BIOL 645 - Freshwater Ecology
Lecture Outline

I. Ecology and evolution
    A. Ecology
    B. Evolution
    C. Natural Selection
    D. Proximate vs. Ultimate factors
II. Methods of Ecological Research
    A. Approaches
        1. Description/individual observations
        2. Classification
        3. Cause-effect relationships
        4. Prediction (Deduction/Induction)
    B. Observations
    C. Correlation using field data
    D. Laboratory and Field Experimentation
    E. Simulation & mathematical models
III. The Aquatic Environment
    A. Properties of Water and their Implications
        1. Molecular structure
        2. Density vs. Temperature
        3. High specific heat
        4. Surface tension
        5. Viscosity (laminar vs. turbulent flow)
        6. Water as a solvent (dissolved gasses, carbonate/bicarbonate, ions/polar molec)
    B. Vertical Gradients
        1. Solar radiation
        2. Temperature & mixing
        3. Oxygen
        4. pH
        5. Redox
    C. Running Water
        1. Flow
        2. Network position
        3. Physical structure
        4. Temperature
        5. Oxygen
    D. Predictability
IV. The Individual
    A. Requirements of the Individual
        1. Ranges of tolerance
        2. The Niche
        3. Variations in the Niche
    B. Abiotic Factors
        1. Temperature

2. Oxygen
3. pH
4. Ions
5. Water flow
6. Buoyancy
7. Surface tension

C. Resources
1. Energy, carbon, and electrons
2. Resource consumption ("Functional Response")
3. Regulation of Growth and Abundance by Resources ("Numerical Response")
4. Nonsubstitutable an Substitutable Resources
5. Light
6. Inorganic carbon
7. Mineral nutrients
8. Inorganic sources of energy
9. Anaerobic respiration
10. Dissolved organic substances
11. Particulate organic carbon

D. Energy Utilization
1. Net vs. Gross production
2. Energetics of photosynthesis
3. Heterotrophic energetics
4. Animals
5. Importance of Body Size

V. Populations
A. Features of a population
B. Control of population size
1. Fluctuations in abundance
2. Mechanisms of change in abundance
3. Growth rate of a population
4. Logistic growth
5. Estimating population dynamics parameters

C. Phenotypic and genotypic variability
1. Selection
2. Genetic structure
3. Founder effects

D. Demography
1. Age-specific mortality
2. Age-specific fecundity
3. Pop'n growth in an age-distributed population
4. Stable age distribution

E. Distribution
F. r and K strategies
G. Distribution and colonization

VI. Interactions
A. Competition

1. Competitive exclusion principle/niche
2. Lotka-Volterra competition model
3. Tilman's resource-based model
4. Competition under variable conditions

(Skip pp 178-186)

B. Predation
1. Models of predation
2. Prey defense mechanisms
3. Grazing in the plankton
    A. Filtration rate
    B. Feeding selectivity
    C. Nutrient regeneration
4. Grazing and periphyton
5. Foraging
    A. Selectivity
    B. Vertebrate predators
        a. Planktivorous fish
        b. Benthic
        c. Trade-offs
    C. Invertebrate predators
    D. Prey defenses
6. Parasitism
7. Interaction of Predation and Competition

First Exam material ends here. (p. 235)

VII. Evolution of Life Histories