

**EPA Grant Number:** R83-1707

**Title:** Economic Effects of HABs on Coastal Communities and Shellfish Culture in Florida

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**EPA Project Officer:** Gina Perovich

**Project Period:** September 1, 2004 - August 31, 2006

**Research Category:** Ecology And Oceanography Of Harmful Algal Blooms

**Description:**

**Objectives:**

- (1) To estimate the change in gross revenues to various business sectors of coastal communities affected by HAB (e.g., red tide) events (e.g., test whether changes in restaurant sales are statistically different during periods of red tide and whether the changes are community specific or vary over time);
- (2) To calculate the costs incurred by coastal communities to address the effects of HAB events including planning efforts, contingency plans, beach patrols and cleanup, etc. (which will allow for a test of a minimum community expenditure level); and
- (3) To quantify the effects of HABs and HAB-related harvest regulations on commercial molluscan shellfish operations (which will allow for an evaluation of proposals to alter water quality standards for shellfish harvesting areas).

Empirical application will be restricted to Florida for manageability and reduced costs.

**Experimental Approach:** Study will use a combination of primary and secondary data, analyzed with econometric techniques and statistical measures. Objective 1 will involve the identification of business sectors impacted by HAB events, such as beachfront lodging and restaurants. A time series of taxable sales will be combined with data on weather (precipitation levels, major storm events, etc.) and HABs (presence and intensity). Municipal and county-level managers and molluscan shellfish (hard clam) culturists will be surveyed following small focus group sessions to identify all HAB-related activities and effects. The managers will be interviewed by telephone to solicit specific information on costs associated with HABs. Culturists will be surveyed by mail to obtain specific information on shellfish losses, harvest closures, cash flow disruptions, etc.). The resulting information will be used to compile a matrix of HAB costs and impacts incurred by coastal communities in Florida.

**Expected Results:** The methodologies developed will have broad applicability for investigating the economic effects of HABs. The findings will allow coastal resource managers, local businesses and HAB researchers to better assess the community and business costs resulting from HAB events. This information will provide for a more accurate evaluation of the costs and benefits associated with HAB mitigation, monitoring, regulation, and clean-up efforts. It will also provide data for subsequent analysis of economic impacts.

**Supplemental Keywords:** *EPA region 4, FL, harmful algal blooms, Karenia brevis, Southeast, FL, survey*

# Economic Consequences and Public Awareness of Red Tide Events In Coastal Florida Communities

## What is a “Red Tide”?

A **red tide** is a naturally occurring algal bloom that occurs around the world. *Karenia brevis* is the **red tide** species indigenous to the Florida coast. Blooms begin offshore in deep waters but the process is not well understood. The bloom moves upward in the water column, then after reaching the surface, moves toward shore in a direction and speed dictated by prevailing winds and currents.



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*K. brevis* produces a toxin that affects the central nervous system of finfish. If the bloom is dense enough, large fish kills occur. Concentrations of dead and dying fish can often be seen at the water surface or on beaches. Denser blooms can discolor the water, hence the name “red tide”.

## How Do Red Tides Affect Humans and Coastal Communities?

The *K. brevis* toxin can become an aerosol as the algal cells are ruptured by wave action, causing nasal irritation, coughing, and a burning sensation to the eyes. Some individuals require medical attention. The odor associated with dead and decaying fish on the water surface and beach adds to the unpleasant experience. As a result, beach-going and other water-related activities (e.g., restaurant patronage, models, boat rentals) may be reduced.

## Project Justification:

The economic consequences of a **red tide** is purported to be significant, yet have never been empirically measured prior to this study. With funding from the Florida Marine Research Institute (FMRI), this study aims to aid in the development of effective red tide education programs that require an understanding of coastal residents’ awareness of **red tide** events.



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## (1) Measuring Economic Consequences:

To find a relationship between the incidence of **red tide** events and (1a) changes in beach attendance and (1b) local business activity, monthly beach attendance data collected by County lifeguard staff, hurricane and precipitation data from the NOAA National Climatic Data Center, **red tide** occurrence data from FMRI and Mote Marine Lab, and business sales data (i.e., gross taxable sales for various business types) from the Florida Department of Revenue was used to estimate the following model for the period 1/95 - 12/00:

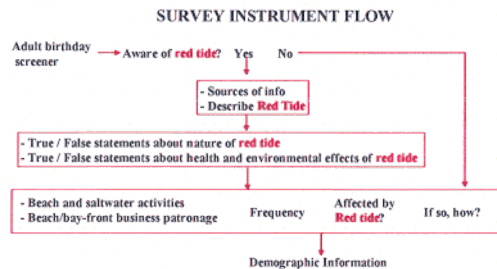
$$Y = B_0 + B_1F + B_2M + B_3A + B_4M + B_5J + B_6J + B_7A + B_8S + B_9O + B_{10}N + B_{11}D + B_{12}HUR + B_{13}PRECIP + B_{14}TIME + B_{15}REDT$$

where:

- Y = beach attendance or \$ sales
- F - D = monthly dummy variables (January, J, base)
- HUR = hurricane / tropical storm (1 if yes; 0 if absent)
- PRECIP = precipitation level (inches)
- TIME = general time trend to capture change in economy
- REDT = red tide (1 if yes; 0 if absent)

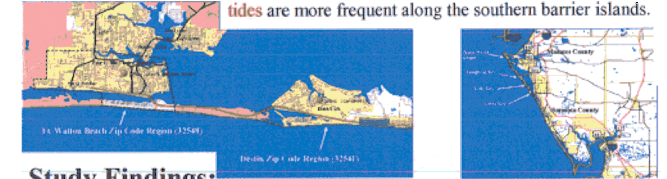
## (2) Measuring Public Awareness:

A telephone survey of 1,000 households in Sarasota and Manatee Counties was conducted to measure the level of awareness and knowledge of **red tide**. Respondents’ knowledge of the biological nature, environmental impact, and human health effects associated with **red tide** was tested. In addition, the manner in which **red tide** affects beach-going, saltwater-related activities, and waterfront business patronage was assessed. The survey progressed as follows:



## Study Regions:

The beach attendance analysis (1a) was conducted for Sarasota and Manatee Counties. The business activity analysis (1b) was conducted for the barrier island region in Sarasota and Manatee Counties (including Anna Maria Island, Longboat Key, Lido Key and Siesta Key) and for the coastal zip code regions in Ft. Walton Beach and Destin. These areas have a recent history of **red tide** events, although **red tides** are more frequent along the southern barrier islands.



## Study Findings:

### Red Tide Affect on Beach Attendance:

- \* Negative and statistically significant decline in average monthly attendance on Sarasota County beaches (13.5% decline → 50,000 per month during a **red tide**)
- \* No relationship found between **red tide** and Manatee County beach attendance

### Red Tide Affect on Business Activity in Sarasota and Manatee Counties Region:

- \* Model explained 91% of variation in monthly gross taxable sales reported to the Florida Department of Revenue
- \* Only a weak negative relationship between **red tide** events and beach & waterfront restaurants, though not statistically significant
- \* No relationship found between **red tide** events and other types of businesses, e.g., hotels, seafood dealers, etc.

### Red Tide Affect on Business Activity in Ft. Walton Beach and Destin Area:

- \* Models explained over 95% of the variation in monthly gross taxable sales reported to the Florida Department of Revenue
- \* Destin waterfront restaurant and hotel/motel sales declined by \$2.2 million and \$2.3 million per month, respectively, during a **red tide** event
- \* No relationship found between **red tide** events and waterfront business activity in Ft. Walton Beach

### Sarasota and Manatee Counties Residents’ Awareness/Knowledge of Red Tide:

- \* 89% of survey respondents were aware of **red tide**
- \* 61% associated fish kills with **red tide**, while only 23% and 40% linked burning eyes and nasal irritation / coughing, respectively, with **red tide**
- \* Three-fourths of the respondents erroneously felt finfish and crustaceans were unsafe to eat during a **red tide**
- \* More than 50% of respondents had altered their outdoor activities due to a **red tide**
- \* Most delayed their activity until later, but about 20% of fishers, beach goers, and boaters went elsewhere... with their expenditures
- \* Only about one-third of waterfront business patrons were affected by **red tide**
- \* 63% of affected restaurant patrons took their business elsewhere during a **red tide**

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