**Reef Survivor Board Game**

In this lab you will play an educational board game designed to teach you about the processes of fossilization. This board game, “Reef Survivor”, was designed by Dr. Martindale from the University of Texas at Austin. The game is modeled around reef (paleo)communities, the natural and human-made threats they face, as well as how reef builders and dwellers interact, evolve, and adapt.

**The goal of the game is to build a healthy, diverse reef ecosystem that can survive natural disasters.** Each player (or team of players) is a conservation expert in charge of keeping their reef healthy. Over time, environmental conditions can change; for example, global temperatures rise or fall, and more or less nutrients are washed off the land and onto the reef. Over many years and generations, species may change as well through genetic mutation, the influx of new organisms (migration), and environmental pressures that affect organisms in different ways (natural selection).

**BEFORE THE LAB:**

* **Watch the “how to play the game” video:** [www.youtube.com/watch?v=bw8geNpuEnQ](http://www.youtube.com/watch?v=bw8geNpuEnQ)
* **Read the game booklet** **and complete the “Pre-Lab” component of the worksheet** so you know the strengths and weaknesses of the different organisms, what environmental settings they can live in, what mutations might arise, and environmental catastrophes you may face. If you want to win, you will have to do your homework and strategize; you will need to be familiar with several concepts to protect these amazing fossils!

**DURING LAB:**

* Remember **to take photos of the game board at the end of each round** (i.e., when you survey your reefs).
* As you play the game, track and calculate the diversity of your table/your board. How does diversity change through time? How is the diversity of your game board different from the abundance of reef builders? How even is your community?
* Note the extinctions of different organisms. Keep track of which disasters have impacted your reef community (you’ll need these for the follow-up worksheet).
* Remember that not all mutations or disasters will apply to all reef organisms, know your reef community so you know how to protect it.

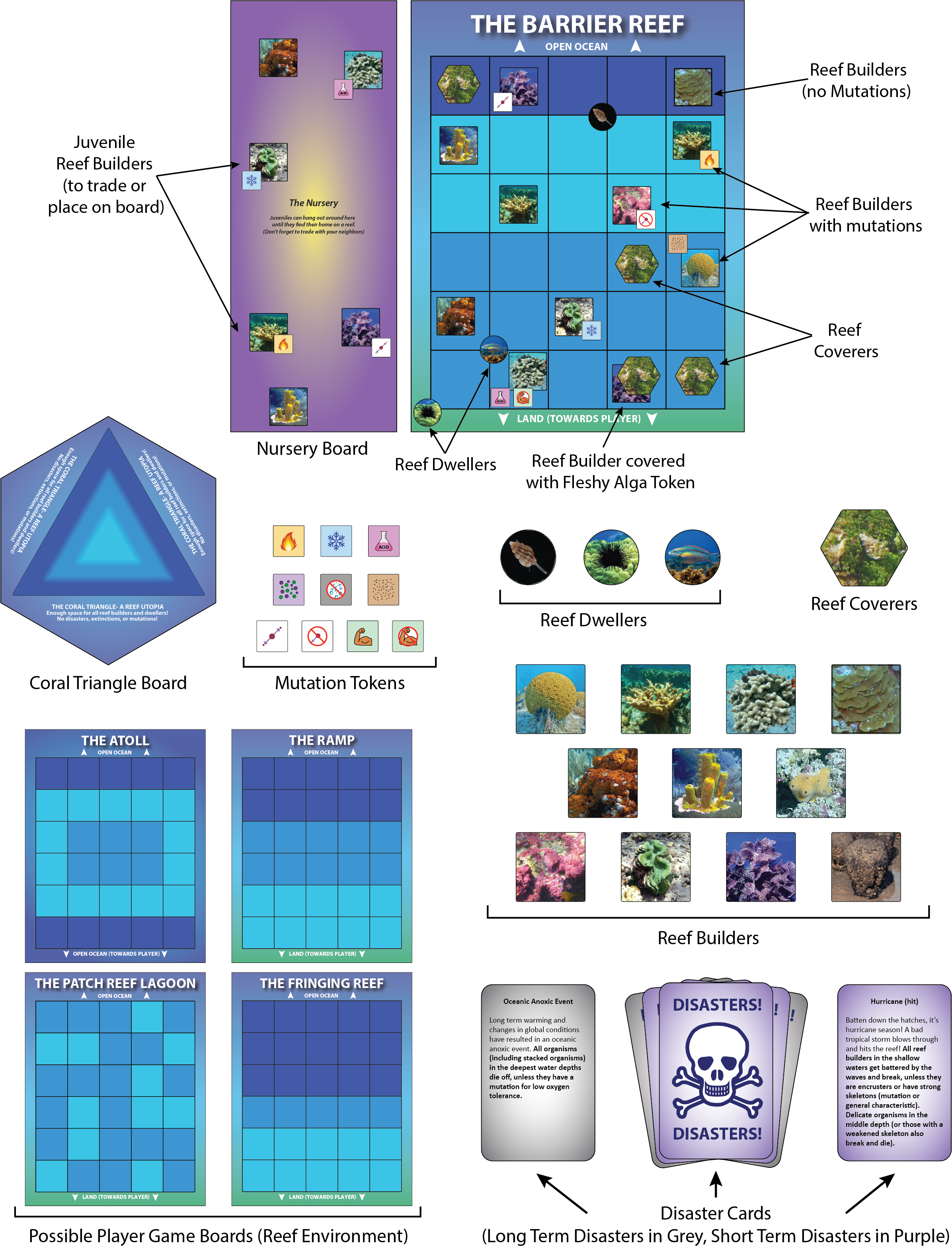
**ONCE YOU HAVE FINISHED THE GAME (STILL IN LAB):**

* Talk to another group about their game outcomes and the disasters they experienced. **You will need this information for the follow-up worksheet.** Each board is like a different region of the world and most of them will not have the same history!
* **Complete the “Follow-up” component of the worksheet.**

**Reef Survivor Pre-Lab Worksheet**

**Background:** The objective of this activity is to familiarize yourself with the different aspects of the game. You will choose your game board and organisms as well as learning about the possible mutations, disasters, and the rules of gameplay! As you learn about the game, you will be able to strategize and develop a plan while also learning about ecology, evolution, extinctions, and how coral reefs may adapt to be resilient to major environmental change.

**Download a copy of the Reef Survivor Gamebook, read through it, and answer the following questions.**

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**Question 1: Who are the reef builders?**

Get to know the reef builders (pages 4-5 and 16-17). Fill out the table below with the names of the reef builders that fit the characteristics described. Note that the table contains a number of different characteristics (e.g., photosynthesizes vs. depth range), so you will need to list the reef builders multiple times, once for each set of characteristics).

Diagram, timeline

Description automatically generated

**Question 2: What components will make up your ecosystem?**

A) Get to know the possible game boards and reef builders! Check out the five possible game boards (pages 2-3). Note that some have land and others do not, some are mainly shallow, and some are deeper. Choose one of the game boards to use for the lab; **explain your strategy** (i.e., which one did you choose and why?).

B) Check out the reef builders that you might add to your reef (pages 4-5 and 16-17). Some of them are made of limestone, some are made of silica, some have zooxanthellae, and some can only live in shallow or deep waters. Use your answer to question 1 to choose five reef builders to add to your ecosystem (i.e., your game board); **explain your strategy** (i.e., which did you choose and why?). Where will you put them on your game board?

**Question 3: What are the dangers?**

A) Check out the possible disasters that you might encounter (pages 19-21). What three disasters might be the most damaging to your reef given the game board and reef builders you have selected (i.e., what are the pros and cons of your particular game board and/or chosen organisms)?

**Question 4: What are the possible genetic mutations?**

1. Read through the instructions for “playing a round”; in phase 1, bullet point 3 (pages 8-10, 18) of your organisms that will mutate. Try a “practice mutation” for each of your 5 organisms. What were the mutations?



1. When would these five mutations improve your organism’s chance of survival? When would these mutations improve your organism’s chance of survival?



1. Give two examples of a mutation that would cancel out another mutation or an inherited organism characteristic.

**Question 5: Assess your strategy -** Are you happy with your choice of game board and reef builders? If yes, why? If not, what would you change and why? **Feel free to change your reef set up based on what you learned in this worksheet.**

You have just done the “Game Set-Up”. In lab, we will start with a quick game set up (you can use the strategy you have outlined here or modify your strategy). Once you have established your reef community, you will jump ahead a million years into your reef’s future to see if it will thrive! Read through the steps you will play in each “round”; be prepared to quickly complete a round at the beginning of the lab period.

**Reef Survivor Follow-Up Worksheet**

1. a. What was the composition of the community at the start of the game? Refer back to the photo taken of your reef BEFORE Disaster #1

b. What was the composition of the community at the end of the game?

c. How did the diversity of your community change over time (e.g., what was the diversity after each disaster?)

d. How is the diversity of your game board different from the abundance of reef builders (e.g., were there times when you had a low diversity but still lots of reef builders, or vice versa)?

e. How even is your community (i.e., a community is very even if there are the same number of each type of organism, an uneven community has a few of one species and many individuals of another)?

2. a. Which were the worst disasters for your reef? For your whole table?

b. Talk to another group, which were the worst disasters for their reef? For their whole table?

3. a. Do genetic mutations occur for the good of the organism or are they random? Do they help or hurt organisms? Or can they do both?

b. Using your experience with the reef game, provide an example of a mutation that was beneficial, another that was detrimental, and a third that was neutral. Include the organism, mutation, and disaster in your examples.

c. If a mutation helps a reef organism survive, explain how it becomes more abundant in a community over time.

d. Can an organism or species "prepare for" environmental changes or stresses? Explain your answer. What does this tell you about natural selection?

e. Does natural selection always impact a community in the same way? Explain your answer.

4. a. Which community is more likely to survive environmental change, one with lots of only a few types of reef builder, or a community with many different types of reef builder? Why?

b. What are some things a conservationist might do to help a reef ecosystem survive environmental change like we are seeing today (i.e., climate change, rising CO2 levels, acidification, pollution, and overfishing)?

5. Find an example of a reef like yours from any place of the world. What are the similarities? What are some potential disasters or threats you might expect in this reef ecosystem?