



## TENTATIVE COURSE OUTLINE

Date		Lecture Topic	Lecturer
Jan-7	1	• Introduction: Structure and Productivity of Aquatic Ecosystems	MD
Jan-14	2	• Structure and Productivity of Aquatic Ecosystems/Carbon and Nitrogen Cycles	MD
Jan-21	3	• Phosphorus Cycle	MD
Jan-28	4	• Food Web, Planktonic Communities/ <b>Demonstration</b> Field equipment for lake studies	MD
Feb-4	5	• Climatology/Dynamics/Assignment	MD/BG
Feb-11	6	• Thermal structure of the Great Lakes	MD/BG
Feb-25	7	• Circulation/Midterm in Class	MD/BG
Mar-4	8	• Eutrophication in Great Lakes/ <b>Demonstration:</b> sediment sampling	MD
Mar-11	9	• Water-Land-Interfaces	MD
Mar-18	10	• Invasive species	MD
Mar-25	11	• Pollutants in Great Lakes	MD
Apr-1	12	• Course Overview/ <b>Demonstration</b>	MD

Week 1 – Jan 7<sup>th</sup> ORIENTATION/GREAT LAKES IN A GLOBAL CONTEXT/ STRUCTURE AND PRODUCTIVITY OF GREAT LAKES/CARBON AND NITROGEN CYCLES

Course Outline; Lecture Schedule

Lake Ecological Concept Ecosystem Interrelationships, Productivity.

Week 2 - Jan 14<sup>th</sup> STRUCTURE AND PRODUCTIVITY OF GREAT LAKES/CARBON AND NITROGEN CYCLES

The Oxygen content of inland waters, distribution of oxygen in Lakes

The occurrence of inorganic carbon in freshwater systems, utilization of carbon by algae

Sources and transformation of nitrogen in water

Nitrogen Loading and Algal Productivity

Week 3 – Jan 21<sup>st</sup> PHOSPHORUS CYCLES

Phosphorus in freshwater systems

Phosphorus and the sediments, internal loading, sediment demonstration

Phosphorus Loading and Algal Productivity

Week 4 – Jan 28<sup>th</sup> FOOD WEB, PLANKTONIC COMMUNITIES/DEMONSTRATION: FIELD EQUIPMENT

Composition of the Algae of Phytoplankton, Importance of size

Phytoplanktonic Communities, Growth Characteristics and Mortality of Phytoplankton

Heterotrophy of organic carbon by algae and cyanobacteria

Seasonal succession of Phytoplankton

Zooplankton, Food, Feeding and Food selectivity, Food-web Dynamics in Great Lakes

Week 5 –Feb 4<sup>th</sup> CLIMATOLOGY/DYMANICS/THERMAL STRUCTURE OF THE GREAT LAKES

Climatology, Thermal Layering & Lake Overturning

Thermocline Development

Thermal Classification of Lakes; Vertical Stability

Examples from the North American Great Lakes Assignment 1 (due: March 1<sup>st</sup>)

- Week 6 – Feb 1<sup>st</sup> THERMAL STRUCTURE OF THE GREAT LAKES  
 Thermal Classification of Lakes; Vertical Stability  
 Examples from the North American Great Lakes  
 Dynamic Forcing of the Lakes
- Week 7 - Feb 25<sup>th</sup> CIRCULATIONS **Midterm in class**  
 Coastal upwelling; Thermal bar revisited  
 Great Lakes Circulation
- Week 8 - March 4<sup>th</sup> EUTROPHICATION PROBLEMS IN THE GREAT LAKES  
 Basic Concepts of Eutrophication  
 Natural and Cultural Processes of Eutrophication  
 Relationships among Nutrients, Water Clarity, and Phytoplankton  
 Eutrophication Problems in: (i) Lake Erie; (ii) Lake Superior; (iii) Lake Michigan, (iv) Lake Huron; (v) Lake Ontario.
- Week 9 – March 11<sup>th</sup> WATER-LAND-INTERFACES  
 The littoral zone: aquatic macrophytes, their metabolism and primary production  
 Productivity of littoral algae  
 Periphyton, littoral zooplankton communities  
 Importance of wetlands and estuaries  
 Sediments: general composition, re-suspension, aerobic and anaerobic decomposition
- Week 10 – March 18<sup>th</sup> INVASIVE SPECIES  
 Stressors and Induced Ecological Changes  
 Invasive exotic Species: Definition and Mechanisms of Introduction
- Week 11 – March 25<sup>th</sup> POLLUTANTS IN THE GREAT LAKES  
 Toxic Substances, Sources of Contaminants, The Fate of Contaminants, The Sediment Record  
 Physical and Chemical Characteristics of Contaminants and Their Distribution in Nature,  
 Toxicity and Its Prediction, Bioaccumulation and Biomagnification, Mercury and the  
 Mercury Cycle, Toxic Chemicals, Environmental Health,
- Week 12 – April 1<sup>st</sup> Course Overview/Demonstration: sediment sampling

The report will be worth 15% of the total course grade.

Last Day of Classes April 1<sup>st</sup>; the deadline for the reports

## READINGS

There is no required text for this course, since there is no book that covers all the course material, while several books cover much more material than is required. Thus, specific readings will be given out during each lecture and/or practical sessions; however, a number of texts cover the course material in part and there is one journal devoted specifically to research on large lakes of the world, but with a dominance of papers on North American Great Lakes research:

Journal of Great Lakes Research | International Association for Great Lakes Research.

<http://www.iaglr.org/jglr/journal.php>

This journal and the reference sources below will be used for course readings and as starting points for student seminars.

Books:

Kalff, J., 2002. Limnology, Prentice-Hall, NJ, 592 pp.

Wetzel, R.G, 2001. Limnology: Lake and River Ecosystems. Third Edition, Academic Press, NY.

Lampert, W., Sommer, U., 2007, Limnology, Oxford ; New York : Oxford University Press Inc., 2007. 2nd ed.

A few Web Reference Sources:

<http://www.epa.gov/glnpo/atlas/> The Great lakes Atlas

<http://www.great-lakes.net/index.html> Great Lakes Information Network (GLIN)

<http://www.epa.gov/glnpo/index.html> U.S.Environmental Protection Agency (EPA)

<http://www.cciw.ca/nwri-e.html> Environment Canada, National Water Research Institute (NWRI)

<http://www.glc.org/> Great Lakes Commission (GLC)

<http://www.ndbc.noaa.gov/index.shtml> National Oceanic and Atmospheric Administration's (NOAA) National Data Buoy Center

<http://www.glerl.noaa.gov/> National Oceanic and Atmospheric Administration (NOAA) Great Lakes Environmental Research laboratory (GLERL)

<http://www.glerl.noaa.gov/res/Programs/ncrais/> National Oceanic and Atmospheric Administration (NOAA) National Center for Research on Aquatic Invasive Species

<http://www.glfc.org/home.php> Great Lakes Fisheries Commission (GLFC)

<http://www.dfo-mpo.gc.ca/regions/central/pub/bayfield/01-eng.htm> Fisheries and Oceans Canada (DFO), Bayfield Institute - Great Lakes Research

<http://www.glsc.usgs.gov/> United States Geological Survey (USGS), Great lakes Science Center