

- Use of data to test hypotheses such as the extent to which various social groups are susceptible to exposure to HAB toxins.

- Quantifying non-market values that are difficult to express in dollar terms such as the emotional trauma caused by HAB illness and recreational pleasure and impacts.

**Outcomes:**

- A typology and inventory of stakeholders affected by this type of bloom.
- In the public health dimension, a characterization of the different potential pathways for exposure to domoic acid and their respective health impacts.
- Identification of various data flows, together with an estimate of the cost of gathering data from these sources on an ongoing basis.
- Prioritization of data needs to improve mitigation of the economic, sociocultural, and health impacts of *Pseudo-nitzschia* blooms.

**Expertise Needed:**

- Economist with expertise in market and non-market valuation techniques, econometrics, and survey design
- Sociologist and Sociocultural Anthropologist
- Database Engineer
- Epidemiologist

**Timeline:** 6-12 months to establish data needs and design a data collection framework.

**Estimated Cost:** \$200,000

**Challenges:**

- Providing a database framework that is useful across local and regional scales.
- Prioritizing data needs.

**Potential Partners:** NOAA, including Sea Grant; universities; local community groups; state health departments; state departments of fish and game; Environmental Protection Agency.

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## 1.2 Assessing Social Impacts

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**Research Need:** Assess the sociocultural impacts of HAB events at local and regional scales.

**Lead Author:** Linda L. Lampl (Email: llampl@lampl-herbert.com)

**Contributor:** Dan Ayres

**HARRNESS Recommendation:** “Compile data and calculate the socioeconomic impacts of HAB events at local and regional scales” (HARRNESS, 55).

Harmful algal blooms can wreak havoc in human coastal communities. For example, during the summer of 2005, a HAB event poisoned clams, oysters, and mussels from Maine to Cape Cod. Massachusetts Governor Mitt Romney reported that this event cost the shellfish industry about \$3 million per week (Scheicher, PBS News Hour Extra, 2005). By late summer, inshore fishermen returned to work as the effects of the red tide abated. However, offshore fishermen are still waiting in early 2006 for government regulators to re-open their fishing grounds. Monte Rome, owner of Intershell USA, the largest processor of whole scallops in Massachusetts, stated that his operation is one of the businesses most affected by the lingering closures and

observed that the scallop fishermen are “really hurting” (Frazer, Cape Cod Times, 2006).

Yet the human toll of HAB events is more complex than landings data or “multipliers” commonly used to assess economic impacts. In addition to economic impacts, coastal communities can suffer profound social and cultural disruption. On the Pacific coasts of Washington and Oregon, a HAB event caused by the toxin domoic acid forced the closure of the widely popular recreational razor clam fishery in the fall of 2002 (Ayres 2003). State agencies closed these fisheries for over twelve months, resulting in the loss of 400,000 potential clam-digging trips. This government action,

necessary to protect human health, also disrupted the long-held recreational traditions of tens of thousands of razor clam enthusiasts from throughout the Pacific Northwest region. In addition, the loss of tourist-related income associated with clam digger visits to small coastal communities resulted in job loss, undetermined social disruption, and an estimated \$10 million in lost income.

Similarly, in the Gulf of Mexico in 2005, the seafood community in Franklin County, Florida, an area known for Apalachicola Bay oysters, endured dislocations, personal hardships, and lapses of trust in resource management agencies. The Franklin County oyster fishery lost an estimated \$6 million and 1,000 jobs per month in the latter half of the year after regulators closed shellfish harvesting in July and August in response to bacterial problems after Hurricane Dennis and from September to November in response to HABs after Hurricane Katrina (Vail 2005). Some long-term oystering families turned to kinship connections to survive. One woman reported that she shifted “from never borrowing money to having to keep a roof over our heads” (Ritchie, Tallahassee Democrat, 2005). In addition, the traditionally fragile trust between the regulated and the regulating communities floundered. Minimizing the human impacts of HABs requires a solid understanding of the unintended sociocultural consequences of alternative regulatory actions, including methods for communicating warnings and timing of closures (discussed in Section 4, *Risk Communication*). Social impact assessments (SIAs) are needed to provide regulating agencies, tribal and non-tribal coastal communities, and other partners with information necessary to focus response strategies in anticipation of HAB events.

## Social Impact Assessment

Regulatory consideration of the social impacts of proposed governmental and private actions emerged with the National Environmental Policy Act of 1969 (NEPA). NEPA requires that federal agencies apply the social sciences to evaluate and consider the direct

Social impact assessments are needed to provide regulating agencies, tribal and non-tribal coastal communities, and other partners with information to focus response strategies in anticipation of HAB events.

and indirect social impacts of alternative courses of action. Specifically, NEPA requires federal agencies to:

- (A) utilize a systematic, interdisciplinary approach which will insure the integrated use of the natural and social sciences and the environmental design arts in planning and in decision making which may have an impact on man’s environment; and
- (B) identify and develop methods and procedures ... which will insure that presently unquantified environmental amenities and values may be given appropriate consideration in decision making along with economic and technical consideration (PL 91-190).

The Council of Environmental Quality promulgated Regulations for Implementing the Procedural Provisions of NEPA that define the “human environment” to include “the natural and physical environment and the relationship of people with that environment.” These regulations require federal agencies to assess “aesthetic, historic, cultural, economic, social, or health” effects “whether direct, indirect, or cumulative” (40 CFR 1508.14).

Following these regulations, the Interorganizational Committee on Principles and Guidelines for Social Impact Assessment (ICPGSIA) (2003) defines “social impacts” as “the consequences to human populations of any public or private actions that alter the ways in which people live, work, play, relate to one another, organize to meet their needs and generally cope as members of society. The term also includes cultural impacts involving changes to the norms, values, and beliefs that guide and rationalize their cognition of themselves and their society.” The Committee notes that SIAs are to be conducted and alternatives considered during the decision making process and not after the fact to allow for changes in a project or policy:

“Properly done, SIAs help the affected community or communities and the agency to plan for social change resulting from a proposed action or bring forward information leading to reasons not to carry out the proposal” (ICPGSIA 2003).

Today, SIAs are routinely conducted during the proposal phase of private projects and the development of governmental policies, plans, and programs. SIAs prepared since the original NEPA legislation have addressed diverse issues ranging from highways to hous-

ing, including fisheries and oil and gas development. The basic variables integral to SIAs include, but are not limited to, changes in population, community, and family; community and institutional infrastructures; and political, social, and community resources (ICPG-SIA 2003).

## Social Impact Assessment and HABs

Following NEPA, the overarching goal of social impact research related to HABs is to inform coordinated mitigation planning and event response (including education, monitoring, early warning systems, closures, aquaculture techniques for minimizing loss to crops, and other mechanisms) to prevent and respond to human impacts by providing decision makers with information about the ways in which alternative strategies will affect geographic and user communities. To achieve this goal, as discussed below, research is needed to (1) develop baseline and event-specific information on communities that may be directly or indirectly affected by toxins, marine animal mortalities, and/or governmental intervention; (2) develop Rapid Assessment techniques for immediate deployment in HAB events; and (3) collect baseline information on institutional arrangements and regulating communities within which governmental decisions are made.

### Definition of Social Impacts

“Consequences for the ways in which people live, work, play, relate to one another, organize to meet their needs and generally cope as members of society. The term also includes cultural impacts involving changes to the norms, values, and beliefs that guide and rationalize their cognition of themselves and their society” (ICPGSIA 2003).

#### Research Objectives 1

#### Rapid Impact Assessment

1. *Develop data-based knowledge of the complex communities commonly located in coastal or near-coastal areas.*

- a. Develop Rapid Assessment methods suitable for profiling communities prior to, during, and after a HAB event or series of HAB events.
- b. Develop individual community profiles that can be used as a baseline by federal, regional, state, and local (tribal and non-tribal) decision makers to craft NEPA-type management alternatives, including a “no action” option.

Identification of the community as a unit of analysis presents a methodological challenge, particularly in the increasingly developed or urbanized coastal areas of the US. For example, Miami-Dade County in Southeast Florida is comprised of 31 municipalities and a myriad of smaller collections of human groups that may be divided by ethnicity, more than 50 languages, socioeconomic factors, and/or occupation. In addition, consideration of impacts to temporary residents, tourists, and seasonal occupants requires non-traditional definitions of community.

The complexity and richness of these human connections can be best understood through the perspectives and methods of anthropology, sociology, psychology, economics, and other social sciences. Rapid Assessment methods may be crafted for use specifically for HAB events (or other coastal hazards). Baseline profiles that consider and map the interactions and expectations of permanent and short-term residents, among other social dimensions, can be developed and maintained as a database by which changes resulting from HAB events and their management can be predicted and assessed.

#### Example Project 1

#### Predicting HAB-Related Social Impacts in Coastal Communities: Developing and Testing Rapid Assessment Methods

**Description:** The objective of this project is to develop and ground truth HAB-specific Rapid Assessment methods in three communities, making resulting data available for use by federal, regional, state, and local (tribal and non-tribal) leaders responsible for decision making in anticipation of or response to HAB-related events. This pilot project is intended to develop and test Rapid Assessment methods for collecting baseline

and event-specific data on social changes that occur in response to a HAB event or series of events in coastal and/or near-coastal communities. The project could focus on three coastal communities, enabling comparison of impacts.

Phase 1 would develop a set of Rapid Assessment methods, establish HAB-focused research questions, and develop preliminary baseline information on social characteristics. Methods would draw from existing Rapid Assessment approaches to create a research design appropriate for HAB events and utilize coastal resource management community studies to develop baseline information. Phase 2 would pilot test the Rapid Assessment methods to create profiles of three communities. Phase 3 research would conduct SIA in response to an actual HAB event. Researchers would enter the field at the onset of the HAB event and return six months after the HAB event. The project would provide: (1) a field-tested Rapid Assessment methodology and (2) baseline and HAB-specific data for three communities. The data will inform allocation of resources and development of strategies to protect public health, economic interests, and communities.

**Methods:** Qualitative and quantitative methods including but not limited to:

- Literature Review
- Document Analysis
- Ethnographic Fieldwork
- Observation (participant and non-participant)
- Focus Group Interviews
- Key Informant Interviews
- Surveys

**Outcomes:**

- Field-tested set of Rapid Assessment methods for application in HAB events.
- Emergent library of cases that can be used to create data-based options for governmental and community decisions in anticipation of or response to HAB events.
- Assessment of the sociocultural impacts of HAB events in three communities.

**Challenges:**

- Establishing trust between researchers and communities.

**Expertise Needed:**

- Anthropologists
- Ethnographers
- Sociologists
- Psychologists
- Economists
- Translators/Interpreters

**Timeline:** 12-18 months.

**Estimated Cost:** Project costs are necessary to cover the following expenses:

- Staff
  - Principal Investigator 1 part-time
  - Community Researchers 3 part-time
  - Graduate Student Support 2 part-time
- Equipment
  - 3 Tablet /Laptop Computers
- Expenses
  - Travel and Per Diem

Research Objectives 2

**Integrating Human Dimensions Data into HAB Research and Response**

1. *Conduct an analysis of the federal, regional, state, local, and tribal governmental and non-governmental organizations responsible for closures, warnings, and other actions undertaken to minimize risks and respond to impacts associated with HABs.*
  - a. Develop a context map or other tool for understanding and representing points of articulation in decision making processes.
  - b. Identify challenges and strategies for integrating human dimensions data (such as the economic, sociocultural, and public health data needs identified in Section 1.1) into HAB research programs and decision processes. Lack of public trust in resource management agencies and inexperience of HAB researchers with social data are two possible challenges.

## Example Project 2

**Integrating Human Dimensions Data into HAB Research and Response**

**Description:** This project will inventory decision making organizations and points of articulation in federal, state, local, and tribal decision making communities with resulting data available for use prior to and during HAB events. Based on this inventory, the goal is to identify opportunities to facilitate integration of human dimensions data into HAB decision making processes. A multi-agency program for human dimensions research modeled after the Ecology and Oceanography of Harmful Algal Blooms (ECOHAB) program could facilitate data collection, sharing, and use (see Recommendation 1.2)

The project would be conducted in two phases. Phase 1 would inventory policy, management, research, public, tribal and other partners integral to decision processes for HAB response. Phase 2 would develop and maintain knowledge of the network of organizations and individuals integral to detection, analysis, prediction, and management of HAB outbreaks and their impacts. These data could be used as a baseline to monitor the regulatory process and to identify points of entry for inclusion of critical human dimensions data such as the economic, sociocultural and public health parameters identified in Section 1.1. Additionally, the data may suggest opportunities for, and benefits or challenges of, specialized training for natural scientists in social science approaches or opportunities for interdisciplinary connection for natural and social scientists.

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### 1.3 Assessing Economic Impacts

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**Research Need:** Assess the economic impacts of HAB events at local and regional scales.

**Lead Authors:** Porter Hoagland (Email: phoagland@whoi.edu)

**Contributor:** Guillermo Herrera

**HARNNESS Recommendation:** “Compile data and calculate the socioeconomic impacts of HAB events at local and regional scales” (HARNNESS, 55).

A first step toward improved understanding and managing HABs is an assessment of their economic, sociocultural, and public health effects. There are well-established methods for estimating the economic damages associated with natural hazards such as HABs. Such methods quantify changes in economic welfare that are reflected in both established markets, where goods and services are traded at a price, and activities and resource uses, such as swimming, that are not directly traded in markets.

Market-based welfare measures quantify the net benefits to parties on both sides of market transactions, i.e., the benefits that consumers enjoy in excess of what they pay for goods and services (called “consumer surplus”) in addition to the revenues that producers earn in excess of their production costs (called “producer surplus”). For example, closure of a commercial shellfishery due to a HAB event could reduce the surplus earned by commercial fishermen. However, affected

fishermen may compensate for lost revenue by transferring their fishing effort to areas that remain open or switching to non-fishing activities to earn income. An accurate estimation of the economic impacts of the HAB event would account for the income earned through such compensation measures, capturing the net loss (or possibly gain) of revenue to commercial fishermen.

Economists rely upon consumer expenditures as data to help estimate the value of non-market goods and services, such as the cultural value of recreational shellfishing or experience of beach visitation. For example, the “travel cost” method of non-market valuation expresses the economic value of an environmental area (such as a beach popular for swimming) in terms of the amount of money that individuals are willing to spend to visit it (see Lipton et al. 1995).

While economists prefer to focus on net benefits, changes in total sales (i.e., revenues) are simpler to