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WATER MONITORING AND STANDARDS ELEMENT
BUREAU OF MARINE WATER MONITORING
P.O. Box 405LEEDS POINT, NEW JERSEY 08220

WORK/QUALITY ASSURANCE PROJECT PLAN

Fish Tissue Monitoring Program – Marine/Estuarine Region

MARCH 2016

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1.0 Project Name:
Fish Tissue Monitoring Program – Marine/Estuarine Region

2.0 Project Request:
Bureau of Marine Water Monitoring (BMWM) and
Division of Science, Research and Environmental Health (DSREH)

3.0 Date of Request:
March 2016

4.0 Date of Project Initiation:
April 2016

5.0 Project Fiscal Information: This project is being funded through EPA S106

6.0 Project Officer:
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7.0 Quality Assurance Officer:
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8.0 Project Description:
8.1 Background:

Fish and shellfish consumption advisories due to chemical contamination were announced in New Jersey in the 1980s and 1990s. Data from the Division of Science, Research and Environmental Health studies revealed that unacceptable risks existed for eating certain amounts and species of fish and shellfish from some waters in the State. Statewide advisories were issued for consumption of selected fish species due to toxic contamination. The advisories are frequently more restrictive for pregnant women, nursing mothers and young children. Many of the contaminants [PCBs and mercury] are known to cause birth defects, developmental problems, neurological problems and/or cancer. Current advisories are listed on NJDEP's Website www.FishSmartEatSmartNJ.org.

In addition to posing human health consumption concerns, many toxic contaminants can result in ecological impacts as well to fish and other biota.

The establishment of a regular tissue monitoring program is a key gap identified in NJ's Long-term Monitoring and Assessment Strategy. Work on sampling fish tissue for advisories, and for assessing the fish consumption use, has been conducted in the past over time by DEP's Division of Science, Research and Environmental Health (DSREH)) on a research project-specific basis with external research institutions. This project will assist in building the capacity of the State fish tissue monitoring program and leverage some existing program

resources (e.g. sampling boats, supplies, fisheries expertise) to transition NJ's fish tissue work from research projects to regular cost efficient monitoring to provide ongoing data to meet the objectives below.

8.2 Objectives

The objective of this project is to collect total mercury, polychlorinated biphenyls (PCBs) and other chemical contaminant data in fish tissue to:

- Provide current and more comprehensive data on concentrations of toxic contaminants in fish in order to assess human health risks and update/recommend fish consumption advisories.
- Provide data to assess the impairment of the designated uses of the waterbodies sampled.
- Provide data to assess the trends in levels of contaminants that contribute to use impairment and fish consumption advisories.

This monitoring project targets key marine and estuarine waters along the Atlantic Coastal and Delaware Bay Region. Striped bass, bluefish, summer flounder, weakfish white perch, catfish and American eel were selected as the finfish target species to sample as they are known to accumulate contaminants and are commonly sought by anglers in the Atlantic Coastal region. Hard clam and oyster were selected for biomonitoring of shellfish in New Jersey waters.

Data Quality Objectives:
For fish tissue analysis, total mercury, PCBs (congener specific) and (if funding allows) limited OCPs will be measured in all samples collected. Measuring bias, precision, accuracy, and sensitivity must meet the standards outlined in EPA Method 1631 for total mercury and EPA Method 1668 for PCBs (Appendix A,B)

9.3 Monitoring Design/ Site Selection:

Site Selection: A total of 17 sites were chosen for 2016 finfish collection within the Atlantic Coastal/Delaware Bay Region (Table 1). These sites were selected with assistance from Bruce Ruppel (DSREH) due to the extensive knowledge base acquired through past sampling events. This data will be used to assess the trends in levels of contaminants that contribute to use impairment and fish consumption advisories. These sites were also targeted because they have known fishing access and angling pressure. Other sites of concern may be added to the site list if the schedule and budget allows. In addition, a total of 15 sites were chosen for 2016 shellfish collection within the Atlantic Coastal/Delaware Bay Region.

Sampling locations will be established using an approved global positioning system (GPS) device (Trimble GeoExplorer 2008 or newer model). Subsequently, all sampling locations will be verified by sampling staff during each sampling event using an approved GPS device.

Field Collection: All fish and shellfish will be collected through NJDEP field sampling personnel using departmental boats and sampling equipment. All crew members are required to wear a Coast Guard approved personal flotation device (PFD) and rubber boots with non-slip soles. In addition to baited hoop nets, traps, trawls, rakes, tongs and gill nets, samples may also be collected by hook and line to ensure the collection of all targeted specimens. Nets will be set in the evening near the appropriate habitat and will be checked early the following morning to minimize mortality of incidental catch. Sampling gear and crew size is at the discretion of the field team leader. A checklist of sampling and safety equipment will be prepared prior to field work.

It is highly desirable to collect live, intact fish that have not been mutilated by the collection gear and that do not have any skin lacerations or fin deterioration that would allow body fluids to leak out of the specimen or contaminants to pass into the specimen after collection. EPA recommends that fish captured in passive collection devices not remain in the water for more than 24 hours after the passive collection device is first deployed and that specimens that show any skin or fin deterioration or external lacerations of any kind not used for chemical analysis. In addition, some fish collected may have ruptured organs and should not be retained as a sample. Fish that are found floating dead at a site should not be used for sample analysis for human risk assessments.

The species collected will include targeted species as described in Table 1. All fish species collected will be analyzed for both total mercury analysis and PCBs. The appropriate number of specimens of the same size/age will be removed for analysis and the remaining fish returned to the waterbody. (See Table 1: Sites)

Sample Identification Forms:
The sample forms for this project will remain with the sample from the time of collection until the result is reported. Sample identification forms are attached (Appendix C).

Sample Containers:
A sample will consist of three fish of similar species collected from a designated area. Fish will be individually wrapped in aluminum foil and then all fish from that sample will be put in a new clean polyethylene bag provided by the BMWM. Both the foil and bags are intended for one time use and are not to be reused for multiple samples.

Whole Fish Samples
Whole fish specimens analyzed for PCBs will be tagged using a Avery tagging gun with numbered t-bar anchor tags and placed in zip-lock bags, then a large polypropylene/polyethylene bag, and then placed in a plastic tray that are set on top of wet ice until return to the office. All persons handling the fish during collection shall wear new nitrile gloves.

Shellfish Samples

Shellfish samples will consist of 12-15 shellfish specimens per species (hard clam or oyster). More specimens will be made available to reach a sample quantity (grams) sufficient for the laboratory to conduct the test required. Samples will be bagged in polyethylene Whirl-Pak bags with a labels both inside and attached to the outside of the bag.

Length and Weight Measurements

All fish specimens collected will be weighed and measured at BMWM lab. Specimens will be measured to the nearest millimeter using a standard measuring board, and will be weighed to the nearest gram using an electronic scale (Mettler PM 4000). Polypropylene will be used to cover the measuring board and electronic scale for each fish sample. The processed specimens will then be bagged in polyethylene Whirl-Pak bags, labeled and stored in a frozen state until picked up for transport to the analytical laboratory (to be determined). Within 1 year of capture, specimens will be transported to the laboratory on either wet or dry ice, with complete sample documentation. Specimens will be held frozen until thawed for sample preparation.

Data Reporting:

Field Data Records:

Sampling personnel within the Bureau are responsible for recording field data. This data includes; collection times, water temperature, dissolved oxygen, pH, and salinity. This information is entered on the Bureau's computer data system.

Calibration Procedures:

Field Equipment Calibration and Record Keeping:

Field staff will be using YSI Professional Plus meters fitted with conductivity/temperature, pH, and dissolved oxygen sensors. Field equipment calibration will be performed according to the Standard Operating Procedures for the Leeds Point Laboratory and recorded in the appropriate notebook.

Table 1: Sites and Fish to be Collected

Site ID	Priority	Waterbody	Location	SB	Bf	WP	Wk	SF
	3	Arthur Kill River	Near Fresh Kills L.F.			X		
	3	Arthur Kill River	Perth Amboy	X	X	X		X
	4	Hudson River	George Washington Bridge	X		X		
	4	New York Harbor	Upper NY Harbor	X	X	X		
	2	Raritan Bay	Near Keyport Harbor					X
	2	Raritan Bay	Lower Bay	X	X			X
	2	Sandy Hook Bay	Lower Bay					X
	1	Atlantic Ocean	Sandy Hook – Sea Bright	X	X			X
	1	Atlantic Ocean	Sea Bright – Belmar	X				X
	1	Atlantic Ocean	Belmar – Barnegat Light	X	X			X
	1	Atlantic Ocean	Barnegat Light – Sea Isle City		X			
	1	Atlantic Ocean	Sea Isle City – Cape May	X	X		X	
	4	Delaware Bay	14ft Shoal (Lighthouse)	X	X		X	X
	4	Delaware Bay	Near Maurice River			X	X	
	4	Delaware Bay	Near Cohansy River			X	X	
	4	Delaware Bay	Near Port Penn (Mid-Bay)	X			X	X
	4	Delaware Bay	Cape May Rips	X	X		X	

SB = Striped Bass, Bf = Bluefish, WP = White Perch, Wk = Weakfish, SF = Summer Flounder

Table 2: Sites and Shellfish to be Collected

HARD CLAMS AND OYSTERS					
Site ID	**Waterbody**	**Location**	**Resource**	**Latitude**	**Longitude**
	Absecon Bay	Southern Coastal Bays	Hard Clams	39.426	-74.443
	Barnegat Bay	Barnegat Bay Estuary	Hard Clams	39.857	-74.104
	Delaware Bay	Delaware Bay	Oysters	39.317	-75.368
	Delaware Bay	Delaware Bay	Oysters	39.280	-75.253
	Great Bay	Southern Coastal Bays	Hard Clams	39.515	-74.366
	Great Egg Harbor	Southern Coastal Bays	Hard Clams	39.292	-74.603
	Great Sound	Southern Coastal Bays	Hard Clams	39.096	-74.774
	Jarvis Sound	Southern Coastal Bays	Hard Clams	38.972	-74.863
	Little Bay	Southern Coastal Bays	Hard Clams	39.438	-74.380
	Little Egg Harbor	Barnegat Bay Estuary	Hard Clams	39.584	-74.309
	Navesink River	Navesink River	Hard Clams	40.379	-74.007
	Raritan Bay	NY/NJ Harbor	Hard Clams	40.482	-74.107
	Sandy Hook Bay	NY/NJ Harbor	Hard Clams	40.450	-74.039
	Shrewsbury River	Shrewsbury River	Hard Clams	40.327	-74.017
	Sunset Lake	Southern Coastal Bays	Hard Clams	38.971	-74.846

Table 3: Fish and Shellfish Naming Conventions

Common Name	Scientific Name
Striped Bass	*Morone saxatilis*
Bluefish	*Pomatomus saltatrix*
White Perch	*Morone americana*
Weakfish	*Cynoscion regalis*
Summer Flounder	*Paralichthys dentatus*
American Eel	*Anguilla rostrata*
Catfish	*Ameiurus catus*
Blue Claw Crab	*Callinectes sapidus*
Lobster	*Homarus americanus*
Hard Clam	*Mercenaria mercenaria*
Oyster	*Crassostrea virginica*

9.4 Laboratory Analysis

The lab selected through the State Request for Proposals process will conduct the fish tissue analyses for total mercury and PCBs on all samples of marine and estuarine fish. This will include the sample preparation (i.e., skinning, filleting and homogenizing) of all fish collected. Plug samples from each species collected from each site will be sampled for total mercury.

Samples (plugs and whole fish) shall be stored frozen (-20 C) until processing in the laboratory. The maximum holding time plugs are 180 days and the maximum holding time for whole fish is 1 year. All transfers of samples will be properly documented throughout transport and analysis (internal lab chain-of-custody). All laboratory equipment will be properly calibrated as per each method completed. Careful cleaning of all laboratory equipment and instruments using the appropriate soaps, solvents, acids, and double deionized water (DDW) will be employed throughout this program.

Tissue preparation of fish will follow common preparation methods for consumption. The specimens will be filleted by the contracted laboratory using clean methods for mercury as outlined in EPA's "*Guidance for Assessing Chemical Contaminant data for Use in Fish Advisories Vol 1 Fish Sampling and Analysis" 2000.*

As part of quality assurance and quality control (QA/QC), Standard Reference Material (SRM) will be analyzed by the analytical laboratory as part of the QA/QC procedure at the required frequency of the laboratory method. This material will be obtained from the National Institute of Standards and Technology (NIST) or equivalent agency (see NOAA, 1992) and may consist of DORM-1, EPA SRS903, SRM 1974 (or equivalent if available). All sample spikes will use specimens from this project only. Also, duplicate samples will be analyzed to help assess laboratory variations in the analysis of fish tissue.

10.0 Schedule of Tasks and Products

Project Requested: March 2016
Station Selection: March 2016
Work/Quality Assurance Plan: June 2016.
Sampling Activities: July 2016 – November 2016
Laboratory Activities: June 2016 – December 2016
Data Reports: data tables (hardcopy and electronic) as laboratory results become available.

11.0 Resource Needs

BMWM will utilize full time and hourly staff to complete this project.

12.0 Quality Assurance

12.1 Laboratory Analysis: The following parameters will be analyzed by the qualified New Jersey certified laboratory listed in Section 9.4. Any laboratory used shall be certified by NJDEP's OQA for the requested parameters. The reporting levels, listed below, are **required** for this project.

Table 4: Required Reporting Limits

FINFISH PLUS CRAB AND LOBSTER							
Parameter	**Laboratory**	**Lab Number**	**Method**	**Detection Level**	**Holding Time**	**Preservative**	**Plug/Filet**
Total Mercury	TBD	TBD	EPA 1631	.0896 ng/g	1 year	Ice to 4°C in field. Freeze within 24 hours.	Plug
PCBs	TBD	TBD	EPA 1668A	See Appendix A	1 year	Ice to 4°C in field. Freeze within 24 hours.	Individual Fillet
HARD CLAMS AND OYSTERS							
Trace Metals	TBD	TBD	EPA 200.8	See Appendix B		Ice to 4°C in field. Freeze within 24 hours.	Whole body Composite

*Laboratory contract is currently under bid so the methods and detection levels are subject to change

Field measurements will include:

Table 5: Field Measurements

Field Name	WQDE Name	Media	Units
DO	Dissolved oxygen (DO)	Water	mg/l
Water Temp	Temperature, Water	Water	deg C
Spec Cond	Specific conductance	Water	uS/cm
pH	pH	Water	None
Salinity	Salinity	Water	ppt

12.2 Sample Containers: Sample containers shall be dedicated, single-use. Sample containers shall be provided by the NJ certified laboratory.

12.3 Sample Retention: All samples must be retained by the laboratory until such time that the reported results are approved.

13.0 Data Quality Requirements

Analytical samples will be done by the methods specified in this QAPP and for which the laboratory has certification. Quality control procedures (including required calibrations, equipment cleaning, and other quality control procedures required by regulation or by the method shall be defined in the laboratory's Quality Manual or Standard Operating Procedures (SOPs). The QM and SOPs must be approved by the OQA.

14.0 Data Completeness

Plug samples for mercury analysis from 3 similar-sized fish per location will be collected. Plug and whole fish samples will consist of fish of similar size; the smallest fish will be no less than 75% of the size of the largest fish. Adult fish of a size targeted by anglers will be collected for human health criteria. Fish samples will be collected during peak water temperatures and high productivity (i.e., June through November) in 2016.

15.0 Sample Custody Procedures

Chain of custody will be required for all samples as per N.J.A.C. 7:18-9.3(b). Laboratories performing the analysis will provide chain of custody forms.

16.0 Data Validation

The Project Officer and the Supervisor are responsible for all initial data validation. If apparent anomalous data are suspected, the Project Officer and/or the Supervisor will review the sampling procedures with the field sampler to make sure the proper collection and preservation procedures were followed. If the data is still suspect, the laboratory will be contacted. An internal review of their laboratory procedures and/or calculations used in the analysis of the suspect sample, with special emphasis on transcription of data to assure that no transposition of figures occurred will be conducted. The laboratory will be asked to check on equipment calibration. They may be further requested to reanalyze the retained portion of the sample. If no problems are found in the analytical laboratory procedures, the data may then be compared to any historical data that might have been collected at the same site prior to the most recent sampling event to see if similar anomalies might have been found previously. The suspect data may also be compared to literature values or standard analytical treatises to verify whether or not the results are within the limits of accuracy of the test method.

If no obvious problems are found after these reviews, the complete data set will be reported with the suspect data identified as such. The BMWM will then conduct its own review of the data, as it relates to the objectives(s) and data accuracy required in this project.

17.0 Performance System Audits

All NJ certified laboratories used are subject to audits and to the requirements of the OQA Laboratory Certification Program as well as internal performance evaluations. The OQA will be notified of field monitoring schedules for possible audits.

18.0 Data Reporting

18.1 Preliminary Reporting of Data

Preliminary analytical data will be reported to BMWM and DSRH, from the laboratory employed for this project, in either electronic format or by verbal communication to the Project Officer, within 45 calendar days from receipt of sample. Samples which yield results considered anomalous by the Project Officer and/ or Supervisor will be validated as specified in section 16.0, Data

Validation, before the holding time of the retained sample is expired. If the results remain suspect after an internal review of the laboratory procedures, calculations, and/or on transcription of data has been conducted, then the sample shall be reanalyzed by the laboratory using the retained portion of the sample. This reanalysis shall be performed within the parameter holding time.

18.2 Final Reporting of Data

Final analytical data will be reported to BMWM and DSRH, from the laboratory employed for this project, in the form of electronic and/ or hard copies of the lab sheets; or in a tabulated form within 60 calendar days from receipt of sample. All data shall be reported in a complete and concise fashion and shall meet the reporting requirements of NJAC 7:18. Routine quality control results must be retained on file for review by the BMWM, DSRH and the OQA.

19.0 Data Storage and Distribution

Sampling results will be stored locally in a Microsoft Excel or Access database. Data will be entered into New Jersey's Water Quality Data Exchange (WQDE) and USEPA STORET Data Warehouse by June of the following year it is verified. Data will be available through STORET and the National Water Monitoring Council Water Quality Portal. All raw data records shall be maintained for a period of no less than five years.

20.0 Assessment, Oversight, and Response

The Project Officer will be responsible for the oversight of all activities relating to this project. The Project Officer will assess field collection functions and make corrections when necessary to maintain the data accuracy as defined in this plan. If any changes or modifications are made to this plan regarding data collection, as it relates to the objectives(s) and data accuracy required in this project, all original signees of the QAPP will be notified

Appendix A:

PCB Congeners

Analyte	Detection Level	Bias	Precision
2',3,3',4,5-PeCB(76842-07-4)	0.01 ng/g	N/A	N/A
2',3,4,4',5-PeCB(65510-44-3)	0.02 ng/g	60% Rec	40.00 RSD
2',3,4,5,5'-PeCB(70424-70-3)	0.03 ng/g	N/A	N/A
2',3,4,5,6'-PeCB(74472-39-2)	0.02 ng/g	N/A	N/A
2',3,4,5-TeCB(70362-48-0)	0.02 ng/g	N/A	N/A
2',3,4-TrCB(38444-86-9)	0.01 ng/g	N/A	N/A
2',3,5-TrCB(37680-68-5)	0.01 ng/g	N/A	N/A
2,2',3',4,5-PeCB(41464-51-1)	0.02 ng/g	N/A	N/A
2,2',3',4,6-Pentachlorobiphenyl(60233-25-2)	0.02 ng/g	N/A	N/A
2,2',3,3',4',5,6-HpCB(52663-70-4)	0.01 ng/g	N/A	N/A
2,2',3,3',4,4',5,5',6,6'-Decachlorobiphenyl(2051-24-3)	0.02 ng/g	60% Rec	40.00 RSD
2,2',3,3',4,4',5,5',6-Nonachlorobiphenyl(40186-72-9)	0.05 ng/g	60% Rec	40.00 RSD
2,2',3,3',4,4',5,5'-OcCB(35694-08-7)	0.02 ng/g	N/A	N/A
2,2',3,3',4,4',5,6'-OcCB(42740-50-1)	0.04 ng/g	N/A	N/A
2,2',3,3',4,4',5,6,6'-NoCB(52663-79-3)	0.05 ng/g	N/A	N/A
2,2',3,3',4,4',5,6-Octachorobiphenyl(52663-78-2)	0.04 ng/g	N/A	N/A
2,2',3,3',4,4',5-Heptachlorobiphenyl(35065-30-6)	0.02 ng/g	N/A	N/A
2,2',3,3',4,4',6,6'-OcCB(33091-17-7)	0.03 ng/g	N/A	N/A
2,2',3,3',4,4',6-Heptachlorobiphenyl(52663-71-5)	0.04 ng/g	N/A	N/A
2,2',3,3',4,4'-Hexachlorobiphenyl(38380-07-3)	0.01 ng/g	N/A	N/A
2,2',3,3',4,5',6,6'-Octachlorobiphenyl(40186-71-8)	0.04 ng/g	N/A	N/A
2,2',3,3',4,5',6-HpCB(40186-70-7)	0.04 ng/g	N/A	N/A
2,2',3,3',4,5'-HxCB(52663-66-8)	0.01 ng/g	N/A	N/A
2,2',3,3',4,5,5',6'-OcCB(52663-75-9)	0.02 ng/g	N/A	N/A
2,2',3,3',4,5,5',6,6'-NoCB(52663-77-1)	0.05 ng/g	60% Rec	40.00 RSD
2,2',3,3',4,5,5',6-OcCB(68194-17-2)	0.02 ng/g	N/A	N/A
2,2',3,3',4,5,5'-HpCB(52663-74-8)	0.04 ng/g	N/A	N/A
2,2',3,3',4,5,6'-HpCB(38411-25-5)	0.02 ng/g	N/A	N/A
2,2',3,3',4,5,6,6'-OcCB(52663-73-7)	0.03 ng/g	N/A	N/A
2,2',3,3',4,5,6-HpCB(68194-16-1)	0.04 ng/g	N/A	N/A
2,2',3,3',4,5-HxCB(55215-18-4)	0.02 ng/g	N/A	N/A
2,2',3,3',4,6'-HxCB(38380-05-1)	0.01 ng/g	N/A	N/A
2,2',3,3',4,6,6'-HpCB(52663-65-7)	0.04 ng/g	N/A	N/A
2,2',3,3',4,6-HxCB(61798-70-7)	0.01 ng/g	N/A	N/A
2,2',3,3',4-PeCB(52663-62-4)	0.01 ng/g	N/A	N/A
2,2',3,3',5,5',6,6'-OcCB(2136-99-4)	0.04 ng/g	60% Rec	40.00 RSD

Analyte	Detection Level	Bias	Precision
2,2',3,3',5,5',6-HpCB(52663-67-9)	0.02 ng/g	N/A	N/A
2,2',3,3',5,5'-HxCB(35694-04-3)	0.02 ng/g	N/A	N/A
2,2',3,3',5,6'-HxCB(52744-13-5)	0.01 ng/g	N/A	N/A
2,2',3,3',5,6,6'-HpCB(52663-64-6)	0.02 ng/g	N/A	N/A
2,2',3,3',5,6-HxCB(52704-70-8)	0.01 ng/g	N/A	N/A
2,2',3,3',5-PeCB(60145-20-2)	0.02 ng/g	N/A	N/A
2,2',3,3',6,6'-HxCB(38411-22-2)	0.01 ng/g	N/A	N/A
2,2',3,3',6-PeCB(52663-60-2)	0.01 ng/g	N/A	N/A
2,2',3,3'-TeCB(38444-93-8)	0.01 ng/g	N/A	N/A
2,2',3,4',5',6-HxCB(38380-04-0)	0.02 ng/g	N/A	N/A
2,2',3,4',5,5',6-Heptachlorobiphenyl(52663-68-0)	0.02 ng/g	N/A	N/A
2,2',3,4',5,5'-HxCB(51908-16-8)	0.02 ng/g	N/A	N/A
2,2',3,4',5,6'-HxCB(74472-41-6)	0.03 ng/g	N/A	N/A
2,2',3,4',5,6,6'-HpCB(74487-85-7)	0.02 ng/g	60% Rec	40.00 RSD
2,2',3,4',5,6-HxCB(68194-13-8)	0.02 ng/g	N/A	N/A
2,2',3,4',5-PeCB(68194-07-0)	0.02 ng/g	N/A	N/A
2,2',3,4',6,6'-HxCB(68194-08-1)	0.03 ng/g	N/A	N/A
2,2',3,4',6-PeCB(68194-05-8)	0.01 ng/g	N/A	N/A
2,2',3,4'-TeCB(36559-22-5)	0.01 ng/g	N/A	N/A
2,2',3,4,4',5',6-HpCB(52663-69-1)	0.04 ng/g	N/A	N/A
2,2',3,4,4',5'-Hexachlorobiphenyl(35065-28-2)	0.02 ng/g	N/A	N/A
2,2',3,4,4',5,5',6-OcCB(52663-76-0)	0.04 ng/g	N/A	N/A
2,2',3,4,4',5,5'-HpCB(35065-29-3)	0.01 ng/g	N/A	N/A
2,2',3,4,4',5,6'-HpCB(60145-23-5)	0.04 ng/g	N/A	N/A
2,2',3,4,4',5,6,6'-OcCB(74472-52-9)	0.05 ng/g	N/A	N/A
2,2',3,4,4',5,6-HpCB(74472-47-2)	0.04 ng/g	N/A	N/A
2,2',3,4,4',5-HxCB(35694-06-5)	0.03 ng/g	N/A	N/A
2,2',3,4,4',6'-HxCB(59291-64-4)	0.02 ng/g	N/A	N/A
2,2',3,4,4',6,6'-HpCB(74472-48-3)	0.04 ng/g	N/A	N/A
2,2',3,4,4',6-HxCB(56030-56-9)	0.02 ng/g	N/A	N/A
2,2',3,4,4'-PeCB(65510-45-4)	0.01 ng/g	N/A	N/A
2,2',3,4,5',6-HxCB(68194-14-9)	0.02 ng/g	N/A	N/A
2,2',3,4,5'-PeCB(38380-02-8)	0.02 ng/g	N/A	N/A
2,2',3,4,5,5',6-HpCB(52712-05-7)	0.04 ng/g	N/A	N/A
2,2',3,4,5,5'-HxCB(52712-04-6)	0.01 ng/g	N/A	N/A
2,2',3,4,5,6'-HxCB(68194-15-0)	0.01 ng/g	N/A	N/A
2,2',3,4,5,6,6'-HpCB(74472-49-4)	0.04 ng/g	N/A	N/A

Analyte	Detection Level	Bias	Precision
2,2',3,4,5,6-HxCB(41411-61-4)	0.03 ng/g	N/A	N/A
2,2',3,4,5-PeCB(55312-69-1)	0.02 ng/g	N/A	N/A
2,2',3,4,6'-PeCB(73575-57-2)	0.02 ng/g	N/A	N/A
2,2',3,4,6,6'-HxCB(74472-40-5)	0.03 ng/g	N/A	N/A
2,2',3,4,6-PeCB(55215-17-3)	0.01 ng/g	N/A	N/A
2,2',3,4-TeCB(52663-59-9)	0.01 ng/g	N/A	N/A
2,2',3,5',6-PeCB(38379-99-6)	0.02 ng/g	N/A	N/A
2,2',3,5'-Tetrachlorobiphenyl(41464-39-5)	0.02 ng/g	N/A	N/A
2,2',3,5,5',6-HxCB(52663-63-5)	0.01 ng/g	N/A	N/A
2,2',3,5,5'-PeCB(52663-61-3)	0.01 ng/g	N/A	N/A
2,2',3,5,6'-PeCB(73575-55-0)	0.01 ng/g	N/A	N/A
2,2',3,5,6,6'-HxCB(68194-09-2)	0.02 ng/g	N/A	N/A
2,2',3,5,6-PeCB(73575-56-1)	0.02 ng/g	N/A	N/A
2,2',3,5-TeCB(70362-46-8)	0.01 ng/g	N/A	N/A
2,2',3,6'-TeCB(41464-47-5)	0.01 ng/g	N/A	N/A
2,2',3,6,6'-PeCB(73575-54-9)	0.02 ng/g	N/A	N/A
2,2',3,6-TeCB(70362-45-7)	0.01 ng/g	N/A	N/A
2,2',3-TrCB(38444-78-9)	0.00 ng/g	N/A	N/A
2,2',4,4',5',6-Hexachlorobiphenyl(60145-22-4)	0.01 ng/g	N/A	N/A
2,2',4,4',5,5'-Hexachlorobiphenyl(35065-27-1)	0.01 ng/g	N/A	N/A
2,2',4,4',5-PeCB(38380-01-7)	0.02 ng/g	N/A	N/A
2,2',4,4',6,6'-HxCB(33979-03-2)	0.03 ng/g	60% Rec	40.00 RSD
2,2',4,4',6-PeCB(39485-83-1)	0.02 ng/g	N/A	N/A
2,2',4,4'-Tetrachlorobiphenyl(2437-79-8)	0.02 ng/g	N/A	N/A
2,2',4,5'-TeCB(41464-40-8)	0.01 ng/g	N/A	N/A
2,2',4,5,'6-PeCB(60145-21-3)	0.02 ng/g	N/A	N/A
2,2',4,5,5'-Pentachlorobiphenyl(37680-73-2)	0.02 ng/g	N/A	N/A
2,2',4,5,6'-PeCB(68194-06-9)	0.02 ng/g	N/A	N/A
2,2',4,5-TeCB(70362-47-9)	0.01 ng/g	N/A	N/A
2,2',4,6'-TeCB(68194-04-7)	0.01 ng/g	N/A	N/A
2,2',4,6,6'-PeCB(56558-16-8)	0.02 ng/g	60% Rec	40.00 RSD
2,2',4,6-TeCB(62796-65-0)	0.01 ng/g	N/A	N/A
2,2',4-TrCB(37680-66-3)	0.01 ng/g	N/A	N/A
2,2',5,5'-Tetrachlorobiphenyl(35693-99-3)	0.02 ng/g	N/A	N/A
2,2',5,6'-TeCB(41464-41-9)	0.01 ng/g	N/A	N/A
2,2',5-Trichlorobiphenyl(37680-65-2)	0.02 ng/g	N/A	N/A
2,2',6,6'-TeCB(15968-05-5)	0.01 ng/g	60% Rec	40.00 RSD

Analyte	Detection Level	Bias	Precision
2,2',6-TrCB(38444-73-4)	0.00 ng/g	N/A	N/A
2,2'-DiCB(13029-08-8)	0.02 ng/g	60% Rec	40.00 RSD
2,3',4',5-TeCB(32598-11-1)	0.02 ng/g	N/A	N/A
2,3',4',6-TeCB(41464-46-4)	0.01 ng/g	N/A	N/A
2,3',4,4',5',6-HxCB(59291-65-5)	0.01 ng/g	N/A	N/A
2,3',4,4',5,5'-HxCB(52663-72-6)	0.01 ng/g	60% Rec	40.00 RSD
2,3',4,4',5-Pentachlorobiphenyl(31508-00-6)	0.02 ng/g	60% Rec	40.00 RSD
2,3',4,4',6-PeCB(56558-17-9)	0.02 ng/g	N/A	N/A
2,3',4,4'-Tetrachlorobiphenyl(32598-10-0)	0.02 ng/g	N/A	N/A
2,3',4,5'-TeCB(73575-52-7)	0.02 ng/g	N/A	N/A
2,3',4,5,'6-PeCB(56558-18-0)	0.02 ng/g	N/A	N/A
2,3',4,5,5'-PeCB(68194-12-7)	0.02 ng/g	N/A	N/A
2,3',4,5-TeCB(73575-53-8)	0.02 ng/g	N/A	N/A
2,3',4,6-TeCB(60233-24-1)	0.01 ng/g	N/A	N/A
2,3',4-TrCB(55712-37-3)	0.01 ng/g	N/A	N/A
2,3',5',6-TeCB(74338-23-1)	0.02 ng/g	N/A	N/A
2,3',5,5'-TeCB(41464-42-0)	0.02 ng/g	N/A	N/A
2,3',5-TrCB(38444-81-4)	0.01 ng/g	N/A	N/A
2,3',6-TrCB(38444-76-7)	0.01 ng/g	N/A	N/A
2,3'-DiCB(25569-80-6)	0.00 ng/g	N/A	N/A
2,3,3',4',5',6-HxCB(74472-45-0)	0.01 ng/g	N/A	N/A
2,3,3',4',5,5',6-HpCB(69782-91-8)	0.01 ng/g	N/A	N/A
2,3,3',4',5,5'-HxCB(39635-34-2)	0.04 ng/g	N/A	N/A
2,3,3',4',5,6-HxCB(74472-44-9)	0.02 ng/g	N/A	N/A
2,3,3',4',5-PeCB(70424-68-9)	0.03 ng/g	N/A	N/A
2,3,3',4',6-PeCB(38380-03-9)	0.02 ng/g	N/A	N/A
2,3,3',4'-TeCB(41464-43-1)	0.01 ng/g	N/A	N/A
2,3,3',4'-TeCB(74338-24-2)	0.01 ng/g	N/A	N/A
2,3,3',4,4',5',6-HpCB(74472-50-7)	0.04 ng/g	N/A	N/A
2,3,3',4,4',5'-HxCB(69782-90-7)	0.01 ng/g	60% Rec	40.00 RSD
2,3,3',4,4',5,5',6-OcCB(74472-53-0)	0.05 ng/g	60% Rec	40.00 RSD
2,3,3',4,4',5,5'-HpCB(39635-31-9)	0.02 ng/g	60% Rec	40.00 RSD
2,3,3',4,4',5,6-HpCB(41411-64-7)	0.02 ng/g	N/A	N/A
2,3,3',4,4',5-HxCB(38380-08-4)	0.01 ng/g	60% Rec	40.00 RSD
2,3,3',4,4',6-HxCB(74472-42-7)	0.01 ng/g	N/A	N/A
2,3,3',4,4'-Pentachlorobiphenyl(32598-14-4)	0.01 ng/g	60% Rec	40.00 RSD
2,3,3',4,5',6-HxCB(74472-43-8)	0.04 ng/g	N/A	N/A

Analyte	Detection Level	Bias	Precision
2,3,3',4,5'-PeCB(70362-41-3)	0.02 ng/g	N/A	N/A
2,3,3',4,5,5',6-HpCB(74472-51-8)	0.04 ng/g	N/A	N/A
2,3,3',4,5,5'-HxCB(39635-35-3)	0.04 ng/g	N/A	N/A
2,3,3',4,5,6-HxCB(41411-62-5)	0.02 ng/g	N/A	N/A
2,3,3',4,5-PeCB(70424-69-0)	0.01 ng/g	N/A	N/A
2,3,3',4,6-PeCB(74472-35-8)	0.01 ng/g	N/A	N/A
2,3,3',5',6-PeCB(68194-10-5)	0.02 ng/g	N/A	N/A
2,3,3',5'-TeCB(41464-49-7)	0.01 ng/g	N/A	N/A
2,3,3',5,5',6-HxCB(74472-46-1)	0.04 ng/g	N/A	N/A
2,3,3',5,5'-PeCB(39635-32-0)	0.02 ng/g	N/A	N/A
2,3,3',5,6-PeCB(74472-36-9)	0.03 ng/g	N/A	N/A
2,3,3',5-TeCB(70424-67-8)	0.01 ng/g	N/A	N/A
2,3,3',6-TeCB(74472-33-6)	0.01 ng/g	N/A	N/A
2,3,3'-TrCB(38444-84-7)	0.02 ng/g	60% Rec	40.00 RSD
2,3,4',5,6-PeCB(68194-11-6)	0.01 ng/g	N/A	N/A
2,3,4',5-TeCB(74472-34-7)	0.01 ng/g	N/A	N/A
2,3,4',6-TeCB(52663-58-8)	0.01 ng/g	N/A	N/A
2,3,4'-TrCB(38444-85-8)	0.01 ng/g	N/A	N/A
2,3,4,4',5,6-HxCB(41411-63-6)	0.01 ng/g	N/A	N/A
2,3,4,4',5-PeCB(74472-37-0)	0.01 ng/g	60% Rec	40.00 RSD
2,3,4,4',6-PeCB(74472-38-1)	0.02 ng/g	N/A	N/A
2,3,4,4'-TeCB(33025-41-1)	0.01 ng/g	N/A	N/A
2,3,4,5,6-PeCB(18259-05-7)	0.01 ng/g	N/A	N/A
2,3,4,5-TeCB(33284-53-6)	0.02 ng/g	N/A	N/A
2,3,4,6-TeCB(54230-22-7)	0.01 ng/g	N/A	N/A
2,3,4-TrCB(55702-46-0)	0.01 ng/g	N/A	N/A
2,3,5,6-TeCB(33284-54-7)	0.02 ng/g	N/A	N/A
2,3,5-TrCB(55720-44-0)	0.01 ng/g	N/A	N/A
2,3,6-TrCB(55702-45-9)	0.01 ng/g	N/A	N/A
2,3-Dichlorobiphenyl(16605-91-7)	0.00 ng/g	N/A	N/A
2,4',5-TrCB(16606-02-3)	0.02 ng/g	N/A	N/A
2,4',6-TrCB(38444-77-8)	0.01 ng/g	N/A	N/A
2,4'-Dichlorobiphenyl(34883-43-7)	0.01 ng/g	N/A	N/A
2,4,4',5-TeCB(32690-93-0)	0.02 ng/g	N/A	N/A
2,4,4',6-TeCB(32598-12-2)	0.01 ng/g	N/A	N/A
2,4,4'-Trichlorobiphenyl(7012-37-5)	0.02 ng/g	N/A	N/A
2,4,5-Trichlorobiphenyl(15862-07-4)	0.01 ng/g	N/A	N/A

Analyte	Detection Level	Bias	Precision
2,4,6-TrCB(35693-92-6)	0.02 ng/g	N/A	N/A
2,4-DiCB(33284-50-3)	0.00 ng/g	N/A	N/A
2,5-DiCB(34883-39-1)	0.00 ng/g	N/A	N/A
2,6-DiCB(33146-45-1)	0.00 ng/g	N/A	N/A
2-Chlorobiphenyl(2051-60-7)	0.01 ng/g	60% Rec	40.00 RSD
3,3',4,4',5,5'-HxCB(32774-16-6)	0.02 ng/g	60% Rec	40.00 RSD
3,3',4,4',5-Pentachlorobiphenyl(57465-28-8)	0.01 ng/g	60% Rec	40.00 RSD
3,3',4,4'-Tetrachlorobiphenyl(32598-13-3)	0.02 ng/g	60% Rec	40.00 RSD
3,3',4,5'-TeCB(41464-48-6)	0.02 ng/g	N/A	N/A
3,3',4,5,5'-PeCB(39635-33-1)	0.03 ng/g	N/A	N/A
3,3',4,5-TeCB(70362-49-1)	0.02 ng/g	N/A	N/A
3,3',4-TrCB(37680-69-6)	0.01 ng/g	N/A	N/A
3,3',5,5'-TeCB(33284-52-5)	0.02 ng/g	N/A	N/A
3,3',5-TrCB(38444-87-0)	0.01 ng/g	N/A	N/A
3,3'-DiCB(2050-67-1)	0.01 ng/g	N/A	N/A
3,4',5-TrCB(38444-88-1)	0.01 ng/g	N/A	N/A
3,4'-DiCB(2974-90-5)	0.00 ng/g	N/A	N/A
3,4,4',5-TeCB(70362-50-4)	0.02 ng/g	60% Rec	40.00 RSD
3,4,4'-TrCB(38444-90-5)	0.01 ng/g	60% Rec	40.00 RSD
3,4,5-TrCB(53555-66-1)	0.01 ng/g	N/A	N/A
3,4-DiCB(2974-92-7)	0.00 ng/g	N/A	N/A
3,5-DiCB(34883-41-5)	0.00 ng/g	N/A	N/A
3-MoCB(2051-61-8)	0.00 ng/g	N/A	N/A
4,4'-DiCB(2050-68-2)	0.02 ng/g	60% Rec	40.00 RSD
4-MoCB(2051-62-9)	0.01 ng/g	60% Rec	40.00 RSD

Appendix B

PBDEs

Analyte	Detection Level	Bias	Precision	Spiking Level
2,2',3,4,4',5',6-Heptabromodiphenyl ether(207122-16-5)	3.00 ng/kg	N/A	40.00 % RSD	50.00 ng/kg
2,2',4,4',5,5'-Hexabromodiphenyl ether(68631-49-2)	2.00 ng/kg	N/A	40.00 % RSD	50.00 ng/kg
2,2',4,4',5-Pentabromodiphenyl ether(60348-60-9)	4.00 ng/kg	N/A	40.00 % RSD	50.00 ng/kg
2,2',4,4',6-Pentabromodiphenyl ether(189084-64-8)	2.00 ng/kg	N/A	40.00 % RSD	50.00 ng/kg

Analyte	Detection Level	Bias	Precision	Spiking Level
Benzene, 2,4-dibromo-1-(2,4-dibromophenoxy)-(5436-43-1)	2.50 ng/kg	N/A	40.00 % RSD	50.00 ng/kg
Decabromobiphenyl ether(1163-19-5)	70.00 ng/kg	N/A	40.00 % RSD	500.00 ng/kg
Polybrominated diphenyl ether 154(207122-15-4)	2.00 ng/kg	N/A	40.00 % RSD	50.00 ng/kg
Tribromodiphenyl ether(49690-94-0)	2.00 ng/kg	N/A	40.00 % RSD	50.00 ng/kg

Appendix C:

Fish Tissue Sample Identification Form

NEW JERSEY DEPARTMENT OF ENVIRONMENTAL PROTECTION
WATER MONITORING AND STANDARDS ELEMENT
BUREAU OF MARINE WATER MONITORING
P.O. Box 405 LEEDS POINT, NEW JERSEY 08220

Date:_____

Site:_____

Crew:_____

Coordinates: Lat_____ Long_____

Field Measurements:

Meter #	Temp (°C)	DO %	DO (mg/L)	Specific Conductance	Salinity (ppt)	pH

Species:_____ Scientific Name:_____

Method of Collection:_____

Date	Tag #	Length (mm)	Weight (g)	Comments

Chain of Custody

Relinquished	Date/Time	Received	Date/Time	Reason