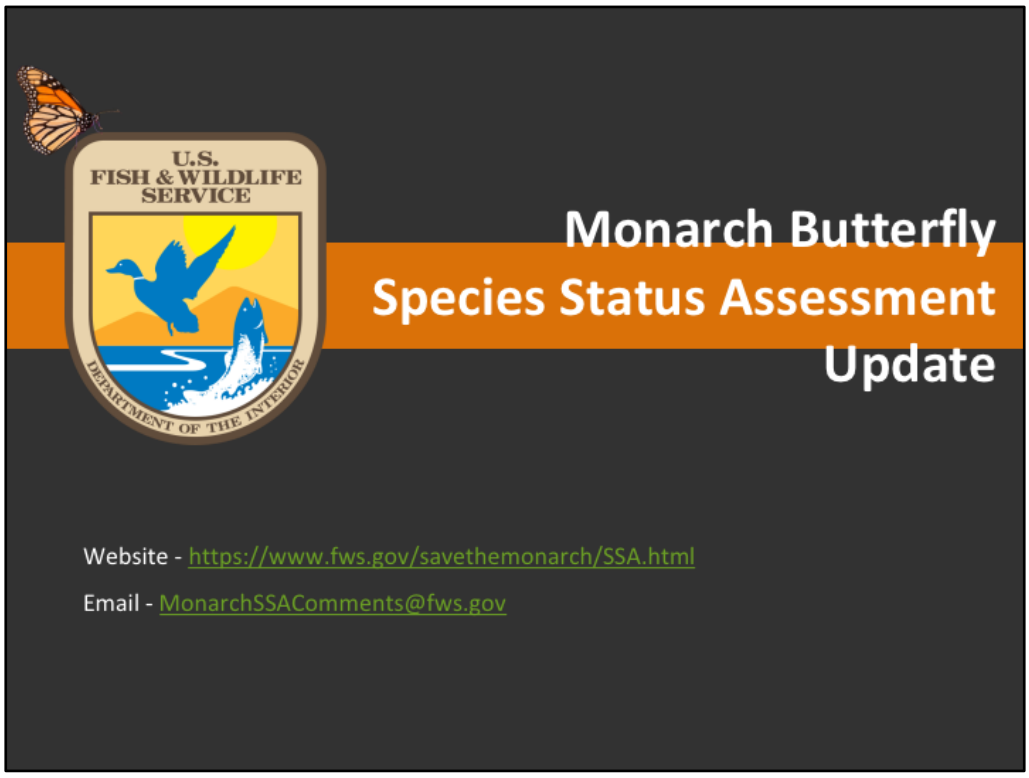
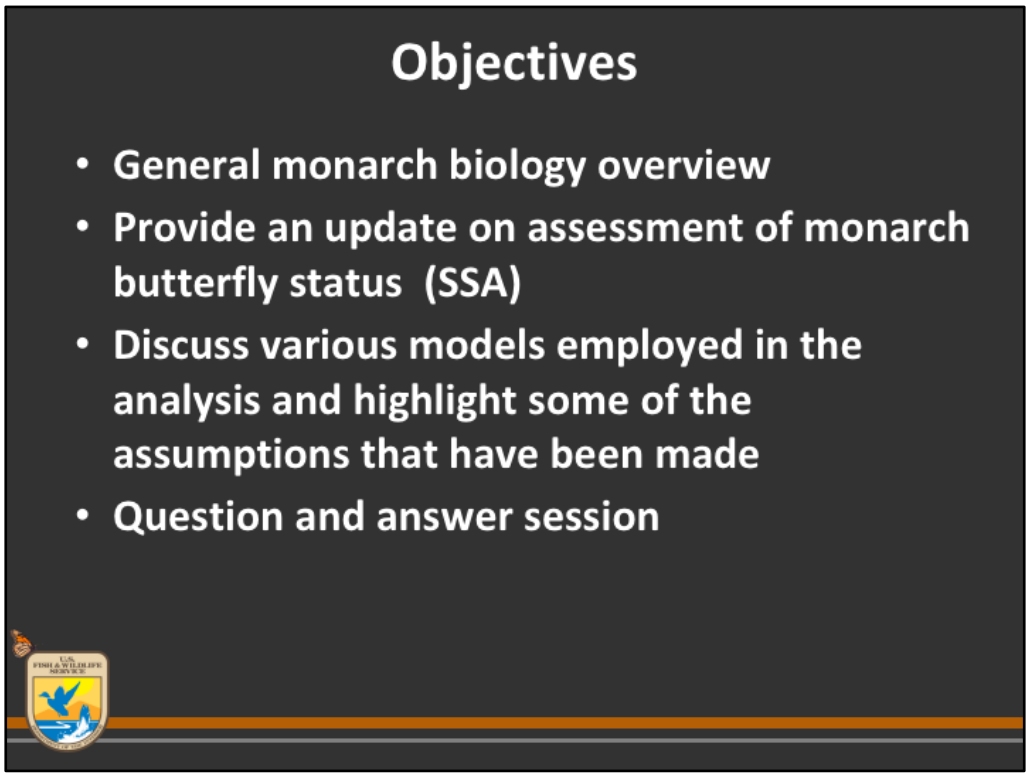
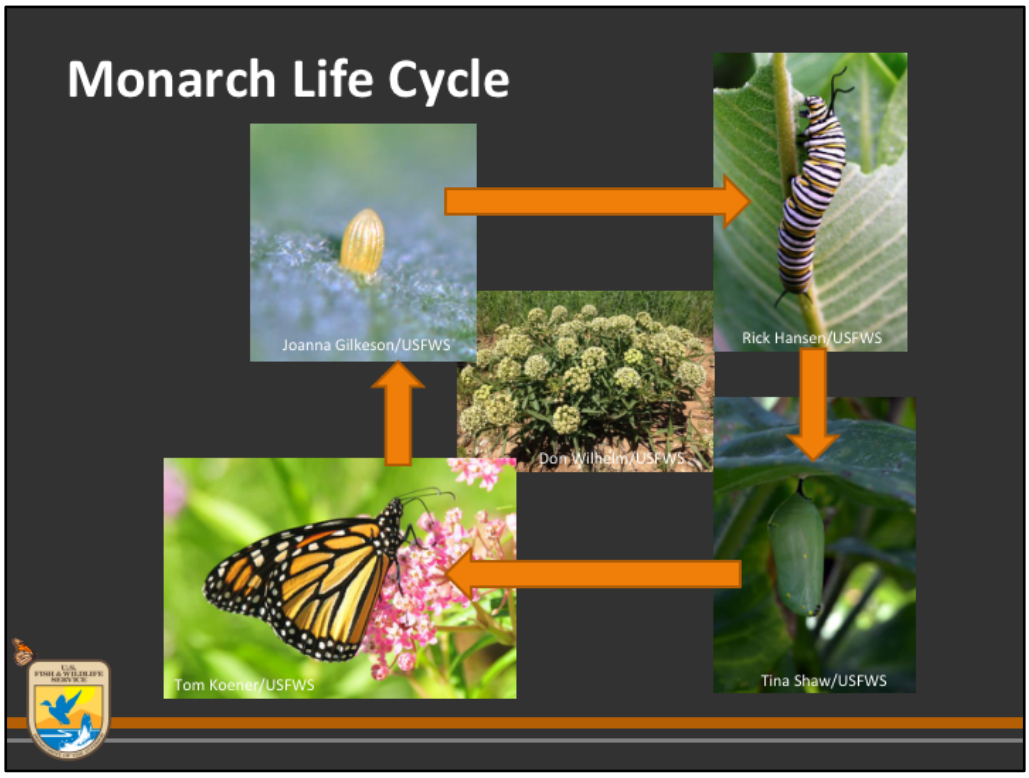



Monarch Butterfly Species Status Assessment Update




In this webinar, I will focus on the regulatory process that is moving forward and parallel to other Service programs that are working closely with our partners to implement conservation activities on the ground for monarch butterflies.

- We will be providing a quick monarch biology 101,
- then move into discussing the species status assessment,
- including some of the models and assumptions we are using in the models,
- finishing with a question and answer session.

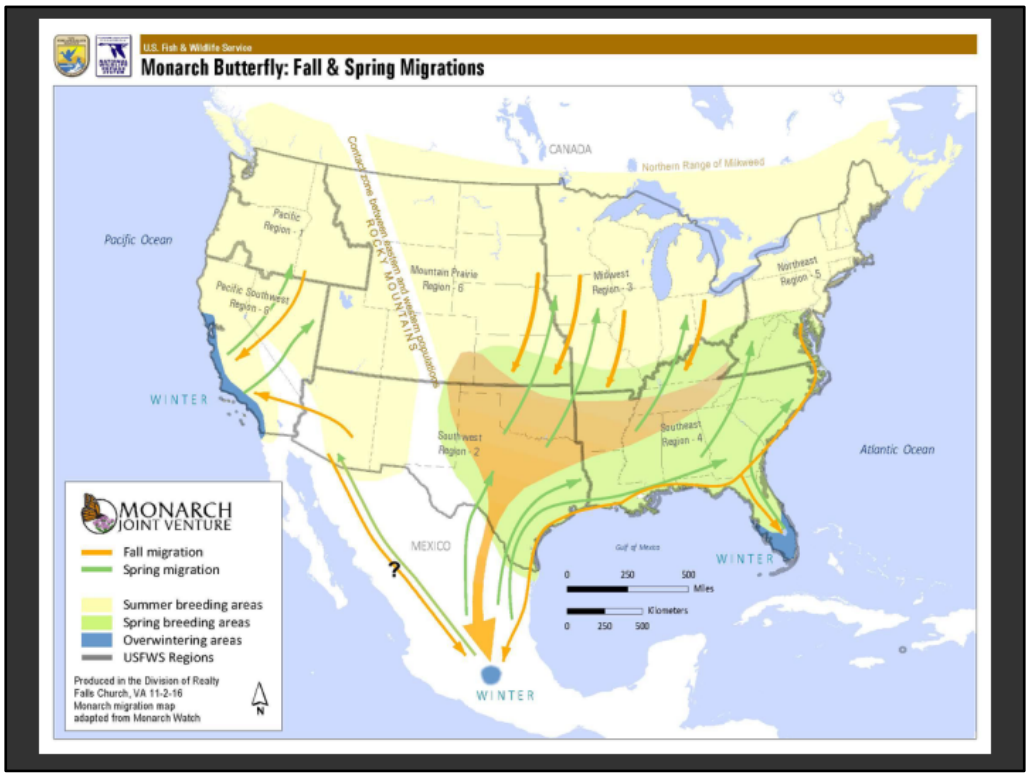



Just a quick Monarch Biology 101

Monarchs undergo complete metamorphosis, including 4 life stages.

1) **Eggs** are laid on milkweed plants and then hatch into
2) the **caterpillar or larval stage** where they only consume milkweed.
3) From there they go through 5 instars and eventually enter the **pupa or chrysalis stage**. They are in this stage for approximately 10-14 days before…
4) eclosing into an **adult**. Unlike the caterpillar, adults need a variety of flowering plants to nectar on.

The entire process from **egg to eclosing as a butterfly** takes about a month.

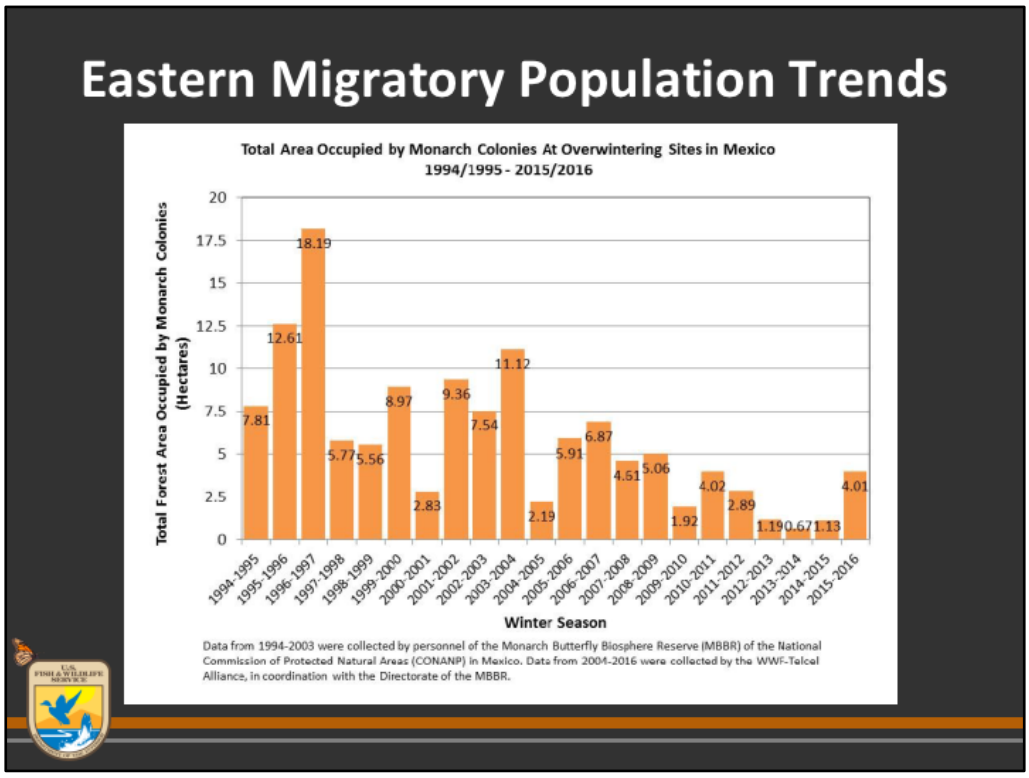



Here's a map of the range within North America. There are 3 populations: 1) the western and 2) eastern populations are migratory, and 3) the Florida population is non-migratory.

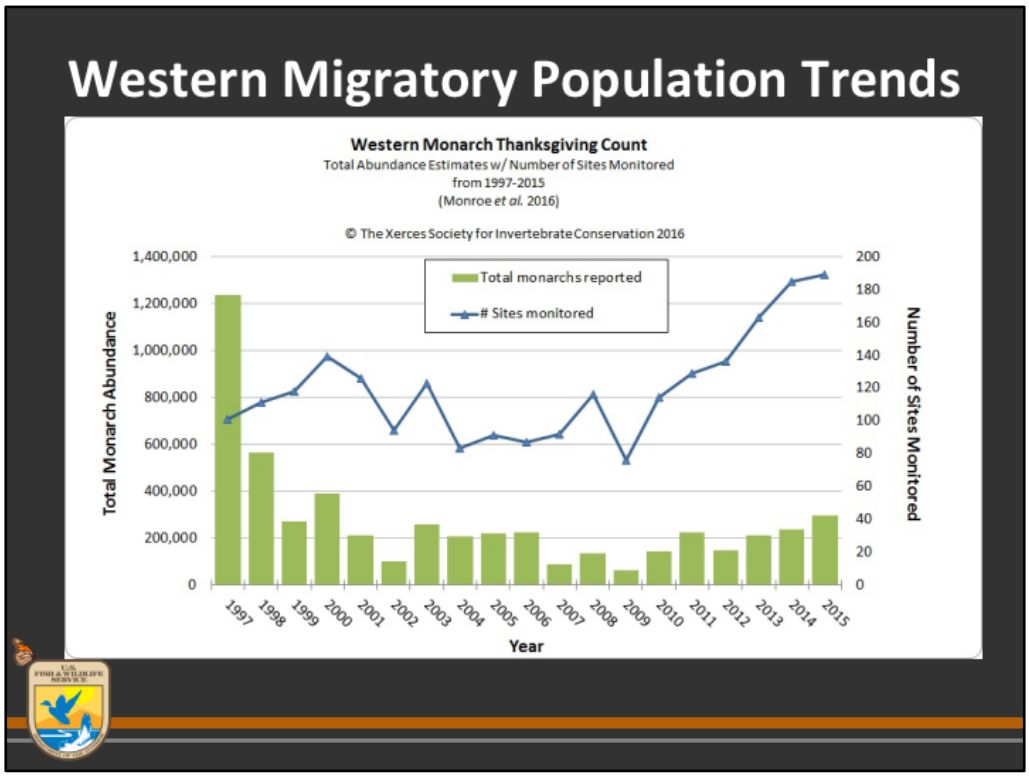
Monarchs overwinter either on the west coast of the United States or in Mexico, depending on the population they are from.

As monarchs move north or east during the breeding season, this life cycle we just discussed is repeated 4-5 times, creating 4-5 generations. So, the monarchs that eventually move back to Mexico are the great great grandchildren of the monarchs that left Mexico and started the cycle that year.

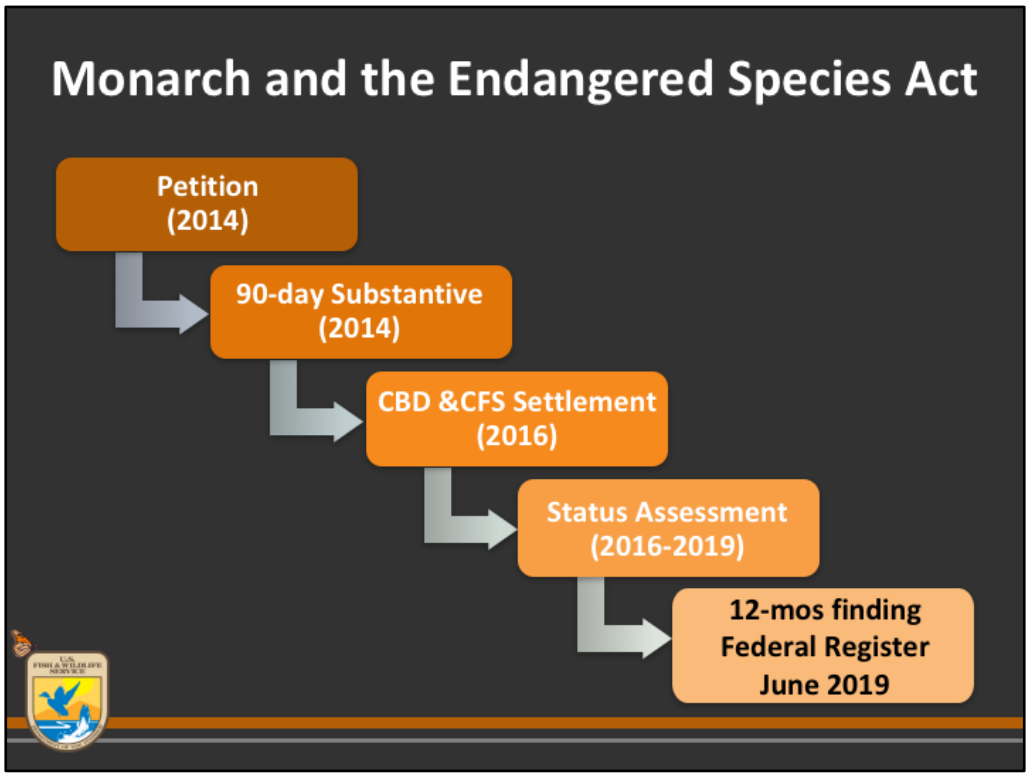
Interesting note here is that, in Mexico, a certain number of overwintering butterflies are needed to create a microclimate that allows them to survive through the winter then they move into the east – therefore, population numbers seem to be an important aspect, given the microclimate needs, at least in the east and likely in the west as well.




As you can see, within the eastern population we have seen 20 years of decline.




Similarly – the western population has also declined. Although the graph may look like a stable population, the total survey monitoring effort has increased from 2009-present, while monarch abundance stayed relatively the same – which generally indicates a lower abundance.




Here's a quick recap of what I mentioned earlier.

Due to these population declines, the Service was petitioned to list the monarch butterfly under the Endangered Species Act in the summer of 2014.

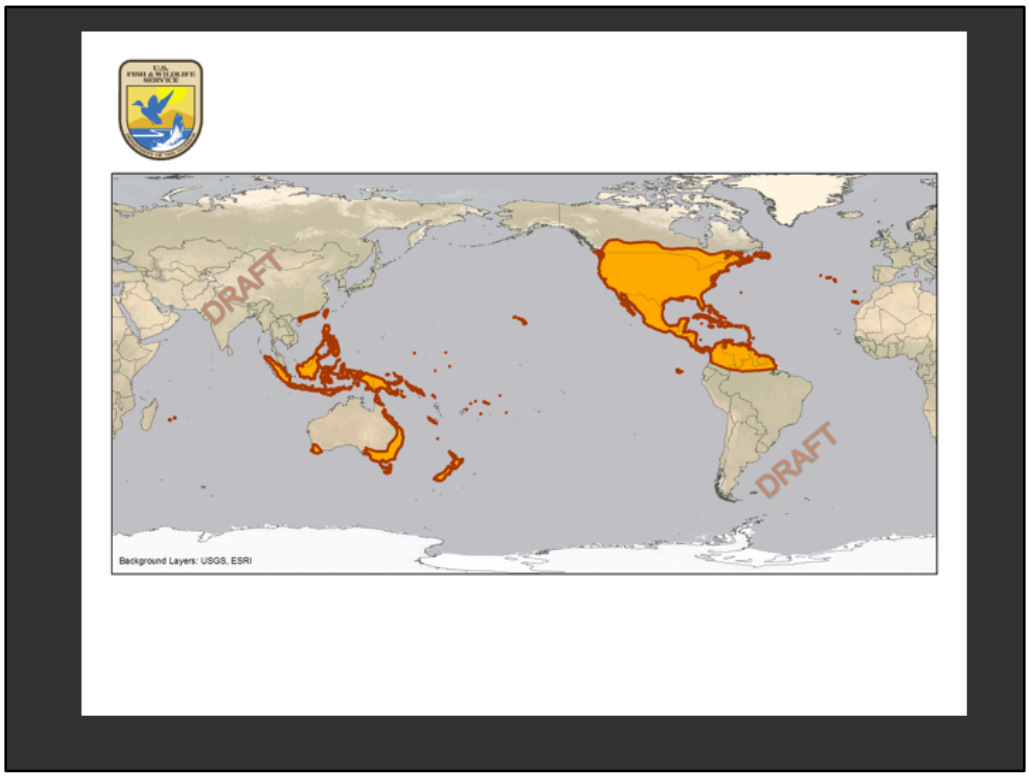
We completed a 90-day finding in December of 2014 and determined that there was substantive information and we should complete a 12-month finding as well.

However, due to workload we did not complete a 12-month finding by the summer of 2015. We received a notice of intent to sue in January 2016.

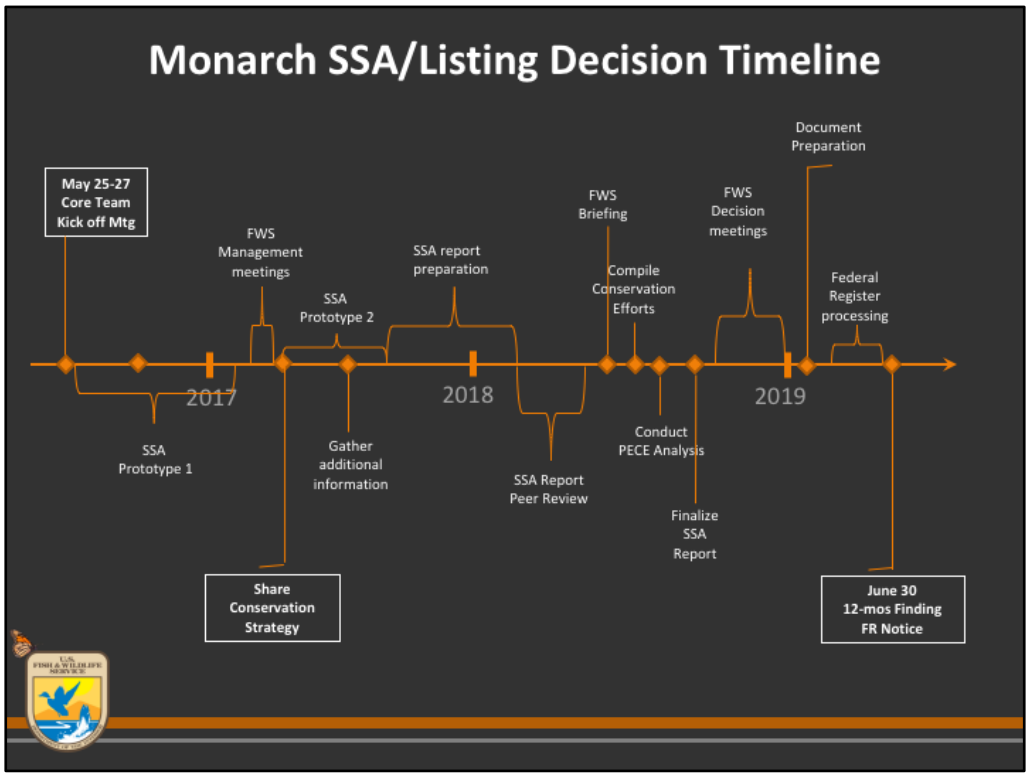
We settled with the Center for Biological Diversity and the Center for Food Safety for failing to meet our statutory deadline; a settlement agreement outlined a due date of June, 30, 2019.

We plan to work on a status review in the coming years which will follow the Service's Species Status Assessment framework.

With the settlement of the lawsuit, we now have a deadline of June 30, 2019 to have a draft 12-month finding to the Federal Register.




Important note: the petition and ultimately the listing decision, was for the subspecies – which ranges throughout a wide area, not just North America.

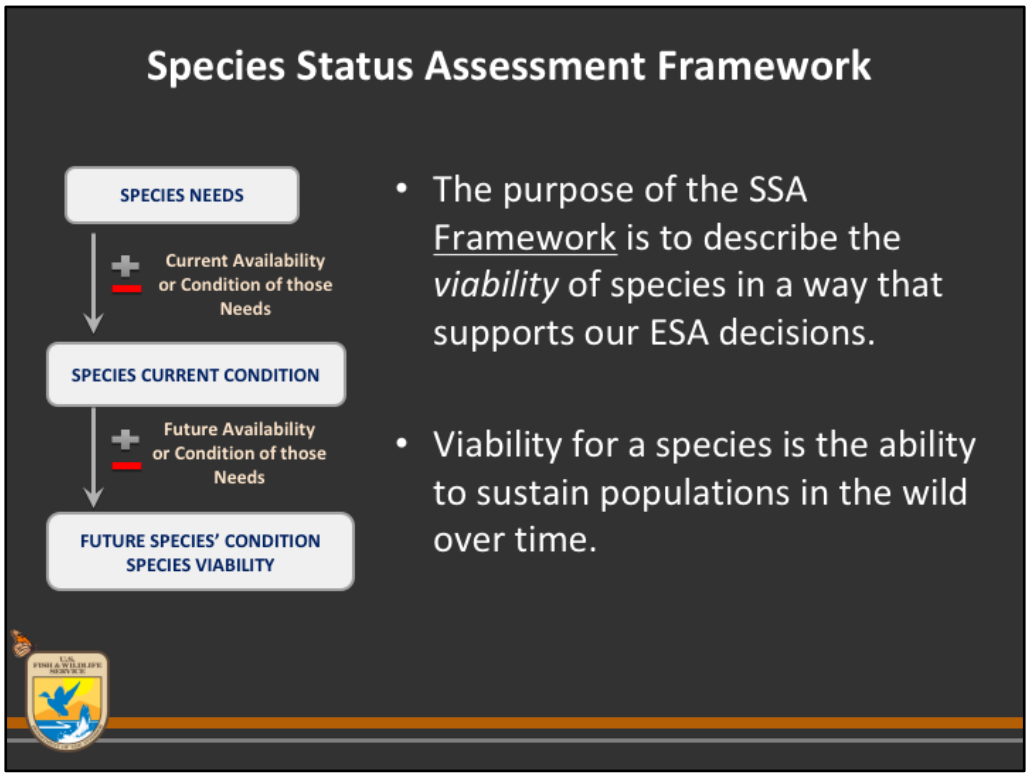



Important to note on the timeline: in order to tackle the conservation strategy goal that the Service has for mid-March, we divided the SSA into prototype 1 (focusing just on North America) and prototype 2 (incorporating the rest of the range).

Here are some critical dates to highlight from the timeline above.

- Webinars –
    - First week Nov. 2016 - Service
    - Week of Nov. 7 with the states and tribes
- Jan. 2017 – Check-in meeting with the states
- March 2017 – Conservation strategy released (before the Annual North American Wildlife and Natural Resources Conference )
- Early Spring 2017– Continue with Prototype 2, including reviewing the status in the rest of the range and expert elicitation
- Early spring 2018 – Peer review of the Draft SSA Report
- Early summer 2018 – Collect information from states on formal conservation efforts – likely through a conservation efforts database
- June 2019 – listing decision due

Note: conservation strategy is a separate and distinct document that is informed by the SSA.




This framework provides a way to piece together the puzzle that reflects the species' biological status through an iterative, rather than a strictly step-by-step, analytical process.

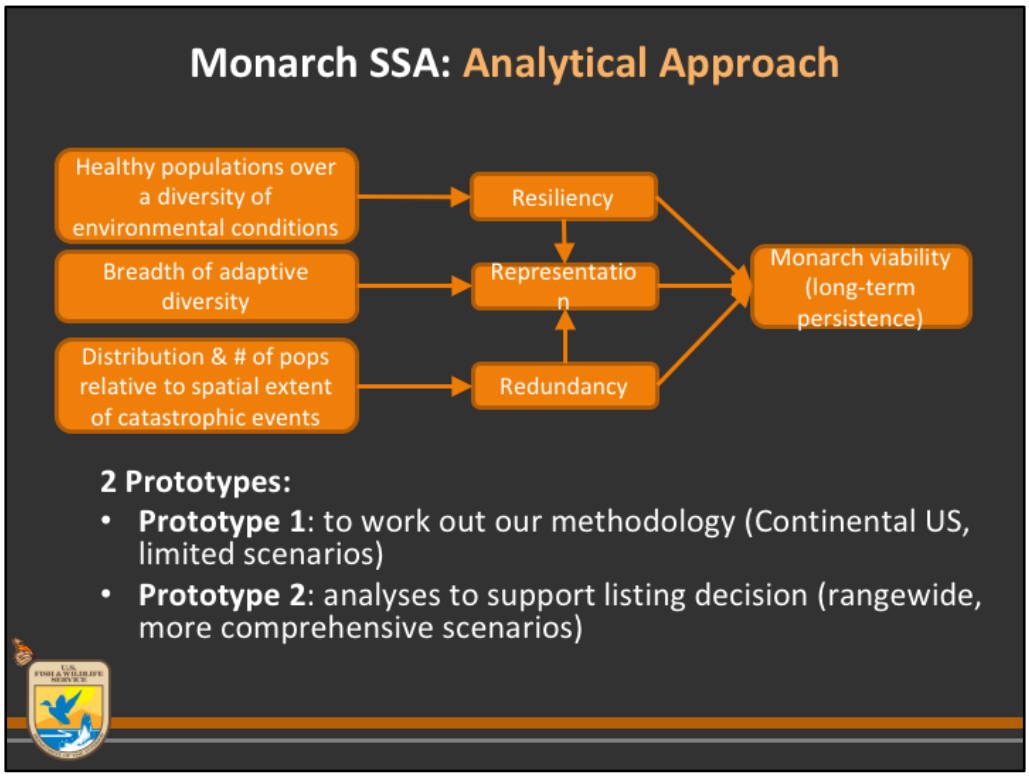
Essentially the SSA is an analytical approach for assessing a species' biological status.

1. First thing we are doing is identifying species' needs. In other words, compile information on the monarch's life history and ecological relationships.

1. Evaluate the current condition of the species, identifying threats/stressors/influences that are acting on the species' needs.

1. Then we will project future conditions, by identifying the differences between what the species has and what the species needs, and what this means to the species.

This leads to an assessment of the overall viability of the species. Viability is the ability to sustain populations in the wild over time.




1. To assess viability over time, we are deconstructing the question into the 3 Conservation Biology principles of Resiliency, Representation and Redundancy.

Briefly,

1. Resiliency is the ability of the species to withstand environmental variation and stochastic events.

1. Representation is the ability of the species to withstand physical and biological changes in its environment, i.e., adaptive capacity of a species.

1. Redundancy is the ability of the species to withstand catastrophic events.

As I discussed earlier, we are conducting the SSA in phases. The first phase is a prototype. We are working out the methodologies; in doing so, we are focusing on North American monarchs and evaluating 1 future scenario. We'll discuss this more in the next couple of slides.

The second phase, prototype 2, will be a more comprehensive and robust analysis. It will expand to rangewide, include additional scenarios, and expert input.

## Monarch SSA: Representation

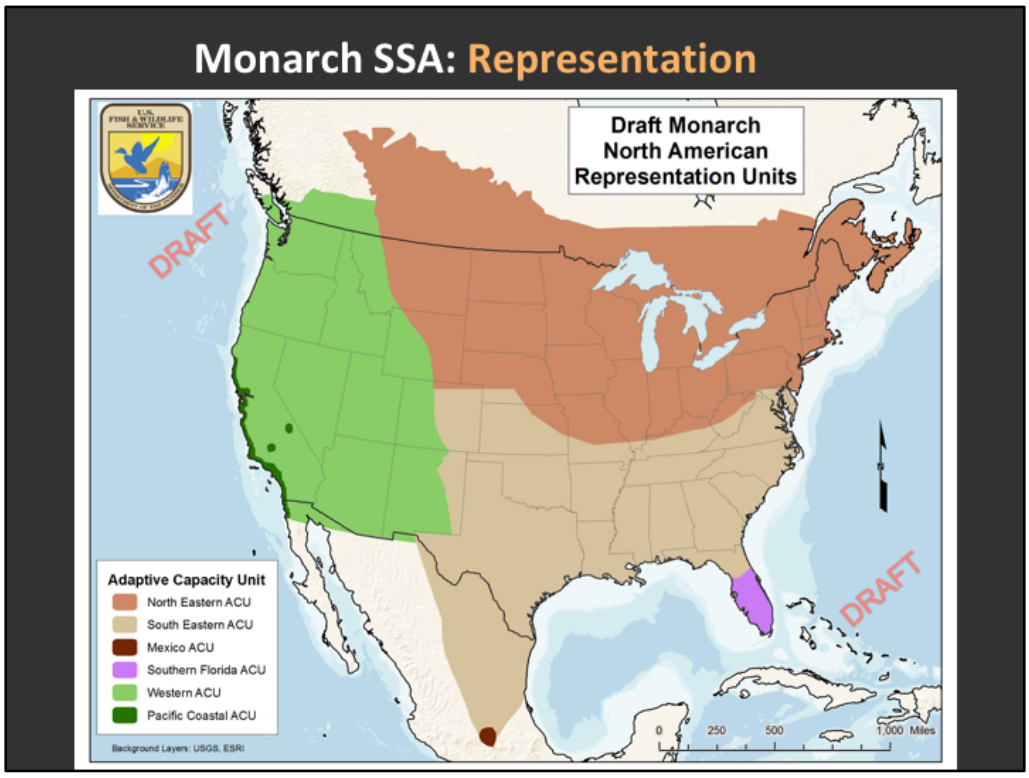
***The ability of monarch to adapt to biological and physical changes in its environment***

- Scoured the literature for potential sources of variation in adaptive diversity across the continental range
- Searched for variation in genetic, behavioral, morphological, and ecological traits


Here is what we have done thus far….

For Representation,

- We have searched for monarch-specific information on sources of adaptive diversity, looking specifically for what ecological, biological traits might be sources of adaptive diversity.




Here's what we have come up with so far . . .

As I noted already, there are 3 populations of monarchs within North America ; within these populations, we've identified variation in adaptive traits, allowing us to delineate 6 areas:

1. Florida  individuals may provide unique adaptive diversity due to genetic variation.

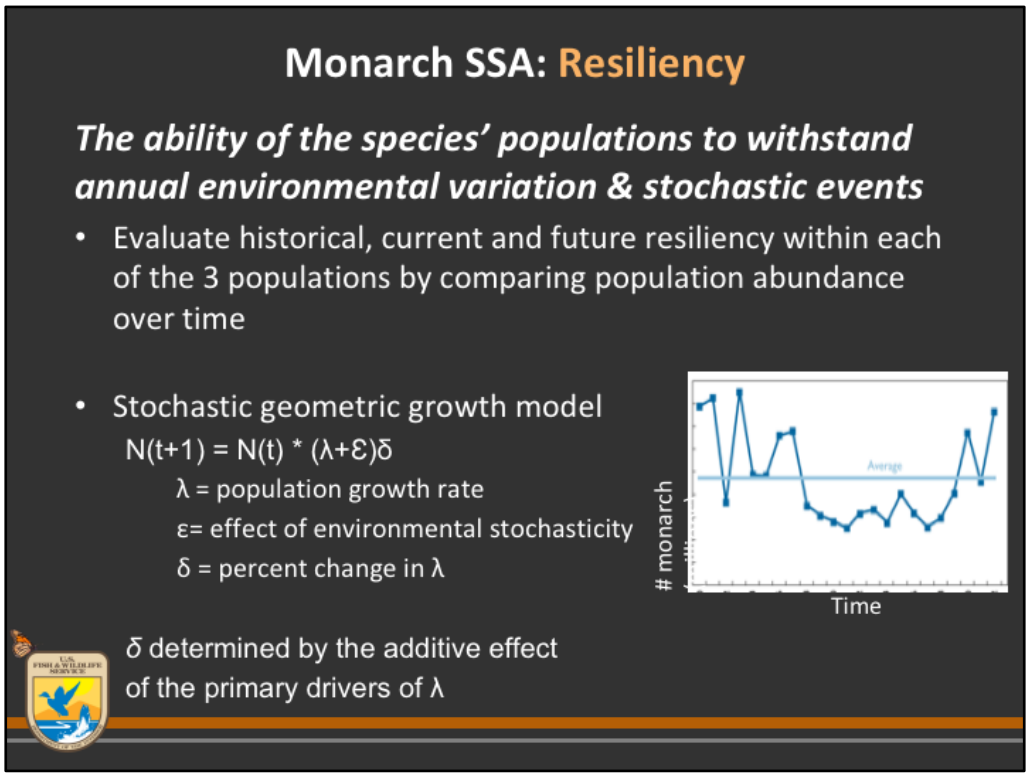
2. The western and eastern units may provide unique adaptive diversity primarily due to differences in migratory behavior.

3 and 4.  Within the Eastern unit, the northern portion may provide uniqueness due to the performance traits associated with long-distance migration.

And finally, 5 and 6, the over-wintering units in Mexico and California due to differences in winter habitat niches.

Our analysis, thus far, indicates that the individual monarchs in these 6 areas may provide unique adaptive potential.  Our analyses will look at likelihood of maintaining monarchs within the 3 populations that are separated into these 6 areas over time.

We are going to do this by evaluating the species Resiliency and Redundancy, given various future scenarios.

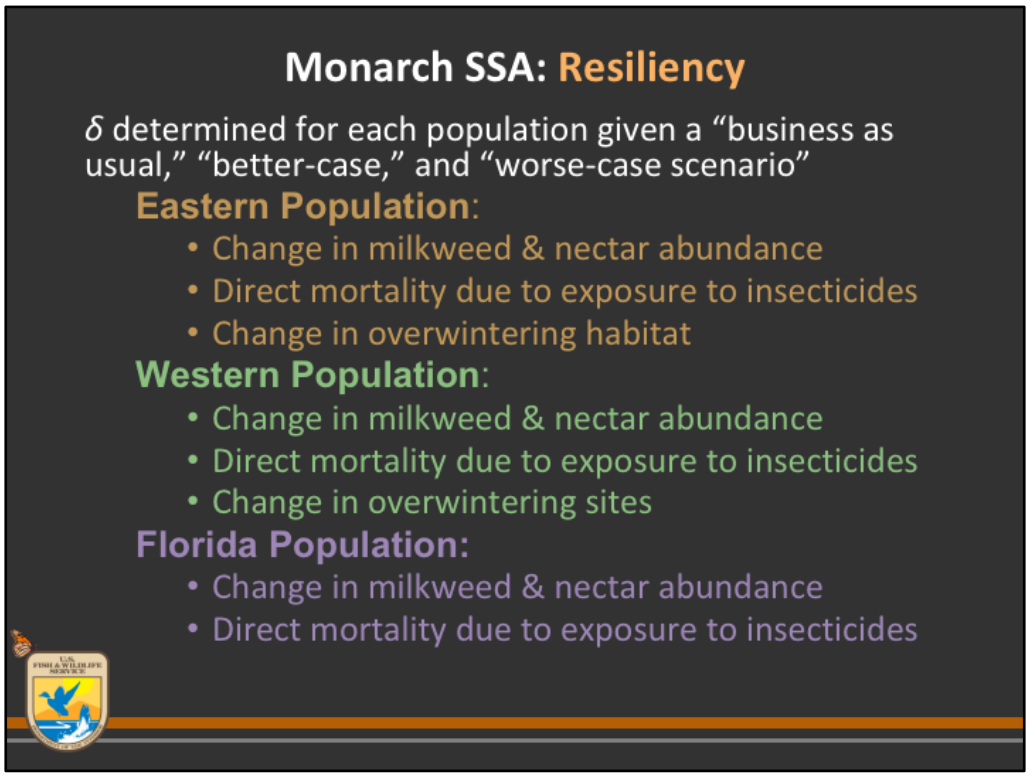



We are evaluating Resiliency by looking at the population (N) over time: historically, currently and into the future - in each of the 3 populations

- We looked at various existing population models and had hoped to use one of the published models.
    - However, though they all give a projection of population number (N) based on current conditions, none answer the question of what happens to the population (N) given reasonable future conditions (i.e., stressor and conservation scenarios).
    - Oberhauser et al., 2016 attempts this by generically increasing or decreasing the population growth rate (λ) by a percentage, but for the listing assessment we need to develop plausible future scenarios.

- So, we are using a stochastic geometric growth model that is very similar to the Semmens et al., 2016, with the addition of incorporating the effect of future scenarios.
    - The model looks at pop abundance next year as it is determined by population (N) this year multiplied by pop growth rate.
    - Pop growth rate, (λ) is modified by the effect of stochasticity (epsilon) and change in a population growth rate (λ) given a future scenario.
    - We are using the effect of stochasticity that Semmens et al. used
    - and then deriving the change in pop growth rate from expert input.

- For Future scenarios we will project those factors (the stressors or threats) that are primarily driving monarch numbers.




The change in population growth rate is being evaluated in 3 future scenarios: business as usual, better case and worse case.

For Prototype 1, we just developed the "business as usual" scenario – ultimately we intend to develop at least 3 future scenarios.

Based on literature and previous Service efforts, we identified the primary drivers (or threats) for each population.

For the eastern population:

- Change in milkweed and nectar abundance (positive and negative), insecticide exposure, and changes in overwintering habitat;
- Changes in milkweed and nectar habitat, we are looking at future glyphosate use, conservation efforts, and climate change. Conservation efforts = changes in Conservation Reserve Program enrollment and compatible management in rights-of-ways and protected grasslands; and
- Change in overwintering habitat due to climate change and illegal logging.

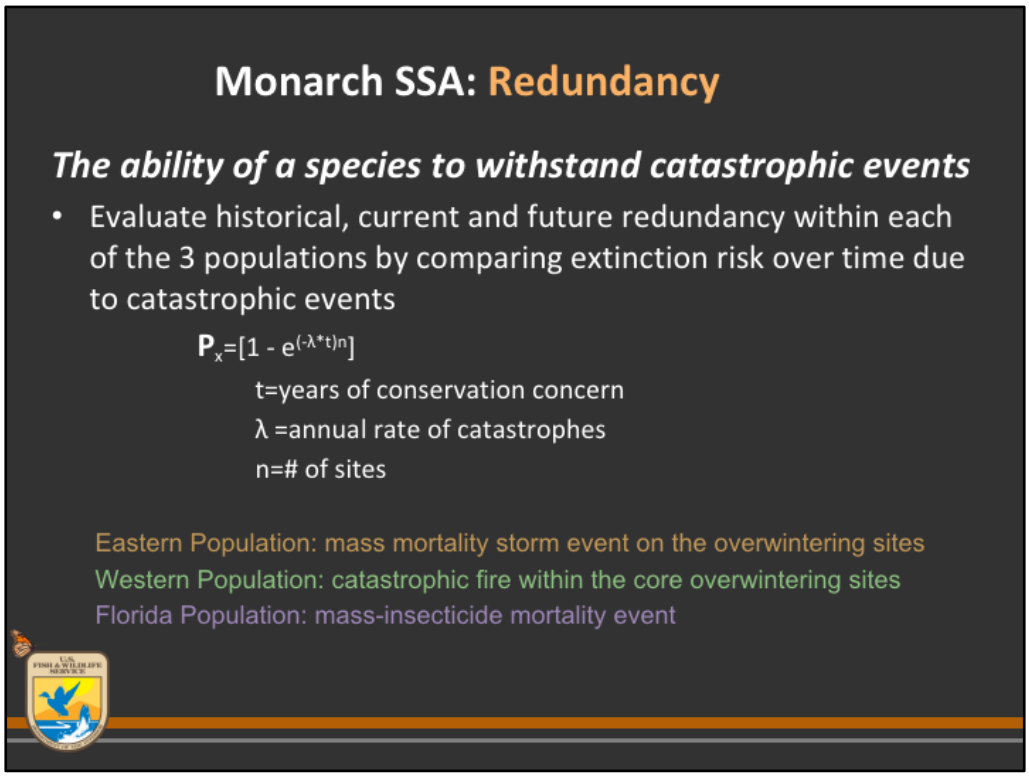
Similarly, in the western population we are looking at:

- Change in milkweed and nectar resources, insecticides, and loss of overwintering sites;
- Change in milkweed and nectar resources due to land cover changes - but lacking sufficient data to model climate change and conservation efforts; and
- Loss of overwintering sites due to tree senescence (trees dying of old age) and storm

events.

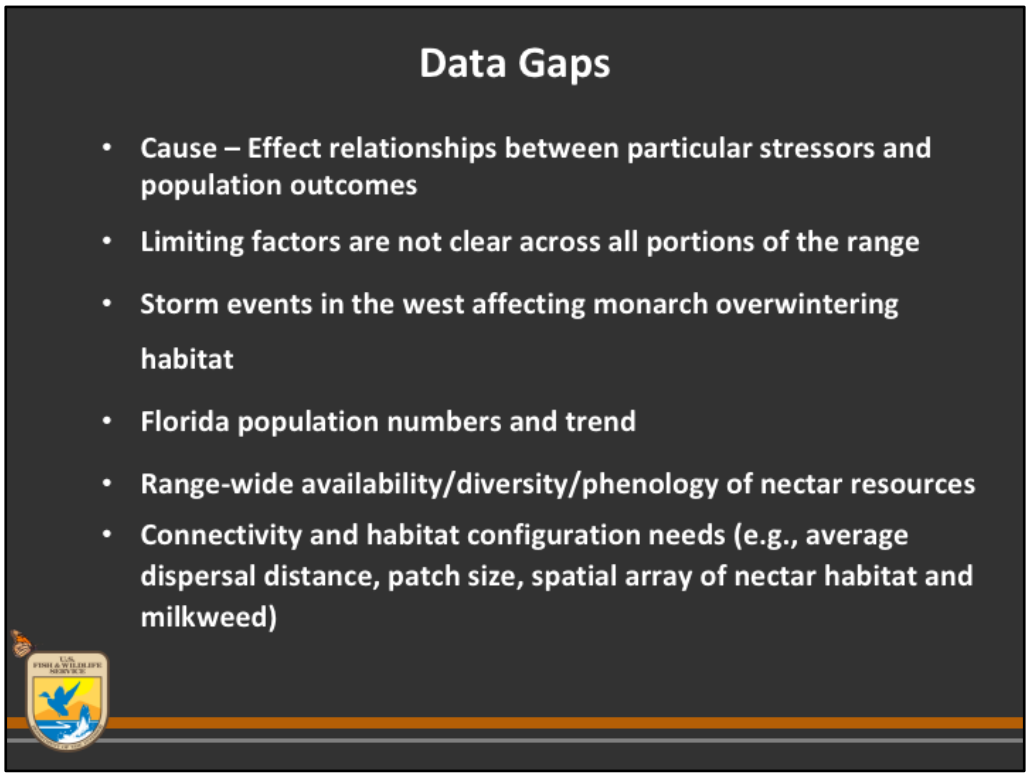
In the non-migratory population - even fewer data available for this population:

- Modeling change in milkweed and nectar due to land cover changes and insecticide exposure; and
- We hope to get data on climate change and conservation efforts; however, if we cannot, we will develop “reasonable” scenarios.




Redundancy is the extinction risk over time due to the frequency of catastrophic events.

Eastern – storm events in Mexico
Western – catastrophic fire in core overwintering sites
Florida – mass insecticide event




This seems to be one of the most well-studied species, yet we lack specific information on areas that are necessary for a robust SSA:

- cause-effect relationships between particular stressors (threats) and population outcomes or vital rates are not well established;
- limiting factors are not clear across all portions of the range; and
- landscape conservation design is a challenge because we lack data on connectivity and habitat configuration needs.

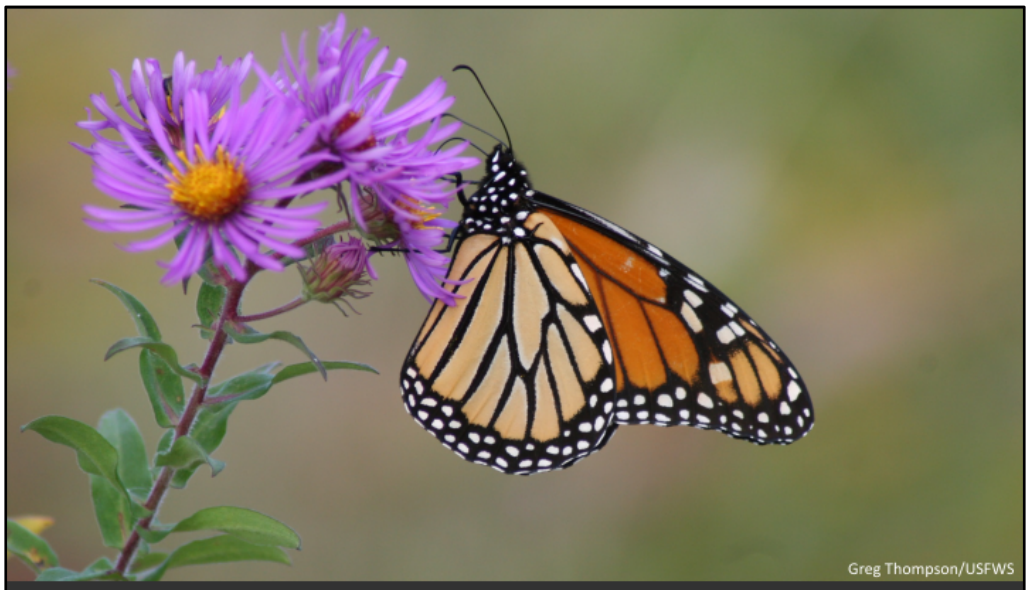

We are using prototype 1 of the SSA to inform the conservation strategy, which is separate and apart from the SSA.

## SSA Core Team Members

Michelle Shaughnessy (Midwest)
Amy McGovern (Midwest)
Barbara Hosler (Midwest)
Erik Olson (Midwest)
Jennifer Szymanski (Midwest)
Kelly Nail (Midwest)
Kristen Lundh (Midwest)
Ryan Drum (Midwest)
Sarah Warner (Midwest)
Kristen Voorhies (Midwest)
Katie Boyer (Southwest)

Cat Darst (Pacific Southwest)
Lara Drizd (Pacific Southwest)
Tara Nicolaysen (Headquarters)
Beth Forbus (Headquarters)
Karen Kinkead (Iowa DNR)
Ed Boggess – Association of Fish & Wildlife Agencies Liaison (Midwest)


Multiple FWS regional representatives lead the effort, in close coordination with states. We have 2 state representatives, Karen Kinkead and Ed Boggess on the core team.




# Questions?

Please email any comments or information specific to this presentation to:

MonarchSSAComments@fws.gov

Website - https://www.fws.gov/savethemonarch/SSA.html