DEPARTMENT OF PESTICIDE REGULATION (DPR) Date: March 14, 2025

SURFACE WATER AMBIENT MONITORING REPORT

1. Study Highlights

- DPR Study Number 319
- Study Title Monitoring of Dissolved Copper in California Coastal Waterbodies, 2023-2024
- Project Lead Rio Mecredy
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- Protocol Source (*protocol available online for five years, thereafter, request a copy from the SWPP list of archived files)*
  Environmental Monitoring Protocol Page

- Study Area

  Marinas: Berkeley Marina, Coyote Point Marina, Santa Barbara Harbor, Channel Islands Harbor, Marina del Rey, King Harbor, Newport Bay, and Shelter Island Yacht Basin.

  Watersheds: San Pablo Bay, San Fransico Bay, Santa Barbara Coastal, Ventura, Santa Monica Bay, Newport Bay, and San Diego.

- Water body type

  ☐ Creek ☐ River ☐ Pond ☐ Lake

  ☐ Drainage Ditch ☐ Storm drain outfall ☒ Other Estuaries/Ocean

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- Objectives

  (1) Determine the concentrations of dissolved copper (DCu) in selected, representative waterbodies.

  (2) Determine the temporal and spatial trends in DCu across and within selected waterbodies.

- Sampling period July 2023 – August 2024

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2. Overview

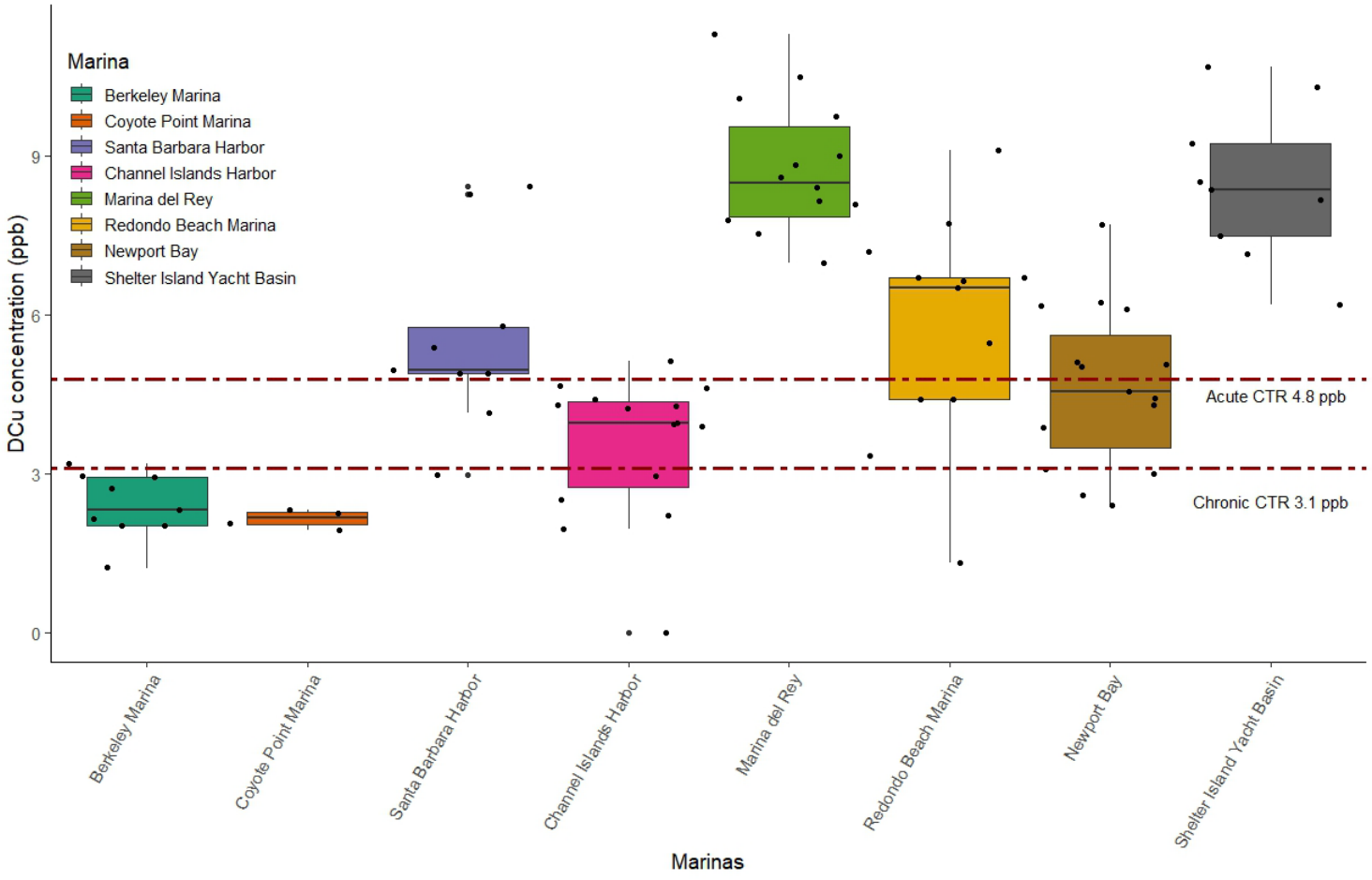
All samples had DCu concentrations above the reporting limit of 0.5 µg/L (Figure 1) and all sampling sites within the selected waterbodies had higher DCu concentrations than their respective local reference sites (LRS) samples. The mean DCu concentrations within all waterbodies ranged from 77% (Coyote Point) to 17393% (Marina del Rey) higher than their respective LRS site. (Table 1) This confirms findings from previous studies that copper antifouling paints (AFP) on vessel hulls are most likely the primary source of DCu in marinas and boat basins.

Coyote Point Marina, Marina del Rey, and Newport Bay experienced significant changes in mean DCu concentrations since baseline sampling in 2019 (Figure 2). Coyote Point reduced in DCu concentrations while Marina Del Rey and Newport Bay increased in concentration. All other marinas did not show significant shifts in detected DCu values.

For the northern waterbodies, Berkeley Marina and Coyote Point Marina, concentrations are compared to the San Fransico Bay's DCu site-specific objectives, which is 6.0 ug/L for chronic and 9.4 ug/L for acute. No sample exceeded either chronic or acute site-specific objectives.

For the Central and Southern California waterbodies, measured DCu concentrations are compared to the California Toxic Rule (CTR) criterion for chronic and acute toxicity which is 3.1 ug/L and 4.8 ug/L, respectively. Eighty-five percent of samples exceeded the chronic criterion and 62% of samples exceeded the acute criterion. Marina del Rey had the highest rate of exceedances with 100% exceedance for both chronic and acute criteria.

Figure 1. DCu concentrations (in parts per billion, ppb) at each marina included within the study for the 2023-2024 sampling season. The dotted lines represent the CTR acute criteria at 4.8 ppb and the CTR chronic criteria at 3.1 ppb.



3. 2023 – 2024 DCu detection values

Table 1. DCu detection summary statistics and percent exceedances to California Toxic Rule Criteria at each marina from 2023 to 2024.

Waterbody	Median (µg/L)	Mean (µg/L)	Std Dev (µg/L)	Local Reference Site (µg/L)	% above Chronic CTR	% above Acute CTR
Berkeley Marina	2.32	2.39	0.622	1.35	11^	0^
Coyote Point Marina	2.17	2.15	0.178	1.20	0^	0^
Channel Islands Harbor	3.95	3.54	1.36	ND, 3.80	67	7
King Harbor	6.51	5.67	2.18	1.14	90	64
Marina del Rey	8.60	8.75	1.24	ND, 1.78	100	100
Newport Bay	4.56	4.65	1.52	3.50, 1.33	73	47
Santa Barbara Harbor	4.96	5.53	1.79	ND	89	78
Shelter Island Yacht Basin	8.36	8.46	1.44	1.63	100	89

ND: Non-detect
Chronic CTR: Chronic California Toxics Rule Criterion for Dissolved Copper in Seawater, 3.1 µg/L
Acute CTR: Acute California Toxics Rule Criterion for Dissolved Copper in Seawater, 4.8 µg/L
^Compared to San Francisco Bay site-specific objectives, which for this part of San Francisco Bay are 6.0 µg/L and 9.4 µg/L chronic and acute toxicity, respectively.

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4. Changes from last round of monitoring (2019)

Kruskal-Wallis and Mann Whitney U tests were used to determine if mean DCu concentrations differed significantly among all three years and from year to year, respectively, within each marina. Relative percent differences (RPD) were also calculated to evaluate positive or negative fluctuations in DCu concentrations from previous sampling events. It should be noted that water samples were not analyzed for dissolved organic carbon (DOC) due to equipment issues at DPR's laboratory, therefore, data were insufficient for input into the Biotic Ligand Model for toxicity analysis.

Higher DCu median values were detected in Southern California waterbodies: 8.60 µg/L at Marina del Rey, 8.36 µg/L at Shelter Island Yacht Basin, and 6.51 µg/L at King Harbor (Table 1, Figure 1). Higher DCu concentrations in Southern California were also detected during previous sampling events in 2019 and 2022. (Figure 2). This is likely due to higher water temperatures in Southern California promoting higher rates of fouling than that of cooler water found in Northern and Central California.

Northern California

DCu concentrations at Berkeley Marina did not differ significantly between the years. Since baseline collection in 2019, there has been a 22% net mean reduction of DCu concentrations. The mean DCu concentration at Berkely Marina is 77% higher than the respective LRS sample. DCu concentrations at Coyote Point Marina significantly decreased with a net reduction of 55% since baseline sampling and a mean concentration 79% higher than the LRS. Neither marina had samples that exceeded the San Francisco Bay site specific acute or chronic objectives of 6.0 µg/L and 9.4 µg/L, respectively.

Central California

Santa Barbara Harbor did not see significant overall changes in mean DCu concentrations. It was noted during sampling in 2022 that the filtration system used for collecting the samples operated poorly leaving cause for concern over the validity of the samples. Despite the drop in mean DCu concentration for sampling in 2022, Santa Barbara Harbor experienced a net 8% increase since baseline sampling in 2019. It is possible that poor pump performance played a part in the drastically low DCu concentrations during the 2022 sampling event.

Channel Islands Harbor did not see significant overall changes in mean DCu concentrations. Samples exceeded 67% and 7% of the chronic and acute objectives, respectively. Channel Islands Harbor has two LRS sites; the first is outside of the marina past the breakwater structures and the second is located in the northern tip of the marina at a water inlet. The second LRS sample contained 7% higher DCu concentration than the overall mean concentration within the harbor.

Southern California

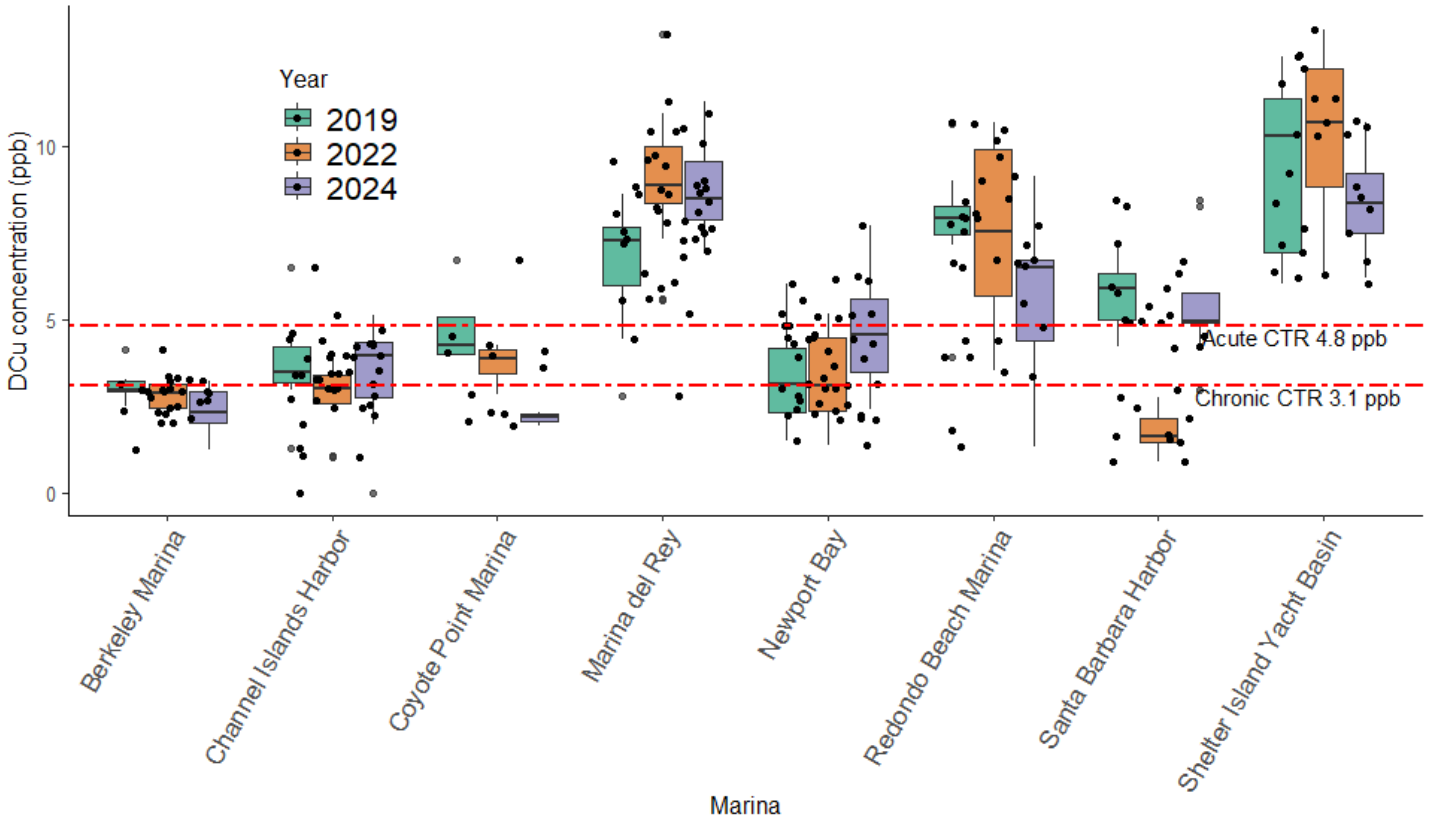
At King Harbor and Shelter Island Yacht Basin, mean DCu concentrations did not significantly differ from year to year with mean DCu concentrations of 5.67 µg/L and 8.46 µg/L, respectively. Both marinas saw slight decreases in net RPD values. All samples from Shelter Island Yacht Basin exceeded the chronic criterion while 89% exceeded the acute criterion. Eighty-nine percent of King Harbor samples exceeded the chronic criterion and 64% exceeded the acute criterion.

Marina del Rey and Newport Bay both saw significant increases since baseline sampling in 2019. Newport Bay has seen a net 37% increase in mean DCu concentrations and has an exceedance rate of 73% and 47% for the chronic and acute criterion, respectively. Marina del Rey has experienced a 32% increase in mean DCu concentration with 100 % exceedance rate for both the chronic and acute criterion.

Table 2. Mean concentrations within each waterbody and the relative percent difference of DCu concentrations between sampling years.

Waterbody	Mean 2019	Mean 2022	Mean 2023/24	RPD 2019/2022	RPD 2022/2024	NET RPD
Berkeley Marina	3.06	2.81	2.39	-8%	-15%	-22%
Coyote Point Marina	4.80	3.70	2.15	-23%	-42%	-55%
Channel Islands Harbor	3.68	2.85	3.54	-22%	24%	-4%
King Harbor	7.32	7.48	5.67	2%	-24%	-23%
Marina del Rey	6.64	9.02	8.75	36%	-3%	32%
Newport Bay	3.40	3.44	4.65	1%	35%	37%
Santa Barbara Harbor	5.13	1.71	5.53	-67%	224%	8%
Shelter Island Yacht Basin	9.27	10.31	8.46	11%	-18%	-9%

Figure 2. The 2019, 2022 and 2024 DCu concentration ranges (ppb) for each waterbody included in the study. The red line represents the CTR acute criteria at 4.8 ppb and the CTR chronic criteria at 3.1 ppb. Coyote Point Marina, Marina Del Rey, and Newport Bay experienced significant changes since 2019. All other marinas remained at relatively the same detection levels.



5. Quality Control

Table 3. Laboratory Quality Control (QC) summary.

QC Type	Sample Matrix	Total Number	Number of QC Out of Control
Chemistry Lab Blank	Water	16	0
Matrix Spike	Water	95	0
Field Duplicate	Water	8	0
Equipment Blank	Water	8	0

6. Data

Water quality data, analytical chemistry and monitoring results are available upon request. Please contact the Project Lead for the data.