Title ...

PART A

The extraordinary number has been established by an international project attempting to catalogue all ocean life.

It suggests microbial biodiversity is much greater than previously thought, say Mitchell Sogin and colleagues.

Their research, published in the journal Proceedings of the National Academy of Sciences, is part of the Census of Marine Life (CoML).

It was undertaken using a new technique that allows for the rapid identification of distinct organisms by probing just small snippets of DNA.

"Microbes constitute the vast majority of marine biomass and are the primary engines of the Earth's biosphere," said Dr Sogin, from the Marine Biological Laboratory's (MBL) Josephine Bay Paul Center for Comparative and Molecular Biology and Evolution, located in Woods Hole, Massachusetts, US.

PART B

Density range

In the PNAS study, microbes were fished up from eight sites in the Atlantic and Pacific Oceans at depths of 550-4,100m (1,800-13,500ft).

The locations included extreme environments, both hot and cold, such as the North Atlantic and a hydrothermal vent located on an underwater Pacific volcano off the coast of Oregon.

The scientists expected to find about 2,000 species per litre of seawater. They were shocked to discover 10 times more biodiversity.

"These observations blow away all previous estimates of bacterial diversity in the ocean," said Dr Sogin. "The number of different kinds of bacteria in the oceans could eclipse five to 10 million."

He told the BBC News website: "It really points to our lack of knowledge and how much more there is to learn."

The powerful new identification technique used by the microbiologists is called "454 tag sequencing".

It enabled the team to identify thousands of unusual types of microbes, some of which were present only in small numbers. They could easily have been overlooked by previous studies.

PART C
'Rare biosphere'
"Peering through a laboratory microscope into a drop of seawater is like looking at the stars on a clear night," said Victor Gallardo, vice chair of the CoML.

"The 454 tag sequencing strategy increases resolution like the Hubble Telescope. We can see marine microbial diversity to which we were blind before." A "rare biosphere" is how the scientists described these low-abundance background populations.

The unusual microorganisms are thought to contribute to an enormous range of novel genetic diversity in the ocean.

The researchers believe that they might serve as a gene pool to preserve genetic innovations.

If environmental changes wiped out a dominant species, the low-abundance ones with a more suitable genetic makeup would be ready to take over.

"We know there will be major ecological changes on our planet. The microbial world has to survive the changes and one way is to have a lot of novelty in your genome so that you can cope with different environmental conditions," explained Dr Sogin.

PART D
Global reach
The census keeps a record of the distribution and numbers of the microbes. Scientists can then trace how the organisms adapt to changes and also, in the long run, understand what evolutionary driving forces might be at play.

"These rare, ancient organisms are likely to prove a key part of nature's history and strategy," explained Dr Gallardo.

Human beings are dependent on microbes for continued survival.

"The photosynthesis in the ocean is carried out by microbial life forms, and that is the major input in terms of capture of energy from the Sun," explained Dr Sogin. "The microbes are a significant input into climate parameters."

The project will scale up to 1,200 marine sites, including different conditions such as surface waters, waters near methane emissions from the sea floor, and deep-sea sediments.

The study forms part of the International Census of Marine Microbes (ICoMM), a component of the Census of Marine Life, a 10-year global initiative started in the year 2000.

The CoML now involves more than 1,700 researchers in over 70 countries in efforts to assess and explain the diversity, distribution, and abundance of life in the oceans - past, present, and future.

Story from BBC NEWS:
http://news.bbc.co.uk/go/pr/fr/-/2/hi/science/nature/5232928.stm
Published: 2006/07/31 21:36:05 GMT

Adapted from http://news.bbc.co.uk/2/hi/science/nature/5232928.stm