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Environmental
Quality
Bioindication

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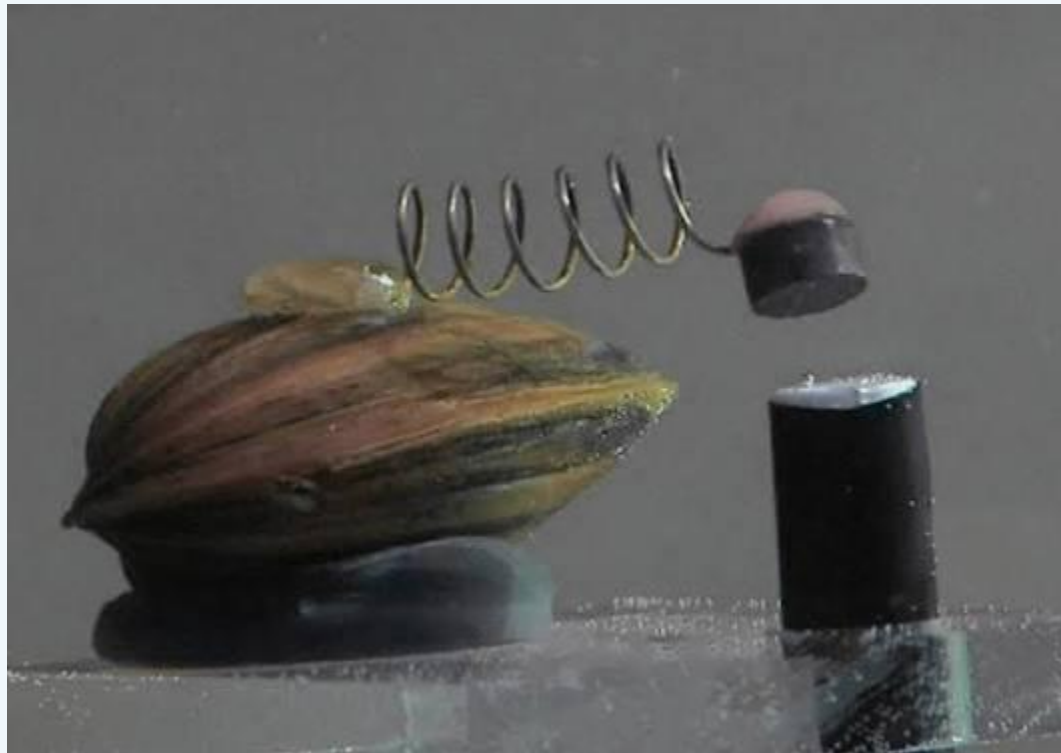
Coalition
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Bioindication is a method of assessing environmental quality based on the condition of living organisms and biological communities. The method relies on changes in the composition, abundance, appearance, or behavior of **indicator species** that are sensitive to air, water, or soil pollution

MAIN TYPES OF BIOINDICATION



- **Species bioindication** – using indicator species.
- **Community bioindication** – assessing changes in species composition and community structure.
- **Physiological bioindication** – evaluating physiological responses of organisms.
- **Biochemical bioindication** – measuring changes in enzymes, pigments, or other biochemical markers.
- **Morphological bioindication** – observing changes in the appearance or structure of organisms.
- **Behavioral bioindication** – monitoring changes in organism behavior caused by environmental factors.



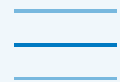
Advantages and Limitations of Bioindication

Advantages

- Cost-effective and relatively inexpensive.
- Integrates the effects of pollutants over time.
- Detects the biological impact of multiple stressors.
- Suitable for long-term environmental monitoring.
- Can identify early signs of ecosystem degradation.
- Reflects the actual ecological condition rather than only chemical concentrations.

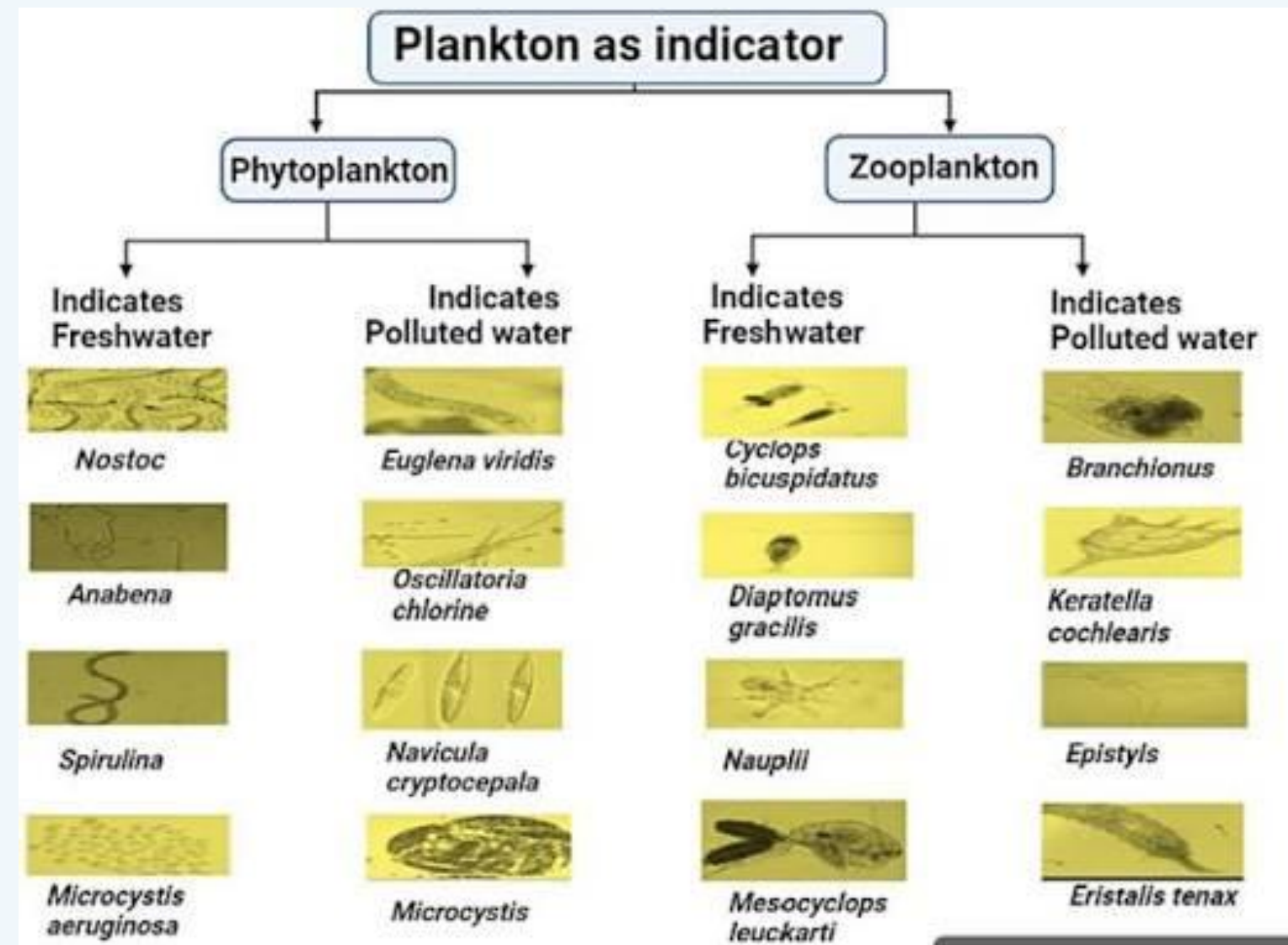
Limitations

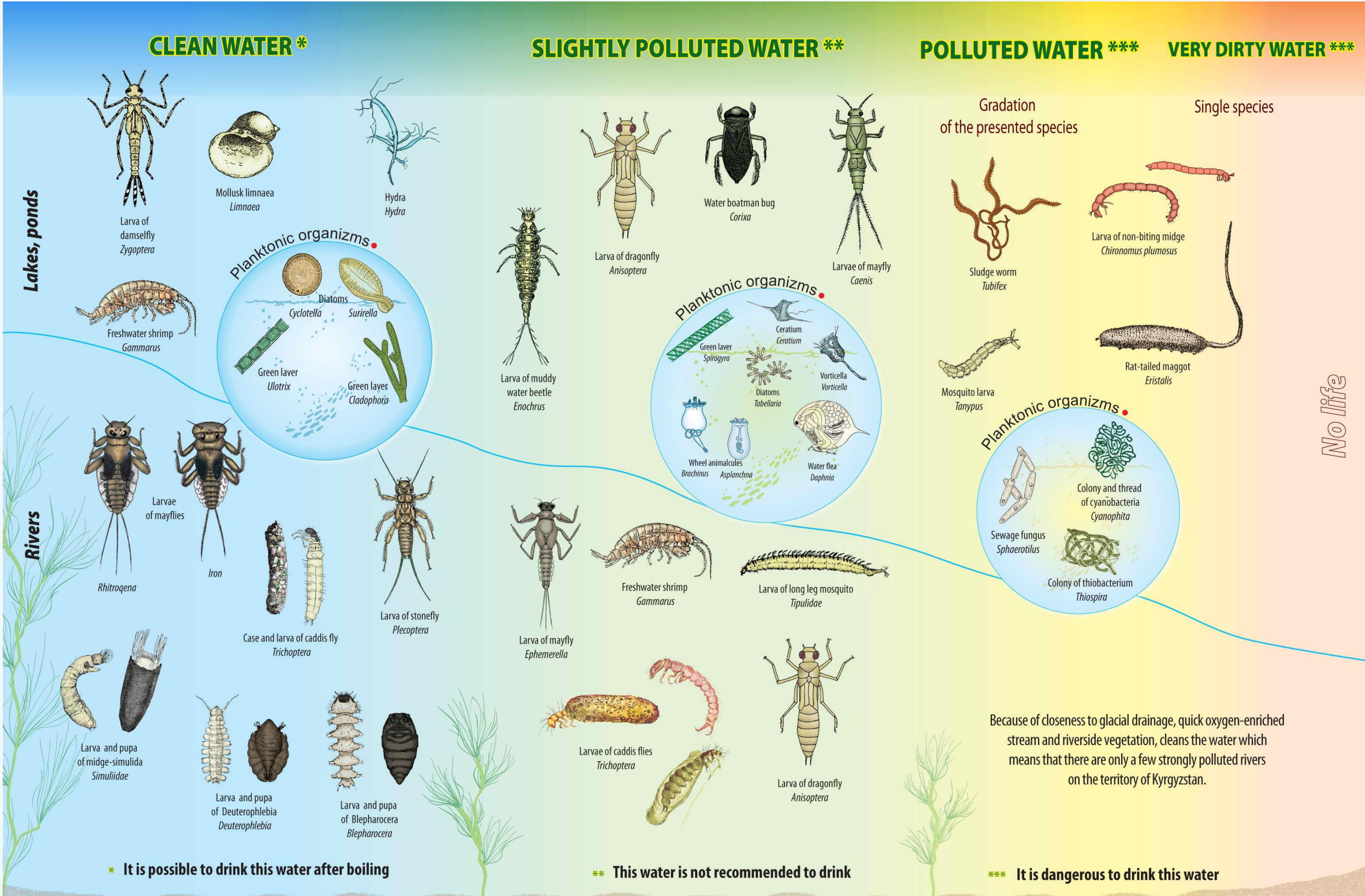
- Results may be influenced by natural environmental variability.
- Requires taxonomic and ecological expertise.
- Some indicator species are region-specific.
- Does not always identify the exact pollutant responsible.
- Responses of organisms may take time to appear.
- Often needs to be combined with chemical and physical analyses for comprehensive assessment.



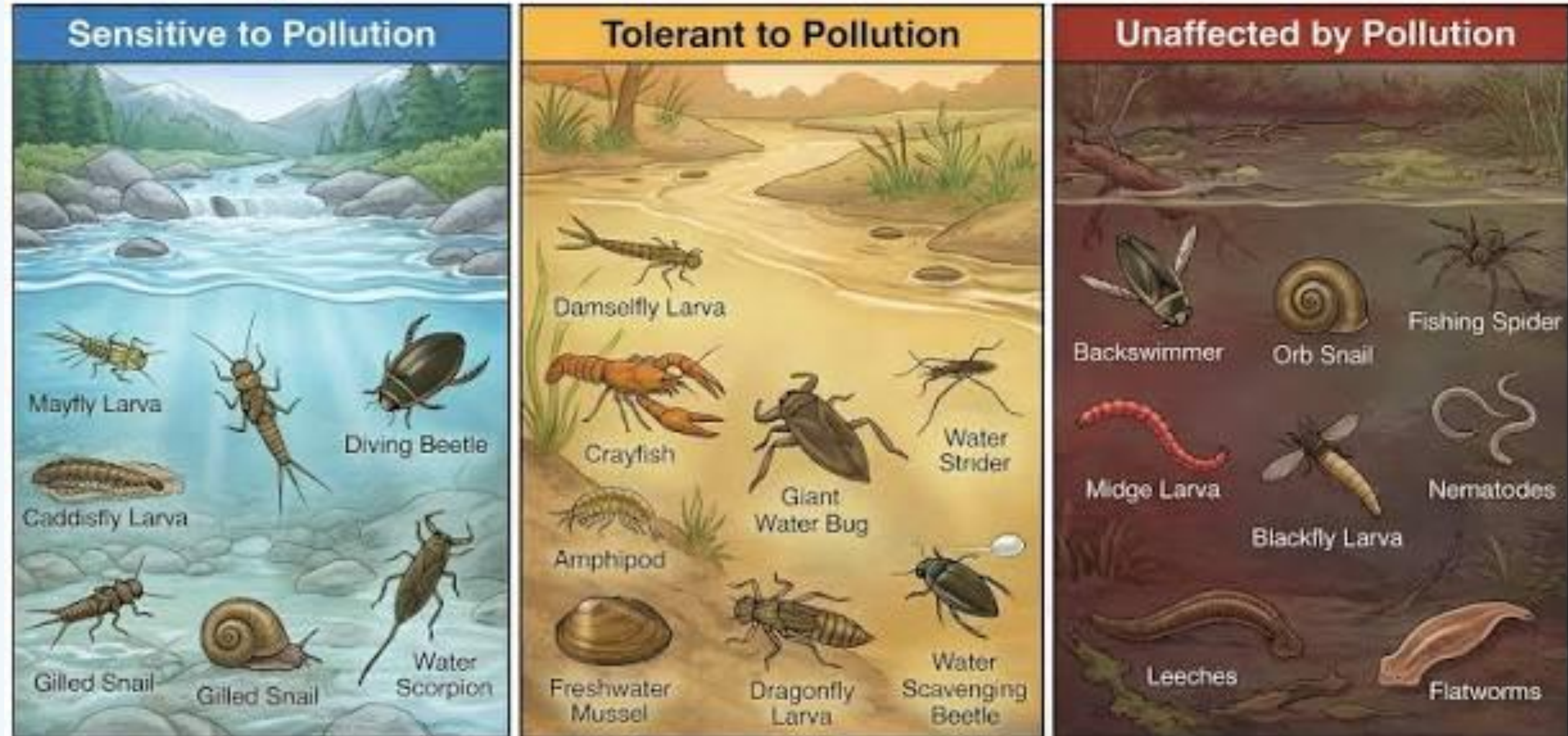
Common Biological Indices Used in Bioindication

- Shannon–Wiener Diversity Index
- Pantle–Buck Saprobity Index
- Woodiwiss Biotic Index
- Goodnight–Whitley Index
- Balushkin Index
- EPT Index
- BMWP Index
- Multimetric Macroinvertebrate Index (MMIF)
- ASPT (Average Score Per Taxon)





Aquatic Macroinvertebrates as Bioindicators





Insects

Ephemeroptera



Small mayfly
Baetidae



Small squaregill mayfly
Caenidae



Prong-gilled mayflies
Leptophlebiidae



Stream mayfly
Heptageniidae

Heteroptera



Backswimmer
Notonectidae



Lesser water boatman
Corixidae



Water scorpion
Nepidae



Marsh treaders
Hydrometridae



Pond skater
Gerridae

Dragonflies



Aeshnid
Aeshnidae



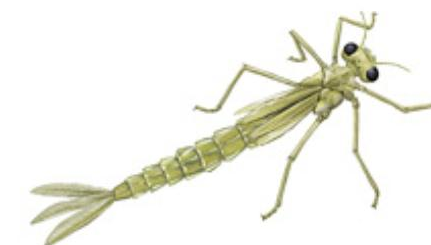
Club-tail dragonfly
Gomphidae



Skimmer or percher
Libellulidae



Broad-winged damselfly
Calopterygidae



Spreadwing
Lestidae



Beetles



Predaceous diving beetle
Dytiscidae



Water-scavenger beetle
Hydrophilidae



Haliplid
Haliplidae



Riffle beetle
Elmidae



Whirligig beetle
Gyrinidae



Long-toed water beetle
Dryopidae

Plecoptera



Spring stonefly
Nemouridae



Needlefly
Leuctridae



Stonefly
Perlidae



Springfly
Perlodidae

Trichoptera



Caddis fly
Limnephilidae



Long-horned caddis fly
Leptoceridae



Net-spinning caddis fly
Hydropsychidae



Free-living caddis fly
Rhyacofilidae



Finger-net caddis fly
Philopotamidae



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Diptera



Lake fly
Chironomidae



Black fly
Simuliidae



Mosquito
Culicidae



Crane fly
Tipulidae



Hoverfly
Syrphidae



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