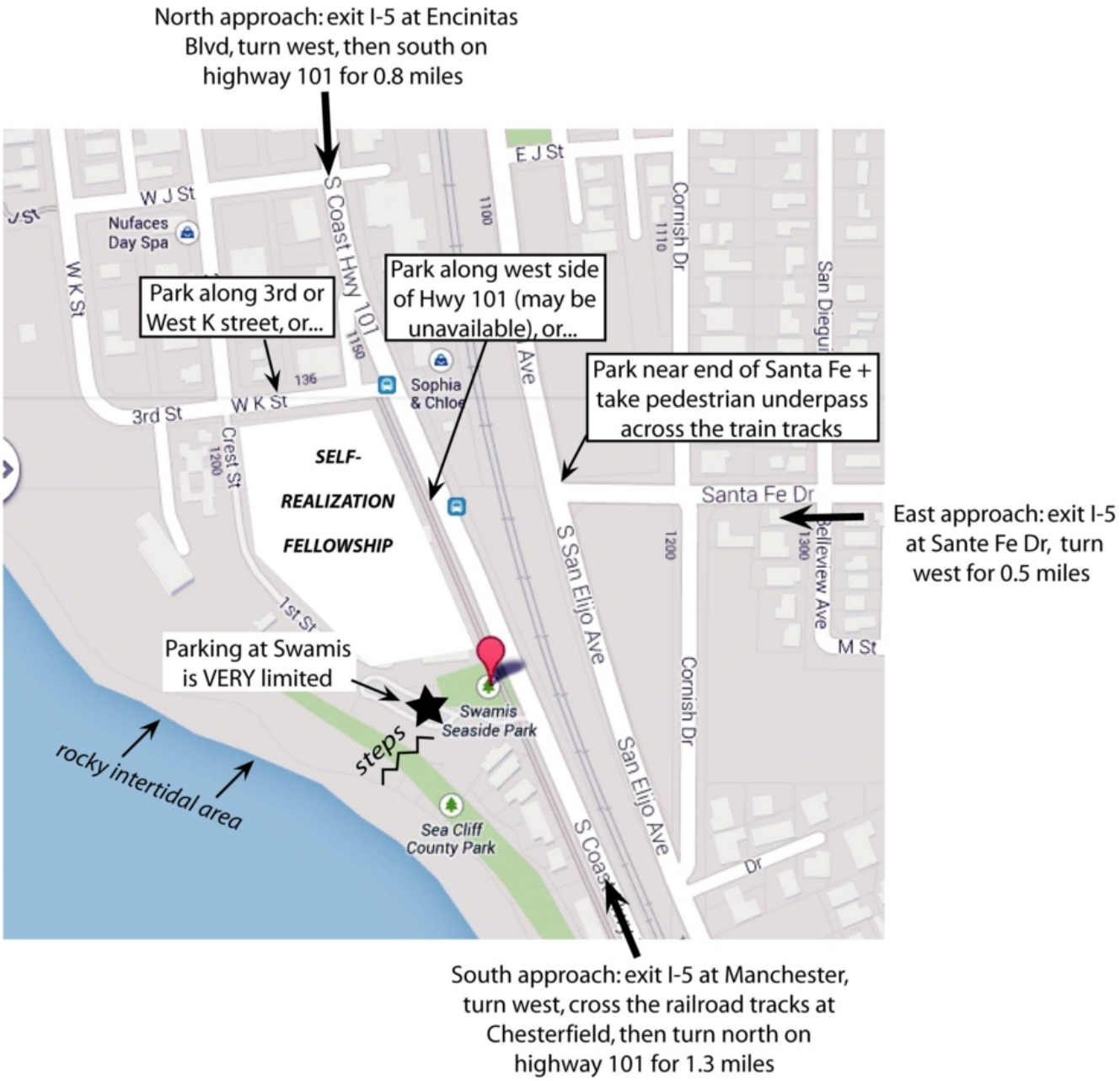
Beach Sands / Rocky Intertidal Field Trip Map

We will meet **Swamis State Beach**. Your instructor will tell you whether to meet in the parking lot above the beach access steps or down on the beach itself. It will take about 30 minutes including walking time from the Oceanside campus, or 20 minutes including walking time from the San Elijo campus.

Map location: **1298 S Coast Hwy 101, Encinitas, CA 92024**

Parking is difficult. You will probably not be able to park in the small parking area by the beach access steps. Three other nearby options are described on the map below. Please allow enough time to park and walk so that you are not late. There are restrooms by the parking area near the top of the access steps.

Be prepared to get your feet wet on this trip.



Name:_____

Beach Sands / Rocky Intertidal Organisms Field Trip

This lab combines two shorter exercises covering different topics: 1) the origin of beach sand, and 2) organisms of the rocky intertidal zone. Although not closely related, both topics are important for understanding our local coastline, and both are easy to investigate at Swamis beach.

Beach Sands

Within my hollow hand,
While round the earth careens,
I hold a single grain of sand
And wonder what it means.
– Robert W. Service

Mineral Specimens

The four mineral specimens shown make up much of the bedrock of San Diego's mountains. Those mountains are built largely of granite and related rocks. The weathering of granite in our local mountains is the starting point for much of our beach sand. The rock in the mountains breaks down into pieces consisting mostly of these four minerals. Rivers carry these pieces downhill toward the coast, where they eventually end up as sand on our local beaches. But as you will see, some changes happen to the sand along the way.

Inspect each mineral specimen and list its distinctive features, such as color, texture (rough or smooth surface?) luster (shiny or dull?), opacity (can you see through it at all?), and anything else that makes it stand out. The key here is to become familiar enough with these minerals so that you can recognize them as tiny pieces in beach sand.

Quartz: _____

Feldspar: _____

Biotite: _____

Magnetite: _____

Sand Samples

Scientific analysis of a sand sample involves identifying **grain size, sorting, roundness,** and **mineral composition**. You will do this for *four* sand samples: the beach sand here, and three other sand samples provided for you.

Fill in the tables that follow with data on grain size, sorting, roundness, and percent mineral composition of the four samples. It is essential that you use a ***hand lens*** as you inspect your samples—you won't be able to see the grains adequately without it. Also make use of the ***magnets*** to identify magnetite, and the ***charts*** provided for estimating grain size, sorting, rounding, and percent mineral composition.

SAMPLE A: Sand forming near granite outcrops in the Laguna Mountains east of San Diego

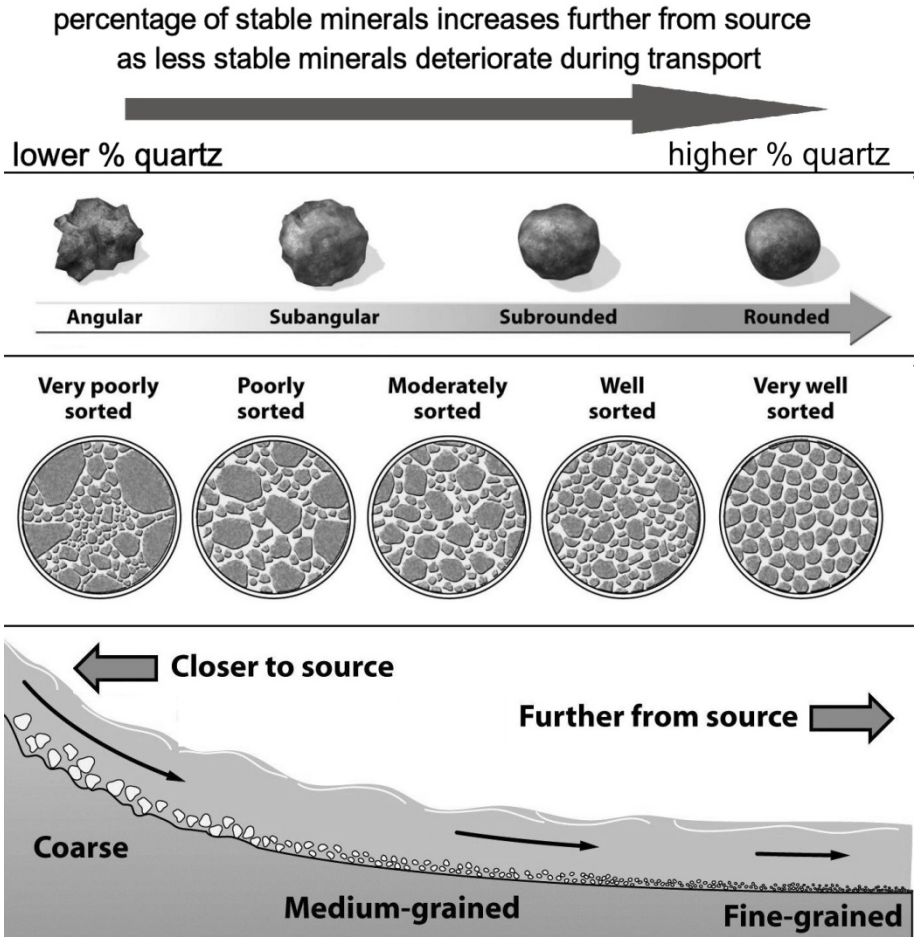
Circle the one or two best options in italics.		
Grain size:	*gravel*	**Percent mineral composition** (make your numbers add up to 100%)
	very coarse sand	Quartz: _____%
	coarse sand	Feldspar: _____%
	medium sand	Biotite: _____%
	fine sand	Magnetite: _____%
	very fine sand	Other: _____%
Grain sorting:	*well sorted*	Total = 100%
	moderately sorted	
	poorly sorted	
Grain rounding:	*angular*	
	subangular	
	subrounded	
	rounded	

SAMPLE B: Swamis Beach Sand (the sand here today)

Circle the one or two best options in italics.		
Grain size:	*gravel*	**Percent mineral composition** (make your numbers add up to 100%)
	very coarse sand	Quartz: _____%
	coarse sand	Feldspar: _____%
	medium sand	Biotite: _____%
	fine sand	Magnetite: _____%
	very fine sand	Other: _____%
Grain sorting:	*well sorted*	Total = 100%
	moderately sorted	
	poorly sorted	
Grain rounding:	*angular*	
	subangular	
	subrounded	
	rounded	

Questions

As rain and rivers move sediments further from a source area (such as mountains) to an area where the sediments are deposited (such as a beach), the sediments undergo changes in grain size, sorting, roundness, and mineral composition, as illustrated here.



Think about the "journey" of sand rolling for miles along riverbeds as it moves down slope from the mountains to the coast, followed by transport along the coast via longshore drift and near-constant reworking by waves.

1. How and why does the **grain size** vary between the sand from the mountains and the sand here on the beach?

2. How and why does the **grain sorting** vary between the two samples?

3. How and why does the **grain rounding** vary between the two samples?

4. How and why does the **mineral composition** vary between the two samples?

5. As it turns out, we now think that rivers supply only about half of the sand on North County San Diego's beaches. So where does the rest of our beach sand come from? Inspect the sample of rock from the local bluffs.

- What is this rock made of (*be specific—what is the dominate mineral*)?

- As the bluffs erode and pieces of this rock fall to the beach to be broken apart by waves, what forms?

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SAMPLE C: Another Beach Sand

Circle the one or two best options in italics.		
Grain size:	*gravel*	**Percent mineral composition** (make your numbers add up to 100%)
	very coarse sand	
	coarse sand	Quartz: _____%
	medium sand	Feldspar: _____%
	fine sand	Biotite: _____%
	very fine sand	Magnetite: _____%
Grain sorting:	*well sorted*	Other: _____%
	moderately sorted	
	poorly sorted	Total = 100%
Grain rounding:	*angular*	
	subangular	
	subrounded	
	rounded	

Questions

1. Compare sand **sample C** to the sand here today (**sample B**) terms of grain size, sorting, roundness, and mineral composition. Both samples come from our local beaches, and so they have some things in common, but there are also differences.

What are the similarities?

What are the differences?

2. Heft (hold in your two hands) the two orange-capped vials, one containing quartz sand, and the other containing magnetite sand. Which sample is denser? *(circle one): quartz sand magnetite sand*

3. You will usually find that beach sands rich in magnetite are more common on our local beaches after periods of heavy wave activity, such as after storms. Why do you think that is the case?

SAND SAMPLE D: Sand Dredged for Beach Replenishment

Circle the one or two best options in italics.		
Grain size:	*gravel*	**Percent mineral composition** (make your numbers add up to 100%)
	very coarse sand	
	coarse sand	Quartz: _____%
	medium sand	Feldspar: _____%
	fine sand	Biotite: _____%
	very fine sand	Magnetite: _____%
Grain sorting:	*well sorted*	Shell and rock fragments: _____%
	moderately sorted	Other: _____%
	poorly sorted	Total = 100%
Grain rounding:	*angular*	
	subangular	
	subrounded	
	rounded	

Questions

1. Compare sand **sample D** to the sand here today (**sample B**) terms of grain size, sorting, roundness, and mineral composition.

What are the similarities?

What are the differences?

2. Sample D comes from a major dredging project in 2012. That project added about 1.5 million cubic yards of new dredged sand to San Diego County's beaches. As surveyors for this project looked for dredge sites in shallow water offshore of the beach, they tried to find sand that was coarser–grained than the sand normally found on our local beaches.

Judging from sample D, would you say that the surveyors were successful in their quest?

What advantage would there be in using coarser-grained sand for a beach replenishment project? Why not just use any sand available, whatever its size?

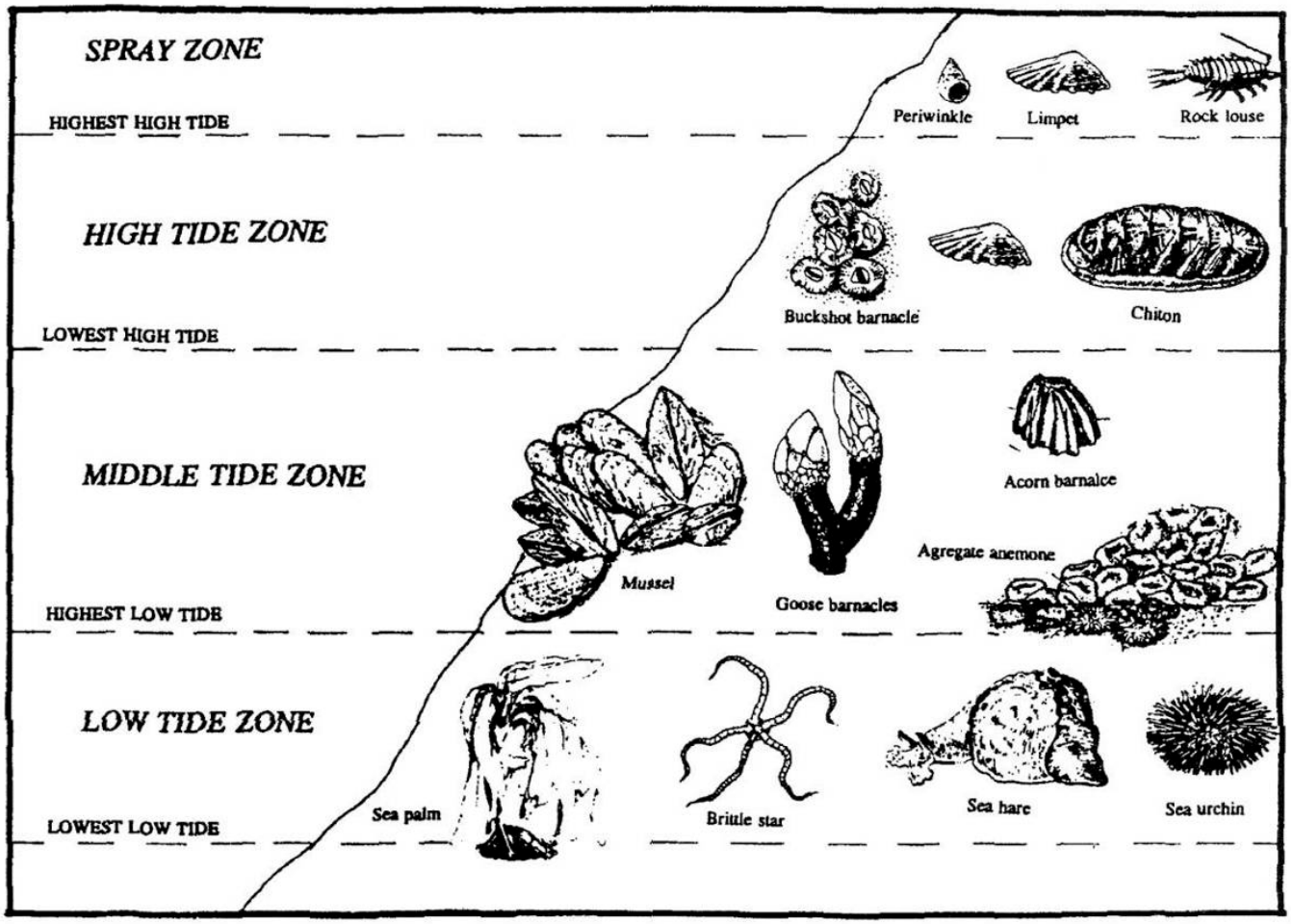
Rocky Intertidal Organisms

For this part of the lab, you will need a copy of the spiral-bound ***Guide to Common Species in Southern California Tide Pools***.

Purposes:
1. Observe the zonation of rocky intertidal habitats
2. Identify particular tide zones based on the presence of index species.
3. Identify various adaptations of organisms in the tide zones.
4. Learn more about specific intertidal organisms using the guidebook.

Perhaps the most distinctive feature of rocky intertidal habitats is **zonation**—the tendency of species to arrange themselves into distinct vertical zones related to the amount of time that they are covered by the tide versus exposed to the air. Each zone of the intertidal environment can be recognized by certain distinctive species—called **index species**—that are characteristic of particular zones.

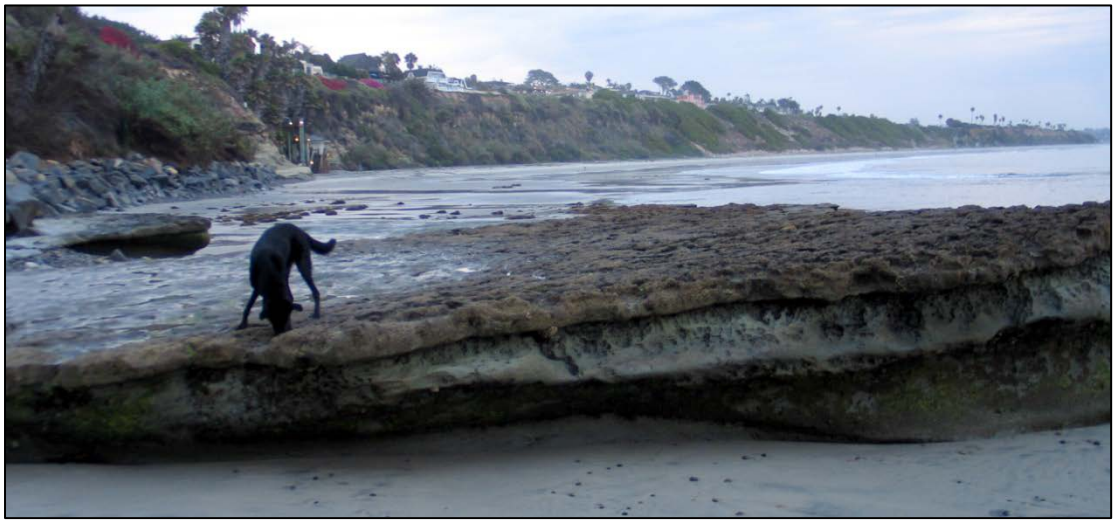
This illustration shows the common **index species** that characterize the tide zones of the southern California coast.



PART 1: Comparison of tide zones and adaptations of organisms

Tide Zone 1

Walk north from the beach access steps until your view matches the photo. (Note that the view looks south, back toward the steps you walked down to get to the beach.) Go and inspect the organisms living on the rocks.



- List all the species that you find here, and estimate the abundance of individuals of each species as a percentage. Make all your percents add up to 100%.

Name	*Percent abundance (total equals 100%)*
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____

- Based in the **index species** present, what tide zone is this (*circle one*)?

  spray/upper zone *middle zone* *lower zone*

- Look at the table two pages ahead, and read the descriptions in the column called *"Adverse conditions of rocky intertidal zones."* What are the main adverse conditions that you think organisms face in this particular zone? In other words, what makes life hard or challenging for the organisms that live here?

- In the table two pages ahead, list examples of species in this zone that illustrate adaptation to the adverse conditions that you identified.

Tide Zone 2

Walk until your view matches this photo. (Notice the white steps in the background and use these to orient yourself.) Go and inspect the organisms living on the rocks.

- List all the species that you can find here, and estimate the abundance of individuals of each species as a percentage. Make all your percents add up to 100%.

Name	*Percent abundance (total equals 100%)*
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____

- Based in the **index species** present, what tide zone is this (*circle one*)?

  spray/upper zone *middle zone* *lower zone*

- Look again at the table and the descriptions in the column called *"Adverse conditions of rocky intertidal zones."* What are the main adverse conditions that you think organisms face in this particular zone? In other words, what makes life hard or challenging for the organisms here?

- In the table, list examples of species in this zone that illustrate adaptation to the adverse conditions that you identified.

Adverse conditions of rocky intertidal zones	Organism adaptations	EXAMPLES you observed
Drying out during low tide	• Ability to seek shelter or withdraw into shells • Thick exterior or exoskeleton to prevent water loss • External surfaces covered with rock or shell fragments to prevent water loss • Adapted to periodic drying out without dying	
Strong wave activity	• In algae: Strong holdfasts to prevent being washed away • In animals: Seeking shelter or employing strong attachment threads, biological adhesives, a muscular foot, multiple legs, or hundreds of tube feet to allow them to attach firmly to the bottom • In both: Hard structures adapted to withstand wave energy; clustering closely together	
Predators occupy area during low tide/high tide	• Firm attachment of body parts, including a hard shell • Stinging cells • Camouflage • Inking response • Ability to break off body parts and regrow them later (regenerative capability)	
Difficulty finding mates for attached species	• Release of large numbers of eggs/sperm into the water column during reproduction • Long organs to reach others for sexual reproduction	
Rapid changes in temperature, salinity, pH, and oxygen content	• Ability to withdraw into shells to minimize exposure to rapid changes in environment • Ability to exist in varied temperature, salinity, pH, and low-oxygen environments for extended periods	
Lack of space or attachment sites	• Overtake another organism's space • Attach to other organisms • Planktonic larval forms that inhabit new areas, which limits parental and offspring competition for the same space	

PART 2: Species Description

Find a place to sit and read the ***Guide to Common Species in Southern California Tide Pools***.

Tide Zone 1

Pick one species that lives in this tide zone and learn more about it using the guide. Draw a simple sketch of this organism in the box to the right.

Common name:_____

Scientific name: _____

In the space below, write a description of this species, including information about how it lives, feeds, and reproduces. What specific adaptations or interesting features does this species have? How do these relate to how it deals with the adverse conditions of its tide zone?

Tide Zone 2

Pick one species that lives in this tide zone and learn more about it using the guide. Draw a simple sketch of this organism in the box to the right.

Common name:_____

Scientific name: _____

In the space below, write a description of this species, including information about how it lives, feeds, and reproduces. What specific adaptations or interesting features does this species have? How do these relate to how it deals with the adverse conditions of its tide zone?