Future Imperfect: The Mid-Pliocene Warm Period as Analog for the Coming North Atlantic

Peter H. Jacobs | pajacobs4@gmu.edu | Kim de Mutsert | kdemuts@gmu.edu | George Mason University | Dept. of Environmental Science and Policy

How Can Paleoceanographic Data Inform Future Policy?

A fundamental part of successful decision-making is correctly identifying sources of knowledge and ignorance. Decision-making is problematic when decision-makers are uncertain about uncertain answers to questions they know they don’t know and questions they aren’t even aware yet. This is the so-called “unknown unknowns.” Equally problematic is the mistaken assumption that there is universal agreement on existing knowledge which is relevant to the problem, i.e. eliminating “unknown knowns.” Paleoceanographic data that have direct or indirect applicability to policy questions but remain unappreciated as a source of information represent an instance of such “unknown knowns.”

North Atlantic Fisheries under Climate Change

The North Atlantic represents a highly variable and complex oceanic system, ranging from cold, nutrient-rich waters of the Labrador Current to more subtropical waters of the Gulf Stream. A number of processes interact to influence the productivity and distribution of marine organisms, including climate-induced changes in ocean circulation and nutrient inputs. Understanding the potential impact of changes in ocean conditions on marine ecosystems is crucial to developing effective conservation strategies.

Modeling Alternative Oceans and Fisheries

Given the complexity of the climate feedbacks relevant to the North Atlantic, it is important to understand the potential impacts of future climate change on marine ecosystems. Modeling climate scenarios can help predict the potential changes in ocean conditions and their effects on marine productivity and biodiversity.

Who Benefits from Including Paleoceanographic Data?

Gieri Iceland Fisherman

Although Gieri has no fish from the North Atlantic, he is a fisherman who relies on halibut fishing. Declining catches and a general lack of interest in salmon species make him wary of the future. However, he prefers to pass the business on to his son. As the climate warms, the ocean environment will bring more fish from the tropics to the Arctic, and Gieri foresees a bright future for salmon fishing.

Maria Greece PolicyMaker

Marina is not from a North Atlantic nation, but she works for a fisheries mission in an international organization focused on sustainable fisheries management. She believes that better understanding of the impacts of climate change on marine ecosystems is crucial to ensuring the long-term sustainability of fisheries.

Fatosou Student

Fatosou is a student at the University of Athens, studying the effects of climate change on marine ecosystems. She acknowledges that ocean warming is a significant issue, but also recognizes the challenges in understanding the complex interactions between climate and marine biology.

Proposed Analyses of Modeling Results

In order to evaluate the differences between climate model simulations, we propose the following analyses:

- **ANOVA** can be used to test for differences in mean species distributions and abundances.
- **Regression analysis** can be used to investigate the relationships between environmental variables and species distributions.
- **Clustering** can be used to group similar species distributions into distinct communities.

Read more in the following sections for details on these analyses.