1.5 Assessing Economic Benefits of Forecasts

Research Need: Conduct socioeconomic studies of how user groups will benefit from HAB forecasts at different temporal and regional scales.

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HARRNESS Recommendation: Same (HARRNESS, 55).

Policy makers, natural resource managers, research scientists, industry officials, the media, and the public now widely recognize that HABs can result in serious economic impacts on a variety of coastal businesses and users of the ocean. Although economic impacts from this kind of natural hazard clearly exist, only a few studies have attempted to document these impacts or to report them on a comparable and consistent basis. In the future, in order to scale levels of investment in the science and management of HABs, it will be important to refine estimates of the nature and size of economic impacts (see Section 1.3, *Assessing Economic Impacts*). Documentation of sociocultural impacts (discussed in Section 1.2, *Assessing Social Impacts*) is also critical.

For many industries and users of the coastal ocean, there may be value in the development of a capability for predicting or forecasting the occurrence of HABs. This value arises from the possibility that some or all of the damages caused by HABs might be averted through advance knowledge about the likelihood of the occurrence of an event and actions that can be taken to mitigate the potential damages. Industries potentially affected by HABs include wild harvesters of shellfish, shellfish growers, and businesses such as hotels, restaurants, and others who are dependent upon coastal tourism. Coastal tourists, who are consumers of environmental goods and services such as clean air, clean beaches, and recreational fishing also may be harmed by HAB events.

Public officials have begun to develop an interest in building regional capacities for predicting HAB events. This interest is reflected in agency budgets and sponsored research on the science relating to the factors that contribute to bloom formation, transport, and fate. Coupled biophysical models useful for predicting blooms are now under development for the Gulf of Maine, the Gulf of Mexico, and the Pacific Northwest. These models are necessary but not sufficient for predicting the economic effects of HAB events.

A well-established "value of information" framework is commonly used to assess the economic value of predictions of future conditions. Using this approach, the value of HAB predictions to firms or individuals is given by the expected difference between the economic surplus that results when the prediction is used in decision making (i.e., the dollar value of the public health and sociocultural benefits of the prediction minus the costs of producing and delivering it) and the surplus that results when the prediction is not considered (i.e., the dollar value of public health and socioeconomic costs). Assessments of the economic value of HAB forecasts are important for federal and state governmental agencies to leverage and justify investments of public dollars in their development and use.

Research Objectives

1. *Analyze the economic impacts of the status quo (i.e., in the absence of forecasting models).* The first objective is to measure the economic impacts of HAB events in the absence of prediction, using a model of firm or individual behavior.

2. *Assign probabilities to the occurrence of a HAB event.* The second objective is to characterize the prediction itself in terms of the occurrence or non-occurrence of an event within a specified time period. The value of HAB prediction will depend on the accuracy or "skill" of the prediction.

3. *Identify the range of feasible responses of public and private decision makers, given that a HAB event has been predicted*. The third objective is to begin to develop a model of economic behavior to examine how decisions would be made in light of a HAB prediction with given characteristics. This step typically involves identifying a range of potential responses by public and private decision makers (e.g., beach goers and tourism operators) to mitigate economic damages.

4. *Characterize the economic effects of alternative responses*. Using the behavioral model, this objective involves the evaluation of the economic consequences – both costs and benefits – of the choice of a particular response for a decision maker. Decision makers are assumed to choose the response that leads to the greatest net present value or utility.

5. *Aggregate the value of individual decisions. It is important to point out that the value of prediction to society, as opposed to the individual decision maker, will be the product of decisions made by many individual decision makers*. A fifth objective would involve the development of a model that can be used to aggregate the decisions of firms and individuals into an overall measure of prediction value.

Example Project

Economic and Public Health Benefits of Predicting Red Tides along the Florida Gulf Coast

Description: Develop a framework for estimating the economic value of predicting (forecasting) blooms of *Karenia breve* along the west coast of Florida in the Gulf of Mexico. The model would rely upon estimates of the economic damages associated with respiratory illnesses that are caused by a bloom that occurs near the coast. (Other categories of economic damages, including losses to the tourist industry, shellfish bed closures, or non-market losses arising from takes of manatees, might also be incorporated into such an analysis.)

Methods:
- Estimates of cost-of-illness or non-market morbidity costs (e.g., pain and suffering) for respiratory ailments in Florida
- Estimates of the increased incidence of respiratory ailments as a consequence of a HAB event
- Identification of mitigation measures and their costs (e.g., public health alerts, avoiding beaches, and rescheduling vacations)

Outcomes: A model to estimate the value of forecasts to individuals to mitigate the medical costs of a *Karenia* bloom. The model could be used to evaluate alternative courses of action. Results of the model can be aggregated to obtain an overall value of a predictive capability.

Challenges:
- Development of predictive model of bloom formation, transport, and fate
- Estimates of cost-of-illness
- Estimates of non-market morbidity costs

Expertise Needed:
- Microeconomic theory
- Econometric analysis
- Policy analysis
- Risk assessment

Timeline: One to two years.

Estimated Cost: $100,000-$350,000, depending upon the scale and scope of the study. Labor costs are predominant.