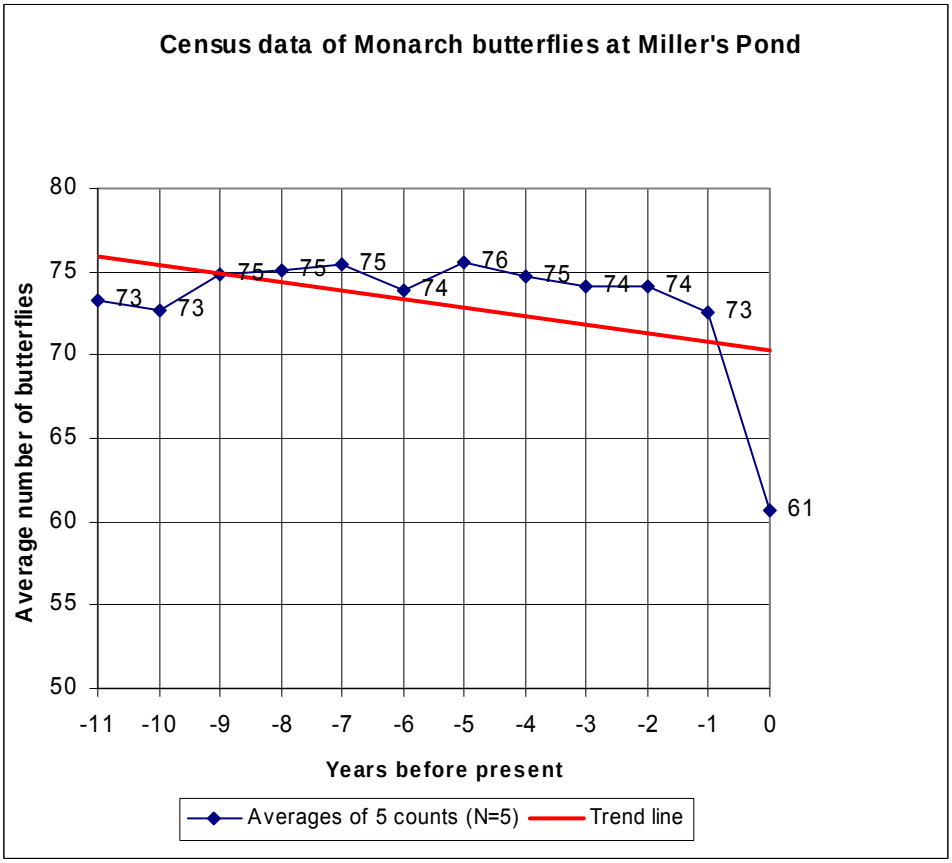
Data Analysis

In the Monarch case students need to gather evidence to support or reject the hypothesis that the monarch butterfly population has declined. After consulting Professor Lincoln Brower to learn how to collect monarch butterfly census data, and studying the natural history of monarchs, students obtain monarch butterfly census data and analyze them.

Years Before Present:	-11	-10	-9	-8	-7	-6	-5	-4	-3	-2	-1	0
	Number of Butterflies Counted:											
Counter 1	73	71	74	70	76	75	75	72	76	71	71	60
Counter 2	74	73	75	74	77	76	76	73	74	74	73	62
Counter 3	73	76	76	77	76	75	73	74	76	73	75	59
Counter 4	73	70	77	78	77	73	77	78	72	76	73	59
Counter 5	74	74	71	77	71	71	77	78	73	77	71	65
Average # of Butterflies:	73	73	75	75	75	74	76	75	74	74	73	61



Review the census data for the previous 11 years at Miller's Pond. What conclusions can you draw from the evidence?	Yes	No
There was an up trend in the Monarch population at Miller's Pond.		√
There was a down trend in the Monarch population at Miller's Pond.		√
There was no up or down trend in the Monarch population at Miller's Pond.	√	
The variation in the numbers of the Monarch population over the last 11 years was random.	√	
Review the census data for the previous 11 years including this year at Miller's Pond. What conclusions can you draw from the evidence?	**Yes**	**No**
There was an up trend in the number of Monarchs at Miller's Pond.		√
There was a down trend in the number of Monarchs at Miller's Pond.	√	
The variation of the Monarch population over the last 11 years including this year was probably random.		√

The average number of Monarchs this year is:

84 % of the average number of Monarchs last year.

The hypothesis that the monarch population declined this year at Miller's Pond was supported by the data. Now students investigate further:

What factors may affect this? (possible causes)

- Increased mortality due to increased predation.
- Increased mortality due to parasitoids or parasites.
- Increased mortality due to pathogens.
- Loss of habitat due to herbicides.
- Reduced food supply due to herbicides.
- Loss of habitat or food supply due to increased development.
- Increased mortality due to pesticide use.
- Weather changes affecting habitat and food supply.
- Loss of winter habitat in Mexico

Can any factors be eliminated as possible causes?

Not at this time

State remaining sub-hypotheses to be investigated

There are many factors that could impact the Monarch population around Miller's Pond, but the following are the most likely and we will investigate these first:

- Monarch mortality has increased due to increased predation.
- Monarch mortality has increased due to an increase in parasitoids or parasites.
- Monarch mortality has increased due to an increase in pathogens.
- Weather changes have led to increased Monarch mortality around Miller's Pond

- Weather changes have reduced the Monarch habitat and food supply around Miller's Pond.
- Herbicide use has reduced the Monarch habitat and food sources around Miller's Pond.
- Pesticide use has reduced the Monarch population around Miller's Pond.
- Severe weather in Mexico has caused increased Monarch mortality.
- Habitat loss in Mexico has caused increased Monarch mortality