

The California Water Boards' Annual Performance Report - Fiscal Year 2010-11

ENVIRONMENTAL INDICATOR: AQUATIC LIFE

WATERBODY TYPE:
RIVERS, LAKES & COASTAL WATERS

MEASURE:
WATER COLUMN TOXICITY

MESSAGE:

Statewide close to 50% of sample water tested for toxicity were non-toxic.

KEY STATISTICS

Number of sites sampled: 646

Sites were sampled in large, mixed land-use watersheds throughout California

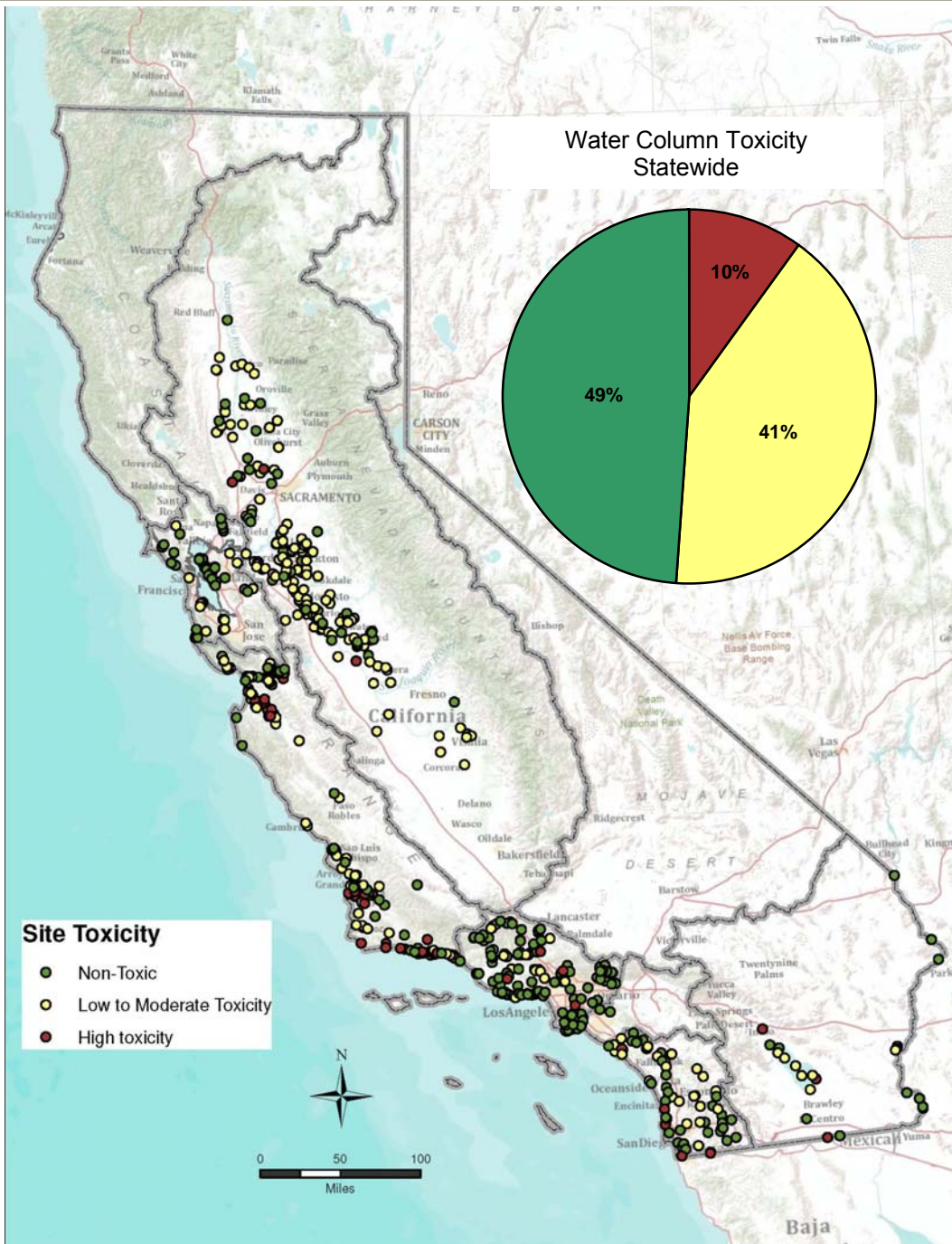


Figure 1. Magnitude of Toxicity in Waters Statewide.

WHAT IS THE MEASURE SHOWING?

This measure shows the extent and magnitude of toxicity in California surface and coastal waters. The report is based on sampling results from a variety of unconnected, largely targeted monitoring efforts over a ten year period.

Figure 1 shows that toxicity was observed in all regions of California. Samples from streams in upper watersheds and mountainous areas tended to be less toxic, while downstream samples from sites in valleys and along the coasts tended to be more toxic. The coastal and valley watershed sites drain larger areas than the upper watershed sites, and are impacted by greater levels of human activity.

There is strong evidence that pesticides are linked to water column toxicity and the toxicity of these pesticides corresponds to the degree of specific land use in the surrounding landscape. The data showed that waters flowing through sites in agricultural and urban areas had significantly higher toxicity than sites in less developed areas (Fig 2). The difference in water toxicity between agricultural and undeveloped areas was statistically significant; and the same is true for difference between urban and undeveloped areas. Greater water toxicity was observed in agricultural relative to urban sites. The evidence suggests that water toxicity in agricultural sites has largely been due to organophosphate pesticides.

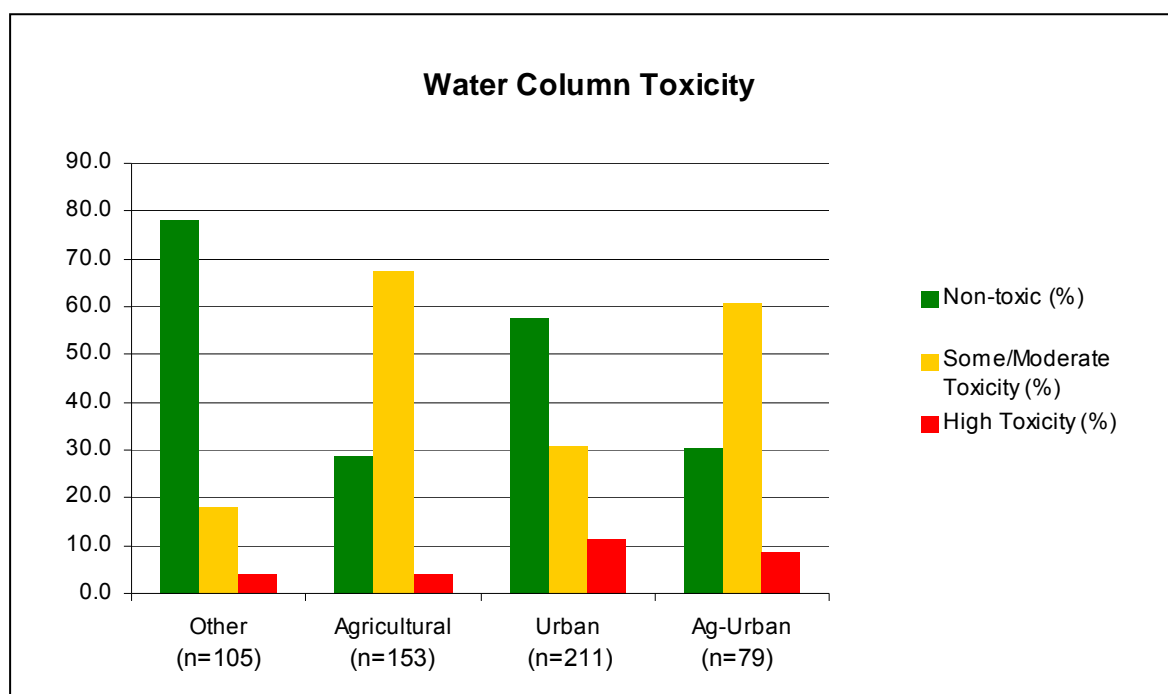


Figure 2. Numbers of sites (as a percentage of all sites in each land-cover category) where water samples were classified as non-toxic, moderately toxic, or highly toxic.

WHY IS THIS MEASURE IMPORTANT?

Toxicity tests are especially useful in water quality evaluation because they reflect the cumulative effects of all chemicals present (whether specifically identified and measured or not). The assessment tells us that toxicity is widespread in the places where monitoring was conducted, and that it is largely associated with agriculture and urban activity. Understanding the connection between toxicity and agricultural and urban sources of contamination will help direct management programs and practices aimed at reducing toxicity such as: 1) the development of TMDL's, 2) EPA restrictions on OP pesticides, 3) pesticide label restrictions, and 4) implementation of best management practices.

WHAT FACTORS INFLUENCE THE MEASURE?

This kind of toxicity studies is more informative when toxicity, chemistry, and small aquatic life (macroinvertebrates) are all conducted at the same time and place, because they involve three lines of evidence. Although there are limited studies conducted using this kind of all inclusive approach in California, there is large body of evidence from elsewhere showing pesticides and other chemicals are linked to impacts on aquatic ecosystems. The limited studies in California using this all inclusive approach indicate that habitat was a less important factor than pesticides.

No general statements can be made on the degree of toxicity of California's surface waters because the locations where the sampling occurred were largely targeted, and may not be representative of a general condition across the state. Specifically, sampling locations were generally targeted in low watershed areas where one stream feeds into another, or occurred upstream and downstream of potential pollutant sources. Data were integrated from various sources for analysis. The different programs often had different monitoring objectives, and there is large variation in the number of samples collected at each site and the number of sites surveyed in each Region.

TECHNICAL CONSIDERATIONS:

- » Data sources: The data used in this analysis were largely from targeted data sets, with a minor component of data from randomly sampled locations. The data used for this assessment was collected by the Surface Water Ambient Monitoring Program (SWAMP), Regional and Statewide monitoring programs, as well as partner programs whose data is available in California Environmental Data Exchange Network (CEDEN) database. Multiple years of data ranging from 2001 to 2010 were used for this analysis.
http://www.waterboards.ca.gov/water_issues/programs/swamp/docs/reports/tox_rpt.pdf
- » Statewide survey: Data were pooled from multiple sources to create the data set used in this statewide report. Data were usable for this analysis if toxicity test controls met test acceptability criteria as set by the test protocols.
- » Threshold development: Thresholds for distinguishing between moderate toxicity and high toxicity were developed using data from multiple laboratories for all toxicity endpoints presented in the analysis. Data batches were used only if classified as following all SWAMP requirements
- » Toxicity tests: Toxicity investigations are most often conducted in a laboratory setting using samples of environmental water/sediment, and a variety free swimming or burrowing test organisms. Mortality (acute toxicity test endpoint), growth, or reproduction (chronic toxicity test endpoints in water samples) of the test organisms is documented to quantify the samples toxicity.

GLOSSARY

Endpoints

Measured effects on test species (e.g., fish, crustaceans, etc.) where mortality is measured and calculated as percent survival.

Test organisms

Surrogates for aquatic species found in the environment.

Toxicity test

Form of toxicity testing conducted in the laboratory where standard aquatic test organisms are exposed to ambient water and sediment, and toxic impacts are measured.

(Updated 9/14/2011)