Scientists Conduct Census of Marine Life

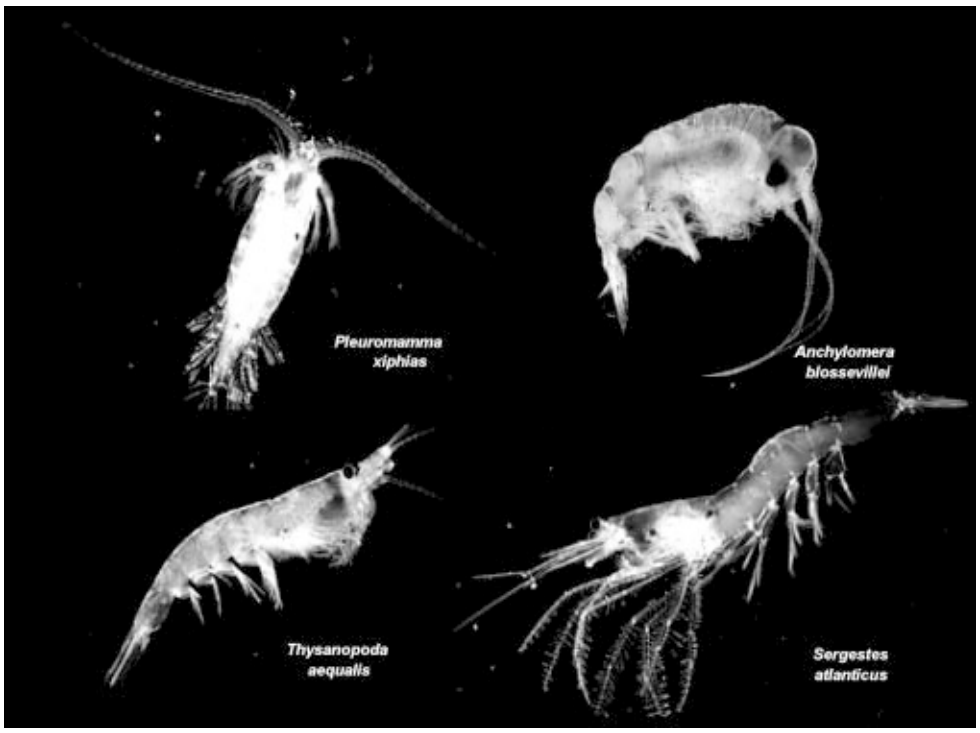
The Census of Marine Life is a 10-year international research program to assess and explain the diversity, distribution, and abundance of the world's marine organisms. The information and technologies developed through the Census will be made publicly available to strengthen management of marine ecosystems and improve public understanding of the ocean environment. The following article is the first in a two-part series designed to highlight the work of VIMS researchers involved in Census of Marine Life projects. The next issue will describe Dr. Mike Vecchione's work with deep-sea squid on the Bear Seamount.

The researchers in Dr. Deborah Steinberg's lab can empathize with the challenges faced by census takers. But rather than unfriendly dogs or unwilling citizens, their trials involve the task of collecting, identifying, and cataloging the myriad species of zooplankton in the mid-Atlantic's Sargasso Sea.

Steinberg, along with VIMS technicians Joe Cope and Stephanie Wilson, is working with collaborators at Woods Hole, the Russian Academy of Sciences, and the Smithsonian on a 2-year, $380,000 grant to provide the first-ever complete census of plankton diversity in the western North Atlantic. Their efforts are part of a U.S. initiative to create an on-line database of marine animal and plant distributions called the Ocean Biogeographic Information System. OBIS is in turn part of the larger international Census of Marine Life program.

The need for a census of marine life is clear. Steinberg notes that oceans cover 70% of Earth's surface, provide 90% of its living space, and harbor a diversity of life that may rival that of rain forests. "But because the world's oceans are so vast and inaccessible, our description of marine biodiversity is far more limited than our description of terrestrial diversity," says Steinberg. "As the health of the world's oceans decline and species are lost, people are becomingly increasingly aware of how important it is to study and maintain biodiversity."

A census of zooplankton diversity and abundance is particularly important, says Steinberg. She notes that "a zooplankton census will ultimately help us better understand the role that plankton play in biogeochemical cycling and the marine food web. Zooplankton provide a direct link between primary producers and higher trophic levels such as fish, seabirds, and marine mammals."



These photos illustrate the diversity of zooplankton near Bermuda. Clockwise from upper left are a copepod, amphipod, shrimp, and krill.

To reveal trends, a census needs to continue through time. "By describing and understanding how patterns of zooplankton distribution and abundance change from day-to-day, season-to-season, or year-to-year," says Steinberg, "we can dissect the difference between natural variability and real 'change' in plankton diversity, and better understand and model the effects of long-term climate change on ecosystems."

But conducting a long-term zooplankton census is easier said than done. The fragility of these creatures makes them difficult to collect, while their small size hinders identification. The researchers must also work around storms, ship time, and funding.

The plankton samples were collected during monthly cruises to the Bermuda Atlantic Time-series Study (BATS) site between 1994-2001. BATS is a 15-year, on-going series of monthly oceanographic measurements collected by scientists associated with the Bermuda Biological Station for Research. It builds on the 49-year-long "Hydrostation S" program to provide one of the most intensively studied patches of ocean in the world.

Sampling in the surface waters of the Sargasso Sea requires use of a large, 3-foot-diameter plankton net to gather the relatively low numbers of plankton these nutrient-poor waters support. Once netted, the plankton are funneled into clear plastic bottles and then split into samples small enough for counting. A peek in Steinberg's lab reveals the fruits of this labor—more than 1,000 small jars filled with a thin plankton soup.

But the hardest part is yet to come—trying to identify the huge diversity of plankton these samples contain. "In the nutrient-rich waters of Chesapeake Bay, plankton are abundant but the diversity is low," says Steinberg. "It's the opposite in the Sargasso, where plankton are less abundant but much more diverse."

Joe Cope, a research technician in Steinberg's lab, is responsible for identifying the ostracods, clam-like crustaceans about the size of a sand grain. He compares this work to sorting a shuffled deck of microscopic cards into suits, with the suits defined by the ostracods' shape, size, and the number of bristles on their limbs. "The microscope work can be tedious and frustrating," he admits, "but we've identified at least 30 species, one that's new to the Sargasso." Technician Stephanie Wilson works with krill, an important food source for whales, and has so far identified 25 species of these shrimp-like creatures.

The copepods, flea-like crustaceans the size of a rice grain, are even more diverse. Dr. Elena Markhaseva, a copepod expert from the Russian Academy of Sciences' Zoological Institute in St. Petersburg (see article on facing page), has identified more than 100 different species of calanoid copepods, including seven that are new to the Sargasso Sea and three never-before recorded from the Atlantic.

Dr. Frank Ferrari, of the Smithsonian's National Museum of Natural History, another partner in this project, will add any rare, previously undescribed, or missing species to the Smithsonian's collections.

To Steinberg and her team, the great diversity of these samples is not surprising. "What is surprising," says Steinberg, "is how different species occur at different times of the year." Thus one species of copepod might appear only in summer samples, while a closely related species, which might differ only in the number of bristles on its legs, occurs in winter.

Steinberg thinks that these seasonal swings might be an example of "niche partitioning," wherein organisms evolve different life-style strategies to avoid competing for food or other resources.

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VIMS By the Numbers.....

- **128,000** Specimens in VIMS' Ichthyological Collection, one of the largest and most diverse collections of marine and estuarine fishes from Nova Scotia to North Carolina. See www.vims.edu/ich_coll.html
- **4,775** Maps and charts available in the VIMS library.
- **2,269,689** Hits on the VIMS web site during October 2002, the busiest month of that year. Hits represent the total number of requests made to a web server.
- **47** Percentage of the $1.5 million in private contributions received by VIMS in 2002 that came from individual donors. Of the remaining contributions, 40% came from private foundations and 13% from corporations.
- **45,174** Number of active grid cells in the VIMS HEM-3D computer model, which is used to perform high-resolution simulations of tidal flow in the Elizabeth River.
- **15** Women in the School of Marine Science 2002 graduating class, 52% of the students who earned Masters and Ph.D. degrees in that year.