

# Channel Islands National Marine Sanctuary

## Climate Change

### Management Issue

To effectively manage the Channel Islands National Marine Sanctuary (CINMS or Sanctuary), it will be important to understand the extent to which climate change affects resources, and be able to differentiate between those effects and those caused by activities that can be managed in a more immediate way.

### Description

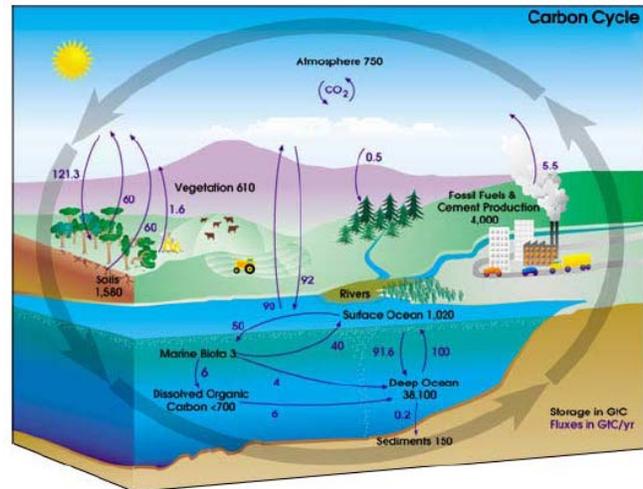
The Sanctuary will certainly manifest the consequences of global climate change. The Channel Islands are at a transition zone between cold northern currents and warm southern currents. Geographic position and variability in this transition are important drivers of community structure and changes in that boundary driven by large-scale climate alteration can be expected to have correlated large impacts in the marine community. Community-level changes may occur as a result of habitat changes and shifts in species ranges; the Channel Islands are a northern and southern range limit for many species. In addition, many local species have multiple, different habitat requirements within their life-histories making access to the diversity of conditions seen in the Sanctuary a critical component of ecosystem health.

Upwelling variability is an important driver of zooplankton productivity and food web integrity on the scale of the California Current (Barth et al., 2007). Changes in upwelling driven by climatic alteration, such as changes in jet stream intensity and trajectory (Archer and Caldeira 2008), can therefore, be expected to have a direct impact on ecosystem health in the Channel Islands Sanctuary. Other possible threats from climate change include changes in ocean chemistry and sea level rise. These impacts are expected to be intense and wide-spread – particularly at the bottom of the food web where trophic process is so tightly coupled to environmental chemistry (Hays et al. 2005; Fabry et al 2008).

To effectively manage the Sanctuary, it will be important to understand the extent to which climate change affects resources. First, a carbon budget of the sanctuary is needed to characterize the human carbon inputs to the sanctuary. Furthermore, a study of species and their ranges, along with a modeling effort, could present scenarios of changes that may occur as a result of climate change. This effort could also lead to the identification of indicator species that are relatively easy to sample and could provide early indications of climate shifts.

### Questions and Information Needs

- 1) What are the human carbon inputs to the Sanctuary?
- 2) What is the net carbon budget for the Sanctuary?
- 3) How will resources of the sanctuary be affected by climate change?
- 4) What is the spatial extent of the aragonite solubility surface and how is that changing?
- 5) How would sea level change affect Sanctuary resources?
- 6) How will changes in ocean chemistry affect resources?
- 7) What results will global climate change have throughout biological communities?



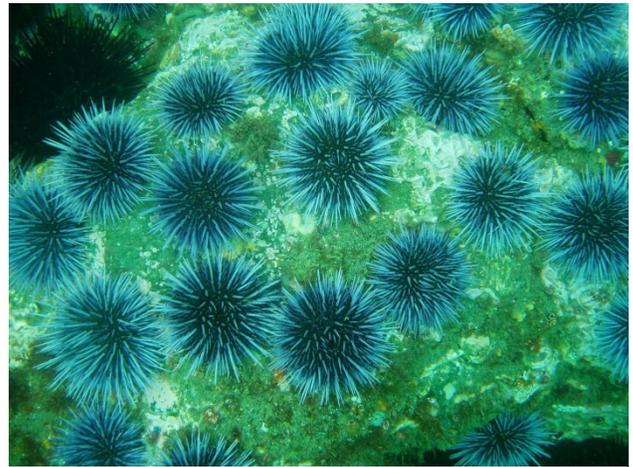
Concept Carbon Cycle – numbers are global estimate in Gigatons for storage and Gigatons/year for exchange rates (from NASA Earth Science Enterprise)

## Scientific Approach and Actions

- Systematic monitoring survey of marine chemistry across the Sanctuary to determine the spatial distribution of the aragonite solubility surface
- Analysis of carbon flux – net inputs and sinks
- Mathematical modeling of mass flux (water, solutes, carbon, etc) through the Sanctuary
- Analysis of species ranges, potential sea level change, and trophic relationships
- Analysis of potential effects of ocean chemistry changes
- Establishment of sentinel sites

## Key Partners and Information Sources

UC Santa Barbara, National Center for Ecological Analysis and Synthesis, National Center for Coastal Ocean Science, National Weather Service, National Marine Fisheries Service, National Aeronautic and Space Administration



*Calcifying organisms like urchins are likely to be affected by changes in ocean chemistry. Photo CINMS/NOAA*

## Management Support Products

- A carbon budget of the Sanctuary is needed to characterize the human carbon inputs to the Sanctuary. This will eventually be part of a larger project to estimate a net carbon budget for the Sanctuary system.
- A study of species and their ranges, along with a modeling effort, that can present scenarios of changes that may occur as a result of climate change. This effort could also lead to the identification of indicator species that are relatively easy to sample and could provide early indications of climate shifts.

## Planned Use of Products and Actions

- Adaptive management of resources likely to be affected by climate change
- Monitoring programs for indicator species
- Inform more environmentally responsible recreational, commercial, and research use of Sanctuary resources

## Program References

### CINMS Management Plan

- Management Plan Conservation Science Action Plan CS.3, Resource Protection Action Plan RP.2.

### CINMS Condition Report

- Are specific or multiple stressors, including changing oceanographic and atmospheric conditions, affecting water quality?
- What is the abundance and distribution of major habitat types and how is it changing?
- What is the condition or health of key species and how is it changing?

### ONMS Performance Measures

- Number of sites in which water quality, based on long-term monitoring data, is being maintained or improved.
- Number of sites in which habitat, based on long-term monitoring data, is being maintained or improved.]
- Number of sites in which select living marine resources, based on long-term monitoring data, are being maintained or improved.

### Other Documents

- 2008 Blue Seas Green Communities Advisory Council Challenge.
- Sanctuary Advisory Council Report (Ocean Acidification and the Channel Islands National Marine Sanctuary: Cause, effect, and response)  
[http://www.channelislands.noaa.gov/sac/pdf/CWG\\_OAR\\_final.pdf](http://www.channelislands.noaa.gov/sac/pdf/CWG_OAR_final.pdf)

*Current as of 11/28/12*

*For More Information -- <http://www.sanctuaries.noaa.gov/science/assessment>*