



Lakes and Reservoirs: Guidelines for Study Design and Sampling -- A New Chapter in the U.S. Geological Survey National Field Manual for the Collection of Water-Quality Data

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Office of Water Quality



Chapter A10. LAKES AND RESERVOIRS: GUIDELINES FOR STUDY DESIGN AND SAMPLING

By W. Reed Green, Dale M. Robertson, and Francesca D. Wilde



Techniques of Water-Resources Investigations Book 9, Chapter A10

Premise:

Monitoring program design and approach often serve as the major sources of error and uncertainty in the resulting data.

Purpose:

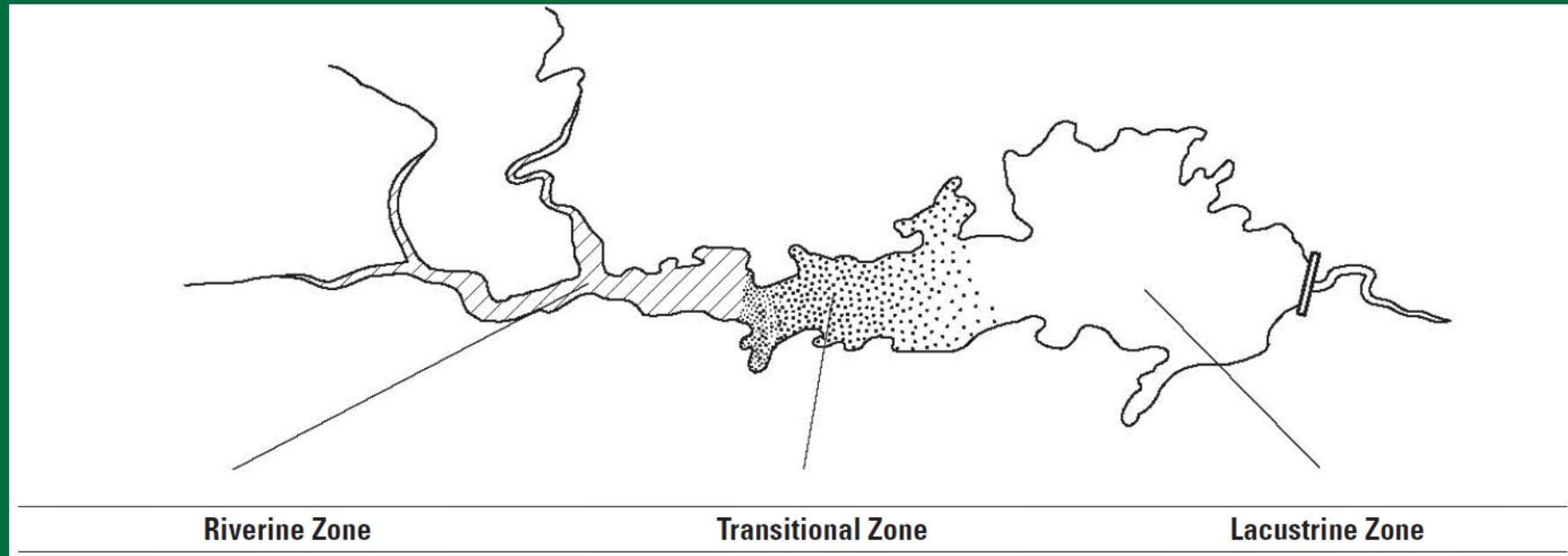
Provide general information, considerations, preparations and USGS-specific guidelines needed to design and implement studies in which lake or reservoir environmental quality can be reliably monitored and evaluated.

Purpose (cont.):

- To this end, this chapter includes a review of the basic principles of limnological science, provides
 - an explanation of the distinguishing characteristics of lakes and reservoirs, and
 - places special emphasis on the appropriate temporal and spatial sampling strategies and
 - approaches needed to account for differing data requirements.
- Topics related to stream and groundwater systems and their interactions with lakes and reservoirs are not addressed.

10.1 -- Basic Limnology

- Differences between natural lakes and manmade impoundments (reservoirs)

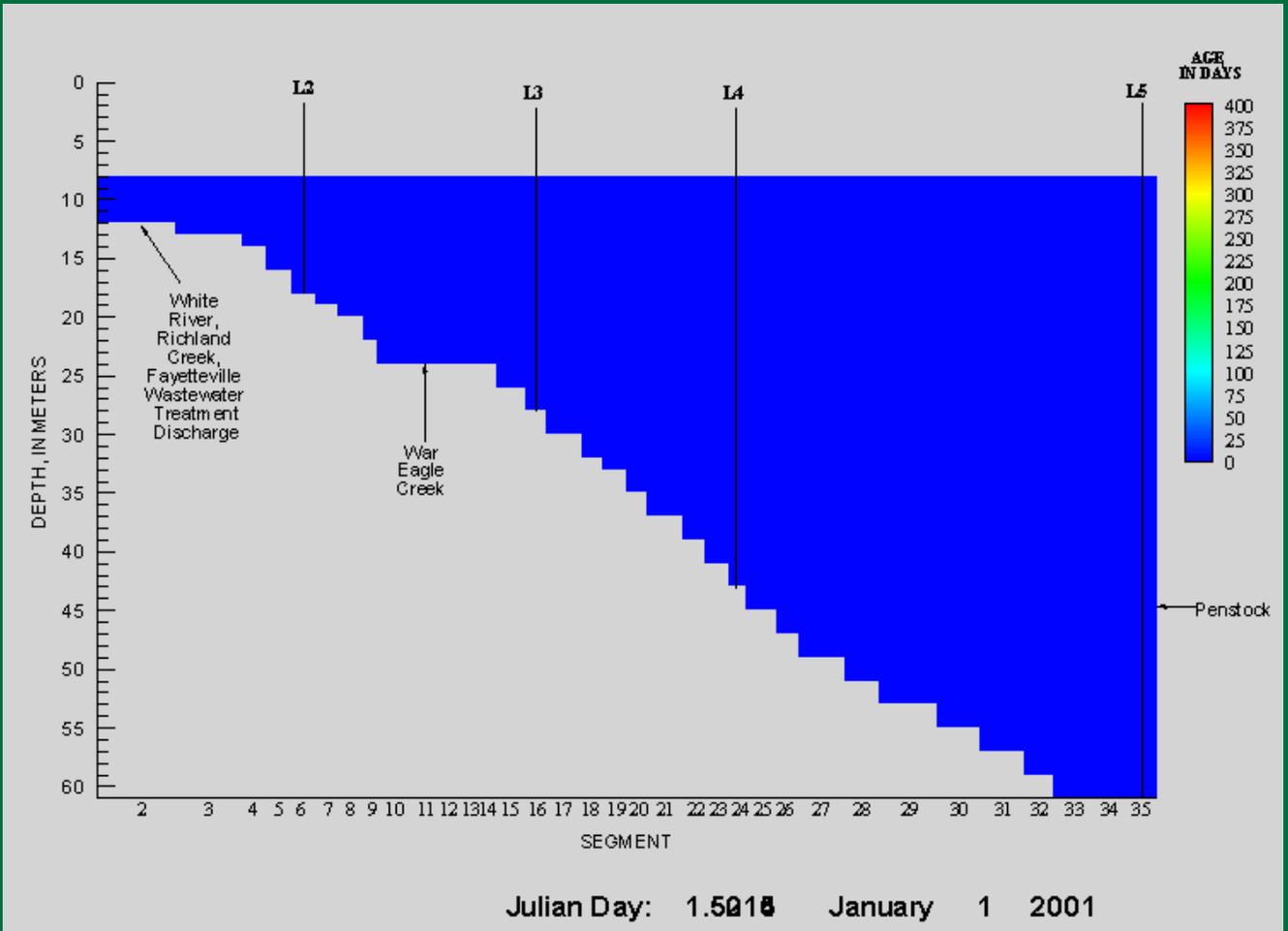


10.1 -- Basic Limnology (cont.)

- **Physical and Chemical Limnology**
 - **Light and Water Clarity**
 - **Temperature and Stratification**
 - **pH**
 - **Dissolved Oxygen**
 - **Phosphorus and Nitrogen**
 - **Chlorophyll *a***

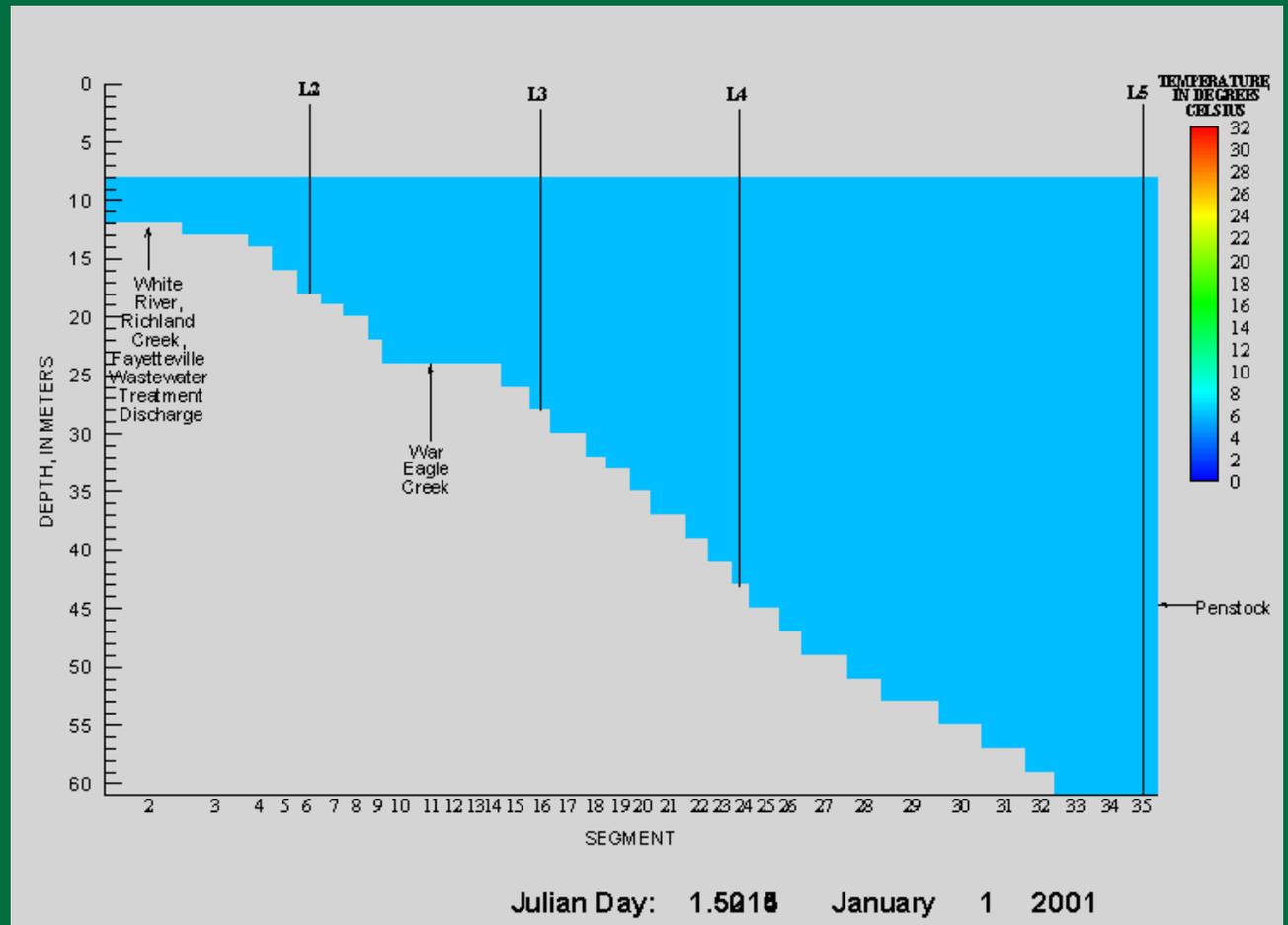
10.1, 10.2 -- Basic Limnology and Comparative Properties

- Overflow
- Interflow
- Underflow



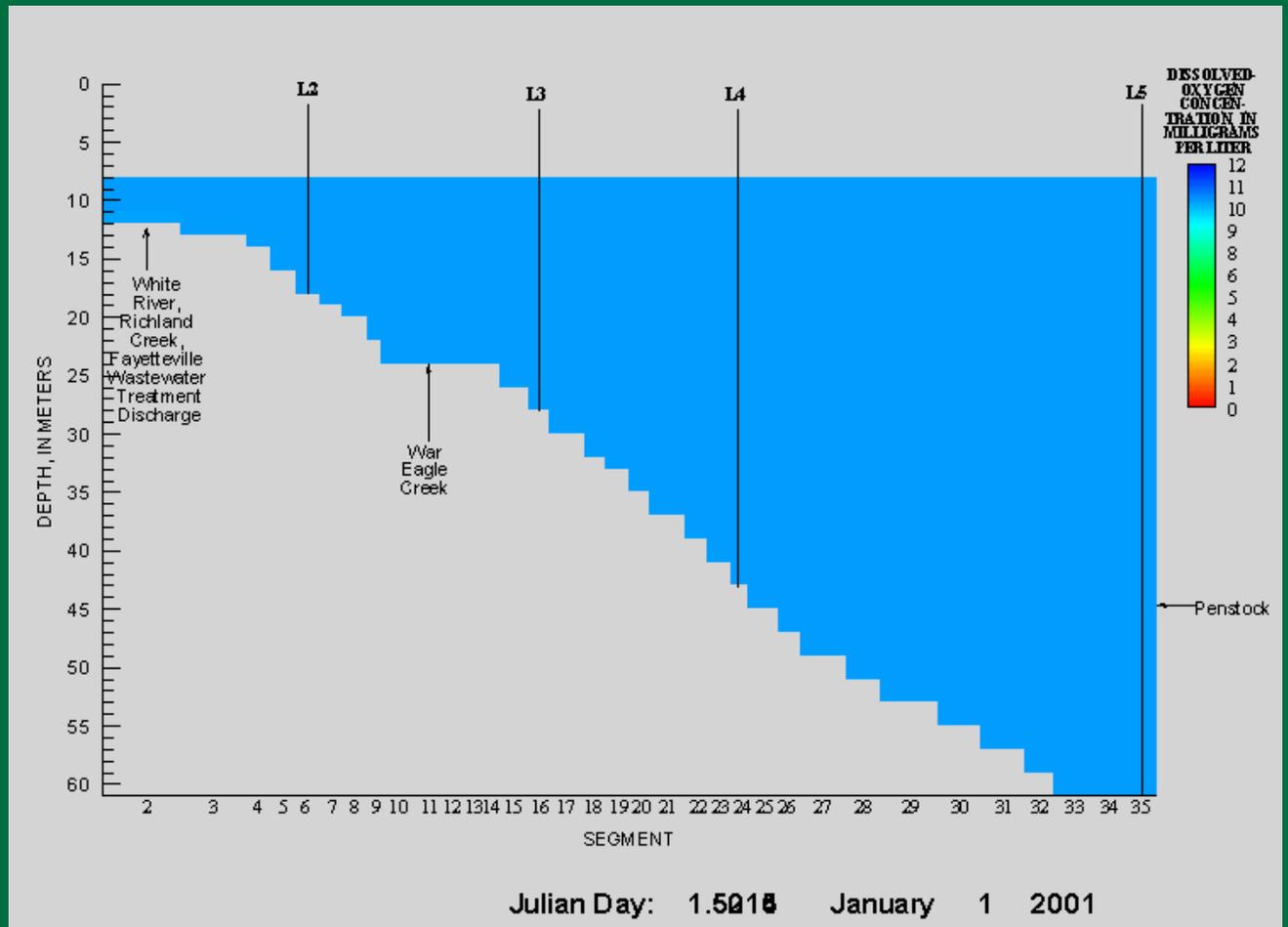
10.1, 10.2 -- Basic Limnology and Comparative Properties

- Water temperature



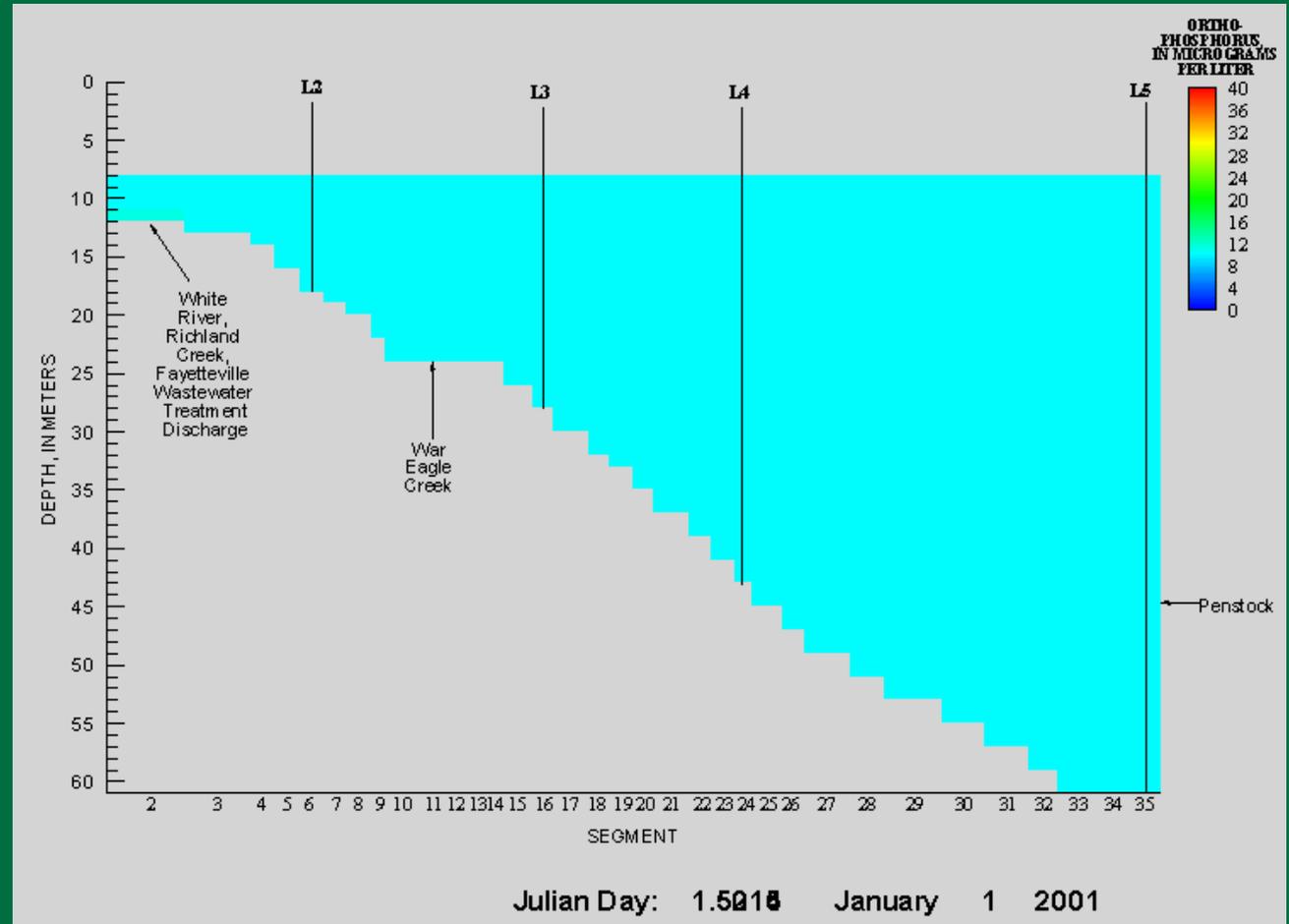
10.1, 10.2 -- Basic Limnology and Comparative Properties

- Dissolved oxygen



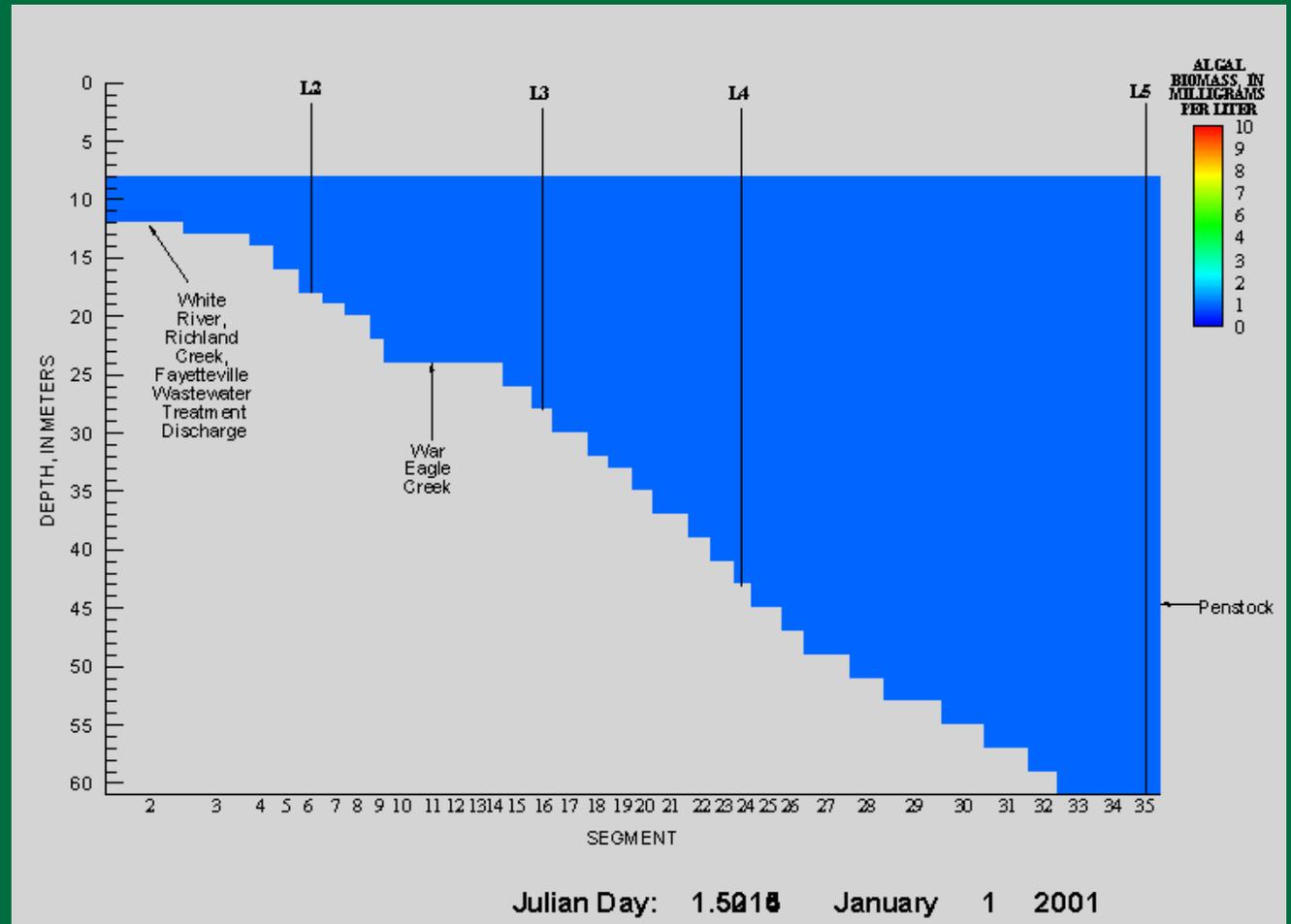
10.1, 10.2 -- Basic Limnology and Comparative Properties

■ Phosphorus



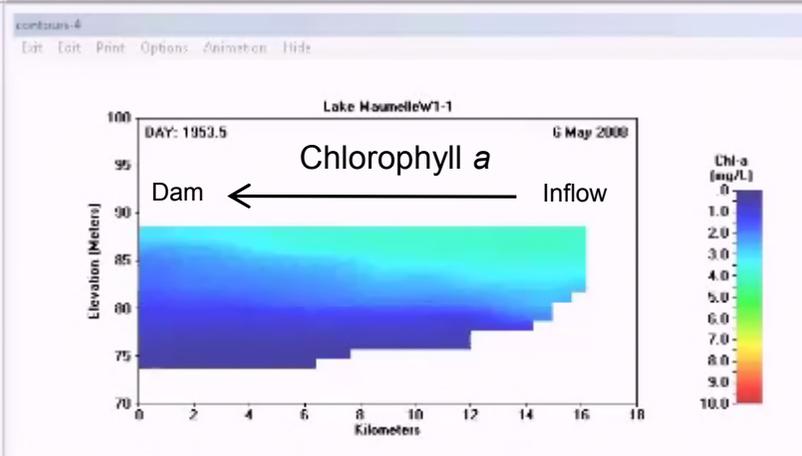
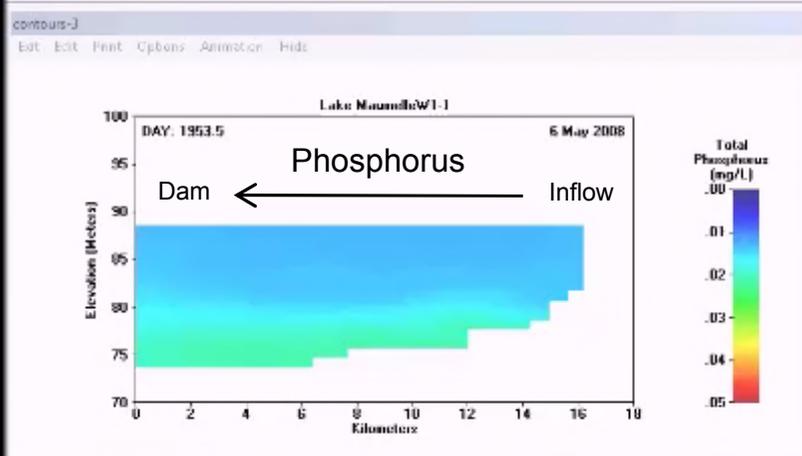
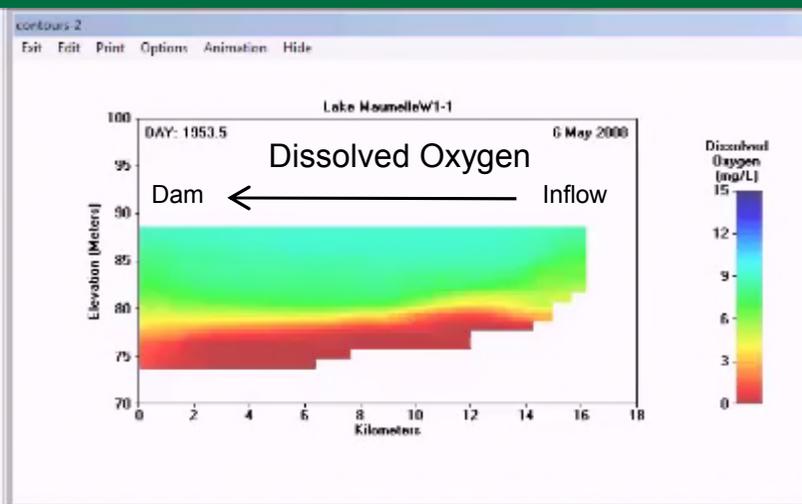
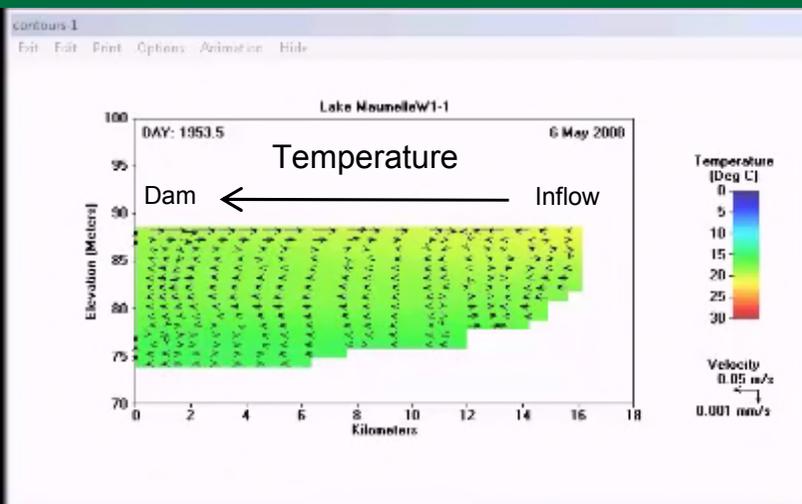
10.1, 10.2 -- Basic Limnology and Comparative Properties

■ Phytoplankton



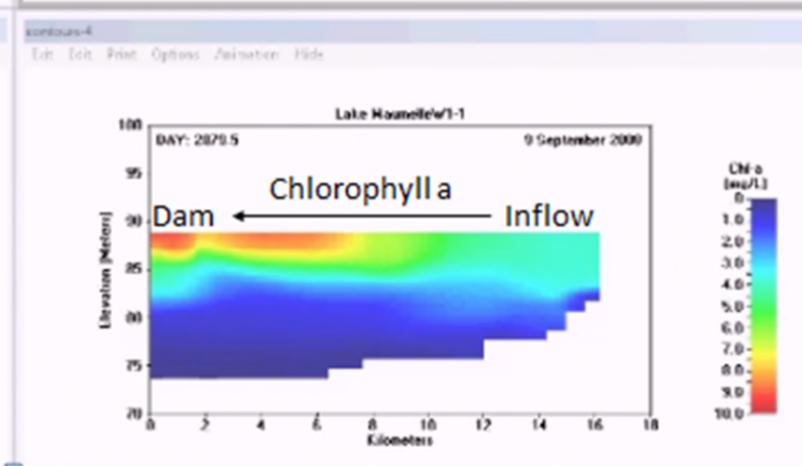
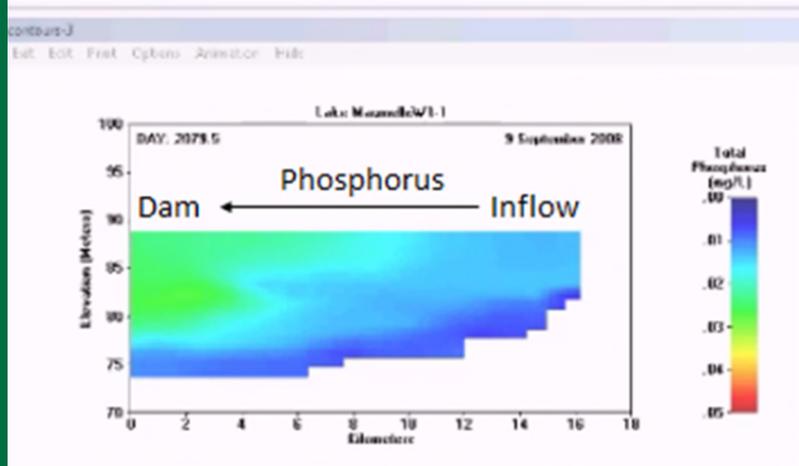
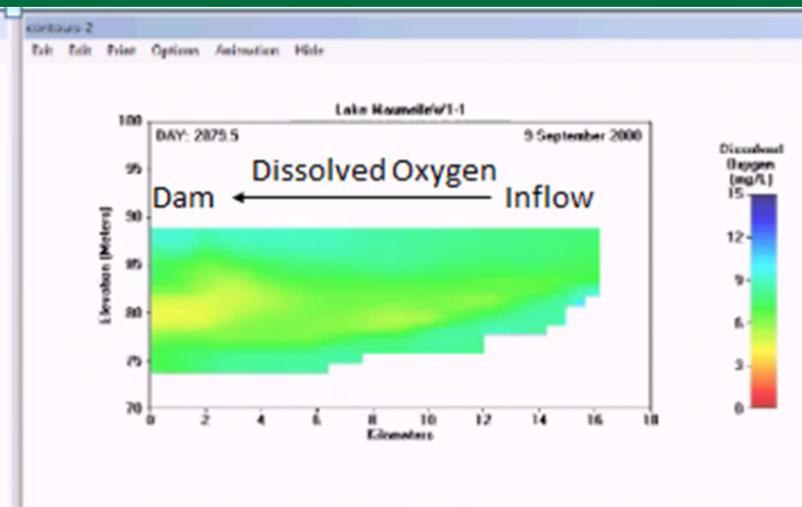
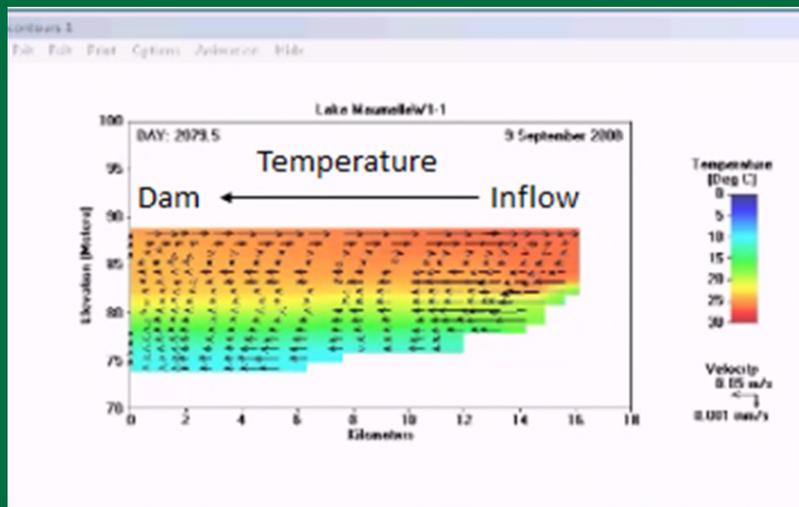
10.1, 10.2 (cont.)

Internal Phosphorus Loading



10.1, 10.2 (cont.)

Internal
phosphorus
loading



10.1, 10.2 (cont.)

- Reservoir aging

Limnological and Ecological Changes Associated with Reservoir Aging

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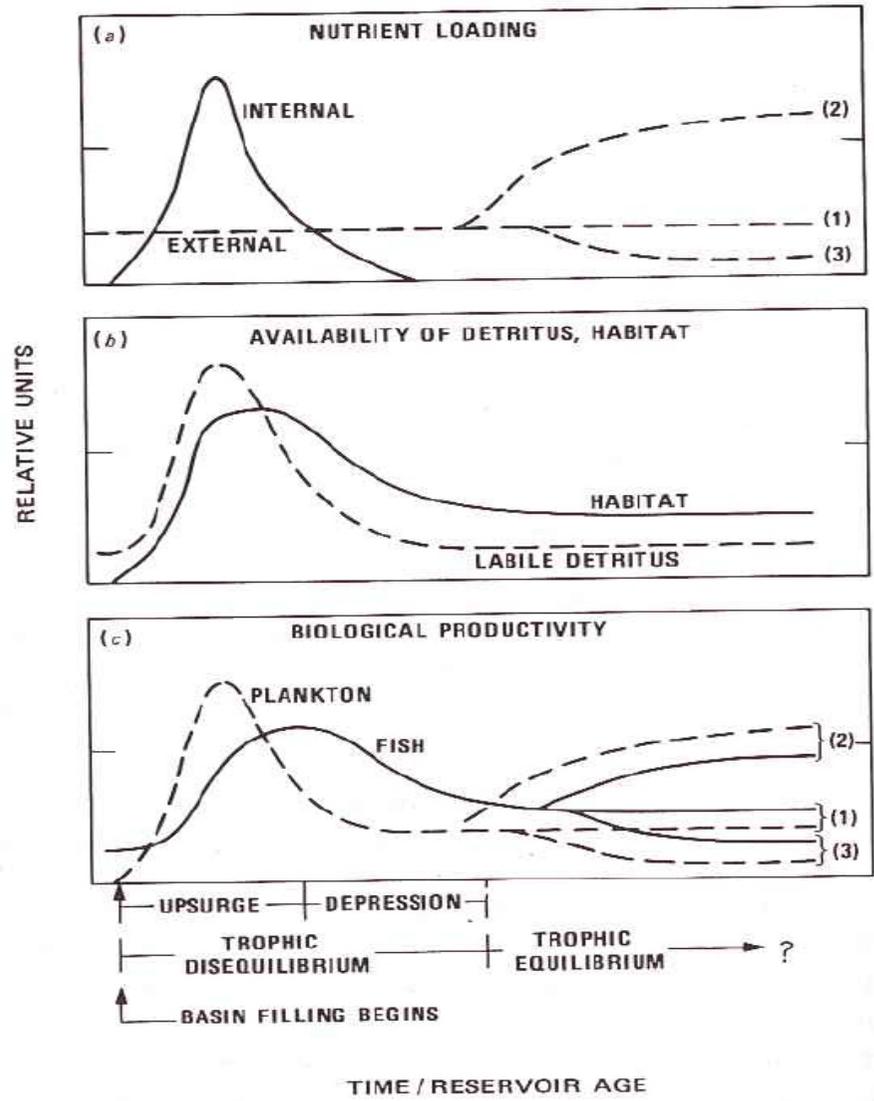
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ABSTRACT

Much scientific attention has been devoted to the "trophic upsurge and depression" observed in recently impounded reservoirs; however, little is known of the longer-term consequences of reservoir aging. Changes in the trophic status of water bodies are often a consequence of man-induced alterations of the watershed, rather than a result of the natural, gradual accumulation of nutrient and sediments. Because the formation of a man-made impoundment frequently promotes additions



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10.1, 10.2 (cont.)

■ Reservoir aging

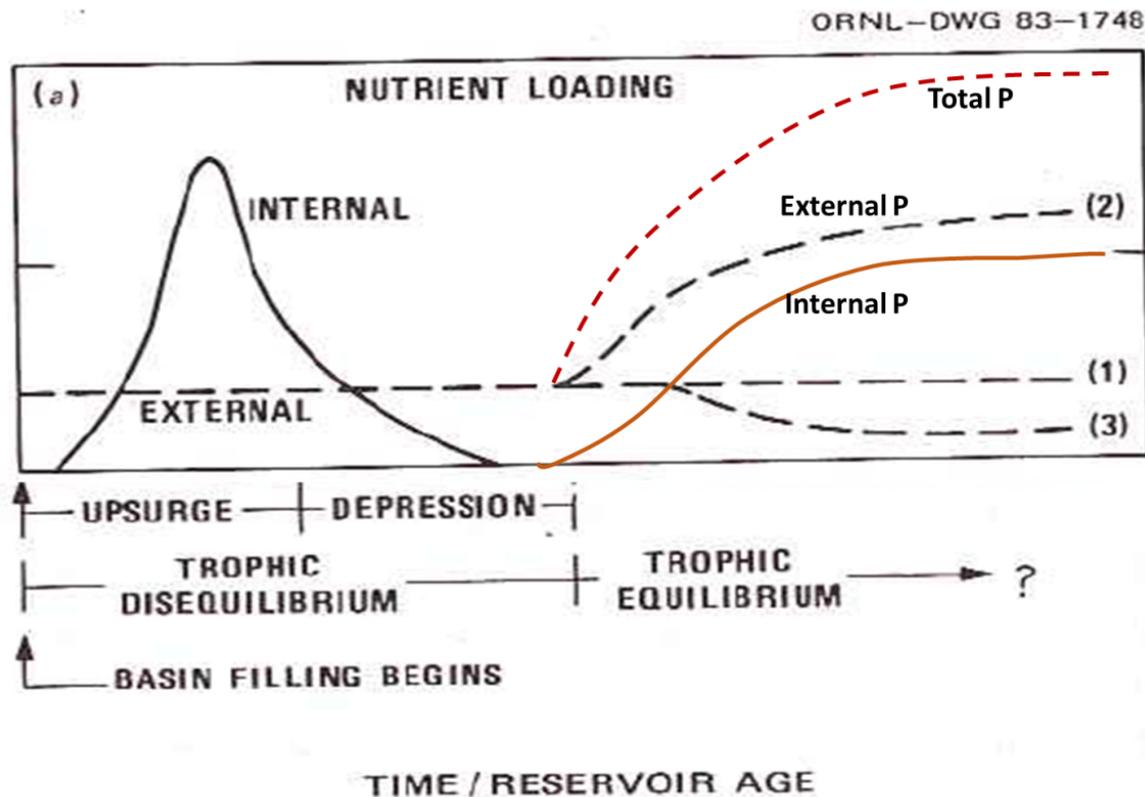
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10.3 General Considerations for Study Design

- **Common study types**
 - Reconnaissance
 - Diagnostic
 - Interpretive
- **Sampling strategies and approaches**
 - What to sample
 - How many samples
 - Where to sample
 - When to sample

10.4 Preparations for data collection: Data management and Safety Precautions

- Site files
- Safety precautions

10.5 Field-Measured Properties

- Light attenuation
- Multiparameter instrument sondes
- Methods for sonde deployment

10.6 Sampling in the Water Column

10.7 Sampling Bottom Material

10.8 Sampling Biological Components

- **Phytoplankton**
- **Zooplankton**
- **Microorganisms**
- **Benthic fauna**
- **Microphytes**
- **Fish**

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