

Syllabi by Discipline :: Fisheries Science

Course Title: Freshwater Ecology/Limnology

Instructor: Dave Potter

School: Unity College

Categories:

Fisheries Science, Environmental Studies

Syllabus:

Course Number: BI 3184 F99

Credits: 4

SC 4; see schedule at office

Prerequisites: BI 1014 and BI 1024 or BI 1114 and BI 1124 and either BI 2004 or GL 1023

Class Hours: 3 hours lecture and one 3 hour laboratory weekly

lecture: 1530-1645 hrs T R ES/KH 14 *

laboratory A: 1430-1720 hrs M ES/KH 14

laboratory B: 1230-1520 hrs R ES/KH 14

Semester Offered: Fall

Service Learning: Included in context of class responsibilities plus additional work

Course Description:

Freshwater ecology/limnology entails the study of aquatic organisms in relation to the environmental conditions of lakes and streams. Lotic and lentic waters will be characterized and contrasted. The physical, chemical, and biological components of these systems will be dealt with in detail in lectures. Laboratory exercises will be oriented toward identification of the biota and water chemistry.

Course Objectives: The primary objective of the course is to contribute to student preparation in aquatic sciences. The course will expose students to a variety of aquatic environments that are relatively unperturbed and those much perturbed by human activity. Techniques to describe, manage, and manipulate freshwater ecosystems will be practiced and observed in anticipation of entry level employment in aquatic science professions.

Assessment: My assessment of your accomplishments in BI 3184 occurs through:

Quizzes: unannounced, any time, 10 points, best 12 15%

Lecture Exams: rigorous, 100 points, 7 OCT, 18 NOV 20%

Final Exercise: rigorous, professional, comprehensive 10%

MFC Contract: role playing as consultants for local client 10%

Service-Learning: context: class, laboratory, agencies 15%

Texts:

Two texts are required. A general limnology text is most important for understanding of lecture topics. A freshwater ecology identification manual is required for laboratory and preparation of the Collection for Freshwater Ecology. I recommend a manual for identification of invertebrates.

NARRATIVE

Assessment: Expect a quiz every time you come to BI 3184. Quizzes will be short and valued at 10

points. We will discuss most quizzes immediately after student papers are collected. There will be no excuse for a missed quiz; there will be no second opportunity to take a missed quiz once papers are collected. However, because I will give many quizzes, I will only include your 15 best quiz grades in calculation of your final course grade. Despite my leniency, you cannot afford to miss any quizzes.

The two lecture exams will be comprehensive for the current interval of the class. There will be problems, essay responses, calculations, definitions, scenarios, matching exercises, and perhaps mapping and other illustrations to interpret or prepare. Each exam may include material from lecture, laboratory, discussions, and readings. Each exam will be offered during the entire lecture period 7 OCT and 18 NOV 1999.

A final exercise during the regular exam period, Wednesday 15 DEC 1999 at 1530-1730 hrs as published in the Final Exam Schedule for Semester 11999, will be determined during November. There will be no excused absence from the final exercise.

Laboratory requirements for BI 3184 are provided on additional pages within this syllabus.

The MFC contract is an opportunity to plan, implement, and evaluate a project in concert with one or more of your peers. In this assignment you will role play as an aquatic science consultant of my fisheries science, public information, and tourism firm, Megaleuctra Fisheries Consultants (MFC). The project must be within the context of limnology and freshwater ecology. I anticipate projects with discrete boundaries that focus effort and develop quality products. My preference is for groups of not more than 4 nor less than 2 individuals, but last year a few students preferred to work alone while one group of six students was rather ineffective. Each group must initially submit a bid that anticipates a project. Contracts to conduct appropriate sampling, to develop pertinent data, to provide description or to pose resolution and remediation to a concern, and to present some "product" to the "client" will be awarded after negotiation. Some groups may work with actual clients, community partners in the **Lake Winnecook Water Quality Project (LWWQP)**. I am the sole proprietor and absolute boss of MFC; I will be constantly observing you as my employee in this exercise even as I expect you to conduct your work without constant supervision. I expect to be advised regularly about group planning, implementation, product delivery, and evaluation regarding the contract. Further description of this component of BI 3184 is presented on additional pages within this syllabus.

Several other service-learning components are incorporated in BI 3184. We will contribute our class data to state and federal agencies and to non-profit organizations. We will receive advice and requests from the same groups. I expect to have field or classroom visits from some agency personnel, but this intent may not be realized because agency personnel have an active field season just as we do in the class. Most service-learning expectations are outlined within the laboratory and MFC consulting components of the syllabus.

25 Mile Pond = Unity Pond = Lake Winnecook

Texts: The required texts are:

Cole, G. A. 199x. Textbook of Limnology. current ed. Waveland Press, Inc. (?)

Thorp, J. T., and A. P. Covich, eds. 1991. Ecology and Classification of North American Freshwater Invertebrates. Academic Press, San Diego, CA, USA. Pp. 911.

There are other adequate and acceptable, even more elaborate, texts that you may find. If you have spare time and a limited budget I recommend you look at used limnology texts by R. Wetzel (highly theoretical and difficult to read), A. Home and C. Goldman (or earlier editions by only Goldman) (examples include mostly California lakes), or by H. B. N. Hynes, G. Reid, or P. Welch (all old but good). Limnological methods are reviewed by R. Wetzel and G. Likens, P. Welch, or O. Lund (my favorite). Used but dated invertebrate identifications by Pennak, by Storer and Usinger, or by Ward and

Whipple may be available if you can deal with the many changes in taxonomy that have occurred since these works were published.

An extremely useful reference for preparation of papers and illustrations is:
McMillan, V. E. 199x. *Writing Papers in the Biological Sciences*. St. Martin's Press (newer edition may be by Bedford Books), New York. About 150 pages, soft cover.
I do not find the similar text by Pechenik to be as user friendly.

Equipment: Some personal equipment will be extremely useful during the course.

Dissecting kit: A student kit will be invaluable. At least have a dropper, two needles or probes, and one or more forceps.

Wading boots: Hip boots or chest waders will be necessary for many of our lake and stream studies. Students without adequate footwear cannot reach, will not appreciate, do not participate adequately in many activities. I do expect you to act as a limnologist with either proper footwear or with wet feet. However, the balmy waters of early September do not last through October and November when we will continue to be immersed for a portion of each laboratory. An inexpensive but rugged pair of hip boots will probably last for the dozen to twenty times that you will be in the water for this class.

Containers for collection: Start to collect small jars and bottles or proper specimen vials in which to fix, preserve, and present specimens for your Collection for Freshwater Ecology. I will request that the bookstore stock for your purchase 3 dram vials for small specimens. Baby food jars, individual juice drink bottles, and some condiment jars may also be useful. Most canning jars are larger than necessary and have embossed ornamentation that is not appropriate for presentation of scientific specimens. A last resort can be self-sealing plastic bags (actually these are best choice for mollusk shells).

Coast Guard Approved Personal Floatation Device (PFD): This is a useful item for any student of field biology. PFD's will be available in class and laboratory when necessary. You must wear a PFD any time you are in a boat as part of activities for BI 3184.

Laboratory:

The laboratory component of BI 3184 will attempt to provide practical experience parallel to the theoretical and conceptual presentations of the lecture component of the course. Individual laboratory exercises will focus on data collection for description or analysis of:

- characteristics of fresh water
- solutes and suspensions in water -biota of aquatic habitats
- actions inherent to that biota -human use, consumption, and appreciation of aquatic ecosystems.

Laboratory exercises will parallel the lectures and lecture assignments to contribute to your knowledge of water; water chemistry; hydrology of the 25 Mile drainage; primary production supported by phytoplankton, other algae, cryptogams, or rooted macrophytes; secondary production by zooplankton, macrobenthos, and fish; energy webs; and sediments. Comparative limnology between lakes in Waldo County is also anticipated.

You must be present to participate in activities and to learn the methods and information. I also expect that you will demonstrate leadership and followership skills as appropriate.

Some product will be expected from each laboratory exercise. Sets of raw data, interpretations or analyses of data, illustrations, or formal laboratory reports will be requested as part of most exercises.

Throughout the semester you will also collect, preserve, identify, and curate specimens for your individual Collection for Freshwater Ecology. You may collect and preserve specimens during

laboratory time, use specimens at the completion of any laboratory exercise, or collect at your own initiative. The Collection for Freshwater Ecology is designed to encourage student familiarity with many taxa of freshwater organisms, to facilitate student preparation of organisms as they might be preserved for posterity in a scientific museum, and to direct students into the specialist literature during the several processes of collection and curation. Expectations for the collection are presented elsewhere in the syllabus.

As you become proficient through laboratory participation with collection and analysis of information about the 25 Mile Watershed or other regional watersheds, you will find planning, implementation, and evaluation of your MFC consulting project to be simplified. I expect myriad questions and comments from student consultants. Use me, the boss, as an initial resource due to my several years of experience in the watershed, basic knowledge of the literature, contacts with experts or agency personnel, and geographic exposure. Do, however, expect me to direct you to appropriate resources rather than merely to provide answers to your queries.

BI 3184 Fall 1999 **Collection for Freshwater Ecology**

Each student will prepare and submit for grading an individual Collection for Freshwater Ecology. The collection will be composed of twenty biological samples as indicated below accompanied by two documents. Each sample will be appropriately labeled and preserved according to instructions given 30 AUG and 2 SEP as well as during several following laboratories. The first document will be a catalogue of specimens cross referenced to the specimen labels. The second document will be a short (3-4 page) paper about one species in the collection (or a species that might be expected in local aquatic habitats).

The collection will include:

-Two photosynthetic algae.

Two different phyla must be represented and identification is adequate to phylum. Present as dry herbarium mount or in liquid preservative.

-Three different aquatic vascular plants

mounted on full herbarium sheets. Identification must be at least to class. One Bryophyta may be substituted for a vascular

plant in which situation the bryophyte may be identified to class but one remaining vascular plant must be identified to family.

-One specimen from each of any two kingdoms including the following choices:

heterotrophic

Protista

Porifera,

Cnidaria

Platyhelminthes

Rotifera

Gastrotricha

Bryozoa

Tardigrada or Annelida

Identification to phylum is adequate. Preservation of some groups is problematic. This is referred to as the CATCHALL

group on the score sheet.

-Three Crustacea:

each from a different class and identified to class. In liquid preservative.

-Two molluscs

including one bivalve and one gastropod. Dry shells identified to family.

-Examples of aquatic insects from any eight of the ten orders likely to be encountered. Either aquatic or terrestrial life stages may be presented. All insects are to be preserved in alcohol in vials except for selected Odonata submitted as MDDS specimens. Identification to order.

Any specimen may be presented with identification to a less inclusive taxonomic category for an additional 20% of the score for that sample. However, if the additional identification is incorrect, a 50% penalty will be assessed for that sample. A collection score sheet is appended to this syllabus.

The entire Collection for Freshwater Ecology will earn as many as 200 points. One hundred points will be allotted

as 5 points per sample as follows:

-specimen quality, 2 points

-label, 1 point

-identification, 2 points

The catalogue will earn as many as 40 points based on accuracy, completeness, readability, and comparison to sample

labels. The species paper must reference at least three sources in the peer reviewed literature. One reference must be electronic, all three cannot be.

The paper may include habitus illustrations, distribution maps, and other illustrative content at part of length to accumulate 60 points.

Collections for Freshwater Ecology will be due no later than 1700 hrs 6 DEC 1999. Collections submitted later will not be graded. Collections submitted in final form by 1700 hrs 19 NOV 1999 will earn a bonus equivalent to 20% of the earned score.

BI 3184 Fall 1999

Service-learning

A major initiative in BI 3184 again for Fall 1999 is the development and enhancement of partnerships with organizations and agencies interested in the 25 Mile Watershed. Freshwater Ecology/Limnology each year develops substantial quantities of data concerning the local watershed. The raw field data, laboratory analyses, and term reports are valuable to community partners in many contexts. Our data are not perfect, but our data are generated with no particular bias. Certain partners will use our information immediately in continuing projects. Other partners will support our efforts in anticipation of future value. Class activities may contribute to public education, resource management, water quality improvement efforts, resource management plans, land use and development, licensing reports, proposals for funding, tourism, property tax determination, public policy and rulemaking deliberations, bills submitted to the Maine Legislature, and other social and cultural development of northern Waldo County and beyond.

Our service-learning projects for Fall 1999 include:

-routine water quality monitoring and the Lake Winnecook Inventory (LWI)

-the contracts for Megaleuctra Fisheries Consultants (MFC)

-the opportunity to participate in the Watershed Stewards workshop

-renewed contributions to Maine Amphibian and Reptile Atlas Project

-and new initiatives with the Maine Vernal Pool Advisory Group and with Maine Damselfly and Dragonfly Survey

I anticipate a laboratory trip to Kanokolus Bog, owned by Hofstra University, to continue a recent cooperative agreement between our college and Hofstra.

Service-learning partnerships will be supported by formal and informal discussions about service performed, in journal entries, and possibly by site visits by partner representatives. Community partners are listed on Lake Winnecook Water Quality Project Community Partners poster. Some partners will teach specific techniques or request explicit ecological data. Other partners will describe their efforts toward resource management. Representatives may offer advice and insight to operations of the partner organization. I am cautious when I describe actual visits by partner representatives, for in past years the actual scheduling of formal visits has been inadequate or absent due to busy schedules. We are most likely to see on site **MDMR or MDIF&W** biologists as they conduct duties in the watershed. At one site we may observe in-stream basket samplers deployed by Lotic, Inc., a local consultant, as part of their consulting contracts for government agencies and private contractors.

Routine water quality monitoring will occur as usual and customary activities within each laboratory session. Most of the routine data will be recorded on Lake Winnecook Inventory (LWI) forms. One LWI form is appended to this syllabus; blank forms will always be available in laboratory or in Potter's mailboxes in Koons Hall and South Coop. Only one LWI form needs to be submitted for any visit to Unity Pond, but I wish to have an LWI for every visit to the lake. A companion form is available for visits at other locations than the Kanokolus site.

The Megaleuctra Fisheries Consultants (MFC) Contract procedures are described below:

A Watershed Stewards workshop sponsored Wednesday evenings in October and November by Waldo County Soil and Water Conservation District and Waldo County Office of Maine Cooperative Extension Service is an option to students wishing to avoid a consulting contract. The Watershed Stewards workshop is not yet completely described, so further information will be forthcoming.

Unity classes contributed to the Maine Amphibian and Reptile Atlas Project (MARAP) in past years. Emphasis on amphibians and reptiles is renewed as cultural development continues in the state. Several species distributions and populations are not as well described as might be, so reports for some species are requested. We will prepare documentation for a variety of amphibians and reptiles that we encounter. We will seek advice from MARAP before we submit quantities of data. An example of the importance of data continuity is the apparent decline of Green Frog (*Rana clamitans*) in the Kanokolus marsh at the Unity Pond outlet.

An additional service project with amphibians is supported by the Maine Vernal **Pool Advisory Group (MVPAG)**. **This project is documenting** vernal pool habitat throughout the state. My goal is to prepare documentation for a minimum of **6 new vernal pool descriptions to MVPAG** by the end of the semester. We may not be able to complete documentation this semester because of certain descriptive requirements. However, both the campus vernal pool and the recently enlarged firepond do meet those requirements. I also know five other sites on private property that meet criteria. Additional sites will need confirmation of biological activity in 2000. Contributions to **MVPAG are not mandatory**.

Contributions to the Maine Damselfly and Dragonfly Survey (MDDS) will be serendipitous. I expect, however, that we will collect numerous adults, exuviae, or larvae for submission to **MDDS**. Descriptions of the project, required procedures, and materials will occur during the semester. I find this project appealing, but I do not expect each student to initially share my enthusiasm. Copies of **MDDS** literature appear in ES/KH 14, in SC 4, and on library reserve.

BI 3184 Fall 1999

MFC Contract

Megaleuctra Fisheries Consultants is a mythical consulting firm for which I have suggested WF 3324 Fisheries Science and Techniques students worked in recent years. In that context 50% of the fisheries student's grade is subjectively evaluated as if the student is a probationary employee of MFC. I will not

subjectively grade you as an employee in BI 3184, but I wish to use this exercise to provide a realistic situation in which you will act as an aquatic scientist. Other faculty may describe this learning style as "problem-based".

Presented below are several questions, scenarios, or tasks posed to me by clients of MFC. Clients actually do include local citizens and property owners, summer visitors to twenty-five Mile Pond, local business persons, inquisitive local youth, and members of the Unity College community. I hope to have some of these people serve as actual client contacts for student teams.

BI 3184 students will gather into teams of 2-4 (1-5) individuals to bid on MFC contracts. Team bids will be reviewed and the contracts awarded to conduct the negotiated tasks. Teams may submit more than one bid and then choose among the offered contracts. Sealed bids must be delivered to me by 1700 hrs 17 SEP 1999. Any early bid will be reviewed and a contract awarded at the request of a prepared team. I reserve the right to reject or negotiate any or all bids or to modify any bid in an offered contract. Default teams or individuals with no submitted bid will work under my direct supervision on a task of my choice.

Specifications: Bids will include: -the title of the contract for which the bid is made -team name and individual names -conditions of the bid including tasks to be attempted -schedule with task and individual work assignments -selected sampling sites -methods and other components deemed appropriate -a preliminary literature review -anticipated equipment and supply needs including expenses -anticipated products for delivery to client -completion date

Every team will give a presentation in format of team's own choice 6, 7, 9, or 15 DEC 1999. Team presentations will be judged on a class approve instrument by peers and clients. further, the client will provide to me an assessment of the completed work and so indicate some level of satisfaction or disappointment that will be reflected in my assignment of your final grade.

This is a group assignment. I understand that students will contribute effort, initiative, enthusiasm, ability, and participation each to their own satisfaction. Satisfaction to one student may not be so identified by another. Despite any frustration that will occur among individuals, the product of the group will be judged by peers and clients, so an individual's grade will reflect the team effort. An opportunity to assess members of your team will be provided.

A year ago I prepared a list of client concerns. Students in BI 3184 Fall 1998 added several contract ideas. Contract opportunities resolved in part in 1998 are marked by F98. Realize that "Sandy Stream" or "Unity Pond" are site names that might be replaced with Halfmoon Stream, Bacon Brook, Sandy Pond, Carleton Pond, or many other sites. These questions include but are not limited to the following:

Does phosphate, measured as orthophosphate, at 4 sites in 25 Mile Pond compare or contrast with phosphate measurements in Sandy Stream at US Route 202 in Unity Village?

Calculate a hydrographic curve for Sandy Stream at Unity Village.

Describe seasonal changes of water quality at any local site.

How do avian predators fish in Unity Pond at such short transparencies? F98

How does stage height or discharge in Sandy Stream and 25 Mile Stream influence water renewal in Lake Winnecook?

Describe oxidation-reduction conditions of shallow and deep sediments in Unity Pond. F98

Which chaoborids occupy Lake Winnecook (Insecta: Diptera: Chaoboridae)? Do chaoborid larvae occur in sediments or do they suspend above sediments? At what densities does Chaoborus occur on a transect from Kanokolus boat landing to the eastern shore of the lake?

Is Secchi disk transparency consistent instantaneously at different locations in Lake Winnecook? **Is transparency consistent through time?** What causes variations in transparency?

What is the annual discharge of any tributary stream into Lake Winnecook?

Compare Secchi disk transparency to chemical or biological water quality in Lake Winnecook.
Is orthophosphate concentration consistent throughout the 25 Mile Watershed? F98
What freshwater clams occur at selected sites throughout the 25 Mile Watershed? Rely on empty shells as there are populations of endangered and threatened species in the drainage. F98
Which Unity Pond snails release worm larvae likely responsible for swimmer's itch?
Will the new pond near Eastview provide water for fire protection? How can the new Firepond be remediated to contain water all year?
Hydrology and biology of the campus Vernal Pool (or Firepond).
Prepare a written history, map, photographic inventory, water quality review, species list, and other descriptive characteristics for the Vernal Pool (or Firepond).
What crustaceans, insects, algae, or macrophytes have colonized (recolonized) the Firepond?
Compare the Firepond to the Vernal Pool.
What are the abundant filamentous algae or rooted macrophytes in Sandy Stream?
Prepare a map of aquatic macrophytes for a portion of 25 Mile Pond. F98
What is the density of Hydra on aquatic plants in Unity Pond?
Historical review and documentation for "protected" macrophytes at Unity Pond.
Fall 1998 projects completed at student initiative included a season long analysis of macrobenthos in Halfmoon Stream, a distribution study of decapods in the watershed, analysis of historical water temperature records in Unity Pond, and comparison of macroinvertebrates in a springbrook and an isolated pool in a dry stream channel.
Any aspect of limnology from the lecture or laboratory may be extended as an MFC contract proposal.

Fall 1999 Option

In lieu of a MFC contract is the opportunity to participate in a Watershed Stewards workshop sponsored this year by Waldo County Soil and Water Conservation District in cooperation with Waldo County Office of Maine Cooperative Extension Service. This workshop will be held several Wednesday evenings beginning 6 OCT 1999. There will be one mandatory Saturday excursion to view land use in the watershed. Full details are not yet available, so watch for further announcements if this is an interesting option. Any student in BI 3184 that completes the portions of the Watershed Stewards workshop offered during the Fall 1998 term will earn a very good grade in lieu of an MFC requirement.

© Copyright Dave Potter. All rights reserved.
Published with permission by Campus Compact

© National Campus Compact, 2005.

Printed from:
<http://www.compact.org/syllabi/syllabus.php?viewsyllabus=400>