Ripples of Red Tide: Quantifying Recreational Losses from Harmful Algal Blooms in Florida

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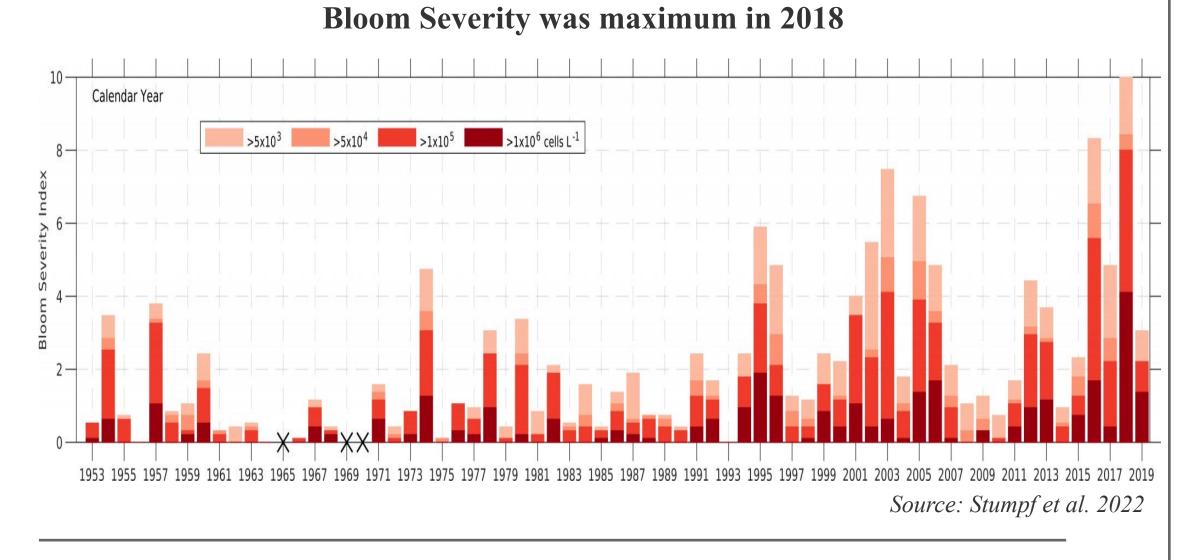Food and Resource Economics Department, University of Florida

Background

Harmful Algal Blooms have become a frequent phenomenon in Florida, causing serious damage to marine biodiversity, posing risks to human health, and negatively impacting the coastal economy (Hallegraeff 2003).

Specifically, the recurrent blooms of the red-pigmented *Karenia brevis* algae, popularly known as 'the red tide', wreaks havoc on hundreds of miles of Florida's coastline (Larkin et al. 2007) and adversely affects Florida's $100+ billion tourism economy (Court et al. 2008).

2018 Red Tide Event

Southwest Coast *Karenia brevis* concentrations
07/31/2018 - 08/07/2018

NOTE: Sampling efforts for other areas are not depicted on this map.

Karenia brevis (cells/liter)
- not present/background (0-1,000)
- very low (>1,000-10,000)
- low (>10,000-100,000)
- medium (>100,000-1,000,000)
- high (>1,000,000)

Source: National Centres for Coastal Ocean Sciences

Bloom Severity was maximum in 2018

Source: Stumpf et al. 2022

Motivation

Limited research have studied the impact of red tide events on beach visitation and tourism.

As the frequency and intensity of red tide events rise, it is critical to evaluate the recreational losses they cause along Florida's Gulf Coast, an area that supports unique ecological diversity and a billion-dollar tourism industry.

Objective

This study estimates the impacts of 2017-2018 red tide event on beach visitation in Florida, focusing on changes in visitation and the associated recreation losses.

Methods

Map of Study Region in Florida's West Coast

Emerald Coast
Forgotten Coast
Nature Coast
Sun Coast
Paradise Coast
• Major City

- Online Qualtrics survey conducted between Nov 22 – Aug 23
- Targeted adults who visited Florida's Gulf Coast for saltwater recreation from 2017 to 2022 or cancelled planned trips
- Survey elicited information on:
  - Visitation history (i.e., number of trips, sites visited, travel destination, number of trip days, saltwater activities, expenditures, etc.)
  - Trip cancellations due to red tide
  - Awareness of and behavioural changes due to red tide
  - Saltwater-based recreational activities
  - Alternative trip location
  - Respondent socio-demographic characteristics

- 2358 adults were surveyed, including 1291 Florida residents and 1067 out-of-state visitors from 14 states that contribute the most tourists to Florida
- Average number of trips to the study region by a Florida resident is 5.5 and 1.66 by an out-of-state visitor in a year
- 312 respondents (13%) cancelled their trips due to red tide

Empirical Model and Results

The study uses a single-site Travel Cost Model to estimate the changes in recreation demand due to red tide.

The model uses data from actual trips taken and the cancelled trips to the study region due to the red tide event to construct a panel with a counterfactual time period without the red tide and an actual time period with the red tide.

The difference in consumer surplus estimated for the two time periods gives the loss in consumer surplus due to red tide.

The empirical travel cost model is based on a log-linear specification of Random Effects Negative-Binomial regression model.

$$Log(TRIPS_{ij}) = \beta_0 + \beta_1 TC_{ij} + \beta_3 Night_{ij} + \beta_2 X_{ij} + \beta_3 RedTide_j + \varepsilon$$

where j=1 denotes actual scenario with Red Tide and j=0 denotes counterfactual scenario without Red Tide

β_k: vector of parameters to be estimated

$TRIP_{ij}$: number of trips made by individual i

$Night_{ij}$: 1 if Nights > Trips, 0 otherwise

TC_i: travel cost incurred by individual i per trip

X_i: vector of demographic variables associated with individual i

$RedTide_j$: dummy variable representing actual trip scenario (RedTide=1) and counterfactual time period without Red Tide (RedTide =0)

Recreation Demand Model Results

	Coefficient
Travel Cost	-0.002***
	(0.0003)
Red Tide	-0.08***
	(0.01)
Nights	-0.79***
	(0.07)
Travel Cost X Nights	0.001**
	(0.0003)
Income	0.003***
	(0.0005)
Age	-0.003*
	(0.001)
White	0.31***
	(0.065)
Female	-0.26***
	(0.04)
Bachelor	-0.18***
	(0.04)
Visitor	0.13
	(0.12)
(Intercept)	1.52***
	(0.095)
N	1240

Conclusion

Preliminary results show that red tide has a significant negative impact on the trip demand. Households (HH) are estimated to take 8% fewer trips when red tide is present.

The effect of red tide on consumer surplus is -$317/HH for out-of-state visitor and -$75/HH for Florida resident.

Estimates of Consumer Surplus (CS per HH)

Without Red Tide
With Red Tide

Next Steps

The analysis of these data will be expanded to include respondents who have engaged in multi-site trips using Random Utility Models and will integrate variables that capture respondents' perceptions of red tide events and characteristics of the sites visited.

Acknowledgment

References

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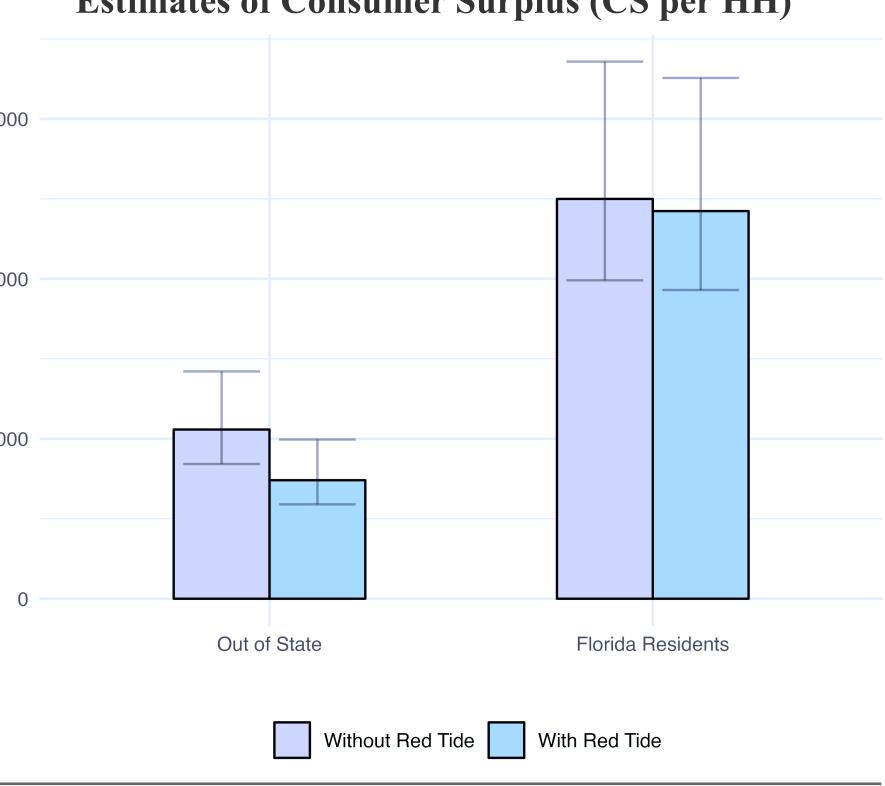
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