

Does Genetically Engineered Color Affect Fish Behavior?

When a sea coral gene is added to a Zebra Fish to give it a bright fluorescent color, what changes happen to the way it treats the “wild” Zebra Fish, or the way the “wild” Zebra Fish treats it?

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## ABSTRACT

The purpose of our project was to find out if adding a coral gene to a Zebra Fish affected how the “wild” Zebra Fish treated them or how they treat it. We predicted that the bright colors would cause the “wild” zebra Fish to be frightened. We thought they would either hide from the fluorescent fish or would try to attack them to keep them away.

To find out the answer to this question, we set up two identical aquarium tanks, making sure to add the same plants, decorations, and other habitat to each tank. Then we put ten “wild” Zebra Fish into the control tank. After that, we put five “wild” Zebra Fish along with five “GloFish” into the second tank. We observed the tanks daily and kept records of the behaviors of the fish at feeding time and at other times in the day. The behaviors included were fighting, chasing, hiding, etc. Finally, we built tables and graphs to compare the behaviors in the two tanks.

We discovered that the coral gene did affect the behavior of the Zebra Fish. The fish in the test tank and the fish in control tank had behaviors that resembled each other, excepting the chasing, which turns out to be very important in Zebra fish society. Comparing the two tanks showed that in the control tank the chasing was almost double the chasing in the test tank.

## QUESTION

When a sea coral gene is added to a Zebra Fish to give it a bright fluorescent color, what changes happen to the way it treats the “wild” Zebra Fish, or to the way the “wild” Zebra Fish treats it?

## PURPOSE

Many people are afraid of genetic engineering. In fact, in some countries it is illegal to have any genetically engineered organisms. Creating a bigger or better vegetable, fruit, or animal might just bring about unexpected negative consequences. If genetic engineering continues, will scientists someday be creating a better, smarter human being?

Through this experiment, we were hoping to find out about unexpected consequences, only in this experiment, using fish instead of people. The purpose of our experiment was to find out if adding the coral gene to the Zebra Fish would affect how the “wild” Zebra Fish act around it. If we can find out about fish behaviors, it will improve the information known by scientists. They will have more knowledge and will be able to explain different phenomenon better.

## BACKGROUND INFORMATION

### Habitat:

Zebra Fish and “Glofish” are very complex, as is any organism that lives. The Zebra Fish is a freshwater fish. They live in water that has no harmful chemicals such as chlorine and ammonia. The correct water temperature for Zebra Fish is 72-80 degrees F (22-27 degrees C).

The fish’s tank cannot be placed directly in sunlight or by a cooling/heating mechanism, because that causes the water’s temperature to change. Zebra Fish should not be overfed, because it pollutes the tank. They enjoy a tropical climate and come from places in Asia. They have been sighted in slow-moving bodies of water, streams, ditches, ponds, etc.

### Food:

“GloFish” and Zebra Fish are able to eat a lot of food. The Commercial Fish Flakes are good for the fish. Also frozen or live Brine shrimp, and Brine shrimp larvae are eaten by the fish. Live tubifex worms and cichlid pellets are common food. Lastly they eat crumbled, hard boiled egg yolk. Adult Zebra Fish should be fed twice, daily. It is important not to overfeed. Having live food promotes breeding and you should use different food, not the same thing all the time.

### Behavior:

Jennifer Sneckser and her lab partners reported in the journal Ethology that they presented wild type and transgenic Zebra fish with same-sex shoals of both strains of fish. They studied behaviors known to be influenced by characteristics such as body coloration, striping pattern, shape of body and size. When presented with opposite-sex individuals, no preference was shown by either sex or either strain, genetically altered or just plain. They concluded that the red colored GloFish did not influence behavior patterns. Our study wanted to see if the same was true for the yellow colored GloFish.

### Sense of Smell:

Copper particles can cause injury to Zebra Fish gills. Small traces of copper nano particles can injure Zebra Fish gills. They have a less complex, but well developed sense of smell. Odorant receptors are being cloned for analysis in hybrid patterns.

### Legal Issues:

GloFish are prohibited in Australia, Canada, and Europe until they are cleared through a formal review process. Because of time, expense and uncertain approval process, Canada and Europe are not trying to get any GloFish approved. Australia recently received an application to allow

GloFish. Providers of GloFish (rights reserved), 5-D Tropical, and Segrest Farms are the only distributors that have a license to produce and market these fluorescent fish, within the United States. GloFish (rights reserved) are currently only available for purchase in the United States. GloFish (rights reserved) are allowed in every U.S. state except California.

What are Zebra Fish?:

The scientific name for the Zebra fish is *Danio rerio*. They are related to the *Danio kyathit*. The Zebra fish originates from the south-eastern Himalayan region. They are native to Eastern India, Pakistan, Bangladesh, Nepal, and Myanmar. Zebra fish grow to around 6.4 cm and live around 5 years. Zebra fish lay 300-500 eggs per spawning. Males have blue and gold stripes while females have blue and silver stripes. Zebra fish are susceptible to Oodinium, an infestation of the body.

Vision:

Behavior depends on vision, and light affects vision. Since GloFish are born with the ability to re-emit more light outwards, it may affect how other Zebra fish see them. This in turn might affect the behaviors of both fish.

### Reproduction:

GloFish are egg layers. They use the same reproductive behaviors as Zebra fish, since they really are the same species. It is also very likely GloFish can't reproduce because they are sterile. Zebra fish are probably sexually active for life. Sometimes Zebra fish eat their own eggs. Spawning occurs usually at dawn. The eggs will be found on the plants and in the gravel. Fry or the baby fish will hatch in 2 days.

### HYPOTHESIS

We think that the bright colors will cause the "wild" Zebra Fish to be frightened by the GloFish. We think they will either hide from the fluorescent fish or will try to attack to keep them away.

## PROCEDURE AND MATERIALS

1. Set up two identical aquarium tanks.
2. Add the same plants, decorations, and other habitat to each tank.
3. When the water and plants are ready for fish to be added, put 10 “wild” Zebra Fish into the control tank.
4. Put 5 “wild” Zebra Fish along with 5 “GloFish” Zebra Fish into the second tank.
5. Observe during class time for six weeks.
6. Keep records of behaviors between fish at feeding times and at other times to keep track of signs of fighting, chasing, hiding, etc.
7. Build tables and graphs to compare the behaviors in the two tanks.

### Materials:

5 “GloFish”

15 “wild” Zebra Fish

2 aquarium tanks

filters

gravel

rocks

decorations

fish food

aquarium lights

heaters

artificial plants

living plants

marbles

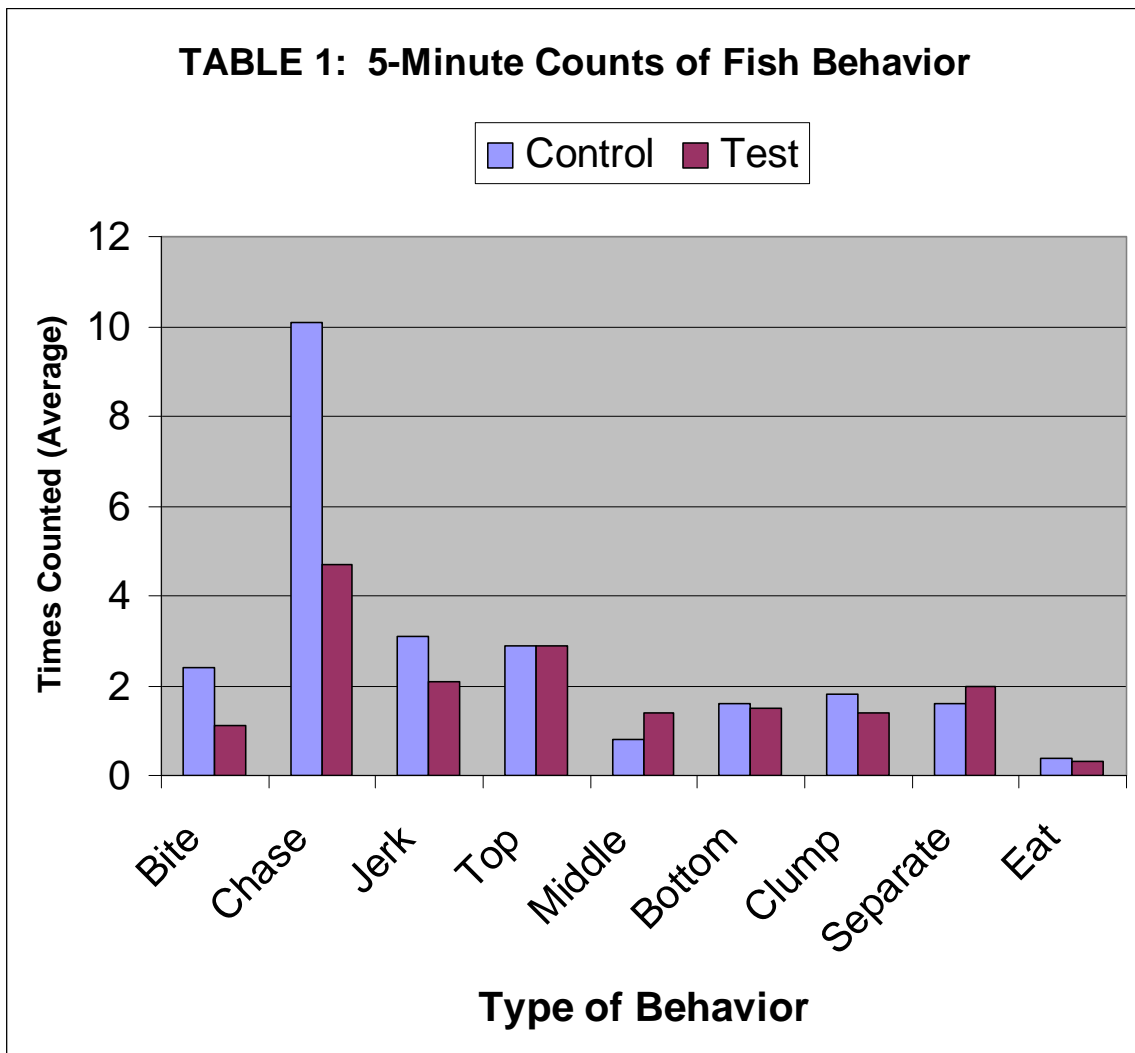
## RESULTS

The original purpose of this experiment was to find out if adding a coral gene to a Zebra Fish affected how a “wild” Zebra Fish treated the “GloFish” or how the “GloFish” treated the “wild” Zebra Fish. The results in Table 1 show that most of the behaviors in the two tanks matched up very well. However, the one behavior that was most important in their interactions was chasing. Table 1 shows that the tank with both types of fish had only half of the chasing that the other tank had, even though the total number of fish in both tanks was almost the same.

The “GloFish” in the test tank have all died. Table 2 shows that the test tank started with equal numbers of GloFish and “wild” fish, and the deaths occurred in the same pattern. All through the experiment the test tank was approximately half GloFish and half “wild” fish.

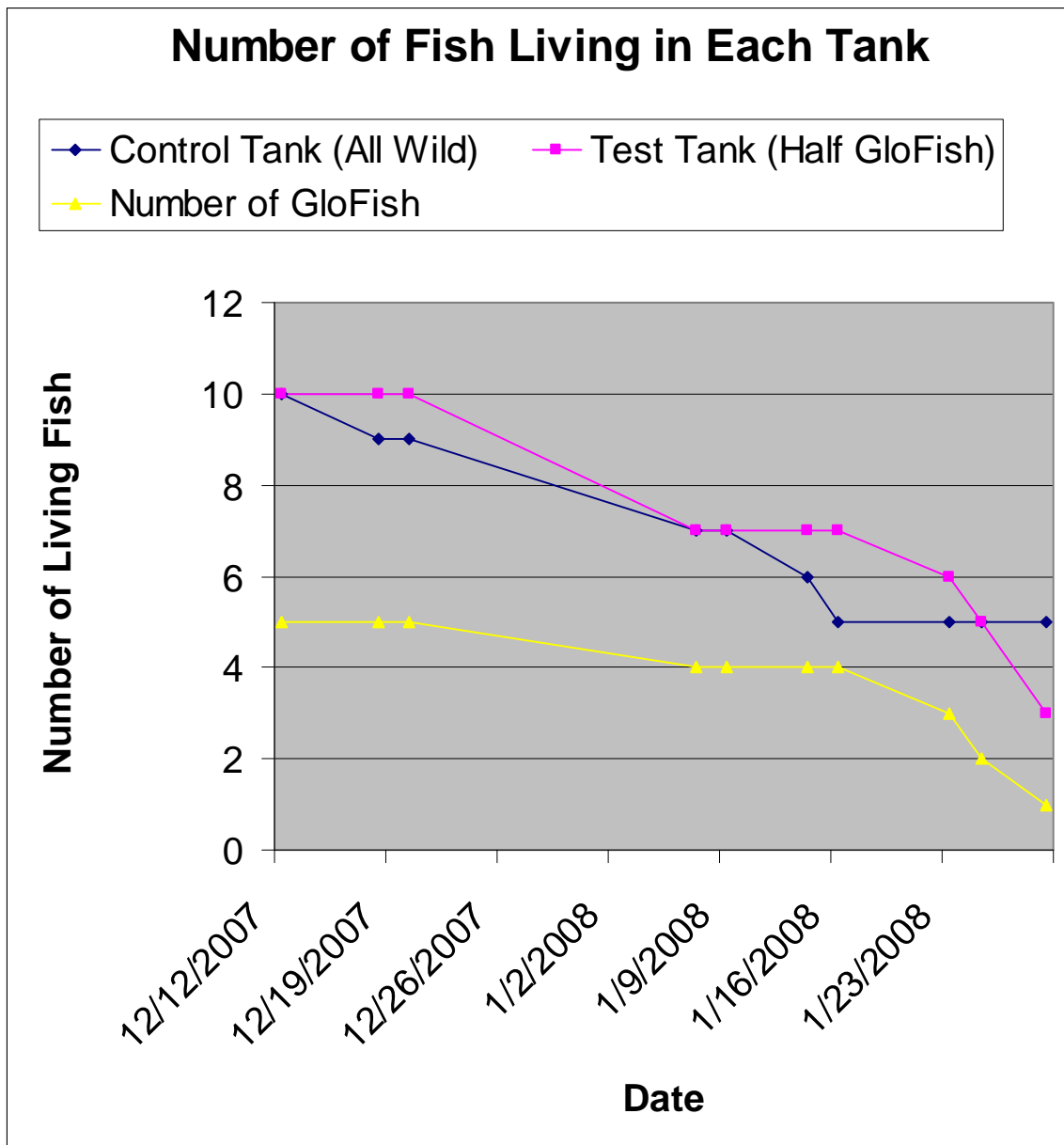
**TABLE 1: Average 5-Minute Counts of Fish Behaviors**

<u>Behavior</u>	<u>Control</u>	<u>Test</u>
Bite	2.4	1.1
Chase	10.1	4.7
Jerk	3.1	2.1
Top	2.9	2.9
Middle	0.8	1.4
Bottom	1.6	1.5
Clump	1.8	1.4
Separate	1.6	2
Eat	0.4	0.3



**TABLE 2: Number of Fish Living in Each Tank**

<u>Date</u>	<u>Control Tank (All Wild)</u>	<u>Test Tank (Half GloFish)</u>	<u>Number of GloFish</u>
12-Dec-07	10	10	5
18-Dec-07	9	10	5
20-Dec-07	9	10	5
7-Jan-08	7	7	4
9-Jan-08	7	7	4
14-Jan-08	6	7	4
16-Jan-08	5	7	4
23-Jan-08	5	6	3
25-Jan-08	5	5	2
29-Jan-08	5	3	1



We don't know why any fish died. There are a few diseases that could have been the cause of these deaths. The first disease is the White Spot Disease, or ICH. The disease appears to look like small granules of salt. The disease can appear on the eyes, fins, gills, skin, and mouth interior. They are easily recognizable by white dots on the surfaces of the fish's body.

The second disease is the Velvet disease. It looks similar to ICH, except these dots appear to be fuzzy. It can form on the eyes, fins, gills, and skin. The fish may try to scrape itself against the aquarium, may lose its appetite or have stressed-rapid breathing. This disease may be cured by the same medicine as ICH.

The third disease is Dropsy. It is one of the worst fish diseases, and is very hard to cure. Dropsy is an internal infection, caused by bacteria. The scales will stand out, making it look like a pine cone. The fish will also start to swell, also the eyes will bulge if the disease is severe enough. Other common diseases are fungus, parasites, and external bacterial infection. These diseases are easily treatable and the medicine is highly effective.

## CONCLUSION

Our hypothesis was that we thought that the bright colors would cause the “wild” Zebra Fish to be frightened. We thought that they would either hide from the fluorescent fish or would try to attack them to keep them away. We rejected our hypothesis because we saw no evidence of fright, hiding, or attacking. But our hypothesis might have been partially correct, because something about the GloFish did reduce the important chasing behaviors that Zebra Fish normally show.

Because of the results of this experiment, we wonder if the yellow fluorescent color reduced the playfulness with the “wild” fish. If we were to conduct this project again, we would make more careful observations about the chasing behavior, and we would especially watch each chase to see if it was Glofish chasing Wild, or Glofish chasing Glofish, or Wild chasing Glofish, or Wild chasing Wild. If we did that, we might get more understanding about how the genetically engineered color affects the natural behaviors of the fish in this species.

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