

AGAINST ALL ODDS
EPISODE 10 – “SCATTERPLOTS”
TRANSCRIPT

FUNDER CREDITS

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INTRO

Pardis Sabeti

Hi, I'm Pardis Sabeti and this is *Against All Odds*, where we make statistics count.

Manatees. These slow-moving sea creatures loll and munch their days away in the warm waters off the Florida coast. They have a certain lumpy cuteness to them... but it must have been wishful thinking that made early European explorers mistake manatees for mermaids!

The gentle giants can weigh more than half a ton – and since they're mainly herbivores, they keep their weight up by feasting on underwater vegetation in shallow coastal waters. They pretty much have no natural predators.

That doesn't mean they don't face any threats, though. Human-related fatalities are a major contributor to manatees' endangered status. Their inquisitive friendliness and their tendency to hang out just under the water's surface can put manatees in the direct path of motorboat propellers.

Marine Biologist

This manatee here is using a line that we call the dental flossing line for manatees. If you're not real careful when you start your motor you could inadvertently end up injuring one of these beautiful animals.

Pardis Sabeti

Many collisions are fatal, and almost all adult manatees are crash survivors – which you can see from the propeller scars on their bodies.

In the wintertime, Florida manatees congregate in warm water areas... areas like the waste heat outlet channel of this power plant. Officials know where manatees are likely to be and impose speed limits on boats to try to protect the marine mammals.

Coast Guard Officer

If you take your boat out of gear, I'll be coming on your port side. Y'all going to have to be more conscientious of this manatee zone, that's too fast in there. I know you don't want to hit one of them, I'm sure you don't want to do that. Watch your water. A good way to tell is you look at the back of your boat, if you're peeling off that white water off the back of the boat it's too fast...

Pardis Sabeti

Even with these precautions, researchers noted back in the 1980s that manatee deaths were rising every year... but why? Were people or manatees behaving in different ways than they had in the past? Statistics to the rescue!

Statistics can help us take a closer look at the relationship between all those motorboat propellers in Florida waterways and manatee fatalities. The number of deaths and the number of powerboat registrations are both quantitative variables – that means they can be measured numerically and we can plot their values. Instead of looking at a single variable, like we did using stemplots and histograms, we can create a scatterplot to consider the relationship between these two variables.

Here we have the data on boat registrations and manatees killed by boats every year from 1977 to 2011. To make a scatterplot we first draw horizontal and vertical axes. But which variable should we plot on which axis?

We suspect that the number of powerboats in the water helps explain the number of manatees killed. So we call the number of powerboat registrations the explanatory variable. And the explanatory variable always goes on the horizontal axis.

Here that's powerboat registrations, which we're showing in thousands. We expect that the more boats that are in the water, the more manatees will be killed, all things being equal. Or to put it another way we assume that the number of manatees killed is a response to the number of boats in the water. So we call the number of manatees killed the response variable and plot it on the vertical axis.

In 1977 the number of registrations was 447,000 and the number of manatees killed by boats was 13. In 1978, there were 460,000 registrations and 21 manatees killed. We keep plotting the points for all the data we have and come up with this picture. What does the scatterplot tell us?

The data confirm our suspicions: as boat registrations rose, so did manatee fatalities. See how the pattern goes from the lower left to the upper right? As one variable increases, so does the other. This is called a positive association – not positive for the manatees, of course, but positive in a statistical sense.

A negative association would be when one variable increases while the other decreases. Learning a skill is a classic example of a negative association. Think about the relationship between, say, how long it takes you to make a pie and how many times you make one. As the number of times you've baked your award-winning pie increases, the amount of time it takes you to create each pie decreases 'til you've mastered the skill. So we say these two variables exhibit a negative association.

There's another feature to look at in our manatee scatterplot. The points roughly fall in a line... we call this pattern linear. Of course all the points don't fall exactly on a perfect straight line, because this is real-world data and reality is rarely so cooperative. But within the realm of statistics, this scatterplot is certainly linear. In fact since the points don't deviate much from a line, we can say that the linear relationship is 'strong' between boats in the water and dead manatees. If our data were all over the place, with lots of deviation from the line, we would call the relationship 'weak.'

Keep in mind that not all relationships are linear. Some relationships show a curved pattern, like this one where the variables start out increasing together, but one speeds up. Or maybe there's no pattern at all.

When you're looking at a scatterplot, you'll want to think about the overall pattern, how strong it is, and its direction. Keep your eyes peeled for deviations from the pattern too – outliers can hold important information about your data.

A scatterplot can show you the nature of a relationship between two variables. But it definitely doesn't prove why the relationship exists. The changes in one variable don't necessarily cause the changes in the other. Back to our old buddies the manatees... Rather than more boat registrations causing more manatee deaths, I can imagine lots of other factors that our scatterplot doesn't take into account that could tell a different story. Maybe the years with more deaths happen to be cooler so manatees cluster even more than usual into the warm water areas where boats are. Or maybe there's an unrelated manatee disease that happened to flare up during the years that boat registrations were higher that made manatees sluggish and less able to get out of the way of motorboats.

But identifying this relationship is a start, and provides enough evidence for the state of Florida to think more about how to protect manatees from those deadly propellers.

Tom O'Shea

The problems the animals face are directly related to the growth of the state and we have to accommodate the animals as we accommodate the human growth. And they're extremely adaptable animals. They're tough, they're resilient. If we just give them a chance I think we can keep them around.

Pardis Sabeti

I'm Pardis Sabeti for *Against All Odds*. See you next time!

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