Name____________________

Make way for mummichogs

Featured scientists: Liz Duff and Robert Buchsbaum from Mass Audubon

Research Background:

Salt marshes are important habitats that contain a large diversity of species. These ecosystems flood with salt water during the ocean's high tide and then drain as the tide goes out. Fresh water also flows into marshes from rivers and streams. Many species in the salt marsh can be affected when the movement of salt and fresh water is blocked by human activity, for example by the construction of roads. These restrictions to water movement, called **tidal restrictions**, can have many negative effects on salt marshes, such as changing the amount of salt in the marsh waters, or blocking fish from accessing different areas.

Figure 1: A mummichog. This species of fish may be the opposite of canaries in a coalmine. They are so hardy, that they can survive extreme changes in salinity, temperature, and water level.

Local managers are working to remove tidal restrictions and bring back valuable habitat. At the same time, scientists are studying how the remaining tidal restrictions impact fish populations. To do this, they measure the number of fish found upstream of tidal restrictions, which is the side connected to the river's freshwater but cut off from the ocean when the restriction is in place. By taking measurements before and after the restriction is removed, scientists can study the impacts that the restriction had on fish populations.

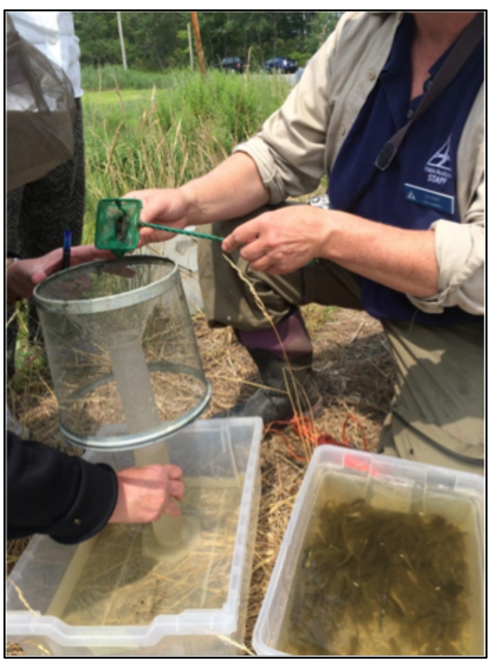


Figure 2: Collecting mummichogs and other fish out of research traps.

Mummichogs are a small species of fish that live in salt marshes all along the Atlantic coast of the United States. They can be found in most streams and marsh areas and are therefore a valuable tool for scientists interested in comparing different marshes. The absence of mummichogs in a salt marsh is likely a sign that it is highly damaged.

In Gloucester, MA, students participating in Mass Audubon's Salt Marsh Science Project are helping Liz and Robert use mummichogs to examine the health of a salt marsh. In 2002 and 2003 Liz, Robert, and the students set traps upstream of a road, which was acting as a tidal restriction. These traps collected mummichogs

Name____________________

and other species of fish. The day after they set the traps, the students returned and counted the number of each fish species found in the traps.

Figure 3: Students participating in Mass Audubon's Salt Marsh Science Project Count fish at Eastern Point Wildlife Sanctuary, Gloucester, MA

In December 2003, a channel was dug below the road to remove the tidal restriction and restore the marsh. From 2004 to 2007, students in the program continued to place traps in the same upstream location and collect data in the same way each year. They then compared the number of fish from before the restoration to the numbers found after the restriction was removed. The students thought that once the tidal restriction was removed, mummichogs would return to the upstream locations in the marsh.

Scientific Question: What effect did the removal of tidal restrictions have on the number of mummichogs found upstream?

Figure 4: In December 2003, scientists dug a channel, which provided fish passage to a culvert under the road. The restoration brought back water flow between upstream and downstream of the tidal restriction.

Name____________________

Scientific Data:

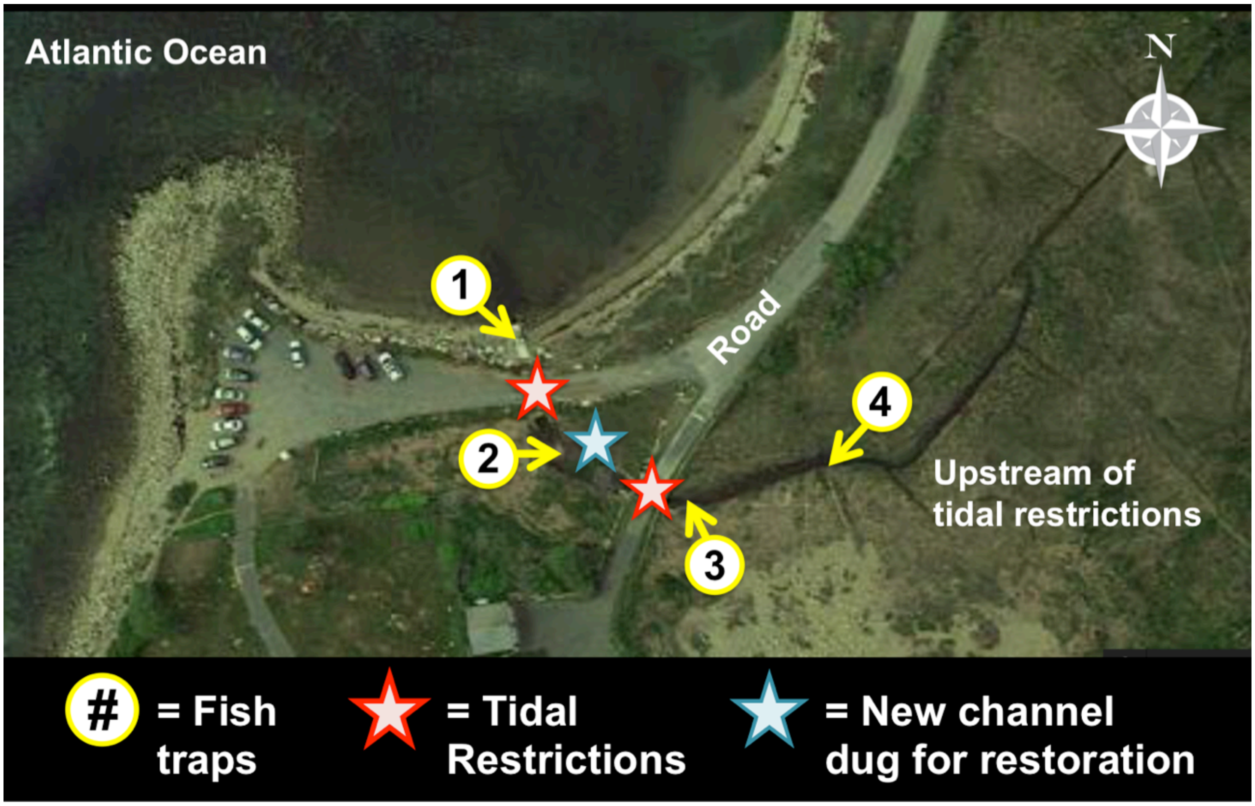
Use the data below to answer the scientific question.

Date	Year	Trap #	Before or After Restoration?	Number of Mummichogs
4/24/02	2002	4	Before	7
4/24/02	2002	3	Before	23
5/8/02	2002	3	Before	0
5/8/02	2002	4	Before	0
5/22/02	2002	4	Before	1
6/3/03	2003	3	Before	1
6/25/04	2004	3	After	14
6/25/04	2004	4	After	13
9/23/04	2004	3	After	78
9/23/04	2004	4	After	37
7/7/05	2005	3	After	25
10/4/05	2005	3	After	123
10/4/05	2005	4	After	161
5/3/06	2006	3	After	373
5/3/06	2006	4	After	30
11/7/06	2006	3	After	68
11/7/06	2006	4	After	355
10/31/07	2007	3	After	680
10/31/07	2007	4	After	656

Calculate the average number of mummichogs trapped upstream each year:

Year	Average Number of Mummichogs	Before or After Restoration?
2002		
2003		
2004		
2005		
2006		
2007		

Name____________________



The data in the table are from Traps #3 and #4, which were upstream of the tidal restriction. Traps #1 and #2 were downstream of the restriction and were only sampled after the restoration.

What data will you graph to answer the question?

Independent variable: ____

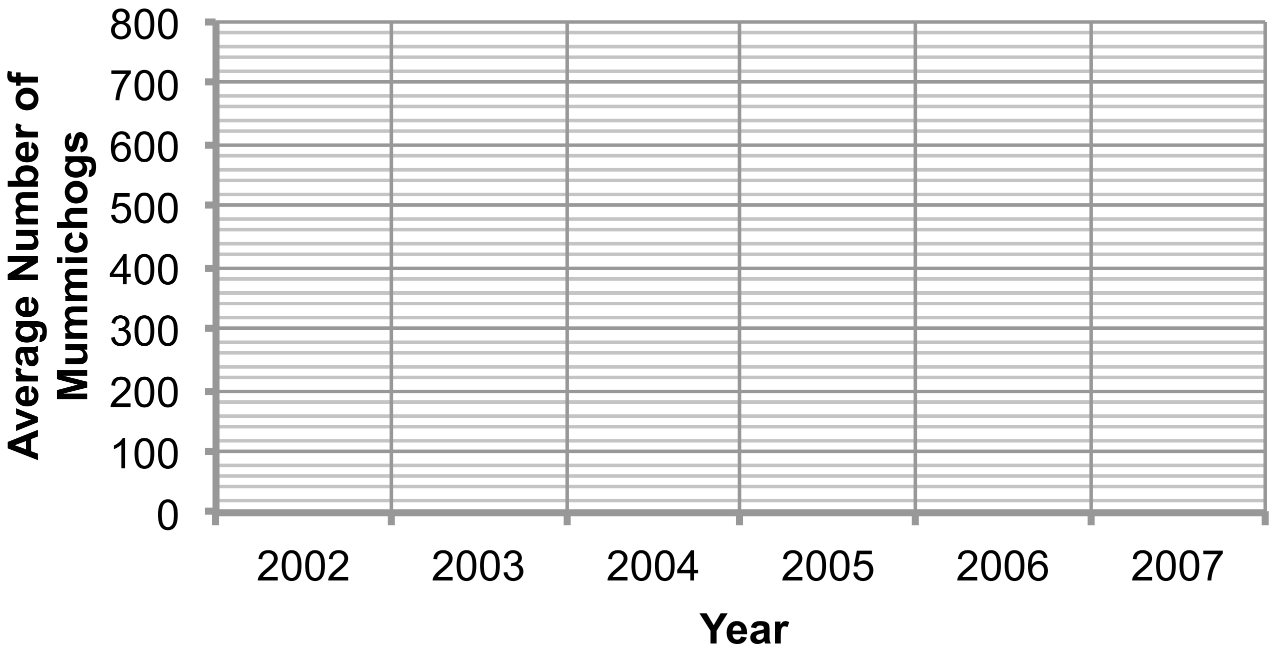
____

Dependent variable: ____

____

Name____________________

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



<u>Interpret the data:</u>

Make a claim that answers the scientific question.

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

Name____________________

Explain your reasoning and why the evidence supports your claim. Connect the data back to what you learned about mummichog fish and their connection to salt marsh health.

Your next steps as a scientist: Science is an ongoing process. What new question(s) should be investigated to build on Liz and Robert's research? What future data should be collected to answer your question(s)?