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Abstract:

In recent years, the Monarch butterfly population has declined significantly along with their host plant where they lay their eggs, milkweed. This recent decrease is due to many factors including extreme weather events, insecticides, pesticides, and habitat loss/fragmentation. Recent studies have pointed out that a protection zone around milkweed plants has been shown to alleviate the pressure presented by these chemicals which decrease egg laying efficiency. This study aims to propose butterfly "refuges" which would give the butterflies areas to rear their young.

Monarch Life Cycle:

There are four generations of butterflies:

The first, second, and third generation only live about two to six weeks.

The fourth lives significantly longer (6-8 months) in order to make the journey down south.

The life cycle of a monarch begins with a female adult butterfly laying an egg on milkweed (Boyle J.; et al, (2019).

Eggs are laid exclusively on milkweed because the consumption allows them to become poisonous to their predators like spiders and birds because the plant is toxic.

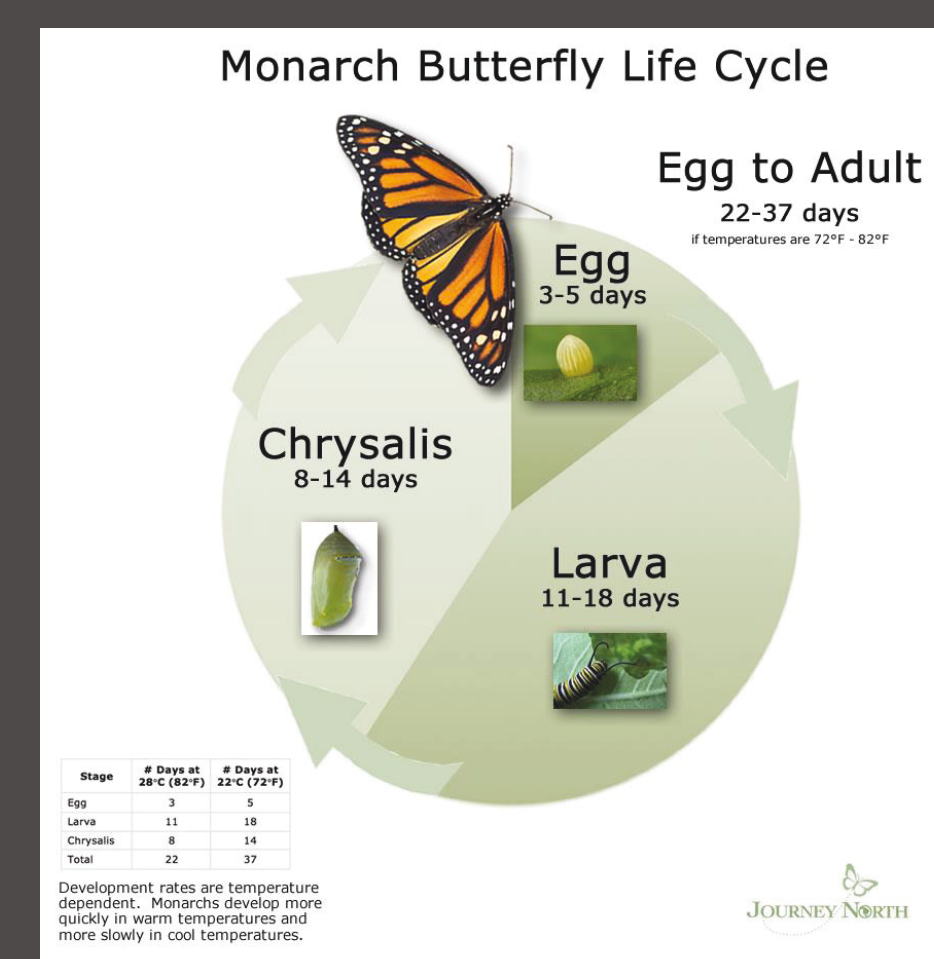
After around four days, the caterpillar emerges from the egg and immediately consumes the eggshell for nutrients. Caterpillar needs to rest and molt (Irving's Think Green...Be Green; (2022). The monarch caterpillar will undergo this process 5 times and each stage is known as an instar.

This process results in a chrysalis or a hard outer shell when the caterpillar is in a quiescent phase.

After a little over a week, the chrysalis changes from a jade green to transparent. This reveals black and orange markings of the butterfly.

The butterfly emerges the following morning.

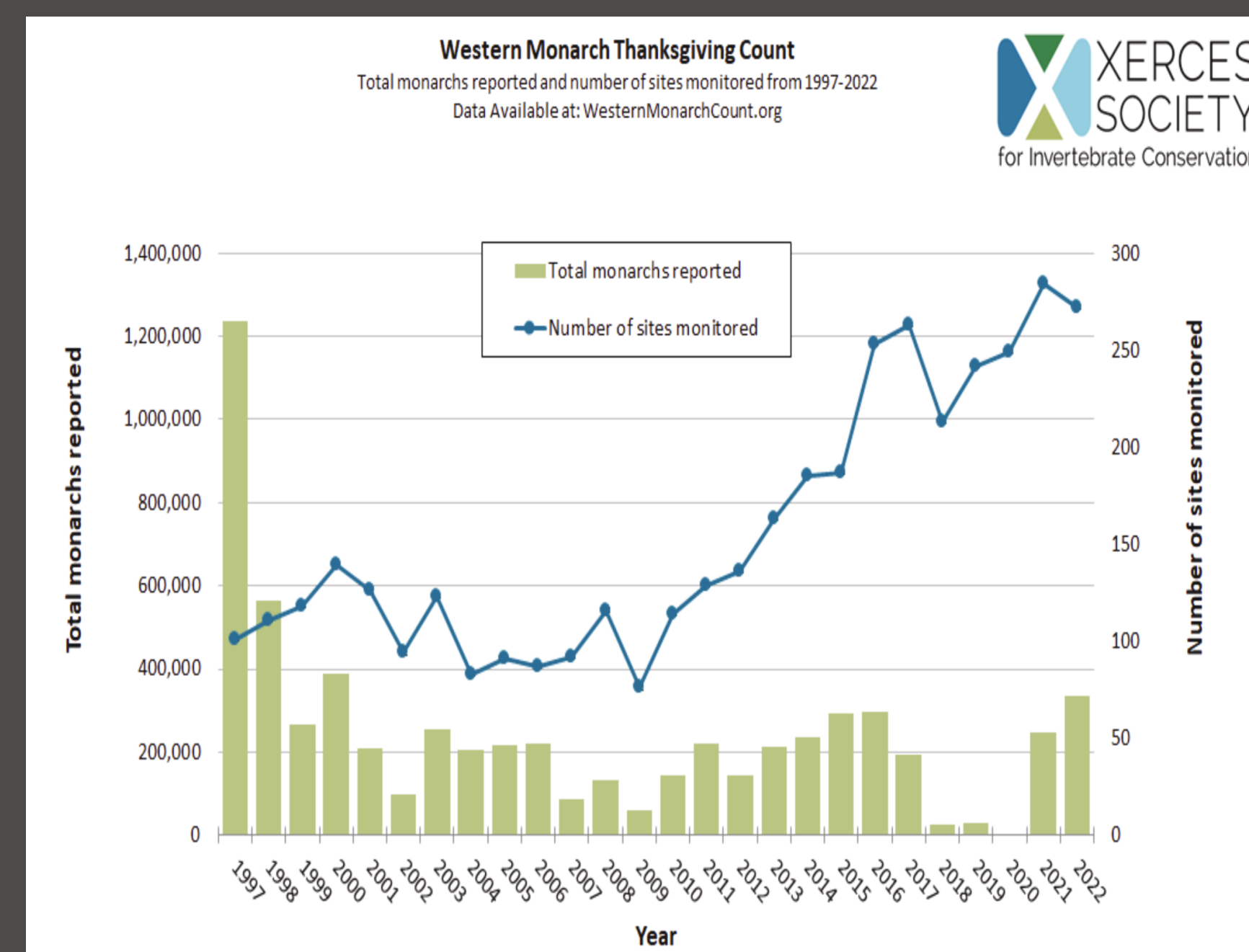
The butterfly pumps fluid from the abdomen is pumped into the wings to expand them like a balloon filling with air; takes several minutes. After this, the butterfly is ready to fly off and start the cycle again. (IBBA 2022).



Journey North 2022

Migratory Patterns:

During early spring to post winter or February and March, the fourth and final generation of monarch butterflies comes out of hibernation to find a mate (Xerces Society 2021). This species of butterfly migrates northeast (the farthest they migrate north being Canada) from as far south as Mexico to lay their eggs. They do this in September, October, and early November (IBBA 2022).



Xerces Society 2021

Human Interference on Migration:

With insecticides and deforestation causing habitat loss and population sinks, it has become increasingly difficult for these butterflies to not only take part in this migration, but also finish their cycle. The decline in milkweed has also made it more difficult for them as this means more energy that the butterfly must expend with less eggs being laid.



Monarch Butterfly and Milkweed Decline Predate the Use of Genetically Modified Crops:

Common theory to the decline is the use of GMO related herbicides. Population of monarchs and milkweed has been declining since the 50's, (Boyle J.; et al, (2019). GMO crops were introduced in 1994 (Royal Society 2015). Culprit is a mix of habitat loss/fragmentation, climate change, and extreme weather events like hurricanes (Xerces Society 2021).

References:

Boyle J.; et al, (2019) *Monarch butterfly and milkweed declines substantially predate the use of genetically modified crops*

Grant T., et al; (2020) *Conservation Risks and Benefits of Establishing Monarch Butterfly (Danaus plexippus) Breeding Habitats Close to Maize and Soybean Fields in the North Central United States: A Landscape-Scale Analysis of the Impact of Foliar Insecticide on Nonmigratory Monarch Butterfly Populations*

International Butterfly Breeders Association (IBBA); (2022) *The Life Cycle of a Monarch Butterfly*

Irving's Think Green...Be Green; (2022) *Monarch Butterfly Life Cycle*

U.S. Department of Agriculture (2005) *Why is Pollination Important?*

Xerces Society (2021) *Western Monarch Thanksgiving Count Tallies Nearly 250,000 Butterflies*

Royal Society, (2015) *What GM crops are currently being grown and where?*