

DATA *Nugget*

Dangerous Aquatic Prey: Can Predators Adapt to Toxic Algae?

Featured scientists: Michael Finiguerra and Hans Dam from University of Connecticut-Avery Point, and David Avery from the Maine Maritime Academy

Research Background:

Phytoplankton are microscopic algae that form the base of all aquatic food chains. While organisms can safely eat most phytoplankton, some produce toxins. When these toxic algae reach high population levels it is known as a **toxic algal bloom**. These blooms are occurring more and more often across the globe – a worrisome trend! Toxic algae poison animals that eat them, and in turn, humans that eat these animals. For example, clams and other shellfish filter out large quantities of the toxic algae, and the toxic cells accumulate in their tissues. If humans then eat these contaminated shellfish they can become very sick, and even die.

One reason the algae produce toxins is to reduce predation. However, if predators feed on toxic prey for many generations, the predator population may evolve resistance, by natural selection, to the toxic prey. In other words, the predators may adapt and would be able to eat lots of toxic prey without being poisoned. Copepods, small crustaceans and the most abundant animals in the world, are main consumers of toxic algae. Along the northeast coast of the US, there is a toxic phytoplankton species, *Alexandrium fundyense*, which produces very toxic blooms. Blooms of *Alexandrium* occur often in Maine, but are never found in New Jersey. Scientists wondered if populations of copepods that live Maine were better at coping with this toxic prey compared to copepods from New Jersey.

Scientists tested whether copepod populations that have a long history of exposure to toxic *Alexandrium* are adapted to this toxic prey. To do this, they raised copepods from Maine (long history of exposure to toxic *Alexandrium*) and New Jersey (no exposure to toxic *Alexandrium*) in



Figure 1: Scientist Finiguerra collecting copepods at the New Jersey experimental site.

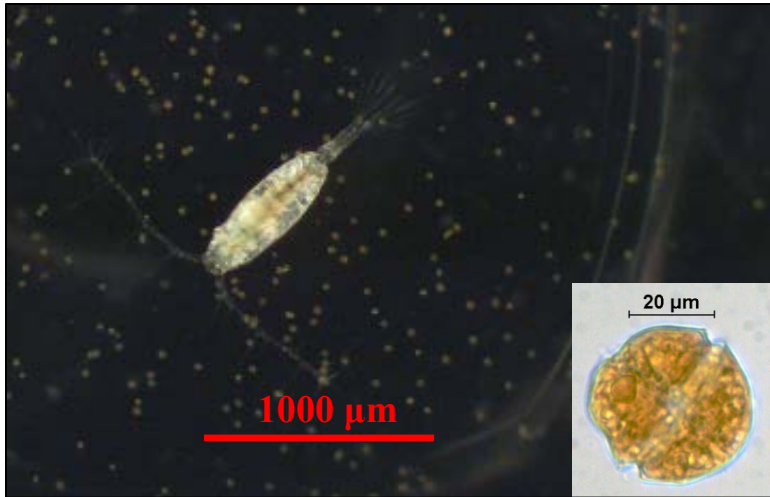


Figure 2: A photograph of a copepod (left) and the toxic alga *Alexandrium* sp. (right).

the laboratory. They raised all the copepods under the same conditions. The copepods reproduced and several generations were born in the lab (a copepod generation is only about a month). This experimental design eliminated differences in environmental influences (temperature, salinity, etc.) from where the populations were originally from.

The scientists then measured how fast the copepods were able to produce eggs, also called their egg production rate. Egg

production rate is an estimate of growth and indicates how well the copepods can perform in their environment. The copepods were given either a diet of toxic *Alexandrium* or another diet that was non-toxic. If the copepods from Maine produced more eggs while eating *Alexandrium*, this would be evidence that copepods have adapted to eating the toxic algae. The non-toxic diet was a control to make sure the copepods from Maine and New Jersey produced similar amounts of eggs while eating a good food source. For example, if the copepods from New Jersey always lay fewer eggs, regardless of good or bad food, then the control would show that. Without the control, it would be impossible to tell if a difference in egg production between copepod populations was due to the toxic food or something else.

Scientific Question: Have the copepods with a long history of eating toxic algae evolved resistance to the toxins in this food source?

What is the hypothesis? Find the hypothesis in the Research Background and underline it. A hypothesis is a proposed explanation for an observation, which can then be tested with experimentation or other types of studies.

Scientific Data:

Use the data below to answer the scientific question:

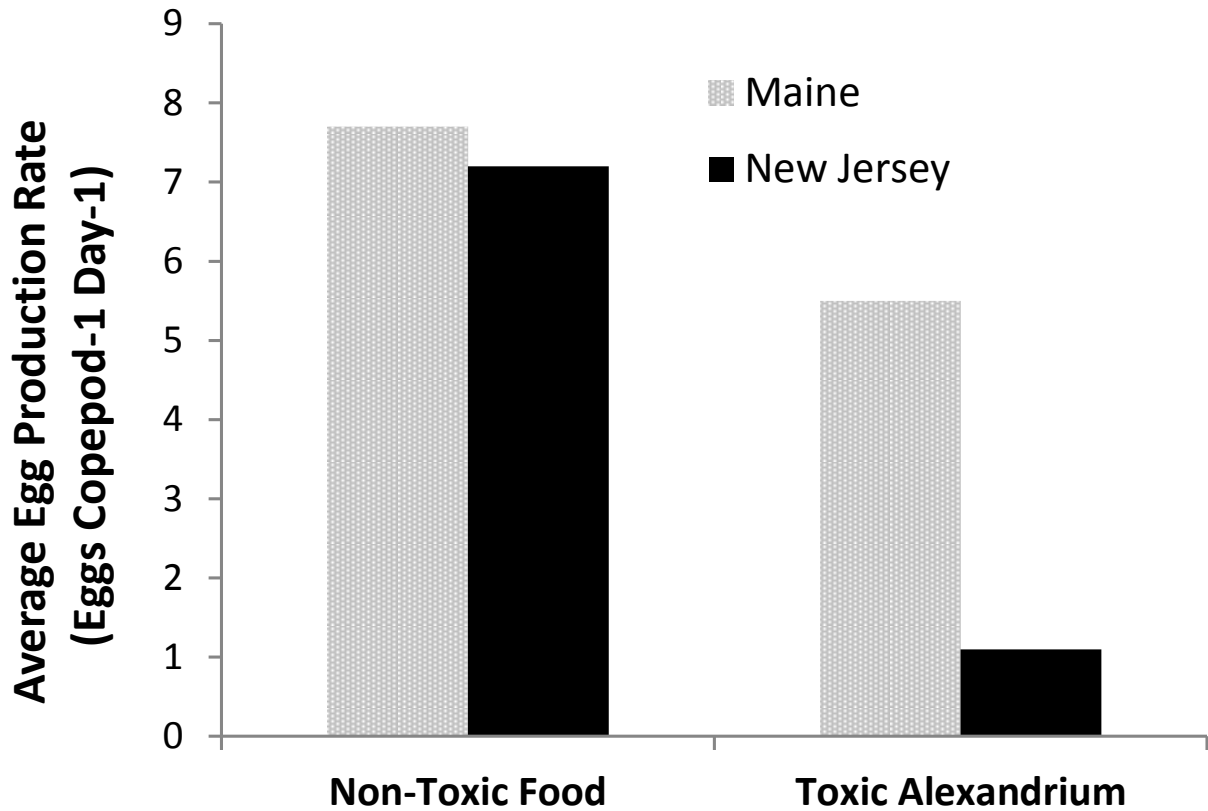
| Population | Average Egg Production Rate (Eggs/Copepod/Day) | |
|------------|---|------------|
| | Non-Toxic Food | Toxic Food |
| Maine | 7.7 | 5.5 |
| New Jersey | 7.2 | 1.1 |

What data will you graph to answer the question?

Independent variables: _____

Dependent variable: _____

Below is a graph of the data: Identify any changes, trends, or differences you see in your graph. Draw arrows pointing out what you see, and write one sentence describing what you see next to each arrow.



Interpret the data:

Make a claim that answers the scientific question.

Name _____

What evidence was used to write your claim? Reference specific parts of the table or graph.

Explain your reasoning and why the evidence supports your claim. Connect the data back to what you learned about predators evolving resistance to toxic algae.

What do the data from this study tell us about Michael and Hans' hypothesis?

Your next step as a scientist: Science is an ongoing process. What new question do you think should be investigated? What future data should be collected to answer your question?