Coastal ecology and water quality have profound influences on socioeconomic well-being. Effective management of coastal ecosystems requires clear understanding of the complex connections between human activities and the physical, chemical and biological dynamics of coastal ecosystems. In concert with ESP network deployments, AUV surveys are regularly conducted to provide synoptic, multidisciplinary high-resolution maps of the coastal ocean environment in which microbiology is being studied. During the October 2008 ESP network deployment, changes in the northern bay water column around mooring E1 and E2 were mapped by AUV surveys (left). This data provides valuable context on the oceanographic processes, pathiness and scales of variability within which ESP sampling takes place. The two vertical sections shown here illustrate the warming and decrease in phytoplankton abundance at the end of the upwelling-generated bloom.

Simultaneous Monitoring of HABs and Water Quality Indicators

Nearshore water quality and human health can be impacted from the ocean-side by HABs and from the land-side by pathogens transported via coastal watersways. Further, the development of HABs in coastal waters can be linked to water quality degradation caused by constituents of land drainages. Because these coastal management issues may be linked and synergistically harmful, the ESP has been developed to simultaneously monitor HAB species and microorganisms associated with human health. During fall 2009, a time-series from the Santa Cruz Pier showed extremely high concentrations of HAB species that can cause amnesic shellfish poisoning. Quantitative PCR results also showed that bacteriophages from a human source were detected by ESP on October 27. These data are being integrated with UCSC monitoring data from Santa Cruz Pier.

Platforms for Molecular Probing of Ocean Life

The ability to receive information from molecular probe techniques in near real-time creates opportunities to advance interdisciplinary ocean research. To explore these opportunities, the ESP has been developed for deployment on a variety of platforms, including moorings, pier, and benthic instrument nodes, from near-surface to 4000 m depth. Fixed-location deployments are yielding unprecedented observations, yet many important questions in marine science require Lagrangian studies in which the processes and evolution of planktonic communities are tracked by following them and the environment in which they are transported. To advance Lagrangian studies, the current generation ESP (G2) is being deployed on a profiling drifter (below) in fall 2010. Miniaturization of ESP capabilities is in progress and deployment of molecular probe techniques on autonomous underwater vehicles (AUVs) in parallel, the artificial intelligence of AUVs is advancing to permit autonomous feature detection, mapping and sampling, thus allowing on-board molecular probe resources to be expended intelligently, efficiently and effectively.

Acknowledgments

Development and application of ESP has been funded in part by grants from the David and Lucile Packard Foundation through funds allocated by MBARI, NSF (OCE-0451223, OCE-0328746), the Keck Foundation, NASA (NNG06G56G), and the Gordon and Betty Moore Foundation.

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