

Assessing the Risk of Toxin Transfer from Algae Blooms to Subsistence Fishing Communities in Martin County, FL: Initial Findings

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Subsistence Fishers often fish during blue -green algae blooms.



Fisher at the Port Mayaca Locks fishing for black crappie (aka specks) during an algae bloom (Moran 2018).

Methodology

Interviews with subsistence fishers and fish and water samples were collected during the summer (Jun 2018 – Sept 2018) around the time of active blooms in southern Florida with additional interviews and sampling taking place during the winter following the blooms.

Semi-structured interviews

- Conducted 27 interviews in English and Spanish
- Exposure estimates developed using fishing sites, frequency, species eaten, and meal preparation
- Assessed additional vulnerability with information on household ages and pregnancy status

Microcystin Testing

- Tested 22 fish collected by angling and donations from fishers at the Port Mayaca Locks
- Measured microcystin from homogenized tissue extracted twice from liver and muscle tissues using 60 % methanol. An Abraxis Enzyme -Linked Immunosorbent Assay (ELISA) test was used to detect total microcystin with a replication for each sample.
- Measured microcystin in water using ELISA test from 5 vertical snap samples taken at two dates (Aug and Sept 2018) from the C44 canal.



Results

Fish tested revealed the presence of microcystin in the liver and muscle of fish eaten by subsistence fishers.



Fishers interviewed ranged in age from 18 to 77 years old and were primarily African American (80%) and Hispanic/Latino (15%).

Fishers reported:

- Fishing an average of 3.32 times per week at sites surrounding Lake Okeechobee
- Eating fish for 1 -7 meals per week, average ~2 meals per week
- Primarily targeting and eating crappie
- Sharing fish with 100+ household members and extended family, many of whom are younger than 6 years old or older than 65
- Two fishers reported sharing fish with pregnant women
- Popular fish species eaten include: crappie (top left), bass (top right), bluegill (bottom left), channel catfish (bottom right), tilapia, and Florida gar.

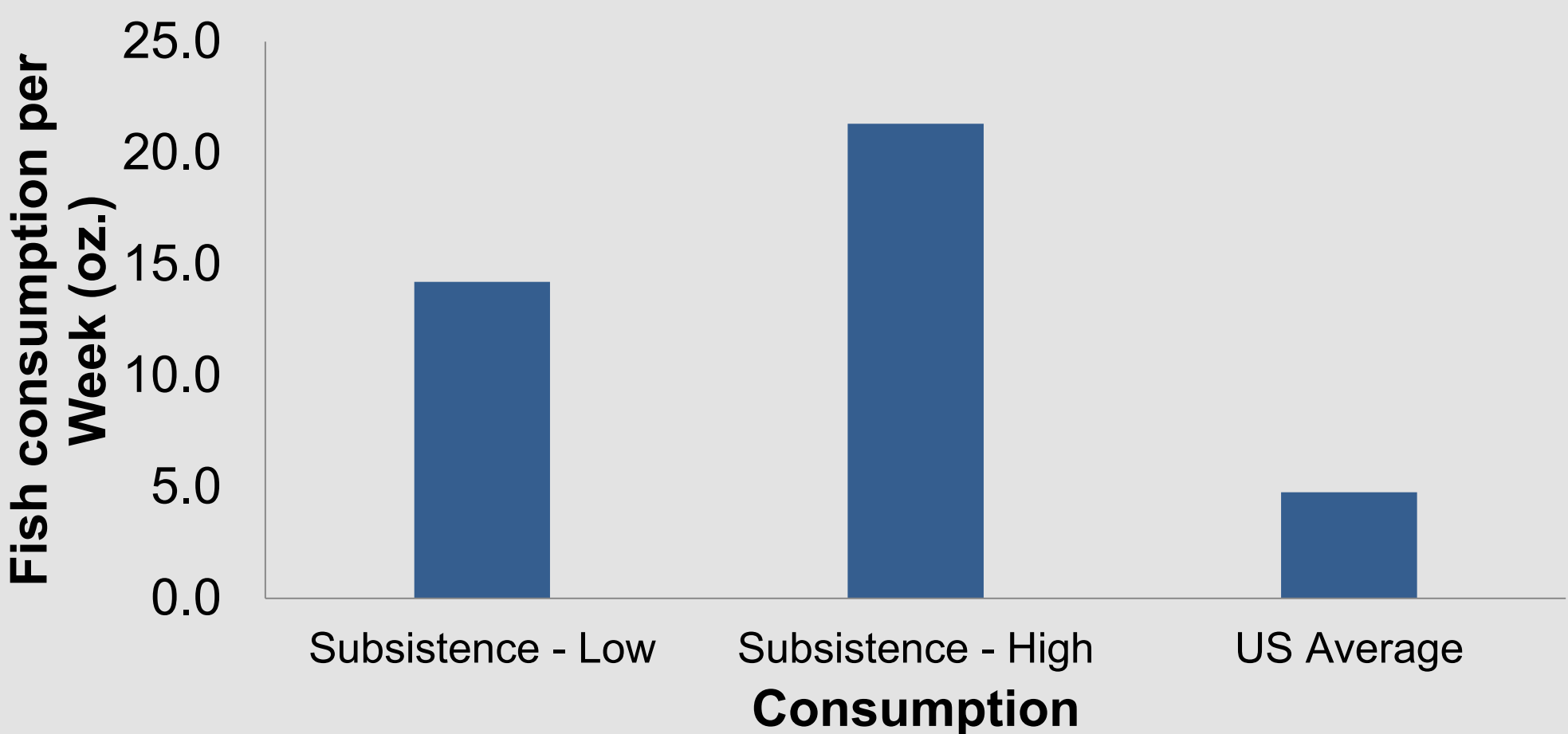
Discussion

- Rough estimates of consumption suggest subsistence fishers in Martin County eat 3 to 4 times more fish each week than the average US citizen suggesting significantly higher exposure.
- Fish tested from the Port Mayaca Locks had an average concentration of microcystin over 3.38 ng/g in the fillets and 15.75 ng/g in the livers .
- Microcystin levels exceeded WHO standards for water quality for water samples. Although not used for drinking water, fishers often come into contact with the water and exposure should be examined.
- Blue-green algae blooms have increased in size and duration and therefore are an increased threat for fishers

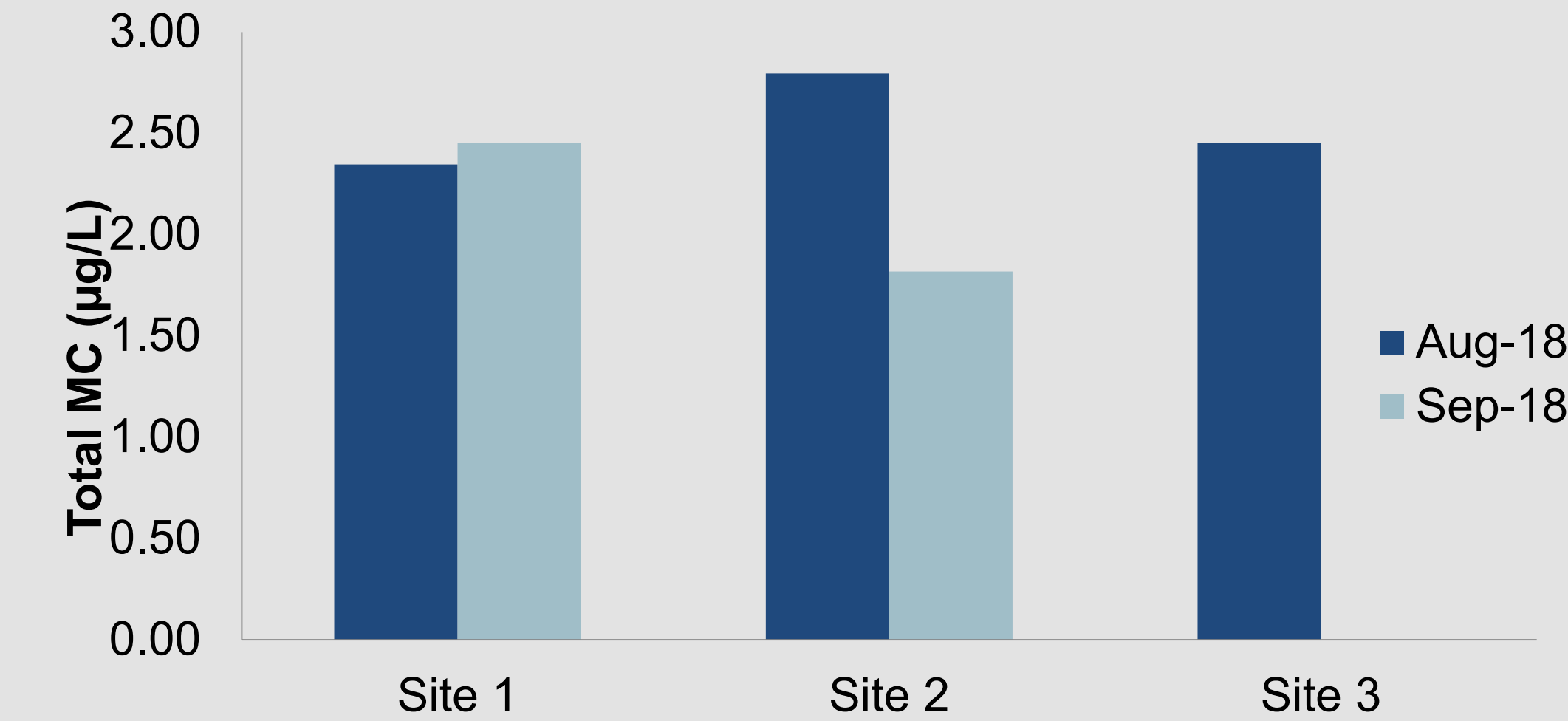
Fish	Sample	Average MC (ng/g)	
		Fillet	Liver
Crappie	11	1.20	13.78
Bass	2	0.425	18.3
Bluegill	1	0	0
Channel catfish	1	0	0
Tilapia	3	3.25	≥ 5.00
Armored catfish	2	≥ 21.88	47.47
Gar	2	0.04	0.54

Table 1: Sample size and average microcystin (ng/g) in the fillet and liver of fish species caught at Port Mayaca Locks in August and September of 2018.

Estimates of Weekly Fish Consumption



Average Microcystin in Water from C44 Canal



Graph 1: Estimates of weekly fish consumption were calculated using data from interviews and average US portion sizes, Low (8oz) and High (12oz). **Graph 2:** Average total microcystin was calculated from vertical snap samples at three sites on the C44 canal on two dates. A sample was not collected for site 3 for Sept 2018.

Conclusion

Fishers in Martin County and the surrounding region depend on fishing as both a food source and social activity. However, increases in algae blooms containing microcystin threaten their way of life. Microcystin was found in the water of the C44 canal and in the fillets and livers of most fish caught at the Port Mayaca Locks. A full risk assessment must be completed to protect the health and wellbeing of fishers, animals, and the environment in Martin County.



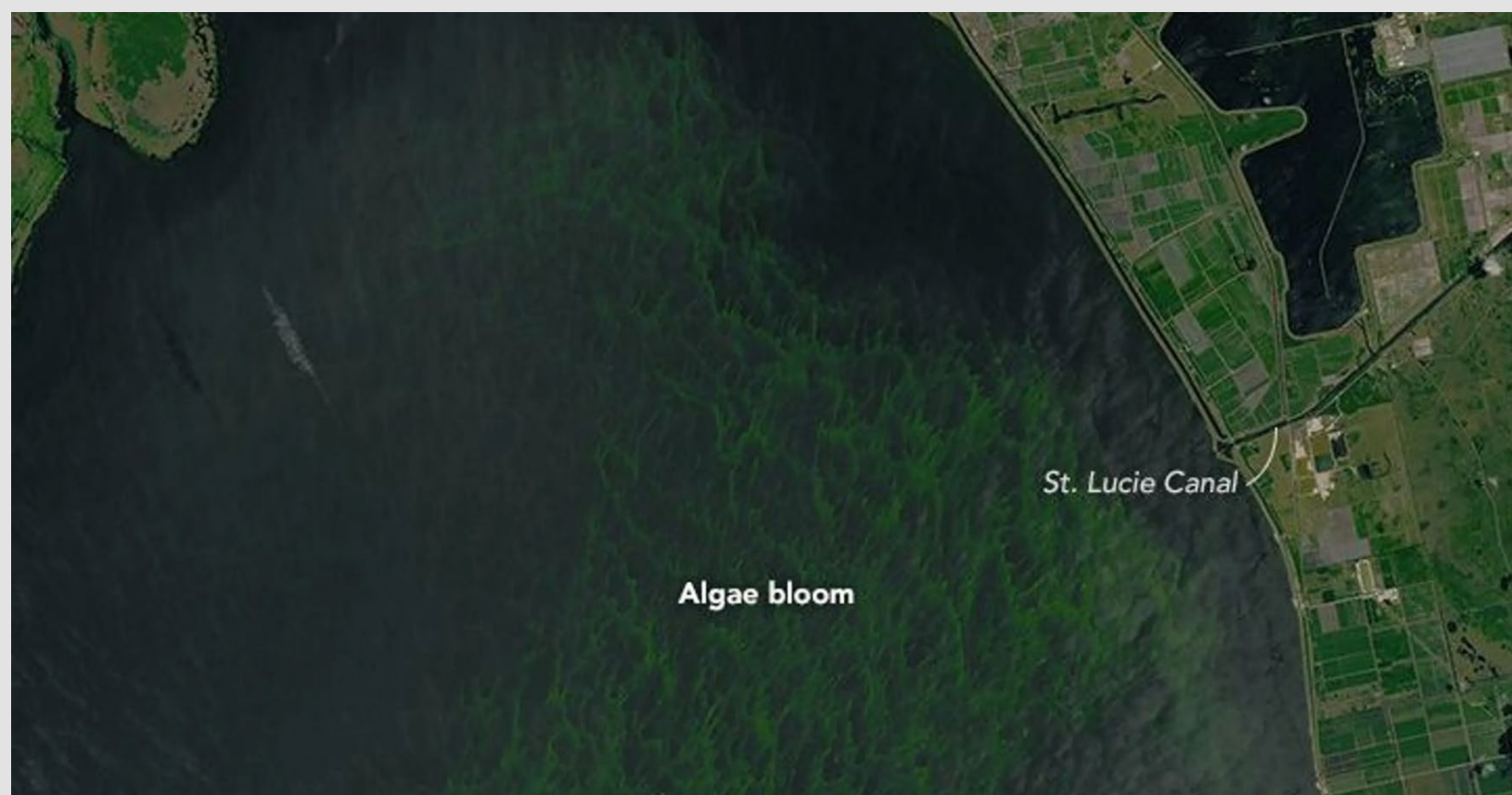
Another fisher at the Port Mayaca Locks during the 2018 algae bloom (Spear 2018).

Introduction

Martin County, Florida hosts a large fishing community who depend on fishing as a food source. However, the region has experienced several critical cyanobacterial blooms. Microcystin, a hepatotoxin produced by *Microcystis aeruginosa*, is the most toxic form produced by cyanobacteria and the most common. The World Health Organization (WHO) has developed standards for chronic microcystin exposure (0.04 µg/kg of body weight) and set acceptable drinking water levels (1 µg/L). However, standards do not consider exposure through direct contact or fish consumption (Poste et al. 2011).

Due to increased concerns about the transfer of toxins from algae to humans, ORCA began research to estimate exposure of Martin County subsistence fishers to microcystin via fish consumption.

Algae covered up to 90% of Lake Okeechobee in 2018.



Water is discharged from Lake Okeechobee through the St. Lucie Canal (Havens 2018).

Next Steps

- Prioritize the preservation of subsistence fishing as a crucial food source and important cultural practice in future research and management decisions.
- Expand research to include year round sampling, tests for additional toxins and routes of exposure (i.e. inhalation, skin contact)
- Connect with health care and social service providers for provider and patient education



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