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CHAPTER: BIOLOGICAL ASSESSMENT

MEAK1063: Water Quality Assessment and Management

Master Eng. (Environmental Management)





TOPIC: BIOLOGICAL ASSESSMENT

MEAK1063: Water Quality Assessment and Management

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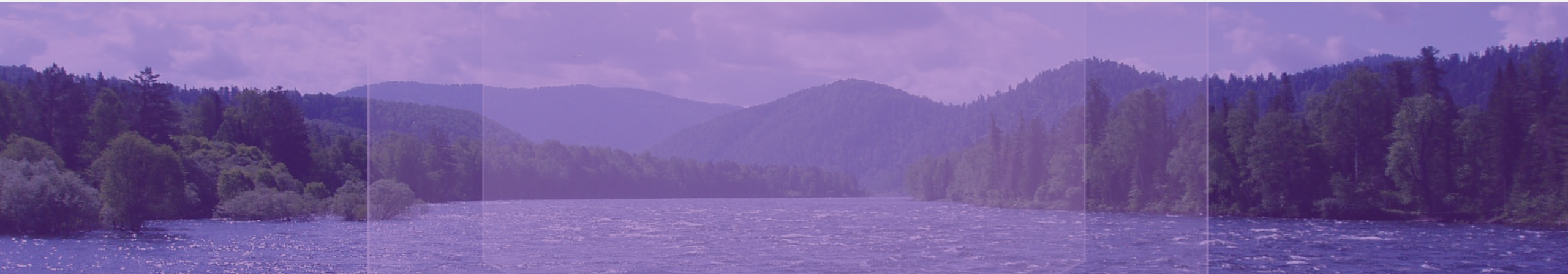
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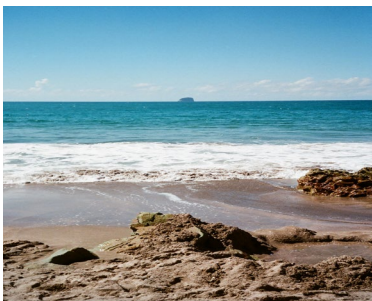
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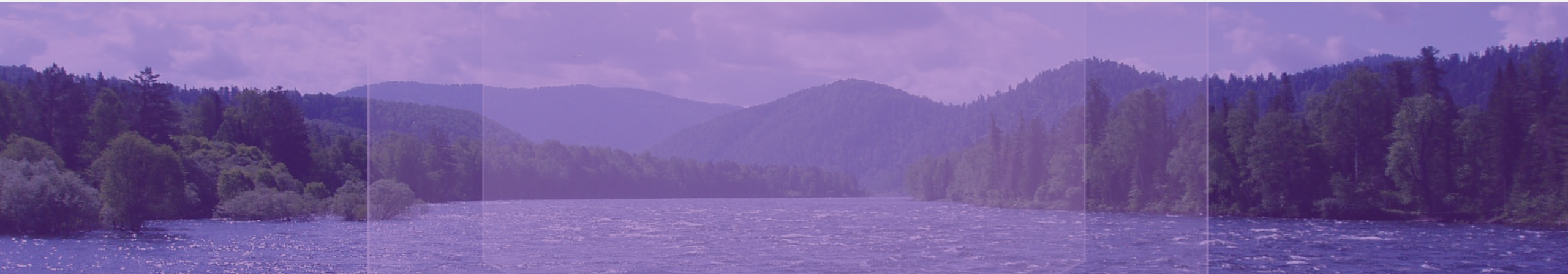
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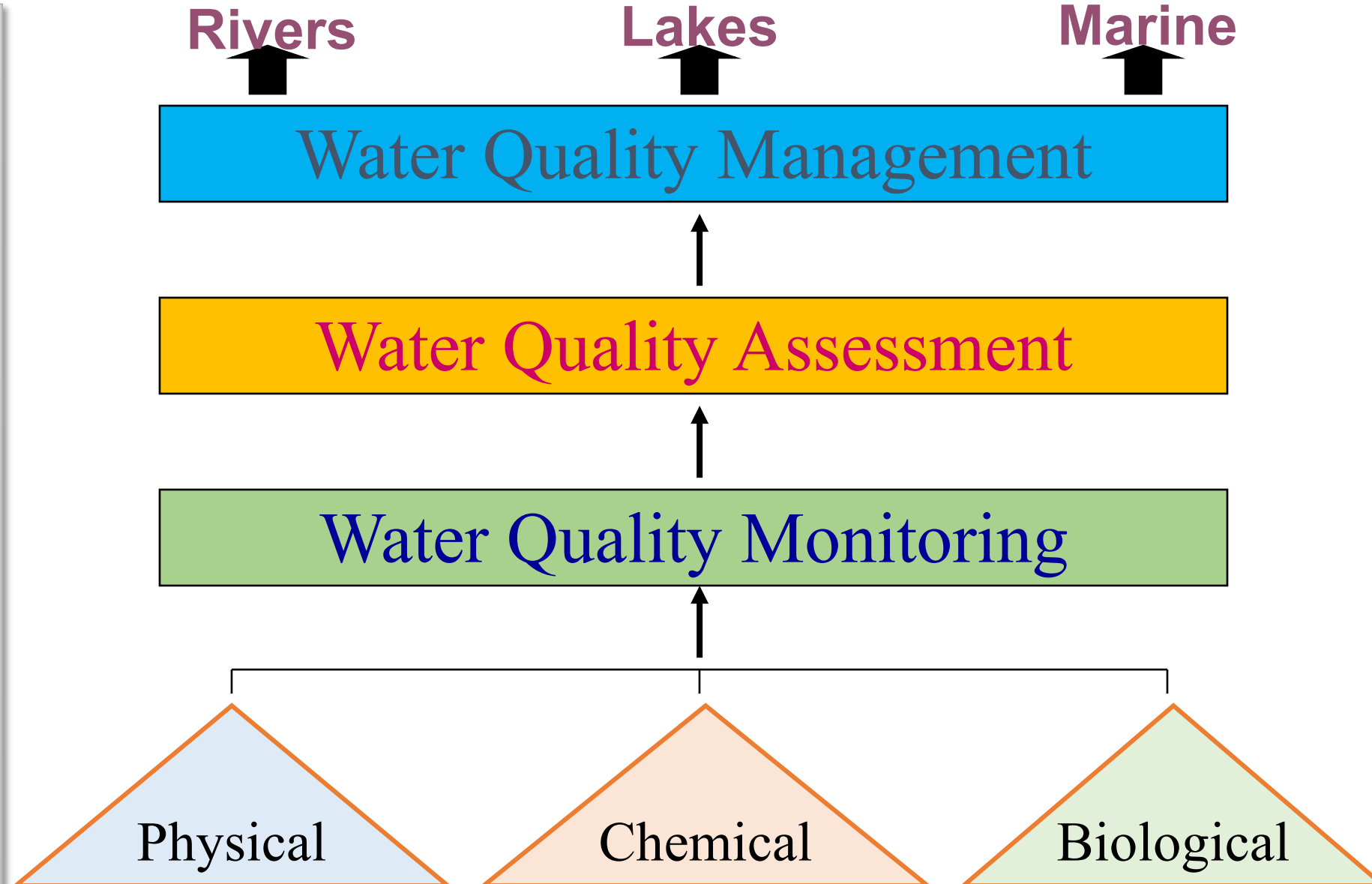
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INTRODUCTION



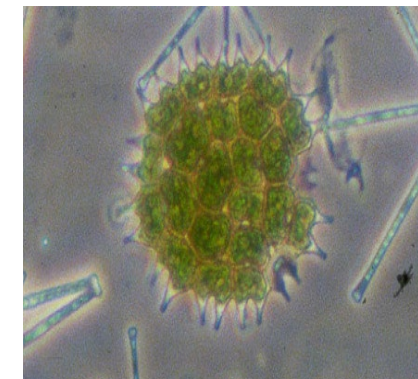
CATEGORIES OF MONITORING



BIOLOGICAL ASSESSMENT- THE DATA



The presence, condition and numbers of type of fish, insects, algae, plants and other organisms are data that provide direct and accurate information about the health of specific bodies of water.





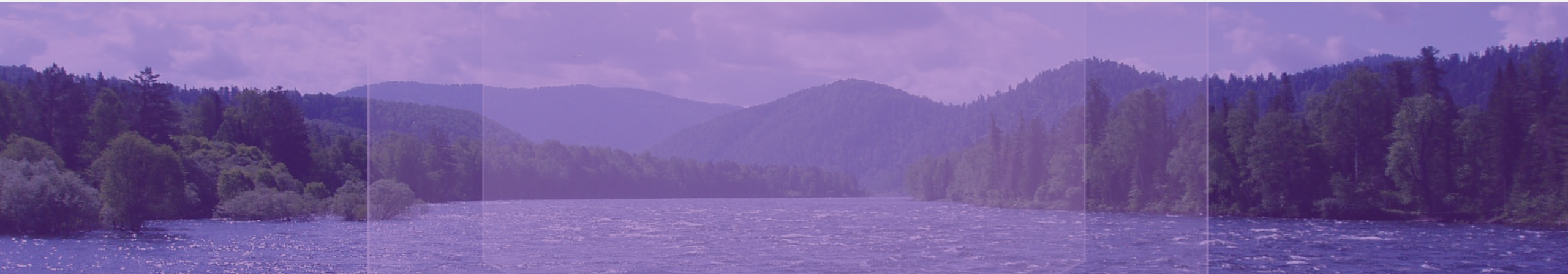
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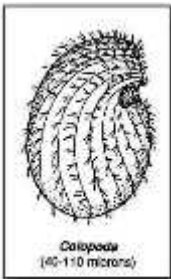


ADVANTAGES OF BIOLOGICAL ASSESSMENT



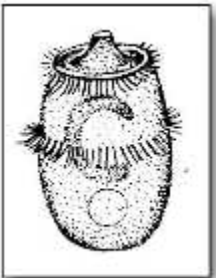
BIOLOGICAL ASSESSMENT

- Chemical, physical & toxicity assessments cannot fully determine whether aquatic resources are being protected.
- Relying totally on chemical and physical measurements alone may lead to situations in which meeting effluent and river standards may not be enough to fully protect the aquatic community.
- May also lead to situations in which the aquatic community remains in satisfactory condition despite a failure to attain standards.



BIOLOGICAL ASSESSMENT- THE ADVANTAGES

1. Able to indicate the effect of contaminant on the ecosystem & help to determine the extent of ecological damage.
2. Enables the researcher to give an assessment of present state of the environment as well as the past.
3. Contaminant concentration in organisms are higher and hence less subject to analytical error than those from sediment and water samples.
4. Measurements from organisms provide data on contaminant in aquatic food system which is not provided from measurement of water and sediment.
5. Quick and cheap and can be integrated into other studies.
6. *The advantages of bioassessment do not eliminate the need for chemical and physical analysis of water samples.*





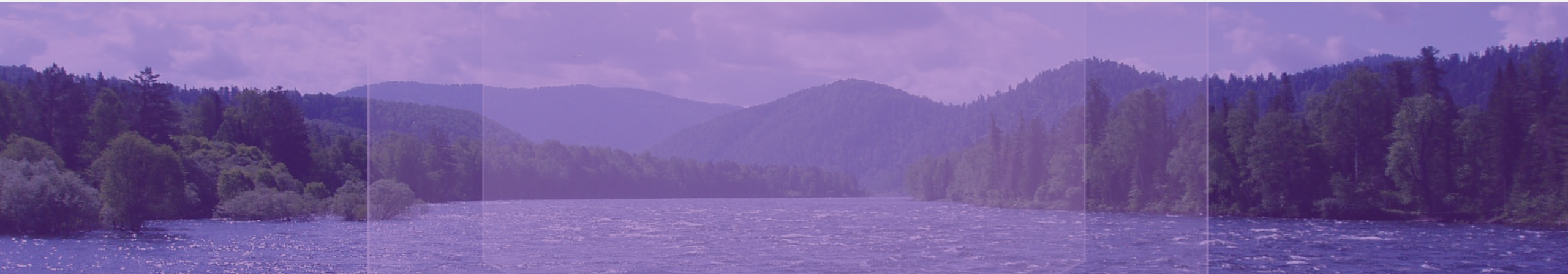
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ELEMENTS OF BIOLOGICAL ASSESSMENT



VARIOUS ELEMENTS OF BIOLOGICAL STUDIES

- **BIOSURVEY** is the process of collecting & processing representative portions of a resident aquatic community to determine the community structure and functions.
- **BIOASSESSMENT** is an evaluation of the biological condition of a waterbody that uses biosurveys & other direct measurements of resident biota in surface waters.
- **BIOCRITERIA** is a method/system describing the qualities that must be present to support a desired condition in a water body.

USES OF BIOASSESSMENT & BIOCRITERIA DATA



1. Provide information to support enforcement investigations and restorative assessments.
2. Set protection and restoration goals – shift from performance-based standards to impact based standards.
3. Assess water quality & identify impaired waters – can be used to identify biologically impaired waters, assess the effects of habitat alterations, verify impact of discharges.
4. Identify stressors to a waterbody – different biological components of an aquatic community will respond differently to certain types of stressors.
5. Track restoration progress – directly measure the response of the biological community to actions taken to restore waterbodies.
6. Watershed protection – biological assessment can shift the focus of water quality programs from strict pollutant source control to a broader resource management.





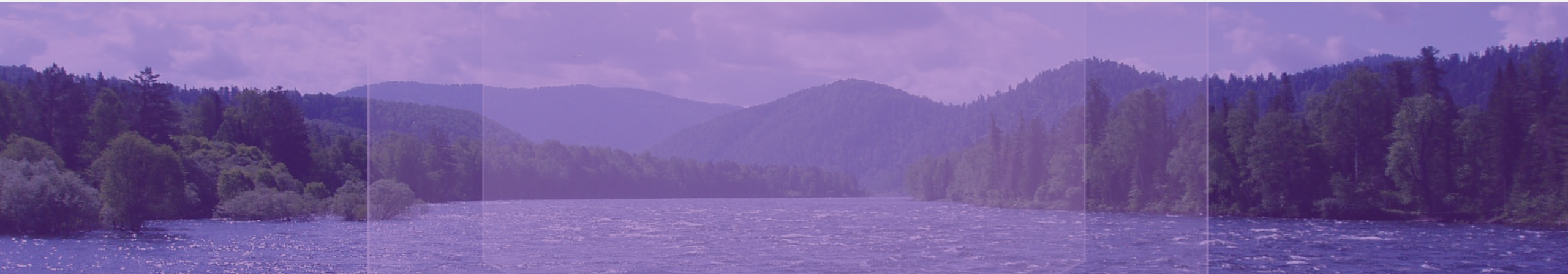
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TYPES OF BIOLOGICAL ASSESSMENT



BIOLOGICAL ASSESSMENT- THE TYPES

1.Ecological Methods

Analysis of biological communities of the water body

Presence or absence of specific species

2.Physiological & Biochemical Methods

Oxygen production and consumption, stimulation or inhibition

Studies of the effects of enzymes.

3.Biological Accumulation

Passive and active monitoring

4.Histological and Morphological Methods

Observation of histological and morphological changes

5.The Use of Organisms in Controlled Environments

Assessment of toxic or beneficial effects of samples on organisms under defined laboratory conditions.

Assessment of behaviour under defined laboratory conditions



INDICATOR SPECIES

MAJOR GROUPS

Fish

Benthic Macro-invertebrate

Periphyton

Macrophytes



FISH AS INDICATOR

ADVANTAGES :

Live in water all of their life

Easy to collect with the right equipment

Life span of several years

Easy to identify in the field

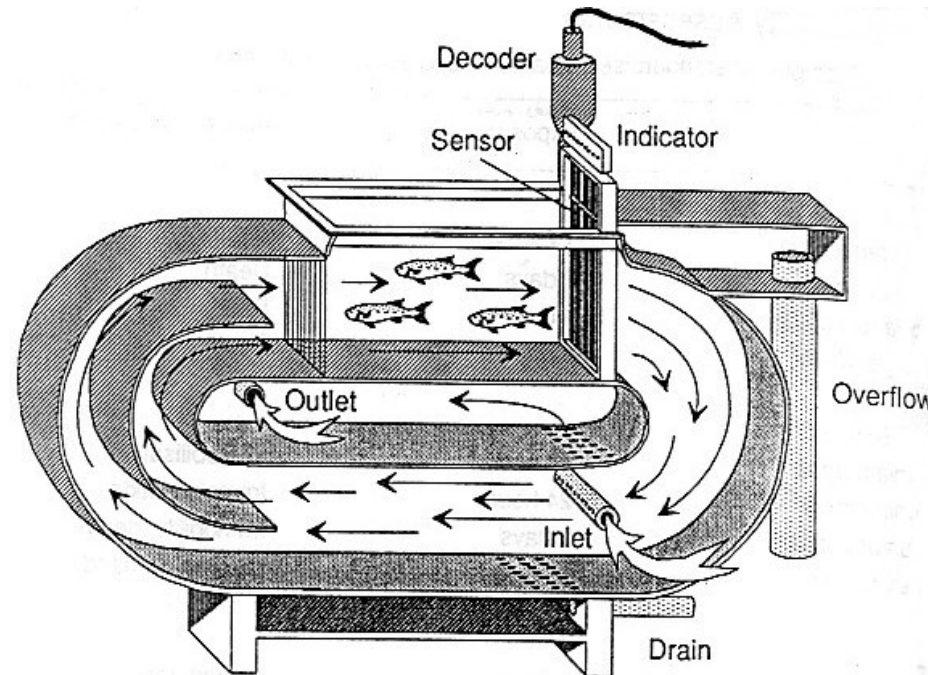
Represent various community tolerance levels from sensitive to highly tolerant & respond to chemical, physical and biological changes



TYPES OF BIOLOGICAL ASSESSMENT

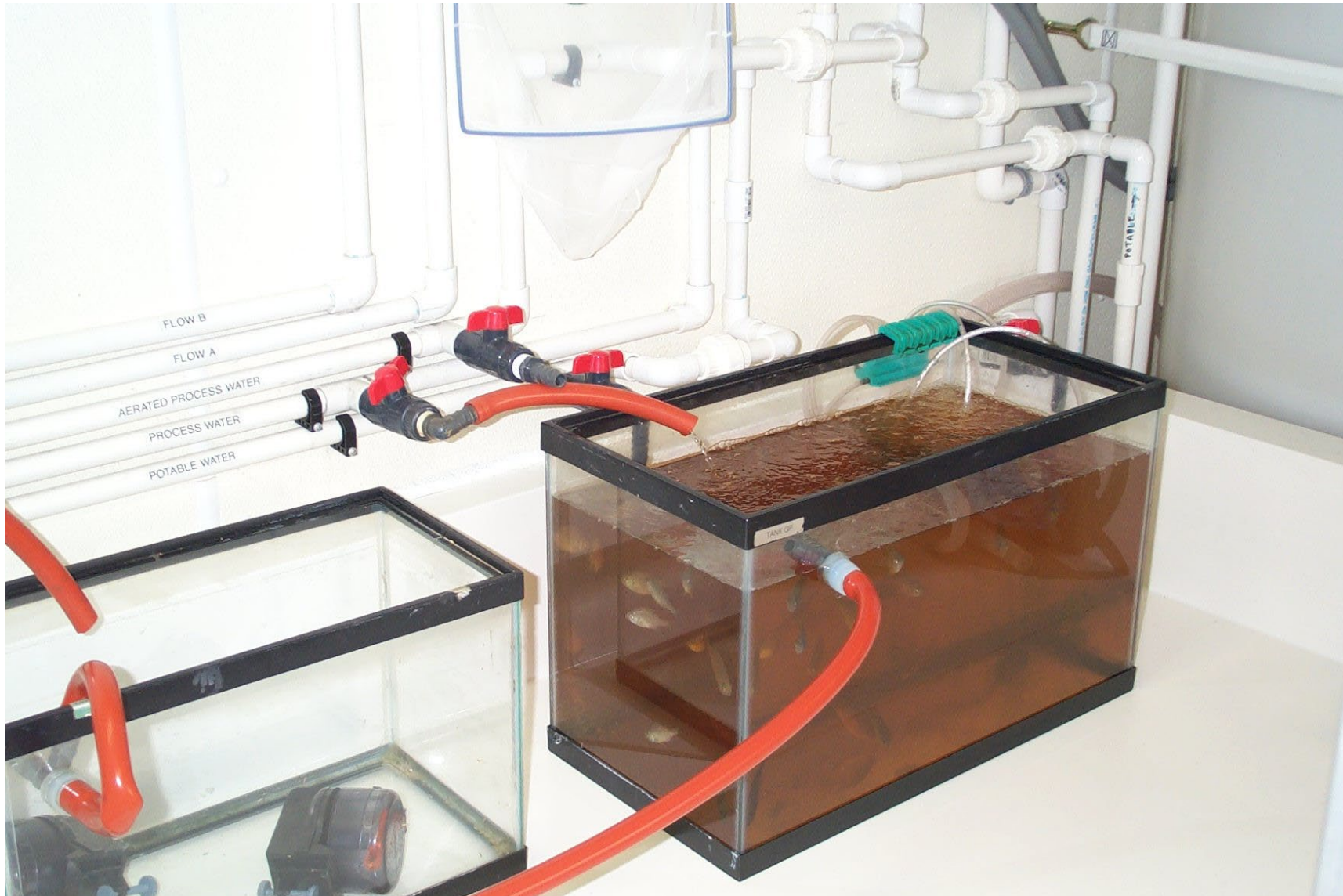
The use of organisms in control environment

Assessment of the toxic effects of samples on organisms under defined laboratory conditions (bioassays)





Bioassays



Scientists can Safely Conduct Aquatic Toxicity Studies in State-of-the-Art Science Exposure Systems



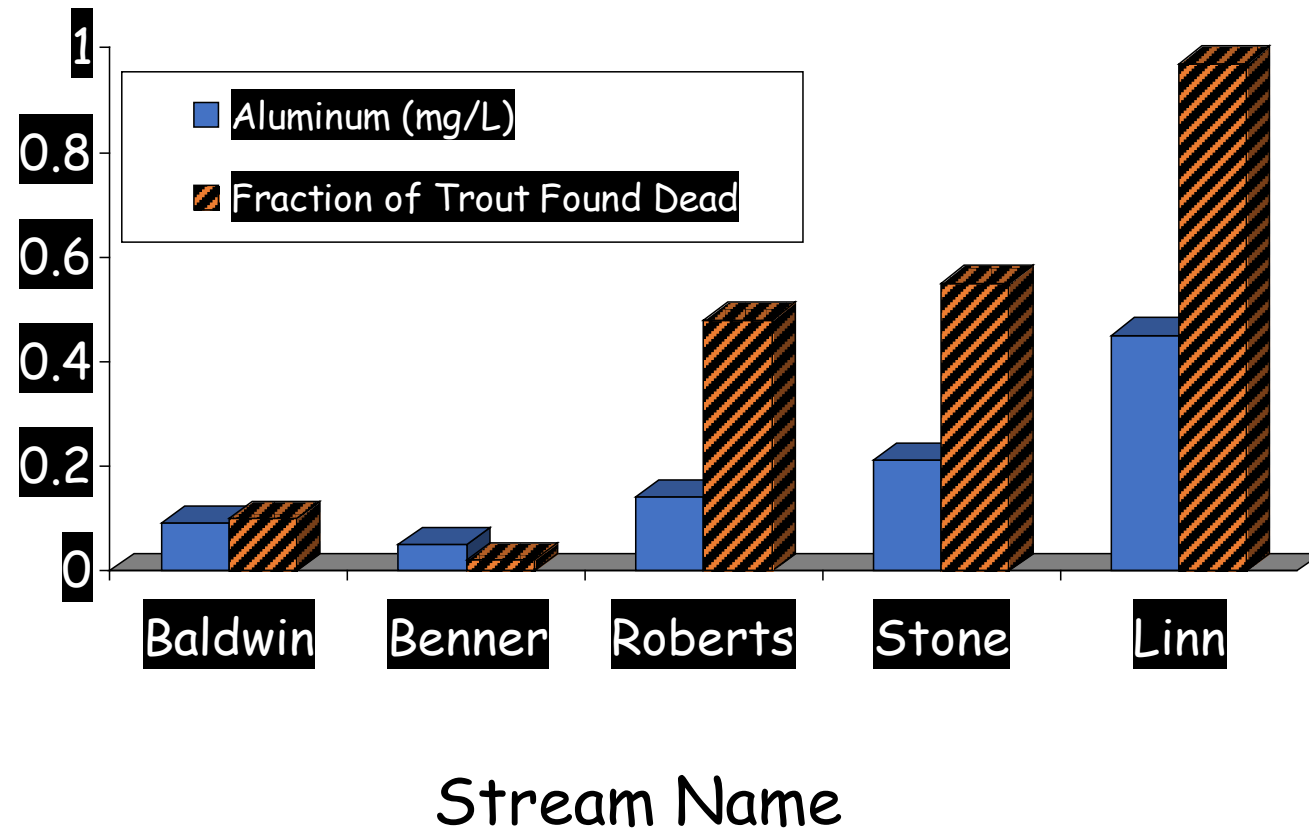
EFFECTS ON FISH

Fish are good indicators of the cumulative impact of acid rain.



- Bioassays
- Radio telemetry
- Population effects

Aluminum Effects on Trout Survival 30-Day Bioassay Results







ANTICIPATORY MONITORING



BENTHIC MACROINVERTEBRATES AS INDICATORS

ADVANTAGES

Live in water for all or most
of their life

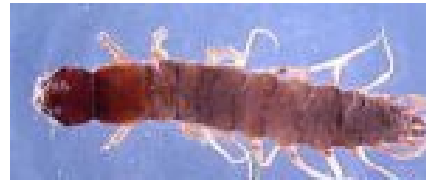
Stay in areas suitable for
their survival

Easy to collect

Differ in their tolerance to
amount and types of
pollution

Easy to identify in laboratory

Have limited mobility



PERIPHYTON AS INDICATORS

Periphyton are benthic algae that grow attached to surfaces such as rocks or larger plants.

ADVANTAGES

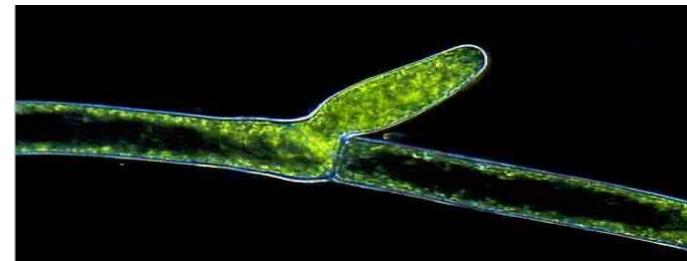
They are good bioindicator due to :

A naturally high number of species.

A rapid response time to both exposure and recovery.

Tolerance or sensitivity to specific changes in environmental conditions are known for many species.

Ease of sampling, requiring few people.



MACROPHYTES AS INDICATORS

Macrophytes are aquatic plants, growing in or near water that are either emergent, submergent, or floating.

ADVANTAGES

- Respond to nutrients, light, toxic contaminants, metals, herbicides, turbidity, water level changes and salt.
- Do not require laboratory analysis
- Integrators of environmental conditions





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Thank you

