California Envirothon
Aquatics Learning Objectives

I. Hydrosphere & Water Systems

Students should be able to:

1. Explain how the physical and chemical properties of water (polarity, temperature, density, pH, salinity) influence aquatic ecosystems.
2. Describe and diagram the water cycle, explaining how water moves between the atmosphere, surface water, groundwater, and living systems, including the role of snowpack and groundwater in California.
3. Compare freshwater, saltwater, and brackish ecosystems, including where they occur and specific adaptations organisms have to survive in these ecosystems.
4. Identify major types of water bodies, wetlands, and estuaries, explaining their distribution, how they form, their ecological importance, and examples in California.
5. Describe the process of thermal stratification of lakes and how this impacts lake mixing, temperature, and oxygen dynamics.

II. Aquatic Ecosystems & Hydrology

Students should be able to:

6. Identify biotic and abiotic components of aquatic ecosystems and explain how they interact.
7. Describe the structure and function of aquatic ecosystems, including productivity, carrying capacity, and species interactions
8. Describe factors that impact aquatic carrying capacity and identify the trophic level of a lake based on productivity.
9. Describe watersheds, including stream order, drainage patterns, and why watershed-scale thinking matters, with reference to major California watersheds.

III. Aquatic Organisms

Students should be able to:

10. Identify major groups of aquatic organisms and their defining characteristics.
11. Analyze adaptations of aquatic organisms that allow them to survive in water environments.
12. Explain unique aquatic life cycles, including anadromous (*e.g., California salmon and steelhead*) and catadromous species.
13. Distinguish between species status categories (common, endangered, invasive, endemic) and explain their ecological significance, using California examples.

IV. Aquatics & Society (Human Impacts & Management)

Students should be able to:

14. Describe major human impacts on aquatic systems, including pollution, habitat alteration, eutrophication, and climate change.
15. Distinguish between point and nonpoint source pollution, giving examples and management strategies.
16. Explain why watershed-scale management is essential for protecting water resources.
17. Analyze competing ecological and human demands on water and evaluate conservation strategies, especially in water-limited regions like California.
18. Identify California laws and agencies that protect water resources, explaining actions they take to protect them.
19. Identify the roles and interests of Indigenous communities regarding conservation, including Traditional Ecological Knowledge.

V. Field Skills & Data Analysis

Students should be able to:

20. Identify common aquatic organisms, including fish, macroinvertebrates, and invasive aquatic species by common and scientific name (*refer to the provided species list*).
    a. *Scientific name for fish and invasive species only*
21. Use biological indicators (macroinvertebrates, biotic index) to assess water quality.
22. Measure and interpret water quality data, including dissolved oxygen, pH, turbidity, nutrients, and bacteria and make connections to why understanding this data matters to ecosystems and humans.
23. Analyze hydrologic data, including hydrographs, flow rate, and runoff.
24. Apply field data to recommend best management practices for improving water quality and habitat.
25. Construct an aquatic food web consisting of producers, consumers, and decomposers for a California aquatic (*i.e. river or lake*) and coastal wetlands ecosystem.