



*CT DEEP Fish Tissue Contaminant Monitoring Project*

**Analysis of Lead (Pb) Levels in Blue Crab Tissue Collected from  
the Lower Mill River (Fairfield, CT)**

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## EXECUTIVE SUMMARY

This study sought to evaluate total lead (Pb) concentration in the edible portions of Blue Crab (*Callinectes sapidus*) collected from the lower Mill River in Fairfield, CT. These data will be utilized by the Connecticut Department of Energy and Environmental Protection (CT DEEP) in order to determine whether update to the water quality assessment for the study area is warranted. In addition, these data will be shared with the Connecticut Department of Public Health (CT DPH) in order to inform updates to an existing crab consumption advisory for this segment of river.

Lead was historically discharged into the lower Mill River (Fairfield, CT) by the former Exide Battery manufacturing plant. Investigation determined that sediments and tissue of aquatic organisms living in the vicinity of the former plant were characterized by elevated lead concentrations. Consequently, the river was placed on the State's "impaired waters" list and a 'do not eat' consumption advisory was issued for Blue Crab collected from the river between Harbor Road and Sturges Road in Fairfield, Connecticut.

A multi-decadal remediation effort successfully removed lead-contaminated sediments from the river, however, the segment remains on the impaired waters list and the crab consumption advisory remains in place. Collection of current crab tissue data from the area is needed to determine whether crab tissue lead levels have declined to concentrations that are safe for consumption and that would warrant removal from the 303(d) Impaired Waters List.

In August 2022, CT DEEP Water Monitoring and Assessment Program staff collected 37 Blue Crab from two locations within the advisory area using baited hand lines. The crabs were submitted to the University of Connecticut Center for Environmental Science and Engineering (UConn CESE) for analysis of total lead. Crabs were analyzed as composite samples; hepatopancreas and muscle (i.e., leg and thoracic) tissues were analyzed separately for each composite. No quality control issues were associated with these data.

Total lead concentration in the composite muscle tissue samples (n=5) ranged from 0.021 ppm to 0.095 ppm, with an average concentration of 0.042 ppm total lead. Total lead concentration in the composite hepatopancreas tissue samples ranged from 0.185 ppm to 0.652 ppm. Average total lead concentration in the hepatopancreas samples (n=5) was 0.261 ppm, approximately 6 times higher than the average muscle tissue concentration. Calculated mass-weighted estimates of the average total lead concentration in the edible portion of the crab (i.e., hepatopancreas and muscle tissue combined) ranged from 0.034 ppm to 0.162 ppm, with a mean value of 0.069 ppm. These results indicate that, on average, remediation efforts successfully achieved a post-remediation site-specific total lead target concentration of less than 0.1 ppm in Blue Crab tissue. Individual crabs with tissue total lead concentrations above the 0.1 ppm target still remain present within the study area, however.



## STUDY BACKGROUND

### *Site Remediation History and Impaired Water Quality Status*

The Mill River is located in Fairfield County, CT. The river begins along the Easton-Monroe town boundary and flows south through Easton and then Fairfield, before emptying into Southport Harbor, and ultimately, the Long Island Sound. For water quality assessment purposes, the river is divided into multiple segments. The lowest segment, CT-W1\_006, is the focus of this investigation. Segment CT-W1\_006 extends from Sturges Road in Fairfield, CT (north of Mill Hollow Park) downstream to Harbor Road in Fairfield, CT. This segment of the river is tidally influenced and supports numerous recreationally important marine species, including Atlantic Blue Crab (*Callinectes sapidus*). Currently, the segment is listed as an EPA Category 4b impaired water body; the river does not support shellfishing or fish consumption use.

The source of water quality impairment is lead contaminated sediments that resulted from historical discharges into the lower Mill River by the former Exide Battery manufacturing plant. Between 1950 and 1981, Exide Corporation owned and operated a site on the east bank of the river, between the Boston Post Road (Route 1) bridge and the Amtrack railroad bridge. In 1983, the property was acquired by International Nickel Corporation (INCO) a subsidiary of Exide Group, Inc. (Exide). Upon discovery of the contamination, and determination that Exide was the responsible party, CT DEEP (then CT DEP) issued a unilateral order requiring the implementation of remedial measures necessary to abate contamination of the Exide site as well as within the river itself.

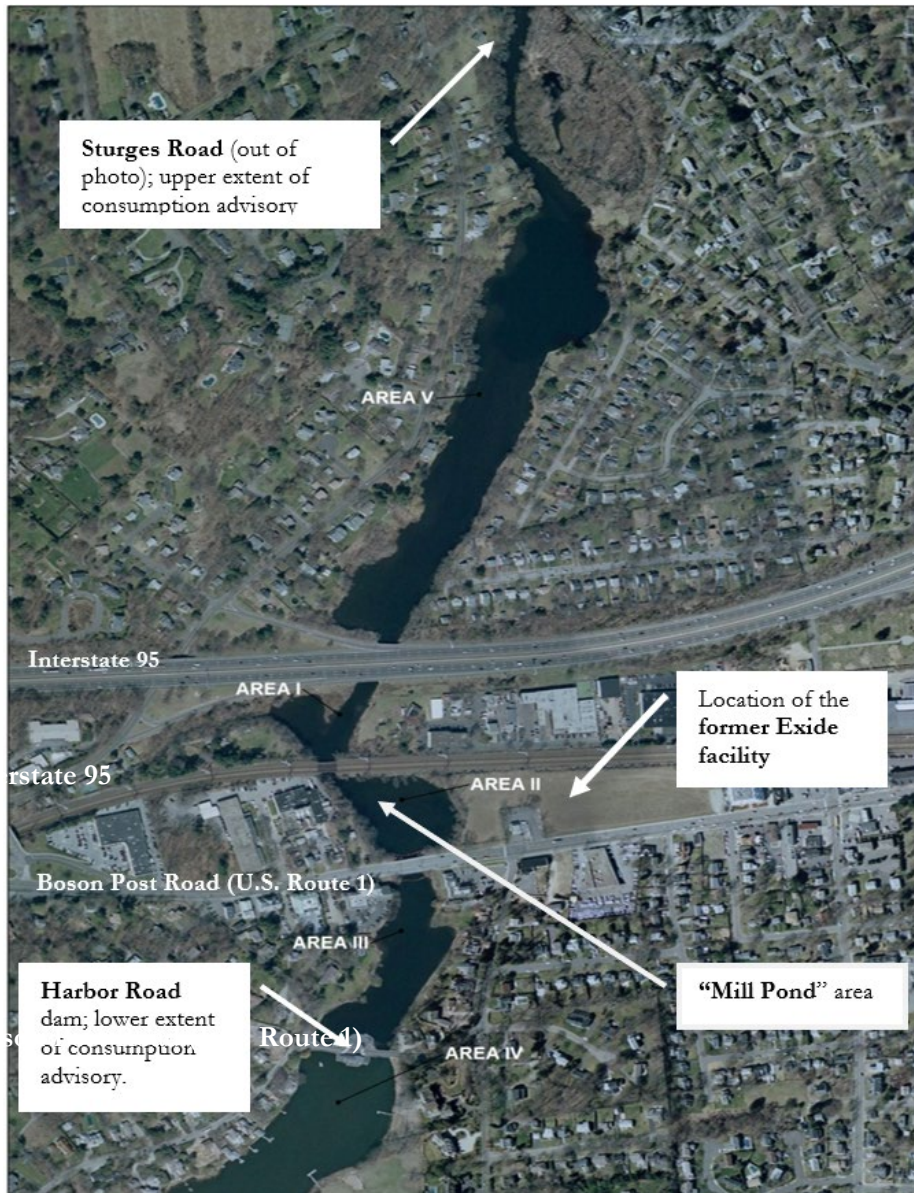
In accordance with the order, a multi-decadal remediation effort, begun in 2005 and concluded in 2013, to remove lead-contaminated sediments from the Mill River. Remediation sought to restore and maintain 1) habitat for fish, other aquatic life and wildlife, 2) contact recreation, and 3) shellfishing and fish consumption uses in the river were developed. A sediment remedial action plan to achieve these remediation goals and to monitor the effectiveness of cleanup was approved by CT DEEP in October 2013. Sediment remediation activities were initiated in 2014. In 2015, Exide completed the in-river hydraulic dredging of contaminated sediment. The dredged sediment dewatering, which included treating the filtrate before being discharged back to the Mill River, continued until 2016 when the dewatered sediment was removed from the site for disposal at an appropriate disposal facility. The demobilization of the wastewater treatment system and dewatering containment system, as well as site restoration was completed in 2017. CT DEEP approved the sediment remediation in October 2017.

Following the successful completion of Exide's sediment cleanup project, post-remediation monitoring occurred. In 2020, CT DEEP had sufficient data to remove the impaired status (*i.e.*, to delist the segment) for contact recreation and for habitat for fish, other aquatic life and wildlife water quality uses. However, insufficient data was available to delist the segment from the impaired waters list in relation to fish consumption (*i.e.*, crab consumption) use; the segment therefore remains listed as impaired for shellfishing/fish consumption.

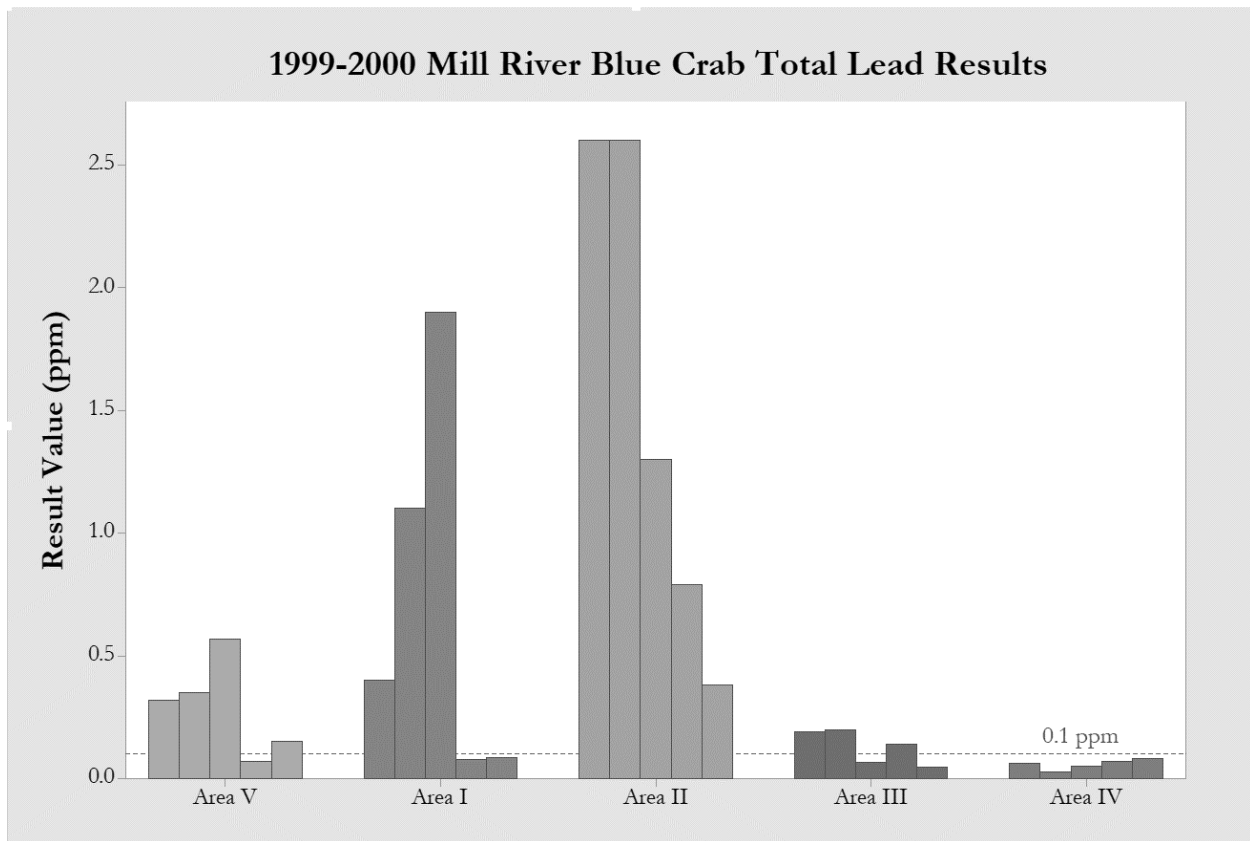
### *Past Blue Crab Monitoring Efforts*

For remediation monitoring purposes, the lower Mill River was divided into five areas (Figure 1). Areas III, II, I, and V are located in segment CT-W1\_006 in downstream to upstream order. Area

IV is located downstream of the segment and consists of Southport Harbor. Between 1999-2000, Blue Crabs were collected from the river and analyzed for total lead. Tissue analysis results (Appendix A) of these samples confirmed that crab tissue lead levels were elevated in the lower Mill River. The highest concentration of total lead (2.6 ppm) was found in crabs collected from the area adjacent to the former Exide facility (Area II) (Figure 2). Consequently, CT DPH issued a ‘do not eat’ consumption advisory for Blue Crab collected from the river between Harbor Road and Sturges Road in Fairfield, Connecticut, which remains in effect at the time of this report writing.



**Figure 1. Aerial image of the Lower Mill River (Fairfield, CT).** For remediation purposes, the river was conceptually divided into five project areas, I-IV. The Blue Crab consumption advisory applies to Areas I-III and Area V, all located upstream of Harbor Road in Fairfield, CT. Southport Harbor (Area IV) is not included in the advisory and therefore was not sampled for this study.



**Figure 2. Total lead levels in Mill River Atlantic Blue Crab 1999-2000.** Bars represent total lead concentration in individual Blue Crab collected from each of the five project areas. Muscle and hepatopancreas tissues were combined for analysis. The reference line indicates the post-remediation target for total lead concentration in crab tissue (Appendix B).

## STUDY OBJECTIVES

The primary objective of the study was to evaluate total lead (Pb) concentration in the edible portions of Blue Crab (*Callinectes sapidus*) collected from the lower Mill River in Fairfield, CT. Collection efforts focused on areas II and III of the remediation project area (Figure 1). These data will be shared with CT DPH in order to inform updates to the crab consumption advisory for this segment of the river.

## STUDY AREA

The study area consisted of the portion of the Mill River for which CT DPH has issued a ‘do not eat’ advisory for Blue Crab, from Harbor Road upstream to Sturges Road in Fairfield, CT). Within the study area, priority was given to collecting crabs from the area adjacent to the former Exide location (Area II, Figures 3-5) and from just upstream of the Harbor Road tide dam (Area III, Figure 6-8). The area closest to the former Exide location was historically the most contaminated area and the Harbor Road site is a popular place locally for crabbing.





Figure 3



Figure 4



Figure 5

**Figures 3-5. Photographs of the Mill River upstream of Route 1 (Fairfield, CT) site.**

**DEEP Station ID 18479  
Sampled August 10, 2022**

Figure 3. The Route 1 overpass taken from the bank of the Mill River, just upstream of Route 1 on the east bank.

Figure 4. The Mill River as seen from just downstream of the former Exide facility. Route 1 is out of the photo to the upper left. The railroad crossing is observed in the upper right of the photo.

Figure 5. The Mill River is seen at the left, while the grassy area to the right is the remediated location of the former Exide facility.





**Figure 6**



**Figure 7**

**Figures 6-8. Photographs of the Mill River upstream of Harbor Road (Fairfield, CT) site.**

**DEEP Station ID 18478  
Sampled August 23, 2022**

Figure 6. The view of the Mill River and the parking area on Harbor Road, taken from the left side of the dam, facing upstream.

Figure 7. The right side of the Harbor Road dam, facing downstream (taken from the Harbor Road parking area).

Figure 8. The Mill River upstream of Harbor Road.



**Figure 8**

## METHODS

Samples were collected by CT DEEP Water Monitoring and Assessment Program staff using hand lines baited with chicken, and scoop nets (Figures 9-10).

Upon capture, crabs were transferred to a large tote bin partially filled with ambient water. No egg-bearing females were encountered during collection, nor were any organisms with obvious deformities, signs of disease, or otherwise in apparent poor health; however, staff were instructed to return any such samples to the water if encountered.

At the conclusion of sampling, crabs were individually removed from the tote bin using tongs and the crab carapace width was measured from tip to tip with a measuring tape. Crabs were then separated by sex into 5-gallon tote buckets for further inspection.

The field crew lead selected specimens for retention as outlined in the project sampling plan (i.e., hard-shell, non-egg bearing, no deformities or signs of disease and  $\geq 125$  mm carapace width.) Retained crabs were recorded on the field chain of custody (Appendix C), assigned a unique crab identification number (beginning with 22-C-001 and increasing incrementally with each crab, recorded on the COC), and placed on wet ice in a cooler for transport. A second layer of ice, sufficient to cover the crabs, was placed in the cooler to euthanize the organisms during transport via rapid cooling. (Crabs not selected for retention were returned to the water.) The sample date, location, and crew members were also recorded on the chain of custody. The chain of custody was then sealed in a LDPE zip bag and placed in the cooler for transport to the CT DEEP Laboratory in Windsor, CT.

Once at the lab, the fish tissue prep counter was cleaned with soap and water and then covered with clean aluminum foil. The fish measuring board was similarly cleaned with soap and water and then dried and placed on the aluminum foil. The field crew lead donned sterile nitrile gloves and then each (euthanized) crab was individually removed from the cooler. The crab carapace width was remeasured to the nearest millimeter (Figure 11).

The corresponding crab was found on the field chain of custody and any abnormalities or missing parts were noted. Using permanent marker, an LDPE zip-locking bag was labelled on the exterior with the unique crab ID, species, collection site, date of collection, sex and carapace width. A second, paper label containing the date of collection, waterbody name, collection location, species, and crab identification number was prepared and placed inside the bag with the crab (Figure 12). The bag was then securely sealed.

Crabs were then assigned to a composite group such that all crabs were from the same location, of the same sex, and of similar size (e.g., the smallest crab width was no less than 75% that of the largest crab in the set.) The assigned composite ID was recorded on the field chain of custody. Then, all crabs from an assigned composite group were placed into a second larger zip locking bag which was labelled with the composite ID (i.e., DEEP Field #) in the format of [StationID]-BLCR-[#] (e.g., 18478-BLCR-1). A second label including the composite ID, the date of collection, the location of collection, species, number of specimens, and the unique ID of each specimen to be included in the composite was placed inside the larger bag, and then the bag was securely sealed and placed into the laboratory freezer. (Figure 13)





Figure 9.



Figure 10.

**Figure 9-10. Photographs of study sample collection methods.**

Figure 9. CT DEEP seasonal monitoring staff hold a Blue Crab in a scoop net at the Harbor Road tide dam in Fairfield, CT. Note the chicken-baited hand line (red twine) to which the crab is attached.

Figure 10. CT DEEP staff use a handline to collect Blue Crab from beneath the Route 1 bridge in Fairfield, CT. (Photo courtesy of Timothy Bishop, Town of Fairfield.)





Figure 11.

**Figure 11. Measuring the crab carapace width.** Carapace width was measured from tip to tip to the nearest millimeter, rounding down.

**Figure 12. Individual crab bag.** Each crab was placed in a labelled HDPE zip locking bag. A second paper label was placed inside and then the bag was securely sealed.



Figure 12.

**Figure 13. Composite group bag.** Crabs were grouped into composites based upon location of collection, sex and carapace width. All crabs assigned to the given composite group were placed into a second larger bag labelled with the composite ID (i.e., DEEP sample ID). A second label (not visible) was placed inside the large bag that included the composite ID, the date of collection, the location of collection, species, number of specimens, and the unique ID of each specimen to be included in the composite.



Figure 13.

All crabs were placed in the laboratory freezer within less than 4 hours of collection and stored at  $\leq 20^{\circ}\text{C}$  as whole crabs. Each individual crab was logged into the Fish Contaminant Monitoring Project electronic sample log within 24 hours. The field chain of custody were stored in HDPE bags on the exterior of the freezer containing the crab samples.

On the day of transport, a UConn CESE chain of custody (COC) was prepared (Appendix C) which included each unique composite ID as the sample ID and noted how many individual crabs were being submitted for inclusion in each composite noted on the COC. Bagged groups of frozen crab were placed on wet ice and driven by CTDEEP staff to the University of Connecticut's Center for Environmental Science and Engineering (UConn CESE) laboratory in Mansfield, CT (approximately 40 minutes away).

Upon receipt, UConn CESE staff verified the presence and suitable temperature of all samples. Both the field and laboratory chain of custody were signed by both the UConn CESE staff receiving the sample and the CT DEEP staff relinquishing the sample. An electronic copy of the signed COCs was placed in the project folder upon return to the CT DEEP Field Laboratory. The original field COCs were retained by CT DEEP and placed in the hard-copy project folder at the CT DEEP Windsor Laboratory.

Tissue extraction from whole crabs was performed by UConn CESE according to standard laboratory procedures. Muscle tissue, including leg meat and 'lump meat', was extracted and preserved separately from the hepatopancreas tissue. Tissue material was then composited as instructed on the COC. The composited tissue samples were prepared utilizing UConn CESE SOP Mets-009-08, Standard Operating Procedure: Sample Preparation for the determination of Total Recoverable Elements in Biological Tissues (EPA 200.3 Modified) Samples were then analyzed for lead, percent solids, and percent lipids utilizing EPA Method 6020A.

Results were reported electronically to the DEEP project manager (Appendix D).

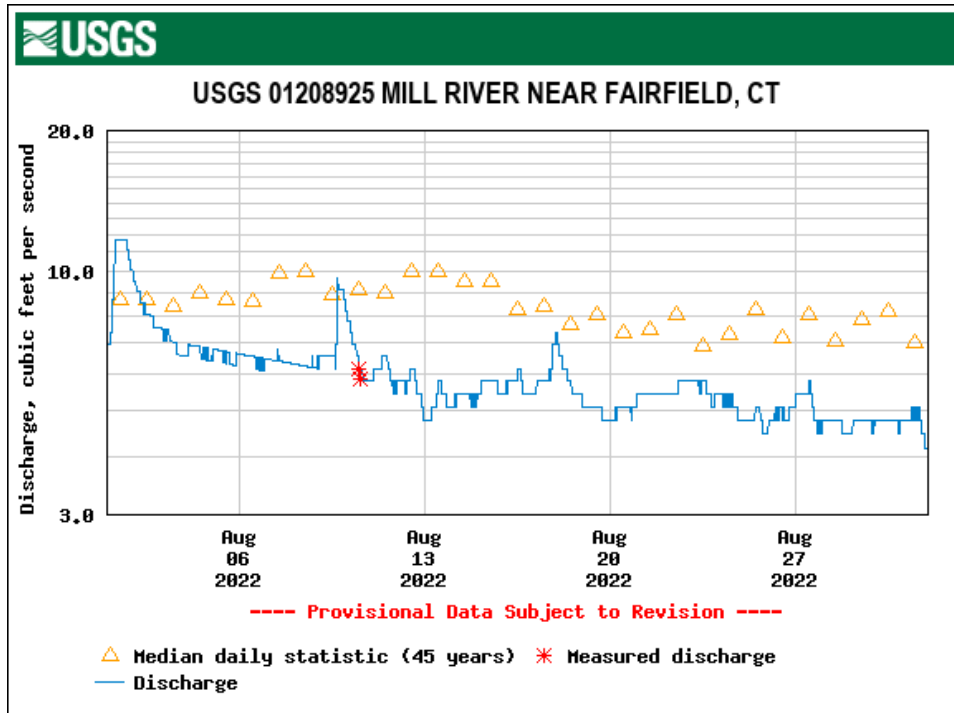
## **RESULTS**

### *Sample Collection*

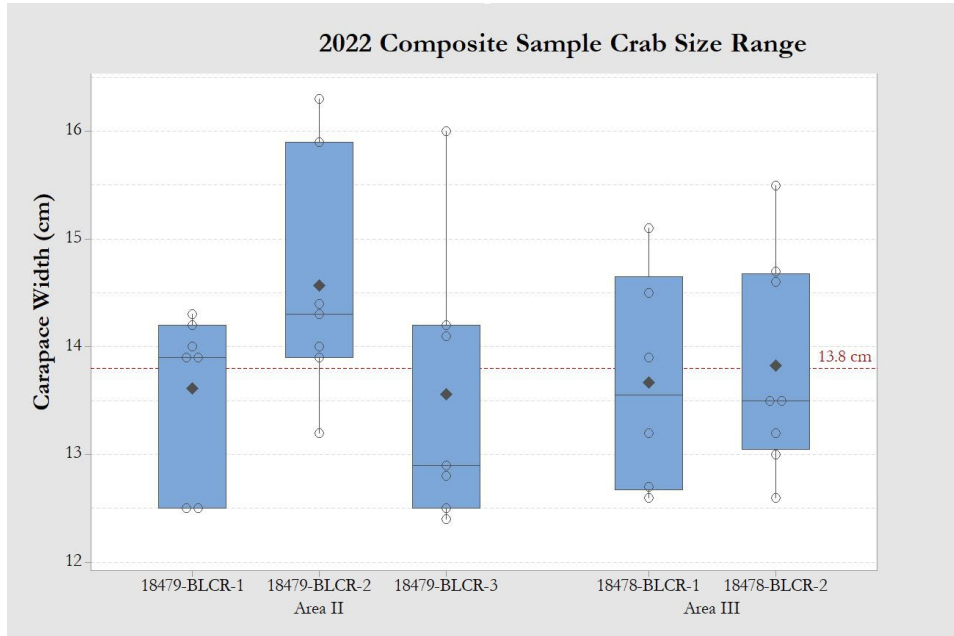
Crab collection activities occurred during August 2022. A total of 37 Atlantic Blue Crab were retained for analysis. Standard Agency field safety was followed at both sites. Field conditions at the time of both sample collections were normal with flows comparable to median daily historic values for the given date range (Figure 14).

Project Area II was sampled on August 10, 2022. A total of 23 crabs were collected from the western shore of the Mill River upstream of Route 1, and downstream of the former Exide location. All crabs were male and ranged in size from 120 mm to 163 mm in carapace width. No members of the public were present during the sampling event and no obvious signs of previous crabbing activity were observed during crab collection.

Project Area III was sampled on August 10 and again on August 23, 2022. In total 14 crabs were collected from the upstream side of the Harbor Road tide dam. All crabs were male and ranged in size from 126 mm to 155 mm in carapace width. A family was observed crabbing at the time of crab collection. Another individual stated that they work in the office building opposite the parking area and routinely see individuals crabbing from the dam.



**Figure 14. Observed discharge at the Mill River USGS gaging station near Fairfield, CT during August 2022.** Flow during sampling was below the historic median daily discharge.



**Figure 15. 2022 composite sample carapace widths.** The average carapace width of the 5 crabs contributing to each composite is symbolized by a black diamond on the boxplot. The red dashed reference line represents the average carapace width of all crabs analyzed in 2022 (13.8 cm, n=35)

**Table 1. 2022 Mill River Blue Crab Details.** All crabs were Blue Crabs (*Callinectes sapidus*) collected from the Mill River in Fairfield, CT at the site noted. Each crab was assigned an individual ID for tracking purposes. The DEEP Field # is the unique composite ID assigned by DEEP to all crabs composited together in the given sample.

DEEP Field # (Composite ID)	Crab ID	Collection Date	Collection Location	Carapace Width (mm)	Comments
18479-BLCR-1	22-C-007	Aug 10	Upstream of Route 1 (Area II)	142	
	22-C-010	Aug 10	Upstream of Route 1 (Area II)	140	
	22-C-013	Aug 10	Upstream of Route 1 (Area II)	125	
	22-C-016	Aug 10	Upstream of Route 1 (Area II)	139	
	22-C-019	Aug 10	Upstream of Route 1 (Area II)	125	1 claw missing
	22-C-023	Aug 10	Upstream of Route 1 (Area II)	139	1 claw, 2 legs missing
	22-C-027	Aug 10	Upstream of Route 1 (Area II)	143	1 claw, 1 leg missing
18479-BLCR-2	22-C-008	Aug 10	Upstream of Route 1 (Area II)	132	
	22-C-011	Aug 10	Upstream of Route 1 (Area II)	159	
	22-C-014	Aug 10	Upstream of Route 1 (Area II)	143	
	22-C-017	Aug 10	Upstream of Route 1 (Area II)	144	
	22-C-020	Aug 10	Upstream of Route 1 (Area II)	140	1 claw missing
	22-C-024	Aug 10	Upstream of Route 1 (Area II)	139	2 claws missing
	22-C-028	Aug 10	Upstream of Route 1 (Area II)	163	1 claw, 1 leg missing
18479-BLCR-3	22-C-009	Aug 10	Upstream of Route 1 (Area II)	125	
	22-C-012	Aug 10	Upstream of Route 1 (Area II)	124	Sublegal
	22-C-015	Aug 10	Upstream of Route 1 (Area II)	141	
	22-C-018	Aug 10	Upstream of Route 1 (Area II)	129	
	22-C-021	Aug 10	Upstream of Route 1 (Area II)	160	1 claw missing
	22-C-025	Aug 10	Upstream of Route 1 (Area II)	128	1 leg missing
	22-C-029	Aug 10	Upstream of Route 1 (Area II)	142	2 legs missing
18478-BLCR-1	22-C-001	Aug 10	Upstream of Harbor Rd. (Area III)	127	
	22-C-002	Aug 10	Upstream of Harbor Rd. (Area III)	151	
	22-C-003	Aug 10	Upstream of Harbor Rd. (Area III)	139	
	22-C-004	Aug 10	Upstream of Harbor Rd. (Area III)	132	
	22-C-005	Aug 10	Upstream of Harbor Rd. (Area III)	126	
	22-C-006	Aug 10	Upstream of Harbor Rd. (Area III)	145	
18478-BLCR-2	22-C-030	Aug 23	Upstream of Harbor Rd. (Area III)	132	
	22-C-031	Aug 23	Upstream of Harbor Rd. (Area III)	155	1 leg missing
	22-C-032	Aug 23	Upstream of Harbor Rd. (Area III)	130	
	22-C-033	Aug 23	Upstream of Harbor Rd. (Area III)	126	
	22-C-034	Aug 23	Upstream of Harbor Rd. (Area III)	135	
	22-C-035	Aug 23	Upstream of Harbor Rd. (Area III)	146	
	22-C-036	Aug 23	Upstream of Harbor Rd. (Area III)	135	
	22-C-037	Aug 23	Upstream of Harbor Rd. (Area III)	147	

The average carapace width across all crabs (i.e., Area II and III samples) was 13.8 cm. Individual crabs were grouped for compositing such that the width of the smallest crab in any composite was no less than 75% of the width of the largest crab in that composite (Figure 15).

A summary of the individual crabs collected from each sampling location and the composites submitted for analysis is provided in Table 1. Two undersized crabs (22-C-022 and 22-C-026) were initially retained but discarded prior to analysis due to minimum size violations; these samples are not included in either Table 1 or Figure 15.

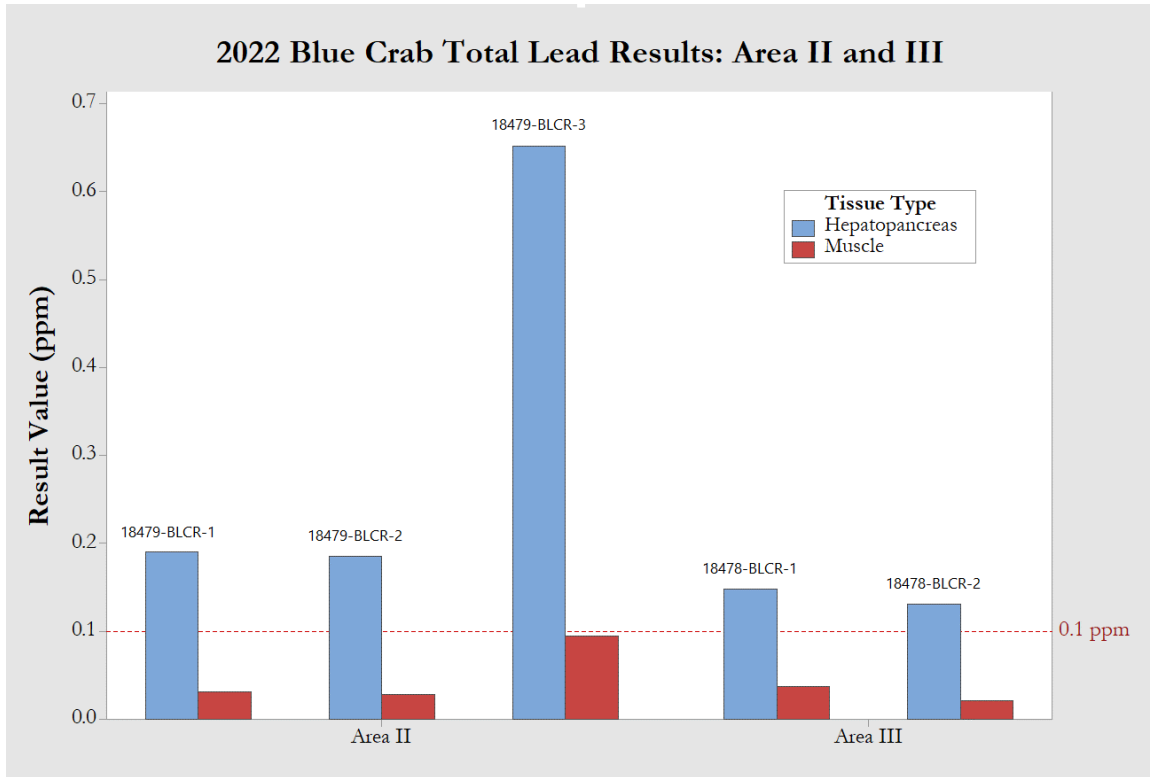
### *Sample Analysis*

All Mill River crab samples retained for analysis (n=35) were delivered to UConn CESE on September 2, 2022. CESE staff extracted tissue from the whole organisms and homogenized composited samples as instructed on the COC by DEEP. Samples were analyzed for percent solids on October 7, 2022. They were prepared and then analyzed for total lead on October 10 and October 11, 2022, respectively. Percent lipid analysis occurred on October 21, 2022. A copy of the original laboratory results report is provided in Appendix D.

The concentrations of total lead detected in the hepatopancreas tissue and in the muscle tissue of the 2022 samples are shown in Table 2.

<b>Table 2. Summary of 2022 Mill River Blue Crab Tissue Analysis.</b>					
Project Area	Collection Date	DEEP Field ID	Crab Count	Total Lead (ppm)	
				Hepatopancreas	Muscle
Area II	8/10/2022	18479-BLCR-1	6	0.190	0.031
Area II	8/10/2022	18479-BLCR-2	8	0.185	0.028
Area II	8/10/2022	18479-BLCR-3	7	0.652	0.095
Area III	8/10/2022	18478-BLCR-1	7	0.148	0.037
Area III	8/23/2022	18478-BLCR-2	7	0.131	0.021

Lead was detected in all Blue Crab tissue samples collected from the Mill River (Fairfield, CT) in August 2022 (Figure 16).



**Figure 16. Total lead concentration in hepatopancreas and muscle tissue of Atlantic Blue Crab collected from the lower Mill River (Fairfield, CT) in August 2022.** The DEEP Field Number is displayed above each tissue analysis pair. The red dashed line represents the 2012 DPH-proposed target of <0.1 ppm for post-remediation crab tissue total lead levels.

Total lead concentration in muscle tissue ranged from 0.021 ppm to 0.095 ppm, with an average concentration of 0.042 ppm.

Total lead concentration in the hepatopancreas tissue was 0.185 ppm to 0.652 ppm. Average total lead concentration in the hepatopancreas tissue was 0.261 ppm, approximately 4-6 times higher than muscle tissue concentrations.

### *Data Quality Assessment*

No quality control issues, or SOP deviations were reported during the study. The project lead was present for both sampling efforts and confirmed that the study sampling and analysis plan was correctly followed. As specified in the project sampling plan, all samples were transported to the Windsor Lab and frozen whole within 12 hours of collection. Samples were delivered to UConn CESE within 30 days of collection. Samples were analyzed for total lead within 60 days of submission. Total hold time did not exceed 90 days from collection.

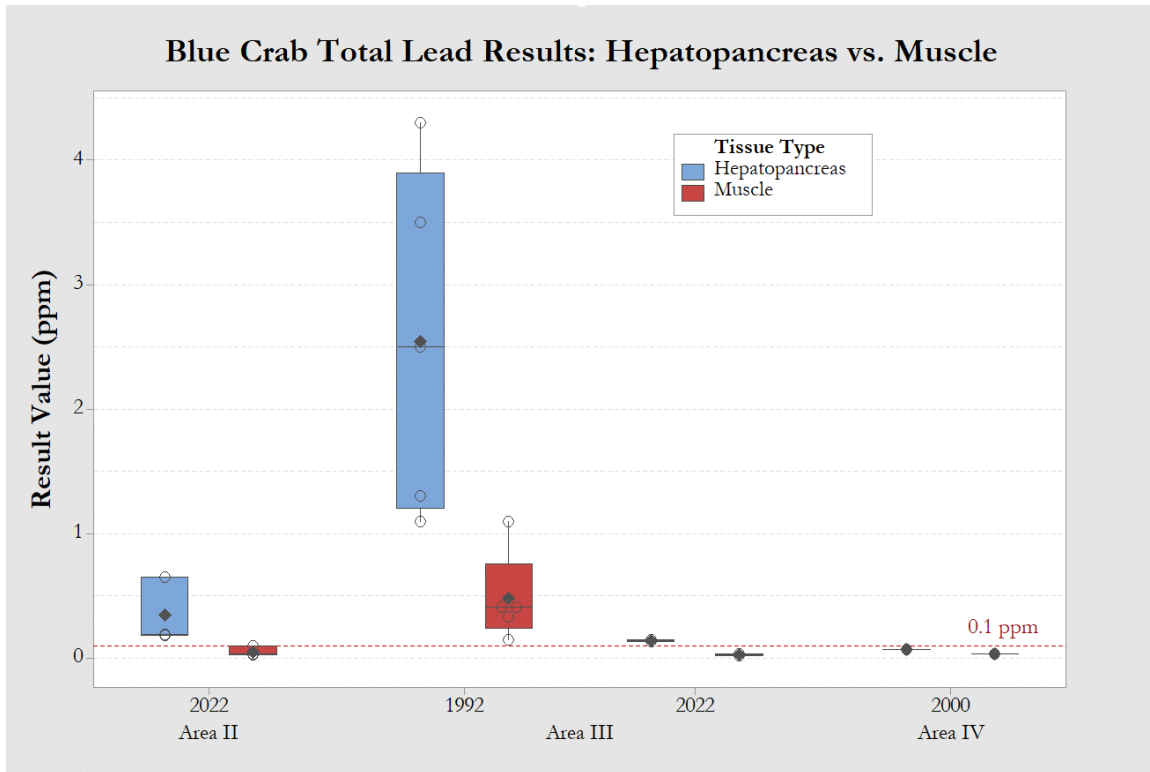
Composite samples are believed to represent total lead levels of the particular species of crab (i.e., Atlantic Blue Crab), in the waterbody where they were collected (i.e., Mill River), at the time of collection. Data were reported by the analytical laboratory as requested and outlined in the project sampling plan. All data are determined to be useable for the state project objectives.



## DISCUSSION

### *Total Lead Concentration Difference by Tissue Type*

It has previously been documented that heavy metals accumulate at greater concentrations in the hepatopancreas than in the muscle tissue of Blue Crab. Available paired Blue Crab hepatopancreas and muscle tissue samples for the lower Mill River are shown in Figure 17.



**Figure 17. Comparison of total lead concentrations in hepatopancreas tissue vs. muscle tissue collected from Mill River Blue Crab.** Hepatopancreas data are shown in blue, while the paired muscle tissue data for the samples are shown in red. Data are grouped by sampling area and then by time period.

Review of the data from Area III in particular (i.e., upstream of Harbor Road in Fairfield), demonstrates that total lead concentration in Mill River Blue Crab tissue has declined substantially since remediation. However, hepatopancreas total lead concentrations exceed muscle tissue concentrations (collected from the same crab), regardless of site or time period (i.e., pre- or post-remediation). This finding is not surprising but is a reminder that application of these data should consider whether the target population will consume both the muscle and the hepatopancreas of the crab, or only one tissue type.

In 2012, CT DPH staff recommended 0.1 ppm total lead as a reasonable site-specific target concentration for Blue Crabs in the lower Mill River (Appendix B). This number was derived based upon data collected in 1999-2000 that indicated background lead concentrations in the lower Mill River were approximately 0.05 ppm.



None of the 2022 muscle tissue samples exceeded the 0.1 ppm post-remediation target total lead concentration. However, all of the 2022 hepatopancreas samples exceeded the target total lead concentration.

The samples used to derive the target concentration were analyzed as combined hepatopancreas and muscle tissue samples. It can therefore be reasonably concluded that the 0.1 ppm target concentration was intended for similarly combined samples (i.e., the edible portion of the crab). Since these two tissue types (i.e., hepatopancreas and muscle) were analyzed separately for the 2022 samples, in order to determine a total lead concentration for the edible portion, a mass-weighted average for each sample was generated.

The individual weights of the hepatopancreas tissue and muscle tissue collected from each crab were not recorded in 2022. However, a study conducted by the New York State Department of Environmental Conservation (NYSDEC), which included analysis of 112 Blue Crabs collected from the Hudson River and two embayments of Long Island Sound, found that, on average, the hepatopancreas accounted for 4.2% of the total crab body weight, while the thoracic and leg muscle accounted for a combined 29.7% of the total weight (Skinner and Kane 2016). Therefore, the mass-weighted estimate of the average total lead (ppm) in the edible portion of the 2022 crab samples was calculated using the following equation:

$$TL_{EP} = (0.12 * TL_H) + (0.88 * TL_M)$$

where  $TL_{EP}$  = the total lead concentration (ppm) in the edible portion,  $TL_H$  = total lead concentration (ppm) in the hepatopancreas tissue, and  $TL_M$  = total lead concentration (ppm) in the muscle tissue.

Table 3 displays the results of these calculations for the 2022 samples. Values that exceed the total lead post-remediation target concentration are shown in red.

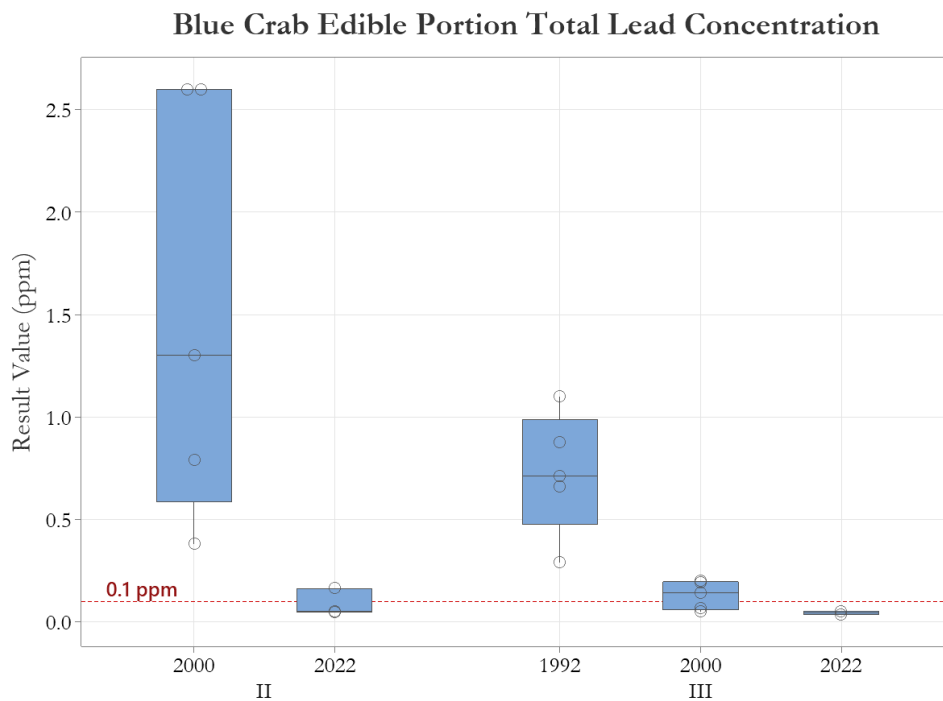
<b>Table 3. 2022 Mill River Blue Crab Edible Portion Estimated Total Lead Concentration</b>				
<b>Project Area</b>	<b>DEEP Field ID</b>	<b>Total Lead (ppm)</b>		
		<b>Hepatopancreas</b>	<b>Muscle</b>	<b>Edible Portion (H+M)</b>
Area II	18479-BLCR-1	0.190	0.031	0.050
Area II	18479-BLCR-2	0.185	0.028	0.047
Area II	18479-BLCR-3	0.652	0.095	0.162
Area III	18478-BLCR-1	0.148	0.037	0.050
Area III	18478-BLCR-2	0.131	0.021	0.034
	<b>Average</b>	<b>0.261</b>	<b>0.042</b>	<b>0.069</b>

The average estimated total lead concentration of the edible portion of all composites was 0.069 ppm. These data suggest that remediation efforts have successfully achieved a  $\leq 0.1$  ppm total lead post-remediation target concentration for Blue Crab tissue collected from the lower Mill River.

Although the average total lead concentration of the edible portion in the 2022 samples was below the target concentration, individual crabs that exceed the target concentration still exist in the area. Sample 18479-BLCR-3, which consisted of 7 male crabs collected from adjacent the former Exide site, had an estimated edible portion total lead concentration of 0.162 ppm. Of the five samples analyzed, this was the only sample that exceeded the total lead target concentration on an edible portion basis.

### *Spatial Differences in Total Lead Concentration*

Evaluation of change in crab tissue total lead concentration at each sampling location is complicated by the nature of tissue handling for analysis (i.e., combined tissue types vs. separated, composite vs. discrete samples). To facilitate comparison of pre- and post-remediation crab tissue data collected from Area III (upstream Harbor Road) and Area II (adjacent the former Exide location), the location of 2022 sample collection efforts, hepatopancreas and muscle tissue data were converted into an estimate of the edible portion (i.e., hepatopancreas and muscle combined) total lead concentration. The equation  $TL_{EP} = (0.12 * TL_H) + (0.88 * TL_M)$  was used as previously described. The results are shown in Figure 18.



**Figure 18. Comparison of total lead concentration in the edible portion of Blue Crabs collected in Areas II and III between 1992 and 2022.** The former Exide facility was located in Area II. Area III is located downstream and includes the Harbor Road dam crabbing area.

Figure 18 shows that crabs collected downstream of the former Exide location (i.e., upstream of Harbor Road, Area III), were characterized by total lead concentrations below the post-remediation target, if both the muscle and hepatopancreas is consumed. Crabs residing closest to the former Exide location (Area II) may have a greater likelihood of being characterized by total lead concentrations that exceed the 0.1 ppm post-remediation target than those collected at the Harbor Road dam.

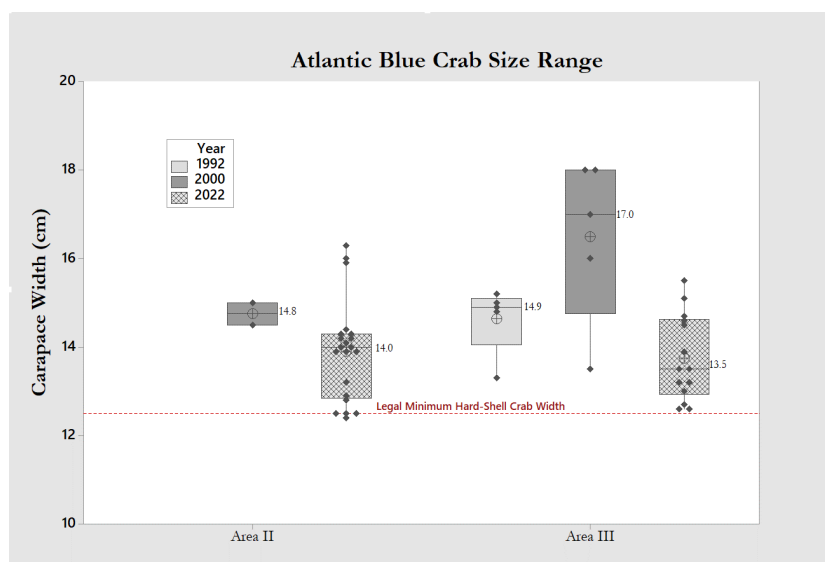
### *Comparability to Historical Datasets*

#### *Crab Size and Sex*

In 1992, five crabs were collected from the Mill River upstream of Harbor Road (i.e., Project Area III) and analyzed for a suite of metals, including lead (Appendix E). (These crabs were collected as part of a larger effort to look at contaminants in crabs collected from Long Island Sound estuaries.) Four out of five of the crabs were male. The crabs ranged in size from 13.3 to 15.2 cm wide (i.e., carapace width).

As discussed previously, between 1999-2000, Blue Crabs were again collected from the river and analyzed for total lead. Crabs were collected from all five remediation project areas as part of a larger ecological impact study. All but one crab collected during the 1999-2000 reference period were male. Size information for the 1999 crabs could not be located, but the crabs collected in 2000 ranged in size from 13.5 cm to 18.0 cm in carapace width.

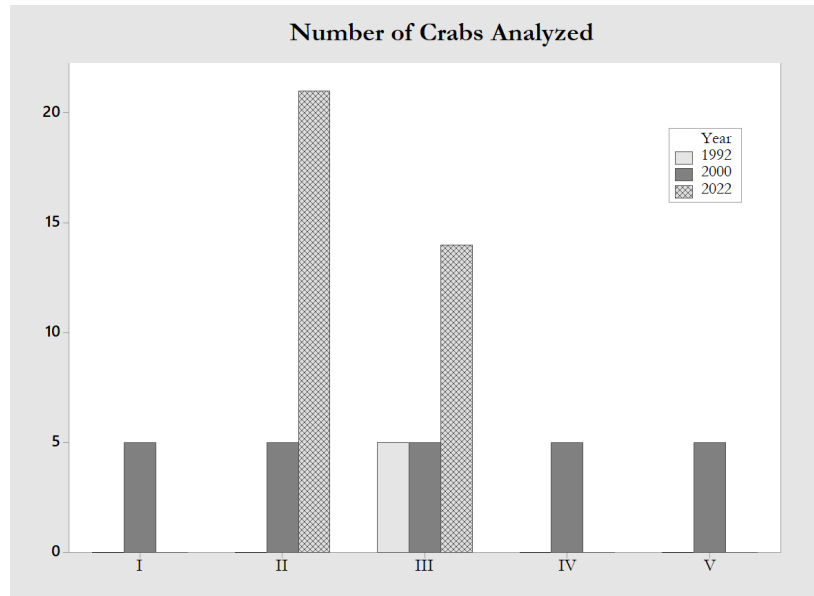
Crabs collected in 2022 from the Mill River in Fairfield consisted of all male specimens ranging in size from 12.4 to 16.3 cm wide. (All female crabs collected were sublegal and therefore returned to the water.) Although the 2022 crabs may be slightly smaller, on average, than the crabs collected in 1992 and in 1999-2000 (Figure 19), this is not expected to affect the usability of the 2022 dataset.



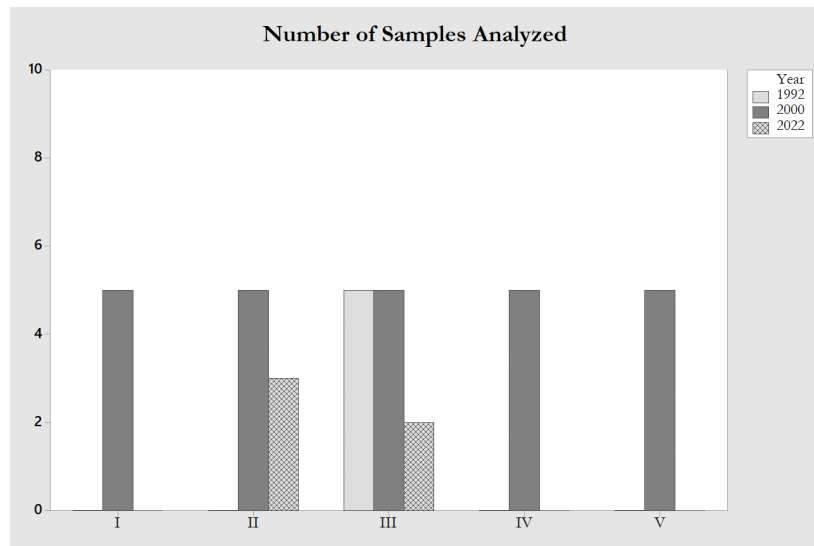
**Figure 19. Size of Blue Crab collected from Mill River project Areas II and III for lead analysis in 1992, 1999-2000, and 2022. Legal minimum harvest size is shown in red.**

### Sample Counts

Substantially more crabs were analyzed in 2022 (n=35) than during previous monitoring cycles (Figure 20). However, because the 2022 crabs were composited, the number of final data points available for review from the study area (n=5) is comparable to the 1992 dataset (n=5, crabs analyzed individually), but less than the 1999-2000 dataset (n=20, crabs analyzed individually) (Figure 21). 2022 project funding limited the Agency's ability to analyze more than 5 samples.



**Figure 20. Number of crabs analyzed during each of the Mill River Blue Crab monitoring studies.)** Bars represent the total number of crabs analyzed from a project area during a monitoring period.



**Figure 21. Number of samples analyzed during each of the Mill River Blue Crab monitoring studies.)** Bars represent the total number of samples, discrete or composite.

In 2022, DEEP staff collected any crabs available that were of legal size from the study area. Although the number of samples available for review may be smaller than in previous years, the number of crabs analyzed is substantially larger and believed to compensate for the smaller sample size. In addition, the sample is considered representative of the crab population that the public would be consuming from the study area and therefore hopefully sufficient to inform the local consumption advisory.

## **CONCLUSION**

Blue Crab collected from the lower Mill River in Fairfield, CT were historically characterized by elevated total lead tissue concentrations as a result of exposure to lead contaminated sediments. To protect public health, a ‘do not eat’ advisory was issued for Blue Crab collected from the river between Harbor Road and Sturges Road in Fairfield. Remediation efforts have since successfully reduced total lead concentrations in river sediment and the total lead concentrations in the tissue of Blue Crab collected from the advisory area have substantially declined compared to pre-remediation levels.

The edible portion of crab tissue (i.e., muscle and hepatopancreas tissues combined) collected from the advisory area during 2022 was, on average, below the 0.1 ppm total lead post-remediation site-specific target concentration established by the CT DPH. However, individual crabs with total lead concentrations in the edible portion above this target value are still present in the area, and crabs collected in closer proximity to the former Exide location in particular, may still have tissue levels above the 0.1 ppm total lead target concentration.

These data have been shared with CT DPH for their use in determining whether an update to the Blue Crab consumption advisory for the lower Mill River in Fairfield, CT is warranted at this time.

## ACKNOWLEDGMENTS

This study would not have been possible without the partnership of the Connecticut Department of Energy and Environmental Protection (CT DEEP), Connecticut Department of Public Health (CT DPH), and the Town of Fairfield. The following individuals in particular, made substantial contributions to the success of this project:

**Meghan Lally** (CT DEEP Water Planning and Management) served as project manager for this study. **Katie O'Brien-Clayton** (CT DEEP Water Planning and Management) served as a technical advisor to the project and field crew lead.

Sampling and analysis plan (SAP) development support and review was provided by **Pete Aarrestad** (CT DEEP Fisheries), **Justin Davis** (CT DEEP Fisheries), **Dave Molnar** (CT DEEP Fisheries), **Matt Gates** (CT DEEP Fisheries Division), **Chris Bellucci** (CT DEEP Water Planning and Management), **Mary Becker** (CT DEEP Water Planning and Management), **Traci Iott** (CT DEEP Water Planning and Management), **Laura Robbins** (CT DEEP Water Planning and Management), **Ray Frigon** (CT DEEP Remediation Division), **Carolyn Fusaro** (CT DEEP Remediation Division), **Abby Plungis** (CT DEEP Remediation Division), **Sharee Rusnak** (CT DPH Environmental Health), and **Tim Bishop** (Town of Fairfield).

Field work was conducted by the following CT DEEP Water Planning and Management Division staff: **Meghan Lally**, **Katie O'Brien-Clayton**, **Grace Hoeckele\***, **Juliana Holcomb\***, **Erich Nitchke\***, and **Tim Strzepa\***.

**Tracy Lizotte**, CT DEEP Water Monitoring Lab Coordinator, provided equipment acquisition support and oversight of interim sample storage.

Laboratory analysis and related support services were provided by **Chris Perkins**, **Anthony Provatas** and **Snieguole (Sniega) Stapcinskaite** at the University of Connecticut Center for Environmental Sciences and Engineering.

Report review was provided by **Pete Aarrestad** (CT DEEP Fisheries), **Mary Becker** (CT DEEP Water Planning and Management), **Katie O'Brien-Clayton** (CT DEEP Water Planning and Management), **Traci Iott** (CT DEEP Water Planning and Management), **Rebecca Jascot** (CT DEEP Water Planning and Management), **Carolyn Fusaro** (CT DEEP Remediation Division), and **Sharee Rusnak** (CT DPH Environmental Health).

*\*Denotes a 2022 WPMD seasonal resource employee*

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- University of Connecticut Center for Environmental Science and Engineering (UConn CESE). 2022. *Standard Operating Procedure: ICP-MS Analysis Method EPA 6020A Inductively Coupled Plasma Mass Spectrometry*. SOP No. Mets-020-02.



## Appendix A. 1999-2000 Mill River Blue Crab Tissue Total Lead Analysis Results

Data sources:

1. Table " Number of Biota Samples Obtained - Current (July 2000) and Previous (October 1999) Field Sampling - Mill River Human Health and Ecological Risk Assessment " in memo dated August 4, 2000. From Susan Kane Driscoll and Rebekah Lacey, Menzie-Cura & Associates, Inc. To: Traci Iott, CT DEP. Subject: Biota obtained during Mill River July sampling.
2. Table "Mill River Site Tissue Sample Results – October 1999 Sampling Event; Total Metals in Fish, Crab, Oyster and Eel Tissues". Located in the Data Usability Review: RCRA Metals plus Aluminum, EPA Region 1 Tier II – type review completed August 2, 2000 by New Environmental Horizons, Inc. for Menzie-Cura & Associates, Inc. Site: Mill River, Fairfield, CT. SDG: WHGEL Lab ETR# 43712.
3. Woods Hole Group Environmental Laboratories Analytical Report dated October 4, 2000, prepared for Menzie-Cura & Associates, Inc. Project: Mill River Crabs. WHGEL Lab ETR# 00044760

Project Area	Collection Location	Year	Sample	Tissue <sup>1</sup>	Total Lead, mg/kg	Qualifier <sup>2</sup>	Sex <sup>3</sup>	Carapace Width, cm	Crab Weight, g
Area V	Upstream of I-95	2000	44762-01	M + H	0.071	J	M	17.0	271
Area V	Upstream of I-95	2000	44762-02	M + H	0.150	J	M	17.0	338
Area V	Upstream of I-95	1999	43712-33	M + H	(0.320)	U			
Area V	Upstream of I-95	1999	43712-34	M + H	(0.350)	U			
Area V	Upstream of I-95	1999	43712-35	M + H	0.570	J			
Area I	Upstream of Exide/DS I-95	2000	44760-03	M + H	0.076	J	M	15.5	296
Area I	Upstream of Exide/DS I-95	2000	44760-04	M + H	0.085	J	M	15.0	234
Area I	Upstream of Exide/DS I-95	1999	43712-06	M + H	(0.400)	U	*	*	*
Area I	Upstream of Exide/DS I-95	1999	43712-07	M + H	1.100	J	*	*	*
Area I	Upstream of Exide/DS I-95	1999	43712-08	M + H	1.900	J	*	*	*
Area II	Exide Location (former)	2000	44760-01	M + H	0.790	J	M	15.0	221
Area II	Exide Location (former)	2000	44760-02	M + H	0.380	J	M	14.5	234
Area II	Exide Location (former)	1999	43712-09	M + H	2.600	J	*	*	*
Area II	Exide Location (former)	1999	43712-10	M + H	2.600	J	*	*	*
Area II	Exide Location (former)	1999	43712-11	M + H	1.300	J	*	*	*
Area III	Upstream of Harbor Road	2000	44760-10	M + H	0.190	J	M	18.0	344
Area III	Upstream of Harbor Road	2000	44760-11	M + H	0.200	J	M	18.0	322
Area III	Upstream of Harbor Road	2000	44760-12	M + H	0.067	J	M	16.0	248

Project Area	Collection Location	Year	Sample	Tissue <sup>1</sup>	Total Lead, mg/kg	Qualifier <sup>2</sup>	Sex <sup>3</sup>	Carapace Width, cm	Crab Weight, g
Area III	Upstream of Harbor Road	2000	44760-13	M + H	0.140	J	M	13.5	212
Area III	Upstream of Harbor Road	2000	44760-14	M + H	0.048	J	M	17.0	306
Area IV	Within Southport Harbor	2000	44760-05	M + H	0.062	J	M	13.5	192
Area IV	Within Southport Harbor	2000	44760-06	M + H	0.028	J	M	18.0	327
Area IV	Within Southport Harbor	2000	44760-07-M	M	0.031	J	M	15.0	235
Area IV	Within Southport Harbor	2000	44760-07-H	H	0.069	J	M	15.0	235
Area IV	Within Southport Harbor	2000	44760-08	M + H	0.069	J	F	15.0	214
Area IV	Within Southport Harbor	2000	44760-09	M + H	0.080	J	M	16.0	242

<sup>1</sup> Tissue Types: M = Muscle ("Lump meat"), H = Hepatopancreas.

<sup>2</sup> Qualifiers: J = The associated numerical value is an estimated quantity due to quality control criteria exceedance(s).

U = The analyte was analyzed for, but not detected. The associated numerical value is the sample reporting/quantitation limit.

#### Table Notes:

1. All samples are comprised of a single Blue Crab (*Callinectes sapidus*). The edible portion of each sample was analyzed; for all samples except 44760-07 the hepatopancreas (H) was combined with claw, leg, and lump meat (M) for analysis (i.e., M+H).
2. 1999 samples were collected between October 27 and October 29, 1999. Information regarding crab sex, carapace width, and crab weight could not be located and are therefore noted as missing by the presence of an Asterix (\*). Similarly, information regarding the analysis dates, laboratory and method could not be located.
3. 2000 samples were collected between July 19, 2000 and July 27, 2000. Samples were analyzed by Woods Hole Group Environmental Laboratories between September 26, 2000 and September 28, 2000 for total lead using EPA method 6020. Results are reported in mg/kg on a wet weight basis.

## Appendix B. DPH Email Discussing Post-Remediation Target Concentration for Total Lead (Pb) in Blue Crab from the Mill River (Fairfield, CT)

**From:** Ginsberg, Gary  
**Sent:** Friday, March 23, 2012 7:11 PM  
**To:** 'mcardle@exponent.com' <[mcardle@exponent.com](mailto:mcardle@exponent.com)>  
**Cc:** Fusaro, Carolyn <[Carolyn.Fusaro@ct.gov](mailto:Carolyn.Fusaro@ct.gov)>; Iott, Traci <[Traci.Iott@ct.gov](mailto:Traci.Iott@ct.gov)>; Toal, Brian <[Brian.Toal@po.state.ct.us](mailto:Brian.Toal@po.state.ct.us)>; Rusnak, Sharee <[Sharee.Rusnak@po.state.ct.us](mailto:Sharee.Rusnak@po.state.ct.us)>  
**Subject:** Mill River Blue Crab Advisory and Future Testing

Meg – in relation to your recent inquiry about the establishment of health-based lead limits in Blue Crabs that underlies the advisory on the Mill River, the following briefly reconstructs the history and puts forward a lead crab target for any post-remediation testing. Please let us know if you need additional information.  
Gary Ginsberg

CTDPH has in the past established a fish consumption advisory for sections of the Mill River in Fairfield CT on the basis of the finding of elevated lead concentration in Blue Crabs (background area mean (Area IV) = 0.05 ppm; impacted sections mean ranging up to 1.5 ppm). Blue crabs in the impacted area had concentrations that were above those associated with sediment remediation targets (e.g., 0.149 ppm in the crab associated with a cleanup target of 400 ppm based upon exposure to sediment + crab ingestion at 3 oz/week).

If there are post-remediation Blue Crab samples, these should be evaluated against a Blue Crab concentration of 0.1 ppm. This concentration is clearly elevated above background as established in the earlier testing and would be associated with 2.54 ug/day of additional lead ingestion assuming two 3oz meals/week (25.7 g fish ingestion/day). This lead exposure (2.54 ug/d) is approximately equal to the estimated dietary contribution of lead from background sources in the lead IEUBK model. When we put this additional dietary source into the IEUBK model at 50% dietary uptake fraction, the increase in blood lead level yielded 0.6% of children above 10 ug/dl and 15.3% above 5 ug/dl. Given recent concerns regarding low dose neurotoxic effects of lead, DPH's preferred target is to maintain the vast majority of children (e.g., 95%) below 5 ug/dl rather than 10 ug/dl. The Blue Crab target concentration of 0.1 ppm would yield an increase of only 5% more children experiencing blood lead over 5 ug/dl relative to the baseline model since the baseline model is already associated with 10% of children above 5 ug/dl.

Thus, overall, **0.1 ppm** is a reasonable site-specific target concentration for Blue Crabs at the Mill River. It is clearly above background concentrations in Blue Crabs but only minimally increases blood lead concentrations above 5 ug/dl relative to the baseline model.

## **Appendix C. 2022 Chain of Custody Forms**



**2022 CRAB TISSUE FIELD CHAIN OF CUSTODY**

For questions regarding this sample contact:  
MEGHAN LALLY 860-424-3061

Waterbody: Mill River Area: I II III V  
 Location: Upstream/At the tide dam on Harbor Rd  
 Town: Fairfield, CT

Station ID: 18478-791  
 Latitude: 41.13780334  
 Longitude: -73.27530496  
 Trip ID: ET22-18478-081022

Collection Date: 8/10/22 @ 1330  
 Gear: Hand lines & net (Bait: chicken)  
 WPLR Lead: Lally, O'Brien, Clayton  
 Crew: JH, GH, TN

SOFT-SHELL, EGG-BEARING FEMALES, AND CRABS WITH A CARPACE WIDTH <125 MM ARE TO BE RETURNED TO THE WATER. KEEP ALL OTHER CRABS ON ICE AFTER COLLECTION.

Specimen Field ID	Species	Carapace Width (mm)	Sex (M/F)	Comments
22-C-001	Blue Crab ( <i>Callinectes sapidus</i> )	127	M	
22-C-002	Blue Crab ( <i>Callinectes sapidus</i> )	151	M	
22-C-003	Blue Crab ( <i>Callinectes sapidus</i> )	139	M	
22-C-004	Blue Crab ( <i>Callinectes sapidus</i> )	132	M	
22-C-005	Blue Crab ( <i>Callinectes sapidus</i> )	126	M	
22-C-006	Blue Crab ( <i>Callinectes sapidus</i> )	145	M	
<del>22-C-</del>	<del>Blue Crab (<i>Callinectes sapidus</i>)</del>			
<del>22-C-</del>	<del>Blue Crab (<i>Callinectes sapidus</i>)</del>			
<del>22-C-</del>	<del>Blue Crab (<i>Callinectes sapidus</i>)</del>			
<del>22-C-</del>	<del>Blue Crab (<i>Callinectes sapidus</i>)</del>			
<del>22-C-</del>	<del>Blue Crab (<i>Callinectes sapidus</i>)</del>			
<del>22-C-</del>	<del>Blue Crab (<i>Callinectes sapidus</i>)</del>			
<del>22-C-</del>	<del>Blue Crab (<i>Callinectes sapidus</i>)</del>			
<del>22-C-</del>	<del>Blue Crab (<i>Callinectes sapidus</i>)</del>			
<del>22-C-</del>	<del>Blue Crab (<i>Callinectes sapidus</i>)</del>			
<del>22-C-</del>	<del>Blue Crab (<i>Callinectes sapidus</i>)</del>			

Field Comments:  
 All females collected were <125mm so released  
 All crabs w/in 75% of each other

Relinquished By: (Print) _____ (Collector) (Sign) <u>N/A DEEP</u> Date/Time: <u>collected</u>	Received by: (Print) <u>M. Lally</u> (Receiving Lab) (Sign) <u>M. Lally</u> Date/Time: <u>08/10/22 14:30</u>
Relinquished By: (Print) <u>Meghan Lally</u> (DEEP Lab) (Sign) <u>M. Lally</u> Date/Time: <u>09/02/22</u>	Received by: (Print) <u>C. Perkon</u> (Receiving Lab) (Sign) <u>[Signature]</u> Date/Time: <u>9/2/22 0930</u>





2022 CRAB TISSUE FIELD CHAIN OF CUSTODY

For questions regarding this sample contact:  
MEGHAN LALLY 860-424-3061

Waterbody: Mill River Area: (I, II, III, V) Station ID: 18479-PRC1  
 Location: DC Route 11 - Behind Market's Latitude: 41.1404358  
(Former Exide site) Longitude: -73.2736972  
 Town: Fairfield, CT Trip ID: FT22-18479-081022

Collection Date: 08/10/22  
 Gear: Hand Lines + Nets (choker)  
 WPLR Lead: Lally/O'Brien-Clayton  
 Crew: JH, GH, EN

SOFT-SHELL, EGG-BEARING FEMALES, AND CRABS WITH A CARPACE WIDTH <125 MM ARE TO BE RETURNED TO THE WATER. KEEP ALL OTHER CRABS ON ICE AFTER COLLECTION.

Specimen Field ID	Species	Carapice Width (mm)	Sex (M/F)	Comments
22-C-007	Blue Crab ( <i>Callinectes sapidus</i> )	142	M	
22-C-008	Blue Crab ( <i>Callinectes sapidus</i> )	132	M	
22-C-009	Blue Crab ( <i>Callinectes sapidus</i> )	125	M	
22-C-010	Blue Crab ( <i>Callinectes sapidus</i> )	140	M	
22-C-011	Blue Crab ( <i>Callinectes sapidus</i> )	159	M	1 leg detached but present
22-C-012	Blue Crab ( <i>Callinectes sapidus</i> )	124	M	<5"
22-C-013	Blue Crab ( <i>Callinectes sapidus</i> )	125	M	
22-C-014	Blue Crab ( <i>Callinectes sapidus</i> )	143	M	
22-C-015	Blue Crab ( <i>Callinectes sapidus</i> )	141	M	
22-C-016	Blue Crab ( <i>Callinectes sapidus</i> )	139	M	
22-C-017	Blue Crab ( <i>Callinectes sapidus</i> )	144	M	
22-C-018	Blue Crab ( <i>Callinectes sapidus</i> )	129	M	
22-C-019	Blue Crab ( <i>Callinectes sapidus</i> )	125	M	Missing F.R. CLAW
22-C-020	Blue Crab ( <i>Callinectes sapidus</i> )	140	M	Missing R. CLAW
22-C-021	Blue Crab ( <i>Callinectes sapidus</i> )	160	M	Missing R. CLAW

Field Comments:  
 23 ♂ crabs incl. 3 undersized crabs.  
 (♀ observed but all <5" so released)

Relinquished By: (Print) (Collector) (Sign) Date/Time:	Received by: (Print) (Receiving Lab) (Sign) Date/Time:
<u>M. Lally</u> <u>M. Lally</u> <u>08/10/22 1430</u>	<u>M. Lally</u> <u>M. Lally</u> <u>08/10/22 1430</u>
Relinquished By: (Print) (DEBP Lab) (Sign) Date/Time:	Received by: (Print) (Receiving Lab) (Sign) Date/Time:
<u>MEGHAN LALLY</u> <u>M. Lally</u> <u>09/02/22</u>	<u>C. Rev Ems</u> <u>[Signature]</u> <u>9/2/22</u>



**2022 CRAB TISSUE FIELD CHAIN OF CUSTODY**

*Pg 2 of 2*

For questions regarding this sample contact:  
MEGHAN LALLY 860-424-3061

Waterbody: Mill River Area: I II III V  
 Location: Behind Martel's Restaurant (Former Exide Site)  
 Town: Fairfield, CT

Station ID: 18479-PRC1  
 Latitude: 41.1404358  
 Longitude: -73.2736972  
 Trip ID: F122-18479-DB1022

Collection Date: 08/10/22  
 Gear: Handline + net (w/ chicken)  
 WPLR Lead: Lally / O'Brien - Clayton  
 Crew: JH, GH, EN

SOFT-SHELL, EGG-BEARING FEMALES, AND CRABS WITH A CARAPACE WIDTH <125 MM ARE TO BE RETURNED TO THE WATER. KEEP ALL OTHER CRABS ON ICE AFTER COLLECTION.

Specimen Field ID	Species	Carapace Width (mm)	Sex (M/F)	Comments
22-C-022	Blue Crab ( <i>Callinectes sapidus</i> )	120	M	8/19/22 25" Discarded
22-C-023	Blue Crab ( <i>Callinectes sapidus</i> )	139	M	Missing R. claw + 2 legs (R+L)
22-C-024	Blue Crab ( <i>Callinectes sapidus</i> )	139	M	Missing R+L claws
22-C-025	Blue Crab ( <i>Callinectes sapidus</i> )	128	M	Missing 1 R. leg
22-C-024	Blue Crab ( <i>Callinectes sapidus</i> )	122	M	25" Missing R. claw - Discarded
22-C-027	Blue Crab ( <i>Callinectes sapidus</i> )	143	M	Missing R. claw + 2 swimmeret
22-C-028	Blue Crab ( <i>Callinectes sapidus</i> )	163	M	Missing R. claw + 2 legs
22-C-029	Blue Crab ( <i>Callinectes sapidus</i> )	142	M	Missing 1 R. leg + 1 L. leg
<del>22-C-</del>	<del>Blue Crab (<i>Callinectes sapidus</i>)</del>			
<del>22-C-</del>	<del>Blue Crab (<i>Callinectes sapidus</i>)</del>			
<del>22-C-</del>	<del>Blue Crab (<i>Callinectes sapidus</i>)</del>			
<del>22-C-</del>	<del>Blue Crab (<i>Callinectes sapidus</i>)</del>			
<del>22-C-</del>	<del>Blue Crab (<i>Callinectes sapidus</i>)</del>			
<del>22-C-</del>	<del>Blue Crab (<i>Callinectes sapidus</i>)</del>			
<del>22-C-</del>	<del>Blue Crab (<i>Callinectes sapidus</i>)</del>			

Field Comments:

Relinquished By: (Print) <u>MEGHAN LALLY</u> (Collector) (Sign) <u>[Signature]</u> Date/Time: <u>08/10/22</u>	Received by: (Print) <u>M. Lally</u> (Receiving Lab) (Sign) <u>[Signature]</u> Date/Time: <u>8.10.22 1430</u>
Relinquished By: (Print) <u>MEGHAN LALLY</u> (DEEP Lab) (Sign) <u>[Signature]</u> Date/Time: <u>09/02/22</u>	Received by: (Print) <u>C. Pavlakis</u> (Receiving Lab) (Sign) <u>[Signature]</u> Date/Time: <u>9/2/22 0830</u>





Connecticut Department of  
**ENERGY &  
ENVIRONMENTAL  
PROTECTION**

**2022 CRAB TISSUE FIELD CHAIN OF CUSTODY**

For questions regarding this sample contact:  
**MEGHAN LALLY 860-424-3061**

Waterbody: Mill River Area: I II III V  
Location: us tide dam at Harbor Rd  
Town: Fairfield, CT

Station ID: 18478-TG1  
Latitude: 41.13280324  
Longitude: -73.27530496  
Trip ID: FT22-18478-082922

Collection Date: 08.23.22 10:30A  
Gear: Handlines/nets  
WPLR Lead: Lally  
Crew: ENITS

**SOFT-SHELL, EGG-BEARING FEMALES, AND CRABS WITH A CARAPACE WIDTH <125 MM ARE TO BE RETURNED TO THE WATER. KEEP ALL OTHER CRABS ON ICE AFTER COLLECTION.**

Specimen Field ID	Species	Carapace Width (mm)	Sex (M/F)	Comments
22-C-030	Blue Crab ( <i>Callinectes sapidus</i> )	132	M	
22-C-031	Blue Crab ( <i>Callinectes sapidus</i> )	155	M	missing left rear leg
22-C-032	Blue Crab ( <i>Callinectes sapidus</i> )	130	M	
22-C-033	Blue Crab ( <i>Callinectes sapidus</i> )	126	M	
22-C-034	Blue Crab ( <i>Callinectes sapidus</i> )	135	M	
22-C-035	Blue Crab ( <i>Callinectes sapidus</i> )	146	M	
22-C-036	Blue Crab ( <i>Callinectes sapidus</i> )	135	M	
22-C-037	Blue Crab ( <i>Callinectes sapidus</i> )	147	M	
<del>22-C-</del>	<del>Blue Crab (<i>Callinectes sapidus</i>)</del>	<del></del>	<del></del>	<del></del>
<del>22-C-</del>	<del>Blue Crab (<i>Callinectes sapidus</i>)</del>	<del></del>	<del></del>	<del></del>
<del>22-C-</del>	<del>Blue Crab (<i>Callinectes sapidus</i>)</del>	<del></del>	<del></del>	<del></del>
<del>22-C-</del>	<del>Blue Crab (<i>Callinectes sapidus</i>)</del>	<del></del>	<del></del>	<del></del>
<del>22-C-</del>	<del>Blue Crab (<i>Callinectes sapidus</i>)</del>	<del></del>	<del></del>	<del></del>
<del>22-C-</del>	<del>Blue Crab (<i>Callinectes sapidus</i>)</del>	<del></del>	<del></del>	<del></del>
<del>22-C-</del>	<del>Blue Crab (<i>Callinectes sapidus</i>)</del>	<del></del>	<del></del>	<del></del>

Field Comments:  
2nd visit to location (previously collected on 8/10/22 composite muscle + hepatopancreas separately - submit to CSE for lead analysis  
DEEP composite ID: 18478-BLCR-2M, 18478-BLCR-2H

Relinquished By: (Print) _____ (Collector) (Sign) _____ Date/Time: <u>N/A</u>	Received by: (Print) <u>Meghan Lally</u> (Receiving Lab) (Sign) <u>M. Lally</u> Date/Time: <u>08/23/22 14:30</u>
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Relinquished By: (Print) <u>Meghan Lally</u> (DEEP Lab) (Sign) <u>M. Lally</u> Date/Time: <u>09/02/22</u>	Received by: (Print) <u>C. Perkins</u> (Receiving Lab) (Sign) _____ Date/Time: <u>9/2/22 0830</u>
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Reviewed By:

**Turn Around Time in Working Days (Circle one)**  
 Standard 28 Day  
 Rush 14 Day  
 Regular 7 Day  
 Price 25% Surcharges may apply  
 Surcharges 50%  
 Discounts or Surcharges may apply

**CESE CHAIN OF CUSTODY**

Center for Environmental Sciences and Engineering

University of Connecticut

3107 Horsebarn Hill Road; U-4210 Storrs, Ct 06269-5210

Phone: (860) 486-4015 Fax: (860) 486-5488

CT DEEP Bureau of Water Management

2022 Mill River Blue Crab Tissue Investigation

(Fairfield, CT)

79 Elm Street

Company	Project Contact	Billing Contact
CT DEEP Bureau of Water Management	Meghan Lally	Meghan Lally
Address	Phone/Fax	Phone
79 Elm Street	860-424-3061	860-424-3061
City	E-Mail	E-Mail
Hartford	Please email data to DEEP_MonitoringData@ct.gov	Please email data to DEEP_MonitoringData@ct.gov
State	Reporting Request	Purchase Order/Reference Number
CT	06106	
Zip		

**SAMPLE TRANSFER (sign below)**

1. Relinquished By:	Date:	3. Relinquished By:	Date:
<i>Meghan Lally</i>	07/02/22	<i>M Lally</i>	07/02/22
(print/sign)	Time: 09:19	(print/sign)	Time:
2. Received By:	Date:	4. Received By:	Date:
<i>[Signature]</i>	07/12/22	<i>[Signature]</i>	07/12/22
(print/sign)	Time: 0930	(print/sign)	Time:

Field Number	CESE ID	Organics:		Nutrients:		Matrix (Key Below)	Preservation (Key Below)	Remediation:	Number of Containers	Comments	Metals - Lead (Pb)	% Moisture	% Lipids
		Collection Date	Time	Collection Date	Time								
1	18479-BLCR-1	220253-001	08/10/22	10:00	T	F	F	1	7 crabs for composting - analyze hepatopancreas and muscle separately	X	X	X	X
2	18479-BLCR-2	-002	08/10/22	10:00	T	F	F	1	7 crabs for composting - analyze hepatopancreas and muscle separately	X	X	X	X
3	18479-BLCR-3	-003	08/10/22	10:00	T	F	F	1	7 crabs for composting - analyze hepatopancreas and muscle separately	X	X	X	X
4	18478-BLCR-1	-004	08/10/22	13:30	T	F	F	1	6 crabs for composting - analyze hepatopancreas and muscle separately	X	X	X	X
5	18478-BLCR-2	220253-005	08/24/22	10:30	T	F	F	1	8 crabs for composting - analyze hepatopancreas and muscle separately	X	X	X	X
6													
7													
8													
9													
10													
11													
12													
13													
14													
15													

Please Circle One: **NON-HAZARDOUS** **HAZARDOUS** **HIGHLY CONTAMINATED** **UNKNOWN**  
 \*\*\*\*\*If needs to be preserved add P next to preservation code \*\*\*\*\*  
 In comments area, designate MS/MSD sample for organics, if needs filtering, why hazardous, known sample matrix and analyte levels, or any additional pertinent information  
 Matrix: DW = Drinking Water, GW = Ground Water, WW = Waste Water, SW = Sea Water, L = Liquid, S = Solid, SO = Soil, A = Air, F = Filter, T = Biological Tissue, O = Other  
 Preservation: R = Refrigerate (4°C), F = Freeze, N = Nitric Acid, H = Hydrochloric Acid, O = Other  
 M = Methanol, MC = Methylene Chloride, SB = Sodium Bisulfite, C = Chloroform, S = Sulfuric Acid

## Appendix D. 2022 Mill River Blue Crab Tissue Total Lead Analysis Results

University of Connecticut Center for Environmental Sciences & Engineering Building 4 Annex 3107 Horsebarn Hill Road, U4210 Storrs, CT 06269-4210					Fax # ( 860 ) 486-5488 Telephone # ( 860 ) 486-4015 Email: cesecustserv@uconn.edu Analyst: Snieguole Stapanskaite		CT DEEP Order # 220253 Matrix: Tissue Contact: Meghan Lally Report Date: 10/31/2022 Reported by: C. Perkins	
Digestion Method #					200.3			
EPA Analysis Method #					6020B		EPA ILM 3.0	
Metals					ICP-MS			
Units					µg/g			
Prep date					10/10/22		10/7/22	
Analysis date					10/11/22		10/21/22	
WET WEIGHT					Pb		% Solid	
LIM #	FIELD #	Tissue Type	Collected	Received			% Lipid	
220253-001	18479-BLCR-1	Muscle	8/10/22	9/2/22	0.031	19.3	4.5	
220253-002	18479-BLCR-2	Muscle	8/10/22	9/2/22	0.028	19.8	4.1	
220253-003	18479-BLCR-3	Muscle	8/10/22	9/2/22	0.095	20.5	3.9	
220253-004	18478-BLCR-1	Muscle	8/10/22	9/2/22	0.037	20.6	5.3	
220253-005	18478-BLCR-2	Muscle	8/24/22	9/2/22	0.021	19.4	4.5	
220253-001	18479-BLCR-1	Hepatopancreas	8/10/22	9/2/22	0.190	25.7	16.7	
220253-002	18479-BLCR-2	Hepatopancreas	8/10/22	9/2/22	0.185	24.4	15.1	
220253-003	18479-BLCR-3	Hepatopancreas	8/10/22	9/2/22	0.652	23.4	14.8	
220253-004	18478-BLCR-1	Hepatopancreas	8/10/22	9/2/22	0.148	27.7	22.1	
220253-005	18478-BLCR-2	Hepatopancreas	8/24/22	9/2/22	0.131	25.2	15.4	
Average Practical Quantitation Limit (PQL) ug/g					0.081			
Limit of Detection (LOD) ug/g					0.008			
NSS = No Sample Sent					ND = Not Detected			

Notes:

18479 samples were collected adjacent to the former Exide site in Fairfield, CT. 18478 samples were collected downstream of the former Exide site, at the Harbor Road tide gate

## Appendix E. 1992 Mill River Blue Crab Tissue Metal Analysis Results

Data Source: Table "Metal Concentrations (mg/kg-wet weight) in Blue Crab muscle tissue and hepatopancreas (tomalley) collected from Tide Mill Inn North, Area III, Fairfield, CT on 22 July 1992" in memo dated 24 September 1992. From Paul Stacey, Senior Environmental Analyst, CT DEP. To: Art Leffert, Director, Town of Fairfield, Department of Health. Subject: Analysis of Blue Crabs from Mill River.

Project Area	Location Description	Collection Date	DEP Sample ID	DOHS Sample ID	Tissue Anatomy	Total Lead (mg/kg)	Sex	Carapace Width (cm)	Weight (g)
Area III	Upstream of Harbor Rd.	7/22/92	BCM-FF-1	22137330	M	0.33	M	15.2	22.8
Area III	Upstream of Harbor Rd.	7/22/92	BCM-FF-2	22137331	M	0.41	F	14.9	14.4
Area III	Upstream of Harbor Rd.	7/22/92	BCM-FF-3	22137332	M	1.10	M	15.0	18.8
Area III	Upstream of Harbor Rd.	7/22/92	BCM-FF-4	22137333	M	0.41	M	13.3	12.9
Area III	Upstream of Harbor Rd.	7/22/92	BCM-FF-5	22137334	M	0.15	M	14.8	11.3
Area III	Upstream of Harbor Rd.	7/22/92	BCM-FF-1	22137335	H	3.50	M	15.2	20.7
Area III	Upstream of Harbor Rd.	7/22/92	BCM-FF-2	22137336	H	4.30	F	14.9	11.3
Area III	Upstream of Harbor Rd.	7/22/92	BCM-FF-3	22137337	H	1.10	M	15.0	8.6
Area III	Upstream of Harbor Rd.	7/22/92	BCM-FF-4	22137338	H	2.50	M	13.3	8.9
Area III	Upstream of Harbor Rd.	7/22/92	BCM-FF-5	D 22137339	H	1.30	M	14.8	12.1

### Notes:

1. Samples were collected on July 22, 1992 by the Fairfield Health Department and shipped to the Connecticut Department of Health Services (DOHS) laboratory on August 28, 1992 for analysis. Results were reported to CT DEP by DOHS on September 11, 1992.
2. Samples represent individual Blue Crab (*Callinectes sapidus*), not composite samples. The muscle (M) of each crab was analyzed separately from the hepatopancreas (H).
3. Total lead detection limit was 0.1 mg/kg wet weight.