Solving the Channel Island Fox Catastrophe

Name:

The Ecosystem of You!
Warm UP

Directions: Describe the ecosystem you call home! Include what you like to eat, where you like to sleep, what it looks like, sounds like and feels like. Include the other people you spend time with! Use pictures, words, rhymes, or lyrics. Be creative!

Island of Happiness!
Warm Up

Directions: Create a list of 5 things that you need to be happy. Take a minute or two to think about this and be thoughtful with your answers.

1. _____

2. _____

3. _____

4. _____

5. _____

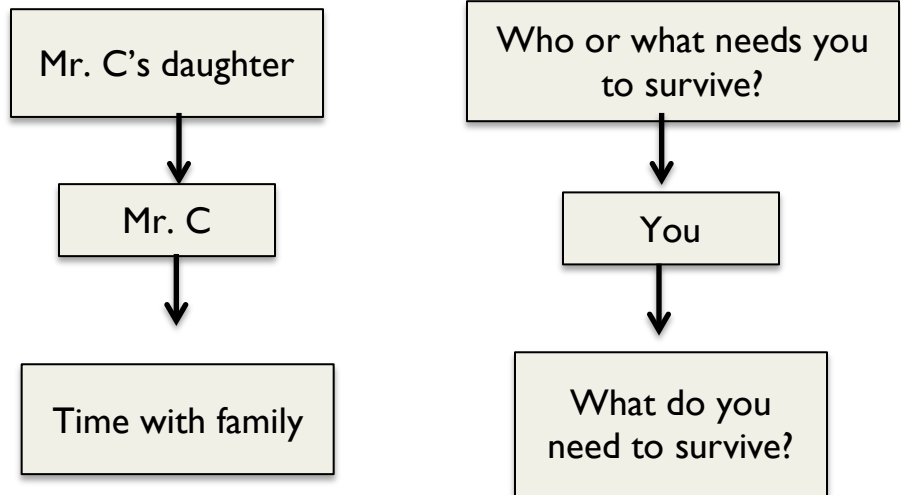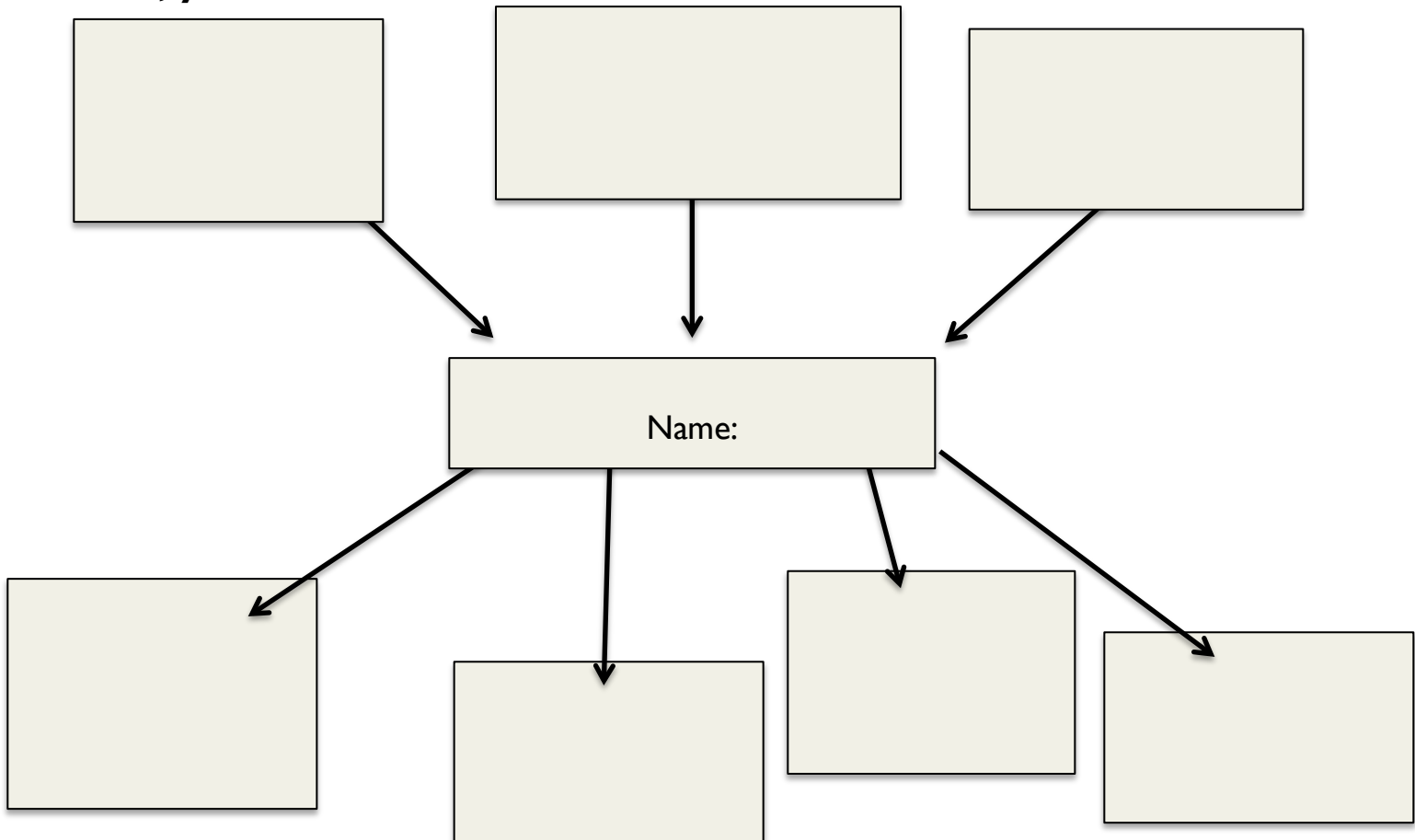Now, draw yourself **on an island** with those 5 things surrounding you:

The Web of Me!
Warm Up

Directions: Draw a food web to show who depends on you and what you need to survive.
Example: *Mr. C's daughter depends on him and he needs to "plop" on the couch for a bit each night.*

Mr. C's daughter	Who or what needs you to survive?

↓ ↓

Mr. C	You

↓ ↓

Time with family	What do you need to survive?

Now, your turn:

[Blank box] [Blank box] [Blank box]

Name: _____

[Blank boxes]

The Perfect School!
#PerfectAttendance Warm Up

Directions: Imagine the PERFECT school building. This building should be so amazing; students just LOVE having perfect attendance. You man DRAW or DESCRIBE IN WORDS this perfect building:

The Simpsons... and Ecology!
Warm Up

Which ecological tool was accidently used?

_____

_____

Why was the "Bolivian Tree Lizard" a problem?

_____

_____

_____

What was the "solution" the town thought of to solve the Lizard problem?

_____

_____

_____

_____

Why might the town's solution be problematic?

_____

_____

_____

_____

Channel Island Essay Rubric

	4	3	2	1
Introduction	*In addition to criteria for a 3*, student includes **supplemental information** about how the population was estimated OR on the biology of the Fox	Student introduces the Island Fox population problem with references to the graph and states an ordered pair on the graph to show the decline.	Student lacks a reference to their graph, does not include an ordered pair OR does not mention the fox decline.	Student does not reference the Fox population graph.
Graph *NGSS Practices: Analyzing Data*	Graph is complete, correct and shows **remarkable commitment to quality**.	Graph is complete and includes all elements of an effective graph.	Graph is missing labels, title, line of best fit OR intervals are incorrect.	Multiple errors are made on the graph.
Food web	Food web is complete, correct and shows **remarkable commitment to quality**.	Food web is complete and includes all correct connections between species. *No more than 1 error.*	Food web has 2-4 errors: - Arrows point in the wrong direction - Connections are incorrect	Food web has four of more errors.
Explanation of Decline *LS2-1 & LS2-4*	*In addition to criteria for a 3*, student identifies the **most correct** reason for the fox decline and includes **multiple sources of evidence** to support their claim.	Student explains why the fox population has declined with cause-and-effect evidence from the food web (including ecological relationships) and data from the graph, including important dates.	Student chose an incorrect reasons **OR** student's explanation lacks appropriate evidence from the food web **OR** lacks data from the graph, including important dates.	Student does not sufficiently explain the decline of the fox.

	4	**3**	**2**	**1**
Ecological Tool Choice*	*In addition to criteria for a 3*, student includes why the **TWO** tools would be least harmful to other species and maintain biodiversity.	1. Student explains how the **TWO** tools would be used. 2. Student includes a cause-and-effect explanation of how the tools would increase the FOX population. 3. Student uses direct evidence from the food web and readings. 4. Student uses proper ecology vocabulary (predator, prey etc)	Student is lacking one of the criteria from earning a 3.	Student does not sufficiently rationalize their choice AND does not use vocabulary.
Ecological Tools to Avoid*	*In addition to criteria for a 3*, student explains how the tool would harm other species and reduce overall biodiversity.	1. Student explains **ONE** tool to avoid. 2. Student includes a cause-and-effect explanation of how the tool would indirectly impact the FOX population negatively. 3. Student uses evidence from the food web and readings to support their claim.	Student is missing one of the criteria from earning a 3.	Student is missing 2 or more of the criteria to earn a 3.
Overall: MS-LS2-5 Grade	*Student exceeds in at least one Ecological Tool category and either Introduction OR Food web. Student is proficient in all other categories.*	Student is proficient in the Ecological Tools categories AND has no more than one approaching score in the remaining categories.	Student is at least approaching in most categories. No more than one developing score.	Student shows a developing under-standing of the standard

Fixing the Channel Island Catastrophe!

TASK 1: In order to process this data, create a graph of best fit.

DO NOT FORGET:
- ☐ Title
- ☐ Axis labels and units
- ☐ Correct intervals
- ☐ Scatter plot of data
- ☐ Appropriate line of best fit

Background: As an ecologist, you are studying the Island Fox population on Santa Cruz Island off the shore of Santa Barbara, California. From 1993 to 1999, you set up traps on the Island. Based on how many foxes you caught per month, you could estimate the fox population on the entire Island. Here is the data you obtained:

Year	Population of Channel Island Fox
1990	1200
1991	1200
1992	1200
1993	1200
1994	900
1995	600
1996	300
1997	200
1998	150
1999	150
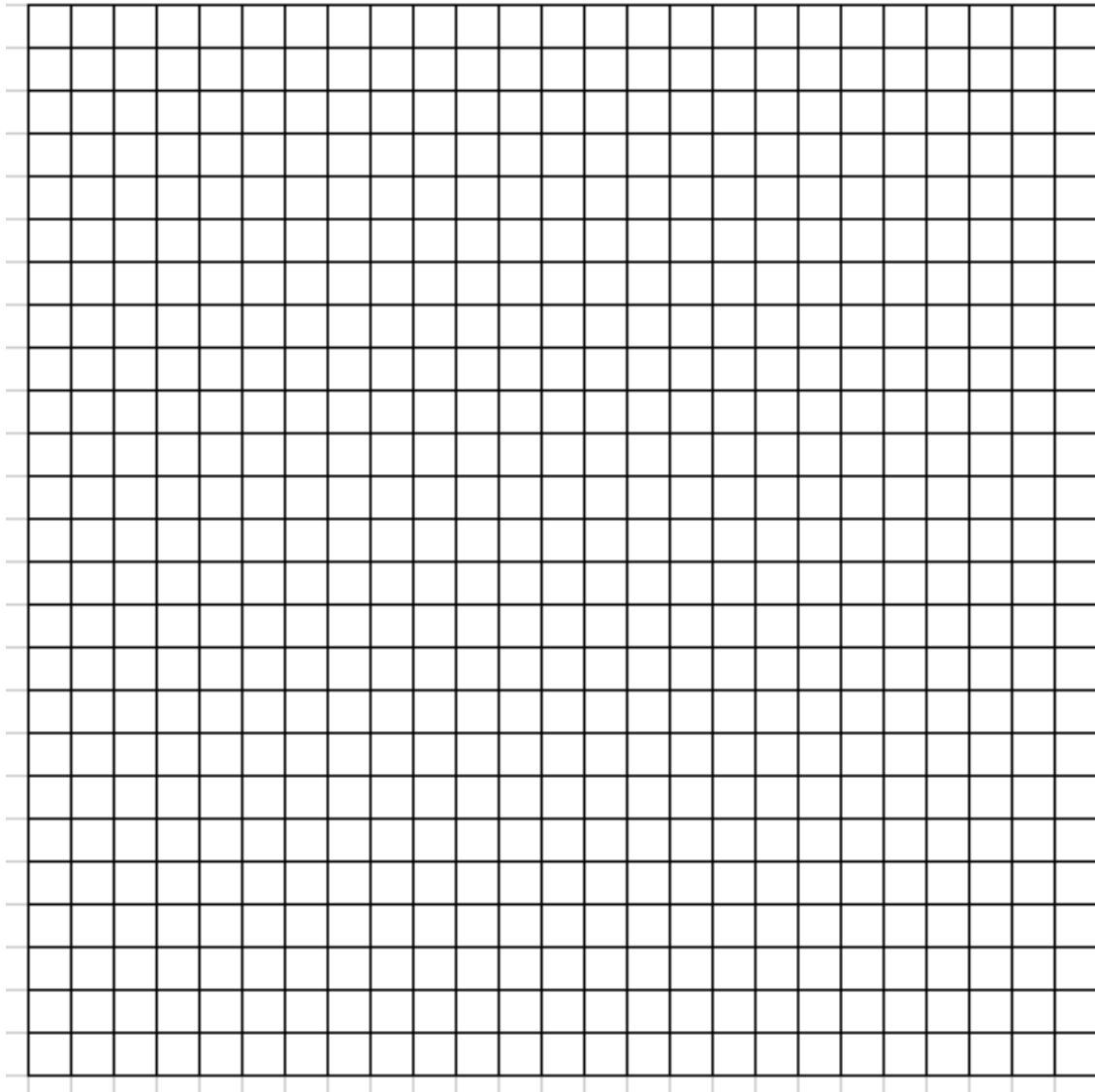
TASK 2: Design a food web using the data below:

Background- As an ecologist, you are trying to understand the Island Fox population decline on Santa Cruz Island off the shore of Santa Barbara, California. You have studied the entire community of organisms on the Island by watching and taking field notes of what each organism preys on. Here are your notes:

Organism:	*Prey:* *(What the organism eats)*	*Predator:* *(What EATS the organism)*
Saltbush	Sun	Island Fox, Feral Pig, Crab
Cactus Fruit	Sun	Island Fox, Feral Pig, Skunk, Beetles, Crickets
Beetles	Cactus Fruit	Feral Pig, Skunk
Crabs	Saltbushes	Island Fox
Crickets	Cactus Fruit	Island Fox, Feral Pig, Skunk
Island Fox	Cactus Fruit, Crabs, Crickets, Saltbush	Golden Eagle, Feral Pig
Skunk	Cactus Fruit, Beetles, Crickets	Golden Eagle
Feral Pig	Cactus Fruit, Beetles, Crickets, Saltbush, Island Fox	Golden Eagle
Golden Eagle	Feral Pig, Island fox, Skunk	Bald Eagle
Bald Eagle	Golden Eagle	None

Food Web:

DRAFT

TASK 3: Choose the best explanation for the population change based on the options below.

Background- As an ecologist, you now have a better understanding of the Channel Island Ecosystem. Based off of all your research, you and your team of scientists have 5 possible explanations for the decline of fox. Here are your possibilities:

Decline Hypothesis 1:

Golden eagles search for their prey during the day by soaring over the island and searching for moving organisms. Golden Eagles can snatch prey as heavy as 4kg with their sharp talons. Fox puppies, and even adult foxes, weigh much less than 4kg, which makes them an easy prey. Once the golden eagles have made their catch, they bring their food to a nest and eat. In 1995, the golden eagle population increased from 4 sightings to 26 sightings. The population grew exponentially in that year.

Decline Hypothesis 2:

The Channel Islands are a sensitive ecosystem, and are home to 60 endemic (only exist there) species. In 1993, pigs were carried over to the islands on a boat to be used for hunting. Soon, the pigs destroyed nine native plant species, including the Saltbush. These pigs have a behavior called "rooting" where they dig into the ground to look for small bugs and food. This digging is what destroyed most of the plant species, including some species that are food for the Island Fox. However, the Cactus Fruit was able to survive the pig's rooting behavior. Because there was more space available, the Cactus Fruit population increased in 1994.

Decline Hypothesis 3:

Skunks and Island Foxes share many of the same food sources. Their niches overlap, so they compete for many of the same prey, including the Crickets and Cactus Fruit. The Island Fox captures most of its prey duding the day, and the skunk does most of its preying at night. Although skunks and Foxes also have the same predator, the Golden Eagle, the skunks are better at avoiding predation because they are nocturnal (awake at night). Golden eagles search for their prey during the day by soaring over the island and searching for moving organisms. The Island Fox population is much more active during the day, so they are easier to catch. The skunk population slightly in increased in 1994, but returned back to normal numbers by 1995.

Decline Hypothesis 4:

After the pigs were introduced to the island in 1993, their population grew quickly. Adult pigs were too heavy to be captured by the Golden Eagle, so they were safe to roam and eat many of the Island's resources including the Saltbush and the Cactus Fruit. Because the Island Fox had less food to eat, their population began to decline in 1993. In 1994, the skunk population slightly increased because the skunks did not have to compete with the fox for food. Also in 1994, the year after the pigs were brought to the island, they started to have baby piglets. These piglets were small and weighed under 4kg so they were the perfect catch for the Golden Eagle. In 1995, the Golden Eagle had more pigs *and* more skunks to prey on. So, the Golden Eagle population started to increase dramatically and continued to prey on Island Fox.

Decline Hypothesis 5:

The Channel Islands used to be home to a large native population of Bald Eagles. But, in the late 1950s, a chemical called DDT was sprayed over the island to get rid of weeds and pests. This chemical was also toxic to other populations of animals including the Bald Eagle. The population of Bald Eagles on the Island shrunk to only 4 birds until 1995. Bald eagles eat fish, seabirds, and animal carcasses, not live foxes, and are very territorial (protective of their home). Because they are so protective, they will kill Golden Eagles who try to invade their space. When the Golden Eagle population grew in 1995, the Bald Eagles showed their territorial behavior and remained very protective of their habitat niche.

TASK 4: Write the first two paragraphs to explain the Channel Island Catastrophe.

Background- As an ecologist, you have a responsibility to the global community to share your results! You finally get to start your paper that you will send to the offices of *Science*, a world-renowned science journal, with the hopes of getting published!

Brainstorm with BULLET POINTS – this is a DRAFT

Paragraph 1 must:

Describe the Fox Population Change:
   a. Introduce the Channel Island Population Problem
   b. Use the graph to show **how** the population changed (correlation)
   c. Find the *ordered pair* on graph **when** the population started to change

1. What is happening to the Fox population on the Channel Island? (use graph evidence)

_____

_____

_____

When did this change start? (use graph evidence)

_____

_____

_____

Why is this change happening? Simply *STATE* the reason

_____

Paragraph 2 must:

Describe Why the Population Changed
   a. State the most likely reason for the population change from the 5 readings.
   b. Use evidence from the food web to defend your reason
   c. Use evidence from the readings to defend your reason
   d. Use evidence from the graph to defend your reason

2. Why is the fox population changing? (USE EVIDENCE from food web and graph)
   (USE VOCAB: predator, prey, niche, competition etc.)

_____

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TASK 5: Choose the best ecological tool to restore the Island Fox Population by analyzing how they could be applied to the Channel Islands

Background- As an ecologist, you now understand the complexity of the Channel Island ecosystem. You know just how fragile and sensitive it is to changes. In order to save the Island Fox, you have done research on 6 ecological tools that are used to save at-risk species. Here are the results of your research:

Tool 1: Eradication
Eradication is a tool that uses human hunting power to reduce to a population. This usually involves gun use, or traps that are set up in the ecosystem to kill a species.

Tool 2: Re-Vegetation
The establishment of vegetation (organisms that are producers) to areas where it has been previously lost. This usually involves a one-time effort to replant hundreds of the organism, and let the organism reproduce in nature to continue growing its own population without any further help.

Tool 3: Habitat Enhancement
Habitat Enhancement is any effort to improve the ABIOTIC factors in an ecosystem to be more suitable for a specific species. This usually involves creating more living space; changing the soil, the rocks, the water type or amount etc.

Tool 4: Captive Breeding
Captive breeding is the process of breeding animals in controlled environments such as wildlife reserves, zoos, and other facilities. Then, these organisms are released into the wild. The goal is to increase the population of one species in the wild.

Tool 5: Introduction
With Introduction, scientists will bring a large population of an organism to the ecosystem. Scientists will introduce a predatory species, or even hundreds of organisms that will be prey for a species already in the ecosystem.

Tool 6: Relocation
Instead of Eradiction, some scientists choose to use the tool of Relocation. In this strategy, one species is removed from the ecosystem and moved to another environment far away.

TASK 5: Choose the best ecological tool to restore the Island Fox Population by analyzing how they could be applied to the Channel Islands.

Background- As an ecologist, you know that the healthiest ecosystem is one that is MOST diverse with native species. Native species are the organisms that lived in a habitat before humans introduced new organisms. This also means that the ecosystem has a lot of different native species, and each species has a large population. Additionally, species introduced by humans are gone or have very limited populations. In ecological terms, this is referred to as maintaining biodiversity.

What are the **native** species on the island?_____

_____

What are the **introduced** species to the island?_____

_____

Tool	Which organism(s) could you use the tool on?	How could the tool help the Island Fox Population? Be Specific. Use Evidence.	How could this tool be harmful to the ecosystem? Are there any negative side effects? Be specific. Use Evidence.
1: Eradication			
2: Re-Vegetation			

3: **Habitat** **Enhancement**			
4: **Captive** **Breeding**			
5: **Introduction**			
6: **Relocation**			

TASK 6: Write the third and fourth paragraphs to explain how to solve the Channel Island Catastrophe.

Background- As an ecologist, you have a responsibility to the global community to share your results! You need to continue your paper that you will send to the offices of *Science*, a world-renowned science journal, with the hopes of getting published!

Paragraph 3 and 4: Pick the TWO Best Ecological Tool:

☐ Identify the TWO best ecological tools to save the island fox population
☐ Explain how these tools could be used with the Channel Island Species
☐ Use evidence from the food web to explain how these tools would save the fox population
☐ Use evidence from all the readings (Task 3 and Task 5) to explain how these tools would save the fox population
☐ Explain why these tools will be the LEAST harmful to the other species in the ecosystem and maintain native biodiversity

Brainstorm the essay below:

3. Which PRIMARY tool (1-6) would you choose to help save the fox population?

_____

_____

How would you use this tool in the Channel Island Ecosystem? (use readings to explain with evidence)

_____

_____

_____

_____

If this tool was used, which populations would change? How would they change? (use food web to explain with evidence)

_____

_____

_____

_____

How does this tool do the least harm and maintain native biodiversity?

_____

_____

_____

4. Which SUPPLEMENTARY tool (1-6) would you choose to help save the fox population?

_____

_____

How would you use this tool in the Channel Island Ecosystem? (use readings to explain with evidence)

_____

_____

_____

_____

_____

If this tool was used, which populations would change? How would they change? (use food web to explain with evidence)

_____

_____

_____

_____

How does this tool do the least harm and maintain native biodiversity?

_____

_____

_____

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Paragraph 5: Advise Against Two Tools

☐ Choose **ONE** tools that would be the <u>LEAST HELPFUL</u> for the Island Fox population
☐ Use evidence from the <u>food web</u> to explain why this tool <u>would not help</u> the fox population
☐ Use evidence from all the <u>readings</u> (Task 3 and Task 5) to explain why this tool would not help the fox population
☐ Explain why this tool could be <u>HARMFUL</u> to the <u>other species</u> in the ecosystem

5. Which tool (1-6) would NOT save the fox population? _

_____

_____

_____

Why would this tool be unsuccessful in the Channel Island Ecosystem? (use readings to explain with evidence)

_____

_____

_____

_____

_____

If this tool were used, which populations would change? How would they change? (use food web to explain with evidence)

_____

_____

_____

_____

_____

What negative biodiversity consequences does this tool have?

_____

_____

_____

TASK 7: Use skepticism to evaluate your science writing. Reread your entire rough draft and place A CHECK in the boxes that you successfully completed:

Self-Editing Checklist

1. **Describe the Fox Population Change:**
   - ☐ Introduced the Channel Island Population Problem
   - ☐ Used the graph to show **how** the population changed (correlation)
   - ☐ Found the *ordered pair* on graph **when** the population started to change

2. **Describe Why the Population Changed**
   - ☐ Stated the most likely reason for the population change from the 5 readings.
   - ☐ Used evidence from the food web to defend your reason
   - ☐ Used evidence from the readings to defend your reason
   - ☐ Used evidence from the graph to defend your reason

3. **Pick the Best Ecological Tool:**
   - ☐ Identified the <u>best ecological tool</u> to <u>save the island fox</u> population
   - ☐ Explained how this tool could be used with the Channel Island Fox
   - ☐ Used evidence from the <u>food web</u> to explain how these tools would save the fox population
   - ☐ Used evidence from all the <u>readings</u> (Task 3 and Task 5) to explain how these tools would save the fox population
   - ☐ Explained why these tools will be the <u>LEAST harmful</u> to the <u>other species</u> in the ecosystem
   - ☐ Explained why these tools would <u>maintain biodiversity of native species</u>

4. **Advise Against ONE Tools**
   - ☐ Chose **one** tool that would be the <u>LEAST HELPFUL</u> for the Island Fox population
   - ☐ Used evidence from the <u>food web</u> to explain why this tool <u>would not help</u> the fox population
   - ☐ Used evidence from all the <u>readings</u> (Task 3 and Task 5) to explain why this tool would not help the fox population
   - ☐ Explained why the tools could be <u>HARMFUL</u> to the <u>other species</u> in the ecosystem
   - ☐ Explained why the tools would be <u>HARMFUL to biodiversity of native species</u>