

Water as a Habitat: Episode 5 What's Lurking in the Waters?



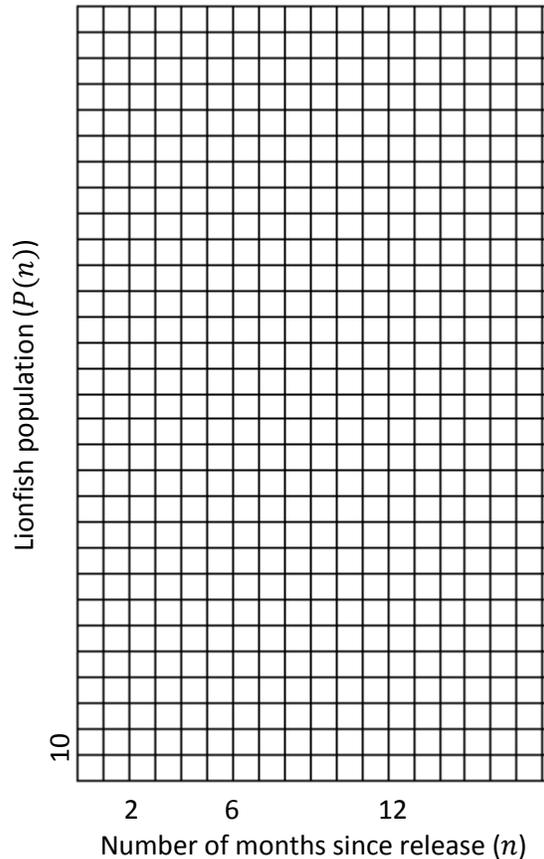
A Lionfish Population Investigation

Scenario 1

Suppose the current population of lionfish off of the Treasure Coast was due to the release of 2 overgrown lionfish pets, one male and one female. If the population of lionfish off the coast is growing at a rate of 50% per month, write and graph an exponential function to represent the lionfish population over a one year time period.

Let n be the number of months since the release of the 2 pets
Let $P(n)$ be the total lionfish population.

Lionfish Population



- A) Is it appropriate to use an exponential model for the population growth of the lionfish? Explain why or why not.

Name: _____

- B) Write the explicit formula to represent the population growth function of the lionfish as a geometric sequence, where the original number of lionfish is given when $n = 0$, or by the zero term, $P_0 = 2$.
- C) How would you find P_{n+1} if you know term P_n ?
- D) Write a recursive formula for P_{n+1} in terms of P_n to represent the population growth function.
- E) Using your explicit formula for the geometric sequence in part B, calculate the total population of the lionfish at the end of the first 2 years.
- F) What is the total change in the number of lionfish over these 2 years?
- G) What is the average rate of change of lionfish per month over the 2 years?
- H) Use the function to determine the value of n when the population reaches 1 million.

Scenario 2

A mature female lionfish can release between 10,000 and 30,000 eggs every 4 days. She can do this year round while living in warm, tropical waters. Suppose the number of eggs that are fertilized and survive to become mature lionfish is 8% of the total number of eggs spawned.

- A) Determine how many times this lionfish will spawn in one year. Round to the nearest whole number of events.

- B) Use the mid-interval value of eggs released to determine how many eggs will develop into lionfish from each spawning event.

- C) Calculate the number of lionfish that were spawned by a female and living in the surrounding area after 30 days.

- D) Juvenile lionfish do have a mortality rate, not all of them reach maturity. Suppose for each day after the first 30 days of life, that 15% of these existing juvenile fish are removed from the ecosystem. Some will perish, others will be eaten, and others will get trapped and/or be caught by divers. Write an exponential model that gives the number of surviving lionfish for the next 30 days.
Let $P(x)$ be the population of lionfish
Let $x = 1$ be the first day the population changes

- E) Is this a growth or decay model? Justify your answer.

- F) How many of the juvenile fish remain on the 45th day?