

RMP Objective / Management Question	Cormorants	Forster's Terns	Higher Value
1: Long-term Trends	+++ (open water)	++ (shallow water)	Cormorants (open water focus, lower variance)
1: Regional Patterns	+++ (open water)	++ (shallow water)	Cormorants (open water focus, lower variance)
1: Emerging Pollutants	+++ (open water)	++ (shallow water)	Cormorants (open water focus, lower variance)
2: Endpoint for Forecasts	+++		Cormorants (link to mass budget models)
3: SP&L			
4: Ecological risks	+	+++	Terns
5: Compare to Guidelines	+	+++	Terns

## Summary

- Cormorants better for trend monitoring of average condition in the Bay
- Terns better for effects-oriented monitoring, high exposure, shallow habitat, TMDL target

# Proposed Long-term Plan for Avian Egg Monitoring in the RMP

## ■ Cormorants

- Analyze eggs collected in 2006
- Accrue funds for triennial sampling again in 2009

## ■ Terns

- Fund EEPS studies developing eggs as an effects indicator - piggyback on FWS study
- Await completion of extensive existing work funded by FWS (organics) and CALFED/RMP (mercury) - includes eggs collected up through 2006
- Develop design for terns (power analysis, location selection)
- Accrue funds for triennial sampling in 2009 concurrent with cormorants



# Terns



Photo from Collin Eagles-Smith

# Recent Highlights

- Status and Trends
  - Valuable for spatial and temporal trends: Hg

TABLE 7. MERCURY CONCENTRATIONS IN TERN EGGS IN SAN FRANCISCO BAY BY LOCATIONS AND REGION (in ppm on a fresh wet weight basis)

REGION	LOCATION	LEAST TERN	FORSTER'S TERN	CASPIAN TERN
NORTH SF BAY	Napa Marsh		0.64b (6)	0.90b (5)
CENTRAL SF BAY	Brooks Island			0.72b (5)
	Alameda Naval Air Station	0.3 (3)		
SOUTH SF BAY	Charleston Slough		0.59b (5)	
	Hayward		0.50b (5)	
	Salt Pond A16		1.62a (5)	
	Salt Pond A7			1.18a (5)
BAY WIDE AVERAGE		0.3	0.83	0.93

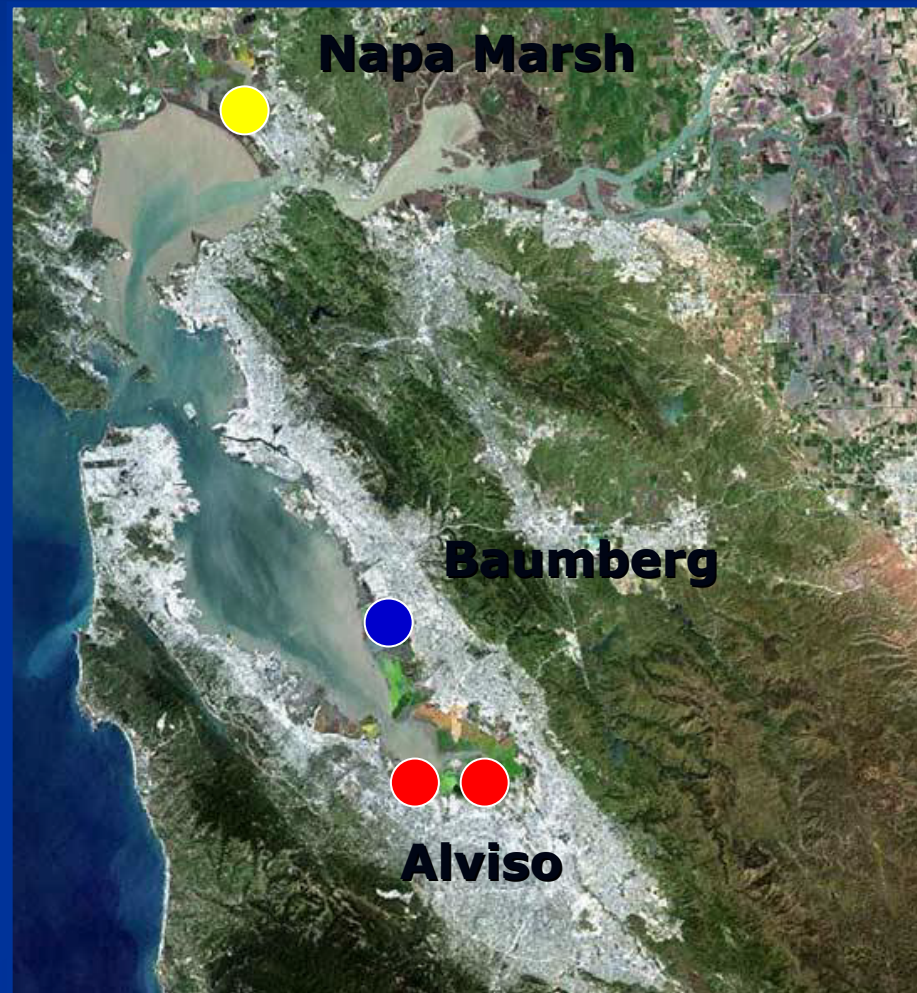


# Recent Highlights

- Status and Trends
  - Valuable for spatial and temporal trends: PBDEs

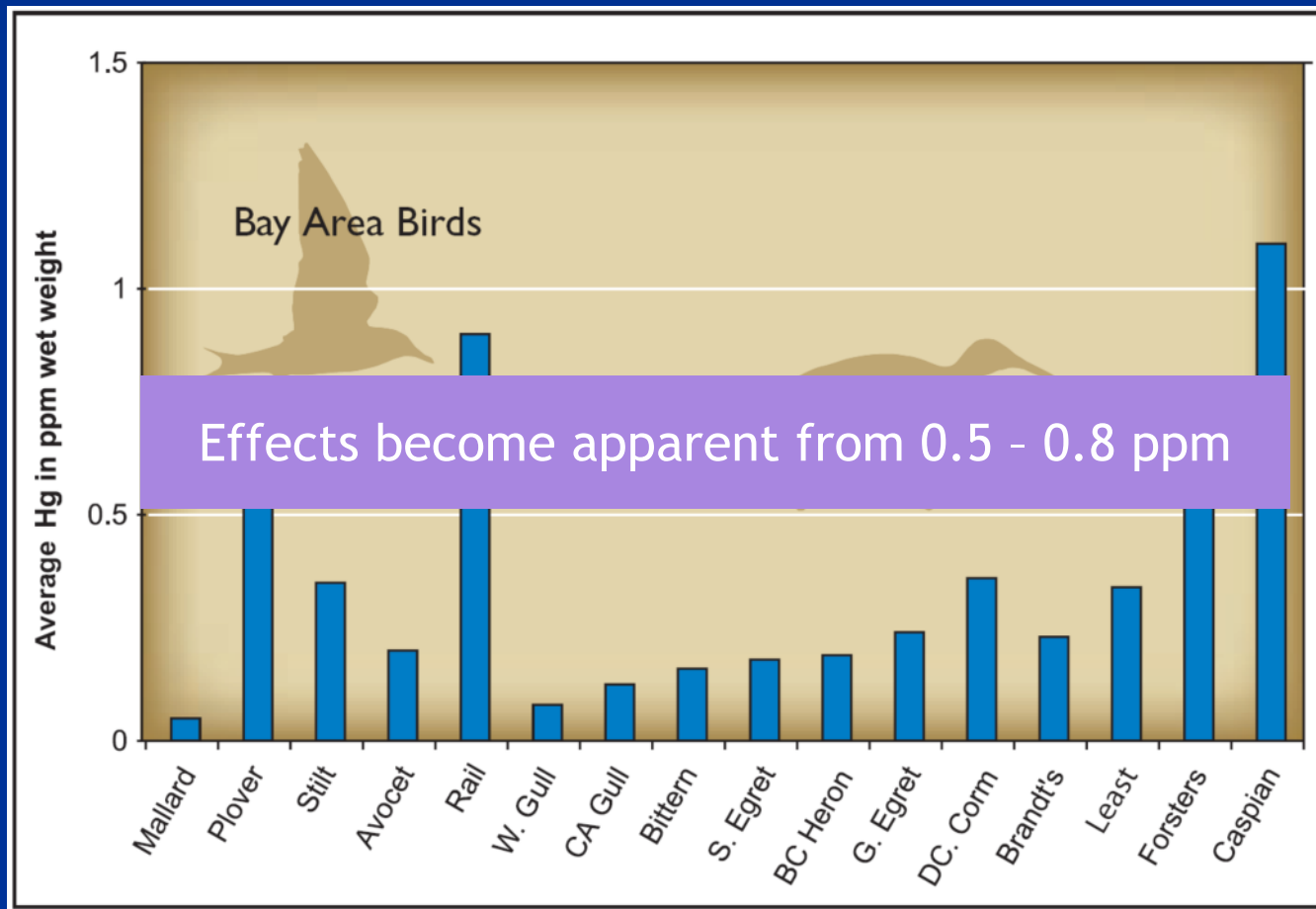
World-record concentration set at Baumberg 2 years in a row

Courtesy of USFWS



# Recent Highlights

- Exposure and Effects
  - High value as effects indicator (reproductive success is low and contaminants could be a factor)

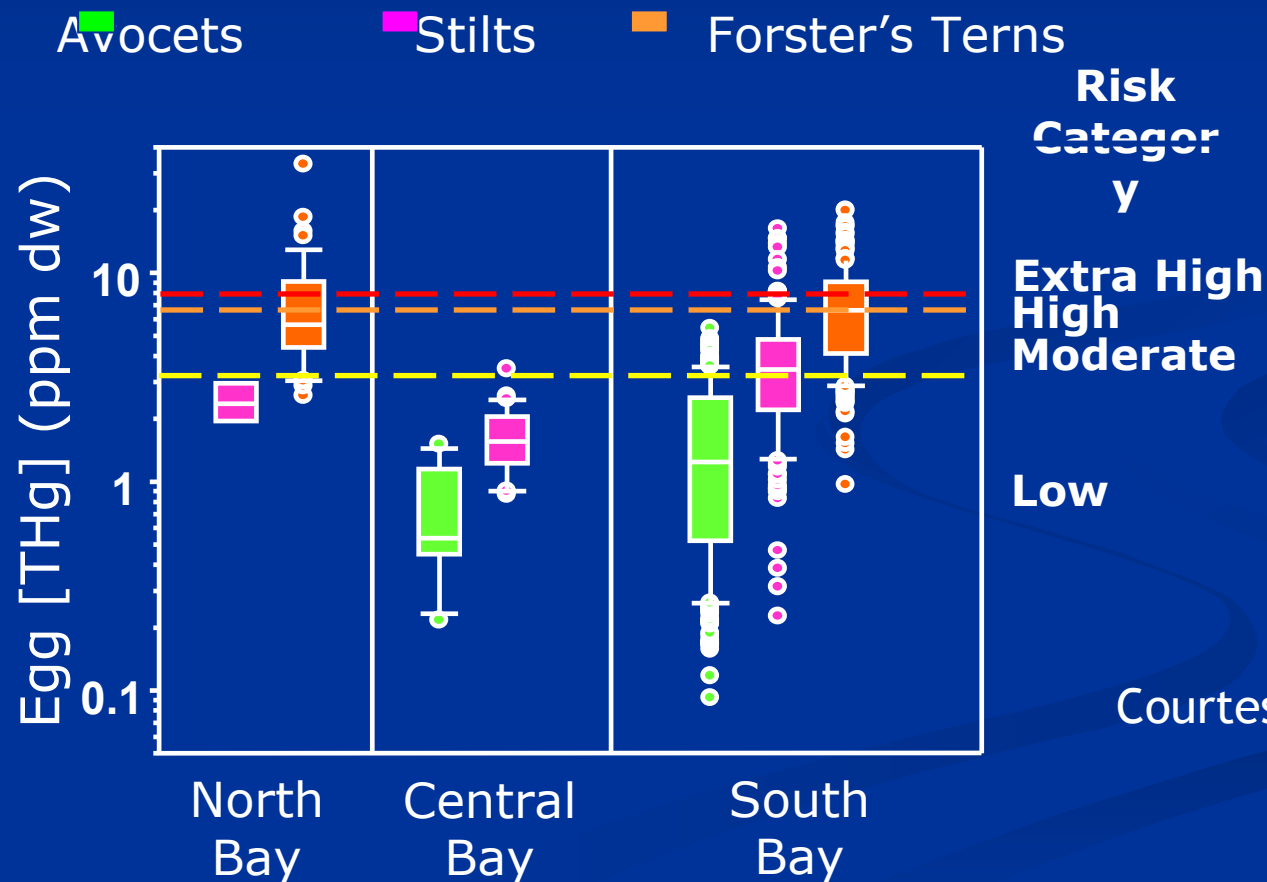


Data from Schwarzbach and Adelsbach (2003)



# Recent Highlights

- Exposure and Effects
  - High value as effects indicator



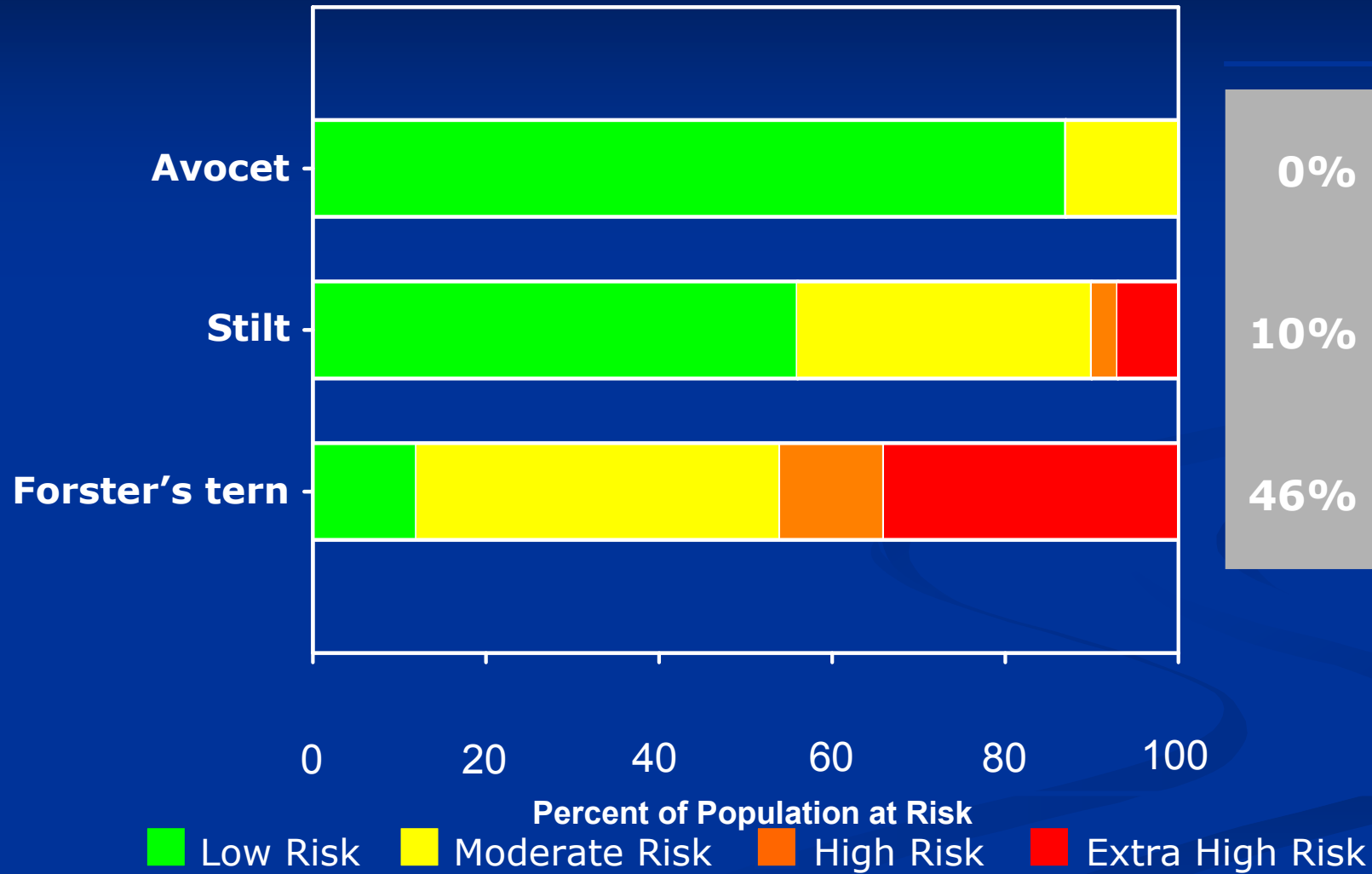
Courtesy of USFWS



# Percent of Population at Risk

## All Eggs

Risk Factor:  
High + Extra High





# Recent Highlights

- Comparison to Guidelines
  - Value associated TMDL target for MQs 5.2 (impaired segments) and 5.3 (linking management to beneficial use endpoints)



# Tern Egg Monitoring

- USFWS Long-term Plans (per Collin Eagles-Smith)
  - Continue long-term dataset
  - Focus on restoration sites
  - Look deeper into effects - more sensitive measures (e.g., biomarkers of disruption of physiological function)
  - Funds from FWS, CALFED?, State Board?, SBSP?



# Tern Egg Monitoring

- Recommended Program
  - Triennial sampling beginning in 2007 - matching cormorants
  - Hg, Se, PBDEs
  - 3 composites at each of 6 locations (west Alviso, east Alviso, Baumberg, Napa Marsh, 2 to be named later - colonies less stable)
  - Sampling costs higher due to need to get second egg



# Design Options

## Terns

DESIGN				BENEFITS					COST	
				Objectives Addressed					Power	
Design	# of sites	Frequenc	Season	1	2	3	4	5	80% Trend Power	Cost/yr
Proposed Design (Triennial)	6	Triennial	Spring						Hg (25/30)	\$20,000
									PBDEs (56/30)	
Quadrennial	6	Quadrenni	Spring						Hg (25/30)	\$15,000
									PBDEs (56/30)	

## Cormorants

DESIGN				BENEFITS					COST	
				Objectives Addressed					Power	
Design	# of sites	Frequenc	Season	1	2	3	4	5	80% Trend Power	Cost/yr
Proposed Design (Triennial)	3	Triennial	Spring						PCBs (20/50)	\$20,000
									Hg (20/20)	
									DDTs (20/50)	
Quadrennial	3	Quadrenni	Spring						PCBs (20/50)	\$15,000
									Hg (20/20)	
									DDTs (20/50)	