2022 RMP Annual Meeting

PFAS in San Francisco Bay

Martin Trinh, Miguel Mendez, Ezra Miller, Diana Lin, Rebecca Sutton

San Francisco Estuary Institute

Emerging Contaminants Team

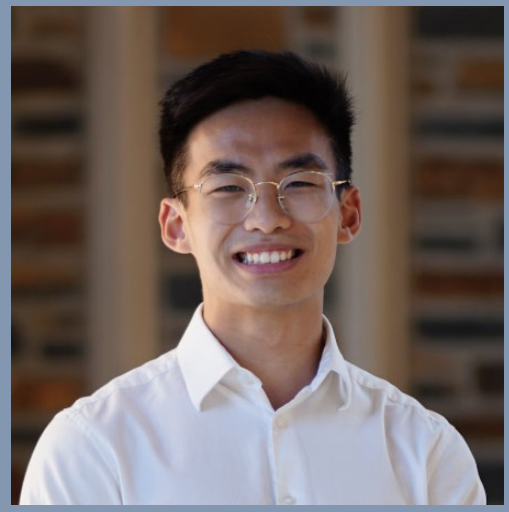
Rebecca Sutton
(she/her)

Miguel Mendez
(he/him)

Ezra Miller
(ze/zir)

Kelly Moran
(she/her)

Diana Lin
(she/her)



Martin Trinh
(he/him)

What are PFAS?

Per- and polyfluoroalkyl Substances

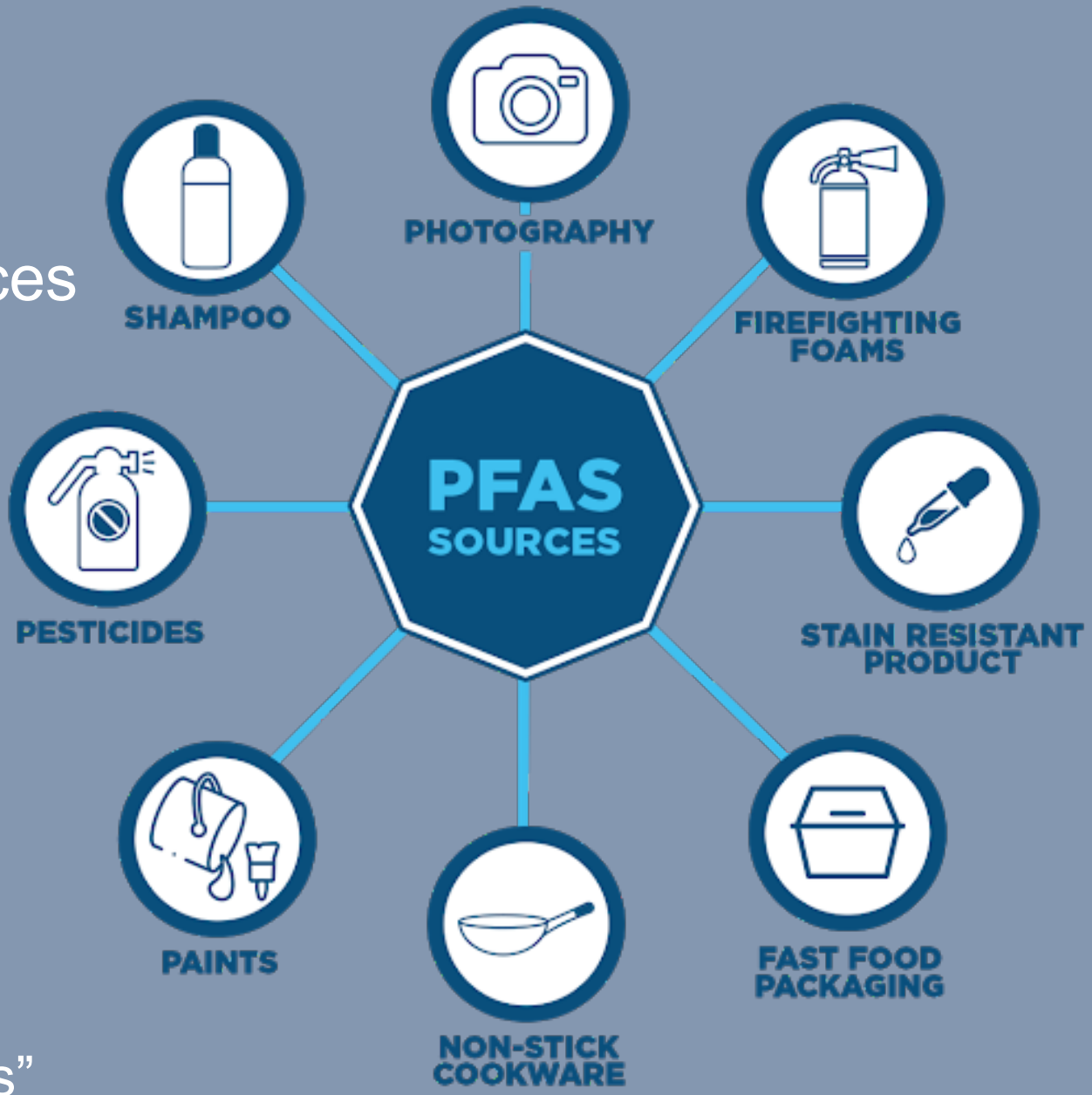


Image Credit: Regenesis

Highly persistent “Forever Chemicals”

What are PFAS?

Per- and polyfluoroalkyl Substances

⬇

No C-H bonds

Not susceptible to biological breakdown

Moderate data available

Restricted production/use

Highly persistent “Forever Chemicals”

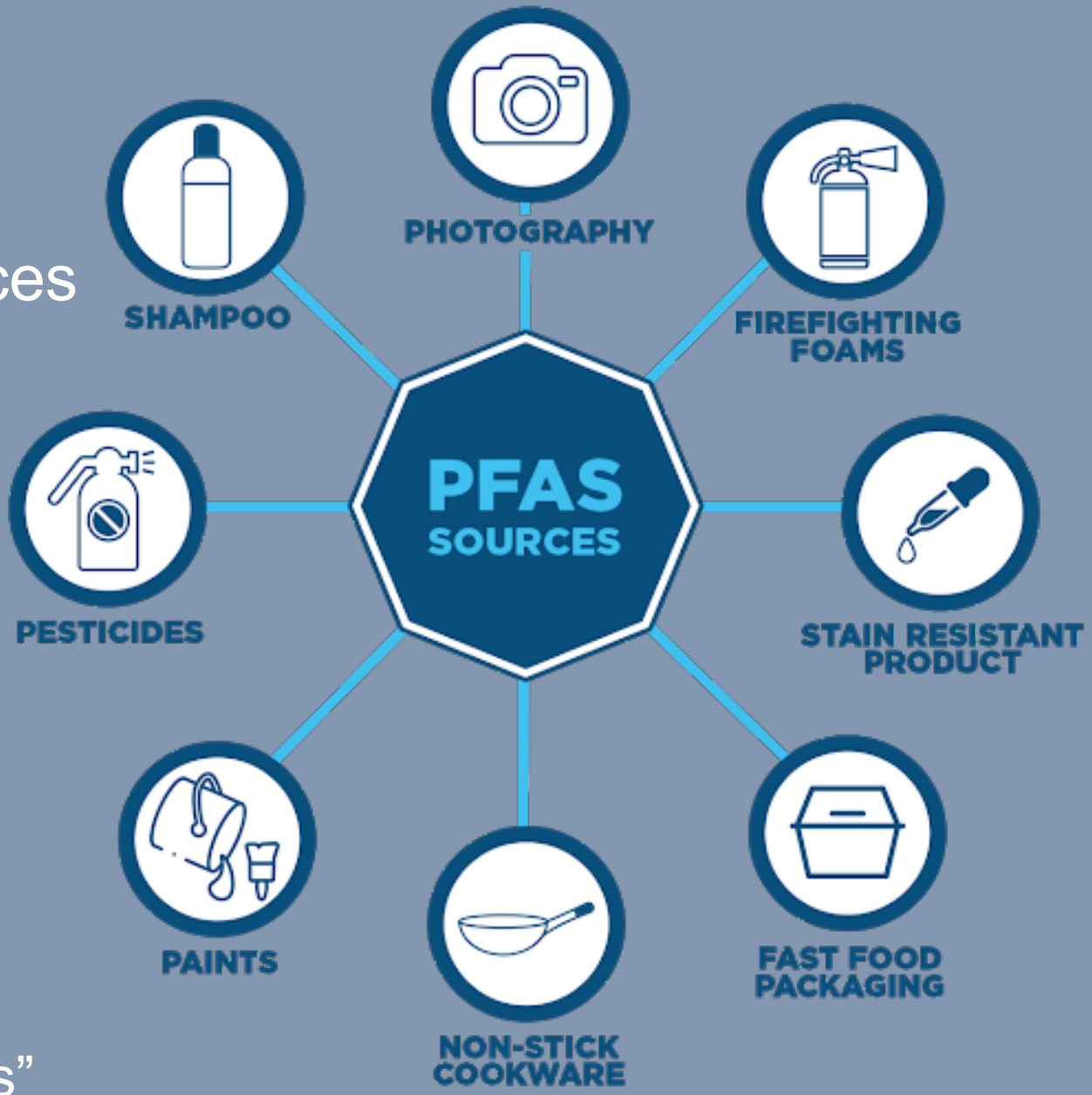


Image Credit: Regenesis

What are PFAS?

Per- and polyfluoroalkyl Substances

No C-H bonds	Contain C-H bonds or other labile features
Not susceptible to biological breakdown	Some can transform in the environment
Moderate data available	Not much data
Restricted production/use	Regrettable substitution?

Highly persistent “Forever Chemicals”

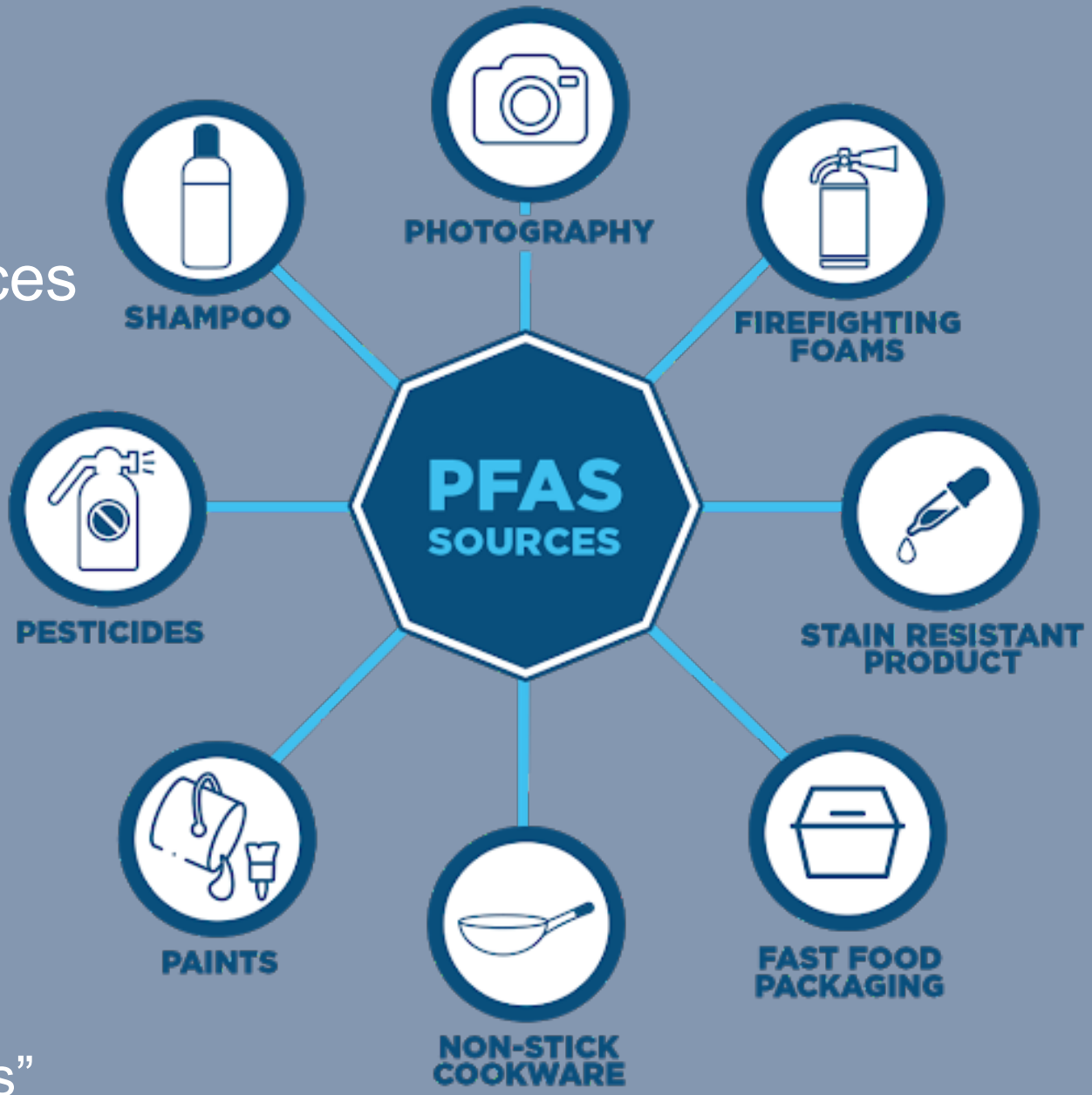


Image Credit: Regenesis

What are PFAS?

Per- and polyfluoroalkyl Substances

No C-H bonds	Contain C-H bonds or other labile features
Not susceptible to biological breakdown	Some can transform in the environment
Moderate data available	Not much data
Restricted production/use	Regrettable substitution?

Highly persistent “Forever Chemicals”

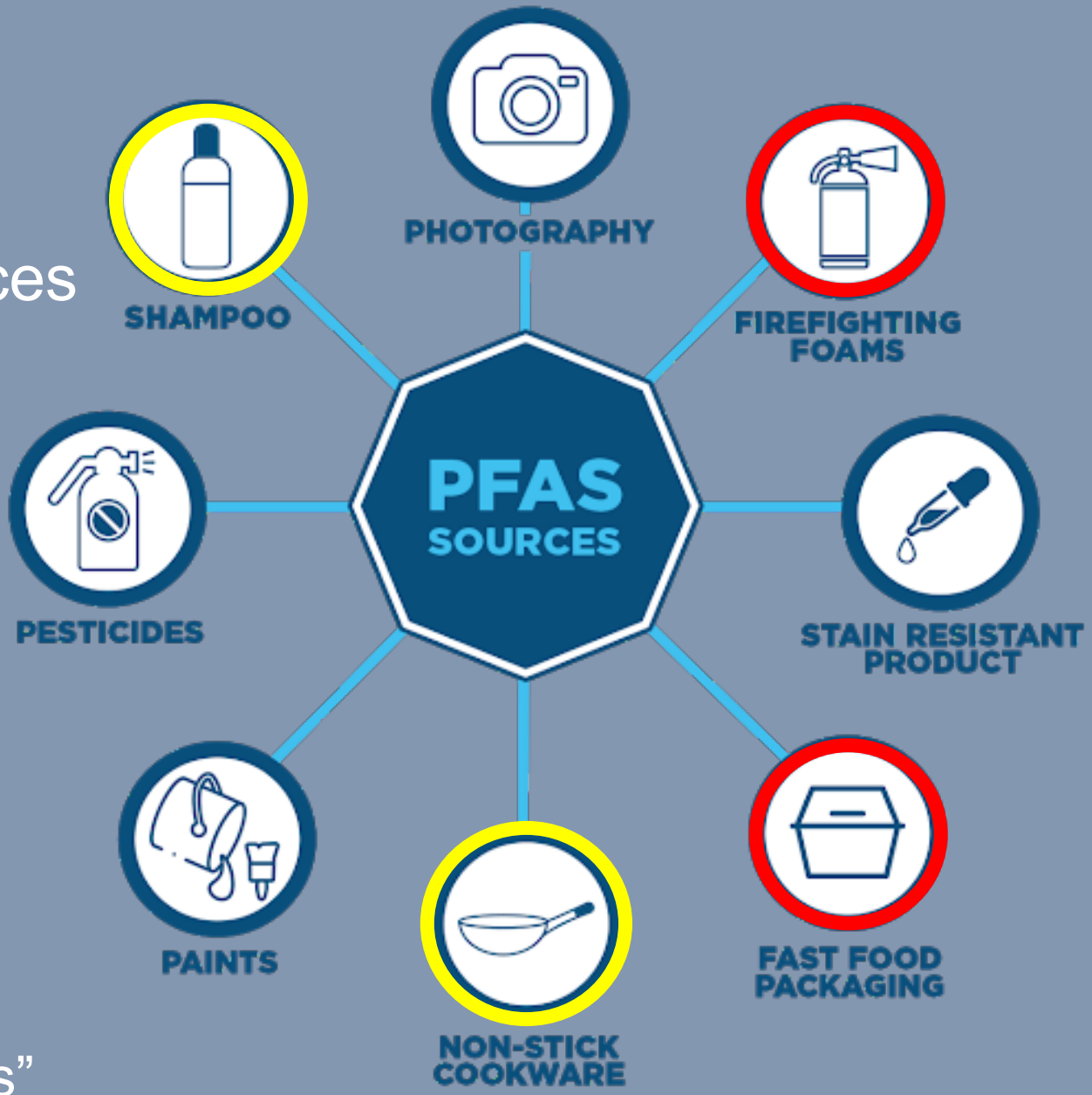


Image Credit: Regenesis

PFAS in Aquatic Animals and Human Consumption

BIOACCUMULATION

- PFOS widely observed, others typically at lower levels

TOXICITY

PFAS in Aquatic Animals and Human Consumption

BIOACCUMULATION

- PFOS widely observed, others typically at lower levels
- Concentrate in blood, brain, liver, other organs
  - Distributions vary by species due to differences in metabolism/excretion

TOXICITY

PFAS in Aquatic Animals and Human Consumption

BIOACCUMULATION

- PFOS widely observed, others typically at lower levels
- Concentrate in blood, brain, liver, other organs
  - Distributions vary by species due to differences in metabolism/excretion
- Maternal transfer to eggs, offspring

TOXICITY

PFAS in Aquatic Animals and Human Consumption

BIOACCUMULATION

- PFOS widely observed, others typically at lower levels
- Concentrate in blood, brain, liver, other organs
  - Distributions vary by species due to differences in metabolism/excretion
- Maternal transfer to eggs, offspring

TOXICITY

- Most studies on PFOS, PFOA
  - Effects vary with chain length, functional groups, species, sex

PFAS in Aquatic Animals and Human Consumption

BIOACCUMULATION

- PFOS widely observed, others typically at lower levels
- Concentrate in blood, brain, liver, other organs
  - Distributions vary by species due to differences in metabolism/excretion
- Maternal transfer to eggs, offspring

TOXICITY

- Most studies on PFOS, PFOA
  - Effects vary with chain length, functional groups, species, sex
- Diverse modes of action
  - Reproduction, development, metabolism, growth

PFAS in Aquatic Animals and Human Consumption

BIOACCUMULATION

- PFOS widely observed, others typically at lower levels
- Concentrate in blood, brain, liver, other organs
  - Distributions vary by species due to differences in metabolism/excretion
- Maternal transfer to eggs, offspring

TOXICITY

- Most studies on PFOS, PFOA
  - Effects vary with chain length, functional groups, species, sex
- Diverse modes of action
  - Reproduction, development, metabolism, growth
- Sensitive species
  - Marine mammals, birds humans

PFAS in San Francisco Bay Fish

A Virtual Forum • Open to Everyone

WHEN: February 4, 2022

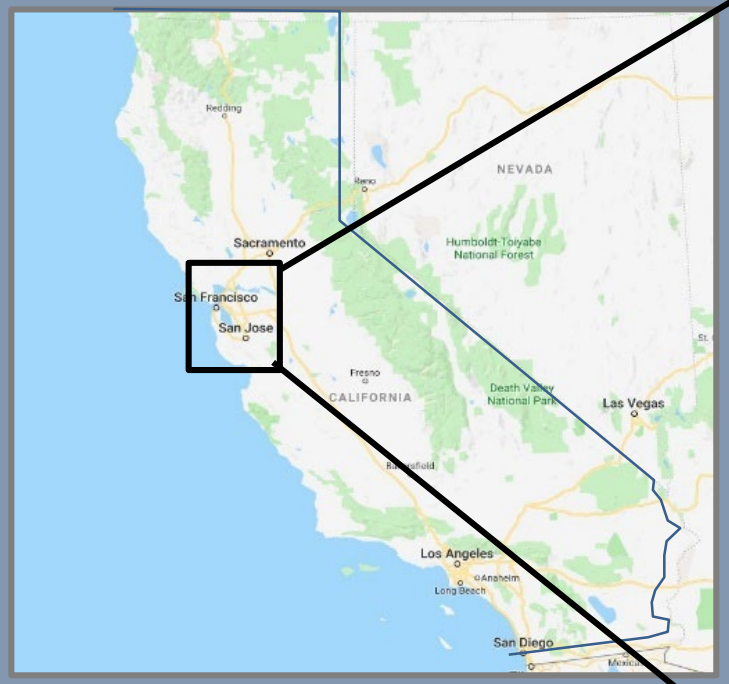
TIME: 9:00am – 3:30pm

WHERE: Online

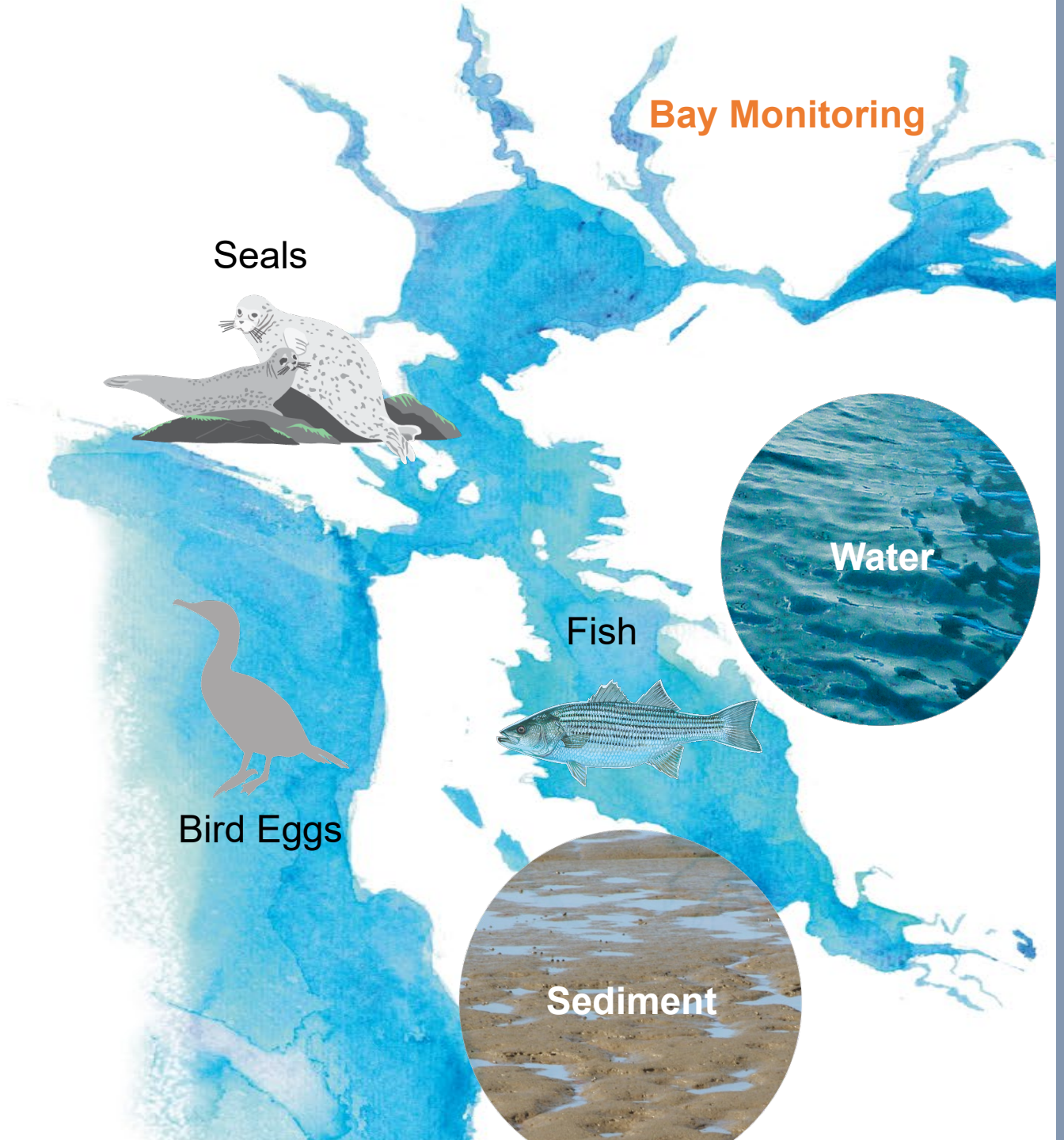
REGISTER: https://www.sfei.org/projects/PFASBayFish

Bringing together environmental and public health agencies, members of tribes and local fishing communities, and the general public to discuss PFAS contamination of San Francisco Bay sport fish and build consensus for next steps to protect everyone who catches and eats fish from the Bay.

Regional Monitoring Program for Water Quality in the San Francisco Bay



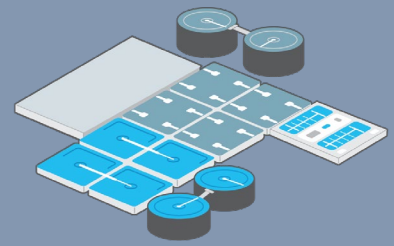
RMP Focus on PFAS



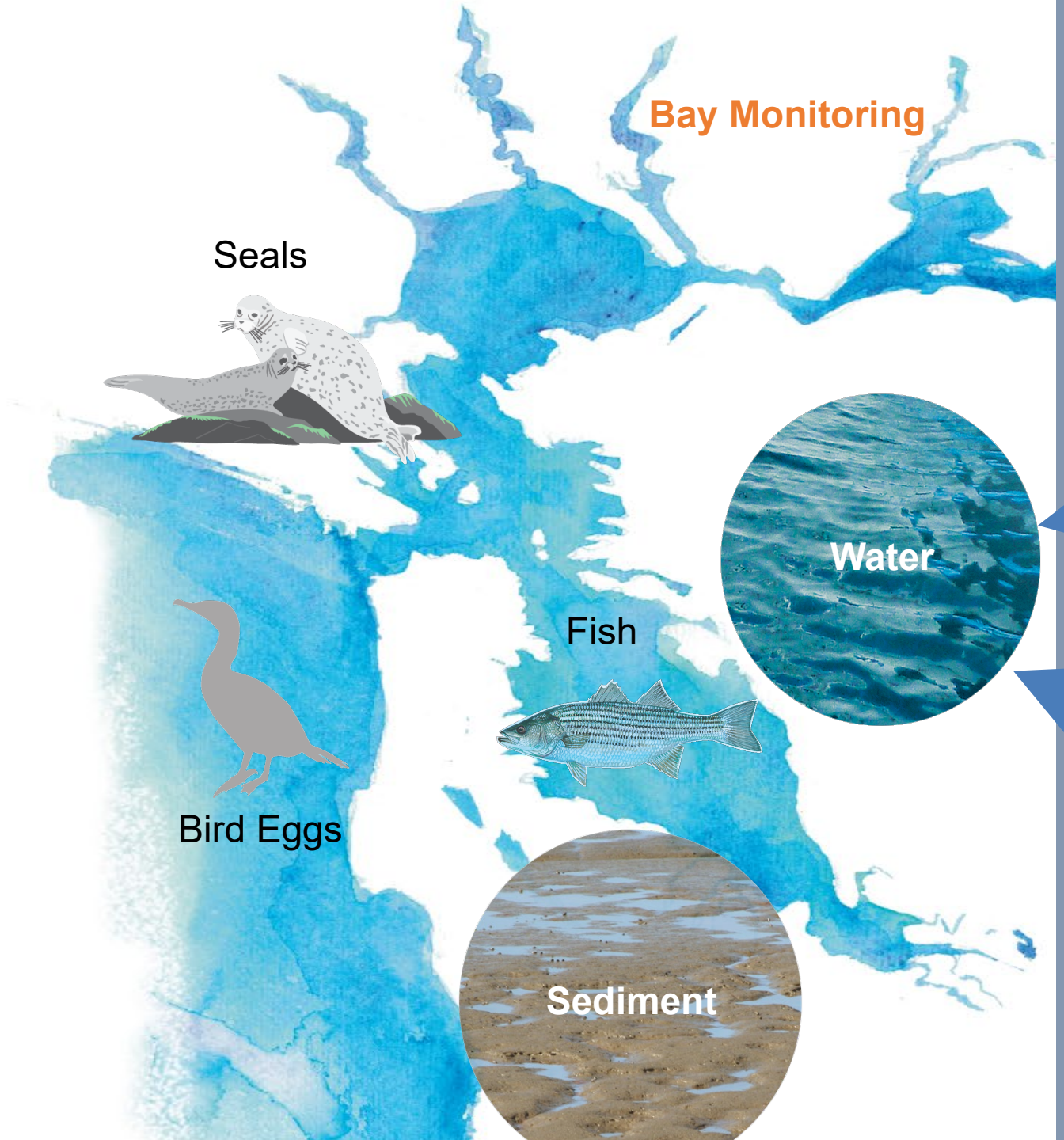
RMP Focus on PFAS

Pollution Pathways

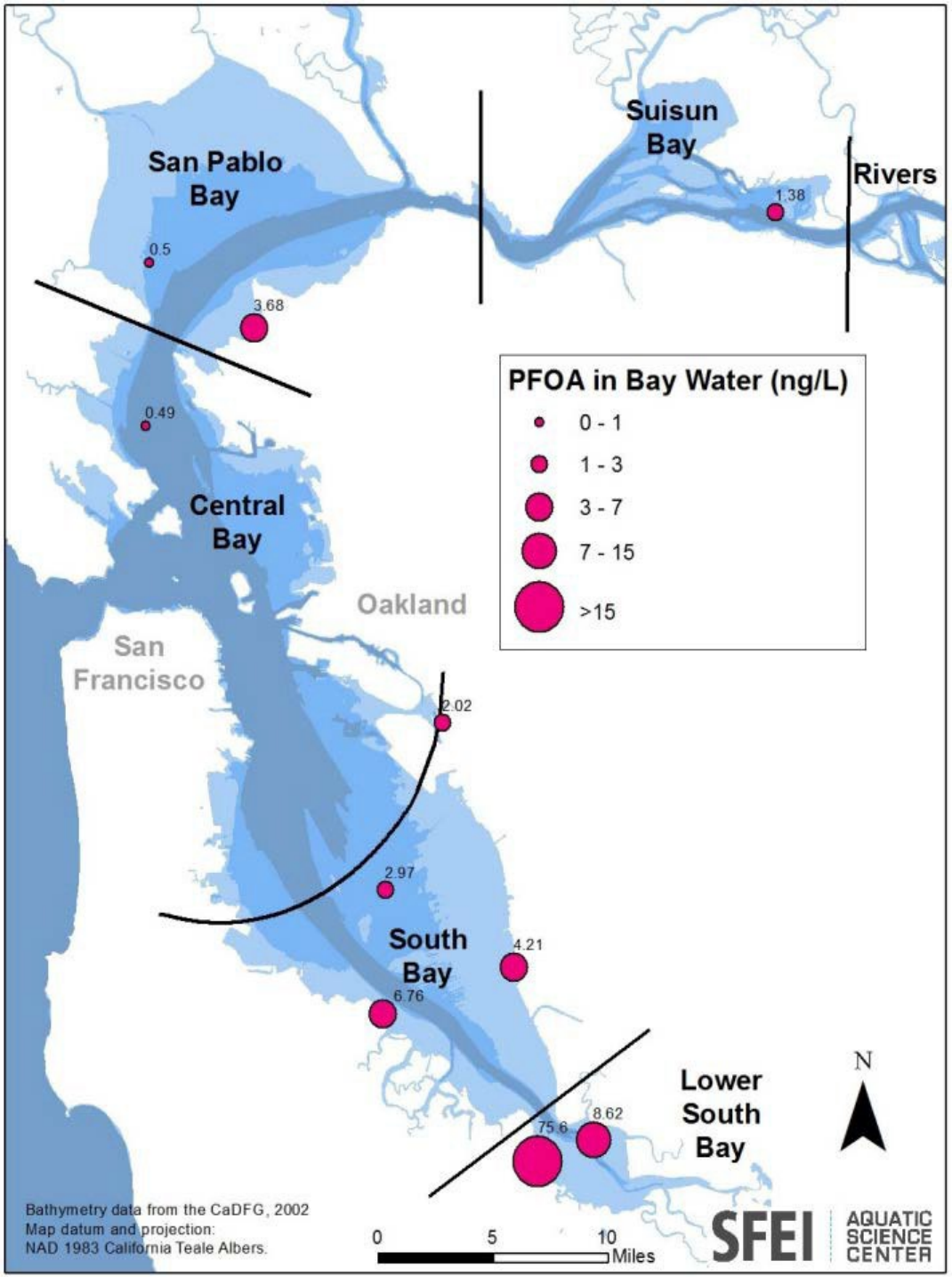
Wastewater



Stormwater



PAST RMP WORK



PFAS in SF Bay Water (2009)

Last monitored in 2009

- 13 PFAS + 4 PFOS precursors
- PFOA Highest

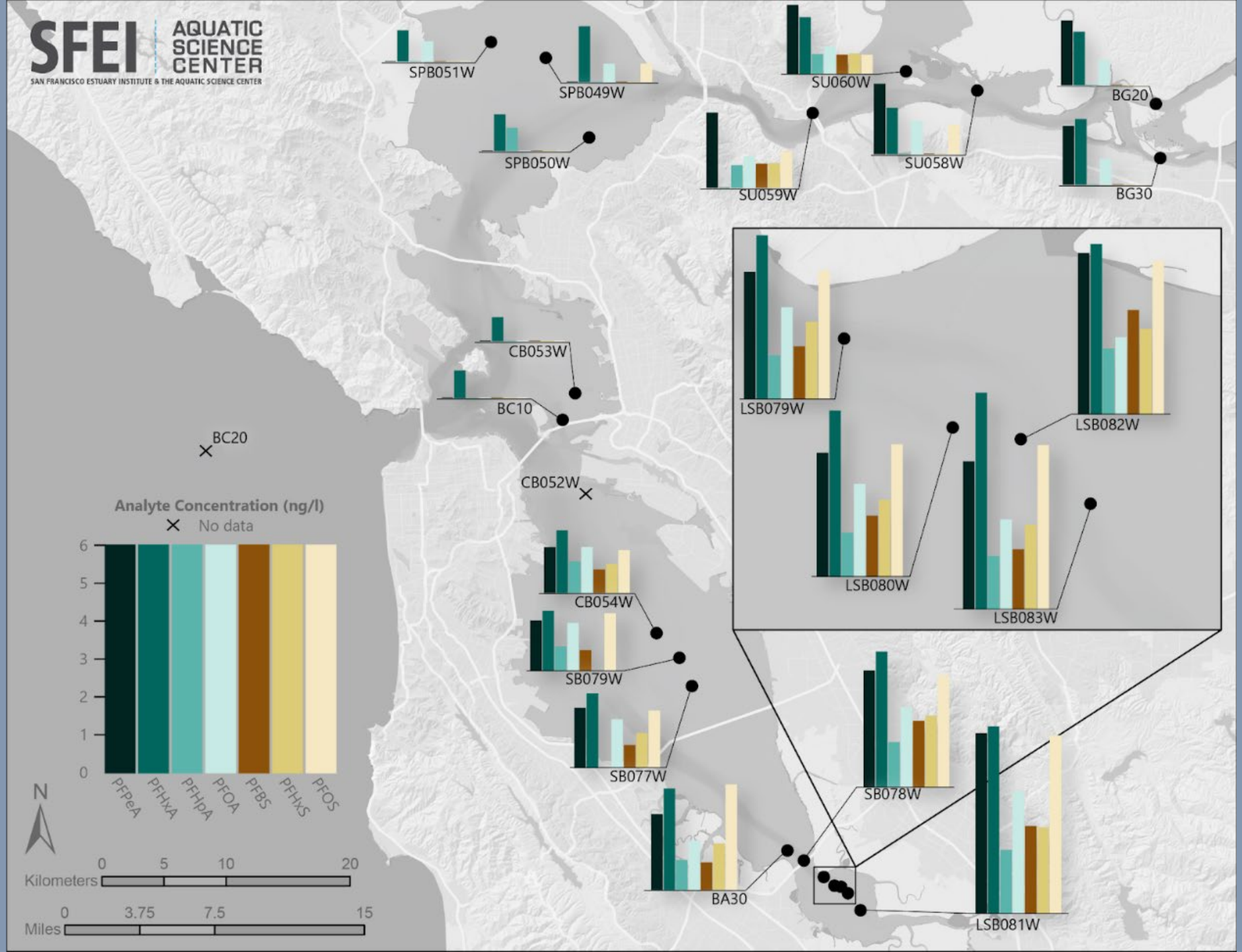
Environmental Screening Levels (ESLs) for Water (2020)

- Ecotoxicity:
  - PFOS: 75 ng/L
  - PFOA: 4,400 ng/L
- Human Health (seafood ingestion):
  - PFOS: 0.0047 ng/L
  - PFOA: 0.022 ng/L

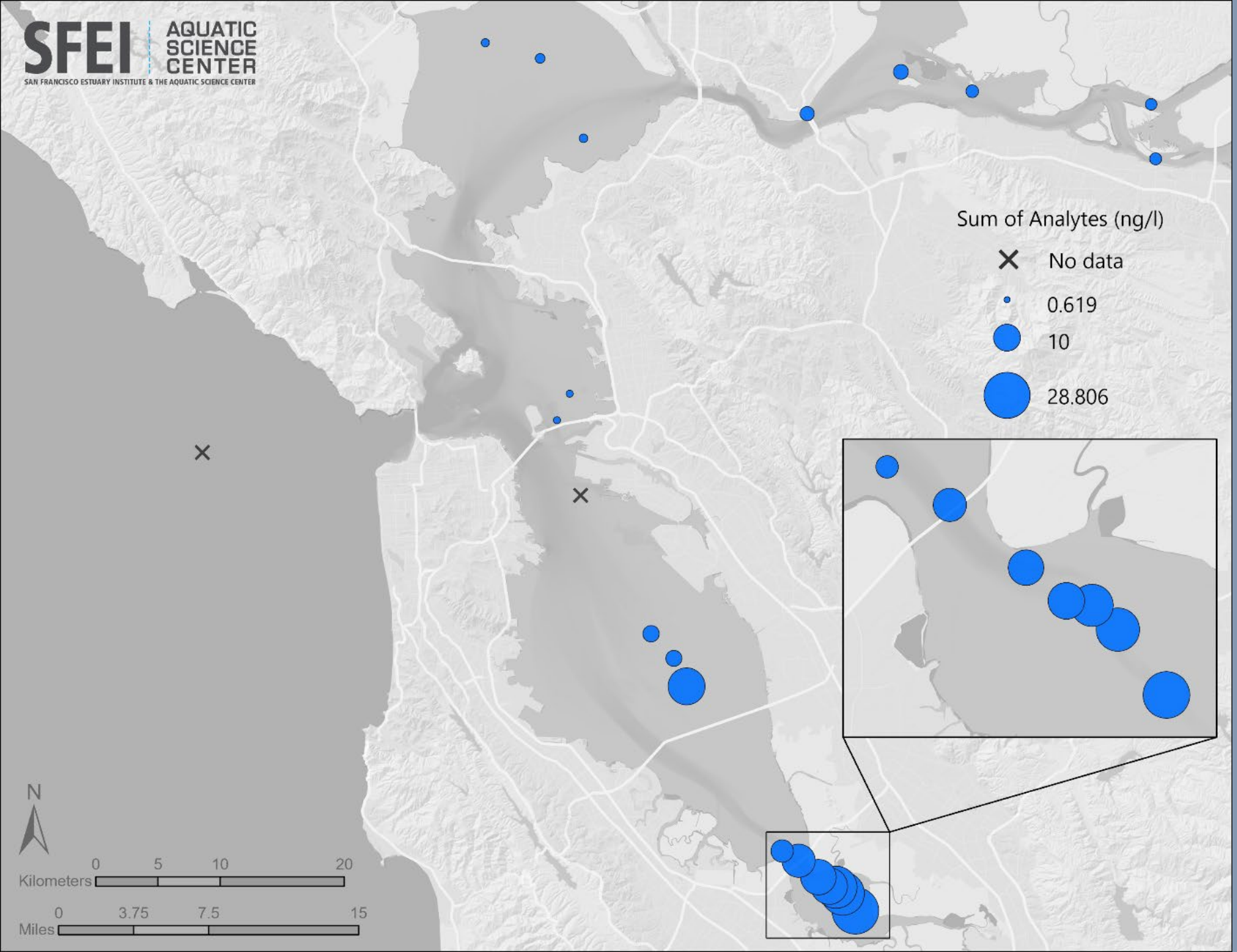
Study Objectives and Key Findings

- Increased sampling locations and analyte list
- Eleven PFAS were detected in ambient surface water
- Seven PFAS were found in at least 50% of sites
- PFPeA and PFHxA were generally found at the highest concentrations across sites

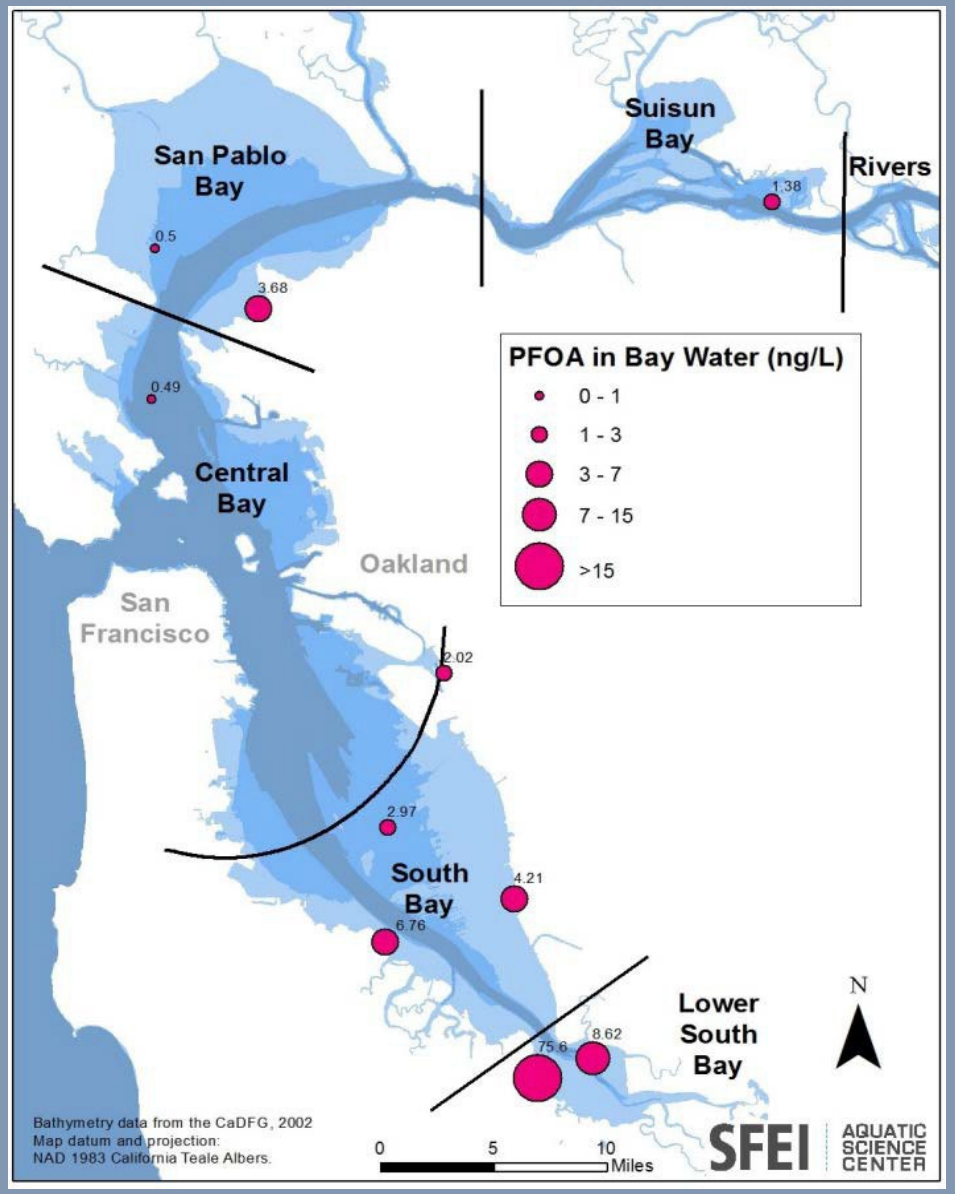
Sample Collection


SFEI
AQUATIC SCIENCE CENTER
SAN FRANCISCO ESTUARY INSTITUTE & THE AQUATIC SCIENCE CENTER
SPB051W
SPB049W
SPB050W
SU060W
SU059W
SU058W
BG20
BG30
CB053W
BC10
BC20
CB052W
LSB079W
LSB082W
LSB080W
LSB083W
CB054W
SB079W
SB077W
SB078W
BA30
LSB081W
Analyte Concentration (ng/l)
No data
6
5
4
3
2
1
0
PFPeA
PFHxA
PFHpA
PFOA
PFBS
PFHxS
PFOS
N
0
5
10
20
Kilometers
0
3.75
7.5
15
Miles

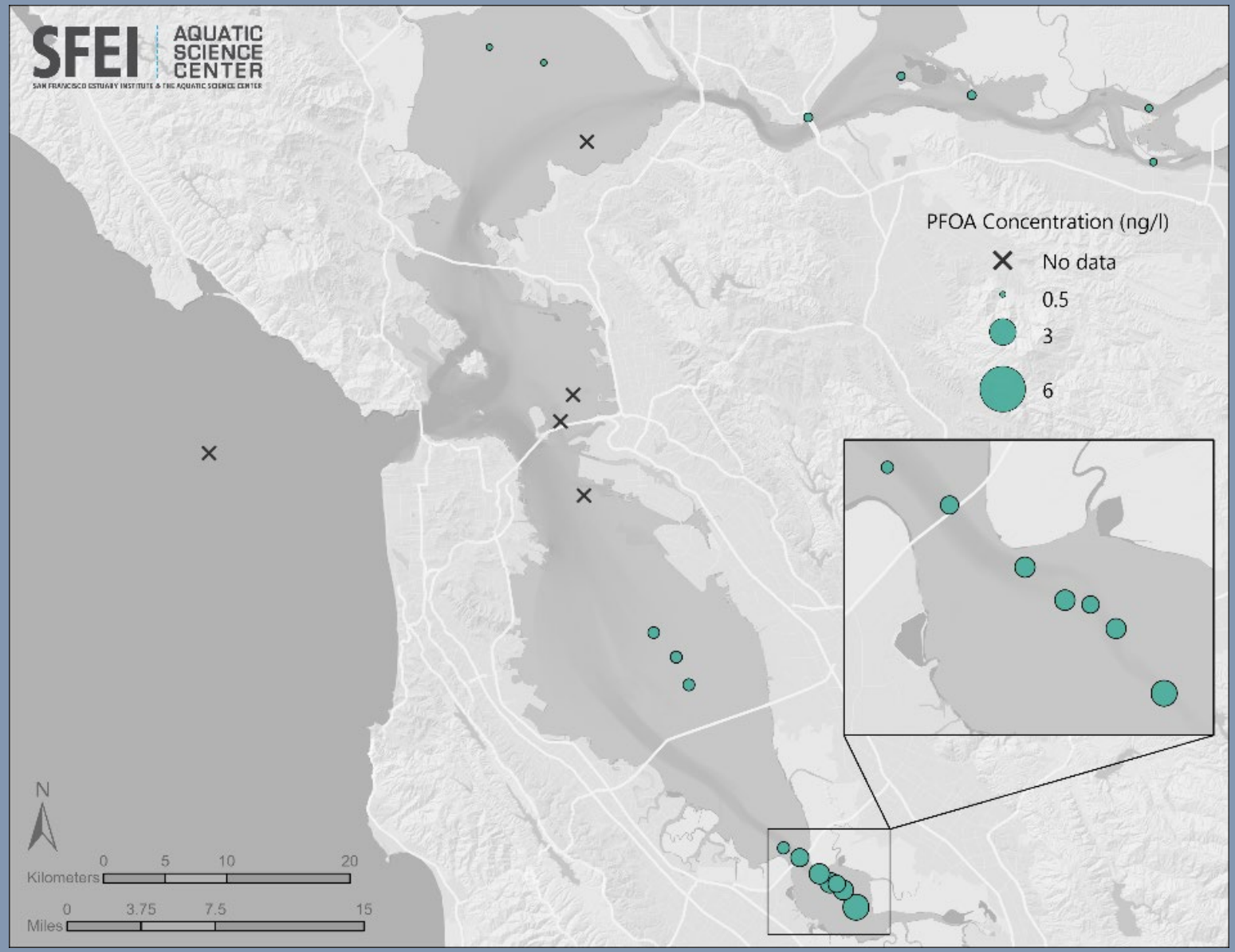
Spatial Patterns



Temporal Comparison



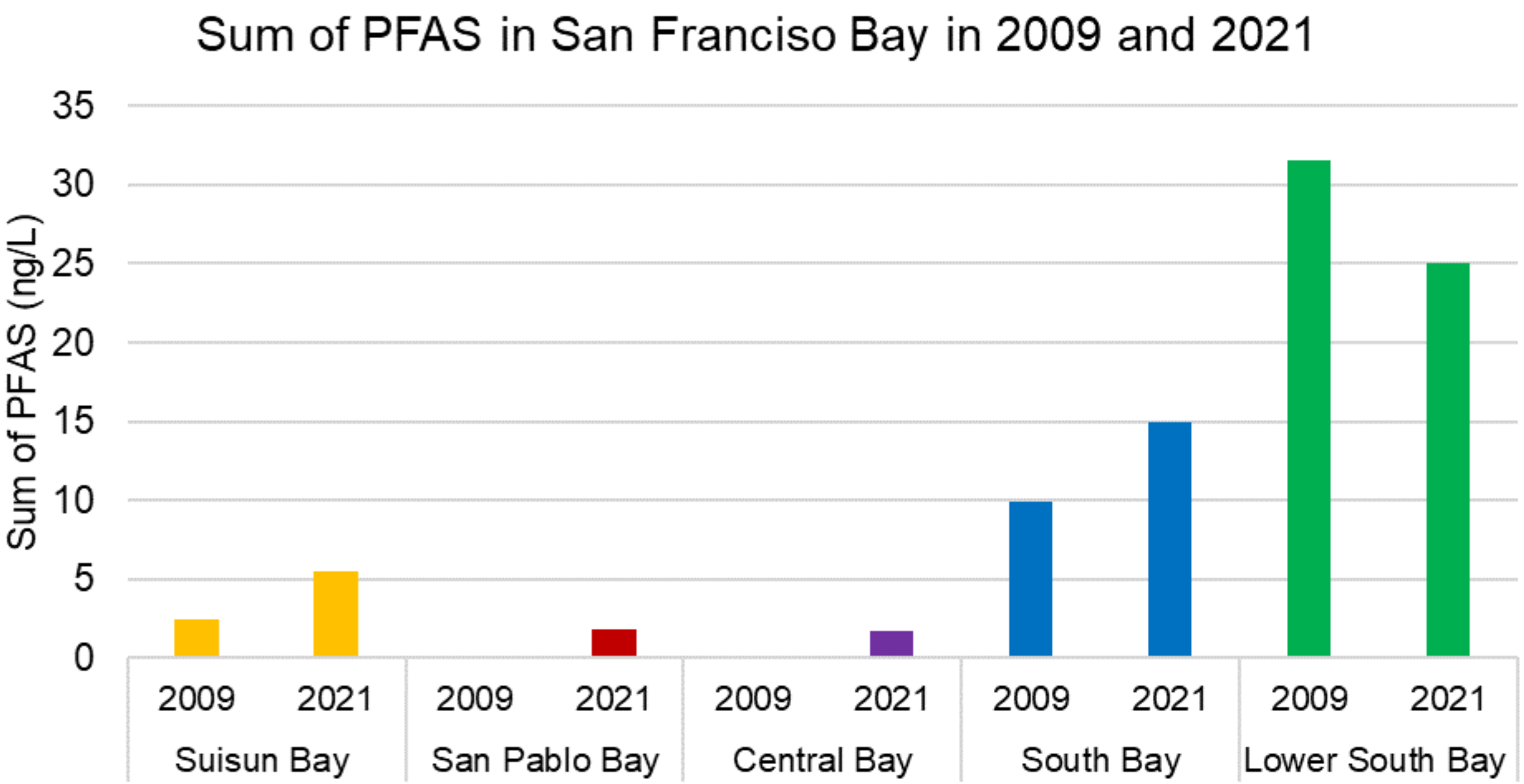
2009

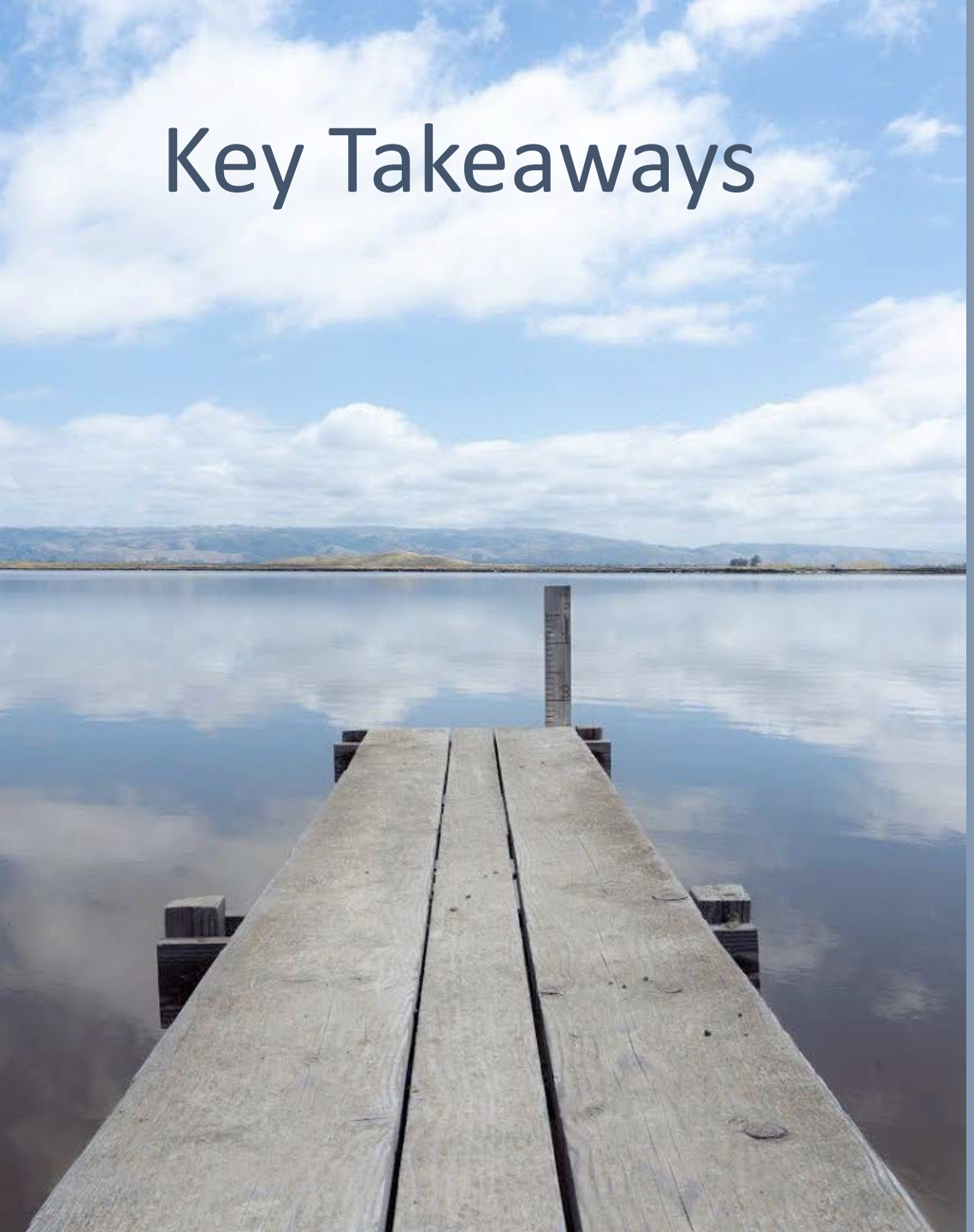


2021

Temporal Comparison

			2009				*2021*			
Analyte	**P-value**	**Non-identical Populations**	**DF**	**Median**	**Mean**	**Max**	**DF**	**Median**	**Mean**	**Max**
PFOA	0.57		60%	1.4	2.6	8.6	77%	0.8	1.1	3.2
PFNA	x		40%	0	0.8	2.4	68%	0	0.1	0.6
PFOS	0.75		40%	0	1.8	6.3	63%	0.9	1.5	4.7
PFPeA	0.22		40%	0	0.8	2.5	68%	1.6	1.7	4.8
PFHxA*	0.18		40%	0	1.1	3.7	86%	1.5	2.1	5.7
PFBS	0.06		0	0	0	0	59%	0.5	0.7	2.7
PFHxS	0.49		20%	0	0.5	2.7	50%	0.3	0.8	2.3


Sum of PFAS in San Franciso Bay in 2009 and 2021
Sum of PFAS (ng/L)
35
30
25
20
15
10
5
0
2009
2021
Suisun Bay
San Pablo Bay
Central Bay
South Bay
Lower South Bay



Key Takeaways

- Results support the continued classification of PFAS as high priority for the Bay due to human health concerns related to fish consumption
- Concentrations of PFAS remain below available ecotoxicity thresholds for aquatic life
- Continued monitoring of ambient water is recommended

PFAS in San Francisco Bay

- Report Coming Soon
  - Internal Draft taking comments now

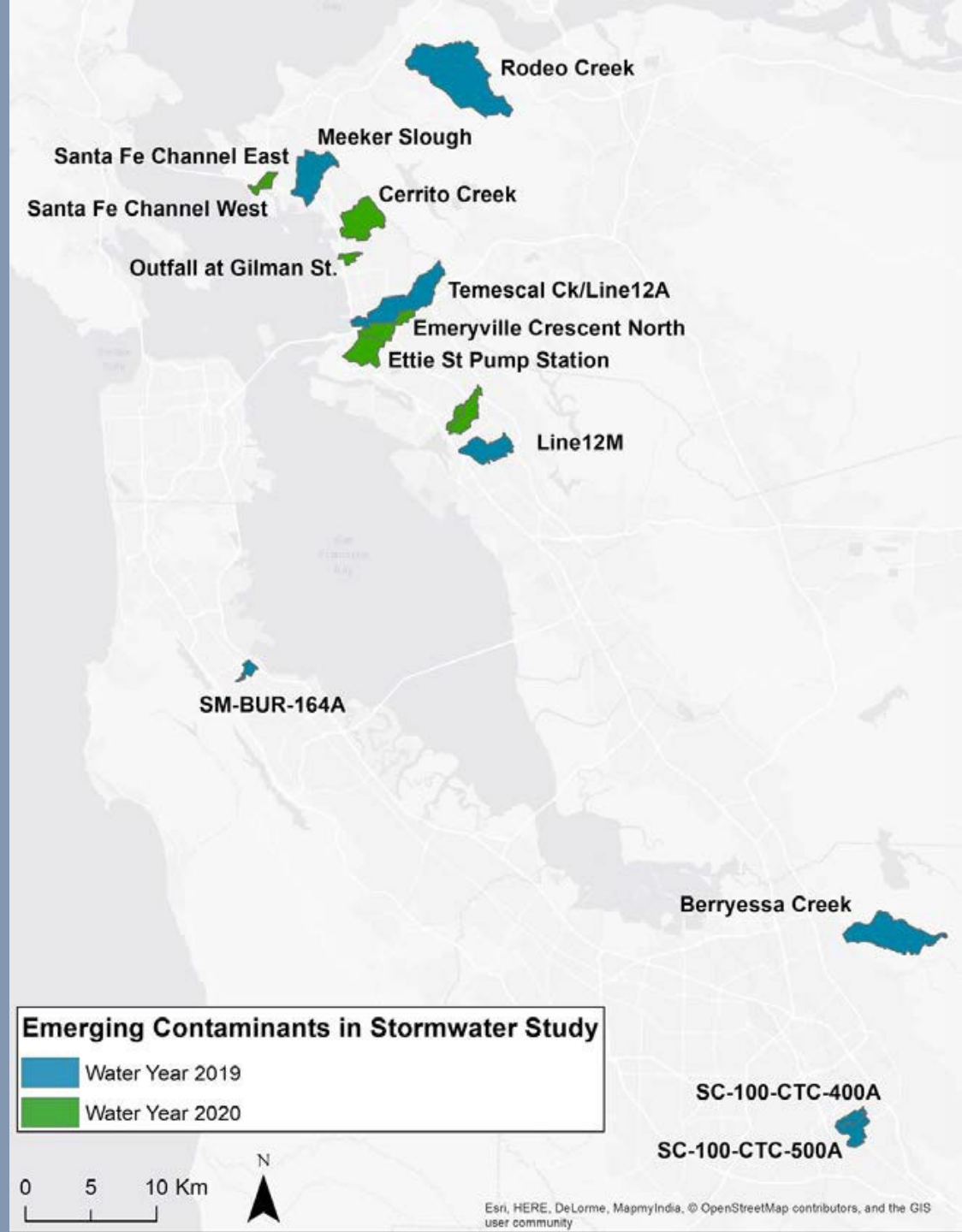
What's next?

ONGOING AND FUTURE RMP WORK

Stormwater monitoring complete

RECENT & UPCOMING WORK

- Ambient Water Report Coming Soon
- 2019 sport fish data (adding archived data)
- Sport fish – 2024
- Bird eggs – 2022
- Marine Mammals – 2023
- Archived and New Sediment – 2025



Recent Legislation

- California has passed:
  - AB 2771 – PFAS-Free Beauty Act
    - Bans the use of PFAS in cosmetic products (2025)
  - AB 1817 – Safer Clothes and Textiles Act
    - Eliminates the use of PFAS in clothes and textiles
      - California

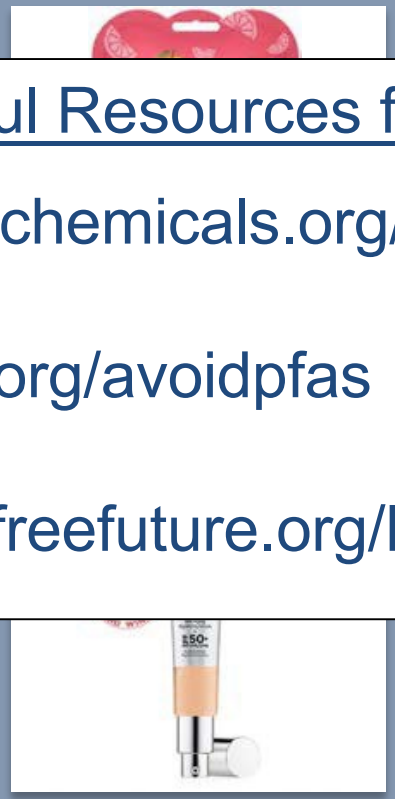
Questions?

- Email: martint@sfei.org

PFAS in Your Life

Microwave popcorn

Cosmetics



Sprayable stain protectors

Fast food packa

ets, rugs,

ith “durable
coating

Useful Resources for the General Public

saferchemicals.org/get-the-facts/toxic-chemicals

ewg.org/avoidpfas

toxicfreefuture.org/key-issues/chemicals-of-concern