NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION

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# Mercury, PCBs, Organochlorine Pesticides, and PFAS Analyses of Fish Collected in 2019 from the Long Island Sound

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## ABSTRACT

The Analytical Services Unit (ASU) at Hale Creek Field Station (HCFS) conducted chemical analyses on a total of 8 fish samples collected from the Long Island Sound. All 8 samples were analyzed for total mercury, total PCBs, selected organochlorine pesticides, and selected per- and polyfluoroalkyl substances (PFAS). Maximum contaminant levels found in the samples were 0.441 µg/g for total mercury, 0.746 µg/g for total PCBs, 0.0741 µg/g for total DDT, 0.0272 µg/g for total chlordanes, 1.00 ng/g for perfluoroundecanoic acid (PFUnA), and 2.44 ng/g for perfluorooctane sulfonamide (PFOSA). Levels were below detection limits for 2,4'-DDE, 2,4'-DDT, heptachlor, heptachlor epoxide, oxychlordane, trans-chlordane, aldrin, photomirex, mirex, hexachlorocyclohexanes, hexachlorobenzene, perfluorohexanoic acid (PFHxA), perfluoroheptanoic acid (PFHpA), perfluorooctanoic acid (PFOA), perfluorononanoic acid (PFNA), perfluorodecanoic acid (PFDA), perfluorododecanoic acid (PFDoA), perfluorobutanesulfonic acid (PFBS), perfluorohexane sulfonate (PFHxS) and perfluorooctanesulfonic acid (PFOS).

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NEW YORK STATE OF OPPORTUNITY | Department of Environmental Conservation

## SAMPLE INFORMATION

This report consists of results of analyses of 8 fish samples collected in 2019 from the Long Island Sound for the Toxic Substance Monitoring Program. The fish collected were 8 Striped Bass (STB). The fish were collected by Kurt Gottschall, David Ellis, and Deb Pacileo from Connecticut Department of Energy and Environmental Protection. Collection records for all samples are attached at the end of this report.

## LABORATORY METHODS

The ASU analyzed all 8 samples for total mercury, total PCBs, selected organochlorine pesticides, and selected PFAS. The ASU Lab Numbers assigned to the samples were 19-1045-H through 19-1052-H. The ASU program name assigned to the samples was LISound-2019.

**Sample preparation.** Samples were transported to HCFS where they were stored at -20°C or colder. The samples were prepared for analysis in accordance with HCFS Standard Operating Procedure (SOP) *PrepLab4*. All samples were dissected, ground, and homogenized at HCFS.

**Mercury analysis.** Samples were analyzed for total mercury in fish tissue by thermal decomposition, amalgamation and atomic absorption spectrophotometry using a Milestone Tri-Cell Direct Mercury Analyzer, DMA-80 [HCFS SOP *HC-405 (Total Mercury)*]. The method is based on EPA method 7473 Mercury in Solids and Solutions by Thermal Decomposition, Amalgamation and Atomic Absorption Spectrophotometry (2007).

**PCB/pesticides analysis.** Samples were analyzed for PCBs and selected organochlorine pesticides by capillary GC-ECD [HCFS SOP *OC1.108 (Organochlorine Residues)*]. At least ten percent of the samples were qualitatively confirmed by capillary GC-MS. Prior to analysis, each sample was freeze-dried and soxhlet-extracted with hexane/acetone (1:1), followed by a florisil cleanup step. All samples were analyzed for three PCB Aroclors (Aroclors 1242 and sum of Aroclors 1254/1260) and 19 organochlorine pesticides and metabolites (4,4'-DDE; 4,4'-DDD; 4,4'-DDT; 2,4'-DDE; 2,4'-DDT; heptachlor; heptachlor epoxide; trans-chlordane; cis-chlordane; trans-nonachlor; cis-nonachlor; oxychlordane; aldrin; photomirex; mirex; HCB; alpha-HCH; beta-HCH; and gamma-HCH). The method is based on *FDA Pesticide Analytical Manual Vol. 1, 3rd edition*, Sections 202, 203 and 304.

**PFAS analysis.** Samples were analyzed for selected PFAS by LC/MS/MS using isotopic dilution [HCFS SOP *HC-511 (PFAS)*]. Prior to analysis, each sample was extracted with 0.05 N KOH in methanol followed by ENVI-Carb and SPE cleanup steps. All samples were analyzed quantitatively for 11 PFAS (7 carboxylic acids: PFHxA, PFHpA, PFOA, PFNA, PFDA, PFUnA, and PFDoA; 3 sulfonic acids: PFBS, PFHxS, and PFOS; 1 sulfonamide: PFOSA). Samples were also qualitatively monitored for an additional 11 PFAS (PFTrA, PFTeA, PFPeS, PFHpS, PFNS, PFDS, N-MeFOSAA, N-EtFOSAA, 4:2 FTS, 6:2 FTS, and 8:2 FTS). The method was developed using guidance from the *Department of Defense and Department of Energy consolidated Quality Systems Manual for Environmental Laboratories Version 5.3* and EPA method 533: Determination of Per- and Polyfluoroalkyl Substances in Drinking Water by Isotope Dilution Anion Exchange Solid Phase Extraction and Liquid-Chromatography/Tandem Mass Spectrometry.

**LABORATORY RESULTS**

Results are contained in the following tables:

- Table 1: Sample collection, preparation information, and concentration of Mercury in µg/g wet weight;
- Table 2: Percent moisture, percent lipid, and concentrations of PCBs and DDT in µg/g wet weight;
- Table 3: Concentrations of Chlordane in µg/g wet weight;
- Table 4: Concentrations of PFAS in ng/g wet weight.

In each table, the rows are ordered by lab number.

Concentrations were below the detection limit for 2,4'-DDE, 2,4'-DDT, heptachlor, heptachlor epoxide, oxychlordane, trans-chlordane, aldrin, photomirex, mirex, hexachlorocyclohexanes, hexachlorobenzene, PFHxA, PFHpA, PFOA, PFNA, PFDA, PFDoA, PFBS, PFHxS, and PFOS.

All sample information and results are also contained in file “REP 21-12 (LISound-2019).xlsx”, formatted in Excel. General information and a data dictionary for the tables and the Excel file are shown in Appendix A. The quality control procedures and quality control results for these analyses are described in Appendix B. The method detection limit (MDL) for each analyte is listed in Table B1 (Appendix B).

## Table 1: Sample Collection, Preparation Information, and Concentration of Mercury in µg/g in Fish Collected from the Long Island Sound in 2019

| LABNO | TAGNO | SPP | SDATE | LOCATION | PREP | LENMM | WGTG | PROGRAM | Hg |
|---|---|---|---|---|---|---|---|---|---|
| 19-1045-H | 0997375 | STB | 20191016 | Long Island Sound | SF | 931 | 6770 | LISound-2019 | 0.343 |
| 19-1046-H | FA2019044-1 | STB | 20191008 | Long Island Sound | SF | 782 | 3835 | LISound-2019 | 0.224 |
| 19-1047-H | FA2019044-2 | STB | 20191008 | Long Island Sound | SF | 751 | 3505 | LISound-2019 | 0.155 |
| 19-1048-H | FA2019044-3 | STB | 20191008 | Long Island Sound | SF | 856 | 5860 | LISound-2019 | 0.441 |
| 19-1049-H | FA2019044-4 | STB | 20191008 | Long Island Sound | SF | 834 | 4730 | LISound-2019 | 0.401 |
| 19-1050-H | FA2019044-5 | STB | 20191008 | Long Island Sound | SF | 972 | 8115 | LISound-2019 | 0.164 |
| 19-1051-H | FA2019044-6 | STB | 20191008 | Long Island Sound | SF | 900 | 6490 | LISound-2019 | 0.364 |
| 19-1052-H | 0997393 | STB | 20191016 | Long Island Sound | SF | 1034 | 12130 | LISound-2019 | 0.353 |

Note: See Appendix A for general information and a data dictionary for this table.

## Table 2: Percent Moisture, Percent Lipid, and Concentrations of PCBs and DDT in µg/g in Fish Collected the Long Island Sound in 2019

| LABNO | TAGNO | SPP | PCTMOIST | PCTLPD | PCB Aroclors | | | DDT and metabolites | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | AR1242 | AR125460 | TPCB | PPDDE | PPDDD | PPDDT | OPDDE | OPDDT | TDDT |
| 19-1045-H | 0997375 | STB | 79.58 | 0.83 | 0.0158 | 0.131 | 0.147 | 0.0107 | -0.002 | -0.002 | -0.005 | -0.005 | 0.0107 |
| 19-1046-H | FA2019044-1 | STB | 78.23 | 1.09 | 0.0156 | 0.213 | 0.229 | 0.0107 | -0.002 | -0.002 | -0.005 | -0.005 | 0.0107 |
| 19-1047-H | FA2019044-2 | STB | 77.93 | 1.80 | 0.0199 | 0.115 | 0.135 | 0.00743 | -0.002 | -0.002 | -0.005 | -0.005 | 0.00743 |
| 19-1048-H | FA2019044-3 | STB | 79.82 | 0.46 | 0.0336 | 0.138 | 0.172 | 0.0134 | -0.002 | -0.002 | -0.005 | -0.005 | 0.0134 |
| 19-1049-H | FA2019044-4 | STB | 79.18 | 0.99 | 0.0832 | 0.406 | 0.489 | 0.0197 | 0.00439 | 0.00314 | -0.005 | -0.005 | 0.0272 |
| 19-1050-H | FA2019044-5 | STB | 76.35 | 4.78 | 0.0854 | 0.307 | 0.392 | 0.0266 | 0.00853 | 0.00284 | -0.005 | -0.005 | 0.0380 |
| 19-1051-H | FA2019044-6 | STB | 74.75 | 6.37 | 0.0798 | 0.629 | 0.709 | 0.0475 | 0.0104 | 0.00512 | -0.005 | -0.005 | 0.0630 |
| 19-1052-H | 0997393 | STB | 70.12 | 10.49 | 0.111 | 0.635 | 0.746 | 0.0560 | 0.0129 | 0.00518 | -0.005 | -0.005 | 0.0741 |

Note: See Appendix A for general information and a data dictionary for this table.

## Table 3: Concentrations of Chlordane in µg/g in Fish Collected from the Long Island Sound in 2019

| LABNO | TAGNO | SPP | Chlordanes | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | OXYCHLOR | TRANSCHL | CISCHL | TRANSNON | CISNON | TCHL |
| 19-1045-H | 0997375 | STB | -0.005 | -0.005 | -0.005 | -0.005 | -0.005 | 0.00000 |
| 19-1046-H | FA2019044-1 | STB | -0.005 | -0.005 | -0.005 | -0.005 | -0.005 | 0.00000 |
| 19-1047-H | FA2019044-2 | STB | -0.005 | -0.005 | -0.005 | -0.005 | -0.005 | 0.00000 |
| 19-1048-H | FA2019044-3 | STB | -0.005 | -0.005 | -0.005 | -0.005 | -0.005 | 0.00000 |
| 19-1049-H | FA2019044-4 | STB | -0.005 | -0.005 | -0.005 | -0.005 | -0.005 | 0.00000 |
| 19-1050-H | FA2019044-5 | STB | -0.005 | -0.005 | -0.005 | -0.005 | -0.005 | 0.00000 |
| 19-1051-H | FA2019044-6 | STB | -0.005 | -0.005 | 0.00697 | 0.00866 | 0.00546 | 0.0211 |
| 19-1052-H | 0997393 | STB | -0.005 | -0.005 | 0.00912 | 0.0116 | 0.00649 | 0.0272 |

Note: See Appendix A for general information and a data dictionary for this table.

## Table 4: Concentration of PFAS in ng/g in Fish Collected from the Long Island Sound in 2019

| LABNO | TAGNO | SPP | PFAS | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | PFHxA | PFHpA | PFOA | PFNA | PFDA | PFUnA | PFDoA | PFBS | PFHxS | PFOS | PFOSA |
| 19-1045-H | 0997375 | STB | -1.00 | -1.00 | -1.00 | -1.00 | -1.00 | -1.00 | -1.00 | -2.00 | -2.00 | -2.00 | -2.00 |
| 19-1046-H | FA2019044-1 | STB | -1.00 | -1.00 | -1.00 | -1.00 | -1.00 | -1.00 | -1.00 | -2.00 | -2.00 | -2.00 | -2.00 |
| 19-1047-H | FA2019044-2 | STB | -1.00 | -1.00 | -1.00 | -1.00 | -1.00 | -1.00 | -1.00 | -2.00 | -2.00 | -2.00 | -2.00 |
| 19-1048-H | FA2019044-3 | STB | -1.00 | -1.00 | -1.00 | -1.00 | -1.00 | 1.00 | -1.00 | -2.00 | -2.00 | -2.00 | -2.00 |
| 19-1049-H | FA2019044-4 | STB | -1.00 | -1.00 | -1.00 | -1.00 | -1.00 | -1.00 | -1.00 | -2.00 | -2.00 | -2.00 | 2.44 |
| 19-1050-H | FA2019044-5 | STB | -1.00 | -1.00 | -1.00 | -1.00 | -1.00 | -1.00 | -1.00 | -2.00 | -2.00 | -2.00 | -2.00 |
| 19-1051-H | FA2019044-6 | STB | -1.00 | -1.00 | -1.00 | -1.00 | -1.00 | -1.00 | -1.00 | -2.00 | -2.00 | -2.00 | -2.00 |
| 19-1052-H | 0997393 | STB | -1.00 | -1.00 | -1.00 | -1.00 | -1.00 | -1.00 | -1.00 | -2.00 | -2.00 | -2.00 | -2.00 |

Note: See Appendix A for general information and a data dictionary for this table.

# APPENDIX A

## General information for using tables and electronic file: "REP 21-12 (LISound-2019).xlsx"

1. Chemical concentrations are reported in µg/g (ppm) and ng/g (ppb) wet weight.
2. The results are reported to no more than three significant figures.
3. A negative concentration indicates the concentration was below the MDL. The number following the negative sign is the MDL.

## Data dictionary for tables and electronic file: "REP 21-12 (LISound-2019).xlsx"

1. LABNO - unique sample lab number assigned at Hale Creek Field Station (character)
2. TAGNO - sample identifier assigned at time of collection and contained in collection records (character)
3. SPP - species code; STB=Striped Bass (character)
4. SDATE - date sample was collected; format is YYYYMMDD (numeric)
5. LOCATION - location where sample was collected (character)
6. AGE - age of fish in years, if determined (numeric)
7. SEX - sex of fish, if determined; M=male; F=female (character)
8. PREP - preparation method; SF=standard fillet, W=whole fish; W-HV=whole fish minus the head and viscera (character)
9. LENMM - fish length in mm; mean length in mm if sample is composite (numeric)
10. WGTG - fish weight in g; total weight in g if sample is composite (numeric)
11. PROGRAM - program name assigned by Hale Creek Field Station (character)
12. MAXLEN - maximum fish length in mm if sample is composite (numeric)
13. MINLEN - minimum fish length in mm if sample is composite (numeric)
14. SDLEN - standard deviation of fish length in mm if sample is composite (numeric)
15. MAXWGT - maximum fish weight in g if sample is composite (numeric)
16. MINWGT - minimum fish weight in g if sample is composite (numeric)
17. SDWGT - standard deviation of fish weight in g if sample is composite (numeric)
18. NOANLY - number of individuals in sample; if NOANLY is greater than 1, then sample is composite (numeric)
19. PCTMOIST - percent moisture in sample (numeric)
20. PCTLPD - percent lipid in sample (numeric)
21. Hg - mercury (numeric)
22. AR1242 - Aroclor 1242 (numeric)
23. AR125460 - sum of Aroclors 1254 and 1260 (numeric)
24. TPCB - total PCBs; sum of AR1242 and AR125460 (numeric)
25. PPDDE - 4,4'-DDE (numeric)
26. PPDDD - 4,4'-DDD (numeric)
27. PPDDT - 4,4'-DDT (numeric)
28. OPDDE - 2,4'-DDE (numeric)
29. OPDDT - 2,4'-DDT (numeric)
30. TDDT - total DDT; sum of PPDDE, PPDDD, PPDDT, OPDDE and OPDDT (numeric)
31. HEPT - heptachlor (numeric)
32. HEPTEPOX - heptachlor epoxide (numeric)
33. THEPT - total heptachlor; sum of HEPT and HEPTEPOX (numeric)
34. OXYCHLOR - oxychlordane (numeric)
35. TRANSCHL - *trans*-chlordane (numeric)
36. CISCHL - *cis*-chlordane (numeric)
37. TRANSNON - *trans*-nonachlor (numeric)
38. CISNON - *cis*-nonachlor (numeric)
39. TCHL - total chlordanes; sum of OXYCHLOR, TRANSCHL, CISCHL, TRANSNON and CISNON (numeric)
40. ALDRIN - aldrin (numeric)
41. MIREX - mirex (numeric)
42. PHOMIREX - photomirex (numeric)
43. TMIREX - total mirex; sum of MIREX and PHOMIREX (numeric)
44. AHCH - α-hexachlorocyclohexane; α-BHC; α-benzene hexachloride (numeric)
45. BHCH - β-hexachlorocyclohexane; β-BHC; β-benzene hexachloride (numeric)
46. GHCH - γ-hexachlorocyclohexane; γ-BHC; γ-benzene hexachloride; lindane (numeric)
47. THCH - total HCH; sum of AHCH, BHCH and GHCH (numeric)
48. HCB - hexachlorobenzene (numeric)
49. PFHxA - Perfluorohexanoic acid (numeric)
50. PFHpA - Perfluoroheptanoic acid (numeric)
51. PFOA - Perfluorooctanoic acid (numeric)
52. PFNA - Perfluorononanoic acid (numeric)
53. PFDA - Perfluorodecanoic acid (numeric)
54. PFUnA - Perfluoroundecanoic acid (numeric)

55. PFDoA - Perfluorododecanoic acid (numeric)
56. PFBS - Perfluorobutanesulfonic acid (numeric)
57. PFHxS - Perfluorohexanesulfonic acid (numeric)
58. PFOS - Perfluorooctanesulfonic acid (numeric)
59. PFOSA - Perfluorooctane sulfonamide (numeric)

# APPENDIX B

## Quality control for mercury

To determine mercury concentration, each sample was analyzed twice (two separate aliquots of the same homogenate) and the average was reported.

The quality control for mercury included analyses of, at minimum, one reference material sample, one laboratory duplicate, and one method blank for every 20 samples. For the reported analyses, there was one method blank, four reference material samples, and one duplicate sample. The reference materials were one SRM 2976, two SRM 1947, and two DORM-4 Dogfish Muscle from NRC, Canada. For each laboratory duplicate analysis, four aliquots of the same homogenate were analyzed; the first and second aliquots were averaged and the third and fourth aliquots were averaged, and the absolute value of the relative percent difference (|RPD|) of the two averages was determined. The reference material sample and laboratory duplicate results were used to determine accuracy and precision, respectively, of the fish tissue sample results. The procedure blank (laboratory water used during the analysis procedure) was analyzed to determine potential contamination of fish tissue samples.

Criteria for control limits for mercury were based on recommended control limits in *Guidance for Assessing Chemical Contaminant Data for Use in Fish Advisories, Volume 1, 3rd edition* (USEPA Office of Water, November 2000) with more stringent modifications as recommended by the instrument manufacturer. Control limits for accuracy were percent recovery = 90-110 percent. The control limit for precision was the relative percent difference (RPD) of laboratory duplicate analyses ≤ 20 percent. The MDL was used to assess potential contamination. The statistically derived MDL was 0.004 μg/g Hg wet weight.

Total mercury in the method blank was below the MDL. The percent recovery of total mercury from the reference material was 100 percent for DORM-4; 100 percent for SRM 2976, and 98.8 percent for SRM 1947. The RPD for the laboratory duplicate was 10.5 percent.

## Quality control for PCBs/organochlorine pesticides

To better assess the overall accuracy and precision of the large number of organic analytes that are measured, a quality control summary is presented for the analysis dates of August 06, 2020 through October 14, 2020 includes the analyses of fish from the Long Island Sound in 2019. The quality control for this period included analyses of seven matrix spikes, six reference materials (six HRM), seven laboratory duplicates, and six method blanks. One matrix spike, reference material, laboratory duplicate, and method blank were analyzed for every 20 samples. The matrix spikes, reference material samples, and laboratory duplicates were used to determine accuracy and precision of the fish tissue sample results. The method blanks (solvent carried through the entire extraction, clean-up and analysis procedure) were used to determine potential contamination of the fish tissue samples.

Criteria for control limits were based on recommended control limits in Guidance for Assessing Chemical Contaminant Data for Use in Fish Advisories, Volume 1, 3rd edition (USEPA Office of Water, November 2000). Control limits for accuracy were percent recovery = 50-150 percent. The control limit for precision was relative standard deviation (RSD) ≤ 50 percent. The MDL was used to assess potential contamination.

The control limit for accuracy was determined to be exceeded for an analyte in the study if the mean percent recovery from the matrix spikes or reference material was outside 50-150 percent (see Table B1).

The control limit for precision was determined to be exceeded for an analyte in the study if the RSD of any of the following measures was greater than 50 percent (see Table B1):

- RSD of replicate analyses of matrix spikes or
- RSD of replicate analyses of the reference material or
- mean RSD of laboratory duplicate.

All analytes in the method blanks were below the MDL. The MDLs for the analytes are listed in Table B1.

## Quality control for PFAS

The quality control for PFAS included analyses of, at minimum, one reference material sample, one laboratory control sample, one laboratory duplicate, and one method blank for every extraction batch of up to 20 samples. For the reported analyses, there were one method blank, one reference material sample, one laboratory control sample and one duplicate sample. The reference material was one SRM 1947. The reference material samples, laboratory control samples, and laboratory duplicate results were used to determine accuracy and precision of the fish tissue sample results. The method blanks (laboratory water used during the analysis procedure) were analyzed to determine potential contamination of fish tissue samples. Criteria for control limits for PFAS were based on recommended control limits in EPA method 533: Determination of Per- and Polyfluoroalkyl Substances in Drinking Water by Isotope Dilution Anion Exchange Solid Phase Extraction and Liquid-Chromatography/Tandem Mass

Spectrometry. Control limits for accuracy were percent recovery = 70-130 percent. The control limit for precision was the relative percent difference (RPD) of laboratory duplicate analyses ≤ 30 percent. The MDL was used to assess potential contamination.

The control limit for accuracy was determined to be exceeded for an analyte in the study if the percent recovery from the laboratory control sample or reference material was outside 70-130 percent (see Table B2).

The control limit for precision was determined to be exceeded for an analyte in the study if the RSD of any of the following measures was greater than 30 percent (see Table B2).

All analytes in the method blanks were below the MDL. The MDLs for the analytes are listed in Table B2.

## Summary of quality control

All quality assurance was within control limits for accuracy, precision, and potential contamination in ASU Report 21-12.

Table B1: Percent Recovery, Precision, and MDLs of PCB Aroclors and Organochlorine Pesticides in Seven Matrix Spikes, Six Reference Material Samples, and Seven Pairs of Laboratory Duplicates Analyzed at Hale Creek Field Station (August 06, 2020 through October 14, 2020).

| ANALYTE | MATRIX SPIKE | | REFERENCE MATERIAL * | | LABORATORY DUPLICATES ** | | MDL (ng/g) |
|---|---|---|---|---|---|---|---|
| | MEAN %R | RSD (%) | MEAN %R | RSD (%) | # of PAIRS | MEAN RSD % | |
| Aroclor 1242 | 106 | 4.72 | - | - | 6 | 6.05 | 10 |
| Aroclor 1254/1260 | 108 | 2.78 | - | - | 6 | 7.51 | 30 |
| SUM Aroclor | | | 114 | 5.02 | | | - |
| 4,4'-DDE | 111 | 3.98 | - | - | 7 | 7.18 | 2 |
| 4,4'-DDD | 111 | 5.42 | - | - | 6 | 9.44 | 2 |
| 4,4'-DDT | 109 | 6.29 | - | - | 6 | 11.5 | 2 |
| 2,4'-DDE | 116 | 3.84 | - | - | - | - | 5 |
| 2,4'-DDT | 111 | 5.58 | - | - | - | - | 5 |
| Heptachlor | 104 | 9.38 | - | - | - | - | 5 |
| Heptachlor epoxide | 104 | 3.36 | - | - | - | - | 5 |
| trans-Chlordane | 103 | 5.64 | - | - | - | - | 5 |
| cis-Chlordane | 107 | 4.20 | - | - | - | - | 5 |
| trans-Nonachlor | 107 | 5.53 | - | - | 1 | 7.63 | 5 |
| cis-Nonachlor | 96.6 | 4.25 | - | - | - | - | 5 |
| Oxychlorodane | 105 | 3.69 | - | - | - | - | 5 |
| Aldrin | 84.5 | 9.22 | - | - | - | - | 5 |
| Photomirex | 105 | 4.04 | - | - | - | - | 5 |
| Mirex | 101 | 4.36 | - | - | - | - | 2 |
| alpha-HCH | 87.1 | 19.1 | - | - | - | - | 5 |
| beta-HCH | 97.5 | 16.10 | - | - | - | - | 5 |
| gamma-HCH | 91.3 | 10.37 | - | - | - | - | 5 |
| HCB | 79.2 | 11.2 | - | - | 1 | 9.20 | 2 |

*Reference material for SUM Aroclor was HRM (N=6).
**Laboratory duplicate RSDs were only used to calculate a mean RSD when the result for each sample in the pair was greater than the MDL.

Table B2: Percent Recovery, Precision, and MDLs of Per- and Polyfluoroalkyl Substances in One Laboratory Control Spike, One Reference Material Sample, and One Pairs of Laboratory Duplicate Analyzed at Hale Creek Field Station for Fish Collected from the Long Island Sound in 2019.

| ANALYTE | LABORATORY CONTROL SAMPLE | | REFERENCE MATERIAL * | | LABORATORY DUPLICATES ** | | MDL (ng/g) |
|---|---|---|---|---|---|---|---|
| | MEAN %R | RSD (%) | MEAN %R | RSD (%) | # of PAIRS | MEAN RSD % | |
| PFHxA | 122% | - | - | - | - | - | 1 |
| PFHpA | 121% | - | - | - | - | - | 1 |
| PFOA | 119% | - | - | - | - | - | 1 |
| PFNA | 123% | - | - | - | - | - | 1 |
| PFDA | 126% | - | - | - | - | - | 1 |
| PFUnA | 125% | - | - | - | - | - | 1 |
| PFDoA | 124% | - | - | - | - | - | 1 |
| PFBS | 111% | - | - | - | - | - | 2 |
| PFHxS | 80.1% | - | - | - | - | - | 2 |
| PFOS | 102% | - | 89.2% | - | - | - | 2 |
| PFOSA | 102% | - | - | - | - | - | 2 |

*Reference material for PFOS was SRM 1947 (N=1).
**Laboratory duplicate RSDs were only used to calculate a mean RSD when the result for each sample in the pair was greater than the MDL.

## APPENDIX C: Chain of Custody and Collection Records

**NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION**
**CHAIN OF CUSTODY**

I, Kurt Cottingham (Print Name), of CT DEEP 333 Ferry Rd Old Lyme (Print Business Address) collected the following on 10/16/19 (Date), 20__ from Long Island Sound (Water Body) in the vicinity of NE of Mattituck Harbor Site 03-30 (Landmark, Village, Road, etc.) Lat/Lon Town of _____, in 4103.716 7230.060 Suffolk County.

Item(s) 1 Striped Bass - tag # 0997375

Said sample(s) were in my possession and handled according to standard procedures provided to me prior to collection. The sample(s) were placed in the custody of a representative of the New York State Department of Environmental Conservation on November 21, 2019.

Signature 2/14/2020 Date

I, Caitlin Craig, received the above mentioned sample(s) on the date specified and assigned identification number(s) 0997375 to the sample(s). I have recorded pertinent data for the sample(s) on the attached collection records. The sample(s) remained in my custody until subsequently transferred, prepared or shipped at times and on dates as attested to below.

Signature 11/21/19 Date

| | | |
|---|---|---|
| SECOND RECIPIENT (Print Name) Megan Barrow | TIME & DATE 2/5/2020 8:54 | PURPOSE OF TRANSFER PCB testing |
| SIGNATURE Megan L Barrow | UNIT Diadromous | |
| THIRD RECIPIENT (Print Name) | TIME & DATE | PURPOSE OF TRANSFER |
| SIGNATURE | UNIT | |
| FOURTH RECIPIENT (Print Name) | TIME & DATE | PURPOSE OF TRANSFER |
| SIGNATURE | UNIT | |
| RECEIVED IN LABORATORY BY (Print Name) DAVID BRYK | TIME & DATE 2/5/2020 0900 | REMARKS |
| SIGNATURE | UNIT HCFS | |
| LOGGED IN BY (Print Name) Chloe Armato | TIME & DATE 1:25 pm 2-10-2020 | ACCESSION NUMBERS 19-1045-H |
| SIGNATURE | UNIT HCFS | |

Richter: revised 21 April 2014; bocker: 23 March 2017

**NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION**
**DIVISION OF FISH AND WILDLIFE**
**FISH COLLECTION RECORD**

Project and Site Name Connecticut DEEP Long Island Sound Trawl Survey DEC Region _____

Collections made by (names) Kurt Gottschall

Sampling Method: ☐Electrofishing ☐Gill netting ☐Trap netting ☑Trawling ☐Seining ☐Angling ☐Other _____

Preservation Method: ☑Freezing ☐Other _____ Notes (SWFDB survey number): FA2019051 / site 0330

| FOR LAB USE ONLY- LAB ENTRY NO. | COLLECTION OR TAG NO. | SPECIES | DATE TAKEN | LOCATION | AGE | SEX &/OR REPROD. CONDIT | LENGTH (mm) Fork | WEIGHT (g) | REMARKS |
|---|---|---|---|---|---|---|---|---|---|
| P-1045-H | 0997375 | STB | 10/16/19 | 41 03.716<br>72 30.060 | | | 877 | 6770 | TL - 931 mm |
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richter: revised 2011, 5/7/15, 10/4/16, 3/20/17; becker: 3/23/17

**NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION**
**CHAIN OF CUSTODY**

I, David Ellis (Print Name), of CT DEEP 333 Ferry Road Old Lyme (Print Business Address) collected the following on Oct 8th (Date), 2019 from Long Island Sound (Water Body) in the vicinity of Mouth of CT River (Landmark, Village, Road, etc.) Town of Old Lyme, in New London, CT County.

Item(s) 6 striped Bass - tags FA2019044 1 → 6

Said sample(s) were in my possession and handled according to standard procedures provided to me prior to collection. The sample(s) were placed in the custody of a representative of the New York State Department of Environmental Conservation on November 21, 2019.

Signature — 2/14/2020 Date

I, Caitlin Craig, received the above mentioned sample(s) on the date specified and assigned identification number(s) FA2019044-1 → 6 to the sample(s). I have recorded pertinent data for the sample(s) on the attached collection records. The sample(s) remained in my custody until subsequently transferred, prepared or shipped at times and on dates as attested to below.

Signature — 11/21/19 Date

| | | |
|---|---|---|
| SECOND RECIPIENT (Print Name): Megan Barrow | TIME & DATE: 2/5/2020 3:54 | PURPOSE OF TRANSFER: Pen testing |
| SIGNATURE: Megan Barrow | UNIT: Diadromous | |
| THIRD RECIPIENT (Print Name) | TIME & DATE | PURPOSE OF TRANSFER |
| SIGNATURE | UNIT | |
| FOURTH RECIPIENT (Print Name) | TIME & DATE | PURPOSE OF TRANSFER |
| SIGNATURE | UNIT | |
| RECEIVED IN LABORATORY BY (Print Name): DAVID BRYK | TIME & DATE: 2/5/2020 0900 | REMARKS |
| SIGNATURE: [signature] | UNIT: HCFS | |
| LOGGED IN BY (Print Name): Chloé Armato | TIME & DATE: 1.27pm 2-10-2020 | ACCESSION NUMBERS: 19-1046-H → 19-1051-H |
| SIGNATURE: [signature] | UNIT: HCFS. | |

richter: revised 21 April 2014; becker: 23 March 2017

**NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION**
**DIVISION OF FISH AND WILDLIFE**
**FISH COLLECTION RECORD**

Project and Site Name Connecticut DEEP Long Island Sound Trawl Survey DEC Region _____

Collections made by (names) David Ellis / DEEP Rec/Leo

Sampling Method: ☐Electrofishing ☐Gill netting ☐Trap netting ☑Trawling ☐Seining ☐Angling ☐Other _____

Preservation Method: ☑Freezing ☐Other _____ Notes (SWFDB survey number): FA2019044 Site: 1534 1240 p.m.

| FOR LAB USE ONLY- LAB ENTRY NO. | COLLECTION OR TAG NO. | SPECIES | DATE TAKEN | LOCATION | AGE | SEX &/OR REPROD. CONDIT | LENGTH (mm) Fork | WEIGHT (g) | REMARKS |
|---|---|---|---|---|---|---|---|---|---|
| ✓19-1046-H | FA2019044-1 | STB | 10/8/19 | 41° 14.985 72° 19.085 | | | 715 | 3835 | Total length - 782 |
| ✓19-1047-H | FA2019044-2 | STB | 10/8/19 | ↓ | | | 705 | 3505 | TL - 751 |
| ✓19-1048-H | FA2019044-3 | STB | 10/8/19 | | | | 800 | 5860 | TL - 856 |
| ✓19-1049-H | FA2019044-4 | STB | 10/8/19 | | | | 788 | 4730 | TL - 834 |
| ✓19-1050-H | FA2019044-5 | STB | 10/8/19 | | | | 927 | 8115 | TL - 972 |
| ✓19-1051-H | FA2019044-6 | STB | 10/8/19 | | | | 835 | 6490 | TL - 900 |
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richter: revised 2011, 5/7/15, 10/4/16, 3/20/17; becker: 3/23/17

**NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION**
**CHAIN OF CUSTODY**

I, Kurt Cothcall (Print Name), of CT DEP 333 Ferry Rd Old Lyme CT (Print Business Address) collected the following on Oct 16 (Date), 2019 from Long Island Sound (Water Body)
in the vicinity of West of Milldock (Landmark, Village, Road, etc.) Lat/Lon 41 01.799 72 34.970
Town of _____, in Suffolk County.
Item(s) 1 Striped Bass - tag # 0997393

Said sample(s) were in my possession and handled according to standard procedures provided to me prior to collection. The sample(s) were placed in the custody of a representative of the New York State Department of Environmental Conservation on November 21, 2019.

Signature 2/14/2020 Date

I, Caitlin Craig, received the above mentioned sample(s) on the date specified and assigned identification number(s) 0997393 to the sample(s). I have recorded pertinent data for the sample(s) on the attached collection records. The sample(s) remained in my custody until subsequently transferred, prepared or shipped at times and on dates as attested to below.

Signature 12/21/19 Date

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|---|---|---|
| SECOND RECIPIENT (Print Name): Megan Barrow<br>SIGNATURE: Megan C Barrow | TIME & DATE: 2/5/2020 8:54<br>UNIT: Diadromous | PURPOSE OF TRANSFER: PCB testing |
| THIRD RECIPIENT (Print Name)<br>SIGNATURE | TIME & DATE<br>UNIT | PURPOSE OF TRANSFER |
| FOURTH RECIPIENT (Print Name)<br>SIGNATURE | TIME & DATE<br>UNIT | PURPOSE OF TRANSFER |
| RECEIVED IN LABORATORY BY (Print Name): DAVID BRYIC<br>SIGNATURE | TIME & DATE: 2/5/2020 0900<br>UNIT: HCFS | REMARKS |
| LOGGED IN BY (Print Name): Chloe Arnato<br>SIGNATURE | TIME & DATE: 1:31pm 2-10-2020<br>UNIT: HCFS | ACCESSION NUMBERS: 19-1052-H |

richter: revised 21 April 2014; becker: 23 March 2017

**NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION**
**DIVISION OF FISH AND WILDLIFE**
**FISH COLLECTION RECORD**

Project and Site Name Connecticut DEEP Long Island Sound Trawl Survey DEC Region _____

Collections made by (names) Kurt Gottschall

Sampling Method: ☐Electrofishing ☐Gill netting ☐Trap netting ☑Trawling ☐Seining ☐Angling ☐Other _____

Preservation Method: ☑Freezing ☐Other _____ Notes (SWFDB survey number): CT2019052 / Site 0198

| FOR LAB USE ONLY- LAB ENTRY NO. | COLLECTION OR TAG NO. | SPECIES | DATE TAKEN | LOCATION | AGE | SEX &/OR REPROD. CONDIT | LENGTH (mm) Fork | WEIGHT (g) | REMARKS |
|---|---|---|---|---|---|---|---|---|---|
| 19-1052-H | 0997393 | STB | 10/16/19 | 41 01.799<br>72 34.970 | | | 974 | 12130 | TL 1034 mm *Tail cut |
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richter: revised 2011, 5/7/15, 10/4/16, 3/20/17; becker: 3/23/17