

# REGIONAL HARBOR MONITORING PROGRAM *Bight '08*



*Mission Bay*



*Oceanside Harbor*



*Dana Point Harbor*

*San Diego Bay*



# Agenda

- RHMP Background
- RHMP Approach & Results
- Future Focused Studies



# RHMP Background



# Regional Harbor Monitoring Program History

## 13225 Directive Issued by RWQCB in July 2003

- Identifies Orange County, Oceanside, San Diego, Port, and Marine Corps as responsible parties.
- Includes Dana Point Harbor, Oceanside Harbor, Mission Bay & San Diego Bay.
- 2004-2005            Program was designed
- 2005-2007           Pilot Program
- 2008                 Core Monitoring
- 2009-2012          Special Focused Studies



# 13225 Directive Questions

- Contributions and spatial distribution of pollutant inputs? How do the inputs vary over time?
- Are waters safe for body contact?
- Are fish safe to eat?
- Do waters and sediments sustain healthy biota?
- Long-term water quality trends?



# RHMP Core Monitoring Approach & Results



# 1. What are the contributions and spatial distributions of inputs of pollutants?



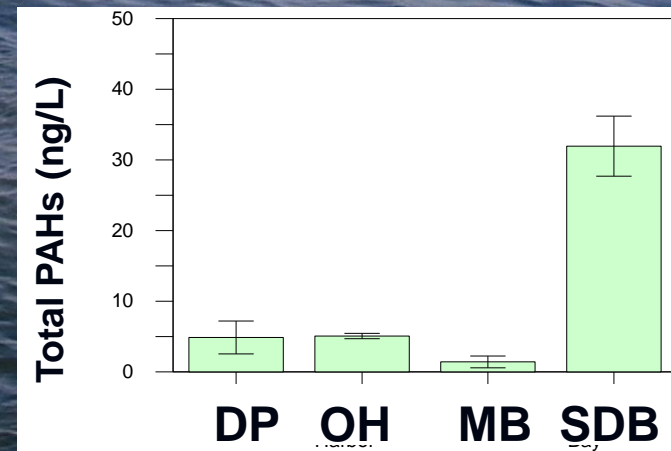
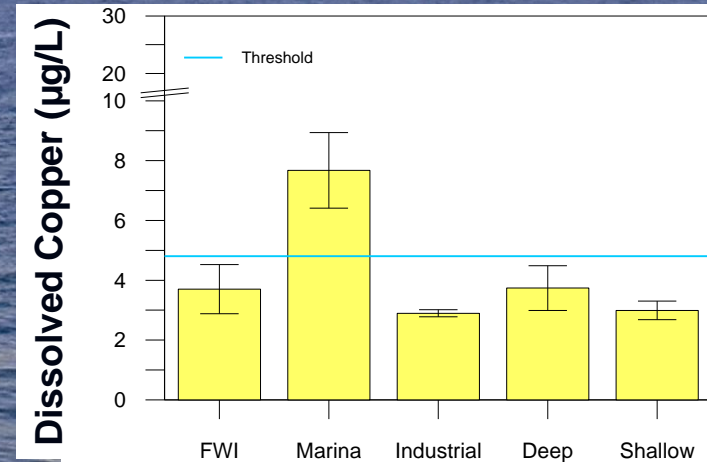
- Monitor Water & Sediment Conditions
- Comparison of Indicators Among Strata
  - Freshwater Inputs
  - Marinas
  - Industrial
  - Deep
  - Shallow



# 1. What are the contributions and spatial distributions of inputs of pollutants?

## Surface Waters:

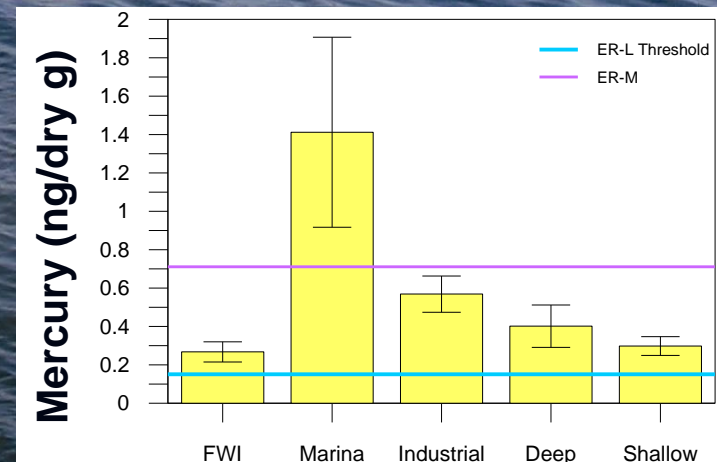
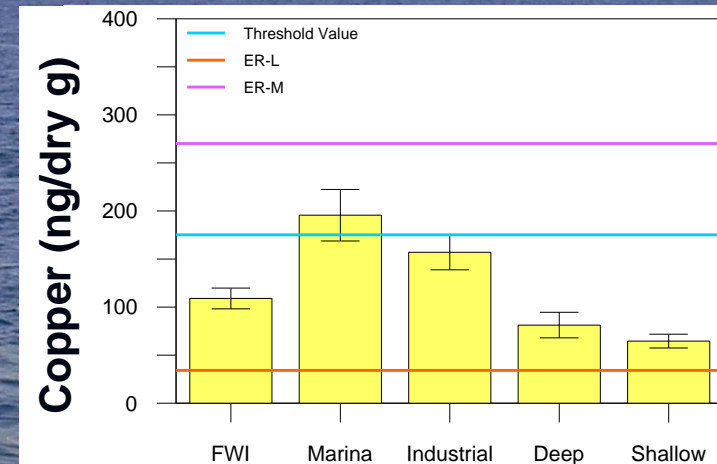
- Metals
  - Only dissolved copper exceeded acute CTR (marinas)
  - No other metals exceeded CTR or COP
- Organics
  - PAHs highest in SD Bay
  - OP pesticides, VOCs, & pyrethroids were not detected



# 1. What are the contributions and spatial distributions of inputs of pollutants?

## Sediment Metals

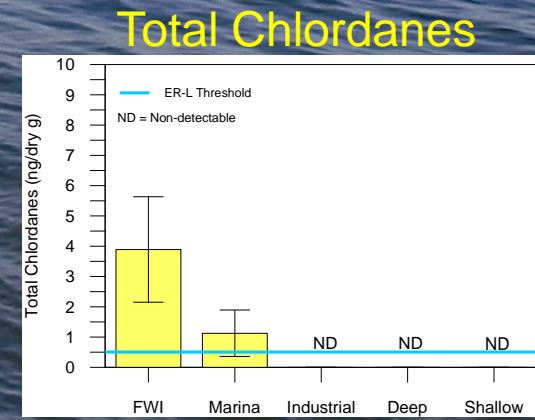
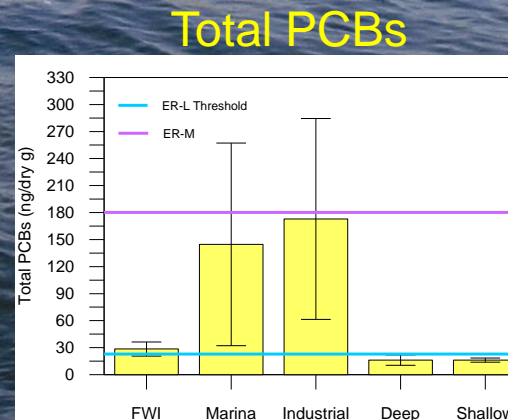
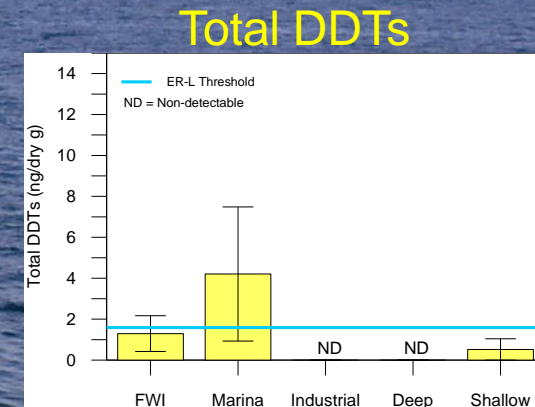
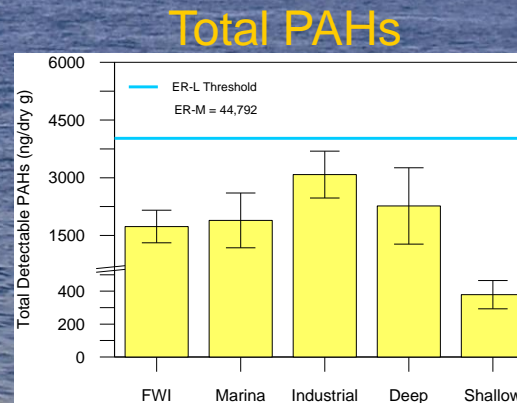
- **Copper & Mercury** exceeded ER-Ms in Industrial and Marina
- **Zinc, Lead, & Arsenic** also exceeded ER-Ls
  - **Zinc:** Marina, Industrial, FWI
  - **Lead:** Industrial
  - **Arsenic:** Marina & Industrial



# 1. What are the contributions and spatial distributions of inputs of pollutants?

## Sediment Organics

- **Total PAHs:** highest in Industrial
- **Total DDTs:** highest in marina
- **Total PCBs:** highly variable, highest levels in the industrial & marina
- **Total Chlordanes:** highest in the FWI (Chollas)
- **Pyrethroids:** detected primarily in FWI



# 1. What are the contributions and spatial distributions of inputs of pollutants?

- The 3 strata indicative of human use had distinct inputs of pollutants
- Elevated exceedances & concentrations within sediments and surface waters
  - Marinas → Copper & Mercury (Zn, As, DDTs, PCBs)
  - Industrial → Copper & Mercury (Pb, PAHs, PCBs)
  - FWI → Total Chlordanes & Pyrethroids



## 2. Are the waters in the harbors safe for body contact activities?

- Measure Bacterial Levels
  - Enterococcus
  - Total Coliform
  - Fecal Coliform



## 2. Are the waters in the harbors safe for body contact activities?

- Yes, water quality parameters are safe for human use in the summer months
- Bacteria levels were far below standards & often undetectable
  - **Total Coliforms**  
No stations exceeded AB411 stds (10,000 MPN/100 ml)  
Range: <20 to 330 MPN/100 ml
  - **Fecal Coliforms**  
No stations exceeded AB411 stds (400 MPN/100 ml)  
Range: <20 to 300
  - **Enterococci**  
No exceedances of AB411 stds (104 MPN/100 ml)  
Range  $\leq 10$



### 3. Are the fish safe to eat?

- 2009 SWAMP State-wide Bioaccumulation Oversight Group
- Performed over 2 Summers
- Assess Latitudinal Gradient in Contamination
- Target Human-caught Species in Bays & Offshore Waters
- Analyze fillets for contaminants (Hg & PCBs)



# 4. Do the waters & sediments support healthy biota?

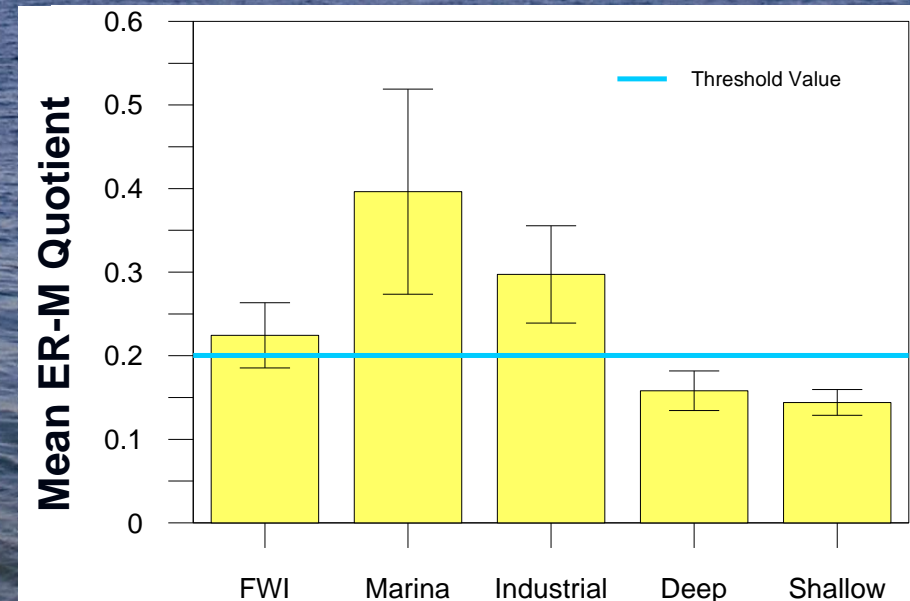
- Weight of Evidence Approach
  - Water and Sediment Contaminants
  - Sediment Toxicity
  - Harbor Biota (Fish, Invertebrates, & Infauna)
  - Compare to Established Thresholds for Adverse Effects (SQOs, CTR, ER-Ms, BRI)



# 4. Do the waters & sediments support healthy biota?

## Sediment Chemistry

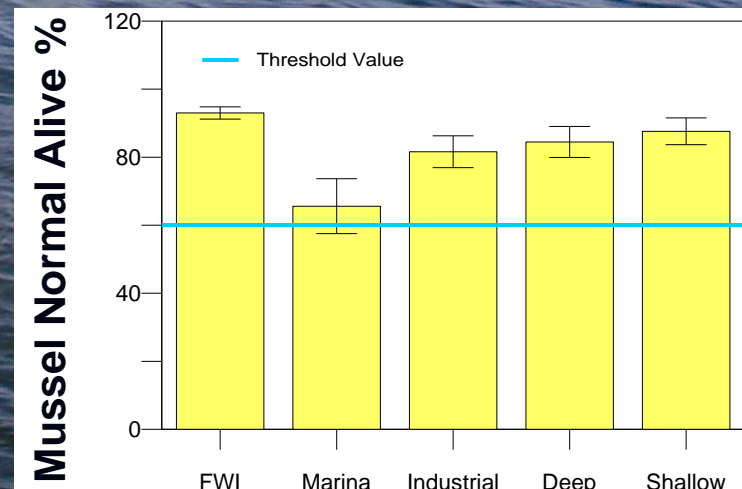
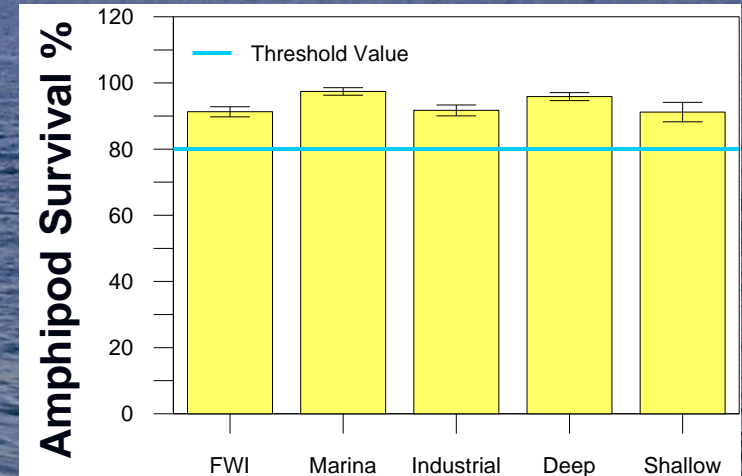
- 77% of all stations did not exceed ER-Ms
- Mean ER-M Quotient
  - 60% of stations were below the 0.2 threshold
  - Marina, Industrial, & FWI on average exceeded the 0.2 threshold
- 87% of stations with Low – Moderate Chemical Exposure (SQOs)



# 4. Do the waters & sediments support healthy biota?

## Sediment Toxicity

- Amphipod Acute Toxicity
  - 95% of stations had survival >80%
  - Survival  $\geq$ 91% in every stratum
- Mussel Chronic Toxicity
  - 85% of stations above the threshold (60%)
  - Highest level of toxicity in marina (54% below threshold)
- SQOs: 92% non-toxic to low

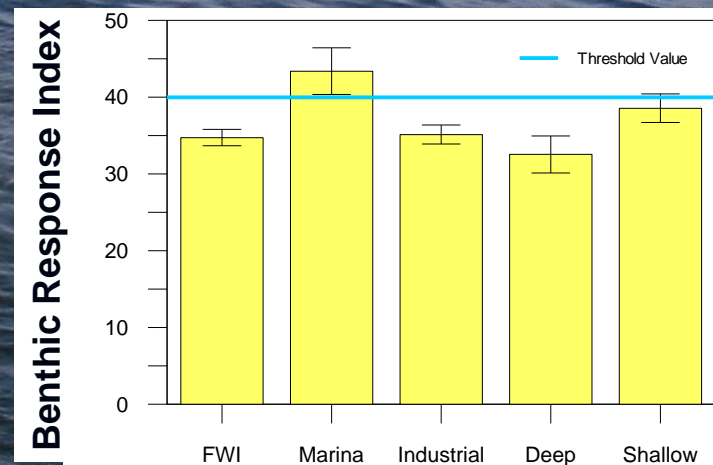


# 4. Do the waters & sediments support healthy biota?

## Benthic Infauna

- 75% of all stations were classified as reference condition (BRI)
- Only marina had a majority of stations classified as low to moderate disturbance
- SQOs: 73% reference - low

Strata	Category 1 Reference (%)	Category 2 Low Disturbance (%)	Category 3 Moderate Disturbance (%)	Category 4 High Disturbance (%)
SD Bay	75	17	8	0
FWI	92	8	0	0
Marina	36	27	36	0
Industrial	87	13	0	0
Deep	73	27	0	0
Shallow	80	10	10	0



# 4. Do the waters & sediments support healthy biota?

## Demersal Community

- Fish:
  - **17 species, 258 individuals**
    - Slough Anchovy (51)
    - Barred Sandbass (48)
    - Yellowfin Croaker (42)
- Invertebrates:
  - **12 species, 467 individuals**
    - Trailtip Seapen (243)
    - Tuberculate Pear Crab (154)
- All animals appeared healthy – no lesions, tumors, or deformities



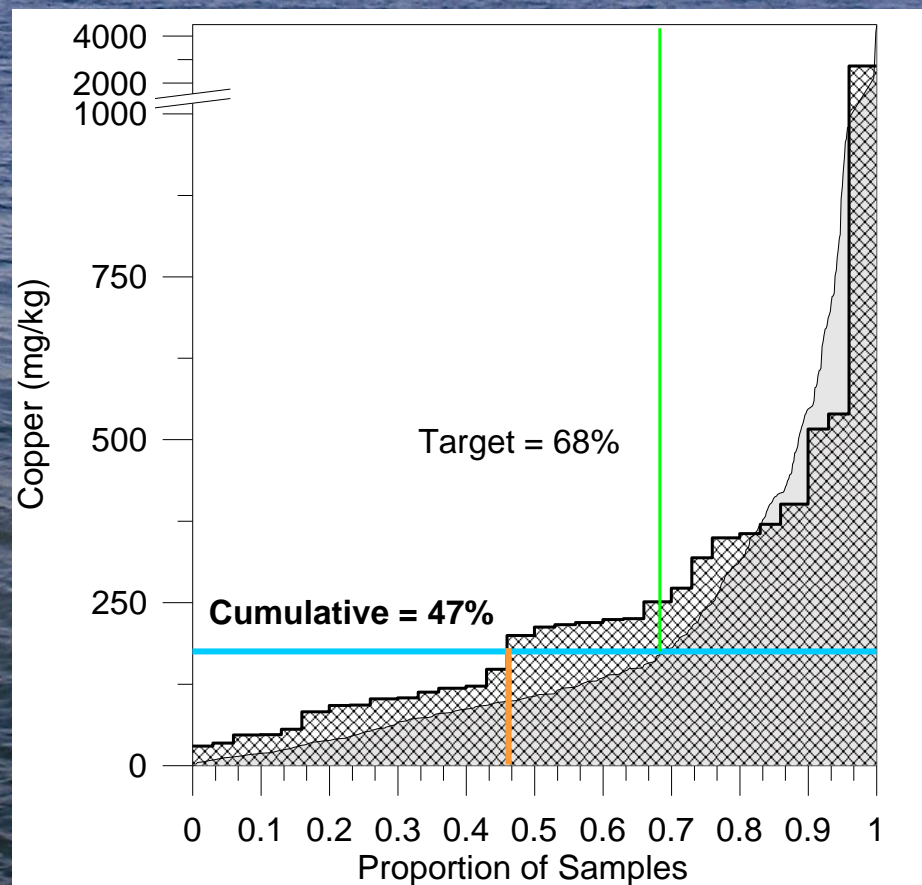
# 4. Do the waters & sediments support healthy biota?

- Yes, lines of evidence support this conclusion
  - SQOs: 62% of stations unimpacted or likely unimpacted
  - Chemistry: Majority of stations low to moderate exposure
    - Marina, industrial, and FWI strata had avg. mean ER-M quotients above threshold for biological effects
  - Toxicity: non-toxic to low levels throughout the bay
    - Marinas are only areas with elevated chronic levels of toxicity
  - Benthic Infauna: vast majority of assemblages were determined to be reference or low disturbance
    - Marinas are only stratum with high frequency of Low/Moderate Disturbance
  - Demersal fish and invertebrate communities appear to be healthy
    - Consistent with findings with previous Bight regional studies



# 5. What are the long-term trends?

- Compare Present to Historical Conditions (Binomial Approach)
- Trend Analysis with Subsequent RHMP data (2008, 2013, 2018, etc.)



# 5. What are the long-term trends?

## Surface Water Chemistry

- Dissolved and Total Copper exceedances are significantly less prevalent in 2008 than historically
- All other parameters remained below thresholds

Metal	Preset Target	RHMP 2008
Dissolved Copper	58	79*
Total Copper	51	72*
Dissolved Nickel	100	100
Total Nickel	100	100
Dissolved Zinc	100	100
Total Zinc	99	100



# 5. What are the long-term trends?

## Sediment Chemistry

- 8 of 12 indicators significantly improved from historical conditions
- No indicators significantly declined

Indicator	Preset Target	RHMP 2008
Mean ER-M Quotient	46	52
Arsenic	52	57
Cadmium	92	100*
Chromium	83	99*
Copper	68	80*
Lead	75	89*
Mercury	26	31
Nickel	80	97*
Zinc	45	44
Total PAHs	79	88*
Total Chlordanes	86	89
Total DDTs	54	79*
Total PCBs	47	63*

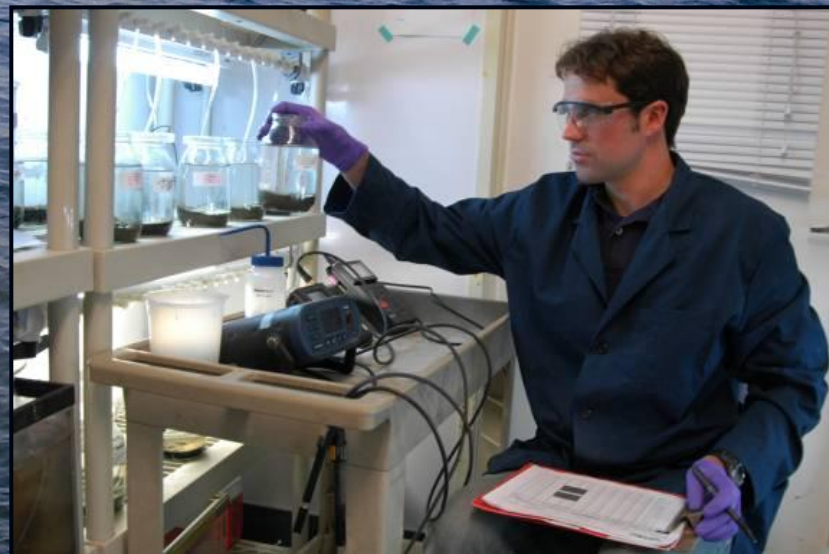


# 5. What are the long-term trends?

## Sediment Toxicity

- RHMP 2008 - 96% of stations had >80% survival
- Significant improvement over historical conditions

Indicator	Preset Target	RHMP 2008
Amphipod Survival	55	96*



# 5. What are the long-term trends?

## Benthic Infauna

- RHMP 2008 - 75% of stations with reference benthic communities
- Significant improvement over historical conditions

Indicator	Preset Target	RHMP 2008
BRI	59	75*



## 5. What are the long-term trends?

- Overall trends appear to be improving for:
  - Surface Water Chemistry (Copper)
  - Sediment Chemistry (8 of 12 analytes)
  - Toxicity (Amphipod tests)
  - Benthic Infaunal Communities (BRI scores)
- Marinas appear to be the exception
  - Elevated surface water copper levels
  - Elevated copper, zinc, & mercury in sediments
  - Higher toxicity (Mussel test)
  - Many infaunal communities low-moderate disturbance



# RHMP Special Focused Studies



# Special Focused Studies

Purpose is to investigate copper-related issues and processes within marinas

- 2009: Extent of Copper Contamination
- 2010: Toxicity Identification Evaluations
- 2011: Water Effects Ratios
- 2012: Sediment Copper Flux Studies



# Questions?

