

## GLOSSARY

**abdomen** - One of the three main body parts of Arthropods. The abdomen is the last section. It has the reproductive organs and may also have a tail or stinger. See the Arthropod diagram on the Special Illustrations page.

**abundant** - More than enough.

**adaptation** - A characteristic (body part, behavior, etc.) that helps a plant or animal survive in its environment.

**algae** (singular alga) - Simple non-seed bearing plants (including one-celled plants and diatoms and colonies of such cells).

**ambush** - To attack from a hiding place. Ambush hunters hide until their prey is very close and then attack.

**amphibian** - An animal that can live in both air and water. Amphibians can breath air with their lungs and can absorb oxygen through their skin.

**analyze** - To examine results to determine what happened or what it means.

**annual** - A plant that lives for only one growing season. In areas with limited growing seasons, this means that the plant may only live for a few weeks or months. Most vernal pool plants are annuals.

**anther** - The part of a flower where pollen is produced.

**antifreeze** - A chemical that keeps water from freezing, often used in car radiators.

**aquatic** - Of or living in water.

**aquatic insect larvae** (singular larva) - The immature form of an insect that lives in water.

**basal rosette** - When the leaves on a plant are arranged in a circular pattern at the base of the stem. Soap Plant has a basal rosette of leaves.

**biennial** - A plant that lives for two growing seasons. Usually this means that it germinates one year and make seeds the following year.

**bract** - A bract is a modified (different shaped) or reduced (smaller than normal) leaf just below a flower. Sometimes bracts can be colorful as in the Owl's-clovers. Sometimes they are very tiny as in grasses.

**camouflage** - A behavior, shape, color and/or pattern that helps a plant or animal blend in with its surroundings.

**carnivore** - An animal that eats meat. In the food web this can be an organism that eats the organism that eats the plants.

**cilia** (singular cilium) - Microscopic short hairs on the surface of an organism.

**colonize** - Move into a new area (as in the pilgrims colonized America). Non-native plants will also colonize new areas, particularly disturbed sites.

**cross-pollination** - When the ovary of one flower is fertilized (pollinated) by the pollen of another flower. Through cross-pollination, each parent flower contributes half of the genetic material to the seeds.

**common name** - The name most people use to refer to a species.

**conclusion** - A reasoned judgment.

**condensation** - The change of a substance from a gas to a liquid usually caused by a decrease in temperature.

**crustacean** - Any member of a taxonomic group of animals which includes crabs, beach hoppers, pill bugs and shrimps.

**cyst** - An embryo (larva) encased in a shell. See also the special report section at the bottom of the Fairy Shrimp page.

**decade** - One decade is equal to ten years.

**depression** - A low spot or the lowest spot in an area.

**detritus** - Particles from dead, decaying plants and animals.

**distinctive** - Something not like anything else. A skunk has a distinctive odor.

**dominant** - A dominant plant is one of the plants that occupies the most space in an area.

**dormant** - Not actively growing or functioning.

**drought** - A period when there is less than average rainfall.

**ecosystem** - A community made up of all of the plants and animals in an area that share a particular physical environment. Examples of aquatic ecosystems are a stream, a lake or a wetland.

**emerge** - To rise, come forth, or come out into view.

**endemic** - When an organism lives in only one habitat, it is said to be endemic to that habitat. A plant or animal can also be endemic to an area or region.

**evaporate** - To dry up.

**evolution** - The gradual change in organisms that occurs over hundreds of thousands or millions of year.

**evolved** - Changed over hundreds of thousands or millions of years.

**feces** - Bodily waste discharged from the intestines. Poop.

**fertilizers** - Nutrients added to improve plant growth.

**floret** - The reduced (smaller than normal) flower of many plant families, but especially those of the grass family.

**flowerhead** - Members of the Sunflower Family have special flowers called flowerheads. They are made up of many, tiny, individual flowers growing together. See the Sunflower diagram on the Special Illustrations page.

**food web** - The network of organisms in an ecosystem that moves food energy from producers (plants) through several layers of consumers (animals).

**grassland** - A plant community containing mostly grasses and other short plants, but few shrubs or trees.

**habitat** - A place to live.

**hardpan** - A clay, rock, or mineral layer beneath the soil that water cannot easily pass through.

**hemi-parasite** - A hemi-parasitic plant is one that receives part of its nutrition by stealing it from other plants. See also parasite.

**herbivore** - An animal that eats plants. This is usually the first level consumer of the food web.

**hypothesis** - An assumption or prediction designed to be tested

**inedible** - Not fit to be eaten. Sometimes used to describe the discarded parts (such as skin, bones, shell) of something otherwise edible.

**invasive** - To encroach upon, to spread through, and usually harm.

**invertebrate** - Small animals without backbones.

**larvae** (singular larva) - The young and immature form of an animal, unlike the adult, that must change to become an adult.

**life cycle** - All of the stages of life of an organism, from the adults of one generation to the adults of the next generation. For example: The life cycle of a frog includes the following life stages: Adult frog - egg - tadpole - immature frog - adult frog.

**macroscopic** - Can be seen by the naked eye, but may be seen clearer with a hand lens.

**mammal** - A warm-blooded animal with hair that breathes air, has internal fertilization and nurses its live-borne young.

**Mediterranean climate** - A yearly weather pattern where rain falls during a wet season, followed by several months of little or no rainfall. This climate is found in several areas of the world including the Mediterranean region of Europe, California, South Africa and Australia.

**metamorphosis** - A complete change in form and habits of an animal that occurs when it transforms from a larva into an adult. Caterpillars go through metamorphosis to become butterflies.

**methods** - Ways or procedures.

**microscopic** - Not able to be seen without a microscope.

**mima mound** - A large hump of soil in a vernal pool grassland. Mima mounds can be a few inches to a few feet high.

**molt** - To shed the outer layer. Usually used in reference to arthropods (insects and related organisms) shedding their exoskeleton.

**mottled** - Covered in blotches of different colors.

**multi-lobed** - Having many lobes or divisions. Think of your fingers as lobes of your hand. This would make your hand multi-lobed.

**nectar** - A sugary juice made by flowers to attract and reward pollinators.

**observe** - To watch carefully, paying attention to details or behavior.

**observation** - A description of a fact or event, often measured with instruments.

**omnivore** - An animal that eats both plants and animals. Humans are omnivores.

**ovary** - The part of a flower that contains the ovules (eggs) where seeds develop.

**ovule** - An egg.

**parasite** - A parasitic plant is one that receives all of its nutrition by stealing it from other plants. See also hemi-parasite.

**parasitism** - A relationship between two organisms, where one uses the other as a host, usually injuring it but not killing it quickly.

**parthenogenesis** - The ability of a female organism to produce fertilized eggs without mating with a male.

**pea flowers** - Members of the Pea Family have special petals, each with a name. They are the banner petal, wing petals and keel petal. See the Pea flower diagram on the Special Illustrations page.

**perennial** - A plant that lives for many years.

**pesticides** - Chemicals designed to kill unwanted plants or animals.

**petals** - The often brightly colored, leaf-like parts of a flower.

**photosynthesis** - Photosynthesis is the process by which green plants use sunlight to turn air and water into sugars and other nutrients. This is how plants make their own food.

**pistil** - The female part of a flower, usually divided into a stigma, style and ovary.

**pollen** - The powdery dust from the parts of a male flower. Pollen is necessary to pollinate the ovary of a plant to make seeds. Pollen is also collected by some insects as food for their offspring.

**pollinate** - To fertilize a plant. This involves moving pollen to the ovary and ovum. See also cross-pollination and self-pollination for additional information.

**pollination** - The transfer of pollen from the anther to the stigma of a flower.

**pollinator** - An animal that moves pollen from the anther of a flower to the stigma.

**pollutants** - Things that pollute water, land, and air, such as metals, chemicals, oil, and sediment (soil).

**polluted** - Unclean or dirty, particularly an environment contaminated by man-made waste.

**precipitation** - A form of moisture that comes from clouds and is deposited on the earth as rain, sleet, snow, hail or mist.

**protozoa** - Microscopic, single-celled organisms.

**pupae** (singular pupa) - The life stage of an insect between the larvae and adult stages. When the insect changes its form through metamorphosis.

**resemble** - Looks similar to something else. The shell of a seed shrimp resembles a seed.

**rhizome** - A plant root which runs horizontally under the soil. New leaves or stalks can grow from the joints in these roots. The perennial grasses used in lawns spread by rhizomes.

**rodent** - Any of a large group of small gnawing mammals (gophers, voles, and mice).

**runoff** - Water that runs off the land.

**saturated** - Filled with water to a point where no more moisture can be absorbed.

**scale** - A proportion between two sizes of an object (as between those of a drawing and its original).

**scavenger** - An animal that eats whatever is available. Usually that means it eats already dead animals. Some carnivores which hunt prey may also scavenge.

**scat** - The droppings (feces) of an animal. Scat usually refers to those droppings left out in the open to mark an animal's territory. Fox and Coyote leave scat in obvious places to show their area and keep other animals away.

**scientific name** - The unique Latin name that scientists assign to each species.

**self-pollination** - When the ovary of a flower is fertilized (pollinated) by the pollen from the same flower. Flowers which are self-pollinated do not require pollinators. Because the flowers do not cross with other plants, all of the genetic material comes from a single parent.

**sepals** - The (sometimes colorful) leaf-like parts of a flower below the petals.

**shore birds** - Birds that search around the edge of the water (shore) for food.

**soil** - The upper layer of earth that may be dug or plowed and in which plants can grow.

**sparse** - Occurring in limited numbers; not very dense. Sparse vegetation refers to areas in which a lot of soil shows through!

**species** - Plants or animals that are the same as each other and breed only with one another.

**sprawling** - To sprawl is to lie in a spread out and relaxed position. Sprawling plants have long, uneven stems which trail along the ground.

**spore** - A spore is like half a seed. It contains the genetic material of only one parent. Seeds always contain the genetic material of two parents even if they are both the same.

**stamen** - The pollen-producing male organ of a flower that consists of an anther and a filament (stalk).

**stamenoïdes** - A structure similar to a stamen but without pollen. Stamenoïdes occur in some flowers in the Lily Family. The photograph for Elegant Brodiaea shows the stamenoïdes.

**stigma** - The tip of the pistil of a flower which receives the pollen grains.

**storm drains** - The openings that lead to the system of underground pipes which collect and move rain water.

**synchronous** - Happening all at the same time. Secret agents synchronize their watches. Many species of vernal pool plants have a synchronous bloom to attract pollinators.

**taproot** - A taproot is a large, single root which grows straight into the ground. A carrot is a type of taproot.

**thorax** - One of the three main body parts of arthropods. The thorax is the central part between the head and abdomen. The legs and wings are attached to the thorax. The thorax contains the muscles necessary for walking and flight. See the Arthropod diagram on the Special Illustrations page.

**translucent** - Describes something that light can pass through but you can't see all the way through. Usually the surface is a bit shiny and the guts only show through a little bit!

**transparent** - Transparent means see-through. This usually means that the skin of an organism is completely see-through and you can see its guts!

**tributary** - A stream that feeds into a larger stream or river.

**umbel** - A cluster of flowers with all the stems coming from one point. Picture in your mind the spokes of an umbrella. White Hyacinth is a good example of a plant with its flowers in an umbel.

**upland** - The higher, drier areas of a vernal pool grassland.

**urban runoff** - Water that runs off land in towns and cities.

**vegetation** - Vegetation refers to plants or plant material in general.

**vernal** - The Latin name for spring.

**wading birds** - A long-legged bird that wades into water in search of food, such as egrets and herons.

**wastewater** - Water that drains from your home or other buildings down pipes and into the sewer system.

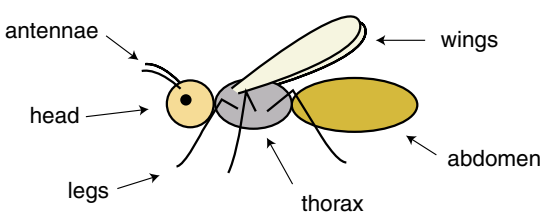
**waterfowl** - A bird that is often near water such as ducks and geese.

**watershed** - All the land connected by the water flowing through it.

**water table** -The surface (top) of water stored in the soil.

# Special Illustrations

**ARTHROPOD - body parts**



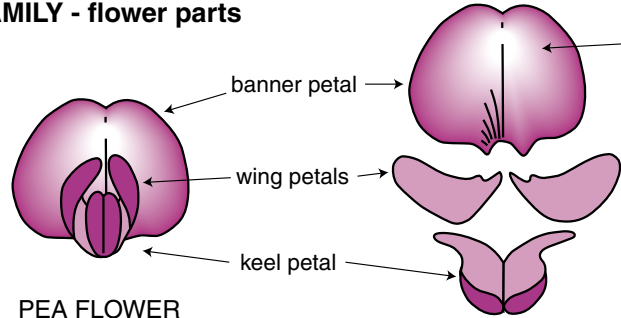
antennae  
head  
legs  
thorax  
wings  
abdomen

TYPICAL FLYING INSECT

All arthropods have the following three main body parts:

- HEAD - The head is usually rounded. The eyes, antennae and mouth are on the head.
- THORAX - The thorax may have segments. It is where the legs and wings are attached.
- ABDOMEN - The abdomen may be segmented. It contains the reproductive organs and may have a stinger or tails.

**PEA FAMILY - flower parts**

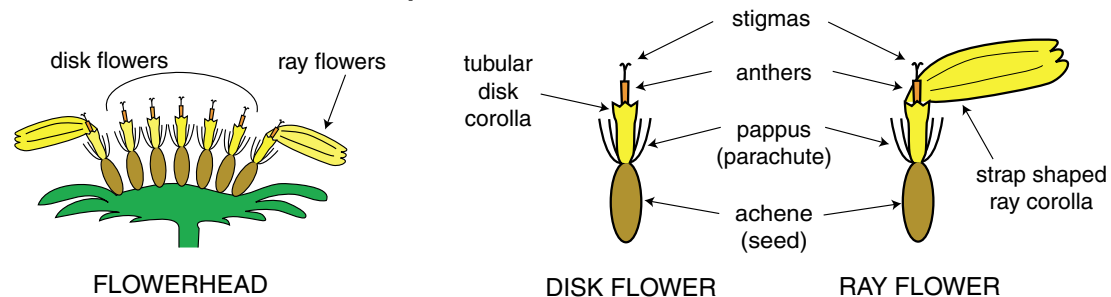


banner petal  
wing petals  
keel petal

PEA FLOWER

Pale area in banner petal is attractive to bees and other pollinators. When the flower has been pollinated, this area turns pink or blue and is no longer attractive to bees.

**SUNFLOWER FAMILY - flower parts**



disk flowers  
ray flowers

FLOWERHEAD

tubular disk corolla  
stigmas  
anthers  
pappus (parachute)  
achene (seed)

DISK FLOWER

strap shaped ray corolla

RAY FLOWER

**Splash Curriculum Alignment with the California State Teaching Standards (Jan 2005)**

The Splash curriculum *Life in Our Watershed: Investigating Vernal Pools* meets the objectives for teaching a high quality elementary educational curriculum. Each lesson has been correlated to the California State Teaching Standards for Science, Math, Language Arts and History/Social Studies developed by the California Department of Education. The tables below summarize this correlation to the standards in a lesson-by-lesson format for grade levels 4 and 5. Please refer to [www.cde.ca.gov/](http://www.cde.ca.gov/) for detailed descriptions of the standards cited.

<b>Lesson 1 – The Watershed Connection</b>		
Students review the water cycle and learn how a watershed functions.		
<b>Subject</b>	<b>Grade 4</b>	<b>Grade 5</b>
<b>Science</b>		
Life Science	3.b	
Earth Science	5.c	3.a, 3.b, 3.c, 3.d, 3.e
<b>History/Social Studies</b>		
California: A Changing State	1.3, 1.4, 1.5	
<b>Math</b>		
Number Sense	1.7	
<b>Language Arts</b>		
Reading	1.0,1.2, 1.3, 1.4, 1.5, 1.6, 2.0, 2.1, 2.2, 2.3, 2.4, 2.5	1.0, 1.2, 1.4, 2.0, 2.1, 2.2, 2.3, 2.4, 2.5
Writing	1.0	1.0
Written and Oral English Language Conventions	1.0, 1.1, 1.2, 1.3, 1.4, 1.5, 1.6, 1.7	1.0, 1.1, 1.2, 1.3, 1.4, 1.5
Listening and Speaking	1.0, 1.1, 1.2, 1.5, 1.6, 1.7, 1.8	1.1, 1.2, 1.3

<b>Lesson 2 – Introduction to Vernal Pools</b>		
Students learn the characteristics of a vernal pool.		
<b>Subject</b>	<b>Grade 4</b>	<b>Grade 5</b>
<b>Science</b>		
Life Science	3.a, 3.b	
Earth Science	5.c	
<b>History/Social Studies</b>		
California: A Changing State	2.1, 3.3, 4.2, 4.4, 4.6, 4.7	
<b>Language Arts</b>		
Reading	1.0,1.2, 1.3, 1.4, 1.5, 1.6, 2.0, 2.1, 2.2, 2.3, 2.4, 2.5	1.0, 1.2, 1.4, 2.0, 2.1, 2.2, 2.3, 2.4
Written and Oral English Language Conventions		1.0, 1.4, 1.5
Listening and Speaking	1.0, 1.1, 1.2	1.1, 1.2, 1.3

<b>Lesson 3 – The Three Phases of the Vernal Pool Ecosystem</b>		
Students learn the three phases of vernal pools and how this ecosystem is adapted to the wet and dry extremes of California’s Mediterranean climate.		
<b>Subject</b>	<b>Grade 4</b>	<b>Grade 5</b>
<b>Science</b>		
Life Science	2.a, 2.b, 2.c, 3.a, 3.b, 3.c	
Investigation and Experimentation		6.a
<b>Language Arts</b>		
Reading	1.0,1.2, 1.3, 1.5, 1.6, 2.0, 2.1, 2.2, 2.3, 2.4, 2.5, 2.6	1.0, 1.2, 1.4, 2.0, 2.1, 2.2, 2.3, 2.4
Writing	1.0, 1.7	1.3
Written and Oral English Language Conventions		1.0
Listening and Speaking	1.0, 1.1, 1.2	1.0, 1.1, 1.3

<b>Lesson 4 – Looking like a Scientist</b>		
Students raise and observe Fairy Shrimp in the classroom; They learn to apply the scientific method and present results using graphs.		
<b>Subject</b>	<b>Grade 4</b>	<b>Grade 5</b>
<b>Science</b>		
Life Science	2.a	
Investigation and Experimentation	6.a, 6.b, 6.c, 6.d, 6.e, 6.f	6.b, 6.c, 6.e, 6.f, 6.g, 6.h, 6.i
<b>Math</b>		
Number Sense	3.1, 3.2, 3.3, 3.4	
Algebra and Function		1.1
Measurement and Geometry	1.1, 2.1	
Statistics, Data Analysis and Probability	1.1, 1.3, 2.1	1.1,1.2
Math Reasoning	1.1, 1.2, 2.1, 2.2, 2.3, 2.4, 2.5, 2.6, 3.1, 3.3	1.1, 1.2, 2.1, 2.2, 2.3, 2.4, 2.5, 2.6, 3.1, 3.3
<b>Language Arts</b>		
Reading	1.0, 1.2, 1.3, 1.4, 2.0, 2.1, 2.2, 2.3, 2.4, 2.5, 2.6, 2.7	1.0, 1.2, 1.4, 2.0, 2.1, 2.2, 2.3, 2.4
Writing	1.0, 1.1, 1.3, 1.4, 1.5, 1.6, 1.7, 2.3.a, 2.3.b, 2.3.c	2.1, 2.3.a, 2.3.b, 2.3.c
Written and Oral English Language Conventions	1.0 – 1.7	1.0 – 1.5
Listening and Speaking	1.1, 1.2	1.1, 1.2, 1.3

<b>Lesson 5 – Tools for the Pools</b>		
Students learn the concept of size and scale and learn which magnification tools are needed to observe various critters.		
<b>Subject</b>	<b>Grade 4</b>	<b>Grade 5</b>
<b>Science</b>		
Investigation and Experimentation	6.b	6.a, 6.f, 6.g
<b>Math</b>		
Number Sense	1.4, 3.2, 3.3, 3.4	1.2, 2.2
Measurement and Geometry	2.1	1.4
Statistics, Data Analysis, and Probability	1.1	
Math Reasoning	1.1, 2.1, 2.2, 2.3, 2.4, 3.1, 3.2, 3.3	1.1, 1.2, 2.1, 2.2, 2.3, 2.4, 3.1, 3.2, 3.3
<b>Language Arts</b>		
Reading	1.0, 1.2, 1.3, 1.4, 2.0, 2.1, 2.2, 2.3, 2.4	1.0, 1.2, 1.4, 2.0, 2.1, 2.2, 2.3, 2.4
Writing	1.1, 1.3	
Written and Oral English Language Conventions	1.0	
Listening and Speaking		1.1

<b>Lesson 6 – Create Your Own Critter Guide</b>		
Students learn to use organizational features of printed text to find information, discern main ideas, and create pages for a critter guide. Each student conducts research, and uses the information in future lessons.		
<b>Subject</b>	<b>Grade 4</b>	<b>Grade 5</b>
<b>Science</b>		
Life Science	2.b, 2.c, 3.a, 3.c, 3.d	
Investigations and Experimentation		6.a
<b>Language Arts</b>		
Reading	1.0, 1.2, 1.3, 1.4, 2.0, 2.1, 2.2, 2.3, 2.4, 2.5	1.0, 1.2, 1.4, 2.0, 2.1, 2.2, 2.3, 2.4
Writing	1.1, 1.3, 1.4, 1.5, 1.6, 1.7, 2.3	1.2, 1.4, 2.0, 2.1, 2.2, 2.3, 2.4
Written and Oral English Language Conventions	1.0-1.7	1.0-1.5
Listening and Speaking		1.1

<b>Lesson 7 – Critter Commercial</b>		
Students learn about other critters in the food web, as they complete a commercial for their vernal pool critter and take notes on other presentations. This lesson prepares students for the field trip, when they will share critter information with their group and their tour guide.		
<b>Subject</b>	<b>Grade 4</b>	<b>Grade 5</b>
<b>Language Arts</b>		
Writing	1.0, 1.1, 1.2, 1.3, 1.4, 1.5, 1.6, 1.7, 2.3.a, 2.3.b, 2.3.c, 2.4	1.0, 1.2, 1.3, 1.6, 2.3.a, 2.3.b, 2.3.c
Written and Oral English Language Conventions	1.0, 1.1, 1.2, 1.3, 1.4, 1.5, 1.6, 1.7	1.0, 1.1, 1.2, 1.3, 1.4, 1.5
Listening and Speaking	1.1, 1.2, 1.5, 1.6, 1.7, 1.8, 1.9, 2.2.a, 2.2.b, 2.2.c	1.0, 1.1, 1.2, 1.3, 1.4, 1.5, 1.6, 2.2.a, 2.2.b, 2.2.c

<b>Lesson 8 – What’s for Dinner</b>		
Students explore how a food web works, where their critter fits in the food web and the importance of plants and water quality to aquatic food webs.		
<b>Subject</b>	<b>Grade 4</b>	<b>Grade 5</b>
<b>Science</b>		
Life Science	2.a, 2.b, 2.c, 3.a, 3.b, 3.c, 3.d	2.f, 2.g
Investigations and Experiments		6.a
<b>Language Arts</b>		
Reading	2.0, 2.1, 2.2, 2.3, 2.4, 2.5, 2.6	2.0, 2.1, 2.3, 2.4
Written & Oral Conventions	1.0	1.0
Listening and Speaking	1.0, 1.1, 1.2, 1.8	1.0, 1.1, 1.3, 1.4, 1.5

<b>Lesson 9 – Flower Facts</b>		
Students learn the biology of flowers and how and why pollination occurs.		
<b>Subject</b>	<b>Grade 4</b>	<b>Grade 5</b>
<b>Science</b>		
Life Science	3.a, 3.b, 3.c	
Investigations and Experimentation	6.e	6.a, 6.g
<b>Math</b>		
Number Sense	1.5, 1.6, 3.1, 3.2, 3.4	1.2, 2.1
Measurement and Geometry	3.2	1.4, 2.1, 2.2
Statistics and Data Analysis	1.1	1.2, 1.3
Math Reasoning	1.1, 2.2, 2.3, 2.4, 3.1, 3.2, 3.3	1.1, 1.2, 2.1, 2.2, 2.3, 2.4, 3.1, 3.2, 3.3
<b>Language Arts</b>		
Reading	1.0, 1.2, 1.3, 1.4, 2.0, 2.1, 2.2, 2.4, 2.5	1.0, 1.2, 1.4, 2.0, 2.1, 2.2
Writing	1.5, 1.6	
Written and Oral English Language Conventions	1.0, 1.7	1.0, 1.5
Listening and Speaking	1.0, 1.1, 1.2	1.0

<b>Lesson 10 – Create Your Own Flower Guide.</b>		
Students learn to use organizational features of printed text to find information, discern main ideas, and create one page for a flower guide.		
<b>Subject</b>	<b>Grade 4</b>	<b>Grade 5</b>
<b>Science</b>		
Life Science	3.a, 3.b, 3.c, 3.d	
<b>Language Arts</b>		
Reading	1.0, 1.2, 1.3, 1.4, 2.0, 2.1, 2.2, 2.3, 2.4	1.0, 1.2, 1.4, 2.0, 2.1, 2.2, 2.3, 2.4
Writing	1.0, 1.3, 1.5, 1.6, 2.0, 2.3.a, 2.3.b, 2.3.c	1.0, 1.2.a, 1.2.b, 1.6
Written and Oral Conventions	1.0	1.0
Listening and Speaking	1.0, 2.2.a, 2.2.b, 2.2.c	1.0, 1.1, 1.2, 1.3, 2.0, 2.2.a, 2.2.b, 2.2.c

<b>Lesson 11 – Create an Origami Book</b>		
Students create a unique book to share their knowledge of vernal pools.		
<b>Subject</b>	<b>Grade 4</b>	<b>Grade 5</b>
<b>Math</b>		
Measurement and Geometry	1.1, 1.4, 3.0	1.1, 2.0
Math Reasoning	1.1, 1.2	1.1, 1.2
<b>Language Arts</b>		
Reading	1.0, 2.0, 2.1, 2.2, 2.3, 2.7	1.0, 2.0, 2.1, 2.2
Writing	1.0, 1.4, 2.3.a, 2.3.b, 2.3.c	1.0, 2.3.c
Written and Oral English Language Conventions	1.0, 1.1, 1.2, 1.3, 1.4, 1.5, 1.6, 1.7	1.0, 1.4, 1.5

<b>Lesson 12 – Water Quality</b>		
Students learn about the importance of clean water and see the effects of pollution using the watershed model and living Fairy Shrimp.		
<b>Subject</b>	<b>Grade 4</b>	<b>Grade 5</b>
<b>Science</b>		
Life Science	3.a, 3.b	
Investigation and Experimentation	6.a, 6.b, 6.c, 6.d, 6.e,	6.a, 6.e, 6.g, 6.h, 6.i
Earth Science		3.e
<b>History/Social Studies</b>		
California: A Changing State	1.2, 4.4, 4.6, 4.7	
<b>Math</b>		
Statistics, Data Analysis and Probability	2.2	1.2
Math Reasoning	1.1, 1.2, 2.1, 2.2, 2.3, 2.4, 3.1, 3.2, 3.3	1.0, 2.0, 3.0
<b>Language Arts</b>		
Reading	1.0, 1.2, 1.3, 2.0, 2.1, 2.2, 2.3, 2.6	1.0, 2.0
Writing	1.0, 1.3, 2.3.a, 2.3.b	2.3.a, 2.3.b, 2.3.c
Written and Oral English Language Conventions	1.0, 1.1, 1.2, 1.3, 1.4, 1.5, 1.6, 1.7	1.0, 1.1, 1.2, 1.3, 1.4, 1.5
Listening and Speaking	1.0, 1.1, 1.2, 1.6, 1.7, 1.8	1.0, 1.1, 1.3, 1.4, 1.5, 1.6

<b>Lesson 13 – How You Can Help</b>		
Students review the importance of keeping water clean and explore ways to share their knowledge with others.		
<b>Subject</b>	<b>Grade 4</b>	<b>Grade 5</b>
<b>Language Arts</b>		
Reading	1.0, 2.0	1.0, 2.0
Writing	1.0, 2.0, 2.3.a, 2.3.b, 2.3.c	2.0, 2.4.a, 2.4.b, 2.4.c, 2.4.d
Written and Oral English	1.0, 1.1, 1.2, 1.3, 1.4, 1.5, 1.6,	1.0, 1.1, 1.2, 1.3, 1.4, 1.5
Language Conventions	1.7	
Listening and Speaking	1.0, 1.1, 1.2	

## Appendix C

### Splash Field Trip Information

Available months	Mid-February through the end of April
Seasonal attractions	February: Vernal pools are usually full of water and critters. Water levels can vary, due to timing and volume of winter rains. Early March: Pools are still full of critters. Late March: Larger pools have plenty of critters. Early April: Pools are beginning to dry. Critter variety is declining, flowers are beginning to bloom. Mid-April: Peak flower bloom, critters are only in big, deep pools. Late April: Good flower bloom (except in a hot/dry spring); critters remain only in the biggest pools.
Number of classes/day	Splash will host two classes per day, either from the same school or different schools
Buses	Buses must remain on site, as they are needed to transport students between the vernal pools and the Resource Center.
Parent Drivers	Parent drivers/chaperones are expected to stay with students and assist with the field trip.
Typical Day	9:30 am: Students arrive Group A visits the Vernal Pools Group B visits the Resource Center 11:00 am: Groups switch 12:30: Dismissal Lunch Option: You may wish to use a local park for an outdoor lunch.
Scheduling Priority	First come, first-served basis
To Schedule a Trip	Visit <a href="http://www.sacsplash.org">www.sacsplash.org</a> to secure an available field trip date. For additional assistance send an email to <a href="mailto:info@sacsplash.org">info@sacsplash.org</a> or call 916-719-4854.

## Preparing for the Splash Field Trip

These are suggestions to make your Splash field trip to Mather Field a fun, educational and safe highlight of the Splash Program.

- Recruit adult assistants to help with the field trip (1 adult per 8 students).
- Remind students to dress appropriately. The wind is often strong and chilly at Mather Field. Students should bring a warm jacket and wear layered clothing that may get dirty. Long pants are required on all field trips, to protect legs from scratches. Sturdy, closed-toed shoes are recommended. Boots are preferred.
- Group Composition and Name Tags  
Several of the field trip activities require that students be grouped according to the critter(s) they have studied. This requires that students be grouped into the three, color groups designated on the Critter Group Assignment Sheet in Lesson 6.

Students must have a name tag bearing their name and a clear indication of the color of their group: orange, green or yellow. Teachers have used colored stickers, markers or paper to designate these colors.

- Snacks are highly recommended for the mid-point of the field trip. Consider asking a parent to bring a large bag of pretzels, or other “clean” snack without wrappers. Students will not have access to water or waste bins at snack time.
- Encourage students to review their Vernal Pool Portfolio prior to the field trip. Students should be prepared to be the expert for their critter(s) and flower during the field trip.
- Review Splash video.

### Recommended Items for Students to Bring

Long pants  
Comfortable walking shoes or waterproof boots (preferred)  
Jacket (rain coat if wet)  
Drinking water  
Hat or visor

### Recommended Items for Teacher or Parent to Bring

Snack for students  
First aid kit  
Antihistamines or allergy remedies (during April)  
Drinking water  
Camera  
Binoculars

Name: \_\_\_\_\_

## Splash Knowledge Assessment

Fill in the blanks with words from the box below.

1. Vernal pools fill with water during the \_\_\_\_\_ season.
2. Flowers bloom and vernal pools dry up during the \_\_\_\_\_ season.
3. \_\_\_\_\_ is a layer of clay or minerals that water cannot pass through easily.
4. In the spring, the flowers bloom as the water \_\_\_\_\_ and slowly leaks through the bottom of the vernal pools.
5. When water first fills the vernal pools, \_\_\_\_\_ creatures called bacteria and protozoa spring to life.
6. Tiny bits of dead plants and animals are called \_\_\_\_\_.
7. All life is connected through a complex \_\_\_\_\_ in which every species is food for another species.
8. The first green plants to appear in the vernal pools are microscopic plants called \_\_\_\_\_.

microscopic	evaporates	detritus	winter
food web	hardpan	algae	spring

Circle the best answer:

9. In which watershed do we live?
  - a. the Kern River watershed
  - b. the Sacramento River watershed
  - c. the San Joaquin River watershed
  - d. the Feather River watershed
10. A species will survive, as long as some individuals of a species \_\_\_\_\_.
  - a. swim
  - b. eat
  - c. grow
  - d. reproduce
11. Water from our sinks, toilets and showers flows into pipes that carry it to be cleaned at a \_\_\_\_\_.
  - a. car wash
  - b. stream
  - c. wastewater treatment plant
  - d. wetland

12. Which of the following is not a source of water pollution?
- Oil dripping from cars
  - Plants
  - Pesticides from people's yards
  - Paint dumped in storm drains
13. What would happen to the plants and animals that live at the vernal pools if most of the vernal pools were destroyed?
- They would go live somewhere else.
  - They would quickly adapt to life in the city.
  - They would learn to live in a vineyard instead of a grassland.
  - They would become extinct.
14. Clean water supports abundant life.
- True                  False
15. Storm runoff that flows into storm drains carries pollutants directly into streams and rivers.
- True                  False
16. Storm drains are a great place to dump used motor oil.
- True                  False
17. The way we live in our watershed affects the quality of the water in our creeks and rivers.
- True                  False
18. Everyone lives in a watershed.
- True                  False

Solve:

19. If 90% of California's vernal pools have already been lost due to agriculture, development and roads, what percent of the vernal pools are left?

\_\_\_\_\_ percent

20. Write a paragraph describing the most important thing you learned from Splash. Explain why it was important to you.

## FAIRY SHRIMP GROWING INSTRUCTIONS

Inside your Fairy Shrimp Kit, you will find a white envelope. Inside the envelope is a folded coffee filter. It contains a small amount of what looks like dust or dirt. In this dust are some of the most amazing structures you can find on earth – the “cysts” of the vernal pool fairy shrimp. Each cyst contains a baby shrimp, an embryo in suspended animation. In its drought resistant casing, it waits patiently for the right time to hatch out and begin its life cycle!

The cysts in this kit are from The Versatile Fairy Shrimp (*Branchinecta lindahli*). This Fairy Shrimp is a common, non-endangered, freshwater shrimp that normally lives in the vernal pools of California and other western United States.

To grow these fascinating little creatures indoors, you will need to create a small artificial vernal pool to mimic their natural environment. These instructions will guide you through the steps of growing healthy, happy critters.

- 1) **TIME** – These fairy shrimp will do best when hatched in the wintertime, between Halloween and Valentines Day. Their hatch rate will be the greatest in cool water (50-65 degrees), which is hard to maintain during warm weather. School classrooms in the winter are perfect for growing fairy shrimp, as they are often poorly heated during the day and are unheated at night.
- 2) **LOCATION** – Choose a level, stable surface, away from heaters and incandescent lights. Try to find a place where your shrimp pan will not be bumped or spilled. Pick a spot with sufficient room to allow students to observe the shrimp with their faces close to the pan. A window ledge is a perfect place as long as they are not in direct sunlight at any time of the day.
- 3) **LIGHT** – Your fairy shrimp will grow bigger and healthier if they are brightly lit with a light that mimics springtime sunshine. This will also encourage the growth of the algae and bacteria that they feed on. If your classroom windows will provide 12 hours of light and 12 hours of dark each day, that should be sufficient. Alternatively (and more reliably), you may hang or support a fluorescent light fixture about 18” above your shrimp pan. An old aquarium hood, or fixture designed to mount under counters will work fine. A simple way to simulate a day/night cycle is to plug your light source into an appliance timer, set to come on at 6:00 am and go off at 6:00 pm.
- 4) **CONTAINER** – A clear glass baking/lasagna pan makes a great tank for your shrimp. The 3-liter size is the best. They have a high heat capacity that helps to stabilize the water temperature. They are also easy to clean. Wash your pan with a very diluted bleach solution. This will clean and sterilize it. Be sure to thoroughly rinse and dry your pan. Do not use any soap or detergent, as even a little residue is very toxic to baby shrimp.
- 5) **WATER** – The best and most economical water for your fairy shrimp to live in is Arrowhead Mountain Spring Water. Make sure the label says **Spring Water**. Spring water mimics the clean but slightly mineralized and alkaline water of a vernal pool. Other brands of spring water could work as well, but Arrowhead works for sure. Do not use tap water, as the chemicals and chlorine are toxic to the shrimp.

- 6) CYSTS – When everything is set up and ready, carefully take your coffee filter out of the envelope, and hold it over your pan. Open it slowly, and gently dump the “dust” (cysts) into the water. Rub the sides of the filter against one another to release all the dust. If you still see a soiled area on the filter, carefully cut out the area with scissors, and float it soiled side down in the pan. (You can remove the filter paper when the first baby shrimp appear). The dust will just float on the water, and does not need to be stirred or shaken. Now you are ready to watch and wait!
- 7) HATCHING – The cysts will immediately begin to absorb water, but the baby shrimp will not come out until they are convinced that the water will last. This will take about 24 to 48 hours, sometimes longer, depending on conditions. The baby shrimp will start swimming right away, in fast jerky movements. They are extremely tiny and easily missed at first. One way of viewing them is to darken the room and shine a flashlight into the side of the pan. They are “phototropic,” meaning they are attracted to bright lights. Leave the flashlight on for several minutes, and the baby shrimp will swim toward the light. A magnifying glass is very helpful in viewing them at this stage.
- 8) FEEDING – The day after you first see your baby shrimp swimming around, you may start feeding them. In the wild, fairy shrimp are filter feeders. They strain tiny particles out of the water for food, mostly bacteria, algae, and fungal spores. In captivity, they will live quite happily on a diet of “yeast soup”.

To make yeast soup, dissolve one packet of dried yeast (either bakers or brewers yeast), one teaspoon of sugar, and a big pinch of crushed fish food flakes in 1/3 cup of hot water (around 100 degrees, microwave some of your spring water). Mix well, and let it sit for about an hour to activate the yeast. Be sure to use a container tall enough to allow the yeast to bubble up. (An old plastic frosting container works well.) Store your “soup” in the refrigerator or another cool place. This will be enough food to feed your shrimp for weeks.

To feed your shrimp, stir or shake the mixture thoroughly. (It settles out quickly.) Use an eyedropper or pipette to drip a few drops of the soup into the water. The baby shrimp are still extremely tiny and need very little food. You can determine how much food is enough by using this rule of thumb: The water should be slightly hazy, but not cloudy. You should be able to see through it. If it becomes cloudy, stop feeding for a day or two until it clears up. If it becomes extremely clear, feed a little bit more. Increase their food as they grow. At about 2 weeks, the shrimp will need approximately 1 ml per day. When they are fully grown, they will need up to 3 mls daily.

- 9) GROWTH – Your little fairy shrimp will grow very quickly. In a couple of days they will look like a small crescent. At about 1 week old, they will begin to elongate. They will reach adulthood when they are about ½ inch long. By four weeks old, they will be close to 1 inch long. The Versatile Fairy Shrimp have a live span of about 6 to 8 weeks, at which time they will start to die off from old age.

10) MAINTENANCE – You should try to keep the water level fairly constant in the pan. As the water evaporates, you will need to top it off with fresh spring water. You might notice a “scum” developing on the surface of the water. While this film might be unsightly, it is not dangerous in any way. It can be removed by dragging a piece of paper towel gently across the top of the water.

11) REPRODUCTION – Your shrimp will have a one-track mind when they reach adulthood. Their only job is to make new cysts. The females will begin to make eggs as soon as they are big enough. The bright white eggs are stored in a transparent cigar shaped pouch that is attached to their abdomen. This brood pouch makes the female easy to identify.

The male shrimp constantly swim around looking for a suitable female. When he finds one, he will grab her with his large antennae. The antennae look like walrus tusks attached to his face. He will quickly fertilize her eggs and swim off to find another suitable mate. You can tell when the eggs have been fertilized because they will get larger and turn a pale tan color. They begin to develop a cyst coat.

Once the cysts are fully coated, the female will push them out of her pouch, where they will sink to the bottom of the pan. The little embryos inside will grow and develop for about a day or two. When they reach the point of about 4,000 cells they will shut down and become dormant. They will not hatch until they are completely dried out, chilled and re-wetted.

12) HATCHING THE NEXT GENERATION – After about 6 to 8 weeks, your shrimp will die of natural causes. There is nothing you can do to change that, as this is the life span of these seasonal creatures. If all went well, you should have more shrimp cysts than you had on your first filter paper.

The best way to save cysts for future cultures is to harvest them from the bottom of your pan. Use a turkey baster to suck up the “gunk” from the bottom of the pan. Your pan should produce about 10 times the number of cysts that you started with. You don’t need all of the gunk, just about 2 to 3 baster-fulls. (You can make extra shrimp packets for other teachers, friends or other interested folks.) Pass the gunk through a coffee filter, and allow the filter to dry out completely for several days. Carefully fold the filter, label it, and store it in the freezer until you are ready to start the process again.

If you are tempted to simply store your pan (and all the gunk) until next year, please beware. Adding water to a “dirty” pan often leads to a lethal bloom of algae and bacteria that can smother the delicate baby shrimp. Many people have had poor results with this technique. For best results, use a clean bleached pan for each new batch of Versatile Fairy Shrimp.