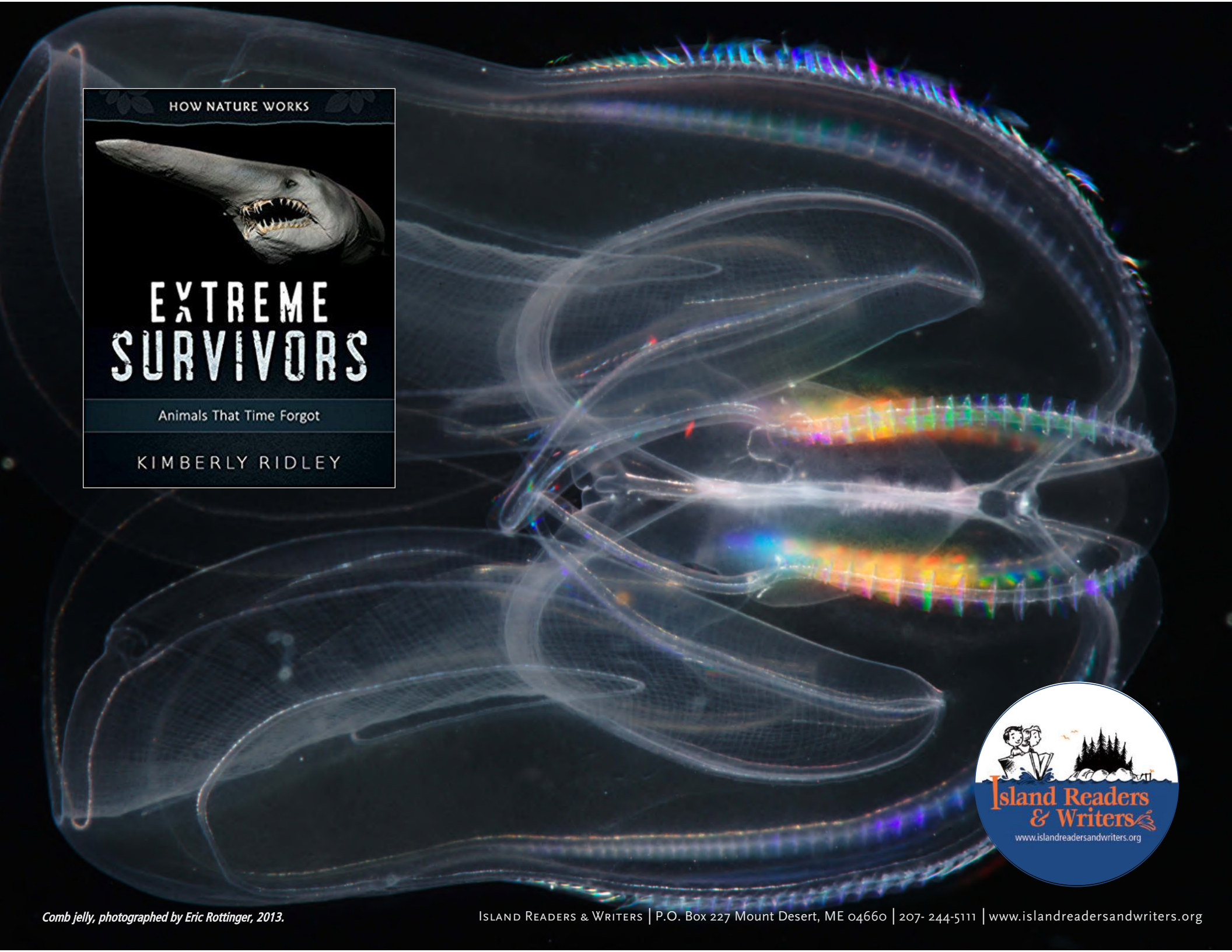


Comb jelly, photographed by Eric Rottinger, 2013.

Written by Kimberly Ridley

Kimberly Ridley is a science writer, editor, and author of *Extreme Survivors: The Animals that Time Forgot, The Secret Bay,* and *The Secret Pool*. A Maine native whose roots go back many generations, Kim is an avid birder and naturalist who loves exploring wetlands, beaches, woods, and other wild places. She never leaves home without her binoculars and hand lens, green rubber boots, and a notebook. For more information, visit Kim's website at www.kimberlyridley.org.

Ask Kim!

What are your favorite extreme survivors?
The four ancient creatures that live in Maine: horseshoe crabs, tardigrades, comb jellies, and sponges. If I had to pick one, it would be the tardigrade, also called the water bear or moss piglet. Tardigrades live on every continent in thin films of water on moss and lichen, and in oceans, lakes, and ponds. If a tardigrade's moss clump dries up, it goes into a dormant form called a tun. Tardigrade tuns can survive droughts, as well as being boiled, frozen, or sent into space without a spacesuit!

Not only are tardigrades tough, they're cute. They look like chubby bears with no ears and eight legs. And they live right here in Maine. A few years ago, a scientist at Unity College discovered a new tardigrade species on a Maine island!

Have you had a close encounter with any of the extreme survivors in your book?
I had a close encounter with an extreme survivor a few years ago when I was swimming in Penobscot Bay. Clear, oval creatures shimmering with bands of rainbow colors drifted in the water all around me. Each was about the size of a walnut. At first I was worried that they were jellyfish, or sea jellies, and that I would get stung, but I didn't. A biologist friend staying on the island told me they were comb jellies, and that they don t sting. I became fascinated with them, but didn't know they would star in one of my books or that scientists would go on to discover that comb jellies can grow new brains.

The *Macro View* – the Ice Ages that have shaped our world and the *Micro View* – what we can still find today in our own backyard

Consider the Macro View - Ice Ages and Their Affects on the Landscape

Glacial Maps of Maine for background:
https://www1.maine.gov/dacf/mgs/explore/surficial/facts/surficial.htm
http://digitalmaine.com/cgi/viewcontent.cgi?article=2967&context=mgs_maps
https://maine.maps.arcgis.com/apps/webappviewer
/index.html?id=f52e6fa4f79b46a48203ad07cd55a9d7

Downeast Ice Age Trail: http://iceagetrail.umaine.edu
Via that link, download an IOS app for offline use

Be a geological Private Eye / Indiana Jones!

Visit these local points on the Downeast Ice Age Trail map:
30, 33, 36, 37, 38, 39, 40, 41

When you visit those sites:

What do you notice?
Similarities and differences between rocks, landscapes, plants?
Can you tell what characteristics of the Ice Age timeline each site exhibits?
What impact has the ice age had on that site or your region? Agriculture, shoreline, temperature etc?

Consider the Micro View - The Organisms that have survived Macro Changes

Enter the Extreme Survivors! In the book, Kimberly reveals the secrets of ten strange extreme survivor creatures, including: goblin shark, sponge, comb jelly, horseshoe crab, tardigrade, tuatara, tadpole shrimp, lungfish, velvet worm, and chambered nautilus.

What do you know about these incredible species and their survival? How do they survive an ice age? Or the vacuum of space?

Let's Talk!

1. How would changes on a macro level impact plants and animals on a micro level? How are extreme survivors living links to the prehistoric past?

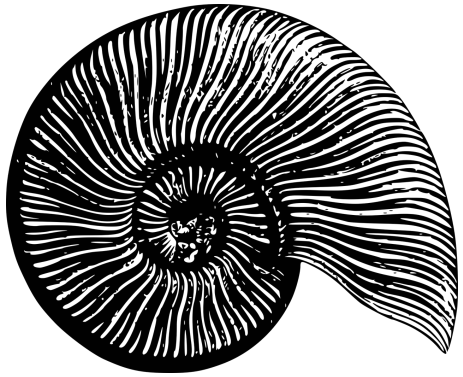
2. Which extreme survivors can be found in your region?

3. What is natural selection, and how does it work? How can humans impact the natural selection of other species?

4. Out of the numerous extreme survivors that Kim explores in her book, which is your favorite? Why?

5. What are some examples of species that haven't survived the test of time? What do you think might have led to their extinction?

6. What are some of the extreme survivors' survival secrets?



Let's Create!

Maker: Make a glacial model: http://www.andrill.org/flexhibit/flexhibit/materials/activities/Activity2A-BuildAModelGlacier.pdf

Science: Collect different kinds of rocks and create an exhibit. Make sure you don t remove any rocks from any conservation areas. Research what kinds of rocks you've found, and write its name and identifying characteristics on an index card.

Literary: Write point-of-view stories from the perspectives of three different extreme survivors.

Historical: Make a Geographic Timescale to show just how much time has gone by since the first land plants, the first sharks, and more! http://www2.mbusd.org/staff/pware/pdf/GeologicalTimeline.pdf

Social/Citizen: Write an opinion piece about whether you believe climate change will affect humans and other species, and if you think people should work to reduce human impact. Is there scientific evidence that strengthens your opinion?

Art: Write a comic strip featuring your favorite Extreme Survivor. What challenges do they face? How do they overcome them? Comic page templates: http://comicbookpaper.com

Let's Read More!

More books by Kimberly Ridley: *The Secret Bay* and *The Secret Pool*

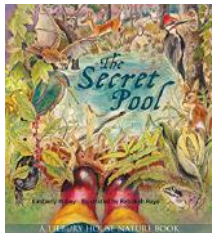
If: A Mind-Bending New Way of Looking at Big Ideas and Numbers, by David J. Smith

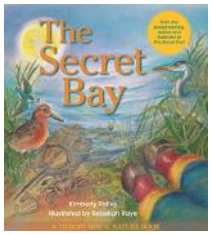
A Really Short History of Nearly Everything, by Bill Bryson

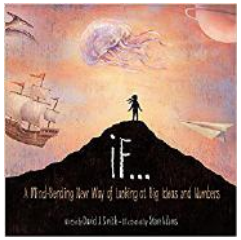
When on Earth? by DK

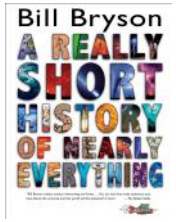
Animals of a Bygone Era, by Maja Safstrom

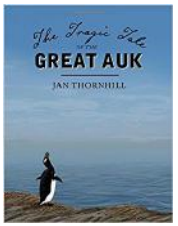
The Tragic Tale of the Great Auk, by Jan Thornhill











Let's Learn More!

1. Four ways to understand the Earth's age: https://ed.ted.com/lessons/the-earth-s-age-in-measurements-you-can-understand-joshua-m-sneideman

2. Glacial Periods in Earth's History: https://opentextbc.ca/geology/chapter/16-1-glacial-periods-in-earths-history/

3. Explore the wonderful world of glaciers! An appreciation of glaciers; analogies and activities: https://rockpaperglacier.wordpress.com

-- info on glaciers and ice sheets: http://www.whoi.edu/main/topic/glaciers-ice-sheets

4. Make a glacier simulation
https://diy.org/skills/geologist/challenges/274/make-a-glacier-simulation

5. Learn more about Extreme Survivors:
Meet the Tardigrade: https://www.youtube.com/watch?v=IxndOd3kmSs

https://www.google.com/amp/s/www.washingtonpost.com/amphtml/news/speaking-of-science/wp/2017/07/14/these-animals-can-survive-until-the-end-of-the-earth-astrophysicists-say/

How to hunt for tardigrades - which sometimes means NOT finding them! (video): https://www.youtube.com/watch?v=ZuxwisK-8f8&t=38s
(Kim's written instructions for hunting tardigrades are on next page)

Meet the Goblin Shark:
https://www.youtube.com/watch?v=Wu-oPjKDsQ0

Hunt for tardigrades and observe them in the classroom!

Collect small clumps of moss and lichen and place them in bags or envelopes labeled with where they were gathered - i.e. from boulder, tree, bog, etc .

Soak the moss clumps in distilled water or bottled spring water overnight. Do not use tap water, which contains chlorine that could kill tardigrades.

Swish the moss around and pour the soaking water into a petri dish.

Place the petri dish on a piece of black paper under a dissecting microscope.

Shine a flashlight sideways across the dish.

Tardigrades and other organisms will glow against the black background.