

Ecosystem analysis is most likely to be successful where the life cycles of the dominant organisms are short and the number of trophic levels is small. These determine the required duration and frequency of field observations. In addition, since the structure of a biotic community is determined more by the history of environmental conditions than by the existing conditions at a given time and place, observations must be continued long enough to provide such a history. For a major ecosystem, this implies a continuing series of observations for years. The nature of the observations to be made will require enlightened insights into causal relationships, insights that perhaps can best be developed through intensive studies of selected processes and mechanisms both in the field and in the laboratory.

The variety of necessary observations makes obvious the reasons why the ecosystem approach has been applied imperfectly and on rare occasions to marine communities. Since no individual can encompass all of the abilities, interests and techniques required, a coordinated attack is needed in the effort to solve some of the major marine problems of pollution, fisheries management, and the deliberate modification of the sea to increase marine resources.

Modification of the Environment

The study of marine ecology by observation and description has not provided an adequate understanding of marine ecosystems. To improve our ability to predict the effects of modifications of the environment, we must analyze ecological processes in stressed and unstressed ecosystems. It seems unlikely that an ecosystem would be stressed appropriately by chance. The deliberate modification of an ecosystem as a research tool appears necessary.

In some instances an ecosystem or a portion of one may be simulated and subjected to a series of experimental changes. This may be both costly and time consuming because of the size of the required simulation and the time needed for meaningful responses. Miniaturization of an ecosystem in space or time may provide useful preliminary information, but one cannot be sure that it will provide information on which one may base predictions of the responses of a full-scale system. Deliberate manipulation of an ecosystem is potentially a powerful research