Name_____

DATA Nugget

Eavesdropping on the ocean

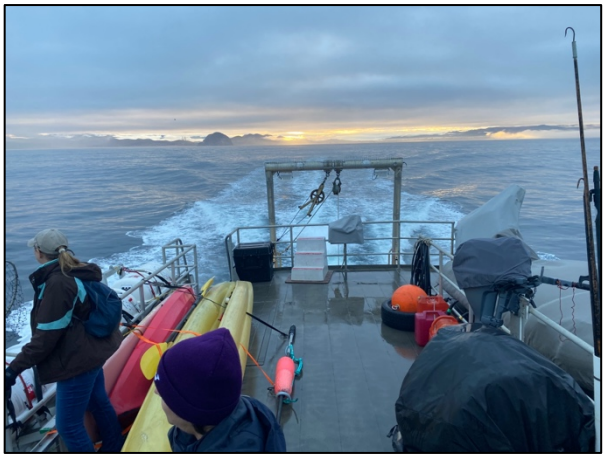
Featured scientists: Shannon Rankin from the NOAA Southwest Acoustic Ecology Lab and Desray Reeb from the Bureau of Ocean Energy Management

Research Background:

Most of our energy in the United States comes from fossil fuels like natural gas, coal, and oil. These energy sources are efficient, but they release greenhouse gases into the atmosphere when burned. They are also non-renewable, meaning there is a limited supply. **Renewable** energy options collect energy from sources that are naturally replenished, such as sunshine, wind, and even ocean waves. By using renewable energy sources, we can fuel our lives without depleting fossil fuel supplies.

Windmills have been used by humans to capture energy from the wind long before electricity was discovered. Historically, they were used to pump water and grind grains to make flour. Today, they are used to generate electricity that can be used in your home. Most of these modern windmills (also known as turbines) are located on land, but researchers and engineers are exploring a new type of site – the ocean.

Offshore wind energy sites in the U.S. are usually at least 20 miles from land. Winds that blow over the ocean are much more consistent than on land, making offshore energy more reliable. In addition, land that can be used for windmills is limited, especially in areas where there are already a lot of people. Offshore wind energy could be a solution where there are a lot of people living along the coast.



Scientists visiting a proposed wind energy site.

Careful planning goes into these large-scale projects. Before any construction begins, scientists want to make sure the benefits outweigh the costs. One topic of concern is marine mammals. Many marine mammals, like whales, are federally protected, and some are endangered species. Scientists are worried that the construction of offshore windmills could impact the whales that live or migrate through the designated wind energy areas.

Whales use sound transmitted through the water to survive. Just like many animals on land, they use sound to communicate, navigate, find food, and avoid predators or other threats. Noise from construction activities could cause whales to avoid the area.

They may need to find a new area to find food, rest, or find mates. Whales typically migrate, so loud noises could also interfere with their migration route.

Shannon is an acoustic ecologist, meaning she uses sound and how it is transmitted to learn more about organisms and their environment. She works with Desray, who is a research biologist specializing in marine mammals. Together, they are leading a large project to collect sound data to assess the risks of a proposed offshore wind energy site off the coast of central California. One specific goal they have is to see whether it is possible to identify the best time of year to build the wind energy platforms with the least disturbance to marine mammals. To do this, they had to learn more about when whales are using and traveling through the area of the proposed site.

Acoustic ecology is a way to learn more about whales and their behavior through sound, which is important because visual detections are limited and take a lot of time out at sea. Instead, scientists can analyze acoustic data to detect which species are present. Each species makes different sounds with unique patterns, and by listening, we can identify which species are in the area.

Deploying the drifting acoustic recorders: Scientists attach a weight to the line and wait to get into position (left), orient the pole buoy with the satellite transmitter on top (middle photo), and let out the line with the acoustic recorder and surface floats (right).

Shannon and a large team of supporting scientists worked together to design floating acoustic recorders. They partnered with Desray to deploy them in the proposed offshore wind energy area. Once the recorders are launched, the team uses satellite location to follow the movement of the recorders from shore. They let the recorders drift in the open ocean for several days before they board a large research boat and pick them up again. While the recorders are drifting, they are continuously recording the ocean sounds below. These drifting recorders cover a larger spatial area, for a longer time, than other types of passive acoustic monitoring methods. The team launched the acoustic recorders in different seasons to learn which whale species are using the proposed site throughout the year and to assess what time of year would have the lowest whale presence near the construction site.

Name_____

Scientific Question: What time of year should wind energy platforms be built to reduce interference with whale populations?

Scientific Data:

Use the data on whale sound detections from the drifting buoys to answer the scientific question.

				Number of hours with detections			Proportion of hours with detections		
Drift Number	Year	Drift Month	Number of hours deployed	Sperm whale	Humpback whale	Blue Whale	Sperm whale	Humpback whale	Blue Whale
ADRIFT_046	2023	March	123	0	116	0	0.00	0.94	0.00
ADRIFT_047	2023	March	123	0	0	0			
ADRIFT_048	2023	March	167	0	0	0			
ADRIFT_049	2023	March	118	0	0	0			
ADRIFT_050	2023	March	119	0	100	0			
ADRIFT_051	2023	March	119	0	0	0			
ADRIFT_052	2023	March	121	0	97	0			
ADRIFT_053	2023	March	122	0	0	0			
ADRIFT_079	2023	July	117	0	0	58			
ADRIFT_080	2023	July	120	0	0	104			
ADRIFT_081	2023	July	117	0	0	94			
ADRIFT_082	2023	July	93	0	0	79			
ADRIFT_083	2023	July	116	0	0	0			
ADRIFT_101	2023	November	98	0	87	75			
ADRIFT_102	2023	November	99	0	66	35			
ADRIFT_103	2023	November	98	18	62	73			
ADRIFT_104	2023	November	100	19	40	21			
ADRIFT_105	2023	November	99	18	47	65			
ADRIFT_106	2023	November	98	20	39	49			
ADRIFT_107	2023	November	96	17	50	72			
ADRIFT_108	2023	November	96	11	80	29			

Note: each time an individual acoustic recorder was launched it was assigned a drift number, therefore each row represents data from one recorder.

Fill in the proportion of hours with detections. Divide the number of hours with detections by the number of hours that drift was deployed. The first row is filled in for you as an example.

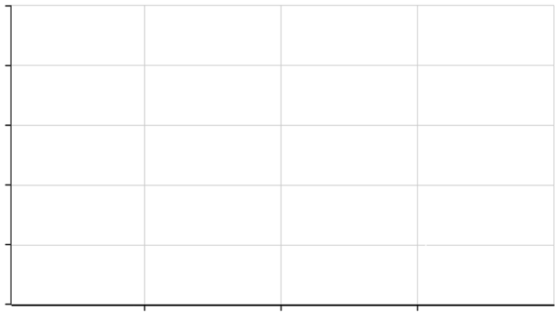
What data will you graph to answer the question?

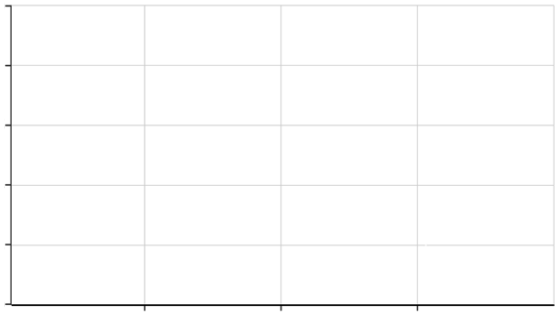
Independent variable(s): _____

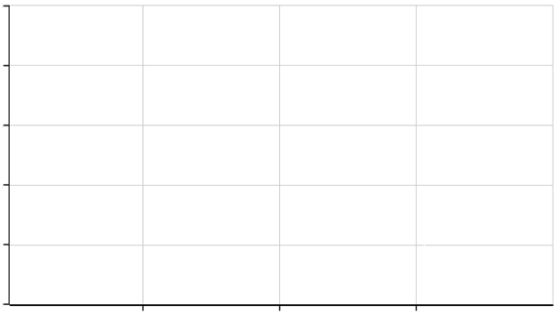
Dependent variable(s): _____

Name_____

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







Interpret the data:

Make a claim that answers the scientific question - what time of year should wind energy platforms be built to reduce interference with whale populations?

Name_____

What evidence was used to write your claim? Reference specific parts of the table or graphs.

Explain your reasoning and why the evidence supports your claim. Connect the data back to what you learned about the potential conflicts that construction noise has with whale behavior.

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