Patterns in mercury and trace organic contamination of sport fish and sediments in San Francisco Bay compared to the offshore coast

RMP Technical Review Committee
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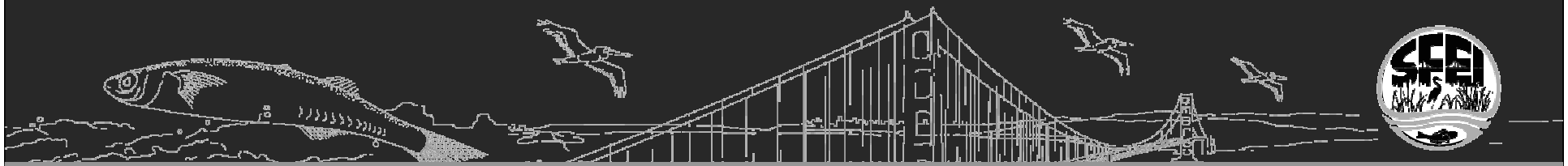
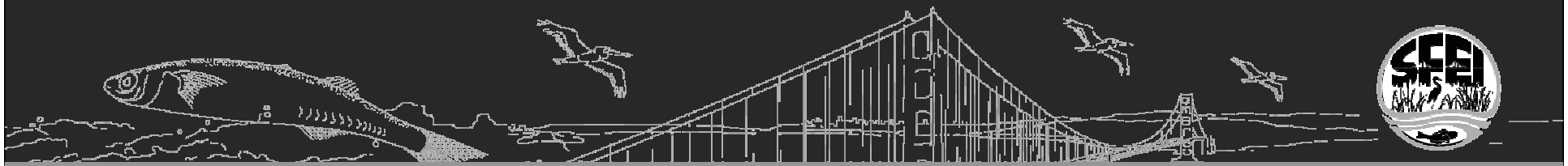
Aroon Melwani, Ben Greenfield,
Laura Targgart, and Mike Kellogg



Outline

- Background
- Goals of the study and RMP Management Questions
- Data/Methods
- Results
  - Mercury and PCB concentrations
  - Comparison to human health (HH) thresholds
  - Interannual trends
- Implications for RMP and SWAMP

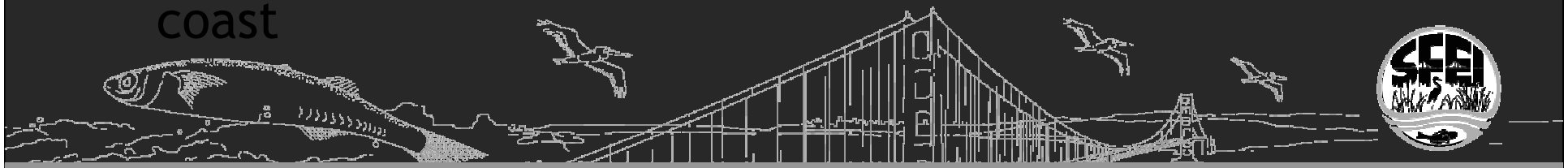


Background

- RMP monitoring in the Bay for contaminants in fish (since 1994) and sediments (since 1993)
- CCSF monitoring for permitting began in 1982
  - Fish/crab bioaccumulation
  - Sediment chemistry
  - Benthic macrofauna

- Integration of these datasets had yet to be performed

- Differences: anthropogenic influence, sources, pathways for particles and contaminants
- Movement range of fish expected to be higher on the coast

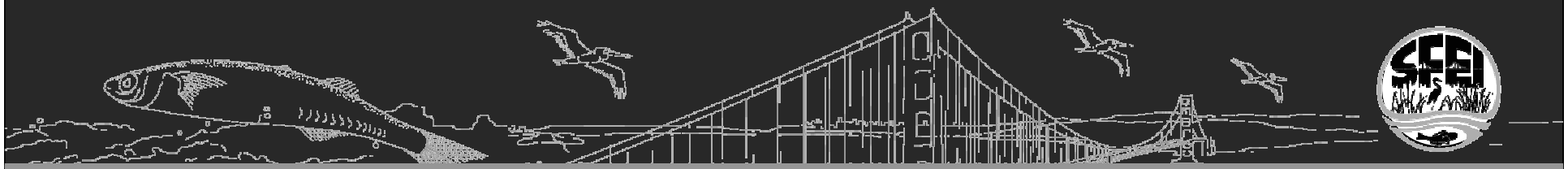


RMP Management Questions

Level I –

1. Are chemical concentrations in the Estuary potentially at levels of concern and are associated impacts likely?

4. Have the concentrations, masses, and associated impacts of contaminants in the Estuary increased or decreased?



Datasets

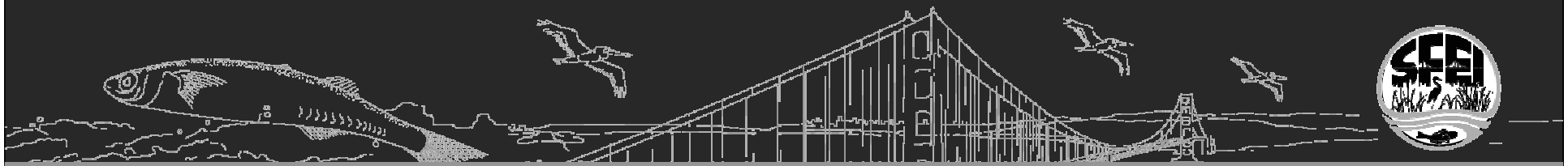
- City and County of San Francisco (CCSF)
  - Two stations
  - 1987 – 2005 (Hg), 1999 – 2005 (Orgs)
  - English sole (sub-adults < 200 mm length)
  - Composites (10 fish)
  - Mercury, PCBs, PAHs, pesticides
  - Sediments (surface)

- Regional Monitoring Program (RMP)
  - Five stations
  - 1997 – 2006
  - White croaker, shiner surfperch, striped bass
  - Composites (5- 20 fish)/individuals
  - Mercury, PCBs, pesticides, PAHs (seds only)
  - Sediments (surface)

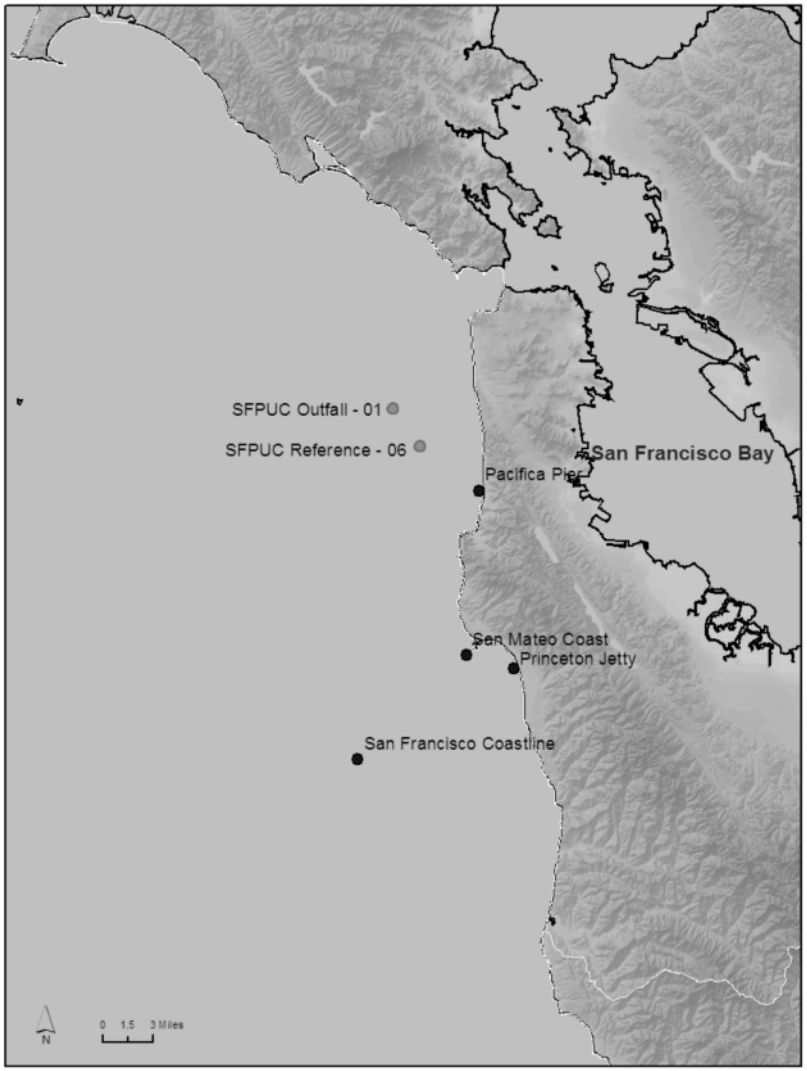
Datasets

- Coastal Fish Contamination Program (CFCP)
  - Four stations (1999 – 2003)
  - Surf perches, white croaker, striped bass
  - Composites (3 – 15 fish)
  - Mercury, PCBs, pesticides

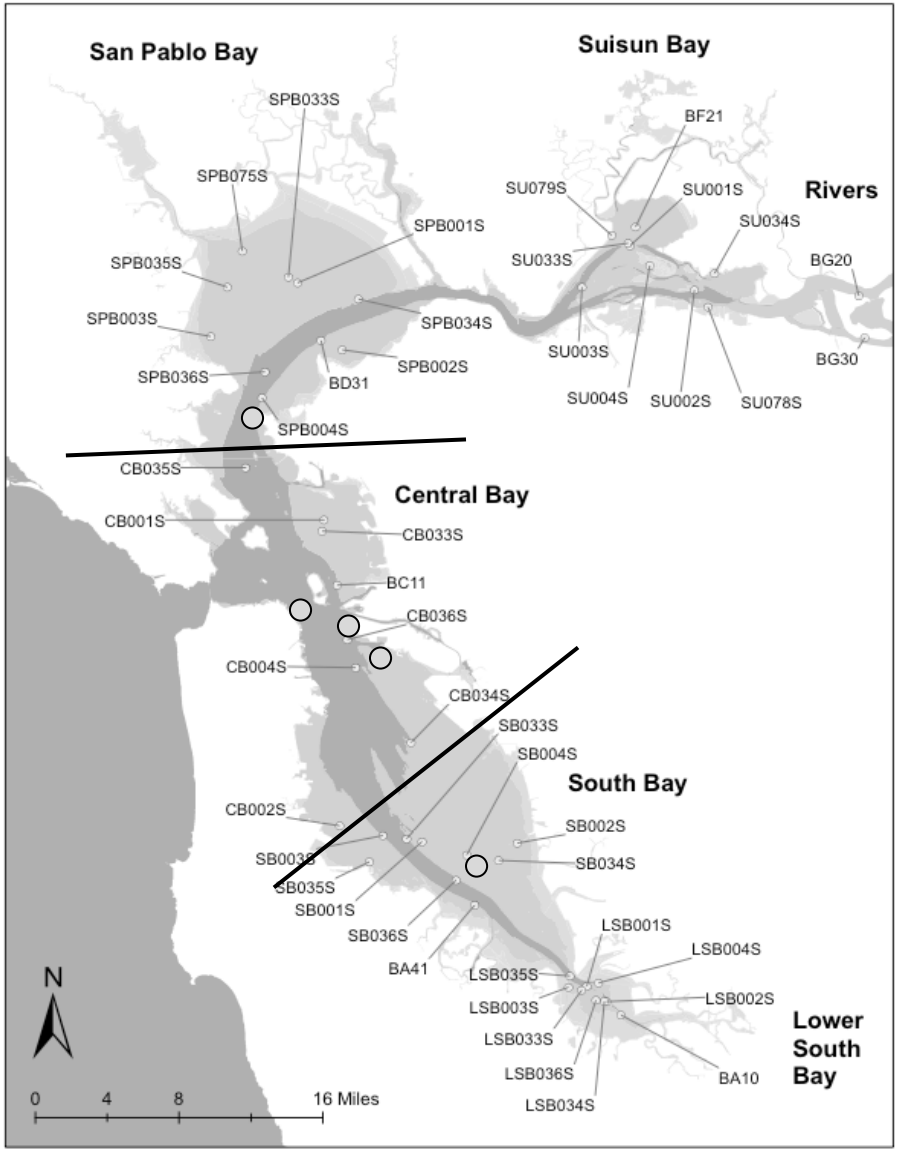
- Value Added: human health assessment, sport fish along the coast, contaminants of concern



Coast


SFPUC Outfall - 01
SFPUC Reference - 06
San Francisco Bay
Pacifica Pier
San Mateo Coast
Princeton Jetty
San Francisco Coastline
N
0 1.5 3 Miles

Bay

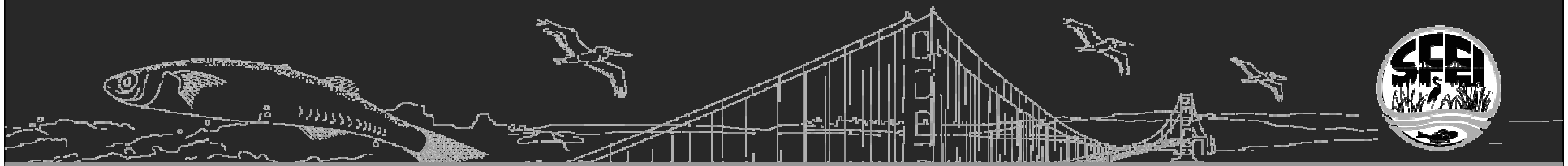

San Pablo Bay
Suisun Bay
Rivers
Central Bay
South Bay
Lower South Bay
SPB033S
SPB075S
SPB001S
SPB035S
SPB003S
SPB034S
SPB036S
BD31
SPB002S
SPB004S
CB035S
CB001S
CB033S
BC11
CB036S
CB004S
CB034S
SB033S
SB004S
CB002S
SB002S
SB003S
SB034S
SB035S
SB001S
SB036S
BA41
LSB001S
LSB004S
LSB035S
LSB002S
LSB003S
LSB033S
LSB036S
LSB034S
BA10
BF21
SU079S
SU001S
SU034S
SU033S
BG20
SU003S
BG30
SU004S
SU002S
SU078S
N
0 4 8 16 Miles

Data Analysis

- Fish and sediment median concentrations
- Sum organic contaminants per RMP methods
- Status: 1999 to 2006, maximized comparability

- HH thresholds from Klasing and Brodberg (2008)
- 2 servings/week advisory tissue level used in this presentation

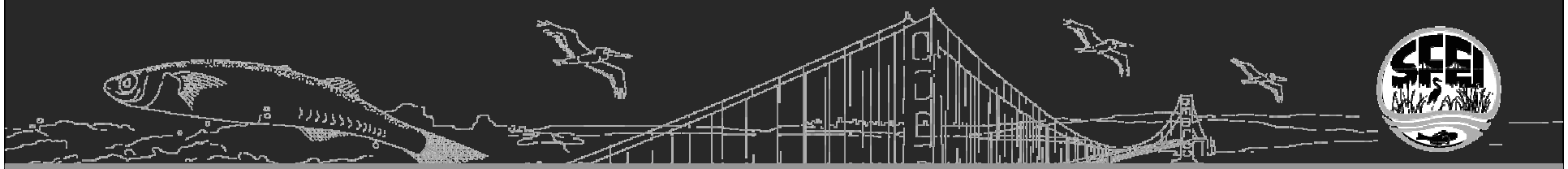
- General linear model used to evaluate trends
- Used widest range in years possible



Mercury

Region	Species	Average Length (cm)	Sample size (% below detection)	Mercury Median ± Std Dev
San Francisco Bay	Shiner surfperch	11	32 (0%)	0.08 ± 0.04
	Striped bass	54	74 (0%)	0.30 ± 0.15
	White croaker	25	26 (0%)	0.21 ± 0.07
	Black surfperch	26	9 (0%)	0.13 ± 0.04
	Walleye Surfperch	28	4 (0%)	0.16 ± 0.04
Offshore Coast	Striped bass	58	1 (0%)	0.42
	Silver perch	17	3 (0 %)	0.08 ± 0.06
	White croaker	25	3 (0 %)	0.15 ± 0.02
	Walleye surfperch	20	3 (33 %)	0.09 ± 0.09
	English sole	17	35 (0%)	0.02 ± 0.01
Coastal Piers	Rainbow surfperch	24	2 (0 %)	0.07 ± 0.00
	White surfperch	19	3 (0 %)	0.06 ± 0.01

wet weight



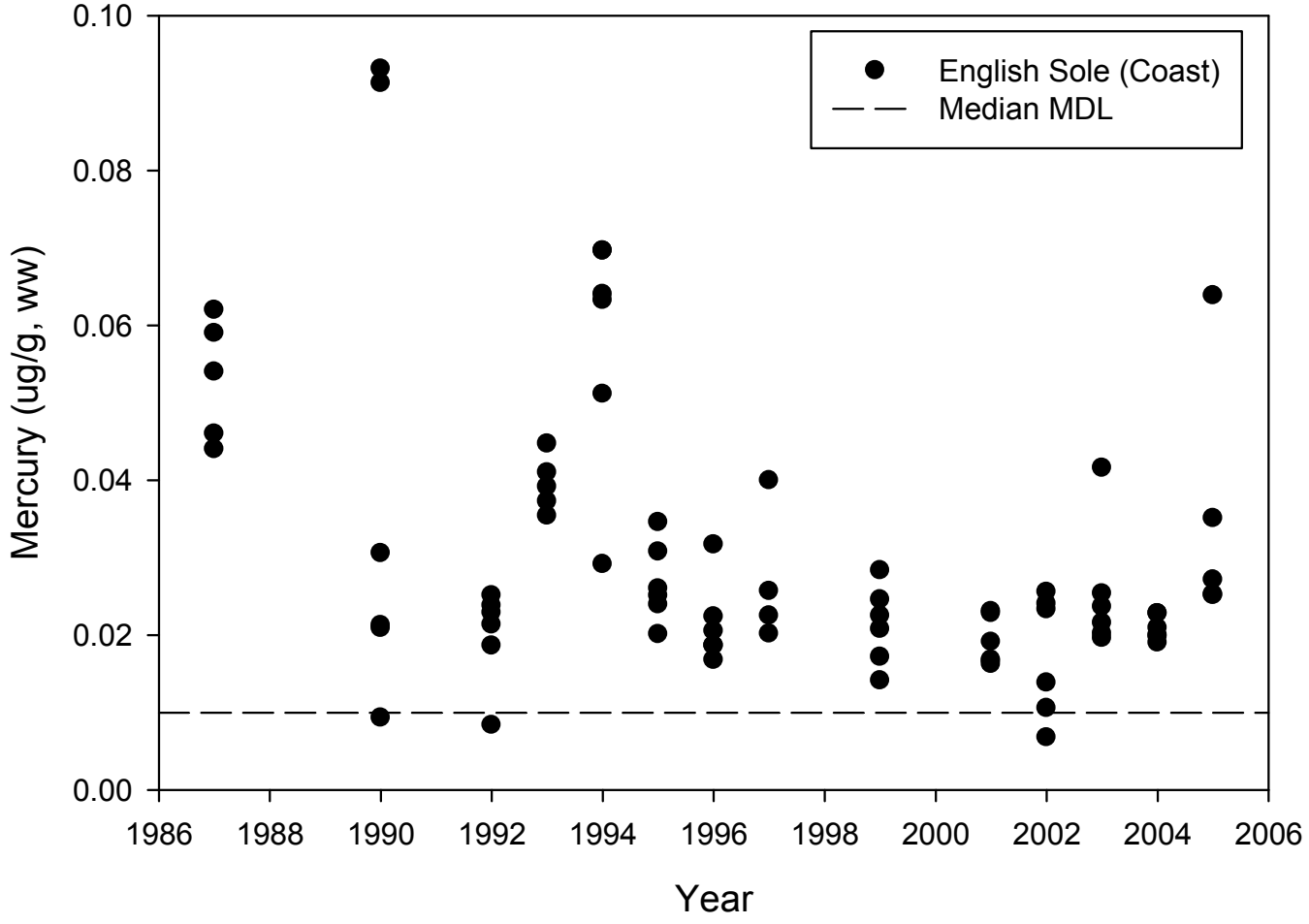
Mercury Comparison to HH Thresholds

Species with Hg > 0.15ppm (2 meals)

- RMP: Shiner perch – 3/32
- RMP: Walleye – 2/9
- RMP: White croaker – 23/26
- RMP: Striped bass – 73/74

- CFCP: Silver perch – 1/3
- CFCP: Walleye – 1/3
- CFCP: White croaker - 1/3
- CFCP: Striped bass – 1/1

Mercury Trends



Sport fish TMDL Target in the Bay

0.2 ug/g

PCBs

Region	Species	Average Lipid (%)	Sample size (% below detection)	PCBs Median ± Std Dev
San Francisco Bay	Shiner surfperch	1.8	47 (0%)	121 ± 77
	Striped bass	2.6	17 (0%)	47 ± 16
	White croaker	4.6	44 (0%)	222 ± 96
	Black surfperch	0.6	9 (0%)	8 ± 4
	Walleye Surfperch	1.0	4 (0%)	41 ± 50
Offshore Coast	Striped bass	1.0	3 (0 %)	34 ± 35
	Silver perch	4.2	3 (0 %)	54 ± 16
	White croaker	0.9	3 (0 %)	2.8 ± 1.0
	Walleye surfperch	2.5	3 (0 %)	29 ± 2.8
	English sole	N/A	35 (80%)	0 ± 2.1
Coastal Piers	Rainbow surfperch	1.5	2 (0%)	3.4 ± 1.2
	White surfperch	1.1	3 (0 %)	4.8 ± 2.0

wet weight

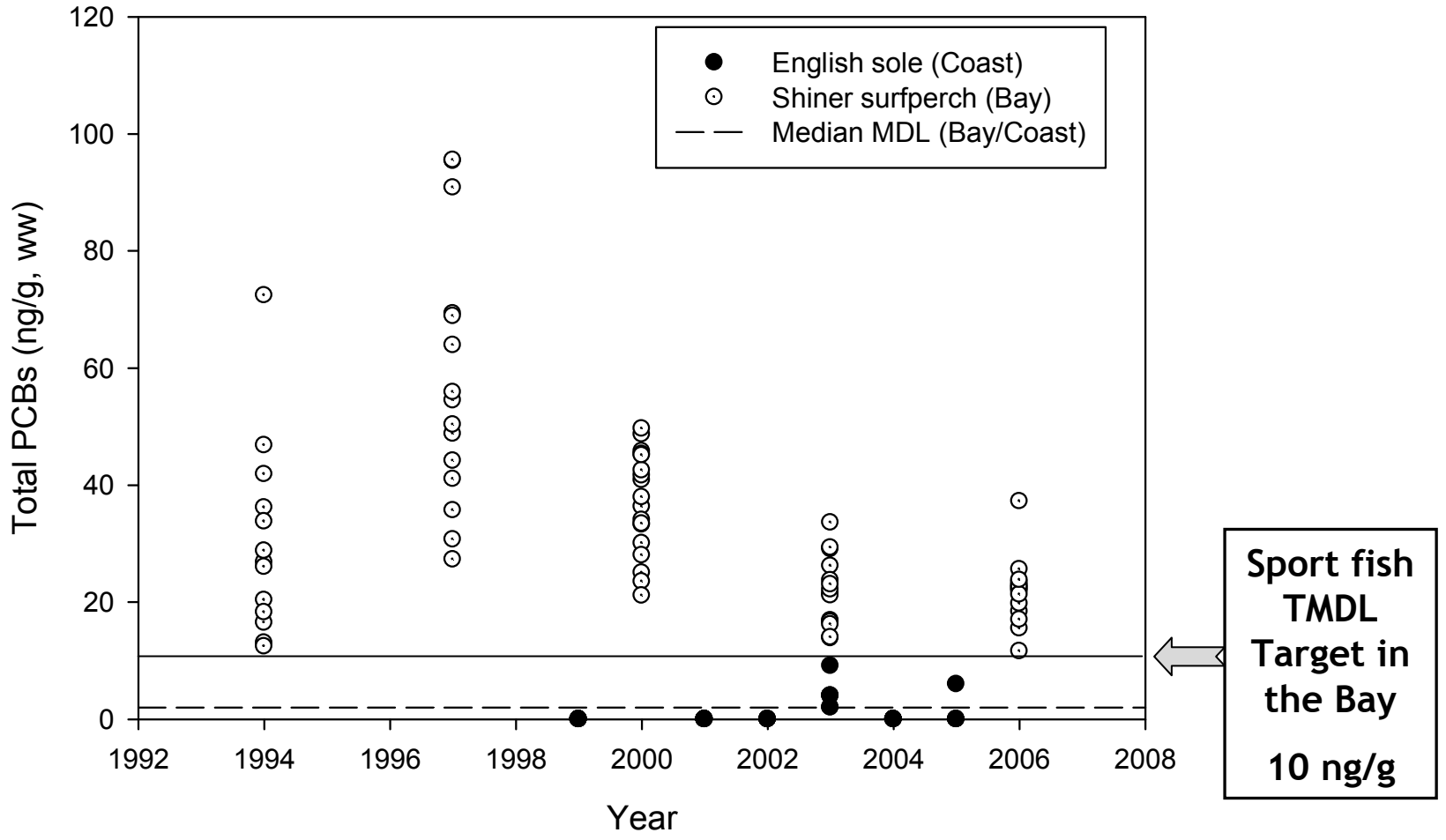
PCB Comparison to HH Thresholds

Species with PCBs > 42 ppb (2 meals)

- RMP: Shiner perch – 45/47
- RMP: White croaker – 44/44
- RMP: Walleye – 2/4
- RMP: Striped bass – 9/17

- CFCP: Silver perch – 2/3
- CFCP: White croaker – 1/3
- CFCP: Walleye: 0/3
- CFCP: Striped bass – 1/3

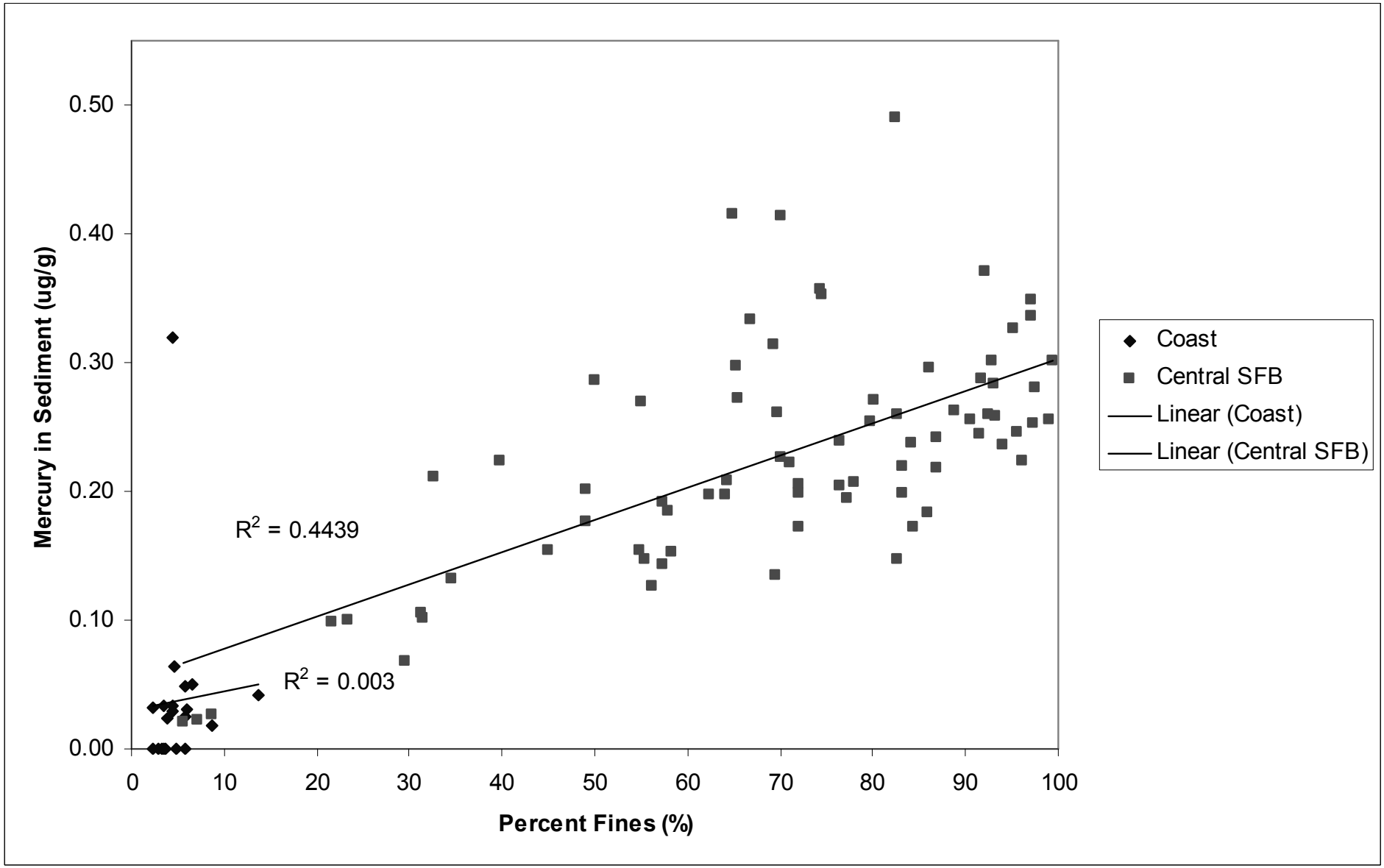
PCB Trends


120
100
80
60
40
20
0
Total PCBs (ng/g, ww)
1992
1994
1996
1998
2000
2002
2004
2006
2008
Year
English sole (Coast)
Shiner surfperch (Bay)
Median MDL (Bay/Coast)
Sport fish TMDL Target in the Bay
10 ng/g

Sediments

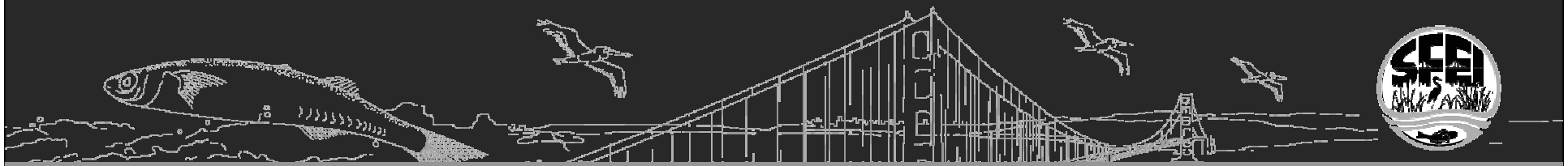
Contaminant (units)	Central San Francisco Bay Median Concentration (St. Dev)	Sample size (% Below Detection)
Mercury (ppb)	223.6 (88.6)	77 (0%)
Napthalene (ppb)	37.60 (18.1)	75 (0%)
p,p-DDE (ppb)	0.60 (0.6)	67 (19%)
PCB110 (ppb)	0.33 (0.6)	59 (22%)
PCB095 (ppb)	0.12 (0.5)	59 (22%)
Fine Grains (%)	72.09 (23.6)	77 (0%)
Organic Carbon (%)	1.06 (0.5)	77 (0%)
Phenanthrene (ppb)	130.00 (206.9)	77 (1%)
Pyrene (ppb)	361.00 (440.7)	77 (0%)

Contaminant (units)	Offshore Coastal Median Concentration (St. Dev)	Sample size (% Below Detection)
Mercury (ppb)	27.02 (69.4)	20 (35%)
Napthalene (ppb)	0 (7.8)	18 (56%)
p,p-DDE (ppb)	0 (0.6)	18 (94%)
PCB110 (ppb)	0	19 (100%)
PCB095 (ppb)	0	19 (100%)
Fine Grains (%)	4.50 (3.2)	20 (0%)
Organic Carbon (%)	0.13 (0.04)	20 (0%)
Phenanthrene (ppb)	2.48 (15.6)	18 (39%)
Pyrene (ppb)	3.50 (34.1)	18 (28%)


Mercury in Sediment (ug/g)
0.50
0.40
0.30
0.20
0.10
0.00
0
10
20
30
40
50
60
70
80
90
100
Percent Fines (%)
R2 = 0.4439
R2 = 0.003
Coast
Central SFB
Linear (Coast)
Linear (Central SFB)

Summary

- PCBs in sport fish and Hg in sediments from San Francisco Bay were relatively high compared to the coast
- PCBs and mercury in sport fish on the coast appear to still be at levels for concern to human health
- CCSF data not useful for HH evaluation but good for trends
- Higher sample sizes required on the coast, need lipids data



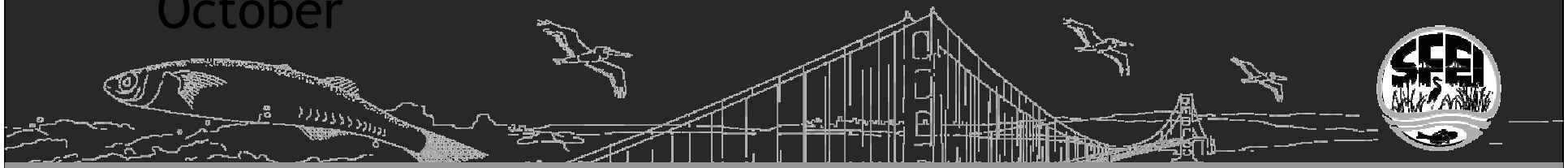
Summary

- Long-term trends not evident, despite different species being evaluated

- Sampling that is currently underway on the coast through SWAMP will help to provide the necessary sample sizes to evaluate the patterns observed in this study

* Report will be distributed to TRC by July 17th

** CCSF data will be available via RMP Web Query Tool in October



Questions ??