

378  
MONTANA  
STATE  
UNIVERSITY



Botanizing in the Sub-Alpine

1957 Session  
Montana State University  
Biological Station

Flathead Lake

June 22 to August 17  
and July 22 to August 24

Bigfork, Montana

BULLETIN





Collecting East of Divide

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Photos by William Mitchell,  
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The Summer Session  
June 22 to August 17  
and  
July 22 to August 24

The Biological Station is a unit of the Summer College of Montana State University. All courses offered at the Station except Field Zoology, Field Botany, and Introduction to Systematic Botany are designed at the upper division and graduate levels. Students who have reached the junior level in college and who have satisfactorily completed necessary course prerequisites are eligible for admission. Other students may petition the Director for entrance. Biology teachers are invited to take advantage of those courses designed particularly to fit their teaching needs. Investigators in all fields of natural history and biological research are encouraged to utilize the facilities of the station.

**GEOGRAPHIC  
LOCATION**

The main station grounds are located on the east shore of Flathead Lake where the north end of the Mission Mountains rises abruptly from the lake shore. The station also owns several acres of land on various islands and along Polson Bay at the south end of the lake. Although the more formal course work is given in the seven well-equipped laboratories, all courses emphasize field work. Trips from one to four days' duration are taken to various ecological areas of Western Montana.

Flathead Lake lies in the Flathead valley at the southern end of the Flathead and Purcell Trenches of the Rocky Mountains. The valley is bordered by mountain ranges showing marked differences in geological structure and lies about 40 airline miles west of the Continental divide, just south of the Canadian border. The entire valley and the adjacent slopes of the surrounding mountains form one of the upper reaches of the Columbia River Drainage. In Glacier National Park the headwaters of the Hudsonian and Mississippian drainage systems are also accessible for study.

Limnology and Entomology Laboratory on Yellow Bay





## OPPORTUNITIES FOR STUDY AND RESEARCH

Flathead Lake and the Station grounds are at an elevation of approximately 3000 feet. The Mission and Swan Ranges reach an altitude of 10,000 feet and several peaks in the Livingston and Lewis Ranges of Glacier National Park exceed 10,000 feet. The variety of habitats found in this range of altitude offers unlimited possibilities for research in botany, zoology and ecology.

Although the predominant vegetation types are those of the montane and sub-alpine forests, there are also present many representations of the coast forest, sage brush, grassland and tundra formations. Botanical research in this region to date has been almost entirely of the preliminary survey type. Research possibilities are unlimited in both higher and lower plant groups on taxonomic, ecological, distributional, and comparative aspects within the three drainage systems.

The possibilities for research in Zoology are equally as good. All of western Montana is practically unknown territory, particularly for taxonomists and ecologists. Seventy-five species of mammals occur in the area. Big game animals are common over the western part of Montana. Among these are the elk, moose, white-tailed deer, mule deer, mountain goat, Rocky Mountain big-horn sheep and grizzly and black bear. The National Bison Range, 40 miles from the Biological Station, supports herds of bison, elk, sheep and deer. Mammals peculiar to mountain ranges such as the pika and hoary marmot, can conveniently be studied near the Station.

Nearly 200 species of breeding birds are to be found in western Montana. Common nesting birds in the vicinity of the Station include the western tanager, Macgillivray's warbler, and the little-known Townsend's warbler. In Glacier Park, the rosy finch and the American pipit are common at high elevations and the white-tailed ptarmigan may be seen. At Nine-Pipe and the Pablo Federal Migratory Bird Refuges, an hour's drive south of the Station, many species of water birds nest, of which the avocet and the western grebe are striking examples.

A few species of amphibians and reptiles are known from western Montana. An unknown number of species of fish inhabit the waters of the region. Three species of trout, the land-locked salmon, Rocky Mountain whitefish, and many introduced species of fish are among those found in Flathead Lake.





No estimate can be made as to the number of species (or genera) of invertebrates found in the region. There are many aquatic and terrestrial gastropods and an abundance of sphaeriids. Fresh water sponges occur in several of the waters. Macro-crustaceans are rare, but at least four species of phyllopods are known to be present. The insect fauna is rich both in numbers of species and in numbers of individuals.

The fields of limnological and fisheries research are also "wide open." Flathead Lake, with its 200 square miles of surface area and maximum depth of 107 meters has yielded such a bare minimum of information that it will supply data for years to come. The same holds true for the hundreds of lakes at all elevations in the many mountain ranges. Very little is known about the distribution, migrations, life histories and natural history of either the native or introduced species of fish now found in western Montana.

#### COOPERATING AGENCIES

The facilities and active cooperation of many state and federal agencies are available to the staff and research workers of the Biological Station. Research projects are conducted independently and in cooperation with biologists and naturalists in Glacier National Park, at the Rocky Mountain Laboratory in Hamilton, at the National Bison Range at Moiese, with the Fish and Wildlife Service Wildlife Research Unit at the Missoula campus, and with the State Fish and Game Department in various sectors of the state. Both long-range and short-term research projects are feasible under these arrangements.

Lunch Stop at Glacier National Park





Limnology Class on  
Flathead Lake



*Citellus columbianus*  
—Palmer



Class Studying a Population of Black Widow Spiders





# Description of Courses

Credits earned at the Biological Station are transferable to other colleges and universities the same as credits earned in the Departments of Botany and Zoology on the University campus. Undergraduates may take only those courses numbered below 500.

Credit is given in quarter hours. The recommended load for students is nine hours for the eight week session. Maximum load for any student is twelve and the minimum load is six hours. Only exceptional students will be granted permission to carry courses in excess of nine hours. Although a six-hour course normally meets two days a week and a three-hour course meets one day a week, all classes are scheduled an extra day each week to reserve time for two-day trips.

**A student electing work in either Botany or Zoology Problems Courses must secure the consent of the instructor in charge before action can be taken on his application by the executive committee.**

## Five-week Session

A special session of five weeks' duration is offered for the summer of 1957. This session runs from July 22 to August 24 and is dovetailed into the regular eight-week course. It is designed particularly for teachers who wish to take course work in Field Zoology and/or Field Botany. Anyone interested in this shorter session should write to Director, Biological Station, Montana State University, Missoula, Montana, and ask for complete details.

## Conservation Education Workshop

The Conservation Education Workshop stresses those problems and principles of conservation which are particularly characteristic of the Northwest. Proper management of natural resources is the keynote of the workshop, and field trips are designed primarily to emphasize management practices. Extending over the five-week period from July 22 to August 24, the workshop can be taken in combination with certain other courses of either the regular session or the five-week session. Credit is variable from 3 to 9 hours. The workshop is under the direction of Professors Gebhart and Waters, assisted by professional men in the conservation field. Anyone interested in this program should write the Director, Biological Station, for more detailed information.

## Courses Offered:

### BOTANY

100. **Field Botany.** 3 cr. No prerequisite. A field course in the collection, preservation, and identification of plants and consideration of where they grow.
124. **Summer Flora.** 3 cr. No prerequisite. A laboratory and field course in the use of a manual for the identification of the flowering plants. Also, methods of collecting, pressing, and mounting plants. Plants of the prairie, forests, and high mountain areas are studied. Botany Laboratory. Tuesday, Wednesday. Preece.
349. **Problems in Morphology.** 2-6 cr. May be repeated during succeeding quarters not to exceed a total of 6 credits. Prerequisites, Botany 341 or 343 and consent of instructor. Individual or group work (consisting of research problems, special readings, discussions, etc.) dealing with aspects of plant morphology not taken up in regular courses. Staff.





Collecting along Shore of St. Marys Lake

Overnight Camp at Isolated Lake—Mitchell





361. **Fresh Water Algae.** 3 cr. Prerequisite, Botany 121, 122, 123 or equivalent (a year's laboratory course in Botany). Identification, classification, distribution, life histories and limnological relationships of the algae of the Northern Rocky Mountains. Botany Laboratory. Wednesday, Thursday. Vinyard.
363. **Bryophytes.** 3 cr. (Omitted in 1957).
365. **General Systematic Botany.** 6 cr. Prerequisites, Botany 121, 122, 123 or equivalent (a year's laboratory course in Botany). The identification and classification of vascular plants; principles of nomenclature; ecological distribution; methods of collecting, pressing, and mounting plants. Three two-day trips are taken into alpine habitats as well as one-day trips to aquatic habitats, typical palouse prairie, western white cedar-western white pine and yellow pine-Douglas fir forests and several mixed habitats. Approximately 120 species in forty families are studied. Botany Laboratory. Monday, Tuesday, Saturday. Harvey.
366. **Agrostology.** 3 cr. Prerequisites, Botany 111 or 121 and 123 or equivalent (a year's laboratory course in Botany). Botany 365 recommended. Identification, classification, and ecological relationships of grasses, sedges, and rushes. Two two-day field trips are taken into alpine habitats and one to the mixed prairie east of Glacier National Park. One-day trips are taken to typical palouse prairie and various marshy areas where sedges and rushes are numerous. Approximately 50 species of grasses, 10 rushes and 20 sedges are studied. Botany Laboratory. Days to be arranged. Harvey.
368. **Aquatic Flowering Plants.** 3 cr. Prerequisite, Botany 365. Identification, classification, and ecological distribution of the higher aquatic plants. The Flathead Lake area is particularly rich in aquatic flowering plants. The small lakes and ponds among the glacial debris of the valley floor provide varying local habitats suitable to a wide range of species. Botany Laboratory. Friday, Saturday. Vinyard.
369. **Problems in Taxonomy.** 2-6 cr. May be repeated during succeeding quarters not to exceed a total of 6 credits. Prerequisites, Botany 365 and consent of instructor. Individual or group work (consisting of research problems, special readings, discussions, etc.) dealing with aspects of plant taxonomy not taken up in regular courses. Staff.
549. **Advanced Morphology.** 2-6 cr. Consent of Instructor. Staff.
569. **Advanced Taxonomy.** 2-6 cr. Consent of Instructor. Staff.
600. **Advanced Botanical Problems.** Credit variable. The department is prepared to arrange for properly qualified graduate students to carry on research in plant anatomy, cytology, ecology, morphology, mycology, pathology, physiology, and taxonomy, leading to a Master's degree. Maximum credit allowable 15. Staff.
699. **Thesis.** Credit variable. Maximum credit allowable 15.

## ZOOLOGY

106. **Field Zoology.** 3 credits. A field and laboratory course in the collection, identification, and preservation of animals. Students not only collect and study animals in the field, but also learn to associate the individual species with certain habitat characteristics. Field work is followed by identification in the laboratory with the use of taxonomic keys. Invertebrate Laboratory. Friday, Saturday. Brunson.
303. **Ornithology.** 3 credits. Prerequisite: One laboratory course in vertebrate zoology. Life history, habits, identification and distribution of birds. Weekly field trips are taken to a variety of habitats extending from the marshlands of the Flathead Valley, the islands of Flathead Lake to the alpine region of Glacier National Park. Mammalogy Laboratory. Wednesday, Thursday. Baldwin.
309. **Mammalogy.** 6 credits. Prerequisite: Comparative vertebrate anatomy. The life history, habits, identification and distribution of mammals, with particular reference to those of the Rocky Mountain region. Four two-day and three-day collecting trips are taken into representative mammal habitats. One of these trips will be taken to the National Bison Range and two to Glacier National Park. The small mammals of a plot on the Station grounds are censused annually by the live trap method. Mammalogy Laboratory. Monday, Tuesday, Saturday. Hoffmann.
310. **Ichthyology.** 3 credits. (Omitted in 1957.)



361. **Limnology.** 6 credits. Prerequisite: Elementary Zoology and one collegiate course in Chemistry. Ecology of lakes, streams and ponds, with emphasis on the physical, chemical and biotic factors which determine their biological productivity. Although most of the work is done on Flathead Lake, a three-day trip is taken to some mountain lake and a complete limnological survey is made of that body of water. The last field trip is one to a glacier in Glacier National Park where students observe the history of the water through a succession of lower lakes to the valley floor. Limnology Laboratory. Monday, Tuesday, Wednesday. Brunson.
364. **Natural History of Invertebrates.** 3 credits. Prerequisite: Invertebrate Zoology. The ecology, taxonomy and distribution of the invertebrates of the Rocky Mountain area. Although all invertebrates other than insects and helminths are studied, emphasis is placed upon the molluscs of the region. At least three overnight trips are taken. The Mission, Whitefish and Cabinet Mountains and Glacier National Park are visited to secure representative invertebrate types. About 30 species of molluscs, 5 species of sponges and the red Hydra are included in the forms studied. Invertebrate Laboratory. Days to be arranged. Brunson.
365. **Entomology.\*** 6 credits. Prerequisite: Two laboratory courses in Zoology, including invertebrate zoology. Introduction to the morphology, physiology, taxonomy and ecology of the Insecta. Invertebrate Laboratory. Days to be arranged. Castle.
366. **Aquatic Insects.\*** 3 credits. Prerequisite: Zoology 141 and 142 (Elementary Invertebrates) or equivalent and consent of instructor. A study of the insect fauna, both immature and adult, of aquatic habitats of Western Montana. Invertebrate Laboratory. Days to be arranged. Castle.
431. **Problems in Vertebrate Morphology and Taxonomy.** 1-5 cr. Prerequisites, 25 credits in Zoology including adequate background courses in the subject and consent of the instructor. Primarily a problems type course, involving semi-independent work. By variation of content, the course may be repeated during succeeding quarters. Staff.
433. **Problems in Vertebrate Ecology.** 1-5 cr. Prerequisites, 25 credits in Zoology including adequate background courses in the subject and consent of the instructor. Primarily a problems type course, involving semi-independent work. By variation of content, the course may be repeated during succeeding quarters. Staff.
434. **Problems in Invertebrate Morphology and Taxonomy.** 1-5 cr. Prerequisites, 25 credits in Zoology including adequate background courses in the subject and consent of the instructor. Primarily a problems type course, involving semi-independent work. By variation of content, the course may be repeated during succeeding quarters. Staff.
436. **Problems in Invertebrate Ecology.** 1-5 cr. Prerequisites, 25 credits in Zoology, including adequate background courses in the subject and consent of the instructor. Primarily a problems type course, involving semi-independent work. By variation of content, the course may be repeated during succeeding quarters. Staff.
561. **Limnological Methods.** 3 cr. (Omitted in 1957.)
600. **Advanced Zoological Problems.** 1-5 cr. Opportunity is given graduate students with sufficient preparation and ability to pursue original investigations. Staff.
699. **Thesis.** Credit variable. Maximum credit allowable 15.

\*Enrollment demands will determine which of these two courses (365 and 366) will be offered in 1957.



# General Information

## FEES

A student fee of \$70.00 (maximum) is charged for both resident and non-resident students.

Resident and non-resident investigators, for whom research space and general laboratory materials will be supplied, are charged a fee of \$50.00.

Dependents of students and investigators must pay a cabin fee. However, there is no charge for children below three years of age.

Board at the commissary is \$16.50 per week.\* This must be paid at the time of enrolling.

Inasmuch as the Biological Station is a part of Montana State University, government educational benefits to veterans under Public Laws 894 and 550 apply at the Station in the same manner as they do on the University campus. Veterans should indicate on the application blank the congressional act under which they will enroll.

Full subsistence will be paid by the Veterans Administration if enrolled for nine or more credit hours.

## BOARD AND LODGING

Board is provided at the Station commissary. All people living at the Station are required to board at the commissary.

Students and faculty live in cabins. Each cabin is provided with beds, mattresses, pillows, chairs, table and minor items of equipment. Blankets, towels and linen must be provided by the occupants. Cabins are supplied with electric lights and electric (AC) outlets.

A combination bath house and latrine, centrally located, has hot showers in addition to regular wash stands. Washing machines and stationary laundry tubs are available for use in both men's and women's sections of the bathhouse. A small ironing room is also available. No irons are supplied by the Station.

## ADVANCED DEGREES

Qualified students who are officially enrolled in the Graduate School may take course work and do research at the Station toward a master's degree. Master's degrees are offered in Botany, Zoology, and Wildlife. Students interested in earning a master's degree through successive summers at the Biological Station should write to the chairman of the department of either Botany or Zoology for additional information.

## FIELD TRIPS

Transportation will be provided for all regular class trips. All field trips are under the supervision of an instructor. Many of the field trips will be completed within one day, although at least one overnight trip in each course may be expected. Meals on such trips are supplied by the commissary. The Station cannot as yet offer transportation for independent research workers; however, space on scheduled field trips will be made available to them.

## REMUNERATIVE WORK

Opportunities for work are not numerous. Graduate assistantships are available in most courses. To be eligible for one of these assistantships, a student should have had the course or its equivalent in some other institution. There will be opportunity to work by the day and by the hour at janitor work, day labor on the Station grounds and driving trucks. Applications for work should be sent to the Director.

\*Subject to the approval of the State Board of Education.



## RECREATION

Opportunities for recreation are many. Mountain climbing, hiking, swimming, boating and fishing offer the best means of relaxation. Some of the best fishing in western United States is found within a few hours' drive of the Station. Fine catches of rainbow, cut-throat and Dolly Varden trout and landlocked salmon are made the year round in Flathead Lake. Ideal trout fishing may be had in most of the streams and rivers in the community. There are excellent Forest Service and Indian Service trails in the Mission and Swan Mountains. There are also many fine trails with overnight accommodations at chalets in Glacier National Park. Weekly climbs into the Missions and community recreation will be planned for those in attendance at the Station.

## EQUIPMENT NEEDED

The student is responsible for supplying his own bedding, linens, toilet articles and proper clothing. As a rule, summer rains will come the last week of June and the first week of July. However, local showers occur at high altitudes, so that rain equipment that is light to carry is desirable. Nights are cool, and temperatures are low at high altitudes. Therefore the student should be supplied with warm clothing, preferably wool. Since many of the classes will do mountain climbing during the course of the summer, students are strongly advised to have adequate footwear. Regular mountain boots are advisable for climbing. For those intending to do aquatic work, tennis shoes or hip boots will probably be the best type of foot wear. Recreational equipment should be supplied by individual students.

Inasmuch as many overnight trips will be taken, back-packs and sleeping bags (such as the inner bag of arctic type) are recommended.

Books and class supplies can be obtained from the student book store.

**Since the Station area is a game reserve, dogs and other pets are not allowed. Firearms may not be brought on the premises without advance written permission from the Director. All guns will be kept in the gun room.**

## ENROLLING

Application for admission to courses should be made before May 1, using the blank provided in the catalog. Additional blanks will be provided on request. Applications will be reviewed on May 1 and notification of acceptance will be mailed soon after. Applications made after May 1 will be considered in the order in which they are received.

Students who have not previously enrolled at the Station must submit a complete official transcript together with recommendations from two instructors. Graduate students must first enroll in the Graduate School of Montana State University. Applications blanks may be secured from the Dean of the Graduate School, Montana State University, Missoula, Montana.

A \$10.00 deposit must be included with the application for admission to the Biological Station. This will be refunded if the applicant withdraws his application before June 1. At the time of registration, this deposit will be credited to the cabin fee. Official registration will be held at the Station on Saturday, June 22. Classwork begins Monday, June 24 and extends through the full session of 8 weeks.





Studying Benthic Invertebrates

## Application for Admission

MONTANA STATE UNIVERSITY  
BIOLOGICAL STATION

Missoula, Montana

SUMMER SESSION, 1957

Name \_\_\_\_\_  
Last First Middle Age \_\_\_\_\_

Mailing Address \_\_\_\_\_

Graduate \_\_\_\_\_ Undergraduate \_\_\_\_\_ Year \_\_\_\_\_ Major Field \_\_\_\_\_

Institutions previously attended (with year of graduation):

College or University \_\_\_\_\_

Degrees With Dates \_\_\_\_\_

Veteran \_\_\_\_\_ ; PL 894 \_\_\_\_\_ ; PL 550 \_\_\_\_\_

Regular session \_\_\_\_\_ Five-week session \_\_\_\_\_

(continued on next page)





McDonald Lake in the Mission Mountains—Mitchell

If a member of some instructional staff, give status: \_\_\_\_\_  
\_\_\_\_\_

Schedule of courses desired:

First Choice: \_\_\_\_\_

Second Choice: \_\_\_\_\_

If Research Work: (a) Independent \_\_\_\_\_, (b) Under Supervision \_\_\_\_\_

If under supervision, with whom or in what field? \_\_\_\_\_

Are you interested in taking a post-session trip? \_\_\_\_\_

Cabin requirement: \_\_\_\_\_

Roommate preferences \_\_\_\_\_

If married, will wife or family accompany you? \_\_\_\_\_

If so, give number and ages of children \_\_\_\_\_

(Instructions for arrival and other pertinent information will be mailed to applicants.)

(Additional bulletins may be obtained by writing to the Director.)



## Bibliography of Recent Papers

—Based on work done in part at the Biological Station of Montana State University—

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- CONAWAY, C. H. 1952. The Life History of the Water Shrew (*Sorex palustris navigator*). *Am. Mid. Nat.* 48 (1):219-248.
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- HARVEY, L. H. 1954. Additions to the Flora of Glacier National Park, Montana. *Proc. Mont. Acad. Sci.* 14:23-24.
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- NEWBY, F. E., and P. L. WRIGHT. 1955. Distribution and Status of the Wolverine in Montana. *Jour. Mammal.* 36:248-253.
- PILSBRY, H. A., and R. B. BRUNSON. 1954. The Idaho-Montana Slug *Magnipelta* (Arionidae). *Notulae Naturae of the Acad. of Nat. Sci. of Phil.* No. 262:1-6.
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- WEISEL, G. W. 1954. A Rediscovered Cyprinid Hybrid from Western Montana. *Mylocheilus caurinum* × *Richardsonius balteatus balteatus*. *Copeia* 4:278-282.
- ..... 1955. Three New Intergeneric Hybrids of Cyprinid Fishes from Western Montana. *Amer. Midl. Nat.* 53 (2):396-411.
- WRIGHT, P. L. 1953. Intergradation between *Martes americana* and *Martes caurina* in Western Montana. *Jour. Mammal.* 34 (1):74-86.
- ..... and R. RAUSCH. 1955. Reproduction in the Wolverine (*Gulo gulo*). *Jour. Mammal.* 36:346-355.





The Mission Range