

# Pharmaceuticals & Personal Care Products: How RMP Science Informs Policy



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San Francisco Estuary Institute  
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# Regional Monitoring Program for Water Quality in SF Bay



Collect data, communicate information about water quality to support management decisions

IS THE BAY SAFE  
FOR AQUATIC LIFE?



**STATUS**

FAIR

**TREND**

IMPROVING

IS THE BAY SAFE  
FOR FISHING?



**STATUS**

FAIR

**TREND**

NO CHANGE

IS THE BAY SAFE  
FOR SWIMMING?



**STATUS**

GOOD

**TREND**

NO CHANGE

# Status and Trends Monitoring

Every 2 Years

Every 3 Years

Every 4 Years

Every  
5 Years

WATER



BIRD EGGS



SEDIMENT



SPORT  
FISH



BIVALVES

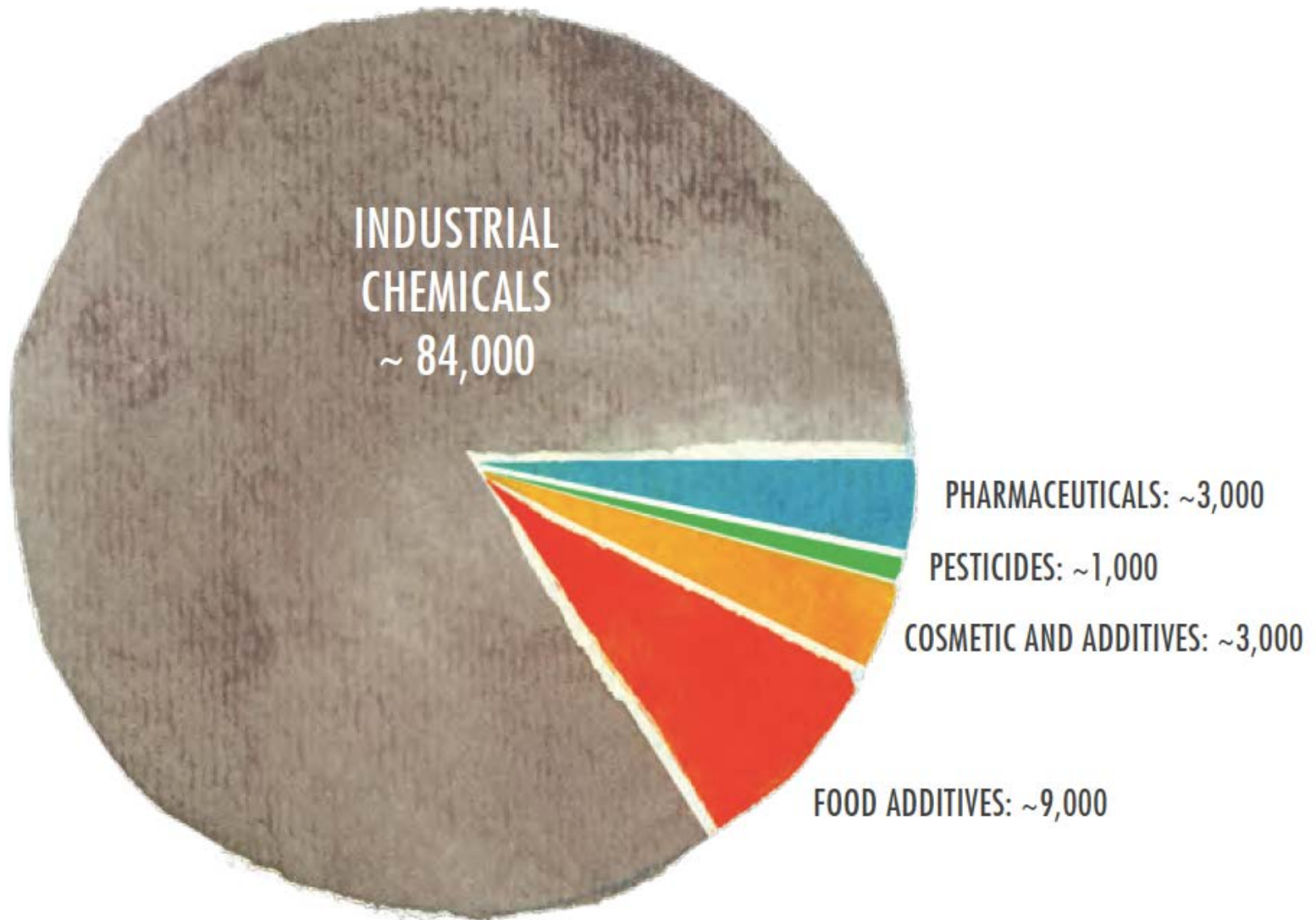


PARAMETERS

Hg, Cu, Se,  
PCBs, PAHs,  
PBDEs, PFASs,  
pesticides,  
dioxin, Toxicity

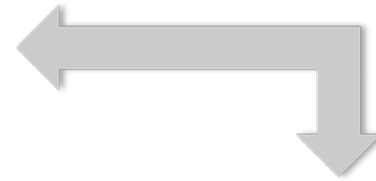


# Chemicals of Emerging Concern (CECs)



# RMP CEC Strategy: Three Elements

**1.** CEC monitoring,  
evaluating risk



**2.** Sharing expertise,  
learning from others



**3.** Non-targeted monitoring  
(bioassays, broadscans)






**MODERATE  
OR HIGH IMPACT**

None currently

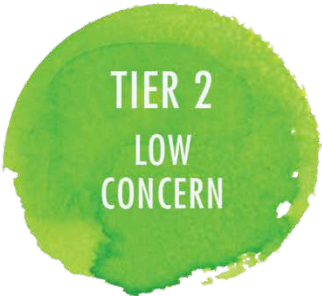
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**LOW IMPACT**

 PFOS  
Fipronil  
Nonylphenol  
PBDEs

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**NO IMPACT**

HBCD  
Pyrethroids\*  
Pharmaceuticals  
Personal Care Product Ingredients  
PBDDs and PBDFs

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**UNCLEAR**

Alternative Flame Retardants  
Fluorinated Chemicals  
Pesticides, Plasticizers,  
Microplastics  
Many, many others

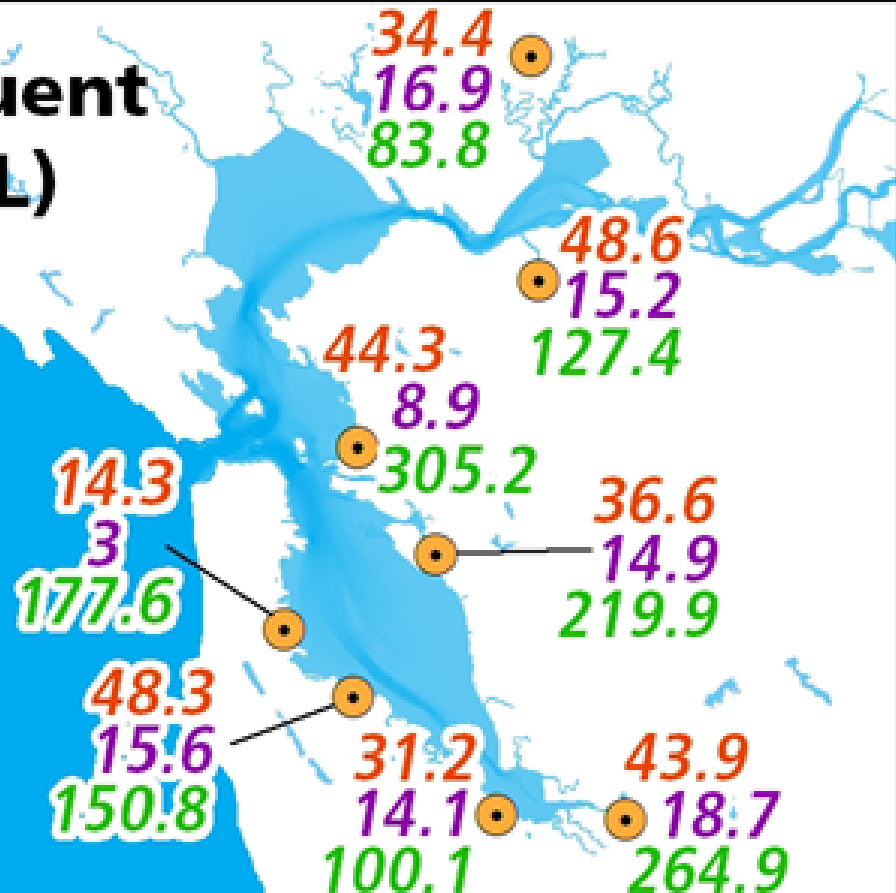
# Final Wastewater Effluent Concentrations (ng/L)

● Wastewater Treatment Plants

*Fipronil*

*Fipronil degradates*

*Imidacloprid*



- Fipronil
  - 11 ng/L (USEPA Aquatic life benchmark)
- Imidacloprid
  - 4.8 ng/L (PNEC)

Sadaria, A et al. In press. Passage of fiproles and imidacloprid from urban pest control uses through wastewater treatment plants in northern California



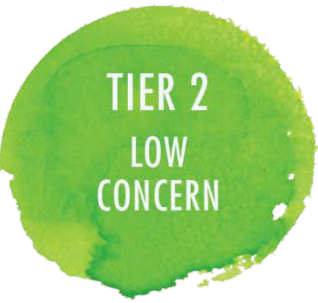
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## U.S. Life Expectancy a Time of Birth

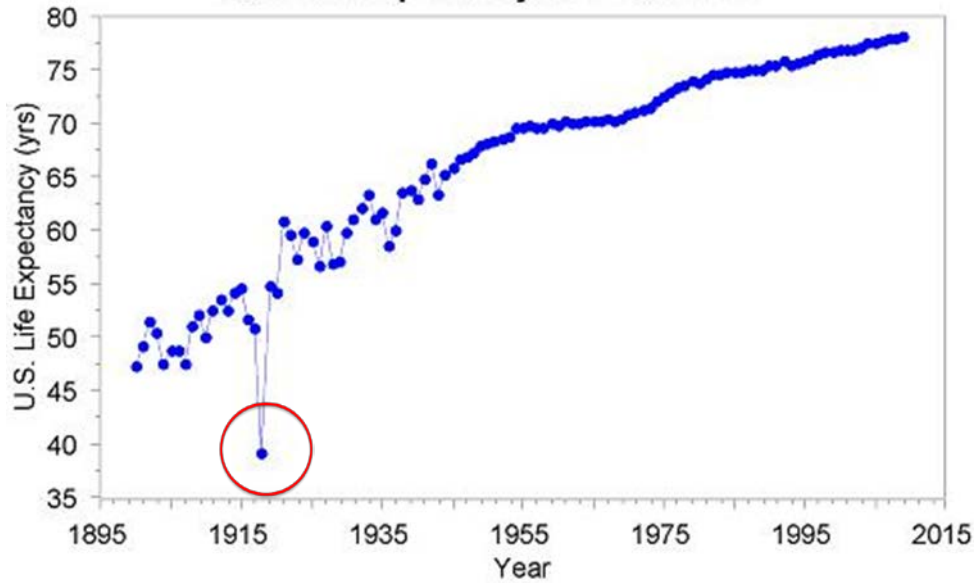
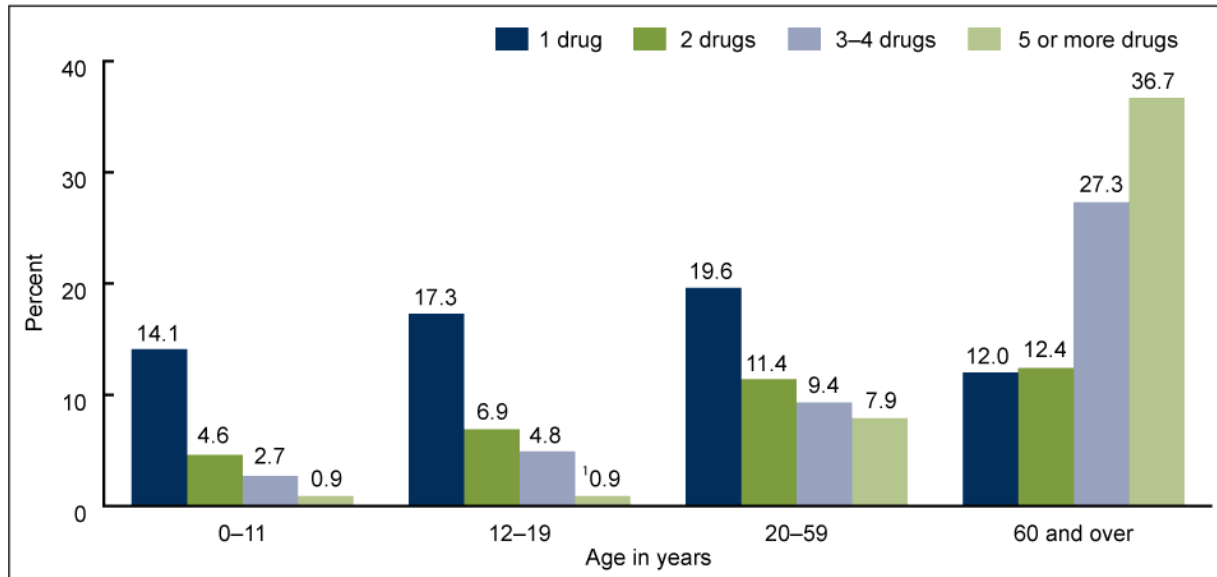
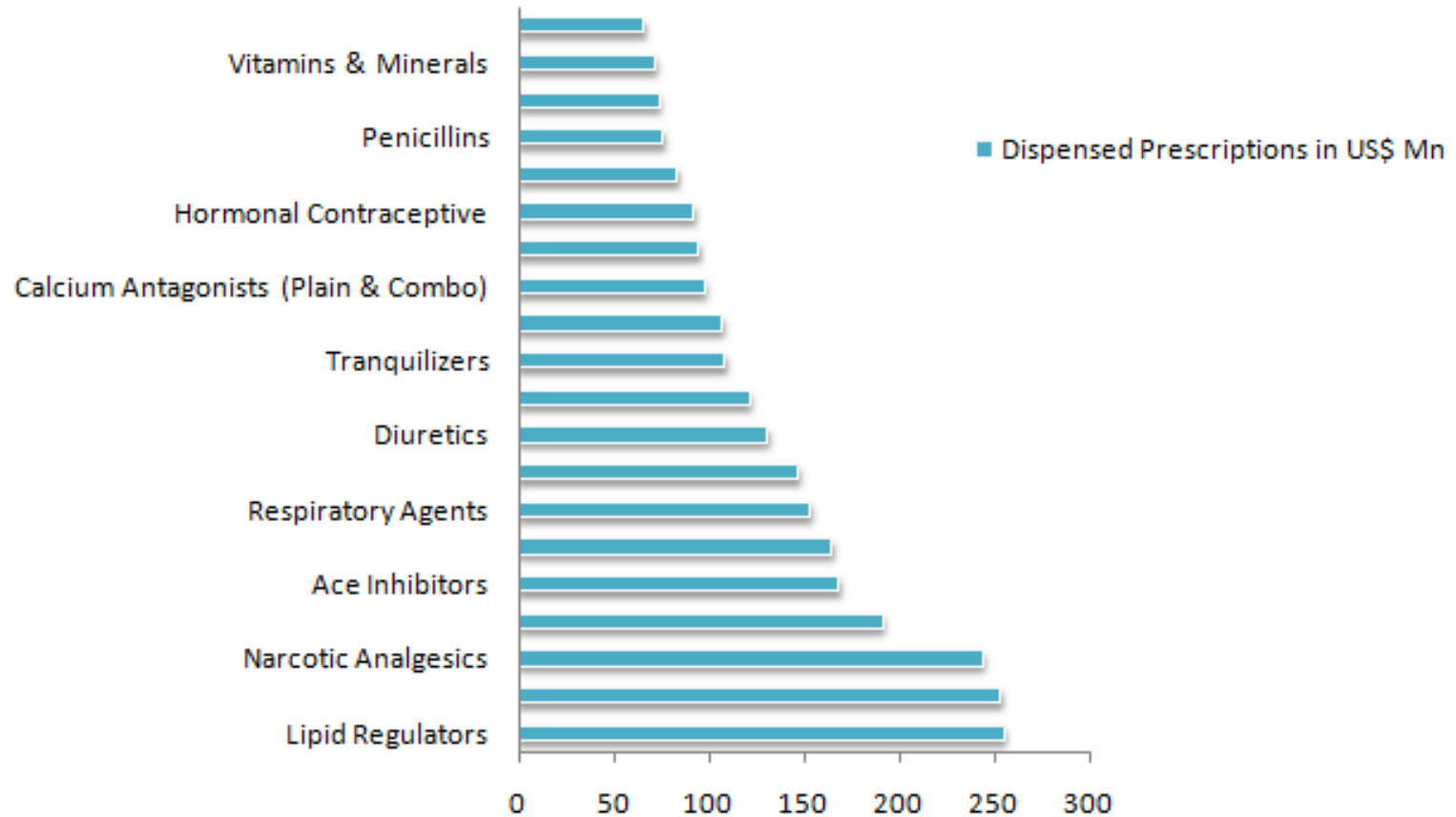


Figure 2. Percentage of prescription drugs used in the past month, by age: United States, 2007–2008



<sup>1</sup>Estimate is unstable; the relative standard error is greater than 30%.  
SOURCE: CDC/NCHS, National Health and Nutrition Examination Survey.

# Top US Prescriptions by Class (2010)



Source: IMS Health, National Prescription Audit, December 2010

in millions \$\$

# Pharmaceuticals

Sources to Bay:

- Disposal of unused medicines

*Policy Solution:*

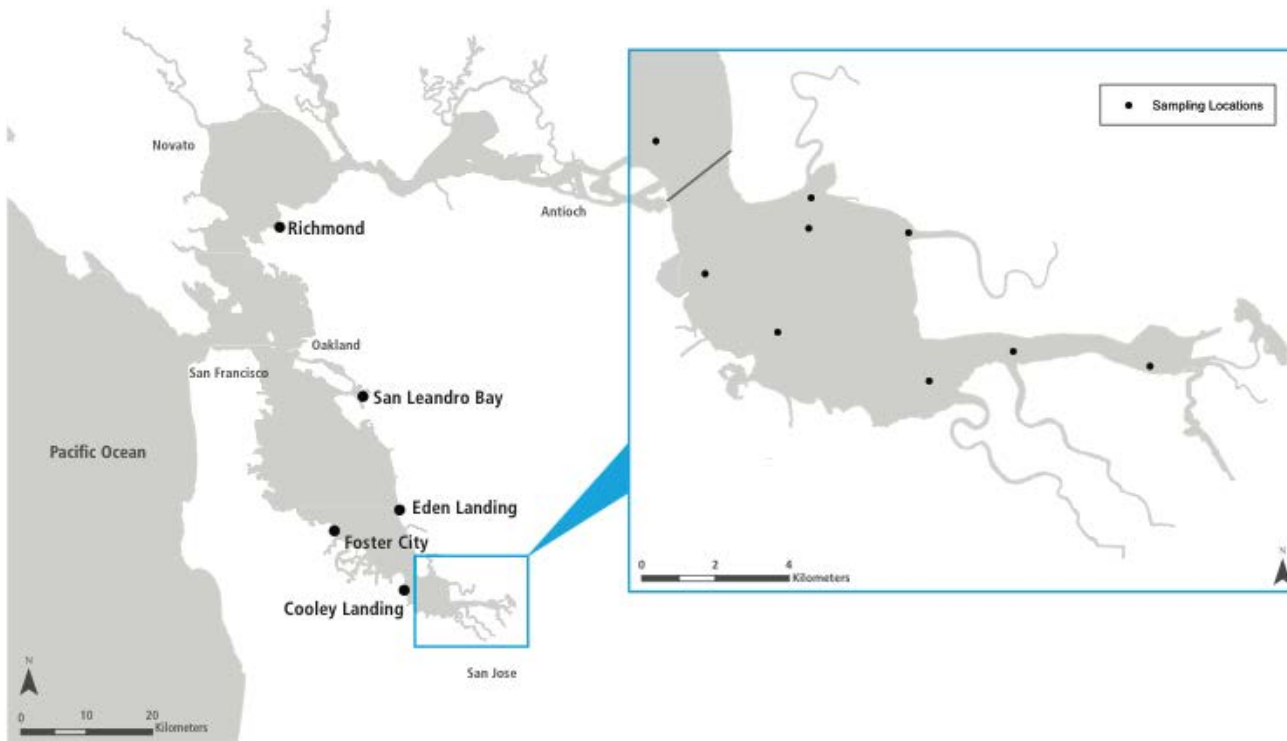
- Human excretion



# Pharmaceuticals

## Bay monitoring: 2006 & 2010

- 44 drugs or drug breakdown products were found in water, sediment, mussels



# Examples of Pharmaceuticals

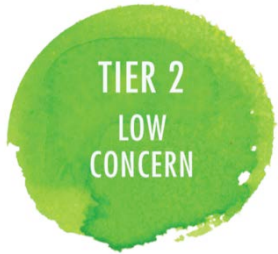
Year	Compound	Influent (ng/L)	Effluent (ng/L)	Bay (ng/L)	Sediment (ng/g)	Mussel (ng/g)	Toxicity
2006	Acetaminophen	60,000	<500	<300		4	9,200 ng/L (PNEC)
2006	Gemfibrozil	1000	30	10			900 ng/L (PNEC)

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2010	Valsartan			92	NA	NA	85 mg/L (NOEC)
2010	Triclocarban			ND	33	2	1,900 ng/L (PNEC)
2006	Sulfamethoxazole	1000	70	200			118 ng/L (PNEC)
2010	Sulfamethoxazole			66.7	0.7	ND	
2010	Erythromycin	200	200	12.1	3.4	0.1	22 ng/L (PNEC)



# Pharmaceuticals

## Bay monitoring: 2006 & 2010

- 44 drugs or drug breakdown products were found in water, sediment, mussels
- Nearly all **below toxicity thresholds**

## Exceptions:

- Sulfamethoxazole
- Erythromycin



***Solution:  
Better  
Prescribing?***

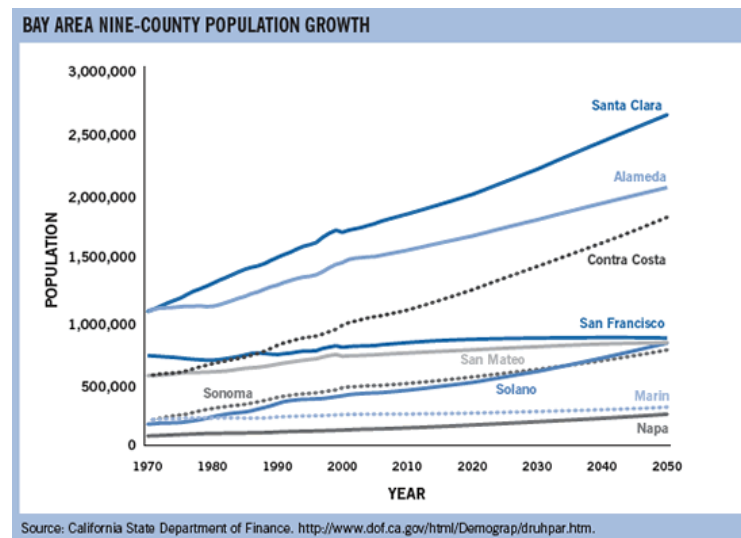






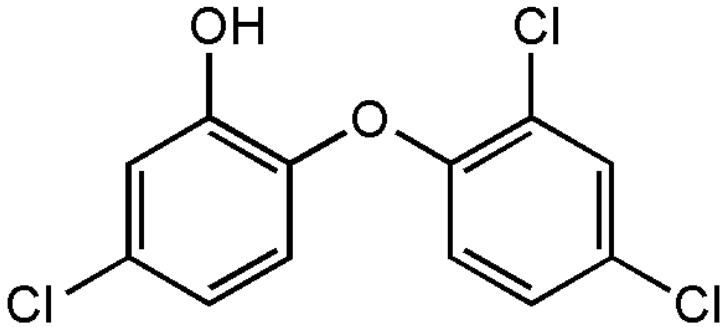
# Pharmaceuticals: Still on our radar screen

- RX change .... populations grow
- Analytical capabilities improve
- Better toxicological information
- 2016 BACWA WWTP study



TIER 2  
LOW  
CONCERN

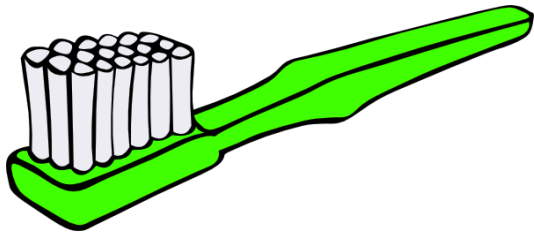
# Personal Care Products: Triclosan



2,000 products



Triclocarban



# Triclosan

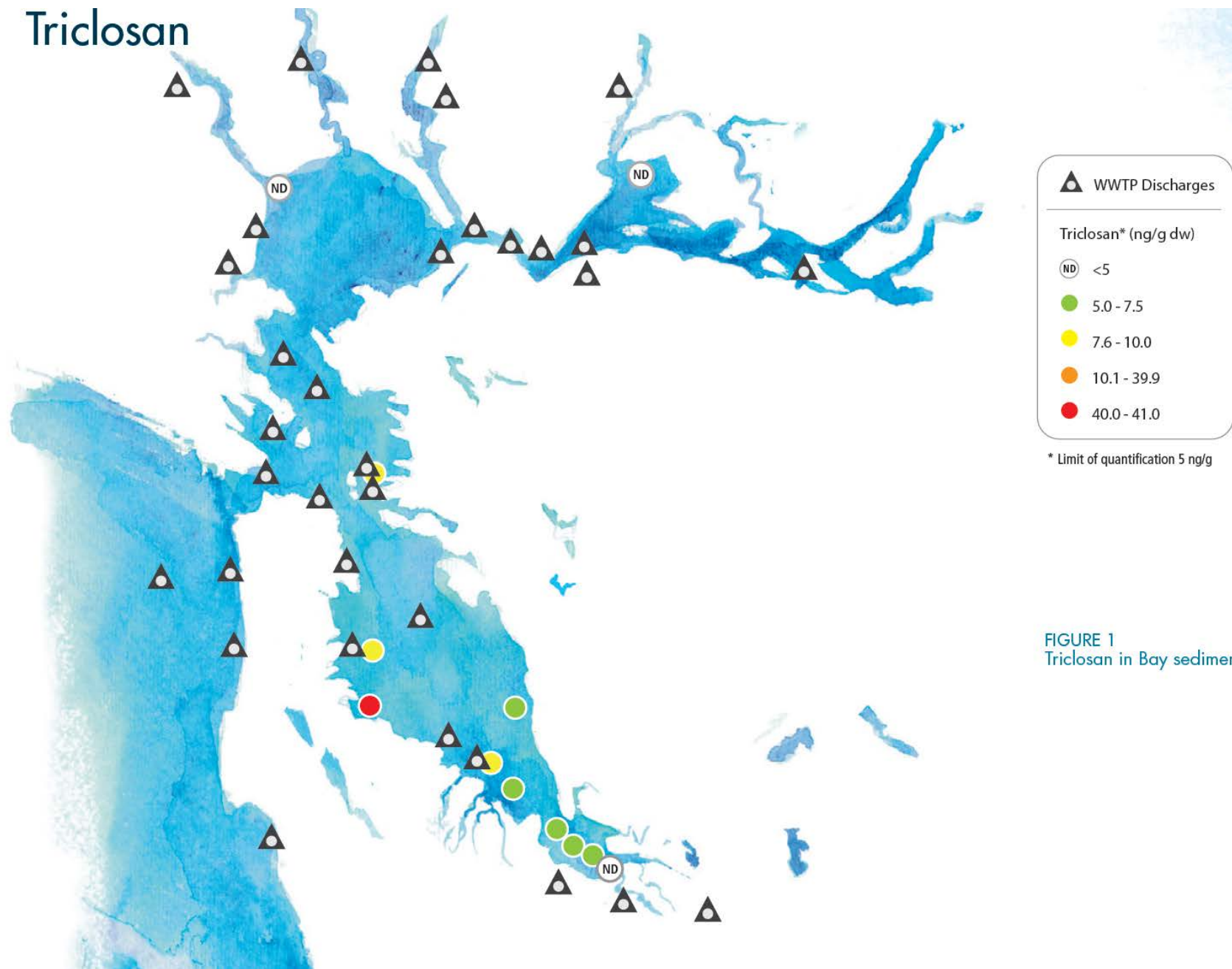


FIGURE 1  
Triclosan in Bay sediment, 2008.

# Evidence of Concern

2011 REVIEW

Kerrigan et al. 2015



Not detected  
< 60 ng/L

Up to  
68 ng/L  
n=2

2012 Toxicity threshold (PNEC) - 115 ng/L



Up to  
40 ng/g dw

Up to  
6 ng/g dw  
n=10

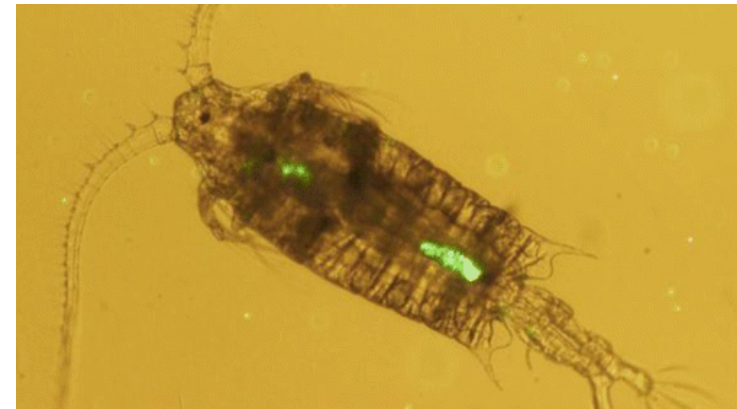
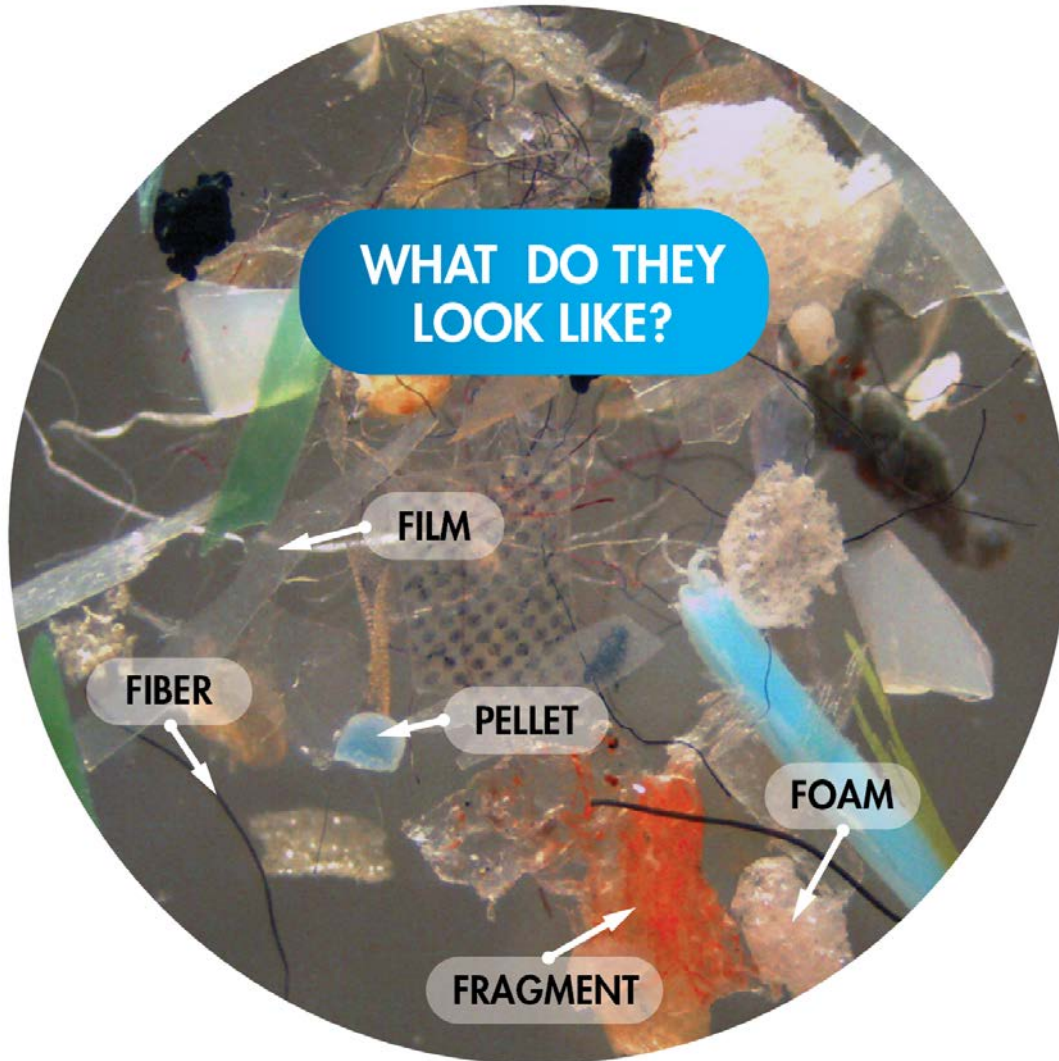


# FDA bans triclosan & triclocarban in handsoaps

- No more effective than plain soap and water
- Concerns over antibacterial resistance and hormonal effects
- Ban covers only hand soap

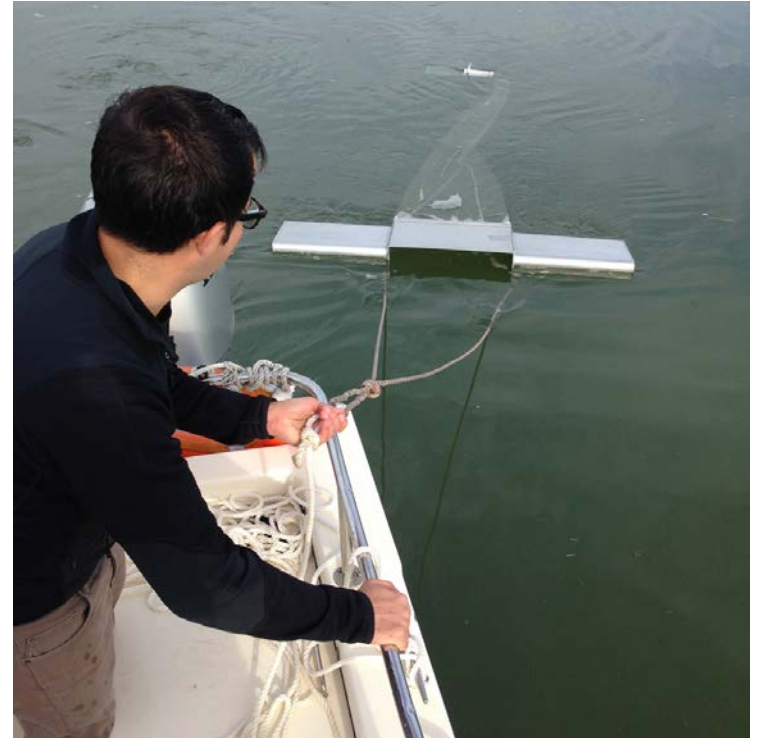
*Review labels before purchasing?*

# Microplastics



# Methods

- Surface water
  - 9 sites in SF Bay
  - Manta trawls
- Wastewater
  - 8 Bay Area WWTP
  - Final effluent



# Microplastic Pollution



*The pilot study suggested that San Francisco Bay has more microplastic pollution than other major water bodies in the US.*

Abundance (particles/km<sup>2</sup>)

**SOUTH BAY**  
1,000,000



**CENTRAL BAY**  
310,000



**SAN FRANCISCO BAY**

**CHESAPEAKE BAY**

**GREAT LAKES**

## Microplastic Particle Abundance

### Microplastic

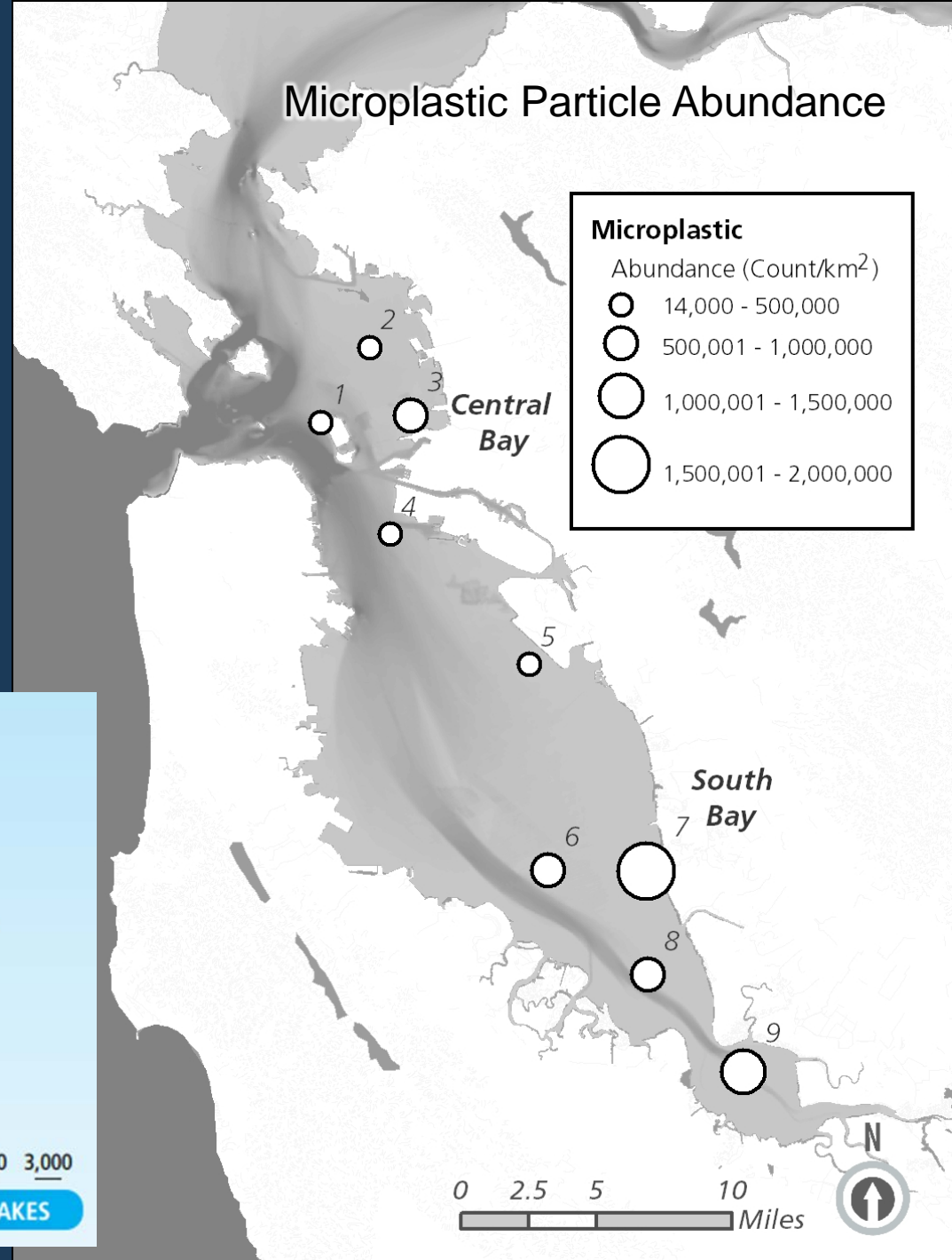
Abundance (Count/km<sup>2</sup>)

○ 14,000 - 500,000

○ 500,001 - 1,000,000

○ 1,000,001 - 1,500,000

○ 1,500,001 - 2,000,000

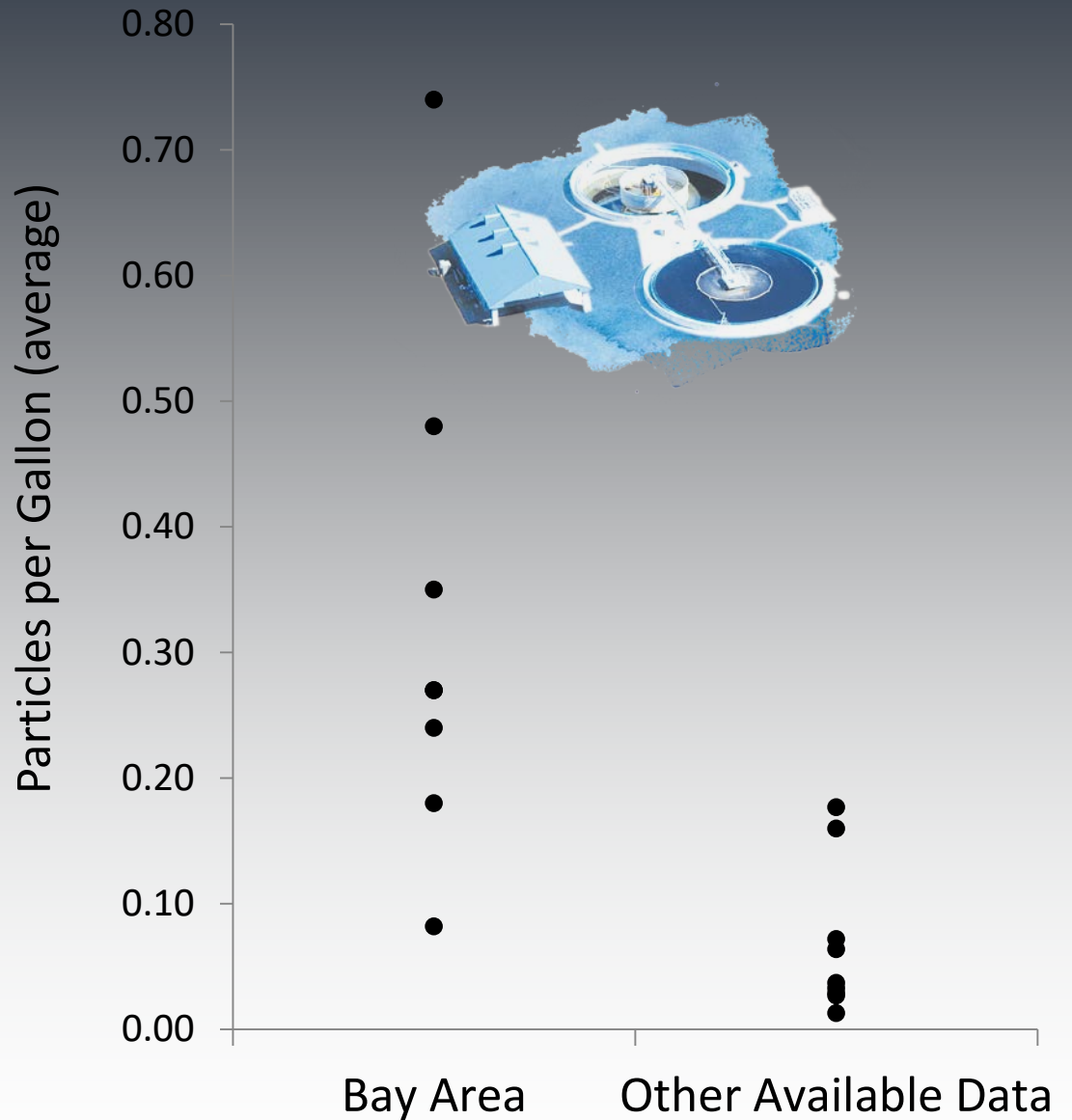


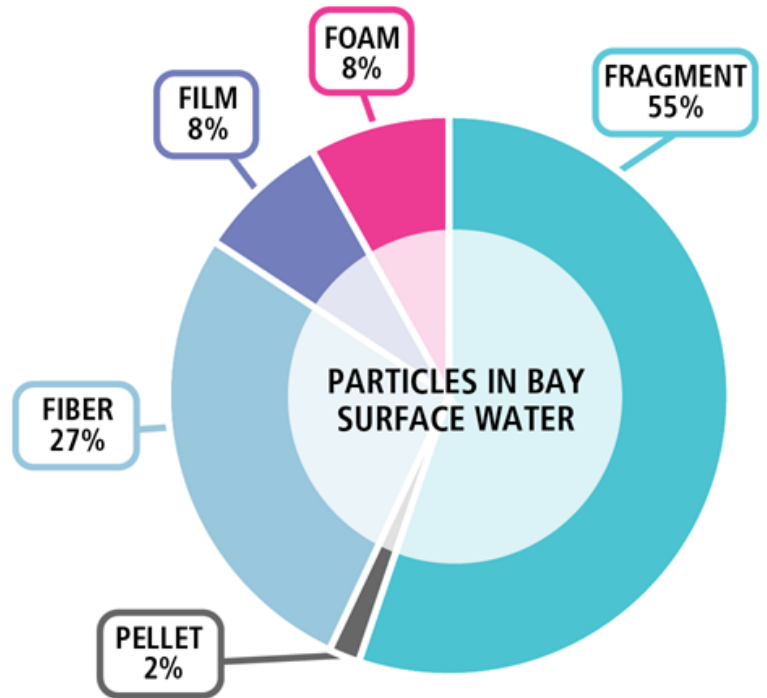
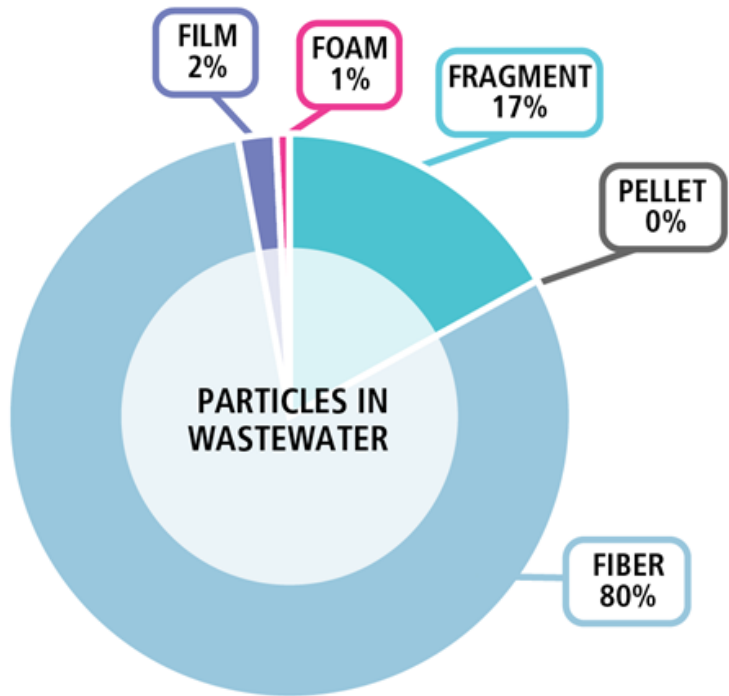
0 2.5 5 10 Miles





# Microplastic Pollution Pathway: Wastewater





# Source Control



**OCTOBER 2015:**

Governor Brown Signs AB 888, the **Microbead Ban Bill**

- Effective 2020
- Strictest among state bans



**DECEMBER 2015:**

Federal **Microbead-Free Waters Act** signed into law

- Microbeads in rinse-off products only
- No “biodegradable” plastic exemption
- Bans production July 2017, sale July 2018
- Preempts state bans

# Future Work (2017-2019): Monitoring in Bay and out Golden Gate

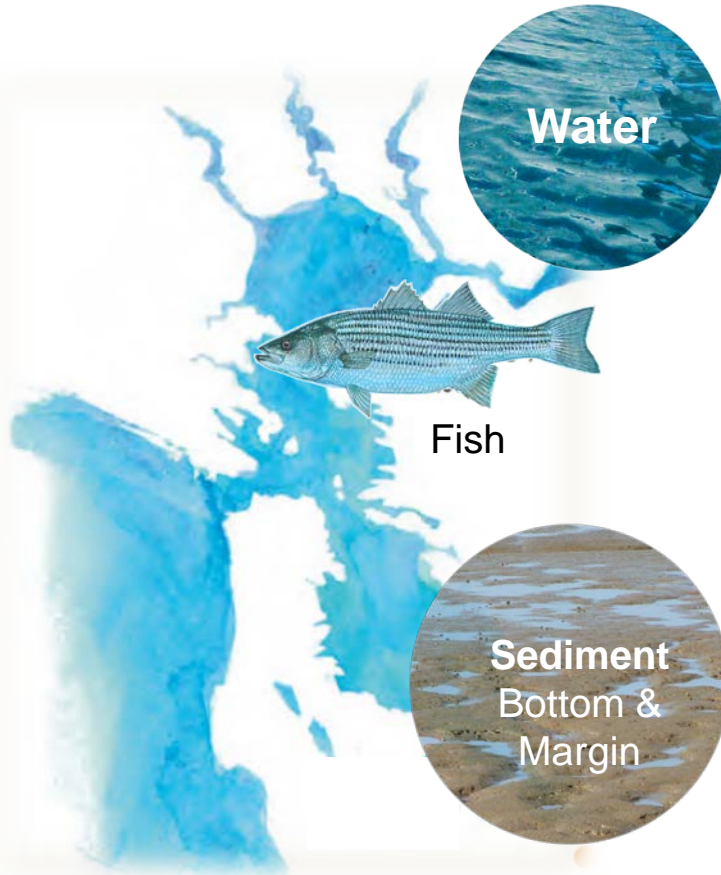
## Pollution Pathways



Wastewater



Stormwater



Water

Fish

Sediment  
Bottom &  
Margin

## Bay Monitoring

## Sanctuary Monitoring



Water



# Questions?



More information  
at [www.sfei.org](http://www.sfei.org) or  
e-mail me  
[meg@sfei.org](mailto:meg@sfei.org)