Name_____

DATA Nugget

Guppies on the move

Featured scientists: Isabela Borges (she/her) and Sarah Fitzpatrick (she/her) from the Kellogg Biological Station at Michigan State University

Research Background:

Guppy parents looking for an ideal place to lay their eggs. Photo by Eva Fischer.

Animal parents often choose where to have their offspring in the place that will give them the best chance at success. They look for places that have plentiful food, low risk of predation, and good climate.

Even though parents pick out these spots, individuals often move away from their birthplace at some point in their lives. Why do animals move away? There are risks that come with moving from one place to another. It can be dangerous to go through unknown places - potentially stumbling into predators or being exposed to diseases. But there can also be benefits to moving, such as discovering a better spot to live as an adult, finding mates, and spreading out to reduce competition.

As someone who loves to travel and has lived in four different countries, Isabela can relate! Isabela likes to see new places, try new foods, and learn new languages. But there can be drawbacks, and occasionally she finds it hard to be in a completely new place. Sometimes people don't understand her accent, or she can't understand them. She also misses her family when she is away. Knowing that traveling and moving can have such highs and lows for herself, Isabela wanted to know more about what motivates animals to seek out new places.

To follow her curiosity, Isabela found a graduate advisor who was also interested in animal movement. She joined Sarah's lab because she had already collected data on the movement of small tropical fish called guppies. Sarah is part of a large collaborative project, where researchers from all over the world come together in Trinidad to study these fish populations.

Name_____

When Sarah first started collecting data in this system, she wanted to track how far guppies move from one place to the next. She used established protocols from previous work in this system to set up a study. With the help of a team, she captured every fish in two similar streams for replication. Every fish that was caught was marked with a small tattoo so the research team could recognize it if it was found again in the future. She did this same procedure every month for 14 months. Each time she sampled the fish, she recorded the individuals that she found and where they were found.

Isabela used this dataset to ask whether guppies benefit from moving from one place to another. In this study, she focused on one type of benefit: having a higher number of offspring. It is through reproduction that animals are able to pass on their genes, so the more offspring an individual fish has, the more successful it is.

First, Isabela used the existing dataset to find out how far each fish moved: if Fish 1 was captured in Portion A of a stream in February and then in Portion B of the same stream in March, Isabela knew it had to move from A to B. She could use the time points to estimate how far each individual had traveled that month.

Guppies from Trinidad.

Second, Isabela used genetics to find out how many offspring each fish had. She looked at genetic markers to determine familial relationships between individuals in each stream. For example, two fish that shared 50% of their genes were probably a parent and an offspring. In this case, the older individual would be marked as the parent. Isabela used the genetic information to build a **pedigree**, or a chart that documents each generation of a population. That way she could track how many offspring each parent had produced.

She used these data to answer her question on whether there are benefits to traveling more. Isabela also wanted to compare whether the potential benefits of dispersal differed across the sexes. Males have to compete for females in order to mate. Isabela wanted to know if males that moved more were able to mate with more females and have more offspring.

Scientific Questions: What reproductive benefits do guppies get from increased movement within a stream? Do these benefits differ for males and females?

Name_____

Scientific Data:

Use the data below to answer the scientific questions:

Fish ID	Stream Name	Sex	Total number of offspring	Total distance moved (meters)
FCA3B4B0911	Caigual	F	0	3
FCA1B2P0906	Caigual	F	5	0
FCA5G6V0907	Caigual	F	0	0
FCA1B5Y0906	Caigual	F	3	42
FCA2G7K0907	Caigual	F	0	13
FCA1O5G0907	Caigual	F	0	36
FCA4V5V8V0907	Caigual	F	0	0
FCA1R2K0905	Caigual	F	0	0
FTY1P5Y0912	Taylor	F	0	0
FTY5B7R1004	Taylor	F	0	0
FTY2W6G0912	Taylor	F	3	0
FTY4V5K1001	Taylor	F	0	0
FTY3G4O5N6N	Taylor	F	4	7
FTY2V4V1004	Taylor	F	0	0
FTY2B7Y0907	Taylor	F	16	4
FTY3B8P0906	Taylor	F	0	198
FTY3K8Y0906	Taylor	F	5	104
FTY3G8K0906	Taylor	F	7	107
FTY5V8V0905	Taylor	F	1	123
FTY5G8G0906	Taylor	F	0	56
MCA5O6Y0907	Caigual	M	0	39
MCA3P6O1004	Caigual	M	0	0
MCA5R6V1002	Caigual	M	0	0
MCA1V2G0910	Caigual	M	29	42
MCA3R6B1004	Caigual	M	0	0
MCA4O5V0911	Caigual	M	0	0
MCA2B7R0912	Caigual	M	0	0
MCA2B4K0912	Caigual	M	4	30
MCA2B3K0901	Caigual	M	3	30
MCA5O8V0906	Caigual	M	3	0
MCA2K7K0907	Caigual	M	0	24
MTY1B3V0912	Taylor	M	0	0
MTY6Y8R0912	Taylor	M	0	0
MTY6Y8O0912	Taylor	M	8	21
MTY3G7G1001	Taylor	M	0	3
MTY4B8Y1001	Taylor	M	5	20
MTY6P8K0912	Taylor	M	12	28
MTY1V2Y1004	Taylor	M	0	18
MTY5B6O0910	Taylor	M	0	0
MTY3G8G0910	Taylor	M	0	0

Name_____

What data will you graph to answer the question?

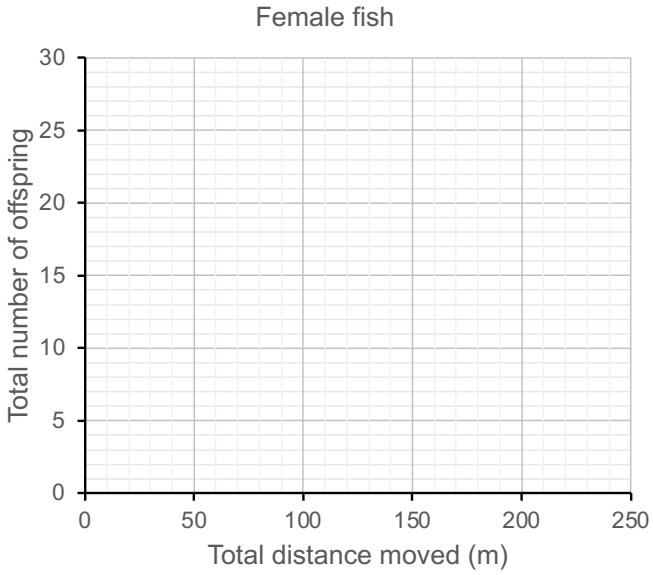
Independent variable(s): _____

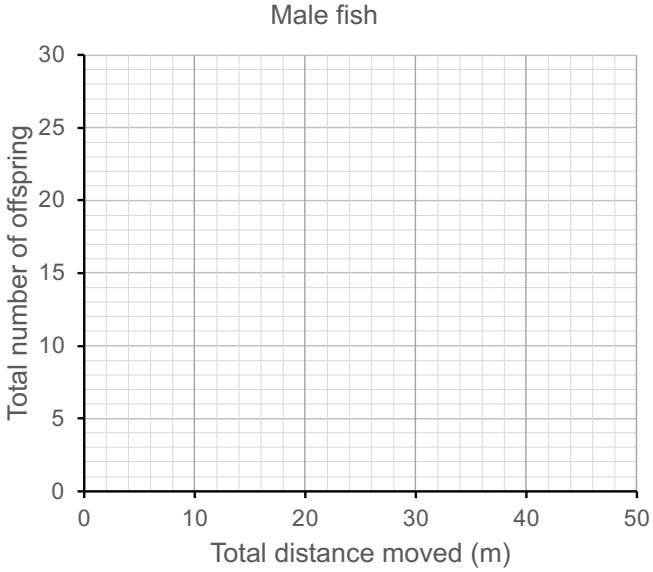
_____

Dependent variable(s): _____

_____

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 questions, What reproductive benefits do guppies get from increased movement within a stream? Do these benefits differ for males and females?

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

Explain your reasoning and why the evidence supports your claim. Connect the data back to what you learned about the risks and benefits of dispersal in animals.

Name_____

Your next steps as a scientist:

Science is an ongoing process. What new question(s) should be investigated to build on Isabela's research? How do your questions build on the research that has already been done?

What future data should be collected to answer your question?

Independent variable(s): _____

Dependent variable(s): _____

For each variable, explain why you included it and how it could be measured.

What hypothesis are you testing in your experiment? A hypothesis is a proposed explanation for an observation, which can then be tested with experimentation or other types of studies.