



# Riparian Mercury Biosentinels for the San Francisco Bay Area

April Robinson, Letitia Grenier, Marcus Klatt, Shira  
Bezalel, Sarah Lowe, Meredith Williams, Josh Collins

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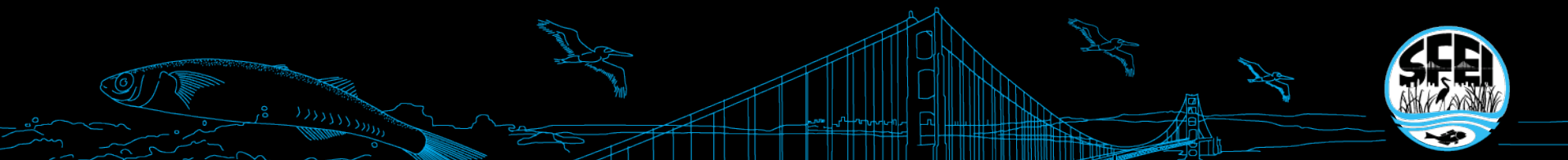


# Presentation Outline

Background: WRMP project, Hg in riparian food webs

Study design: Choosing and testing a biosentinel species

Study results: Hg levels observed in biosentinels



# Wetlands Regional Monitoring Program (WRMP)

## Pilot of the 1-2-3 monitoring and assessment framework

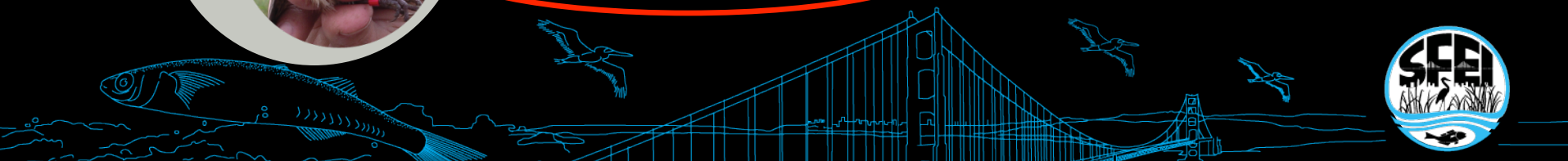
Landscape-level tools:  
Map-based inventories  
Landscape analysis



California Rapid  
Assessment Method  
(CRAM)



Geomorphic protocols  
Riparian biosentinels























# Project Goal

*To develop a monitoring tool that will be useful for protecting the environment in the San Francisco Bay Area by indicating methylmercury exposure in riparian food webs*



# Mercury Risk

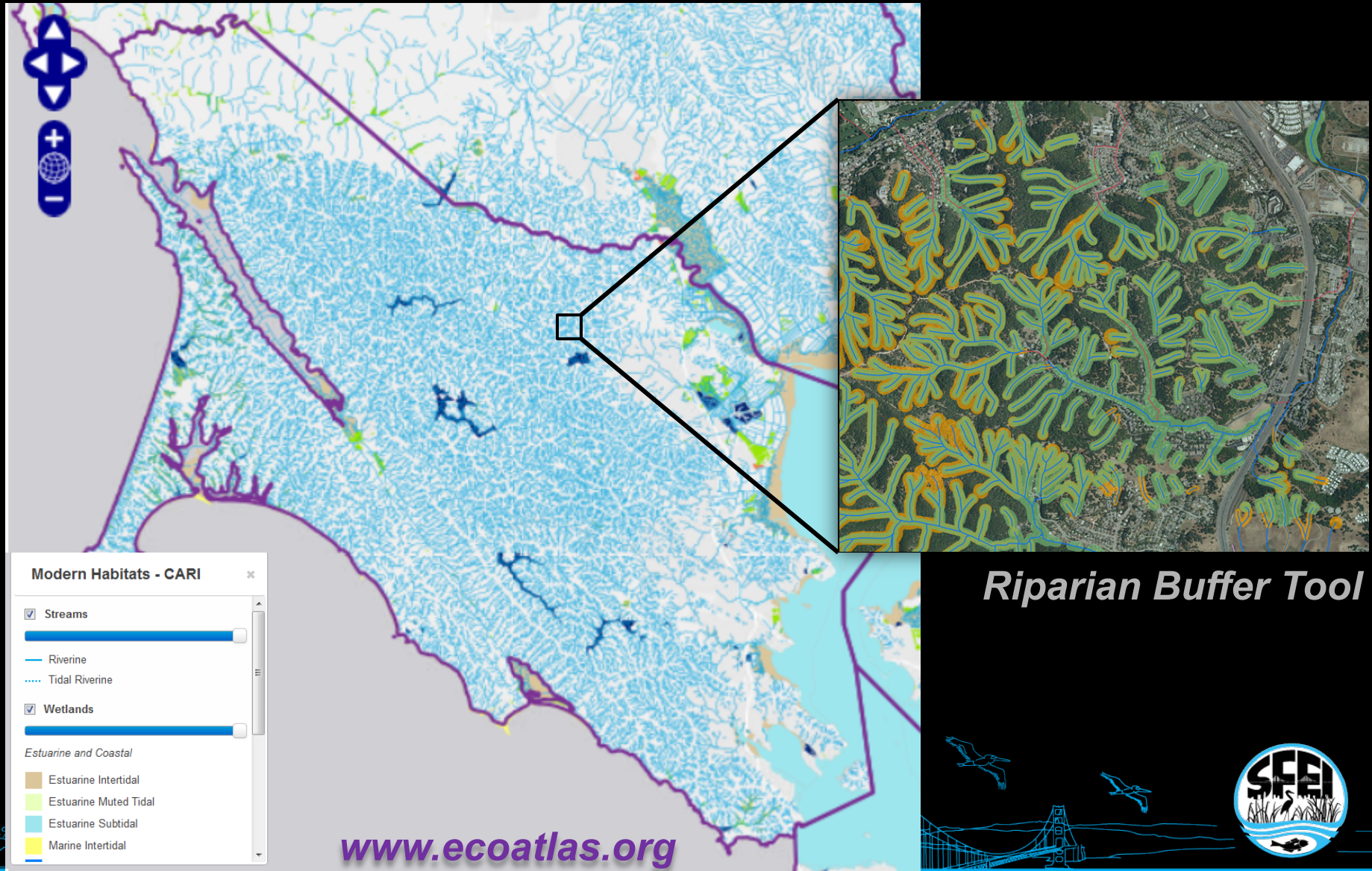
- Mercury is a problem in Bay Area aquatic and wetland habitats
- Little is known about exposure of wildlife in stream riparian areas

A guide to eating San Francisco Bay fish and shellfish		
Women 18 - 45 and children 1 - 17		
Safe to eat 2 servings per week	OR	Safe to eat 1 serving per week
 Chinook (king) salmon ♥  Brown rockfish  Red rock crab  Jacksmelt		 California halibut  White croaker
		 Striped Bass  Surfperches  Sharks  White sturgeon
♥ = High in Omega-3s		
Men over 17 and women over 45		
Safe to eat Salmon — 7 servings per week OR Brown rockfish OR red rock crab — 5 servings per week	OR	Safe to eat 2 servings per week
 Chinook (king) salmon ♥  Brown rockfish  Red rock crab		 California halibut  Jacksmelt  Striped Bass
		 White croaker  Sharks  White sturgeon <div>Do not eat</div>  Surfperches
♥ = High in Omega-3s		

Jacksmelt photo: Rick Lombard; California Halibut: John Shelton



# Lots of Riparian Area

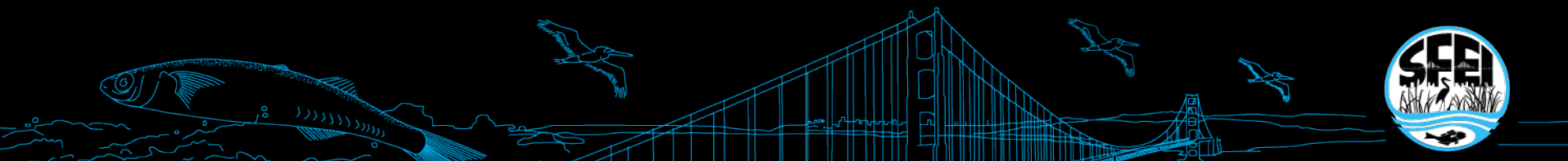


*Riparian Buffer Tool*

# Riparian Biosentinel Species

**Biosentinels:** “Carefully chosen species that are sensitive indicators of a condition (methylmercury bioaccumulation) over a specific area and time of interest.”

- Integrate over appropriate spatial and temporal scales
- Exposure can be interpreted in terms of effects



# Local and national experts

- Mercury science
- Riparian wildlife natural history
- Riparian mercury bioaccumulation
- Biosentinels
- Mercury monitoring





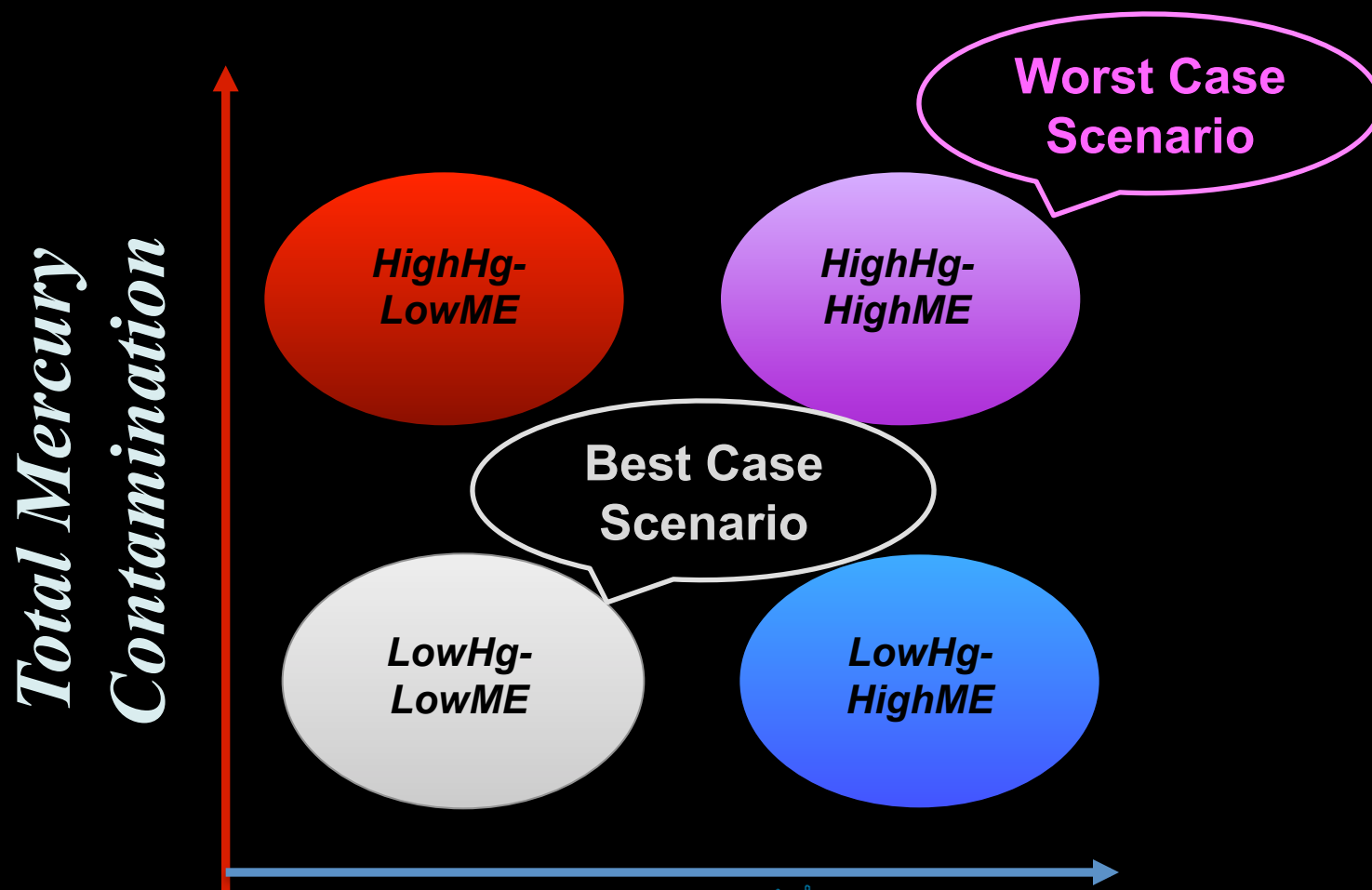
# Selecting a Biosentinel Species

- Represents the habitat of interest
  - ✓ Riparian associated
  - ✓ Year round residents
  - ✓ Small home ranges
- Feasible to capture
  - ✓ Widespread and abundant
  - ✓ Established mist netting methods
- Able to accumulate methylmercury to a range of detectable levels
  - ✓ Previous Hg studies
  - ✓ High trophic level
  - ✓ Adult survivorship not impacted by ambient Hg



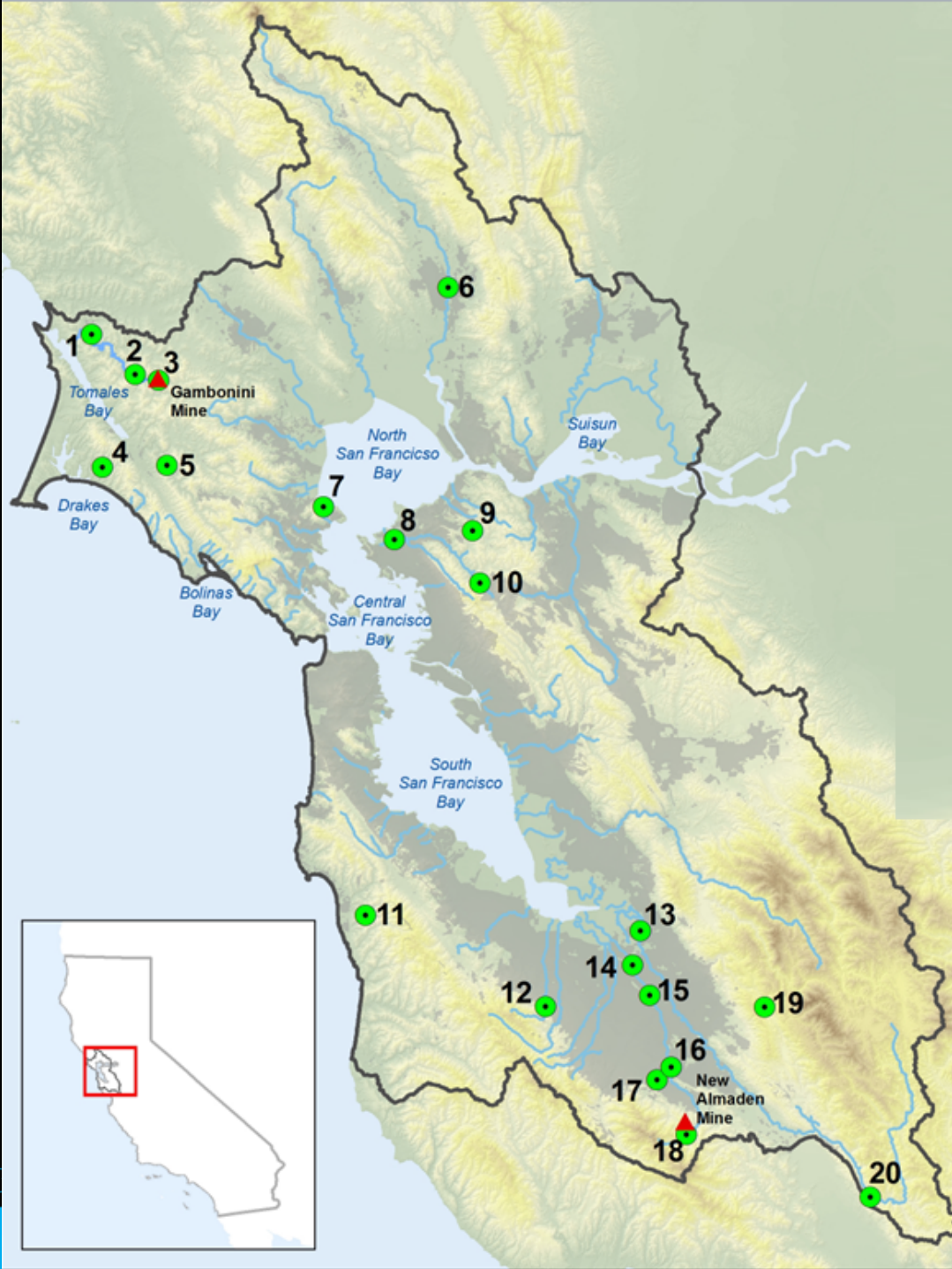
*Song Sparrow*  
(*Melospiza melodia*)

# Conceptual Model








*Methylating Environment*





## Site Name

- 1 Lower Walker Creek
- 2 Middle Walker Creek
- 3 Upper Walker Creek
- 4 Muddy Hollow
- 5 Lagunitas Creek
- 6 Napa River
- 7 China Camp State Park
- 8 Wildcat Creek
- 9 Simas Creek
- 10 San Pablo Creek
- 11 Mills Creek
- 12 Hanson's Cement Plant
- 13 Lower Coyote Creek
- 14 Lower Guadalupe River
- 15 Middle Guadalupe River
- 16 Upper Guadalupe River
- 17 Guadalupe Creek
- 18 Almaden Reservoir Upstream
- 19 San Felipe Creek
- 20 Coyote Reservoir Upstream

-  Site Location
-  Mine Location
-  San Francisco Bay RWQCB Boundary
-  Stream
-  Urban Areas

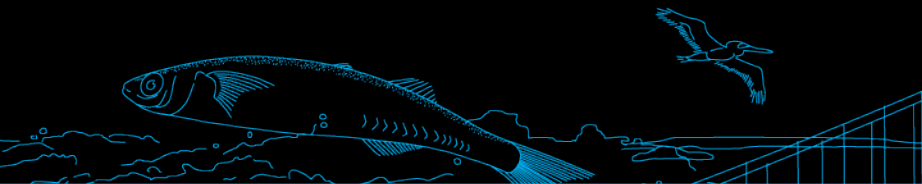
0 10 20 Miles





# Field Work!

- 20 sites, 1-2 days
- Field teams of 2-3 people
- Target  $\geq 3$  SOSP/site
- Blood and feather samples
- Birds were released after sampling

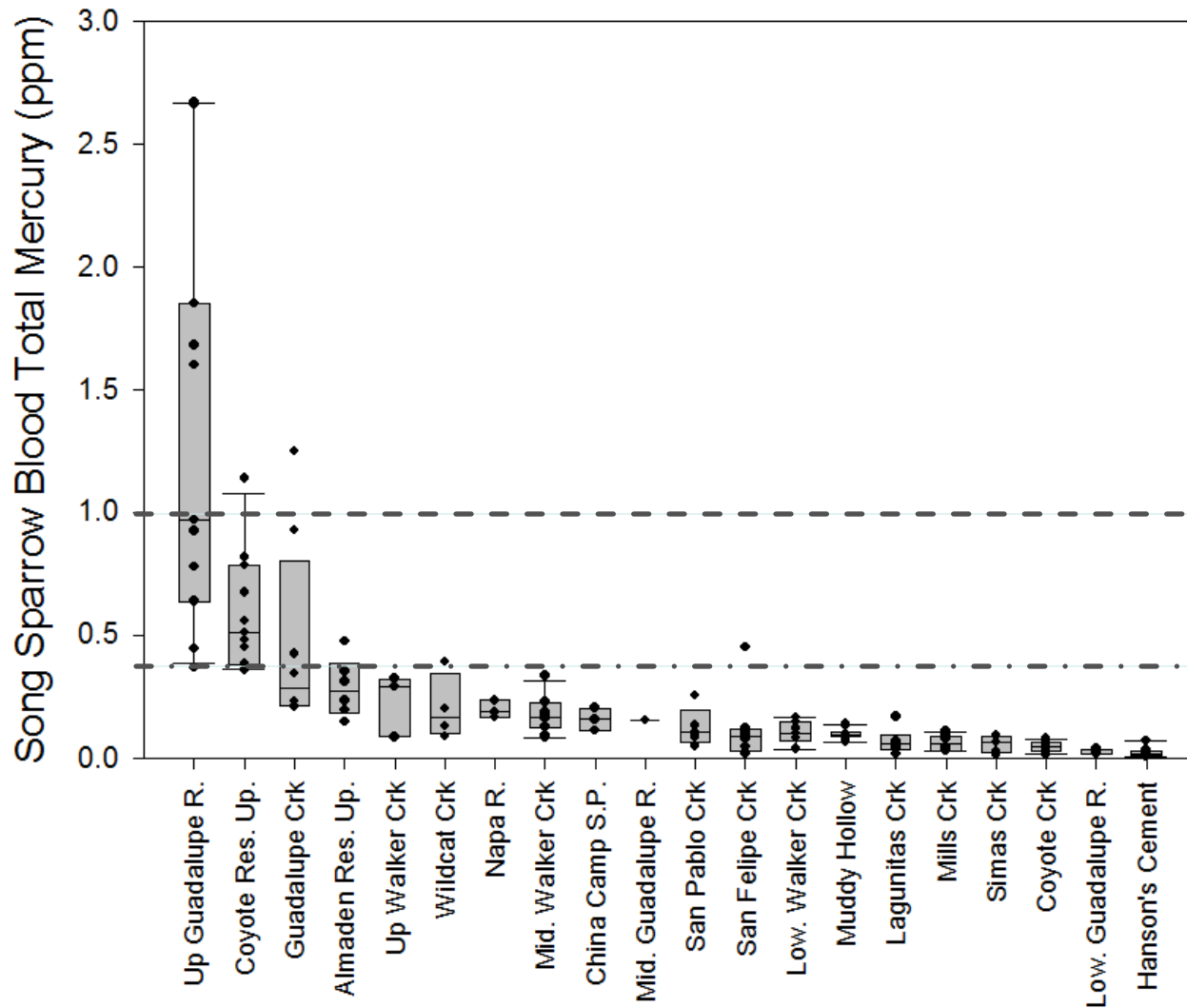


# Success!!

- *Song Sparrows sampled at **all 20 sites***
- *Samples sizes were **3-13 SOSP** at 19 sites*
- *Range of Hg values: **0.01 - 2.7 ppm***



# Song Sparrow Hg by Site



*Reduced  
breeding  
success  
by*

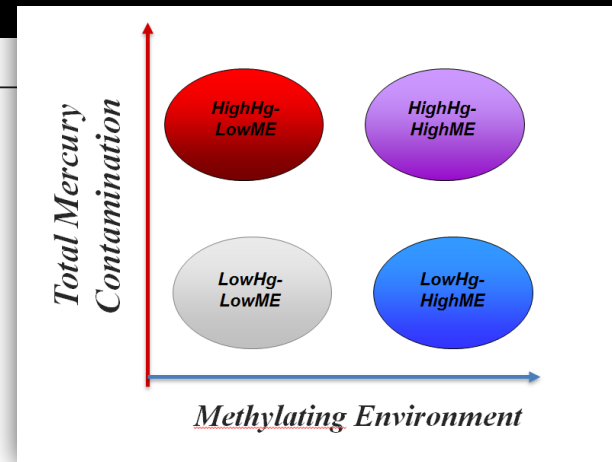
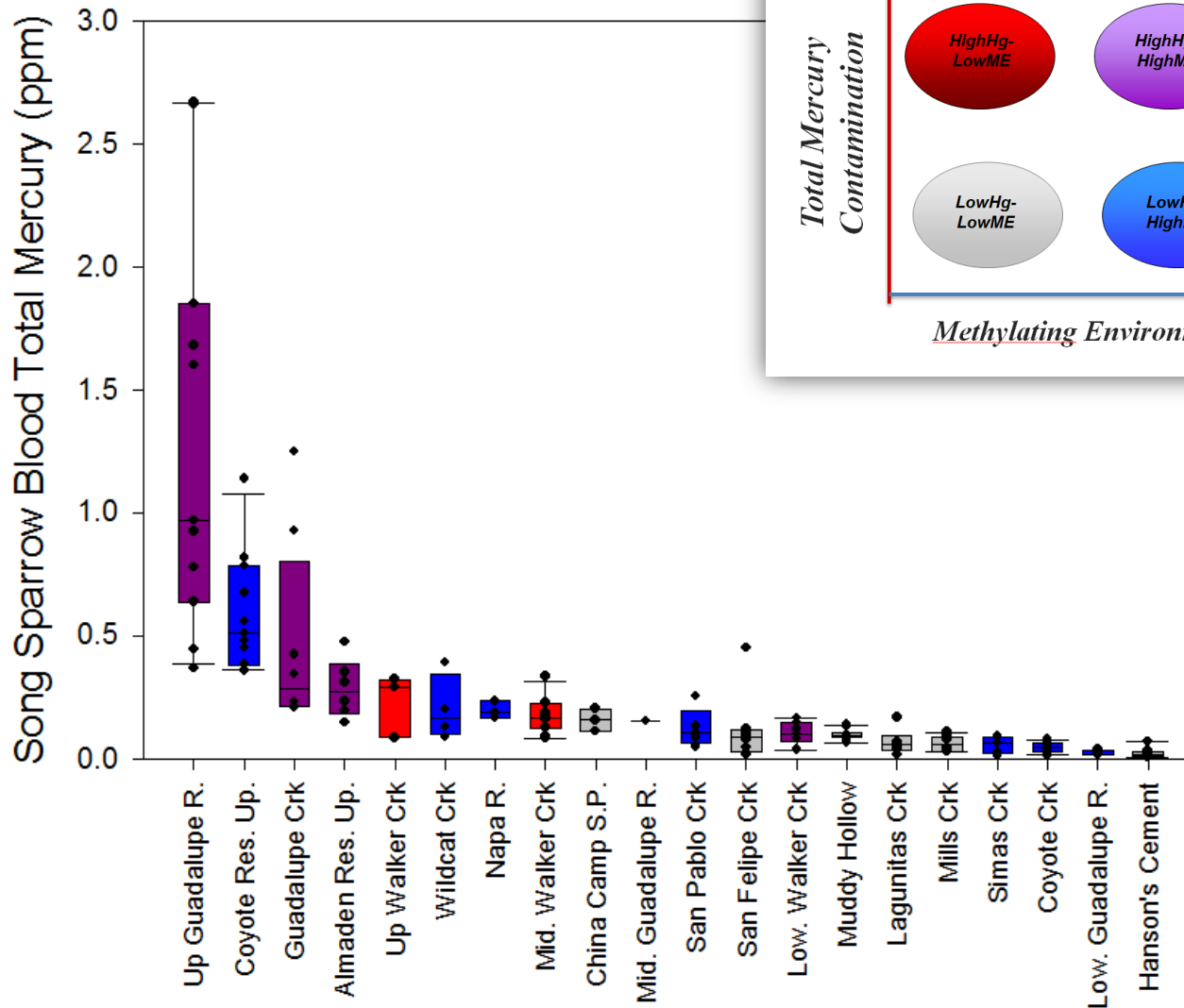
15%

5%





# Song Sparrow Hg by Site

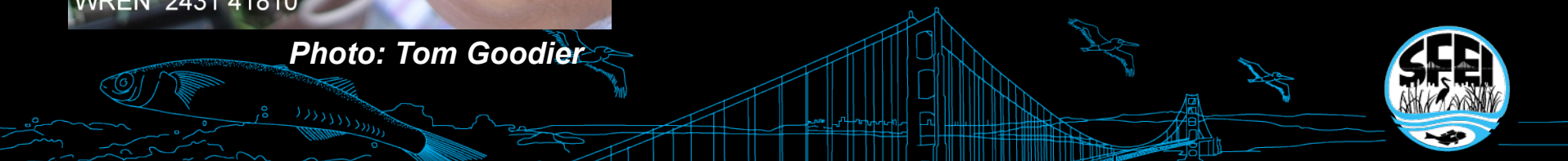


# SOSP protective of other species



*Photo: Tom Goodier*

- 25 Species sampled
- Avg Hg by species of  $< 0.01 - 0.51 \text{ ppm}$   
(0.26 ppm in SOSP)
- Hg highest in flycatchers, and lowest in finches  
(but small sample sizes)



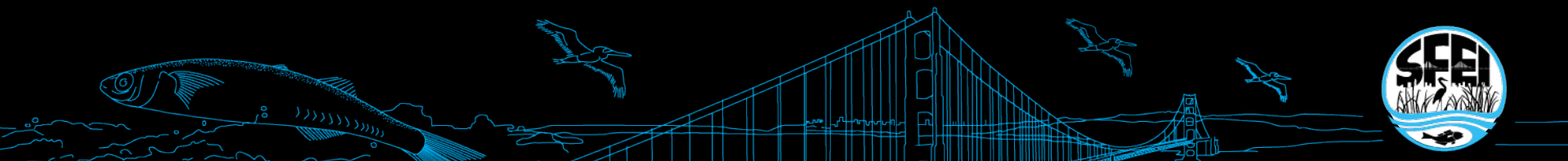
# Uses for this tool

- Establishing baselines or targets:
  - What is ambient?
  - What is best achievable condition?
- Site conditions:
  - Do riparian birds at a particular site have high methylmercury exposure relative to ambient?
- Stream projects and management actions:
  - Project performance
  - Before vs. after
  - Upstream vs. downstream



# Summary

- Song Sparrows are a good biosentinel
- Exposure at some sites was above levels of concern
- Landscape level indicators of Hg and methylation environment were predictive



# Acknowledgements

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SF Bay Regional Water Quality  
Control Board

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# Thank you

Questions?  
[april@sfei.org](mailto:april@sfei.org)