CHANS: MODELING THE DYNAMICS OF HABs, HUMAN COMMUNITIES, AND POLICY CHOICES ALONG THE FLORIDA GULF COAST*

Porter Hoagland et al.

Marine Policy Center
Woods Hole Oceanographic Institution

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et al.:

- Amo Amaya
- Lorrie Backer
- Andy Beet
- Robert Botta
- Margaret Byrne
- Amy Clement
- Roberto Diaz
- Jeremy Faris
- Lora Fleming
- Bruce Garrison
- Nicholas Hahlbeck
- Daniel Herrera
- Gary Hitchcock
- Porter Hoagland
- Derrick Hudson
- Di Jin
- Andrew Kenney
- Barb Kirkpatrick
- Gary Kirkpatrick
- Katie Kubicki
- Becky Lazensky
- Cathy Li
- Stephanie Lavey
- Vince Lovko
- Diana Moanga
- Tamecia Moore
- Laura Morse
- Andy Reich
- Katrin Rudge
- Karen Scheller
- Zoe Shoesmith
- Jamie Studts
- Sarah Spiegler
- Rick Stumpf
- Steve Ullmann
- Sharon Watkins
FIELDS

- Public health
- Marine policy
- Oceanography
- Engineering
- Ecology
- Statistics
- Economics
- Medicine
- Remote sensing
- Education
- Communications
SUMMARY

• Florida red tide as a “natural hazard” can be conceptualized as a coupled human and nature system (“CHANS” or “CNH”)

• Dynamics of Florida red tides are a continuing focus of scientific research

• Dynamics of human populations are well understood, but “legends” about human behavior in the face of Florida red tides persist

• Estimates of the public health impacts of Florida red tides (in terms of both illnesses and economic costs) have been developed and refined

• The public remains largely unaware and somewhat unresponsive to the hazard

• It is important to select and scale policies that recognize the nature of the relevant hazard

• Given ongoing uncertainties about the physical properties of Florida red tide blooms, policies that educate the public and increase the flexibility of the public to respond to red tide are likely optimal
Red tide in golf cancels Sarasota tournament.
Officials are hopeful that the red tide will be blown offshore.

SARASOTA, FL. (WFLA) - Red tide in the gulf has now forced the cancellation of a Sarasota fishing tournament. The Snook Shindig Fishing Tournament was supposed to start this weekend. Instead, the participants are out of luck, and scientists are hoping the red tide doesn't get worse.
Florida Red Tide Dynamics

- Concentration ("bloom")
- Location (velocity)
- Scale
- Duration
- Toxicity

- Vargo (2009)
- ~ 24 thoughts and hypotheses have been put forward to account for blooms of $Kb$ along the west coast of Florida
- $Kb$ blooms must be related to a combination of local environmental factors and its physiological ecology
- Background nutrient levels on the West Florida Shelf are insufficient to maintain a high biomass
- $Kb$ is capable of using a wide range of available nutrients:
  - Riverine, estuarine fluxes of N, P
  - Submerged groundwater discharges
  - Atmospheric N
  - Benthic fluxes
  - Zooplankton excretion
  - Dead fish
Sarasota Tourism: 1987-2012

- Concentration
- Location
- Trends
- Demographics
Natural Hazard

Policy Responses

Natural Hazard
UPDATE FROM 7TH SYMPOSIUM:

- Expanded estimates of public health impacts
- SHA closures may be ineffective for recreational shellfishing
- Public’s understanding of the effects of red tide has stagnated or declined
- Media tends to treat red tide as an environmental but not a health risk
- Public is largely unaware and therefore possibly unlikely to adhere to policies instituted to mitigate red tide
## IN PROGRESS (AT THIS MEETING)

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RED TIDE BLOOM

Prevent/Control Blooms
- Fertilizer ordinances
- Other non-point controls
- Wastewater treatments
- Runoff holding ponds
- Septic upgrades
- Other preventive actions:
  - Chemical/biological/physical controls

Mitigate Illnesses
- Self-medication
- Physician visits
- Emergency Department visits
- Hospital Stays

Understanding and Notification
- Monitoring
- Forecasting
- Alerts
- Publications (media, scientific)
- Scientific research
- Education
- Other control actions

Reduce Population at Risk
- Visit substitute beaches, restaurants
- Remain indoors
- Travel away from the coast
- Reductions in regional tourist visits

EXPOSURES

M³
Can we shorten the lag between the hazard and responses to mitigate harm?

Is there a policy or a set of policies that is more effective than others in that respect?
Vargo (2009): hypotheses posed for *Kb* bloom initiation, growth, maintenance, and termination

Many potential sources of nutrients cannot be controlled (e.g., Trichodesmium N-fixation, zooplankton grazing and excretion, decomposing fish)

Humans (possibly) could control the magnitude of “cultural eutrophication” by limiting land and fertilizer uses and the release of atmospheric N

Increased nutrient fluxes to the coastal zone fuel phytoplankton blooms, including HABs or hypoxia, so reductions in anthropogenic nutrient fluxes are sensible

HABs should not be used as the sole reason to reduce coastal eutrophication since not all HABs are directly related to estuarine or coastal eutrophication
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Reduce Population at Risk

Exposures
From September 2006 to July 2014, the odds that all beaches in Sarasota County experience high respiratory irritation simultaneously:

Morning: ~150:1

Evening: ~100:1
This service provides beach conditions reports from select beaches in the Southwest coast of Florida and the Florida Panhandle. The reports are subjective (no measurements taken, just an estimate) and designed to indicate to the beachgoer which beach may be more preferable to visit at a particular time. Most reports will be posted at 10 am and 3 pm local time. If a posting is late, please understand that the beach reporters may be involved in more pressing matters.
RELEVANT QUESTIONS FOR THE FUTURE

• What are the set of feasible policies?
• What are their levels of effectiveness in reducing the hazard?
• What are their costs?
• Are there complementarities across policies?
• Can we improve on the existing set of policies?
  • Especially as we learn more about:
    • how blooms occur
    • how humans behave