California Regional Water Quality Control Board

San Francisco Bay Region

Analysis and Interpretation of Tomales Bay 2022 Mercury Data and Future Sampling Recommendations

Final Staff Report

April 2024

CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD

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1 Executive Summary

In 2022, the San Francisco Bay Regional Water Quality Control Board (Water Board) collected biota from the shore of Tomales Bay for mercury analysis. The purpose was to compare mercury concentrations from a site polluted by a mercury mine (Walker Creek Delta) to a site without local mercury contamination (Millerton Point, near the mouth of Tomales Bay). This comparison was needed because two of three species (i.e., yellow shore crabs and threespine stickleback) collected at Walker Creek Delta had higher mercury concentrations in 2019 compared to 2010, whereas surface sediment mercury concentrations had declined subsequent to mine cleanup two decades prior. Thus, we wanted to know how mercury sediment concentrations and fish and crab mercury concentrations differed between the two sites. Because this study was unable to collect prey fish samples from Walker Creek Delta in 2022, it was not possible compare mercury levels between the impacted Walker Creek and Millerton Point reference site with samples from the same year. However, if we presume concentrations at Walker Creek between 2019 and 2022 were similar, then prey fish mercury concentrations at Walker Creek are higher than prey fish mercury concentrations at Millerton Point. Methylmercury concentrations in crabs do not tell a consistent story for the relationship between the Walker Creek Delta and Millerton Point or for time trends at Walker Creek Delta. For sediment, the mercury concentrations measured at Walker Creek Delta were more than six times greater than the mercury concentrations at Millerton Point. Ultimately, the mercury trends being observed in sediment are not being witnessed in the mercury biota data. In the future, we recommend resampling both Walker Creek Delta and Millerton Point to collect a greater number of prey fish (in the adequate size range) and shore crabs to further assess time-trends and comparison between sites. We also recommend collecting sediment samples at both sites during the same sampling period to allow for site-to-site comparison as well as confirmation of concentrations and trends.

2 Locations Sampled and Methods

Figure 1 provides a map of Tomales Bay, and Figures 2 and 3 provide detailed maps of sample locations at Millerton Point and Walker Creek Delta, respectively. Biota were collected from both Millerton Point in Tomales Bay State Park and the Walker Creek Delta.

Fieldwork was led by Carrie Austin, Kristina Yoshida, Jamal Jaffer, Jacqueline Hewitt, and carried out with the support of Watershed Stewards Program Corps members. Fish and shore crabs were collected with baited minnow traps, and shore crabs were also collected by hand. We secured a collection permit from California State Parks for the Millerton Point site in Tomales Bay State Park. We obtained a scientific collection permit from the California Department of Fish and Wildlife (S-183580001-19123-001-01) to collect fish and crabs from all sites.

Figure 1. Map of Tomales Bay with sampling sites

Walker Creek Delta is downstream of the Gambonini Mercury Mine that was remediated in 2000. Biota from Millerton Point in Tomales Bay State Park represents “clean” site conditions, i.e., no local mercury source.

Figure 2. Map of sediment and biota sampling locations at Millerton Point

Sediment samples were collected at all sites ending in 1, 2, or 3. Biota samples were collected at all sites except MC-2.

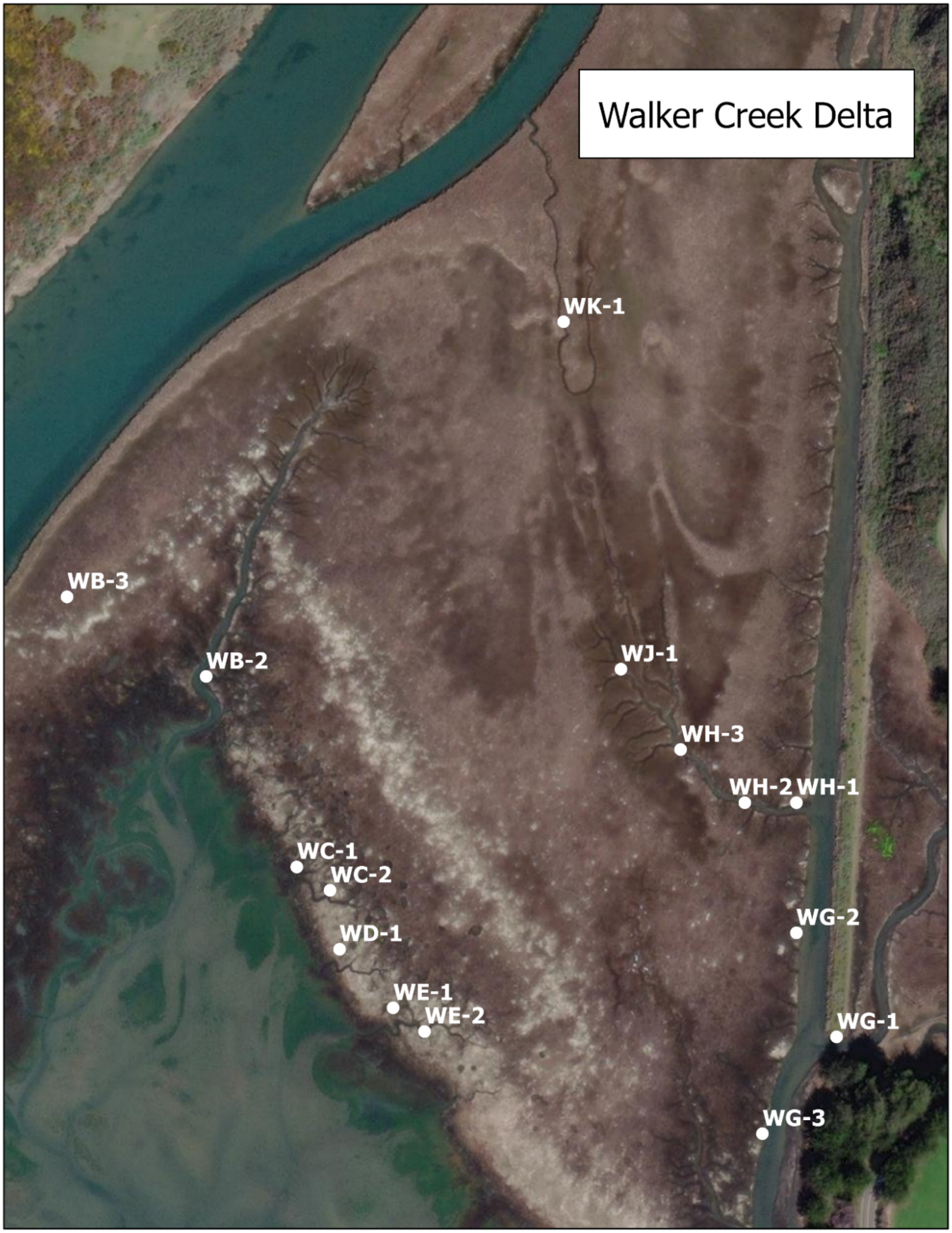

Figure 3. Map of biota sampling locations at Walker Creek Delta

Biota samples were collected at all sites. No sediment samples were collected during this sampling trip.

Biota and sediment were collected at Millerton Point (see Figure 1) on May 6, 2022. The weather was overcast and muggy. Millerton Point was divided into three sites: north, mid, and south (see Figure 2). The northern Millerton Point site was a salt marsh with wide channels that consisted of fine mud. Teams started at northern Millerton Point site, setting up three minnow traps in the channels and then hand trapping (MA-1 – MA-4). Hand trapping was accomplished by trapping and grabbing crabs from the holes and tunnels along the banks of the channel. A few crabs were caught along the shore by turning over large rocks.

The second “mid” site at Millerton Point was at Croi Point. At this site, three minnow traps were set in the channels (MB-1 – MB-3). Two of the traps set closer to the mouth of the channel (MB-1 and MB-2) were exposed and not deep enough in the water to collect any biota. The sediment at these two traps was also sandier than at the northern site. Hand trapping at the “mid” site was within the channel and was done by trapping and grabbing crabs from the holes and tunnels along the bank.

At the southern site, three traps were set in a large channel that led into Millerton Gulch (MC-1 – MC-5). The most upstream trap was set in a bed of vegetation and 25 fish were collected in this one trap (MC-3). Crabs were hand collected within Millerton Gulch in one of the larger channels, although the crabs were sparse and large. Crabs were also hand caught along the shoreline where there was a bank that had small holes. Most of the crabs along this area of the coastline were yellow crabs. Traps were set for at least two hours before being checked and contents collected.

Biota was collected at Walker Creek Delta (see Figures 1 and 3) on May 7, 2022. We presumed that mercury concentrations in sediment would be similar to those sampled in 2018 and 2020, therefore no sediment samples were collected at Walker Creek Delta during this sampling trip. Walker Creek Delta is a large tidal salt marsh with small channels throughout and larger channels on either side. The weather was sunny and moderate with slight wind. The field crew was split into two groups of three for efficiency. One team covered sites towards the mouth of the Delta (westward) while the other team covered the sites farther upstream and eastward. Traps were set first in channels that were deep enough to cover them, then teams went back to hand catch around where the traps were set. Hand catching of crabs took place in the salt pannes around the channels near the traps and in the channels around the traps. The crabs were abundant so digging into the sides of the channels was not as necessary as at Millerton Point. Again, the traps were set for about two hours before being checked, contents collected, and traps removed.

For future sampling, data should be collected under moderate tide conditions and not during the lowest tide. This would ensure that the traps would be more fully submerged and allow for a higher capture rate. It is also important to pay attention to neap and spring tides. Neap tides are lower than normal high and low tides. Spring tides are higher than normal high and low tides. Sampling after a large spring tide will help to fill the salt pannes. Based upon site reconnaissance, crabs are not as actively present when the salt pannes are dry. Traps should be set as early as possible on the sampling day before sampling begins to give the organisms as much time as possible to move into the traps. Previous sampling (2010 and 2019) was conducted during moderate to high tide, while this sampling was conducted during the lowest tide (Figure 4). Although this makes sampling effort easier than previous years and allows access to some areas, it does not assure that traps will be fully submerged thus leading to a lower capture rate.

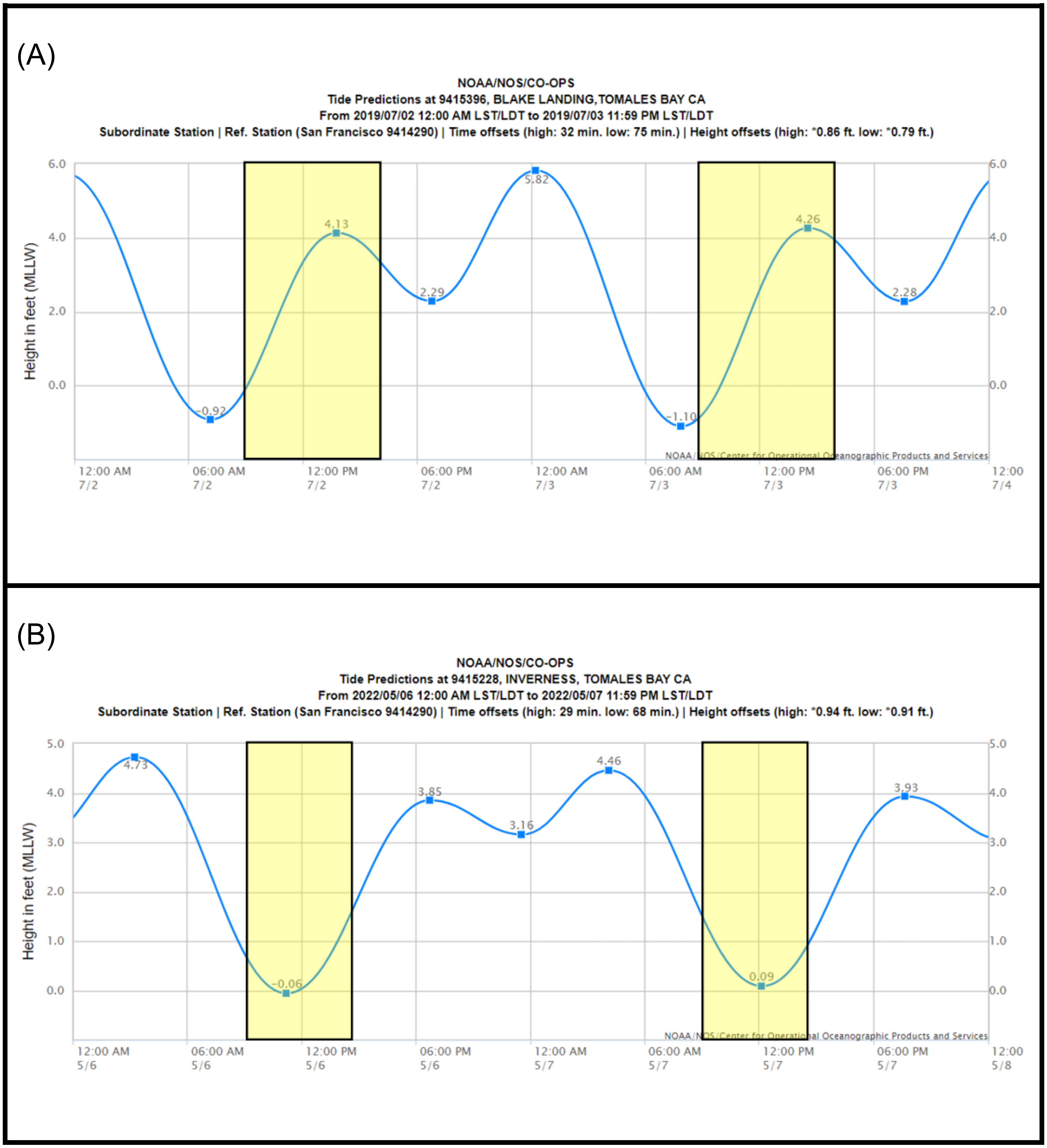

Figure 4. NOAA Tide Prediction for 2019 and 2022 Sampling Trips in Tomales Bay

The first graph (A) shows tide predictions for Blake's Landing in Tomales Bay during the 2019 sampling trip. In this graph, low tide was early in the morning around 7:00-7:30 AM and high tide was around 2:00 PM. The shaded area for this plot shows the time of sampling ranging from 8:00 AM to 4:00 PM. The second graph (B) shows tide predictions for Inverness in Tomales Bay during this sampling trip in 2022. This graph shows a low tide later in the morning around 11:40 AM and high tide was around 6:15 PM. The shaded area for the second plot shows the time of sampling ranging from 9:00 AM to 2:30 PM. It is evident from the highlighted areas that the tides chosen are starkly different and this could have caused implications on sampling efforts.

It was extremely helpful to work with a group of six people at each location on separate days. At each location, the field crew should split into two teams of three to increase efficiency and limit long walks. It is also advised to sample only one location (i.e., either Millerton Point or Walker Creek Delta, not both) per day so that the teams can assist each other if needed. It is also important to have two separate sets of equipment (i.e., waders and minnow traps) for each location so that sites are not contaminated. Having other Watershed Stewards Program Corps members site share is extremely beneficial.

All biota were submitted to the Marine Pollution Studies Laboratory (MPSL) of San Jose State University's Research Foundation for laboratory analysis using funding from the Water Board Surface Water Ambient Monitoring Program. Prior to submission for analysis, Water Board staff composited shore crabs based on carapace width: (1) crabs with a carapace width ≥ 35 mm were analyzed individually; (2) crabs with a carapace width greater than 25 mm but less than 35 mm were analyzed as a composite of two organisms; lastly, (3) crabs with a carapace width ≤ 20 mm were analyzed as a composite of six to nine organisms to obtain sufficient tissue for analysis. Upon arrival at MPSL, shore crab samples were dissected, and all the soft body material was pulled for analysis. For prey fish, Water Board staff composited threespine stickleback into six composites of five organisms, while staghorn sculpin were analyzed individually (see Table 1). Total mercury in fish tissue and sediment was analyzed by U.S. EPA method 7473 with reporting limits of 0.006 ug/g wet weight (wet wt.) and 0.006 ug/g dry weight (dry wt.), respectively. Methylmercury in crab soft tissue was analyzed by U.S. EPA method 1630 (modified) with a reporting limit of 6.56 ng/g wet wt. There were no quality assurance (QA) issues noted by the analytical laboratory for any of the mercury data for fish or crab tissues. These data will be posted to the California Environmental Data Exchange Network.

All crab soft tissue samples were analyzed for methylmercury, which is the form of mercury that bioaccumulates. All fish and sediment samples were analyzed for total mercury. These data for fish are equivalent to methylmercury because there is much documentation in the scientific literature that nearly all mercury in fish is methylmercury. Historically, since the late 90s, crab samples have been analyzed for methylmercury while fish and sediment samples have been analyzed for total mercury. Therefore, we wanted to remain consistent with previous sampling protocol testing to allow for temporal trend analysis.

Table 1. Samples Collected

Location and Date(s)	Yellow shore crab	Green shore crab	Striped shore crab	Threespine stickleback	Staghorn sculpin	Sediment sampling
Walker Creek Delta May 7, 2022	No Indiv 2 Comp of up to 9	3 Indiv 6 Comp of 2	No Indiv 28 Comp of 2	None	None	None
Millerton Point May 6, 2022	No Indiv 5 Comp of up to 7	12 Indiv No Comp	1 Indiv 5 Comp of 2	6 Comp of 5	2 Indiv	9 grab samples

Notes:

Indiv = Individuals; Comp = Composites. Where a row indicates individuals and composites, the individual samples were large enough to be analyzed separately. The table shows the number of samples in each composite. Despite setting minnow traps at various locations, the field crew was unable to capture any prey fish at Walker Creek Delta. Sediment samples at Walker Creek Delta were not collected during this sampling trip.

Crab species: Yellow shore crab (mud-flat crab) *Hemigrapsus oregonensis*; green shore crab (European green crab) *Carcinus maenas*; and striped (lined) shore crab *Pachygrapsus crassipes.*

Fish species: Threespine stickleback, *Gasterosteus aculeatus*; and Pacific staghorn sculpin, *Leptocottus armatus.*

Table 2 provides a summary of biota methylmercury and total mercury concentrations for 2022.

Table 2. Summary of Tomales Bay 2022 Biota Mercury Data

Biota	Location	Number of analyzed samples[1]	Methylmercury (crabs) and Total Mercury (fish) ug/g wet wt.				Carapace width (crabs) and Total length (fish) mm			
			Min	Mean	Median	Max	Min	Mean	Median	Max
Yellow shore crab	Walker	2	0.07	0.07	0.07	0.07	14.93	15.61	15.61	16.28
Yellow shore crab	Millerton	5	0.02	0.04	0.03	0.05	11.76	14.63	12.66	18.41
Green shore crab	Walker	9	0.02	0.07	0.05	0.18	33.06	41.03	33.57	65.72
Green shore crab	Millerton	12	0.02	0.09	0.10	0.14	34.45	61.75	63.80	84.73
Striped shore crab	Walker	28	0.10	0.15	0.15	0.23	29.26	31.02	31.05	31.50
Striped shore crab	Millerton	6	0.04	0.09	0.07	0.19	25.07	30.41	29.13	42.35
Threespine stickleback	Walker	0	-	-	-	-	-	-	-	-
Threespine stickleback	Millerton	6	0.05	0.06	0.06	0.07	33.20	36.18	36.31	38.70
Staghorn sculpin	Walker	0	-	-	-	-	-	-	-	-
Staghorn sculpin	Millerton	2	0.04	0.04	0.04	0.04	24.79	37.36	37.36	49.93

Notes:

[1]Number of analyzed samples includes both composites and individual crab samples. Where the sample was a composite, the mean composite concentration was combined with the data from the individual samples. This occurred for green shore crabs at Walker Creek Delta, and striped shore crabs for Millerton Point (refer to Table 1).

Currently, there is no established Water Quality Objective for methylmercury concentrations in crabs or other invertebrates to protect birds that consume them. According to the Tomales Bay Mercury TMDL Staff Report, Section 4.8. recommends that shore crabs are used to measure methylmercury time trends in marsh prey, but not as targets. This is specifically due to the uncertainty in the portion of the diet of sensitive bird species made up of shore crabs.

The methylmercury target for the Tomales Bay Mercury TMDL to protect birds that consume prey fish is 0.05 ug/g wet wt. Even though all the threespine stickleback collected at Millerton Point were smaller than the size range specified in the objective (50-150 mm), the mean mercury concentrations still exceeded the 0.05 ug/g wet wt. target. Therefore, there is evidence of high concentrations despite the lack of larger fish. We were unable to collect longjaw mudsucker data in either Walker Creek Delta or Millerton Point.

3 Crab Methylmercury Concentrations

The full results are shown in Table 2 and Figures 5-7. Figure 5 shows violin plots of crab methylmercury concentrations. These plots demonstrate that crab methylmercury concentrations are not normally distributed. For example, we can see that for some years the data are bimodal and for others the data are skewed. The non-normality of these distributions motivates the decision to proceed with the Mann-Whitney non-parametric tests.

Statistical analysis (Mann-Whitney non-parametric test) indicates that methylmercury concentrations at Walker Creek Delta 2022 are significantly greater compared to Millerton 2022 for striped shore crabs (p = 0.0063). As shown in Figure 6, methylmercury concentrations in striped shore crabs for Walker Creek Delta 2022 (median MeHg = 0.151 ug/g) are generally higher than those at Millerton 2022 (median MeHg = 0.074 ug/g). Methylmercury concentrations in green shore crabs at Millerton 2022 (median MeHg = 0.0.097 ug/g) are slightly higher than those at Walker Creek Delta 2022 (median MeHg = 0.052 ug/g), however there is no statistically significant difference between these values (p = 0.1657). Conversely, methylmercury concentrations in yellow shore crabs are slightly higher at Walker Creek Delta 2022 (median MeHg =0.071) in comparison to Millerton 2022 (median MeHg = 0.032), but there is no statistically significant difference between the concentrations (p = 0.0952).

Although green shore crab methylmercury concentrations from Millerton 2022 were slightly higher than methylmercury concentrations in Walker Creek Delta 2022, the plot of carapace width (Figure 7) elucidates that higher methylmercury concentrations can be partially explained due to the crab size difference between the sites, with larger crabs collected at the clean site (Millerton Point) and smaller crabs collected at the polluted site (Walker Creek Delta). In addition, the size range for striped and yellow shore crabs has been fairly consistent over the years among all sites. If green crabs are sampled in the future, the field crews should focus efforts to collect similar size classes to remove the possible confounding nature of older organisms having more time to bioaccumulate mercury.

Statistical analysis for yellow shore crab time trend (Walker2010, Walker2019, and Walker2022) suggests that there was a statistically significant difference in methylmercury concentrations between 2010 and 2019 (p-value = 0.001), with 2019 being higher than 2010. However, from 2019 to 2022 there was no statistical difference between methylmercury concentrations or apparent increase in yellow shore crabs. Therefore, the difference between 2010 and 2019 could be explained by interannual variability. Overall, there is no consistent time trend for any of the shore crabs. Future sampling efforts, if taken, should focus on yellow shore crabs since there is a robust sampling effort in 2010 and 2019 to serve as time comparisons.

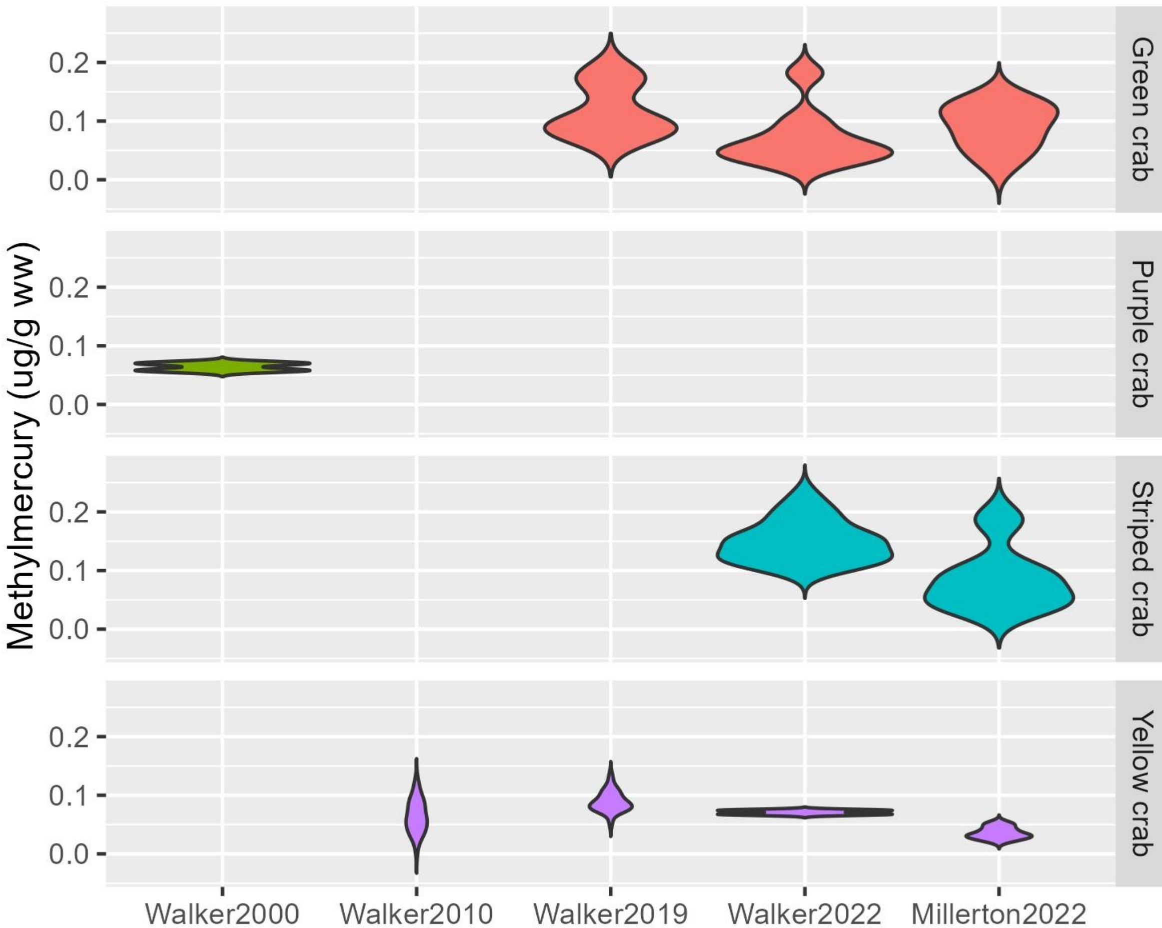

Figure 5. Violin plots showing the distribution of methylmercury concentrations for shore crabs over time.

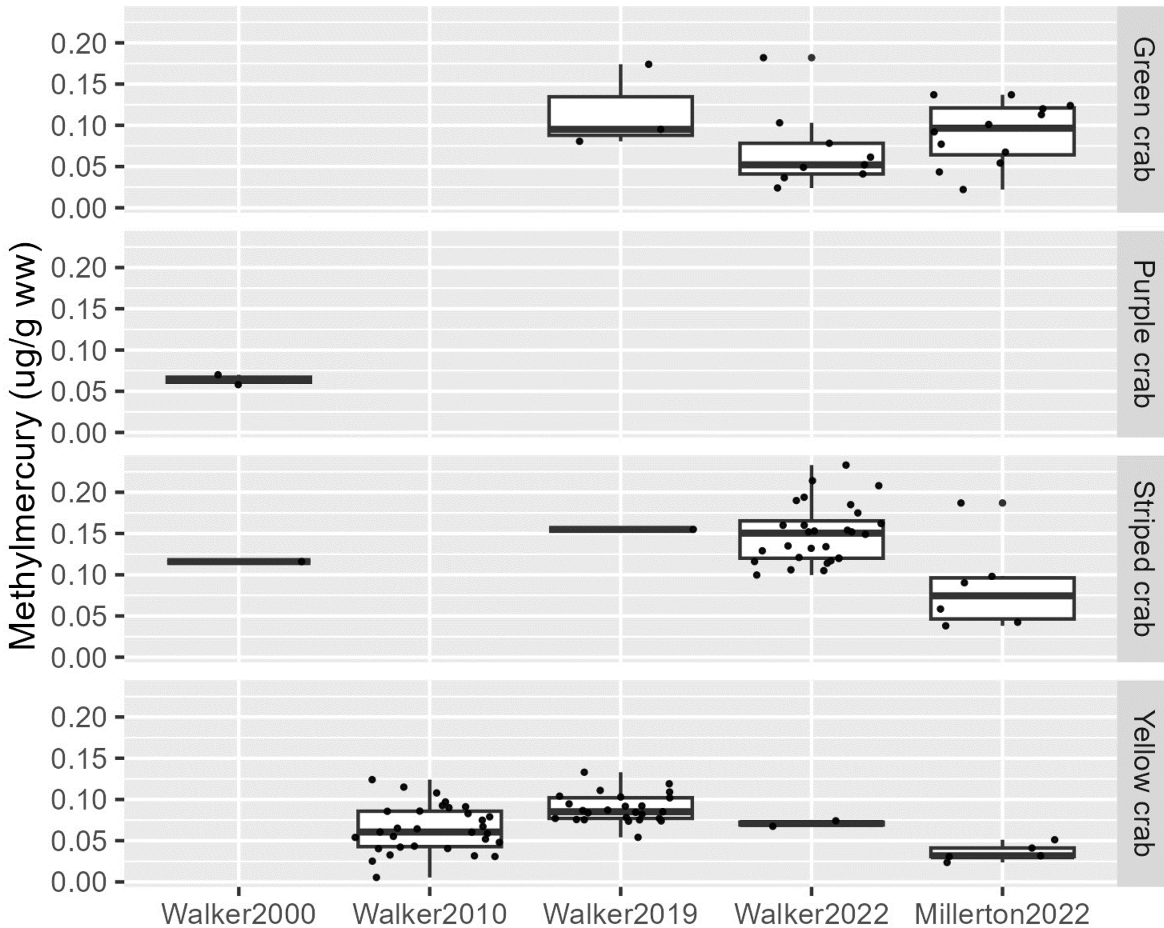

Figure 6. Shore Crab Methylmercury Concentrations in 2022 and Prior Years

Methylmercury concentrations in four shore crab species at Walker Creek Delta (2000, 2010, 2019, and 2022) and Millerton Point (2022). Walker Creek Delta refers to a site polluted by a mercury mine. Millerton Point is a reference site at the head of Tomales Bay without local mercury contamination. There is no established threshold for methylmercury concentrations in crab or other invertebrates to protect birds that consume them.

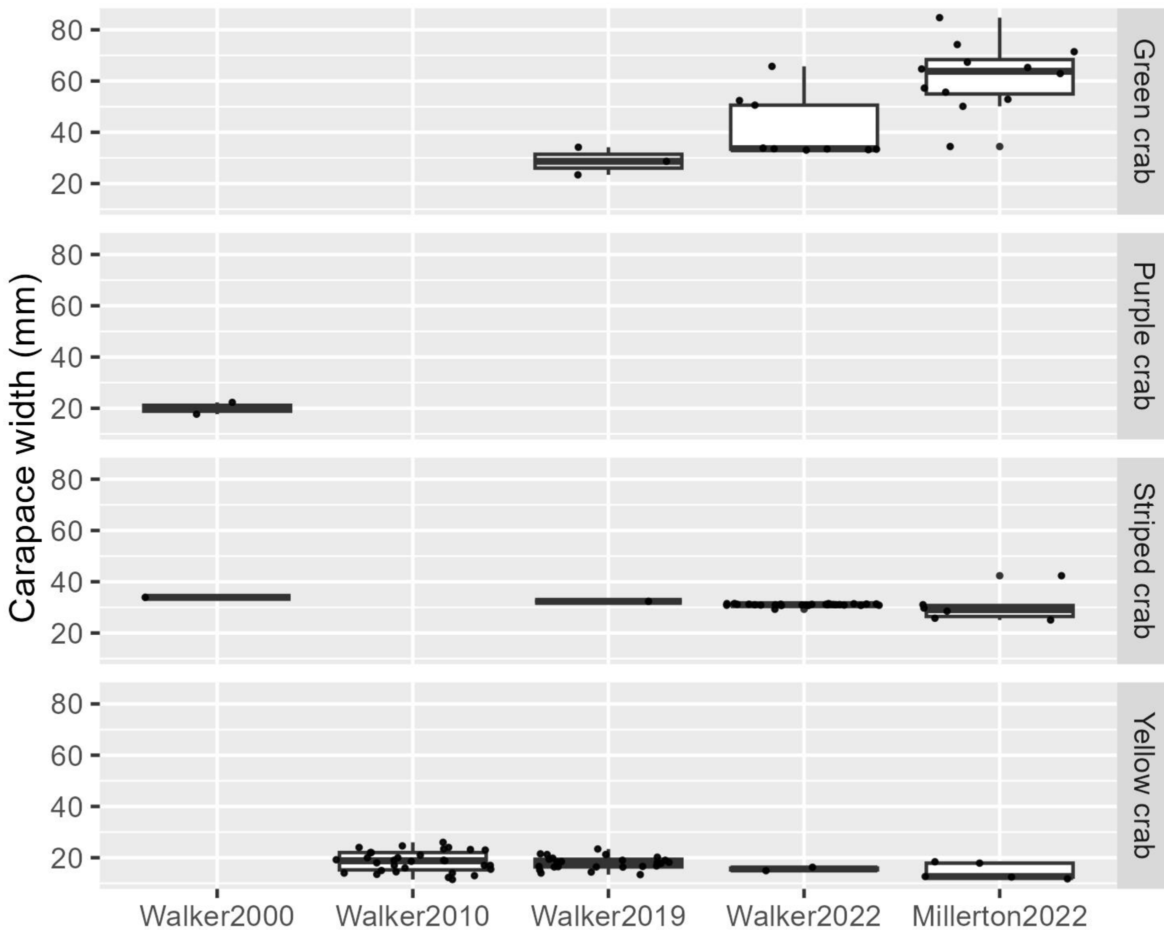

Figure 7. Shore Crab Carapace Width (mm) in 2022 and Prior Years

Carapace width for all shore crab species at Walker Creek Delta (2000, 2010, 2019, 2022) and Millerton Point (2022). The carapace width for striped shore crabs and yellow shore crabs are relatively consistent across all years and sites allowing for an easy comparison of methylmercury concentrations. In contrast, the carapace width for green shore crabs collected at Millerton Point was greater than the carapace width for green shore crabs collected at Walker Creek Delta for 2022 and 2019. This size difference confounds comparisons of methylmercury concentrations among sites and years for green shore crabs.

4 Fish Total Mercury Concentrations

The full results are shown in Table 2 and Figures 8-9. From 2010 to 2019, the only prey fish species which showed a decline in mercury concentrations was longjaw mudsucker. However, this species was unable to be captured in 2022. Table 2 also highlights that none of the prey fish samples collected are in the adequate size range of 50 – 150 mm (bolded and shown in red), instead the size range of fish collected are from 24 – 49 mm. The size range mismatch confounds interpretation of the results as the threespine stickleback mean total mercury concentration is above the target of 0.05 ug/g wet wt., while the staghorn sculpin mean total mercury concentration is below the target.

When comparing prey fish mercury concentrations over the three years of data (2010, 2019, and 2022), Figure 8 shows that total mercury concentrations in the two prey fish species collected at

Millerton 2022 (clean site) were lower than those at Walker Creek Delta 2019 (polluted site). However, as stated above, this can partially be explained due to the smaller size range of fish collected at the Millerton sites versus those from Walker Creek Delta since smaller fish have less cumulative time to bioaccumulate mercury (Scudder Eikenberry et al., 2015). When comparing mean prey fish total mercury concentrations between Walker Creek Delta and Millerton Point, all mean total mercury concentrations are above the 0.05 ug/g wet wt. TMDL target to protect birds that consume prey fish (Figure 9). Yet it is very important to note that the sample size for all years shown is small: Walker 2010, n=13, Walker 2019, n=6, and Millerton 2022, n=8.

The purpose of this study was to compare prey fish mercury concentrations from a site polluted by a mercury mine to a site without a local mercury source, and unfortunately, despite setting traps in the same fashion at both sites, prey fish were not captured at Walker Creek Delta in 2022 hindering a comparison between the two sites. Ultimately, there is not enough evidence and certainty that prey fish mercury concentrations at Millerton Point (clean site) are lower than mercury concentrations at Walker Creek Delta (polluted site). In addition, mean total mercury concentrations in prey fish at Walker Creek Delta have not significantly decreased from 2010 to 2019 to meet the methylmercury target for the Tomales Bay Mercury TMDL to protect birds that consume prey fish, and we did not detect a decrease in prey fish tissue concentrations. However, interpretation of the prey fish mercury data is challenged by the small size of the collected fish falling outside the size range required by the water quality objective. In the future, to conduct a stronger comparison between polluted sites and clean sites, it is essential to collect prey fish samples in the adequate size range from both Walker Creek Delta and Millerton Points. It is also essential to capture adequate samples sizes, preferably getting at least 10 individuals if analyzed separately or 5 to 10 composites of 5 samples at each site.

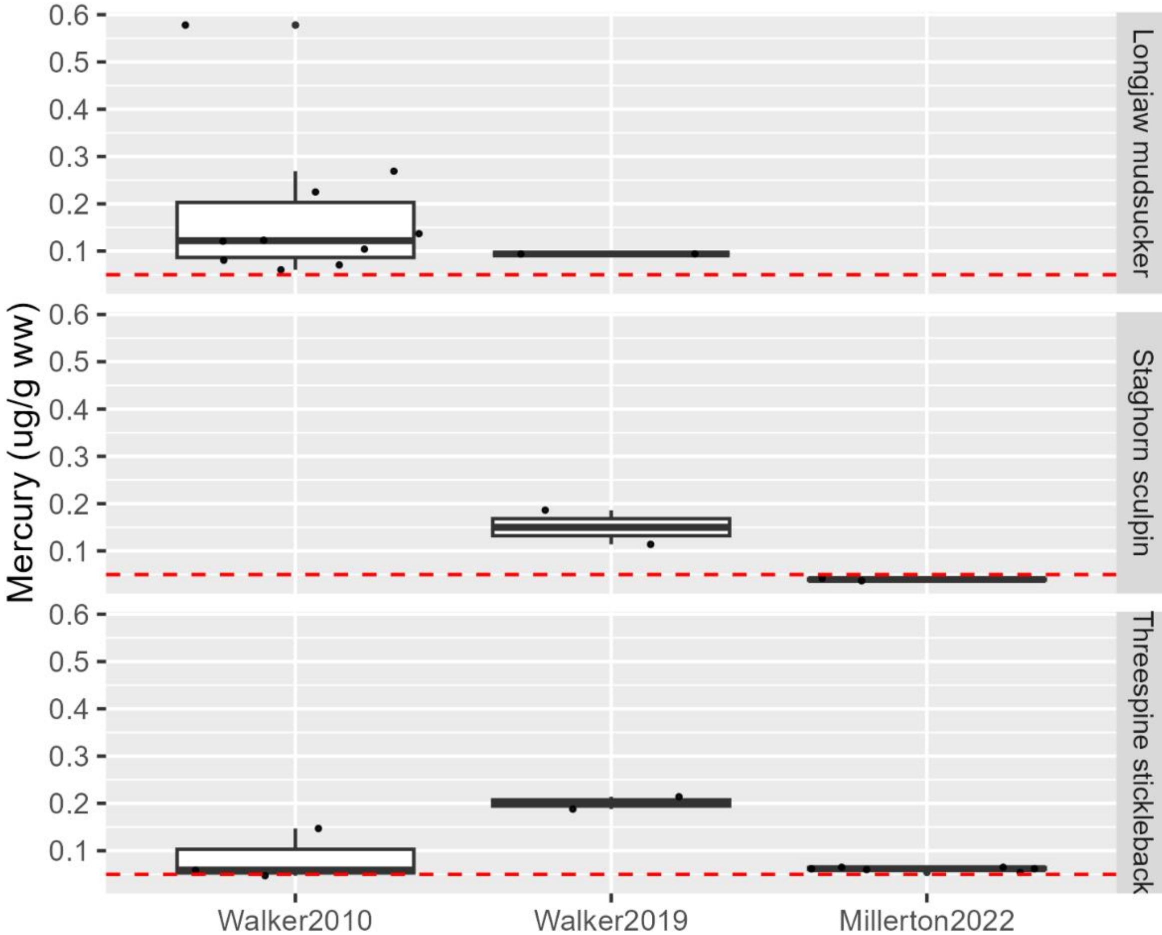

Figure 8. Prey Fish Total Mercury Concentrations in 2022 and Prior Years

Total mercury concentrations in three prey fish species at Walker Creek Delta (2010, 2019) and Millerton Point (2022). Walker Creek Delta refers to a site polluted by a mercury mine. Millerton Point is a reference site at the head of Tomales Bay without local mercury contamination. It is important to note that all the samples collected for Millerton Point (2022) were 24-49 mm in total length, therefore falling outside the 50-150 mm size range needed to compare against the prey fish water quality objective. Considering that all these samples are smaller than those collected in 2010 and 2019, we expected the mercury concentrations to be lower than Walker Creek Delta.

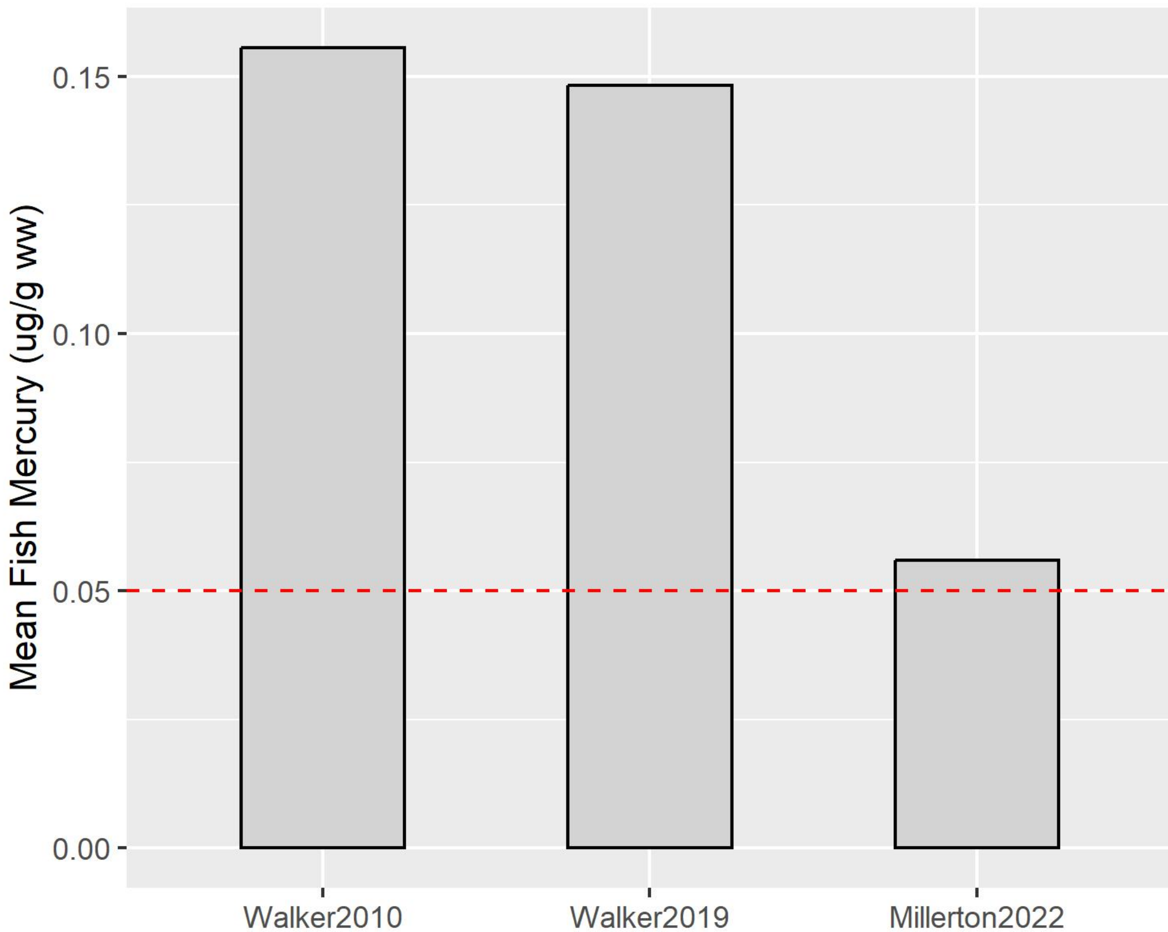

Figure 9. Mean Prey Fish Total Mercury Concentrations Compared to Target

Mean prey fish total mercury concentrations across multiple species at Walker Creek Delta (2010, 2019) and Millerton Point (2022). Mean mercury concentrations in prey fish ranging from 50 – 150 mm total length for Walker Creek Delta. Mean mercury concentrations in prey fish ranging from 24 – 49 mm total length for Millerton Point. The dashed line is the methylmercury target for the Tomales Bay Mercury Total Maximum Daily Load to protect birds that consume prey fish of 0.05 ug/g wet wt. The lower mean mercury concentration at Millerton Point is likely related to the small size of the fish analyzed for this location.

5 Sediment Total Mercury Concentrations

In 1982, a tailings dam at Gambonini Mine failed catastrophically, sending large quantities of mercury-laden sediment downstream into Walker Creek and out into Tomales Bay. In 1998-2000, the mine site was remediated by waste pile stabilization, revegetation with native plants, and storm water diversion. As shown in Figure 10, the mine cleanup has led to a decrease in total mercury concentrations in sediment at Walker Creek Delta over the last two decades. Unfortunately, we did not collect sediment samples at Walker Creek Delta during this sampling trip as we assumed the concentrations would be similar to 2018 and 2020. From 2009 to 2018 there was a decrease in mean mercury concentrations. However, from 2018 to 2020 there was a small increase between the concentrations. During this sampling trip, we collected sediment samples at Millerton Point. When comparing these mercury concentrations against Walker Creek concentrations, it is clearly evident that mean mercury concentrations are significantly lower. In addition, Millerton Point mean mercury sediment concentrations are also signficantly lower than the Tomales Bay TMDL allocation of 0.5 ppm. While mean mercury sediment concentrations at Walker Creek are still slightly above the TMDL threshold.

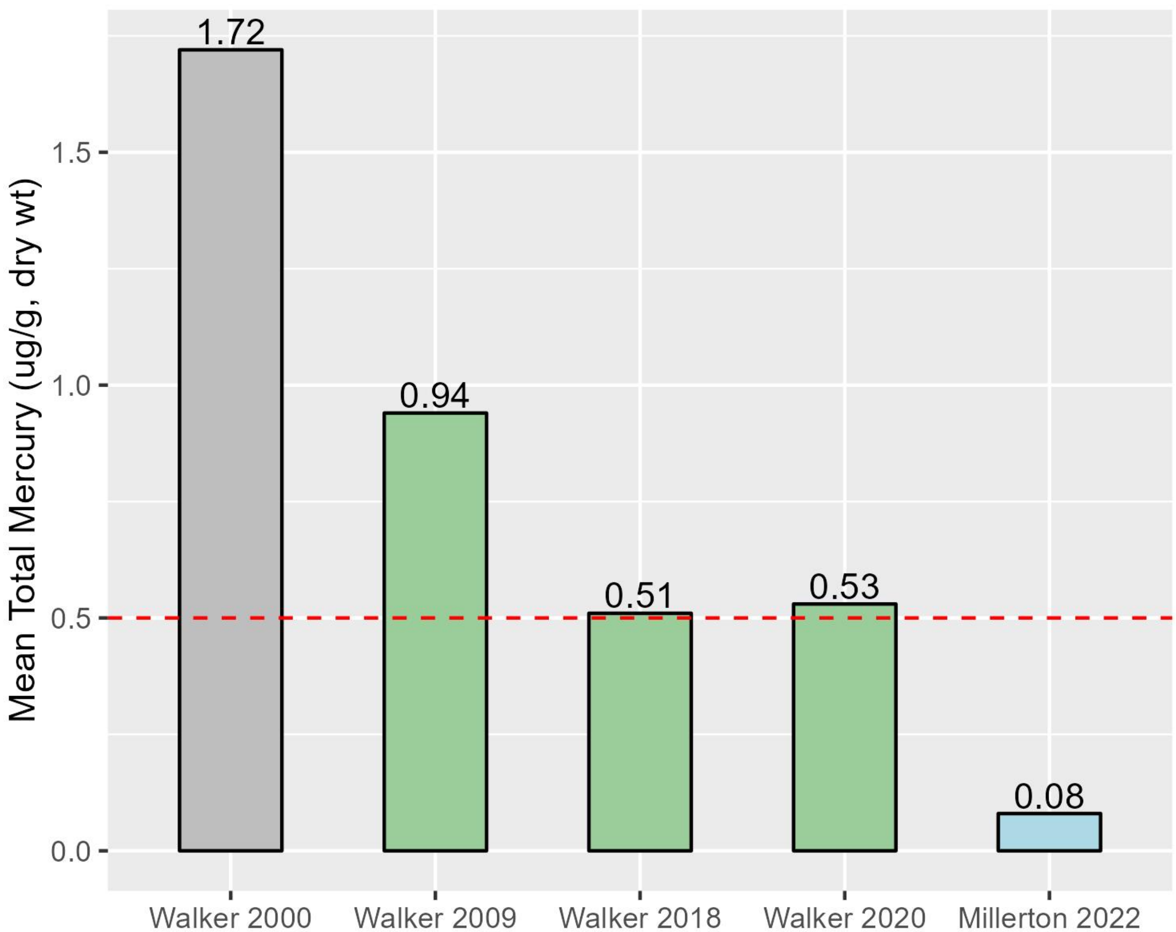

Figure 10. Mean Total Mercury Concentrations in Sediment at Walker Creek Delta and Millerton Point over Time

Walker Creek Delta refers to a site polluted by a mercury mine. The Walker 2000 sample (grey) was taken before mine site remediation at Gambonini Mine. The Walker 2009, 2018, and 2020 samples (green) were taken after mine site remediation. Millerton Point (blue) is a reference site at the head of Tomales Bay without local mercury contamination. The dashed line is the 0.5 ppm load allocation target established by the Tomales Bay Mercury Total Maximum Daily Load.

6 Conclusions and Recommendations

The purpose of this study was to compare mercury concentrations from a site polluted by a mercury mine (Walker Creek Delta) to a site without local mercury contamination (Millerton Point, head of Tomales Bay). In this study, the 2022 results were compared to previous years, however, we did not see the expected decrease in prey fish or shore crab mercury concentrations after mine cleanups and TMDL implementation. Despite not seeing any decreases in mercury concentrations in biota, mercury concentrations in sediment at Walker Creek Delta have been reduced by more than 50%. However, this reduction is still more than six times greater than mercury concentrations measured at a site with no local mercury source—Millerton Point.

For shore crabs, methylmercury concentrations in striped shore crabs at Walker Creek Delta are significantly greater than concentrations in striped shore crabs at Millerton Point. However, there was no statistically significant difference in methylmercury concentrations in green or yellow shore crabs between Walker Creek Delta and Millerton Point. Therefore, we cannot conclude that there is a statistically significant difference in methylmercury concentrations from the site polluted by a mercury mine to a site without local mercury contamination. Overall, there was a slight increase in methylmercury concentrations in striped shore crabs in Walker Creek Delta from 2010 to 2019, but aside from this statistically significant difference, there was no difference in methylmercury crab concentrations at Walker Creek from 2019 to 2022. Thus, at this time, there is no evidence that methylmercury concentrations in crabs are increasing or decreasing as a result of TMDL implementation actions.

Regarding prey fish, total mercury concentrations in 2022 at Millerton Point were significantly lower than mercury concentrations at Walker Creek Delta in 2010 and 2019. However, this can be partially explained because all the prey fish sampled at Millerton Point were significantly smaller than previous years (total length range = 21 – 49 mm) and outside the water quality objective size range criteria of 50 – 150 mm. Unfortunately, despite setting traps similarly across sites, the field crew did not capture prey fish at Walker Creek Delta in 2022. Therefore, these data are inadequate to make any conclusions on time trends regarding mercury concentrations for Walker Creek Delta. In the future, it is recommended that a larger sample size of prey fish be collected from both Millerton Point and Walker Creek Delta, and in the adequate size range to conduct an accurate and valid comparison. Future fish sampling efforts should focus on the longjaw mudsucker, and threespine stickleback, for which there are ample pre-TMDL mercury data from 2010.

Lastly, over the last two decades there has been a decrease in total mercury concentrations in sediment samples collected at Walker Creek Delta. This decrease has largely been attributed to the Gambonini mine cleanup conducted by the U.S. EPA. The cleanup largely focused on stabilizing the primary mine waste deposit and reducing the erosion of mercury-laden sediment. To date, the cleanup has proved effective as mercury loads in the stream draining the mine were significantly reduced and as shown in this report the mercury concentrations at Walker Creek Delta are almost meeting the Walker Creek Watershed mercury TMDL of 0.5 ppm threshold. However, it is important to note that this trend is not being witnessed in the biota collected at Walker Creek Delta. Therefore, future biota and sediment sampling at Walker Creek Delta are necessary to continue analyzing long-term time trends.

7 References

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