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SAULT COLLEGE OF APPLIED ARTS & TECHNOLOGY

SAULT STE. MARIE, ONTARIO

COURSE OUTLINE

COURSE TITLE: INTRO TO FISHERIES

CODE NO.: FOR 233 SEMESTER: III

PROGRAM: FISH AND WILDLIFE TECHNICIAN

AUTHOR: VALERIE WALKER

DATE: SEPTEMBER 1995 PREVIOUS OUTLINE DATED: JANUARY 1995

APPROVED: _____ Sept 13/95

DEAN, SCHOOL OF SCIENCES & NATURAL RESOURCES

DATE

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TOTAL CREDIT HOURS: 48

PREREQUISITE(S):

I. PHILOSOPHY/GOALS:

This course introduces fundamental aspects of ecology, biology and classification of major fishes of Ontario. Emphasis will be placed on identification as well as life histories of important species. Basic principals of fisheries management will also be covered which will include a trip to the municipal hatchery.

II. STUDENT PERFORMANCE OBJECTIVES:

Upon successful completion of this course the student will be able to:

1. Discuss the taxonomy of modern fishes including their evolutionary histories.

2. Identify and outline the life histories of important fish species of Ontario and their parasites.

3. Demonstrate an understanding of reproductive strategies and basic ecology of selected species as well as the importance of Ontario's fisheries as a reflection of environmental health.

4. Explain the importance of fish age data and growth determination in fisheries management and demonstrate specific techniques in removal, preparation and assessment of ageing structures.

5. Outline Ontario's fisheries management plan and discuss various strategies to protect, enhance and rehabilitate the fisheries resource.

III. TOPICS TO BE COVERED:

1. Introduction to Ichthology
2. Fish Ecology
3. Classification of Fishes
4. Fish Biology
5. Fish Ageing and Growth
6. Introduction to Fisheries Management

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IV. LEARNING ACTIVITIES:

Topic 1 Introduction to Ichthology

Upon completion of this unit, the student will be able to:

1. Define ichthology.
2. Discuss the relative proportions of marine versus freshwater species as well as the significance of fish relative to other vertebrates.
3. Differentiate between anadromous and catadromous fishes, giving examples of each.
4. Outline generally the evolutionary histories of the three major groups of modern fishes.
5. Recognize common fish families given key characteristics.
6. List the major fish orders and their associated families with species representatives for each family.
7. Demonstrate effective use of a bifurcated (dichotomous) fish key.

Topic 2 Fish Ecology

Upon completion of this unit, the student will be able to:

1. Explain the characteristics of water and its influence on fish design.
2. List the six (6) basic fish body shapes and key features for each.
3. Discuss the various reproductive strategies of fish and their relative success.
4. List the various fish scale shapes and structures and discuss the distinguishing feature for each.
5. Describe the general ecology of a fish species based on key anatomy features.
6. Discuss the role of fisheries as a reflection of the health of the environment.

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IV. LEARNING ACTIVITIES: (continued)

Topic 3 Classification of Fishes

Upon completion of this unit, the student will be able to:

1. Discuss the use of meristics and morphometrics in the classification of fish.
2. Define primitive characters of fish.
3. Define advanced characters of fish.
4. List the major orders and their associated families with species representatives for each family.
5. Identify by sight Ontario's important sports and commercial fish species.

Topic 4 Fish Biology

Upon completion of this unit, the student will be able to:

1. Identify and discuss the function of external/internal structures and basic physiology of a generalized fish.
2. Discuss fish development from egg to adult.
3. Demonstrate an understanding of terminology specific to the Salmon Family.
4. Distinguish between parr of trout and salmon.
5. Summarize the biology of an Ontario fish species based on classification, range, description, habitat, food habits, reproduction and importance.
6. Outline the life cycle and discuss the importance of common fish parasites in Ontario.

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IV. LEARNING ACTIVITIES: (continued)

Topic 5 Fish Aging and Growth

Upon completion of this unit, the student will be able to:

1. Define fish growth.
2. List and briefly describe factors affecting fish growth.
3. Discuss the four basic approaches to determine or assess fish growth.
4. Discuss the theory behind the use of bony structures in age determination.
5. Explain the value of fish age data.
6. Demonstrate the removal and preparation of anatomical structures commonly used in aging.

Topic 6 Introduction to Fisheries Management

Upon completion of this unit, the student will be able to:

1. State the goal and strategic management actions of the Strategic Plan for Ontario Fisheries.
2. Outline and discuss the three (3) general approaches to fisheries management.
3. List and briefly discuss five methods of fisheries habitat enhancement.
4. Describe a typical fish culture operation.
5. List and explain various management prescriptions to reduce the harvest of a given fishery.
6. Explain the principal objective and operational units of the Department of Fisheries, Sea Lamprey Control.

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V. EVALUATION METHODS:

Unit Tests	50%
Lab Tests/Assignments	50%
	100%

A+ = 90%
A = 80 - 89%
B = 70 - 79%
C = 60 - 69%

N.B. ***There will be no rewrite opportunity in this course.***

VI. REQUIRED STUDENT RESOURCES:

Introduction to Fisheries Study Guide.

Scott, W.B. and E.J. Crossman. 1973. Freshwater Fishes of Canada. Fisheries Research Board of Canada. Bulletin 184.

Strategic Plan for Ontario Fisheries II

VII. ADDITIONAL RESOURCE MATERIALS:

FISHERIES BIOLOGY REFERENCES

Adams, S. Marshall (ed.) 1990. Biological Indicators of stress in Fish. American Fisheries Society Symposium 8. AFS, Bethesda, Maryland.

Cailliet, G.M., M.S. Love and Q.W. Ebeling. 1985. Fishes, A Field Manual on Their Structure, Identification and Natural History. Wadsworth Publishing Co., Belmont, CA.

Calow, P. (ed.) 1985. Fish Energetics. New Perspectives. The Johns Hopkins University Press, Baltimore, MD.

Carlander, K.D. 1977. Handbook of Freshwater Fishery Biology, Vol. 2. Iowa State University Press. QL625.C373 V.2

Cooper, E.L. (ed.) 1987. Carp in North America. AFS, Bethesda, Maryland.

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VII. ADDITIONAL RESOURCE MATERIALS: (continued)

FISHERIES BIOLOGY REFERENCES

Craig, John F. 1987. The Biology of Perch and Related Fish. Timber Press, Portland, Oregon.

Goldman, C.R. 1983. Freshwater Crayfish. AVI Publishing Co. Inc. QL444.M33I57 1981.

Hoar, W.S. and D. J. Randall. 1983. Fish Phisiology. Academic Press Inc., New York, N.Y.

Johnson, J.E., 1987. Protected Fishes of the United States and Canada. American Fisheries Society. Bethesda, Maryland. QL 625.J63

Johnson, L. and B. Burns (eds). 1984. Biology of Arctic Charr. Proceedings after International Symposium, 1981. University Manitoba Press. Winnipeg, Manitoba.

Kendall, R.L. (ed.) 1978. Selected Coolwater Fishes of North America. American Fisheries Society, Bethesda, Maryland.

Lagler, K.F., J.E. Bardach and R.R. Miller, 1977. Ichthyology. John Wiley and Sons Inc., New York.

McKeown, B.A. 1984. Fish Migration. Timber Press. Portland, Oregon.

Moyle, P.B. and J.J. Cech, Jr. 1982. Fishes: An Introduction to Ichthyology. Prentice-Hall Inc., New Jersey.

Page, Lawrence M. 1983. Handbook of Darters. TFH Publications, Inc. Ltd. Neptune City, New Jersey.

Pickering, A. (ed.). 1981. Stress and Fish. Academic Press, Inc., New York, N.Y. QL639.1.S74 1981.

Potts, G.W. and R.J. Wooton. 1984. Fish Reproduction: Strategies and Tactics. Academic Press, Inc., New York, New York

Raat, A. 1988. Synopsis of Biological Data on the Northern Pike, Esox lucius Linneaus. FAO Fisheries synopsis No. 30, Rev. 2. FAO.

Scott, W.B. and E.J. Crossman, 1973. Freshwater Fishes of Canada. Bulletin 184. Fish Res. Board of Can., Ottawa.

Scott, W.B. and Mildred Grace. 1988. Atlantic Fish of Canada. University of Toronto Press, Downsview, Ont., QL 626.5 A8 S36 1988

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VII. ADDITIONAL RESOURCE MATERIALS: (continued)

FISHERIES BIOLOGY REFERENCES

Sedgwick, Stephen Drummond. 1982. The Salmon Handbook. Andre Deutsch Ltd. London.

Sigler, William and J.W. Sigler. 1987. Fishes of the Great Lakes Basin: A Natural History. University of Nevada Press.

Sigler, W. F. and J. W. Sigler, 1990. Recreational Fisheries Management, Theory and Application. University of Nevada Press.

Thompson, P. 1980. The Game Fishes of New England and S.E. Canada. Down East Books. Camden, M.E.

Tytler, Peter and Calow Peter. 1985. Fish Energetics - New Perspectives. John Hopkins University Press. QL639.1.F554 1985.

Weatherly, A.H. and H.S. Gill. 1987. The Biology of Fish Growth. Academic Press Inc., New York, N.Y.

Welcomme, R. 1988. International Introductions of Inland Aquatic Species. FAO Fisheries Technical Paper No. 294. FAO.

FISHERIES MANAGEMENT REFERENCES

Anderson, L.G. (ed). 1986. The Economics of Fisheries Management (2nd ed). The Johns Hopkins University Press, Baltimore, MD.

Bennett, G.W. 1971. Management of Lakes and Ponds. 2nd edition. Van Nostrand Reinhold, Toronto.

Butler, M. et al. 1988. The Application of Remote Sensing Technology to Marine Fisheries: An Introductory Manual. FAO Fisheries Technical Paper #295. Unipub SH334.7.A66.

Everhart, W.H., A.W. Eipper and W.D. Youngs. 1981. Principles of Fisheries Science. Cornell University. Press, Ithaca, London.

Grant, W.E. 1986. Systems Analysis and Simulation in Wildlife and Fisheries Science. John Wiley and Sons, Rexdale, ON.

Gresswell, R.E. (ed.). 1988. Status and Management of Interior Stocks of Cutthroat Trout. A.F.S. Symposium SO892-2284 4. Bethesda, Maryland. QL 638 S2 S785

Lackey, R.T. and L.A. Nielson (eds). 1980. Fisheries Management. John Wiley and Sons. Toronto, Ontario.

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VII. ADDITIONAL RESOURCE MATERIALS: (continued)

FISHERIES MANAGEMENT REFERENCES

McNeil, William J. (ed.). 1988. Salmon Production, Management and Allocation: Biological, Economic and Policy Issues. Proceedings of the World Salmonid Conference, Portland, Oregon in 1986. Oregon State University Press, Oregon.

Mills, Derek and David Piggins (eds). 1988. Atlantic Salmon: Planning for the Future. Proceedings of the Third International Atlantic Salmon Symposium, Biarritz, France in 1986. Timber Press. Portland, OR. SH 346.I57 1986

Mills, D. 1989. Ecology and Management of Atlantic Salmon. Chapman and Hall. QL 638 S2 M48 1989

Nielsen, Larry A. and David L. Johnson (eds). 1983. Fisheries Techniques. AFS, Bethesda, Maryland.

Royce, William F. 1984. Introduction to the Practice of Fishery Science. Academic Press, New York, N.Y.

Royce, William. F. 1987. Fishery Development. Academic Press Inc., New York, N.Y. SH328.R74 1987.

AQUACULTURE/NUTRITION REFERENCES

Beveridge, Malcolm, C.M. 1987. Cage Aquaculture. Fishing New Books Ltd. New York, N.Y. SH151.B48

Bonn, E.W. et al. 1976. Guidelines for Striped Bass Culture. AFS Publishing Co., Bethesda, MA. SH351.B3G85

Brown, E. Evan. 1980. Fish Farming Handbook. AVI Publishing Co., Inc. Westport, CT.

Brown, E. Evan. 1980. Crustacean and Mollusk Aquaculture in the United States. AVI Publishing Co., Inc. Westport, CT

Cowey, C., A. Mackie and J. Bell (eds). 1985. Nutrition and Feeding in Fish. Academic Press, Inc., New York, N.Y. SH156.N88 1985.

Davis, H.S. 1973. Culture and Diseases of Game Fishes. University of California Press, Berkeley, CA.

Goldman, Charles R. 1983. Freshwater Crayfish V. AVI Publishing Co., Inc. Westport, CT.

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VII. ADDITIONAL RESOURCE MATERIALS: (continued)

AQUACULTURE/NUTRITION REFERENCES

Hall, G.E. (ed) 1986. Managing Muskies. Papers from the International Muskie Symposium at LaCrosse, Wisconsin, April 4-6, 1984. AFS Publishing Co., Bethesda, MA.

Halver, John E. 1988. Fish Nutrition (2nd ed). Academic Press, Inc., New York, N.Y.

Harrell, R.M. 1990. Culture and Propagation of Striped Bass and its Hybrids. A.F.S. Bethesda, Maryland.

Huner, J.V. and E.E. Brown 1985. Crustacean & Mollusk Aquaculture in the United States. AVI Publishing Co. Inc. SH365.A3C78 1985.

Lannan, J.E. 1986. Principles and Practices of Pond Aquaculture. AVI Publishing Co., Inc. Westport, CT.

Leitritz, Earl and Robert C. Lewis. 1980. Trout and Salmon Culture (Hatchery Methods). ANR Publications, Oakland, CA.

McLarney, William, O. 1984. The Freshwater Aquaculture Book: A Handbook for Small Scale Fish Culture in North America. Hartley and Makrs, Inc.

Meade, J.W. 1989. Aquaculture Management. Van Nostrand Reinhold. SH135 M43 1989.

Muir, J.F. and R.J. Roberts (eds). 1985. Recent Advances in Aquaculture. Vol. 2. Westview Press, Boulder, CO.

Piper, Robert G. et al. 1982. Fish Hatchery Management. United States Dept. of the Interior. Fish and Wildlife Service, Washington, DC.

Sedgwick, Stephen Drummond. 1973. Trout Farming Handbook. Seeley Service, London.

Spotte, S. 1979. Fish and Invertebrate Culture (2nd ed). John Wiley and Sons, Inc., Rexdale, ON.

Stickney, R.R. 1979. Principles of Warmwater Aquaculture. John Wiley and Sons, Inc., Rexdale, ON.

Stickney, Robert R. 1986. Culture of Nonsalmonid Freshwater Fishes. CRC Press, Inc., Boca Raton, FLA.

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VII. ADDITIONAL RESOURCE MATERIALS: (continued)

AQUACULTURE/NUTRITION REFERENCES

Stroud, R.H. (ed). 1986. Fish Culture in Fisheries Management. AFS, Bethesda, Maryland.

Swift, Donald R. 1985. Aquaculture Training Manual, Fishing News Books Ltd., Surrey, England

Thorpe, J.E. 1980. Salmon Ranching. Academic Press, Inc. New York, New York.

Tucker, C.S. (ed). 1985. Channel Catfish Culture. Elsevier Science Publishing Co., New York, N.Y. SH167.C35C48 1985.

FISH DISEASE REFERENCES

GENERAL

AMOS, K.H. (ed). 1985. Procedures for the Detection and Identification of Certain Fish Pathogens. 3rd edition. AFS, Bethesda, Maryland.

ELLIS, ANTHONY E. 1985. Fish and Shellfish Pathology. Academic Press. Harcourt and Brace Jovanovich, Don Mills, Ont.

MAWDESLEY THOMAS, L.E., ed. 1972. Diseases of Fish. No. 30. Symposia of the Zoological Society of London, Acamdemic Press, London and New York.

POST, G. 1983. Textbook of Fish Health. TFH Publication, Inc. Ltd., Neptune city. N.J.

RIBELIN. W.E., and G. MIGAKI, eds. 1975. Pathology of Fishes. University of Wisconsin Press, Madison, WI. pp. 1004.

ROBERTS, R.J., ed., 1978. Fish Pathology. Bailliere Tindall, London. pp. 1978.

ROBERTS, R.J. and C.J. SHEPHERD, 1974. Handbook of Trout and Salmon Diseases. Fishing News (Books) Ltd., Surrey, England. pp. 168

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FISH DISEASE REFERENCES (continued)

WARREN, J.C. 1978. Diseases of hatchery fish. United States Fish and Wildlife Service. Twin Cities, Minnesota. pp. 94

WOOD, J.W. 1968. Diseases of Pacific Salmon, their Prevention and Treatment. Hatchery Division, Department of Fisheries, State of Washington, Olympia, WA. pp. 82.

BACTERIAL AND FUNGAL (see also GENERAL references above)

BULLOCK, G.L., D.A. CONROY, S.F. SNIEZSKO 1971. Bacterial diseases of fishes. In Snieszko S.K. and H.R. Axelrod, eds. Book 2A of Diseases of Fishes. T.F.H. Publications, Inc., Neptune City, N.J. pp. 151.

VIRAL (see also GENERAL references above).

SNIESZKO, S.F., R.F. NIGRELLI, K. WOLF. 1965. Viral Disease of Poikilothermic Vertebrates. New York Academy of Sciences. Annals of the New York Academy of Sciences, New York, N.J. pp. 680.

WOLF, K. 1966. The Fish Viruses. Advances in Virus Research. Vol. 12, Academic Press. New York, N.J. pp. 36-101.

WOLF, K. 1988. Fish Viruses and Fish Viral Diseases. Cornell University Press.

PARASITIC (see also GENERAL references above).

BOUSFIELD, E.L. 1987. Amphipod Parasites of Fish of Canada. Canadian Bulletin of Fisheries and Aquatic Sciences #217, Fisheries and Oceans, Ottawa.

HOFFMAN. G.L., 1967. Parasites of North American Freshwater Fishes, University of California Press, Berkeley, CA pp. 486.

HOFFMAN, G.L. AND F.P. MEYER. 1974. Parasites of Freshwater Fishes. T.F.H. Publications, Inc., Neptune City, N.J. pp. 224.

KABATA, Z. 1970. Crustacea As Enemies of Fishes. In S.F. Snieszko and H.R. Axelrod, eds. Book 1 of Diseases of Fishes. T.F.H. Publications, Inc., Neptune City, N.J. pp. 171.

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FISH DISEASE REFERENCES (continued)

NUTRITIONAL

ASHLEY, L.M. 1972. Nutritional Pathology. In Halver, J.W., ed. fish Nutrition. Academic Press, New York N.Y. pp. 439-537.

HALVER, J.E. 1976. Nutritional Deficiency Diseases In Salmonids. Fish Pathology 10: 165-180.

ENVIRONMENTAL AND EFFECTS OF ENVIRONMENT ON INFECTIOUS DISEASES

(see also GENERAL references above).

FRYER, J.L. AND K.S. PILCHER. 1974 Effects of Temperature on Diseases of Salmonid Fishes. U.S. Environmental Protection Agency. Washington, D.C. pp. 115.

WEDEMEYER, G.A., F.P. MEYER, L. SMITH. 1976. Environmental Stress and Fish Diseases. In S.F. Snieszko and H.R. Axelrod, eds. Book 5 of Diseases of Fishes. T.F.H. Publications, Inc., Neptune City, N.J. pp. 192

ENVIRONMENT/FISHERIES REFERENCES

Cairns, V.W., P.V. Hodson and J.O. Nriagu. 1984. Contaminant Effects of Fisheries. John Wiley and Sons, Inc., Rexdale, ON

Gore, J.A. (ed). 1985. The Restoration of Rivers and Streams: Theories and Experience. Butterworth Pub., Stoneham, MA.

Heath, Alan G. 1987. Water Pollution and Fish Physiology. CRC Press Inc., Boca Raton, Fla.

Krumholz, L.A. (ed). 1981. The Warmwater Streams Symposium. AFS, Bethesda, Maryland.

Marshall, Adam S. 1990. Biological Indicators of Stress in Fish. A.F.S. Symposium No. 8. Bethesda, Maryland. 904712

Rand, G. and S. Petrocelli (eds). 1985. Fundamentals of Aquatic Toxicology. Hemisphere Publishing Corp. New York, N.Y.

Schmidtke, Norbert W. (ed). 1987. Toxic Contamination in Large Lakes. Lewis Pub. Inc., Chelsea, Ml.

Shubert, L.E. (ed). 1984. Algae as Ecological Indicators. Academic Press, Inc., New York, N.Y.

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VIII. SPECIAL NOTES:

Students with special needs (e.g. physical limitations, visual impairments, hearing impairments, learning disabilities) are encouraged to discuss required accommodations confidentially with the instructor.

Your instructor reserves the right to modify the course as he/she deems necessary to meet the needs of students.