	43	38
Average body weight in grams when trapped and when sacrificed .....	311	249-308	314-372
Average adrenal weight in millegrams.	20.6	20.4	21.4
Number of squirrels infected with pinworm .....	53	27	22
Incidence of infection .....	71%	63%	58%
Average number of worms in squirrels which were infected .....	54.7	34.7	83.2

The temperature in the animal room ranged from a daytime maximum of 70° F. to a minimum of 50° F. at night.

Discussion. The increase in body weight during the summer was normal. There was no significant difference in adrenal weights, which might indicate good adjustment to stress. The caged controls were selected for statistical analysis since they showed the highest worm count. The t-test of significance using the controls and field animals showed a value of 1.970. The probability of exceeding this observed value is 5-10 per cent. Thus the difference in the mean number of worms in the two groups was not significant.

As the first part of a three-year study the results are especially challenging since they are at variance with most other research results in this field, including previous work by the author. Further study will be made next year using a different approach.

Assisted by Joseph Choi, California State Polytechnic College.  
Supported by the National Science Foundation.

Social Organization among Colonies in Ants  
Gerald Scherba  
San Bernardino State College  
Project Number 80

Work continued during the summer months in an attempt to describe the characteristics of a population of Formica opaciventris at the level of the population of colonies.

A total census of the mound nests on Moose Island included a tabulation of: density, activity level, size classes, presence of brood, release of sexuals and the occurrence of new and dead nests. Because this population has been under surveillance since 1957 we are able to establish trends in this population and begin to detect events which occur in the ontogeny of individual mounds.

Since 1957, the population size, now at 389 mounds, has declined by 9.1%. There has been a similar decrease in the proportion of active (level 3 and 4) mounds. The proportion of large (diameter > 48 in.) mounds has decreased, with a corresponding increase, by threefold, in the proportion of small (diameter < 24 in.) mounds. Brood are present in 82.9% of the mounds, and 33% of the mounds release sexuals. Of the 75 mounds which released sexuals in 1963, only 5 released females. These findings, with respect to brood presence and sexuals released are consistent with data of earlier years.

The spatial distribution of the population can be characterized as aggregated. Using the distance to nearest neighbor method, we have determined that the mounds are an average of 5.8 meters apart, and that this spacing differs significantly from that expected of a random distribution pattern.

The mean birth rate, averaged over the five years of census, is 8.23%. The mean mortality rate is 9.95%.

Workers visit between nests. Extensive marking of thousands of individual ants at each of 7 nests in a group of nests, together with the results of earlier years permit the following statements.

Workers visit between nests up to a distance of 82 feet. Visiting rate is low, of the order of 1% to 3%, with a greater visiting rate between bud nests and presumed parental nests, than between adjacent established nests. Workers from one nest visit at several nests, and individual nests are, in turn, visited by workers from several different nests. Attempts to influence the visiting rate by heavy feeding at one nest and partial mound destruction at another have been unsuccessful.

The operation of a pattern of visiting and the low rate of production of sexuals suggest that colonies in the population do not function independently of one another, but are integrated to form a social organization at the level of the population of societies.

It is planned that future work will continue the population census, attempt to relate microclimate changes to behavioral events at the mating flight, investigate the pattern of feeding and attempt to trace the course of individual ants while visiting at nests. The suspected existence of male polymorphism in this species will be investigated during the coming year using a sample of 500 males collected during the summer.

Assisted by Daniel C. Smith, Glendale College.

Supported by the National Science Foundation, Grant No. G23423.

Melanophore-Stimulating Substances in Amphibia  
William Thurmond  
California State Polytechnic College  
Project Number 122

A study of the Northwestern tiger salamander, Ambystoma tigrinum melanostictum (Baird), has confirmed a study of the Pacific tree frog, Hyla regilla, that a melanophore-stimulating substance is produced in the infundibulum of the embryo and young larva. In addition, this study has confirmed the observation that this melanophore-stimulating substance can be detected at an earlier stage in the developing embryo than can the melanophore stimulating substance, intermedin, from the adenohypophysis.

Thirty-five infundibula from embryos of modified Harrison stages 32 to 37 were homoplastically transplanted to subcutaneous tissue of 14-16 mm. albino larvae previously hypophysectomized. Thirty-four grafts evoked a pigment response in the hosts melanophores and one was negative. All seven infundibular grafts from hypophysectomized larvae evoked pigment responses.

Sixty one of sixty-six grafts of anterior forebrain, mandibular mesenchyme, and stomodeal and flank ectoderm did not evoke pigment responses. All seven control grafts of larval tissue from the telencephalon and medulla gave negative responses.

Determination of the first evidence of melanophore-stimulating activity of the infundibular and adenohypophysial grafts required that each graft be observed at least once and sometimes twice a day and that the stage of the donor be recorded at each observation. The results are shown in the following table.

Melanin Dispersion in Melanophores of Albino Larvae  
Evoked by Infundibular and Adenohypophysial Grafts

Age of Graft (in stage of donor)	Infundibular Grafts (34)	Adenohypophysial Grafts (16)
36	3% (1)	0
37	29% (10)	0
38	85% (29)	6% (1)
39	97% (33)	56% (9)
40	97% (33)	77% (13)
41	100% (34)	94% (16)
42	100% (34)	100% (17)

By stage 38, 85% of the infundibular grafts had evoked melanin dispersion in the host's melanophores adjacent to them whereas only one of the adenohypophysial grafts had initiated a response by this stage. Not until stage 40 or 41 do most of the adenohypophysial grafts become active.

In normal and hypophysectomized larvae of Ambystoma tigrinum melanostictum pigment cells become visible at stage 37 and then stellate during stages 38 and 39. During stage 40 the melanin granules in pigment cells of hypophysectomized animals become aggregated and give the cells a punctate appearance whereas the melanin granules remain dispersed in the cells of the normal larvae. This same sequence of events as occurred in the cells of hypophysectomized larvae occurred in the melanophores in the control graft of flank ectoderm. Preliminary observations indicate that the pigment cells in embryos of stages 37 to 40 exhibit the "Babak response". This is a response in which the pigment cells remain punctate in the dark and stellate in bright light. This response appears to be lost at stage 40 to 41. At stage 40 the larvae are just emerging from their jelly membranes. Ninety-three percent of 116 larvae hatched at this stage.

Thus it appears that there are coincident but independent developmental phenomena occurring about stage 40. Four events observed are: (1) the release of intermedin from the adenohypophysis; (2) melanophore dependence upon intermedin for melanin dispersion; (3) loss of the "Babak response"; and (4) hatching.

The report of Drager and Blount, ('41) that the adenohypophysis begins to release intermedin at stage 38, or earlier, in Ambystoma maculatum embryos should now be questioned. The work this summer on Ambystoma tigrinum would suggest that they may have been detecting a melanophore-stimulating substance produced by the infundibulum since they tested extracts of the heads of embryos rather than the adenohypophysis itself.

Identification of the hypothalamic melanophore-stimulating substance is still to be determined. Localization of the source of this substance in the brain of the adult salamander may cast some light on this subject. Certainly the extensive work of Judson Herrick on, "The Brain of the Tiger Salamander", as well as Paul G. Roofe's work on the circulation of the brain in this animal will aid significantly in localizing the area of activity of this melanophore-stimulating substance in the brain.

Supported by the New York Zoological Society.

A Taxonomic Study by Chemical Differentiation of the Genus Artemesia

Alvin Young

University of Wyoming  
Project Number 128

Work this past summer has involved a study of the chemical composition of sagebrush and how this composition varies within species. The particular area in and around Teton County was selected because of the availability of eight distinct types of Sagebrush.

1. A. arbuscula subsp. arbuscula - (Low Sagebrush)
2. A. arbuscula subsp. thermopola - (Hotsprings Sagebrush)
3. A. longiloba - (Alkali Sagebrush)
4. A. cana subsp. cana - (Silver Sagebrush)
5. A. cana subsp. viscidula - (Mountain Silver Sagebrush)
6. A. tridentata subsp. vaseyana - (Big Sagetruish)
7. A. tridentata subsp. vaseyana f. spiciformis - (Subalpine Sagebrush)
8. A. tripartita subsp. tripartita - (Threetip Sagebrush)

Leaf and flower extracts were prepared in ethanol. Two drops of the extracts were then applied to thin layers (Silicon oxide) chromatographic plates. The prepared plates were then run in a 65:30:5 solvent of n-propanol, water, and ammonium hydroxide. While the plates were still wet they were examined under ultra violet light and all fluorescent spots were marked off and  $R_f$  values determined.

Results showed that each of eight species varied distinctly both in color and number of fluorescent spots. Variations in complexes and forms were obvious. It was found also that these spots varied only slightly when examining a given population, and where variation occurred, it was found that these plants were different morphologically as well as chemically. In some cases these abnormal plants could be shown to be hybrids between two known species, i.e. A. tridentata subsp. vaseyana X A. cana subsp. cana, in this particular case the resultant proved to give the same chromatographic patterns as those obtained for A. tridentata subsp. vaseyana f. spiciformis.

Attempts are now underway to examine a given species over a variety of growth stages, and soil conditions. As a result of this summer's work, it is felt that this chromatographic method will prove to be more valuable as a means of examining populations rather than as a sure method of taxonomy.

Supported by W-25, Western Region Research.

Plant Ecological Studies in Grand Teton National Park  
John H. Rumely  
Montana State University  
Project Number 123

Summary not available at the time this Report was prepared.

Supported by Grand Teton National Park.

## SEMINARS

Weekly seminars were held at 7:30 P.M. each Thursday at the home of the Director. These seminars proved to be stimulating to the research workers at the Station as well as many interested visitors. The following is a list of the seminars presented during the summer.

- Margaret Altmann - Communication between species and within species of wild ungulates.
- Kenneth L. Diem - Substrate influences on the physiological ecology of dependent plant and animal populations.
- Glenn A. Noble - Biological science in Taiwan.
- John Rumely - Program for the study of plant ecology in Grand Teton National Park.
- Ralph Dimmick - Canada goose population study.
- Gerald Scherba - Social organization of ants.
- William Thurmond - Study of melanophore-stimulating substances in the amphibians.
- John Merkle - Alpine plant ecology.
- William C. Edwards - Plant ecology of the willow flats.
- Michael Kersten and Warren Schimpff - A vegetative study of Point Island.

## LIBRARY

Periodicals previously subscribed were continued but no new ones added. 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 now 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.

## VISIT BY A COMMITTEE OF THE NATIONAL ACADEMY OF SCIENCES

Research Station personnel met with an advisory committee to the National Park Service on Research. This was a committee of the National Academy of Sciences which agreed to make a study of national parks and make recommendations concerning research needs and opportunities in national parks. The committee consisted of the following members:

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| William J. Robbins, Chairman<br>C. J. S. Durham, Executive Secretary<br>Edward A. Ackerman<br>Marston Bates<br>Stanley A. Cain<br>F. Fraser Darling<br>John M. Fogg, Jr. | Tom Gill<br>Joseph M. Gillson<br>E. Raymond Hall<br>Carl L. Hubbs |
|--|---|

The Director of the Station as well as other personnel emphasized to this committee the importance of the operation of independent research agencies in Grand Teton National Park. The University of Wyoming in cooperation with the New York Zoological Society represents one of these agencies which can through cooperative projects make valuable contributions to problems of significance to Grand Teton National Park and also provide opportunities for research investigators to pursue projects of general biological significance, and to provide opportunities for young research workers to gain valuable information on procedures and methods of research investigation. A report by this committee has been completed and is now available through the National Park Service.

#### A VISIT BY A COMMITTEE OF THE NATIONAL SCIENCE FOUNDATION

A committee of the National Science Foundation consisting of Dr. M. Dale Arvey, Special Assistant Biological and Medical Sciences Division; Dr. Frank Richardson, zoologist; and Dr. Lewis E. Anderson, botanist, visited the Station July 13-17. This visit was made to determine the nature of research activities at the Station and no doubt was of importance in determining the extent to which the National Science Foundation will be willing to finance investigators who make application for funds for research projects. The committee members visited with all the research workers, were taken on field trips, and were briefed completely not only on current operations but on the plans for development at the Station. An automobile was made available for use by members of the committee, and the Station entertained them socially. Because of the short term lease which the Station now has with the National Park Service, this committee, as has been true with previous committees visiting the Station, was not too optimistic about the possibility of obtaining National Science Foundation funds for buildings and general improvement of facilities. The committee was extremely enthusiastic about the quality of work being done by the Station and the tremendous opportunities for future development. They assured us that they would cooperate in every way possible to help further the Research Station objectives. It is hoped that a long term lease can be obtained with the Park Service so that federal funds can be more fully utilized for the improvement of the Research Station.

#### COOPERATION WITH OTHER AGENCIES AND INDIVIDUALS

Cooperation with Grand Teton National Park continued to be a very pleasant and profitable relationship. Much of the credit for this must go to Superintendent Fred Fagergren, Chief Naturalist Willard Dilley, and Park Biologist Glen Cole. Forest Service personnel, principally Robert Casebeer, biologist, contributed effectively to the Station operations.

Cooperation with Grand Teton National Park was continued in line with general agreement arrived at during the preceding year. A summary, prepared by Mr. Dilley in 1962, of the points on which the Research Station and Grand Teton National Park personnel were on general agreement are as follows.

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.

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The following is a list of research projects in which the Research Station cooperated with the Grand Teton National Park.

1. Some aspects of plant and animal distribution as affected by geologic formations - Kenneth L. Diem and Garth S. Kennington.
2. Ecological investigations at Holly Lake, Teton Mountains - John Merkle.
3. Study of ecology and physiology of moose - Douglas Houston.
4. Study of plant ecology in Grand Teton National Park - John Rumely.

The Wyoming Game and Fish Department cooperated in the continuation of a study by Mr. Ralph Dimmick on the ecology and breeding behavior of the Canada goose.

Both the Park Service and the Game and Fish Department provided the necessary permits for collecting necessary to the pursuit of all research projects.

Personnel of the Biological Research Station, as in past years, were utilized for advice and consultation on problems as requested by the Park Service, other agencies and individuals. Many scientists of national and international repute were visitors at the Station during the summer of 1963. Among these were foreign visitors who were interested in the operation of national parks in this country as well as biological research stations. A list of the visitors to the Station during the summer is too large to include in this report.

As in all previous summers since the Research Station has been administered by the University of Wyoming, the New York Zoological Society has cooperated effectively. Dr. Fairfield Osborn, President of the New York Zoological Society, and Mr. William Conway, Director of the New York Zoological Park, should be mentioned specifically for their cooperation.

## STUDENT TRAINING PROGRAM

The Research Station continues to provide opportunities for training of young research workers. The following were given opportunity for this training during the summer of 1963.

1. Michael Kersten and Warren Schimpff - under the Student Conservation Program supported by the National Park Service and Olympic Natural History Association. These students did a research project under the supervision of Mr. William C. Edwards on the ecology of the willow flats area. They were also provided with the opportunity to become acquainted with all research projects underway at the Station as well as to observe the operation of Grand Teton National Park, Yellowstone National Park, the U.S. Reclamation Service, The Federal Fish Hatchery, U.S. Fish and Wildlife Refuge, U.S. Geological Survey, Wyoming State Range Survey and other activities.
2. Steve Martin, who served as assistant to Dr. Margaret Altmann on the study of communication among wild ungulates.
3. Ralph Dimmick continued his research for a Ph.D. degree on the study of Canada geese in the area.
4. Daniel Smith, assistant to Dr. Gerald Scherba on a study of the ecology of ants on Moose Island.
5. Joseph Choi, assistant to Dr. Glenn A. Noble on study of stress factors in relation to parasitism in Uinta ground squirrels.
6. Webster Jones working on his graduate research project on a study of forty big game and livestock exclosures in Northwestern Wyoming.
7. Allen Young assisted Dr. Owen Asplund and Dr. Alan A. Beetle on a taxonomic study by chemical differentiation of the genus Artemisia.
8. Douglas Houston doing research on moose ecology and physiology for the Ph.D. degree.

In addition graduate students from the University of Wyoming and other institutions stopped by the Station for short visits to observe some of the research activities being carried on this summer. We feel that the Research Station is providing a worthwhile opportunity for training of young biological investigators.

**FINANCIAL REPORT  
1962-1963**  
October 16, 1962 - June 30, 1963

<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	874.84	406.15	468.69
Supplies	766.46	163.84	602.62
Contractual	1,422.39	159.90	1,262.49
Travel	226.56	115.56	110.96
Fixed Charges	36.00	36.00	
Extraordinary Expense	53.66		53.66
	<hr/>	<hr/>	<hr/>
	\$3,579.91	\$1,081.45	\$2,498.42

July 1, 1963 - October 31, 1963

<u>Item</u>	<u>Budgeted*</u>	<u>Expended</u>	<u>Unexpended</u>
Research Projects	\$ 966.00	\$ 966.00	\$
Part-time Assistants	1,600.00	1,400.00	200.00
Equipment	1,168.69	547.13	621.56
Supplies	1,322.62	752.57	570.05
Contractual	2,505.49	445.25	2,060.24
Travel	365.96	136.00	229.96
Fixed Charges	132.00		132.00
Extraordinary Expense	128.66	76.12	52.54
	<hr/>	<hr/>	<hr/>
	\$8,189.42	\$4,323.07	\$3,866.35

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

Rent received in the amount of \$963.00 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 \$1800.00 were given by the New York Zoological Society.

Grand Teton National Park grant (Merkle) - \$1200.

National Science Foundation Research Grant (Noble) - \$4,465.20.

Student Conservation Program - \$575.55

Financial support to other projects has been indicated at the conclusion of summaries appearing in this Report.

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*, 6(3-4):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.
- 1963 Naturalistic studies of maternal care in moose and elk. Chapter in Maternal Behavior in Mammals Ed. by Harriet L. Rheingold. John Wiley & Sons, pp. 233-253.
- 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.
- 1962 Social behaviour of a colony of the yellow-bellied marmot (Marmota flaviventris). *An. Behav.*, 10(3-4):319-331.

Bangham, Ralph

- 1951 Parasites of fish in the Upper Snake River drainage and in Yellowstone Lake, Wyoming. *Zoologica*, 36(III).
- 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*. (Mimeo.)
- 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.
- 1962 Range Survey in Teton County, Wyoming. Part II. Utilization and Condition Classes. *Bulletin 400*, University of Wyoming Agricultural Experiment Station, December.

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.  
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- 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.
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1951 A biological and economic evaluation of coyote predation.  
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- 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  
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- Denniston, R. H.  
1948 Certain aspects of the behavior of the Wyoming moose.  
*Jour. Colo.-Wyo. Acad. of Sci.*, 3(6):55.
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- 1956 Ecology, behavior and population dynamics of the Wyoming or Rocky Mountain moose, Alces alces shirasi. *Zoologica*, 41(3):105-118.
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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.

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- 1954 Reproduction in two species of Myotis in Jackson Hole, Wyoming. Jour. Mammal., 35(3):434.

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

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

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- 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.

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- 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.

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Simon, James R.

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The Wyoming or Yellowstone moose. Wildlife Series No. 2, Jackson Hole Wildlife Park.

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- 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.

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

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

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