those few that are well-adapted may be able to be very productive because of energy subsidies. Rapid changes in environmental conditions, however, can prevent the full development of an ecosystem. If conditions continually change before any one group of organisms becomes established, then ecological production may be restrained (Montague et al., unpubl. manuscr.).

Although rising sea level will cause a succession of ecosystems, the rate of rise is probably not rapid enough to prevent full ecosystem development in coastal zones. The seeds and larvae of plants and animals that occur at different points along environmental gradients are widely distributed in estuarine waters. Marshes can become established within one to five years following a sudden appearance of a favorable environment (Montague, unpubl. data). Mangroves may take at most 15 to 25 years to become fully developed (Odum et al., 1982). The rate of sea level rise may or may not be gradual enough to create a significant long-term lag time in the development of successive ecosystems.

Despite the possibility of a timely replacement of coastal ecosystems, whenever a large mass of existing organisms dies, short-term perturbations may accompany the transition to a new ecosystem. Dead plant matter, for example, may temporarily increase in coastal waters and sediment, formerly held in place by roots and rhizomes, may become unstable (Montague, 1986). The added dead matter will decompose, and so may reduce dissolved oxygen levels sufficiently to cause local fish kills. Destabilized sediment will increase turbidity in coastal waters, which will most likely reduce seagrass and phytoplankton production and may foul the filtering mechanisms of filter feeders such as clams and oysters.

11.3 RESEARCH NEEDS

The responses of some of the more prevalent coastal plants and animals to environmental changes are known. As predictions of the effects on sea level rise on ecologically important variables improve, better predictions of the nature and timing of ecological changes can be made using existing information. For the best predictions, however, new ecological and physiological information may also be required. The most important information needs can be identified with the aid of a literature synthesis and subsequent simulation model. The model will simulate ecological responses to predicted environ-