OEHHA Fish Advisory Development Process: Considerations for PFASs

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OFFICE OF ENVIRONMENTAL HEALTH HAZARD ASSESSMENT

BIOMONITORING CALIFORNIA SCIENTIFIC GUIDANCE PANEL MEETING

7/19/24

The Office of Environmental Health Hazard Assessment (OEHHA) issues consumption advisories for recreationally-caught fish from water bodies throughout California, including state waters of the Pacific Ocean

Fish advisories:

- Are guidelines that recommend how often you can safely eat fish that you catch – from no consumption to 7 meals per week
- Use the best available science to balance the benefits and risks of eating fish
- Are based on thorough data review and best professional judgement

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Fish Advisories

Good Catch California is the OEHHA fish advisory program.
We provide advice so that you can make healthy choices about eating the fish you catch.

Fish Advisories are guidelines that recommend how often you can safely eat fish caught from water bodies in California. The Office of Environmental Health Hazard Assessment (OEHHA) offers over 100 site-specific advisories for lakes, rivers, bays, reservoirs, and the coast. For water bodies without site-specific advice, look for the appropriate statewide advisory below.

OEHHA provides two sets of guidelines for eating fish, one for each of the following populations:

- Women 18-49 years and children 1-17 years
- Women 50 years and older and men 18 years and older

General Information

- Fish Advisory Fact Sheet (PDF) English | Spanish (Español)
- How to Follow Advisories
- Women & Children
- General Tips

How to Use the Fish Advisories
How to read and use the safe fishing advisories for California waterbodies issued by OEHHA.

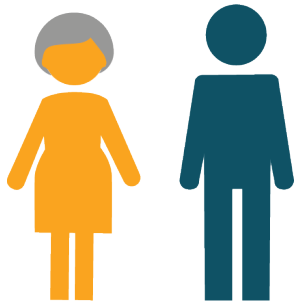
Statewide Advisories

- Statewide Advisory for Eating Fish from **California's Lakes and Reservoirs** without site-specific advice
- Statewide Advisory for Eating Fish from **California Coastal Locations** without site-specific advice
- Advisory for Fish that Migrate

OEHHA provides two sets of guidelines for eating fish, one for each of the following populations based on mercury:

- Women 18-49 years and children 1-17 years ("Sensitive population")

- Women 50+ years and men 18+ years ("General population")

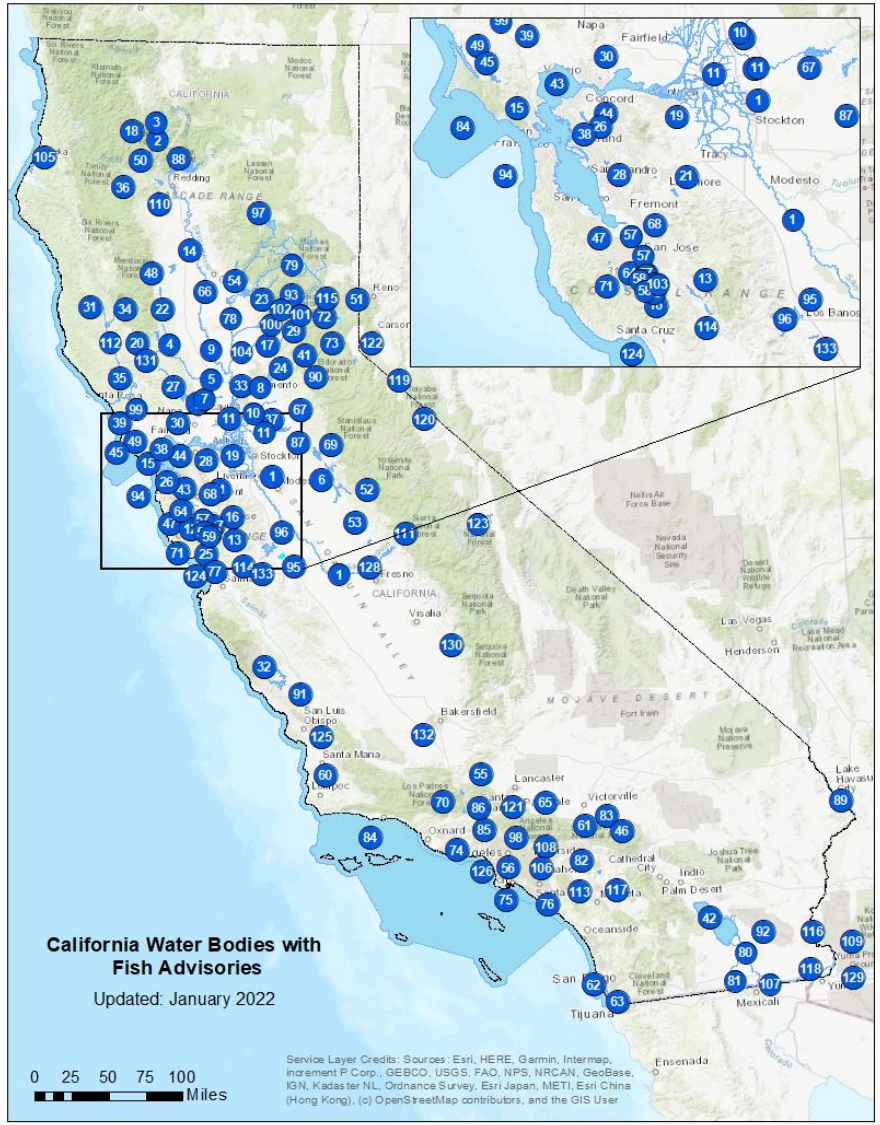


Current Fish Consumption Advisories

Risk Driver*	Percent of Advisories
Mercury	97
PCBs	40
Selenium	8
DDTs	5
Dieldrin	4
PBDEs	1

*Consumption advice is based on the chemical with the lowest allowable number of servings per week (“risk driver”). More than one risk driver may affect advice in a single advisory.

Total number of advisories – 140



A GUIDE TO EATING FISH *from* SAN FRANCISCO BAY

(ALAMEDA, CONTRA COSTA, MARIN, NAPA, SAN FRANCISCO, SAN MATEO, SANTA CLARA, SOLANO, SONOMA COUNTIES)

WOMEN 18 – 49 YEARS AND CHILDREN 1 – 17 YEARS

Eat the Good Fish
Eating fish that are low in chemicals may provide health benefits to children and adults.

Avoid the Bad Fish
Eating fish with higher levels of chemicals like mercury or PCBs may cause health problems in children and adults.

Choose the Right Fish
Chemicals may be more harmful to unborn babies and children.

Women (18 – 49 Years)

Children (1 – 17 Years)

2 TOTAL SERVINGS A WEEK

OR

1 TOTAL SERVING A WEEK

0 DO NOT EAT

American Shad
♥ high in omega-3s

Chinook (King) Salmon
♥ high in omega-3s

California Halibut

Jacksmelt

Barred Surfperch

Black Perch

Walleye Surfperch

Northern Anchovy
♥ high in omega-3s

Rubberlip Surfperch

White Surfperch

White Croaker

Do Not Eat Any Fish from Lauritzen Channel

Mississippi Silverside

Shark species

Pacific Sardine

Striped Bass

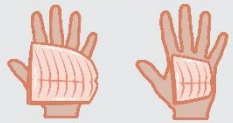
Shiner Perch

Topsmelt

White Sturgeon

Serving Size
A serving of fish is about the size and thickness of your hand. Give children smaller servings.

For Adults **For Children**



Eat only the skinless fillet

Eat only the meat

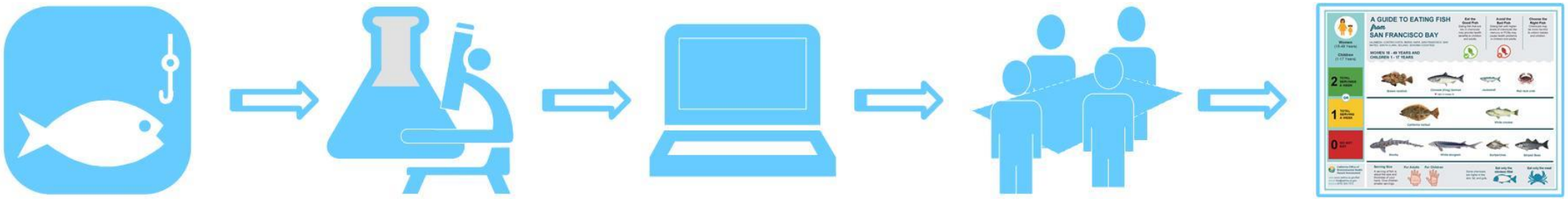
Some chemicals are higher in the skin, fat, and guts.

Updated 04/2023

California Office of Environmental Health Hazard Assessment
web www.oehha.ca.gov/fish
email fish@oehha.ca.gov
phone (916) 324-7572

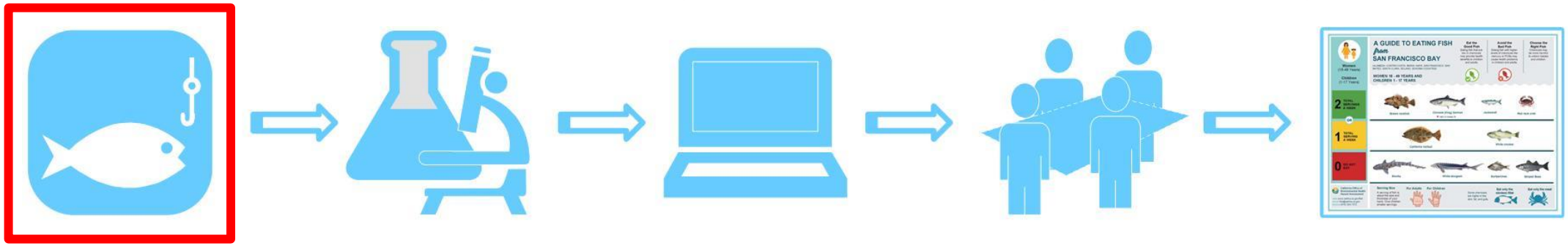
GOOD CATCH CALIFORNIA
Your Fish Advisor

Advisories are developed through a multi-step process:



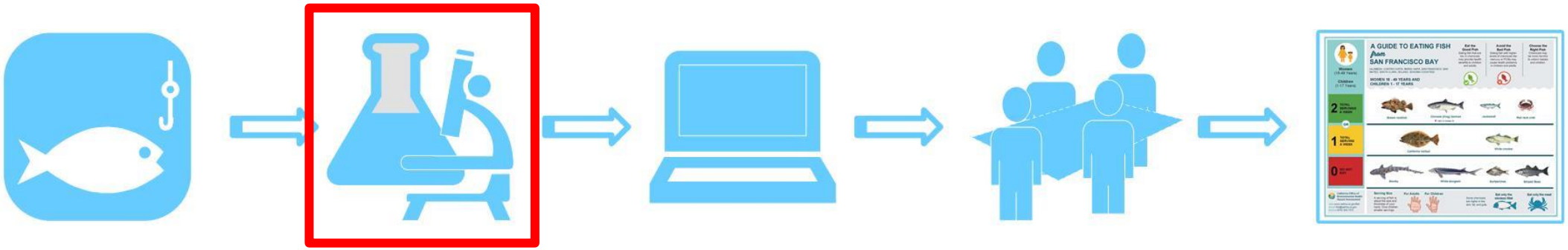
Advisories are developed through a multi-step process:

- Fish samples are collected
  - The Safe to Eat Workgroup (STEW) arranges the collection for most fish samples used in advisory development
  - Additional samples are collected by water utilities, FERC (Federal Energy Regulation Commission) relicensing, and other governmental and nongovernmental organizations



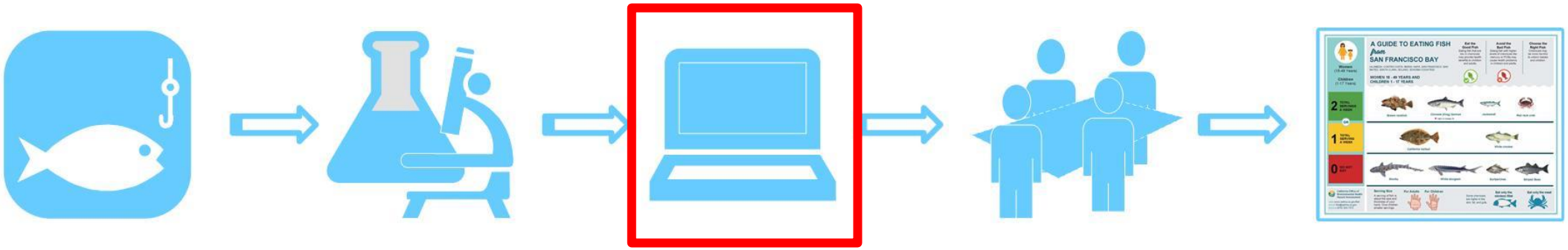
Advisories are developed through a multi-step process:

- Fish samples are generally analyzed at Moss Landing Marine Laboratories and/or contracted to other certified laboratories



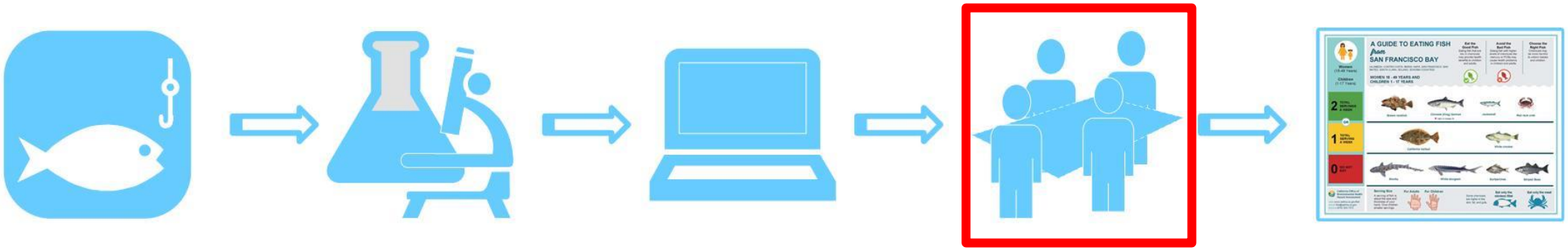
Advisories are developed through a multi-step process:

- Most fish contaminant data are uploaded to the California Environmental Data Exchange Network (CEDEN) and retrieved by OEHHA for use in fish advisory development



Advisories are developed through a multi-step process:

- Data that meet our criteria (minimum fish length, sample size, and data quality) are evaluated to confirm a final data set
- A **tissue concentration** for each chemical is calculated for each species at a water body



Tissue concentrations are compared to **Advisory Tissue Levels (ATLs)** that have been developed for each chemical

ATLs:

- Provide recommended 8-ounce servings (0-7 per week)
- Encourage consumption of fish to provide health benefits
- Are not "bright lines" between safe and unsafe but part of a complex decision-making process
- Can be based on cancer or non-cancer endpoints

ATL Equations: Non-cancer

Reference Dose (RfD)

- health effects are not expected to occur at or below this dose

Body Weight (BW)

- 70 kg (154 lbs)

Consumption Rate (CR)

- corresponding to 1 – 7 (8-ounce) servings per week

Cooking Reduction Factor (CRF)

- a factor of 0.7 for the reduction of organic contaminants during cooking

$$ATLs = \frac{\mathbf{RfD} \times BW}{CR \times CRF}$$

ATL Equations: Cancer

Cancer Slope Factor (CSF)

- Cancer risk from lifetime exposure

Exposure Duration (ED)

- 30 years of exposure

Averaging Time (AT)

- 70-year average lifetime

Risk Level (RL)

- 1 in 10,000 (1×10^{-4}) is used to balance benefits and risks of eating fish

$$ATLs = \frac{RL \times BW}{\mathbf{CSF} \times (ED/AT) \times CR \times CRF}$$

ATLs have been developed for:

Natural elements

- Mercury – a global contaminant and legacy of California's gold and mercury mining
- Selenium – a micro-nutrient that can be redistributed and concentrated as a result of human activity

Industrial chemicals

- Polychlorinated biphenyls (PCBs) – banned in the 1970s; still pervasive in some areas
- Polybrominated diphenyl ethers (PBDEs) – flame retardants; some forms are no longer produced

Pesticides

- DDTs – banned in the 1970s; still present in some environments
- Dieldrin – banned in the 1970s; still present in some environments
- Chlordane – banned in the 1970s
- Toxaphene – banned in 1988

Contaminant	Consumption Frequency Categories (8-ounce servings/week) and ATLs (in ppb)							
	7	6	5	4	3	2	1	0
Chlordanes	≤ 80	>80-90	>90-110	>110-140	>140-190	>190-280	>280-560	>560
DDTs	≤ 220	>220-260	>260-310	>310-390	>390-520	>520-1,000	>1,000-2,100	>2,100
Dieldrin	≤ 7	>7-8	>8-9	>9-11	>11-15	>15-23	>23-46	>46
Mercury (Women 18-49 and children 1-17)	≤ 31	>31-36	>36-44	>44-55	>55-70	>70-150	>150-440	>440
Mercury (Women 50+ and men 18+)	≤ 94	>94-109	>109-130	>130-160	>160-220	>220-440	>440-1,310	>1,310
PBDEs	≤ 45	>45-52	>52-63	>63-78	>78-100	>100-210	>210-630	>630
PCBs	≤ 9	>9-10	>10-13	>13-16	>16-21	>21-42	>42-120	>120
Selenium	≤ 1,000	>1,000-1,200	>1,200-1,400	>1,400-1,800	>1,800-2,500	>2,500-4,900	>4,900-15,000	>15,000
Toxaphene	≤ 87	>87-100	>100-120	>120-150	>150-200	>200-300	>300-610	>610

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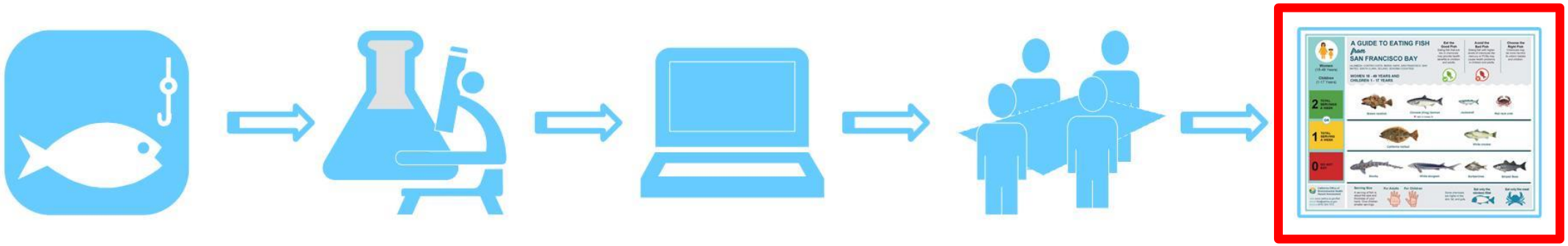
	7	6	5	4	3	2	1	0
Mercury (Women 18-49 and children 1-17)	≤ 31	>31-36	>36-44	>44-55	>55-70	>70-150	>150-440	>440
Mercury (Women 50+ and men 18+)	≤ 94	>94-109	>109-130	>130-160	>160-220	>220-440	>440-1,310	>1,310

Multiple Chemical Exposure

- If two or more chemicals (e.g., mercury and PCBs) with similar adverse effects are present in fish tissue, multiple chemical exposure methodology is employed
- This may result in advising fewer servings per week than for one chemical alone

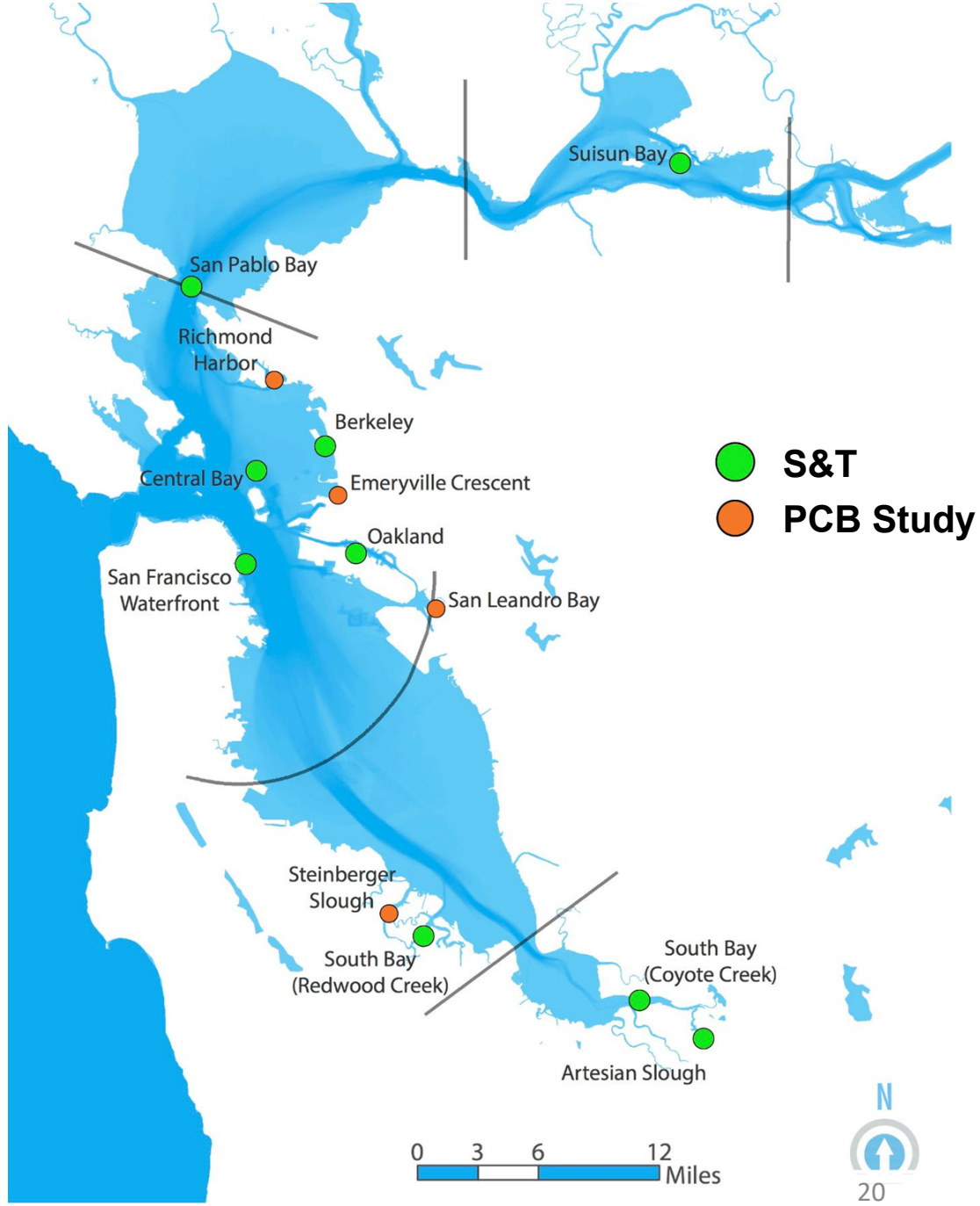
Advisories are developed through a multi-step process:

- A final report and posters are developed and posted at: https://oehha.ca.gov/fish/advisories



Regional Monitoring Program (RMP): Sport Fish Monitoring

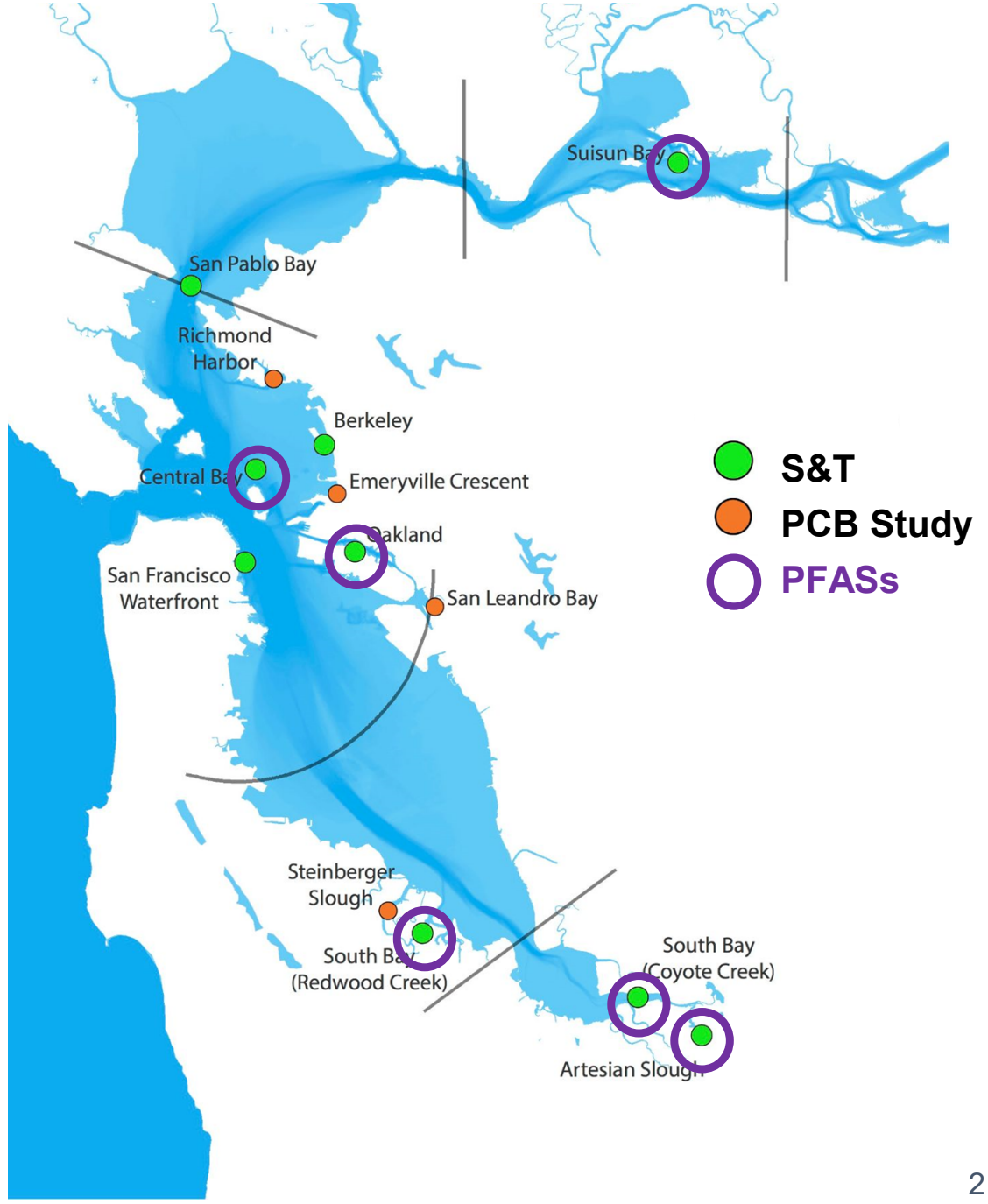
- One of the best fish monitoring programs anywhere
- Began in 1994
- Most recently in 2019
  - 3-year cycle through 2009; 5-year cycle since
  - Various species (16 in 2019)
  - Hundreds of samples
  - Many contaminants
- Gaps remain



Slide courtesy of San Francisco Estuary Institute (SFEI)

RMP ***PFASs*** Fish Monitoring

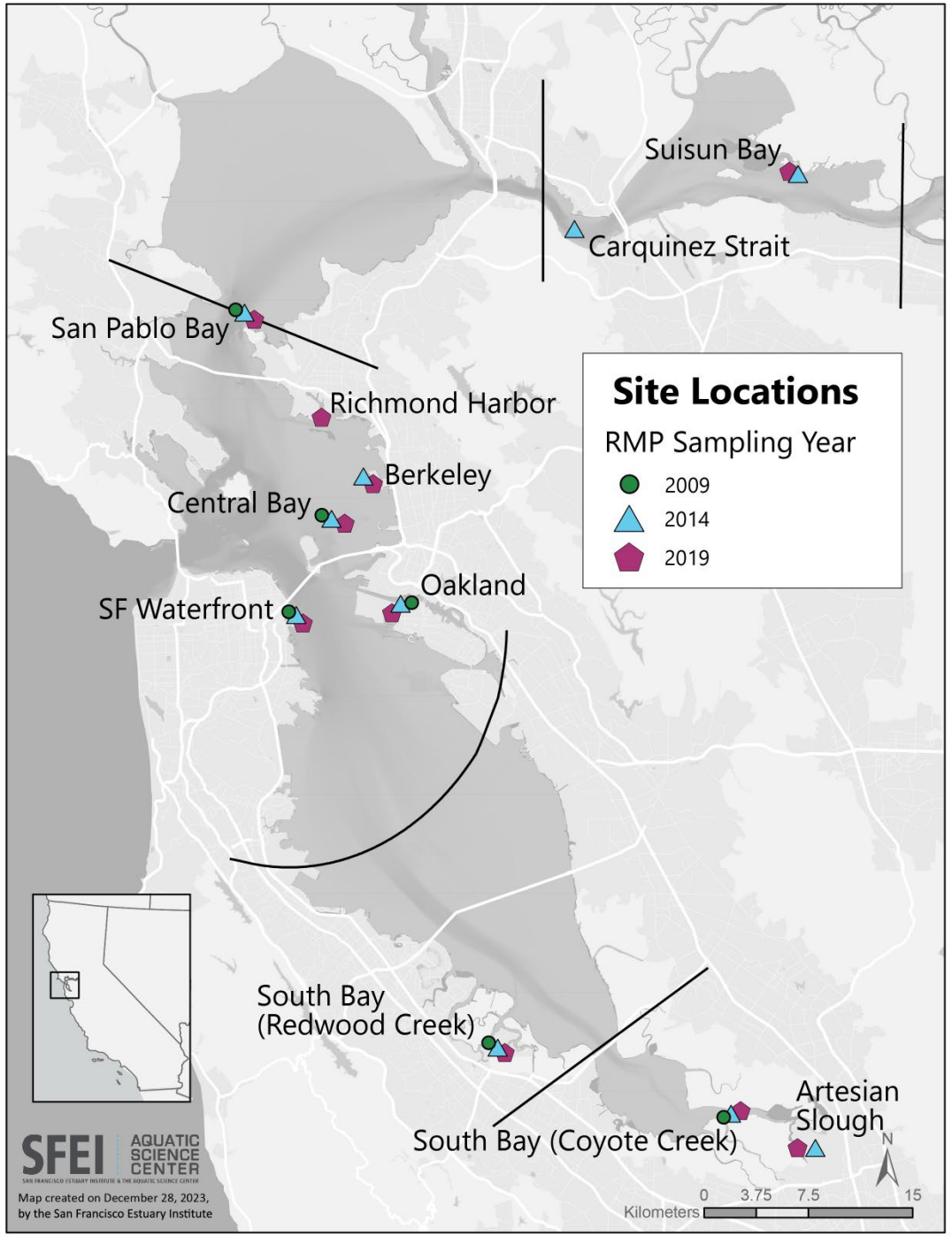
- One of the best fish monitoring programs anywhere
- Began in 2009
- Most recently in 2019
  - 6 locations
  - 5 species
  - 111 fish
  - 16 samples
- Gaps remain



Slide courtesy of SFEI

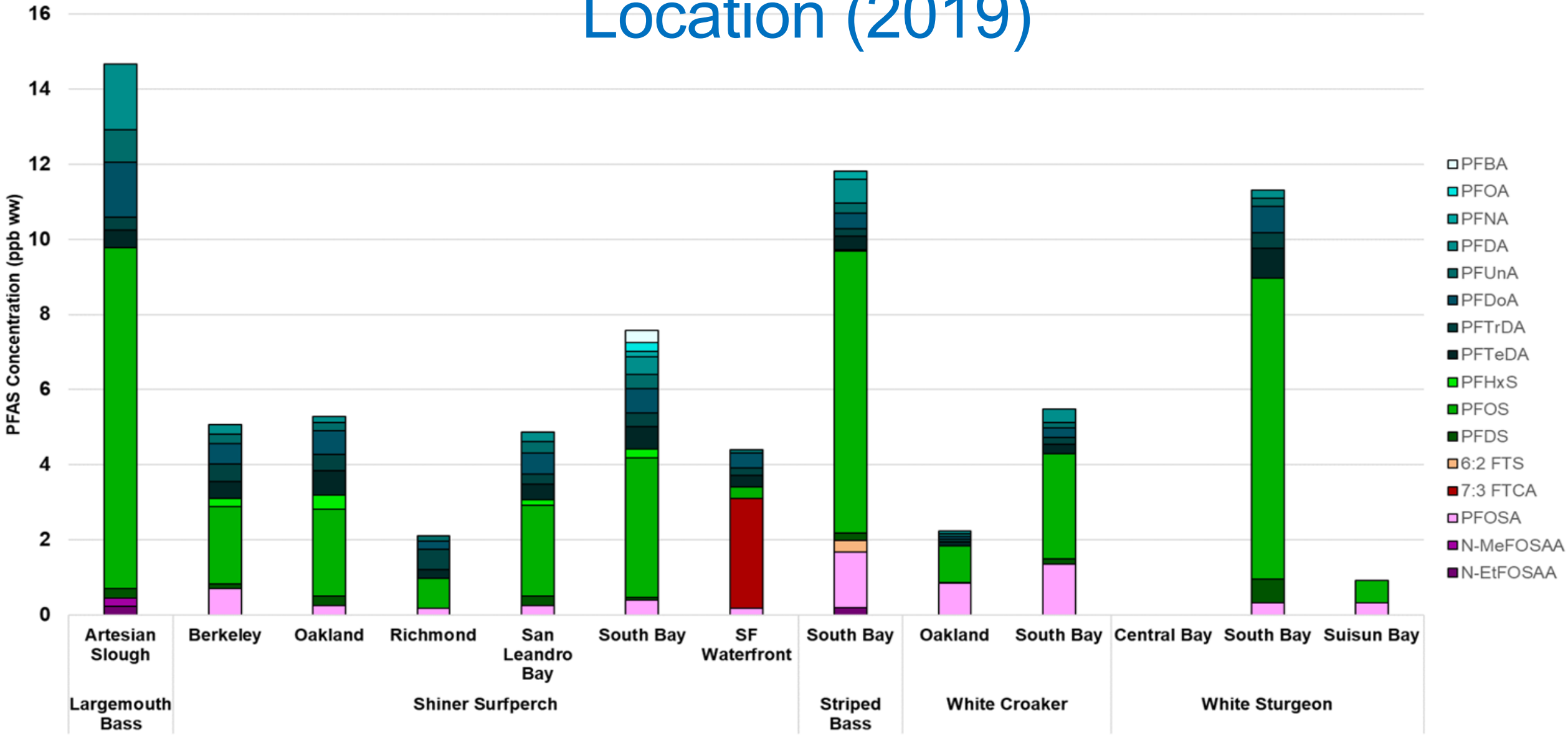
RMP *PFASs* Fish Monitoring
2022 Update

- Analysis of 57 archived samples from 10 Bay locations
  - 4 species
  - 2009: 7 samples
  - 2014: 28 samples
  - 2019: 22 samples
- Targeted method for 40 PFASs
- Analysis of combined dataset
  - Varying analytical methods



Slide courtesy of SFEI

Average Sum of PFASs by Species and Location (2019)



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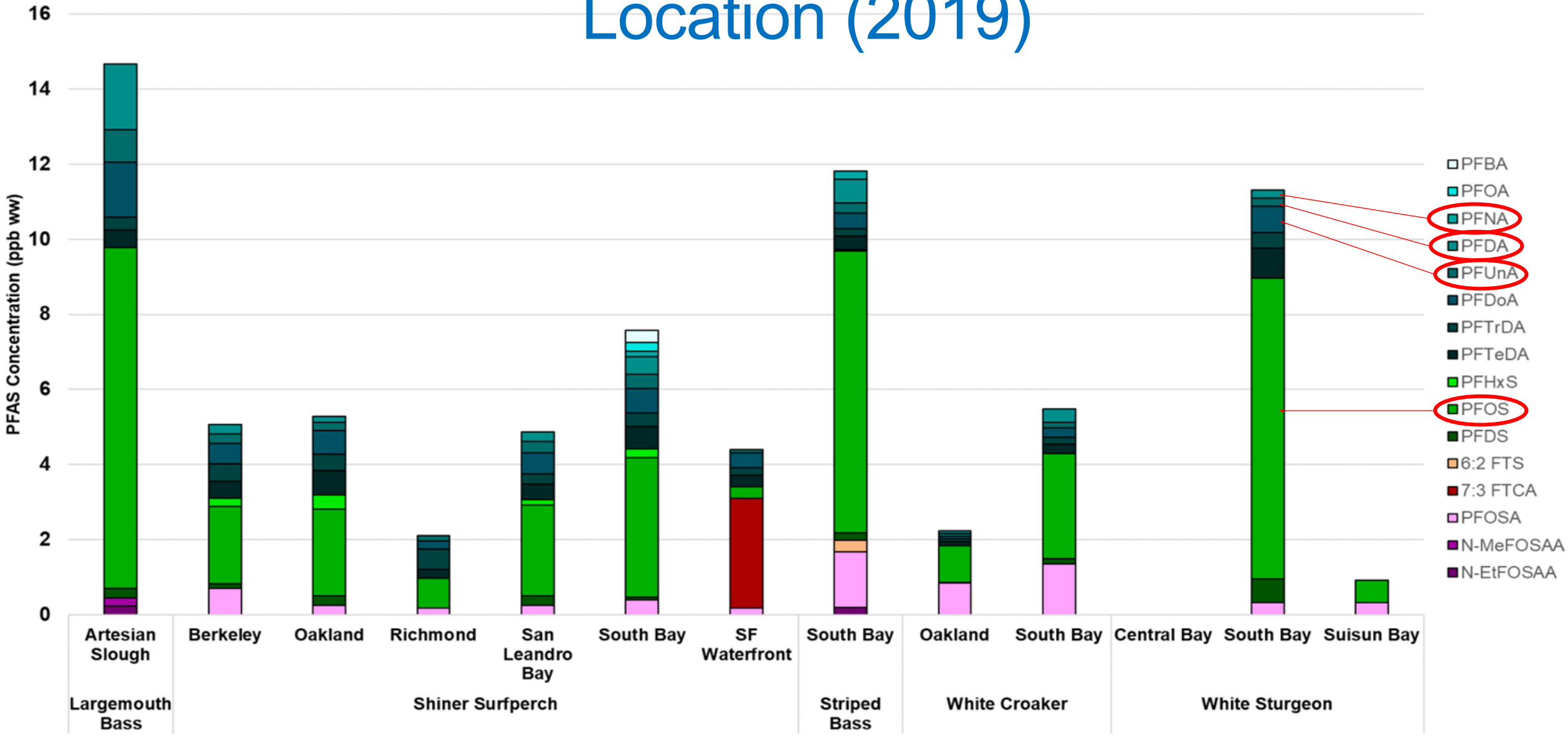


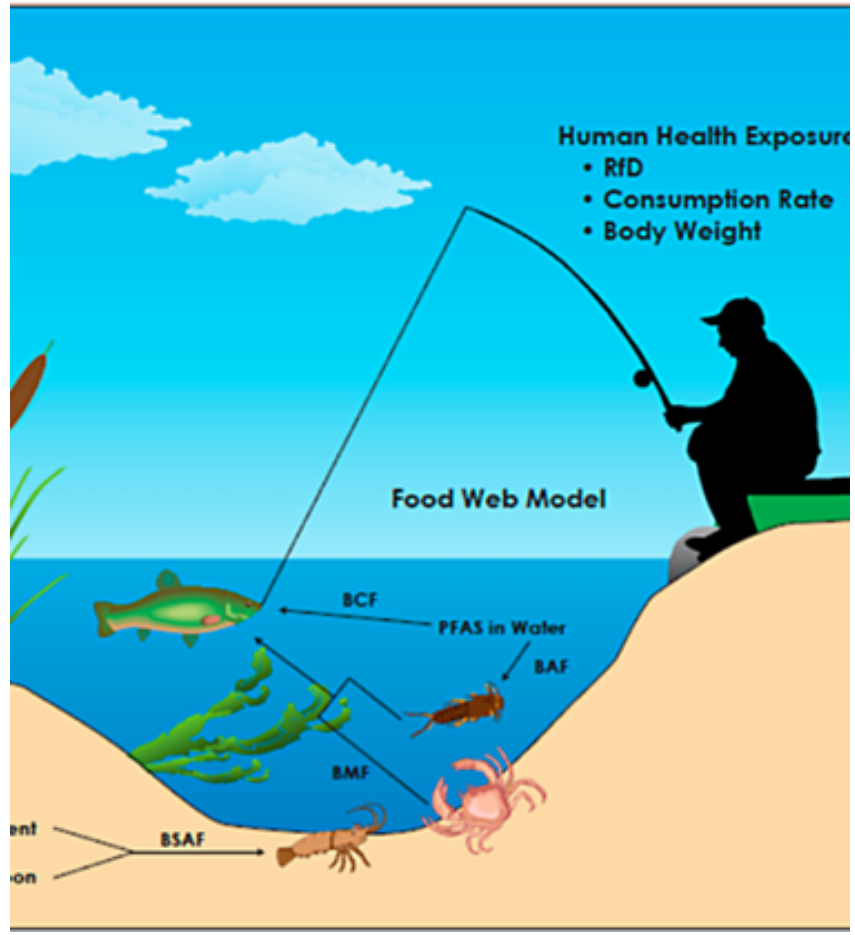
Slide courtesy of SFEI

Additional PFASs Sampling Efforts

- The Safe to Eat Workgroup (STEW) will be analyzing more than 150 archived samples from across the State
- To find out more details, tune into the July 31st STEW meeting here: https://waterboards.zoom.us/meeting/register/tJwqdu-qqDMpHtLYmmWqV0tlprI-MEflMoej#/registration

Bioaccumulation and Exposure Considerations for PFASs

- Models for persistent organic pollutants, such as DDTs and PCBs are not predictive of PFAS bioaccumulation due to partitioning to proteins and phospholipid membranes (Ankley et al, 2021)
- Some studies show no significant correlation between fish length or age with concentration (Pan et al, 2018; Fair et al, 2019)
- Higher trophic species (SFEI, 2019) and bottom-feeding species can accumulate high levels of PFASs (Ye et al, 2008)
- PFOS dominates fish tissue concentrations at approximately 64 – 77% of total PFASs (Barbo et al, 2023, Penland et al, 2020, SFEI, 2019)



Development of an ATL for PFOS

- Currently reviewing literature and fish tissue data in California and other states
  - SF Bay RMP sampling
  - STEW statewide sampling
- Scoping ATLs for PFOS
  - PFOS constitutes approximately 75% of total PFASs in fish
  - Health Protective Concentrations (OEHHA, 2024) for drinking water based on:
    - Acceptable daily dose (ADD) – 0.64 ng/kg-day
    - CSF – 15.6 $(mg/kg\text{-}day)^{-1}$

Looking Forward…

- Evaluate the levels of PFOA in tissue samples
  - Elevated PFOA concentrations have been detected in clams (Young et al, 2022)
- Further evaluate compounds commonly detected in seafood
  - PFOS, PFDA, PFUnA, and PFDoA account for 94.6% of PFASs found in freshwater fish nationwide (Barbo et al, 2023)

Acknowledgements

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- Tran Pham
- Beckye Stanton

STEW

- Anna Holder