

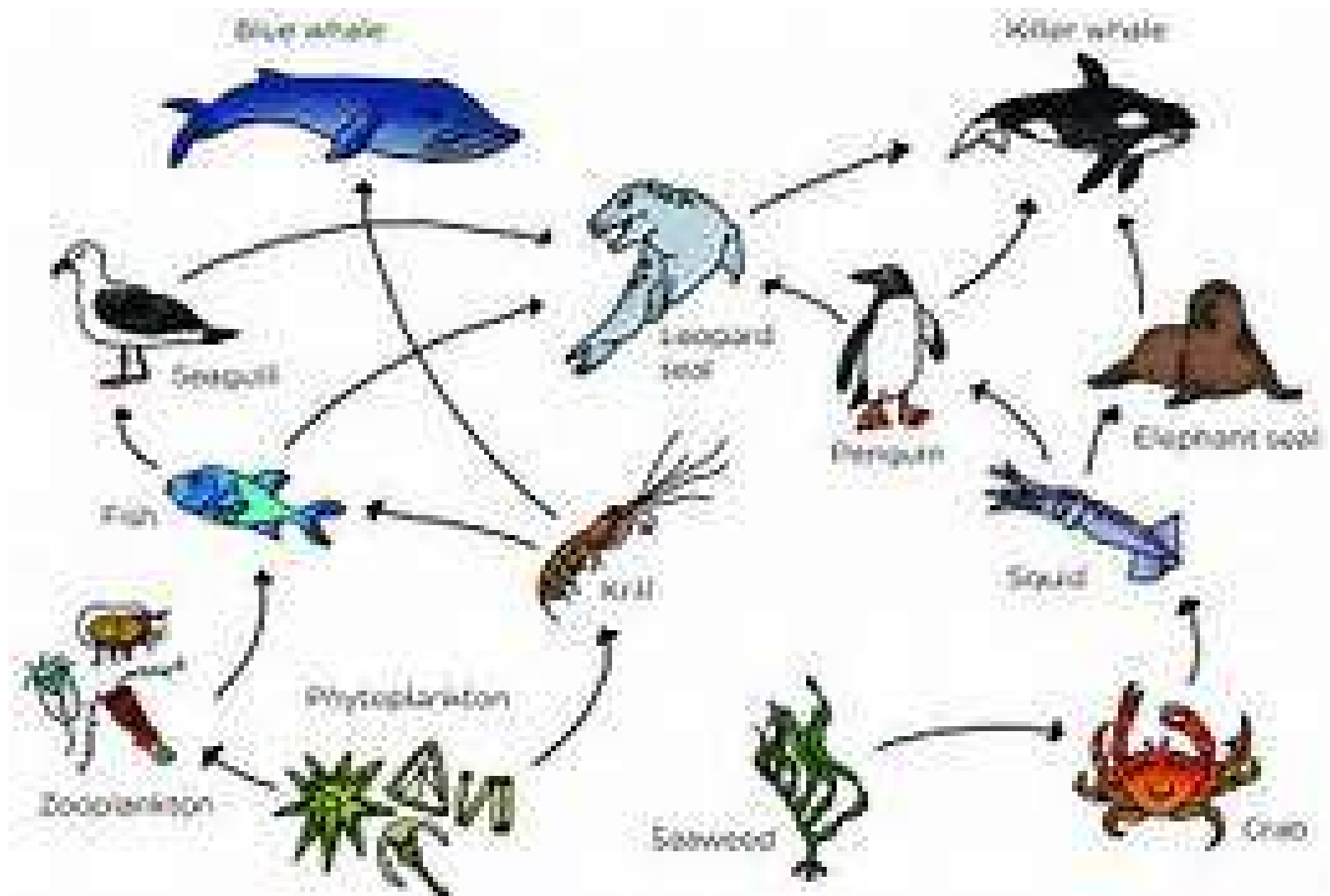
Resources at Risk from NFO Spills: Water Column and Benthic Organisms

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CDFW- OSPR
November 15, 2017





Marine Food Web



Marine Water Column Species



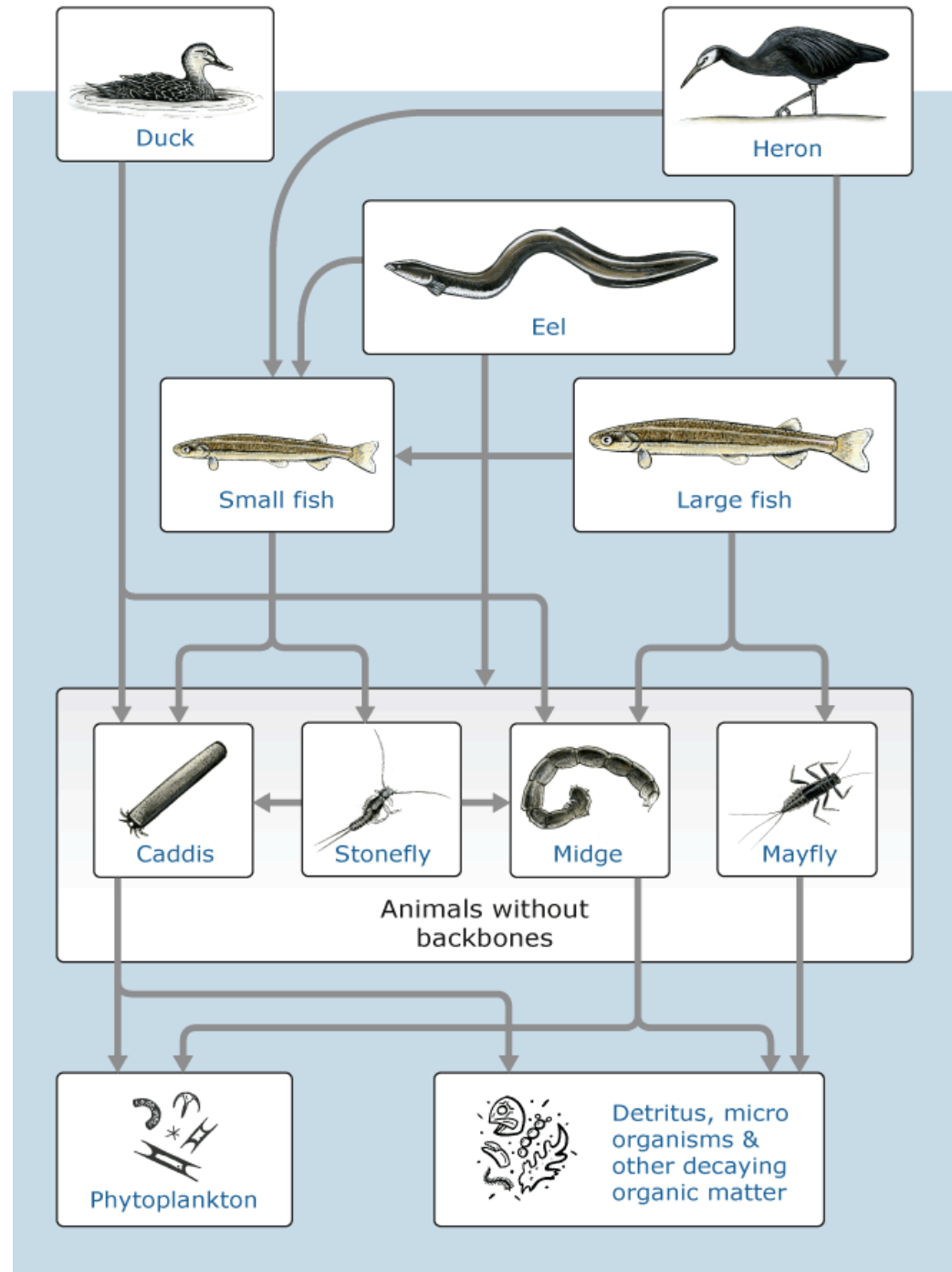
Marine Benthic Fish Species



Marine Benthic Invertebrates



Freshwater Food Web



Riffles and Pools



Salmon Redd



Fresh Water Column Species



Freshwater Benthic Invertebrates



Aquatic Invasive Species
A Guide to Identifying Threats to California Freshwater Environments

Quagga and Zebra Mussels

Dreissena rostriformis bugensis and *D. polymorpha*



Shell - 2-shelled bivalve, may have dark colored "bricks" on the edge.

Size - From microscopic to up to 2" long. Free-floating (nektonic) adults are microscopic and cannot be seen by the naked eye.

Color - Usually alternating light and dark brown stripes, but can also be solid light brown to dark brown.

Dityro or "Rock Snail"

Dityrochorda geminata



Appear - Appear slimy, but have coarse, bumpy skin. Can look like wet sand paper in streams.

Size - Starts as small bumps and grows to form thick mats that can cover river and streambeds.

Color - Pale yellowish brown to white.

New Zealand Mudsnail

Potamocorbula amurens



Shell - Single, elongated, right-handed coiled shell, usually consisting of 3-6 whorls, and an operculum (cap covering the shell opening).

Size - From microscopic, up to 1/2" long.

Color - Variable, light to dark brown.

Curatian Watermilfoil

Wolffia linearis



Stems - Branches and 25-30" long, reddish-brown or white-pink.

Leaves - Arranged circularly around the stem in groups of 4-8, usually 4. Each leaf is less than 2" long, with a reddish-brown.

Flowers - From spikes 2-4" long that are held above the water. Individual flowers are 1/8-1/4" long, reddish.

Roots - Fibrous, often develop from small pieces broken off target plant.

Channelled Apple Snail

Pomacea canaliculata



Shell - Single shell with compact, deeply grooved whorls.

Size - Adult shells can reach up to 2" long.

Color - Yellowish to brown.

Eggs - Eggs laid in masses (300-600) bright pink to reddish.

Hydrilla

Hydrilla verticillata



Stems - Branches and 25-30" long, and green.

Leaves - Arranged in groups of 4-8 around the stem, spear-shaped, 1/8-1/4" long and 1/16" wide. Often 1-2 sharp teeth along the underside of the leaf.

Flowers - Grow on long stalks anther on the surface of the water. Individual flowers are 1/8-1/4" long, white or reddish brown.

Roots - 1/12" long, white, and may have yellowish, gelatinous structures, or tubers, on the ends.

To report invasive species, call 1-888-412-6130 or email www.invasives@wildlife.ca.gov

Benthic Macroinvertebrates

- Benthic Macroinvertebrates.

Benthic: Living on the bottom

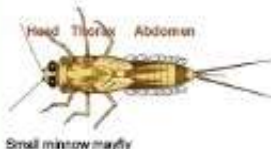
Macro: Large

Invertebrates: Without a backbone



Freshwater Benthic Macroinvertebrates

WV Save Our Streams' Macroinvertebrate ID-Guide



Small minnow mayfly

What is an insect? An insect is an invertebrate (an animal with no spine) that has three pairs of legs (except *Diptera*) and three body divisions; the head is the location of the mouth, antenna and eyes; the thorax is the attachment site for the legs and wing pads; and the abdomen, which often has a variety of structures attached including filaments, gills and tails. Gills are usually leaf-like, plate-like, or thin filaments. Tails can be long and thin, hairy, webbed or paddle-like. Most of the benthic macroinvertebrates you will encounter during stream surveys are aquatic larva or nymphs of insects. Most adult stages are not aquatic but the beetles are the exception. The majority of the insects are described and illustrated on page one and the top of page two; non-insect group descriptions and illustrations begin on page two.

Instructions provided at the bottom of page two

Insect Groups



Mayflies

(Order Ephemeroptera): Three-pairs of legs with a single hook at the end; three some-times two tail filaments; gills attached to the abdomen, which may sometimes be covered and difficult to see. Mayflies exhibit several types of movements (or habits): swimmers, clingers, crawlers and burrowers. (VS-M) (M)



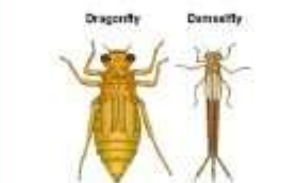
Stoneflies

(Order Plecoptera): Three-pairs of legs with two-hooks at the end, two tail filaments; no gills attached to the abdomen but some kinds may have gills near the top of the abdomen; gills if visible, mostly on the legs and thorax. (S-VL) (M)



Case-building caddisflies

(Order Trichoptera): Grub-like soft body and a hard head; Three-pairs of legs located on the upper third of the body; tail is small and usually forked, sometimes fringed with hairs; gills are scattered on the underside of the abdomen. The case (retreat) is a relatively solid structure made of a variety of stream-bed materials held together by silk. (VS-L) (M)



Dragonflies and Damselflies

(Order Odonata): Three-pairs of legs, large eyes; long spoon-like jaws, no tails on the abdomen. Dragonflies have a broad shaped abdomen, while the Damselfly abdomen is much narrower. Damselfly gills are attached to the end of the abdomen, they look like tails. (M-VL) (M)



Fishflies and Alderflies

(Order Megaloptera): Three-pairs of legs, large pinching jaws, eight-pairs of filaments attached to the sides of the abdomen. Fishflies also called hellgramites have a two-hooked tail, whereas Alderflies have a single tapered tail and are usually much smaller and lighter in color. (M-VL) (M)



Net-spinning caddisflies

(Order Trichoptera): Similar characteristics as above but the abdomen usually has more abundant gills, especially the common net-spinner (family Hydropsychidae). The net-spinner's retreat is also made of a variety of streambed materials, which are held together more loosely by fine strands of silk. The free-living caddisfly (right) does not build a case or net. (S-L) (M)



Beetles

(Order Coleoptera): Three-pairs of legs; body usually covered by a hard exoskeleton. The most common kinds collected are the water penny and riffle beetles (left-right), but others kinds are also found. (VS-L) (M)

True flies

(Order Diptera): Usually the body is segmented with some type of visible features either along the body, or at the head or tail regions (i.e. head, tails, protuberances, etc.). This order is the only aquatic insect without fully developed legs in the larval stages. Diptera are very diverse order with many aquatic varieties. Several common kinds are described here. (M)



Non-biting midge

(Order Diptera; family Chironomidae): Segmented body with a visible head; two leg-like projections at the front and rear. Sometimes they are bright red in color. (VS-M)

WV Save Our Streams' Macroinvertebrate ID-Guide



Crane fly

(Order Diptera; family Tipulidae): No legs, no visible head, plump body with lobes along the segments; may have structures that look like tentacles, lobes or one bulb at the end of the body. (S-VL)



Black fly

(Order Diptera; family Simuliidae): Body has a bowling-pin shape (lower is wider than the upper); there are multiple brushwheats on the head and a ring of hooks on the abdomen. (VS-M)



Watersnipe fly

(Order Diptera; family Athericidae): Plump body, looks very much like a caterpillar; on the underside there are structures that look similar to legs but are not segmented; the tail is forked and fringed with hairs. (S-L)

Non-Insect Groups



Crayfish

(Class Crustacea; order Decapoda): Five pairs of legs, the first two usually have large claws; large flipper-like structure at the end of the abdomen. (M-VL)



Scud/Sideswimmer

(Class Crustacea; order Amphipoda): Seven pairs of legs, the first two may be claw-like; body is somewhat higher than it is wide. Usually swims with a sideways motion. (S-M)



Aquatic sowbug

(Class Crustacea; order Isopoda): Seven pairs of legs, the first two may be claw-like; very long antenna; body is wider than it is high, giving the animal a fairly flattened appearance. (S-M)



Clams and Mussels

(Class Bivalvia): Fleishy body enclosed between two-hinged shells; the shape and ridge spacing of the shells can determine different kinds. Mussels are usually larger than clams and have dark colored oblong shells. (VS-VL) (M)



Operculate snails

(Class Gastropoda; sub-class Prosobranchia): Fleishy body enclosed by a single shell, which is usually coiled in an upward spiral. The opening of the shell is covered by an operculum (door). (VS-L) (M)



Non-operculate snails

(Class Gastropoda; sub-class Pulmonata): Fleishy body enclosed by a single shell, which is sometimes coiled upward but also may be flat or have a conical shape. The opening of the shell is not covered by an operculum. (VS-L) (M)



Aquatic worms

(Phylum Annelida; class Oligochaeta): Body is long with numerous segments along its entire length; has no visible head or tail. (VS-VL)



Leeches

(Phylum Annelida; class Hirudinea): Body is long and thin or slightly widened; 34-segments along its length, but there appears to be many more. (S-VL)



Flatworms

(Class Turbellaria): Soft elongate body without segment; head triangular shaped with eyes on top, which give the animal a cross-eyed appearance. (VS-L)

Sizes illustrated not proportional

<http://www.dep.wv.gov/sostr>



WV Save Our Streams
601 57th Street, SE
Charleston, WV 25304

Instructions: Identification is easier when the organism is viewed in the same orientation as its illustration.

Illustrations are drawn mostly in top and side views; the water penny is shown in underside view. The (M) symbol indicates that multiple kinds may be collected from the group (Order or Class). Use morphological features as your basis for identification; the size and color are often variable and influenced by environmental factors. Only a few of the many kinds possible are illustrated. (Size range in mm)

Size categories: > 50 Very large (VL); 50 - 30 Large (L); 29 - 10 Medium (M); 10 - 5 Small (S); < 5 Very small (VS)

Note: This field guide will help you identify common aquatic invertebrate classes and orders, and a few families. You should always refer to a more complete guide for verification of family level identification. Eventually, you will be able to identify a wide variety of families in the field.

Sensitivity of Benthic Macroinvertebrates

- Biological: The following live only in unpolluted waters with high levels of dissolved oxygen

- E- Ephemeroptera (Mayfly)

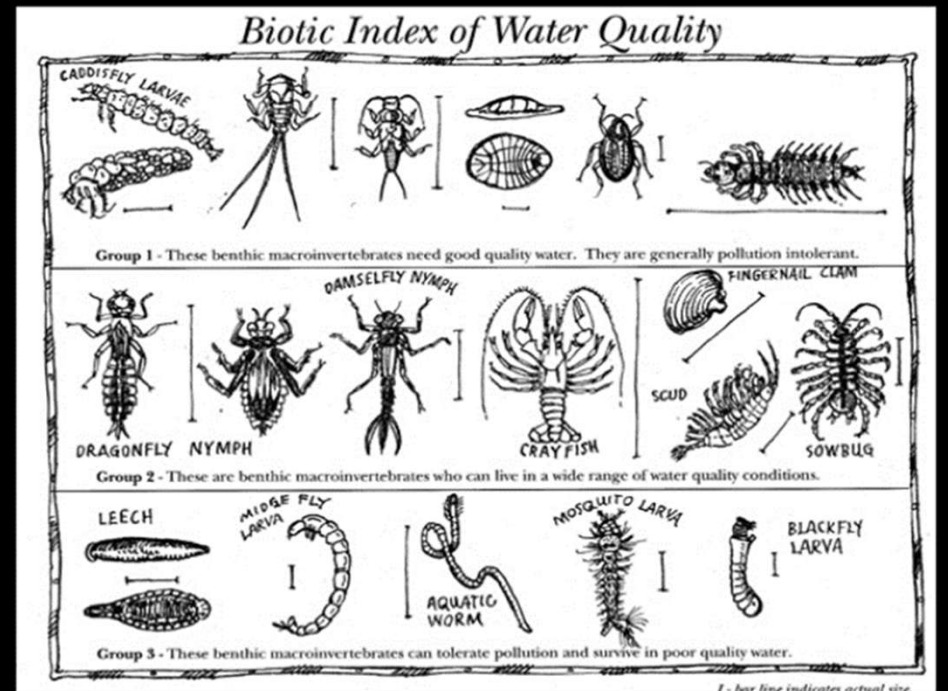
- P- Plecoptera (Stonefly)

- T- Trichoptera (Caddisfly)

- Megaloptera (Hellgrammite)

- Coleoptera (Waterpenny)

- Gilled Snail



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An aerial photograph showing a dense, intricate network of dark, winding lines (likely rivers or streams) snaking across a light-colored, textured landscape. The pattern is highly irregular and fractal-like, with many small tributaries joining larger channels. The overall tone is muted, with shades of brown, tan, and dark grey against a lighter background.

QUESTIONS?