

## Scientists detect 'milky sea' phenomena

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Scientists at the Naval Research Laboratory's Marine Meteorology Division in Monterey, CA, (NRL-Monterey), working with researchers from Monterey Bay Aquarium Research Institute and the National Geophysical Data Center, presented the first satellite detection of a phenomenon known as the "milky sea." The satellite observations were corroborated by a ship-based account. This research was published in the October 4, 2005, issue of the Proceedings of the National Academy of Sciences (PNAS).

Since the 17th century, "milky seas" have been associated more commonly with maritime folklore than scientific knowledge. They are mentioned in the Jules Verne classic 20,000 Leagues Under the Sea. Until this satellite detection was achieved by NRL researchers, the phenomena had only been reported in ship's logs and their descriptions were subject to the uncertainties of human perception. Mariners have described the phenomena as giving the impression of sailing upon a field of snow or gliding over the clouds--all under the darkness of a moonless night. The glowing waters appear to extend to the horizon in all directions, and can last from several hours to several days. They are thought to be caused by enormous populations of bacterial bioluminescence, but their ephemeral nature has made it difficult to place appropriately equipped research craft in their locations.

Dr. Steven Miller, from NRL's Marine Meteorology Division, explained that the milky sea presented in the paper was detected by the Defense Meteorological Satellite Program (DMSP). These polar-orbiting satellites feature the Operational Linescan System (OLS) instrument,

which was designed primarily to monitor global cloudiness under both solar and lunar illumination. To achieve nighttime detection, the OLS uses a sensor capable of registering extremely low levels of visible light. This system has been used to detect terrestrial and atmospheric emission sources such as fires, lightning, and human activity (city lights, fishing boats, etc.) around the world. However, there have been no previous reports or demonstrations of the OLS being used to detect bioluminescence.

Dr. Miller and the research team searched ship reports of milky sea sightings since 1992 and compared these with archived OLS satellite data. A British merchant vessel, the S.S. Lima, was transiting the northwestern Indian Ocean on the night of January 25, 1995 when it encountered the milky sea. Enhancement of OLS imagery collected roughly 30 minutes after the ship's report of initial sighting revealed a massive region of low-level light emission. The glowing waters spanned an area roughly the size of Connecticut (over 15000 km<sup>2</sup>) and lasted at least three nights. The event took place in the northwest Indian Ocean, approximately 280 km off the Somali coast. The boundaries of the feature matched closely with a surface ship's reported entry and exit of the brightly glowing waters.

Although such observations cannot be fully explained based on the known features of any light-emitting organism, these so-called "milky seas" are hypothesized to be manifestations of strong bioluminescence produced by colonies of bacteria associated with a microalgal bloom in the surface waters. Because of the lack of scientific observations, a full explanation of milky seas has remained elusive. With the current state of satellite technology, and sampling limitations, remote sensing researchers have generally thought that the detection of bioluminescence emission from space was unlikely if not impossible.

Demonstration of their detection by low-light detectors on current and

future satellite systems provides a possible means to targeting these events in the future by properly equipped research vessels. This creates opportunities for new research and insight pertaining to the cause, role, and implications of these poorly understood phenomena, said Dr. Miller. Professor. J. Woodland Hastings of Harvard University, a leader in the field of bioluminescence and communicator of this paper to PNAS, called this research a "beautiful discovery."

Source: Naval Research Laboratory

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