Deep-sea species' loss could lead to oceans' collapse, study suggests

December 27 2007

The loss of deep-sea species poses a severe threat to the future of the oceans, suggests a new report publishing early online on December 27th and in the January 8th issue of *Current Biology*, a publication of Cell Press. In a global-scale study, the researchers found some of the first evidence that the health of the deep sea, as measured by the rate of critical ecosystem processes, increases exponentially with the diversity of species living there.

“For the first time, we have demonstrated that deep-sea ecosystem functioning is closely dependent upon the number of species inhabiting the ocean floor,” said Roberto Danovaro of the Polytechnic University of Marche, in Italy. “This shows that we need to preserve biodiversity, and especially deep-sea biodiversity, because otherwise the negative consequences could be unprecedented. We must care about species that are far from us and [essentially] invisible.”

Ecosystem functioning involves several processes, which can be summarized as the production, consumption, and transfer of organic matter to higher levels of the food chain, the decomposition of organic matter, and the regeneration of nutrients, he explained.

Recent investigations on land have suggested that biodiversity loss might impair the functioning and sustainability of ecosystems, Danovaro said. However, the data needed to evaluate the consequences of biodiversity loss on the ocean floor had been completely lacking, despite the fact that the deep sea covers 65% of the Earth and is “by far the most important

ecosystem for the cycling of carbon, nitrogen, and phosphorus of the biosphere."

The deep sea also supports the largest "biomass" of living things, including a large proportion of undiscovered species.

In the new study, Danovaro's team examined the biodiversity of nematode worms and several independent indicators of ecosystem functioning and efficiency at 116 deep-sea sites. Nematodes are the most abundant animals on earth and account for more than 90% of all life at the bottom of the sea. Earlier studies have also suggested that nematode diversity is a good proxy for the diversity of other deep-sea species.

They found that sites with a higher diversity of nematodes support exponentially higher rates of ecosystem processes and an increased efficiency with which those processes are performed. Efficiency reflects the ability of an ecosystem to exploit the available energy in the form of food sources, the researchers said. Overall, they added, "our results suggest that a higher biodiversity can enhance the ability of deep-sea benthic systems to perform the key biological and biogeochemical processes that are crucial for their sustainable functioning."

The sharp increase in ecosystem functioning as species numbers rise further suggests that individual species in the deep sea make way for more species or facilitate one another, Danovaro said. That's in contrast to terrestrial-system findings, which have generally shown a linear relationship between diversity and ecosystem functioning, he noted, suggesting complementary relationships among species.

"Deep-sea ecosystems provide goods (including biomass, bioactive molecules, oil, gas, and minerals) and services (climate regulation, nutrient regeneration and supply to the [upper ocean], and food) and, for

their profound involvement in global biogeochemical and ecological processes, are essential for the sustainable functioning of our biosphere and for human wellbeing," the researchers concluded. "Our results suggest that the conservation of deep-sea biodiversity can be crucial for the sustainability of the functions of the largest ecosystem" on the planet.

Source: Cell Press