Cell Assay Bioscreening in the Santa Ana Region

Alvina Mehinto

Southern California Coastal Water Research Project

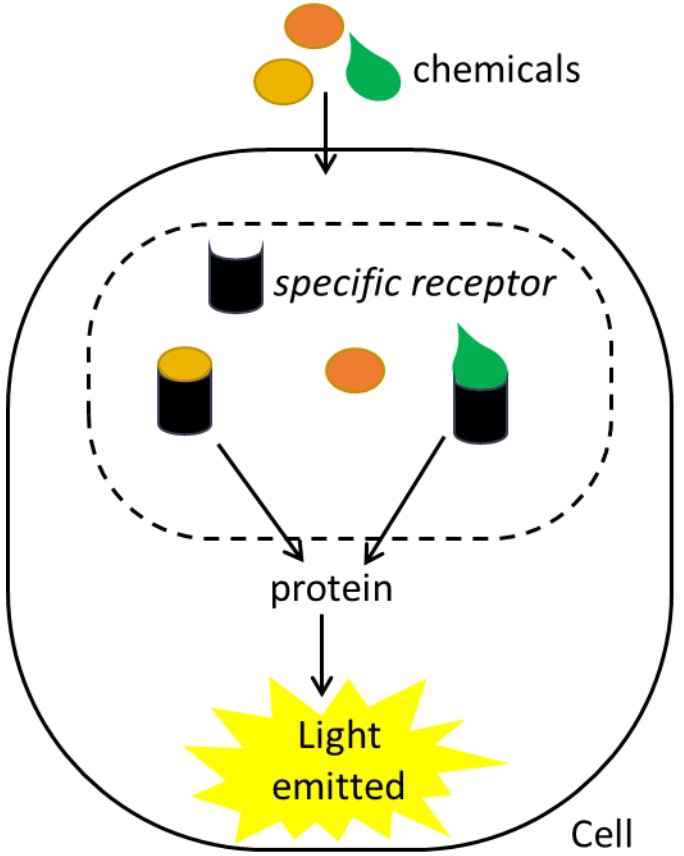
SAWPA EC Task Force, October 24, 2023

Monitoring Impacts of Emerging Contaminants

- Chemical monitoring alone is not enough to assess biological impacts
- Limited toxicity data and thresholds are available for CECs
- California Expert Science Panel recommended the use of other methods to better integrate chemical occurrence and impacts

Cell Bioassays

- Rapid, high-throughput methods to supplement chemical monitoring
  - Provides a semi-quantifiable and integrated response of known and unknown chemicals
- Tools developed as an alternative to animal testing
  - Routinely used by CEC manufacturers
  - Can be more sensitive than traditional bioassays
  - Measure chemical interactions on specific response pathways



Adapting Cell Bioassays for Water Quality

Tools Development

- Endpoint selection
- Standardized protocols
- Intercalibration studies

Implementation

- Case studies

Field assessment and site prioritization

Toxicity identification

CEC removal efficiency

Technology Transfer

- Guidance documents
- Training sessions
- Lab accreditation program

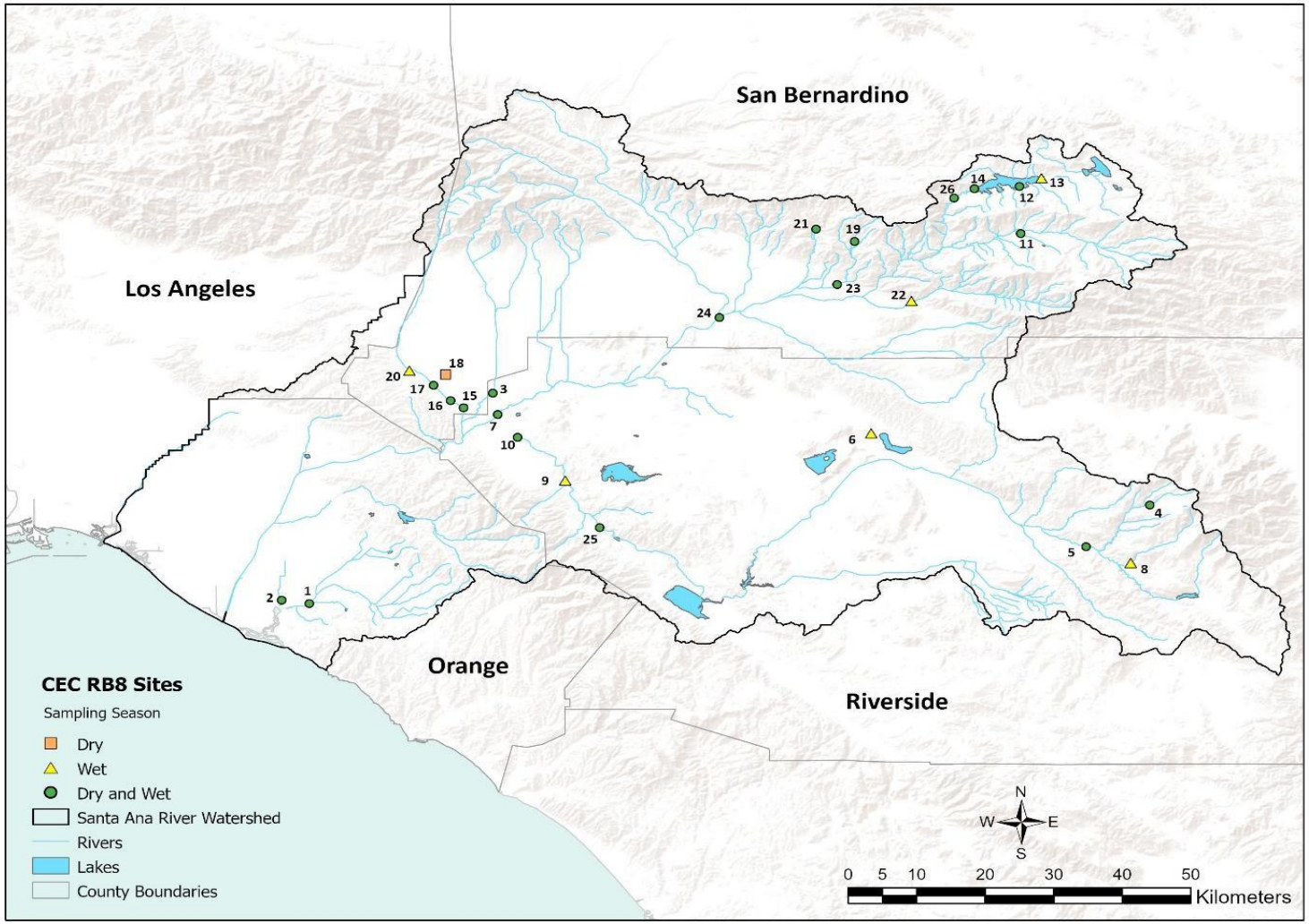
Rationale for the Study

- Cell bioassays have been proposed to prioritize sites requiring further costly and time-consuming analyses
- Pilot testing is needed to assess their utility as part of monitoring programs
  - Where they should be applied
  - Which endpoints are most useful for initial screening of contaminants of concerns
- Goals of the study were to (1) assess the presence of bioactive chemicals in Santa Ana Region and (2) compare cell assay data to known CECs

Study Design

- Twenty-six sites selected in collaboration with the Regional Board and members of the SAWPA EC Task Force

- Grab water samples collected during the dry and wet (did not target storm events) seasons



Study Design

- Cell bioassay screening using three endpoints (i.e, receptors)
  - Estrogen Receptor alpha (ERa), Aryl Hydrocarbon Receptor (AhR), Glucocorticoid Receptor (GR)

- Targeted chemical analysis on a subset of samples during the wet season (list from the CEC Expert Panel)

Chemical class	Analytes
Hormones	17β-Estradiol, estriol, estrone, testosterone
Industrial chemicals	4-Nonylphenol, bisphenol A, perfluorooctanoic acid (PFOA), perfluorooctane sulfonate (PFOS), polybrominated diphenyl ethers (PBDE-47 and -99)
Pharmaceuticals and personal care products	17α-Ethinyl estradiol, carbamazepine, diclofenac, galaxolide, gemfibrozil, ibuprofen, naproxen, triclosan
Pesticides, herbicides	Bifenthrin, chlorpyrifos, fipronil, permethrin

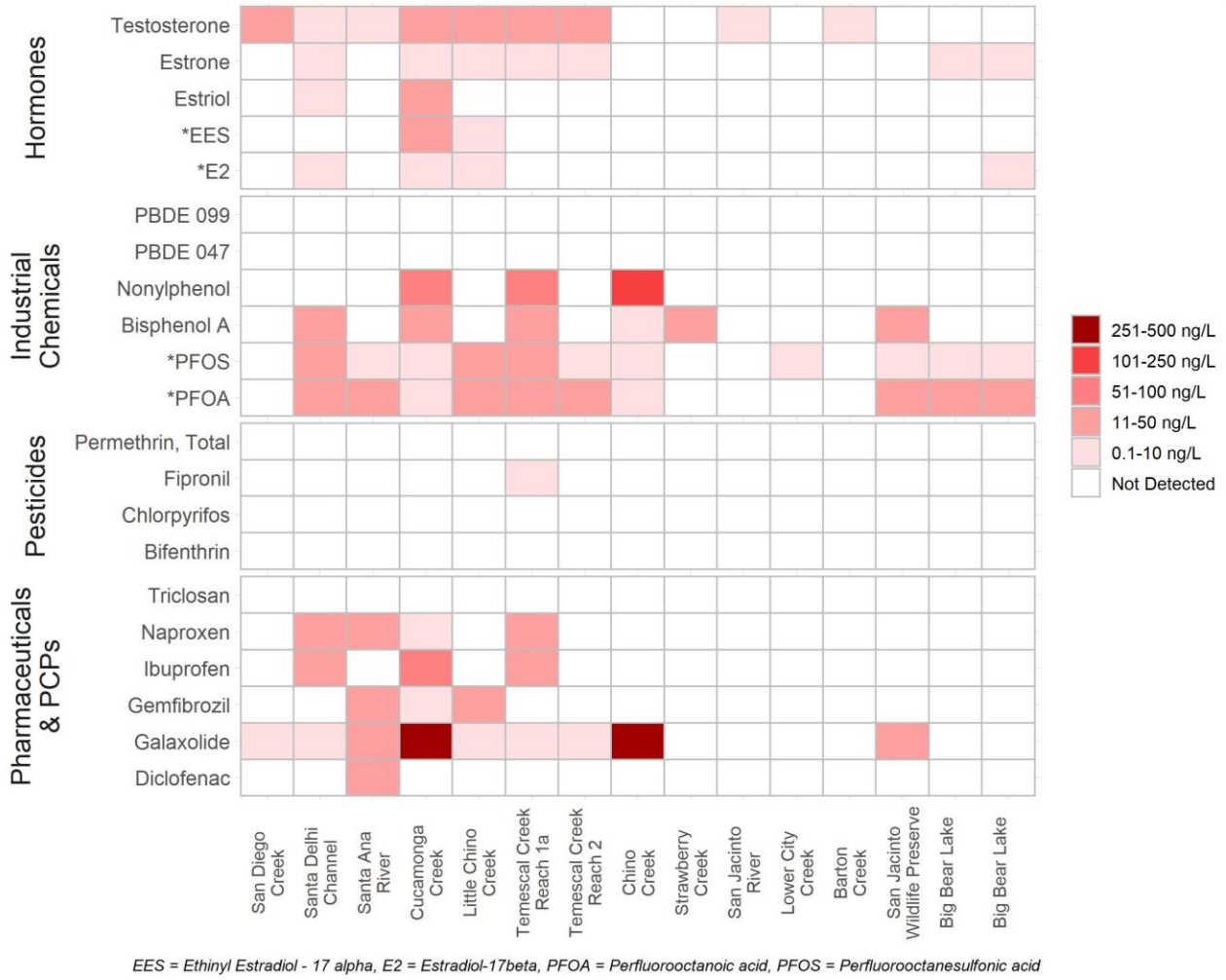
Cell Bioassay Results

- Most sites had no ERa or GR responses
- AhR responses detected at a dozen sites but most were relatively low
- No seasonal patterns observed

Site Name	ER BEQ (E2 ng/L)	GR BEQ (Dex ng/L)	AhR (TCDD ng/L)
Cypress Channel	**0.8**	<25	0.8
Chino Creek Reach 1B (A)	<0.5	**41**	0.3
Chino Creek Reach 1B (B)	<0.5	**36**	<0.2
Santa Ana River R3	<0.5	**30**	<0.2
Big Bear Lake West	**1.1**	<25	0.4
Temescal Creek Reach 1a	<0.5	<25	**0.9**

Targeted Chemistry Results

- Individual chemicals detected in most samples
- PFOS and PFOA were the most frequently detected
  - up to 19 and 28 ng/L respectively
- Galaxolide was detected in 9 out of 15 samples



Comparing Cell Bioassay and Chemistry Data

	CEQs for estrogenic chemicals						Sum of CEQs	ERα-BEQ
Chemical Relative Potency	**E2 1**	**BPA 0.000047**	**E1 0.015**	**E3 0.018**	**EE2 1.56**	**4-NP <0.000001**		
Big Bear Lake West	1.4		2.4				1.4	1.1
Little Chino Creek	0.17	26	0.41		0.12	69	0.4	<0.5
Barton Creek					0.28		0.4	<0.5
Big Bear Lake East	0.27		1.4				0.3	<0.5
Santa Ana Delhi Channel	0.2	37	0.4	0.26			0.2	<0.5
Temescal Creek Reach 1a		26	0.75			69	0.1	<0.5
Chino Creek Reach 1 (A)		5.6				160	<0.01	<0.5
San Jacinto Wildlife Preserve		12					<0.01	<0.5

Conclusions

- Little to no occurrence of estrogens, glucocorticoid steroids and dioxin-like (e.g., PCBs) chemicals in most water samples
  - One site had ER levels that would warrant further chemical analyses
  - Estrogen screen results were supported by chemistry data
- Target CECs were detected in most samples
  - Most were at relatively low levels
- Study was limited to screening for 3 classes of chemicals in water
  - Data on sediment quality is needed to determine overall impact of CECs in these habitats

Thank You!

alvinam@sccwrp.org

714-755-3210