Animal Adaptations to Wetland Life

(Mostly assumes adaptations to aquatic life)

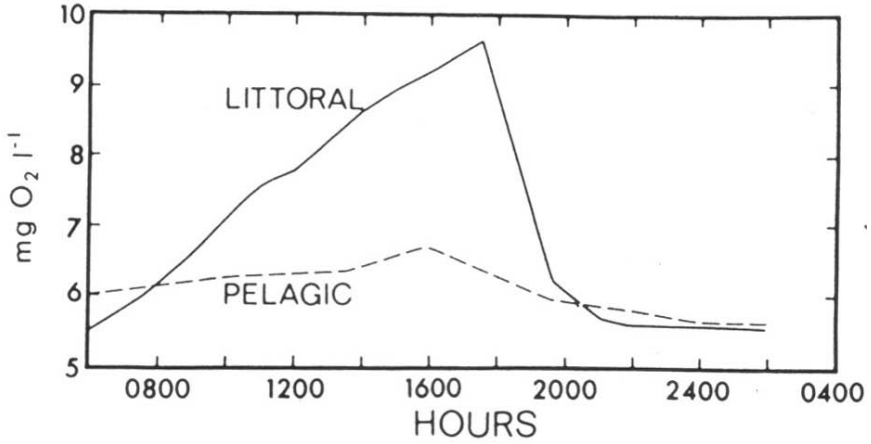
1. Respiration
2. Osmoregulation
3. Feeding
4. Movement
5. Reproduction & life history

Invertebrates
Fish
Amphibians
Reptiles
Birds
Mammals

Respiration

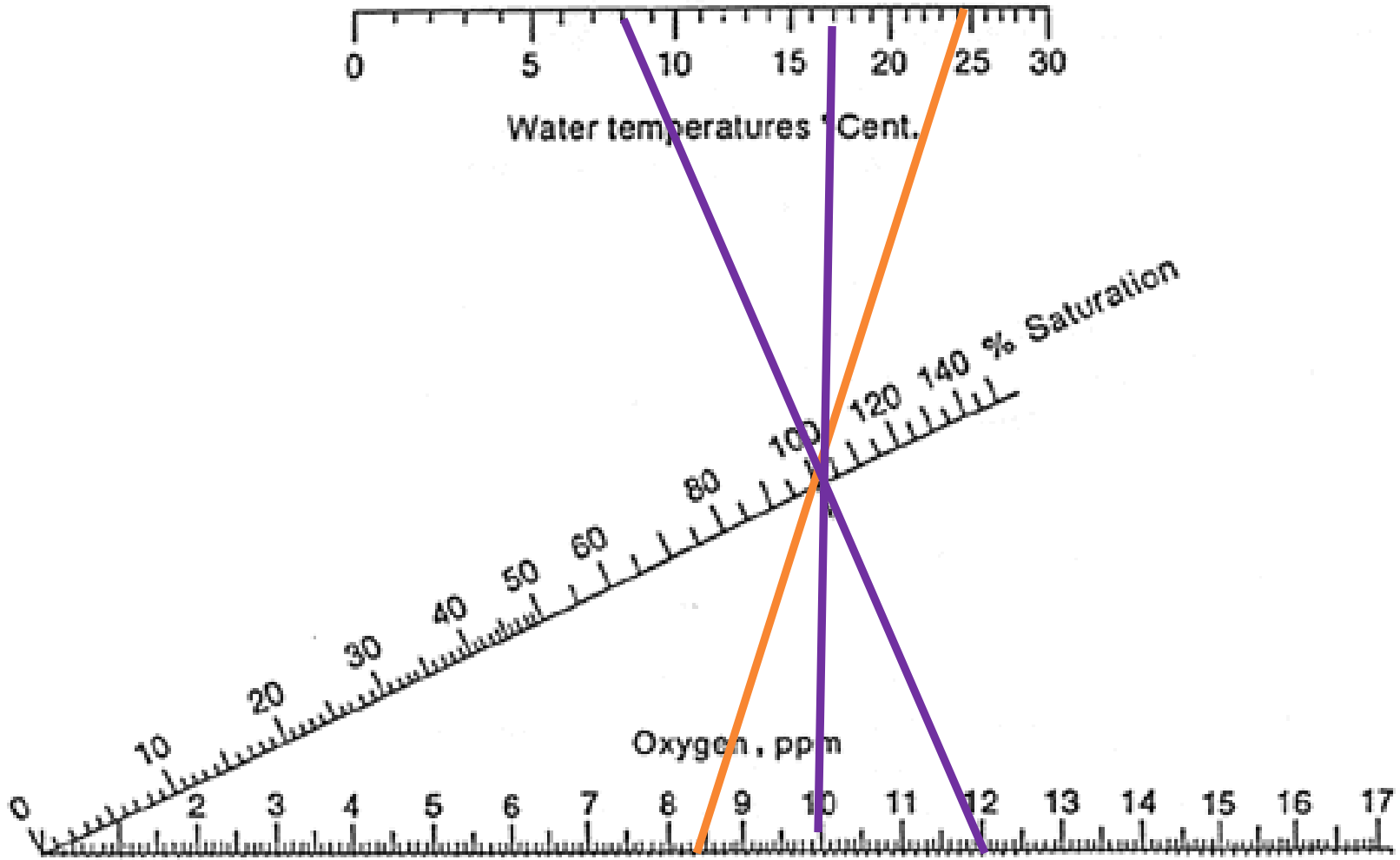
Water has ~ 1/30th the oxygen of air

Stagnant water may have much less



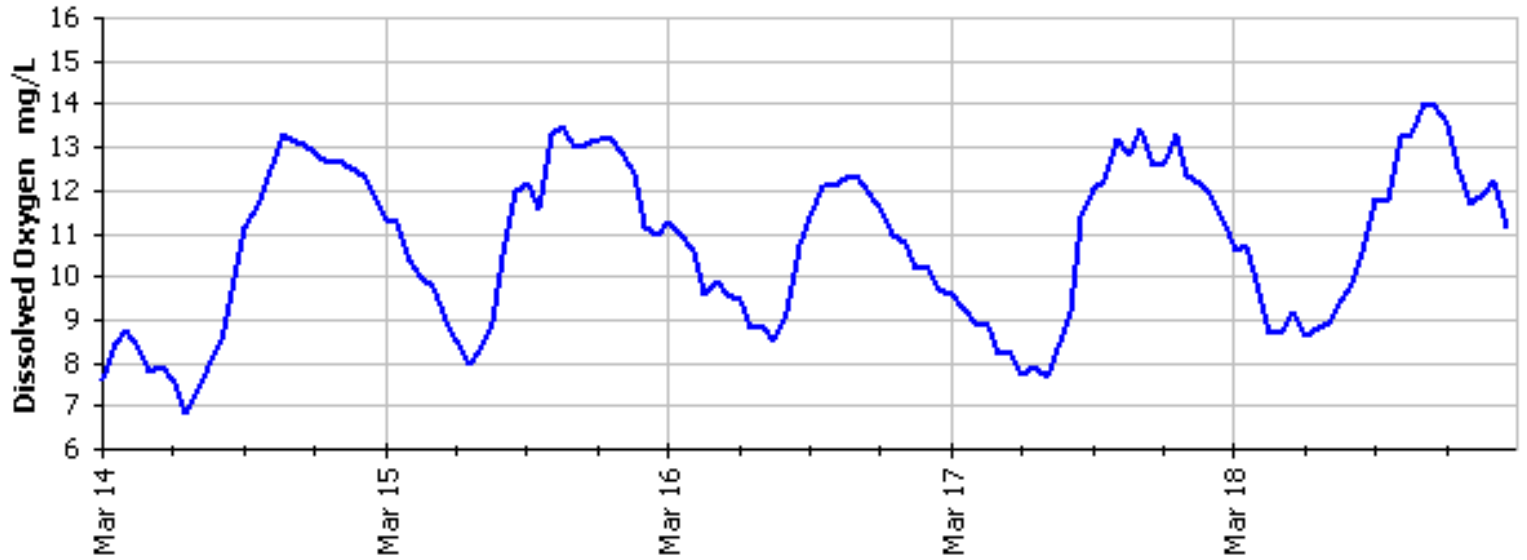
Scott 1924, Buscemi 1958

Effect of temperature on water's ability to hold oxygen



www.watertheweb.org

Respiration



www.jacksonbottom.org

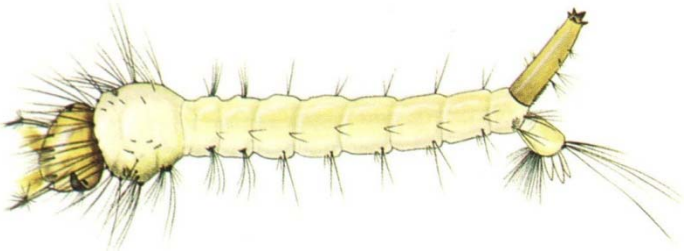
Respiration (cont)

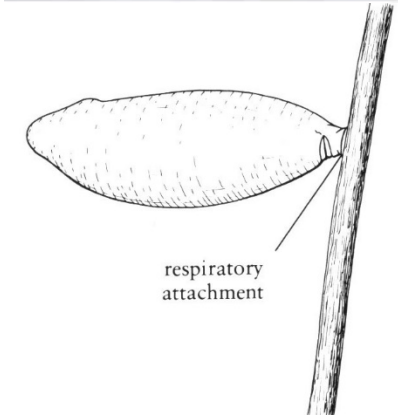
Adaptations:

1. **Breathe air:** Mammals, birds, some amphibians, reptiles
   - some fish:
     - Obligate air-breathers: lungfish & electric eel
     - Facultative air-breathers: Mudsucker, bowfin & gar

Respiration (cont)

1. **Breathe air (cont):**
   - some invertebrates:
     - Surface to breathe
     - Carry an air bubble
     - Novel ways to find air





Respiration (cont)

2. **Hemoglobin:**
   - Invertebrates: midges, worms
   - fish
     - Warm vs. cold water
     - Fresh vs. salt water
     - pH
   - Amphibians: larval vs. adult forms

3. **Blood physiology:**
   Fish: blood physiology - hemoglobin oxygen delivery during low DO

4. **Behavioral:**
   - increase ventilatory rate (fish, amphibians, inverts)
   - Increase ventilatory volume (fish, amphibians)

Osmogregulation

Concentration of common ions in animals, sea water, and freshwater

Ions	Sea water*	Soft frwater*	Hard frwater*	Crab blood*	Frog blood*	Crayfish blood**	Fw fish	Marine fish
Na^+	478.3	0.24	2.22	487.9	109	212	140	198
K^+	10.13	0.005	1.46	11.32	2.6	4.1	3	3
Ca^{2+}	10.48	0.067	3.98	13.61	2.1	15.8	3	2
Mg^{2+}	54.5	0.043	1.67	44.14	1.3	1.5		
Cl^-	558.4	0.226	2.54	552.4	78	199		
SO_4^{2-}	28.77	0.045	3.95	14.38	-	-		
HCO_3^{2-}	-	-	2.02	-	26.6	15		

* Concentration in mM/kg water
** Concentration in mM/L blood

Wilson 1972, Forster & Berglund 1956, Shell 1959

Osmogregulation (cont).

Euryhaline: tolerate wide salinity fluctuations
Stenohaline: tolerate only very limited salinity ranges

Osmoconformers vs. osmoregulators

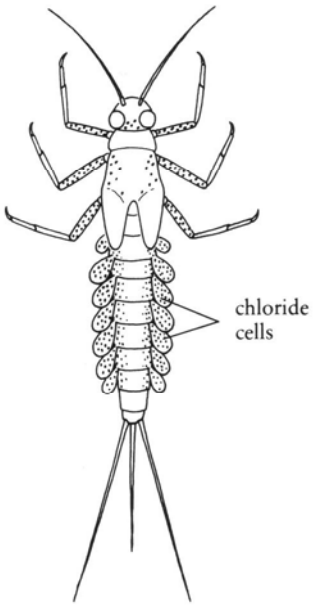
Water regulation:

- Dilute urine: freshwater (fish, invertebrates, amphibians)
- Concentrated urine: saltwater (insects, birds, mammals)
- Behavior: freshwater (amphibians)

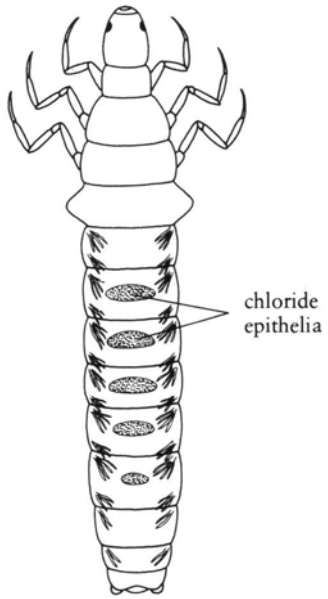
Osmogregulation (cont).

Ion Regulation:

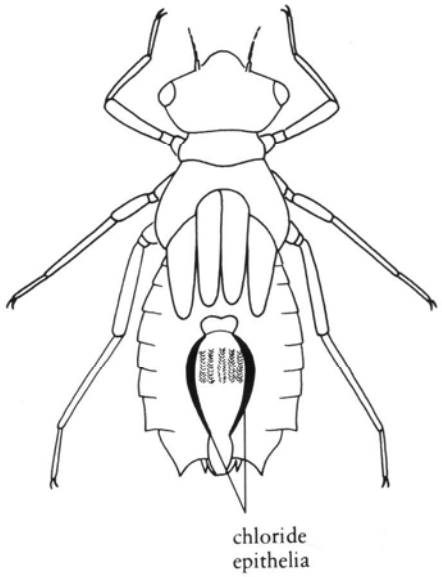
- Uptake: freshwater
  - Chloride cells or epithelia (insects)
  - Gut absorption (all groups)



mayfly



caddisfly

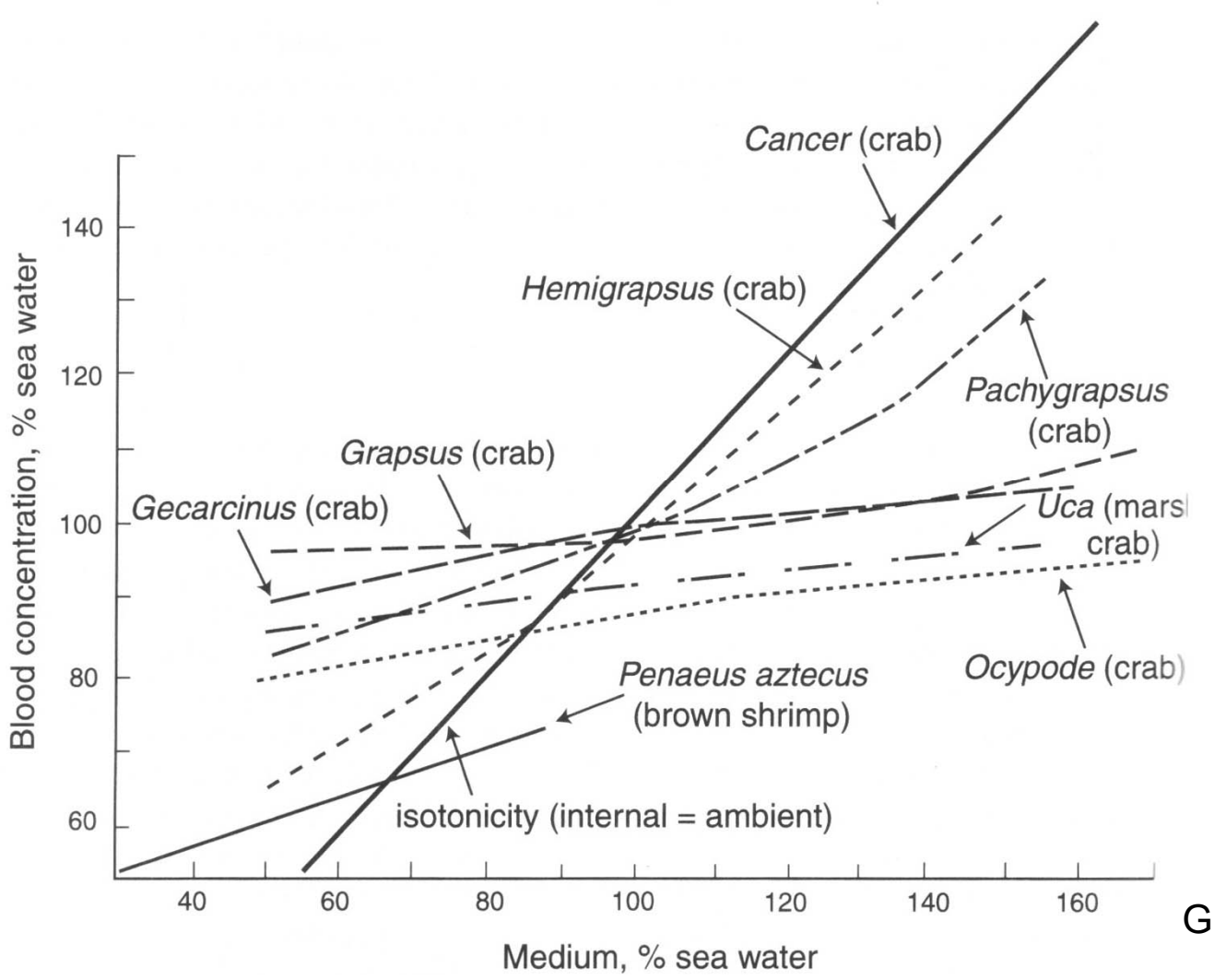


dragonfly

Osmogregulation (cont).

Ion Regulation (cont):

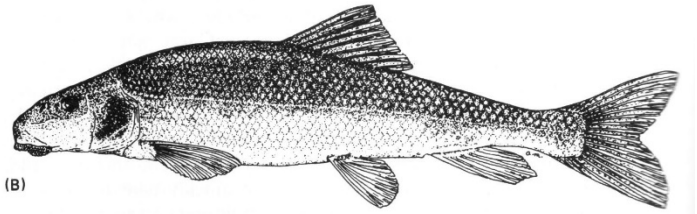
- Excretion: saltwater
  - Concentrated urine (insects)
  - Salt excretion glands or cells (birds, fish, reptiles, mammals)

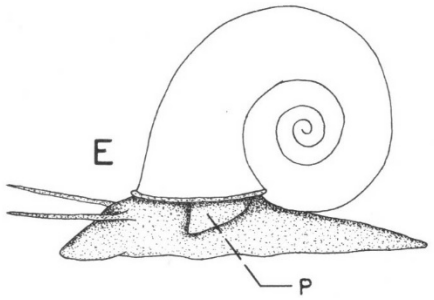


Gross 1964, Bishop et al. 1980

Feeding

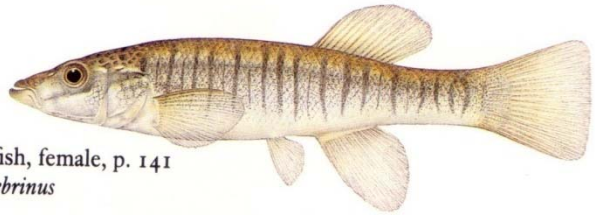
1. Bottom feeders





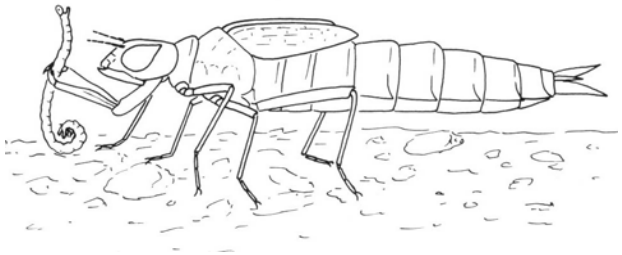
   - Scrapers

2. Surface feeders


Plains killifish, female, p. 141
Fundulus zebrinus

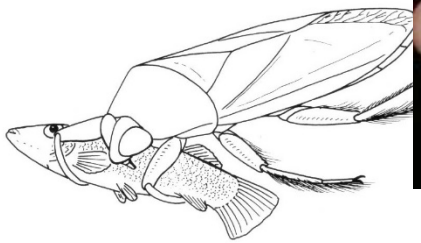

11. Northern pike, p. 63

3. Sit & wait predators



Feeding (cont)

4. Active predators



5. Shredders

6. Suspension feeders

Movement

Fish: Body shapes for maneuvering in tight spaces, surface feeding, soft-sediment bottom dwellers

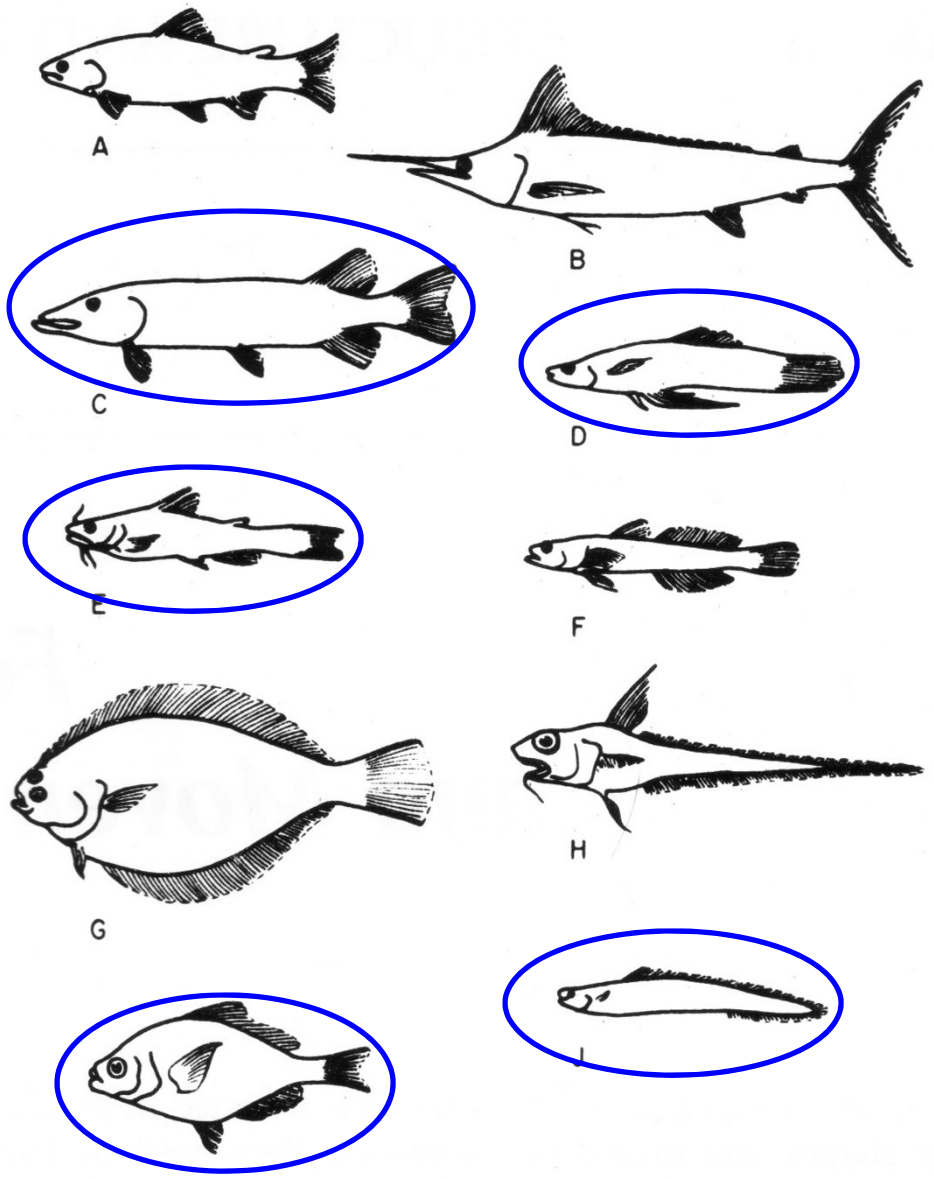
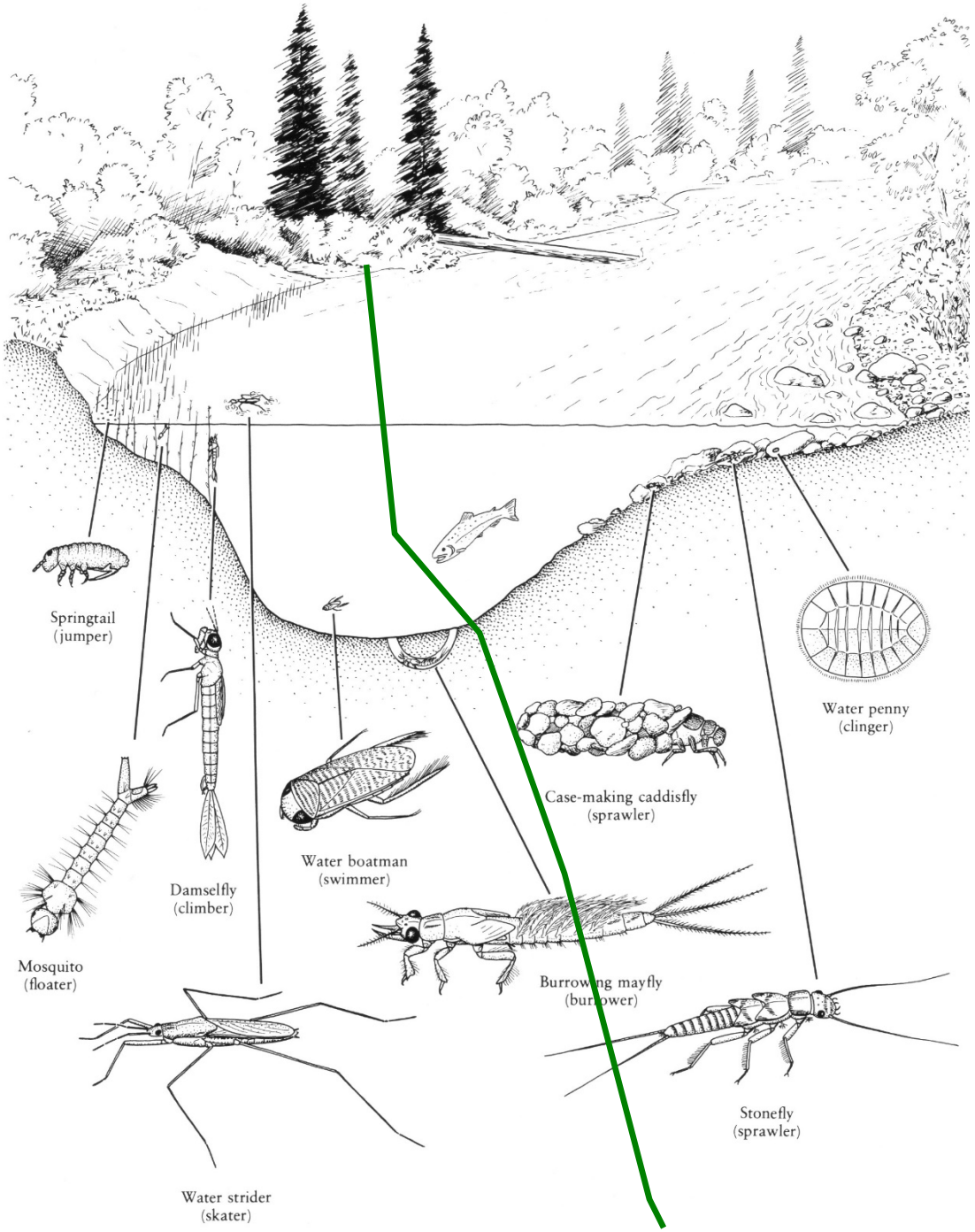


Figure 2.1 Typical fish body shapes: (A) and (B) rover-predator; (C) lie-in-wait predator; (D) surface-oriented fish; (E) bottom rover; (F) bottom clinnger; (G) flatfish; (H) rattail; (I) deep-bodied fish; (J) eel-like fish.

Movement



Invertebrates:
Shapes that favor soft-sediments or life on or among vegetation

Climbers, sprawlers, burrowers, floaters, swimmers, skaters, jumpers

Life History

1. Timing of reproduction:
   - water presence (insects, amphibians, birds)
   - water temperature (fish, insects, amphibians)
   - food presence/abundance (most groups)
   - predator absence (insects, amphibians)
2. Timing of egg-hatching
3. Timing of maturation

Life History (cont)

1. Dry period survival
   - Aestivation (amphibians, inverts, reptiles)
   - Terrestrial life stage (amphibians, insects)
   - Dormant eggs (invertebrates)
2. Overwinter survival
   - Antifreeze or controlled freezing (invertebrates, amphibians, fish)
   - Life stage (insects, amphibians)
   - Migration (insects, birds, fish)