UTAH LAKE ASEXUAL REPRODUCTION
OF UTAH LAKE ORGANISMS

This lesson plan has been created as a resource for seventh grade teachers to teach the new core standards to their students. It integrates science standards in a meaningful and fun way. To see which specific standards are addressed, please refer to them below.

OBJECTIVE:

1. Students will be able to explain asexual reproduction.
2. Students will be able to explain that all the traits of the parents are passed on to the offspring.

STANDARDS ADDRESSED:

7th Grade Science

Standard 4: Students will understand that offspring inherit traits that make them more or less suitable to survive in the environment.

Objective 1: Compare how sexual and asexual reproduction passes genetic information from parent to offspring.

Indicators:

a. Distinguish between inherited and acquired traits.
b. Contrast the exchange of genetic information in sexual and asexual reproduction (e.g., number of parents, variation of genetic material).
c. Cite examples of organisms that reproduce sexually (e.g., rats, mosquitoes, salmon, sunflowers) and those that reproduce asexually (e.g., hydra, planaria, bacteria, fungi, cuttings from house plants).
d. Compare inherited structural traits of offspring and their parents.

Objective 2: Relate the adaptability of organisms in an environment to their inherited traits and structures.

Indicators:

a. Predict why certain traits (e.g., structure of teeth, body structure, coloration) are more likely to offer an advantage for survival of an organism.
b. Cite examples of traits that provide an advantage for survival in one environment but not other environments.
c. Cite examples of changes in genetic traits due to natural and manmade influences (e.g., mimicry in insects, plant hybridization to develop a specific trait, breeding of dairy cows to produce more milk).
d. Relate the structure of organs to an organism's ability to survive in a specific environment (e.g., hollow bird bones allow them to fly in

air, hollow structure of hair insulates animals from hot or cold, dense root structure allows plants to grow in compact soil, fish fins aid fish in moving in water).

TEACHER BACKGROUND:

(The lessons *Asexual Reproduction of Utah Lake Organisms*, and *Sexual Reproduction of Utah Lake Organisms*, should be used to distinguish the difference between asexual and sexual reproduction.)

Utah Lake is home to many examples of organisms that reproduce by asexual and sexual reproduction. An asexual organism passes on all its genetic information, whereas sexual reproduction creates a mixture of genes from both parents. Many organisms reproduce both asexually and sexually. This lesson will focus on duckweed, phragmites, and planaria -- these species will reproduce asexually and sexually. This lesson will focus on the asexual reproduction of these two species.

Asexual reproduction occurs when an organism produces offspring, which are genetically identical to the parent. Phragmites, for example, produces rhizomes, underground stems, from which new plants grow. Planaria, a type of flat worm, can split itself in half and regenerate missing parts. Each piece of the planaria becomes a separate worm. Asexual reproduction is usually quick, allowing a small population of organisms to multiply quickly in an environment. Asexual reproduction creates clones of the parents. Populations of asexual organisms lack genetic variation, with the exception of mutations. Both phragmites and planaria also reproduce sexually, which allow the populations to adapt.

Duckweed (*Lemna minor*): This is a small, floating, aquatic plant. It has the smallest flower of any of the flowering plants. This plant asexually reproduces rapidly in nutrient rich waters when the water begins to warm in the summer. This plant is eaten by both waterfowl and some fish. Duckweed can be found floating on the surface of Utah Lake, usually in higher populations in the reeds. The teacher may collect and maintain duckweed in a jar with water, bright light, and nutrients (one eighth of a teaspoon per gallon water of houseplant fertilizer). Duckweed, when it reproduces asexually, can be dispersed by water over great distances giving duckweed plants the possibility to disperse quickly. Duckweed, when sexually reproducing, has seeds that will sink, and can survive short dry spells.

Phragmites: Phragmites reproduces asexually by rhizomes and stolons. Phragmites may also reproduce sexually by producing seeds. Specimens for phragmites should be collected with an observable root system including rhizomes and possibly stolons, and sexually reproductive flowers (the plume). Phragmites is a tall plant, growing to a height of more than 12 feet. Phragmites roots are thickly matted. They will require diligent work to retrieve specimens. Take a shovel and axe, if you have one. The plant will flower in late summer, however specimens

hold onto the floral spiketes for many months. Phragmites when reproducing asexually cannot disperse its species very far; it is limited to a few meters. Phragmites, when reproducing sexually, has a significant advantage of dispersal. The seeds are used as food by some animals including birds, which can spread the plant great distances. The seeds can also be transported by wind and water.

Planaria: Planaria can be collected by placing a piece of meat or liver in an area of calm water. Hobble Creek is one good location for collection. Planaria will be attracted to the meat or liver and can then be collected. It can also be ordered from science suppliers.

Stolon: An above ground horizontal stem, lies close to the ground. Stolons have the purpose of reproducing a plant asexually.

Rhizome: An underground stem, usually thick and has the purpose of reproducing a plant asexually. Phragmites rhizomes can penetrate the ground as much as six feet.

Examples of Utah Lake Organisms and their mechanisms of reproduction:

Asexual (many organisms that reproduce asexually can also reproduce sexually) -- bacteria, phragmites, duckweed, planaria, cattail, aphid, blue-green algae, diatoms, zooplankton, hard stem bulrush, tamarisk, etc.

Sexual Reproduction -- June Sucker, Carp, waterfowl, plants, mosquitoes, gnats, rodents, sponge (Ephydatia fluviatilis), Ute ladies' tress, tamarisk, channel catfish, black bullhead, walleye, large mouth bass, bluegill, black crappie, yellow perch, carp, Utah sucker, mallard, northern pintail, killdeer, tree swallow, American white pelican, muskrat, big brown bat, western spotted skunk.

TEACHER MATERIALS:

- Living or preserved specimens of phragmites, duckweed, and planaria.
- Pictures of phragmites, planaria, and stolon (attached).

STUDENT MATERIALS:

- Paper, pencil, masking tape.
- Two (2) small clear containers to grow planaria and duckweed.
- Specimens of duckweed and/or planaria.
- Bottled spring water.
- Razor.
- Petri dish.

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PROCEDURE: ***This will take several weeks from start to finish.***

OBSERVATION #1- Asexual reproduction of duckweed and planaria.

Place students into partnerships to work with the materials. Students will be observing the asexual reproduction of both duckweed (Lemna minor) and planaria. The conditions needed for planaria and duckweed are similar. Students will be placing a specific number of each into a jar and observing the reproduction of the organisms.

Observe asexual reproduction of duckweed:

A. Give each partnership a small clear jar filled with bottled spring water (non-chlorinated), with several specimens of duckweed. Give students time to observe and record the plant. Take note of the different sizes of leaves, quantity of plants, etc. Record this information by writing on masking tape placed on the jar.
Explain:
Each leaf will produce its own root system. Once the root system is developed, the new leaf will split away creating a new plant. This is asexual reproduction. There may or may not be observable small flowers. If there are flowers, explain the flowers, after being pollinated by movement (waves and wind), will create seed. The seeds will then create a new plant.

B. **Experiment**: Make sure the number of leaves is recorded on the observation jar with the date. Make sure the students count the number of leaves even if they are not yet separated.
Explain:
Over a few days, the duckweed will multiply by growing new leaves that will separate and become a new plant.

C. Place in a bright location. Fluorescent lights work well with the light placement within a few inches of the plants. A windowsill will also provide the lighting requirements.

Observe asexual reproduction of planaria:

A. Place the planaria in a Petri dish with bottled spring water. Have students carefully cut the planaria in half, separating the head from the tail. You will want several specimens per jar since some may die. Place the cut planaria in the observation jar. Label the number of "original" specimens, and the number of new "cut specimens," and the date.
Explain:

Planaria will regenerate the missing parts of its body becoming two separate organisms. Since planaria will be regenerating their digestive system, they will not need a food source for several days.

B. Set the observation jars in a location where they can be easily maintained. They do not need light. Planaria are often found under rocks, in dark locations. Make sure to check the water level occasionally. Set aside a few minutes once or twice a week to observe the jars again and record the new number of specimens present and living within the jars. Have students look for regenerated tails and heads.

Discuss the following questions:

- Why is asexual reproduction advantageous to duckweed/planaria?
- Why is asexual reproduction of these species a disadvantage?

OBSERVATION #2- Asexual reproduction of phragmites.

Observe asexual reproduction of phragmites:

A. Give each partnership a specimen of phragmites. Give the students time to observe the specimens. Take note of the specialized underground stems called rhizomes, and occasionally phragmites will grow an above ground stolon (similar to a rhizome except it is above ground). Rhizomes and stolons are both plant stems used for asexual reproduction. Take special note of the developing new roots and shoots. Node elongation can also be noted. Discuss the advantages/disadvantages to using rhizomes/stolons as a form of reproduction.

Examples:

- Disadvantage: The plant is only able to reproduce in proximity.
- Advantage: The plants are able to form a dense mat of roots, rhizomes, and stolons that block other plants from the ability to grow in that location.

Discuss the following questions:

- Why is asexual reproduction of phragmites a contributing factor to its invasiveness?
- Why are rhizomes and stolons an important adaptation for asexual reproduction?
- Why is sexual reproduction an important adaptation for plant dispersal?

ASSESSMENT:

- Ask students to describe how asexual reproduction creates offspring that have the same traits as the parents.

EXTENSIONS:

- Students may observe differences in a specific plant or animal that reproduces asexually. For example, a student could go to a greenhouse and observe all the plants that are propagated by cuttings like most trees.

PHRAGMITES RHIZOME

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PHRAGMITES SAMPLES

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DUCKWEED SAMPLES

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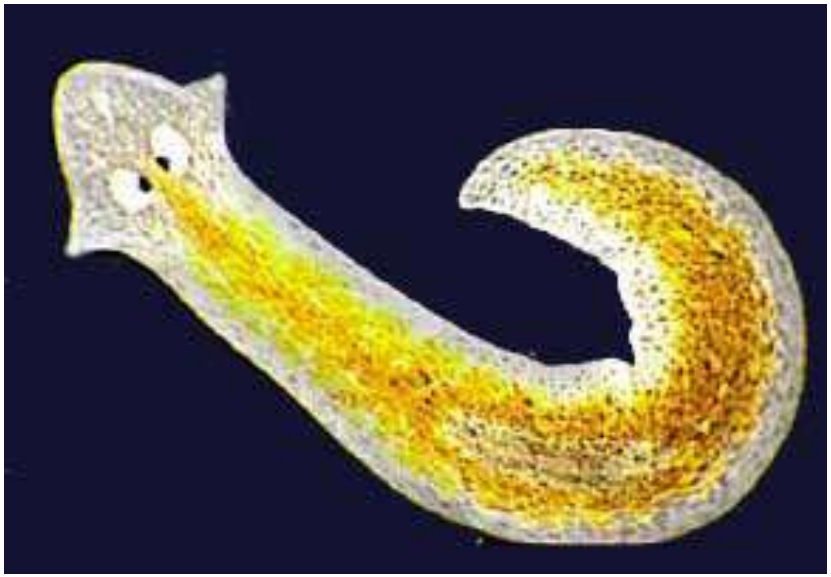
PLANARIA EXAMPLES



PLANARIA EXAMPLES

RHIZOME SAMPLES

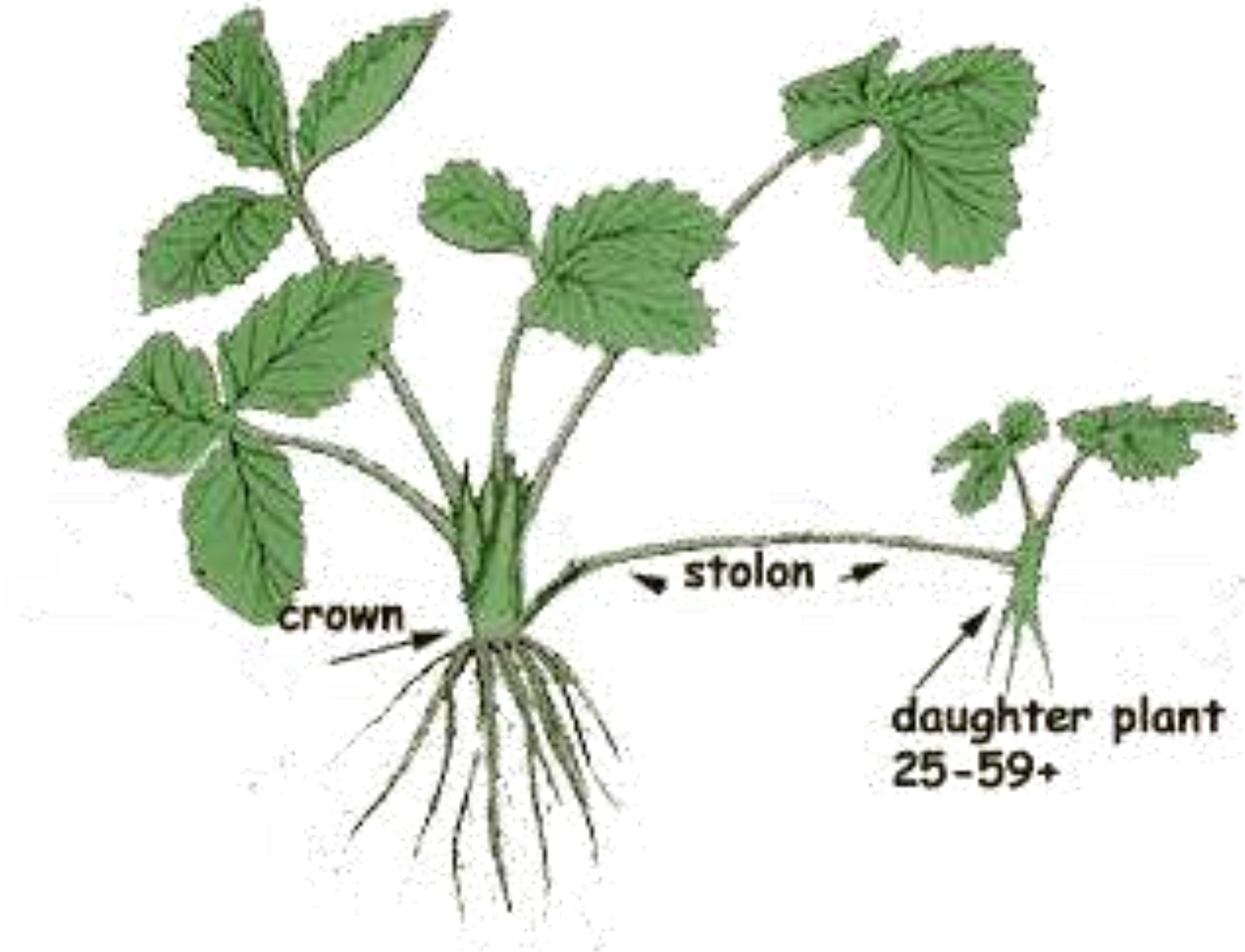
RHIZOME SAMPLES

RHIZOME SAMPLES

RHIZOME SAMPLES

STOLEN SAMPLES

STOLEN SAMPLES



STOLEN SAMPLES

Organisms of Utah Lake

Blue-green algae
*Aphanizomenon flos-aquae**
Anabaena spiroides
*Microcystis**

Diatoms
Planktonic diatoms*
Pennate diatoms*

Insects and such
Chironomids - *Dictrotendipes fumidus*
Tabanids – Deerflies and horseflies
Culicid - Mosquitoes
Oligochaetes – fresh water worms*

Zooplankton
Ceriodaphnia*
Cyclops
Daphnia
Diaptomus*

Sponge
*Ephydatia fluviatilis**

Plants
Ute ladies'-tress – wild orchid
Cattail - *Typha latifolia*
Hardstem bulrush - *Scirpus acutus*
Nebraska sedge - *Carex nebrascensis*
Common spikerush - *Eleocharis palustris*
Olnyey's threesquare - *Scirpus americanus*
Saltgrass - *Distichlis spicata*
Foxtail barley - *Hordeum jubatum*
Alkali saccaton - *Sporobolus aeroides**
Tamarisk - *Tamarix ramosissima*
Russian olive - *Elaeagnus angustifolia*
Big sagebrush - *Artemisia tridentate*

Amphibians
Colombia spotted frog - *Rana luteiventris*

Organisms of Utah Lake

Fish

Channel catfish - *Ictalurus punctatus*
Black bullhead - *Ictalurus melas*
Walleye - *Stizostedion vitreum*
Large mouth bass - *Micropterus salmoides*
Bluegill - *Lepomis macrochirus*
Black crappie - *Pomoxis nigromaculatus*
Yellow perch - *Perca flavescens*
White bass - *Morone chrysops*
Carp - *Cyprinus carpio*
Utah sucker - *Catostomus ardens*
Fathead minnow - *Pimephales promelas*
Spottail shiner - *Notropis hudsonius*
June sucker - *Chasmistes liorus*

Birds

Mallards - *Anas platyrhnchos*
Northern pintail - *Anas acuta*
Cinnamon teal - *Anas cyanoptera*
American avocet - *Recurvirostra americana*
Killdeer - *Charadrius vociferous*
Canada goose - *Branta canadensis*
Tree swallow - *Iridoprocne bicolor*
American white pelican - *Pelecanus erythrorhynchos*
Great blue heron - *Ardea herodius*
Snowy egret - *Egretta thula*
Cattle egret - *Bubulcus ibis*
Black-necked Stilt - *Himantopus mexicanus*
Black-crowned night heron - *Nycticorax nycticorax*
California gull - *Larus californicus*
Redhead ducks - *Aythia americana*
White-faced ibis - *Plegadis chichi*
Double-crested cormorant - *Phalacrocorax auritus*
Pied-billed grebe - *Podilymbus podiceps*
Common raven - *Corvus corax*
Red-winged blackbird - *Agelaius phoeniceus*
Yellow-headed blackbird - *Xanthocephalus xanthocephalus*
Black-billed magpie - *Pica pica*
European starling - *Sturnus vulgaris*
Ring-necked pheasant - *Phasianus colchicus*
Turkey vulture - *Cathartes aura*
Red-tailed hawk - *Buteo jamaicensis*
Barn owl - *Tyto alba*
Bald eagle - *Haliaeetus leucocephalus*

Organisms of Utah Lake

Mammals

Muskrat - *Ondatra zibethicus*
Pennsylvanian meadow mouse - *Microtus pennsylvanicus*
Pronghorn Sheep - *Antilocapra americana*
Mule deer - *Odocoileus hemionus*
Vagrant shrew - *Sorex vagrans*
Big brown bat - *Eptesicus fuscus*
Hoary bat - *Lasiurus cinereus*
Brazilian free-tailed bat - *Tadarida brasiliensis*
Black-tailed jackrabbit - *Lepus californicus*
Pygmy rabbit - *Brachylagus idahoensis*
Townsend ground squirrel - *Spermophilus townsendii*
Rock squirrel - *Spermophilus veriegatus*
Least chipmunk - *Tamias minimus*
Deer mouse - *Peromyscus truei*
Bushy-tailed woodrat - *Neotoma cinerea*
Desert woodrat - *Neotoma lepida*
Coyotes - *Canis latrans*
Long-tailed weasel - *Mustela frenata*
Western spotted skunk - *Spilogale gracilis*