



Pond and Stream Study Guide

Interpreting Physical and Chemical Factors

Water Temperature and Fish—Fish Commonly Found in Aquatic Field Studies and Temperature Preferences

COLDWATER FISH

Fish that require water temperatures **less than 70 degrees** to grow and reproduce.



Rainbow Trout



Brown Trout



Brook Trout



Blacknose Dace



Longnose Dace



Slimy Sculpin

COOLWATER FISH

Fish that require temperatures **higher than 65 degrees but less than 75 degrees** to grow and reproduce.



Fallfish



Logperch



Creek Chub



Common Shiner



White Sucker



Smallmouth Bass

WARMWATER FISH

Fish that require water temperatures **higher than 75 degrees** to grow and reproduce.



Margined Madtom



Largemouth Bass



Bluegill



Redbreast Sunfish



Rock Bass



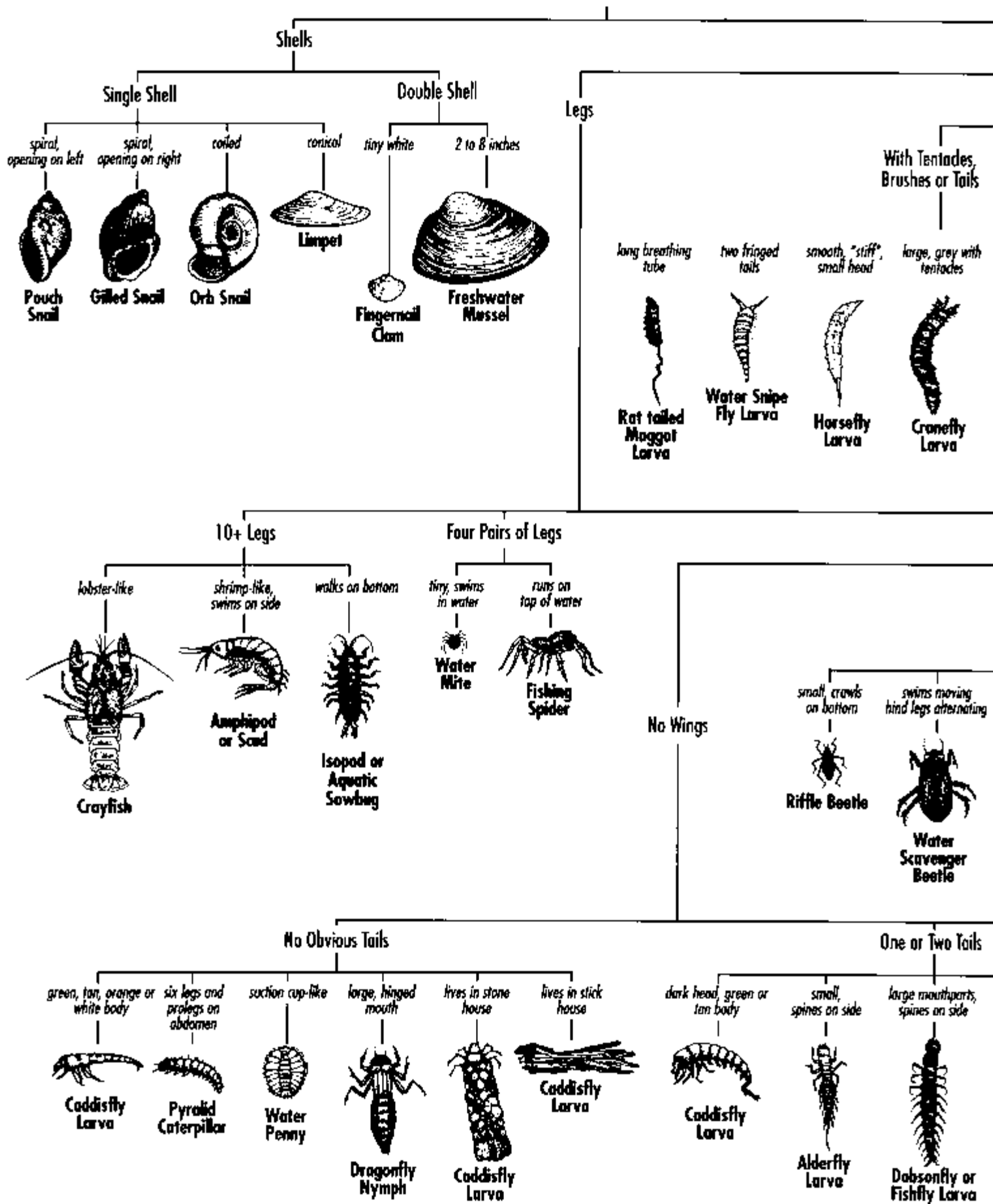
Brown Bullhead

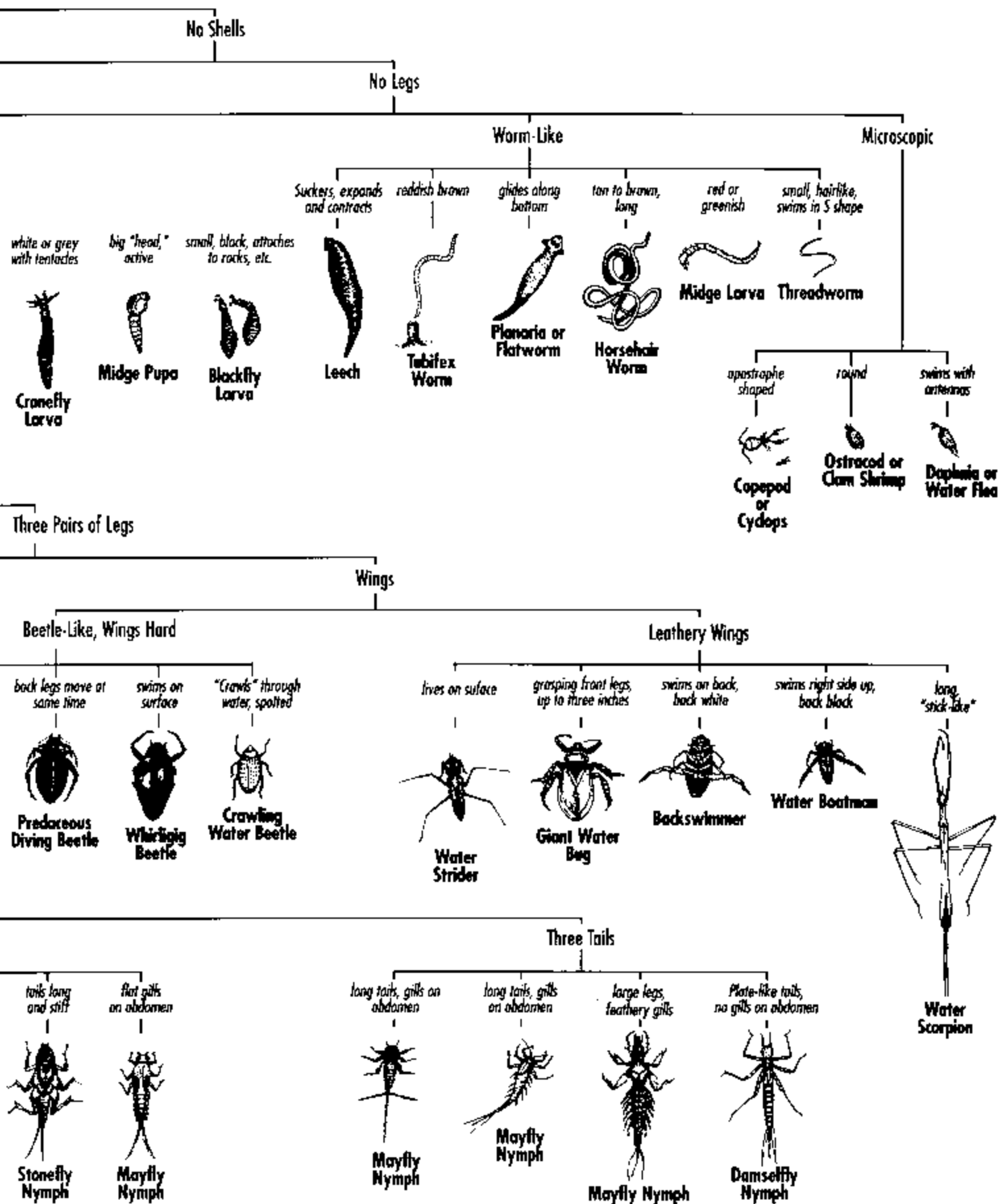


Channel Catfish

Species shown are not in proportion to each other, but are enlarged to facilitate identification.

Key to Macroinvertebrate Life





Dissolved Oxygen (DO) *Dissolved Oxygen Requirements by Fish Community*

Cold Water Fishes: 6 mg/l and above

Warm Water Fishes: 5 mg/l

Solubility of Dissolved Oxygen

Solubility: Amount of dissolved oxygen that distilled water can hold at given temperature

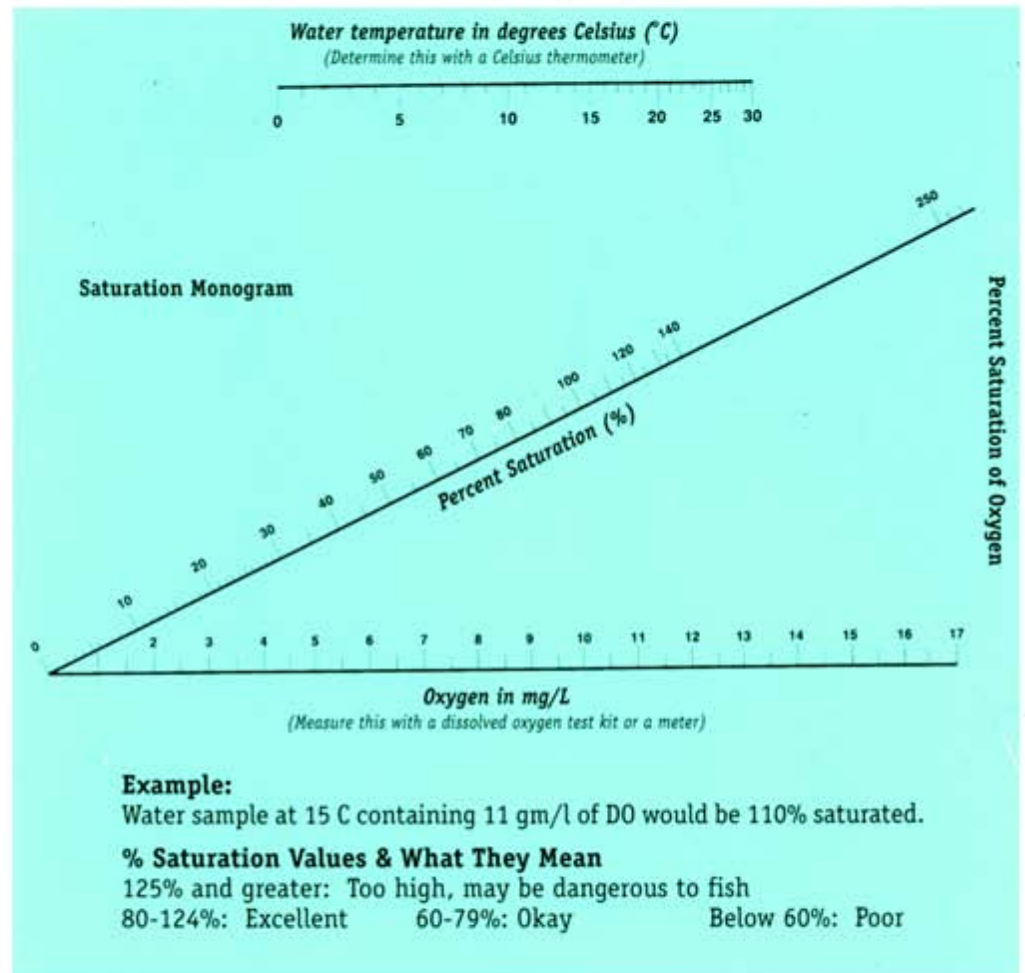
Temperature (C°): Solubility (mg/l)

| | |
|-----|------|
| 0: | 14.6 |
| 1: | 14.2 |
| 2: | 13.8 |
| 3: | 13.5 |
| 4: | 13.1 |
| 5: | 12.8 |
| 6: | 12.5 |
| 7: | 12.2 |
| 8: | 11.9 |
| 9: | 11.6 |
| 10: | 11.3 |
| 11: | 11.1 |
| 12: | 10.9 |
| 13: | 10.6 |
| 14: | 10.4 |
| 15: | 10.2 |
| 16: | 10.0 |
| 17: | 9.8 |
| 18: | 9.6 |
| 19: | 9.4 |
| 20: | 9.2 |
| 21: | 9.0 |
| 22: | 8.9 |
| 23: | 8.7 |
| 24: | 8.6 |
| 25: | 8.4 |
| 26: | 8.2 |
| 27: | 8.1 |
| 28: | 7.9 |
| 29: | 7.8 |
| 30: | 7.7 |

Dissolved Oxygen Percent Saturation

Directions

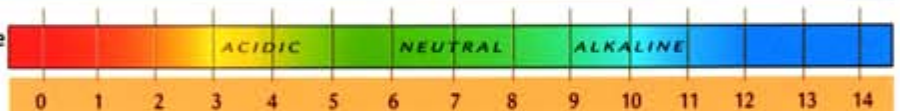
1. Determine water temperature in degrees C, and find that value on upper (temperature) scale. *To convert F to C: $[(F-32) \times 5] / 9 = C$
2. Determine dissolved oxygen and find that value on the lower (DO) scale.
3. Using a straight edge (ruler, piece of paper), draw a line from the temperature value to the dissolved oxygen value. The point at which the line crosses the middle (saturation) scale is the percent saturation of oxygen.



Adapted from: Water, Water Everywhere: Water Quality Factors Reference Unit, HACH, Inc., Loveland CO, 800-227-4224.

pH and Aquatic Organisms

pH Scale



Tolerant ranges for certain species

| | | | | | |
|------------------------|------------|-----------------|------------|--------------------|------------|
| Mayfly | 5.5 to 7.5 | Brown trout | 5.0 to 9.5 | Carp | 5.0 to 9.0 |
| Caddisfly | 5.5 to 7.5 | Brook trout | 4.5 to 7.5 | Catfish | 5.0 to 9.0 |
| Stonefly | 5.5 to 7.5 | Yellow perch | 4.5 to 7.5 | Bullfrog | 4.5 to 7.5 |
| Snails, clams, mussels | 6.0 to 9.0 | Smallmouth bass | 5.5 to 7.5 | Wood frog | 4.0 to 7.5 |
| Crayfish | 5.5 to 7.5 | Pumpkinseed | 5.0 to 7.5 | American toad | 4.5 to 7.5 |
| Rainbow trout | 5.5 to 9.5 | Fathead minnow | 6.0 to 7.5 | Spotted salamander | 5.0 to 7.5 |

Alkalinity

(Calcium carbonate:)CaCo₃

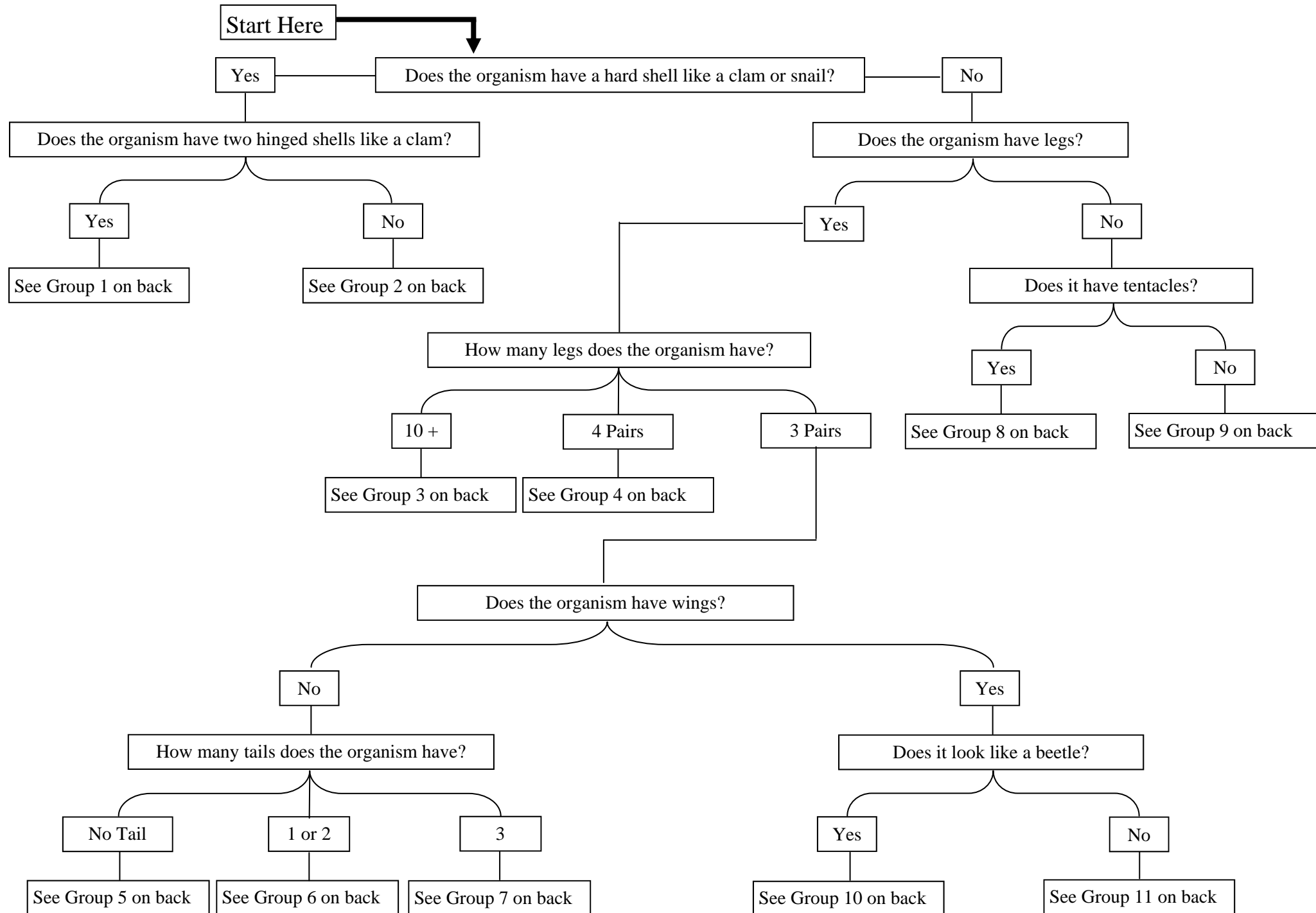
Freestone Streams

10 mg/l or less: Very sensitive to acid precipitation
10-20: Somewhat sensitive to acid precipitation
20mg/l or greater: Not sensitive to acid precipitation

Limestone Streams

75 mg/l or greater

Macroinvertebrate Dichotomous Key



Group 1:
Fingernail Clam -
Very small, white
Freshwater Mussel-
2 - 8 Inches with ridges on shell

Group 2:
Pouch Snail -
Spiral Shell, opening on the left
Gilled Snail-
Spiral Shell, opening on the right
Orb Snail -
Coiled Shell
Limpet -
Flat looks like one clam shell

Group 3:
Crayfish-
Looks like a lobster
Amphipod-
Looks like a shrimp
Isopod-
Looks like a sowbug on land but lives in the water

Group 4:
Water Mite-
Very small looks like a tick
Fishing Spider-
Large has hairs on body and legs

Group 5:
Caddisfly Larva-
Green, tan, orange or white body
Home building Caddisfly Larva-
Builds a home of sticks or stones
Water Penny-
Flat copper colored
Dragonfly Nymph-
Large mouth, and abdomen with distinct separation between head and abdomen
Pyralid Caterpillar-
Segmented with hairs on body, darkened head

Group 6:
Caddisfly Larva-
Dark head, green or tan body
Alderfly Larva-
Segmented body starts after legs, each segment has paired projections
Dobsonfly-
Similar to Alderfly but larger with large head and mouth
Stonefly Nymph-
Long tails and stiff body
Mayfly Nymph-
Flat Gills visible on abdomen

Group 7:
Mayfly Nymph-
Gills visible on abdomen
Damselfly Nymph-
Large head, long legs, and no gills visible

Group 8:
Rat Tailed Maggot Larva-
Long rat tail like breathing tube, segmented body
Water Snipe Fly Larva-
Two tails with fringes, segmented body with paired projections on each segment
Horsefly Larva-
White with darker thickened bands defining each segment. Small pointed head and tail
Cranefly Larva-
Grey or white with tentacles that look like starfish arms
Midge Pupa-
Large head, segmented body
Blackfly Larva-
Body generally has black strips, with one slender end with small tentacles

Group 9:
Leech-
Has sucker, black or brown
Tubifex Worm-
Thin threadlike reddish brown
Planaria-
Grey, flat, with two “eyes” and distinct head
Horsehair Worm-
Long very thin tan or brown worm
Midge Larva-
Red or green, thread like
Threadworm-
Small and hairlike, white

Group 10:
Riffle Beetle-
Ends of legs forked, black with smooth transition for head to body
Water Scavenger Beetle-
Hairs on legs, shiny outer covering, black
Predaceous Diving Beetle-
Similar to Scavenger Beetle but brown
Whirligig Beetle-
Back legs less visible than other beetles, brown
Crawling Water Beetle-
Light with spots, long thin legs

Group 11:
Water Strider-
Thin legs, and antenna
Giant Water Bug-
Front legs appear like arms to push food in mouth, often times with eggs on back
Backswimmer-
White or light back with dark underside, long back legs
Water Boatman-
Similar to Backswimmer with dark back
Water Scorpion-
Very thin with long legs, looks like a stick

Biological Integrity Score (BIS)

| | Column A | Column B |
|------------|----------------------|----------------------|
| # of Red | _____ x 1 = _____ | _____ x 1 = _____ |
| # of Green | _____ x 2 = _____ | _____ x 2 = _____ |
| # of Blue | _____ x 3 = _____ | _____ x 3 = _____ |
| Total | <input type="text"/> | <input type="text"/> |

Divide the total from Column B by the total from Column A to determine the BIS. Write the BIS for this sample here _____
The closer to 3 this number is the better.

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Use this worksheet to find the biological integrity of Stream A.

Stream A

Group 1 Can live in very polluted waters

NUMBER OF MIDGES _____ $\times 1 =$

NUMBER OF WORMS _____ $\times 1 =$

Group 2 Can live in mildly polluted waters

NUMBER OF CRANEFLIES _____ $\times 2 =$

NUMBER OF SCUD _____ $\times 2 =$

NUMBER OF CRAYFISH _____ $\times 2 =$

NUMBER OF DRAGONFLIES _____ $\times 2 =$

NUMBER OF CADDISFLIES _____ $\times 2 =$

Group 3 Very sensitive to pollution.

NUMBER OF STONEFLIES _____ $\times 3 =$

NUMBER OF MAYFLIES _____ $\times 3 =$

NUMBER OF WATERPENNIES _____ $\times 3 =$

Sum of Shaded Boxes

\div

Total Number of Organisms in

$=$

This is the **biological integrity score**