Seaweed Aquaculture in the Classroom – Hollarsmith, et al.
Appendix C. Curricular Lessons

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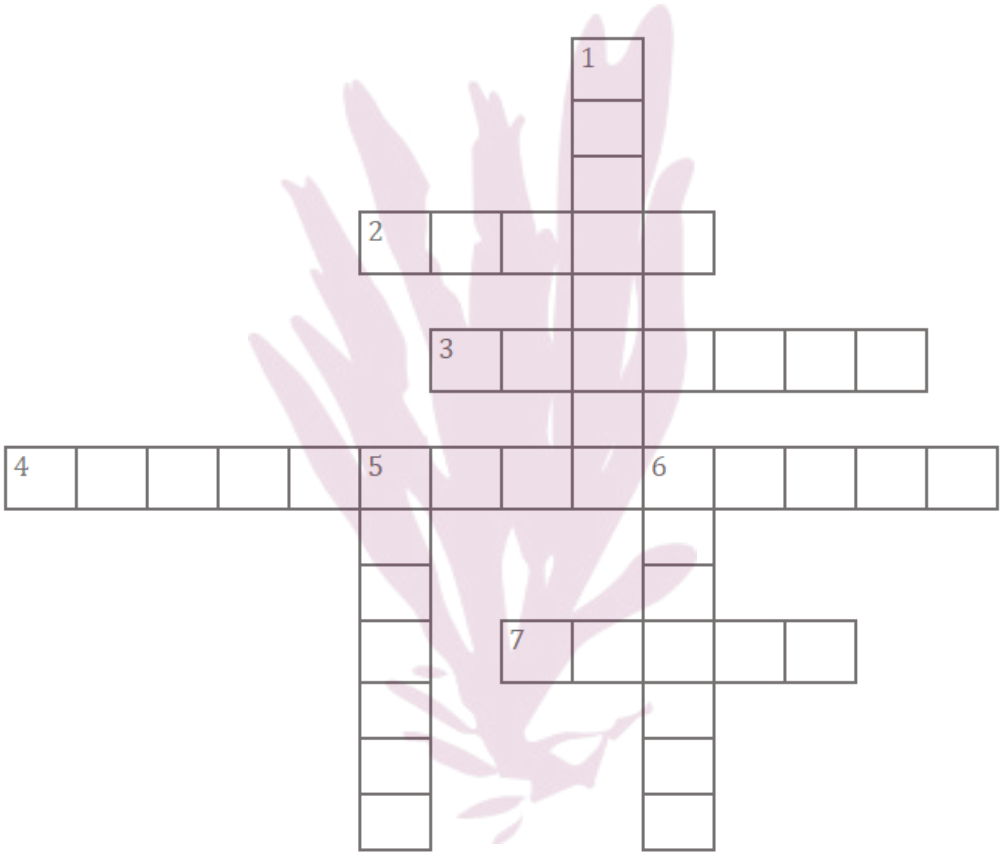
Seaweed in the Classroom

Grades K-5 Lessons on Seaweed in Southeast Alaska

k'áach (dulse, red ribbon seaweed)

Name _____

What is Seaweed? Crossword Puzzle



Down:
1. Base of a seaweed that attaches it to a rock; this resembles roots.
5. Algae found in saltwater environments.
6. Place where a plant or animal lives (its home).

Across:
2. Flattened part of a seaweed that resembles a leaf.
3. The body or part of the algae above the holdfast.
4. A process used by plants and other organisms to convert light energy from the sun into energy that can be stored for later use.
7. Stalk of a seaweed between holdfast and blade; this resembles a stem.

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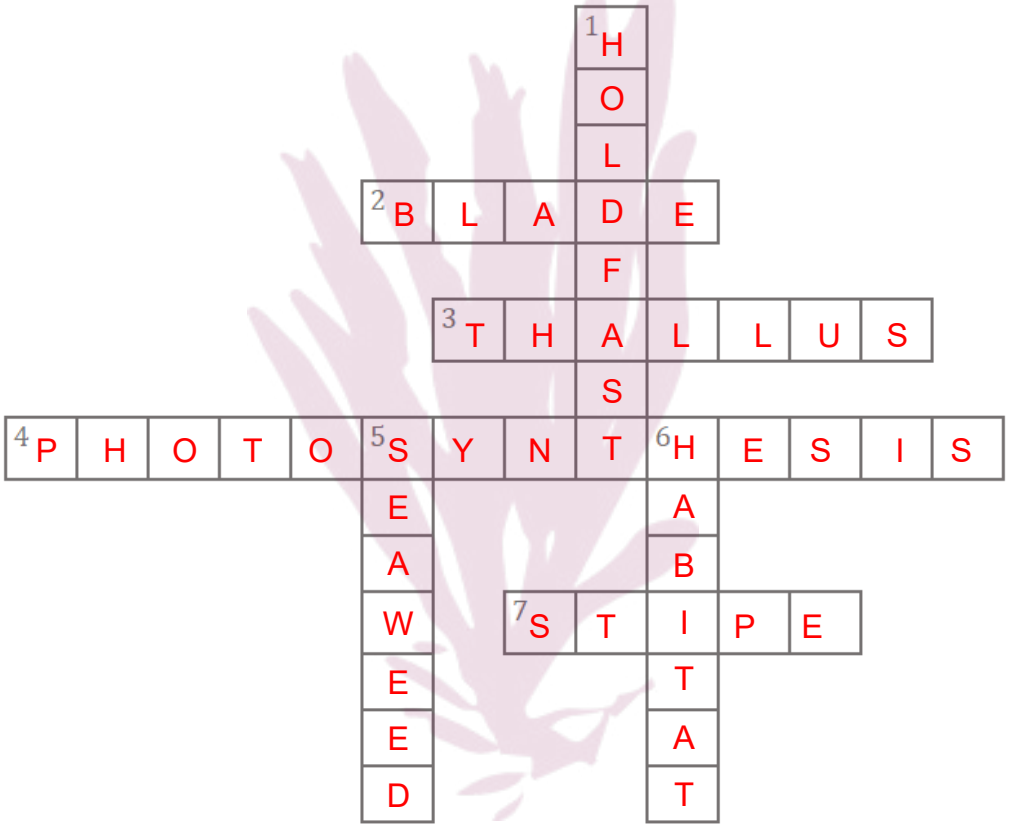
Name _____

What is Seaweed? Crossword Puzzle



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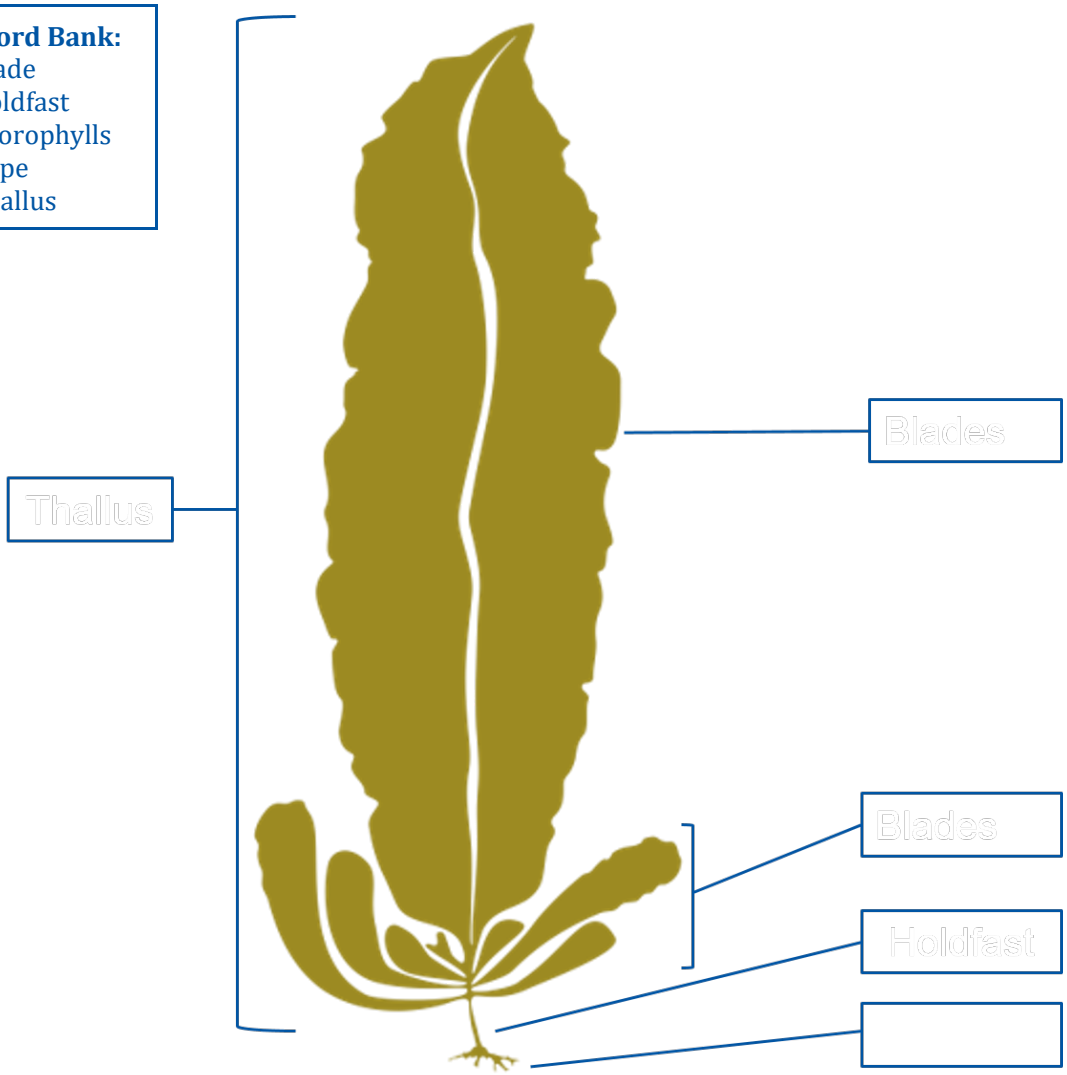
Name _____

Seaweed Anatomy - Structure and Function Activity Worksheet

Part 1. Look at the image below. Using the word bank, label each part of the seaweed with the correct name.

Word Bank:
Blade
Holdfast
Sporophylls
Stipe
Thallus



geesh (ribbon kelp)

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1

Name _____

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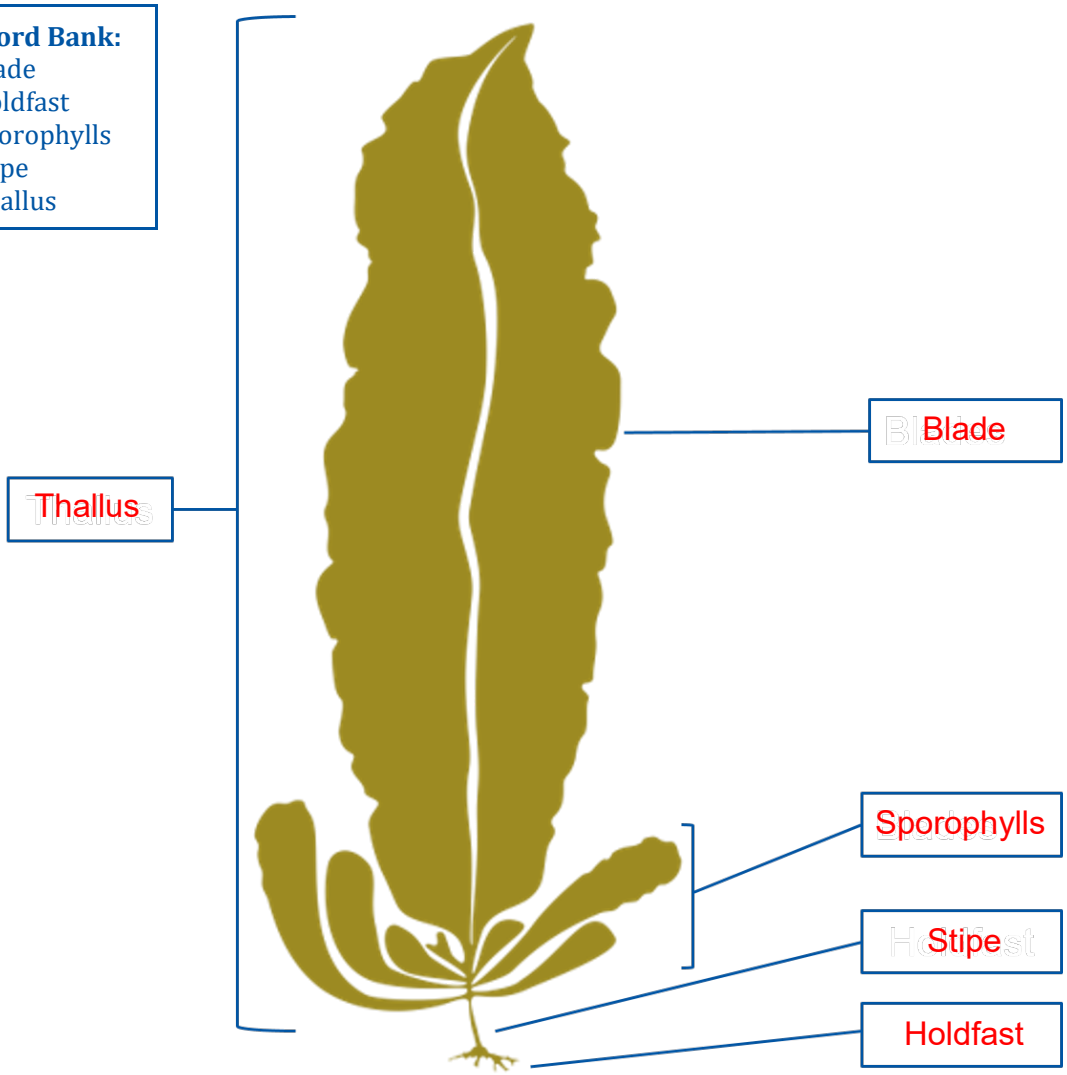

geesh (ribbon kelp)

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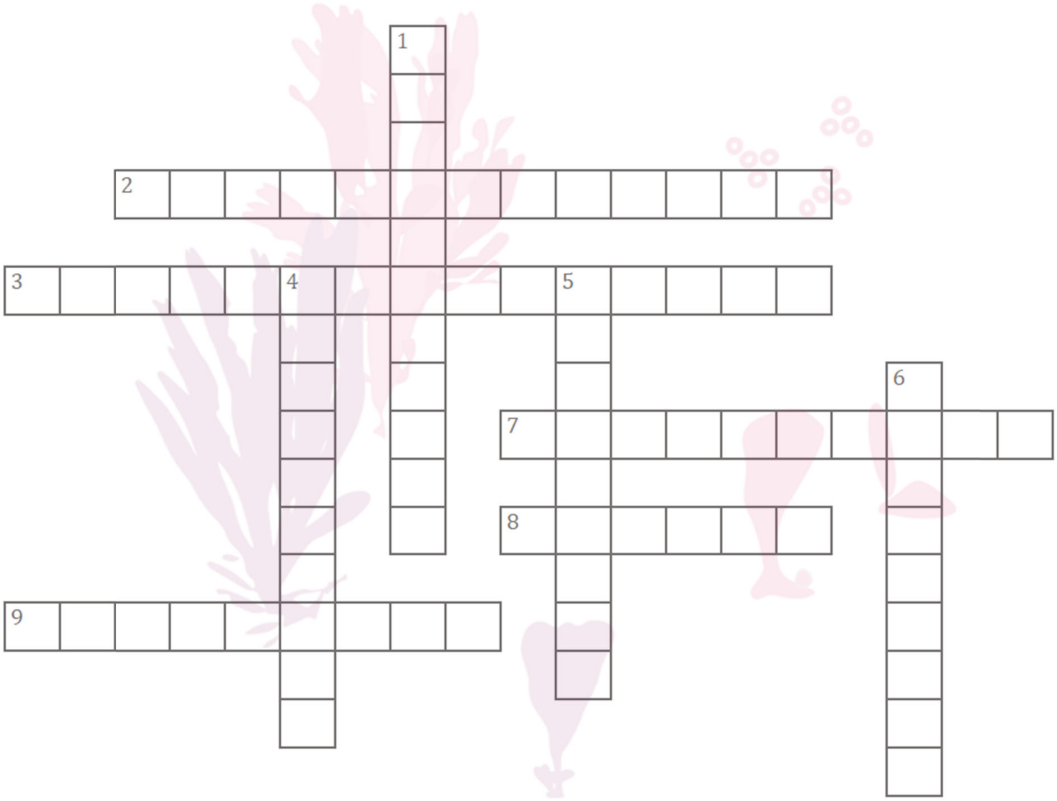
1

Name _____

Seaweed Life Cycle Crossword Puzzle



Down:
1. the stage which produces sex cells in plants and algae that undergo alternation of generations
4. spore-producing phase of life cycle of plant or algae body that undergo alternation of generations
5. a seaweed or plant that lives more than two years
6. tiny, seed-like cells that propel themselves using a long appendage called a flagellum

Across:
2. a form of asexual reproduction or cloning, where an organism is split into fragments. Each of these fragments develops into mature, fully grown individuals that are clones of the original organism
3. adult stage of red algae
7. specialized red algae reproductive cell
8. a seaweed or plant that completes its life cycle within one growing season and then dies
9. the series of changes and developments that an organism passes through from the beginning of its life until its death

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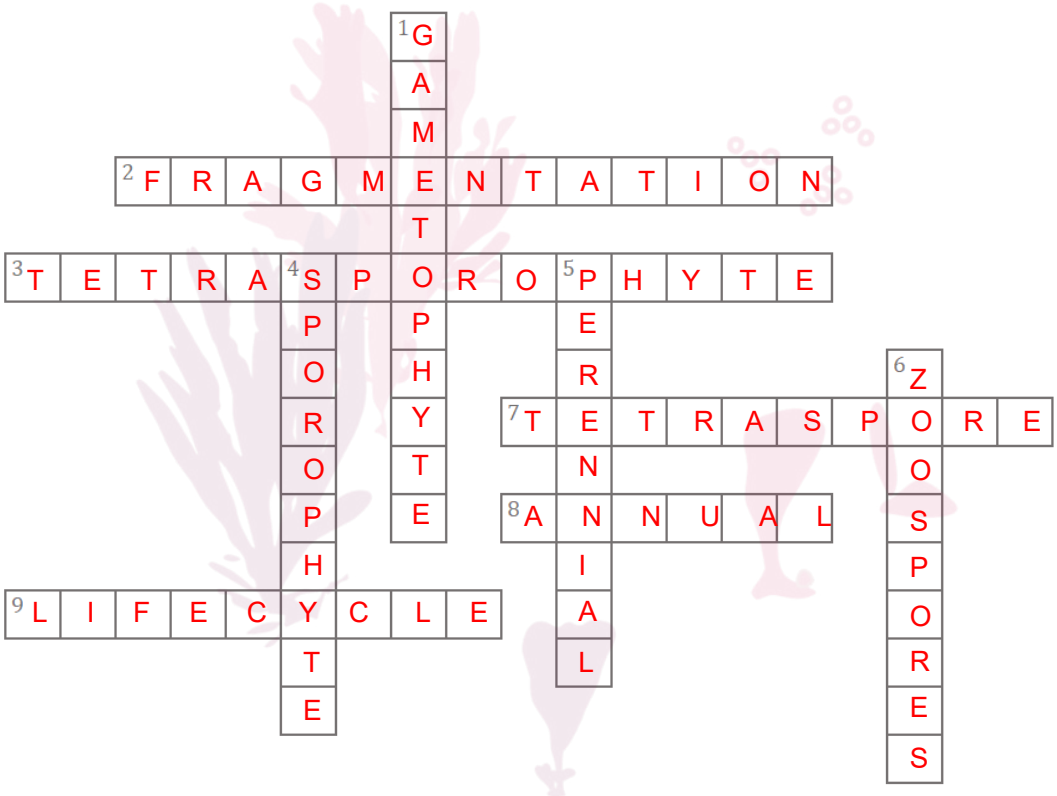
Name _____

Seaweed Life Cycle Crossword Puzzle



Name _____

Name That Seaweed Word Search

r	o	c	k	w	e	e	d	d	k'
t	s	b	s	d	v	c	x	u	á
u	a	u	e	j	g	q	t	l	a
g	l	o	a	o	s	e	k	s	c
j	g	l	w	r	ú	e	e	e	h
t	a	y	e	i	d	í	l	s	s
l	e	j	e	y	f	q	p	q	h
g	k	k	d	j	z	m	x	r	d
t	x	l	y	n	v	l	u	e	d
a	l	a	a	k'	á	s	k	t	u

rockweed k'áach kelp geesh laak'ásk

tayeidí seaweed algae dulse sú

Name _____

Name That Seaweed Word Search

r	o	c	k	w	e	e	d	d	k'
t	s	b	s	d	v	c	x	u	á
u	a	u	e	j	g	q	t	l	a
g	l	o	a	o	s	e	k	s	c
j	g	l	w	r	ú	e	e	e	h
t	a	y	e	i	d	í	l	s	s
l	e	j	e	y	f	q	p	q	h
g	k	k	d	j	z	m	x	r	d
t	x	l	y	n	v	l	u	e	d
a	l	a	a	k'	á	s	k	t	u

Making Seaweed Bookmarks

"Seaweed" is the common name for species of algae that grow in the marine environment. Seaweeds are found in all oceans of the world. They occur in the sun-lit subtidal and intertidal areas along varied coastlines from tropics to arctic areas. **There are over 500 (and counting) species of seaweeds in Alaska!**

Seaweeds are important to nearshore ecosystems because they provide refuge for many invertebrates and fishes, and are a source of food and nutrients for many nearshore species. Thousands of edible seaweeds of various shapes and sizes occupy a wide array of ecological niches. The distribution of seaweeds worldwide and within regions depends on sea temperature, light availability, suitable attachment surfaces, nutrients, and wave action.

Today, scientists use seaweed pressings to travel back in time. Newly developed methods of extracting data from seaweed pressings, such as stable isotope analysis and DNA sequencing, allow scientists to measure the impacts of pollutants on coastal ecosystems, document changes in marine community structure, and create evolutionary trees for a wide variety of seaweed species.

Vocabulary

- bladder rack; rock weed; yellow seaweed (*Fucus spp.*): **tayeidí**
- black seaweed (*Pyropia abbottiae*): **laak'ásk**
- bull kelp (*Nereocystis luetkeana*): **sú**
- ribbon kelp (*Alaria marginata*): **geesh**
- ribbon seaweed (dulse, *Palmaria mollis*): **k'áach'**
- hairy grass seaweed on which herring spawn: **né**
- seaweed, kelp on which herring spawn: **daaw**
- half-dried, compressed food, esp. berries or seaweed: **kat'ákxi**

Materials

- Seaweed*
- Bucket of seawater
- 140 lb. watercolor paper
- Cardboard sized to cover your paper
- Weed cloth or other mesh fabric sized to cover your paper
- A medium-size artist's paintbrush
- Two pieces of wood sized to cover your paper
- Something heavy, such as books, to use as weights

*More translucent and delicate seaweeds make better (and less messy) prints.

Instructions

Step 1: Gather your specimens and then place them in a bucket filled with clean seawater.

Step 2: Fill another bucket with two inches of water. Then slide a piece of watercolor paper into the tub and arrange the seaweed on top, keeping both paper and seaweed submerged.

Step 3: Carefully lift the paper out of the water, tilting it this way and that so the water drains away but you still maintain your design (more or less). Using a small brush, reposition the seaweed into the desired composition and brush away any unwanted bits of seaweed and sand.

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Step 4: Carefully place your arrangement on a piece of corrugated cardboard and gently place a piece of mesh fabric on top. You can layer several prints this way.




Step 5: Place your stack of prints between the two flat boards and put something heavy on top, such as a brick or your Introduction to World Art books. Wait several days, depending on the relative dryness of your climate. A fan also helps.

Step 6: After several days, remove the weights and layers to reveal your prints. (If they're not fully dry, it's fine to put them back under the weight.) Write the names of the specimens in pencil.



Name _____

The Life Cycle of Seaweeds Activity Worksheet

Part 1. Read the section below to learn about each stage in the red seaweed life cycle. Then, use the word bank to label each part of the life cycle with the correct name.

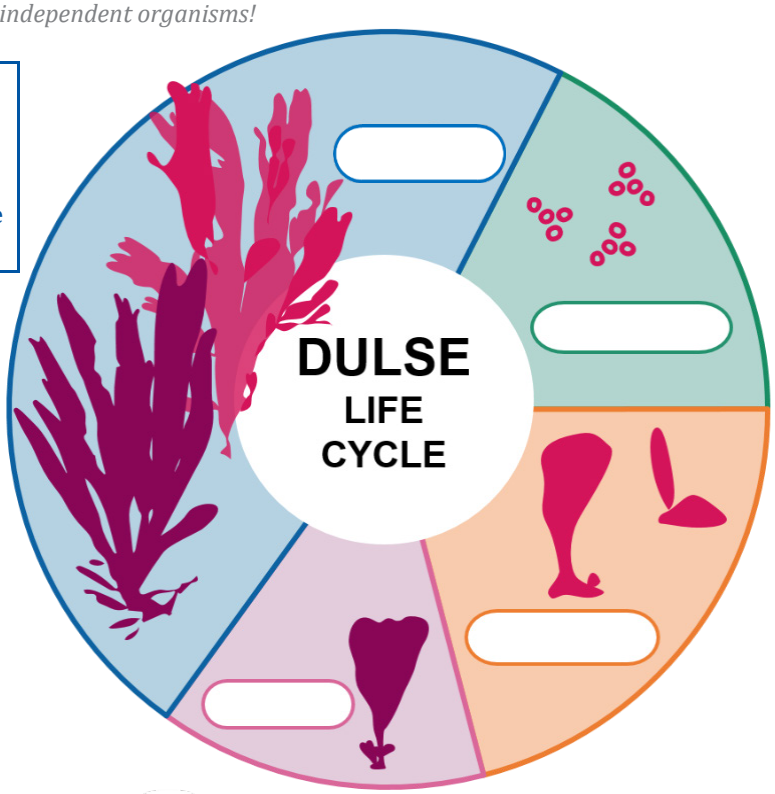
*K'áach (dulse) is a **perennial (a plant or seaweed that lives more than two years)** that can regrow new blades every year from the same holdfast. The maximum life span of individual blades or holdfasts is unknown other than they can persist through the winter.*

The life cycle of dulse is unusual in that females from each generation are reproductive their first year but males aren't reproductive until their second year.

*After **tetraspores (specialized reproductive cells)** are released from specialized patches of sorus tissue on the tetrasporophyte blades, they quickly adhere to any suitable substrate (rock, shell, or kelp stipes). The tetraspores then develop into male and female **gametophytes.** One-year-old male gametophytes release spermatia which combines with the carpogonia (egg) from the female gametophyte to create a **tetrasporophyte (tetraspore producing individual)**.*

Dulse can also reproduce asexually, by fragmentation — that is, the blades shed small pieces that develop into completely independent organisms!

Word Bank:
Mature tetrasporophyte
Gametophyte
Tetraspores
Immature tetrasporophyte



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1

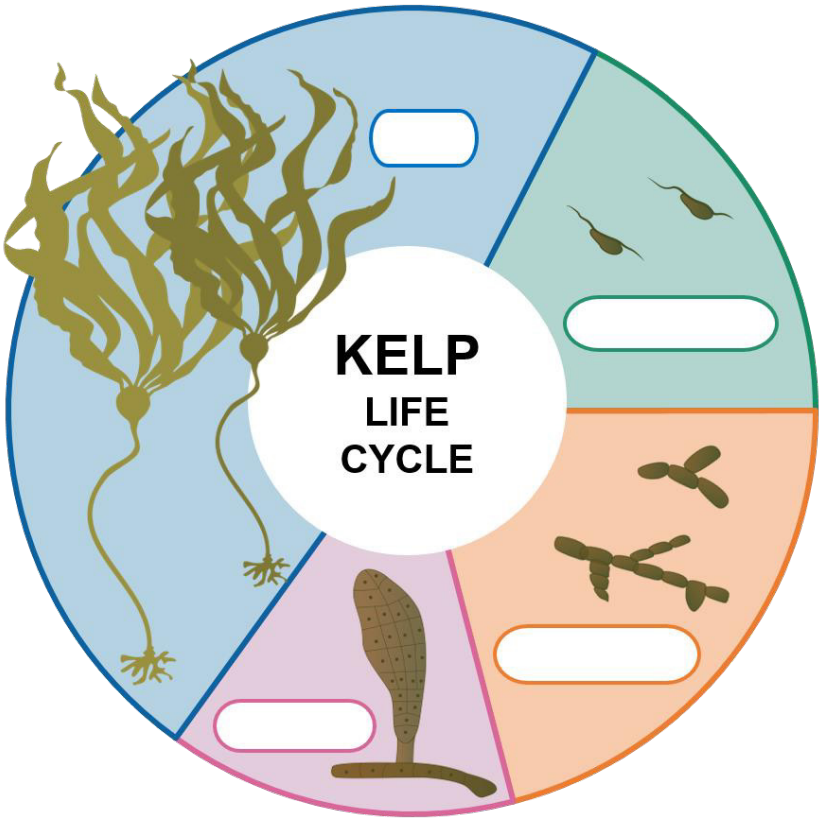
Part 2. Read the section below to learn about each stage in the kelp life cycle. Then, use the word bank to label each part of the life cycle with the correct name.

Sú (bull kelp) is an ***annual*** *geesh (kelp),* ***meaning it usually lives for one year and dies off in the winter.***

Like dulse, the life cycle of kelp involves two major life stages: the microscopic gametophyte stage and the very large sporophyte stage.

After ***zoospores (tiny, seed-like cells that propel themselves using a long appendage called a flagellum)*** *are released from specialized patches of sorus tissue on the sporophyte fronds, they quickly adhere to suitable hard substrate. The zoospores then develop into male and female* ***gametophytes (the stage which produces sex cells in algal species that undergo alternation of generations)****. The gametophytes release* ***gametes (reproductive cells of a plant or algae)*** *which, when they meet, create a* ***sporophyte (spore-producing phase of life cycle an algal body that undergoes alternation of generations)****.*

Word Bank:
Adult sporophyte
Gametophytes
Juvenile sporophyte
Zoospores



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2

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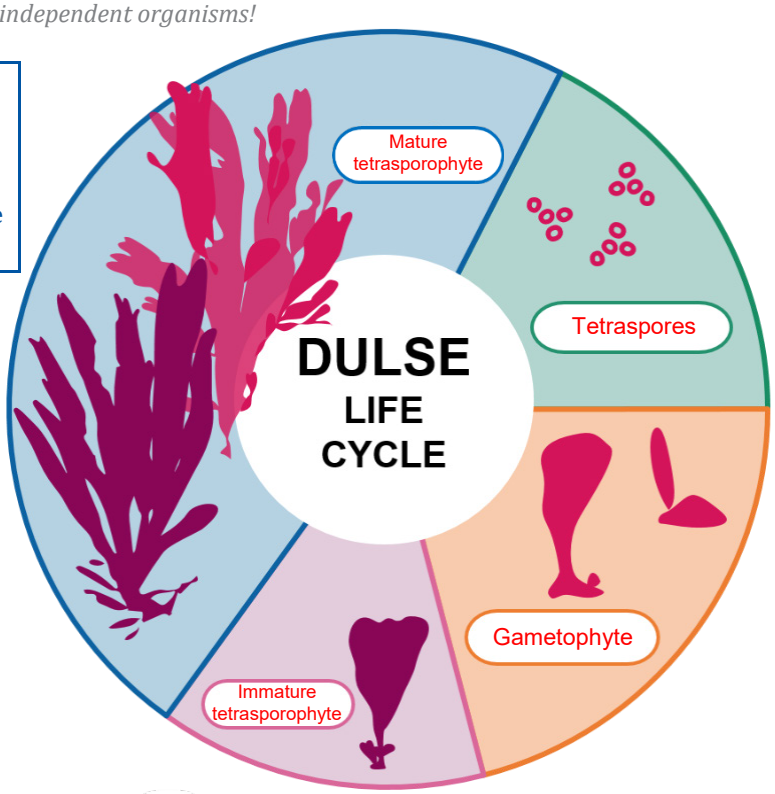

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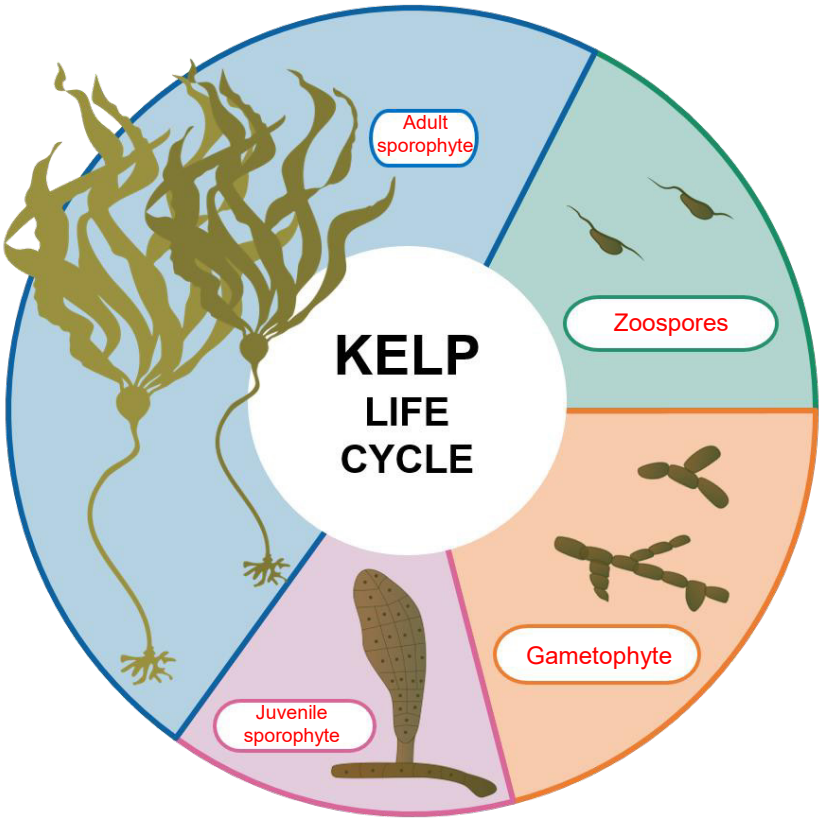

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2

Name _____

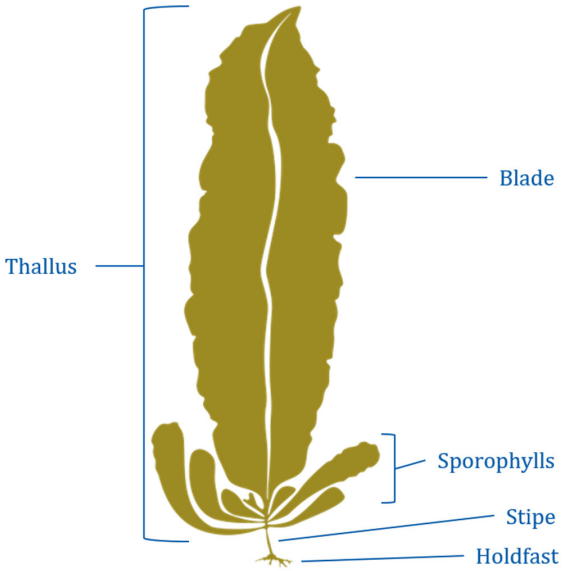
Seaweed vs. True Plant - Microscope Activity Worksheet

Part 1. Select a seaweed sample and a true plant sample to examine close up.

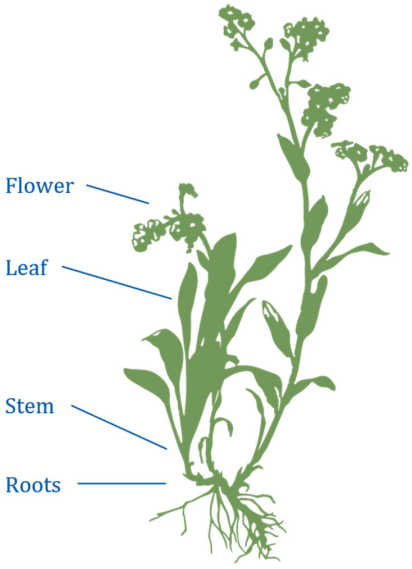
Using the figure below as a guide, what similarities **and** differences do you predict you will observe between your two specimens? In your own words, write 1-2 sentences describing your predictions.

_____

_____



geesh (ribbon kelp)



alpine forget-me-not

Seaweeds:
May be unicellular, colonial, or multicellular
Holdfast, stipes, and blades compose multicellular algae
Generally, each cell in algae must obtain its own nutrients from water for survival
Photosynthetic
Can only be found in water
Reproduction: can reproduce through tiny spores or some species by replication of the growth of broken pieces

True Plants:
Only multicellular
Roots, stems, leaves, flowers, fruits, seeds, and cones
Have vascular systems
Photosynthetic
Can be found on land and water
Reproduction: multi-cellular reproductive systems and certain species require assistance from wind, insects, or bats for pollination

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1

Part 2. Take a few minutes to then carefully look at the samples up close, using only your eyes and draw what you see:

Seaweed (with my own eyes)

True plant (with my own eyes)

What similarities did you observe with your own eyes? _____

_____

_____

What differences did you observe with your own eyes? _____

_____

_____

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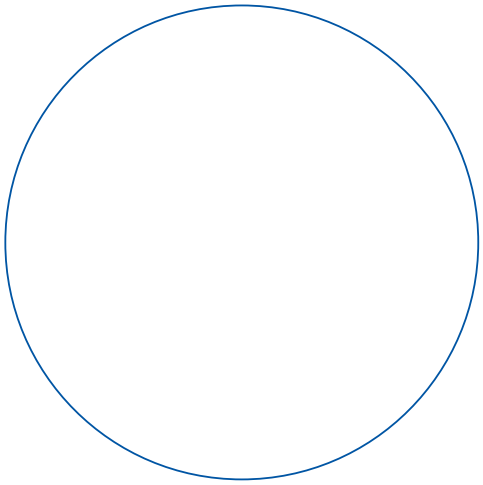
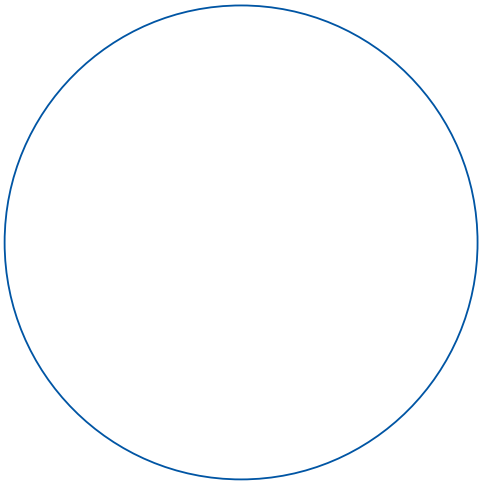
2

Part 3. Now use a microscope to carefully observe the samples and draw what you see:

Seaweed (with microscope)



True plant (with microscope)



What similarities did you observe when looking through the microscope?_____

_____

_____

What differences did you observe when looking through the microscope?_____

_____

_____