

SAULT COLLEGE  
of Applied Arts and Technology  
Sault Ste. Marie

COURSE OUTLINE

LAKE, POND AND STREAM SURVEYS

LABORATORY OUTLINE

FOR 306-8

(AQUATIC SURVEYS)

revised June, 1981 by Harvey Robbins

LAKE, POND AND STREAM SURVEYS

FORESTRY 306-8

COURSE OUTLINE AND OBJECTIVES

W. H. Robbins

Dept. of Forestry

Sault College of Applied Arts & Technology

Sault Ste. Marie, Ontario

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TEXTS:

Ayers, H.D., H.R. MacCrimmon and A. H. Berst, 1967, "The Construction and Management of Farm Ponds in Ontario", Toronto, Ontario, Dept. Agriculture, Food, Publ. 515;43p.

Cole, G.A. 1975. Textbook of limnology. St. Louis, C.V. Mosby 283 p.

Scott, W.B. 1967, "Freshwater Fishes of Eastern Canada", 2nd ed. Toronto, Univ. Toronto Press, 137p.

Scott, W.B., and E. J. Crossman 1973, "Freshwater Fishes of Canada", Fish. Res. Board Can., Bull. 184: 966 p.

REFERENCE TEXTS:

Bailey, R.M. et al. 1970. "A List of Common and Scientific Names of Fishes from the United States and Canada", 3rd ed. Am. Fish Soc., Spec. Publ. 6:149p.

Bennett, G.W. 1971, "Management of Lakes and Ponds", 2nd ed. Toronto, Van Nostrand Reinhold, 375p.

Davis, H.S. 1973. "Culture and Diseases of Game Fishes", Berkeley, Univ. California Press. 332p.

Lagler, K.F., J.E. Bardach and R.R. Miller 1967. "Ichthyology", New York, Wiley, 545p.

Leim, A.H., and W.B. Scott 1966, "Fishes of the Atlantic Coast of Canada", Fish. Res. Board Can., Bull. 155:485p.

MacKay, H.H. 1969, "Fishes of Ontario" (Toronto), Ontario Dept. Lands & Forests. 292p.

McPhail, J.D. and C.C. Lindsey 1970. "Freshwater Fishes of Northwestern Canada and Alaska", Fish. Res. Board Canada, Bull.173:381p.

Sidbec - Dosco 1968, "Conversion Factors and Tables", Montreal, J.A.M. Gaboury. 72p.

Robbins, W.H., and H. R. MacCrimmon. 1974. The blackbass in America and overseas. Sault Ste. Marie, Biomanagement and Research Enterprises. 196 p.

Sidbec - Dosco. 1968. Conversion factors and tables. Montreal, J.A.M. Gaboury. 72 p.

### Additional References

Hynes, H.B.N. 1970. The ecology of running waters. Toronto, Univ. Toronto Press. 555p.

Scott, W.B., and E.J. Crossman. 1969. Checklist of Canadian freshwater fishes with keys for identification. Life Sci. Publ., Rog. Ont. Mus. 104p.

Vibert, R. (Editor) 1967. Fishing with electricity; its application to biology and management: contribution to a symposium. London, Fishing News Books. 276p.

Wallace, R.G. 1976. About bait fish in Ontario (Toronto), Ont. Ministry Natural Resources. 55p.

Lake, Pond and Stream Surveys  
Lecture Portion

UNIT #1 - Course Introduction and Fish Classification

PART A - 2 hrs.

Objectives:

- 1) To become familiar with the course outline and objectives.
- 2) To define a fish and describe its place in the animal kingdom.
- 3) To name and characterize the major groups of living fishes.
- 4) To describe a number of characteristics of extinct fishes.

Description: review of the course outline and objectives, course assignments and other requirements; characteristics of fish and their place among chordates, the major groups of fishes according to the classifications of Jordan, Regan, Berg and Romer; Agnatha and subclasses with characteristics, Osteichthyes and subclasses with characteristics, major groups of extinct fishes and peculiar characteristics, hypothetical relationships, abundance and evolution of major groups of fishes.

Assignment:

Read pages 1 - 31, Lagler, Bardach and Miller

Part B - 4 hrs.

Objectives:

- 1) To name the families of Great Lakes fishes, describe their distinguishing characteristics and place them in the orders of fishes according to Berg (1940).

Description: distinctive characteristics of lamprey, sturgeon, paddlefish, bowfin, gar, herring, smelt, salmon, mooneye, mudminnow, pike, sucker, minnow, North American catfish, freshwater eel, killifish, livebearer, cod, troutperch, pirateperch, silverside, temperate bass, sunfish, perch, drum, sculpin and stickleback families.

Assignment:

Read the family descriptions included from pages 36 to 848. Scott and Crossman 1973.

UNIT #2 - Creel Census, Fish Anaesthetics and Poisons

PART A - 2 hrs.

Objectives:

- 1) To describe the possible reasons for carrying out a creel census.
- 2) To name and describe some of the sources of error which might bias the results of a creel census.
- 3) To outline the procedure for approaching an angler and requesting information for a creel census.

Description: major uses of creel censuses such as tag return, angling pressure, biological information, angling success, origin of anglers and success of stocked fish; biases in performing creel censuses such as pattern of doing census and working hours; procedure of approaching an angler for census information; critical evaluation of a published creel census result.

Assignment:

- 1) Read pages 252 to 256 Bennett.
- 2) Critically evaluate a published creel census report (provided by the instructor) for lack of bias, purposes, and whether these purposes were fulfilled. Censuses by the following authors may be used: McKechnie, R.J. 1966; Murphy, D. 1970; Sequin and Veilleux 1970; Surber, E.W. 1947; and Von Geldern, C.E. 1972. Your findings are to be given orally in the next lecture class.

PART B - 2 hrs.

Objectives:

- 1) To critically evaluate verbally a sample published creel census.
- 2) To name the important fish anaesthetics and describe their uses.
- 3) To name and describe the use of the important fish poisons.

Description: creel census evaluation presented verbally by each student; fish anaesthetics such as chloretone, MS-222, quinaldine, cresylic acid, and sodium amytal and their uses; rotenone, copper sulfate, guthion, formalin, thanite as fish poisons.

Assignments:

- 1) The student will give verbally the results of his evaluation of a published creel census.
- 2) Read pages 203 - 209 Bennett.



UNIT #3 - Propagation of Salmonids and Bass

PART A - 2 hrs.

Objectives:

- 1) To describe the important considerations in trout hatchery location.
- 2) To state the tolerance limits for a number of physical properties for a trout hatchery water supply.
- 3) To describe the requirements for buildings and other equipment needed to set up a trout hatchery.

Description: species propagated, natural habitat; water supply, its volume, fluctuation, temperature range, O<sub>2</sub> content, CO<sub>2</sub> content, H<sub>2</sub>S and nitrogen content, hardness, pH, turbidity and siltation level; topography of the site, allocation of water supply, height of head or source of water, exclusion of foreign fish; hatchery buildings required, hatchery troughs and their water supply, raceway design, rectangular and circular ponds.

Assignment:

Read pages 10 to 26 Davis.

PART B - 2 hrs.

Objectives:

- 1) To describe the procedures for spawn taking at salmonid hatcheries and sources of brood fish.
- 2) To outline the structure and development of the fertilized egg in the hatchery.
- 3) To describe the treatment of eggs, their rate of development and transportation.
- 4) To describe the care of young trout prior to removal to rearing troughs.

Description: inducement of fish to spawning condition, capture of spawning fish, stage of optimum fertility, stripping the eggs by wet and dry methods, number of eggs to be expected per fish and methods of estimation; structure of the fertilized egg, development and early structural changes, incubation of eggs and their requirements, removal of dead eggs, fungus treatment, treatment of eyed eggs, incubation periods, transportation of eggs, care of sac-fry and crowding effects.

Assignment:

Read pages 27 - 51 Davis.

PART C - 2 hrs.

Objective:

1) To describe the operation of the Tarentorus trout rearing station as a typical government hatchery.

Description: Field trip to the Tarentorus trout rearing station with a guided tour of all the facilities; facilities and attributes of the hatchery are to be noted.

Assignments:

1) During the tour of the hatchery students will ask the manager questions pertinent to the location, operation and purposes of the hatchery. Sample questions are found on the following page.

2) A neat one page report covering all the details of the Tarentorus hatchery operations is to be handed in one week after the field trip.

Questions That Might Be Posed To Hatchery Manager  
-----Tarentorus Trout Hatchery - Field Trip-----

- 1) What is the water flow? Is it sufficient?
- 2) What is the water source?
- 3) What range in temperature, pH, dissolved oxygen etc. do you have?
- 4) What is the rate of flow into each trough or pond based on?
- 5) When was the hatchery built?
- 6) What species are reared and to what size? How long does it take to produce fish of each size?
- 7) Are the eggs hatched here or brought from elsewhere?
- 8) What is each size or class of fish used for (i.e. are they stocked in streams, lakes etc. and where)?
- 9) What types of food are used and what is the conversion rate for each species of fish?
- 10) How much does it cost to produce each size of fish?
- 11) What are some of the drawbacks of this hatchery as it is at present?
- 12) Any other questions you might have.

Each student will hand in a neat and informative one page report of the field trip.

PART D - 1 hr.

Objectives:

- 1) To review and discuss the operation of the Tarentorus hatchery and to clarify any questions that might have arisen.
- 2) To state reasons for selective breeding of brood stocks.
- 3) To state the vitamin requirements of trout and which foods provide them.
- 4) To describe the other dietary needs of trout and the rate of conversion.

Description: discussion of field trip to hatchery and clarification of questions; breeding of trout for specific purposes such as early maturity, growth, egg production and time of spawning; vitamin requirements of trout, pantothenic acid, thiamin, cholin, biotin; meat, fish and dry products as diets, carbohydrate and roughage requirements, caloration and diet.

Assignment:

Read pages 51 to 82 Davis

PART E - 1 hr.

Objectives:

1) To describe the methods presently used to rear bass and other warmwater fish.

Description: warmwater fish culture, historical development, brood stock, breeding ponds and preparation, nursery ponds, preparation and description, spawning stalls, stocking rates, capture of fry, supplementary foods for brood fish and fry, forage fish, discussion of general methods of culturing other warmwater species.

Assignment:

Read handout "Artificial Culture of the Blackbasses"

UNIT #4 - Aquatic Invertebrates

PART A - 2 hrs.

Objectives:

- 1) To recognize the major groups of invertebrates found in the streams and lakes of this region.
- 2) To state the importance of members of each of these groups in the aquatic ecosystem.

Description: a superficial review of the invertebrates normally found in freshwaters and their importance to other invertebrates and fish; includes roundworms, earthworms, leeches, crustaceans, insects, snails and limpets and clams. This is a review to assist the student in preparing his aquatic invertebrate collection for the laboratory portion of the course.

UNIT #5 - Construction and Management of Farm Ponds

PART A - 4 hrs.

Objectives:

- 1) To state the uses of a farm pond.
- 2) To describe the selection of a pond site considering the water supply, soil conditions, topography, proposed uses, size, and drainage area.
- 3) To describe the construction of a dugout pond and dam to form an impoundment.
- 4) To describe the management of a farm pond for warm and cold water fish production.
- 5) To recognize the reasons for problems in managing a farm pond for fish and state what can be done to alleviate them.
- 6) To state the legal aspects of building and managing a farm pond.

Description: household, fire protection, irrigation, livestock watering, fish production, and recreation as pond uses; water sources for ponds, pond types and site selection, construction of the pond, dimensions, slope of sides, dam construction, equipment and dam design, managing the pond for trout or warmwater species, managing the pond for wildlife production particularly waterfowl, problems in management such as obtaining fish, fish kills, aquatic vegetation control, water turbidity, control of undesirable fish, control of nuisance animals, fertilization, seepage and erosion control, and legal responsibilities associated with farm ponds.

Assignment:

Read "The Construction and Management of Farm Ponds in Ontario" and other publications on farm ponds as might be available.



Lake, Pond and Stream Surveys

Laboratory Portion

(TO be used in conjunction with the laboratory manual)

UNIT #1 - Fish Anatomy

PART A - 5 hrs.

Objectives:

- 1) To identify the external parts of a fish as outlined in the laboratory manual.
- 2) Through dissection, to identify the internal organs and parts of a fish outlined in the laboratory manual.
- 3) To dissect caudal and trunk vertebrae and identify the parts.

Description: identification of external parts of a fish such as the fins, lengths, scale counts, muscle parts and other external parts; parts of the mouth and head; fish dissection for the purpose of identifying the internal organs, circulatory system, respiratory system, endoskeleton, nervous system and brain; scientific names of fishes.

Assignment:

- 1) Read pages 19 - 27 Hubbs & Lagler.
- 2) Read pages 52 - 133 Lagler, Bardach and Miller.
- 3) Complete laboratory 1 by making a sketch of a fish labelling the external features and counts and by dissection the internal organs and other parts.

## UNIT #2 - Lake Survey

### PART A - 1 day field trip

#### Objectives:

- 1) To become familiar with the body of water to be surveyed over the next 3 weeks.
- 2) To do preliminary echosounding in order to determine the best locations for setting gill nets.
- 3) To set gill and possibly trap nets in order to sample the fish population.
- 4) To complete the echosounding so that an accurate contour map of the lake can be made.
- 5) To begin a survey of the surrounding physical features as needed to complete the lake survey summary form FR3.

Description: the first of three days used to survey a small lake is taken up by familiarization with the water body, preliminary echosounding prior to setting of gill and trap nets and minnow traps, completion of the echosounding sufficient for making an accurate contour map, survey of the surrounding physical features including topography, vegetation and human activities.

#### Assignments:

Students will be doing all of the activities mentioned in the lab manual and above and should also on their own begin their contour map of the lake. A small outline map is provided for use in the field.

PART B - 2 day field trip

Objectives:

- 1) To set gill and trap nets and minnow traps in preferred localities throughout the lake for the collection of fish.
- 2) To sample the aquatic invertebrates on the bottom of the lake and inlet/outlet streams.
- 3) To collect and survey the aquatic plants found in the lake and its tributaries.
- 4) To complete physical and chemical tests as outlined in the lab manual using a Hach chemical kit.
- 5) To collect and record small fish that might be found in the shallow waters of the lake using a minnow seine.
- 6) To collect data such as lengths, sexes, scales, stomach contents from selected species caught in the nets.
- 7) To establish a bench mark near the edge of the lake.
- 8) To make measurements for determination of the flow of all inlet and outlet streams.

Description: further sampling of the fish population using gill and trap nets, minnow traps and seines; determination of the best locations for setting nets, sampling aquatic invertebrates using the Ekman dredge for the lake bottom and surber samples for stream bottom, collection and survey of aquatic plants, establishment of a bench mark, determination of rate of flow of all tributary and outlet streams, completion of survey of physical features of surrounding terrain, collection of data from fish caught including lengths, sex, scale samples, stomach contents and numbers of each species caught; water chemistry tests including dissolved oxygen and carbon dioxide, total dissolved solids, conductivity, pH, at the surface, top of the thermocline (if present), at the lake trout survival level and at the bottom, determination of the temperature profile, other chemical tests as needed and the secchi disc reading, the proper labelling of all fish, invertebrate plant and water samples along with their preservation.

Assignment: continue to work on contour map, begin the physical map and work on lake survey summary form.

PART C - 12 hrs.

Objectives:

1) To work on the lake survey maps, calculations for determination of physical features of the lake and its tributaries and on the lake survey summary form.

Description: use of overhead to draw large-scale maps for contours and physical features, determination of scale of your map, determination of lake area through use of a planimeter, calculation of lake volume and shoreline development factor, calculation of rate of flow of tributary and outlet streams, drawing of maps with India in and information to be included on each, completion of FR3 lake survey summary form.

Assignment:

The lake survey summary form and accompanying maps and notebook as described in the assignment in the lab manual are to be completed and handed in by November 15.

## UNIT #3 - Stream Survey

### PART A - 1 day field trip

#### Objectives:

- 1) To record the physical features of the surrounding terrain at the site to be surveyed.
- 2) To record the depth of pools, rate of flow, bottom type, ratio of pools to riffles etc. of the stream to be surveyed.
- 3) To complete physical and chemical tests of the stream water.
- 4) To sample the fish population using minnow traps, minnow seine and perhaps a fish shocker.
- 5) To make and label collections of aquatic insects using a surber sampler or Ekman dredge.
- 6) To establish a bench mark for water level determination.
- 7) To make the measurements required for determination of the rate of flow of the stream.

Description: physical features such as topography, vegetation, human activities, erosion, pool depth, bottom composition, amount of pools and riffles, water velocity, temperature, turbidity, pH, dissolved oxygen and carbon dioxide, total dissolved solids, conductivity and other chemical tests, fish collection using seines, minnow traps and fish shocker, labelling of all collections, collection of invertebrates using the Surber sampler or Ekman dredge, choosing sites for taking samples, the collection of data from fish captured; establishment of a bench mark, measurements made for the determination of rate of flow of the stream; aquatic plant collection, other measurements as required for stream survey summary form.

#### Assignment:

- 1) Begin calculations and other work for completion of the stream survey summary form as described in the laboratory manual.

PART B - 6 hrs.

Objectives:

1) To do calculations and other measurements necessary to complete the stream survey summary assignment as outlined in the laboratory manual.

Description: a lab designed to provide the student with help and time for completion of stream survey summary form and accompanying notebook, calculation of stream flow rate, interpretation of requirements for stream survey summary.

Assignment:

1) The student must complete and hand in the stream survey summary form by December 1, as described in the laboratory manual.

UNIT #4 - Fish Identification

PART A - 6 hrs.

Objectives:

- 1) To key fish collected during our lake and stream surveys, and others, down to families.
- 2) To become familiar with the use of bifurcating fish keys and terms used to describe fish in the keys.

Description: use of bifurcating keys for fish identification, familiarization with terms used to key out fish, measurements made, location of little-known fish parts; use of a key to determine the families of the fish collected during the lake and stream surveys, recognition of family characteristics by sight, labelling of collections by family, review of fish preservatives used.

Assignment:

- 1) Read pages 28 - 33 Hubbs & Lagler and look up difficult terms in other reference texts.
- 2) Key out all fish from our collection and place in proper families labelling as to location of capture.

PART B - 6 hrs.

Objectives:

- 1) To key out and recognize on sight the characteristics of the major groups of fishes.
- 2) To key out to species all specimens in our collection included in families from the lampreys to the mooneyes.
- 3) To recognize members of each of these families on sight and state their distinguishing characteristics.
- 4) To recognize the distinguishing characteristics of the individual species found in the collection.
- 5) To use and write out the scientific and common names of the species in our collection up to the mooneyes.

Description: major groups of fishes and their characteristics, orders of fishes up to the mooneyes and their characteristics, keying out of specimens from our collection to species, sight recognition of most of these species, their common and scientific names.

Assignment:

- 1) Students will use the keys in Hubbs & Lagler (p.34 to 57) and (92-94) or Scott and Crossman (p 31 to 44) to identify specimens as to species. Leim and Scott may be used for the major groups of fishes while many other texts will serve as reference books. Notes on distinguishing characters of each species should be made.
- 2) Students will begin their list of fishes (common and scientific names) for each of the collections made by the class.



PART C - 9 hrs.

Objectives:

- 1) To key out and recognize on sight the characteristics of the species of suckers and minnows represented in our collection.
- 2) To recognize the distinguishing characteristics of each of these families on sight.
- 3) To use and write out the common and scientific names of these species.

Description: a lab designed to help students key out and recognize fishes from the sucker and minnow families; learning of their distinguishing characteristics, common and scientific names.

Assignment:

- 1) Students will use the keys in Hubbs & Lagler (p. 66 to 87) and Scott & Crossman (p 45 - 59) to determine the species from these families represented in our collections.
- 2) Students will continue their lists of species collected on our field surveys.

PART D - 9 hrs.

Objectives:

- 1) To key out and recognize on sight the characteristics of the species representing the catfish family through to the sculpin family.
- 2) To recognize the distinguishing characteristics of each of these families on sight.
- 3) To use and write out the common and scientific names of these species.

Description: a lab designed to help students key out and recognize fishes from the catfish family through to the sculpin family (primarily spring-rayed fishes); learning their distinguishing characteristics, common and scientific names.

Assignment:

- 1) Students will use the keys in Hubbs & Lagler (p. 95 to 120) and Scott & Crossman (p. 59 to 74) to determine the species from these families represented in our collection.
- 2) Students will continue their lists of species collected on our field surveys. These lists are to be handed in by December 5.

Lake, Pond and Stream Surveys  
Student Evaluation

A) Term Tests

Term tests will be given at the end of units 2 and 5 of the lecture outline. The first term test will include only lecture material but the second term test will also test the students knowledge of equipment and procedures used during the field trips. The first will be worth 50 marks, the second 75.

A laboratory practical test based on laboratories 1, and 9 to 12 (fish anatomy and identification) will be given in early December. The student will be expected to have a thorough knowledge of fish anatomy and be able to identify fish and recall their common and scientific names. This test will be worth 100 marks.

In addition to the above term tests, a practical test to assess the students ability to perform field operations may be given. This will be marked subjectively only.

B) Assignments

- 1) The report on the Tarentorus trout hatchery trip described in Unit 5, Part D of the lecture outline will be marked out of 10.
- 2) The lake survey report as described in Unit 2, Part C of the laboratory outline and in the laboratory manual will be marked out of 100.
- 3) The stream survey report as described in Unit 3 Part B of the laboratory outline and laboratory manual will be marked out of 50.
- 4) The list of fish species from each of the various waters collected will be marked out of 15.
- 5) The aquatic invertebrate or plant collection as described in the laboratory manual will be marked out of 50.

Total course marks will be 450. Students will receive grades based on their course average and consistency of performance. Each student must, however, complete all of the course requirements. The pass mark for each is 50%.