Slide 1

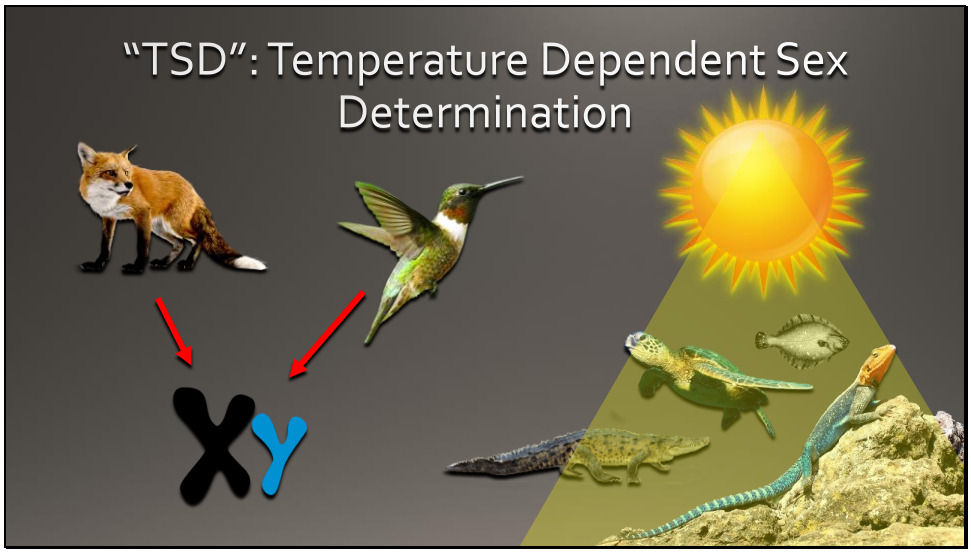

Climate Change and
Sex Ratios in Snapping Turtles
Melanie Massey, M. Sc. Candidate
Photo by Larry Master

Slide 2


About me
Saskatchewan, 2013
Algonquin Provincial Park, 2016
Maine and New Hampshire, 2014
McGill, 2014

Slide 3

Slide 4

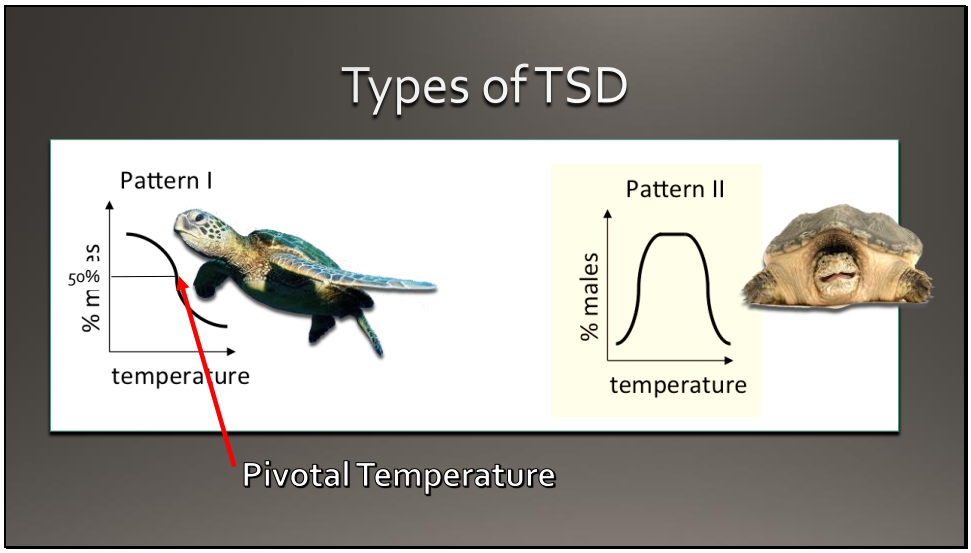


Unlike mammals and birds, which have *chromosomal sex determination,* a turtle's gender is determined by the temperatures that its eggs experience while they incubate. The fish is Verasper Moseri, the barnfin flounder, and the lizard is Agama agama, the first species TSD was discovered in

This method of conferring gender is called "temperature-dependent sex determination" or TSD

Because the climate is rapidly warming, species with TSD are at risk of having their populations collapse. One author has dubbed them the "Canaries in the Coal Mine" for global warming.

Slide 5

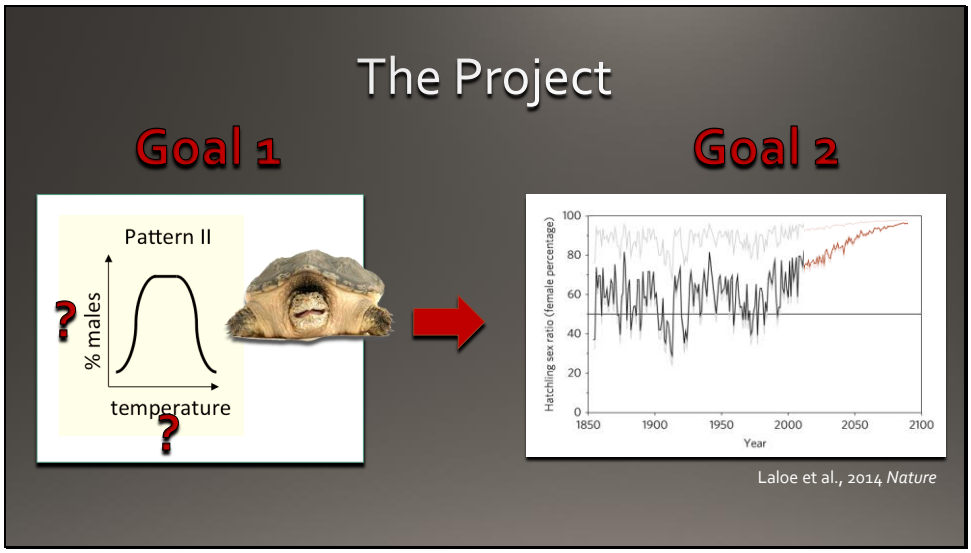


Pattern I is the more common type of TSD, exhibited by sea turtles and alligators. At cold temperatures males are produced, at hot ones, females are.
Pattern II is less common, and found in many other turtle species including the snapping turtle. Males are produced at middle temperatures.

TSD is characterized by having one or more **pivotal temperatures**, at which the sex ratio is 1:1

Image from wikipedia

Slide 6

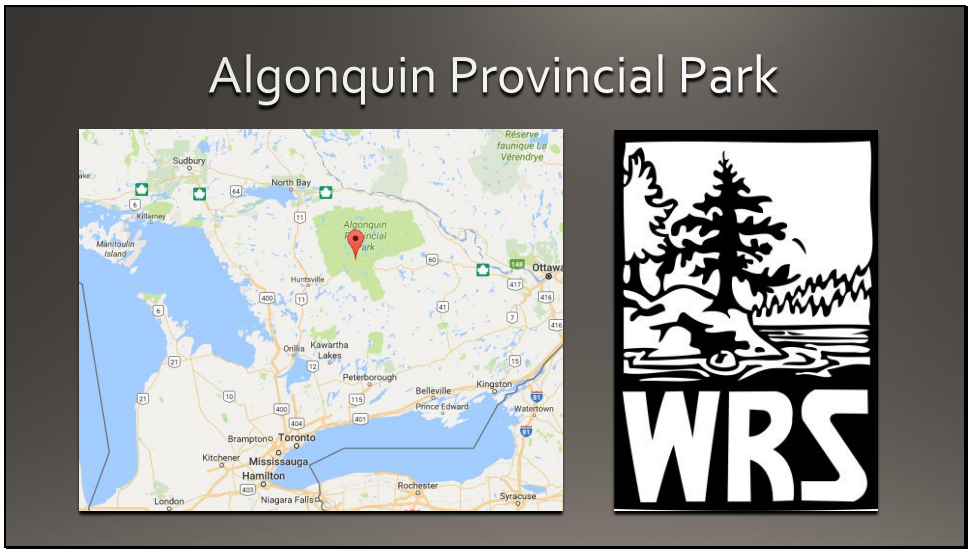


I am investigating a Snapping Turtle population from Algonquin Park. We have 30 years of data for this population from a long-term study spearheaded by Dr. Ron Brooks of Guelph University.
I want to find out what temperatures make male turtles, and what temperatures make female turtles.
I want to use our historical nest data to make a model that shows how the sex ratio will change as the climate warms.

Slide 7

Tom Thompson introduction ~

Slide 8



APP facts
-Canada's oldest pp (1893)
-7700 sq kilometers
-2400 lakes and 1200 km of streams and rivers many of which were formed by the glacial retreat

-Unofficially considered the divide between North and South Ontario, APP's unique mixture of coniferous and deciduous forest gives it a singular level of diversity. However, of the 10 species

Slide 9

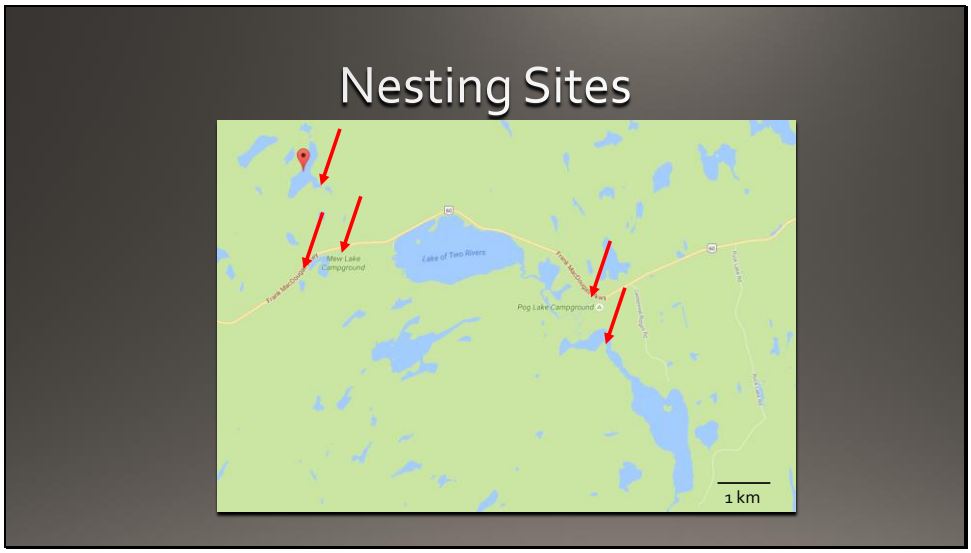
Slide 10

Slide 11

Turtle Nesting

Bastian Sander

Slide 12



The pin is dropped at the location of the wildlife research station. We sampled along several other sites across this stretch of Highway 60, including an abandoned airfield near mew lake, and whitefish dam.

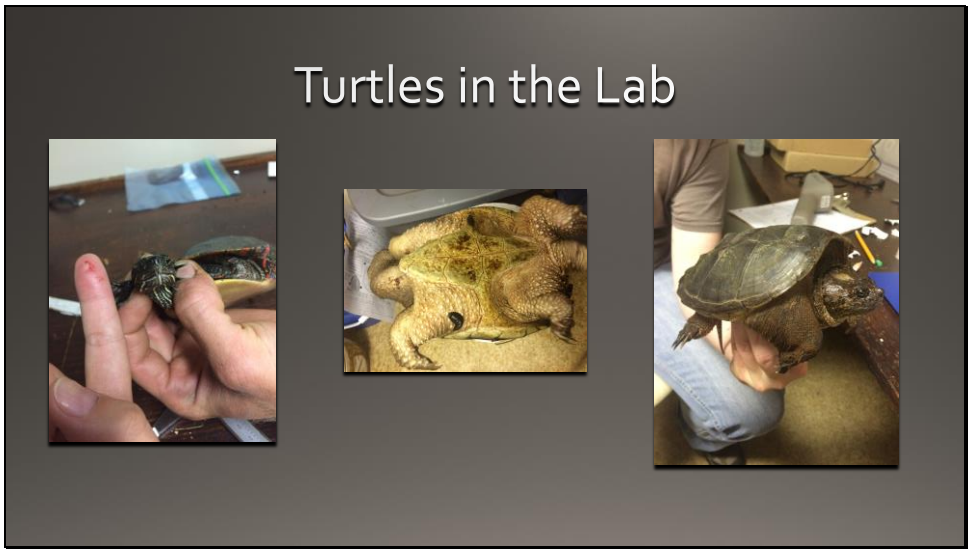
Slide 13

Slide 14

Slide 15

Slide 16

Slide 17



Slide 18

Slide 19

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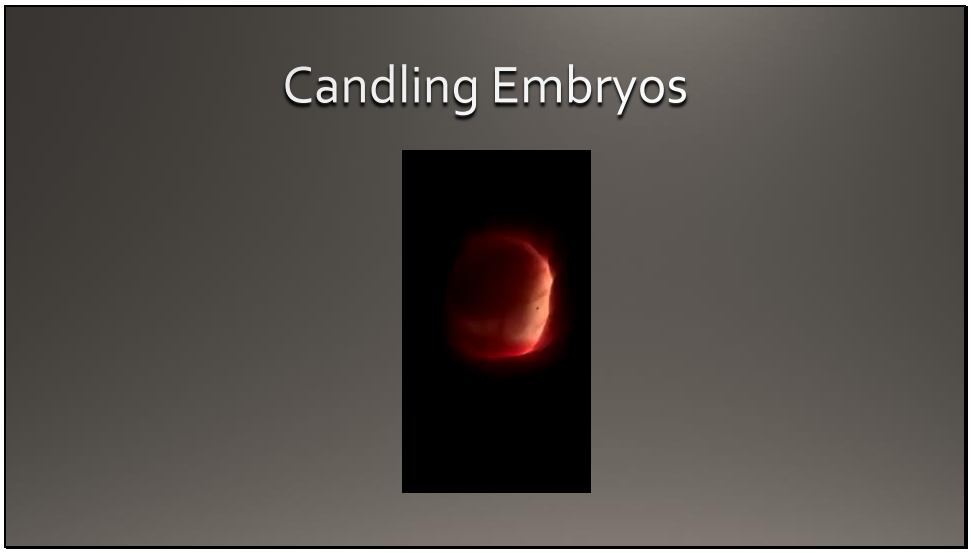

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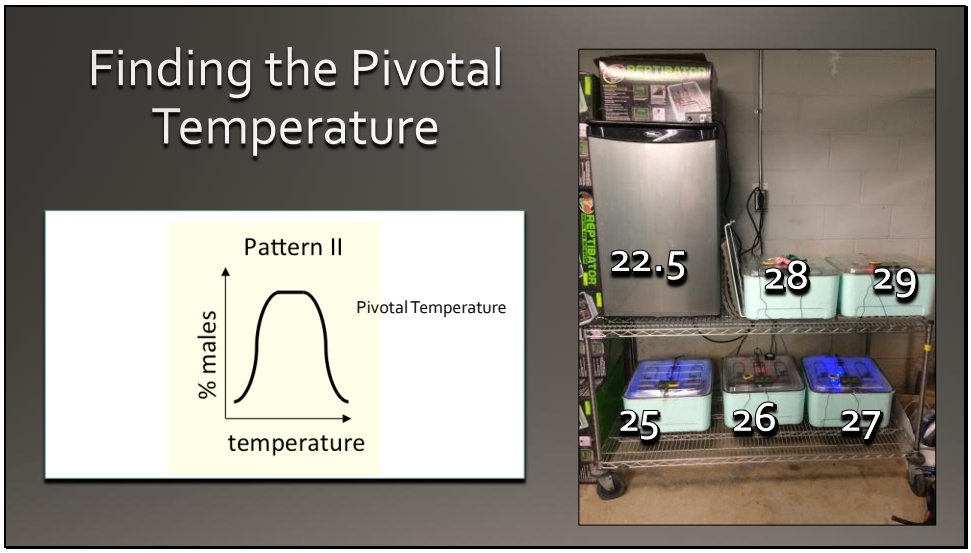
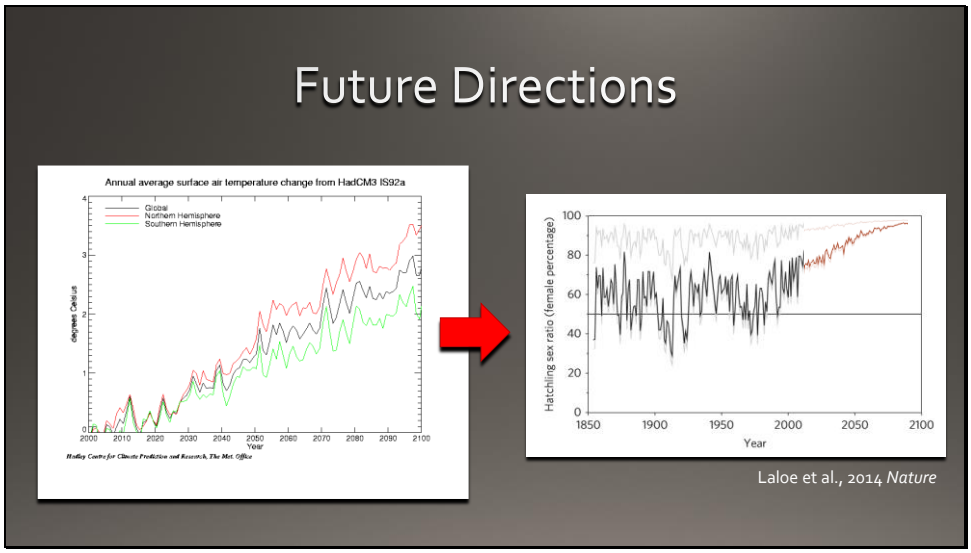

Finding the Pivotal Temperature
Pattern II
% males
temperature
Pivotal Temperature
22.5
28
29
25
26
27

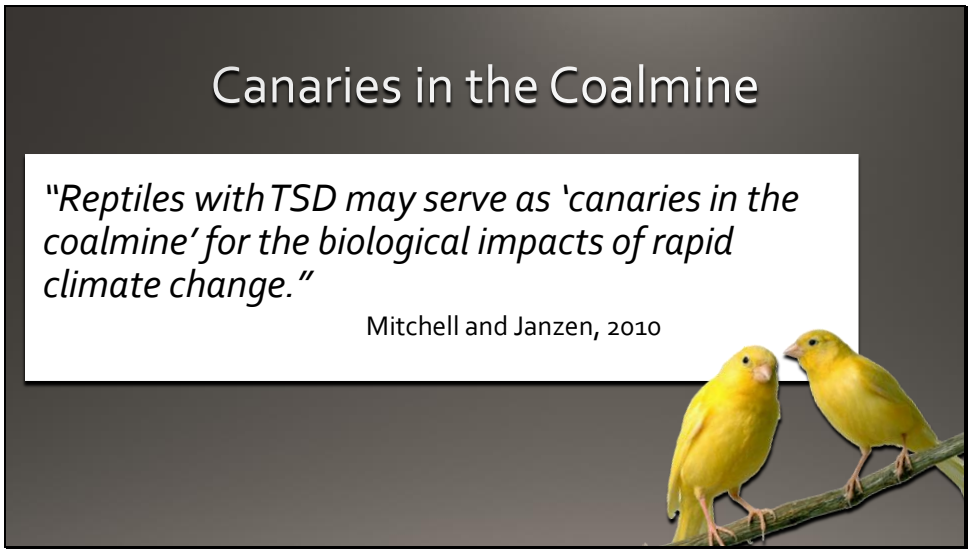
Slide 22



I hope to take climate change data, such as this from the Hadley centre, and apply it to sex ratios to model the turtle's response to warming temperatures

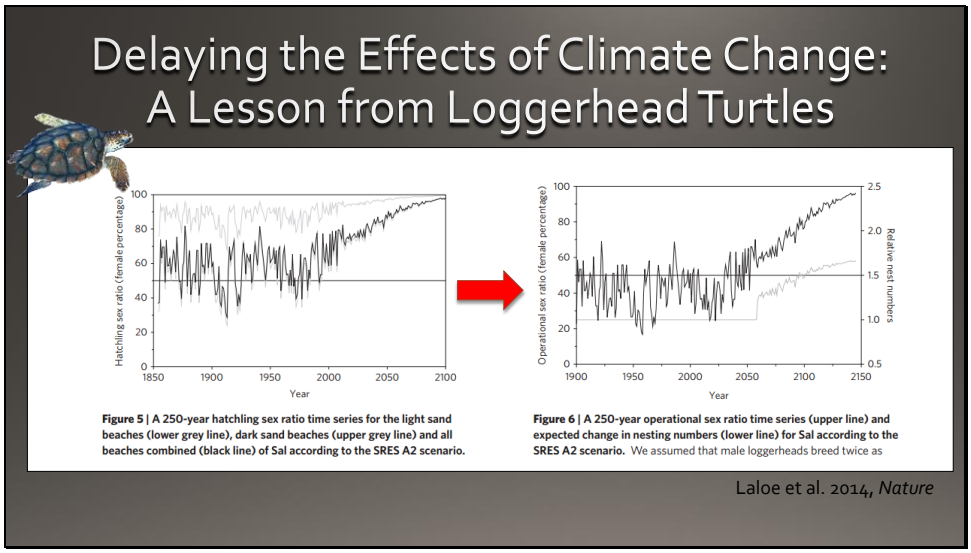
Slide 23

Slide 24



Because few traits are as fundamental to the likelihood of a population persisting, as sex ratio – having two few of one gender can lead to serious genetic implications as well as a lower reproductive success for the population making them extremely sensitive – an indicator species

Slide 25



Loggerhead turtles are a type 1a group, where females are produced at higher temperatures. This paper modeled warming beach sand temperatures and found that by 2100, the hatchling sex ratio would reach 100% females. However, because one male can mate with many females, this may for a time increase the number of nests made (note the grey line). However, once there are extremely few or no more males left, the situation will become extremely dire. At this point in time, scientists are unsure of how many males are needed to keep the population viable.

With this case study I want to highlight the fact that there are more complexities to turtles than just tsd – and that it may not be so grim, at least for a time. These creatures survived the Permian extinction after all

Slide 26

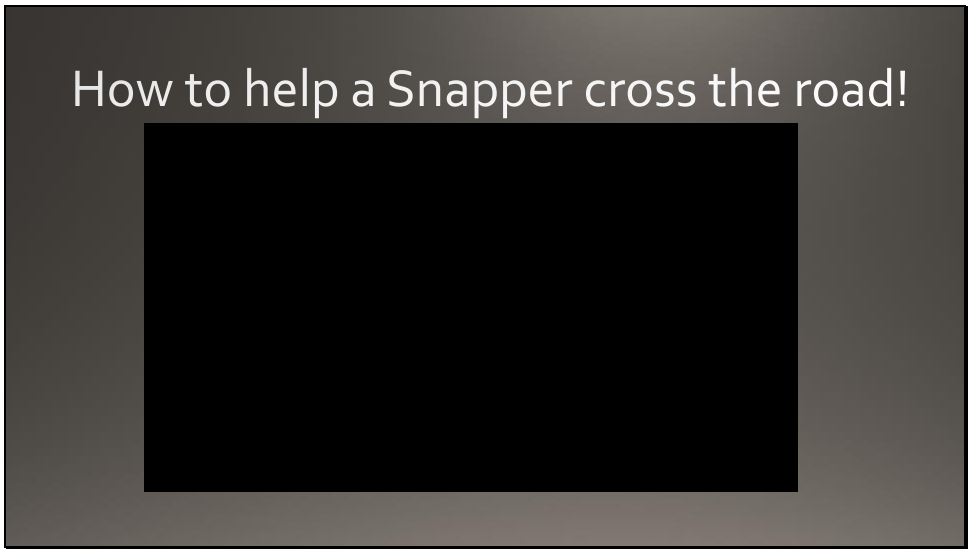
There are more threats to turtles beyond climate change, and in some cases these threats are even more pressing. Illustrated in this photo is one of them – becoming roadkill

Slide 27

- Was a juvenile in the early 80s, appx 50 yrs old

- Not all turtles are so lucky. This year we found the body of a female that was likely over 100 years old.

Slide 28



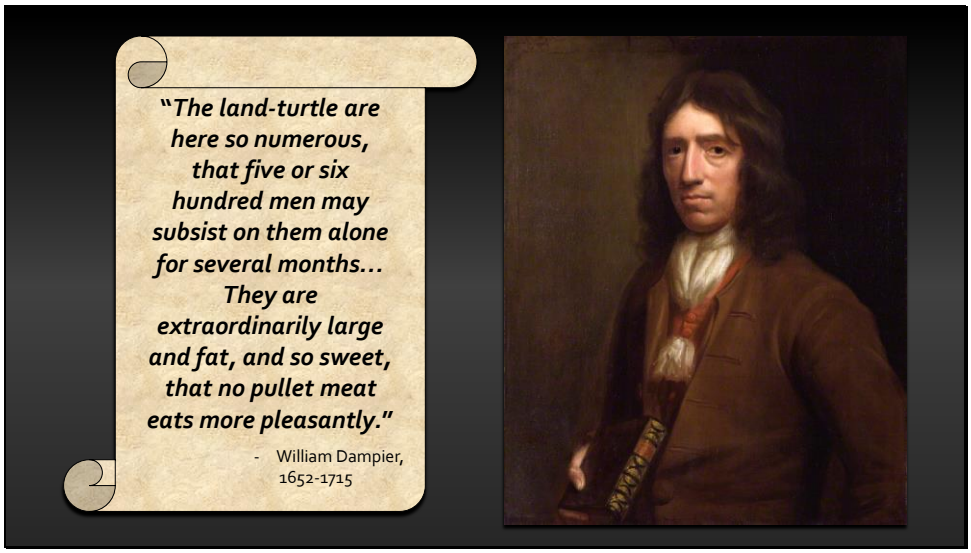
From the Toronto Zoo.

Slide 29

You can also hold it by its plastron.

Slide 30

Slide 31



The pirate William Dampier sait this about Galapagos toirtoises.

Slide 32

Demonstration

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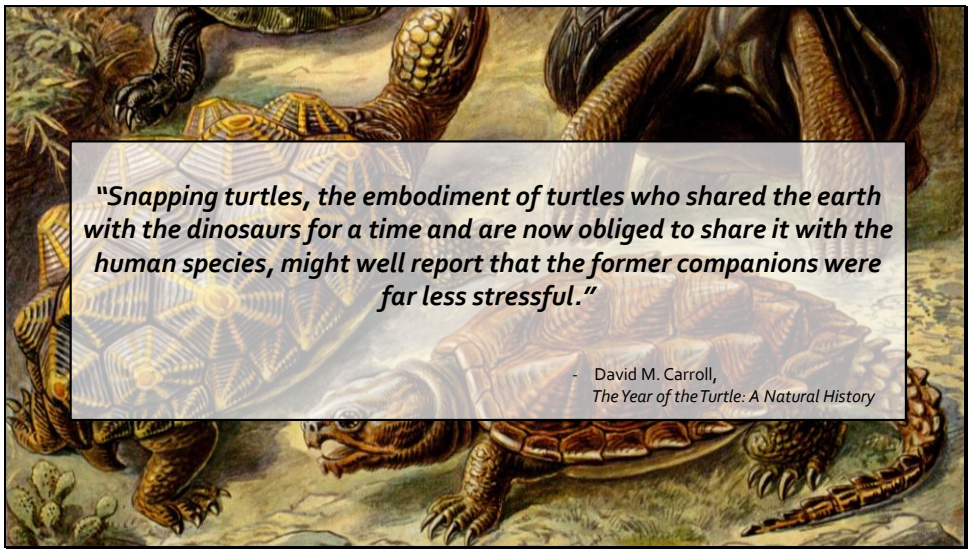
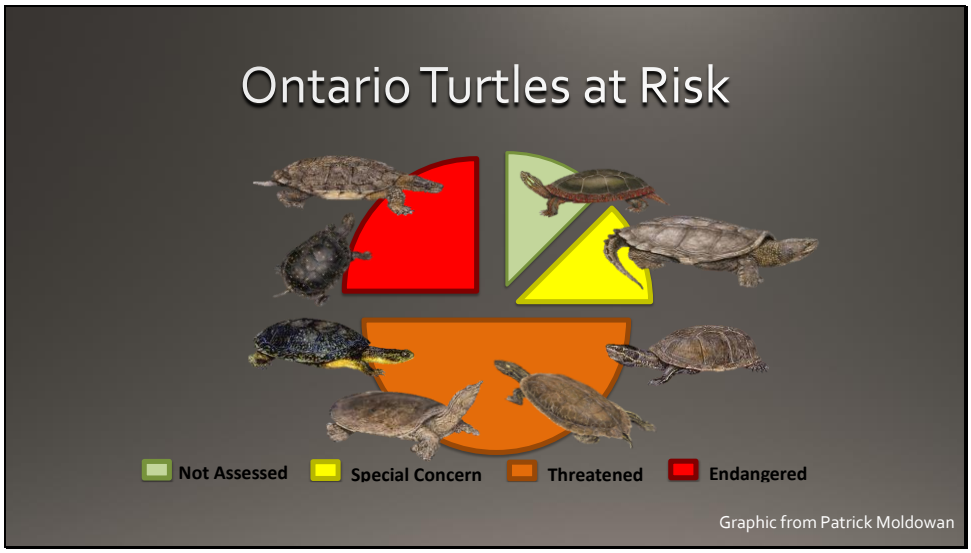


This is a quote from David M Carroll on Snapping Turtles, which are considered a living fossil due to their remarkable similarity to the fossil turtle Proganochelys.

Hopefully we can work towards making the world a little less stressful for this singular and remarkable creature.

Slide 34



Algonquin Park used to boast 10 species of turtles, all of which were populous. Now nearly every single species in the park (and Ontario) are at risk.
The Painted turtle is currently not assessed, but my peers believe it to be at risk. The Snapping turtle is currently considered of special concern, which means it is at risk of becoming endangered.

The stinkpot, map turtle, spiny softshell, and blandings turtles are threatened, while the spotted turtle and wood turtle are endangered.

The box turtle, which is not pictured, is now locally extinct in Ontario.