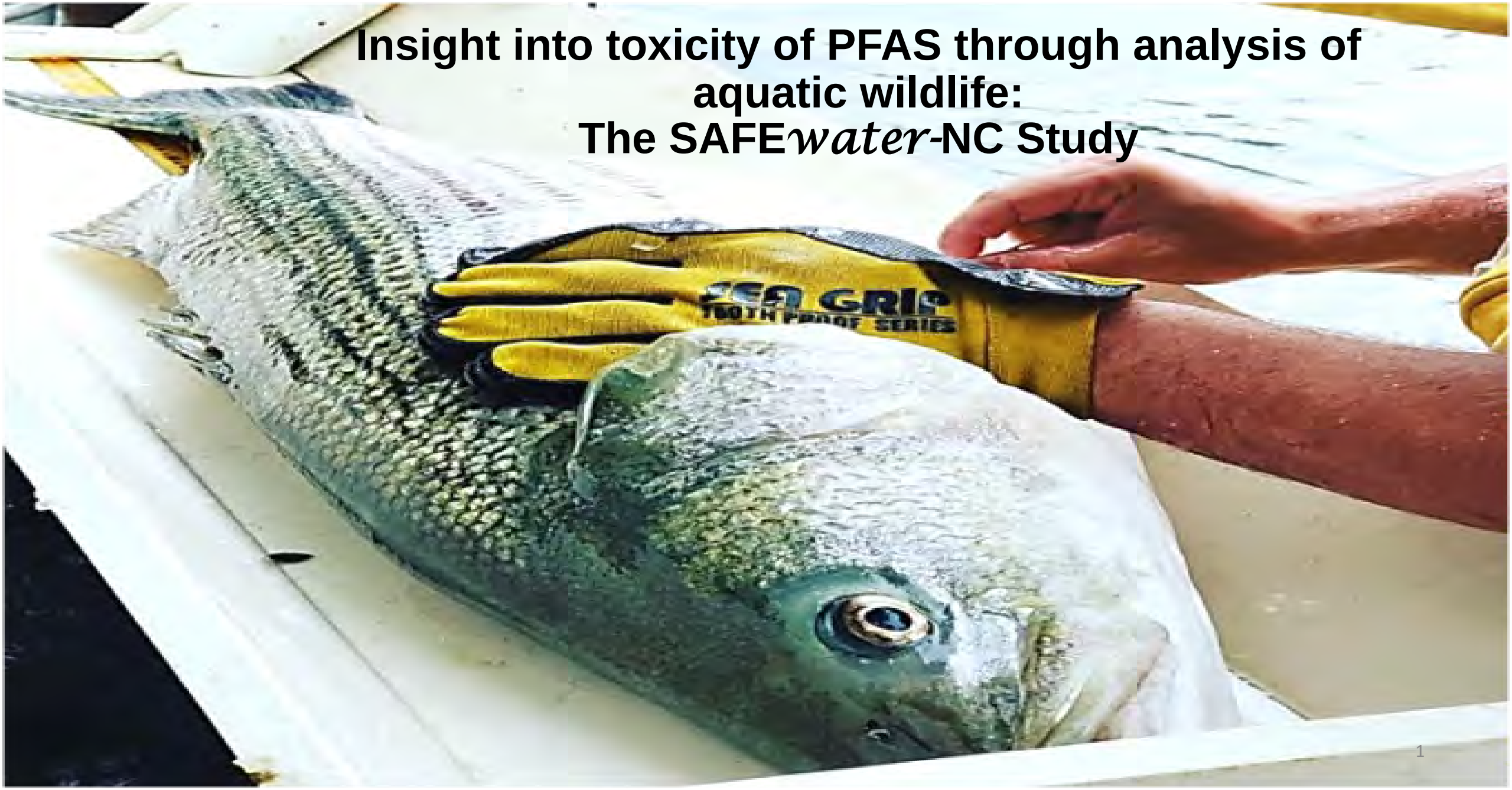
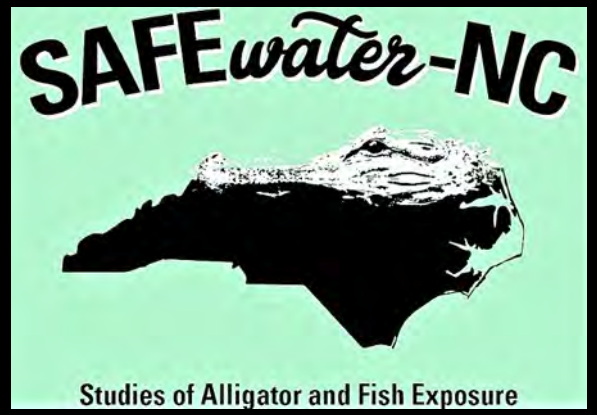
Insight into toxicity of PFAS through analysis of aquatic wildlife: The SAFE*water*-NC Study





Study goals:

Characterize levels of PFAS in blood/serum, tissue, and water (LC/MS/MS)

- Striped Bass
- Commonly consumed fish (community driven)

Evaluate: 1) Exposure

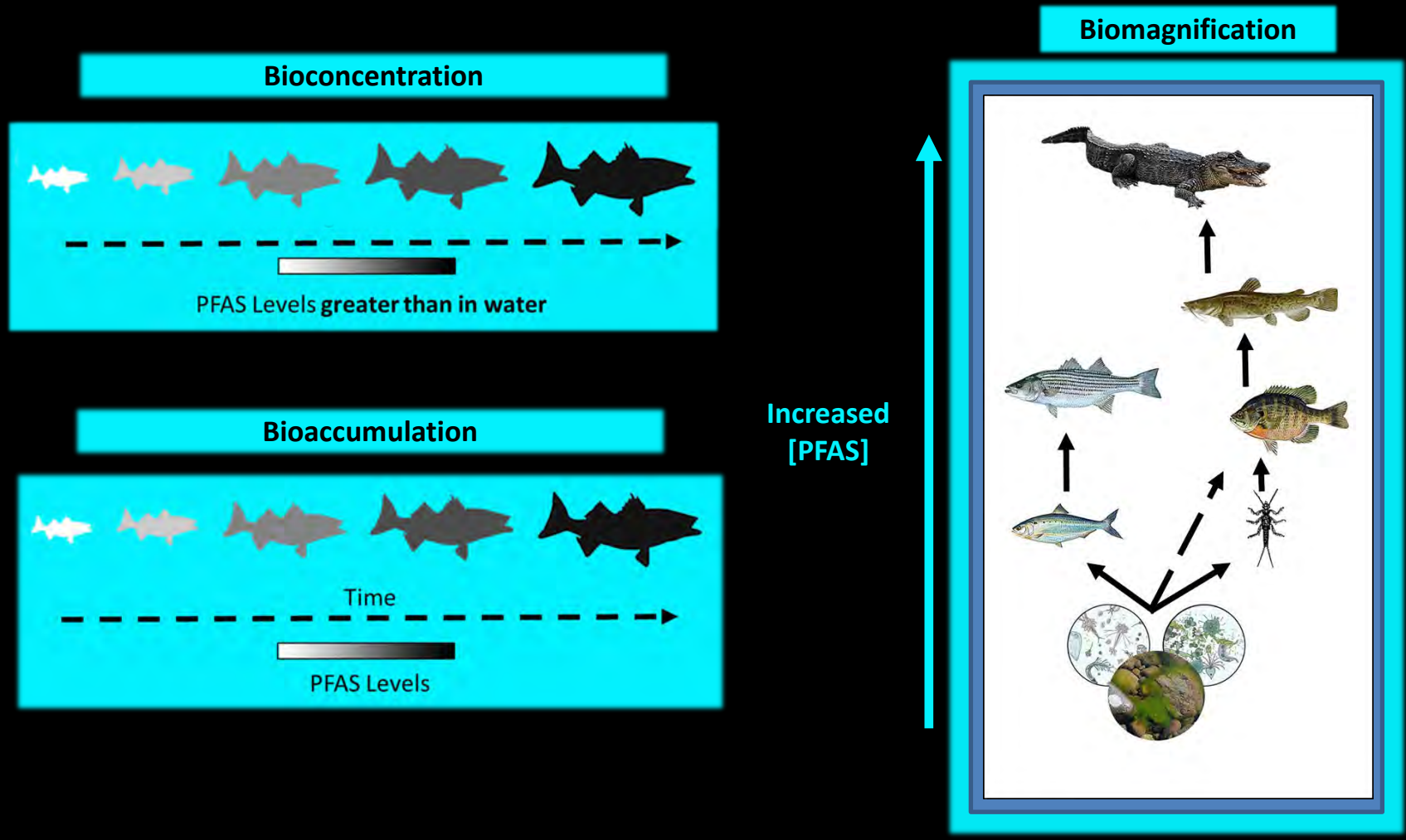
2) Bioaccumulation, bioconcentration, biomagnification

3) Impacts on health (wildlife and human)

Communicate findings to stakeholders – Community Engagement

www.safewaternc.org

Bioaccumulation, Bioconcentration, and Biomagnification



1. Are PFAS present and accumulating in NC wildlife?
    - Which ones and how much?
    - Do “short-chain” and ether-containing PFAS bioaccumulate?
2. Are PFAS levels associated with indicators of adverse wildlife/ecosystem health?



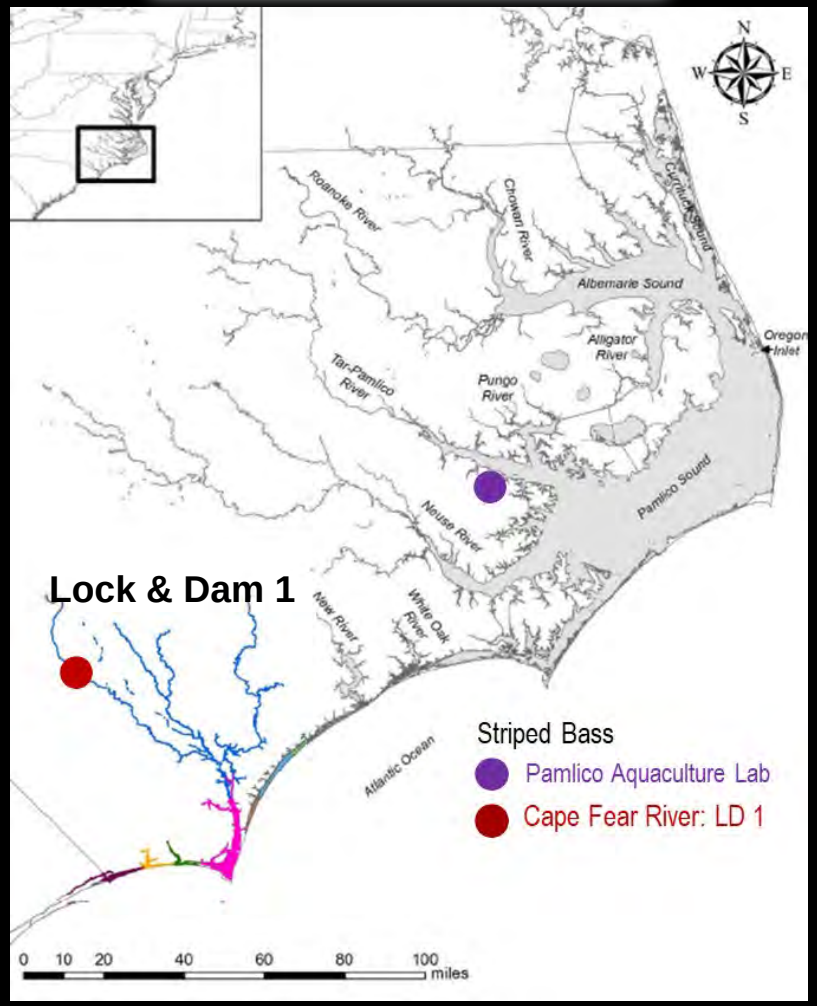


* New * *Are North Carolinian’s exposed to PFAS from consuming fish they catch and eat?*

- www.tinyurl.com/SAFEwaterFish

There is No Striped Bass Reproduction on the Cape Fear River

- The Cape Fear River Striped Bass spawning stock is in complete collapse
- A total harvest moratorium was implemented for the Cape Fear in 2008
- Additional restoration efforts over the last decade have focused on improving passage and habitat
- Egg quality may be impaired by contaminants of concern



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Elevated levels of per- and polyfluoroalkyl substances in Cape Fear River Striped Bass (*Morone saxatilis*) are associated with biomarkers of altered immune and liver function

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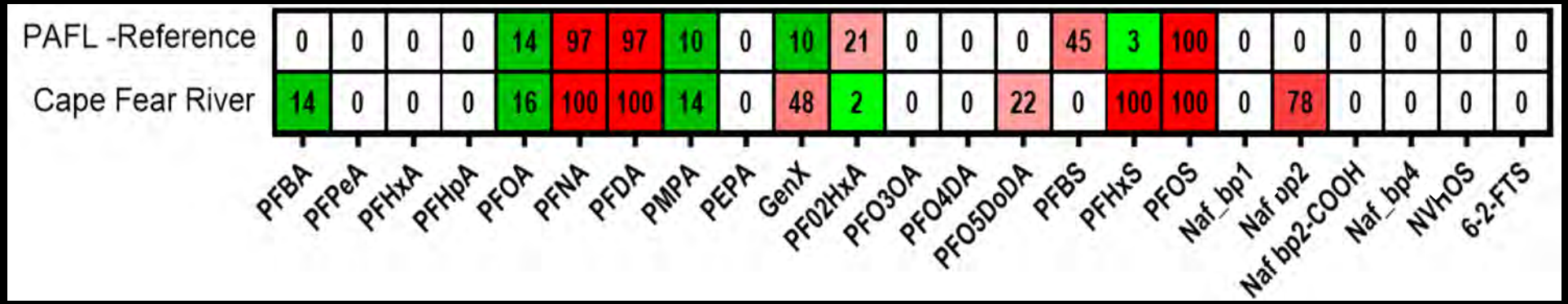
- **May 2018 Striped Bass from Cape Fear River**
- **Blood/Serum Collected**
- **Analyzed fish were between ~2-7 years old**
  - ***Residents of the Cape Fear River from 1-6 years***
- ***Exposure*** **compared to aquaculture-reared fish (background)**

PFAS in Striped Bass Serum Samples

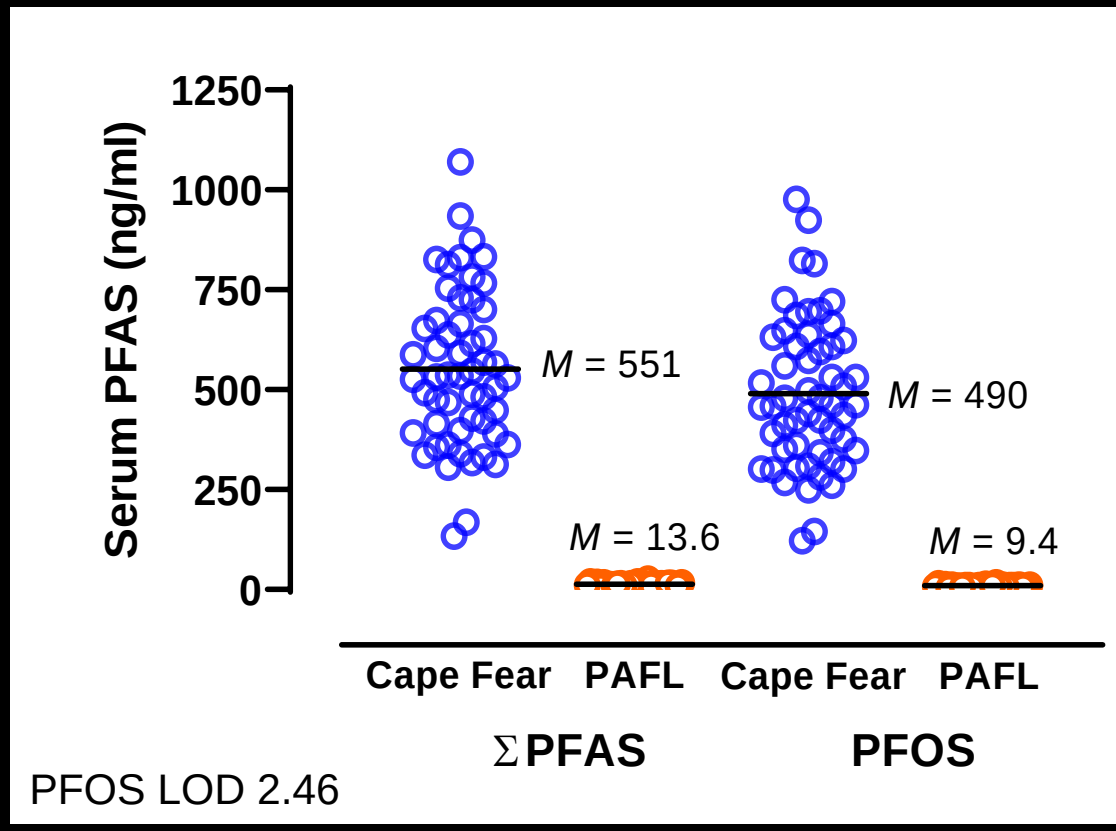
Detection Frequency > LOD

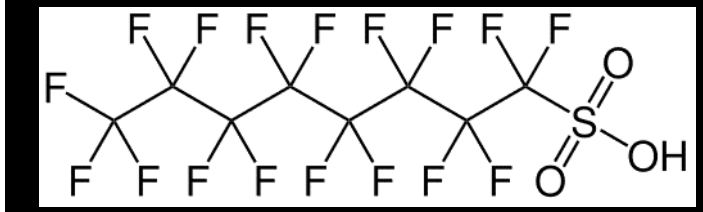
(PAFL n =29; CFR n = 58)



- **PFAS were detected in every sample**
  - *PFOS, PFNA, PFDA were detected in **every** Striped Bass*
- Nafion byproduct 2 was **only** detected in Cape Fear samples
- GenX and PFHxS are highly **enriched** in Cape Fear samples

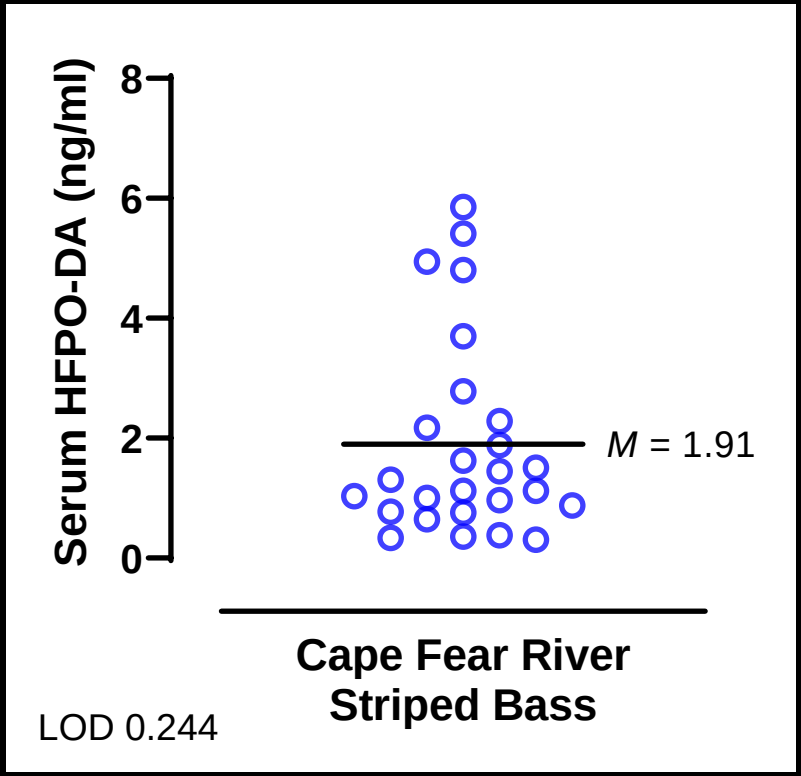
PFOS accounted for 89% of PFAS present in serum of Striped Bass from the Cape Fear River

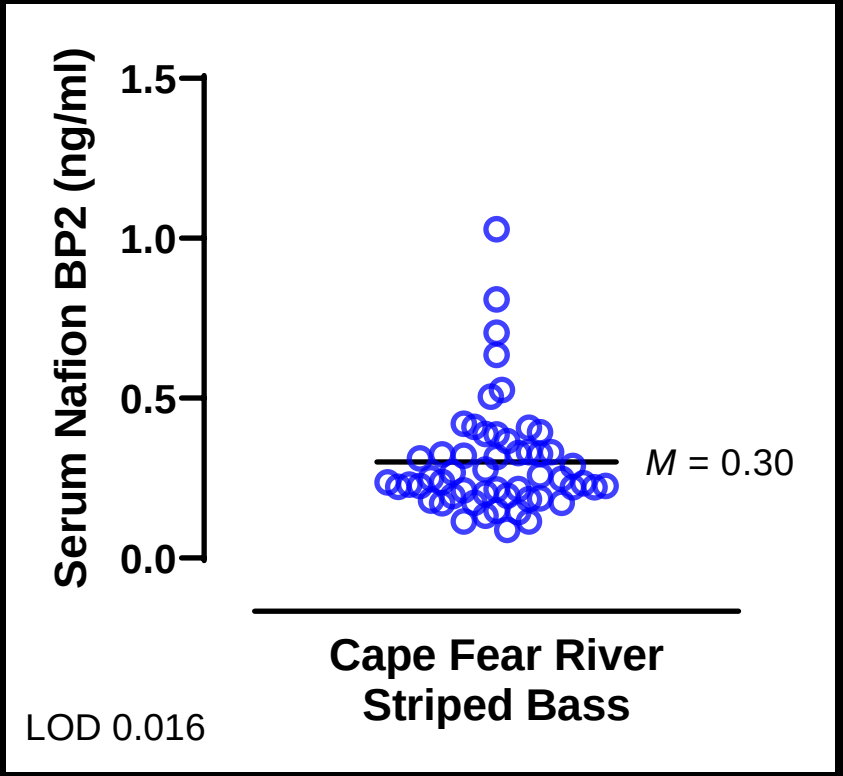




PFAS in Cape Fear Striped Bass Serum

- GenX was detected in half the samples
- Nafion byproduct 2 was detectable in 78% of samples

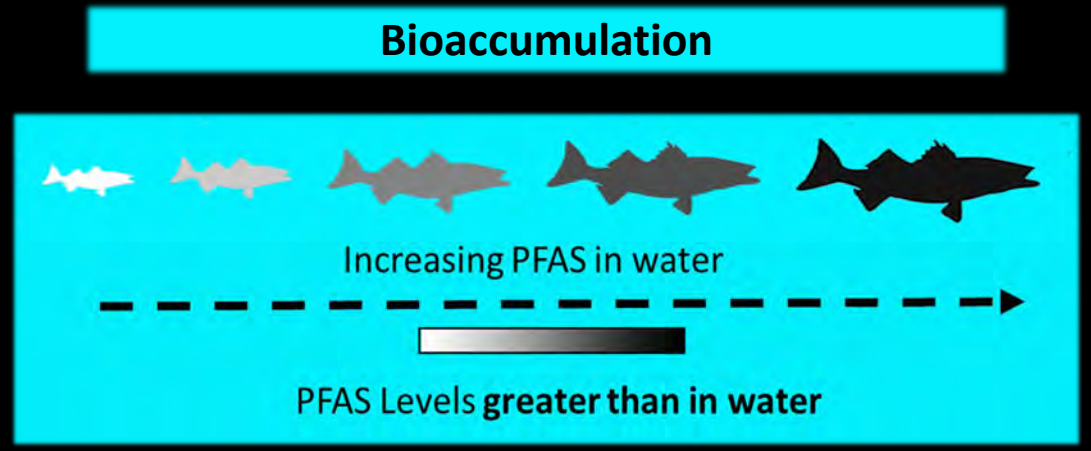




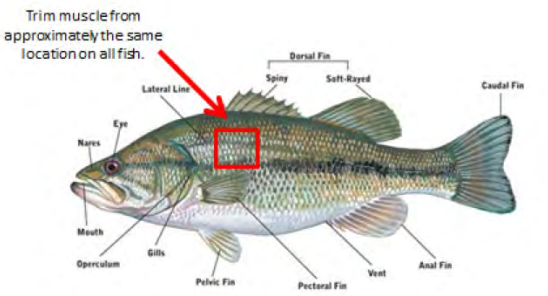
PFAS Accumulate in Striped Bass Blood

PFAS in Cape Fear (Lock and Dam #1, 4/10-5/22/18)

	Water	Serum
PFOS	<3 ng/L	> 500,000 ng/L
GenX	8-25 ng/L	~ 2,000 ng/L
NBP 2	9-25 ng/L	~ 300 ng/L



Differential Accumulation in Striped Bass Blood and Fillet



Serum PFAS – 2018

PFAS	LOD (ng/ml)	Serum Conc (ng/ml)
PFBA	0.11	0.11 (0.11-0.18)
PFOA	**0.16**	**0.57 (0.16-4.29)**
PFNA	0.34	4.49 (0.81-11.6)
PFDA	0.10	68.0 (10.2-146)
PFBS	0.01	0.15 (0.01-1.35)
PFHxS	0.09	0.78 (0.15-2.23)
PFOS	**0.10**	**490 (122-977)**
PMPA	0.12	0.12 (0.12-0.19)
GenX	**0.24**	**1.91 (0.31-5.85)**
Nafion byproduct 2	0.25	0.30 (0.25-1.03)
PFO5DoDA	0.01	0.49 (0.01-1.35)

From Guillette et al, 2020

Fillet PFAS – 2019 (n =5)

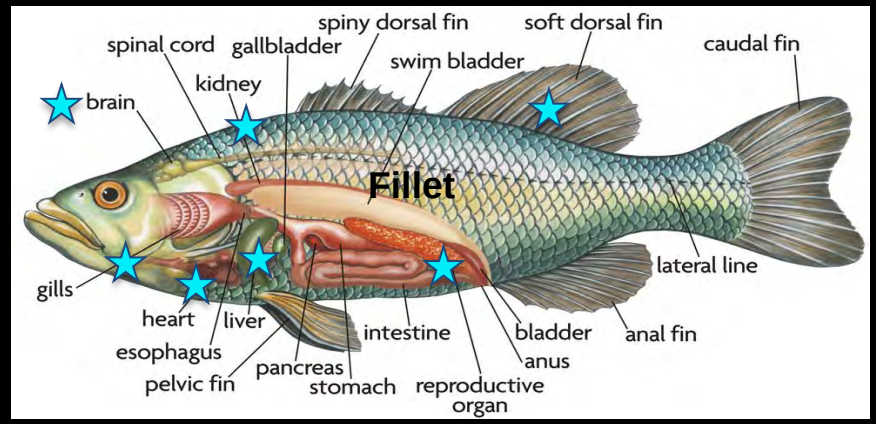
PFAS	LOD (ng/ml)	Serum Conc (ng/ml)
PFBA	0.10	0.35 (0.11—1.44)
PFHpA	0.02	37.8 (25.1-61.6)
PFOA	**0.16**	**ND**
PFNA	0.30	0.55 (0.17-1.44)
PFDA	0.10	20.1 (15.9-27.8)
PFBS	0.01	18.7
PFHxS	0.09	4.35 (.03-18.9)
PFOS	**0.10**	**7.02 (2.80-13.3)**
PMPA	0.10	0.06
GenX	**0.24**	**1.63 (0.30-5.09)**
Nafion byproduct 2	0.20	0.43
PFO3DoDA	0.01	9.74
PFO5DoDA	0.01	0.21

Differential Accumulation in Other Body Compartments?

Summer 2020 – ~~striped bass~~

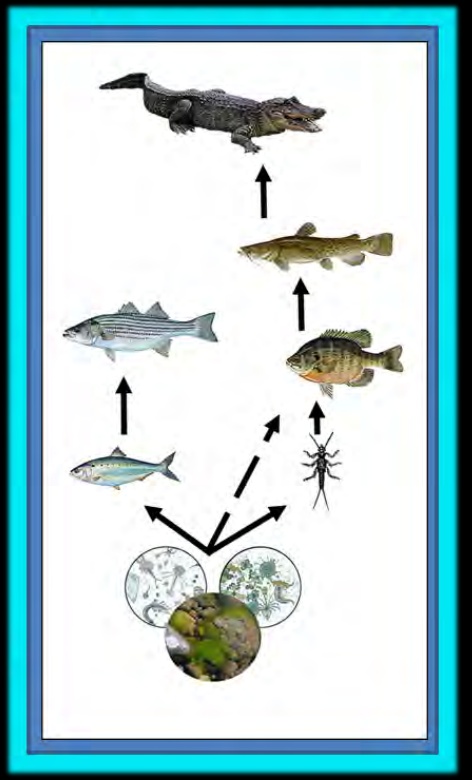
- Bi-monthly sampling of consumed fish (upper Cape Fear)
- Angler Fish Consumption study - online

Compartmentalization



Biomagnification

Increased [PFAS]



Summary and Getting Involved

- High levels of PFAS present in Cape Fear fish
- Most serum PFAS is **PFOS**
- PFAS exposure is associated with biomarkers of *adverse effects* on liver and immune function in CFR Striped Bass
- Both exposure and effects mirror known toxic impacts of PFAS
- Many PFAS are at similar levels in fish tissue – some important differences
- Cape Fear anglers: Take the survey about catching and eating fish!
  www.tinyurl.com/SAFEwaterFish

www.safewaternc.org

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