Name_____

DATA Nugget

The sound of seagrass

Featured scientists: Megan Ballard (she/her) and Kevin Lee (he/him) from the University of Texas at Austin. Scientist team: Preston Wilson, Kenneth Dunton, Kyle Capistrant-Fossa, Colby Cushing, and Thomas Jerome

Research Background:

Seagrasses are a type of plant that grows underwater. They have long, green leaves and form thick underwater meadows. Seagrass meadows have high plant **productivity**, or growth, which could help offset the effects of climate change. A major driver of climate change is excess carbon in the atmosphere. Plants can help by pulling carbon from the atmosphere during photosynthesis. Because seagrasses have such high productivity, a lot of carbon is stored in the sediment below them.

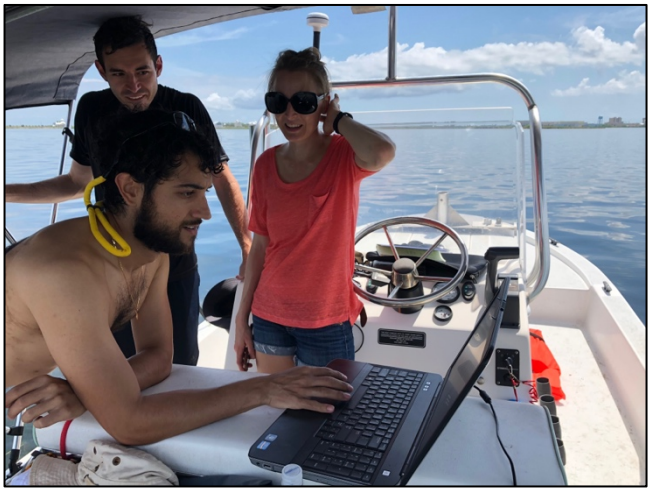
Underwater view of a seagrass meadow.

Megan and Kevin live in Texas, where these seagrasses are an important part of Gulf Coast ecosystems. Although Megan and Kevin are not ecologists, their expertise is in underwater sound. They are working with biologists to determine the value of applying sound-based methods to monitor the productivity of seagrass meadows.

If you know how to listen, seagrass meadows are full of sound! Sound sources include waves, wind, rain, shrimp, fish, boat engines… and the seagrass itself! It might be surprising that plants produce sound, but Megan and Kevin found that sometimes seagrasses are the main source of naturally occurring, or **ambient,** sound.
So where does this sound come from? Pulsating sounds are made when bubbles are released from the seagrass leaves. Seagrasses emit oxygen into the water during photosynthesis and most of the time this oxygen dissolves into the water. However, when the water has reached its limit and cannot hold more oxygen, bubbles are formed. Megan and Kevin wanted to see whether they could use these bubbles to monitor the photosynthesis levels in seagrass meadows through sound.

They started by developing a technique to record measurements of ambient sound in the underwater ecosystem. In the laboratory, they were able to use measurements of sound waves to determine a bubble's size. However, when the ambient sound from

seagrass meadows is recorded, there are many bubbles produced simultaneously. This means it is not possible to identify all the bubbles individually through sound recordings. Instead, Megan and Kevin decided to look at changes in the ambient sound level of the meadow as a measure of how much oxygen is produced.



Megan and graduate students examining seagrass sound data in the field.

Megan and Kevin wanted to see whether ambient sound levels were noticeably different during peak photosynthesis times. You can relate this to how the background noise changes throughout your school day. The ambient sound level in school is louder during lunchtime when many students are talking at the same time. It's not possible to identify all the individual conversations taking place throughout the room, but the overall background sound level is higher during lunchtime than when you are doing schoolwork or taking a test.

Similarly, the sound of bubble production during photosynthesis is expected to increase the ambient sound level during periods of high productivity. Additionally, bubbles will be produced when the surrounding water is supersaturated with oxygen, indicated by the time the dissolved oxygen level is greater than 100%.

After they developed their methods, Megan and Kevin headed to the field! They placed a hydrophone (underwater microphone) in the seagrass meadow to record ambient sound data for a year. The hydrophone recorded thirty-second audio clips every ten minutes and they analyzed the clips for sound level, measured in decibels. They also installed a sensor that recorded the dissolved oxygen levels at the site.

Scientific Question: How can measurements of ambient sound levels be used to monitor photosynthesis in seagrass meadows?

What is the hypothesis? Find the hypothesis in the Research Background and underline it. A hypothesis is a proposed explanation for an observation, which can then be tested with experimentation or other types of studies.

Name_____

Scientific Data: In the table below, you will find the ambient sound levels and dissolved oxygen levels over a single day in the seagrass meadow.

Use the data below to answer the scientific question:

Time (hr)	Sound Level (decibels)		Dissolved Oxygen Level (%)	
	Average	Standard Deviation	Average	Standard Deviation
1	35	0.6	72	6
3	36	0.9	56	7
5	36	0.6	32	8
7	37	1.8	26	12
9	39	1.1	99	32
11	45	2.5	173	15
13	48	0.2	207	14
15	48	0.4	231	3
17	47	0.9	221	10
19	43	2.2	179	18
21	38	1.9	129	13
23	35	0.7	88	12

Which data will you graph to answer the question?

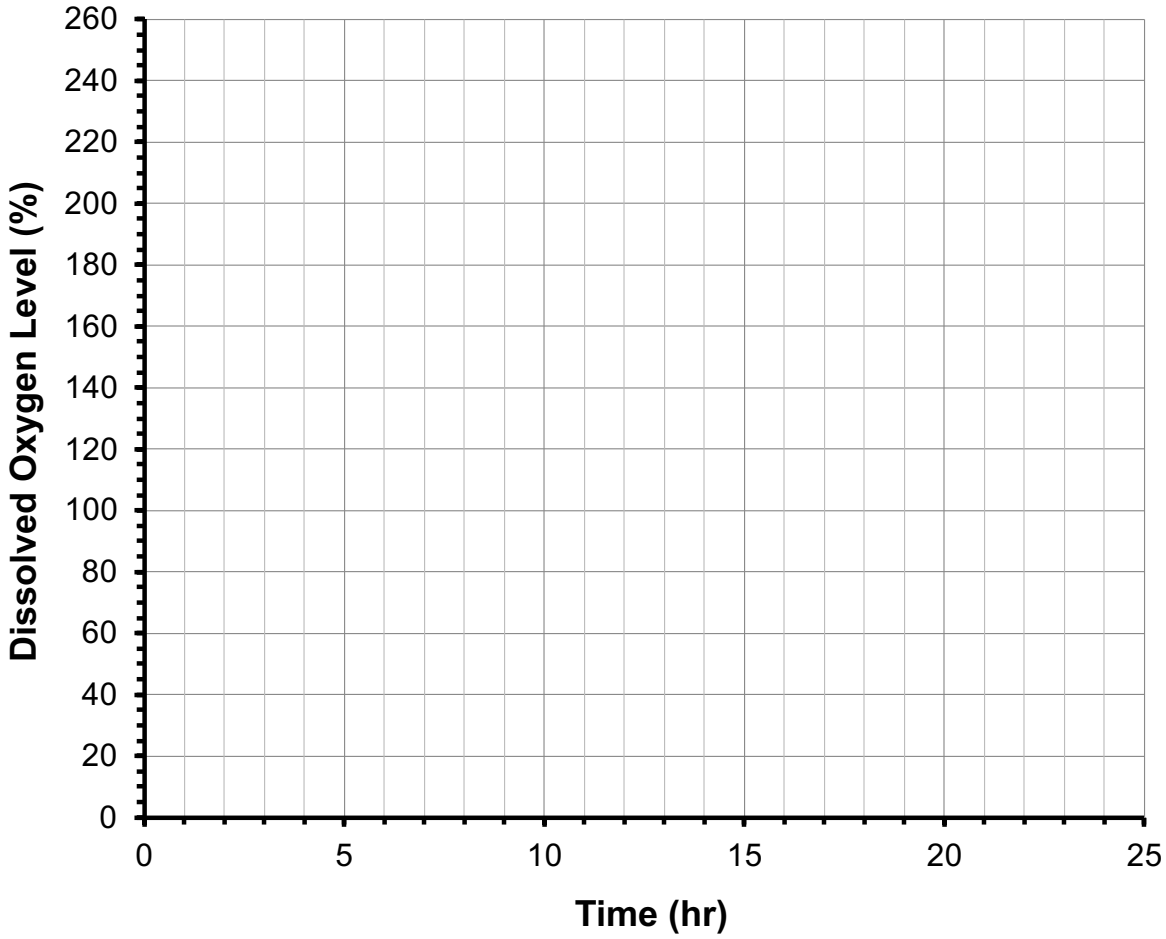
Independent variable(s): _____

Dependent variable(s): _____

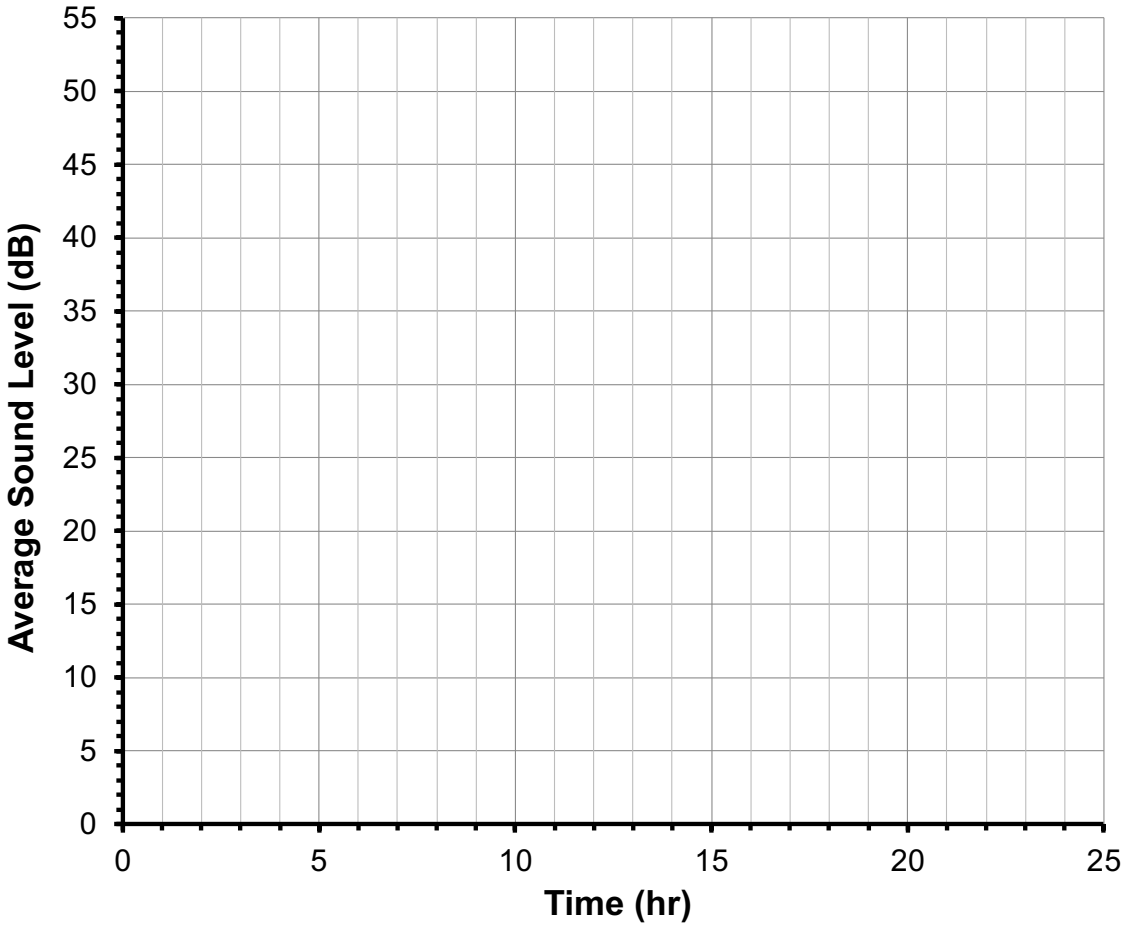
_____

Name_____

Draw your graph(s) below: Identify any changes, trends, or differences you see in your graph(s). Draw arrows pointing out what you see and write one sentence describing what you see next to each arrow.



Name_____



Interpret the data:

Make a claim that answers the scientific question - how can measurements of ambient sound levels be used to monitor photosynthesis in seagrass meadows?

Name_____

What evidence was used to write your claim? Reference specific parts of the table or graph(s).

Explain your reasoning and why the evidence supports your claim. Connect the data back to what you learned about using sound to study seagrass photosynthesis.

Did the data support Megan and Kevin's hypothesis? Use evidence to explain why or why not. If you feel the data are inconclusive, explain why.

Name_____

Your next steps as a scientist: Science is an ongoing process. What new question(s) should be investigated to build on Megan and Kevin's research? How do your questions build on the research that has already been done?