

Wastewater and Stormwater Impacts in Florida Estuaries

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University of South Florida

Florida Local Environmental Resource Agencies 2026 Annual Conference



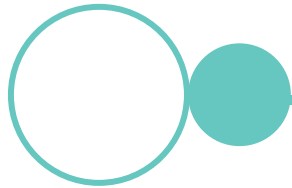
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South Carolina



CECs and CKCs

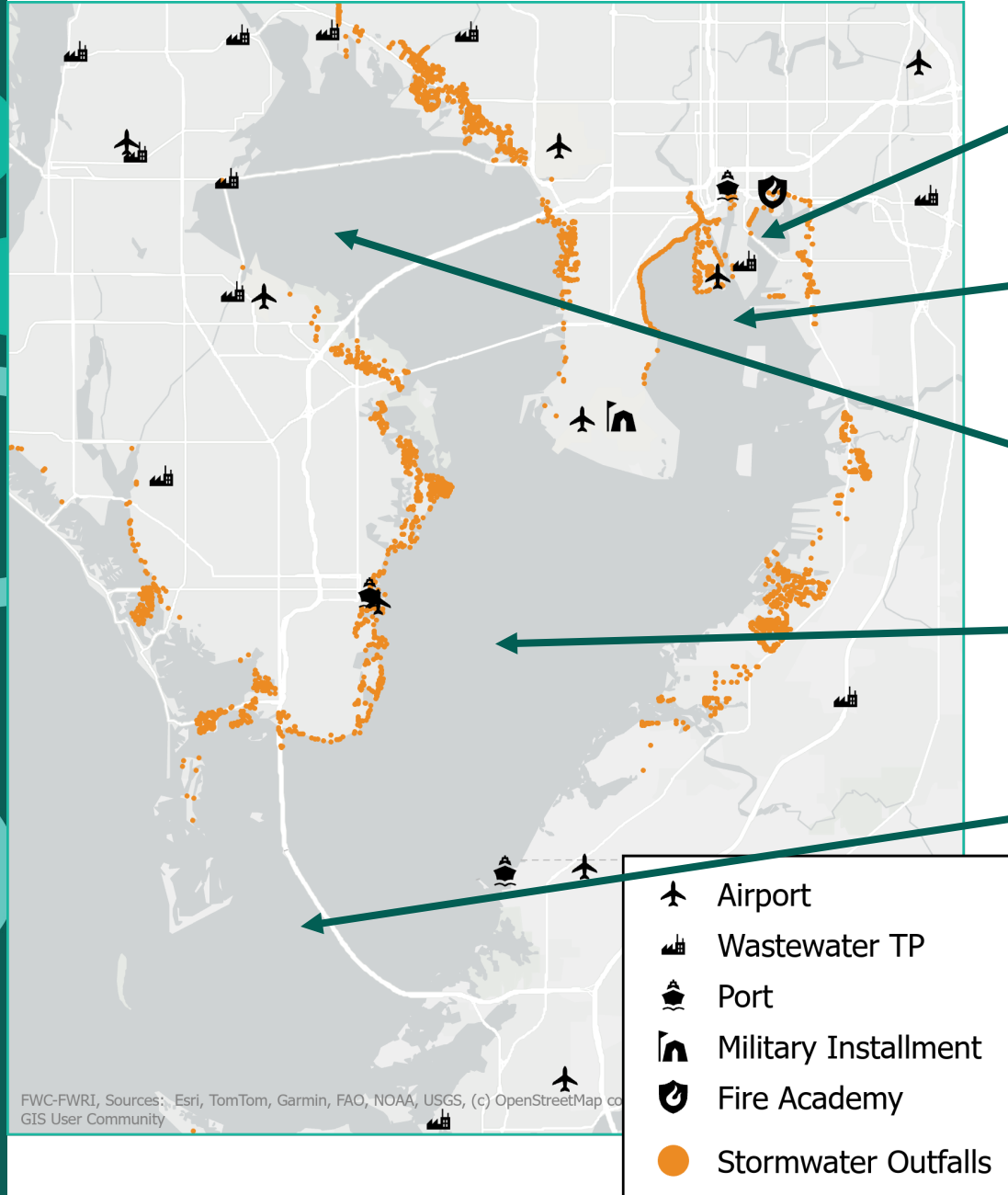


Contaminants of Emerging Concern (CECs): pollutants for which there are “limited data on occurrence, environmental fate, and toxicity” (EPA 2008)

- PFAS compounds (per- and polyfluoroalkyl substances),
- pharmaceuticals,
- phthalates,
- personal care products (PCPs),
- UV filters,
- flame retardants, et al.

Contaminants of Known Concern (CKCs)

- banned pesticides (e.g., DDT),
- PCBs,
- radionuclides,
- PAHs,
- toxic metals (e.g., Hg), etc.



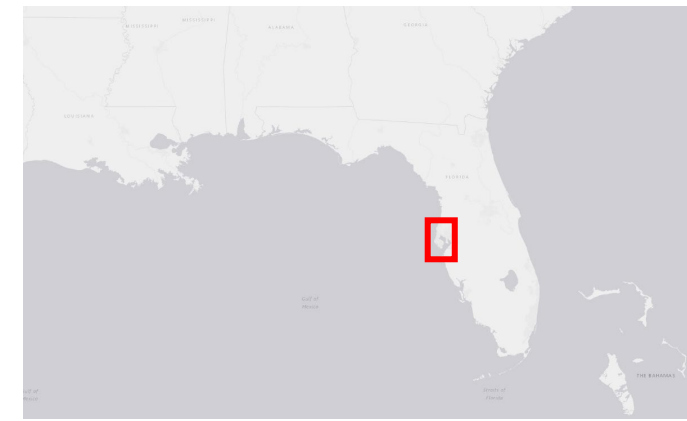
McKay Bay

Hillsborough Bay

Old Tampa Bay

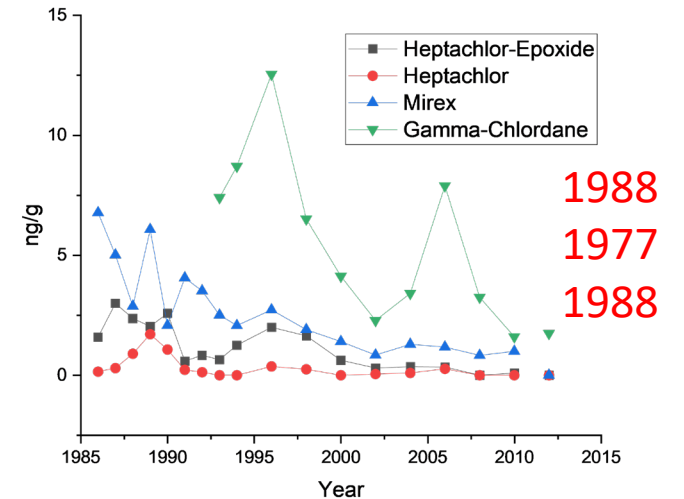
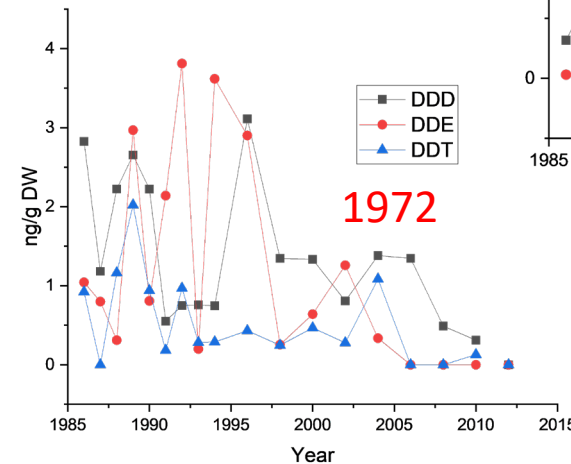
Mid Bay East and West

Lower Bay East and West

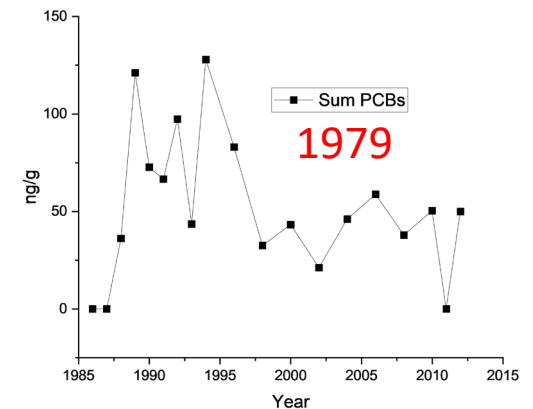


CKC Contaminants in TB

- NOAA Mussel Watch sites in Tampa Bay tested for a range of legacy pollutants in oysters (up to 2012)
- Legacy pollutants (**banned** pesticides, DDT, Mirex, etc., PCBs,) generally declining....
- Our research extends historical series and add a suite of new contaminants of emerging concern including replacement pesticides, PFAS, pharmaceuticals, UV filters, phthalates and other chemicals



The Rise of CECs?



Buildable Seed Projects

- Based on initial project conducted in TB 2020-2022 (funded by TB Estuary Program)
- Four funded projects focusing on various aspects of contaminants of emerging concern (CECs) & legacy pollutants
- EPCHC projects focus effort on McKay Bay and Hillsborough Bay



Tampa Bay
Surveillance
PROJECT



Barnacle
Baseline
PROJECT



Tampa Bay
REACH
PROJECT

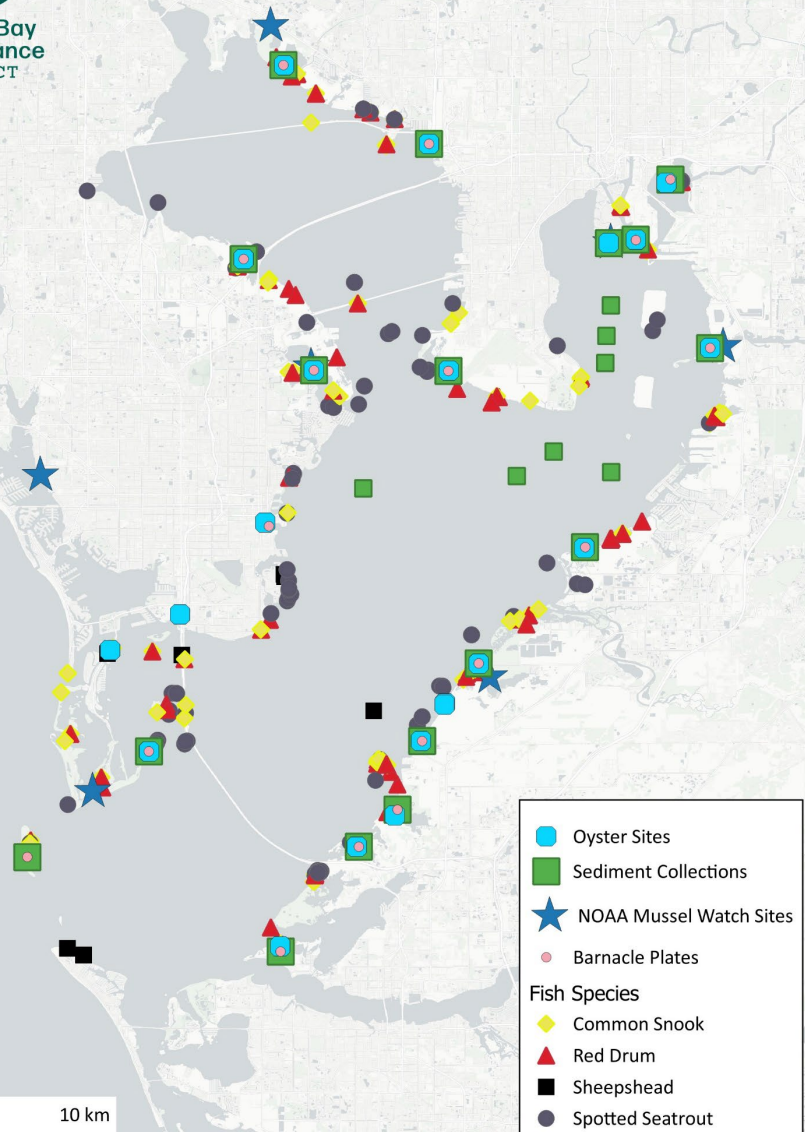


McKay Bay
TRACE
PROJECT

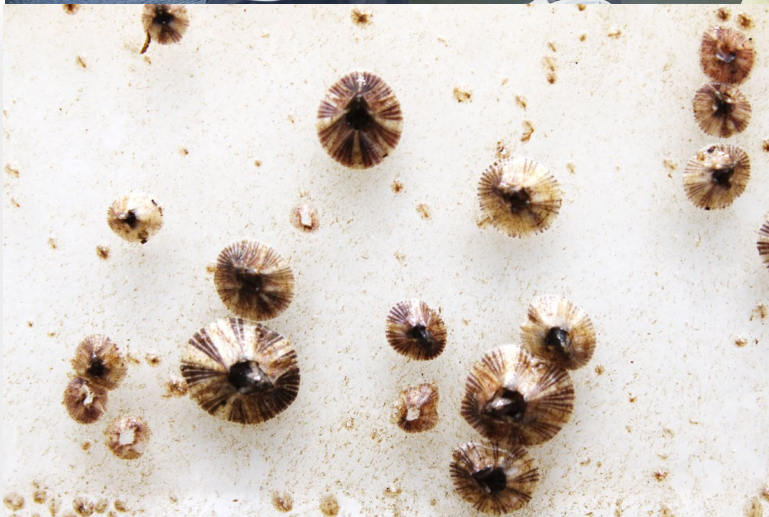


Tampa Bay
Surveillance
PROJECT

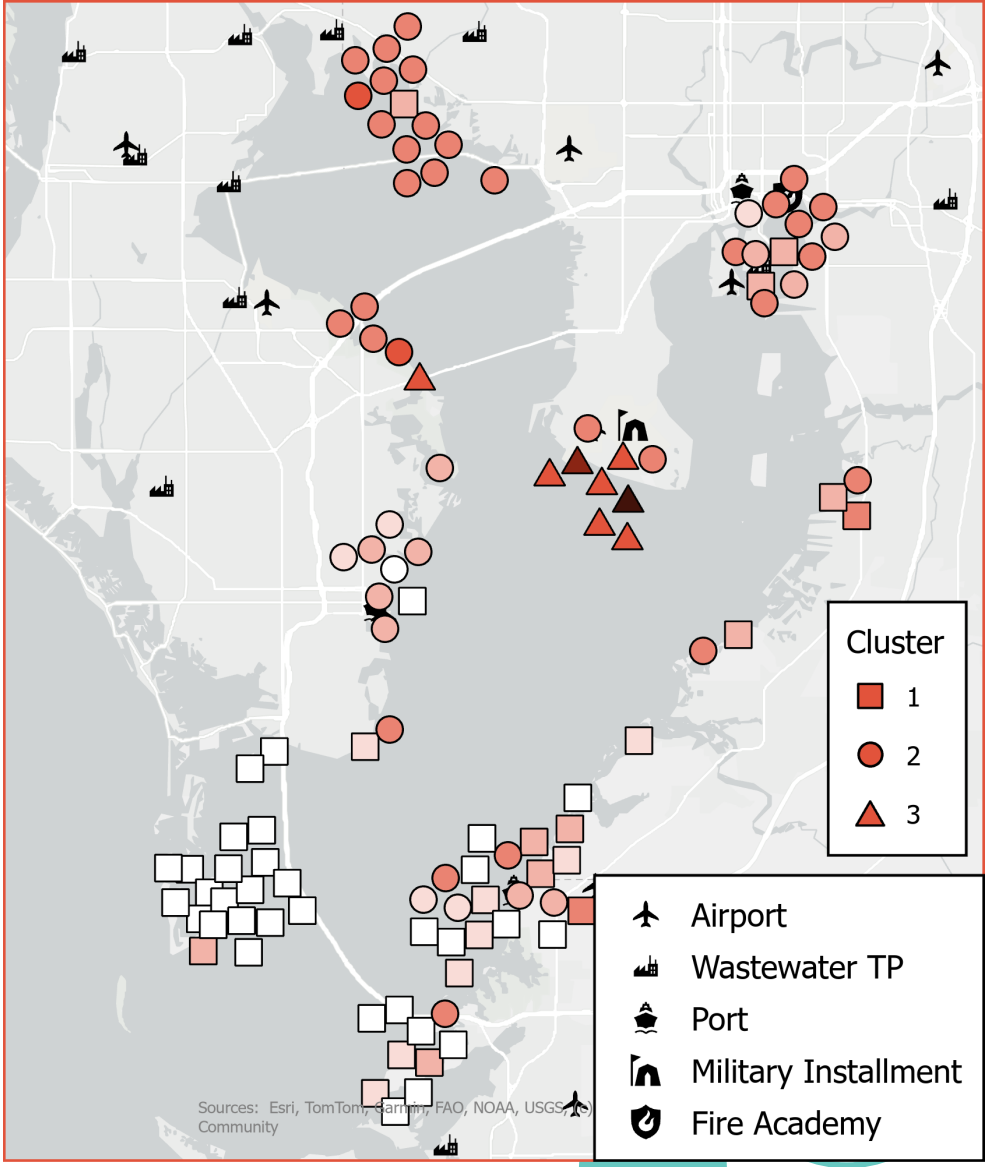
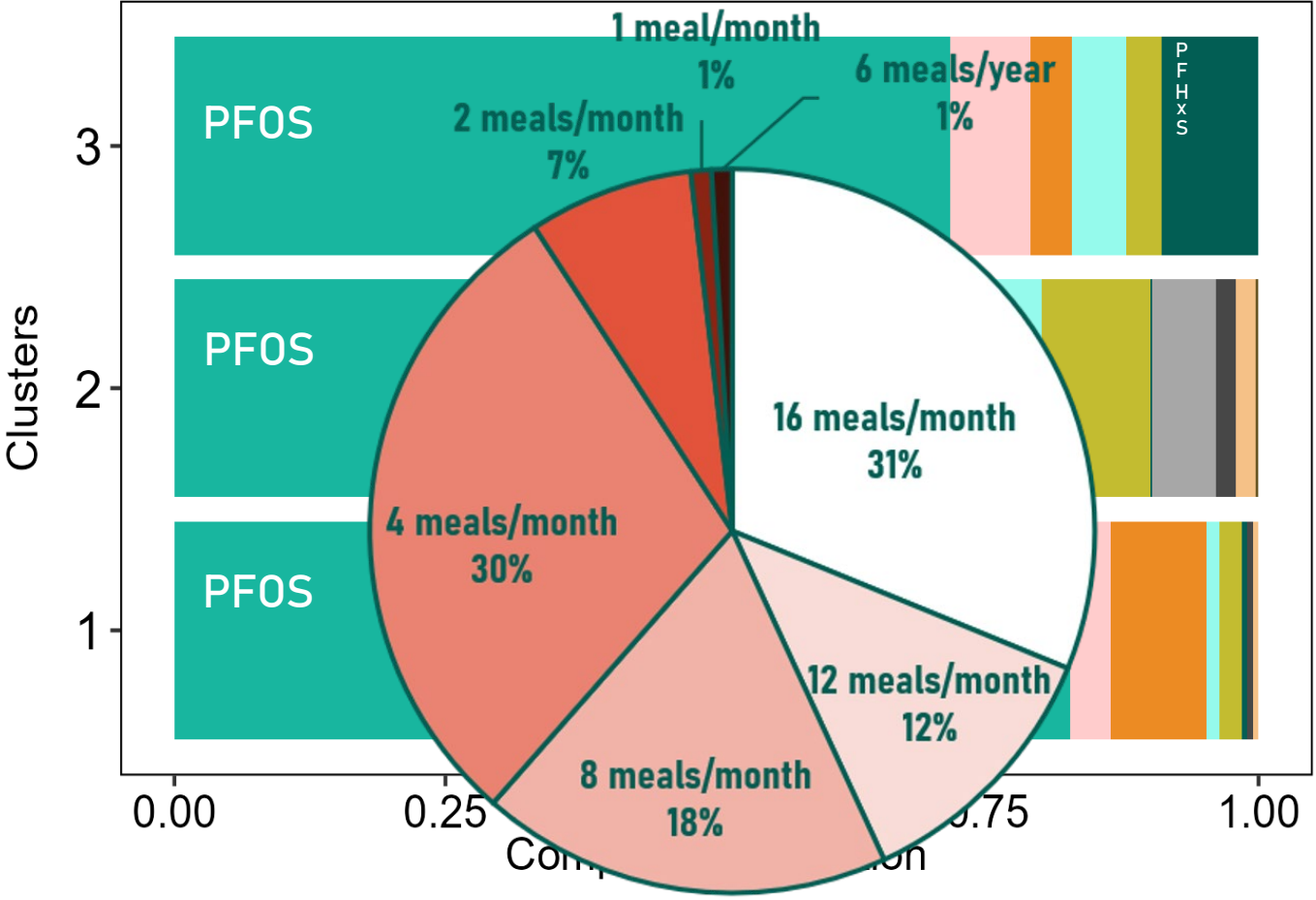
What are we sampling?



Map was created with Quantum Geographic Information System (QGIS), version 3.40.5. Imagery provided by Google Earth. Map author S. Gilbert.

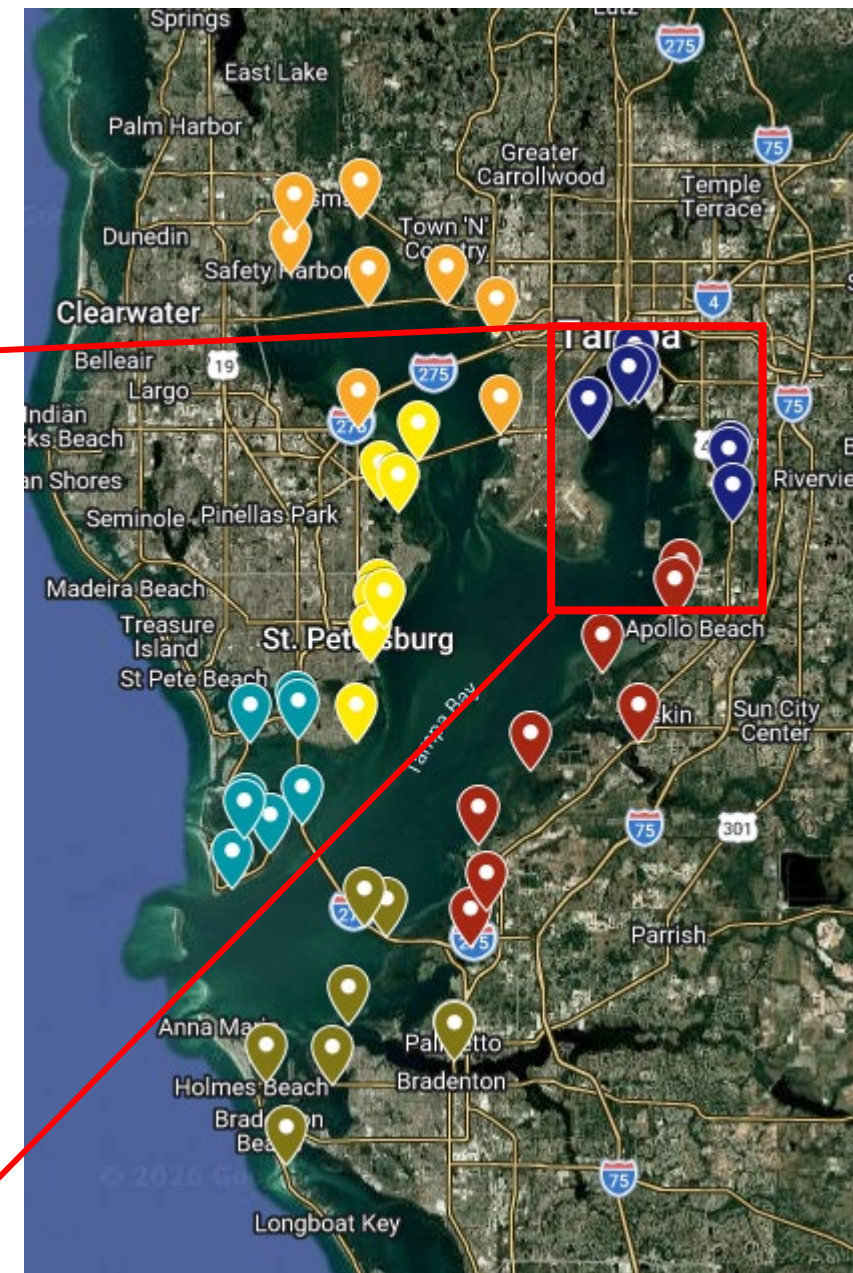
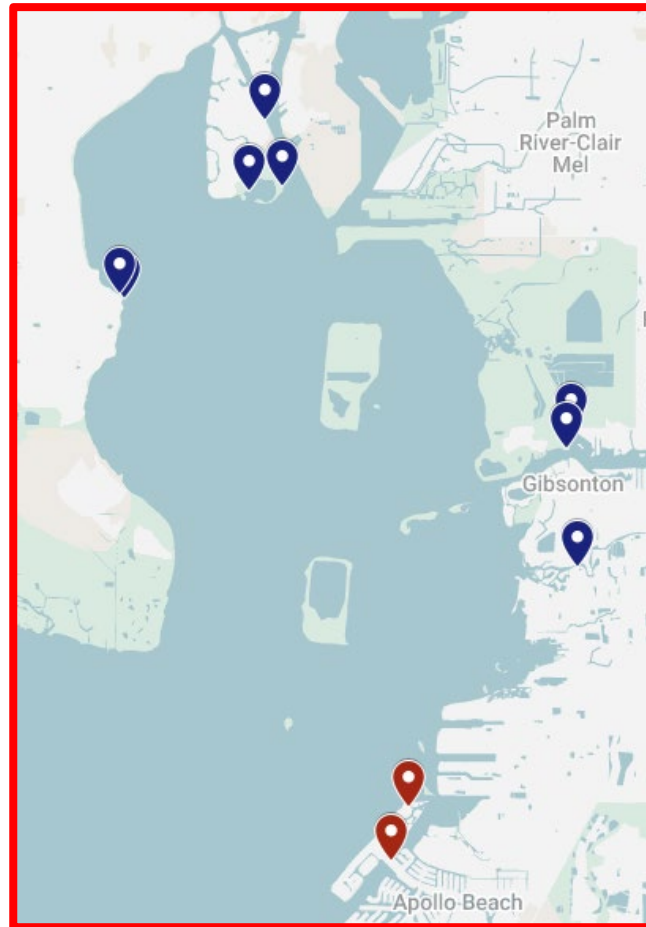


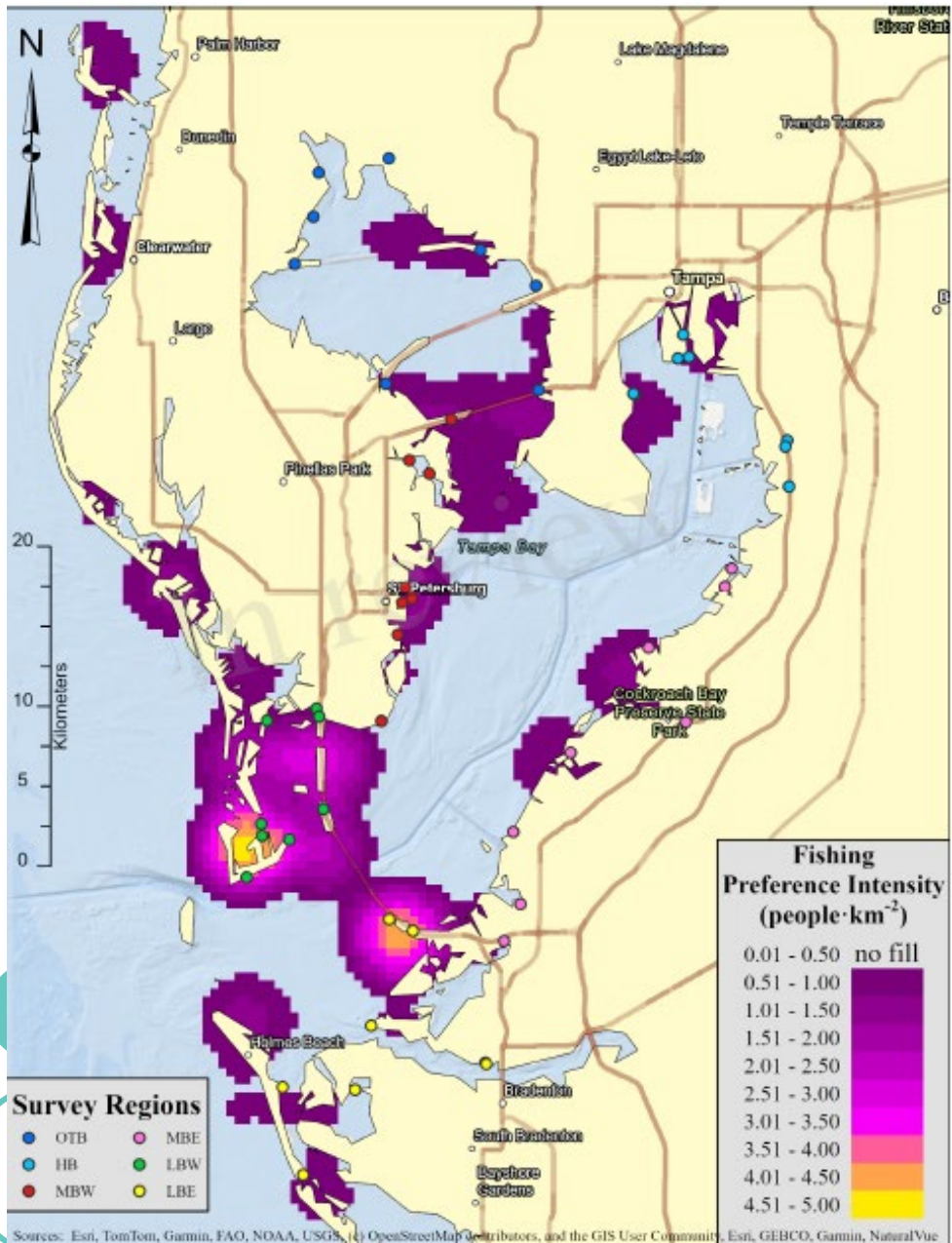
PFAS results so far from TB



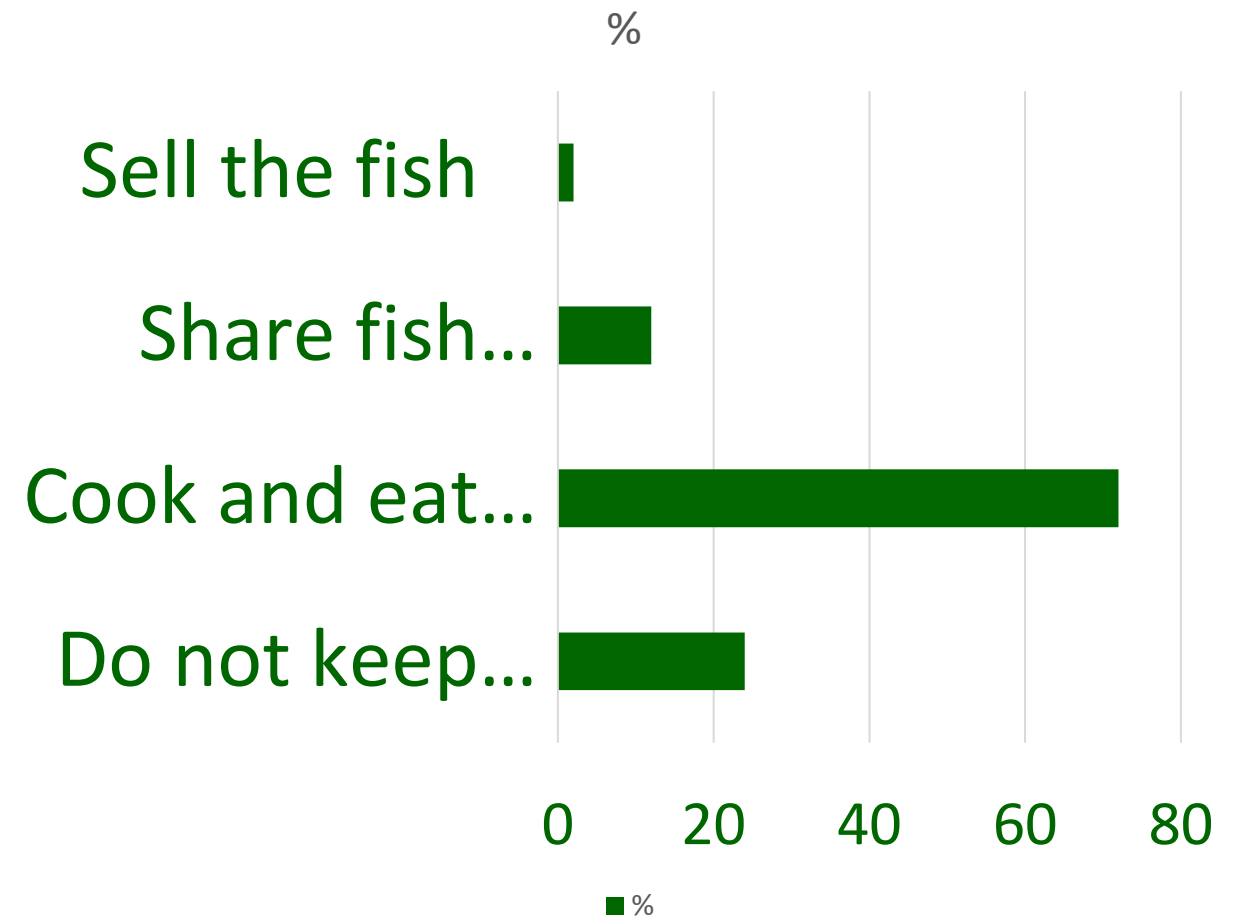
Fisher Surveys

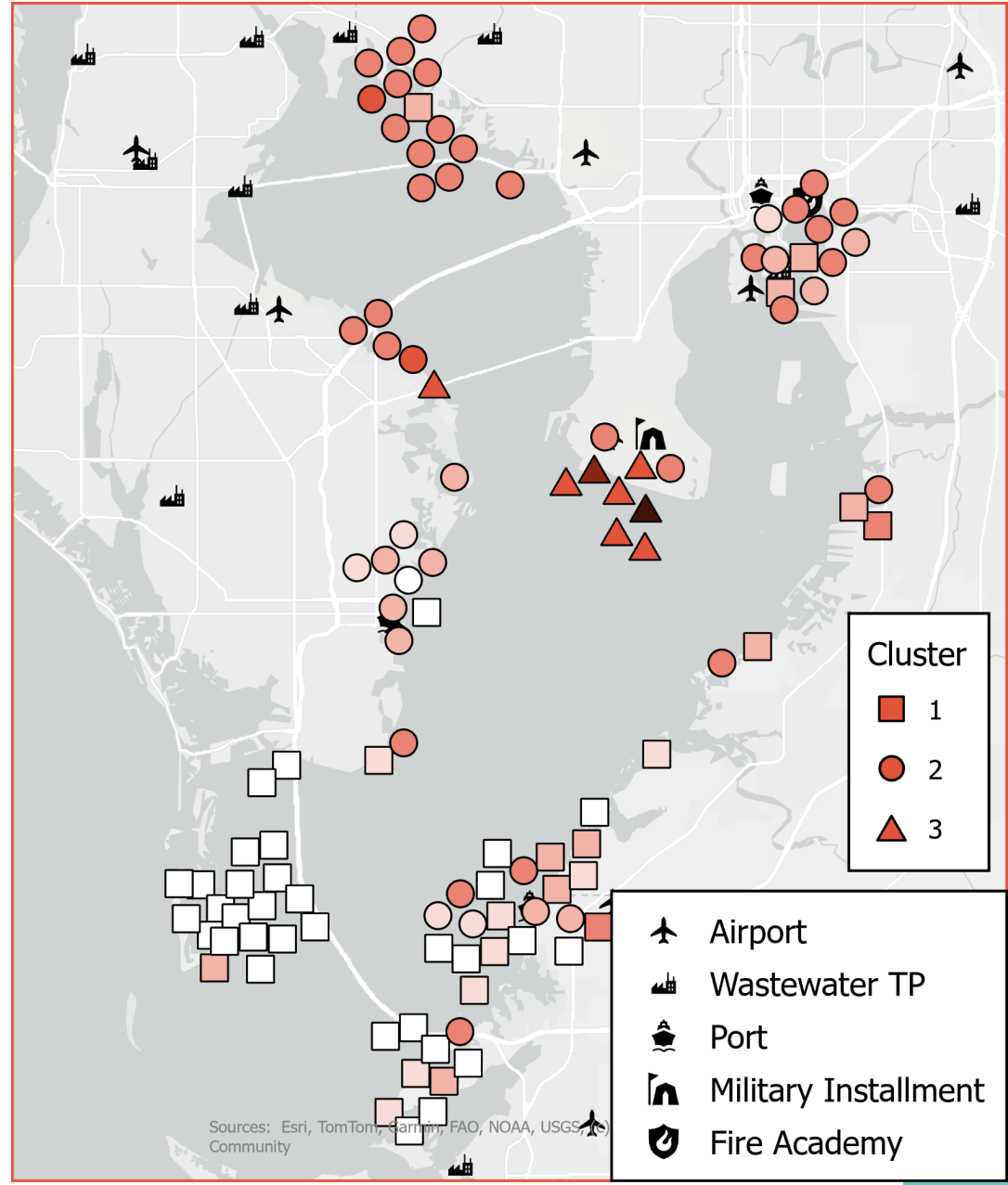
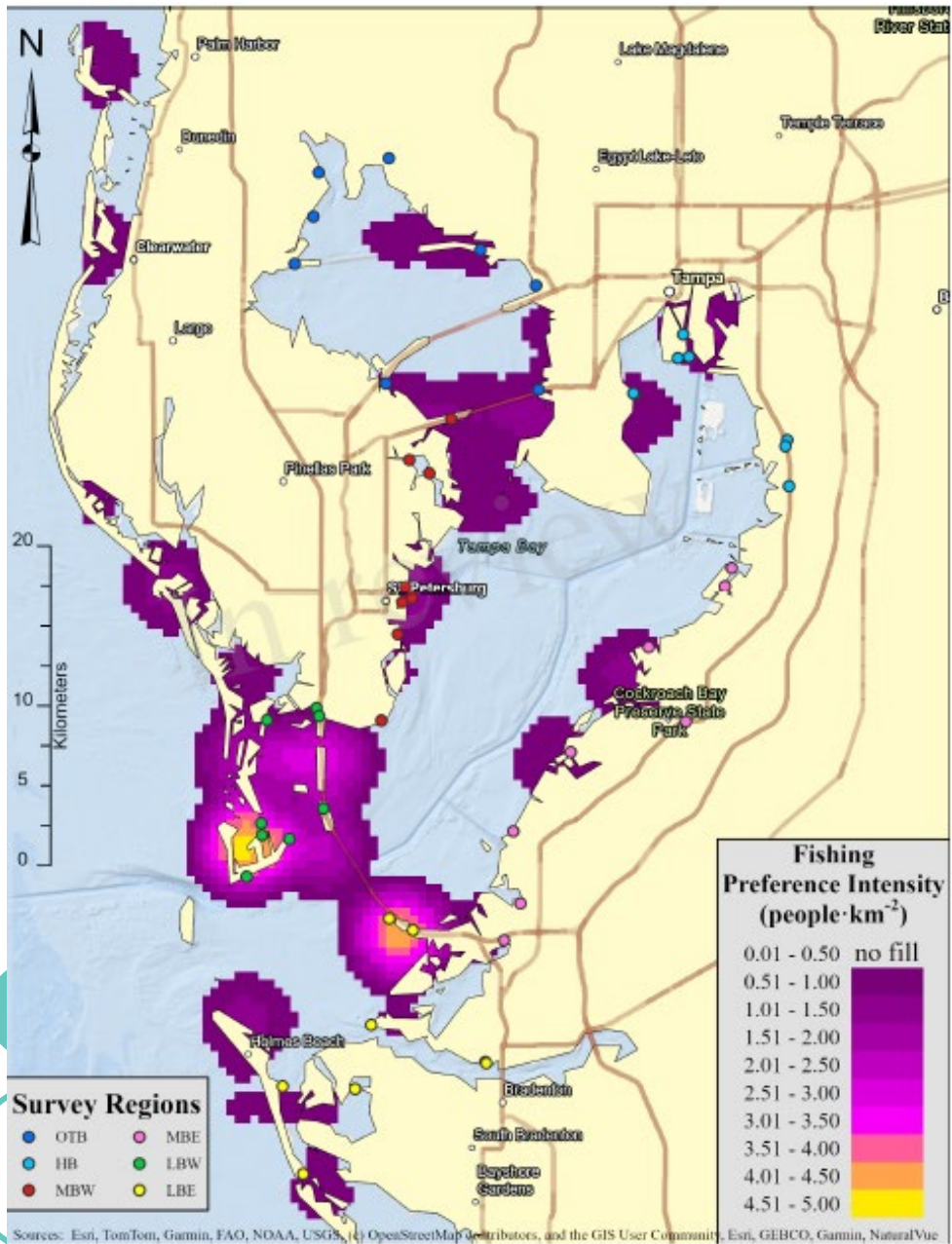
- Boat Ramps
- Bridge
- Seawall
- Shore





Sources: Esri, TomTom, Garmin, FAO, NOAA, USGS, OpenStreetMap contributors, and the GIS User Community, Esri, GEBCO, Garmin, NaturalVue





Objectives of the EPCHC-Funded Project



- Evaluate the concentrations of pollutants, including PFASs, polychlorinated biphenyls (PCBs), organochlorine pesticides (OCPs), and selected metals in sediments and recreationally caught fishes and invertebrates in McKay Bay and its tributary the Palm River,
- Compare contaminant levels with a previous (2014) study of contaminants in McKay Bay,
- Assess patterns of sportfishing effort, species composition of the catch and consumption risks of fishes and oysters harvested from McKay Bay and the Palm River.

McKay Bay

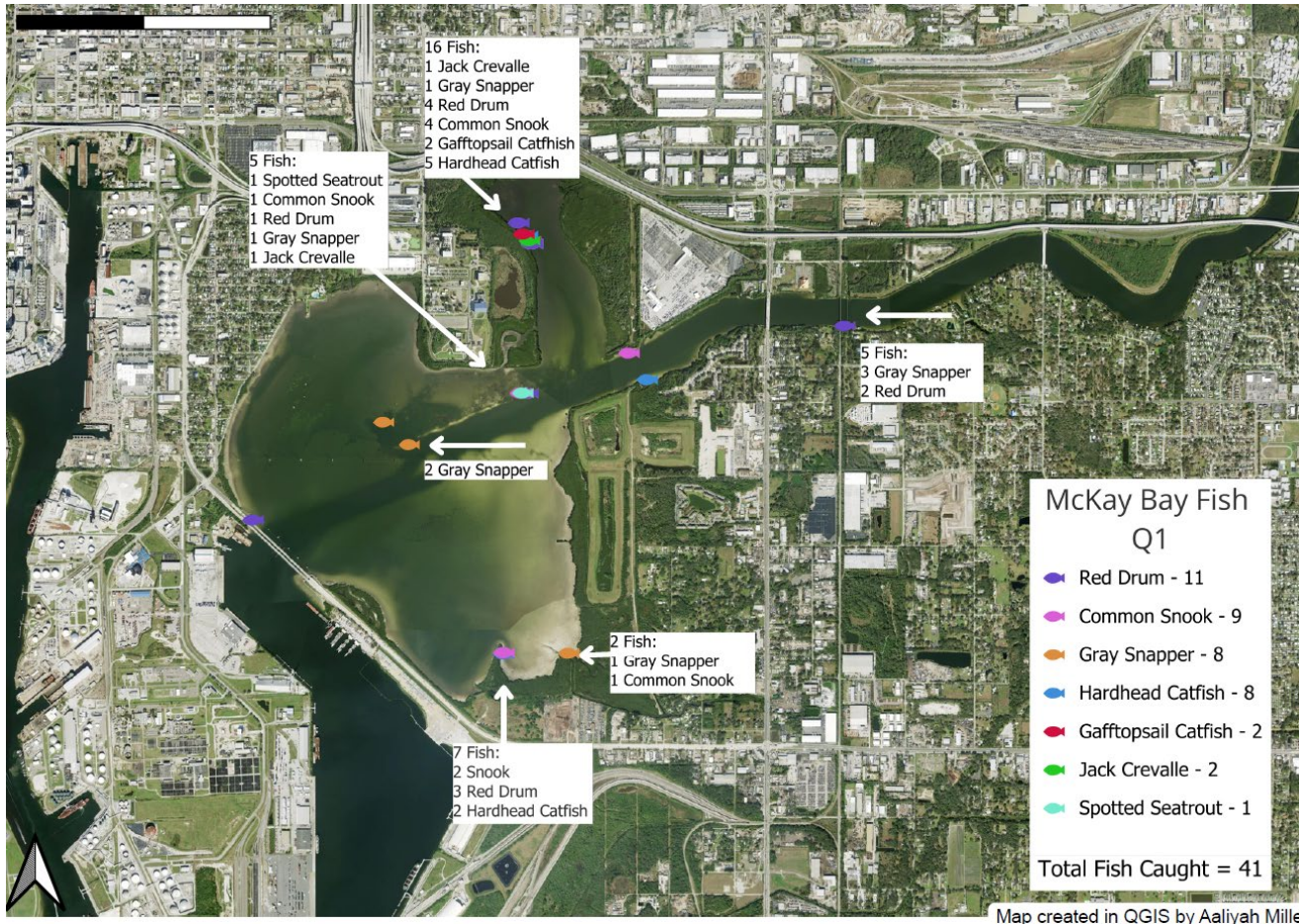


Specific Projects as part of EPCHC Study



- Collect & analyze 10 of each target species quarterly for a year + other species of interest (trout, redfish, snook, + others being fishes) using local charter vessels
- Replicate sediment sampling at 20 sites including those previously sampled by EPCHC
- Collect & analyze oyster samples from five naturally occurring reefs quarterly
- Use a roving intercept study, to obtain information on the demographics, frequency of participation, consumption patterns and species sought of coastal fishers utilizing the Bay (40 question survey)

McKay Bay Sampling – Quarter 1



- Almost completed Q1 sampling
- Collect oysters at spatial gradient:
Palm River → Hillsborough Bay
- Begin fisher surveys

Next steps – comprehensive FLORIDA study



- FL DEP, USF, UF, FIU
- Comprehensive state-wide review
- Focus on fish/fish habitats
- PFAS, pharmaceuticals and microplastics



Tampa Bay
Surveillance Project

Characterization of contaminants
of emerging and known concern
(CECs/CKCs) from wastewater
effluent and remediation via iron
electrocoagulation.



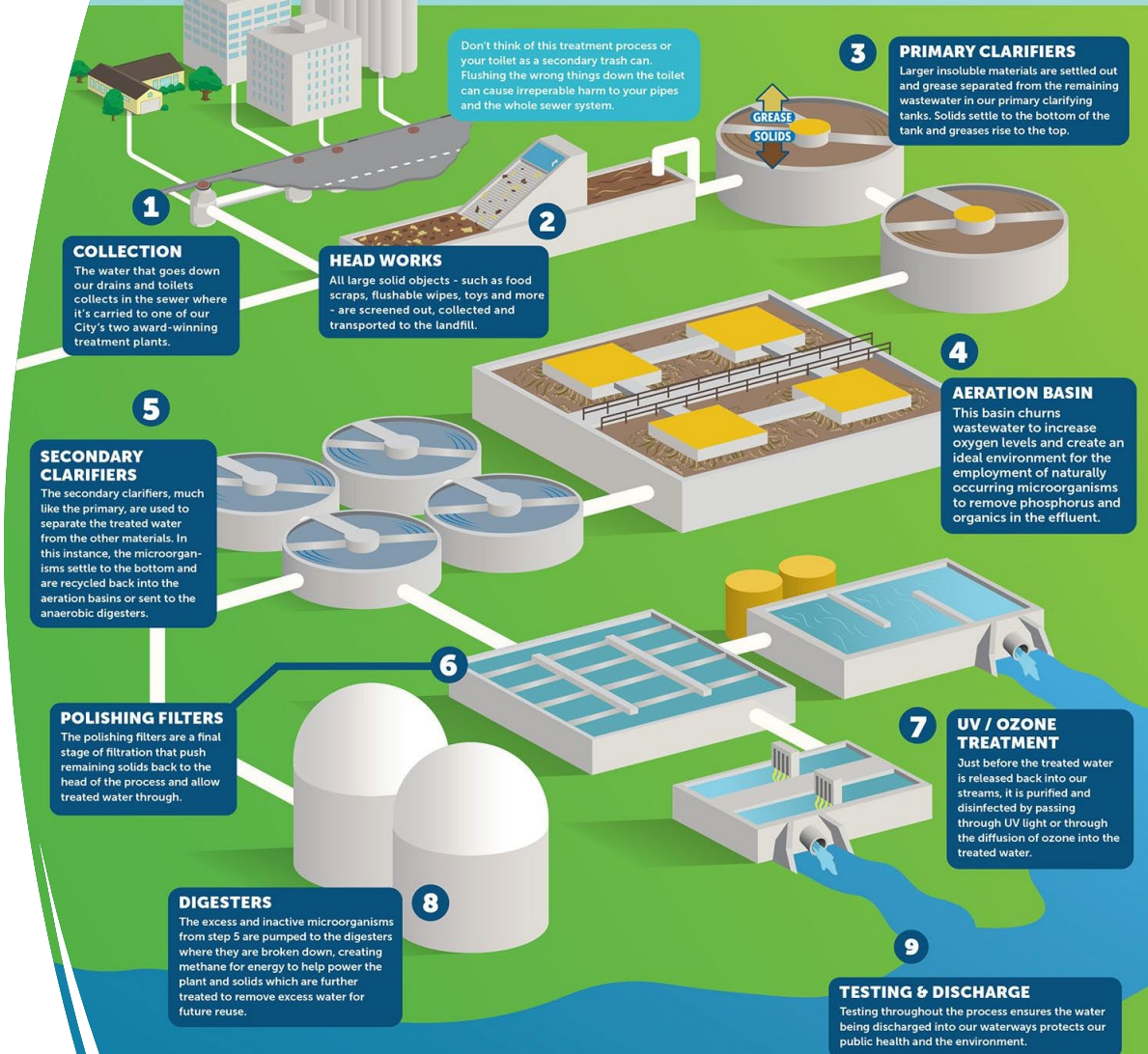
AJ Gross*, Isabel
Romero, Steve
Murawski, Mya Breitbart
FLERA 2026



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SOUTH FLORIDA

Springfield's two award-winning wastewater treatment plants use high tech processes and innovative technology to treat our community's wastewater for the protection of human health and the environment. But this job doesn't rest solely on the shoulders of our dedicated plant workers. **The water treatment process starts at home!** Learn more about the treatment process and what you can do to help at springfieldmo.gov/wastewater.

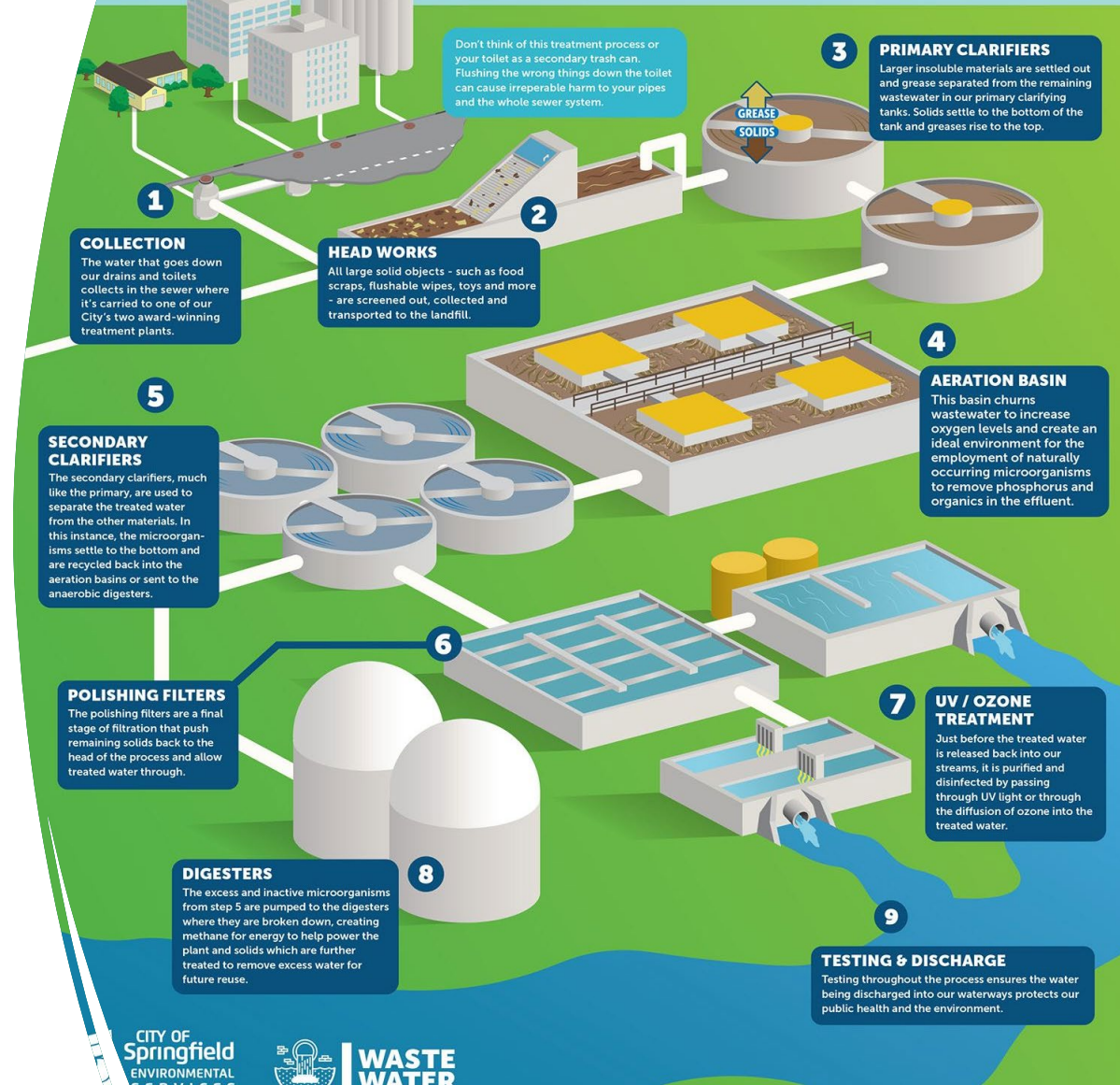
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Wastewater Treatment

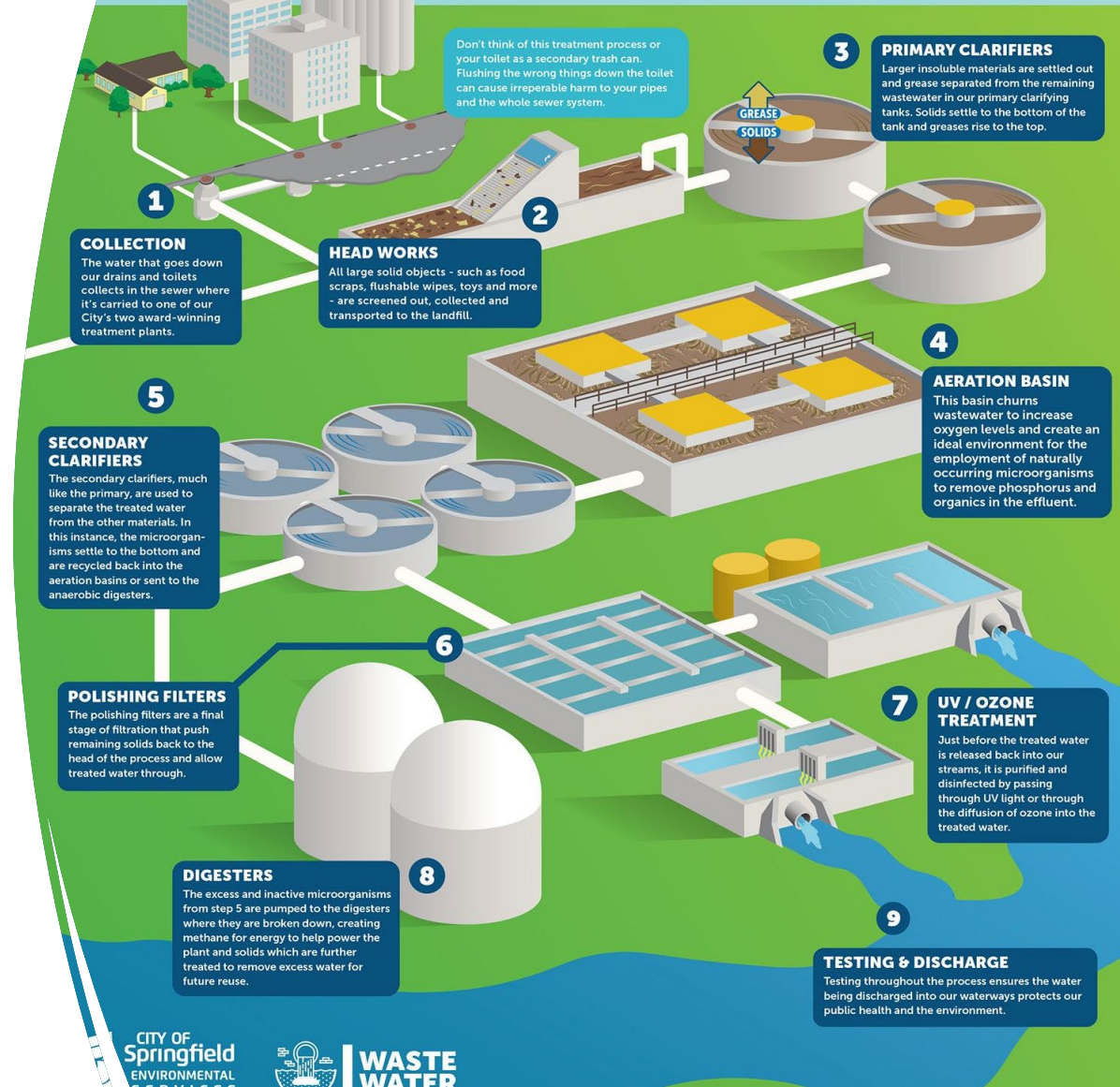
- Processes and treats water from showers, toilets, and sinks
- Creates reclaimed water that we can use to water our lawns and gardens



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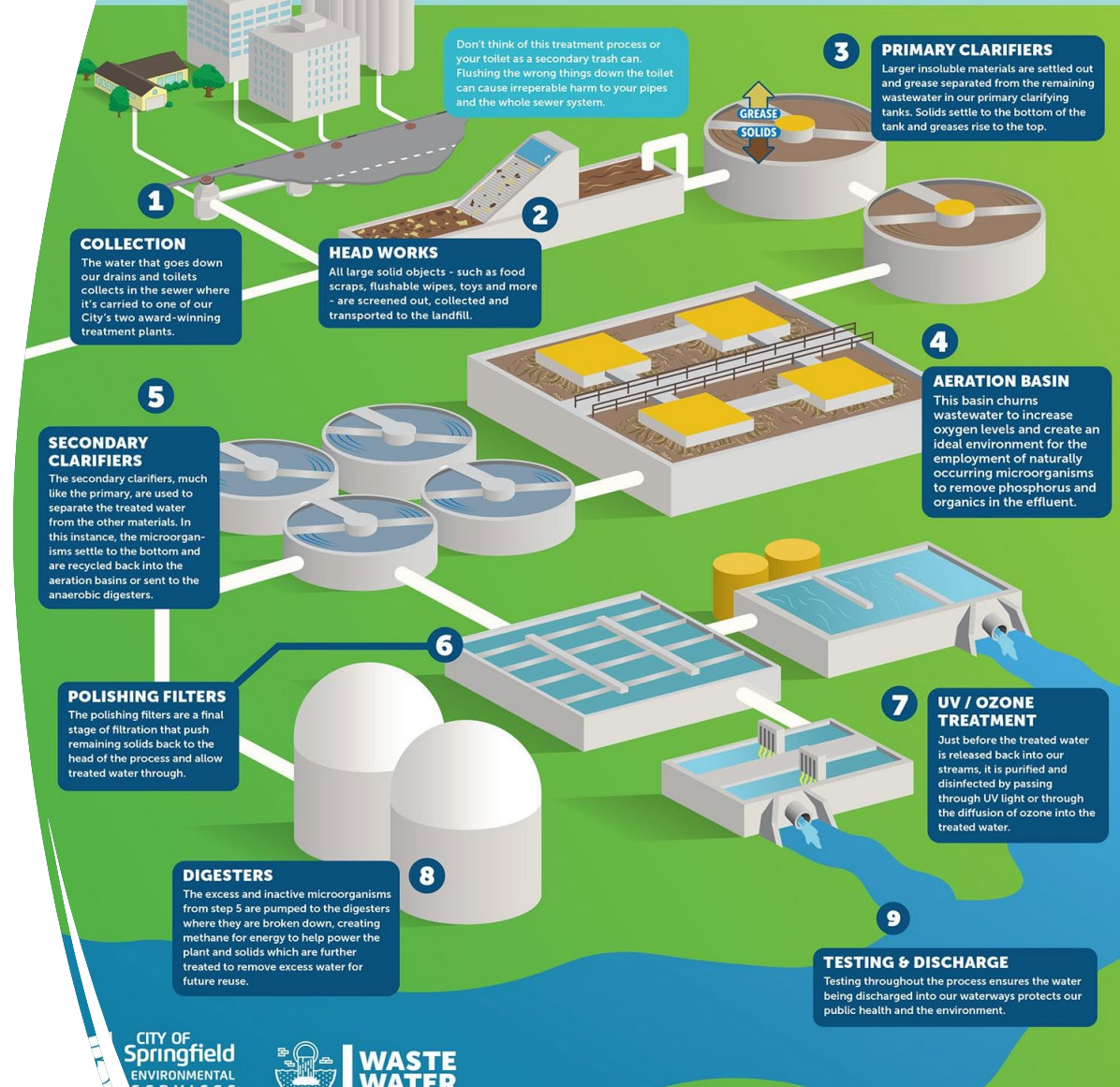
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- Can also discharge this water into nearby surface waters



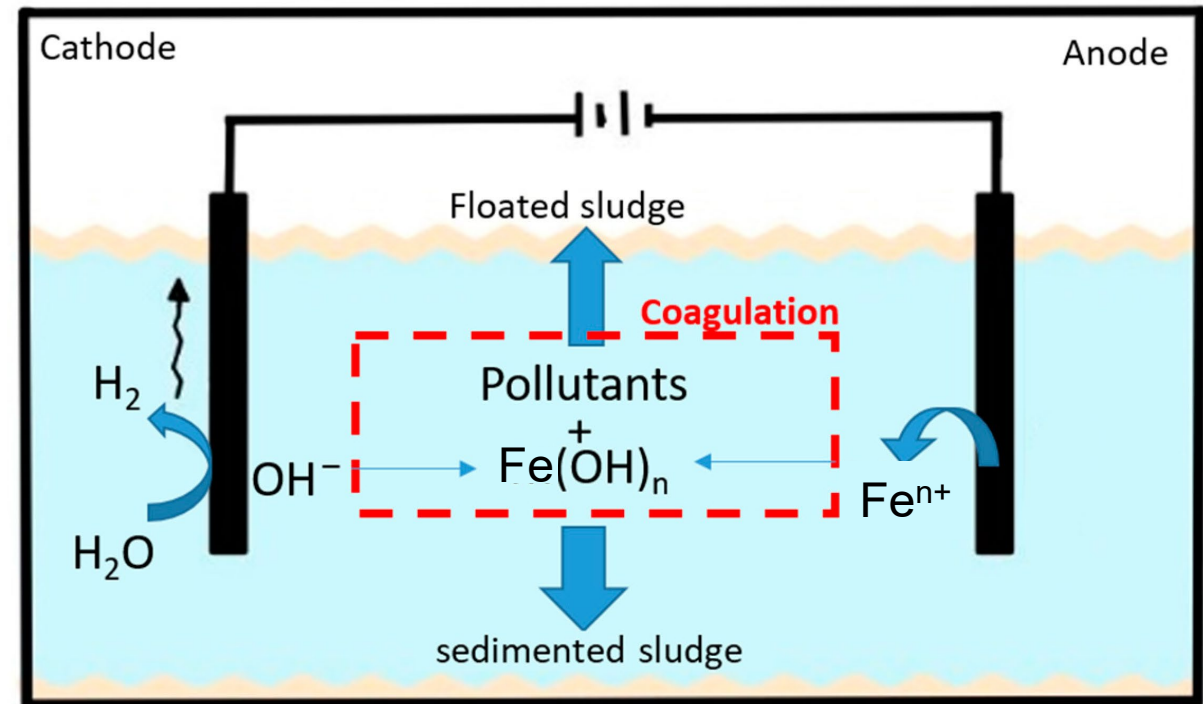
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Wastewater Treatment

- Processes and treats water from showers, toilets, and sinks
- Creates reclaimed water that we can use to water our lawns and gardens
- Can also discharge this water into nearby surface waters
- Requires specialized equipment to process chemical contaminants



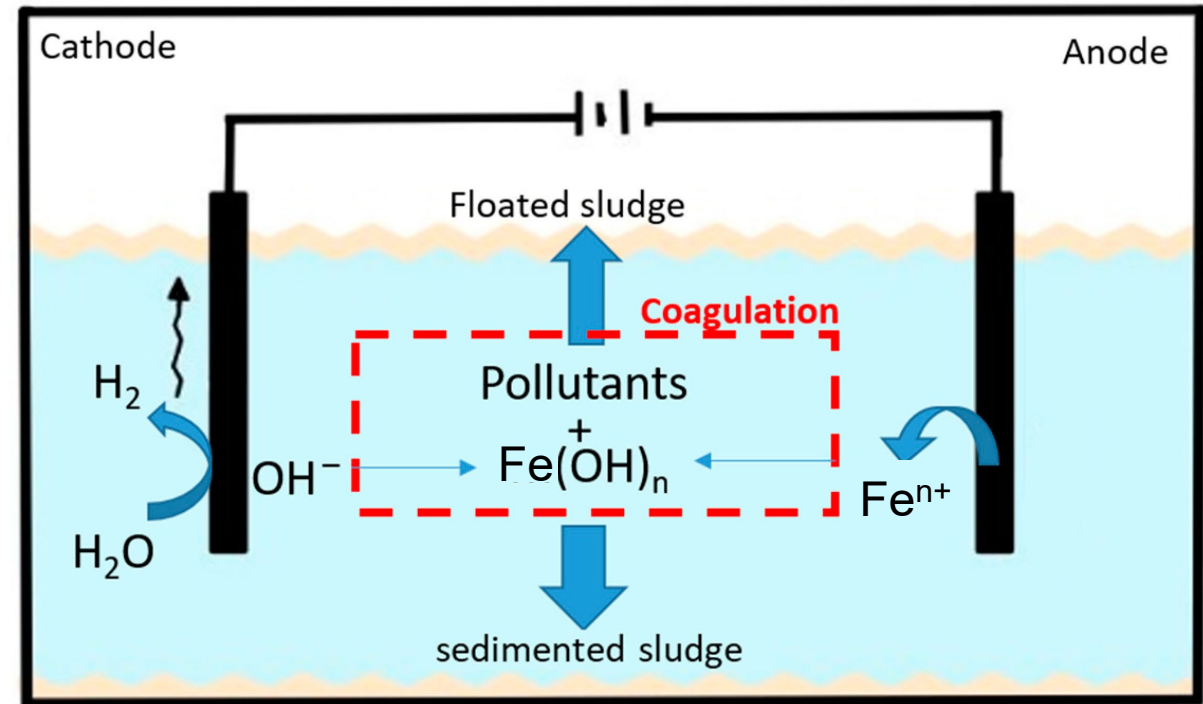
Electrocoagulation



Włodarczyk-Makula et al. 2023

Electrocoagulation

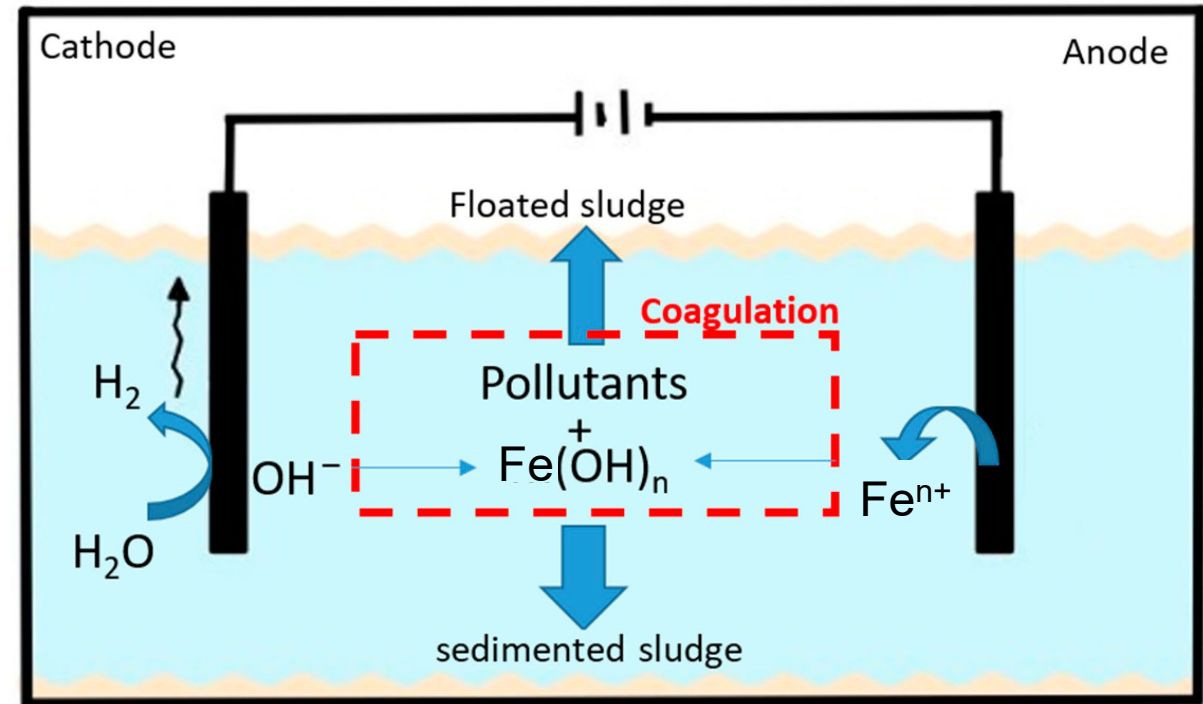
- Utilizes electricity to coagulate particulates and dissolved chemicals into flocculant and sludge



Włodarczyk-Makula et al. 2023

Electrocoagulation

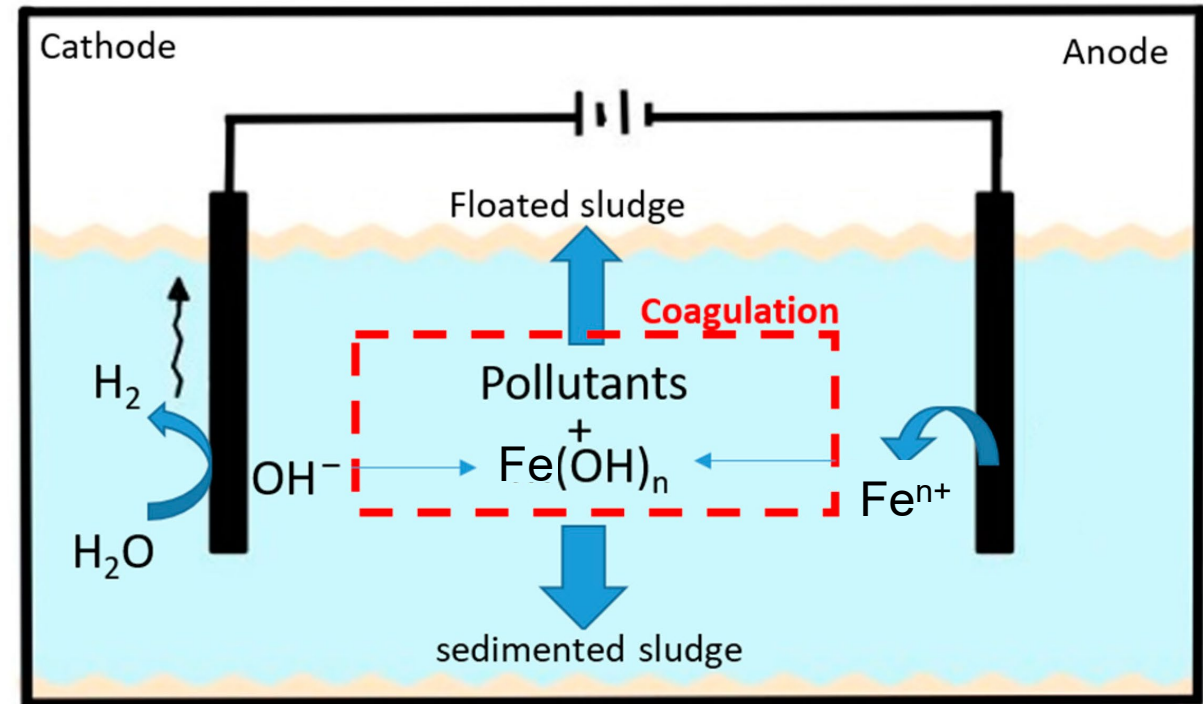
- Utilizes electricity to coagulate particulates and dissolved chemicals into flocculant and sludge
- Iron and Aluminum are the most common metals used
 - Cheap, nontoxic, and easily available



Włodarczyk-Makula et al. 2023

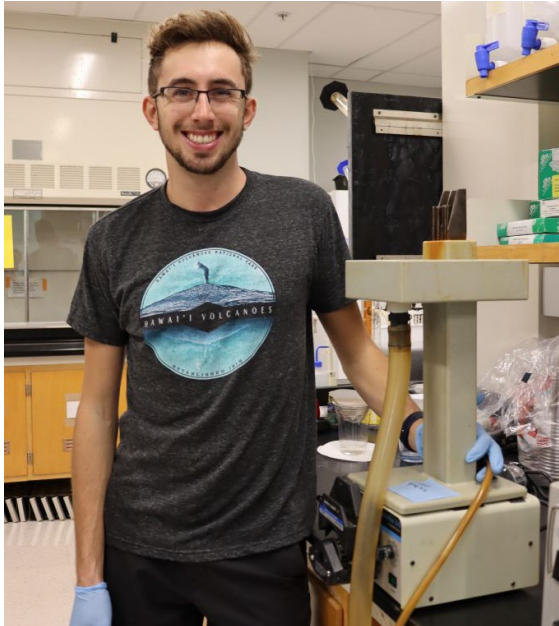
Electrocoagulation

- Utilizes electricity to coagulate particulates and dissolved chemicals into flocculant and sludge
- Iron and Aluminum are the most common metals used
 - Cheap, nontoxic, and easily available
- Flocculant or sludge is then filtered or settled out and removed



Włodarczyk-Makula et al. 2023

Electrocoagulation



Experimental Design

- Philosophy: 'real-world' conditions



Experimental Design

- Philosophy: 'real-world' conditions
- Three main compound groups:
 - 32 Polychlorinated biphenyls (PCBs)
 - 36 Organochlorine pesticides (OCPs)
 - 14 Phosphorus flame retardants (PFRs)

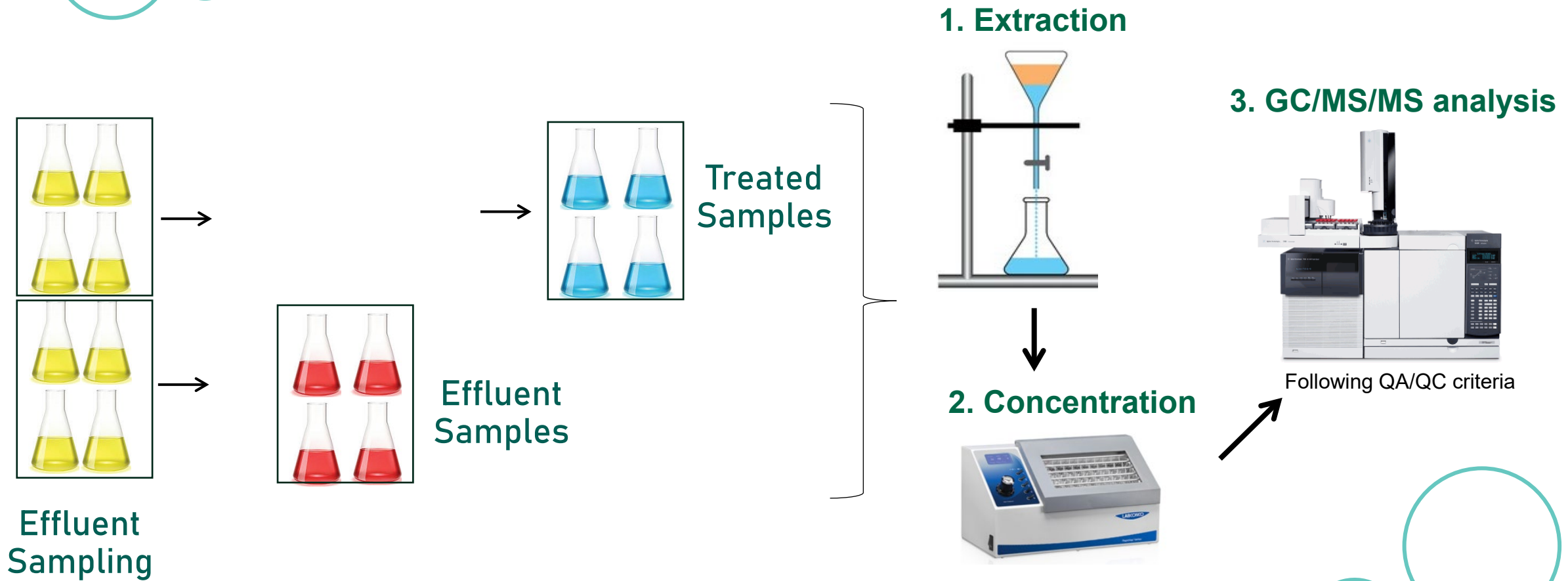


Experimental Design

- Philosophy: 'real-world' conditions
- Three main compound groups:
 - 32 Polychlorinated biphenyls (PCBs)
 - 36 Organochlorine pesticides (OCPs)
 - 14 Phosphorus flame retardants (PFRs)
- Iron electrode, 1 minute retention time
- 4-5 amps, 95-99 volts



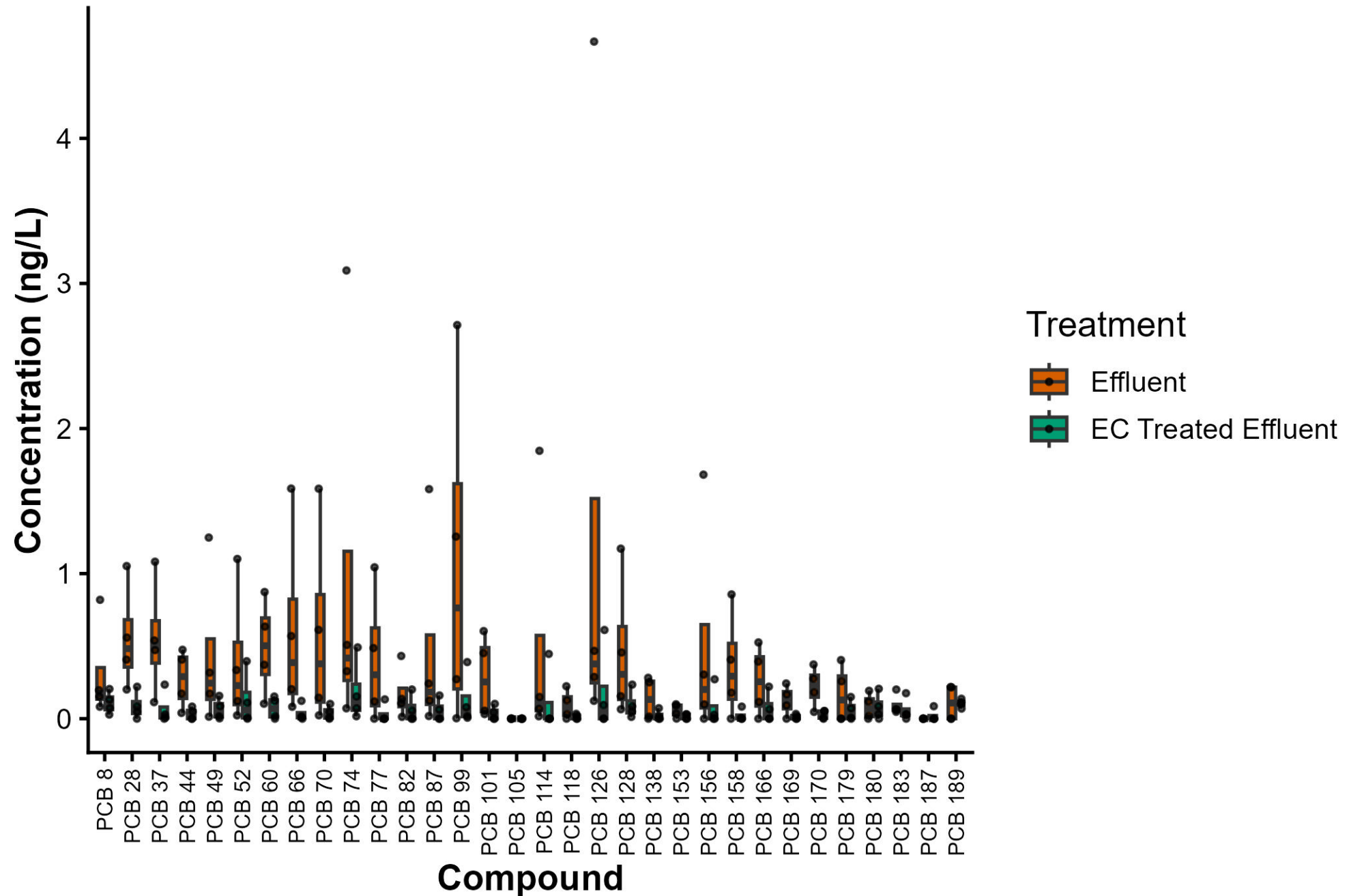
Methodology



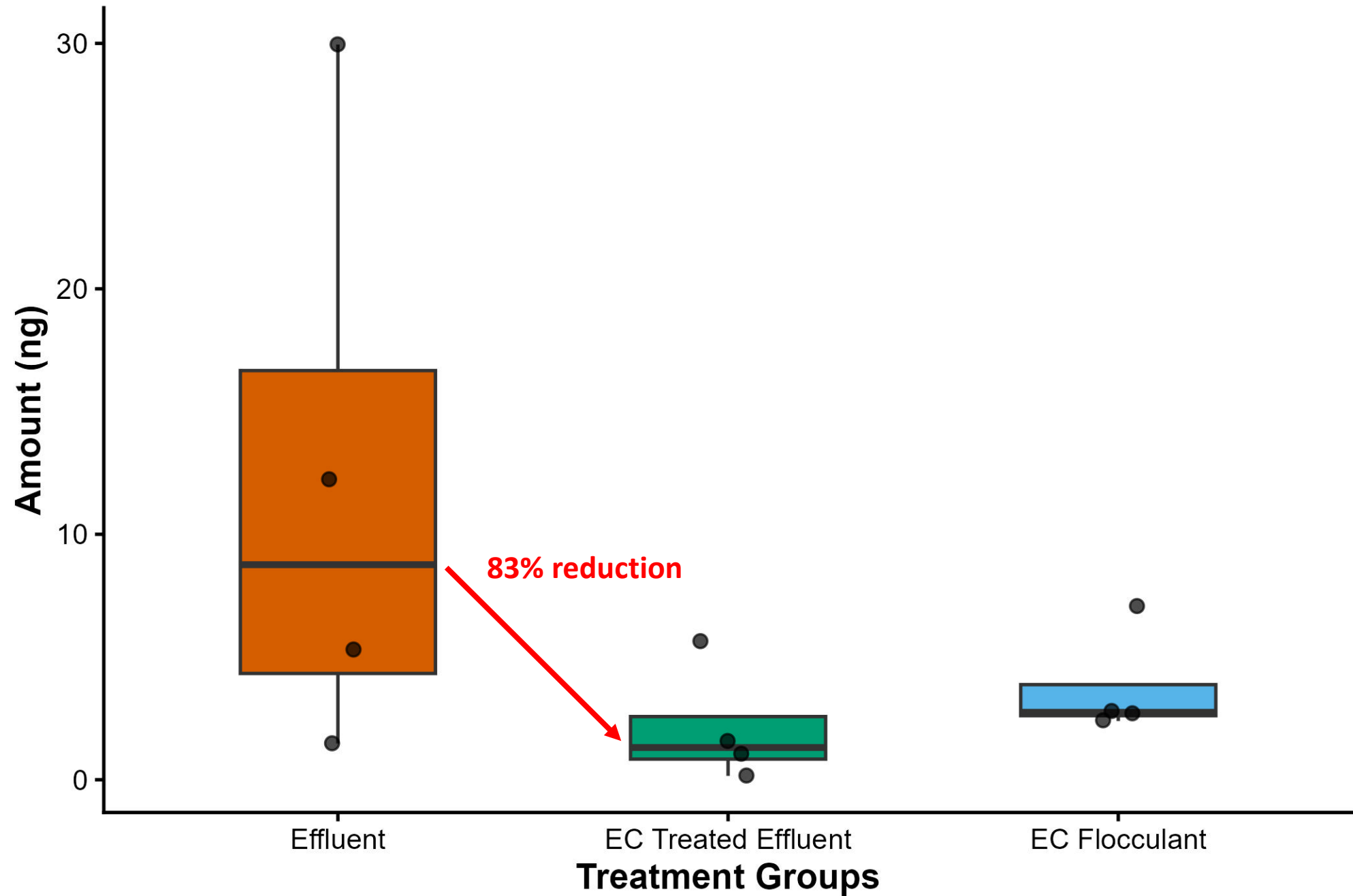
The background is a dark teal color, populated with various geometric shapes. There are several circles of different sizes, some in a medium teal and others in a lighter teal. Interspersed among these are a few grey hexagons. Some of the circles are solid, while others are just outlines. The shapes are scattered across the frame, creating a modern, abstract pattern.

Results

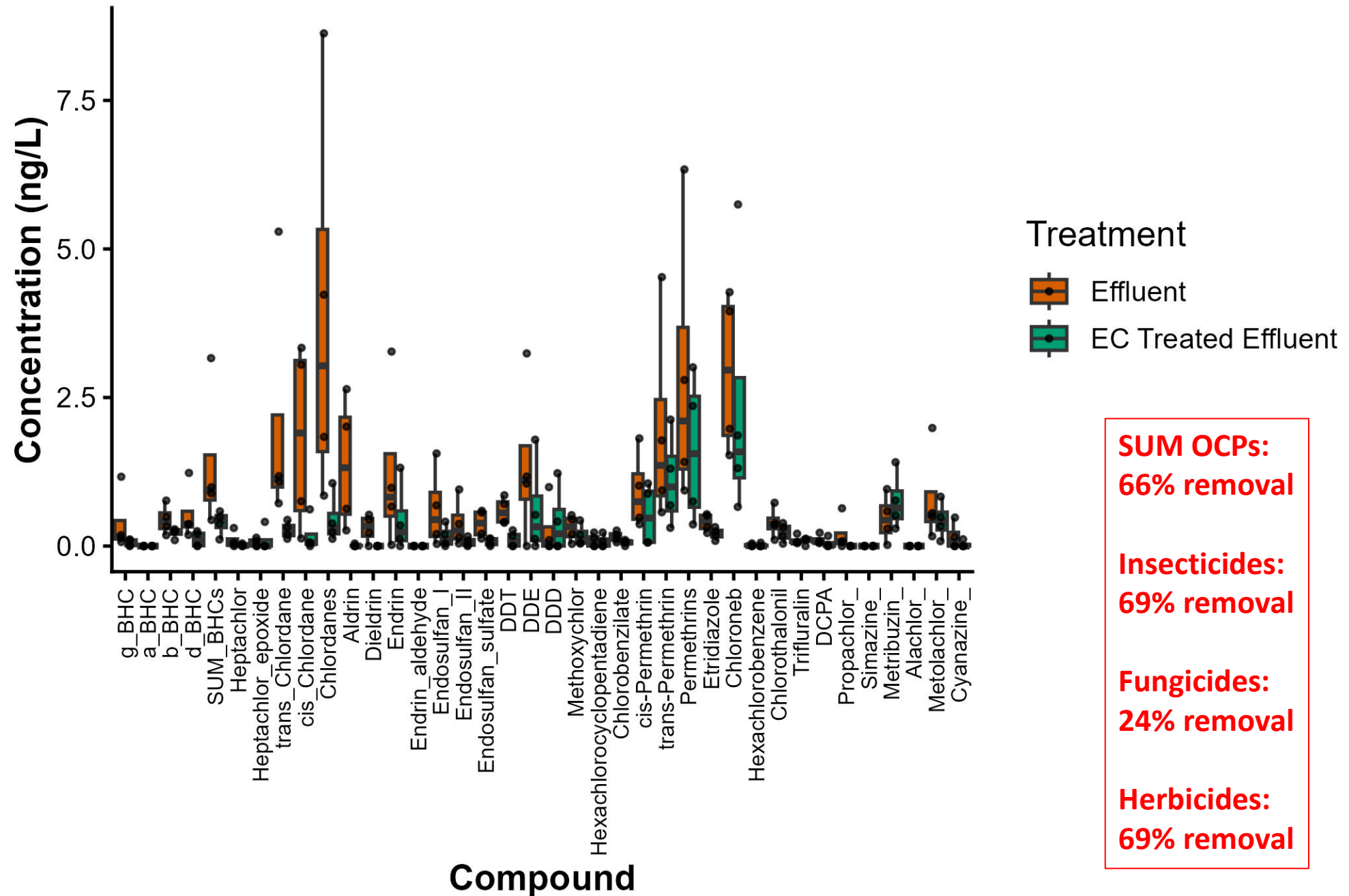
Iron Electrode Experiment: Individual PCBs



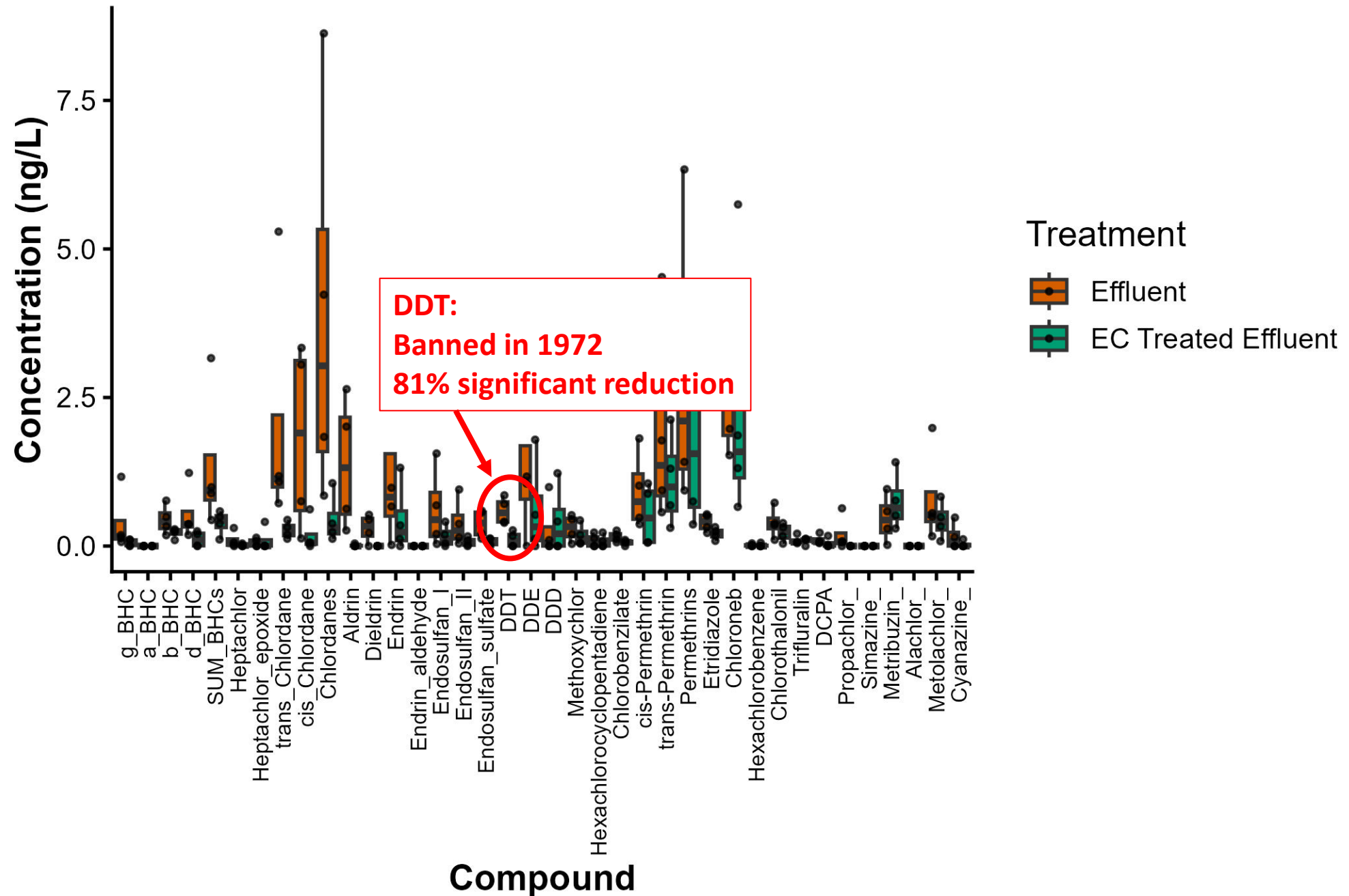
Iron Electrode Experiment: SUM PCBs



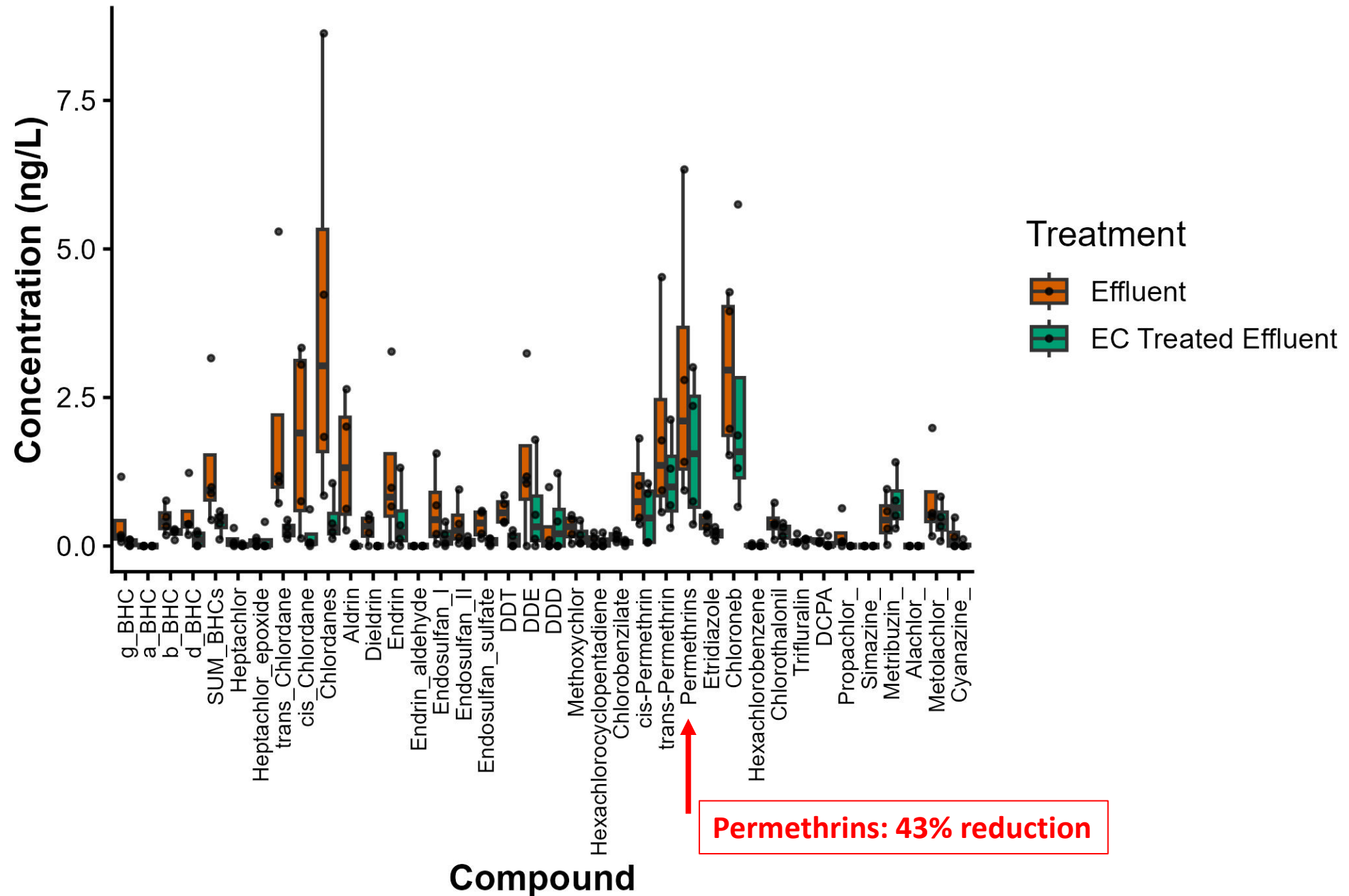
Iron Electrode Experiment: Individual OCPs



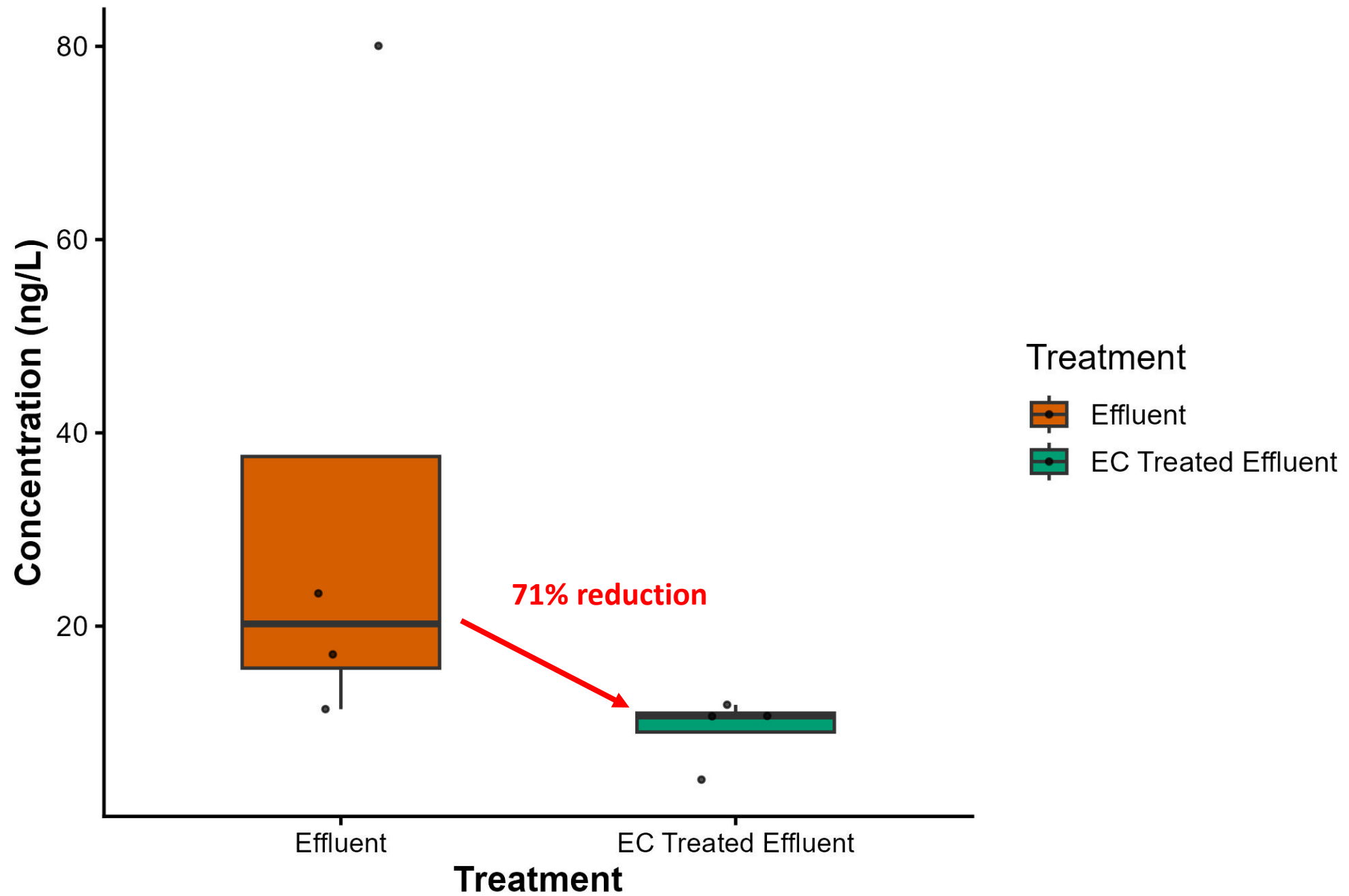
Iron Electrode Experiment: Individual OCPs



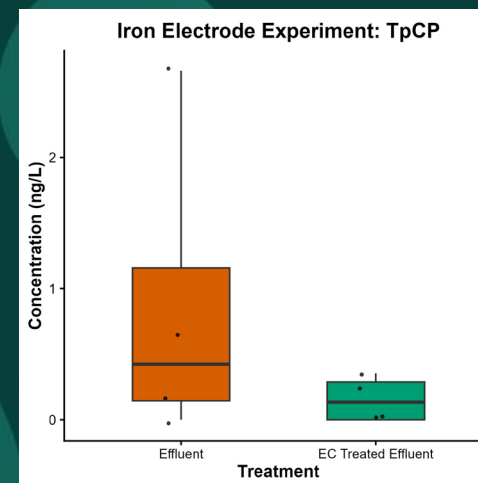
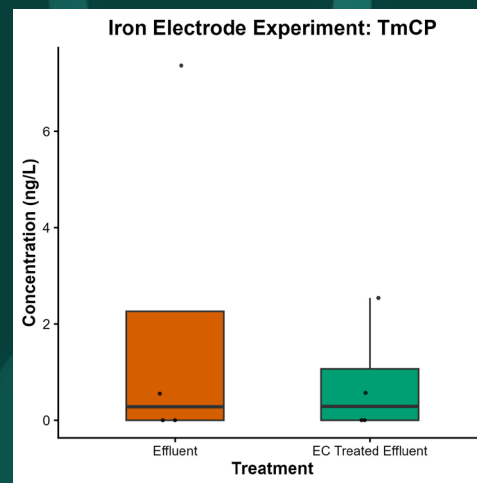
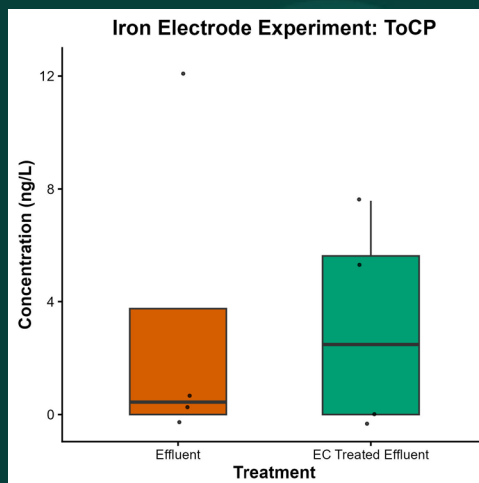
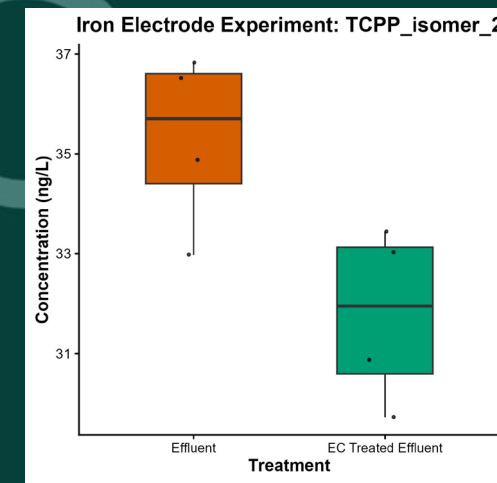
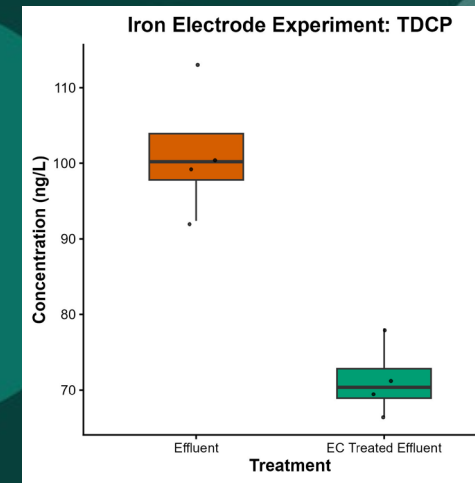
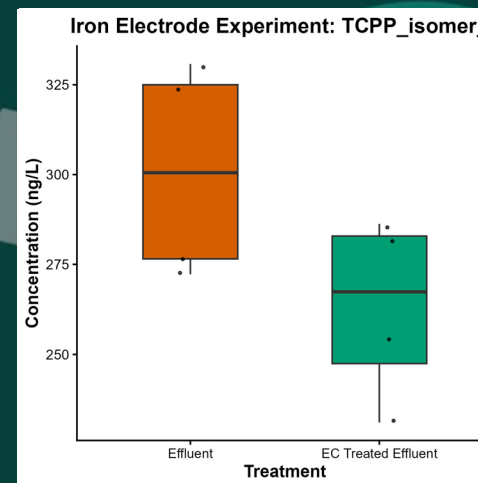
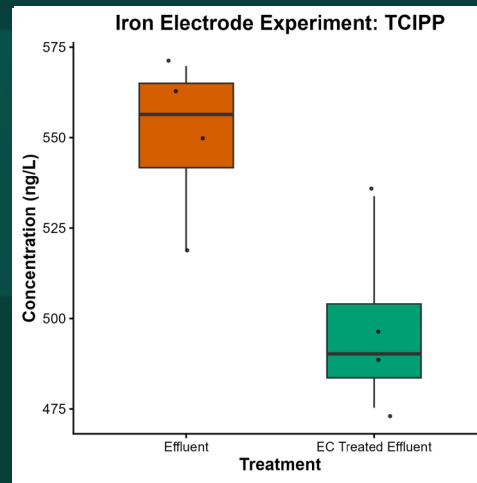
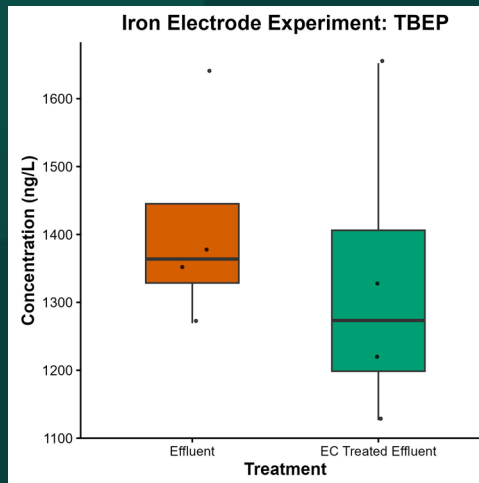
Iron Electrode Experiment: Individual OCPs



Iron Electrode Experiment: Atrazine



IRON ELECTRODE – PFRs

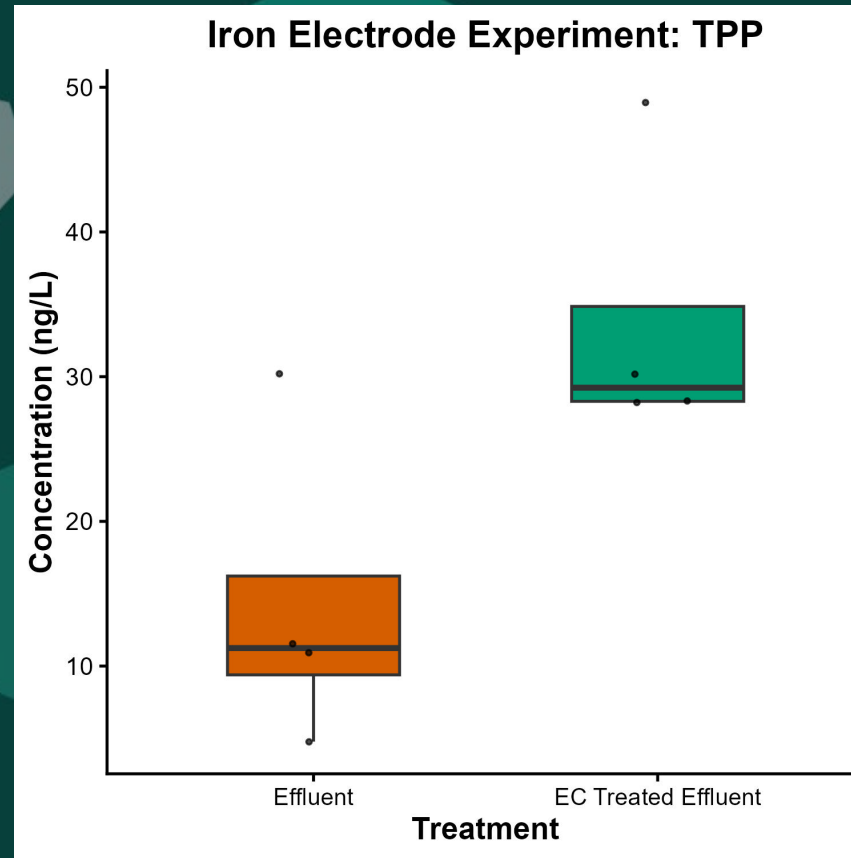
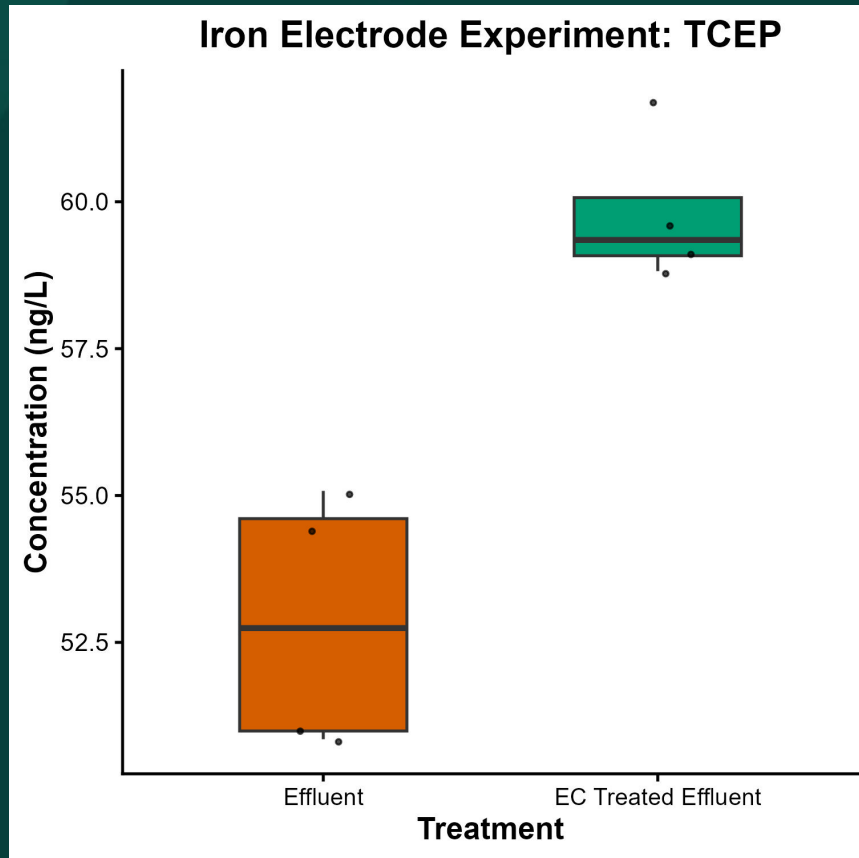


Treatment

Effluent

EC Treated Effluent

IRON ELECTRODE increased PFRs



Treatment

- Effluent
- EC Treated Effluent

Concluding Thoughts



- Electrocoagulator treatment shows removal of contaminants
 - Ability to change parameters of the method: (retention time, power, electrodes)
- CECs/CKCs in wastewater effluent are numerous and concerning

Future Directions



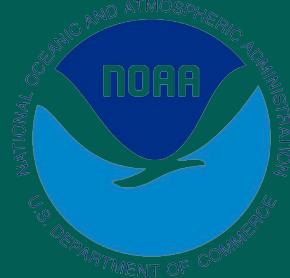
- Multivariate Analyses between compound groups
- Manuscript in prep.
- My Master's Project: Contaminants in oysters in Tampa Bay, FL



Thank You!



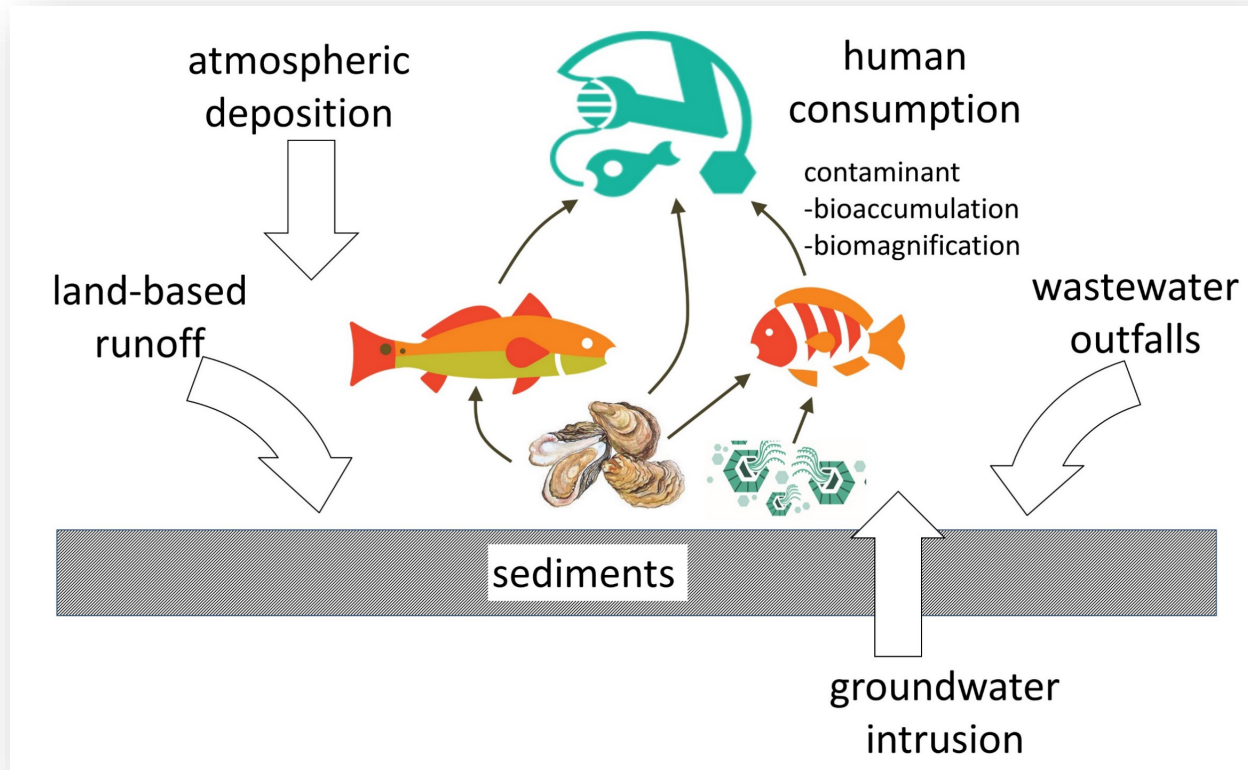
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Where we want to take this study....Systems Analysis & Modeling

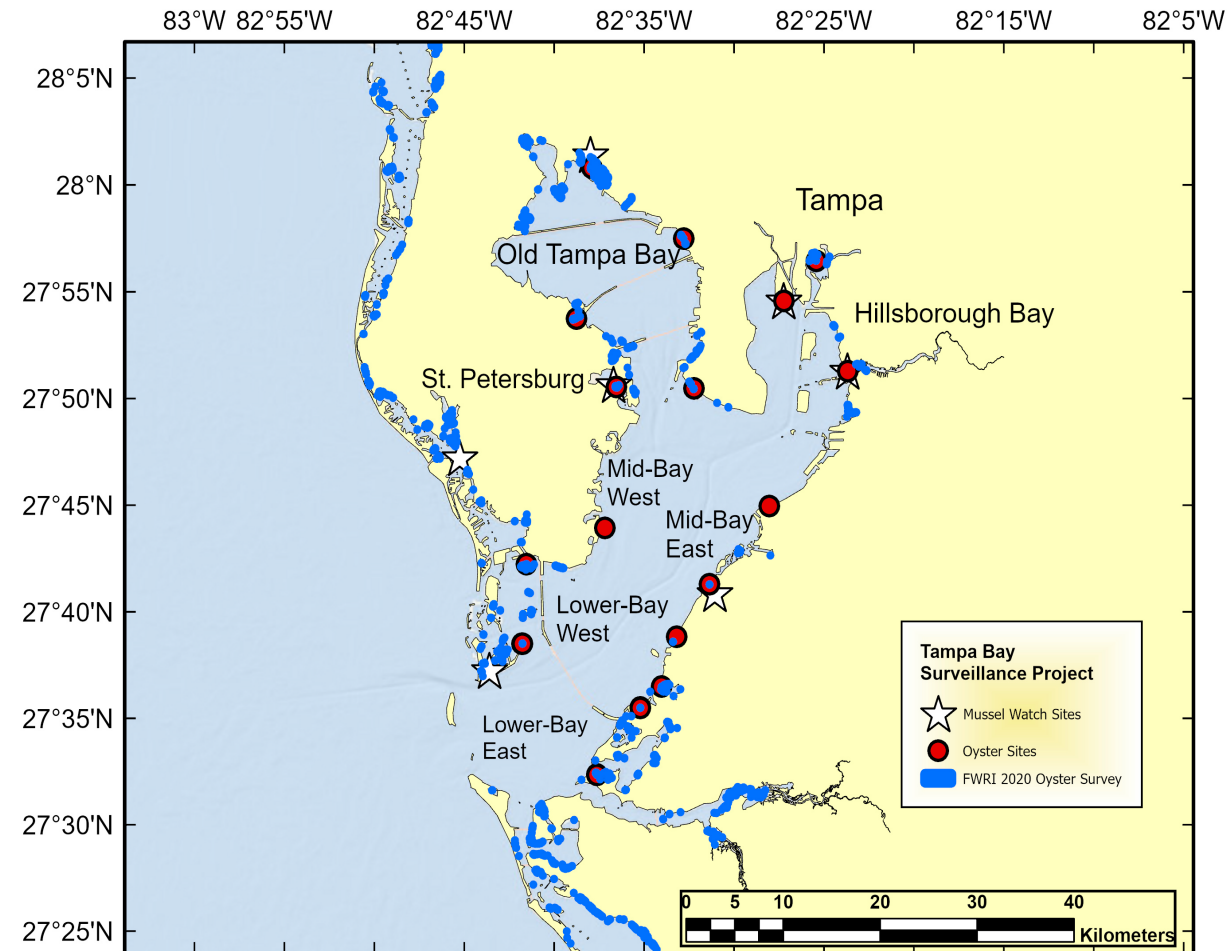
- Mass Balance of pollutants entering/exiting the Bays
- Particle tracking
- Food web and contaminant flows, including bio-accumulation/magnification, pollutant degradation/offloading



Back-up Slides

Oysters in Tampa Bay

- Sedentary adult stages amenable to site-based studies, human consumption (leases, subsistence)
- Considerable natural oyster beds in Tampa Bay (2020 FWRI assessment)
- Ongoing NOAA Mussel Watch sites (6) use oysters (protocol, methods and historical data- 1986-2012)
- 18 sites * 4 quarters * 2 sub-sites (2x8 oyster composites, total n=16 oysters per site) = 1152 oysters



McKay Bay



Sediments



Barnacles/Oysters



Fish

