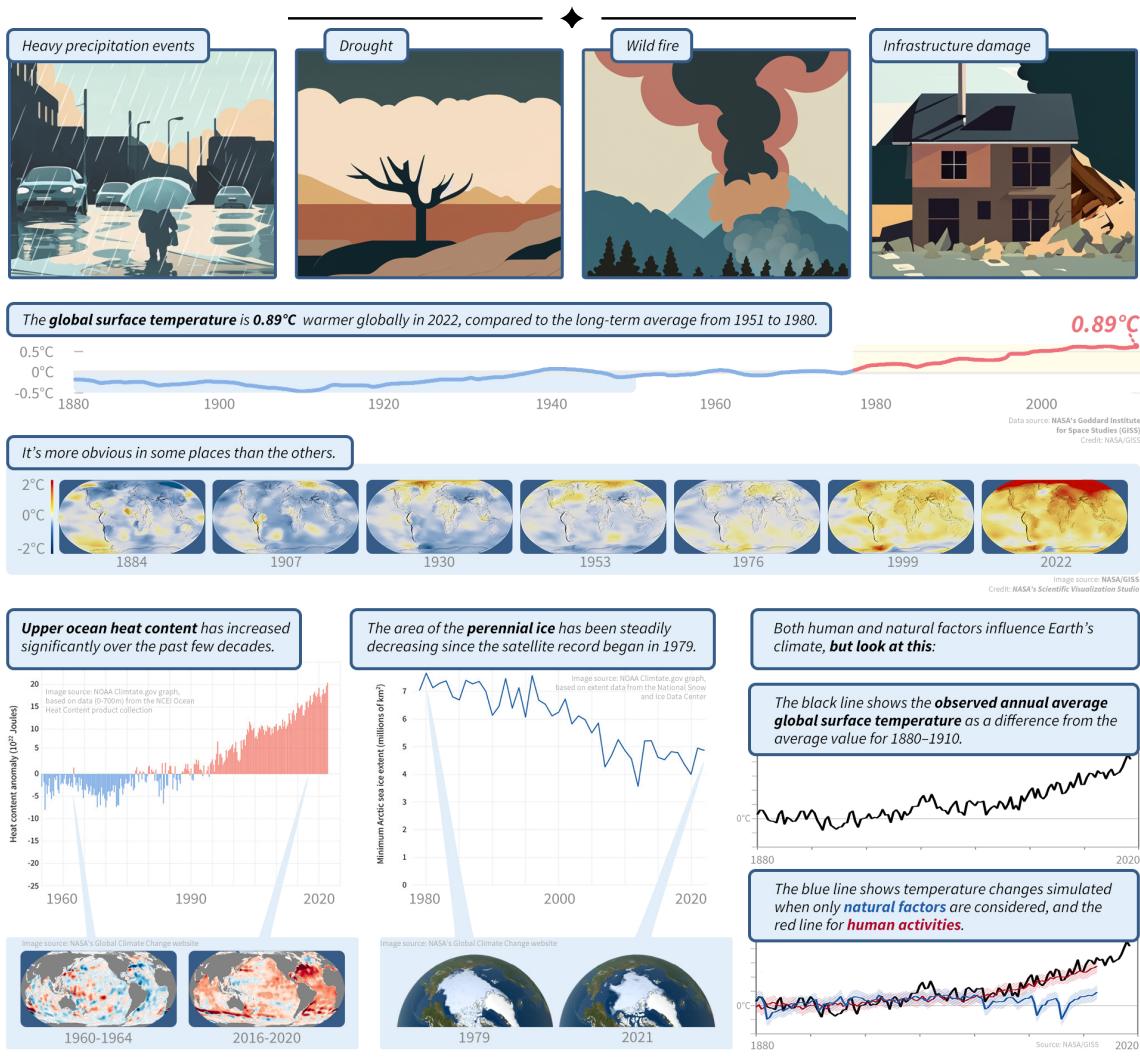


Data Comics for Climate Change

Zezhong Wang , Stephan Gruber, Claire Herbert, Zandria Sarrazin, Michelle Levy and Sheelagh Carpendale

Abstract—While there is a well-known gap between what the general public and policymakers understand about science and what is known by experts, this gap is particularly perilous in regard to climate change. Currently, scientists inform each other via expert publications and conferences. We, as part of the public and policymakers, receive our information via the media and the web – and in our current catastrophic blending of information with misinformation, we are at risk of well-intentionally taking ineffective or even harmful actions and decisions. To close this gap, a team of experts in data visualization, narrative construction, data comics, and climate change work collaboratively to develop climate change data comics that combine compelling narratives with comprehensible data visuals that are informed and verified by the appropriate scientists. This pictorial outlines our approach and provides two examples, emphasizing the integration of storytelling, scientific explanation, and data visualization through expressive visual presentations.

Index Terms—data comics, climate change, data-driven storytelling

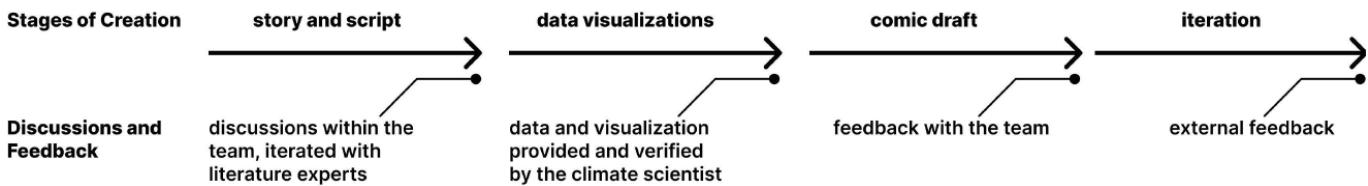
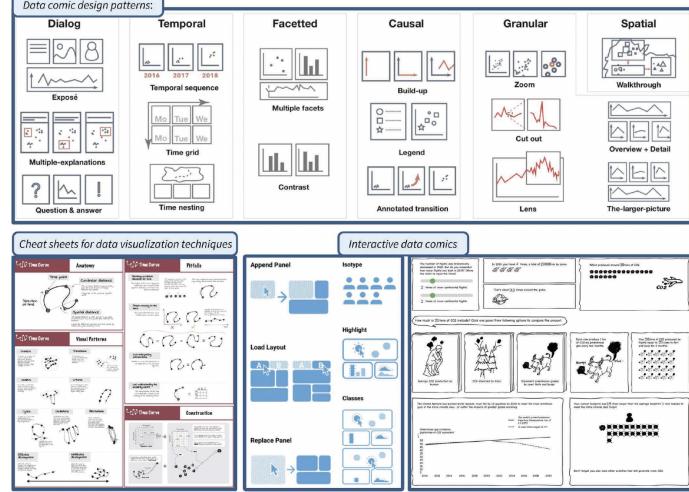
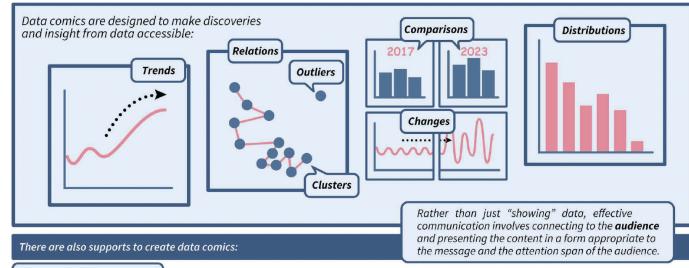
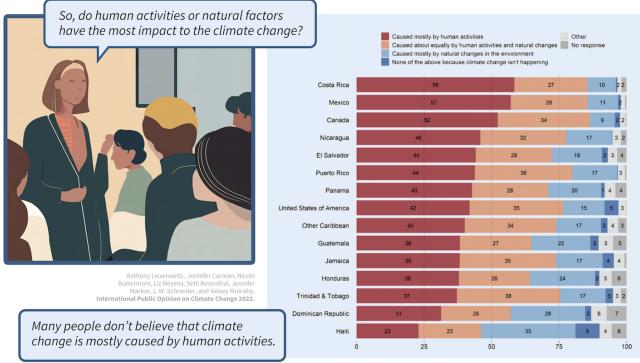


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1 INTRODUCTION

Data comics offer a novel format for data-driven storytelling, inspired by the way people read comics [7]. Accessible to diverse audiences, comics don't require a presenter, can be read at one's own pace, and are easily created without specific software [15]. Beyond cartoons and superheroes, comics effectively explain science [5, 8]. Data comics blend images and text to simplify complex visualizations into sequential panels, enhancing narrative with contextual illustrations [2, 3, 14, 16]. Recently, data comics have been used in various fields, including historical event depiction [1], scientific reporting [11], teaching data visualization literacy [9, 13], and incorporating interactive elements [6, 12].



2 METHODOLOGY

2.1 Design Process

To address this pressing communication challenge, we have assembled a team that has expertise in data visualization, narrative construction, data comics, and climate change. We collaboratively develop climate change data comics that combine compelling narratives with comprehensible data visuals informed and verified by the appropriate expert scientists. The creation process includes four main stages, led by a data comic creator, we choose a different area for each comic. The creation process is illustrated by the flowchart above. Specific topics are chosen based on the research areas of our collaborating climate scientists, who contribute to concept development, explaining the science, data provision, and visualizations. English and literature experts help refine the story script and language. Scientists provide data visualizations and diagrams, which are redesigned to fit the plot. The data comic creator manually draws and digitally edits the comic using a drawing tablet, polished with Adobe Photoshop and Stable Diffusion. External feedback is collected to iterate and improve the design.

2.2 Design Approach

We explore different approaches to deliver the validated data in an accessible way. Our approaches include:

Faction: Combining elements of *fact* and *fiction* to make verifiable and justifiable claims to truth and simultaneously engage readers [4].

Explaining Scientific Concepts: Using diagrams to explain climate

science concepts, preparing the audience to understand the data and its relation to climate.

Expressive Data Visualizations: Adapting visualizations from technical reports and academic papers to fit the scenarios and narratives with expressive design, integrating them seamlessly into the storytelling.

3 EXAMPLES

3.1 Pasta or Disaster

This 10-page data comic explains permafrost and its interaction with climate change [10]. The story is based on regional news events and a fictional narrative of a family hiking trip in Banff National Park (Alberta, Canada), a popular tourist destination with mountain peaks underlain by permafrost. The narrative then explains the concept of permafrost and its local distribution in Canada. The full comic can be found at <https://dc4cc.github.io/permafrost.html>.

Science and data visualizations are embedded and illustrated within the comic. For example, the character draws charts on the snow (Fig.1), and explains the physical phenomena of latent heat by observing the temperature of ice and snow melting in a camping pot.

Explaining the physics of latent heat helps understand why locations with temperatures near 0 degrees Celsius have mild temperature increases compared to those with lower temperatures. When temperatures hover around the freezing point, the energy absorbed goes into the phase change from ice to water rather than raising the temperature.

Design approaches in this example include:

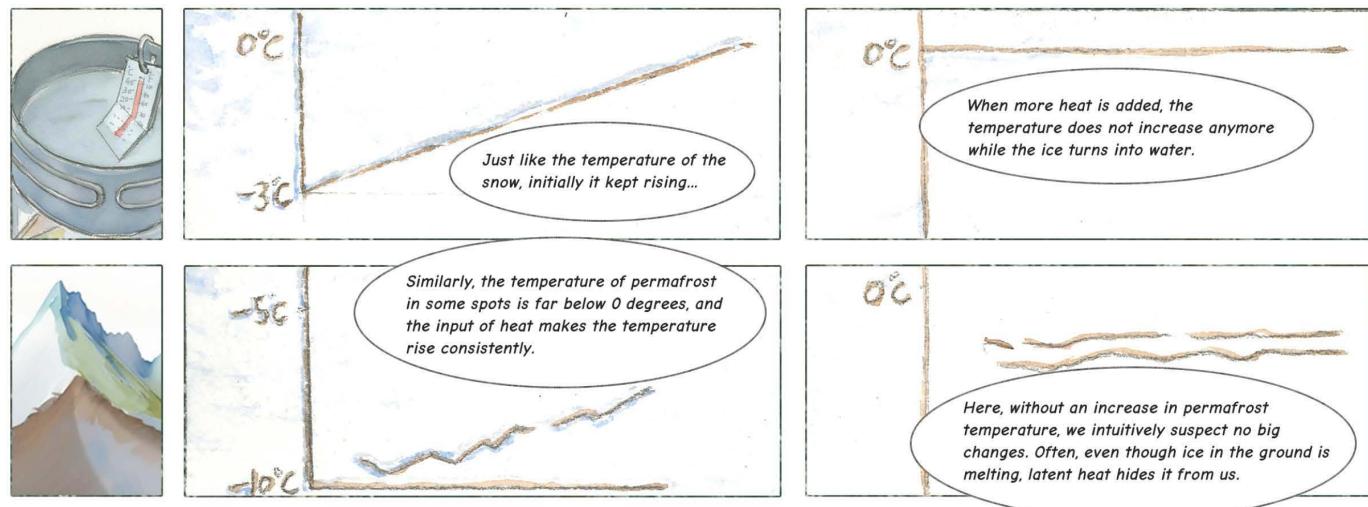
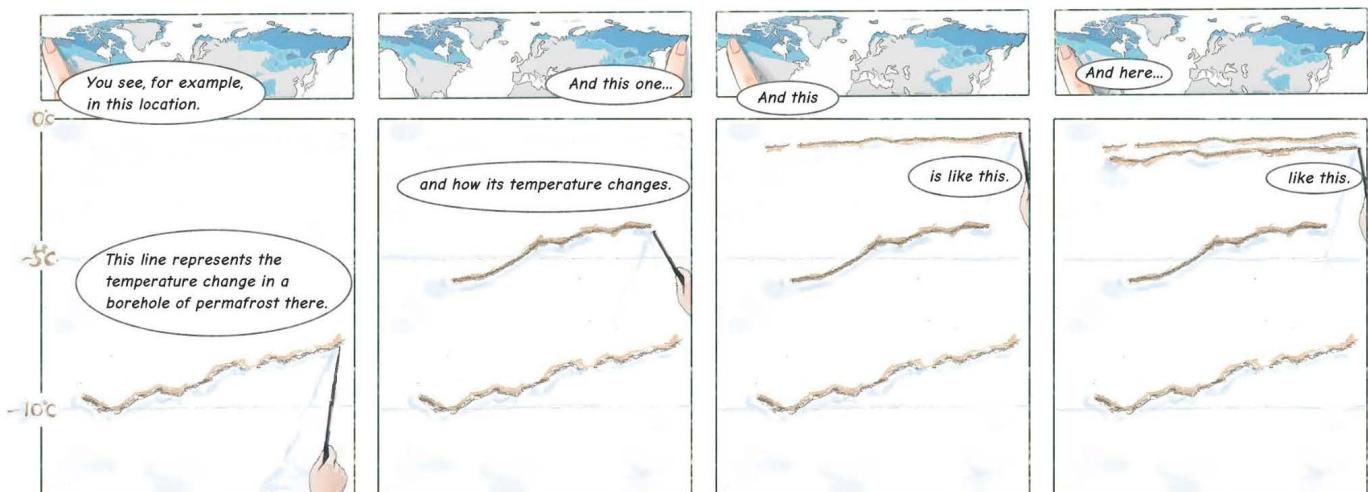
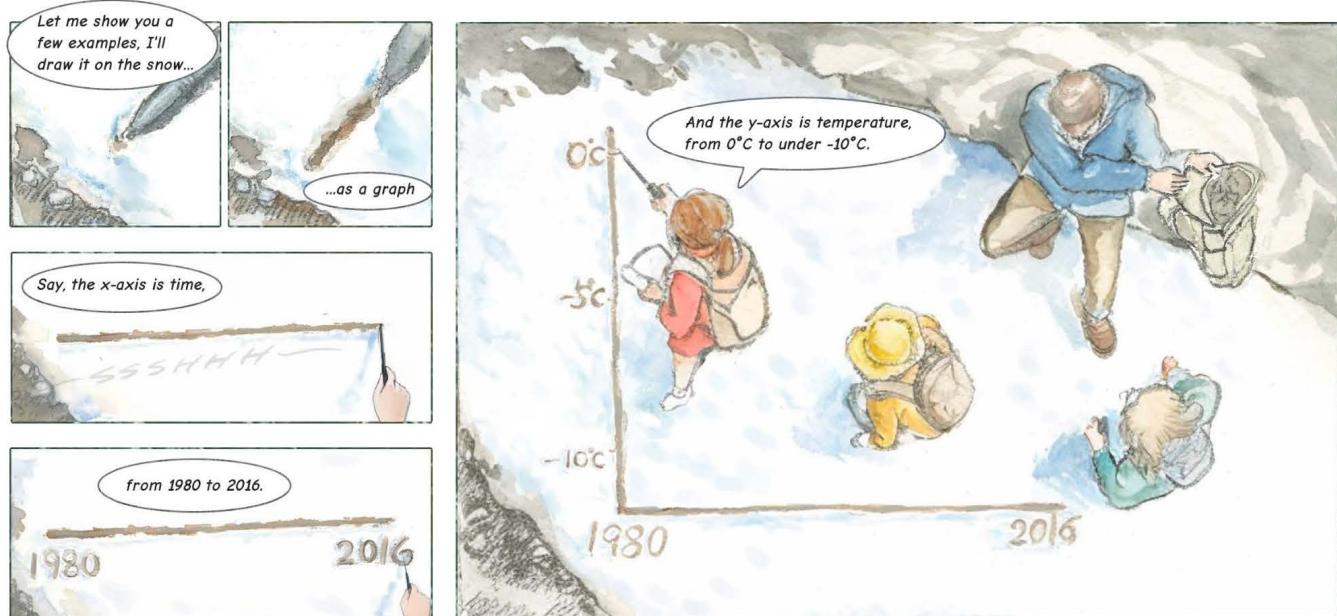


Fig. 1: Comic snapshots from *Pasta or Disaster* [10] CC BY-NC-SA 4.0 DEED.

Faction: Facts include recent news of the Abbot Pass Hut demolition and data on permafrost, such as geographic distribution and temperature changes. The narrative of a family hiking and their conversations are fictional.

Explaining Scientific Concepts: Definitions of permafrost and the physics of latent heat, explaining how it impacts temperature interpretation in permafrost.

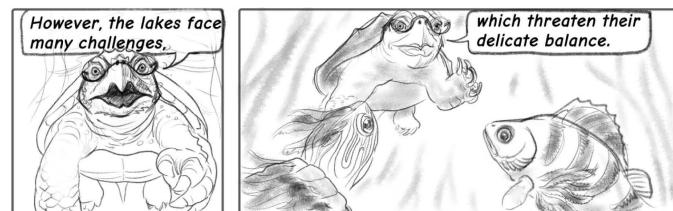
Expressive Data Visualizations: Line charts are drawn on the snow, integrating explanations through the drawing process. Visualizations based on temperature observations of melting snow connect “real-time” on-site data with historical records of permafrost temperature changes.

3.2 Blooms

This 27-page data comic focused on lake eutrophication, is currently a work in progress and will be released on <https://dc4cc.github.io> upon completion. A scientist on our team conducts research in the Manitoba Great Lakes, Canada. Their methods include collecting and analyzing data from various sources, such as remote sensing (i.e., satellite images) and ground-truthing (i.e., water sampling and surface optical observations from a boat) to assess water conditions. Recent findings highlight increasing ecosystem problems in freshwater due to the proliferation of blue-green algae.



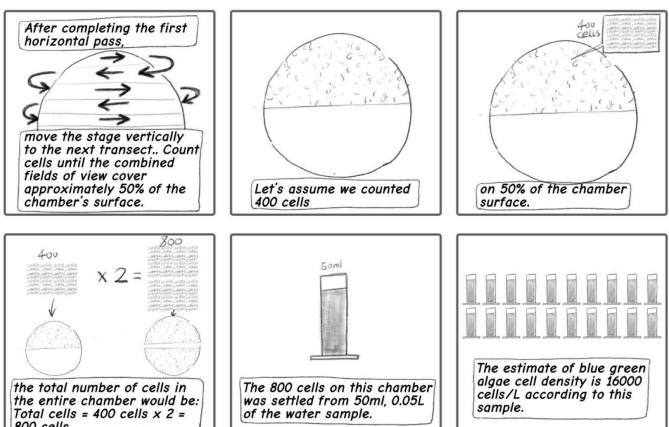
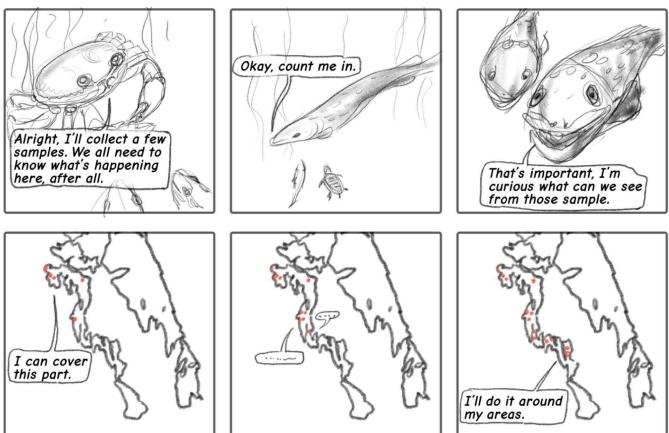
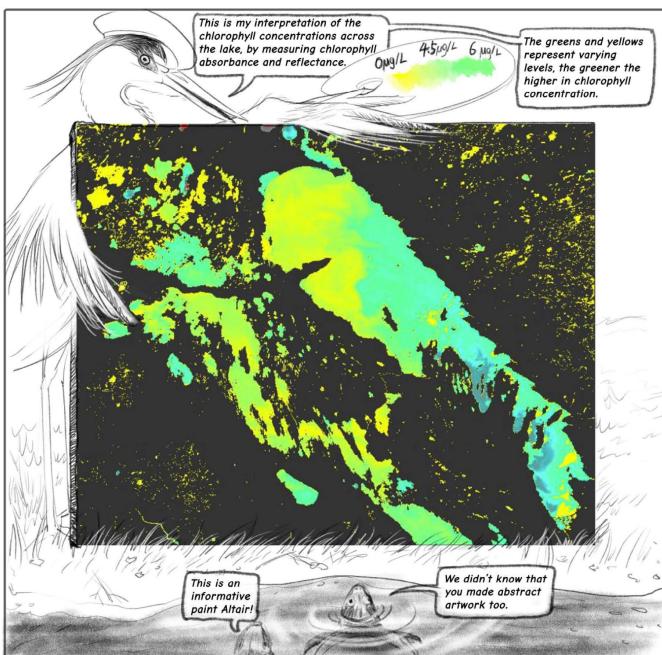
Since animals are directly impacted by lake eutrophication due to food chain disruptions and the toxicity of blue-green algae, we chose animals from the lakes as the main characters. These characters investigate the strange occurrences in their lakes and seek to understand what is making their friends sick.



The animal characters are motivated to uncover the problems affecting their lakes and play roles in data collection using their unique abilities. For instance, the great blue heron observes from the sky and creates an “abstract” art piece representing chlorophyll concentrations, which is based on actual satellite data measuring chlorophyll absorbance and reflectance.

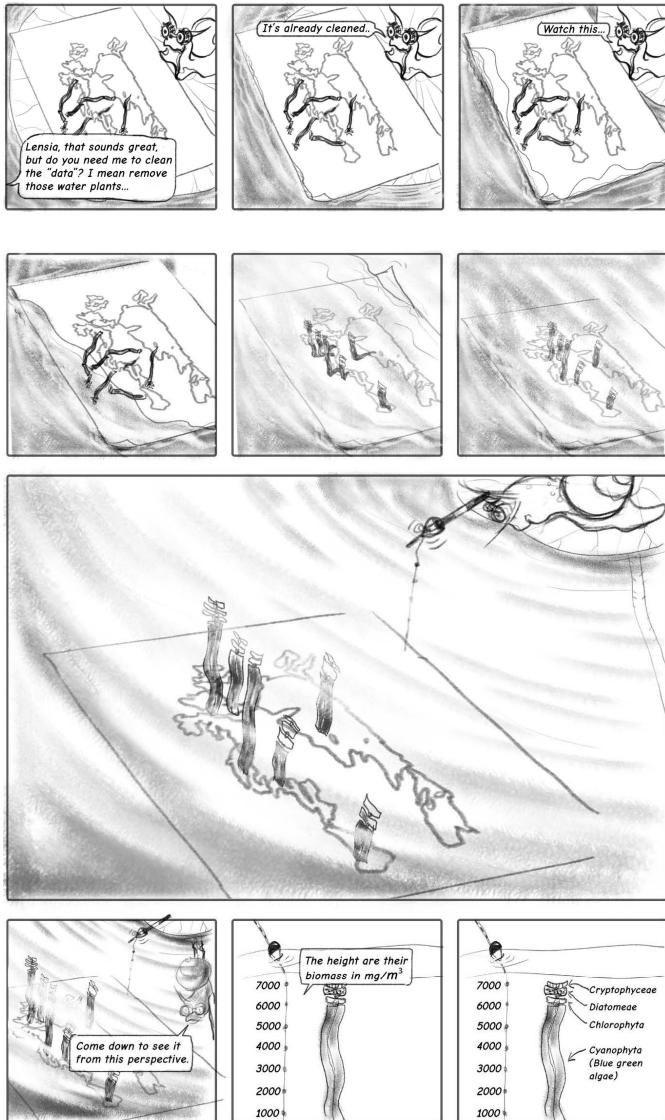
The underwater animals from different locations contribute to water sampling as part of a citizen science initiative. A tadpole snail analyzes the water samples to estimate the biomass of algae, presenting the

process of counting and estimation methods.



The final results of the water sample analysis are presented through a data physicalization created by different types of water plants on the map, representing the biomass of various algae types. This underwater

display uses a fish float and fishing line as the y-axis.



Design approaches in this example include:

Faction: Facts include data from various sources to form an accurate understanding of water conditions, collected and interpreted by fictional characters within their stories.

Explaining Scientific Concepts: Demonstrates the scientific method for assessing lake health by measuring the biomass of different algal types and combining various data sources. The comic also explains the causes of algal bloom proliferation.

Expressive Data Visualizations: Original visualizations from technical reports are “recreated” by different characters using their unique “abilities”, incorporating the material nature of data visualization and the fun of viewing from different perspectives.

4 CONCLUSION

We collaborate with experts in climate science, literature, and data visualization to create data comics that present verified science and data in an accessible way for the general public. Our design approaches include using faction, combining the explanation of scientific concepts and data, and employing expressive data visualizations to craft compelling storytelling. We are exploring more approaches to communicating complex scientific information engaging and understandable for diverse audiences.

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