

## Background

Founded in 1930, Woods Hole Oceanographic Institution (WHOI) is a world-class, independent, non-profit organization based on Cape Cod, Mass., dedicated to research, engineering and higher education at the frontiers of ocean science. Its primary mission is to develop and effectively communicate a fundamental understanding of the ocean and its interaction with the Earth system for the benefit of society. As the world's largest non-profit oceanographic research institution with more than 1000 employees and 150 graduate students, WHOI achieves its leadership position in ocean science research and higher education by nurturing inventive minds in an independent, creative atmosphere. The Institution's funding comes from a combination of government grants, foundations, and private donations.

## Challenge

Jennie Rheuban, a research associate at WHOI, led the development of a model to forecast the impacts of climate change and ocean acidification on the US Atlantic Sea Scallop fishery. Helen Gordon, an information specialist at WHOI, and Jennie were looking for a flexible, user-friendly tool that could extract and visualize large datasets of model output quickly, over the web, and across multiple browser platforms. Several requirements included the ability for researchers to develop, modify, and deploy the dashboard independently in order to display on a website that was open to the public and did not require login to view the model. The dashboard they had in mind was needed to visualize future possible outcomes of the New England sea scallop fishery as an education and outreach tool for fisheries managers, industry representatives, and the general public. Ocean acidification, the ongoing decrease in the pH of the ocean due to rising atmospheric CO<sub>2</sub>, is likely to negatively

impact the sea scallop fishery, and the dashboard is used to illustrate what the long term trends might look like. Climate change scenarios from the Intergovernmental Panel on Climate Change (IPCC) were used to estimate how the physical environment experienced by scallops will change.

Helen and Jennie were looking for technology that allowed them to visualize a series of possible impacts of climate change on sea scallops. They looked at a bunch of different products and landed on Panopticon because of its customizability and lack of coding.

## Solution

Using Panopticon, researchers at WHOI on Cape Cod are able to showcase data visualizations on the impacts of ocean acidification and climate change on the \$500 million scallop industry in the New England and Mid-Atlantic regions. Helen and Jennie are able to take model output on key biological and economic indicators such as scallop biomass, landings, and industry revenues and use Panopticon to display how these indicators will change in the future based on different levels of global climate policy. The combination of biology, chemistry, and socioeconomics for the sea scallop industry was the most important aspect of the study. The visualizations created using Panopticon are now serving as the foundation for future education and outreach, and additional scientific research on how ocean acidification and climate change can affect one of the top-grossing fisheries in the United States.

In addition to providing valuable insights on ocean acidification and climate change, the visualizations and PDF outputs from WHOI can serve as important assets for determining the economic outlook and business plans for the scallop fishing industry into the future. New England fisheries can use this information to create effective long-term business models.

