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Flathead Lake Biological Station

1973

Biological Station Summer Session, 1973

University of Montana (Missoula, Mont. : 1965-1994)

Flathead Lake Biological Station

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**biological station issue
flathead lake**

summer session / june 23-august 18, 1973

No. 546

Missoula, Montana 59801

January, 1973

Number 546

January, 1973

UNIVERSITY OF MONTANA

Published at Missoula, Montana. Issued 4 times yearly; twice in January, once in February and December. Entered as second-class matter at the post office at Missoula, Montana, under Act of Congress Aug. 24, 1912.

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Visiting Professor of Zoology, Eastern New Mexico University
Portales, New Mexico

GARY W. CROSBY, PH.D.
Professor of Geology, University of Montana

Please send an application for the Biological Station to:

(name)

(address) (city) (state)

(zip code) Telephone number: _____

College/University attending: _____

- Status (check one): _____ (a) Special Student (summer only—undergraduate credit)
_____ (b) UM Student: Quarter last attended _____, Student I.D. number
_____, Undergraduate or Graduate _____
_____ (c) Visiting Graduate Student (students currently enrolled in a graduate program at another university).
_____ (d) Unclassified Graduate Student (students who have completed a Bachelor's degree and wish to receive graduate credit although it does not apply to a degree program).

STEVEN C. EGELINE, B.S. Biology
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University of Montana, Missoula

SHARON R. EVERSMAN, M.S. Botany
Instructor, Biology Program
Montana State University, Bozeman

ELLEN FARR, B.S. General Science
Graduate Student, Department of Biology
Virginia Polytechnic Institute and State University, Blacksburg

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Biological Station
University of Montana
Missoula, MT 59801

Cover Photo Courtesy Wes Hulla

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Curator, Royal Ontario Museum
Toronto, Ontario, Canada

*Address all correspondence



— Plankton sampling in Yellow Bay on the Biological Station's research vessel, *Daphnia II*. Elrod laboratory can be seen in the background.

1973 SUMMER SESSION

University of Montana

BIOLOGICAL STATION

June 23 to August 18

The Biological Station is a unit of the College of Arts and Sciences of the University of Montana. All courses offered at the Station give graduate credit and are designed for those working at the upper division and graduate level. 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 Station is located on Yellow Bay on the east shore of Flathead Lake at the base of the northern end of the Mission Mountains. The Station also has land on Bull Island and on Polson Bay and owns the two small Bird Islands. Flathead Lake lies in the Flathead Valley at the southern end of the Flathead and Purcell Trenches of the Rocky Mountains. The valley, bordered by mountain ranges showing marked differences in geological structure, lies about 40 airline miles west of the Continental Divide and 100 airline miles south of the Canadian Border. This valley and the adjacent valleys and mountains form one of the upper reaches of the Columbia River Drainage. The headwaters of the Mississippi and Hudsonian Drainages are easily accessible in Glacier National Park.

OPPORTUNITIES FOR STUDY AND RESEARCH

Although the more formal part of the course work is given in well-equipped laboratories, all courses emphasize field work.

The many mountain ranges and valleys, with altitudes from 3,000 to 10,000 feet, which are accessible from the Station offer a wide variety of habitats. Plant associations include palouse prairie; sage brush; montane, coast and sub-alpine fir forests; sub-alpine to alpine meadows; and tundra. Aquatic environments include eutrophic and oligotrophic lakes, glacial potholes, ponds, swamps, bogs, streams, and rivers. Opportunities for field trips and for problem work are therefore many and varied.

There is a stimulating, academic environment at the Biological Station. Students, instructors, researchers and others work together very closely maintaining a scholarly and sociable atmosphere. A number of scientists conduct research at the Biological Station; visiting scientists and guest lecturers stop by often throughout the summer. Academic activities are not restricted to the courses listed below.

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 Cooperative 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. Graduate students from a number of universities conduct thesis and dissertation research at the Station. The Station is a hub of field activity for the Intermountain Aquatic Studies Consortium.

SUMMER MAILING ADDRESS

University of Montana Biological Station
Yellow Bay, Flathead Lake
Bigfork, Montana 59911

Description of Courses

Credits earned at the Biological Station are transferable to other colleges and universities the same as are credits earned in academic departments on the University's Missoula Campus.

Credit is given in "quarter credits." The maximum load for any student is thirteen credits and the minimum load is six credits. Graduate Assistants must register for at least three credits and may carry a maximum of six credits. Only in exceptional cases will students be granted permission to carry courses in excess of thirteen credits. A three- or six-credit course normally meets two and one-half days a week and is scheduled for an extra half day each week to make three-day field trips possible.

Below is a calendar of courses which require firm daily scheduling:

Course	1st through 4th weeks 23 June - 21 July		5th through 8th weeks 22 July - 18 August	
	M T W	Th F S	M T W	Th F S
Limnology	_____	_____	_____	_____
Phycology	_____	_____	_____	_____
Mycology	_____	_____	_____	_____
Ichthyology	_____	_____	_____	_____
Ornithology	_____	_____	_____	_____
Plant Systematics	_____	_____	_____	_____
Zooplankton Biology	_____	_____	_____	_____
Animal Behavior	_____	_____	_____	_____
Plant Ecology	_____	_____	_____	_____
Physical Geology	_____	_____	_____	_____
Lake Processes	_____	_____	_____	_____

Some of the courses are eight weeks long, and some are only four weeks long. Individual supervised research problems may be taken for either four or eight weeks. A student wishing to take twelve quarter credits of work, for example, may sign up for: two eight-week courses—or one eight-week course and two four-week courses—or 1 eight-week course and one four week course with one research problem—and so forth.

Examples of possible schedules are as follows:

course	credits	weeks	class days
(a) Limnology	6	1 - 8	M T W
Physical Geology	3	1 - 4	Th F S
Research			
	9 ++ credits		
(b) Mycology	6	1 - 8	M T W
Phycology	6	1 - 8	Th F S
Seminar	1	1 - 8	
	13 credits		
(c) Ornithology	3	1 - 4	M T W
Phycology	6	1 - 8	Th F S
Zooplankton or Animal Behavior	6	5 - 8	M T W
or	3		
Lake Processes		5 - 8	M T W
	12 credits		
(d) Ornithology	3	1 - 4	M T W
Ichthyology	3	1 - 4	Th F S
Lake Processes	3	5 - 8	M T W
Plant Ecology	3	5 - 8	Th F S
Seminar	1		
	13 credits		

COURSES OFFERED

BOTANY

Call Numbers	Course Numbers	Description
0900	441. Phycology.	6 cr. Prerequisites: one year laboratory course in botany and consent of instructor. Identification, classification, distribution, life histories and limnological relationships of the algae of the Northern Rocky Mountains. Thursday, Friday, Saturday. Prescott.
0901	449. Problems in Plant Science.	(Sec. 2) 1-5 cr. Prerequisites: junior standing and consent of instructor. Individual or group research problems dealing with aspects of plant science not taken up in regular courses. Hours by arrangement. Staff.
0902	449. Biological Illustration.	(Problems Sec. 3) 1 cr. Prerequisites: consent of instructor. Basic principles and skills of producing illustrative materials relevant to the biological sciences. (Also listed as Zoology 498, Section 10.) Hours by arrangement. Everman.

- 0903 **449. Plant Systematics.** (Problems Sec. 4) 3 cr. Prerequisites: a course in general botany and consent of instructor. Systematics of vascular plants, with special reference to those of the Northern Rocky Mountains. Thursday, Friday, Saturday. Turner.
- 0904 **449. Plant Ecology.** (Problems Sec. 5) 3 cr. Prerequisites: a course in general botany and consent of instructor. Community concepts of ecology including succession, stratification, periodicity and energy relationships, with special reference to the flora of the Northern Rocky Mountains. Thursday, Friday, Saturday. Daubenmire and Turner.
- 0905 **461. Limnology.** 6 cr. Prerequisites: a year of chemistry and consent of instructor. Ecology of lakes, streams, and ponds, with emphasis on the chemical, physical, and biotic factors which determine their biological productivity. (Also listed as Zoology 461.) Monday, Tuesday, Wednesday. Gaufin.
- 0906 **475. Mycology.** 6 cr. Prerequisites: a course in general botany and consent of instructor. The morphology, taxonomy, and ecology of the fungi species of the Northern Rocky Mountains. NSF Institute Course. Monday, Tuesday, Wednesday. Miller.
- 0907 **490. Seminar in Biology.** 1 cr. Lectures and discussions of special problems in biology. (Also listed as Zoology 490.) One evening each week. "Pass or Fail" grade only. Staff.
- 0908 **539. Problems in Plant Anatomy and Morphology.** 1-5 cr. Prerequisites: consent of instructor. Individual or group work consisting of research problems, special readings or discussions dealing with aspects of plant anatomy and morphology not taken up in regular courses. Hours by arrangement. Staff.
- 0909 **549. Problems in Plant Cytology and Genetics.** 1-5 cr. Prerequisites: consent of instructor. Individual or group work consisting of research problems, special readings or discussions dealing with aspects of plant cytology and genetics not taken up in regular courses. Hours by arrangement. Staff.
- 0910 **559. Problems in Plant Ecology.** 1-5 cr. Prerequisites: consent of instructor. Individual or group work consisting of research problems, special readings or discussions dealing with aspects of plant ecology not taken up in regular courses. Hours by arrangement. Staff.
- 0911 **569. Problems in Plant Taxonomy.** (Sec. 2) 1-5 cr. Prerequisites: consent of instructor. Individual or group work consisting of research problems, special readings or discussions dealing with aspects of plant taxonomy not taken up in regular courses. Hours by arrangement. Staff.
- 0912 **579. Problems in Mycology and Forest Pathology.** (Sec. 2) 1-5 cr. Prerequisites: consent of instructor. Individual or group work consisting of research problems, special readings or discussions dealing with aspects of mycology and plant pathology not taken up in regular courses. Hours by arrangement. Staff.
- 0913 **600. Research.** Credit variable. The Botany 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 allowed is 15. Staff.
- 0914 **699. Thesis.** Credit variable. Maximum credit allowed is 15.

ZOOLOGY

- 0915 **461. Limnology.** 6 cr. Prerequisites: a year of chemistry and consent of instructor. Ecology of lakes, streams, and ponds, with emphasis on the chemical, physical, and biotic factors which determine their biological productivity. (Also listed as Botany 461.) Monday, Tuesday, Wednesday. Gaufin.
- 0916 **490. Seminar in Biology.** 1 cr. Lectures and discussions of special problems in biology. (Also listed as Botany 490.) One evening each week. "Pass or Fail" grade only. Staff.

- 0917 **498. Problems in Zoology.** (Sec. 5) 1-5 cr. Prerequisites: junior standing and consent of instructor. Semi-independent work under the direction of a faculty member. Hours by arrangement. Staff.
- 0918 **498. Ichthyology.** (Problems Sec. 6) 3 cr. Prerequisites: junior standing and consent of instructor. The biology and methods of study of fishes, with special reference to the fauna of Western Montana. Thursday, Friday, Saturday. Buscemi.
- 0919 **498. Zooplankton Biology.** (Problems Sec. 7) 3 cr. Prerequisites: junior standing and consent of instructor. The biology and methods of study of the zooplankton of freshwaters of the Northern Rocky Mountains. Monday, Tuesday, Wednesday. Buscemi.
- 0920 **498. Ornithology.** (Problems Sec. 8) 3 cr. Prerequisites: junior standing and consent of instructor. The structure, classification, and life histories of birds. Monday, Tuesday, Wednesday. Wright.
- 0921 **498. Animal Behavior.** (Problems Sec. 9) 3 cr. Prerequisites: junior standing and consent of instructor. Normal behavior of animals under natural conditions; observation and recording of animal behavior. Monday, Tuesday, Wednesday. Ligon.
- 0922 **498. Biological Illustration.** (Problems Sec. 10) 1 cr. Prerequisites: consent of instructor. Basic principles and skills of producing illustrative materials relevant to the biological sciences. (Also listed as Botany 449, Section 3.) Hours by arrangement. Eversman.
- 0923 **600. Advanced Zoological Problems.** (Sec. 2) 1-5 cr. Opportunity is given to graduate students with sufficient preparation and ability to pursue original investigations. Staff.
- 0924 **699. Thesis.** (Sec. 2) Credit variable. Maximum credit allowed is 15.

GEOLOGY

- 0925 **490. Physical Geology.** (Senior Seminar, Sec. 3) 3 cr. Prerequisites: junior standing and consent of instructor. Minerals, rocks, and structures of the earth's crust and the processes of its formation. Thursday, Friday, Saturday. Fields and Crosby.
- 0926 **490. Lake Processes.** (Senior Seminar, Sec. 4) 3 cr. Prerequisites: junior standing and consent of instructor. Geological phenomena and processes of importance to lakes, and techniques for the study of these features. Monday, Tuesday, Wednesday. Crosby and Fields.

General Information

FEES (Subject to change)

All students pay a \$10.00 Field Trip Fee to cover in part the cost of field trip transportation.

Those other than registered students desiring to carry on independent research, resident or non-resident, are charged an investigator's fee of \$25.00 per week. This entitles him to the use of one 4' x 6' table and a proportionate amount of shelving. Chemicals and glassware are provided in reasonable amounts. Microscopes will be provided if available. Those with special equipment, supplies or space problems should write the Director.

The student fee on a per quarter credit basis is as follows:

Four or Eight Week Session

Credit Hours	Resident Fees	Non-Resident Fees
1	\$ 21.00	Add
2	42.00	\$10.00
3	63.00	Per
4	77.00	Credit
5	90.00	
6	103.00	
7	116.00	
8	129.00	
9	142.00	
10 or More	No Additional Fees	

(plus \$10.00 transportation fee)

LODGING

All individuals are housed in 12' x 14' or 12' x 16' cabins which have three 36" x 24" windows. Each cabin is provided with lights and electric (AC) outlets, beds, mattresses, pillows, chair, table, dresser, and minor items of equipment. The cabin fees are \$4.00 weekly per person. **Student families may not live in Station housing.** Only persons enrolled in Station courses may live in Station housing. Guest cabins, however, are sometimes available for periods not exceeding one week.

BOARD

All resident station students and personnel are required to board at the Commissary; 8-week costs: \$252.28 for adults and \$184.44 for those under twelve. Costs for only four weeks' residence are proportionately reduced. First meal served will be dinner on Saturday, June 23, and last meal served will be lunch on Saturday, August 18. **No refunds are made for absences of less than a week, and any absence must be preceded by a one-week prior notification.** All commissary facilities are under the direction of the central University Food Service.

BATHING FACILITIES

The Station has three modern washrooms with hot and cold running water and toilet facilities. The central one, in addition, has showers and laundry facilities. It also has an ironing room and ironing boards. The Station does not provide irons.

HEALTH SERVICES

Each student is covered by the student health plan which covers sickness and certain accidents which may occur during the session at the Biological Station. This is paid by the health service fee. The nearby towns of Polson and Kalispell have excellent doctors and hospital facilities for emergencies, and the student health center in Missoula remains open 24 hours a day for those who can avail themselves of its services. An additional supplementary health plan is available at minimal cost and is recommended.

ADVANCED DEGREES

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

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 overnight and three-day trips in each course may be expected. Meals on such trips are supplied by the commissary. The Station cannot provide transportation for independent research workers; however, space on scheduled field trips may be used when available.

REMUNERATIVE WORK

Opportunities for work are not numerous. Assistantships which pay \$750.00 per session are available for some courses. To be eligible for these the student should have a major in the field concerned and experience in the subject matter of the course to which the assistantship is assigned. Research assistantships are occasionally available. There are some part time jobs for janitorial work, labor, and driving vehicles.

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 the western United States is found within a few hours' drive of the Station. Fine catches of rainbow, cutthroat, Mackinaw 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 area. There are 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.

The Station is a game reserve: dogs and other pets are not allowed. Firearms may not be brought onto the premises without advance written permission from the Director.

EQUIPMENT AND SUPPLIES NEEDED

Course and field trips: The student should, if he has them, bring dissecting kits, hand lens, field glasses, musette bag, and other usual field and laboratory course supplies. The Station is located in a mountain valley and many of the classes will work in the mountains during the course of the summer; students, therefore, must have adequate clothing and footwear. Nights are cool and temperatures can be low. There will be cool, rainy as well as warm to cool, dry weather; one should have warm, wool clothing, cotton clothing, and rainy weather equipment. Good hiking boots with 6 to 8 inch tops are advised for field trips in the mountains. Tennis shoes or hip boots are the best type of footwear for aquatic work. Remember that mountain streams are cold. Inasmuch as

some overnight trips will be taken, back packs, warm sleeping bags (such as the inner arctic type) with liners and ground-cloth are recommended.

Living equipment: The student is responsible for supplying his own blankets, bed linen, towels, toilet articles, and proper clothing. Most students wear slacks or jeans. A flashlight, small mirror, reading lamp, and curtains for the three cabin windows (36 x 24) also will be useful. Recreational, musical, and photographic equipment are also useful.

STUDENT STORE

The Associated Student Store from the Missoula Campus will be at the Station for one week at the beginning of the session to sell books and other course supplies. Limited scientific equipment such as vials may also be purchased. For your other needs (toilet articles, stationery, confections, etc.), there is a complete grocery store within walking distance of the Station.

ENROLLING

Application for admission to courses should be made before May 15. To obtain an application blank, return the postal card included herein, or write the Director.

Students who have not previously enrolled at the Station must submit a complete official transcript. Graduate students must first enroll in the Graduate School of the University of Montana. Application blanks for this will be sent to all such students.

Official registration will be held at the Station on Wednesday, June 27. Classwork begins Monday, June 25 and extends through the entire 8 weeks.

An institute for secondary school teachers of biology supported by the National Science Foundation will be offered in part at the Biological Station.

During the summer, a course in mycology will be provided for students of this institute. Students in attendance at the Station will also register for additional courses chosen from among the offerings at the Station, and for the seminar offered at the Station. For further information, write Dr. J.F. Tibbs, University of Montana.

ENROLLMENT PROCEDURE

Return the postal card included herein for applications; complete applications and mail to "Biological Station, University of Montana, Missoula, Montana 59801."

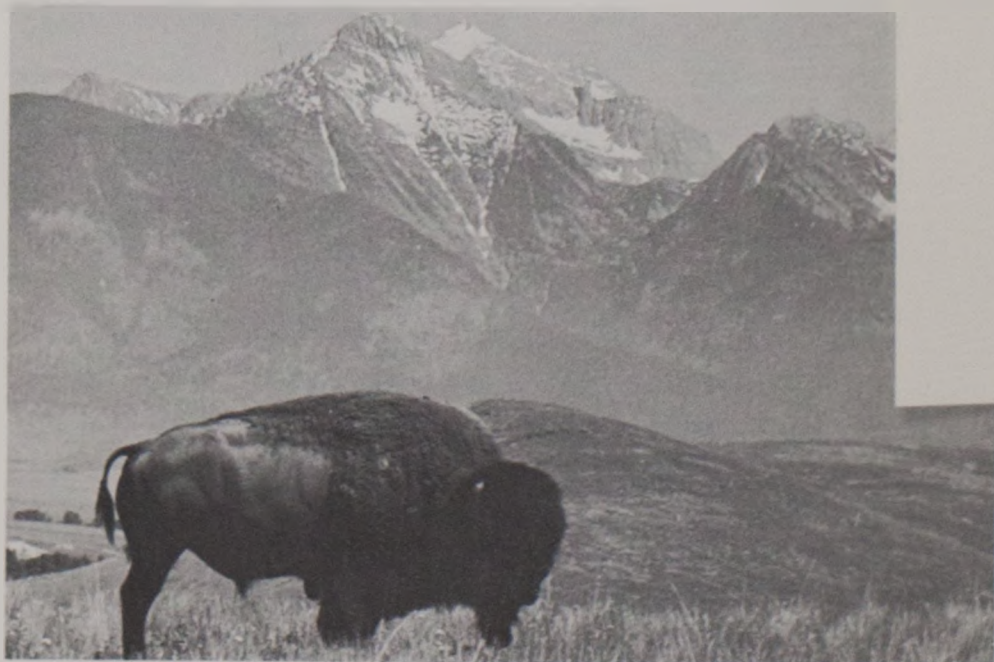


Alga species, new or interesting from the Flathead Region

1. Lemanea annulata Kuetz.
2. Pediastrum Taylori Sieminska
3. Trochocia Prescottii Sieminska
4. Tetraedron Starmachi Sieminska
5. Ceratium hirundinella (O.F.M.) Schrank
6. Spinoclosterium curvatum
var. spinosum Prescott
7. Glaucocystis sp. nov. unknown sp.
8. Monostroma latissimum (Kuetz.) Witt.
9. Stigeoclonium Nelsonii Prescott
10. Cosmarium margaritatum (Lund.) Roy et Biss.



—A view of some student cabins which have an unrestricted view of the entire lake.

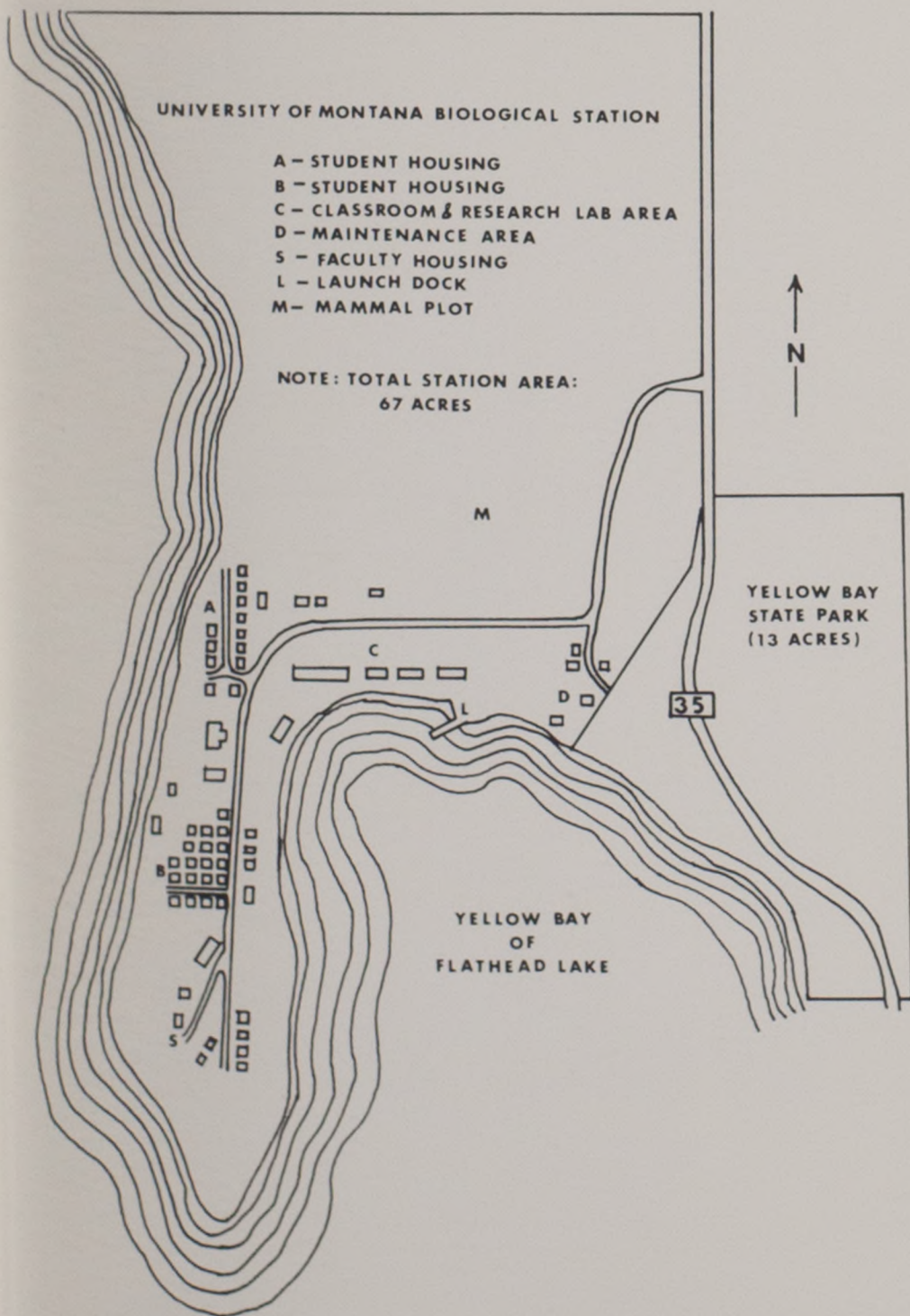
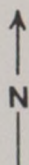


—The proximity of the National Bison Range at Moiese affords occasion for interesting wildlife studies. The Mission Range is in the background.

UNIVERSITY OF MONTANA BIOLOGICAL STATION

- A - STUDENT HOUSING
- B - STUDENT HOUSING
- C - CLASSROOM & RESEARCH LAB AREA
- D - MAINTENANCE AREA
- S - FACULTY HOUSING
- L - LAUNCH DOCK
- M - MAMMAL PLOT

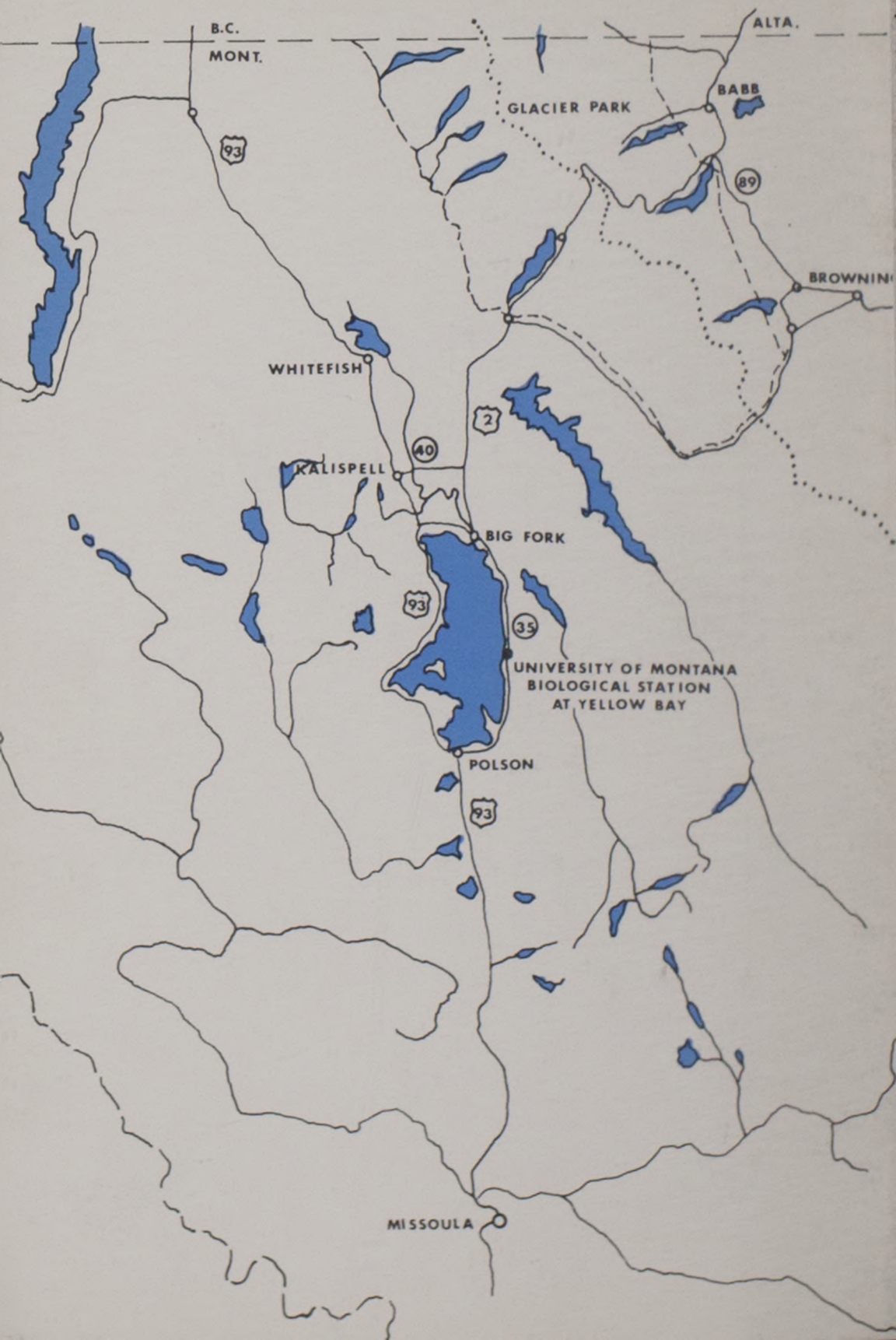
NOTE: TOTAL STATION AREA:
67 ACRES



YELLOW BAY
STATE PARK
(13 ACRES)

35

YELLOW BAY
OF
FLATHEAD LAKE





**UNIVERSITY OF MONTANA
BULLETIN**

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_____ (name)

_____ (address) _____ (city) _____ (state)
_____ (zip code) Telephone number: _____

College/University attending: _____

Status (check one): _____ (a) Special Student (summer only—undergraduate credit)

_____ (b) UM Student: Quarter last attended _____, Student I.D. number
_____, Undergraduate or Graduate _____

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_____ (d) Unclassified Graduate Student (students who have completed a Bachelor's degree and wish to receive graduate credit although it does not apply to a degree program).

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Professor of Botany, University of Montana
Missoula, Montana
- PHILIP A. BUSCEMI, PH.D.
Visiting Professor of Zoology, Eastern New Mexico University
Portales, New Mexico
- GARY W. CROSBY, PH.D.
Professor of Geology, University of Montana
Missoula, Montana
- REXFORD DAUBENMIRE, PH.D.
Visiting Professor of Botany, Washington State University
Pullman, Washington
- THOMAS L. EVERSMAN
Visiting Instructor, Bozeman City Public Schools
Bozeman, Montana
- ROBERT W. FIELDS, PH.D.
Professor of Geology, University of Montana
Missoula, Montana
- J. DAVID LIGON, PH.D.
Visiting Associate Professor of Zoology, University of New Mexico
Albuquerque, New Mexico
- ORSON K. MILLER, PH.D.
Visiting Associate Professor of Botany, Virginia Polytechnic Institute
and State University
Blacksburg, Virginia
- B. L. TURNER, PH.D.
Visiting Professor of Botany, University of Texas at Austin
Austin, Texas
- PHILIP L. WRIGHT, PH.D.
Professor of Zoology, University of Montana
Missoula, Montana

Teaching Assistants

- STEVEN C. EGELINE, B.S. Biology
Graduate Student, Department of Zoology
University of Montana, Missoula
- SHARON R. EVERSMAN, M.S. Botany
Instructor, Biology Program
Montana State University, Bozeman
- ELLEN FARR, B.S. General Science
Graduate Student, Department of Biology
Virginia Polytechnic Institute and State University, Blacksburg

CHRISTOPHER J. HUNTER, B.A. Biological Sciences
Graduate Student, Department of Zoology
University of Montana, Missoula

DAVID S. POTTER, M.A. Zoology
Graduate Student, Department of Zoology
University of Montana, Missoula

JACK A. STANFORD, M.S. Zoology
Graduate Student, Department of Biology
University of Utah, Salt Lake City

YVONNE B. WEBER, M.S. Biology
Research Associate, Oregon Zoological Research Center
Portland, Oregon

Visiting Investigators

GARY E. DILLARD, PH.D.
Associate Professor of Botany, Western Kentucky University
Bowling Green, Kentucky

BENJAMIN A. FOOTE, PH.D.
Associate Professor of Zoology, Kent State University
Kent, Ohio

WILLIAM C. VINYARD, PH.D.
Professor of Botany, California State University, Humboldt
Arcata, California

GLENN B. WIGGINS, PH.D.
Curator, Royal Ontario Museum
Toronto, Ontario, Canada

*Address all correspondence



— Plankton sampling in Yellow Bay on the Biological Station's research vessel, *Daphnia II*. Elrod laboratory can be seen in the background.

1973 SUMMER SESSION

University of Montana

BIOLOGICAL STATION

June 23 to August 18

The Biological Station is a unit of the College of Arts and Sciences of the University of Montana. All courses offered at the Station give graduate credit and are designed for those working at the upper division and graduate level. 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 Station is located on Yellow Bay on the east shore of Flathead Lake at the base of the northern end of the Mission Mountains. The Station also has land on Bull Island and on Polson Bay and owns the two small Bird Islands. Flathead Lake lies in the Flathead Valley at the southern end of the Flathead and Purcell Trenches of the Rocky Mountains. The valley, bordered by mountain ranges showing marked differences in geological structure, lies about 40 airline miles west of the Continental Divide and 100 airline miles south of the Canadian Border. This valley and the adjacent valleys and mountains form one of the upper reaches of the Columbia River Drainage. The headwaters of the Mississippi and Hudsonian Drainages are easily accessible in Glacier National Park.

OPPORTUNITIES FOR STUDY AND RESEARCH

Although the more formal part of the course work is given in well-equipped laboratories, all courses emphasize field work.

The many mountain ranges and valleys, with altitudes from 3,000 to 10,000 feet, which are accessible from the Station offer a wide variety of habitats. Plant associations include palouse prairie; sage brush; montane, coast and sub-alpine fir forests; sub-alpine to alpine meadows; and tundra. Aquatic environments include eutrophic and oligotrophic lakes, glacial potholes, ponds, swamps, bogs, streams, and rivers. Opportunities for field trips and for problem work are therefore many and varied.

There is a stimulating, academic environment at the Biological Station. Students, instructors, researchers and others work together very closely maintaining a scholarly and sociable atmosphere. A number of scientists conduct research at the Biological Station; visiting scientists and guest lecturers stop by often throughout the summer. Academic activities are not restricted to the courses listed below.

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 Cooperative 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. Graduate students from a number of universities conduct thesis and dissertation research at the Station. The Station is a hub of field activity for the Intermountain Aquatic Studies Consortium.

SUMMER MAILING ADDRESS

University of Montana Biological Station
Yellow Bay, Flathead Lake
Bigfork, Montana 59911

Description of Courses

Credits earned at the Biological Station are transferable to other colleges and universities the same as are credits earned in academic departments on the University's Missoula Campus.

Credit is given in "quarter credits." The maximum load for any student is thirteen credits and the minimum load is six credits. Graduate Assistants must register for at least three credits and may carry a maximum of six credits. Only in exceptional cases will students be granted permission to carry courses in excess of thirteen credits. A three- or six-credit course normally meets two and one-half days a week and is scheduled for an extra half day each week to make three-day field trips possible.

Below is a calendar of courses which require firm daily scheduling:

Course	1st through 4th weeks 23 June - 21 July		5th through 8th weeks 22 July - 18 August	
	M T W	Th F S	M T W	Th F S
Limnology	_____	_____	_____	_____
Phycology	_____	_____	_____	_____
Mycology	_____	_____	_____	_____
Ichthyology	_____	_____	_____	_____
Ornithology	_____	_____	_____	_____
Plant Systematics	_____	_____	_____	_____
Zooplankton Biology	_____	_____	_____	_____
Animal Behavior	_____	_____	_____	_____
Plant Ecology	_____	_____	_____	_____
Physical Geology	_____	_____	_____	_____
Lake Processes	_____	_____	_____	_____

Some of the courses are eight weeks long, and some are only four weeks long. Individual supervised research problems may be taken for either four or eight weeks. A student wishing to take twelve quarter credits of work, for example, may sign up for: two eight-week courses—or one eight-week course and two four-week courses—or 1 eight-week course and one four week course with one research problem—and so forth.

Examples of possible schedules are as follows:

<u>course</u>	<u>credits</u>	<u>weeks</u>	<u>class days</u>
(a) Limnology	6	1 - 8	M T W
Physical Geology	3	1 - 4	Th F S
Research			
	9 ++ credits		
(b) Mycology	6	1 - 8	M T W
Phycology	6	1 - 8	Th F S
Seminar	1	1 - 8	
	13 credits		
(c) Ornithology	3	1 - 4	M T W
Phycology	6	1 - 8	Th F S
Zooplankton or Animal Behavior		5 - 8	M T W
or	3		
Lake Processes		5 - 8	M T W
	12 credits		
(d) Ornithology	3	1 - 4	M T W
Ichthyology	3	1 - 4	Th F S
Lake Processes	3	5 - 8	M T W
Plant Ecology	3	5 - 8	Th F S
Seminar	1		
	13 credits		

COURSES OFFERED

BOTANY

<u>Call Numbers</u>	<u>Course Numbers</u>	
0900	441. Phycology. 6 cr.	Prerequisites: one year laboratory course in botany and consent of instructor. Identification, classification, distribution, life histories and limnological relationships of the algae of the Northern Rocky Mountains. Thursday, Friday, Saturday. Prescott.
0901	449. Problems in Plant Science. (Sec. 2) 1-5 cr.	Prerequisites: junior standing and consent of instructor. Individual or group research problems dealing with aspects of plant science not taken up in regular courses. Hours by arrangement. Staff.
0902	449. Biological Illustration. (Problems Sec. 3) 1 cr.	Prerequisites: consent of instructor. Basic principles and skills of producing illustrative materials relevant to the biological sciences. (Also listed as Zoology 496, Section 10.) Hours by arrangement. Eversman.

- 0903 **449. Plant Systematics.** (Probelms Sec. 4) 3 cr. Prerequisites: a course in general botany and consent of instructor. Systematics of vascular plants, with special reference to those of the Northern Rocky Mountains. Thursday, Friday, Saturday. Turner.
- 0904 **449. Plant Ecology.** (Problems Sec. 5) 3 cr. Prerequisites: a course in general botany and consent of instructor. Community concepts of ecology including succession, stratification, periodicity and energy relationships, with special reference to the flora of the Northern Rocky Mountains. Thursday, Friday, Saturday. Daubenmire and Turner.
- 0905 **461. Limnology.** 6 cr. Prerequisites: a year of chemistry and consent of instructor. Ecology of lakes, streams, and ponds, with emphasis on the chemical, physical, and biotic factors which determine their biological productivity. (Also listed as Zoology 461.) Monday, Tuesday, Wednesday. Gaufin.
- 0906 **475. Mycology.** 6 cr. Prerequisites: a course in general botany and consent of instructor. The morphology, taxonomy, and ecology of the fungi species of the Northern Rocky Mountains. NSF Institute Course. Monday, Tuesday, Wednesday. Miller.
- 0907 **490. Seminar in Biology.** 1 cr. Lectures and discussions of special problems in biology. (Also listed as Zoology 490.) One evening each week. "Pass or Fail" grade only. Staff.
- 0908 **539. Problems in Plant Anatomy and Morphology.** 1-5 cr. Prerequisites: consent of instructor. Individual or group work consisting of research problems, special readings or discussions dealing with aspects of plant anatomy and morphology not taken up in regular courses. Hours by arrangement. Staff.
- 0909 **549. Problems in Plant Cytology and Genetics.** 1-5 cr. Prerequisites: consent of instructor. Individual or group work consisting of research problems, special readings or discussions dealing with aspects of plant cytology and genetics not taken up in regular courses. Hours by arrangement. Staff.
- 0910 **559. Problems in Plant Ecology.** 1-5 cr. Prerequisites: consent of instructor. Individual or group work consisting of research problems, special readings or discussions dealing with aspects of plant ecology not taken up in regular courses. Hours by arrangement. Staff.
- 0911 **569. Problems in Plant Taxonomy.** (Sec. 2) 1-5 cr. Prerequisites: consent of instructor. Individual or group work consisting of research problems, special readings or discussions dealing with aspects of plant taxonomy not taken up in regular courses. Hours by arrangement. Staff.
- 0912 **579. Problems in Mycology and Forest Pathology.** (Sec. 2) 1-5 cr. Prerequisites: consent of instructor. Individual or group work consisting of research problems, special readings or discussions dealing with aspects of mycology and plant pathology not taken up in regular courses. Hours by arrangement. Staff.
- 0913 **600. Research.** Credit variable. The Botany 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 allowed is 15. Staff.
- 0914 **699. Thesis.** Credit variable. Maximum credit allowed is 15.

ZOOLOGY

- 0915 **461. Limnology.** 6 cr. Prerequisites: a year of chemistry and consent of instructor. Ecology of lakes, streams, and ponds, with emphasis on the chemical, physical, and biotic factors which determine their biological productivity. (Also listed as Botany 461.) Monday, Tuesday, Wednesday. Gaufin.
- 0916 **490. Seminar in Biology.** 1 cr. Lectures and discussions of special problems in biology. (Also listed as Botany 490.) One evening each week. "Pass or Fail" grade only. Staff.

- 0917 **498. Problems in Zoology.** (Sec. 5) 1-5 cr. Prerequisites: junior standing and consent of instructor. Semi-independent work under the direction of a faculty member. Hours by arrangement. Staff.
- 0918 **498. Ichthyology.** (Problems Sec. 6) 3 cr. Prerequisites: junior standing and consent of instructor. The biology and methods of study of fishes, with special reference to the fauna of Western Montana. Thursday, Friday, Saturday. Buscemi.
- 0919 **498. Zooplankton Biology.** (Problems Sec. 7) 3 cr. Prerequisites: junior standing and consent of instructor. The biology and methods of study of the zooplankton of freshwaters of the Northern Rocky Mountains. Monday, Tuesday, Wednesday. Buscemi.
- 0920 **498. Ornithology.** (Problems Sec. 8) 3 cr. Prerequisites: junior standing and consent of instructor. The structure, classification, and life histories of birds. Monday, Tuesday, Wednesday. Wright.
- 0921 **498. Animal Behavior.** (Problems Sec. 9) 3 cr. Prerequisites: junior standing and consent of instructor. Normal behavior of animals under natural conditions; observation and recording of animal behavior. Monday, Tuesday, Wednesday. Ligon.
- 0922 **498. Biological Illustration.** (Problems Sec. 10) 1 cr. Prerequisites: consent of instructor. Basic principles and skills of producing illustrative materials relevant to the biological sciences. (Also listed as Botany 449, Section 3.) Hours by arrangement. Eversman.
- 0923 **600. Advanced Zoological Problems.** (Sec. 2) 1-5 cr. Opportunity is given to graduate students with sufficient preparation and ability to pursue original investigations. Staff.
- 0924 **699. Thesis.** (Sec. 2) Credit variable. Maximum credit allowed is 15.

GEOLOGY

- 0925 **490. Physical Geology.** (Senior Seminar, Sec. 3) 3 cr. Prerequisites: junior standing and consent of instructor. Minerals, rocks, and structures of the earth's crust and the processes of its formation. Thursday, Friday, Saturday. Fields and Crosby.
- 0926 **490. Lake Processes.** (Senior Seminar, Sec. 4) 3 cr. Prerequisites: junior standing and consent of instructor. Geological phenomena and processes of importance to lakes, and techniques for the study of these features. Monday, Tuesday, Wednesday. Crosby and Fields.

General Information

FEES (Subject to change)

All students pay a \$10.00 Field Trip Fee to cover in part the cost of field trip transportation.

Those other than registered students desiring to carry on independent research, resident or non-resident, are charged an investigator's fee of \$25.00 per week. This entitles him to the use of one 4' x 6' table and a proportionate amount of shelving. Chemicals and glassware are provided in reasonable amounts. Microscopes will be provided if available. Those with special equipment, supplies or space problems should write the Director.

The student fee on a per quarter credit basis is as follows:

Four or Eight Week Session

Credit Hours	Resident Fees	Non-Resident Fees
1	\$ 21.00	Add
2	42.00	\$10.00
3	63.00	Per
4	77.00	Credit
5	90.00	
6	103.00	
7	116.00	
8	129.00	
9	142.00	
10 or More	No Additional Fees	

(plus \$10.00 transportation fee)

LODGING

All individuals are housed in 12' x 14' or 12' x 16' cabins which have three 36" x 24" windows. Each cabin is provided with lights and electric (AC) outlets, beds, mattresses, pillows, chair, table, dresser, and minor items of equipment. The cabin fees are \$4.00 weekly per person. **Student families may not live in Station housing.** Only persons enrolled in Station courses may live in Station housing. Guest cabins, however, are sometimes available for periods not exceeding one week.

BOARD

All resident station students and personnel are required to board at the Commissary; 8-week costs: \$252.28 for adults and \$184.44 for those under twelve. Costs for only four weeks' residence are proportionately reduced. First meal served will be dinner on Saturday, June 23, and last meal served will be lunch on Saturday, August 18. **No refunds are made for absences of less than a week, and any absence must be preceded by a one-week prior notification.** All commissary facilities are under the direction of the central University Food Service.

BATHING FACILITIES

The Station has three modern washrooms with hot and cold running water and toilet facilities. The central one, in addition, has showers and laundry facilities. It also has an ironing room and ironing boards. The Station does not provide irons.

HEALTH SERVICES

Each student is covered by the student health plan which covers sickness and certain accidents which may occur during the session at the Biological Station. This is paid by the health service fee. The nearby towns of Polson and Kalispell have excellent doctors and hospital facilities for emergencies, and the student health center in Missoula remains open 24 hours a day for those who can avail themselves of its services. An additional supplementary health plan is available at minimal cost and is recommended.

ADVANCED DEGREES

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

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 overnight and three-day trips in each course may be expected. Meals on such trips are supplied by the commissary. The Station cannot provide transportation for independent research workers; however, space on scheduled field trips may be used when available.

REMUNERATIVE WORK

Opportunities for work are not numerous. Assistantships which pay \$750.00 per session are available for some courses. To be eligible for these the student should have a major in the field concerned and experience in the subject matter of the course to which the assistantship is assigned. Research assistantships are occasionally available. There are some part time jobs for janitorial work, labor, and driving vehicles.

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 the western United States is found within a few hours' drive of the Station. Fine catches of rainbow, cutthroat, Mackinaw 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 area. There are 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.

The Station is a game reserve; dogs and other pets are not allowed. Firearms may not be brought onto the premises without advance written permission from the Director.

EQUIPMENT AND SUPPLIES NEEDED

Course and field trips: The student should, if he has them, bring dissecting kits, hand lens, field glasses, musette bag, and other usual field and laboratory course supplies. The Station is located in a mountain valley and many of the classes will work in the mountains during the course of the summer; students, therefore, must have adequate clothing and footwear. Nights are cool and temperatures can be low. There will be cool, rainy as well as warm to cool, dry weather; one should have warm, wool clothing, cotton clothing, and rainy weather equipment. Good hiking boots with 6 to 8 inch tops are advised for field trips in the mountains. Tennis shoes or hip boots are the best type of footwear for aquatic work. Remember that mountain streams are cold. Inasmuch as

some overnight trips will be taken, back packs, warm sleeping bags (such as the inner arctic type) with liners and ground-cloth are recommended.

Living equipment: The student is responsible for supplying his own blankets, bed linen, towels, toilet articles, and proper clothing. Most students wear slacks or jeans. A flashlight, small mirror, reading lamp, and curtains for the three cabin windows (36 x 24) also will be useful. Recreational, musical, and photographic equipment are also useful.

STUDENT STORE

The Associated Student Store from the Missoula Campus will be at the Station for one week at the beginning of the session to sell books and other course supplies. Limited scientific equipment such as vials may also be purchased. For your other needs (toilet articles, stationery, confections, etc.), there is a complete grocery store within walking distance of the Station.

ENROLLING

Application for admission to courses should be made before May 15. To obtain an application blank, return the postal card included herein, or write the Director.

Students who have not previously enrolled at the Station must submit a complete official transcript. Graduate students must first enroll in the Graduate School of the University of Montana. Application blanks for this will be sent to all such students.

Official registration will be held at the Station on Wednesday, June 27. Classwork begins Monday, June 25 and extends through the entire 8 weeks.

An institute for secondary school teachers of biology supported by the National Science Foundation will be offered in part at the Biological Station. During the summer, a course in mycology will be provided for students of this institute. Students in attendance at the Station will also register for additional courses chosen from among the offerings at the Station, and for the seminar offered at the Station. For further information, write Dr. J.F. Tibbs, University of Montana.

ENROLLMENT PROCEDURE

Return the postal card included herein for applications; complete applications and mail to "Biological Station, University of Montana, Missoula, Montana 59801."

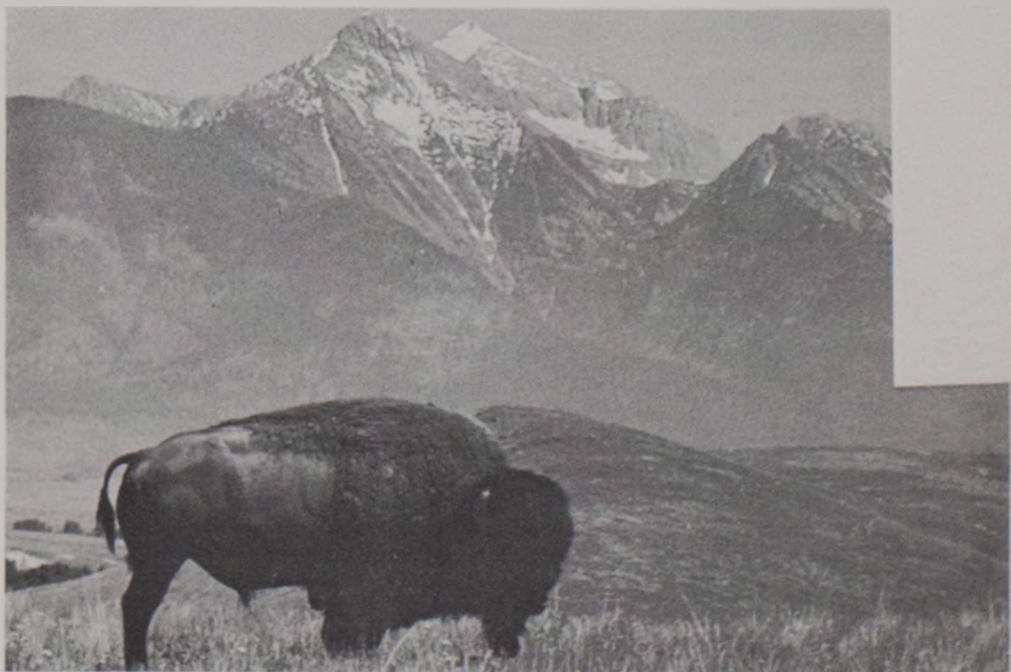


Alga species, new or interesting from the Flathead Region

1. Lemanea annulata Kuetz.
2. Pediastrum Taylori Sieminska
3. Trochocia Prescottii Sieminska
4. Tetraedron Starmachii Sieminska
5. Ceratium hirundinella (O.F.M.) Schrank
6. Spinoclosterium curvatum
var. spinosum Prescott
7. Glaucocystis sp. nov. unknown sp.
8. Monostroma latissimum (Kuetz.) Wittr.
9. Stigeoclonium Nelsonii Prescott
10. Cosmarium margaritatum (Lund.) Roy et Biss.



—A view of some student cabins which have an unrestricted view of the en lake.

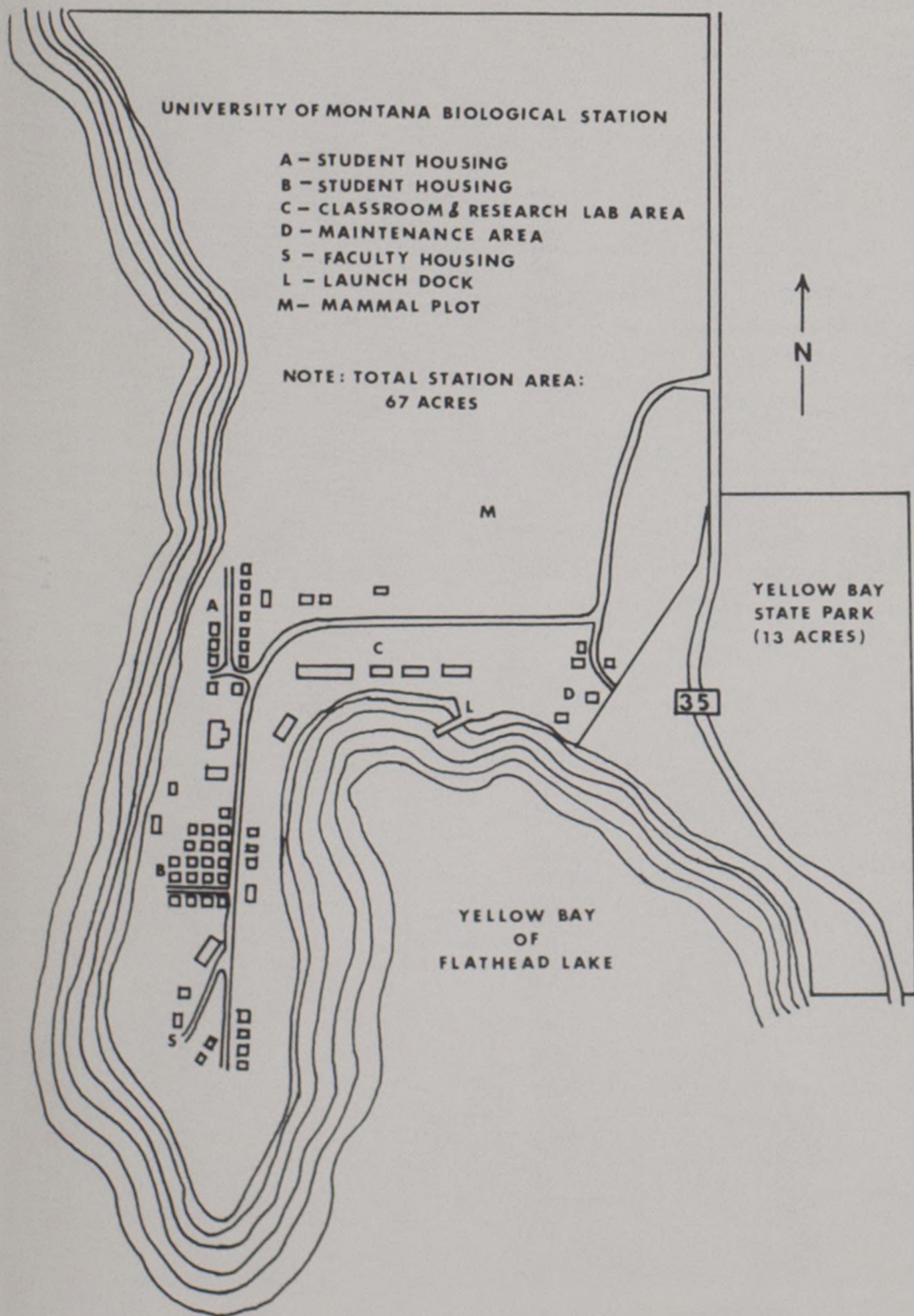
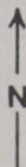


—The proximity of the National Bison Range at Moiese affords occasion for interesting wildlife studies. The Mission Range is in the background.

UNIVERSITY OF MONTANA BIOLOGICAL STATION

- A - STUDENT HOUSING
- B - STUDENT HOUSING
- C - CLASSROOM & RESEARCH LAB AREA
- D - MAINTENANCE AREA
- S - FACULTY HOUSING
- L - LAUNCH DOCK
- M - MAMMAL PLOT

NOTE: TOTAL STATION AREA:
67 ACRES



YELLOW BAY
STATE PARK
(13 ACRES)

35

YELLOW BAY
OF
FLATHEAD LAKE



—A view of some student cabins which have an unrestricted view of the entire lake.

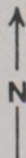


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M

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STATE PARK
(13 ACRES)

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YELLOW BAY
OF
FLATHEAD LAKE

