Box 9.3. Continued

recruitment and so may be more sensitive to overfishing than previously believed. This has important management implications. For instance, aggregating fish stocks during mass spawning need protection. Legislation has recently been passed to close fishing on particular reefs for particular fish during such periods. This technology could be readily applied to the coral reef fisheries in other areas.

CONTRASTING REAL AND MODELED SEAS

Visualization provides a powerful tool to explain model output and compare it with field data. Such explanations are difficult when both model output and field data are patchy or variable in time and space. Computer animations of the data used to visually compare observations with model output suggest that in coastal systems, models tend to underestimate natural variability and patchiness (see, e.g., Schwab et al. 2000; Signell et al. 2000; He and Hamblin 2000).

APPLICATION TO SAFETY OF LIFE, AND OIL SPILLS

Computer visualization technology will also increasingly be used in human emergencies. One clear application is its use with dispersion models to predict the likely drift of people lost at sea and to guide search planes and ships. In oil spill emergencies, managers routinely use the same visualization packages. These applications demand the use of oceanographic data in real-time for assimilation into numerical models.

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CHALLENGES AND RECOMMENDATIONS FOR DEVELOPING AND USING NEW TECHNOLOGIES

Advances in our understanding of ocean conditions and our capabilities to observe and predict them will not come easily, because several important challenges remain. For example:

- Most of the systems and platforms described here are not designed for sampling within 30 m of the shoreline, which is the most important ocean zone for direct human interaction.
- Data telemetry is bandwidth limited at present. More capable communication satellite and cabled network systems are essential.
- Propelled AUVs are still power limited, and fuel cell advances are needed.
- Biofouling of many of the in situ sensors is still a problem for longer duration sampling.
- Satellite observation of higher trophic organisms remains a major research goal.