
Key Issues & Potential Modifications: Se TMDLs for the Newport Bay Watershed

Workshop #2: Numeric Targets

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January 30, 2014**



Purpose

- Identify best scientifically-based numeric targets for:
 - Bird Egg Tissue
 - Fish Tissue
- Ensure approach explicitly considers fish as a separate end-point independent of birds
- Revise, as necessary, numeric targets approach

Bird Eggs

Fish Tissue

**Water
Column**

Key Points of Consensus

- Not proposing SSOs as part of this BPA, only numeric targets for the TMDL
- Tissue-based targets are preferred targets
- Tissue-based targets are protective of aquatic life and aquatic-dependent wildlife
- Bird Egg Tissue Target of 8 ug/g dw is protective
- No native freshwater fish present in Newport Bay watershed

Key Issues Overview

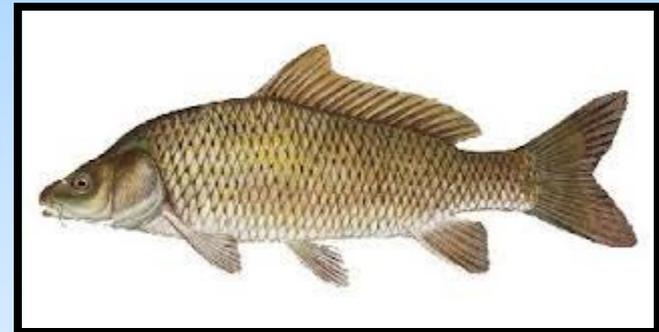
- Numeric Targets for Birds (Harry Ohlendorf)
- Numeric Targets for Fish (Steve Canton)
- Numeric Targets Approach (Karen Cowan)



Birds
(Bird Eggs)



Piscivorous Birds
(Bird Egg and Fish
Tissue)



Fish
(Fish Tissue)

Aspects of Numeric Targets

Numeric
Target #1:
Birds



Bird Egg Value that is protective
of birds as the endpoint



FUNDAMENTAL QUESTION:
Does the fish tissue value
protective of FISH also protect
piscivorous birds?

Numeric
Target #2:
Fish



Fish Tissue Value that is
protective of fish as the endpoint

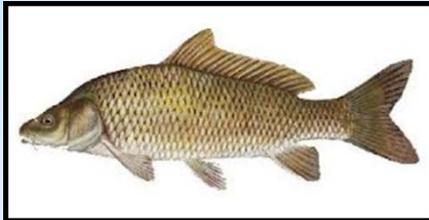
If Fish Tissue Values ARE Protective of Piscivorous Birds...

Numeric
Target #1:
Birds



Bird Egg value that is protective
of birds as the endpoint

Numeric
Target #2:
Fish



Fish Tissue Value that is
protective of fish (which is also
protective of piscivorous birds)

If Fish Tissue Values ARE NOT Protective of Piscivorous Birds...

Numeric
Target #1:
Birds

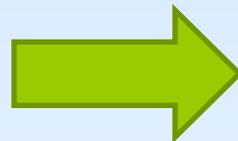


Bird Egg value that is protective of birds as the endpoint

Numeric
Target #2:
Fish

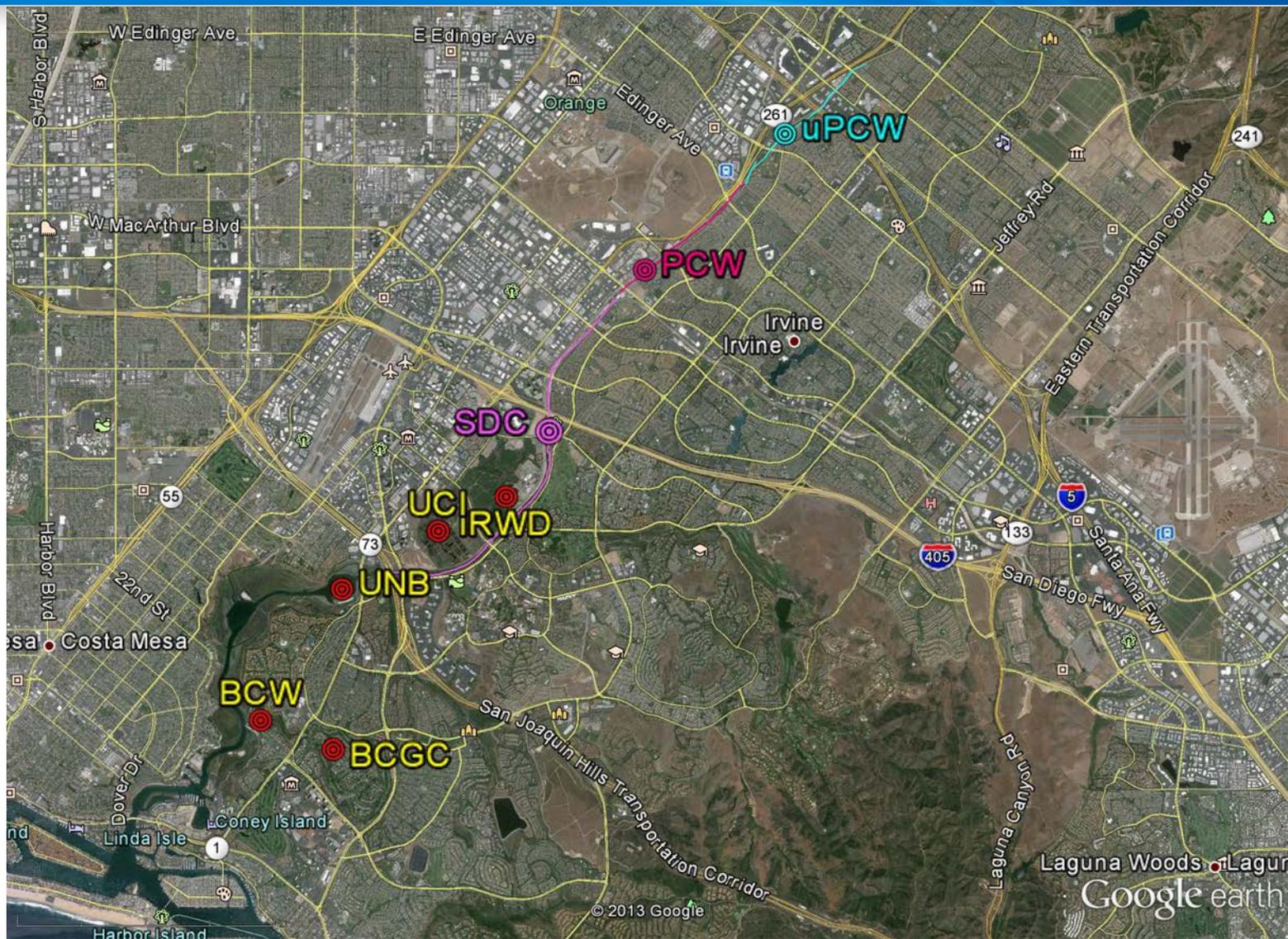


Fish Tissue value that is protective of fish as the endpoint

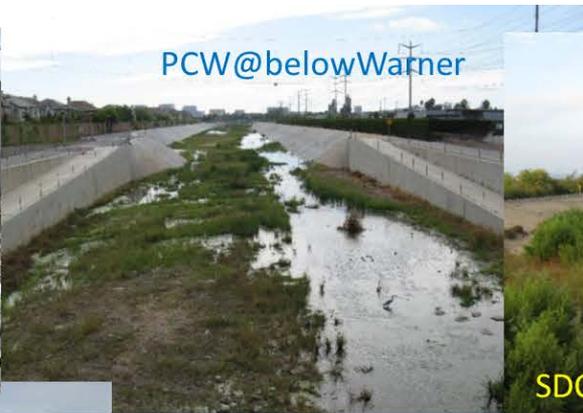


Fish Tissue value that is protective of piscivorous birds

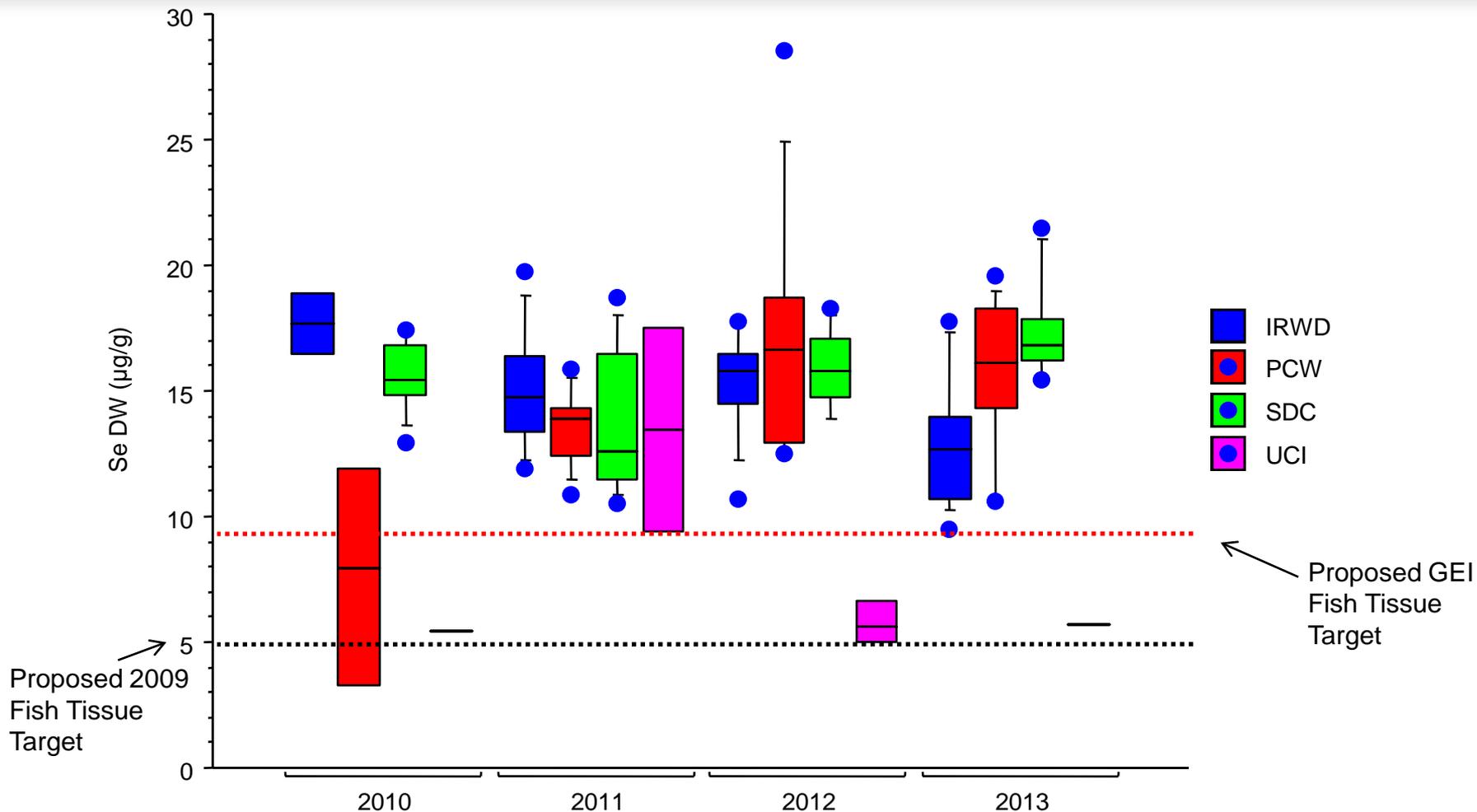
Sampling Areas for Fish and Birds, 2010-2013



Habitat Views in Sampling Areas, 2010-2013

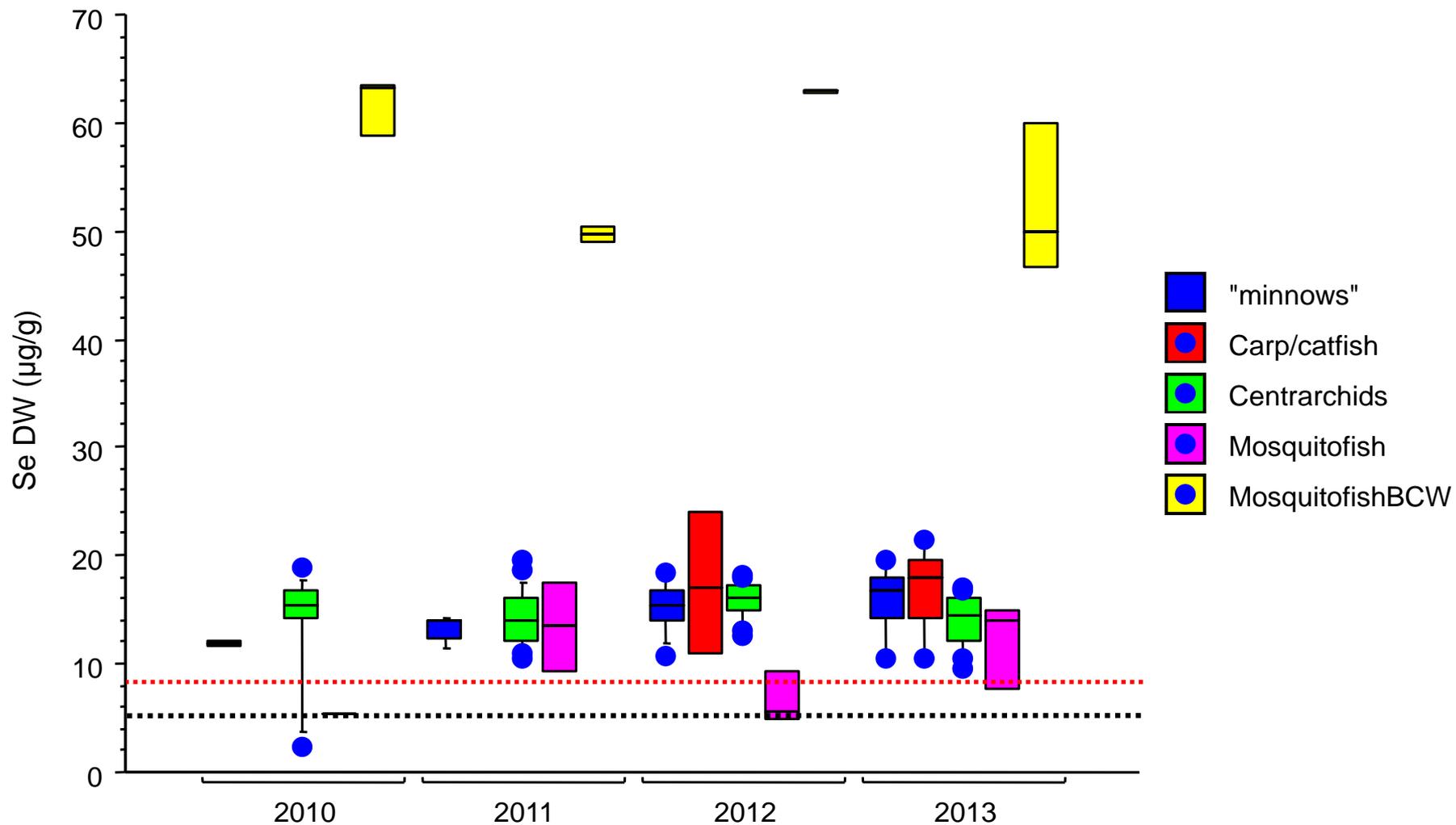


Selenium in Whole-Body Fish by Area, excluding Big Canyon Wash, 2010 – 2013

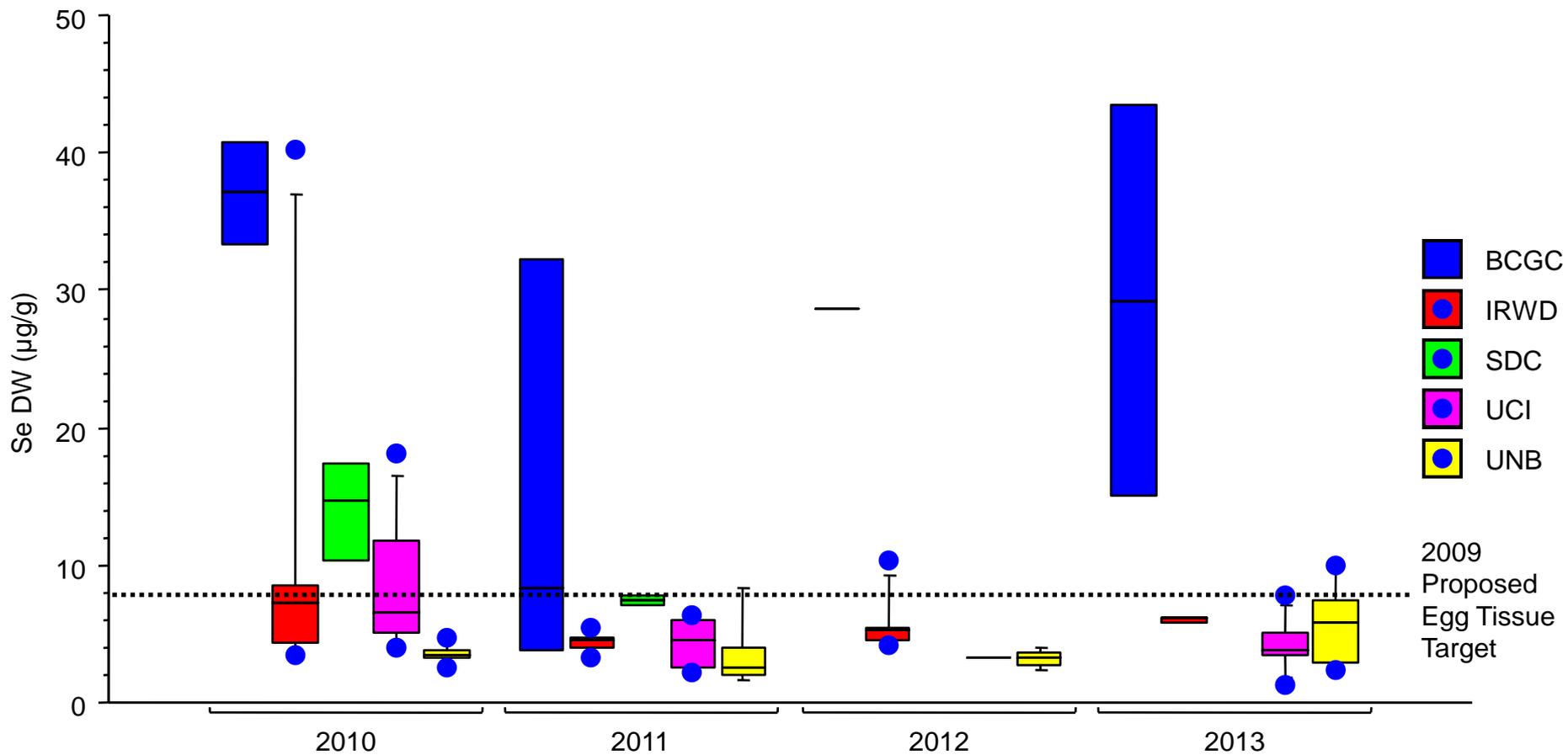


The bars from the bottom up for each plot are the 10th, 25th, 50th, 75th, and 90th percentiles, and the circles are outliers.

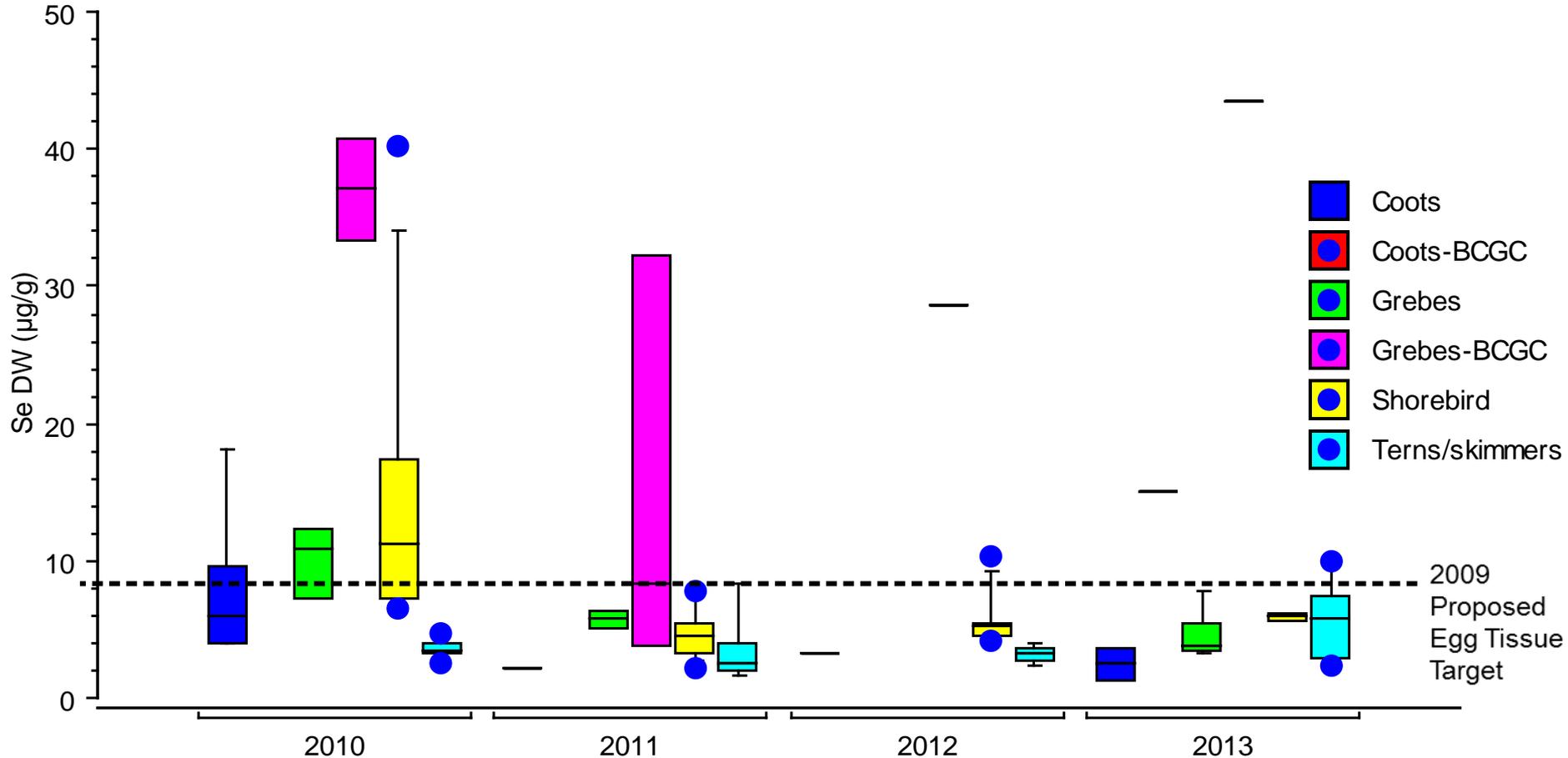
Selenium in Whole-Body Fish by Species, 2010 – 2013



Selenium in Bird Eggs by Area, 2010 - 2013



Selenium in Bird Eggs by Species, 2010 - 2013



Key Issue and Proposed Modifications: Numeric Target for Bird Eggs

- Current target: 8 μg Se/g, dry weight; eggs analyzed individually
- No new information indicating the current target is not appropriately protective
- **Proposed modification: None**

Key Issue: Fish Tissue Target to Protect Piscivorous Birds

- During 2010-2013, annual geometric mean Se in fish was 14.6 to 15.3 $\mu\text{g/g}$; by area they were as follows:
 - BCW: 56.4 $\mu\text{g/g}$
 - PCW: 14.0 $\mu\text{g/g}$
 - SDC: 15.4 $\mu\text{g/g}$
 - IRWD: 13.9 $\mu\text{g/g}$
 - UCI: 7.0 $\mu\text{g/g}$
 - Upper PCW: 4.0 $\mu\text{g/g}$
- During 2010-2013, maximum Se concentration in eggs of piscivores (fish-eaters; terns and skimmers) was 10 $\mu\text{g/g}$, and only one other egg (8.4 $\mu\text{g/g}$) of 28 collected exceeded 8 $\mu\text{g/g}$ target; geometric means were 2.9 to 5.0 $\mu\text{g/g}$.

Proposed Modifications: Fish Tissue Target to Protect Piscivorous Birds

- **Fish Tissue Target: No separate (or lower) numeric target needed for fish tissue to protect piscivorous birds**
- Note that for piscivore eggs, the frequency of exceedance of the numeric target (8 $\mu\text{g Se/g}$) is less than 8%, so they are in the “Compliance” tier according to Table 12-3 of the 2009 Draft Technical Staff Report, **despite the current concentrations in fish.**
- Fish and birds largely rely on aquatic invertebrate diets; if Se concentrations in fish are reduced to within compliance levels through watershed TMDL implementation actions, bird eggs should reflect similar changes in the food web, whether plants (coot diet), invertebrates (grebes and shorebirds) or fish (terns and skimmers).

2013 Update to Se Fish Tissue Numeric Target



- **Considered and evaluated the studies EPA used in 2004, as well as additional data published since then**
 - EPA published a list of studies since 2004 they found merited consideration for use in chronic criterion development

- **Also reviewed other compilation reports**
 - DeForest and Adams (2011)
 - DeForest et al. (2012)
 - Ohlendorf (2008)



2013 Update to Se Fish Tissue Numeric Target



- **Revised approach builds upon the previous evaluations conducted for NBW**
 - Addresses key concern from RWQCB related to limited data
 - Especially with regard to bluegill data
 - Report expanded to include more detailed reviews of all toxicity studies
 - Additional supporting information provided for why studies could or could not be used to derive numeric target as part of an Appendix
 - Further expanded “useable” data by using EPA methods to translate from whole-body to egg/ovary (and vice versa)

Updated NBW-specific Chronic Database

Inclusive of data on fish species present in the watershed or surrogates for fish present in watershed

Species	Endpoint	Reference	Egg/Ovary			Whole-body		
			CV µg/g	GMCV µg/g	Egg/ Ovary Rank	CV µg/g	GMCV µg/g	WB Rank
<i>Lepomis macrochirus</i> Bluegill	Juvenile mortality LOEC	Lemly 1993	17.01	22	1/2	7.91	8.9	1
	Larval edema EC ₁₀	Hermanutz et al. 1992, 1996	30			7.7		
	Larval survival EC ₁₀	Coyle et al. 1993	23			8		
	Larval edema EC ₁₀	Doroshov et al. 1992	18.3			8.12		
	Juvenile mortality 4°C EC ₁₀	McIntyre et al. 2008	18.3			9.56		
	Juvenile mortality 9°C EC ₁₀	McIntyre et al. 2008	28.6			13.3		
<i>Micropterus salmoides</i> Largemouth bass	Larval mortality EC ₁₀	CP&L 1997	22	22	1/2	10.96	11	2
<i>Catostomus commersonii</i> White sucker	Larval deformities EC ₁₃	de Rosemond et al. 2005	25.6	25.6	3	13.1	13.05	3
<i>Gambusia affinis</i> Western mosquitofish	Larval deformities/mortality NOEC	Saiki et al. 2004	>37.2	37.2	4	>17.5	17.5	4
<i>Pimephales promelas</i> Fathead minnow	Larval deformities EC ₁₀	GEI 2008	45	42	5	33	31	5
	Larval edema/lordosis LOEC	Schultz and Hermanutz 1990	<39.3			<28.99		



Fish Tissue Numeric Target for NBW

- Not enough toxicity data for NBW species to derive criteria per EPA's 1985 Guidelines
- Therefore, propose to use toxicity thresholds protective of most sensitive species for expected community
 - Where reproducing bluegill are present:
 - Whole body = 8.9 $\mu\text{g/g}$ total Se dw, or
 - Egg/ovary tissue = 22 $\mu\text{g/g}$ total Se dw
 - Where reproducing bluegill are absent:
 - Whole body = 13.1 $\mu\text{g/g}$ total Se dw, or
 - Egg/ovary tissue = 25.6 $\mu\text{g/g}$ total Se dw





Habitat where Bluegill
NOT present



Habitat where
Bluegill present



Key Issue:

Numeric Targets Approach

- Dependent upon discussion for numeric target values, approach may need to be modified to capture fish as a separate end-point from birds

Approach 1

NUMERIC TARGETS ¹		
Bird Egg Tissue	Fish Tissue	
8 ug/g dw	Reproducing Bluegill Present	
	Whole Body Tissue	8.9 ug/g dw
	Egg-Ovary Tissue	22 ug/g dw
	Reproducing Bluegill Absent	
	Whole Body Tissue	13.1 ug/g dw
	Egg-Ovary Tissue	25.6 ug/g dw

1 = The tissue-based tissue targets may be subject to revision upon adoption and approval of revised objectives (e.g., a site-specific objective)

Approach 2a

PRIMARY NUMERIC TARGETS ¹		SECONDARY NUMERIC TARGET ²
Bird Egg Tissue	Fish Tissue	Freshwater Water Column
8 ug/g dw	Reproducing Bluegill Present	
	Whole Body Tissue	8.9 ug/g dw
	Egg-Ovary Tissue	22 ug/g dw
	Reproducing Bluegill Absent	
	Whole Body Tissue	13.1 ug/g dw
	Egg-Ovary Tissue	25.6 ug/g dw
		5 ug/L

1 = The tissue-based tissue targets may be subject to revision upon adoption and approval of revised objectives (e.g., a site-specific objective)

2 = Target is based on CTR criterion for freshwater. This target will no longer be in effect once the CTR freshwater criterion has been replaced by revised objectives.

Approach 2b

PRIMARY NUMERIC TARGETS ₁					SECONDARY NUMERIC TARGET ₂
Bird Egg Tissue	<u>AND</u>	Fish Tissue if Bird Egg Target Attained in Piscivorous Birds		<u>OR</u>	Freshwater Water Column
8 ug/g dw		Reproducing Bluegill Present		5 ug/g dw	5 ug/L
		Whole Body Tissue	8.9 ug/g dw		
		Egg-Ovary Tissue	22 ug/g dw		
		Reproducing Bluegill Absent			
		Whole Body Tissue	13.1 ug/g dw		
		Egg-Ovary Tissue	25.6 ug/g dw		

1 = The tissue-based tissue targets may be subject to revision upon adoption and approval of revised objectives (e.g., a site-specific objective)

2 = Target is based on CTR criterion for freshwater. This target will no longer be in effect once the CTR freshwater criterion has been replaced by revised objectives.