

The Rise and Fall of *Danaus plexippus* in Duluth, MN

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Problem

How does the ratio of *Danaus plexippus* eggs and larvae to *Asclepias syriaca* plants surveyed change on an annual basis at two combined sites in Duluth, Minnesota?

Hypotheses

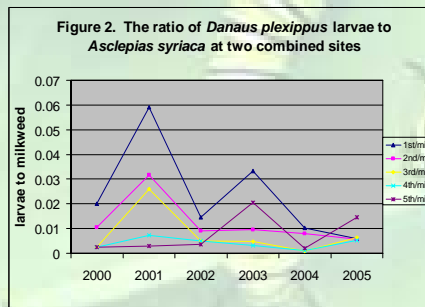
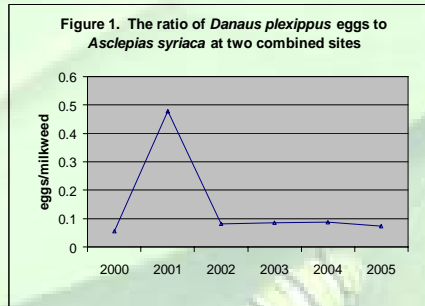
- H₁: The ratio of monarchs to milkweed will decrease year to year.
 H₂: Monarch eggs will always be in more abundance than the larvae.
 H₃: In six years the overall numbers of monarchs have decreased.
 Null: The ratio of monarchs to milkweed will not change from year to year.

Methods

The methods used are outlined by Monarch Larvae Monitoring Project (Activity #1: Estimating monarch densities each week at the site).

Data Collection

1. During 2000-2005, we monitored weekly at two sites in northern MN from early June to early September. Starting in 2003 both sites were monitored, previously only one was surveyed.
2. We randomly selected plants to monitor using a deck of cards, with the number determining distance to travel and the suit direction of travel. We tallied the number of plants in a 2 m square around the plant closest to where the card led, then tallied the number of monarch eggs and larvae on the surveyed plants.
3. We repeated the plant section process until at least 100 plants were monitored.



Year	Eggs/ Milkweed	1 st Instars/ Milkweed	2 nd Instars/ Milkweed	3 rd Instars/ Milkweed	4 th Instars/ Milkweed	5 th Instars/ Milkweed
2000	0.113 ± 0.198	0.022 ± 0.039	0.012 ± 0.014	0.008 ± 0.024	0.002 ± 0.004	0.002 ± 0.004
2001	0.426 ± 0.261	0.082 ± 0.085	0.045 ± 0.042	0.020 ± 0.050	0.056 ± 0.136	0.003 ± 0.005
2002	0.077 ± 0.142	0.020 ± 0.035	0.007 ± 0.010	0.003 ± 0.006	0.001 ± 0.004	0.016 ± 0.019
2003	0.044 ± 0.053	0.006 ± 0.010	0.007 ± 0.011	0.004 ± 0.008	0.006 ± 0.017	0.005 ± 0.012
2004	0.040 ± 0.095	0.008 ± 0.025	0.005 ± 0.013	0.001 ± 0.002	0.001 ± 0.002	0.002 ± 0.005
2005	0.068 ± 0.127	0.007 ± 0.017	0.006 ± 0.013	0.004 ± 0.008	0.003 ± 0.005	0.009 ± 0.024

We reported average and standard deviation.

Results

We observed an overall downward trend from 2000 to 2005.

- Eggs, 1st, 2nd, 3rd, and 4th instars were at their highest point in 2001; 5th instars peaked in 2003.
- Eggs were at their lowest point in 2000 but not by a large margin compared with 2002 and onward. Eggs were always more abundant than larvae (Fig. 1).
- 1st and 2nd instar numbers were lowest in 2005; in 2004, 3rd, 4th, and 5th instars were lowest point (Fig. 2).
- All stages increased in number in 2001, as did many in 2003. They decreased in 2002 and 2000.
- Abundances decrease with age (Fig. 2). This illustrates high larval mortality.

Conclusion

- Every other year, the ratio of monarchs to milkweed increased or decreased; H₁ was not supported.
- H₂ was correct: eggs were always more abundant than larvae.
- In six years of monitoring, overall monarch numbers declined, supporting H₃.
- Ratios of monarchs to milkweed change annually, therefore rejecting the null hypothesis.
- Monarch kills in Mexican wintering grounds due to severe storms may have affected monarch numbers in Duluth. According to Lincoln Brower, over 75% of the monarch population at two combined sanctuaries in Mexico died January 12-16, 2002. Around February 3, 2004, about 10% of the monarch population was killed after another severe storm. We found low monarch numbers after each of these events.
- 2004 produced the lowest number of monarchs during our 6 years of monitoring.

References

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