

Twitter Analytics for Florida Red Tide Impact Assessment.

Andrey Skripnikov¹, PhD

Nathaniel Wagner¹,

Jennifer Shafer², PhD

¹New College of Florida

²Science and Environment Council of
Southwest Florida

2018 Florida Red Tide

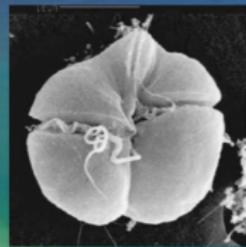
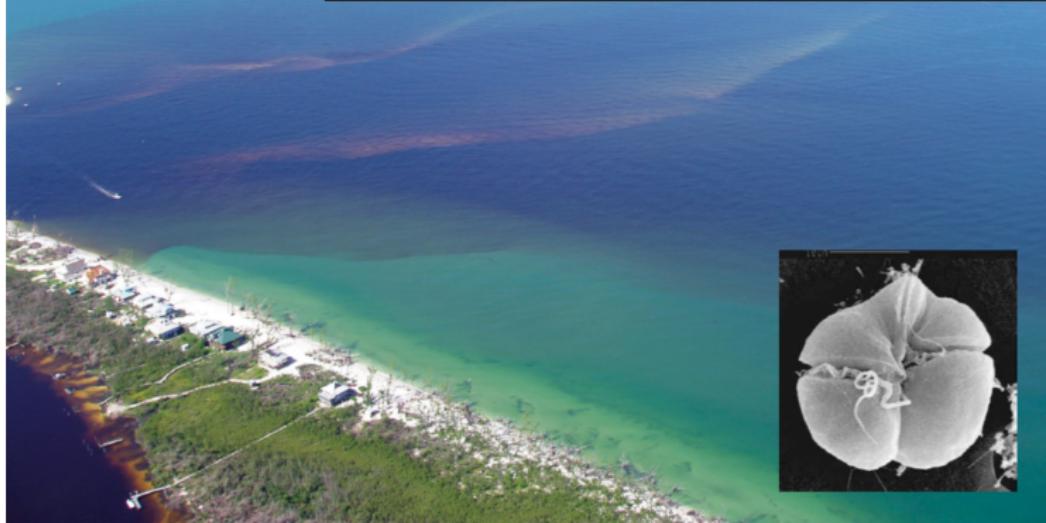


Photo Credit: South Florida Water Management District

Red tide results from an algal bloom of the dinoflagellate *Karenia brevis*. It is toxic to fish, wildlife and humans.

A photograph showing a massive pile of dead fish, likely sardines, floating in a canal or waterway. The fish are piled high, covering most of the visible water surface. In the background, there are wooden docks and some palm trees under a clear blue sky.

“It’s a wildlife massacre of massive proportions”
-- National Geographic

Associated

Photo Credit: Dale White

While not the longest duration red tide event on record, the severity and extent of Florida 2018 red tide brought national attention to the impacted Florida Gulf Coast communities.

the first major red tide since ubiquitous
social media



Casey Key, Florida, before (June 2018) and during (August 2018) red tide. Credit: Cody Johnson, Source: NOAA NCCOS

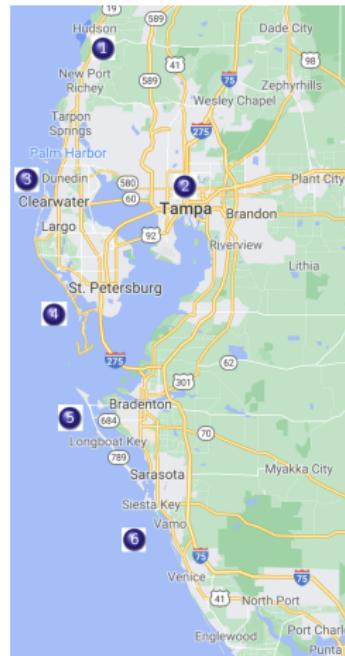
Residents and visitors turned to social media platforms like Twitter, Facebook, Instagram to both

- receive information, and
 - communicate their own sentiments and experiences.

Local Twitter dynamics were used to retrospectively measure the 2018 Florida red tide event impacts, for the purposes of potentially quicker assessment and better response to future events.

Focused on 6 Metro Areas surrounding **Tampa Bay** on FL Gulf Coast:

- ① Pasco county
- ② Tampa/Hillsborough county
- ③ Clearwater metro
- ④ St Petersburg metro
- ⑤ Manatee county
- ⑥ Sarasota county



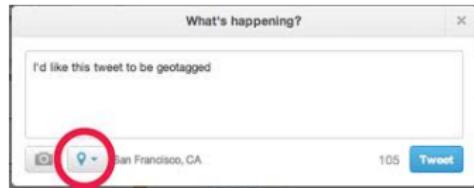
Twitter Data Mining.

To make sure tweets came from 6 metro areas surrounding Tampa Bay, we used

- ① Tweets explicitly geo-tagged in the area:

Kim Kuizon FOX 13 
@kkuizon

Cortez service industry bands together to keep
struggling workers afloat @FOX13News #Manatee
#Cortez #RedTide fox13news.com/news/local-new...
7:42 AM · Sep 19, 2018 · From Gulf Gate Estates, FL · Twitter for iPhone



Found a total of $\approx 1,200$ such explicitly geo-tagged tweets with explicit mention of "red tide".

Twitter Data Mining.

To make sure tweets came from **6 metro areas surrounding Tampa Bay**, we used

- ② Tweets from users whose **geoprofile location** was in the area:



Zack Sampson
@ZackSampson

More Red Tide fallout: 554 manatees have died in 2018, with four months left to go. Last year's total was 538. [@craigtimes tampabay.com/news/environment...](#)

9:18 AM · Aug 21, 2018 · TweetDeck

Zack Sampson
@ZackSampson

Environment reporter @TB_Times. Fluent in English & Rhode Island, getting there on Florida. zsampon@tampabay.com. On Signal: 813-534-0157. he/him.

© St. Petersburg, Fla. [tampabay.com/author/zachary...](#)
 Joined November 2010

758 Following 2,946 Followers

Found a total of $\approx 16,000$ geoprofile-matched tweets that had an explicit mention of "red tide".

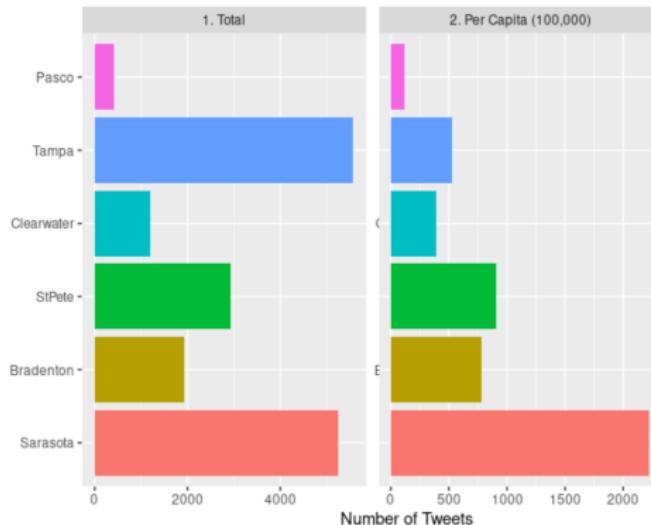
Overall, there were **17,306 relevant unique geo-matched tweets**, including

- original posts,
- replies and
- retweets.

Tweet Counts by Metro Area: Totals vs Per-Capita.

Place & Geoprofile Matched Tweets

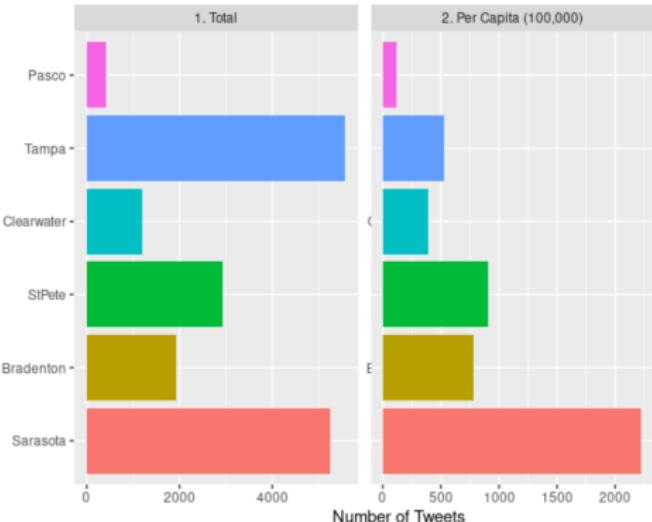
Tweets: Total 17306



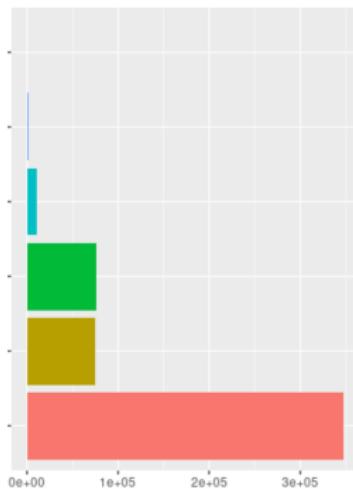
Tweet Counts by Metro Area: Totals vs Per-Capita.

Place & Geoprofile Matched Tweets

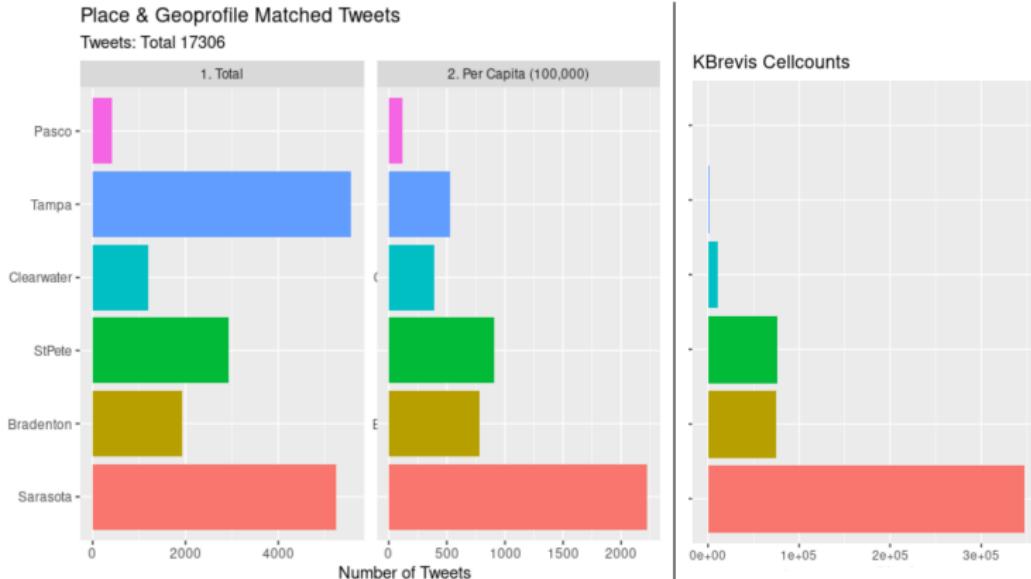
Tweets: Total 17306



KBrevis Cellcounts

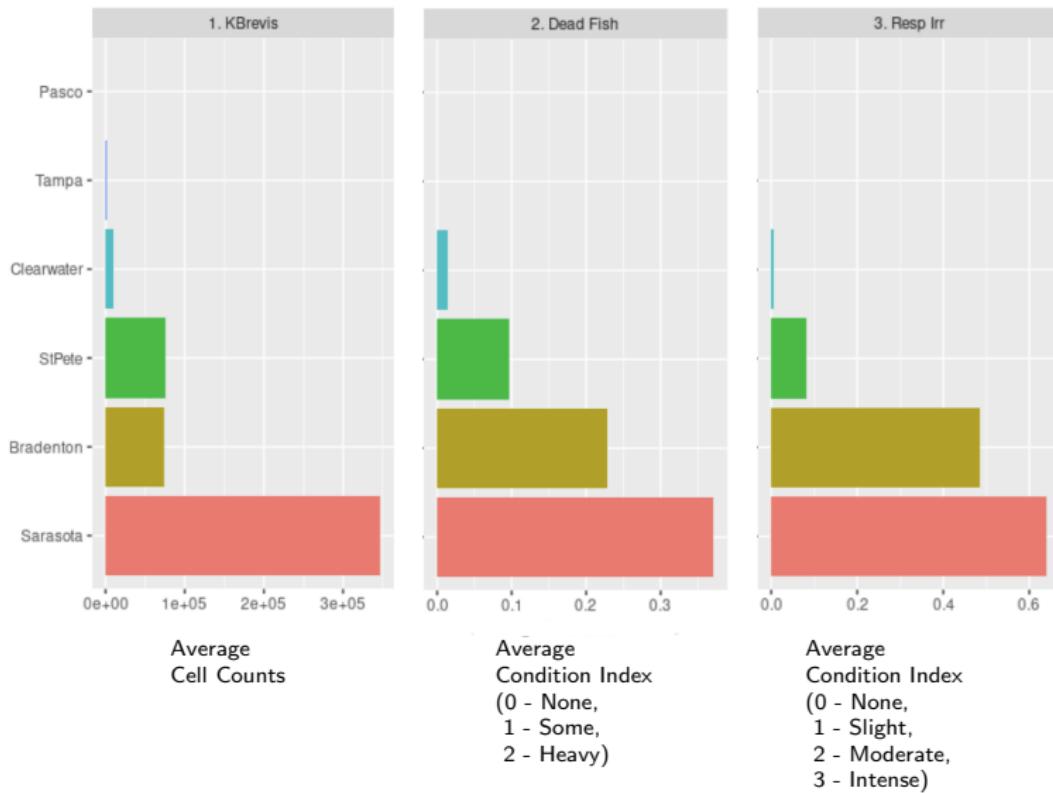


Tweet Counts by Metro Area: Totals vs Per-Capita.



- Tampa's twitter activity is in large part due to **much larger # of users**.
- This effect is **alleviated** when doing **per-capita** tweet counts.

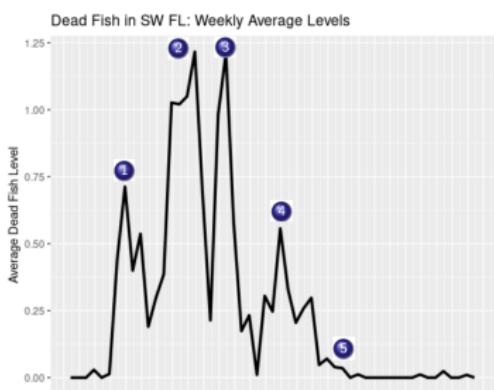
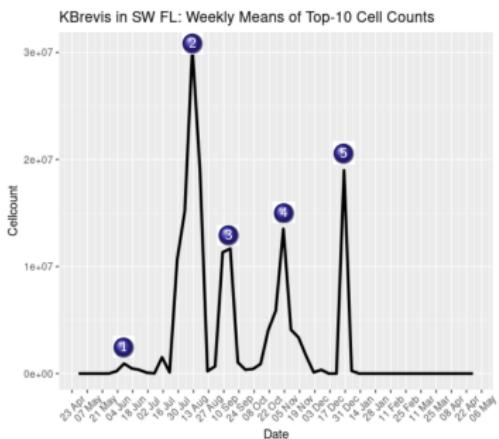
Actual Red Tide Conditions by Metro: Cumulative Averages.



Data sources: *Wildlife Commission (Kbrevis)*, and
Mote Marine Laboratory (beach conditions)

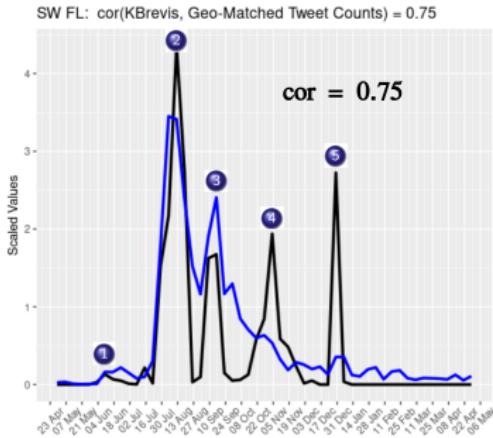
Actual Red Tide Conditions Over Time (Weekly).

Five waves of red tide detected from the plots:



Data sources:
Florida Fish and Wildlife Commission
and
Mote Marine Laboratory.

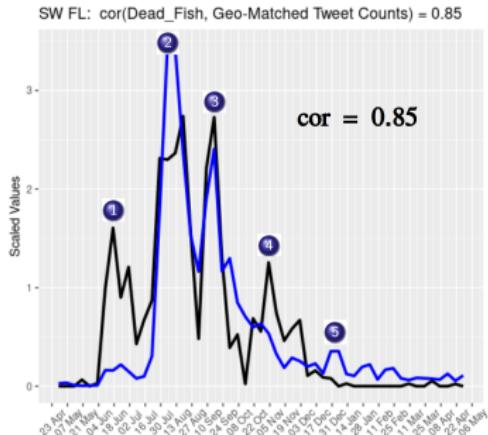
Tweet Counts versus Red Tide Conditions: Overall.



Total weekly tweets

versus

red tide cell counts
(correlation = 0.75)



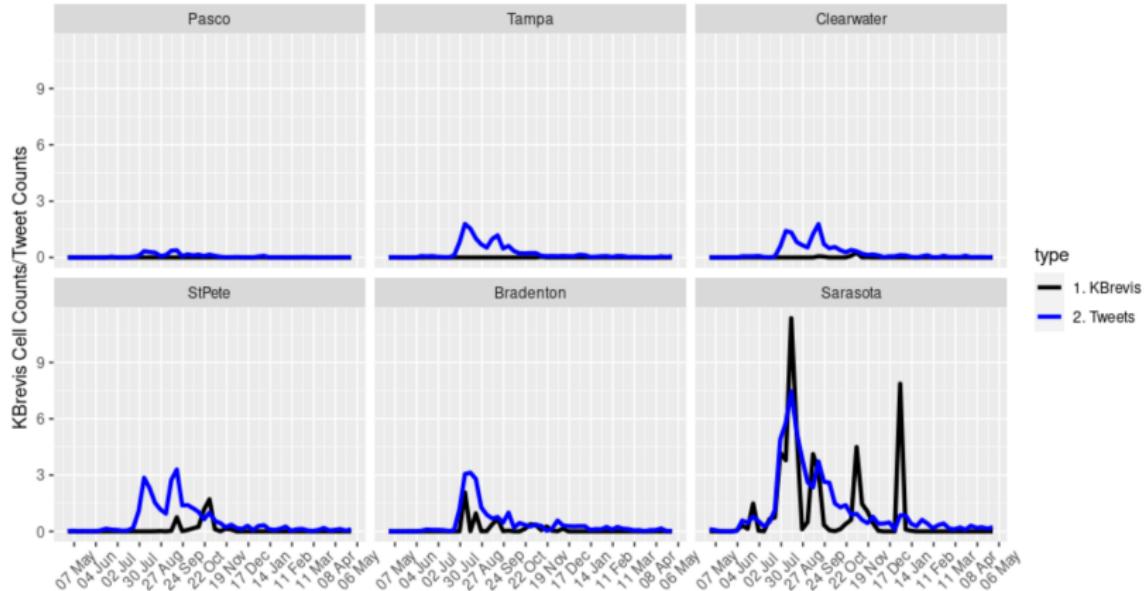
Total weekly tweets

versus

dead fish level
(correlation = 0.85)

Tweet Counts versus Red Tide Conditions: By Metro.

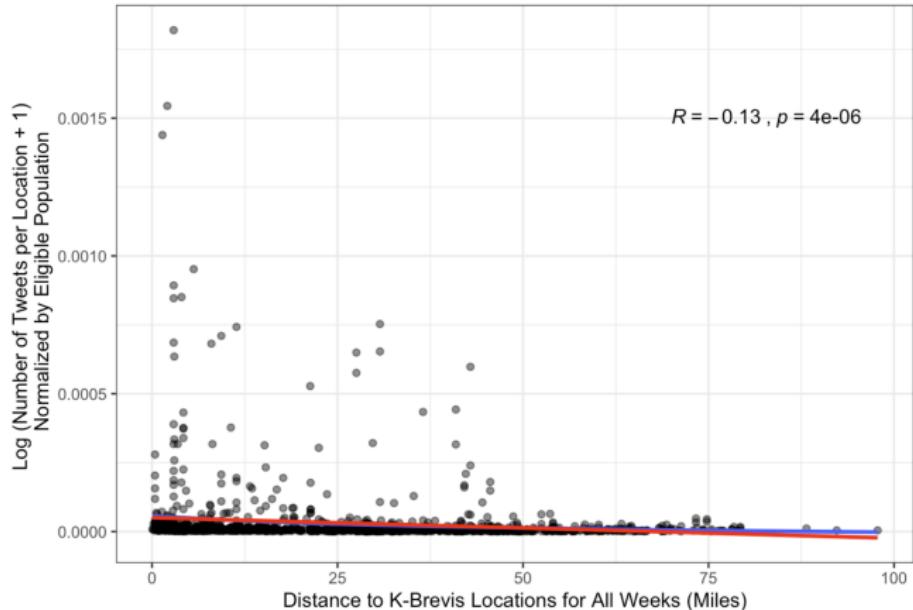
BY METRO: $\text{cor}(KBrevis, \text{Geo-Matched Tweet Counts}) = 0.66$



Distance From Red Tide vs Twitter Activity: Correlation.

Farther from red tide (distance \uparrow)
↓
less tweets posted (tweet counts \downarrow)

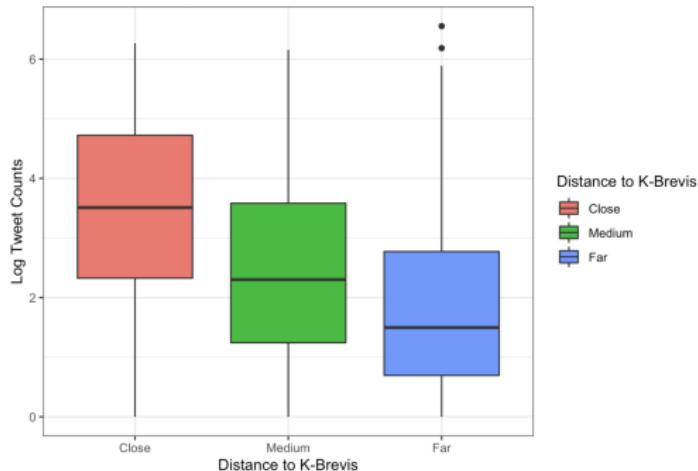
Tweet Counts vs. Distance to K.Brevis - Geo-Matched Tweets



Distance From Red Tide vs Twitter Activity: Close vs Far.

Analysis of variance for red tide tweet counts based on if tweet location is at Close/Medium/Far distance from impacted area:

Distribution of Log Weekly Tweet Counts for Each Level of Distance to K.Brevis



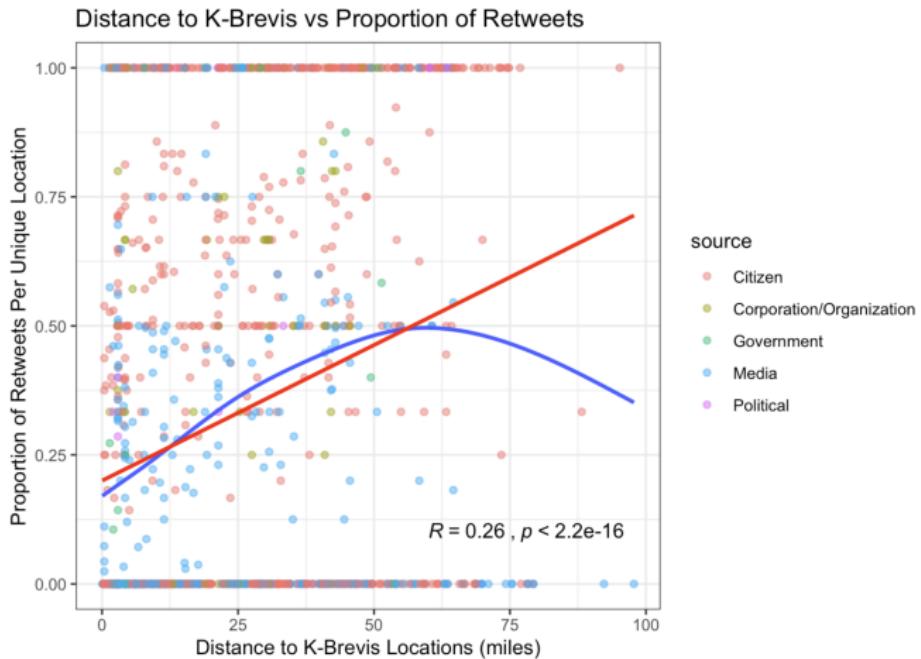
- p -value of $2.37 \times 5 \times 10^{-7}$, R^2 of 0.11
- 95% CI for {Medium - Close} $\in (-1.43, -0.38)$
95% CI for {Far - Close} $\in (-2.01, -0.96)$

Distance From Red Tide vs % of Retweets.

Farther from red tide (distance \uparrow)



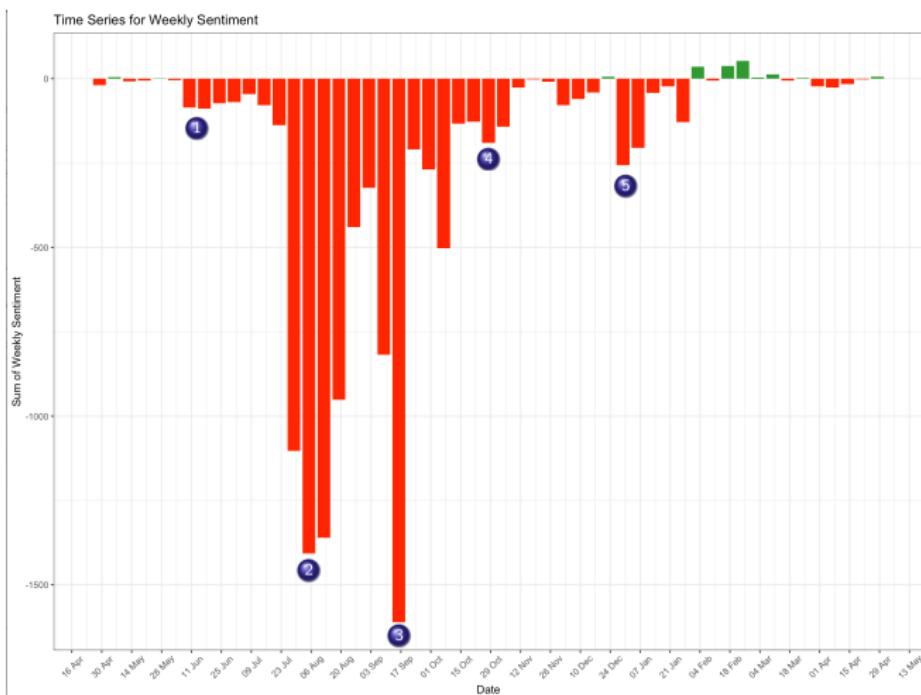
higher % of retweets (% retweets \uparrow).



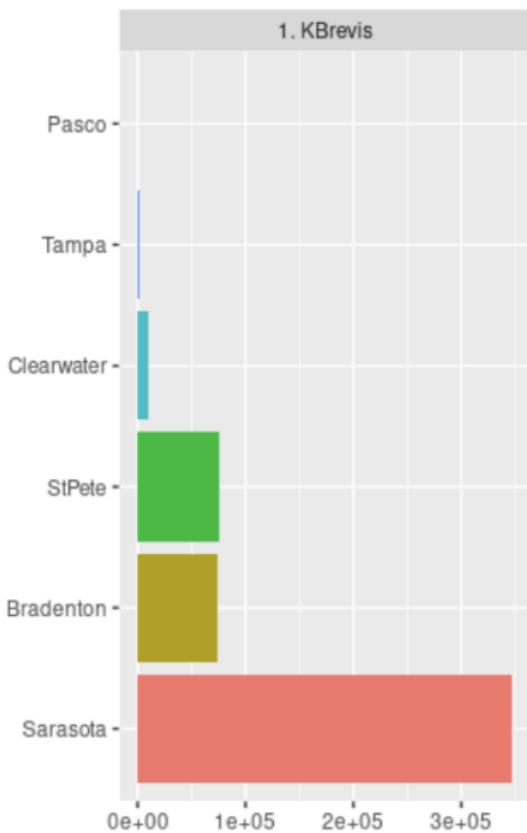
Sentiment Analysis of Tweets.

Each tweet was assigned a numeric score based on **direction** (+/-), and **strength** of **emotion** expressed in the tweet.

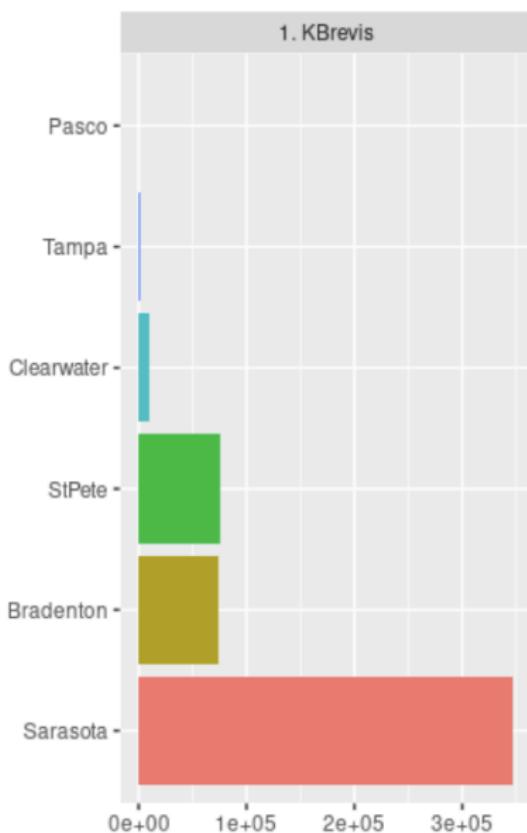
Weekly total sentiments:



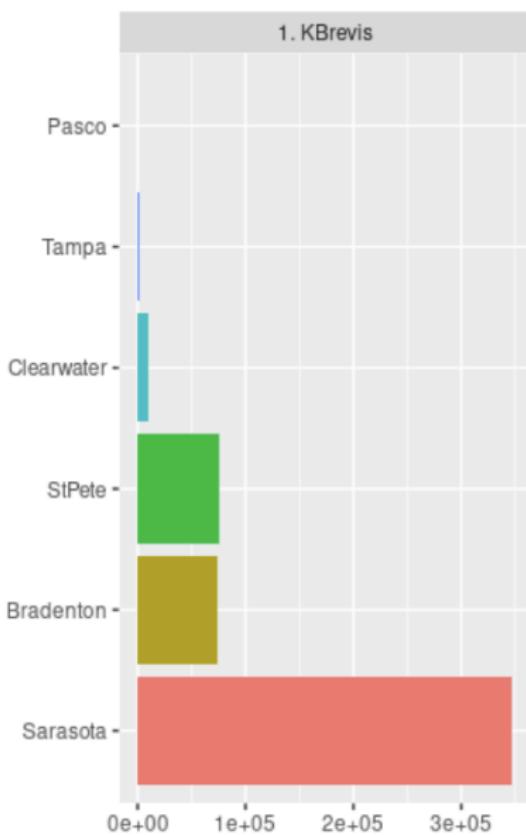
Sentiment Analysis of Tweets.



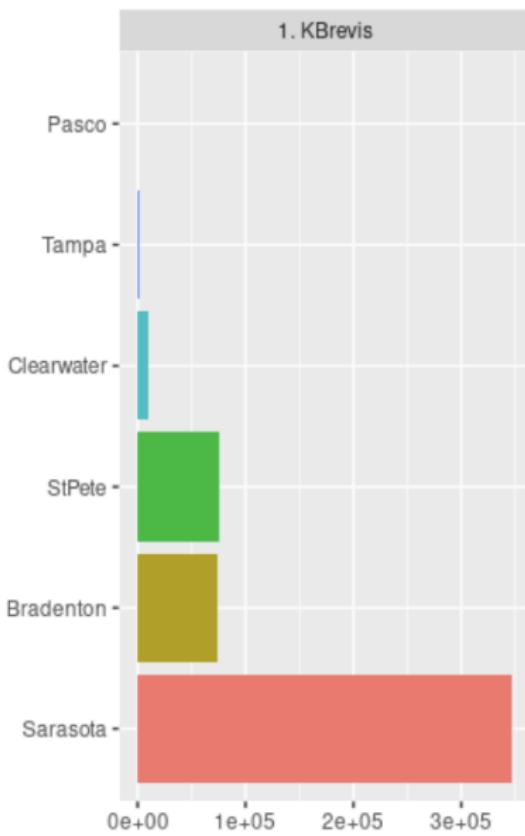
Sentiment Analysis of Tweets.



Sentiment Analysis of Tweets.



Sentiment Analysis of Tweets.



Pasco



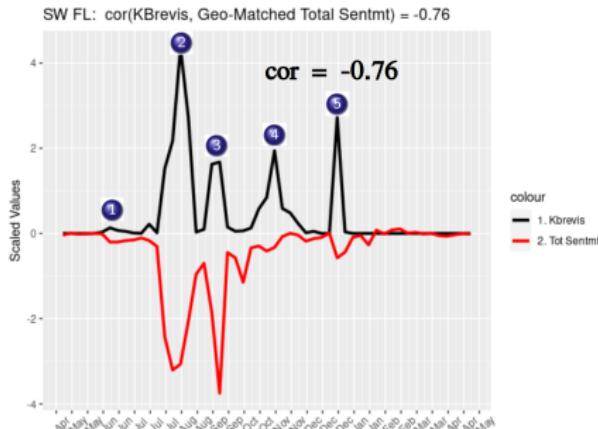
StPete



Sarasota

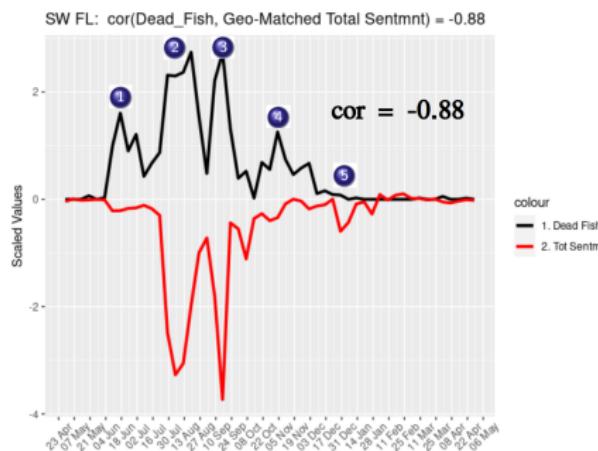


Tweet Sentiments versus Red Tide Conditions: Overall.



Total weekly
sentiment

versus
red tide cell counts
(correlation =
-0.76)



Total weekly
sentiment

versus
dead fish level
(correlation =
-0.88)

Conclusions and Future Work.

- Our analysis of over 17,000 geo-matched tweets from Florida's west coast during the 2018 red tide event showed very strong localized correlations between red tide conditions and public response in terms of the number and sentiment of tweets, along with % of retweets.
- Twitter showed to be a reliable indicator of community awareness and actual red tide impact.
- We are conducting further analysis into different Twitter user groups (e.g. Citizens, Media, Government,etc) to characterize social influencers and identify strategies for improved public communication. Moreover, we plan on utilizing tweets matched to a particular location via explicit mention of that local area in the tweet content for an even better local impact assessment.

THANK YOU!

Sponsors and Partners



Jennifer Shafer, PhD
jennifer@scienceandenvironment.org



Andrey Skripnikov, PhD
askripnikov@ncf.edu

Nathan Wagner
nathaniel.wagner19@ncf.edu