

UTAH LAKE SEXUAL REPRODUCTION

This lesson plan has been created as a resource for seventh grade teachers to teach the new core standards to their students. It integrates math and 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 that through sexual reproduction traits are passed on to their offspring by combination of genes.
2. Compare how sexual and asexual reproduction passes genetic information from parent to offspring.

STANDARDS ADDRESSED:

7th Grade Science

Standard 4: Students will understand 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).

UTAH LAKE SEXUAL REPRODUCTION

TEACHER BACKGROUND:

(These lessons, Sexual Reproduction of Utah Lake Organisms, and Asexual Reproduction of Utah Lake Organism, 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 two species of plants (duckweed and phragmites) and two species of animals (June Sucker and planaria).

Sexual reproduction occurs when two organisms of the same species combine gametes (eggs and sperm) creating offspring. June Sucker, spawn in some of the inlets of Utah Lake during June (hence, they are called June sucker). There are also efforts to spawn artificially the June Sucker to maintain the genetic variability. This combination of gametes creates a population that has genetic variation. Sexual reproduction affords a population of species a better ability to adapt for survival in an environment. Phragmites, an invasive species of reed, can reproduce by seed. The resulting new plant could show better adaptability for survival, making the plant more invasive. Sexual reproduction is the best mode for allowing a population to develop traits that will help them survive.

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.

June Sucker: The June Sucker is a native species to Utah Lake. The spawning of June Sucker traditionally occurred in June after the high flows of runoff in late May. The water would “clean” the gravel beds in the tributaries, preparing it to receive the eggs of the June Sucker. June Sucker females lay about 20,000 eggs. The June Sucker puts a lot of its energy into producing large numbers of eggs at one time, because of high predation of the young fries. In the 1980s, the population of the June Sucker population was below 1,000. The June Suckers, because of the ability artificially to spawn the eggs, are now raised in several hatcheries throughout Utah. The success has been so high, the June Sucker has been placed in other reservoirs such as the Red Butte Reservoir, and other ponds.

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For this lesson, place emphasis on the rapid success of raising a large population of June Sucker by sexual reproduction. In contrast, the reason why June Suckers lay so many eggs is because so few will survive to a spawning age in a natural environment.

Stolon: An above ground horizontal stem, which 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, largemouth 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, etc.

TEACHER MATERIALS:

- *Utah Lake: Legacy* Chapter 7 - Describes reproduction of June Sucker
- American Fork June Sucker Spawning Video

STUDENT MATERIALS:

- Paper and pencil.
- Phragmites.

PROCEDURE:

OBSERVATION #1 -- Sexual reproduction of phragmites.

- A. Observe sexual reproduction of phragmites: Give each partnership a specimen of phragmites. Give the students time to observe the specimens. Identify the structure of the sexually reproductive parts of the phragmites flowers. Phragmites florets contain small flowers. Flowers are only observable during the late months of summer; however, the ovaries and seeds are still available. Take notice of the seed and the modes of transportation that the seeds could have to distribute the species to new areas.

Advantage: Seeds can be dispersed by water, animals, and wind. Phragmites, when grown from a seed, has the possibility of having new traits, which may or may not be advantageous for the plant.

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Discuss the following questions:

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

OBSERVATION #2 -- Sexual Reproduction of June Sucker

- A. Using the background information on June Sucker, explain to the students how the June Sucker reproduces by spawning. Spawning results in a mix of gametes one set from the male and one from the female June sucker.
- Students will observe the reproduction of June Sucker by watching a clip from *Utah Lake: Legacy*.
 - American Fork River June Sucker Spawn (2010).
- B. After the clip, a discussion will be held with the students about the following points of information found in either the clip or information provided by the teacher.
- June Sucker is artificially spawned to maintain a genetically diverse population of the species in the June Sucker Recovery Program. The purpose behind this project is to preserve the June Sucker species and prevent an artificial selection from occurring.
 - June Sucker populations in Utah have risen, due to reproduction in hatcheries and proper management of Utah Lake tributaries.

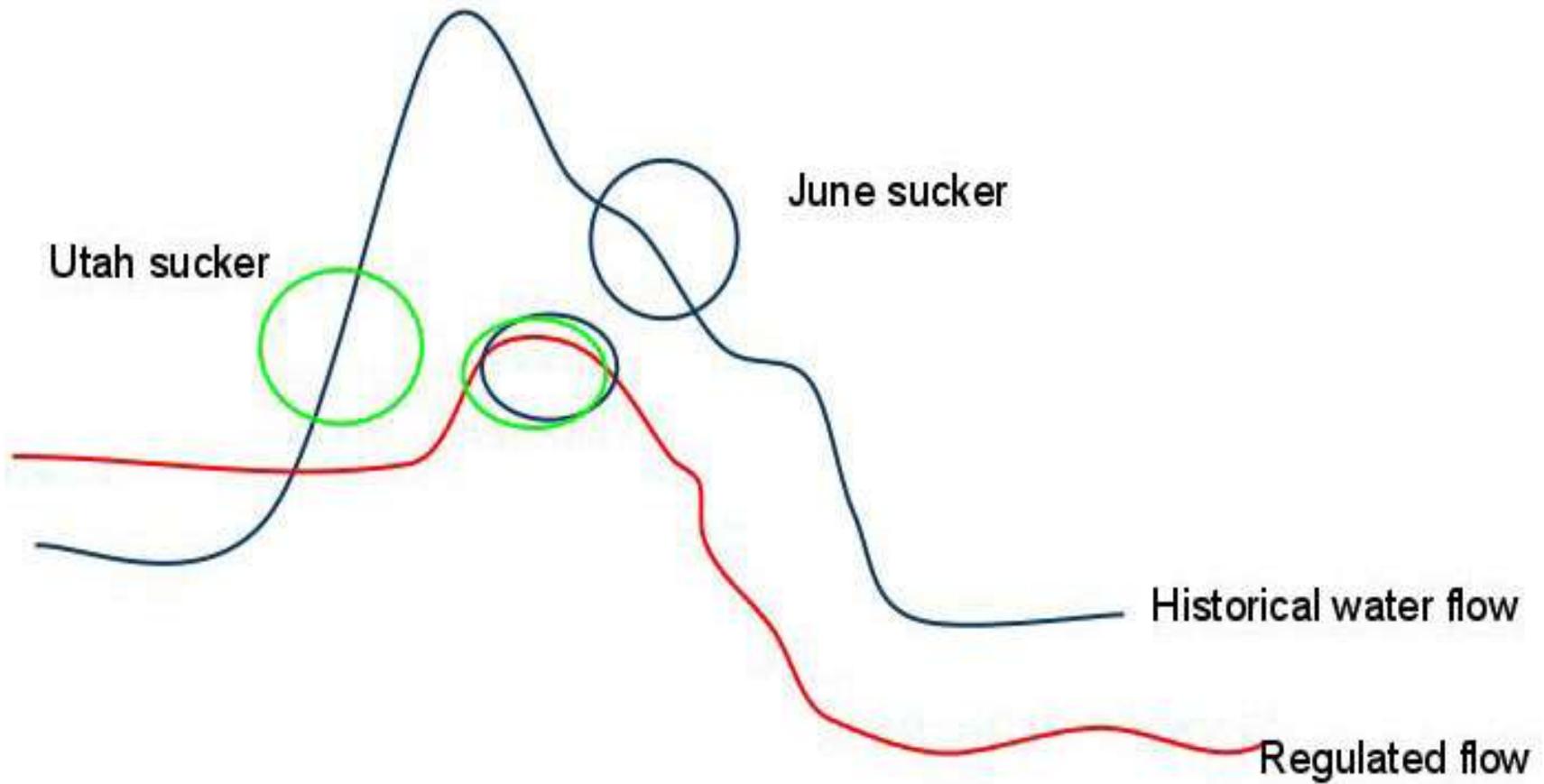
ASSESSMENT:

- Ask the students to describe how sexual reproduction creates offspring that inherit traits from both parents by a combination of gametes, allowing for the development of new traits.

EXTENSIONS:

- Students may observe differences in a specific plant or animal that reproduces sexually. For example, a student could go to a greenhouse and observe all the different varieties of pansies or petunia.
- A student could go to a pet store and observe the different variations of goldfish or guppies.

SPAWNING GRAPH OF JUNE SUCKER AND UTAH SUCKER FISH



UTAH LAKE ORGANISMS

Blue-green algae

*Aphanizomenon flos-aquae**
Anabaena spiroides
*Microcystis**

Diatoms

Planktonic diatoms*
Pennate diatoms*

Insects and such

Chironomids - *Dictotendipes 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*

UTAH LAKE ORGANISMS

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 platyrhynchos*
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 herodias*
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 - *Aythya 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*

UTAH LAKE ORGANISMS

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*