

Hardy-Weinberg Goldfish Lab

Background

Predators (students) selectively prey upon (eat) fish (Goldfish crackers). Prey will be replaced with fish randomly selected from the ocean (bowl full of Goldfish crackers) to create the next generation. You will calculate the allele and genotypic frequencies for each generation using the Hardy-Weinberg rules. Then you will examine your data to see if the genotypic frequencies have shifted as a result of selective predation.

Hardy-Weinberg Equations:

Allele Frequencies:

$$p + q = 1$$

Genotypic Frequencies:

$$p^2 + 2pq + q^2 = 1$$

Fish Genetics

For these fish, the gold-color allele (f) is *recessive*. The other allele for non-gold (other colors), F , is *dominant*. Fish can be multicolored (genotype FF or Ff) or gold-colored (genotype ff).

Procedure

1. Fill your “ocean” with some rainbow Goldfish crackers.
2. Take a random population of 10 fish from the ocean.
3. Record on your chart (Chart #1) under “Generation 1” the number of gold-colored (yellow) fish and multicolored (non-yellow) fish. The gold-colored fish represent the homozygous recessive genotype, ff , and the multicolored fish represent the dominant phenotype (FF and Ff genotypes).
4. Choose 3 gold fish from the 1st generation and eat them. If you do not have 3 gold fish, fill in the missing number by eating non-gold fish.
5. Choose at random 3 fish from the ocean to replace the 3 that “died”. Add them to your population. *Do not use artificial selection.*
6. Record on your chart under “Generation 2” the new number of gold fish and multicolored fish.
7. Choose 3 gold fish from the 2nd generation and eat them. If you do not have 3 gold fish, fill in the missing number by eating non-gold fish.
8. Choose at random 3 fish from the ocean and add them to your population. *Do not use artificial selection.*
9. Record on your chart under “Generation 3” the new number of gold fish and multicolored fish.
10. Repeat steps 7-9 until you have gathered data for 5 generations.

Chart #1: Individual Data

Generation	Colored (<i>FF</i> or <i>Ff</i>)	Gold (<i>ff</i>)	q^2	q	p	p^2	2pq
1							
2							
3							
4							
5							

Chart #2: Class Data

Generation	Colored (<i>FF</i> or <i>Ff</i>)	Gold (<i>ff</i>)	q^2	q	p	p^2	2pq
1							
2							
3							
4							
5							

Data Analysis

1. Calculate the allele and genotypic frequencies for each generation using the data and fill in the data table for your individual results.
2. Collect the class data for each generation and calculate the allele and genotypic frequencies for the entire class population of fish.

Conclusion

1. How did the selective eating of the gold fish affect the genotypic frequencies (p^2 , $2pq$, q^2) of the overall fish population?
2. Describe how allelic frequencies can attribute to the evolutionary change of a population.
3. How does using the Hardy-Weinberg principles help evolutionary biologists recognize evolving populations?
4. If these cracker fish represented a real population, would the recessive allele eventually disappear? Explain your answer.
5. Describe how the results of the simulation would have been different if you had selectively eaten the fish exhibiting the dominant trait.
6. Describe the 5 assumptions of the Hardy-Weinberg equilibrium and how each applies to supporting the theory of evolution.