

Fish Biology Basics

- I. Why do we need to know fish biology as managers? Helps us to predict their distributions based on physiological ecology. Predict the *potential niche* of the fish, based on environmental characteristics.
- II. Respiration - uptake of oxygen and the production of carbon dioxide; necessary to fuel the metabolism of the fish
  - A. Skin absorption of oxygen; probably only important for eggs and larvae
  - B. Lungs or modified guts; a teleost (i.e., bony fish) invention, probably to persist in stagnant, low oxygen freshwater, where teleosts evolved
  - C. Gills - site of major gas and ion exchange in most fishes
    1. Gill arches - support
    2. Gill filaments - area of gas and ion exchange
    3. Gill rakers - rakers protect filaments and select food particles
- III. Buoyancy - weight of fish in water depends on its density (mg/ml) relative to that of the water (mg/ml) and the volume (ml) of water it displaces
  - A. Types of buoyancy
    1. Positive - rise
    2. Neutral - no change
    3. Negative - sink
  - B. How do fish regulate buoyancy?
    1. No regulation; use swimming and lift
    2. Low density substances (e.g., fat)
    3. Swimbladders (modified lungs)
      - a. Physostomous - shallow water
      - b. Physoclistous - deep water; rete mirabile regulates gas flow
  - C. Swimbladders...
    1.  $PV=PV$ ; the relationship between pressure (atm) and volume (ml) must always be proportional
    2. Sound reception; Weberian ossicles connect swimbladder and the inner ear
    3. Sound transmission; identification of species?
- IV. Reproduction - extremely variable ways that fish reproduce; just about any method can be found in fish; varies both among species and within species
  - A. Timing of spawning - some species spawn seasonally, corresponds with seasonality in food availability; other species spawn continuously.
  - B. Frequency of spawning-
    1. Constant, stable environment - semelparity; spawn once and die
    2. Variable, unstable environment- iteroparity; spawn multiple times during life
  - C. Reproductive modes
    1. Internal fertilization - sharks, guppies
    2. External fertilization - many fishes
      - a. Nonguarders
      - b. Guarders

- c. Bearers
  - D. Hybridization - fairly common; may be used in management to “improve” sportfish through hybrid vigor
    - 1. Positives
    - 2. Negatives - introgression
- V. Temperature - major factor regulating the distribution of fish on global scale
  - A. Warm-water fishes - tolerate warm temperatures; grow best at temperatures > 20 C
  - B. Cool-water fishes - tolerate cold temperatures; grow best at temperatures < 20 C
  - C. Temperature regulation in fishes
    - 1. Behavioral
    - 2. Physiological - rete systems
- VI. Osmoregulation - regulation of water and minerals in fish; maintaining homeostasis
  - A. Freshwater fish- hyperosmotic to the surrounding water
    - 1. Challenge
      - a. Salts are lost
      - b. Water is gained
    - 2. Solution
      - a. Do not drink
      - b. Copious, dilute urine
      - c. Conserve salts at the gills
  - B. Marine fish - hyposmotic to the surrounding water
    - 1. Challenge
      - a. Salts are gained
      - b. Water is lost
    - 2. Solution
      - a. Drink
      - b. Scant, concentrated urine
      - c. Actively remove salts at the gills