CALIFORNIA SEA LIONS

What Happens if Prey Moves Away?

The Story of a Movable Feast

The baitfish preferred by California sea lions are predicted to move in response to changes in ocean conditions. If you can't stand the heat move north!

Global climate change has altered our oceans in a variety of ways already, and more changes are on the way. Ocean temperatures are increasing and predicted to continue to rise given current levels of greenhouse gas emissions and policy frameworks. Locally, ocean temperatures are predicted to rise by about 2 degrees in the coming 25 years. Two degrees? How can that tiny change possibly matter?

Many ocean processes are sensitive to temperature, even a seemingly small shift like this one. We've found that this projected shift in temperature could be associated with significant movements in the small fishes that comprise much of the diet of California sea lions. If their prey moves, perhaps the sea lions will move as well, or perhaps they will change their diets to include other prey; the consequences of such shifts are unknown.

How We Did It

We tracked movements of 25 California sea lions off Oregon, Washington, and Vancouver Island between April and June 2005 and 2007, and then used a set of mathematical equations (a "model") to examine their distribution relative to depth, sea surface temperature, and chlorophyll concentration (a proxy for ocean productivity). Using this model, we generated forecasts of sea lion distribution patterns under different regional ocean temperature patterns that could occur in the future.

Data on distribution of sea lion prey – Northern anchovy, Pacific sardine, and Pacific herring – were collected during NOAA fish trawl surveys off Oregon and Washington during May and June between 2003 and 2011. Prey distribution was correlated to depth, sea surface temperature, chlorophyll, and other oceanographic factors. Similar to the sea lion analysis, we used these model results to generate forecasts of fish distribution under different ocean temperature scenarios.

Forecasts of sea surface temperatures between 2016 and 2100, based on reliable, commonly-accepted projections made by the Intergovernmental Panel on Climate Change were then used to generate future distribution patterns of California sea lions and three of their prey species.

Why Do These Results Matter?

Won't sea lions simply move to follow their prey, or maybe eat something else ? They might. Or they might starve, as has been observed in recent years of prey scarcity. Fewer sea lions could be bad news for their predators, wreaking havoc with the ecological checks and balances of our ocean.

Changes in distribution of these prey species could be important to humans in a variety of ways. For example, sea lions aren't the only animals that eat anchovy, sardine, and herring. Humans eat a small amount of these species, too (Caesar salad, anyone?), and they provide food for species above them in the food web. All of these complex interactions can be disrupted if one strand in the web is broken or changed.

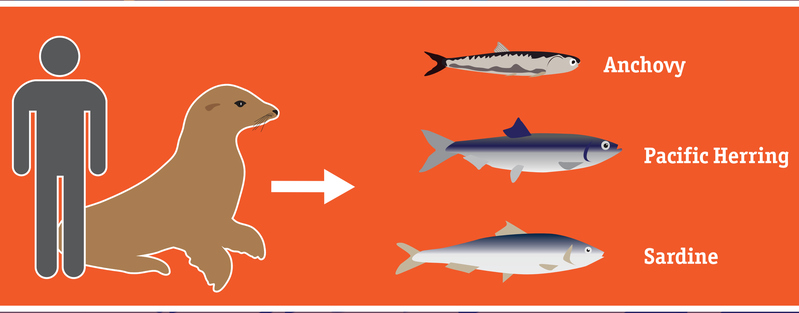
Furthermore, this study demonstrates just one way in which large-scale climatic changes could lead to significant changes in distribution of resources. If it can happen to sea lion food, it can happen to human food, too. What if the shift in ocean conditions is mirrored by shifts in climatic changes over the land as well? What if the growing conditions for wheat or corn change dramatically?

We looked at where the sea lions and their prey are now under current ocean conditions, and then predicted where they will likely be found under future ocean condition scenarios.

What We Found

The maps below show how sea lion and prey distribution might change in response to changes in sea surface temperature.

Computer Monitor Goes Here



Will the sea lions follow the relocated prey? Turn to another source of food? Starve? Each possibility could affect the strands of the food web to which these mammals and their prey are connected.