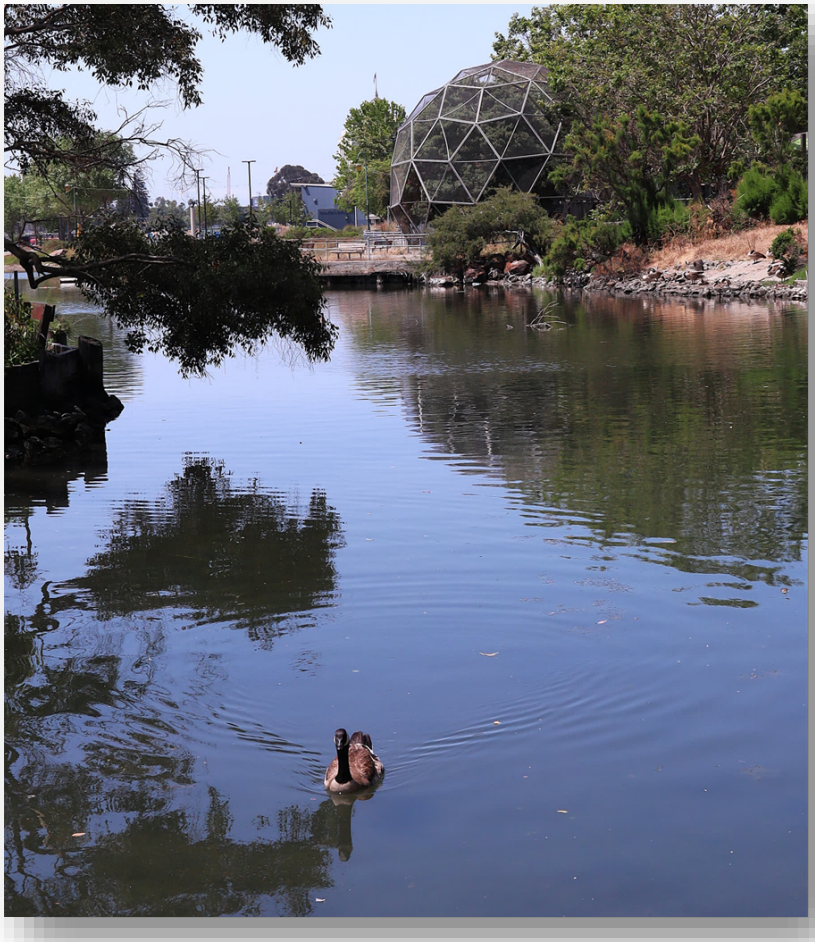
California Regional Water Quality Control Board

San Francisco Bay Region

# Lake Merritt June 2025

# Small-Scale Fish and Shrimp Mortality Events



Final Staff Report

October 2025

**CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD**

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## 1. Executive Summary

Two small-scale aquatic die-off events occurred at Lake Merritt on June 4 and June 7, 2025. The first incident was reported around 3:30 p.m. on June 4 by Katie Noonan of the Rotary Nature Center Friends, who observed dead fish, shrimp, and worms at two near-shore locations: near the Rotary Nature Center (RNC) and at the Lake Merritt Boating Center (LMBC) docks. The second event was reported around 12:20 p.m. on June 7, by James Robinson of the Lake Merritt Institute (LMI) who observed dead and stressed fish and shrimp at the LMBC docks.

Volunteer observations conducted on June 4–5 and June 7–8 indicate that the first mortality event was primarily localized to the northern end of the lake, extending from just outside the boom near the aeration fountain by the Pergola to the LMBC docks. The second event appeared to be confined to the LMBC dock area. In both cases, the majority of observed mortalities were shrimp, with fewer dead fish, primarily gobies, mixed in. Grab samples collected by volunteers revealed very low dissolved oxygen (DO) concentrations near the RNC and the LMBC docks following both events. In contrast, other shoreline areas of the lake did not show signs of fish or shrimp mortality and exhibited normal DO levels.

Extremely low DO concentrations were also recorded at two of the City of Oakland's three in-lake continuous monitoring stations. These low levels occurred briefly prior to both die-off events and aligned with the timing of the observed mortality events.

No visible signs of algal blooms or harmful algal blooms (HABs) were present immediately before or after the first fish kill. Additionally, HABs monitoring data confirmed that cyanotoxins were not detected at levels of concern during this period.

The tide gates had been closed for over ten days and were reopened two days before the first aquatic die-off. However, the available data do not provide sufficient evidence to directly link tide gate operations to the observed low DO conditions. A more detailed analysis of DO patterns during previous gate closures and openings will be conducted to better assess the potential influence of tide gate operations on DO dynamics in the lake.

Based on volunteer observations and photographic evidence, it is estimated that up to 1,000 aquatic organisms were affected during the two events. The majority of mortalities were *Palaemon* shrimp, with up to 200 small fish (likely Chameleon Goby, *Tridentiger triconocephalus*, or Yellowfin Goby, *Acanthogobius flavimanus*) also observed.

This report summarizes key findings from the June 2025 fish and shrimp mortality events, including visual documentation and water quality data collected around the time of the incidents. While the underlying mechanism of the June 2025 events is not fully understood, evidence from continuous and grab DO monitoring and cyanotoxin data collected during the events suggests that these events were distinct from the more severe August 2022 fish kill (see *2022 Lake Merritt Fish Kill Report*). The June 2025 events were smaller in scale (localized vs. lake-wide), involved fewer organisms (up to

1,000 vs. up to 10,000), and were associated with brief low DO episodes, in contrast to the prolonged DO depletion caused by HABs in 2022.

## 2. June 4, 2025 Fish and Shrimp Mortality Event

On June 4, 2025, Water Board staff received reports from Katie Noonan of the Rotary Nature Center Friends (RNCF) regarding the presence of dead aquatic organisms, including worms, gobies, and shrimp, near the shoreline by the Rotary Nature Center (RNC) and at the Lake Merritt Boating Center (LMBC) docks (see Figure 1).




**Figure 1. Aerial map of Lake Merritt showing observed aquatic mortality locations and continuous monitoring stations in June 2025**

Later that day, volunteers conducted a visual survey around the lake and documented additional locations where dead aquatic organisms were observed. Photos and observations from many of these locations were submitted to iNaturalist and are shown on Figure 1 using numbered icons (1–12) with a dead fish symbol.

The majority of observed mortality was concentrated along the northeastern shoreline of the lake, extending from just outside the boom near the aeration fountain by the Pergola

(starting at Spot #1) to the boat docks at the LMBC. Two isolated observations were recorded in the Glen Echo arm on the same side of the lake: Spot #11 included a single dead shrimp, and Spot #12 involved an unspecified number of dead gobies. Due to the lack of specific counts, and assuming low numbers where unspecified, it is possible that these two locations in the Glen Echo arm represent background mortality unrelated to the larger event.

The size of the dead fish icon on Figure 1 reflects the approximate number or density of dead organisms observed at each location. For example, Spots #1, 2, 3, 8, and 9, and 10 had only one or a few organisms reported (or unspecified), and are marked with the smallest icon. The areas with the highest reported mortality, supported by photographic evidence, were near the RNC (“RNC” and Spots #4 to #8) and at LMBC docks. Representative photographs from locations with higher organism mortality are shown below (see Figures 2–6).



**1Figure 2. Photos taken near the Rotary Nature Center (RNC on Figure 1) by Katie Noonan on June 4, 2025, at 3:29 p.m.**

Note: The above photos capture approximately 150–200 dead organisms, mostly shrimp, along with four easily identifiable fish.



**Figure 3. Additional photos taken near the Rotary Nature Center (RNC on Figure 1) by Katie Noonan on June 4, 2025, at 3:29 p.m.**
Note: The two photos above were taken from the same shoreline as Figure 2. It is unclear whether they overlap or depict different areas than Figure 2. Collectively, the images show an estimated 100–150 dead organisms, primarily shrimp, along with two easily identifiable fish.



**Figure 4. Photo taken at Spot #4 (see Figure 1) and uploaded by user "eleggua" to iNaturalist on June 4, 2025, at 6:22 p.m.**
Note: The photo shows approximately 30 dead shrimp (https://www.inaturalist.org/observations/287643646).



**Figure 5. Photo taken at Spot #6a (see Figure 1) and uploaded by user "wildave" to iNaturalist on June 4, 2025, at 5:10 p.m.**
Note: The photo shows numerous small dead fish—approximately 100 individuals, mostly gobies (https://www.inaturalist.org/observations/289304283).



**Figure 6. Photo taken at Spot #7 (see Figure 1) and uploaded by user "eleggua" to iNaturalist on June 4, 2025, at 6:48 p.m.**
Note: The photo shows approximately 50 dead shrimp https://www.inaturalist.org/observations/287643768).

## 3. Water Board Staff Site Inspection Findings

On June 5, 2025, between 10:00 a.m.–12:00 p.m., Water Board staff member Tong Yin conducted a site inspection at Lake Merritt and met with City of Oakland staff, Jennifer Stern, on-site. During the site visit, Water Board staff observed that dead fish and shrimp were still present near the RNC shore and at the LMBC docks; however, the numbers were significantly reduced compared to those documented in the photos taken by Katie Noonan on June 4th (Figures 2–3).

Staff inspected over 300 feet of shoreline, indicated by the red line on Figure 7. No dead organisms were observed at either end of this stretch, including at specific sites previously documented by volunteers on June 4 (Figure 1). Additionally, staff noted improved water clarity moving eastward, away from the RNC toward the right side of the map.

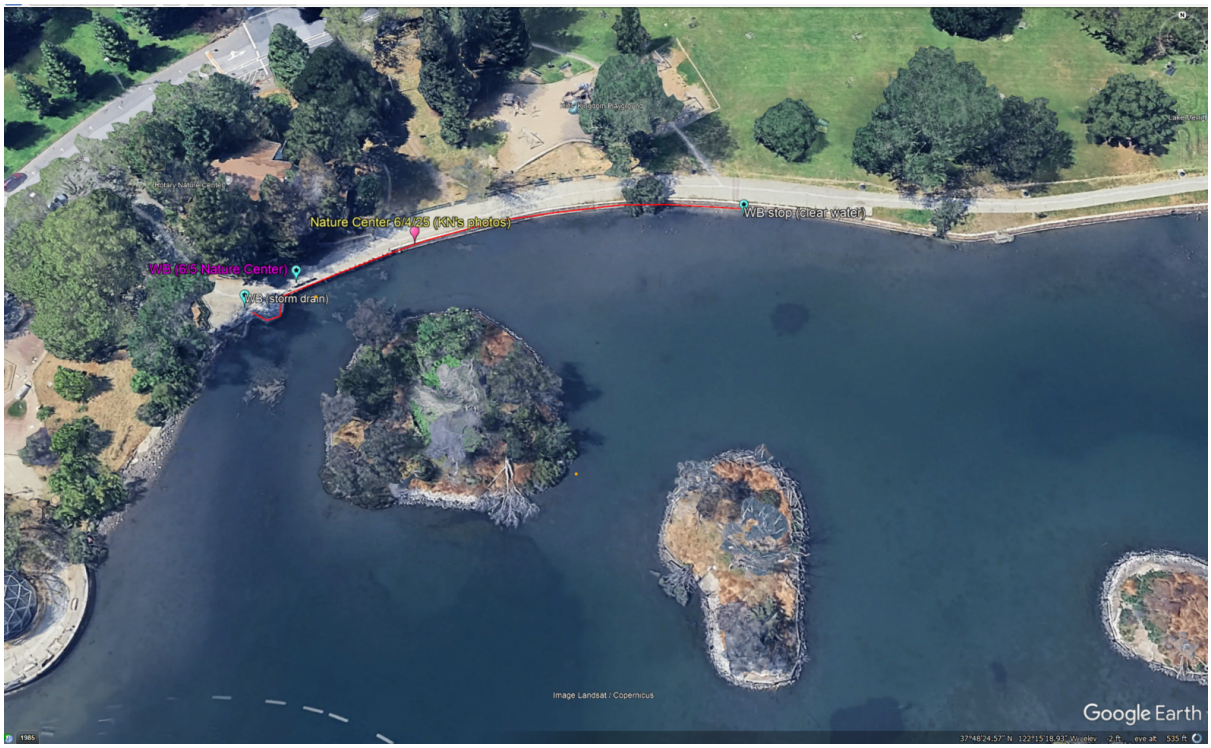



**Figure 7. Aerial map showing the Water Board staff inspection path near the Rotary Nature Center on June 5, 2025**



**Figure 8. Photo showing the area near the Rotary Nature Center with the highest concentration of dead organisms observed during the June 5, 2025, site inspection**

The photo above (Figure 8), taken by Water Board staff near the RNC around 10:20 a.m. on June 5, 2025 (marked as “WB (6/5, Nature Center)” on Figure 7), shows approximately 50 dead organisms, nearly all of which appear to be shrimp. Visibility beyond the immediate shoreline was limited due to glare on the water.

This location is approximately 70 feet west of the location where Katie Noonan took her June 4 photos. It represented the area with the largest number of dead organisms observed during the visit. However, as staff moved away from this location in either direction, the number of visible dead organisms declined significantly.

The following photo (Figure 9, left), showing a pipe discharging into the lake, was taken at the western endpoint of the inspection route (labeled “WB (storm drain)” on Figure 7). No dead organisms were observed at this location, and the water appeared clear. There were no signs of active discharge from the pipe during the visit, nor were there any reported discharges in the preceding days. The next photo (Figure 9, right), taken at the eastern endpoint of the inspection route (labeled “WB stop (clear water)” on Figure 7), similarly showed only clear water with no visible dead organisms.

In a follow-up email dated June 11, 2025, Katie Noonan noted that an “unusual numbers of birds along the shore, including American white pelicans, brown pelicans, snowy egrets, and gulls,” were observed on June 4 near the bird islands. It is possible that a significant portion of the initially observed dead fish and shrimp were scavenged by birds prior to the Water Board staff inspection the following morning.



**Figure 9. Photos from June 5, 2025: Western end (left) and eastern end (right) of Water Board staff inspection path**

Moving to the LMBC docks near the main boat floats (as indicated in Figure 1), Water Board staff observed fewer dead organisms during the inspection. The lake at the LMBC docks is significantly deeper than the nearshore areas by the RNC and appeared murkier at the time of the inspection. The two photos below (Figure 10), taken between 10:40 and 11:00 a.m. on June 5, 2025, show the conditions at the docks. The photo on the left captures an estimated 10–20 dead organisms, primarily shrimp. The photo on the right shows one dead fish and a few shrimp. The fish and one shrimp were retrieved from the water for closer inspection (see Figure 11).



**Figure 10. Photos taken by Water Board staff at the Lake Merritt Boating Center docks on June 5, 2025**



**Figure 11. Photo showing a dead fish and shrimp retrieved at the Lake Merritt Boating Center docks on June 5, 2025**
Note: The fish retrieved was likely a Chameleon Goby (*Tridentiger trigonocephalus*)**,** and the shrimp an oriental shrimp (*Palaemon macrodactylus*), based on identification by Katie Noonan.

Water Board staff observed no signs of dead fish at two locations within the Trestle Glen arm, as indicated by “WB Stop” on Figure 7. One stop was near the Pergola and aeration fountain, where volunteers had reported dead organisms the previous afternoon. The photo below (Figure 12) was taken at the second stop, located on the other side (Lakeshore Ave side) from the RNC. The photo shows clear water, visible aquatic vegetation on the lake bottom, and no signs of dead organisms.



**Figure 12. Photo showing clear water and no visible dead organisms in the Trestle Glen arm at 12:00 p.m. on June 5, 2025**

## 4. June 7, 2025 Fish and Shrimp Mortality Event

On June 7, 2025, James Robinson of the Lake Merritt Institute (LMI) reported observing dead and distressed fish and shrimp near the LMBC docks. James shared videos taken at the docks that showed fish and shrimp swimming near the surface (Figure 13)—behavior associated with low dissolved oxygen conditions—as well as footage of

clumps of dead or dying shrimp near the dock posts and dead fish lying on the lakebed. No dead fish were observed near the nearby RNC during his inspection.



**Figure 13. Still image from a video clip showing fish swimming near the surface at the LMBC boat docks on June 7, 2025**

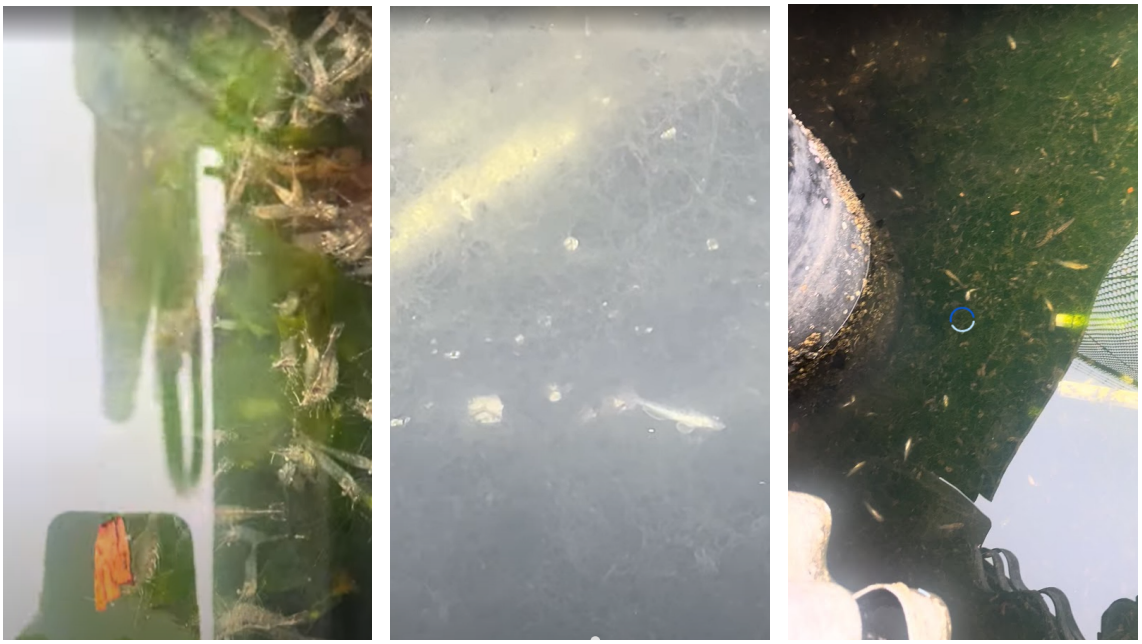


**Figure 14. Still images from video clips showing dead and struggling shrimp and fish at the Lake Merritt Boating Center docks on June 7, 2025**

These photos show a significant number of dead shrimp (Figure 14, left) and dead fish (Figure 14, middle and right) in the lake near the LMBC docks on the morning of June 7, 2025. The images are screen captures from videos taken by LMI staff. The videos also captured fish swimming near the surface and shrimp jumping out of the water. In the left image, close to 100 shrimp are visible in the video frame, while the right image shows approximately 20-30 dead fish.

At LMBC (as shown on Figure 1), RNC staff conducted follow-up observations on the afternoon of June 8, 2025, the day after the second fish and shrimp mortality event. From three traps set at the LMBC docks, they retrieved one dead Chameleon Goby

(*Tridentiger trigonocephalus*) and approximately 50 dead shrimp. No additional dead organisms were observed elsewhere in the lake by RNC staff.

## 5. Post-Fish Kill Grab Monitoring by Volunteers

Following the first fish and shrimp mortality event on June 5, 2025, Katie Noonan and RNCF staff measured DO at multiple shoreline locations between 9:00 a.m. and 12:30 p.m. using a handheld YSI ProDSS sonde. Results showed very low DO levels near the bottom at the LMBC boat docks, while all other monitored locations exhibited normal conditions (Figure 15a). These findings were consistent with visual observations by Katie Noonan and RNCF staff, who noted dead organisms primarily at the LMBC docks and near the RNC, with no mortalities observed along other shorelines of the lake.




**Figure 15a. Grab sampling locations and measured dissolved oxygen concentrations on June 5, 2025, conducted by Rotary Nature Center Friends Staff**
Note: DO concentrations shown in yellow indicate values below the Basin Plan water quality objective of 5.0 mg/L, while those in green indicate values above the objective. Where two numbers are shown at a site, they represent surface and bottom DO readings, respectively. If only one value is shown, it reflects a surface measurement.

On June 8 around 12:00 p.m., after seeing dead shrimp and fish at the LMBC docks the previous morning, RNCF volunteers measured DO at the docks and retrieved dead organisms from fish traps (Figure 15b).




**Figure 15b. Zoomed-in map showing details of the Lake Merritt Boating Center dock area, with dissolved oxygen measurements taken on June 8, 2025, and the location of the fish traps with dead fish/shrimp retrieved**

In addition, James Robinson and LMI staff measured DO near the RNC shoreline and the LMBC boat docks, beginning after the first fish and shrimp mortality event and continuing through June 9, covering the period of the second mortality event on June 7. Their measurements also indicated very low DO levels at both the LMBC docks and near the RNC. DO results collected by LMI staff during this period are summarized in Table 1, and the sampling locations are shown in Figure 16.

**Table 1. Volunteer dissolved oxygen monitoring by Lake Merritt Institute using YSI Pro2030**

| Site[1] | 6/5/2025 (following first fish kill) | 6/6/2025 | 6/7/2025 (dead and struggling fish and shrimp observed) | 6/9/2025 |
|---|---|---|---|---|
| 1 | 0.16 mg/L @ 12:44 p.m. | 3.37 mg/L @ 11:04 a.m. | 0.63 mg/L @ 9:51 a.m. (Depth: 3 ft) | 1.65 mg/L @ 11:03 a.m. |
| 2 | 0.70 mg/L @ 12:52 p.m. | 4.22 mg/L @ 10:57 a.m. | 0.12 mg/L @ 9:57 a.m. (Depth: 3 ft) | 1.58 mg/L @ 11:10 a.m. |
| 3 | 0.72 mg/L @ 12:58 p.m. | 4.95 mg/L @ 11:11 a.m. | - | 3.86 mg/L @ 11:17 a.m. |
| 4 | 3.87mg/L @ 1:14 p.m. (Depth 3 ft) | 1.87 mg/L @ 11:22 a.m. (Depth: 2 ft) | - | 1.84 mg/L @ 11:36 a.m. (Depth: 2 ft) |

[1]Sites 1–4 correspond to monitoring locations shown in Figure 16.




**Figure 16. Lake Merritt Institute's June 5–9, 2025 monitoring locations**

Following the first mortality event on June 4, LMI staff recorded very low DO concentrations (ranging from 0.16 – 0.72 mg/L) at Sites 1 – 3 near the LMBC docks on June 5. In contrast, Site 4, located near the RNC, had the highest DO concentration at 3.87 mg/L. The next morning, June 6, DO concentrations at Sites 1 – 3 had increased to above 3.3 mg/L, while Site 4 showed a slight decrease. Similarly, around the time of seeing dead/struggling fish and shrimp on June 7, LMI staff measured very low DO concentrations at Sites 1 and 2. When LMI staff returned on June 9, DO levels at Sites 1 and 2 remained low (1.65 and 1.58 mg/L, respectively), although both sites showed slight increases from earlier measurements (previously 0.63 and 0.12 mg/L, respectively).

## 6. Analysis of Central Lake DO Conditions Using Continuous Monitoring Data

Water Board staff reviewed continuous DO data collected at the City of Oakland's three in-lake monitoring stations to assess whether the low DO conditions observed along the shoreline, particularly near the RNC and the LMBC docks, were also observed at the fixed sonde locations. The analysis aimed to determine whether these low DO events could be linked to broader lake conditions, including algal blooms or recent tide gate closures.

The DO data from June 2025, particularly around the time of the mortality events, are shown in the plots below (Figures 17–19). In all figures, surface DO concentrations are shown in blue and bottom (benthos) concentrations are shown in orange. In addition, the figures also include the Basin Plan water quality objective of 5 mg/L shown in the red dashed line.

Station 3 is located in the center of the Trestle Glen arm on the opposite side of the bird islands (see Figure 1). Despite not being directly adjacent to the mortality event sites, it

is the closest of the three stations to the observed events.

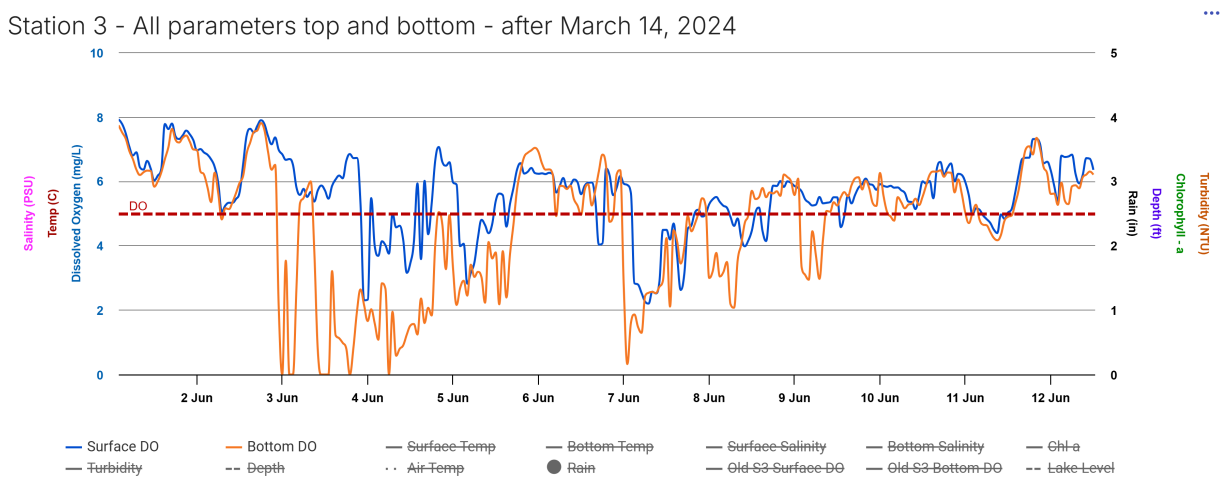



**Figure 17a. DO levels at Station 3 from June 1–12, 2025**

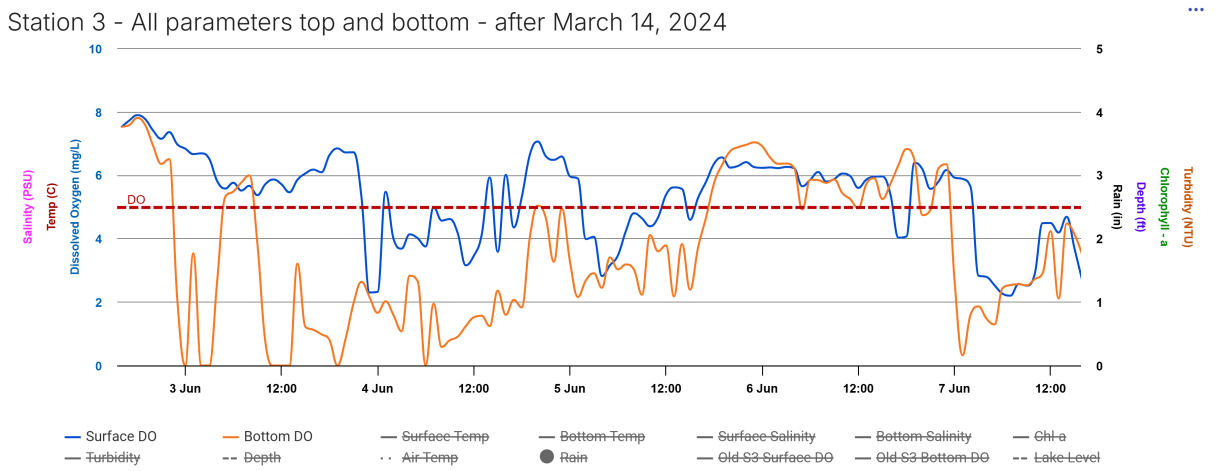



**Figure 17b. Zoomed-in view of DO levels at Station 3 during the period surrounding the mortality events (June 3–June 7, 2025)**

Station 3 recorded several episodes of low bottom DO levels beginning around 12:00 a.m. on June 3, with the final low DO episode occurring around 1:00 a.m. on June 7 (Figure 16b). However, the DO trends during this period did not follow typical diurnal patterns, in which DO levels are usually lower during the night or early morning and higher during the day. Instead, sharp and rapid fluctuations, particularly on June 3, indicate more complex dynamics that merit further investigation. While surface DO levels decreased on June 4, it did not exhibit the sharp fluctuations seen in bottom waters on June 3.

Following the first observed mortality event on June 4, bottom DO levels at Station 3 began to gradually increase and remained consistently above 5 mg/L. However, a sharp decline was recorded between approximately 11:00 p.m. on June 6 and 1:00 a.m. on June 7. Surface levels also declined during this period but never dropped below 2 mg/L.

This timing corresponds with field observations reported by James Robinson of LMI, who observed fish swimming near the surface, shrimp jumping out of the water, and dead fish and shrimp appearing at the LMBC docks in the morning of June 7.

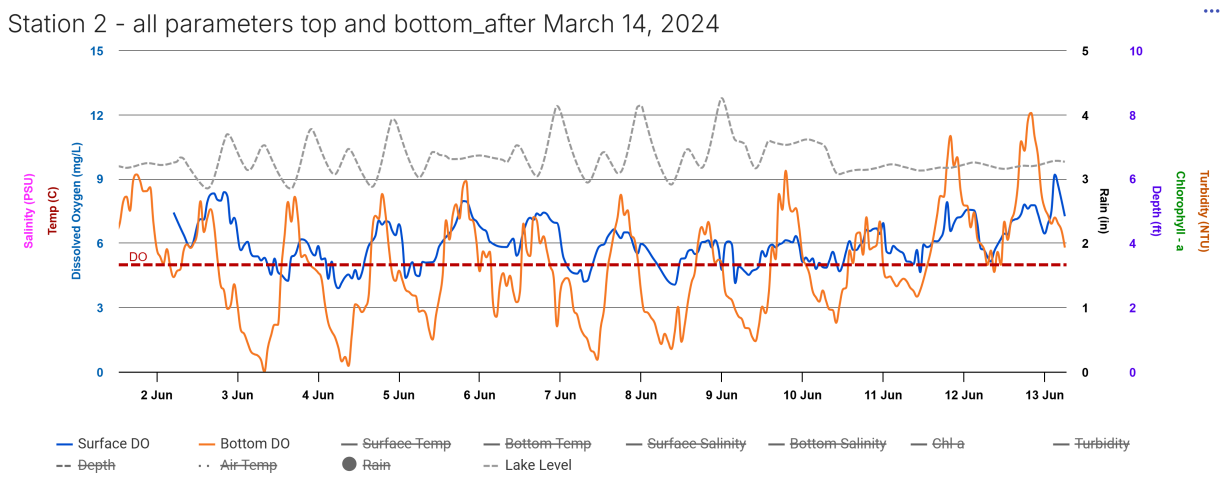



**Figure 18a. DO levels at Station 2 from June 1–12, 2025**

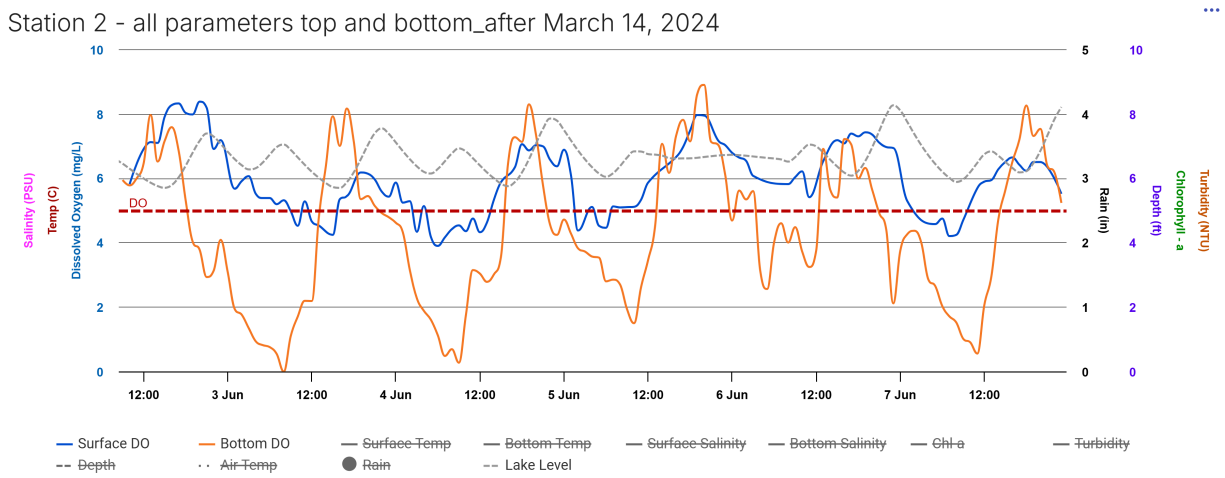



**Figure 18b. Zoomed-in view of DO levels at Station 2 during the period surrounding the mortality events (June 3–June 7, 2025)**

At Station 2, both surface and bottom DO levels began to decline in the early morning of June 3. By 8:00 a.m., surface DO had decreased from approximately 8 mg/L to 5 mg/L, while bottom DO dropped sharply from around 7.5 mg/L to 0 mg/L. However, the period of bottom DO at 0 mg/L was very brief; between 8:00 a.m. and 12:00 p.m., bottom DO levels rapidly increased back to 8 mg/L. A second episode of low bottom DO levels occurred on June 4 between 7:00 a.m. and 9:00 a.m., aligning with the timing of the first observed mortality event that afternoon. A third episode followed on June 7 around noon, when bottom DO levels dropped to approximately 0.8 mg/L. This decline was also brief, as bottom DO levels rebounded to 8 mg/L by 4:00 p.m.

Despite these three low DO events, bottom DO levels generally remained above 2 mg/L and surface DO levels generally remained above 4 mg/L. Unlike Station 3, DO levels at Station 2 exhibited a typical diurnal pattern throughout. However, daily DO fluctuations were slightly more muted at the surface compared to the bottom. Notably, despite bottom DO dropping to very low levels on multiple occasions, no fish kills were reported in the Glen Echo arm, suggesting that these short-duration hypoxic events did not result in observable ecological impacts in this area.

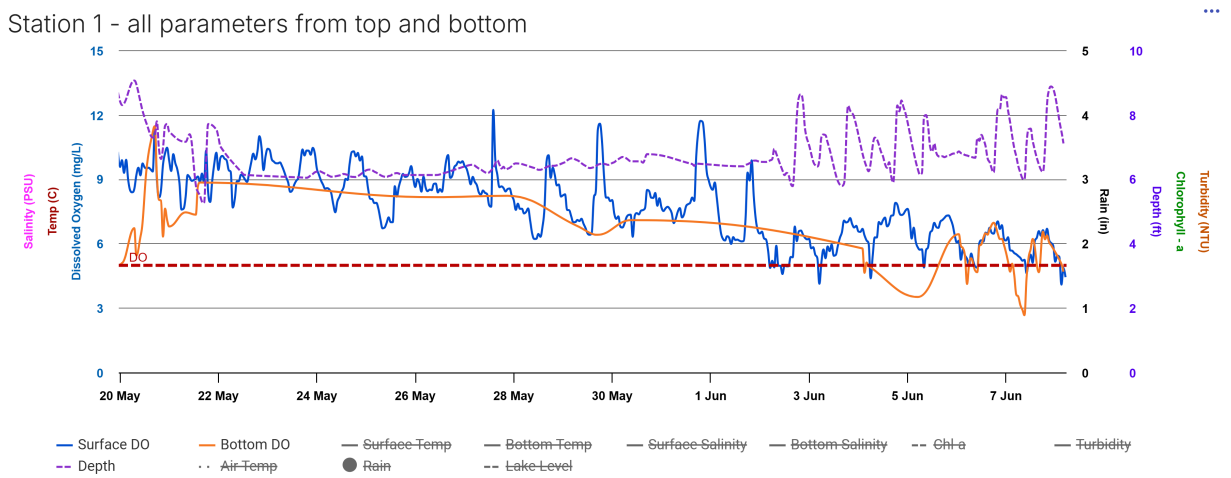



**Figure 19. DO levels at Station 1 from May 20–June 7, 2025**

There were intermittent data gaps in the bottom DO measurements at Station 1 from May 21 through approximately June 6. Thus, it is not possible to determine whether the lake experienced extremely low bottom DO conditions near this location on June 4 or 5. However, while surface DO followed typical diurnal patterns during this period, DO levels beginning on June 2 were generally lower compared to earlier measurements dating back to May 20.

When bottom DO readings resumed around 1:00 a.m. on June 6, lower DO values were observed near the bottom at approximately 9:00 a.m. on June 7. This trend is consistent with low DO episodes recorded at Stations 2 and 3 during the same time frame.

## 7. Algae Activities Around Fish and Shrimp Kills

The plots below show chlorophyll-a concentrations recorded at Stations 1 and 3 during the period surrounding the observed fish and shrimp die-offs.

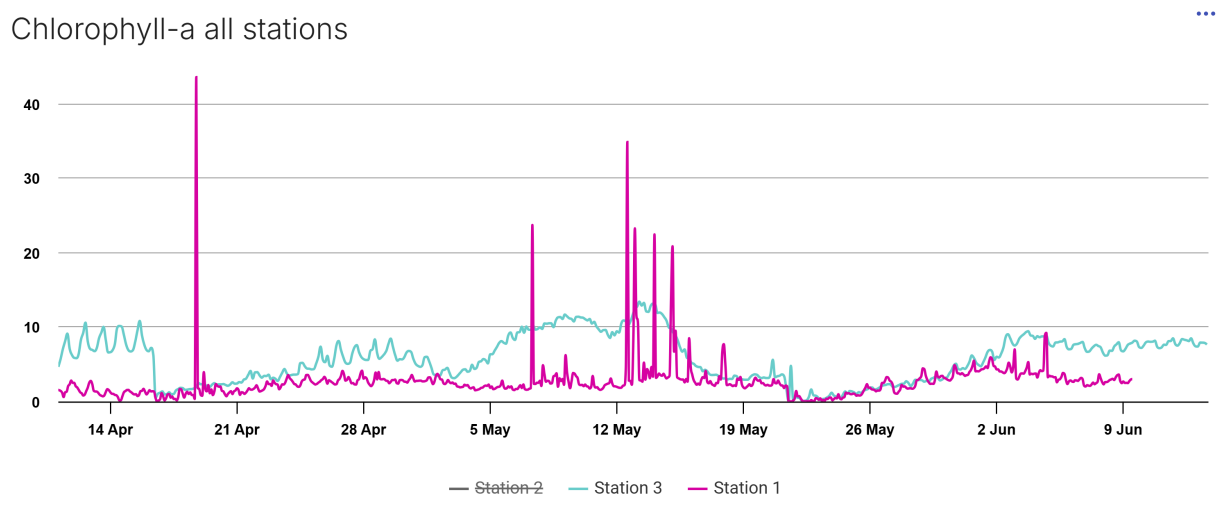



**Figure 20. Chlorophyll-a concentrations at Stations 1 and 3, April–June 2025**

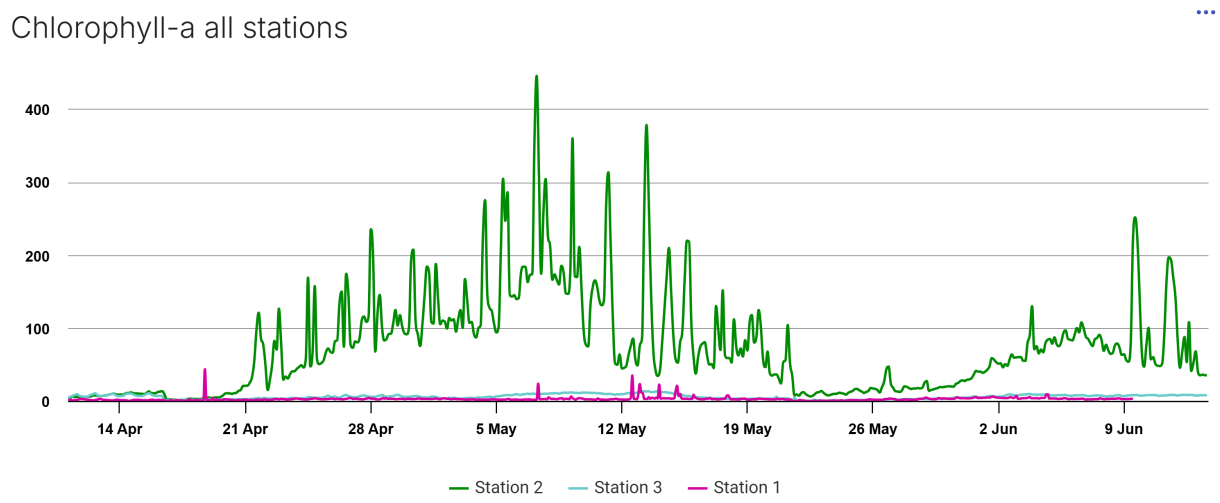



**Figure 21. Chlorophyll-a concentrations at all three stations, April–June 2025**
Note: Station 2 exhibited extremely high chlorophyll-a concentrations from late April to mid-May; however, these values may be the result of sensor error or other anomalies and are being further investigated.

Based on the chlorophyll-a data from Station 3, there is no indication of a harmful algal bloom (HAB) prior to the fish and shrimp mortality observed in the Trestle Glen arm. Water Board staff did not observe any visible signs of algal blooms, such as surface scums or discolored water, during field inspections near the RNC or the LMBC docks.

In contrast, Station 2 showed unusually high chlorophyll-a readings from April 21 to May 21, with values exceeding 50 Relative Fluorescence Units (RFU)—levels that would typically be visually detectable from shore. However, no algal blooms were reported near Station 2 on June 4 or in prior months. Due to this inconsistency, the City's monitoring contractor has been asked to investigate the source of the chlorophyll-a

signal at Station 2. If a true bloom had occurred at Station 2, it would have likely spread to other parts of the lake through tidal mixing, particularly to Stations 1 and 3. However, both of these stations consistently recorded low chlorophyll-a concentrations during the same period, further suggesting that the elevated values at Station 2 may not reflect actual algae conditions.

As part of the Water Board's ongoing Lake Merritt HABs monitoring program (initiated in 2023), Katie Noonan and volunteers from the Rotary Nature Center Friends assist with water sample collection and coordination with the Water Board's contract laboratory. Samples are analyzed for total cyanotoxins (i.e., anatoxin-a, cylindrospermopsin, microcystin/nodularin, and saxitoxin) using enzyme linked immunosorbent assay (ELISA) and identification of potentially toxigenic (PTOX) cyanobacteria.

Two samples were taken on May 29. For both samples, all of the toxins were below advisory signage levels, with the exception of anatoxin. The current advisory level is for cautionary signage for anatoxin is any detectable limit. The levels of the two samples were very low (0.26 and 0.29 micrograms per liter (µg/L), or ppb) and far below the warning advisory level of 20 µg/L.

One sample (204LME025, collected at the LMBC docks) contained a very low amount of eukaryotic algae, but no cyanobacteria. Another sample (LM1, near the RNC) contained low levels of *Wilmottia sp*. and *Geitlerinema sp*., which are filamentous cyanobacteria.

In conclusion, there is no evidence that HABs or elevated cyanotoxins played a role in the observed fish and shrimp mortality events. The data do not support a DO crash caused by bloom activity during nighttime or early morning hours.

## 8. Tide Gate Operation (Open vs. Closed) and DO

Lake depth has been monitored continuously since late March 2025 using two pressure transducers installed by Lake Tech—one on the lake side at the boat docks and one outside the tide gates near the mouth of the Lake Merritt Channel. Depth measurements on the lake side depth can be used as a proxy indicator of tide gate status (i.e., open or closed).

Figure 22 presents lake depth observations from March 2025 onward. Periods of relatively stable depth over an extended duration suggest that the tide gates were closed, while greater variability in depth indicates gate openings allowing for tidal exchange.

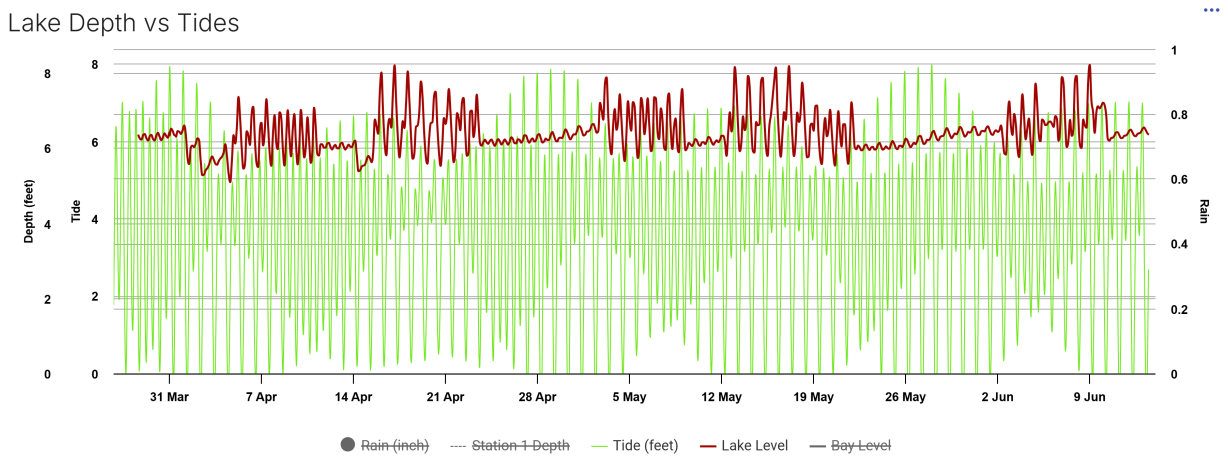



**Figure 22a. Lake depth and tidal patterns from late March to early June 2025**

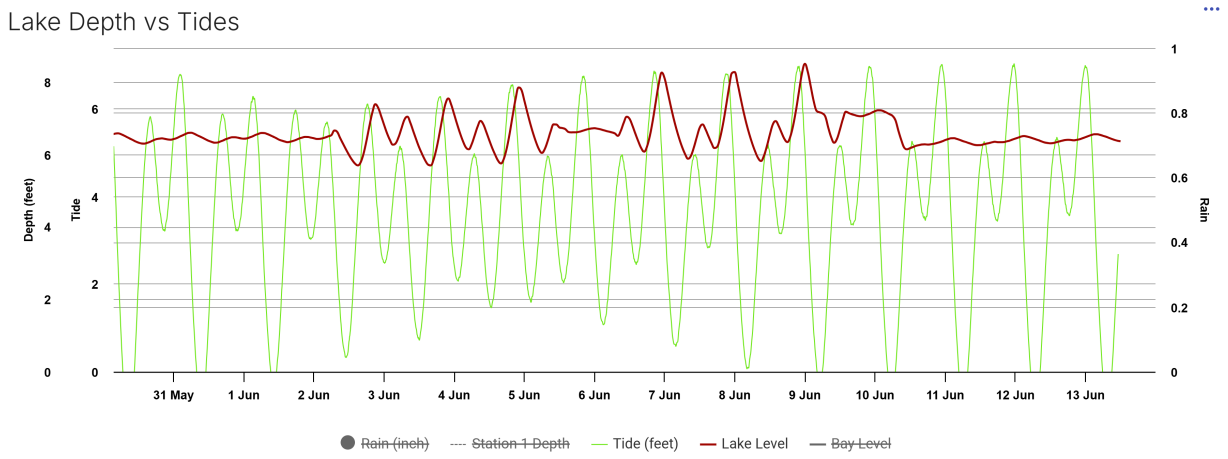



**Figure 22b. Zoomed-in view of lake depth from May 30 to June 13, 2025**

Lake depth data indicate that the tide gates were closed several times in May 2025, often during periods of elevated high tides (i.e., king tides). The most recent gate closure prior to the first mortality event occurred from May 22 approximately at 6:00 a.m. to June 2 at 7:00 a.m., lasting 11 days—an atypically long closure period for tide muting purposes. DO levels began to decline approximately one day after the gates were reopened.

A second closure occurred from June 5 at 9:00 a.m. to June 6 at 8:00 a.m. (approximately 24 hours). Following this reopening, DO levels dropped across all three monitoring stations and near the LMBC docks, as measured by LMI staff. Fish and shrimp mortality was subsequently observed near the boat docks.

A third closure was recorded from June 13 at approximately 10:00 a.m. to 2:00 p.m. the same day. During this period, no extremely low DO conditions were observed at any of the monitoring stations.

Figure 23 presents bottom DO concentrations at all three stations, along with the lake level data (with small fluctuations interpreted as periods of gate closure). While Stations 2 and 3 showed a gradual decline in bottom DO levels during the May 21–June 2 closure, followed by further drops after the gates were reopened, similar trends were not observed during earlier extended gate closure periods dating back to late March. Therefore, it remains inconclusive whether tide gate closures were a direct cause of the low DO conditions preceding the observed fish and shrimp kills.

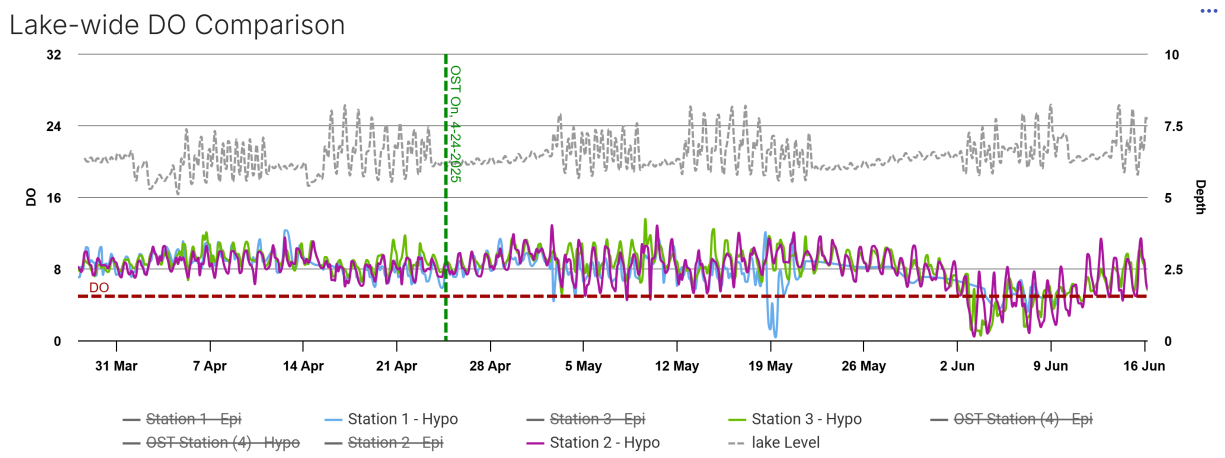



**Figure 23. Tide gate closures (indicated by flat lake level) and bottom DO at all three stations, late March 2025–June 2025**

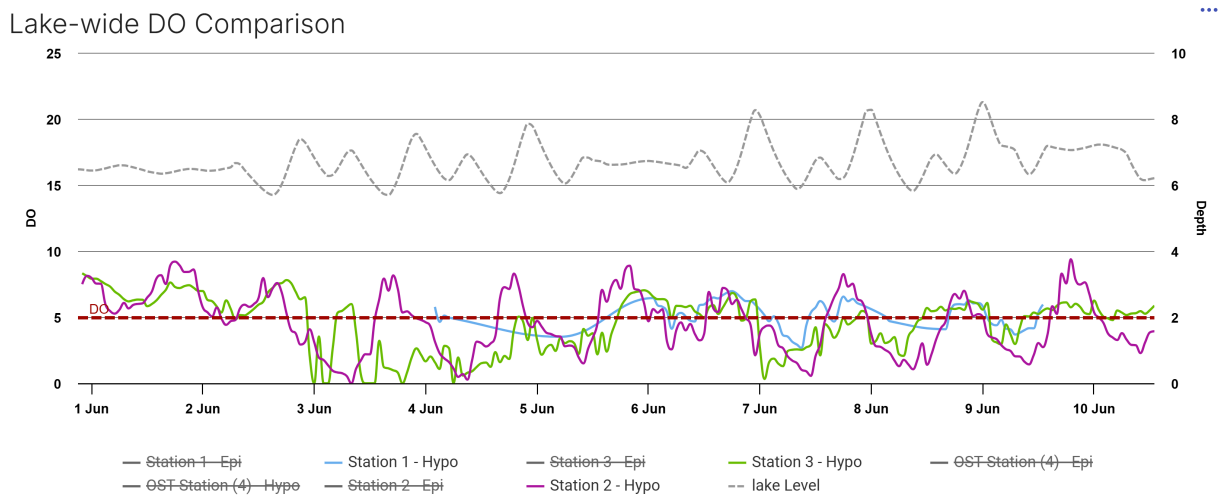



**Figure 24. Zoomed-in view of bottom DO at all three stations around mortality events (June 4 and June 7, 2025)**

It is also unclear whether tide gate closures may have had delayed effects contributing to the low DO levels observed during the mortality events—this remains an important area for further investigation. Historically, tide gates have been closed in both winter and

summer months as part of routine operations to manage flooding or for other management needs.

Since the August 2022 fish kill, which was attributed to DO depletion caused by HABs (and not linked to gate operations), no similar mortality events have been reported. A more comprehensive analysis of the entire monitoring period, incorporating both lake depth and DO records, is warranted to evaluate whether a consistent or delayed relationship exist between tide gate closures and low DO conditions.

## 9. Summary

Continuous water quality monitoring at the City of Oakland's three stations revealed several episodes of low DO at both Station 2 (located in the Glen Echo arm) and Station 3 (located in Trestle Glen arm, nearest to the RNC). Near-zero DO concentrations were recorded briefly during the early morning hours of June 3 and 4, preceding the first reported aquatic mortality event on June 4. A similar pattern was observed on the morning of June 7, shortly before the second mortality event at the LMBC docks. These observations suggest that the extremely low DO levels likely contributed to both mortality events.

The mass fish kill in Lake Merritt in August 2022 was associated with a HAB and likely triggered subsequent DO depletion (Water Board, 2023). The species responsible for the HAB was *Heterosigma akashiwo*, a type of marine algae species known to cause red tides. DO levels throughout much of the lake were measured at or near 0 mg/L from August 29 to September 2, 2022. Contributing factors included low wind, minimal mixing, and elevated temperatures, which created favorable conditions for the bloom and subsequent DO crash. San Francisco Baykeeper estimated that "as many as 10,000 dead fish" were observed at Lake Merritt the day following the event.

In contrast, DO levels during the June 2025 fish and shrimp mortality events recovered relatively quickly after each die-off. Unlike in 2022, near-zero DO concentrations were not observed across the entire lake but were instead localized in the Trestle Glen arm, where most of the mortalities occurred. As a result, the die-offs appeared to be limited to initial events, with no additional mortalities reported in the days that followed. It is estimated that up to 1,000 organisms died during the June 2025 events, the majority being *Palaemon* shrimp, along with up to 200 small fish—likely Chameleon Goby or Yellowfin Goby. This represents an order of magnitude fewer mortalities than those documented in August 2022.

Chlorophyll-a concentrations measured at Station 2, which can serve as a proxy for algal activity, did not correspond with field observations at the time of the first mortality event. The lake did not exhibit signs of excessive algal growth, discoloration, or surface scums. In addition, HAB monitoring detected no cyanotoxins at levels of concern, and no visual signs of HABs were reported.

Although the underlying mechanism of the June 2025 mortality events is not fully understood, the evidence suggests that it is distinct from the more severe August 2022 fish kill. Because there were low levels of cyanobacteria and cyanotoxins detected in

samples collected during the June 2025 event, there is no evidence that HABs or elevated cyanotoxins played a role in the fish and shrimp mortality events. Moreover, the data do not support a nighttime DO crash caused by the bacterial digestion of high levels of algae produced during daylight photosynthesis (i.e., an algae bloom).

Although DO declined after tide gate openings in both observed events, a direct or immediate link between tide gate closures and low DO conditions cannot be established. The influence of tide gate operations, especially any delayed effects, remains inconclusive based on current data.

As a next step, Water Board staff plan to conduct expanded analyses to further evaluate the potential effects of algae activity and tide gate operations on DO conditions in Lake Merritt.