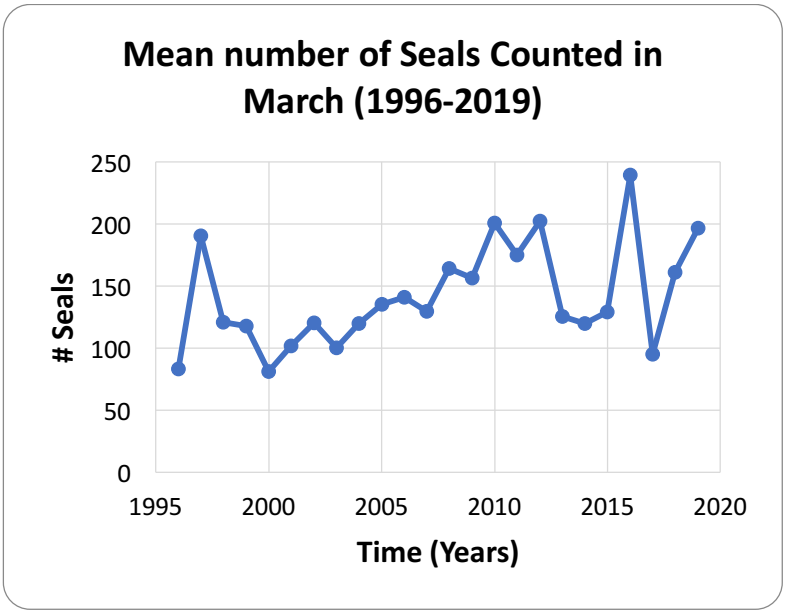
PROJECT O*CEANOLOGY*

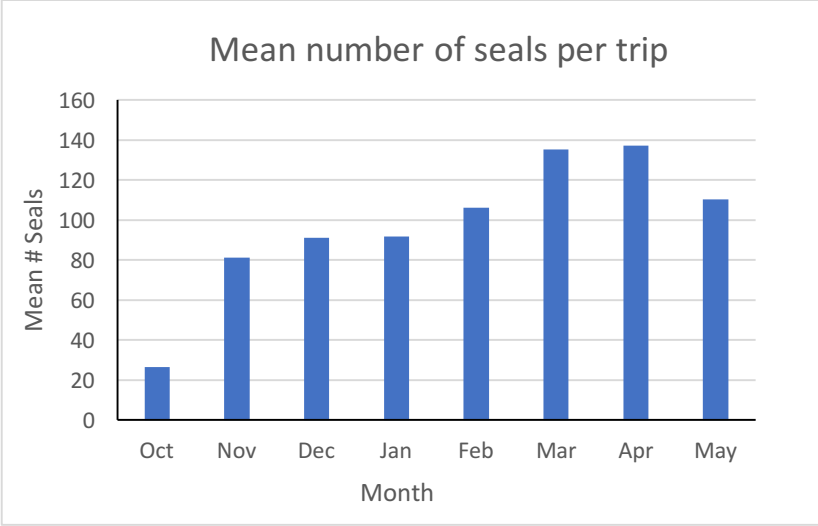
Seal Watch Data Analysis: Teacher Key to Graphs

How has the seal population in Fishers Island Sound changed over time?

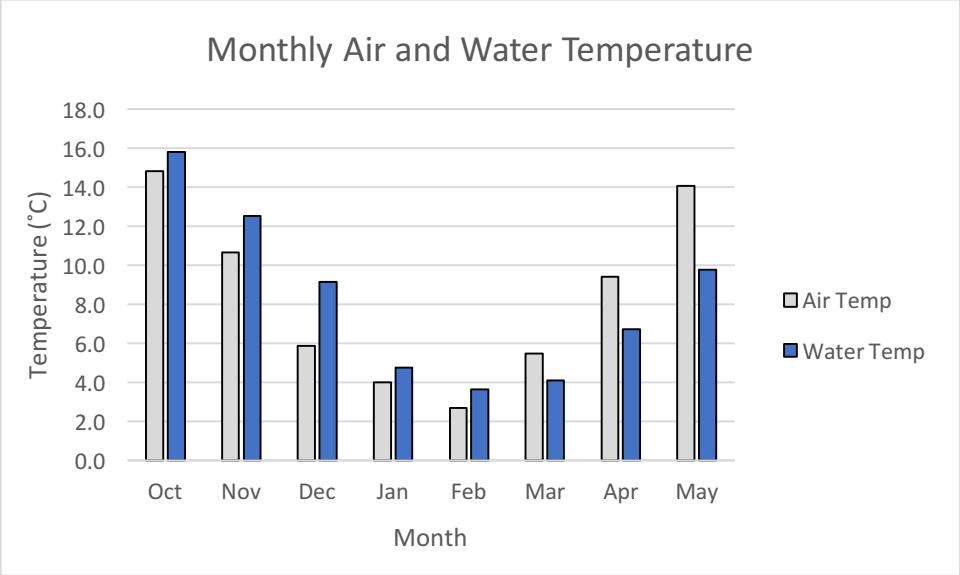


Our time series data are from March, a month when we see large numbers of seals and have historically run the most seal watch trips. The mean number of seals seen per trip fluctuates but has increased overall between 1996 and 2019. This is consistent with data from NOAA and other sources: seal populations in our region have increased over the past several decades.

How does the seal population in Fishers Island Sound change over the course of a year?

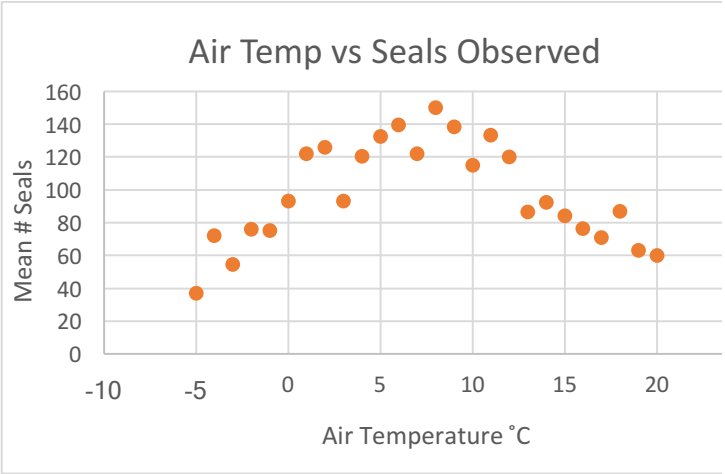


Seals arrive in our waters in October, and depart in May. We see the most seals on trips in March and April. For advanced classes: one interesting reason for this can be found in the monthly air and water temperature graph below.



Seals haul out to warm up, and the thermal benefit of hauling out is greatest when the air is warmer than the water. In October-February, conditions are the opposite (water temperature is warmer than air), but beginning in March, air temperatures are frequently warmer. Thus, we are more likely to see them hauled out in the spring months.

How does air temperature affect the number of seals observed?



The number of seals observed increases as air temperature increases between -5˚C and 10˚C. This is likely because seals derive more thermal benefits from hauling out in warmer air temperatures. However, at temperatures higher than 10˚C, the number of seals declines again. Seals can actually get too hot at high temperatures, so it's possible that they stay in the water to avoid overheating.

There could also be a seasonal effect: the warmest air temperatures in our dataset occur in October and May, when there are fewer seals present.

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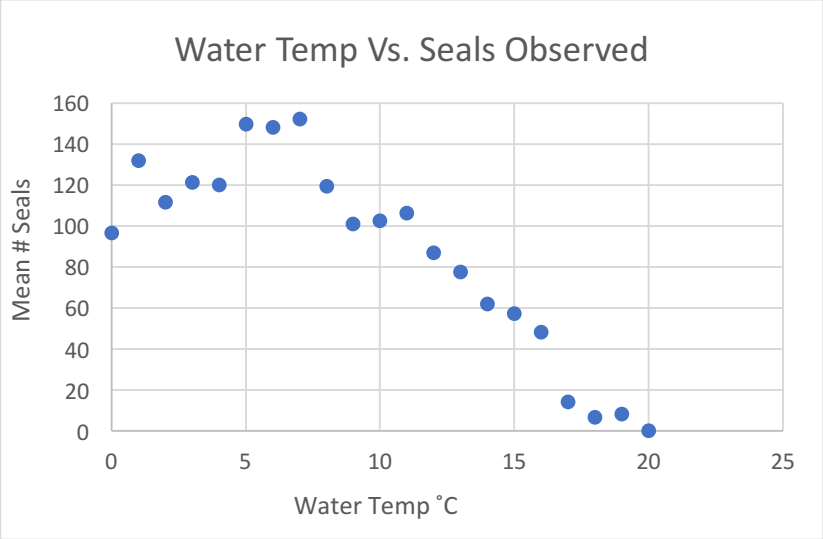
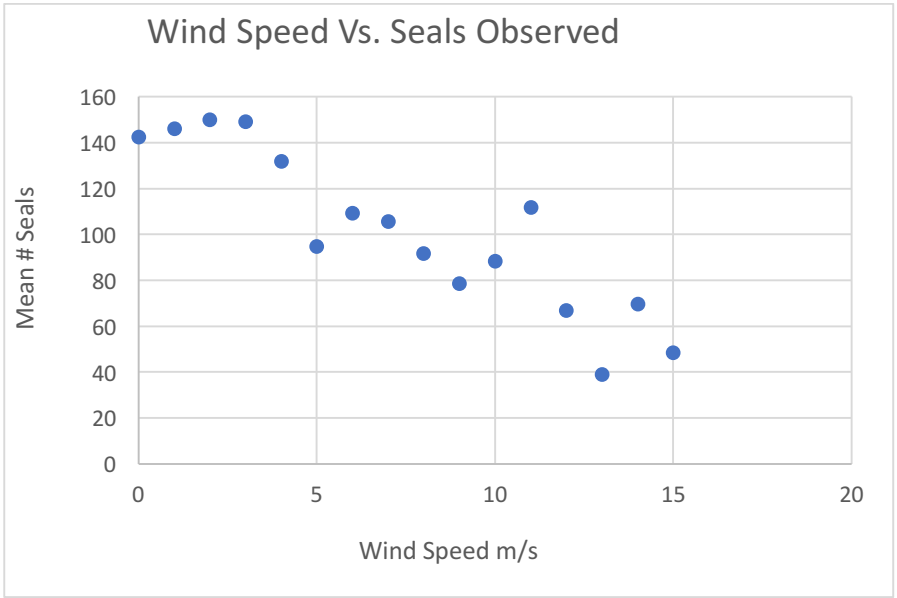
How does water temperature affect the number of seals observed?



The number of seals observed declines with increased water temperature. This is not surprising: seals overheat in warm weather, and mammals lose body heat much faster in water than in air. On days when the air and water are both warm, they're better off in the water! The warmest water is also observed in October, when fewer seals are present because most are still migrating from Maine and Canada.

How does wind speed affect the number of seals observed?



The number of seals observed declines with increasing wind speed. There are several reasons for this. On windy days, wind chill and wave splash can decrease the effective air temperature, and seals do not gain as much thermal benefit from hauling out. There could also be an observer bias: it's harder to see and count seals from our boat in windy conditions!

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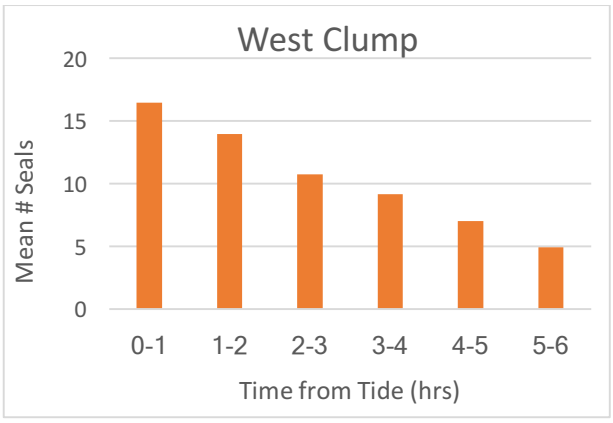
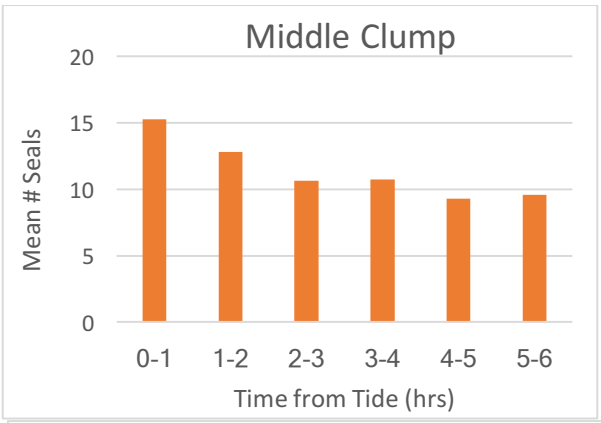
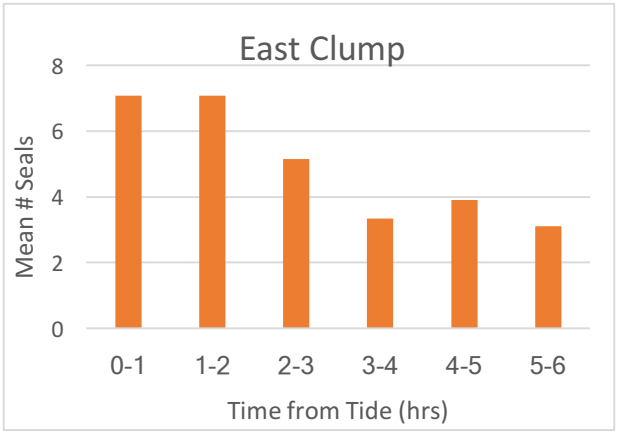
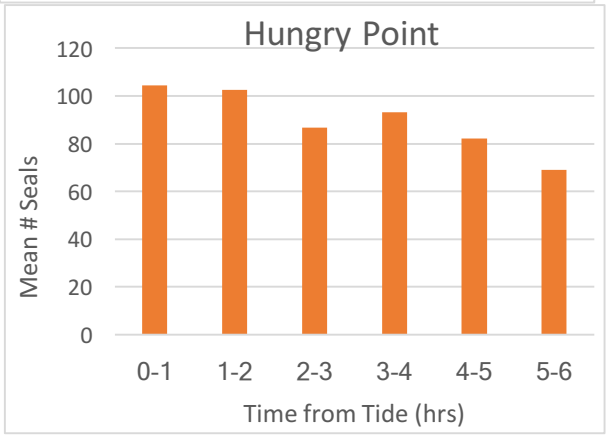
How does time of tide and location affect the number of seals observed?



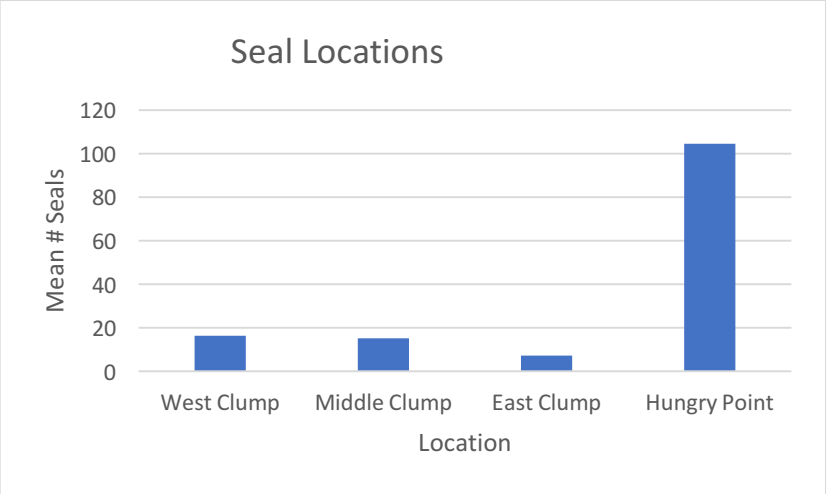


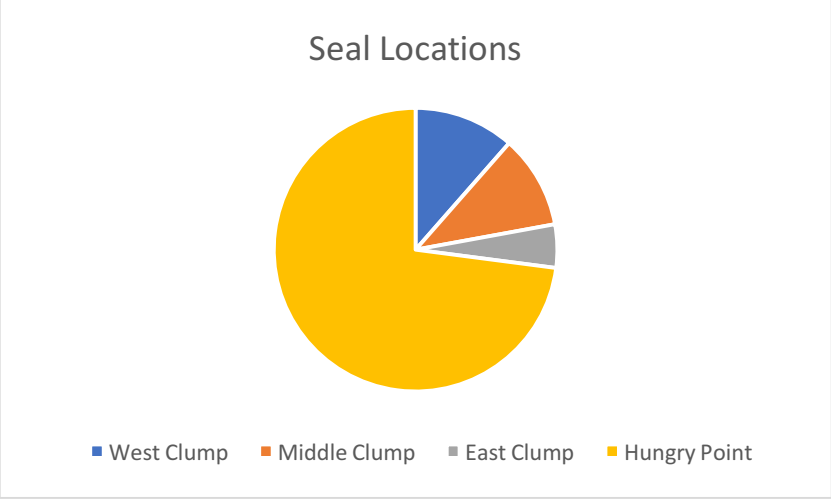




The lower the tide, the more seals we see. This is true for all locations, but the pattern is strongest at West Clump, which is frequently completely underwater at high tide. This dataset can also be used to show that different locations have different numbers of seals (particularly if you did not assign the location research question below). Compare the y-axes on the graphs above – we see the most seals at Hungry point. West Clump and Middle Clump are a distant second, and we see the fewest seals at East Clump. The number of seals is determined by the amount of available haul-out space. On their boat trip, students may have noticed that East Clump was a small cluster of rocks, and that many of them were too tall and steep for seals to haul out. In contrast, Hungry Point has large numbers of shallow rocks, and is also more protected.

How does location affect the number of seals observed?





This is one of the few research questions for which a pie chart might be appropriate. A column graph works as well, although it's harder to see the differences between West Clump, Middle Clump, and East Clump.

We see the most seals at Hungry point, with West Clump and Middle Clump a distant second, and the fewest seals at East Clump. The number of seals is determined by how sheltered the location is and by the amount of available haul-out space. On their boat trip, students may have noticed that East Clump was a small cluster of rocks, and that many of them were too tall and steep for seals to haul out. In contrast, Hungry Point has large numbers of shallow rocks, and is also more protected.

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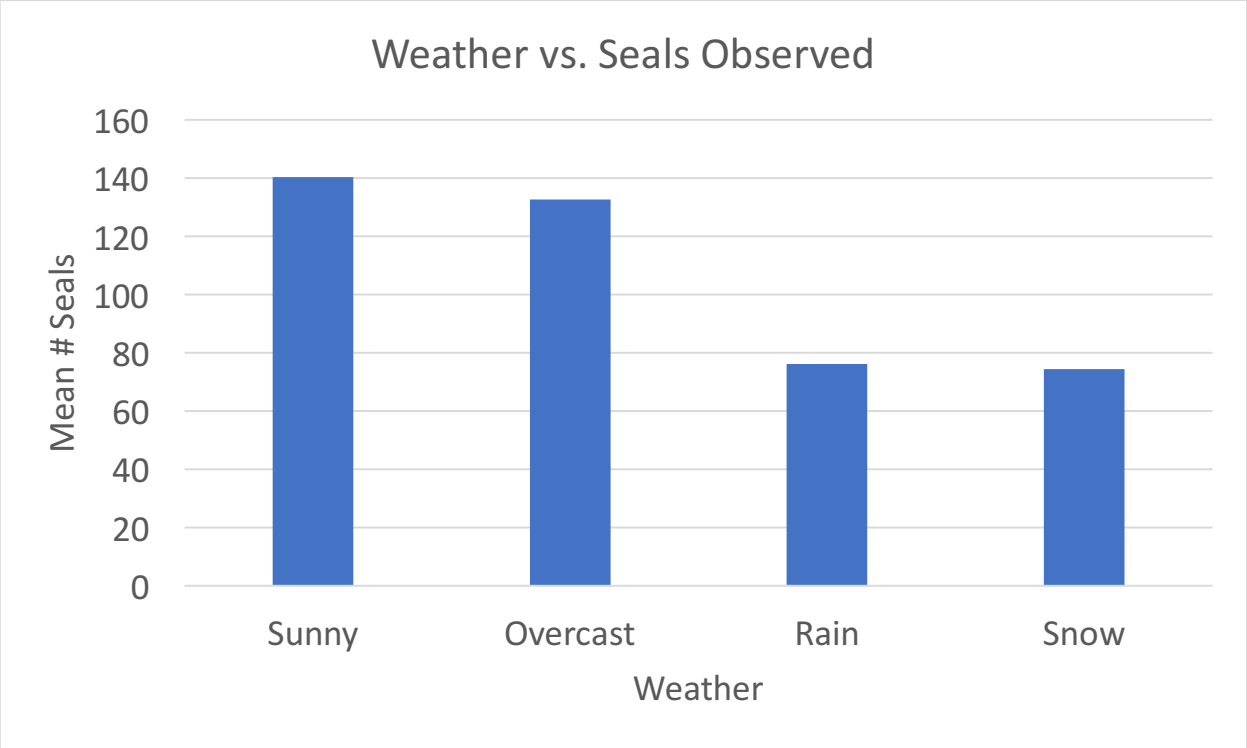
How does weather affect the number of seals observed?



We see fewer seals when it is raining or snowing. This is because seals can't get dry when they haul out under those conditions, so they don't get as much of a thermal benefit from being on the rocks. Interestingly, we do not see a big difference in the number hauled out in sunny vs. overcast conditions. If there is an advantage to hauling out in the sun, it's tiny compared to the advantage of being able to get dry.

This dataset may be challenging for students who don't know what to do with the list of numbers for each weather condition. You may choose to suggest calculating an average and/or provide the formula to do so, or just let them flounder a little and try to figure out the best way to show the data.

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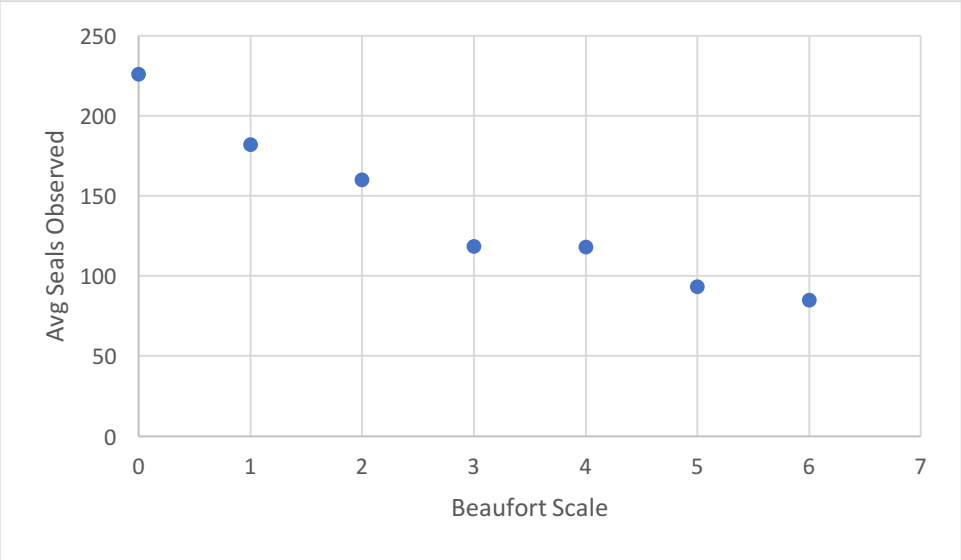
How does Beaufort Scale affect the number of seals observed?



Beaufort scale is a measure of how rough the seas are. It is strongly correlated with wind speed, although it is also affected by other factors such as local geography, ocean currents and waves, etc. It may be helpful to think of the Beaufort Scale as a measurement of how the wind affects the sea surface.

As the Beaufort scale increases, the number of seals observed decreases. In rough seas, seals do not gain much thermal benefit from hauling out because they are constantly splashed by waves and buffeted by wind (wind chill is also a factor). There may also be observer bias: it is more difficult to count seals in rough seas!