Tourism and Algal Blooms: What the Research Says

In review of the literature, there has not been a lot of definitive studies conducted to evaluate the economic losses attributed to HABs. Much of this is due to the difficulty in designing a study that also incorporates exogenous factors for revenue increases and losses. For example, tourism spending is particularly vulnerable to rainfall (Morgan, Larkin, & Adams, Firm-level economic effects of HABs: A tool for business loss assessment, 2009), general economic conditions, large event/conference pre-bookings, holiday travel (Morgan, Larkin, & Adams, Firm-level economic effects of HABs: A tool for business loss assessment, 2009), and other factors unique to the local destination. Any study needs to incorporate these independent variables in order to rule out other reasonsfor revenue loss or gain. In addition to reviewing economoic impacts related to harmful algal blooms, this review also includes literature analyzing tourism economic impacts losses due to other disasters.

Studies Related to Harmful Algal Blooms

Morgan, K. L., Larkin, S. L., & Adams, C. M. (2009). Firm-level economic effects of HABs: A tool for business loss assessment. *Harmful Algae 8* , 212-218.

Restaurants experienced a 13.7 to 15.3 percent loss in daily sales when red tides were present according to this study in Florida. The relative loss was greater on low volume sales days, such as Mondays and Tuesdays. Restaurants are particularly susceptible to HABs and represent a large portion of sales within the tourism industry. The authors collected proprietary sales data from three beachfront restaurants on the Gulf of Mexico in Florida, all of which were located within 50 feet of the water's edge. Sales data was adjusted for inflation, presence of red tide conditions, storm events, holidays, and rainfall. Rainfall led to a sales reduction of 23 to 27 percent, indicating that rainfall has a larger impact on sales than red tides. Storm events reduced sales 20.8 to 40.1 percent. Holidays increased sales 21.4 to 29.9 percent. On holiday Saturdays, an increase in spending of 55.9 to 62.8 percent was recorded. Regarding red tides, the smallest restaurant was the least effected; the authors attribute this to the property's historic character which attracts visitors and reduces its dependency on the water resources and its low prices that attracts patrons more tolerant of environmental conditions. They also state that the restaurant attracts a greater number of local residents who may be more tolerant as well. The authors recommend issuing beach conditions report from lifeguards who provide twice-daily updates on six characteristics of beach conditions to keep beach-goers locally by directing them to those beaches with the best conditions. They also recommend exploring development of private business disruption insurance (such as flood insurance) for HABs, as well as exploring economic recovery assistance such as loans from the Small Business Administration.

Morgan, K. L., Larkin, S. L., & Adams, C. M. (2010). Empirical analysis of media versus environmental impacts on park attendance. *Tourism Management* , 1-8.

Red tide presence did not affect park attendance; however, the appearance of the search phrase "red tide" in the media was correlated with a 20 percent loss in attendance. Recreationists altered their behavior based on when "red tide" was mentioned in a news story and not based on whether the counts for that day indicated a problem. Authors recommend that tourism practitioners and the media should work together in delivering information to the public. They also recommend better and more frequent monitoring of beaches so that those wanting the beach experience can be directed to unaffected beaches.

Nexus Consulting. (2008). *Economic Impact of the 2008 Blue Green Algal Bloom on the Gippsland Lakes Tourism Industry.* Bairnsdale, Victoria, Australia: Nexus Consulting.

This study focused on the 2008 outbreak of blue green algae in Gippsland Lake in Australia. The economic impacts of the bloom were $18.2 million in direct losses and $26.6 million in direct/indirect impacts. A $256 million revenue and 6,000 job loss was projected on a 20-year horizon. Although the methodology of this report was almost entirely self reporting and is questionable due to a small sample size, the document provides some insights that could prove useful. Self-reported losses due to HABs by sector included marine services (30 percent loss), boat charters/ cruising (20 percent loss), accommodations of 3 to 3.5 stars (20 percent loss), restaurants (15 percent loss), and accommodations of 4 to 4.5 stars (10 percent loss). Losses were felt through customers leaving early, cancellations, decreased sales, and negative publicity that chased away potential customers. Sixty-five percent of businesses surveyed did nothing to mitigate the impacts of the bloom. Ways to mitigate that they are considering now include changing their market focus, reducing costs, educating the media and the industry, improving communications between industry members using a website and blog, developing a strategy to counter the negative exposure, increasing advertising efforts, promoting non water-based activities, and contacting customers. The authors warn of the echo effect (referred to later in this literature review as a "halo effect"), or a loss of visitors in future seasons because of the negative publicity surround the bloom. Another interesting comment expressed by one respondent was that he/she did not feel the HABs survey related to them because the algae bloom wasn't toxic – the labeling of all blooms as toxic created a disconnect re the impact of non-toxic blooms, whose economic impacts are just as serious.

Larkin, S. L., & Adams, C. M. (2007). Harmful Algal Blooms and Coastal Business: Economic Consequences in Florida . *Society and Natural Resources, 20*, 849-859.

Restaurant and lodging economic losses of 32.3-percent ($6.5 million) per month were reported during the 1995-1999 HABs in Ft. Walton Beach and Destin areas of Florida. The 5-year time series studied used tax revenues and gross revenue as reported to the Florida Department of Revenue. Gross revenue data was corrected for general inflation using the CPI. It was also indexed to rainfall. The precipitation coefficient indicated that every one inch of rain reduced restaurant revenues by an additional $41,000 per month, but did not impact lodging revenues. In essence, average rainfall of 5.8 inches in a month reduced

revenues 2.5 percent for restaurant sector. So although the lodging sector is not as impacted by rainfall, it is more susceptible to HABs.

Hoagland, P., & Scatasta, S. (2006). The Economic Effects of Harmful Algal Blooms. *Ecological Studies, 189*, 391-402.

The authors present a discussion on the economic effects of HABs by reviewing studies in the U.S. and the European Union. They identify that the effects of HABs that are noxious and nontoxic have an impact on the tourism industry. They tackle the issue from an economist's view, focusing their discussion on changes in the patterns of human activities and resource uses that result from HABs. Economic effects can be used to justify mitigation costs, as they should be scaled appropriately to the loss, but they caution against using economic impacts alone to measure these losses. They differentiate between economic effect (measurement of value and consumer/producer surpluses) and economic impact (measurement of losses only without consideration of changes in consumer/producer surpluses or the shifts in market behavior caused by these surplus changes.) They state that the most efficient action to respond to a HAB requires estimates of the damages as well as the costs associated with mitigation. As the marginal cost of treating or mitigating a HABs event increases, the damages associated with a bloom decreases. This means that the optimal amount to invest through a policy response is where the sum of damages and response costs is the most minimal. They also present the case for a "halo effect," whereby HABs impacts economic activity and seafood consumption long after an active bloom exists or in areas/goods where the blooms aren't present. An interesting study they discuss is one that shows the economic losses attributed to public announcements for safety reasons on seafood consumption. Less harmful to the economy are seafood inspection programs. They categorize economic losses into four areas – 1. Public health (lost productivity caused from sick days, medical treatments, transportation, causal investigations), 2. Commercial fisheries (closures of operations, mortalities in aquaculture operations, prohibitions on sale of recreational fish, untapped fishery resources, and halo effects created by government policies and public announcements), 3. Recreation and tourism (not exact measures, but coastal visitor surveys regarding presumed behavior; not conclusive studies), and 4. Monitoring and management costs (also not conclusive due to problems with methodology).

Priskin, J. (2008). Implications of Eutrophiciation for Lake Tourism in Quebec. *Teoros, 27-2* .

The author explored literature related to how tourism and recreation are part of the eutrophication problem in Quebec as well as some solutions. Algal outbreaks in 2007 led to beach closures. The authors could not define conclusively that tourism contributes to the algal situation, except for fertilizer use at golf courses. In trying to determine economic impact of HABs, the authors state that it will depend on the relative size of expenditures for tourism activities dependent on water activities. They also state that a more diversified tourism economy will have less revenue loss. To mitigate, the authors emphasize preventive measures, and they state that the tourism industry must adopt a sense of ownership over the natural resources it is dependent upon. They recommend water consumption education, as well as education regarding the use of less toxic substances by the tourism industry. However, they refer to a study conducted in Hungary that found that while only 43 percent of residents consider water quality important to recreation, only 13 percent considered water quality important to the economic well-being of a community.

Oh, C.-O., & Ditton, R. B. (2006). A time series approach to estimating the economic impacts of exogenous events on a local economy. ***Northwestern Recreation Research Symposium*** **(pp. 240-247). Newton Square, PA: Department of Agriculture, Forest Service, Northern Research Symposium.**

Researchers assessed the impact of 2001 golden algal blooms (Prymnesium parvum) on Possum Kingdom Lake in Texas. The researchers were primarily interested on the blooms' negative impact on spending related to recreational sport-fishing and made the assumption that impacts are entirely dependent on the fishery health. They used a univariate time series intervention analysis using county-level gross sales and state tax on total expenditures based on five tourism-related SIC code categories. Data was collected from 1986 to the second quarter of 2004. Original SIC codes were adjusted to the IMPLAN codes for analysis and to 2001CPI. The authors also used visitation data from a nearby state park. The 9-11 terrorist attacks were also incorporated into the study. Total economic impact was an estimated 5 percent loss related to the algal blooms, while visitation loss was estimated at 57 percent.

Measuring Impact of other Disasters on the Tourism Industry

Chandler, J. A. (2004). An analysis of the economic impact of hurricane's Dennis, Floyd, and Irene on North Carolina's lodging industry. ***Journal of Hospitality & Tourism Research, Vol. 28 (3)*****, 313-326.**

Following a 1999 series of hurricanes and flooding, a study on the economic impact to the North Carolina lodging industry revealed between a $96 and $125 million loss for September and October 1999. The authors recommend an extensive time-series in order to calculate economic loss for the tourism sector. Their methodology consisted of working with the state hotel and lodging association and developing a survey to determine guestroom nights available, occupancy, and average daily rates for August, September, and October of 1998 and 1999. Survey questions also focused on guestrooms out of order due to the disasters, guestrooms occupied by displaced residents and/or relief workers, adjusted average daily rates for affected groups, and the amount of physical damage. Working with the state association, a sample was based on proportionate distribution of properties and guestrooms by county geographically. The sample was further stratified according to the rate-point categories of Smith Travel Research, number of guestrooms, and whether the property is part of a chain or independent. Surveys were mailed to 453 hotels and motels with a response rate of 14.1 percent. Impact was reported statewide, and not just in coastal counties. This study only reported losses attributed to lodging, and it did not account for expenditures lost in restaurants, gift shops, etc. owned by lodging properties. The authors state that the lodging industry was in the midst of growth, so ADR could also be affected by increased supply. They recommend a 10-year series analysis at minimum.

Au, A. K., Ramasamy, B., & Yeung, M. C. (2005). The effects of SARS on the Hong Kong tourism industry: an empirical evaluation. ***Asia Pacific Journal of Tourism Research, Vol 10 (1)*****, 85-95.**

This paper analyzes the temporary and/or permanent impacts of SARS on Hong Kong arrivals from 36 key origin markets. Researchers used an econometric strategy. External shocks (such as SARs) were

evaluated by measuring whether or not a series is stationary (if statistical property is constant along time and therefore temporary) or nonstationary (if it has no long-run statistical property over time). They identified unit roots in order to determine permanence. Twenty-four origin countries were vulnerable to any form of external shocks and adjusted their travel plans. These countries make up in excess of 60 percent of Hong Kong's tourism market. The authors recommend damage control by investing in promoting and incentivizing more to these markets based on their unique characteristics.

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