FAQ Document

Bigelow | Laboratory for Ocean Sciences

MAINE SCIENCE FESTIVAL

Unveiling invisible ocean life at Bigelow Laboratory

Each pair of images represents what is visible and what is invisible that scientific tools enable us to see.

A gallery of scientific images captured by researchers at the Bigelow Laboratory for the Maine Science Festival March 20th – 24th, 2024.

Mark your calendars for the Bigelow Lab Gallery Reception on **Sunday (March 24th) at 10:30am** here at Chimera Coffee.

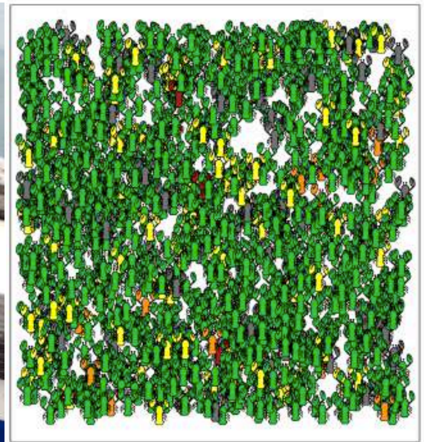
Q: What is the Bigelow Laboratory of Ocean Sciences?
A: Founded in 1974, as stated on our website (bigelow.org), "the Bigelow Laboratory of Ocean Sciences is an independent, nonprofit research institute located in East Boothbay, Maine. From the Arctic to the Antarctic, Bigelow Laboratory scientists use innovative approaches to study the foundation of global ocean health and unlock its potential to improve the future for all life on our planet."

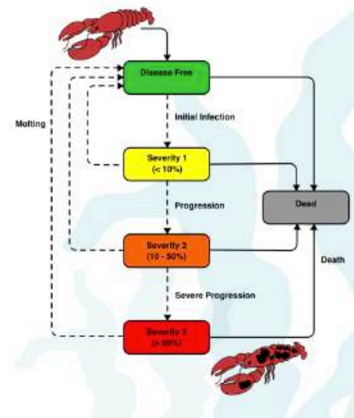
Q: How does this gallery relate to research at the Bigelow Lab and the Maine Science Festival?
A: To participate in the Maine Science Festival, a group of researchers and marine educators at the Bigelow Lab wanted to share some of the incredible and diverse science conducted at the Bigelow Lab. The Bigelow Lab primarily focuses on life at the microscopic-level, which is hard for our eyes to see, and the scientist at Bigelow have found very creative ways to study the invisible realm of microbes. The images displayed in the gallery here come from ten different research groups and twelve different projects, the focus on topics form cancer in clams to carbon released from kelp.

Q: How long will the images of this gallery be available?
A: The images will be displayed from March 19 – 24th, 2024 at Chimera Coffee from open to close. There will be a reception to discuss the images at 10:30am on Sunday, March 24th.

Q: Who should I contact for more information about a particular image?
A: The gallery coordinator, Alaina Weinheimer (aweinheimer@bigelow.org)

The following pages contain each image with its caption, as shown in the gallery.





<table>
<tr>
<td><u>The visible</u> <u>(left):</u> Photo of a Gulf of Maine lobster (species: Homarus americanus) with orange tag.
Credit: Dr. Maya Groner</td>
<td><u>The invisible</u> <u>(right)</u>: A model depicting factors the spread of epizootic shell disease through lobster populations.
Credit: Dr. Melissa Rocker</td>
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<tr>
<td colspan="2"><u>Significance</u>: This model will enable the lobster fishery to plan for and respond to the spread of epizootic shell disease within the Gulf of Maine.</td>
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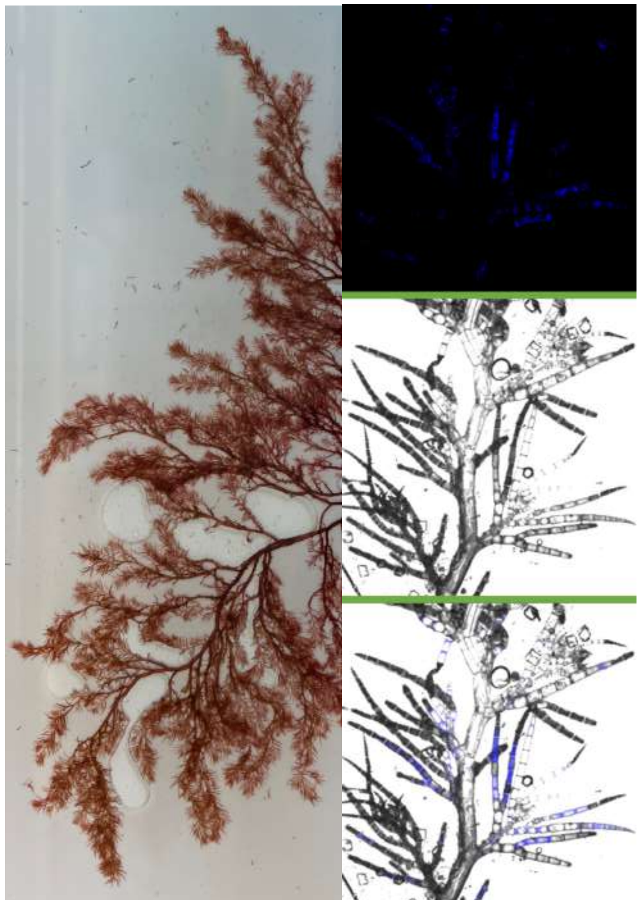
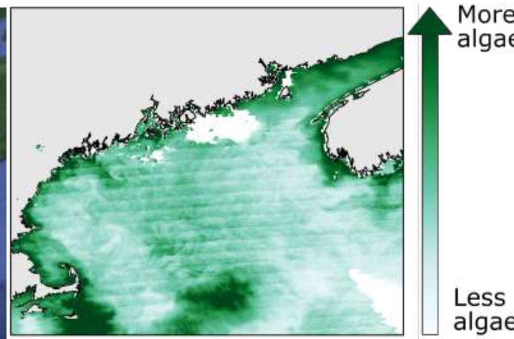
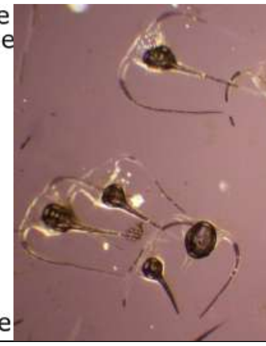


<u>The visible</u> <u>(left):</u> Photo of the invasive red turf algae of the species *Dasysiphonia japonica*. Credit: Shane Farrell, PhD candidate	**<u>The invisible</u>** <u>(right):</u> First: fluorescence microscopy image of blue dye that has entered damaged cells walls of red turf algae. Middle: Light microscopy image of red turf algae cell walls. Last: Combined image of the fluorescence and light microscopy images showing where the cell wall has been damaged. Credit: Shane Farrell, PhD candidate

<u>Significance</u>: Kelp forests on the coast of Maine are in decline, and in their place, small filamentous red algae are taking over. These red algae can produce chemicals that negatively impact surrounding organisms. We sample these chemicals by collecting them from the surface of the algae without breaking their delicate cell walls, which is viewed using the fluorescent dye.





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<td><u>The visible</u> <u>(left):</u> Google Maps image of the Gulf of Maine
Credit: Google Maps</td>
<td><u>The invisible</u> <u>(right):</u> Satellite image of ocean color data showing areas of high and low patches of the phytoplankton (microscopic algae) species Tripos muelleri in the Gulf of Maine
Credit: Dr. Cath Mitchell</td>
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<tr>
<td colspan="2"><u>Significance</u>: Phytoplankton, or microscopic algae, are the base of marine food webs and support all the important fisheries in the Gulf of Maine. By monitoring the abundance of phytoplankton via satellites, we can check the health of the Gulf of Maine ecosystem daily.</td>
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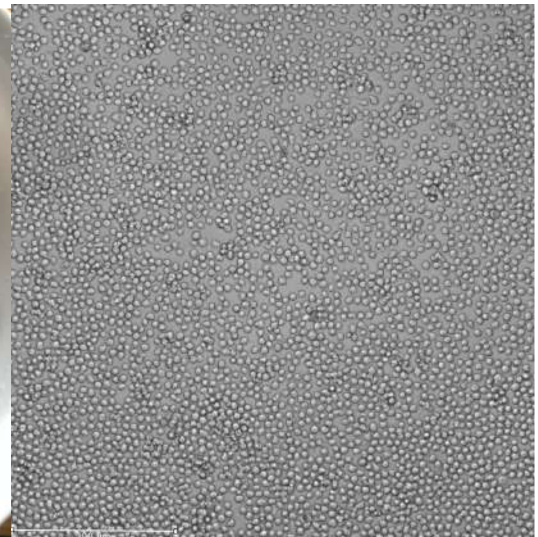

<table>
<tr><td><u>The visible</u> <u>(left):</u> Photo of a bucket of soft-shell clam of the species Mya arenaria, from the New England coast.
Credit: Dr. José Fernandez-Robledo</td><td><u>The invisible</u> <u>(right):</u> Microscopy image of cancer cells of a clam, specifically the cancer called transmissible neoplasia (MarBTN).
Credit: Dr. José Fernandez-Robledo</td></tr>
<tr><td colspan="2"><u>Significance</u>: Cancer cells can devastate clam populations. However, current research could uncover secrets to save clams, as well as provide the key to innovative cancer treatments for humans.</td></tr>
<tr><td><u>The visible</u> <u>(left):</u> Photo of a test tube of seawater collected from a dock in East Boothbay
Credit: Dr. Ramunas Stepanauskas</td><td><u>The invisible</u> <u>(right):</u> Plot of data from fluorescence activated cell sorting (FACS) that measured each microbe's cell size (x-axis) and respiration rate (y-axis).
Credit: Dr. Ramunas Stepanauskas</td></tr>
<tr><td colspan="2"><u>Significance</u>: Marine microbes are responsible for half the planet's oxygen production and consumption, but it's unclear which types of microbes are the most active. At the Single Cell Genomics Center at the Bigelow Lab, we use special instruments like FACS to examine one cell at a time to measure its activity and classify it.</td></tr>
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<table>
<tr><td><u>The visible</u> <u>(left):</u> Photo of a variety of seaweeds separated by type
Credit: Dara Yiu, PhD Candidate</td><td><u>The invisible</u> <u>(right):</u> Images taken with a microscope of tiny animals that live in and among seaweeds
Credit: Dara Yiu, PhD Candidate</td></tr>
<tr><td colspan="2"><u>Significance</u>: Seaweeds provide both food and shelter for a variety of animals, with different seaweeds having different traits. The small animals that live in them provide the food web link between the seaweeds and larger animals like fish and lobster.</td></tr>
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<table>
<tr><td><u>The visible</u> <u>(left):</u> Photo of a bottle of seawater collected from the dock at Bigelow Lab
Credit: Maura Nimesto</td><td><u>The invisible</u> <u>(right):</u> Images taken with a microscope of small, drifting animals called zooplankton in the seawater. Organisms left to right: Podon intermedius, barnacle larvae, copepod Calanus finmarchicus
Credit: Maura Nimesto</td></tr>
<tr><td colspan="2"><u>Significance</u>: Zooplankton sit just above the base of marine food webs, providing food for all sorts of animals. Changes to the species and numbers of these zooplankton in turn change the whole ecosystem.</td></tr>
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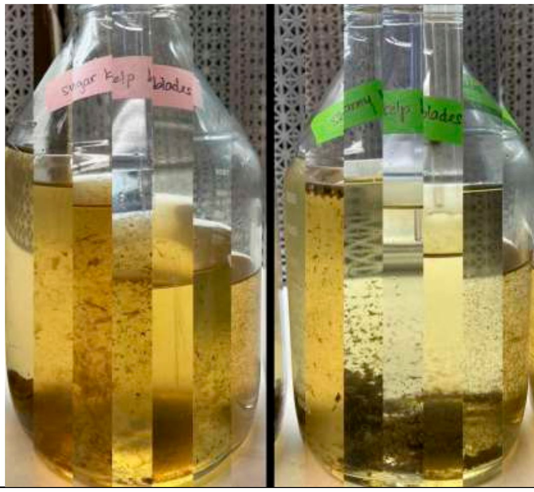

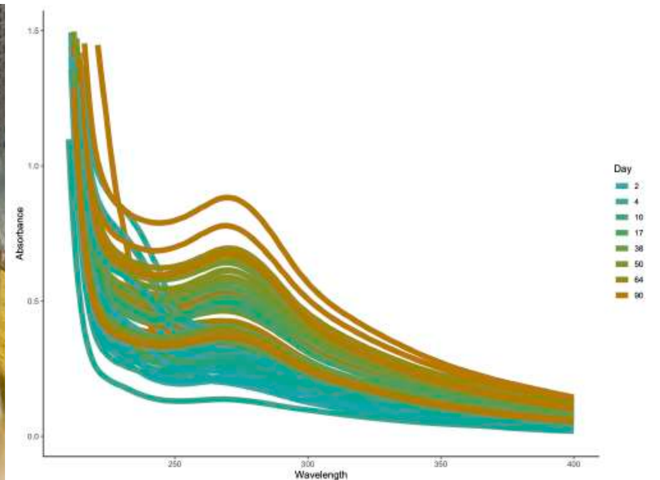

<table>
<tr><td><u>The visible</u> <u>(left):</u> Photo of sugar kelp and skinny kelp that have leached organic matter into seawater over 3 months during an experimental incubation.
Credit: Dr. Sarah Douglas</td><td><u>The invisible</u> <u>(right):</u> Absorbance spectra of dissolved organic matter from kelp measured using a UV-Vis Spectrophotometer. Over time and as the amount of organic matter in seawater increases, absorbance values in some wavelengths also increase.
Credit: Dr. Sarah Douglas</td></tr>
<tr><td colspan="2"><u>Significance</u>: As kelp and other seaweed decompose in the ocean, they leave behind dissolved organic carbon, similar to steeping tea. Part of the dissolved carbon from kelp may last for a long time in the ocean, which helps to lock carbon away from the atmosphere.</td></tr>
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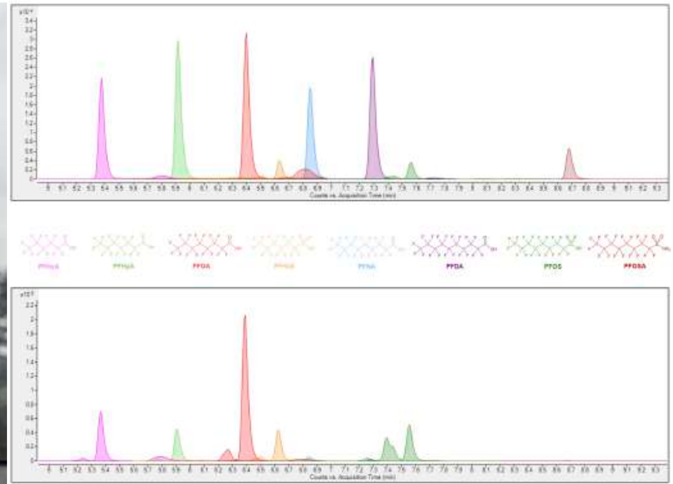
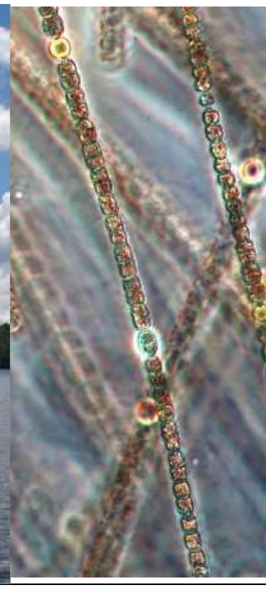


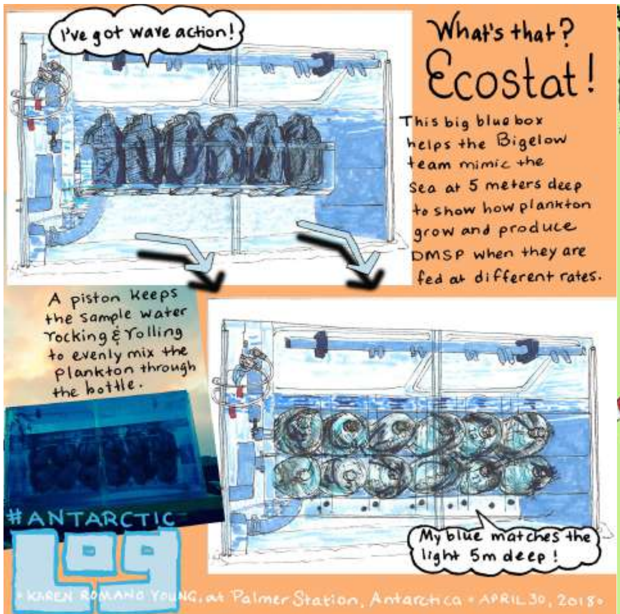
The visible (left): Photo of a bottle, test tube, and vial of seawater from a tidal river in Maine to be tested for per- and poly-fluoroalkyl substances (PFAS) contamination. Credit: Amanda Pinson	**The invisible** (right): Spectra representing different PFAS detected using liquid chromatography (top), and actual PFAS substances detected from a field sample (bottom). Credit: Amanda Pinson
Significance: PFAS, also known as "forever chemicals", are compounds that resist degradation and consequently persist in the environment. There is still much unknown about these compounds, including their presence in aquatic environments. Measuring PFAS in field samples is necessary to understand their distribution and impact, as well as the risks they pose for human exposure.	



<u>The visible</u> <u>(left):</u> Damariscotta Lake
Credit: Flickr user, bhansmeyer

<u>The invisible</u> <u>(right):</u> Microscopy image of the micro-algae species *Dolichospermum planctonicum* (left). Chromatogram output from a sequencer to determine the DNA sequence of this organism (right).
Credit: Dr. Pete Countway
Funding: NSF EPSCoR: Maine-eDNA Project

<u>Significance</u>: *Dolichospermum planctonicum* is a Cyanobacteria that sometimes produces the toxin microcystin. Fortunately, this particular strain was negative for the genes that produce microcystin.



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<tr><td><u>The visible</u> <u>(left):</u> Artistic depiction with a photo of an Ecostat, which is an environmental experiment chamber used at the Palmer Station, Antarctica to manipulate microbial growth.
Credit: Karen Romano Young</td><td><u>The invisible</u> <u>(right):</u> Artistic depiction of Bigelow scientists assembling the Ecostat to experiment with microbes like phytoplankton and bacteria found in the Southern Ocean surrounding Antarctica
Credit: Karen Romano Young</td></tr>
<tr><td colspan="2"><u>Significance</u>: These images were drawn by artist Karen Romano Young as part of her work with the National Science Foundation's Antarctic Artists and Writers Program, interpreting science in Antarctica through new perspectives. The experiments that use the Ecostat help us understand how food webs in the Antarctic respond to changes in nutrients and temperature.</td></tr>
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