GULFWATCH
2001 Data Report:

ELEVENTH YEAR OF THE GULF OF MAINE ENVIRONMENTAL MONITORING PLAN

Ninth Year of the 9-Year Monitoring Design

June 2005

Prepared for:

The Gulf of Maine Council on the Marine Environment

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Final Year of the 9-Year Monitoring Design

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1.0 INTRODUCTION

1.1 RATIONALE

The Gulf of Maine is the region of the North Atlantic Ocean that extends from Cape Sable, Nova Scotia, through New Brunswick, Maine, and New Hampshire to Cape Cod, Massachusetts, and includes the Bay of Fundy and Georges Bank. The combined productivity of seaweed, salt marsh grasses, and phytoplankton make it one of the world's most productive ecosystems supporting a vast array of animal species, including some of great commercial importance. Commercial fisheries are its principal income-generating enterprise. Tourism is also economically important to coastal communities and marine aquaculture is rapidly expanding. Increases in coastal populations and industrial and residential development have contributed to the deteriorating quality of portions of the Gulf's coastal environment (Crawford and Sowles 1992, Dow and Braasch 1996). One important factor resulting from human activities is the steady input of toxic chemicals into the estuarine and coastal environments, despite efforts to improve pollution treatment. Many of these anthropogenic chemicals are bioaccumulated as they transfer through the food chain and have been found in organisms to be elevated above natural levels (Shaw et al., 2003; Aguilar et al., 2002; Weisbrod et al., 2000). Furthermore, some of these environmental contaminants may also be present at toxic concentrations, and thus induce adverse biological effects on productivity, reproduction and survival of marine organisms and humans (Kawaguchi et al. 1999, Wells and Rolston 1991).

To protect water quality and commercial uses in the Gulf of Maine, the *Agreement on the Conservation of the Marine Environment of the Gulf of Maine* was signed in December 1989 by the premiers of Nova Scotia and New Brunswick and the governors of Maine, New Hampshire and Massachusetts establishing the Gulf of Maine Council on the Marine Environment. The overarching mission of this council is to maintain and enhance the Gulf's marine ecosystem, its natural resources and environmental quality. To help meet the council's mission statement, The Gulf of Maine Environmental Monitoring Committee was formed and charged with the development of the Gulf of Maine Environmental Monitoring Plan. The monitoring plan is based on a mission statement provided by the council:

> **It is the mission of the Gulf of Maine Environmental Quality Monitoring Program to provide environmental resource managers with information to support sustainable use of the Gulf and allow assessment and management risk to public and environmental health from current and potential threats.**

Three monitoring goals were established to meet the mission statement:

(1) To provide information on the status, trends, and sources of risk to the marine environment in the Gulf of Maine;
(2) To provide information on the status, trends and sources of marine based human health risks in the Gulf of Maine; and
(3) To provide appropriate and timely information to environmental and resource managers that will allow both efficient and effective management action and evaluation of such action.

In support of the mission and as a first step towards meeting the desired goals, the Gulfwatch Program was established to measure chemical contamination Gulfwide (Barchard and Johnson-Hayden, 1990; Barchard, 1991)

1.2 GULFWATCH OBJECTIVES

Gulfwatch (GW) is presently a program in which the blue mussel, *Mytilus*, is used as an indicator for habitat exposure to organic and inorganic contaminants. Bivalves such as *M. edulis* have been successfully used as an indicator organism in environmental monitoring programs throughout the world (see NAS, 1980; NOAA, 1991; Widdows and Donkin, 1992) to identify variation in chemical contamination between sites, and contribute to the understanding of trends in chemical contamination (NOAA, 1991; O'Connor, 1998; Widdows et al., 1995). The blue mussel was selected as an indicator organism for the Gulfwatch program for the following reasons:

(1) mussels are abundant within and across each of the 5 jurisdictions (Nova Scotia and New Brunswick, CA; and the U.S. states of Massachusetts, New Hampshire and Maine) bordering the Gulf and they are easy to collect and process;
(2) blue mussels have been comparatively well-studied in the scientific and technical literature;
(3) mussels are a commercially important human food source and may be used to monitor human exposure to chemical contamination;
(4) mussels are sedentary, thereby eliminating the complications in interpretation of results introduced by mobile species;

(5) Mussels are suspension feeders that pump large volumes of water and concentrate many chemicals in their tissues. Therefore, the presence of trace contamination is easier to document, and the measurement of chemicals in bivalve tissue provides an assessment of biologically available contamination that is not always apparent from measurement of contamination in environmental matrices such as water, sediment, and suspended particles).

Throughout the history of the program, GW has refined its approach to using mussels as bioindicators of anthropogenic contamination. During the first two years of the program (1991 & 1992), both transplanted and native mussels sampled from areas adjacent to the transplant sites were analyzed for organic and inorganic contaminants (GOMC, 1992). Transplanted mussels were initially collected from relatively pristine sites in each jurisdiction, relocated to targeted sites (for a myriad of reasons) and held there for approximately 60 days. Because of the logistics and the analytical costs, however, only two sites per jurisdiction were monitored each year using this transplant technique. Transplants provided an assessment of the short-term exposure (on the order of weeks to months) to bioavailable contaminants whereas sampling of native mussels provided more of an assessment of long-term exposure to bioavailable contaminants (on the order of months to a year). An objective of the first two years (1991 and 1992) of the Gulfwatch program was to evaluate the feasibility of the project and the level of cooperation required for collecting comparative data from different locations along the Gulf of Maine crossing both national and state boundaries. Having met this objective, the program recognized more monitoring sites were needed throughout the Gulf of Maine in order to adequately assess the degree and extent of contamination of the region. As such a sampling scheme involving a three-year rotation of sites was implemented in 1993 and continues to date. The sites included in the GW monitoring program consisted of two categories; test sites that were suspected or known to be contaminated, and reference sites that were free of any known contaminant source. One location in each jurisdiction was designated as a benchmark station and is continually re-sampled each year. The sampling design implemented in 1993 added additional stations thereby increasing the ability to characterize contaminants in the coastal Gulf of Maine and the potential for identifying unforeseen environmental contamination. Additionally, transplant experiments were to be conducted at two sites within each jurisdiction during the last year of each three-year sampling cycle. This 3-year cycle was to be initiated and repeated for the next nine (9) years to allow assessments of both short-term and long-term contaminant exposure of the Gulf of Maine.

In 1996, regional scientists independently conducted a five-year review of the program for the GOM Council. The feasibility of continuing transplant studies (Jones et al., 1998) was evaluated and abandoned from the program, citing the cost of performing transplant experiments, the low rate of return, missing data, and the complications with the interpretation of the data. In 1998, additional sites in New Hampshire and New Brunswick (previously unsampled) were added to the program to increase the spatial coverage within the GOM and to target subregions where GW data indicated need for further investigation. Sampling of the New Hampshire sites was conducted in conjunction with the New Hampshire Gulfwatch program. The New Brunswick sites were located in the Saint John Harbor, a region of concern for petroleum and sewage-born contaminants. Expanded sampling in New Hampshire was conducted during the 2001 sampling season. The expanded sampling in New Hampshire conducted during the later part of the 9-year cycle offers an opportunity to evaluate exposure to contaminants on a more local scale with that of the GOM region.

In addition to documenting the level of contaminants in mussel tissue, biological variables, including shell growth and condition index, were determined as a measure of the organism's stress and its relationship to different concentrations of contaminant burden. Growth is often one of the most sensitive measures of the effect of a contaminant on an organism (Sheehan, 1984; Sheehan et al., 1984; Howells et al., 1990). Specifically, shell growth has often been used as a measure of environmental quality and pollution effects. The rate of growth is a fundamental measure of physiological fitness/performance (Widdows and Donkin, 1992; Salazar and Salazar, 1995) and, therefore, a direct integrative measure of impairment to physiology.

Gulfwatch uses the condition index (CI), traditionally engaged by shellfishery biologists (Widdows, 1985), as an indicator of the physiological status of mussels. CI relates the tissue's wet weight to shell volume. Because gonadal weight is a significant contributor to total body weight just prior to spawning, CI generally reflects differences in the reproductive state of sampled mussels. Since gonadal material tends to have low concentrations of metals (LaTouche and Mix, 1981), tissue metal concentrations may be reduced in mussels having a high CI due to ripened gonads. Organic contaminants, however, would tend to partition into both somatic and gonadal lipids, and may be less impacted by changes in CI that are due to the presence of ripe gametes. Variable amounts of ripe gametes have been found in some mussel populations even in late fall (Kimball, 1994) when Gulfwatch sampling occurs. Granby and Spliid (1995) found a significant negative correlation between PAHs and CI but no correlation between PCB or DDE concentration and

CI. Regardless, the relationship between CI and contaminant concentrations must be carefully considered.

2.0 METHODS

2.1 2001 Sampling Locations

The 2001 Gulf of Maine GW mussel survey is the last year of the 9-year sampling design (see Sowles et al., 1997). The 2001 sampling represents the last year of the third cycle. As such, many of the 17 stations sampled in 2001 were re-visits of stations sampled in 1995 and 1998. In addition to the benchmark stations (MASN, MECC, MEKN, NBHI, and NSDI), which are sampled annually, many of the other sites have now been sampled three times and may provide added value to temporal analysis of GW data. Four additional sites were sampled in New Hampshire: Pierce Island (NHPI), South Mill Pond (NHSM), Schiller Station (NHSS), and Fox Point (NHFP). These New Hampshire sites are sampled as part of the New Hampshire Gulfwatch Program and are included to provide a more local assessment of toxic contaminant exposure, especially oil, to biota in New Hampshire estuarine waters. The stations sampled in 2001 are presented in Table 1 with reference to site locations in Fig. 1.

2.2 Field and Laboratory Procedures

Details regarding the mussel collection, measurement, and sample preparation are published in Sowles et al. (1997) and are summarized briefly here. Gulfwatch attempts to control confounding variables by collecting organisms within a specific size range, at the same site, at similar tidal levels and similar times of the year after major spawning has occurred. The mussels collected were intended to be *Mytilus edulis*. However, a related species, *Mytilus trossulus*, was identified in some Bay of Fundy samples (Mucklow, 1996). Gulfwatch results could be confounded by inadvertent selection, by field personnel, of the wrong species. To alleviate this problem, a description of *M. edulis* was developed for the Gulfwatch program using shell criteria such as length:height ratio, internal colour, weight, and location and size of the adductor scars (Jones et al., 1998).

Field sampling occurred between mid-September and mid-November. Mussels were collected from four discrete areas within a segment of the shoreline to be representative of local water quality. Using a polycarbonate gauge or a ruler, four (4) replicates of 45-50 mussels of 50-60 mm shell length were placed in field containers and transported in coolers with ice packs to labs for processing. Those mussels predestined for organic analysis were wrapped in pre-combusted aluminum foil prior to placing in field containers. Mussels were not depurated prior to processing.

From each replicate, 20 mussels were analyzed for trace metals and 20 for organic contaminants. Mussels were washed in the laboratory to remove any external growth, sediment and debris. Excess seawater was drained from their mantles. Individual mussels were then measured to the nearest 0.1mm for length (anterior umbo to posterior growing lip) and their soft tissue was removed and combined in their respective organic or metals composite. In addition to shell length, shell height, width (mm), and soft tissue wet weight (to the nearest 0.01g) were typically performed on three (3) subsets of ten mussels destined for the metal analysis composite to allow for the calculation of CI. The CI was calculated using the following formula (after Seed, 1968):

*Condition index (CI) = wet tissue weight (mg) / [length (mm) * width (mm) * height (mm)]*

All samples for trace metal and organic contaminant analysis were placed in pre-cleaned or quality-assured bottles (Sowles et al., 1997). These composite samples (20 mussels/composite; 4 composites/station) were capped, labelled and stored at -15°C for 3-6 months prior to analysis.

TABLE 1. Gulf of Maine Gulfwatch study site locations sampled in 2001.

Jurisdiction	Site Code	Site Name	Site Type	W Longitude (decimal degrees)	N Latitude (decimal degrees)
Massachusetts					
	MASN	Sandwich	Benchmark	070.4840	41.7645
	MAIH	Boston Inner Harbor	3-year rotation	071.0284	42.3637
	MAPR	Pines River	3-year rotation	070.9793	42.4312
New Hampshire					
	NHHS	Hampton/Seabrook Harbor	3-year rotation	070.8163	42.8972
	NHLH	Little Harbor	3-year rotation	070.7154	43.0581
	NHPI	Pierce Island	Expanded GW	070.7433	43.0717
	NHSM	S. Mill Pond	Expanded GW	070.7489	43.0727
	NHSS	Schiller Station	Expanded GW	070.7883	43.1017
	NHDP	Dover Point	3-year rotation	070.8267	43.1196
	NHFP	Fox Point	Expanded GW	070.8389	43.1201
Maine					
	MECC	Clark's Cove	Benchmark	070.7244	43.0774
	MEDM	Damariscotta	3-year rotation	069.5817	43.9383
New Brunswick					
	NBNR	Niger Reef	3-year rotation	067.0680	45.0663
	NBHI	Hospital Island	Benchmark	067.0082	45.1205
Nova Scotia					
	NSCW	Cornwallis	3-year rotation	065.6480	44.6447
	NSDI	Digby	Benchmark	065.7523	44.6170
	NSGC	Grosse Coques	Occasional	066.0950	44.3728

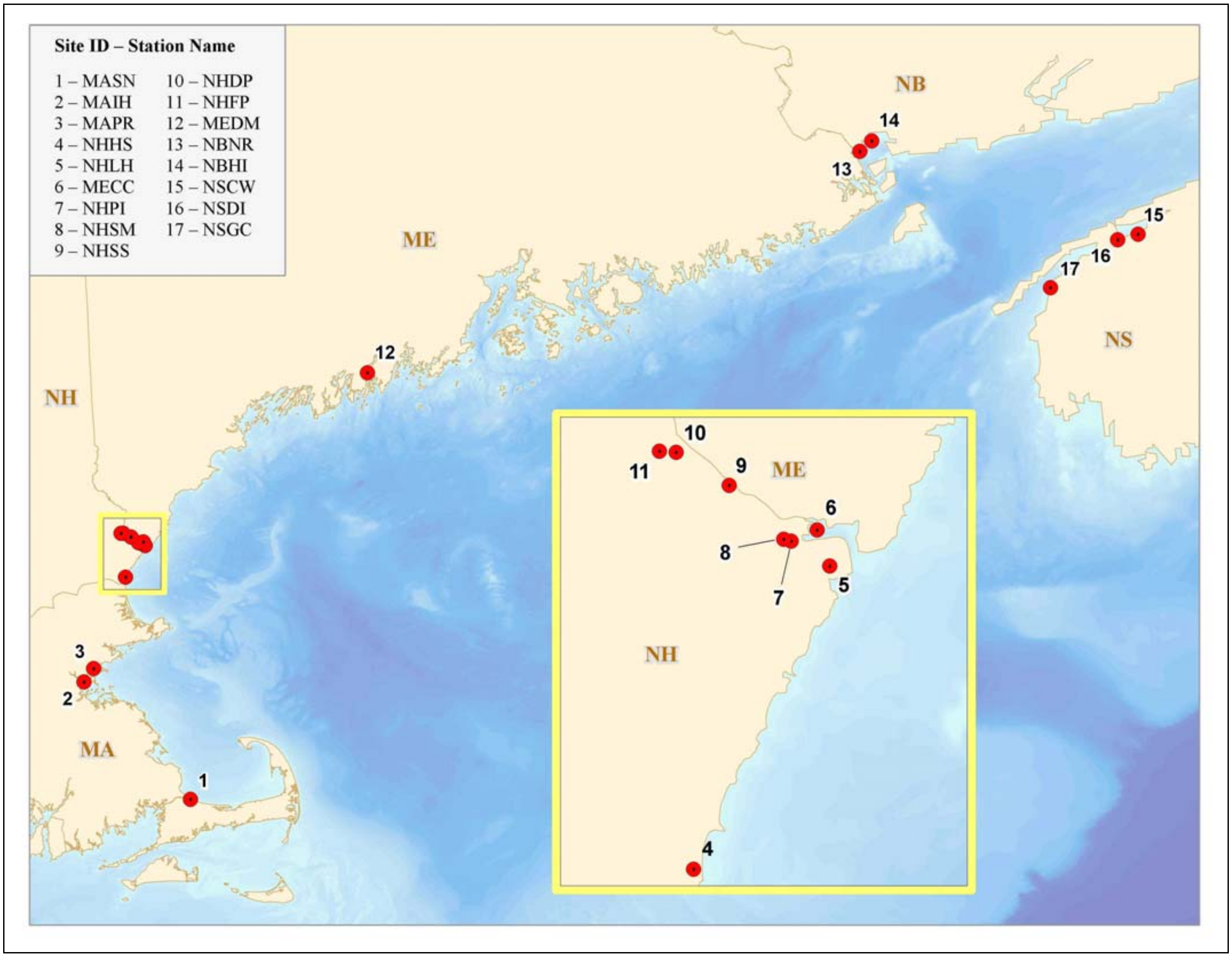

Figure provided by Marc Carullo of Massachusetts Office of Coastal Zone Management

Figure 1. Locations along the Gulf of Maine of Gulfwatch sampling sites, 2001.

2.3 ANALYTICAL PROCEDURES

Analytical procedures used followed those reported for the previous years (Jones et al. 1998). Table 2 contains a summary of trace metal and organic compounds measured.

2.3.1 Metals

Inorganic contaminants were analyzed at the State of Maine Department of Health and Environmental Testing Laboratory (HETL, Orono, ME). Analyses for mercury were conducted on a sub-sample of 1 to 2 g of wet tissue and measured by cold vapor atomic absorption using a Perkin Elmer Model 503 atomic absorption spectrometer. Analyses for all other metals were conducted on 5 to 10 g of homogenised wet tissue dried at 100°C. These sub samples were acid digested by EPA Method 3050, which involves boiling the sample with concentrated HNO_3. Zinc and iron were measured by flame atomic absorption using a Perkin Elmer Model 1100 atomic absorption spectrometer. All remaining metals (Ag, Al, Cd, Cr, Cu, Ni and Pb) were analyzed using Zeeman background corrected graphite furnace atomic absorption on a Varian Spectra AA 400. The instrumental method detection limits for the metals in µg/g dry weight were as follows; Ag, 0.1; Cd, 0.2; Cr, 0.3; Cu, 0.6; Fe, 6.0; Hg, 0.1; Ni, 1.2; Pb, 0.6; and Zn, 1.5; Al, 3.0. These differ from the overall Gulfwatch method detection limits that include sampling and sample processing. These detection limits are presented in Appendix A.

2.3.2 Organic Contaminants

Organic contaminants in mussel samples were analyzed at the Environment Canada Environmental Quality Laboratory in Moncton, New Brunswick. The analyte detection limits ranged from 2-8 ng/g for aromatic hydrocarbons, from 1-2 ng/g for PCB congeners and chlorinated pesticides (Appendix A). Eighteen of the PCB congeners identified and quantified correspond to congeners monitored by the National Oceanographic and Atmospheric Administration's (NOAA) National Status and Trends (NS&T) Program in the U.S.A. Other organic compounds selected for analysis are also consistent, for the most part, with NOAA National Status and Trends mussel monitoring (NOAA, 1989).

A description of the full analytical protocol and accompanying performance based QA/QC procedures are found in Sowles et al. (1997), and more comprehensively in Jones et al. (1998). Briefly, tissue samples were extracted by homogenization with an organic solvent and a drying agent. Solvent extracts were obtained by vacuum filtration, and biomatrix interference was separated from target analytes in extracts through size exclusion chromatography. Purified extracts were subjected to silica gel liquid chromatography, which provided a non-polar PCB/chlorinated pesticides fraction and a polar chlorinated pesticide fraction. PCBs and pesticides were analyzed by high-resolution dual column gas chromatography/electron capture detection (HRGC/ECD). Following PCB and pesticide analysis, the two fractions were combined and the resulting extract was analyzed for aromatic hydrocarbons by high-resolution gas chromatography/mass spectrometry (HRGC/MS).

TABLE 2. Inorganic and organic compounds analyzed in mussel tissue from the Gulf of Maine in 2001.

INORGANIC CONTAMINANTS		
Metals		
Ag, Al, Cd, Cr, Cu, Fe, Hg, Ni, Pb, Zn		
ORGANIC CONTAMINANTS		
Aromatic Hydrocarbons((ΣPAH$_{24}$)	*Chlorinated Pesticides*	
Naphthalene	Hexachlorobenzene (HCB)	
1-Methylnaphthalene	gamma-Benzenehexachloride (BHC)	
2-Methylnaphthalene	Heptachlor	
Biphenyl	Heptachlor epoxide	
2,6-Dimethylnaphthalene	Aldrin	
Acenaphthylene	cis-Chlordane	
Acenaphthalene	trans-Nonachlor	
2,3,5-Trimethylnaphthalene	Dieldrin	
Fluorene	alpha-Endosulfan	
Phenanthrene	beta-Endosulfan	
Anthracene		
1-Methylphenanthrene		
Fluoranthene		
Pyrene	*DDT and Homologues*	
Benzo [a] anthracene		
Chrysene	2,4'-DDE	4,4'-DDE
Benzo [b] fluoranthene	2,4'-DDD	4,4'-DDD
Benzo [k] fluoranthene	2,4'-DDT	4,4'-DDT
Benzo [e] pyrene		
Benzo [a] pyrene		
Perylene	*PCB Congeners (ΣPCB$_{22}$)*	
Indo [1,2,3-cd] pyrene	PCB 8, PCB 18, PCB 28, PCB 29,	
	PCB 44, PCB 50, PCB 52, PCB 66,	
Dibenze [a,h] anthracene	PCB 77, PCB 87, PCB 101, PCB 105,	
Benzo [g,h,I] perylene	PCB 118, PCB 128, PCB 138, PCB 153,	
	PCB 170, PCB 180, PCB 187, PCB 195,	
	PCB 206, PCB 209	

2.4 Quality Assurances / Quality Control

Standard laboratory procedures for metals incorporated method blanks, spike matrix samples, duplicate samples, surrogate addition, and the analyses of standard reference materials (NIST 1974a and 2976 Mussel Tissue (*Mytilus edulis*) and; DORM: Trace elements in Dogfish (*Squalus acanthias*) mussel from the National Research Council of Canada). The method blanks were inserted: three at the beginning of the run, one at the end, and six at various intervals during the run. Duplicate samples and matrix spike recoveries were conducted on approximately 15% of the samples.

Standard operating procedures for the analysis of mussel samples and related laboratory quality control performance criteria are described in *Gulfwatch Project Standard Procedures: Field and Laboratory (GOMCME August 1997)*. Quality assurance provisions described in the manual serve as a guide for the generation of acceptable analytical data for the Gulfwatch program. The quality control results produced, when compared to Gulfwatch data quality objectives also permit users of the data measures of accuracy and precision among the sampling years as well as a comparative measure with that of other environmental contaminant monitoring programs.

Appendix B contains the trace metal contaminant QC sample results for the 2001 Gulfwatch samples and a brief summary of results, and Appendix C contains the organic contaminant QC sample results for the 2001 Gulfwatch samples and a brief summary of results. Laboratory QC measures reported in Appendices B and C include procedural blanks, duplicate sample analyses, contaminant surrogate sample spikes, sample matrix spikes, and the analysis of certified reference material.

2.5 Statistical Methods and Data Analysis

Total PAH (ΣPAH_{24}), total PCB (ΣPCB_{22}) and total pesticides ($\Sigma TPEST_{17}$) values were calculated from the sum of all individual compounds or congeners with values greater than the detection limit for the compound. Total DDT ((ΣDDT_6) is the sum of 2,4-DDT and 4,4-DDT and homologues (2,4-DDE, 4,4-DDE, 2,4-DDD and 4,4-DDD). Several tissue samples for metals and organics were below the detection level. Variables in which all replicate measurements were below the detection limit were treated as zero and recorded as not-detected (ND). However, if at least two of the replicates were greater than the detection limit, then the other replicates were recorded as ½ the method detection limit (MDL).

From each site, arithmetic means, standard deviations (SD) and geometric means were calculated for all metal and organic contaminants. Arithmetic means were calculated for metals and organics at each station. Graphs of the mean concentrations (±SD) are presented for all stations sampled. For comparative purposes in Section 3 (Results and Discussion), Gulfwatch compares arithmetic meane values with the geometric mean plus the 85th percentile of *M. edulis* data from the National Status and Trends' Musselwatch Program (NS&T) of the National Ocean and Atmospheric Administration. For interpretive purposes, Clark Cove, Maine (MECC) serves as the benchmark site for the group of New Hampshire sites because of its location in the Great Bay / Piscataqua River watershed and, therefore, is more comparable to the other sites in New Hampshire. Gulfwatch data from 1995, 1998 and 2001 are summarized, along with all annual data for the 5 benchmark sites to help evaluate general temporal trends of contaminant exposure along the rim of the Gulf of Maine.

3.0 RESULTS AND DISCUSSION

3.1 FIELD OPERATIONS AND LOGISTICS

Sampling of *M. edulis* from stations visited in 1995 and 1998 were revisited in the Fall of 2001. The Maine Kennebec benchmark station (MEKN) was not sampled as scheduled. Four additional sites in New Hampshire were also sampled. Overall, mussels were successfully sampled at a total of 17 sites. Each jurisdiction processed mussel samples by extracting soft tissue and performing measurements to determine Condition Index (CI, see section 2.2.) Tissue composites were frozen prior to shipping to the analytical laboratories. Appropriate field and initial sample preparation information were provided to the Program coordinators shortly after collection and preparation of composite samples.

3.2 TRACE METAL CONCENTRATIONS

Table 3 contains the metal concentrations (geometric and arithmetic means ± SD, µg/g dry weight) of mussel tissue composites (n=4) from all 2001 sites. All summary statistics using the four replicate compositess attributed ½ method detection limit (MDL) values when 2 or more of the replicates were above the reported MDL. Metal concentrations for each individual composite sample are provided in Appendix D. Overall metal concentrations for all mussels are also given as medians (MD) and plus the 85^{th} percentile (85^{th} P) to allow for a program-level comparison with NOAA National Status and Trends (NS&T) concentrations (Table 4). Table 4 compares the overall 2001 Gulfwatch values for MD and the 85^{th} P with the 1991 through 1996 NS&T Mussel Watch data (O'Connor, 1998; http://ccmaserver.nos.noaa.gov/). Although the NS&T data were summarized for years 1991 to 1996, only 1991 NOAA data were used for comparison to GW results since 1991 represents the most complete year with respect to sampled sites in the NOAA Mussel Watch Program (Tom O'Connor, pers. comm.). Most of the summarized Gulfwatch metals concentrations were comparable to the 1991 NS&T MD + 85^{th} P values, with the exception of Pb and Hg, which were significantly higher in 2001 Gulfwatch samples. Pb and Hg, both of which are thought to have significant atmospheric component to their loading to the Gulf of Maine, have typically been elevated in GW samples when compared to NOAA NS&T data.

TABLE 3. Summary of tissue metal concentrations (ug/g dry weight) for Gulfwatch mussels in 2001. The arithmetic (±SD) and geometric mean of all indigenous mussels is given; (n=4 replicates/sample), as well as the overall Gulf of Maine median (and 85th percentile). All summary statistics were computed from all individual replicate data points. Non-detectable amounts were treated as ½ the method detection limit for respective metals.

A. 2001 Massachusetts Stations

Massachusetts	Statistic	Ag	Cd	Cr	Cu	Fe	Ni	Pb	Zn	Al	Hg
MASN	$Mean_A$	0.1	1.3	0.6	6.3	205	0.7	1.7	85	65	0.12
	SD	NA	0.1	0.0	0.5	39	0.1	0.2	13	16	0.05
	$Mean_G$	0.1	1.3	0.6	6	202	0.7	1.6	84	64	0.11
MAIH	$Mean_A$	ND 0.1	2.1	1.7	21.5	545	1.0	29.8	155	153	0.45
	SD	NA	0.5	0.4	3.9	62	0.2	5.7	29	29	0.09
	$Mean_G$	ND 0.1	2.0	1.7	21	542	1.0	29.4	153	150	0.44
MAPR	$Mean_A$	ND 0.1	1.7	2.5	8.3	410	1.1	5.9	85	140	0.41
	SD	NA	0.1	0.6	1.0	64	0.2	0.4	10	14	0.07
	$Mean_G$	ND 0.1	1.7	2.5	8	406	1.1	5.9	85	139	0.40

B. 2001 New Hampshire Stations

New Hampshire	Statistic	Ag	Cd	Cr	Cu	Fe	Ni	Pb	Zn	Al	Hg
NHHS	$Mean_A$	ND 0.1	1.7	1.6	6.8	228	0.9	2.1	90	138	0.31
	SD	NA	0.1	0.5	0.5	111	0.1	0.5	8	41	0.16
	$Mean_G$	ND 0.1	1.7	1.5	7	197	0.9	2.0	90	133	0.27
NHLH	$Mean_A$	0.1	1.4	4.6	6.5	373	1.1	2.8	88	270	0.77
	SD	0.0	0.1	2.0	0.6	88	0.2	0.3	5	339	0.09
	$Mean_G$	0.1	1.3	4.4	6	366	1.1	2.7	87	167	0.76
NHPI	$Mean_A$	0.1	1.6	2.1	8.1	380	2.4	4.0	135	121	0.73
	SD	0.0	0.1	0.3	0.8	49	0.0	0.3	6	35	0.08
	$Mean_G$	0.1	1.6	2.0	8	378	2.4	3.9	135	117	0.73
NHSM	$Mean_A$	0.3	1.1	2.7	8.2	558	2.5	7.0	92	198	0.71
	SD	0.4	0.2	0.3	1.4	70	0.2	0.8	16	15	0.10
	$Mean_G$	0.2	1.1	2.6	8	554	2.4	6.9	91	197	0.71
NHSS	$Mean_A$	ND 0.1	1.7	1.3	6.5	273	0.9	2.3	93	86	0.93
	SD	NA	0.3	0.3	0.6	45	0.1	0.5	19	10	0.28
	$Mean_G$	ND 0.1	1.6	1.2	6	270	0.9	2.3	91	85	0.90
NHDP	$Mean_A$	ND 0.1	2.0	2.6	6.5	343	1.1	2.4	100	125	0.54
	SD	NA	0.2	0.6	0.6	43	0.1	0.4	12	19	0.34
	$Mean_G$	ND 0.1	2.0	2.6	6	340	1.1	2.4	99	124	0.48
NHFP	$Mean_A$	0.1	1.5	3.0	6.4	710	2.4	2.6	111	265	0.76
	SD	0.0	0.2	0.3	1.1	135	0.2	0.5	17	57	0.12
	$Mean_G$	0.1	1.5	3.0	6	700	2.3	2.6	109	260	0.75

C. 2001 Maine Stations

Maine	Statistic	Ag	Cd	Cr	Cu	Fe	Ni	Pb	Zn	Al	Hg
MECC	$Mean_A$	ND 0.1	1.9	2.2	5.8	473	1.2	2.5	83	178	0.71
	SD	0.0	1.1	0.7	1.5	90	0.2	0.4	10	43	0.20
	$Mean_G$	ND 0.1	1.7	2.1	6	466	1.2	2.5	82	174	0.69
MEDM	$Mean_A$	0.1	1.2	1.2	6.0	395	1.8	2.3	59	140	0.09
	SD	0.0	0.2	0.2	0.6	131	0.2	0.6	6	41	0.05
	$Mean_G$	0.1	1.2	1.2	6	380	1.8	2.2	59	136	0.08

D. 2001 New Brunswick Stations

New Brunswick	Statistic	Ag	Cd	Cr	Cu	Fe	Ni	Pb	Zn	Al	Hg
NBNR	$Mean_A$	0.2	1.0	0.9	6.3	423	1.8	1.5	80	178	ND 0.1
	SD	0.1	0.1	0.2	0.9	114	0.1	0.3	8	60	NA
	$Mean_G$	0.2	1.0	0.9	6	412	1.8	1.5	80	170	ND 0.1
NBHI	$Mean_A$	0.1	1.2	0.8	7.2	325	1.5	0.9	66	148	ND 0.1
	SD	0.0	0.1	0.1	1.3	64	0.1	0.2	4	26	NA
	$Mean_G$	0.1	1.2	0.8	7	320	1.5	0.9	66	146	ND 0.1

E. 2001 Nova Scotia Stations

Nova Scotia	Statistic	Ag	Cd	Cr	Cu	Fe	Ni	Pb	Zn	Al	Hg
NSCW	$Mean_{Ah}$	ND 0.1	0.8	0.4	6.3	325	0.8	1.4	43	125	ND 0.1
	SD	NA	0.1	0.0	0.5	31	0.1	0.1	5	10	NA
	$Mean_G$	ND 0.1	0.8	0.4	6	324	0.7	1.3	42	125	ND 0.1
NSDI	$Mean_A$	ND 0.1	1.3	0.7	6.5	308	0.9	2.1	55	118	ND 0.1
	SD	NA	0.3	0.2	1.0	30	0.2	0.5	6	15	NA
	$Mean_G$	ND 0.1	1.3	0.7	6	306	0.9	2.0	55	117	ND 0.1
NSGC	$Mean_A$	ND 0.1	1.4	0.8	5.5	395	1.2	1.5	58	130	ND 0.1
	SD	NA	0.0	0.1	0.6	33	0.1	0.1	5	12	NA
	$Mean_G$	ND 0.1	1.4	0.8	5	394	1.2	1.4	57	130	ND 0.1
Gulf of Maine	**Median**	**ND 0.1**	**1.40**	**1.5**	**6.8**	**360**	**1.2**	**2.3**	**82**	**130**	**0.35**
	85th percentile	**0.1**	**1.8**	**2.8**	**8**	**550**	**2.2**	**5.6**	**120**	**190**	**0.78**

Monitored trace metals were detected at all Gulfwatch sites except for Ag and Hg, which were below the detection limit (0.1 µg/g dry weight) at 7 and 5 of the 2001 sites, respectively. Using the 2001 GW geometric means when compared to the NS&T MD + 85th P value as a measure of elevated concentrations, 1 site exceeded the Cr value (NHLH), 1 site exceeded the Cu value (MAIH), 9 sites exceeded the Hg value (MAIH, MAPR, NHLH, NHPI, NHSM, NHSS, NHDP, NHFP, and MECC), 3 sites exceeded the Pb value (MAIH, MAPR, and NHSM), and 1 site exceeded the Cu value (MAIH). Trace metals for which a few sites exceeded the NS&T MD + 85th P value, when viewed with nearby GW sites, suggests highly localized sources of these contaminants, especially for Hg, Pb, and Cu in the inner portion of Boston Harbor, and Hg and Pb in the NH estuary –bay system.

TABLE 4. Comparison of median metal concentrations (and 85th percentile) for the 2001 Gulfwatch Samples with NOAA Status & Trends program (1991-1996) statistics.

	GW 2001		NS&T 1991		NS&T 1992		NS&T 1993		NS&T 1994		NS&T 1995		NS&T 1996	
	Median,	85th P	Median,	85th P	Median,	85th P	Median,	85th P	Median,	85th P	Median,	85th P	Median,	85th P
Ag	ND 0.1	0.1	0.08	0.48	0.09	0.55	0.05	0.85	0.12	0.56	0.05	0.76	NA	NA
Cd	1.4	1.8	2.33	5.43	2.08	4.46	2.47	4.67	1.97	4.29	2.4	4.39	1.88	4.23
Cr	1.5	2.8	1.43	2.73	1.41	3.5	1.21	2.71	1.16	2.21	1.8	5.18	11.1	3.1
Cu	6.8	8.0	8.83	11.67	8.64	10.11	8.35	10.5	8.69	10.54	8.41	12.62	7.3	9.9
Fe	360	550	400	790	338	690	340	673	350	774	607	1615	424	985
Ni	1.2	2.2	2.07	3.6	2.09	3.85	1.64	2.66	1.46	2.78	1.98	3.46	1.6	3.3
Pb	2.3	5.6	0.77	3.57	0.7	2.3	0.78	2.9	0.99	2.73	0.7	2.36	0.75	2.4
Zn	82	120	130	200	120	170	120	200	120	170	115	169	102	148
Al	130	190	280	653	210	510	120	280	350	1100	480	1577	340	1020
Hg	0.35	0.78	0.11	0.24	0.1	0.23	0.11	0.2	0.1	0.21	0.11	0.23	0.11	0.2

3.3 ORGANIC CONTAMINANTS CONCENTRATIONS

The total concentration (arithmetic mean ± SD, ng/g dry weight) of detectable polynuclear aromatic hydrocarbons (ΣPAH_{22}), polychlorinated biphenyls (ΣPCB_{24}) and organochlorine pesticides ($\Sigma TPEST_{17}$) measured in mussel tissue samples of indigenous mussels are presented in Table 5. Arithmetic means rather than geometric means were used for comparison with median NOAA Mussel Watch data since geometric means were essentially equivalent to the arithmetic means. Individual analyte concentrations of each compound class are provided in Appendix E.

Overall gulf-wide medians (MD) and the 85^{th} percentile of the organic contaminant concentrations for indigenous mussels are reported in order to allow for a program-level comparison with NOAA National Status and Trends concentrations (Table 6). The GW ΣPCB_{22} median is not directly comparable to NOAA's 1991 Mussel Watch ΣPCB value since the NOAA Mussel Watch PCB data is determined from 18 congeners, while GW included an additional 4 congeners in the ΣPCB_{22}. However, the GW ΣPCB_{18} median and 85^{th} percentile was calculated by summing the 18 common congeners of the two programs. The 2001 Gulfwatch overall average concentrations for summary organic contaminant statistics are significantly lower than the 1991 NS&T MD values and the respective 85^{th} percentile values.

Only one Gulfwatch site, located in the inner portion of Boston Harbor (MAIH) exceeded the 1991 NS&T median value + the 85^{th} percentile for ΣPAH"18". All other sites had average summary organic contaminant concentrations below the 1991 NS&T median value + the 85th percentile.

TABLE 5. Arithmetic mean (± SD) tissue organic concentrations (µg/g dry weight) from mussels collected by the Gulfwatch Program, 2001. ND = not detected, and NA = not assessed. The geometric mean of all indigenous mussels is given; n=4 replicates/sample.

A. 2001 GW organic contaminants arithmetic means (and SD) for sites in Massachusetts

Site	ΣPAH_{24}	ΣPCB_{22}	$\Sigma TPEST_{17}$	$\Sigma OPEST_{11}$	ΣDDT_6
MASN	56	36	20	2.6	17.4
(SD)	(4)	(9)	(5)	(0.7)	(5.3)
MAIH	3004	560	150	26.5	123.6
(SD)	106	(54)	(29)	(3.4)	(25.6)
MAPR	647	144	61	13.2	47.6
(SD)	(78)	(26)	(11)	(1.4)	(11.3)

B. 2001 GW organic contaminants arithmetic means (and SD) for sites in New Hampshire

Site	ΣPAH_{24}	ΣPCB_{22}	$\Sigma TPEST_{17}$	$\Sigma OPEST_{11}$	ΣDDT_6
NHHS	91	10	7	ND	6.7
(SD)	(7)	(3)	(1)	NA	(0.6)
NHLH	109	22	4	ND	4.2
(SD)	(12)	(3)	(0)	NA	(0.5)
NHPI	232	40	6	ND	5.8
(SD)	(33)	(2)	(2)	NA	(1.6)
NHSM	633	45	32	8.0	24.4
(SD)	(51)	(9)	(6)	(2.0)	(4.3)
NHSS	257	36	7	ND	6.6
(SD)	(46)	(4)	(1)	NA	(0.6)
NHDP	213	30	8	ND	6.8
(SD)	(20)	(3)	(2)	NA	(1.3)
NHFP	241	40	11	ND	10.9
(SD)	(20)	(2)	(1)	NA	(1.5)

C. 2001 GW organic contaminants arithmetic means (and SD) for sites in Maine

Site	ΣPAH_{24}	ΣPCB_{22}	$\Sigma TPEST_{17}$	$\Sigma OPEST_{11}$	ΣDDT_6
MECC	152	25	3	ND	3.3
(SD)	(11)	(4)	(1)	NA	(0.9)
MEDM	34	6	4	ND	4.4
(SD)	(2)	(2)	(2)	NA	(2.5)

D. 2001 GW organic contaminants arithmetic means (and SD) for sites in New Brunswick

Site	ΣPAH_{24}	ΣPCB_{22}	$\Sigma TPEST_{17}$	$\Sigma OPEST_{11}$	ΣDDT_6
NBNR	55	6	8	4.0	4.3
(SD)	(6)	(1)	(1)	(1.5)	(1.0)
NBHI	30	ND	5	2.2	3.1
(SD)	(6)	NA	(1)	(0.9)	(1.3)

E. 2001 GW organic contaminants arithmetic means (and SD) for sites in Nova Scotia

Site	ΣPAH_{24}	ΣPCB_{22}	$\Sigma TPEST_{17}$	$\Sigma OPEST_{11}$	ΣDDT_6
NSCW	27	ND	5	3.5	1.5
(SD)	(6)	NA	(1)	(0.9)	(0.1)
NSDI	39	ND	4	2.0	2.0
(SD)	(9)	NA	(0)	(0.3)	(0.1)
NSGC	26	ND	3	1.6	1.3
(SD)	(4)	NA	(1)	(0.7)	(0.9)

TABLE 6. Comparison of median summary organic contaminant concentrations (and 85th percentile) for the 2001 Gulfwatch Samples with NOAA Status & Trends program (1991-1996) statistics. Values are µg/g dry weight.

	GW 2001		NS&T 1991		NS&T 1992		NS&T 1993		NS&T 1994		NS&T 1995		NS&T 1996	
	Median,	85th P	Median,	85th P	Median,	85th P	Median,	85th P	Median,	85th P	Median,	85th P	Median,	85th P
ΣPAH_{24}	110	582	227	937	233	959	253	1201	210	1291	190	913	274	851
ΣPCB"18"	27	42	26	145	31	186	30	157	39	152	28	207	58	180
$\Sigma TPEST_{17}$	6.7	27	30	116	37	132	37	131	38	127	31	127	40	126

Note: only the 18 PCB congeners common to both GW and NOAA Mussel Watch were used.

4.0 2001 DISTRIBUTIONS OF CONTAMINANTS IN *MYTILUS EDULIS*

4.1 SPATIAL PATTERNS

Figures 2 to 5 show the concentration of the metals measured in the tissue of *M. edulis* collected from the 2001 Gulfwatch sites arranged clockwise around the GOM, beginning with the sites in Massachusetts and ending in Nova Scotia (Fig. 1 above). Overall, the concentrations of most metals were relatively evenly distributed around the Gulf of Maine, with no apparent spatial trends and an occasional hot spot of elevated concentrations. Exceptions to this general pattern and further details for metals and organic contaminants are noted in the following individual sections:

4.1.1 Silver (Ag)

Silver concentrations ranged from below the MDL (0.1 µg/g dry weight) in over half of the sites (9 of 17) sampled in 2001 (Table 3; Figure 2, top panel). The highest Ag concentration (0.3 µg/g dry weight) was observed at the South Mill Pond site in New Hampshire (NHSM). However, one replicate significantly different from the other three and is suspected as an artefact of sampling and handling. 2001 is the first year of the Gulfwatch monitoring program where Ag was reported near the MDL of 0.1 ug/g dry weight for Sandwich, MA (MASN), which has historically been one of the more contaminated sites, with respect to Ag, of the Gulfwatch Program. Elevated silver concentrations in sediments and water column have been shown to coincide with regions receiving municipal sewage (Sanudo-Wlhelmy and Flegal, 1992; Buchholz ten Brink et al., 1997). Because of silver's use in the photographic and jewelery industries, part of the coastal waters of Massachusetts are up to 1000 times more concentrated in Ag than in northern coastal Gulf of Maine waters (Krahforst and Wallace 1996). The higher levels previously reported for MASN may have been a function of transport and deposition of sewage-derived particles from Boston Harbor (Bothner et al. 1993) that were sequestered in Cape Cod Bay sediments and taken up by mussels. Recent coastal management practices associated with the Boston Harbor cleanup (source load reduction and movement of the major outfall further offshore) may be important to understanding changes in the body burden of Ag in mussels collected in coastal Massachusetts waters, especially at MASN.

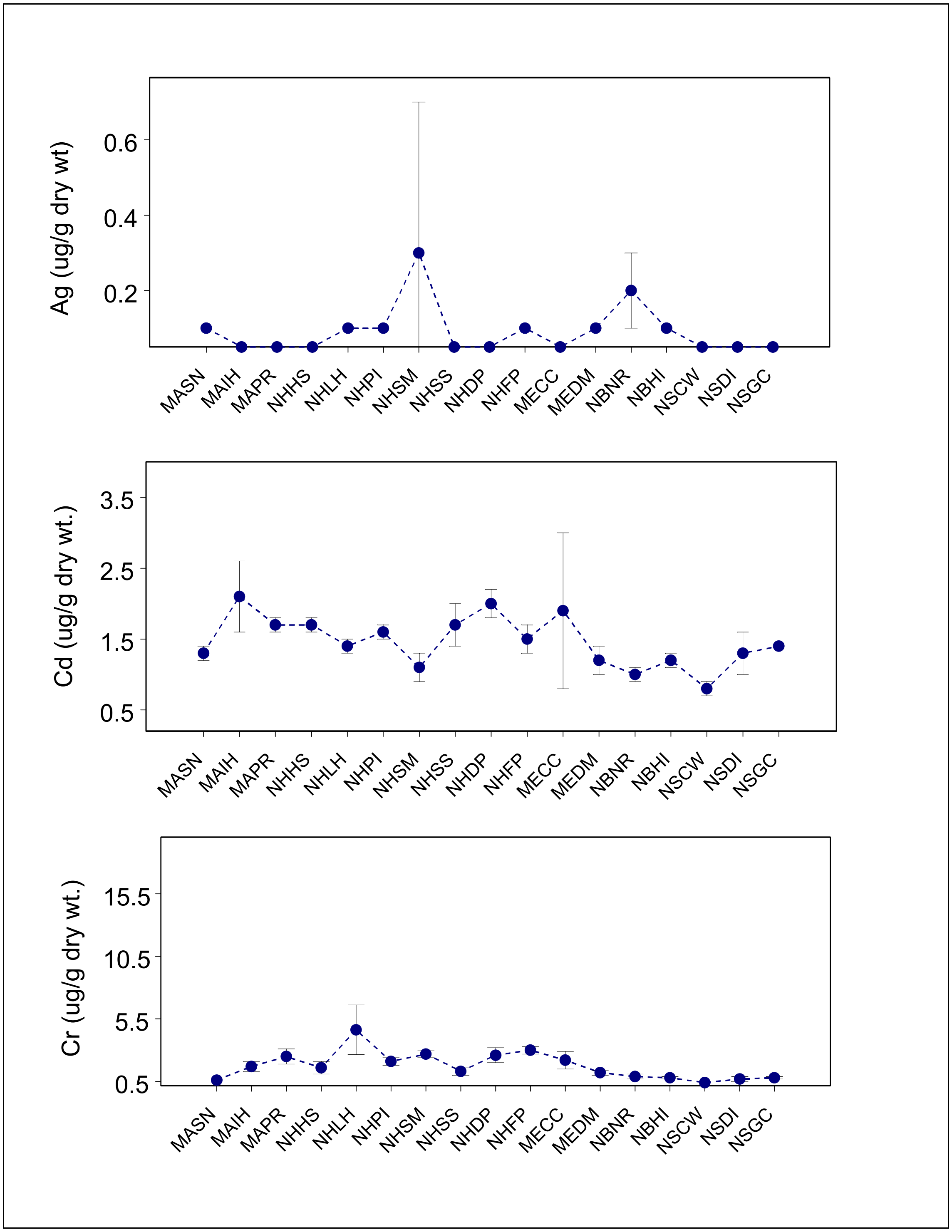

Figure 2. Distribution of silver, cadmium, and chromium tissue concentrations (arithmetic mean +/- SD, µg/g dry weight) in mussels at Gulfwatch sites in 2001.

4.1.2 Cadmium (Cd)

Cadmium was rather uniformly distributed among the Gulfwatch 2001 samples reflecting the control natural coastal sediments and ubiquitous non-point sources may play on Cd bio-availability in the Gulf of Maine. Sediments can act as a major pollutant reservoir because metals and other contaminants can bind to the sediments and become bioavailable to the rest of the food chain. Cadmium is mainly delivered to the aquatic environment from airborne chemicals that are both natural and man-made and include sources from fossil fuel burning, industrial airborne chemicals, auto exhausts, intensive agriculture, and forestry. Localized sources of Cd from industrial waste associated with the production of batteries, plating, stabilizers, and nuclear energy production may be important sources of exposure for *M. edulis* collected in Boston Harbor and the New Hampshire Great Bay Estuary system. The concentration of cadmium in mussel tissue ranged from 0.8 µg/g dry weight at Cornwallis, N.S. (NSCW) to 2.1 µg/g dry weight at the Boston Inner Harbor, MA (MAIH) (Table 3; Figure 2, middle panel).

4.1.3 Chromium (Cr)

The mean Cr concentrations in *M. edulis* collected from the Little Harbor site, NH (NHLH) exceeded the Gulfwatch MD + PC85 (Table 3; Figure 2, bottom panel) when all replicates were considered (NHLH = 9.5 ± 9.8 µg/g dry weight). However, NHLH showed the greatest scatter in replicate data as well. Much more "typical" Cr concentrations (~3 µg/g dry weight) were reported for NHLH in 1995 and 1998. Further review shows one of the four replicates to be suspect for contaminant artifacts (being >3 SD of the mean of remaining replicates). Therefore, potential contamination from sampling and handling cannot be ruled out. We chose the value of 4.63 (±1.98) µg/g dry weight to better represent the Cr value for NHLH. The lowest concentration observed by Gulfwatch for 2001 (0.4 µg/g dry weight) was at the Cornwallis site in Nova Scotia (NSCW).

Chromium is the primary agent used in the tanning process and was discharged with untreated tannery wastes throughout much of this century. Chromium persists in the environment as shown by elevated concentrations in the sediments near such sources (Capuzzo, 1974; NCCOSC, 1997). During the 19^{th} and 20^{th} centuries, coastal New Hampshire was one of the hide tanning centres of the United States. Other tannery centers were located in Salem, MA and on the Saco River, ME (Capuzzo, 1996). High Cr was also observed in the sediments of the Gulf of Maine by other studies (Mayer and Fink, 1990).

4.1.4 Copper (Cu)

In 2001, the concentration of copper in *M. edulis* ranged from 6 µg/g dry weight at several locations around the GOM to 22 µg/g dry weight at Boston Inner Harbor (MAIH) (Table 3; Figure 3, top panel). Copper in mussels collected from Boston's Inner Harbor site (MAIH) exceeded the 1991 NS&T MD + PC85 concentration. Other than MAIH, Cu in 2001 Gulfwatch samples were more uniformly distributed throughout the study region. Copper in Boston Harbor and surrounding waters is well associated with municipal waste waters (Krahforst, in prep). Elevated concentrations of Cu at MAIH is most likely associated with municipal waste water discharges to Boston Harbor and the legacy of contamination in Boston Harbor sediments.

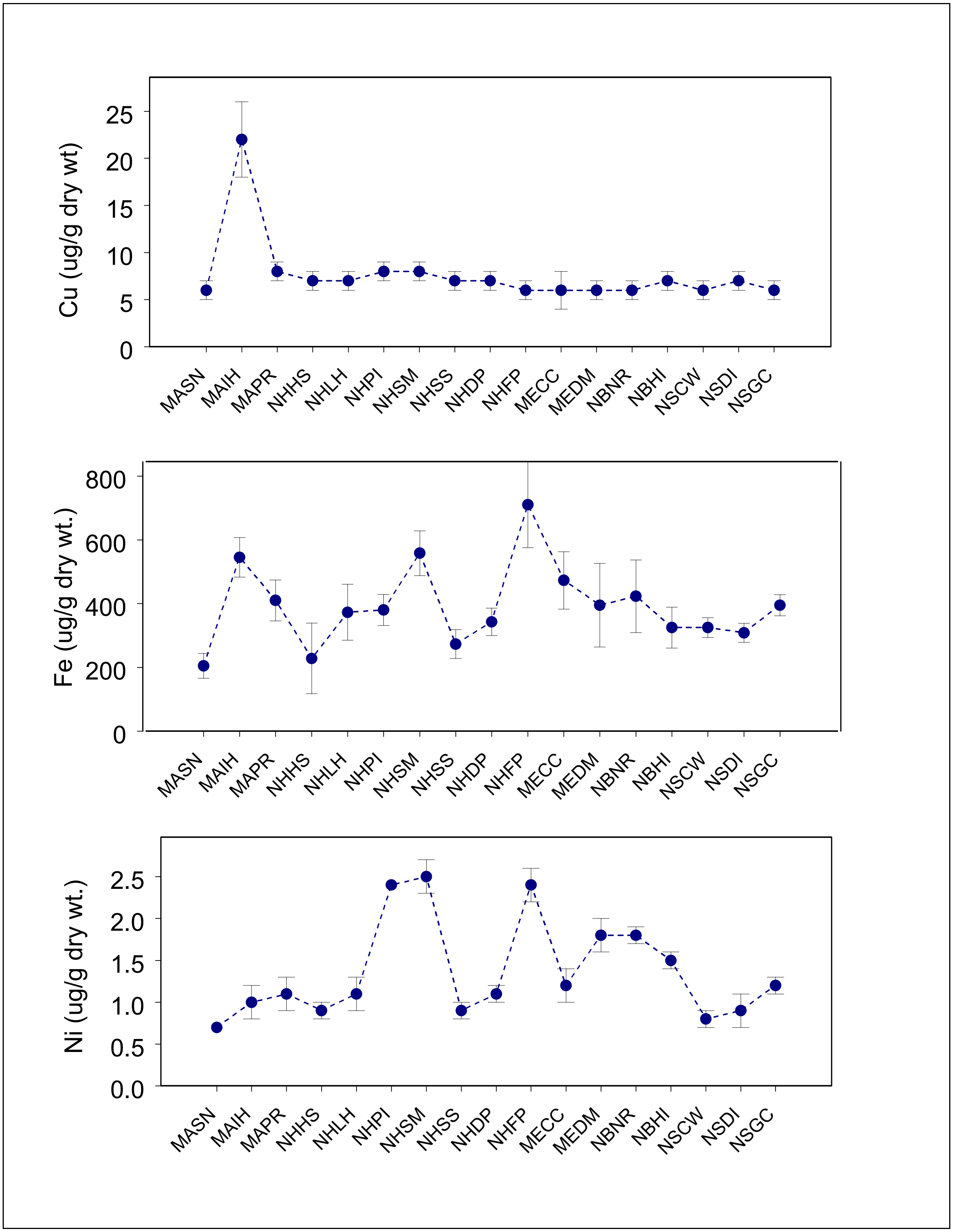

Figure 3. Distribution of copper, iron, and nickel tissue concentrations (arithmetic mean +/- SD, µg/g dry weight) in mussels at Gulfwatch sites in 2001.

4.1.5 Iron and Aluminium (Fe & Al)

The highest concentrations for both Al and Fe were generally found at New Hampshire and southern Maine sites (Table 3; Fig. 3, middle panel; and Fig. 4, bottom panel). The concentration of Fe ranged from 205 µg/g dry weight at Sandwich, MA (MASN) to 710 µg/g dry weight at the Fox Point site in NH (NHFP). Similarly, the concentration of Al ranged from 65 µg/g dry weight at MASN to 265-270 µg/g dry weight at NHFP and Little Harbor, NH, respectively. Consistent with previous year results, the sites with the lowest and highest Fe concentrations generally were mimicked in respective Al concentrations. The tissue analysis for Al and Fe is included to serve as a potential measure of sediment-associated metals captured along with mussel tissue composite preparation. The concern within the Gulfwatch program is that the observed elevated levels of some trace metals may be a function of sediment that had been incorporated into the samples (sediment material attached to mussel tissue or contained within mussel's gut). Sites where resuspension during windy storm events or intensive tidal action (such as in the Bay of Fundy) occur may be more susceptible to sediment contamination in their respective composites.

Aluminium values may prove valuable for correcting metal concentrations in mussel tissue to better reflect exposure of *M. edulis* to contamination. Average Metal-to-Al ratios can be derived from crustal abundances reported in literature (Wedepohl, 1995) and the potential crustal contribution may be removed from the metal concentrations of each sample to strengthen the analysis of metal contamination in the Gulf of Maine. However, recoveries of Al from standard reference materials (Appendix B) were exceptionally low (34%) and somewhat inconsistent (± 29%) and should be viewed with caution.

4.1.6 Nickel (Ni)

Nickel in Gulfwatch 2001 samples exhibited the following sub-regional differences: highest values and greatest variability occurred in the New Hampshire Great Bay Estuary system; and greater than the median 2001 Gulfwatch value for sites located in New Brunswick. The concentration of nickel ranged from 0.7 µg/g dry weight at the Sandwich, MA site, (MASN) to 2.4-2.5 µg/g dry weight at Pierce Island and Fox Point in NH (NHPI, NHFP), respectively. (Table 3; Figure 3, bottom panel). Sub-regional impacts may be from local uses of Ni, such as in electroplating processes, production of batteries, and as catalysts, which contribute to municipal wastewater contamination as well as forming the legacy of some of the local sediment contamination. The levels of Ni in NH Great Bay Estuary sites may be related to the proximity of the Portsmouth Naval Shipyard where waste plating sludge and lead batteries were both stored and disposed (NCCOSC, 1997). Outside of the

2001 MA samples, Ni appears to show some similarity in distribution with that of Fe, and possible Pb (Fig. 4, top panel).

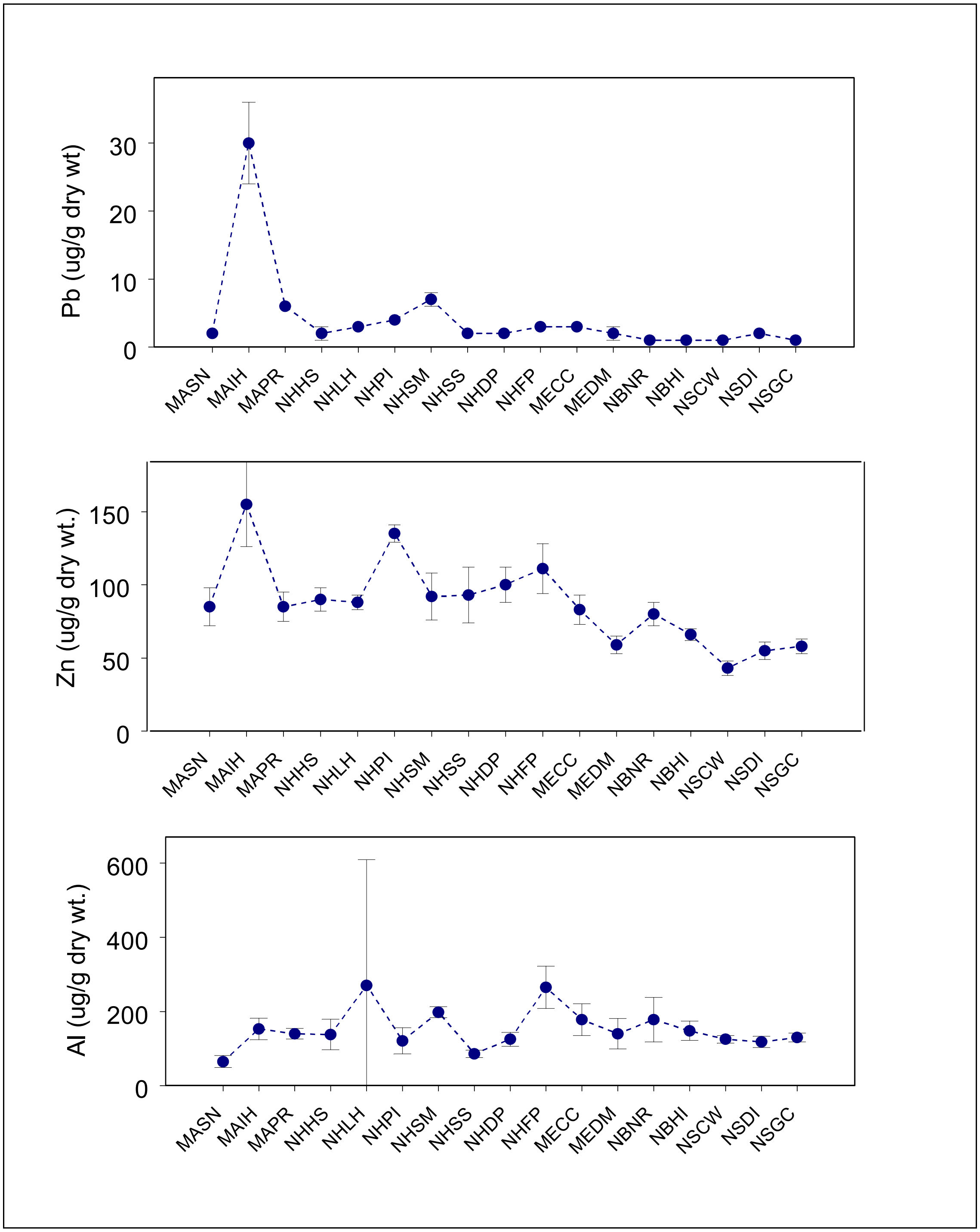

Figure 4. Distribution of lead, zinc, and aluminum tissue concentrations (arithmetic mean +/- SD, µg/g dry weight) in mussels at Gulfwatch sites in 2001.

4.1.7 Lead (Pb)

The concentration of lead ranged from a value of 0.9 µg/g dry weight at Hospital Island, N.B. (NBHI), to 29.8 µg/g dry weight at the Boston Inner Harbor site, MA (MAIH) (Table 3, Figure 4, top panel). Lead levels at MAIH, the Pines River site, MA (MAPR), and the Little Harbor site (NHLH) exceeded NS&T MD + PC85 value of 4.34 µg/g dry weight. The highest Pb concentrations were observed in mussels collected at the MAIH. Lead concentrations in surface sediments in the inner portion of Boston Harbor have been reported as high as 245 µg/g dry weight (in Stolzenbach and Adams, Ed., 1998). Boston Inner Harbor is impacted by the largest municipal wastewater treatment facility and receives the drainage from highly industrialized watersheds. Historical contamination to the sediments of Boston Harbor and the Pines and Saugus Rivers in Massachusetts is well documented. The NH South Mill Pond site was the second most contaminated site, with respect to Pb, of the 2001 Gulfwatch sites. As with Ni, some of the elevated Pb in NH Great Bay Estuary sites may be related to activities associated with the Portsmouth Naval Shipyard. The potential for the Shipyard area to be a source of lead to estuarine biota is supported by observation of contaminated soil adjacent to the Shipyard, containing as much as 14.2 mg Pb/g soil dry weight, and from estimates of contaminated sediment flux from the Shipyard area down the Piscataqua River (Cohen, 2000).

4.1.8 Zinc (Zn)

Zinc contamination is fairly ubiquitous in our environment. Concentrations generally reflect human activity associated with tire wear, galvanized materials and industrial waste discharges. The concentration of zinc ranged from a value of 43µg/g dry weight at the Cornwallis site, NS (NSCW) 155 µg/g dry weight at the Boston Harbor site (MAIH). (Table 3; Figure 4, middle panel). For 2001, there generally seemed to be less Zn contamination in mussels as the sites progressed further north and east along the GOM.

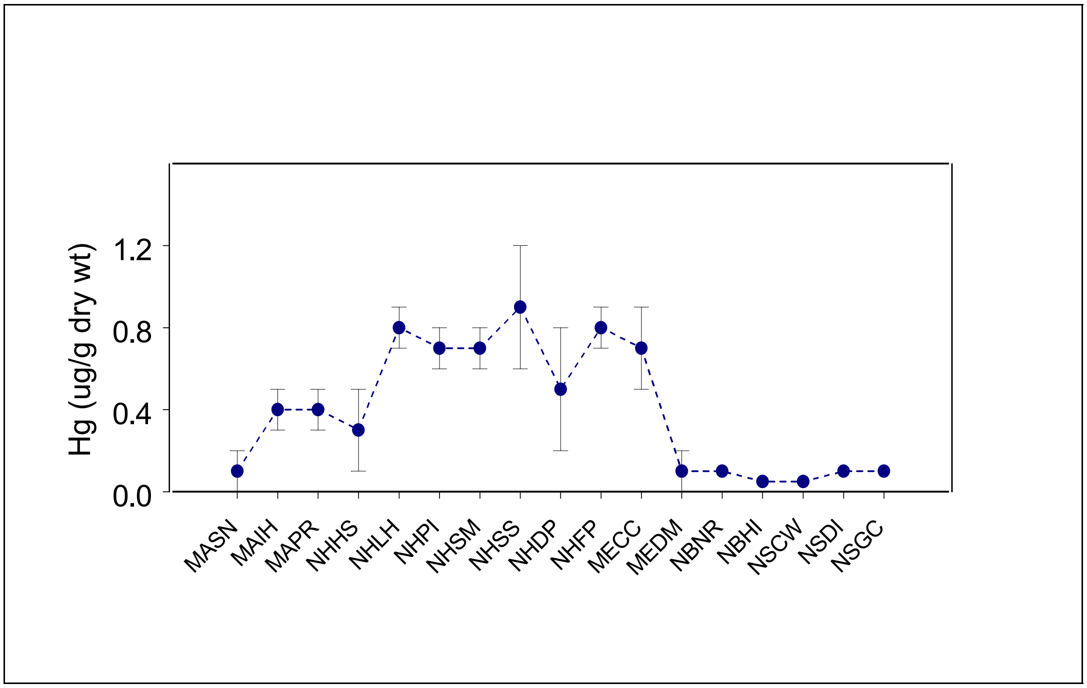

Figure 5. Distribution of mercury tissue concentrations (arithmetic mean +/- SD, µg/g dry weight) in mussels at Gulfwatch sites in 2000.

4.1.9 Mercury (Hg)

The concentration of Hg in mussel tissue were <0.10 µg/g dry weight (non-detectable) at all the Gulfwatch Canadian sites for 2001 (NBNR, NBHI, NSCW, NSDI, and NSGC). Mercury was detected in *M. edulis* collected from all but one of the stations in the United States portion of Gulfwatch sites. For the US sites, Hg ranged from just below the detectable level to 0.93 µg/g at the Schiller Station site, NH (NHSS) (Table 3; Figure 5). All but three (3) of the 12 US sites (MASN, NHHS, and MEDM) exceeded the NS&T MD + PC85 value of 0.35µg/g dry weight. Overall for 200l, the mussel Hg levels from New Hampshire sites were higher than sites in other jurisdictions. Mussels from the reference station for NH, which is located within the Great Bay Estuary, but along the Maine coast (MECC), had levels of Hg comparable to the remaining Great Bay Estuary sites. The consistently higher Hg in the Great Bay Estuary system warrants further evaluation of Hg loading, and its fate and transport to adjacent coastal waters.

There are several known historical Hg sources in the Gulf of Maine (Jones 2004, NCCOSC, 1997). Mean values of Hg in *Mytilus* spp. from coastal regions world-wide range from 0.1 to 0.4 µg/g dry weight (Kennish, 1997), but can be much higher in areas like the south-west Pacific, where sites average as much as 2.7 µg Hg/g dry weight (Fowler, 1990). The 2001 GOM-wide median and 85th Percentile for Hg is 0.35 and 0.78 µg/g dry weight, respectively. In a review of the first five years of the Gulfwatch program, tissue concentrations of Hg were discussed as being unusually high and a possible concern for human health (Tripp et al., 1997).

4.1.10 Organic Contaminants

Analytes within each category of organic contaminant were detected at all US sites and most of the Canadian sites. ΣPCB_{22} was detected at only one of five Canadian sites (Niger Reef, New Brunswick -NBNR - Table 5; Fig. 6, middle panel). The pattern of higher ΣPAH_{24}, ΣPCB_{22}, $\Sigma TPEST_{17}$ and ΣDDT_{6} concentrations in the south-western Gulf compared to the north-eastern Gulf (Figs. 6, 7) continues as observed from previous observations of Gulfwatch data (Jones et al., 2005). This is particularly so for ΣPAH_{24}, ΣPCB_{22}, and ΣDDT_{6} concentrations, where significant increases are observed in mussels collected at many of the US sites. The concentrations of all organic classes were an order of magnitude higher in mussels from Boston Inner Harbor (MAIH), followed by samples from the Great Bay Estuary sites.

ΣPAH_{24} concentrations ranged from 26 and 27 ng/g dry weight at the Grosse Coques and Cornwallis sites in Nova Scotia (NSGC and NSCW), respectively to 3004 ng/g dry weight at the Boston Harbor site (MAIH) (Table 5; Figure 6, top panel). ΣPAH_{24} concentrations in mussels from the sites in the Great Bay Estuary of NH ranged from 91- 633 ng/g dry weight. The only sites that exceeded the NS&T MD + 85P concentrations for ΣPAH_{24} was the MAIH in Boston Harbor.

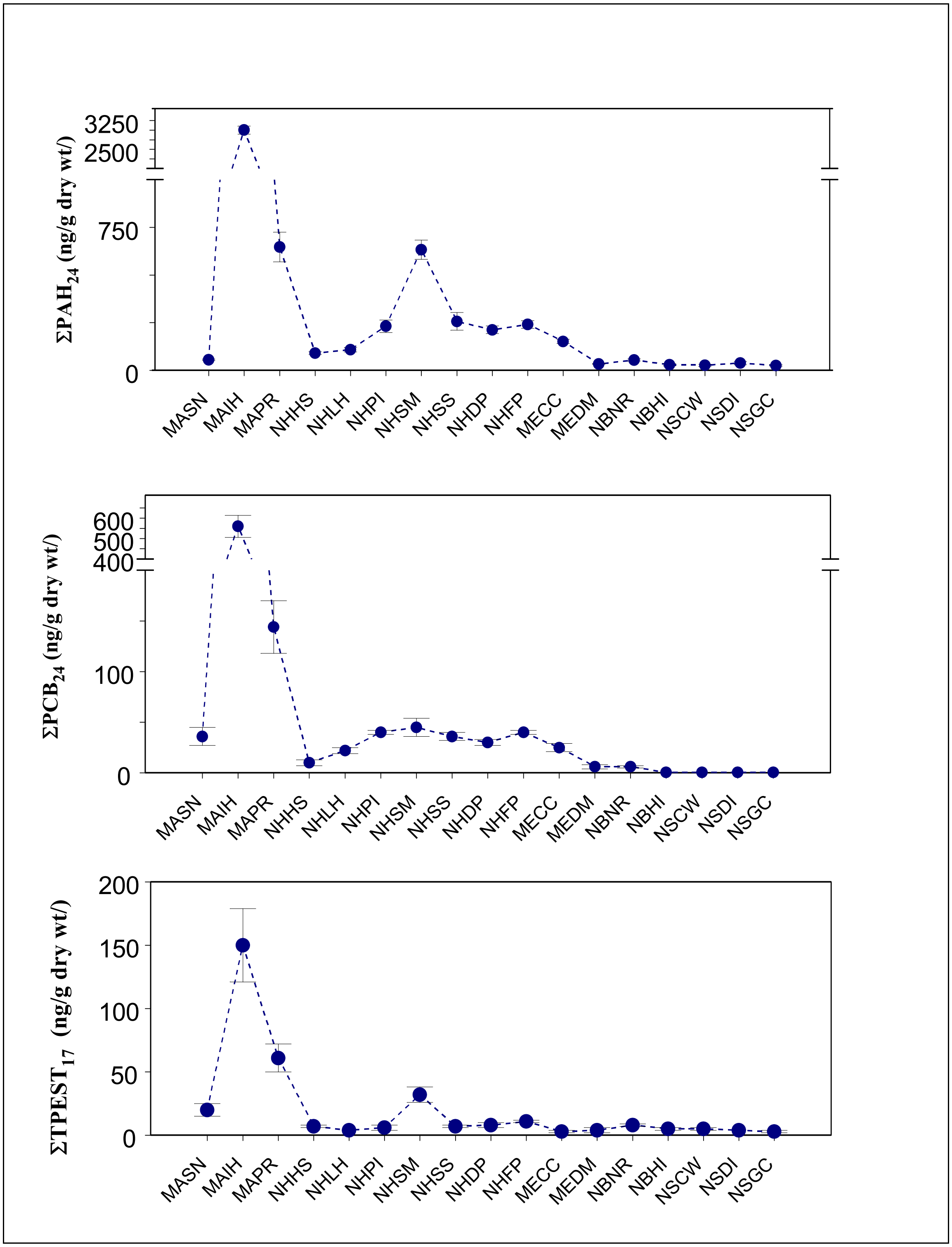

Figure 6. Distribution of ΣPAH24, ΣPCB22, and ΣTPEST17 tissue concentrations (arithmetic mean +/- SD, ng/g dry weight) in mussels at Gulfwatch sites in 2001. Note the split in ΣPAH24 and ΣPCB22 concentration axes.

Detectable concentrations of ΣPCB_{22} were observed in all of the US and one of five of the Canadian Gulfwatch sites. Detectable ΣPCB_{22} concentrations ranged 6 ng/g dry wt. at the Darmariscotta site in Maine (MEDM) and the Niger Reef site in New Brunswick (NBNR) to 560 ng/g dry wt. at MAIH (Table 5; Figure 6, middle panel). Highest levels of ΣPCB_{22} concentrations were observed in the urbanized estuaries of Massachusetts, followed by most of Great Bay Estuary sites and the Massachusetts reference site in Sandwich (MASN).

The concentration of $\Sigma TPEST_{17}$ ranged from 3 ng/g dry wt at Clark's Cove, ME and Grosse Coque in Nova Scotia (MECC and NSGC) to 150 ng/g dry weight at MAIH (Table 5; Figure 6, bottom). In 2001, as in previous reports, ΣDDT_6 and its degenerative metabolites were the main contributors to total detectable pesticides, and exhibited the same spatial pattern as seen for $\Sigma TPEST_{17}$ (Figure 7, bottom panel). ΣDDT_6 is the only contributor to $\Sigma TPEST_{17}$ in mussels collected from the Hampton/Seabrook Harbor (NHHS), Little Harbor (NHLH), Pierce Island (NHPI), Schiller Station (NHSS), Fox Point (NHFP) sites in New Hampshire, and the Clark's Cove (MECC) and Darmiscotta (MEDM) sites in Maine.

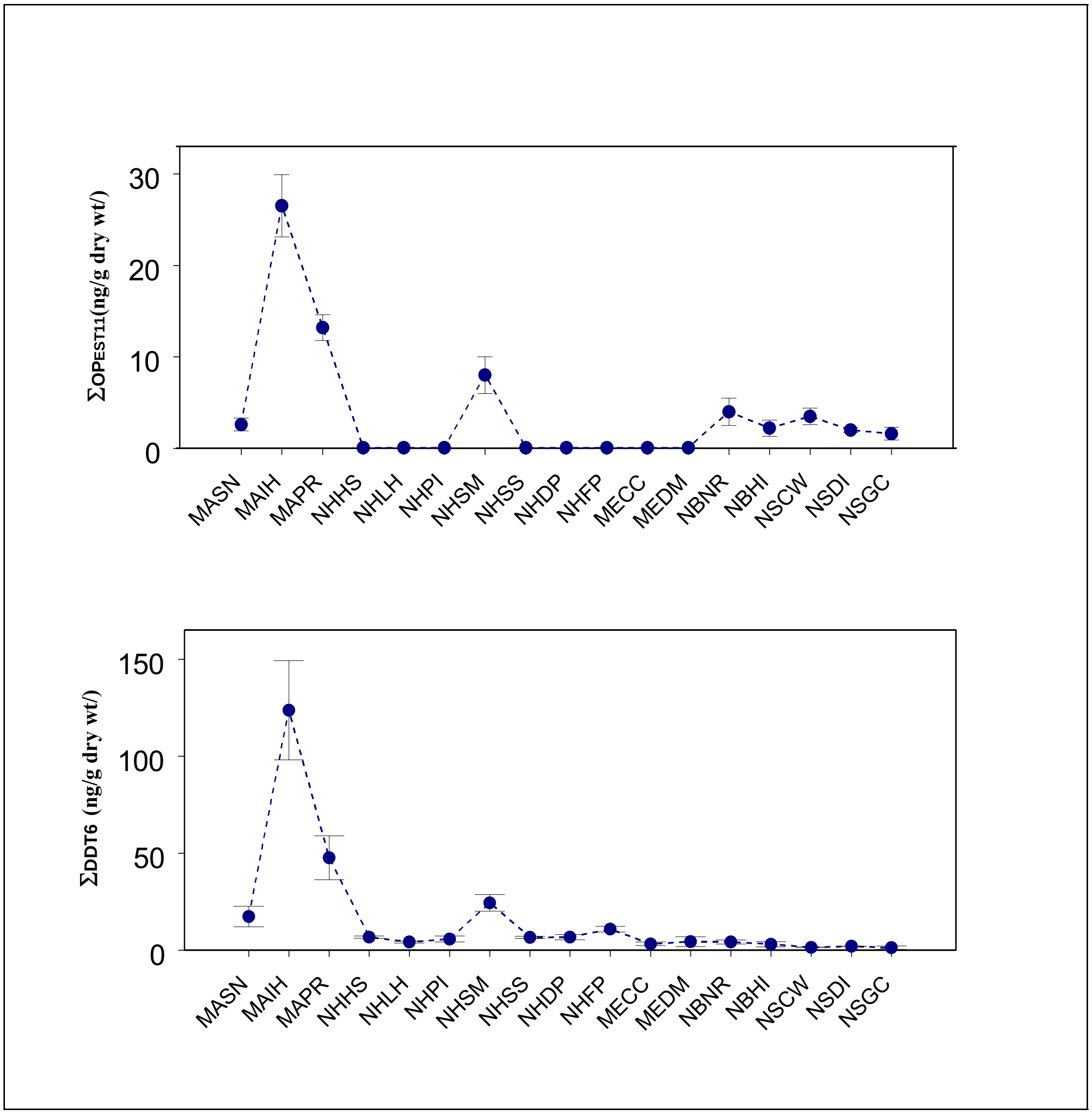

Figure 7. Distribution of other pesticides (no DDT) and ΣDDT_6 tissue concentrations (arithmetic mean +/- SD, ng/g dry weight) in mussels at Gulfwatch sites in 2001.

4.2 Temporal Patterns

Seven of the sites collected in 2001 had been previously sampled at least two times (typically in 1995 and 1998) as prescribed by sampling design of the 9-year Gulfwatch Program. The temporal variability of the distributions of contaminants at seven of the 3-year rotational sites are shown in Figures 8-20. The distribution of contaminants at 5 benchmark, which were scheduled for sampling each year between 1993-2001 are shown in Figures 20-33. For plotting purposes, each non-detectable value was assigned ½ the MDL value and used as the lower limit of each concentration axis to help visualize any potential temporal trends.

4.2.1 3-Year Rotational Sites.

For the 3-year rotational sites, there were examples of apparent linear temporal trends either increasing or decreasing for each metal and suites of organic chemicals. However, the trends were often heavily influenced by large variability among the replicates within the year rather than the result of temporal differences among the years sampled. (e.g., Fig. 20, bottom panel). Most notable for 2001 may be apparent decline of Pb (Fig. 16) at the Pines River site in Massachusetts (MAPR) and Little Harbor, New Hampshire (NHLH); apparent decreases in Hg (Fig. 19) exposure at MEDM and NBNR. Increases in ΣPAH_{24} and ΣPCB_{24} were found for NHLH, MEDM, and possibly NBNR (Fig. 21). For $\Sigma TPEST_{17}$, NSCW showed significant increases since first monitored in 1993. Most of this increase is not from DDT and DDT homologues that are included in the suite of pesticides monitored by the Gulfwatch Program.

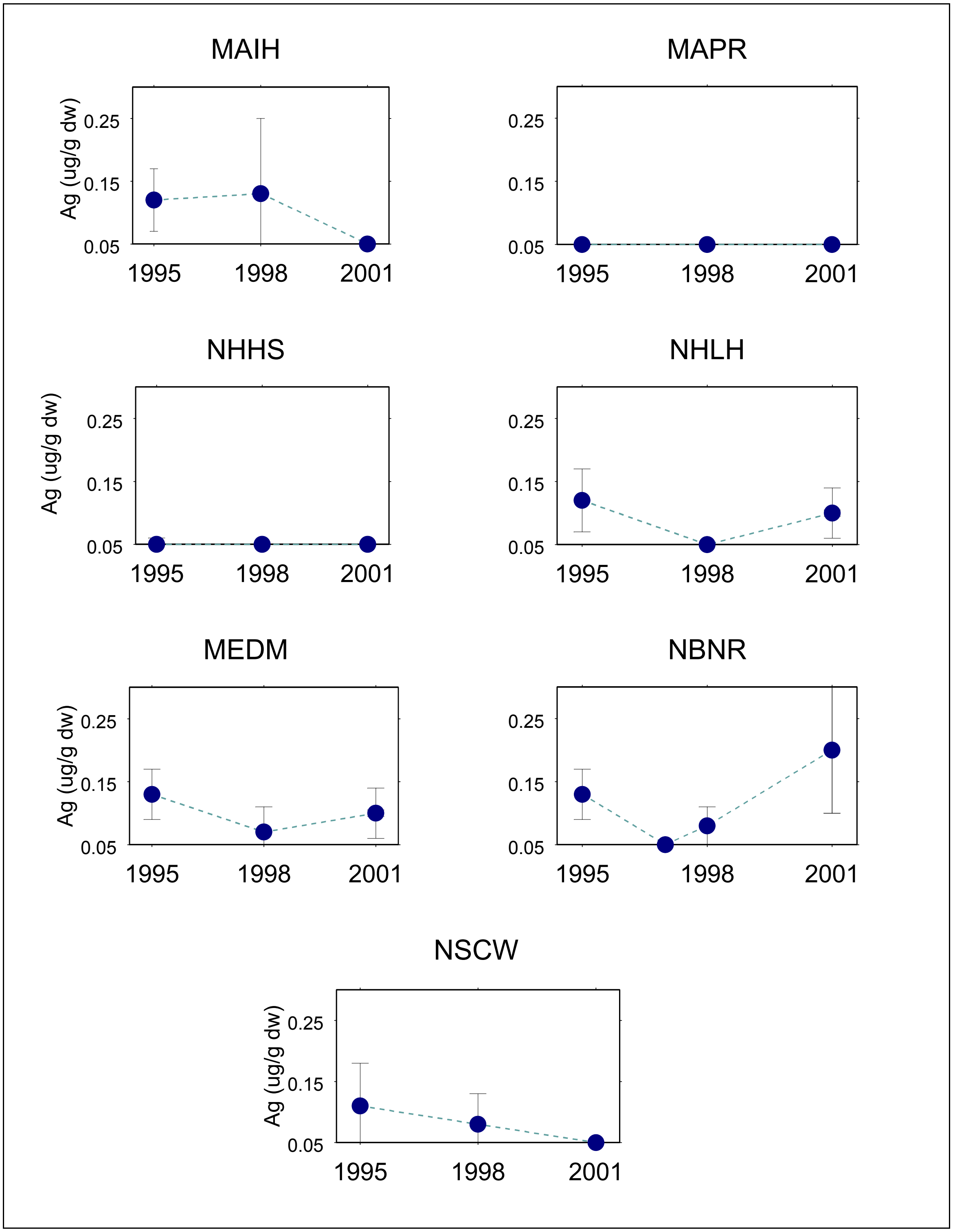

Figure 8. Distribution of silver tissue concentrations (arithmetic mean +/- SD, µg/g dry weight) in mussels collected at Gulfwatch sites from 1995, 1998 & 2001. Note: NBNR sampled in 1997 as well.

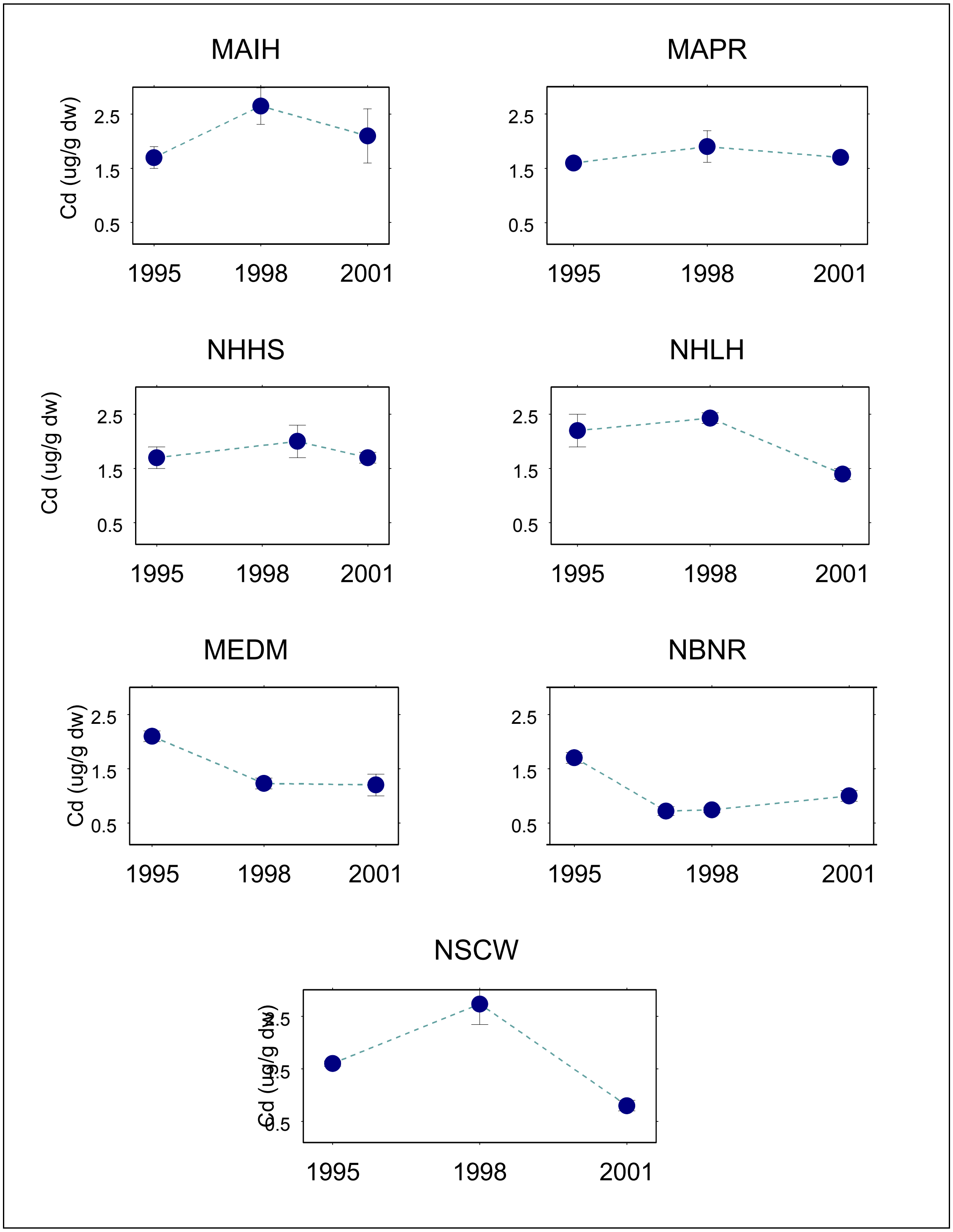

Figure 9. Distribution of cadmium tissue concentrations (arithmetic mean +/- SD, µg/g dry weight) in mussels at Gulfwatch sites in 1995, 1998 & 2001. Note: NBNR sampled in 1997 as well.

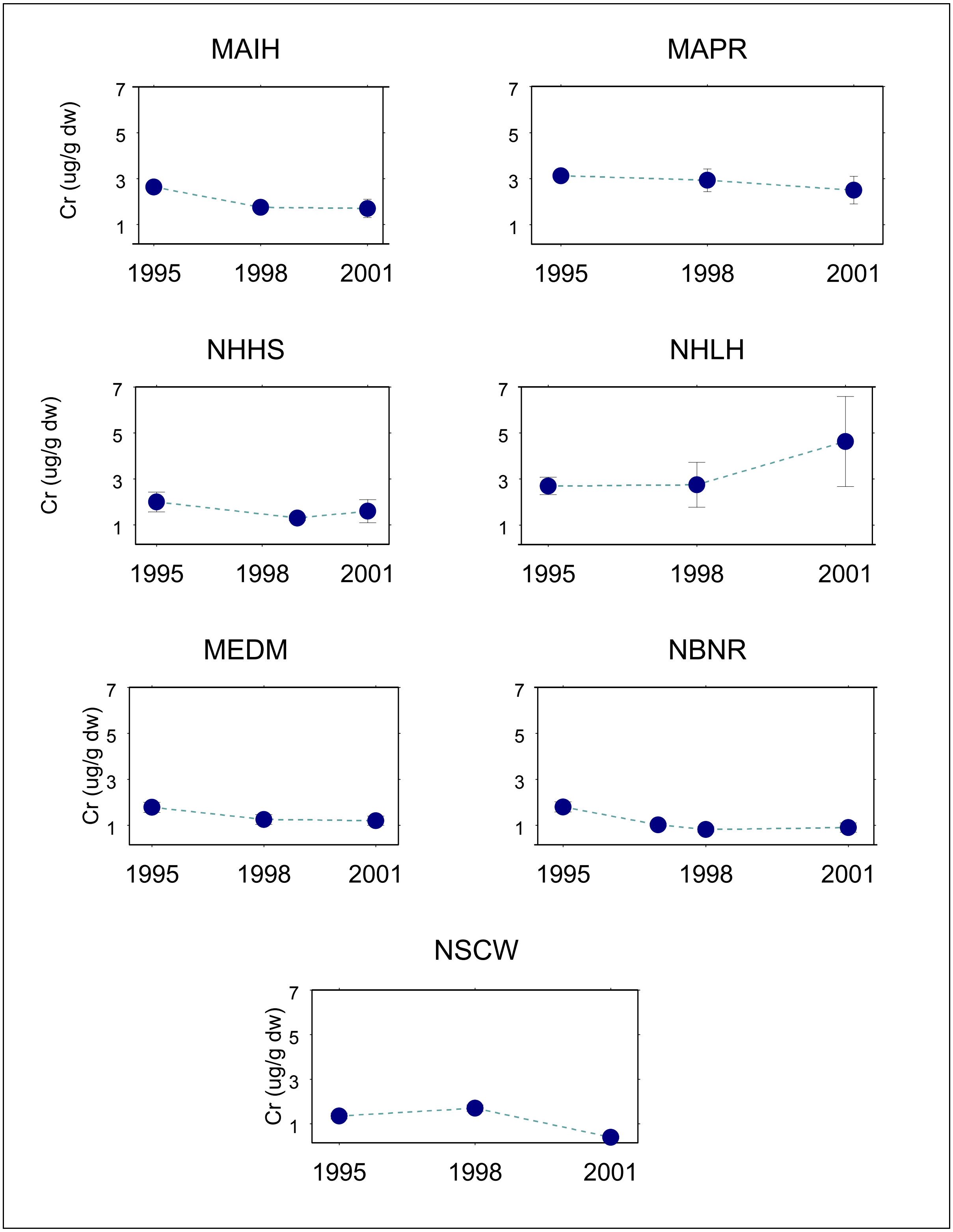

Figure 10. Distribution of chromium tissue concentrations (arithmetic mean +/- SD, µg/g dry weight) in mussels at Gulfwatch sites in 1995, 1998 & 2001. Note: NBNR sampled in 1997 as well.

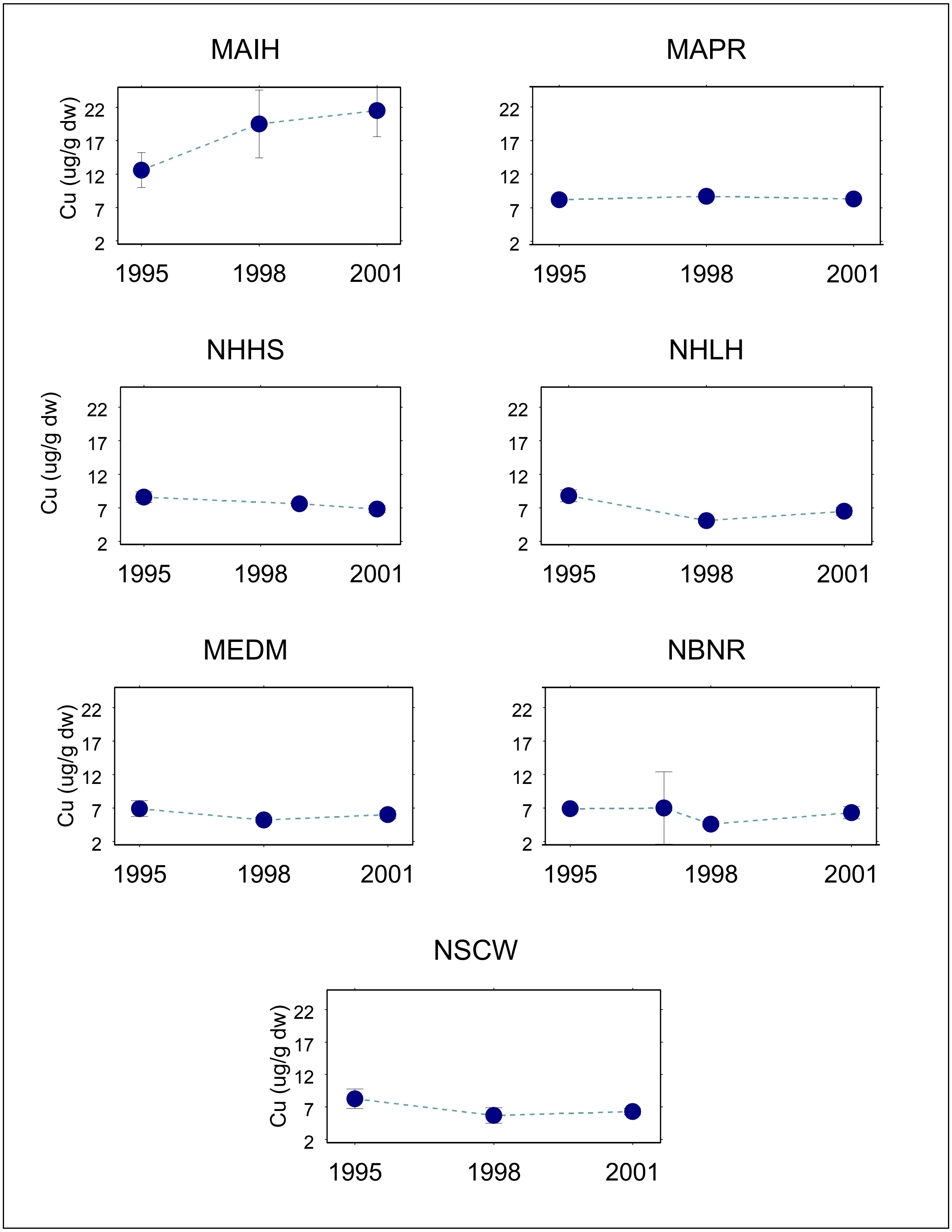

Figure 11. Distribution of copper tissue concentrations (arithmetic mean +/- SD, µg/g dry weight) in mussels at Gulfwatch sites in 1995, 1998 & 2001. Note: NBNR sampled in 1997 as well.

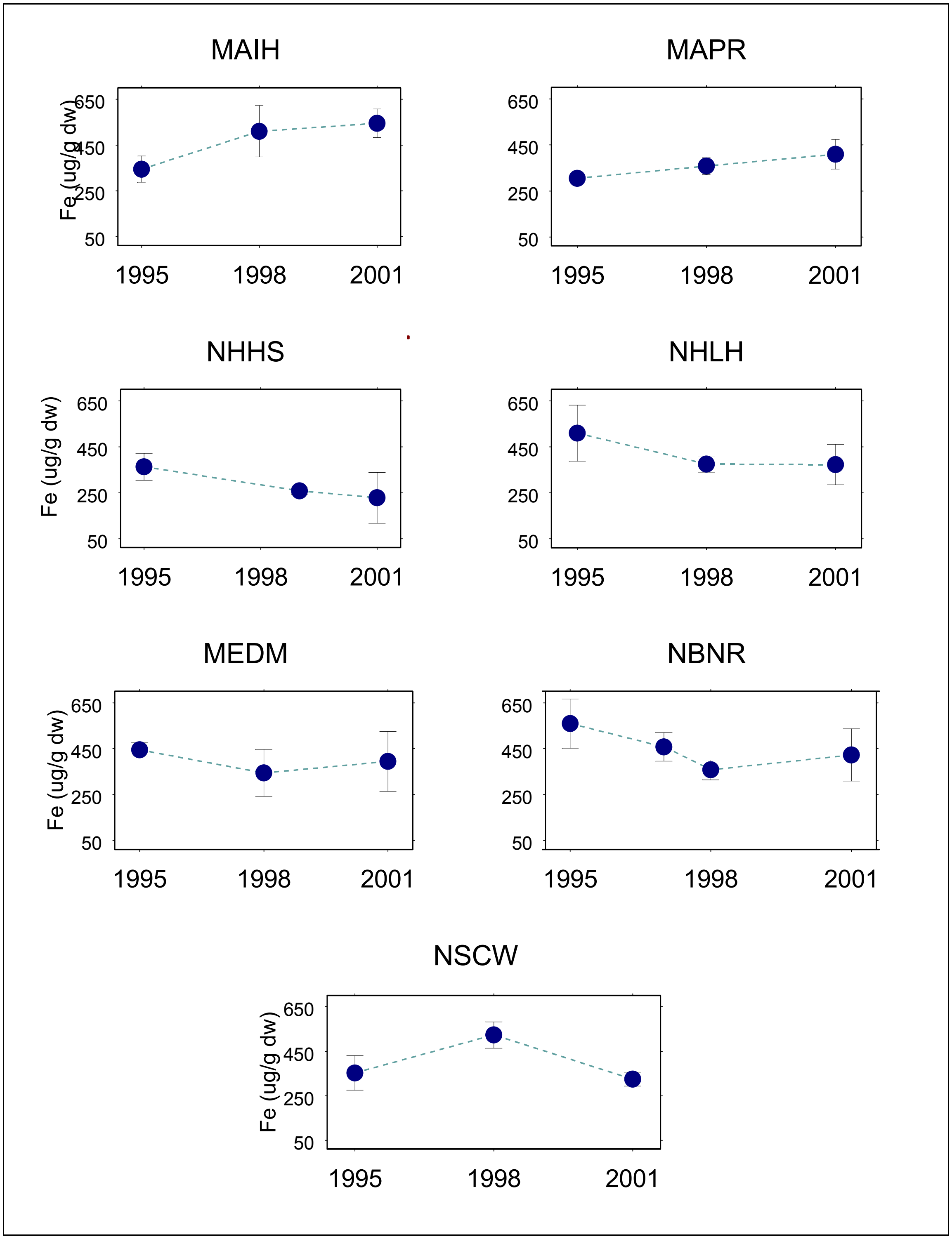

Figure 12. Distribution of iron tissue concentrations (arithmetic mean +/- SD, µg/g dry weight) in mussels at Gulfwatch sites in 1995, 1998 & 2001. Note: NBNR sampled in 1997 as well.

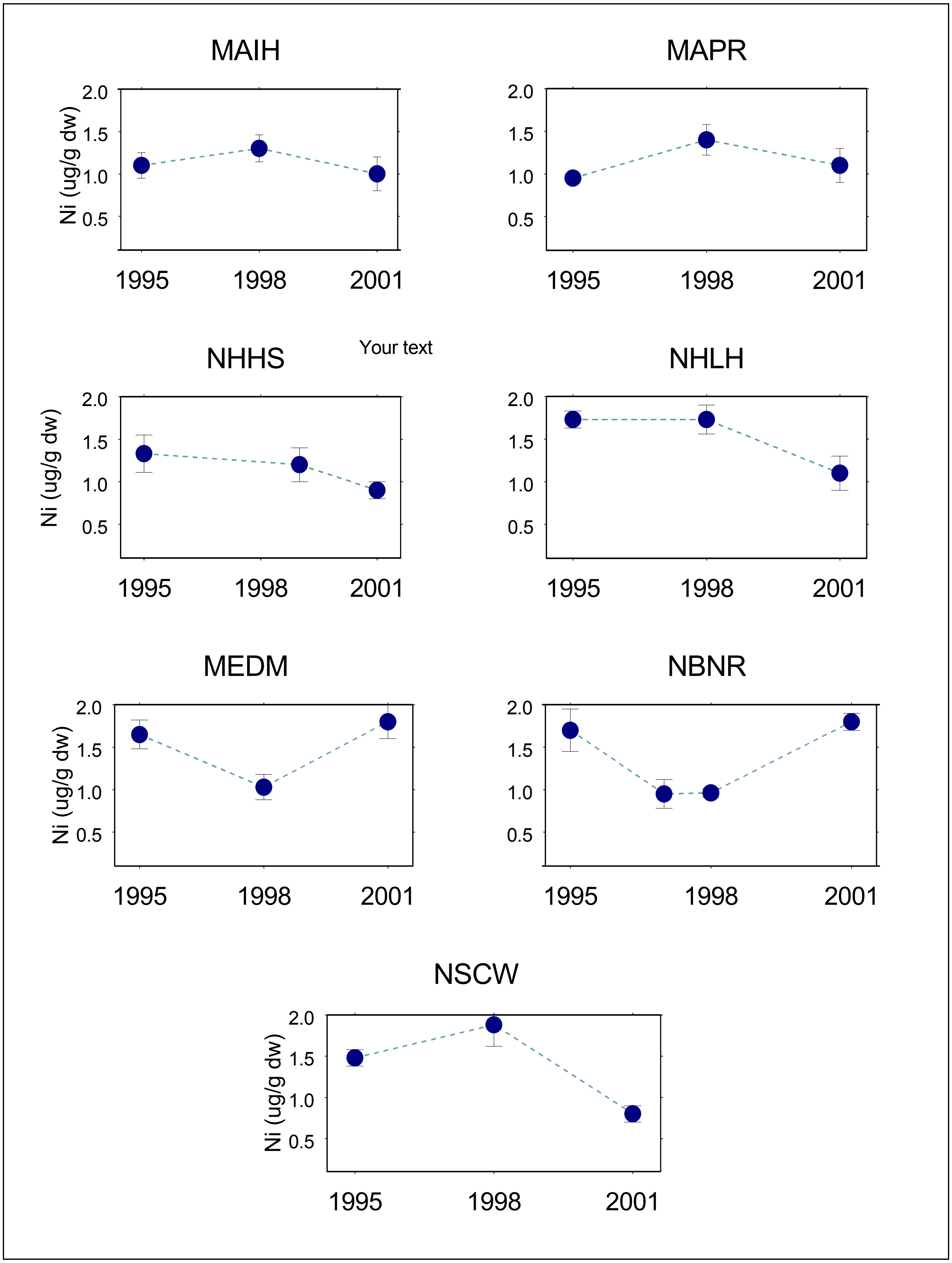

Figure 13. Distribution of nickel tissue concentrations (arithmetic mean +/- SD, µg/g dry weight) in mussels at Gulfwatch sites in 1995, 1998 & 2001. Note: NBNR sampled in 1997 as well.

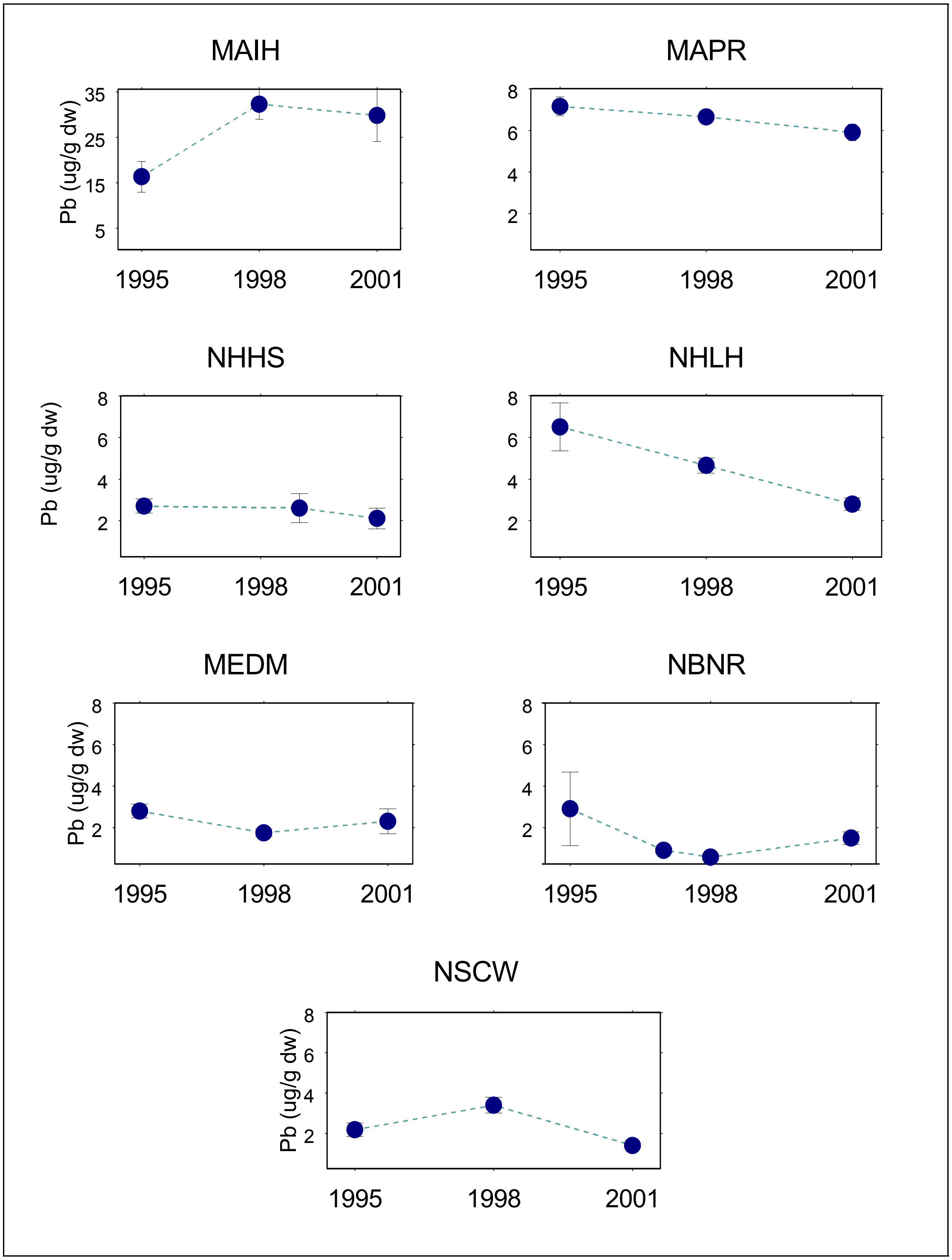

Figure 14. Distribution of lead tissue concentrations (arithmetic mean +/- SD, µg/g dry weight) in mussels at Gulfwatch sites in 1995, 1998 & 2001. Note: NBNR sampled in 1997 as well. Also note the change in concentration scale for MAIH compared to the rest of the plotted stations.

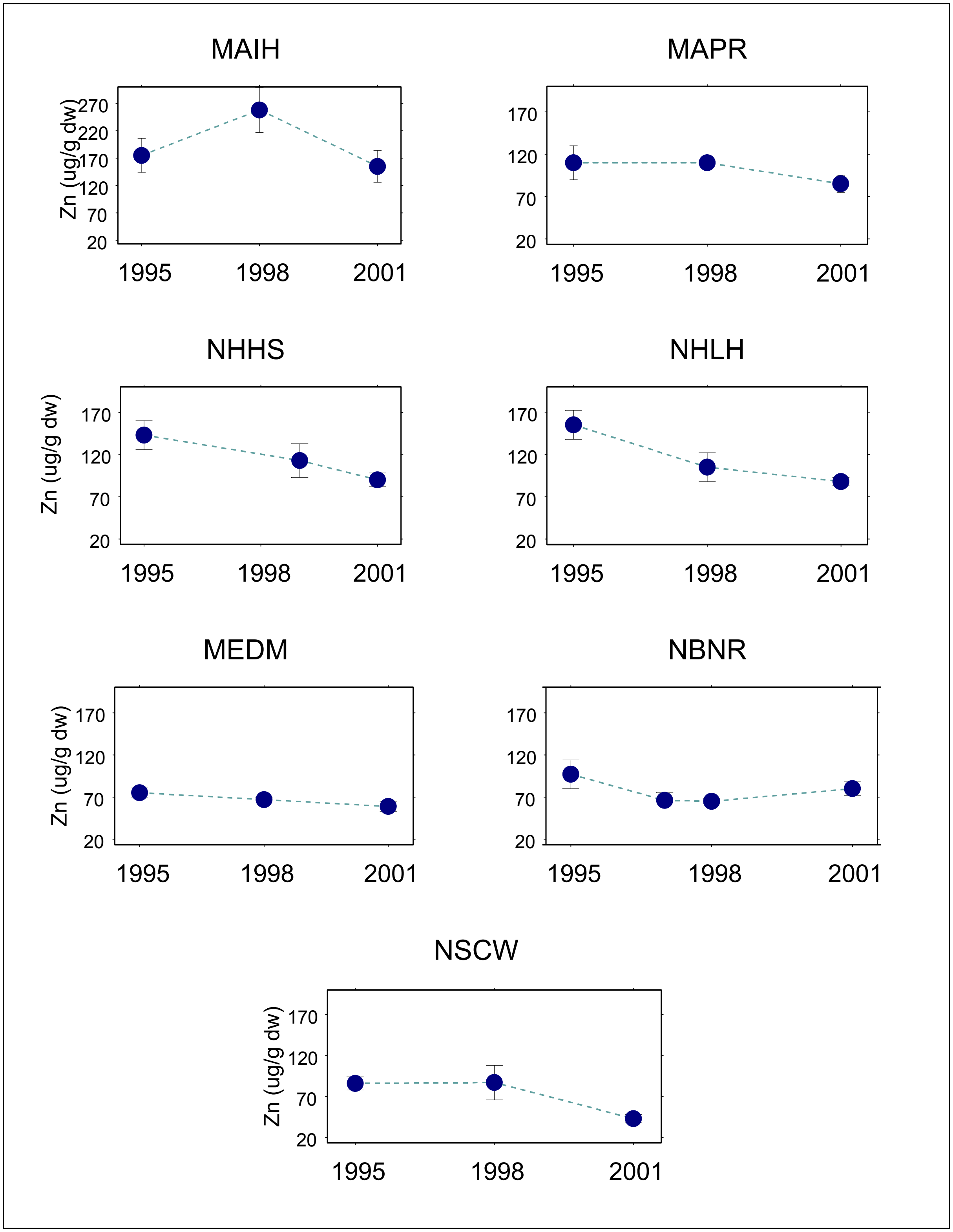

Figure 15. Distribution of zinc tissue concentrations (arithmetic mean +/- SD, µg/g dry weight) in mussels at Gulfwatch sites in 1995, 1998 & 2001. Note: NBNR sampled in 1997 as well. Also note the change in concentration scale for MAIH compared to the rest of the plotted stations.

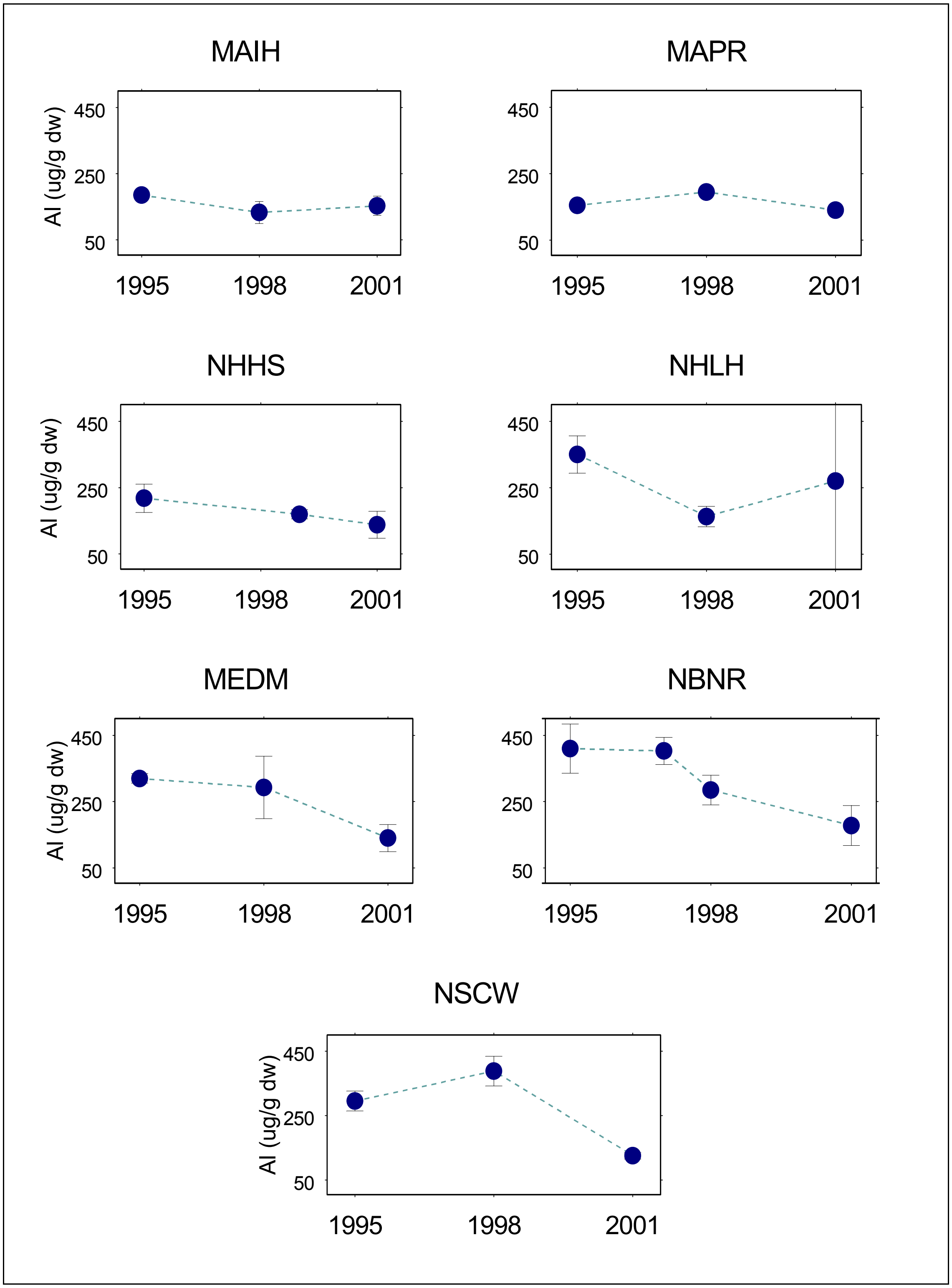

Figure 16. Distribution of aluminum tissue concentrations (arithmetic mean +/- SD, µg/g dry weight) in mussels at Gulfwatch sites in 1995, 1998 & 2001. Note: NBNR sampled in 1997 as well.

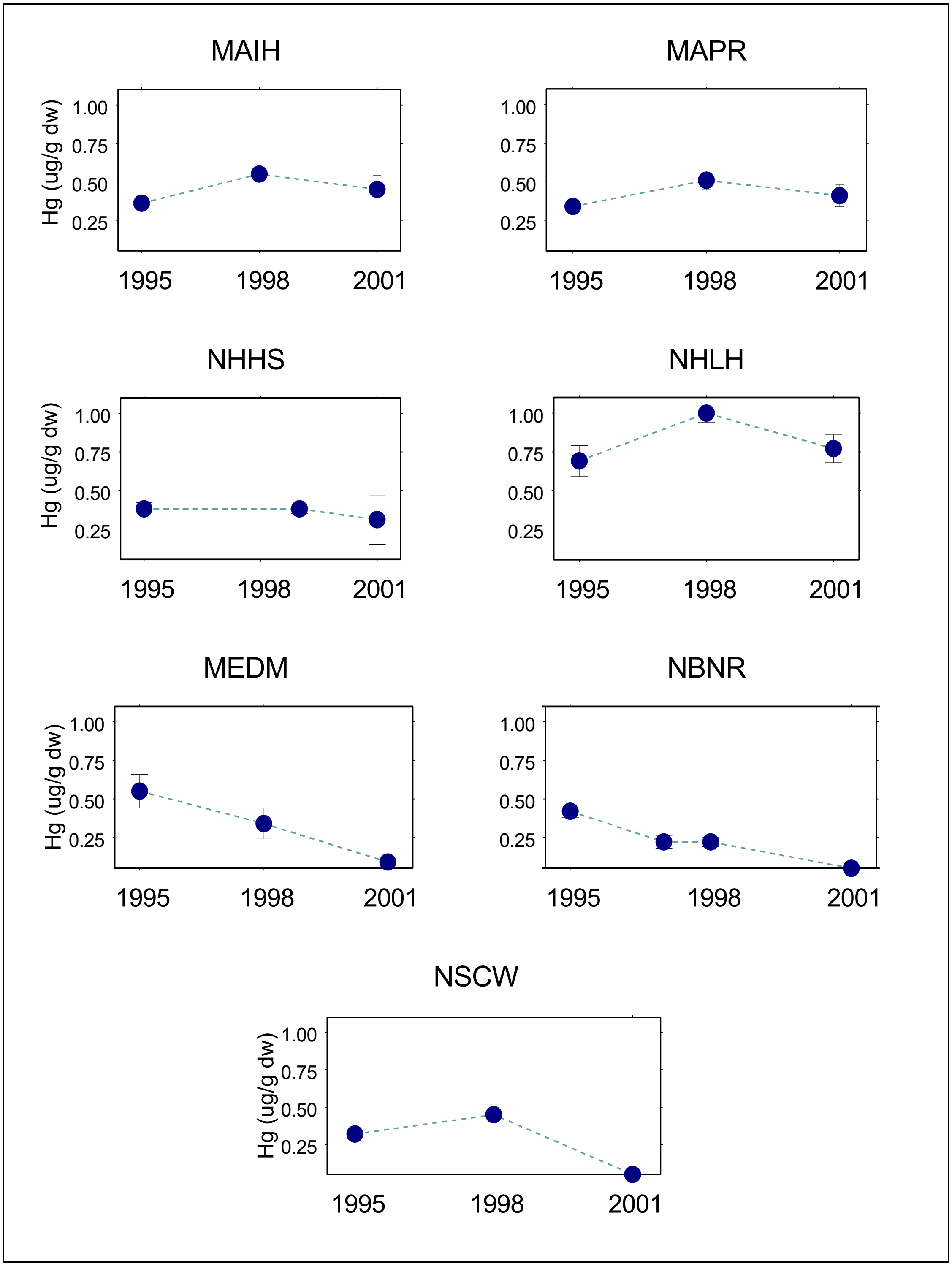

Figure 17. Distribution of mercury tissue concentrations (arithmetic mean +/- SD, µg/g dry weight) in mussels at Gulfwatch sites in 1995, 1998 & 2001. Note: NBNR was sampled in 1997 as well.

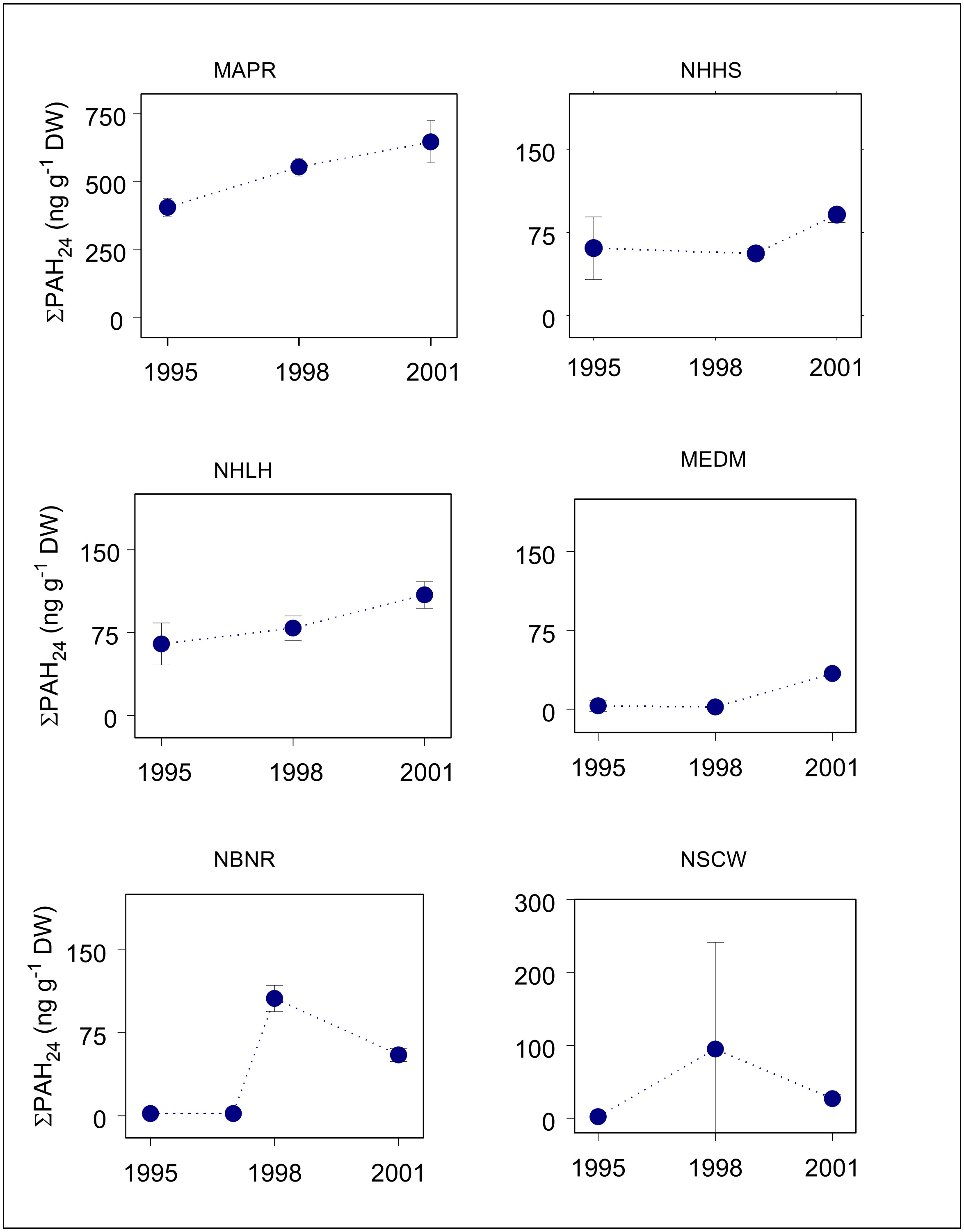

Figure 18. Distribution of ΣPAH24 tissue concentrations (arithmetic mean +/- SD, ng/g dry weight) in mussels at Gulfwatch sites in 1995, 1998 & 2001. MAIH was not analyzed for ΣPAH24 in 1995. Note: NBNR sampled in 1997 as well. Also note the change in concentration scale for MAPR and NSCW compared to the rest of the plotted stations.

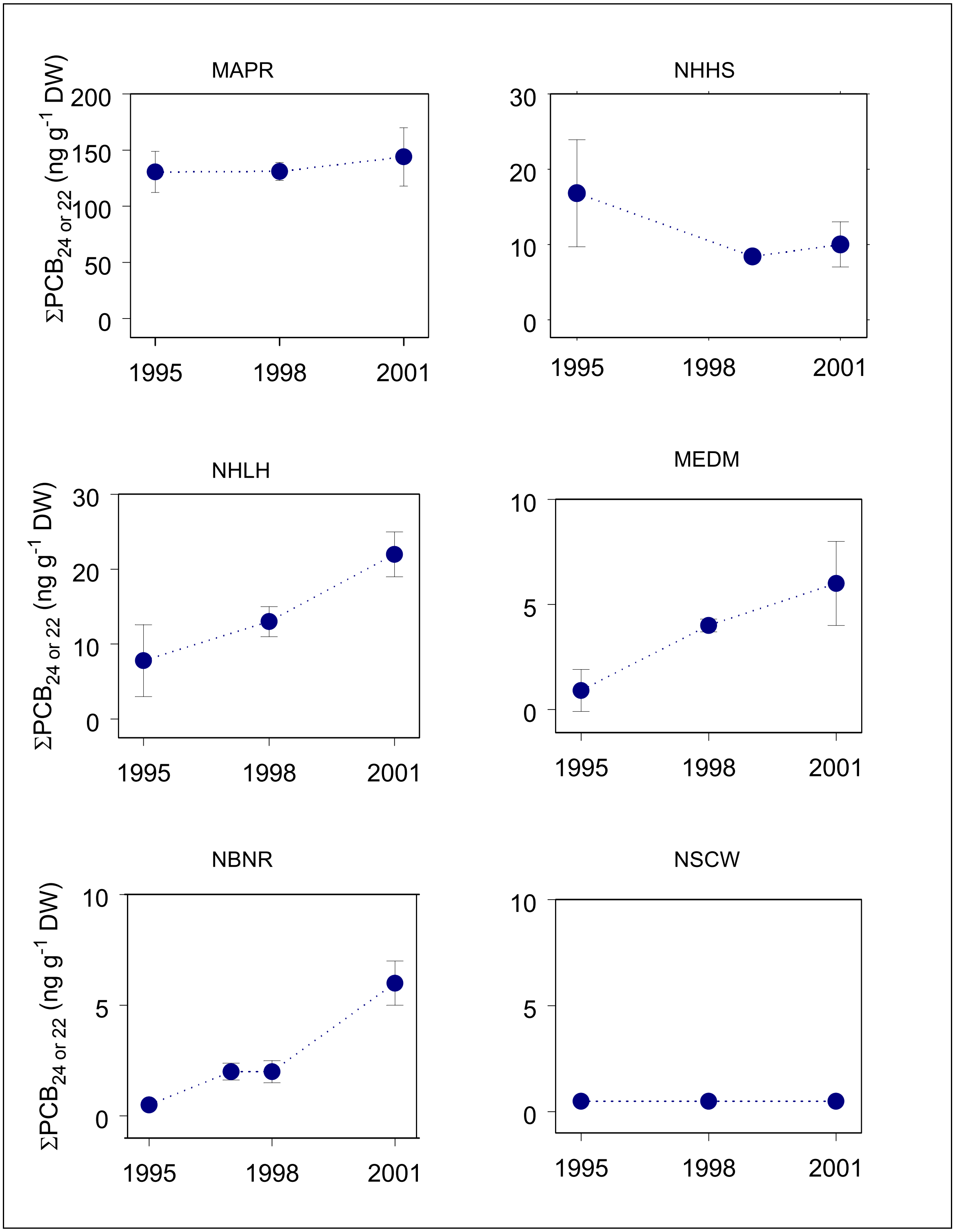

Figure 19. Distribution of ΣPCB24 (or 22 for 2001) tissue concentrations (arithmetic mean +/- SD, ng/g dry weight) in mussels at Gulfwatch sites in 1995, 1998 & 2001. MAIH was not analyzed for ΣPCB_{22} in 1995. Note the differing concentration scales among sites shown.

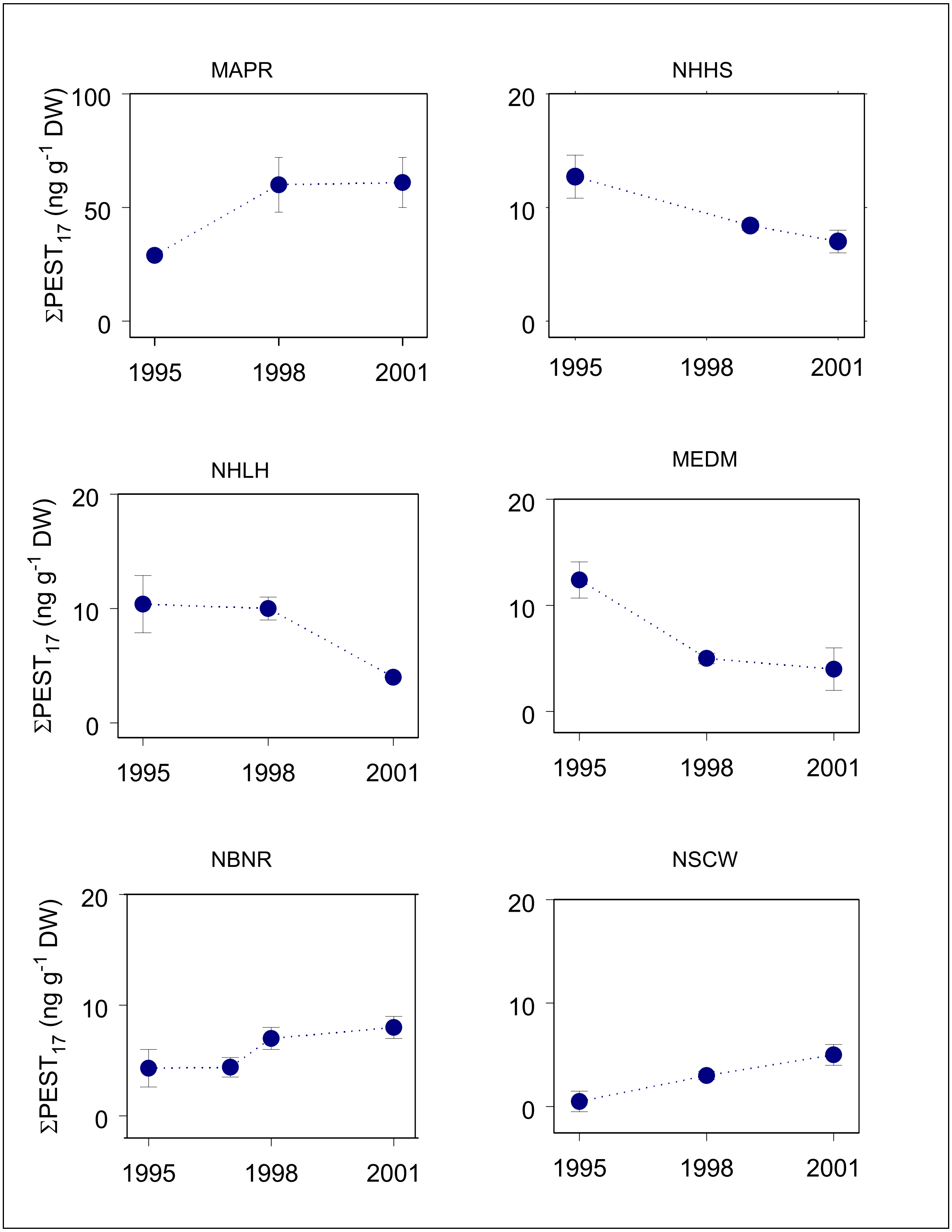

Figure 20. Distribution of $\Sigma PEST_{17}$ tissue concentrations (arithmetic mean +/- SD, ng/g dry weight) in mussels at Gulfwatch sites in 1995, 1998 & 2001. MAIH was not analyzed for $\Sigma PEST_{17}$ in 1995. Note different concentration scale for MAPR.

4.2.2 Benchmark Sites.

Five benchmark sites that were scheduled for sampling each year in addition to the rotational sites were plotted for the 1993-2001 Program period. The temporal variability of contaminants in mussels collected at Gulfwatch benchmark sites are shown in Figures 21-34. Many of metals showed decreasing trends during this period. Statistically significant decreases for several contaminants over time were reported in Jones et al. (in press) using the full 1993-2001 database for benchmark sites. The sites with significant trends were Sandwich, MA (MASN) for Ag, Pb and Cr, Clark Cove, ME (MECC) for p,p'-DDE, Hospital Island, NB (NBHI) for Pb and Hg, and Digby, N.S. (NSDI) for Pb and Cr.

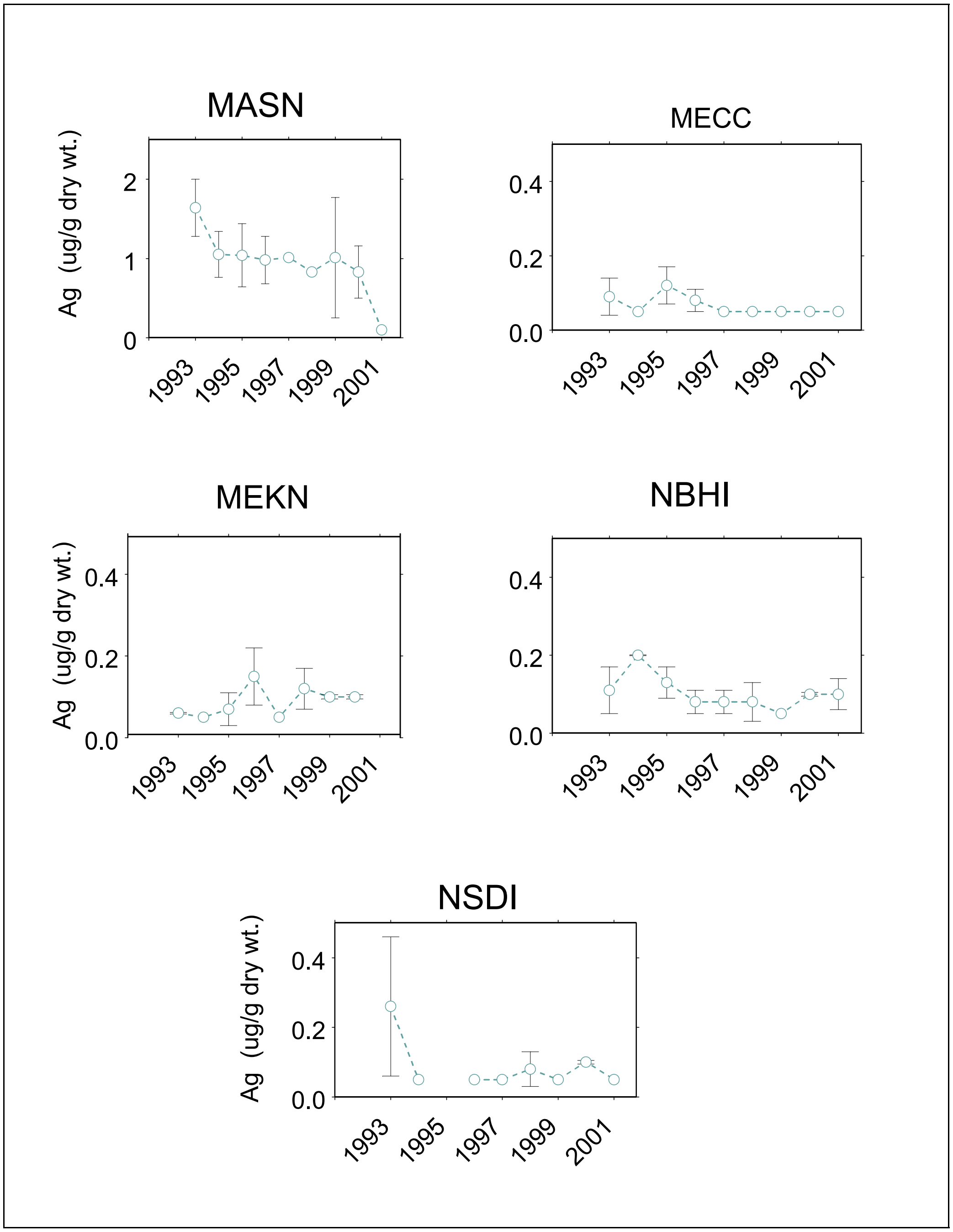

Figure 21. Distribution of silver tissue concentrations (arithmetic mean +/- SD, µg/g dry weight) in mussels at Gulfwatch benchmark sites in 1993-2001. Note the higher concentration scale for MASN (top-left panel).

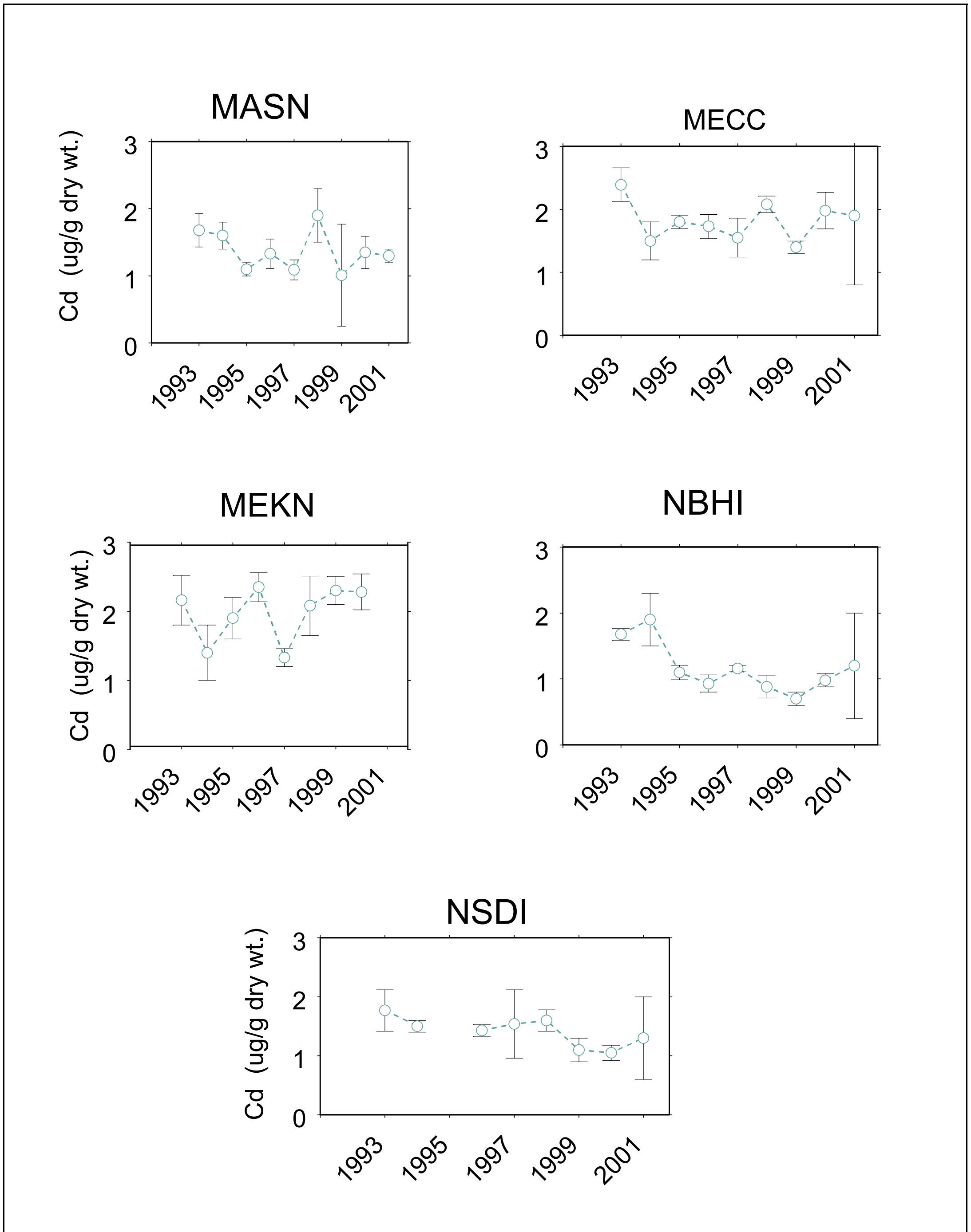

Figure 22. Distribution of cadmium tissue concentrations (arithmetic mean +/- SD, µg/g dry weight) in mussels at Gulfwatch benchmark sites in 1993-2001.

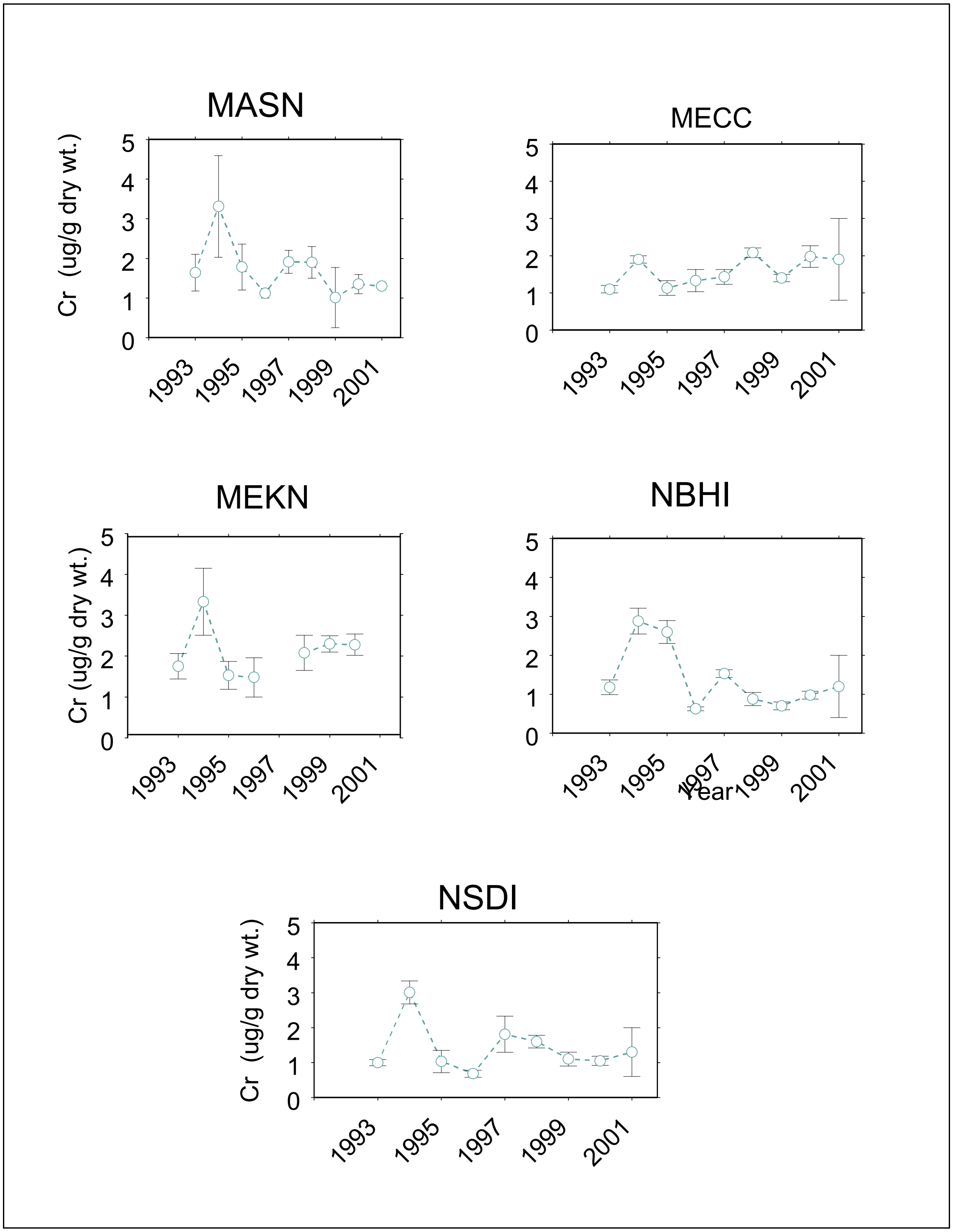

Figure 23. Distribution of chromium tissue concentrations (arithmetic mean +/- SD, µg/g dry weight) in mussels at Gulfwatch benchmark sites in 1993-2001.

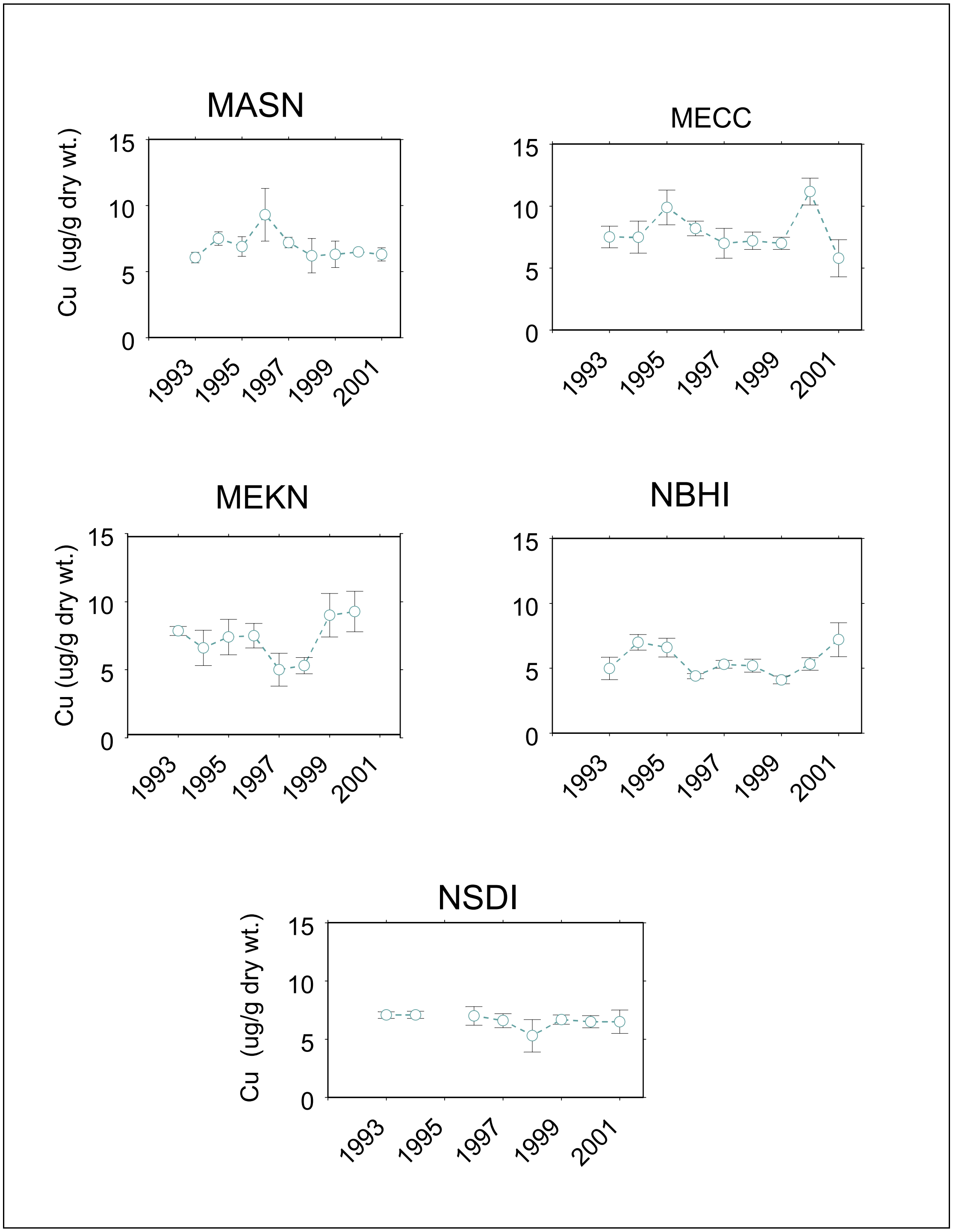

Figure 24. Distribution of copper tissue concentrations (arithmetic mean +/- SD, µg/g dry weight) in mussels at Gulfwatch benchmark sites in 1993-2001**.**

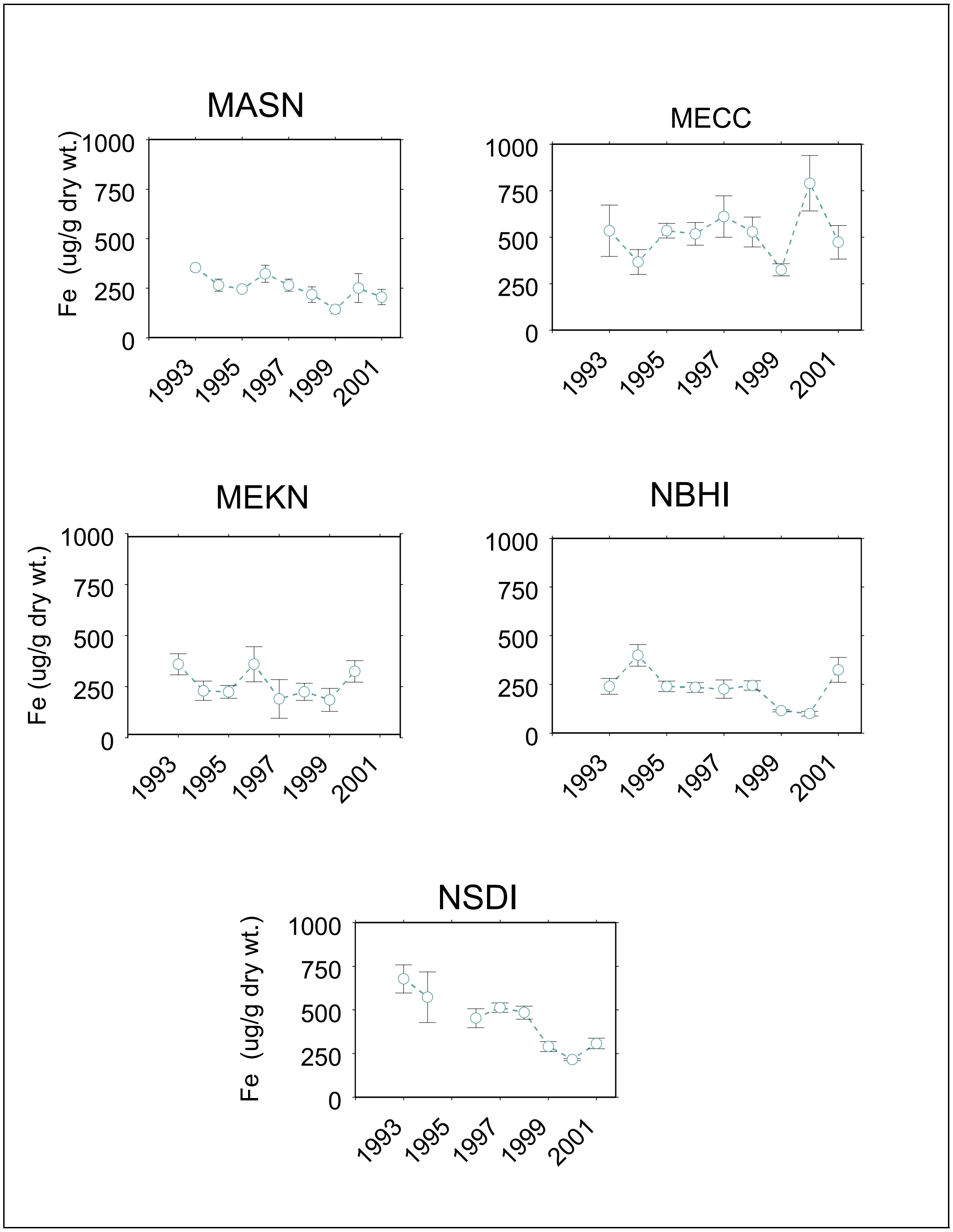

Figure 25. Distribution of iron tissue concentrations (arithmetic mean +/- SD, µg/g dry weight) in mussels at Gulfwatch benchmark sites in 1993-2001.

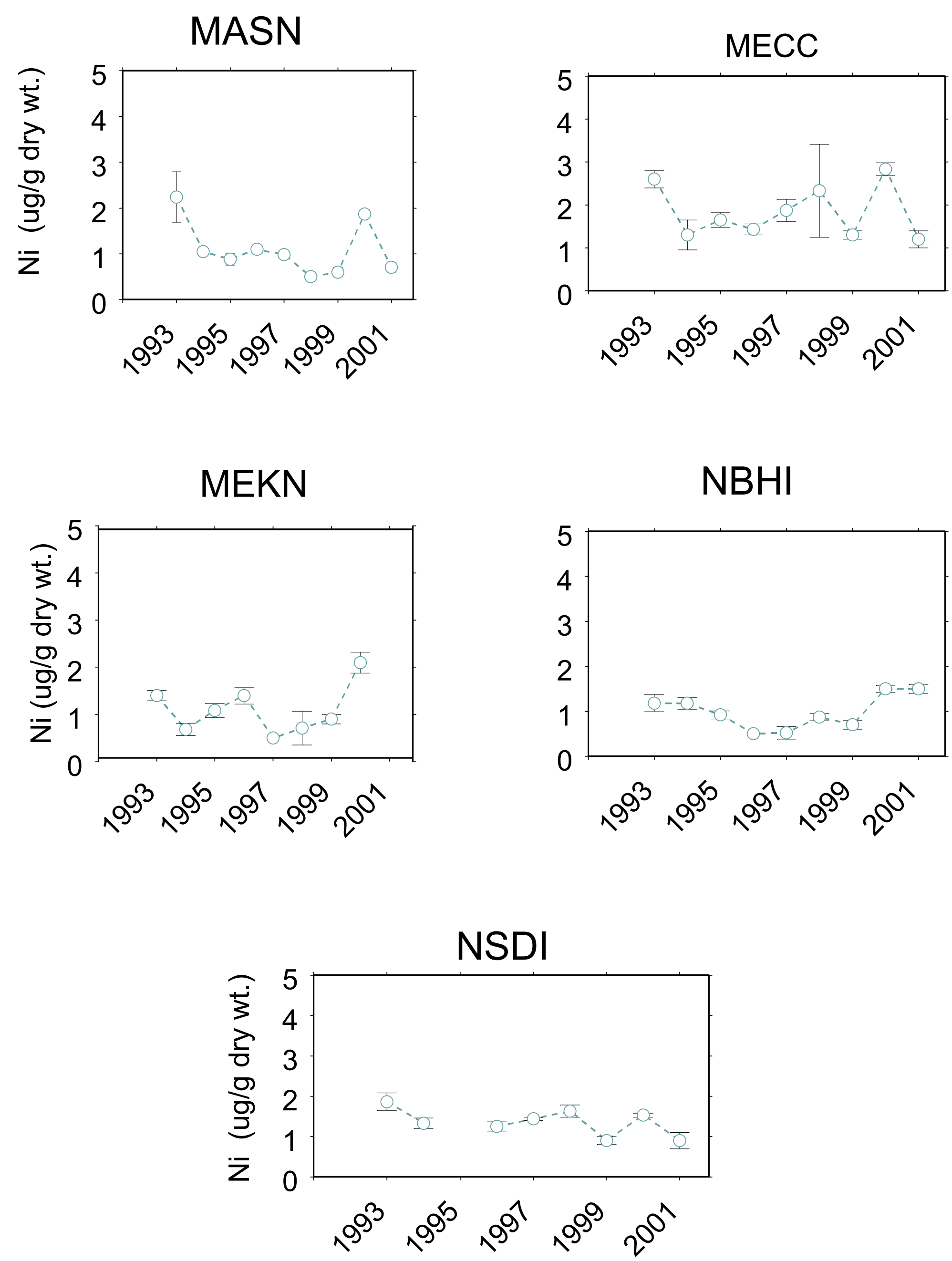

Figure 26. Distribution of nickel tissue concentrations (arithmetic mean +/- SD, µg/g dry weight) in mussels at Gulfwatch benchmark sites in 1993-2001.

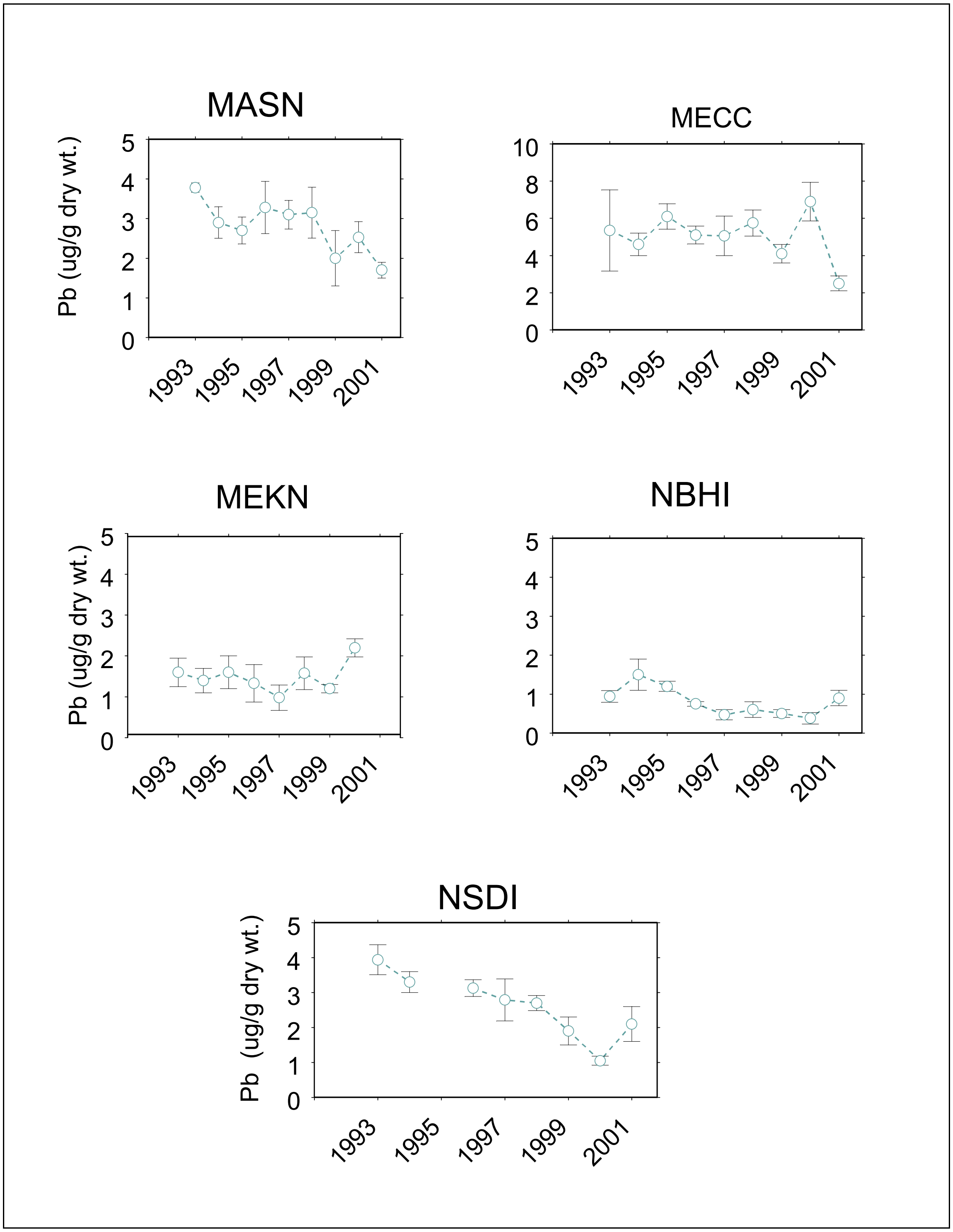

Figure 27. Distribution of lead tissue concentrations (arithmetic mean +/- SD, µg/g dry weight) in mussels at Gulfwatch benchmark sites in 1993-2001.

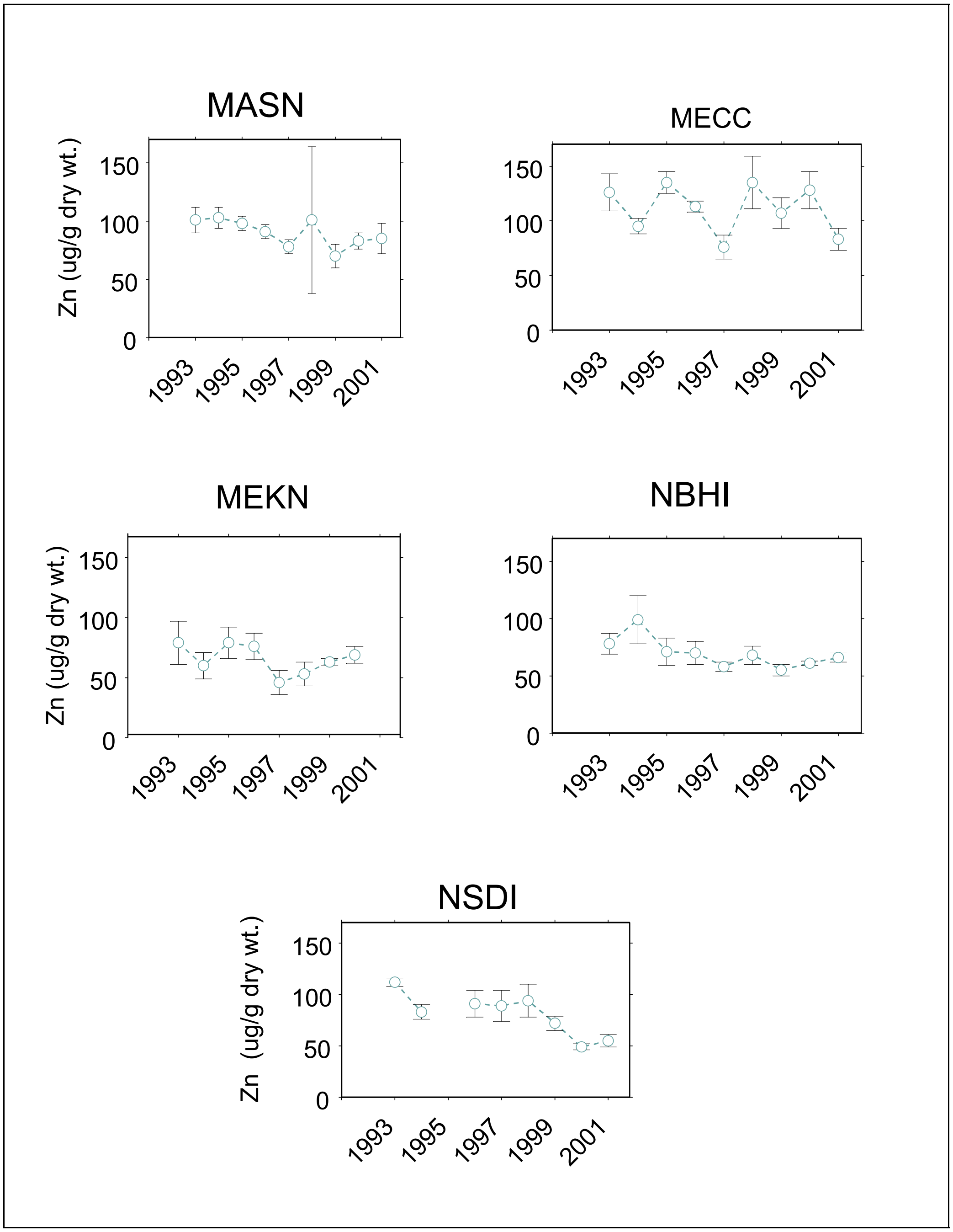

Figure 28. Distribution of zinc tissue concentrations (arithmetic mean +/- SD, µg/g dry weight) in mussels at Gulfwatch benchmark sites in 1993-2001.

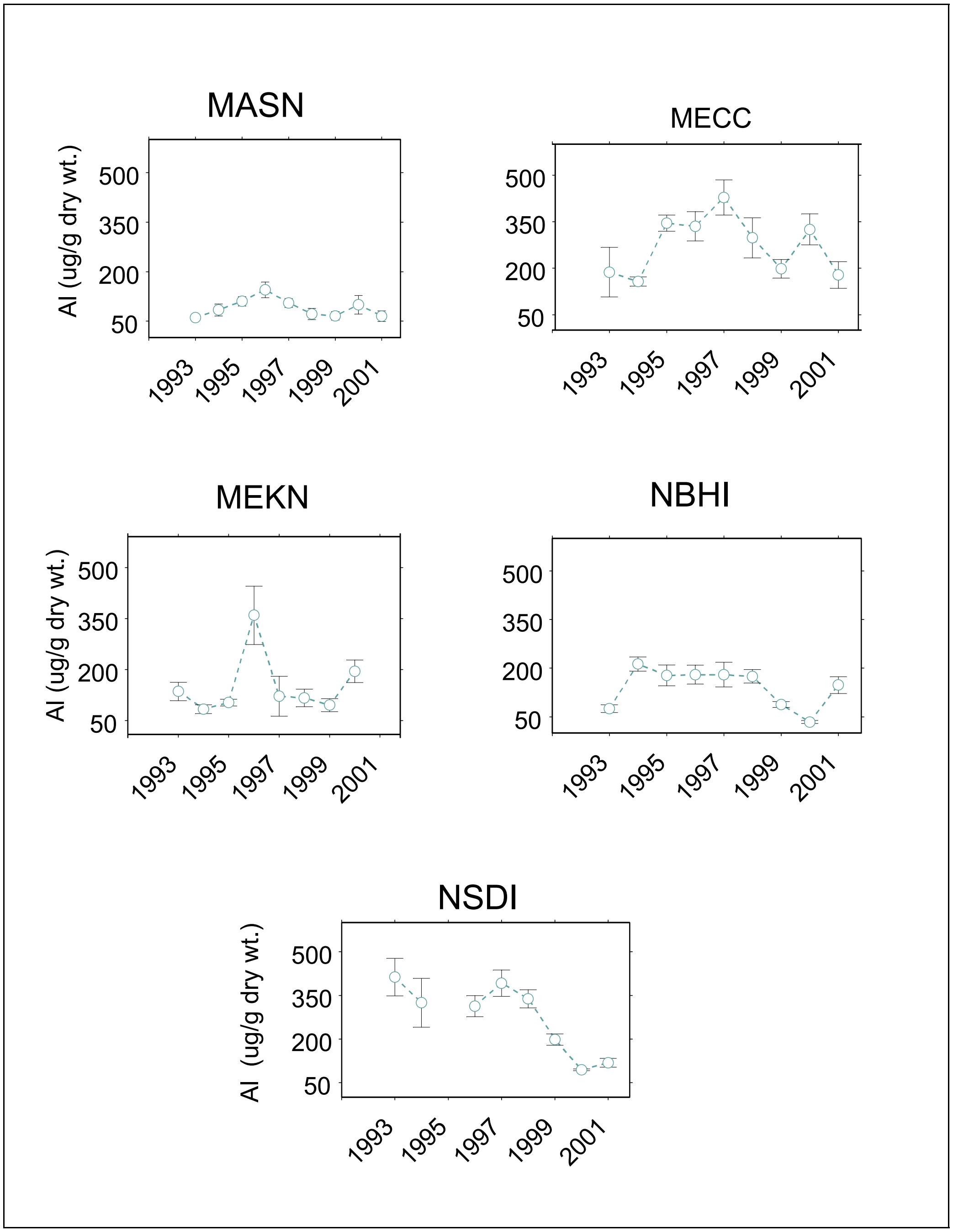

Figure 29. Distribution of aluminum tissue concentrations (arithmetic mean +/- SD, µg/g dry weight) in mussels at Gulfwatch benchmark sites in 1993-2001.

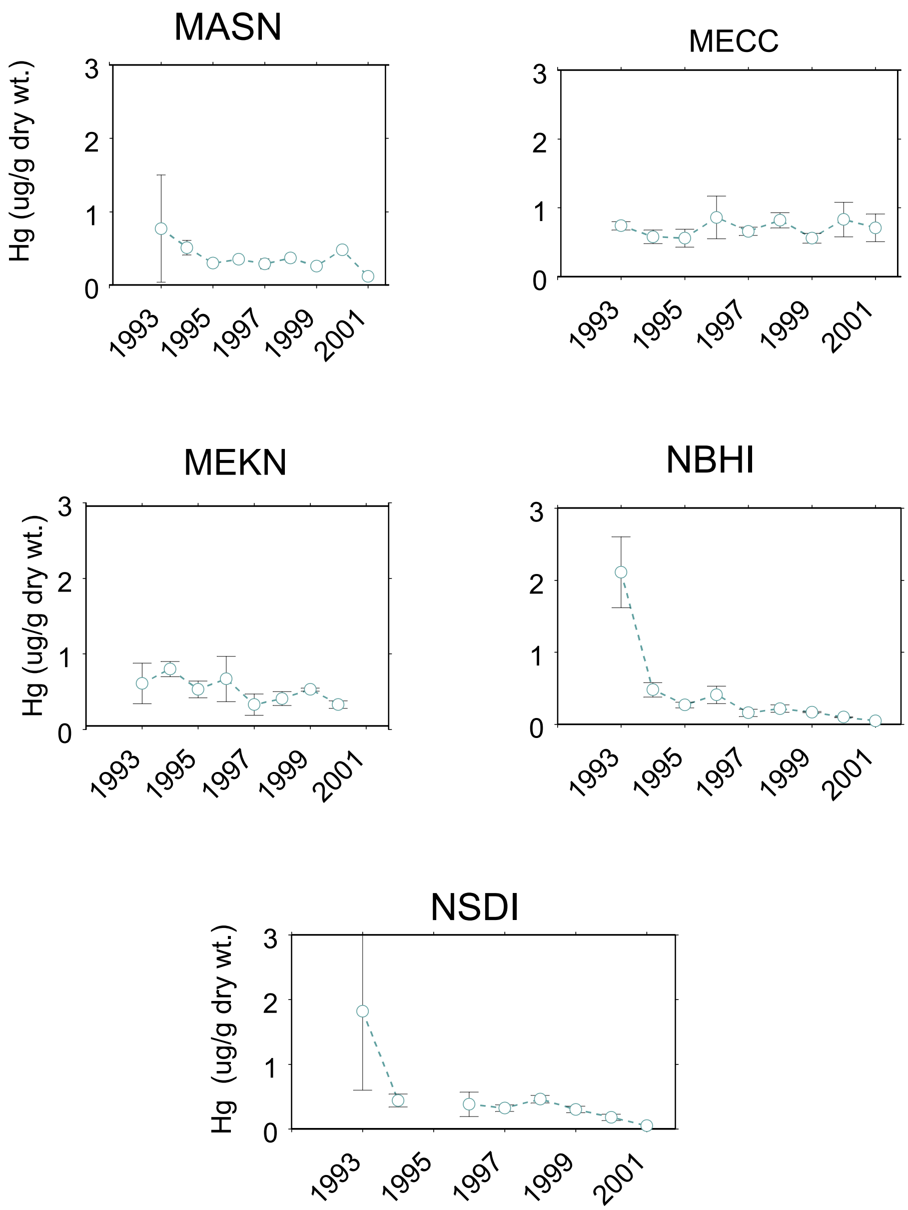

Figure 30. Distribution of mercury tissue concentrations (arithmetic mean +/- SD, µg/g dry weight) in mussels at Gulfwatch benchmark sites in 1993-2001.

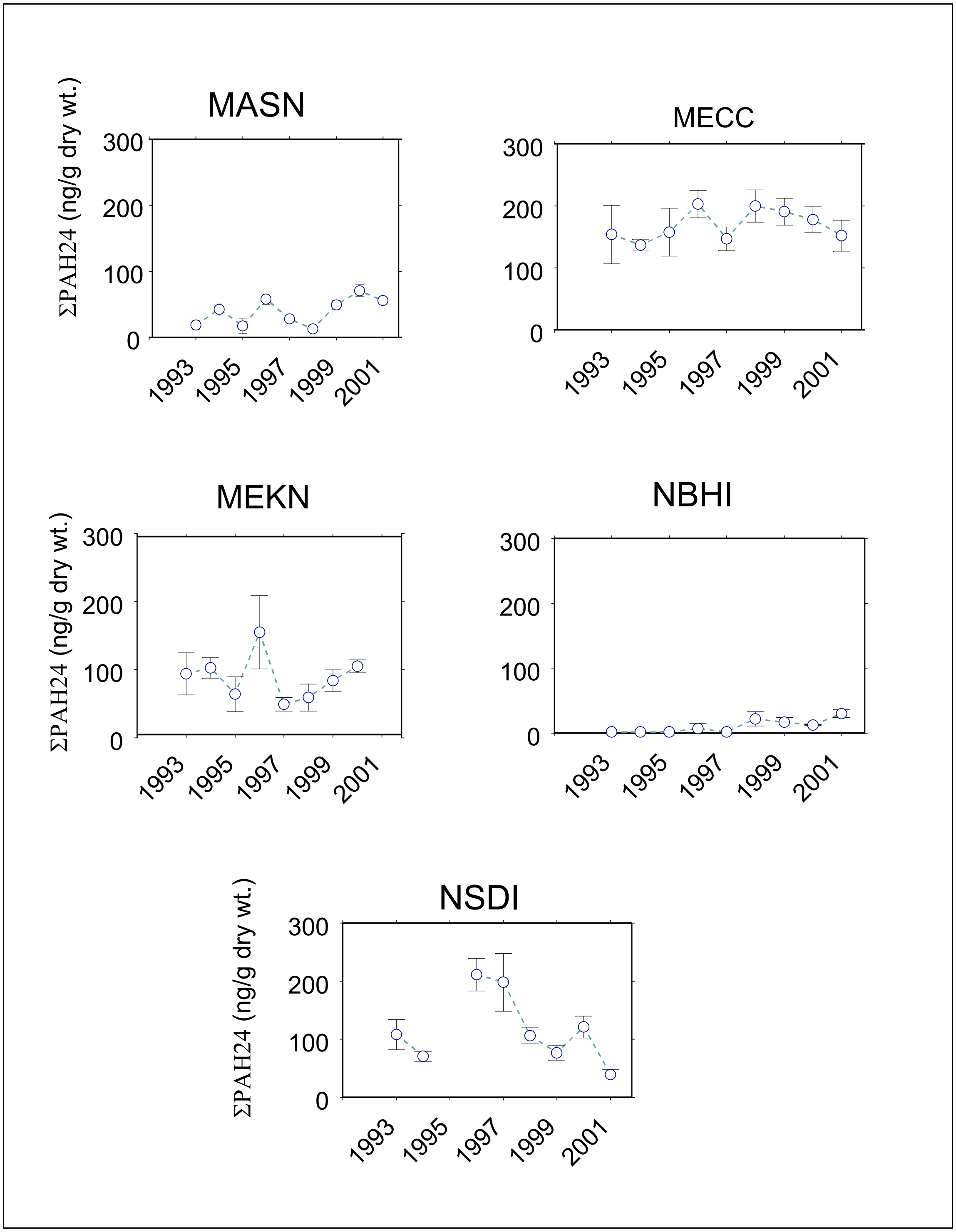

Figure 31. Distribution of ΣPAH24 tissue concentrations (arithmetic mean +/- SD, ng/g dry weight) in mussels at Gulfwatch benchmark sites in 1993- 2001.

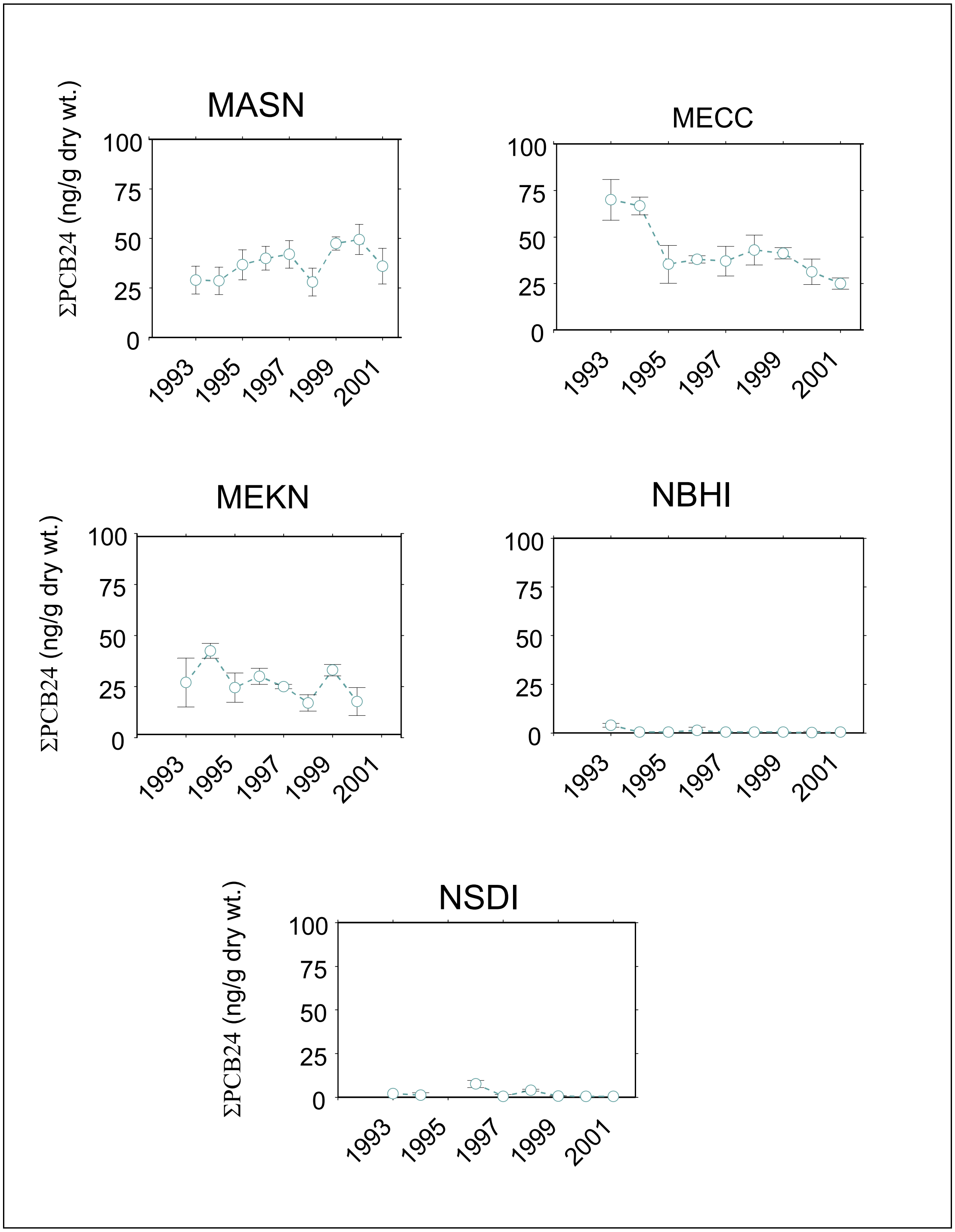

Figure 32. Distribution of ΣPCB_{22} tissue concentrations (arithmetic mean +/- SD, ng/g dry weight) in mussels at Gulfwatch benchmark sites in 1993- 2001.

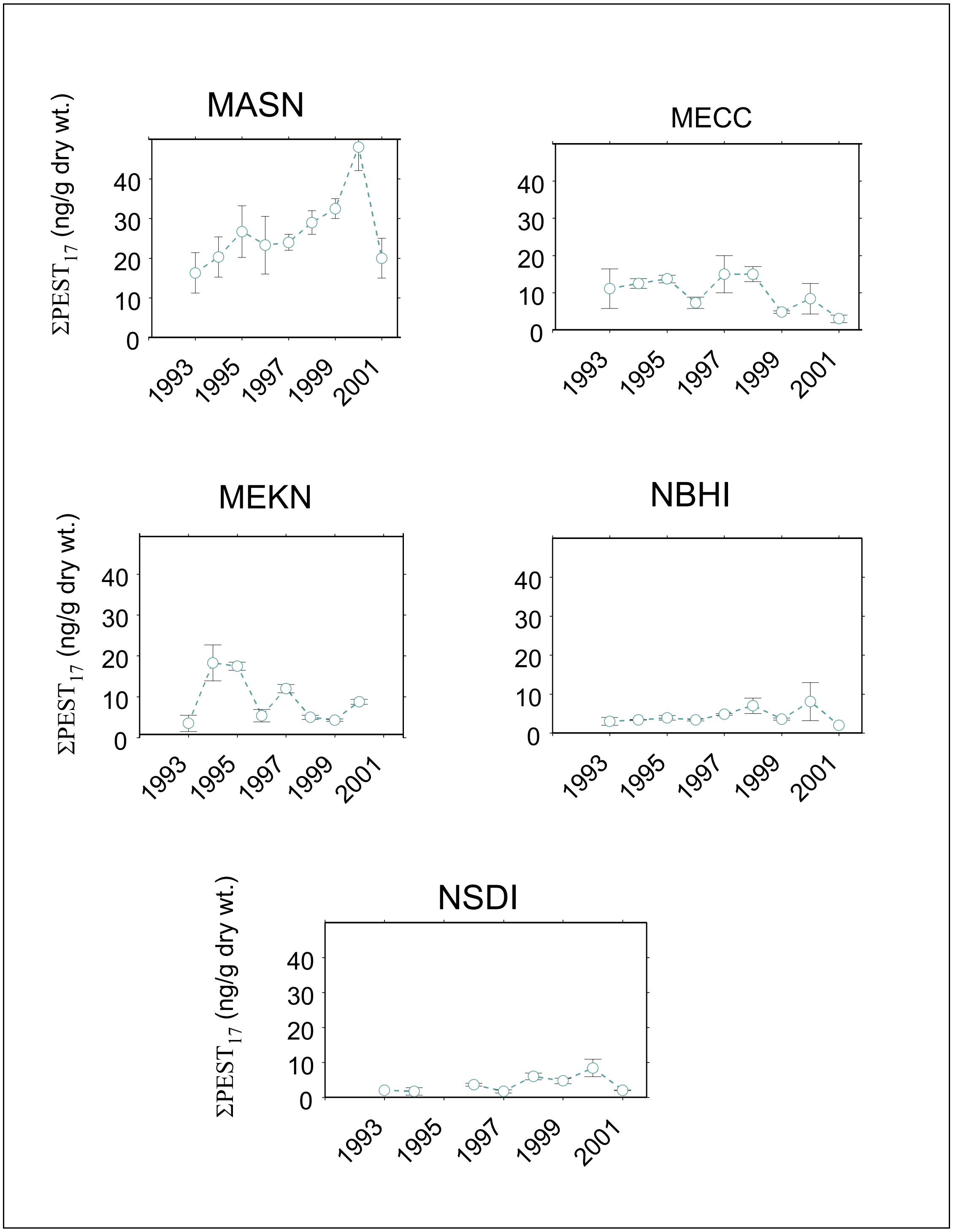

Figure 33. Distribution of ΣPEST17 tissue concentrations (arithmetic mean +/- SD, ng/g dry weight) in mussels at Gulfwatch benchmark sites in 1993 - 2001.

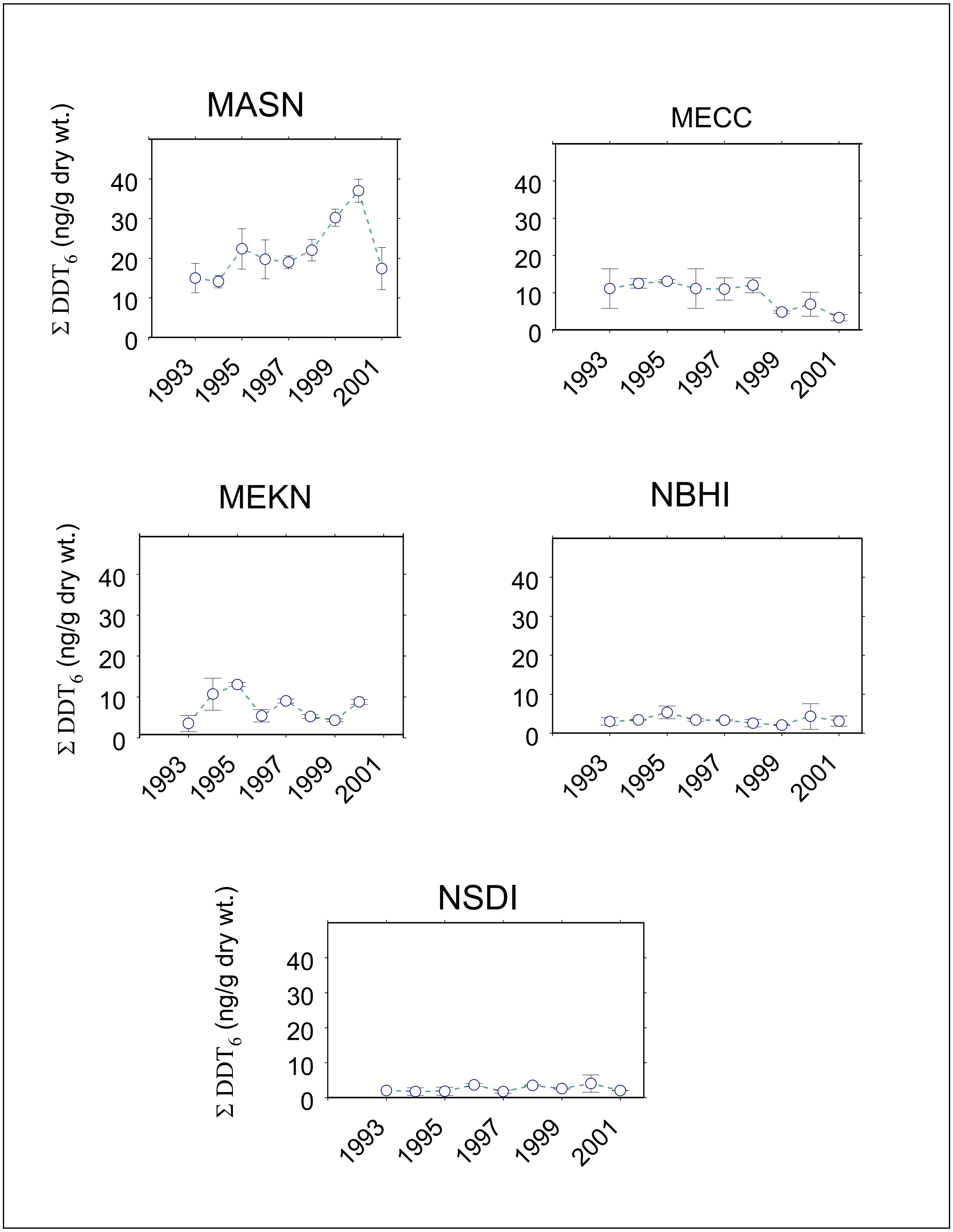

Figure 34. Distribution of ΣDDT_6 tissue concentrations (arithmetic mean +/- SD, ng/g dry weight) in mussels at Gulfwatch benchmark sites in 1993- 2001.

4.3 DRY WEIGHT AND LIPID FRACTIONS

Lipid content and percent dry weights (determined on subsamples of composites, typically between 5-10 g of wet tissue, after drying to a constant weight at 100^{0}C) are plotted in Fig. 35. Greater lipid content where found in mussels collected the New Brunswick and Nova Scotia sites and may be somewhat reflected in the dry weights of these samples from these locations as well.

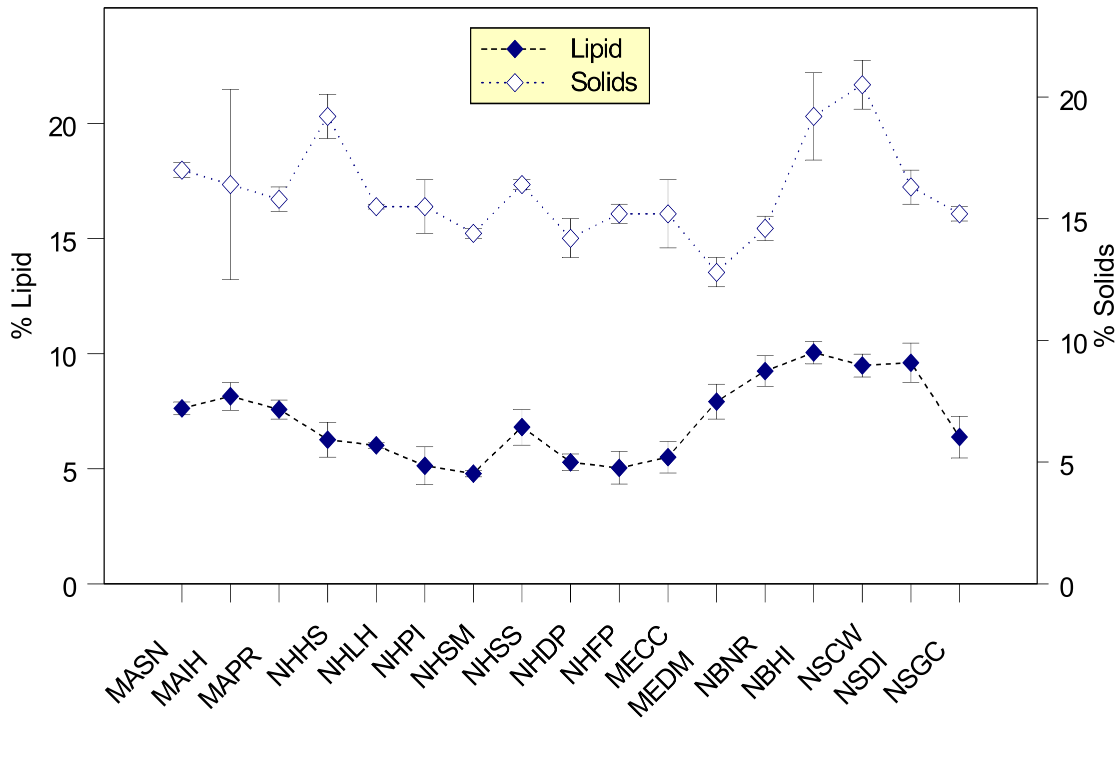

Figure35. Mean percentage (and standard deviation) of lipid and residual solids content (wt/wt) of mussels collected during the 2001 Gulfwatch Program.

4.4 Shell Length and Condition Index

Table 7 contains a summary of the morphological measurements and condition indices for mussels collect at each site in 2001.

4.4.1 Shell Morphology and Weight

GW Field collection protocol recommends collecting *M. edulis* within the length range of 50-60 mm. The Gulfwide mean shell length (±SD) from the 17 sites was 54.9 (±2.8). Analysis of variance on height and width, and to a lesser extent, wet weight, on the mussels collected among the 2001 sites was significant ($p<0.05$) and suggest significant differences in the morphology of mussels collected at sites in New Brunswick and Nova Scotia. Shell height and width were significantly larger for mussels collected in Canada (Fig. 36).

4.4.2 Condition Index

Mean condition indices (CI) calculated from morphological measurements of 2001 GW mussels are also listed in Table 7 and shown in Figure 37. The mean CI (±SD) for mussels from all GW sites was 0.19 (±0.03). ANOVA performed on CI means was significant ($p<0.05$). An analysis of covariance (ANCOVA) on wet weight using shell height and width as covariates was performed to evaluate the CI differences observed between the Candian and U.S. samples. The ANCOVA revealed significant differences in the covariates of shell width and shell height.

TABLE 7. Morphometric determinations (Mean, standard deviation) on mussels collected along the Gulf Maine, 2001 Gulfwatch stations. Sample size (n) is reported for computing means and SD for length (n_L) and other parameters (n_O).

Station	n_L	n_O	Length		Height		Width		Wet Wt.		CI	
	Length	other	(mm)	SD_L	(mm)	SD_H	(mm)	SD_W	(g)	SD_{WW}		SD_{CI}
MASN	158	30	54.9	2.7	29.8	1.6	22.0	2.3	5.9	1.3	0.162	0.013
MAIH	160	30	54.2	2.6	29.3	1.7	25.0	2.4	7.2	1.3	0.179	0.022
MAPR	160	30	54.9	2.7	29.6	1.2	24.1	1.5	7.5	1.5	0.186	0.023
NHHS	160	30	54.8	2.3	29.5	1.6	23.7	2.3	6.8	1.3	0.177	0.017
NHLH	160	30	55.3	2.3	30.0	2.0	22.6	1.7	5.5	1.0	0.146	0.016
NHPI	160	30	54.6	2.4	27.8	3.7	24.3	4.0	6.4	1.6	0.173	0.028
NHSM	160	29	54.8	2.5	30.1	1.4	23.1	2.1	5.9	1.3	0.153	0.03
NHSS	160	30	54.5	2.5	29.1	1.4	22.4	1.6	6.2	1.6	0.174	0.043
NHDP	160	30	54.2	2.5	26.7	1.8	21.9	1.9	4.9	1.0	0.156	0.018
NHFP	160	30	54.4	2.5	28.1	1.6	23.6	2.2	6.2	1.7	0.167	0.027
MECC	160	29	55.5	2.4	29.7	2.6	21.5	2.8	5.5	1.0	0.156	0.021
MEDM	160	60	55.5	3.0	30.6	2.5	22.5	2.0	10.1	2.2	0.271	0.041
NBNR	70	40	52.2	5.3	21.4	2.9	25.4	2.6	7.0	3.5	0.228	0.063
NBHI	70	40	58.7	4.7	23.8	2.3	27.8	2.7	11.6	3.0	0.292	0.049
NSCW	80	40	55.6	2.6	21.9	1.7	29.8	2.3	8.9	2.1	0.224	0.036
NSDI	70	40	55.6	2.2	24.7	2.1	28.4	2.0	8.5	1.2	0.22	0.023
NSGC	80	40	53.4	2.5	22.3	2.7	26.3	2.0	5.7	1.2	0.181	0.024

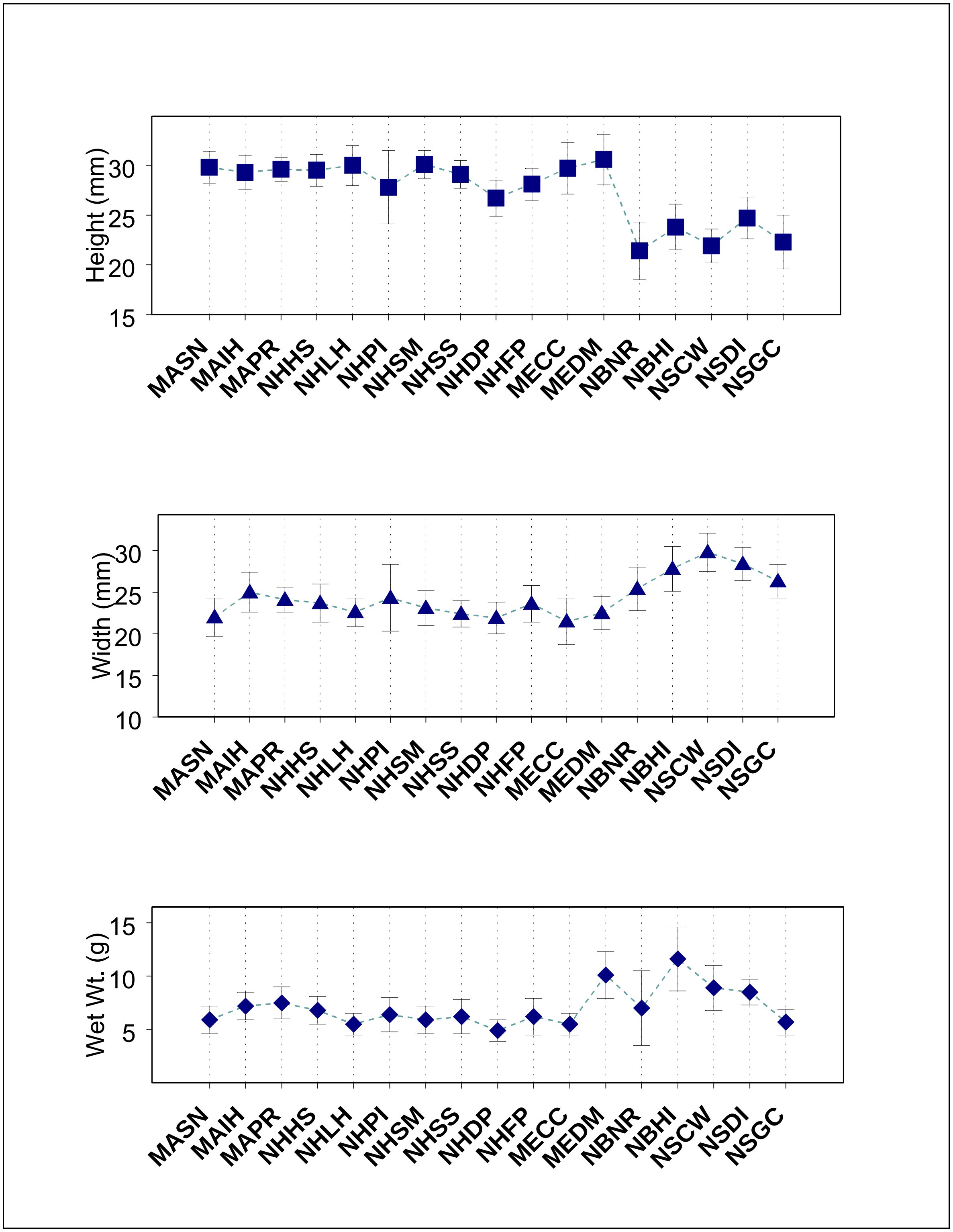

Figure 36. Mean (and standard deviation) of height, width, and wet weight of mussels collected during the 2001 Gulfwatch Program.

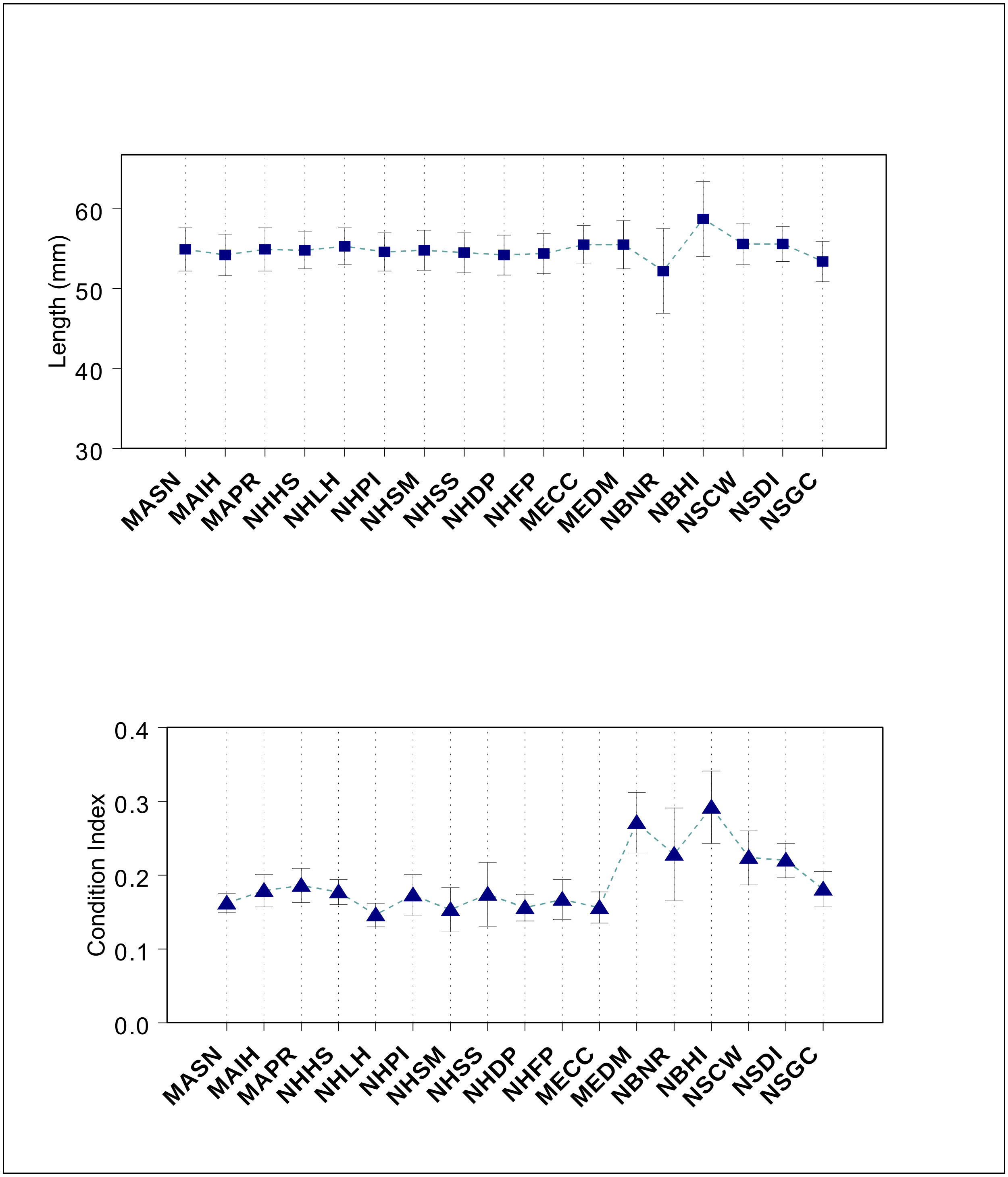

Figure 37. Mean (and standard deviation) of length and condition index (CI) of mussels collected during the 2001 Gulfwatch Program.

5.0 2001 GULFWATCH SUMMARY

The 2001 GW field season concludes the last year of the 9-year sampling design. Monitoring of contaminants in the soft tissue of *M. edulis* from Nova Scotia to Massachusetts during this 9 year period has provided enough information over time to begin to evaluate trends in contamination to the Gulf of Maine. Reference sites have as much as 9 years of data while rotational sites have been sampled up to 3 times over this period. Temporal and spatial analysis of the data is beyond the scope of GW data reporting. Detailed analysis of the 9-year program is underway and will be published by GW as a separate document.

For 2001, many of the metals monitored at the 3-year rotational sites where lower than previously observed. In general, organic contaminants seem to indicate increases over the 9 year sampling period. The greater temporal resolution provided by the annual sampling of reference sites show metal contamination to be decreasing and organic contaminantion remaining constant or increasing for the Gulf of Maine in general. Particularly, silver concentrations appear to have significantly decreased in recent samples collected at the Sandwich, MA site (MASN) and may be related to source reduction in wastewater effluents and/or relocation of the Massachusetts Water Resource Authority's wastewater discharge in Massachusetts Bay. DDT-related pesticides at MASN also seemed to be increasing. However, the most recent data from this site was the lowest observed during the 9-year program and may also be related to similar processes underlying the silver observations. Many of the organic contaminants where higher in MA waters and may be related to the influence of highly industrialized watersheds that drain into these waters.

The NH Great Bay Estuary received greater spatial resolution in the sampling design as GW progressed through the 9-year program. NH added additional sites through their own initiative and have demonstrated the utility of using mussels as contaminant indicators at smaller spatial scales. The Great Bay Estuary system appears to have greatest contamination and exposure for aquatic organism in the Gulf of Maine region with respect to Hg, and possibly Cr.

Overall, the 2001 data show the urban estuaries (Boston Harbor and Pines River) to be the most contaminated, especially for Pb, DDT, and PCBs, among the sites collected for that year. Mussels from the NH Great Bay Estuary system were the most contaminated with respect to Hg and seemed to be second in overall exposure to contamination with respect to the above-mentioned sites in Massachusetts. Detailed trend and spatial analysis is underway such that meaningful descriptions of contamination in the Gulf of Maine can be made available to coastal environmental managers of the region.

Gulfwatch is in the process of evaluating its 9-year program to improve analytical reporting, redesign of sampling to better evaluate contamination in Gulf of Maine, and meet the needs of coastal management for present and emerging issues. The value of long term environmental monitoring is beginning to be realized from the Program's data set. Local hot spots, like Boston Inner Harbor (MAIH), the Pines River (MAPR), and the Great Bay Estuary system along the NH-ME jurisdictional boundary point to the need for more focused monitoring at the sub regional scale.

Coastal monitoring programs like Gulfwatch provide valuable measures, which can enable managers to better understand the ecological condition of the Gulf of Maine system and to reveal the direction that coastal ecosystems may be heading. GW results provide the most geographically intensive perspective in the region on relative contaminant exposure, extending across the contamination (or contaminant exposure) spectrum, ranging from relatively pristine coastal waters to highly impacted urban estuaries. As such, GW provides a unique and invaluable source of information for management decisions on issues related to toxic contamination in the near coastal waters of the Gulf of Maine. It is anticipated that the results of the GW program to date will be used as guidance for improving monitoring by this Program and continue to strengthen the temporal perspective necessary to determine trends and impacts of anthropogenic perturbation for more effective coastal management for the Gulf of Maine region.

6.0 ACKNOWLEDGEMENTS

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Appendix A Methods Detection Limits

For organic analysis, method detection limits (MDL) are estimated following the U.S Environmental Protection Agency's procedure for the determination of method detection limits described in the US Federal Register (40 CFR part 136 appendix B). Briefly, this method uses the standard deviation of replicate analyses of low level spiked mussel tissue. Analyte MDLs are calculated at a 95% confidence level, rather than the 99% confidence level specified in 40 CFR part 136 appendix B. Tables A-1 and A-2 list the MDLs for the respective contaminants monitored for 2001.

TABLE A-1. 2001 Organic Analytical Methods Detection Limits (ng/g dry wt.)

PAH		**PCB congener**		**Pesticide**	
Naphthalene	<4	8 ; 5	<2	HCB	<1.2
2-Methyl-naphthalene	<3	18 ; 15	<1.2	lindane (□-HCH)	<1.2
1-Methyl-naphthalene	<3	28 ;	<1.2	αναφλυσοδνε–	<1.2
Biphenyl	<3	29 ;	<1	βναφλυσοδνε–	<2
2,6-Dimethyl naphthalene	<4	44 ;	<1.2	Cyclodienes	
Acenaphthylene	<4	50 ;	<1.2	*cis*-chlordane	<1
Acenaphthene	<4	52 ;	<1.2	*trans*-nonachlor	<1
2,3,5-Trimemethyl naphthalene	<3	66 ; 95	<1.5	heptachlor	<1
Fluorene	<4	77 ;	<1.5	heptachor epoxide	<1.2
Phenanthrene	<2	87 ;	<1.5	dieldrin	<1.2
Anthracene	<2	101 ; 90	<1.5	aldrin	<1.5
1-Methyl phenanthrene	<4	105 ;	<1	mirex	<1.5
Fluoranthene	<2	118 ;	<1	DDT isomers	
Pyrene	<2	128 ;	<1	o,p'-DDD	<1
Benzo(a)anthracene	<2	138 ;	<1.5	p,p'-DDD	<1.5
Chrysene	<2	153 ; 132	<1.5	o,p'-DDE	<1.2
Benzo(b+k)fluoranthene		170 ; 190	<1.5	p,p'-DDE	<1.2
Benzo(b)fluoranthene	<8	180 ;	<1	o,p'-DDT	<1.2/2.0
Benzo(k)fluoranthene	<2	187 ;	<1	p,p'-DDT	<1
Benzo(e)pyrene	<3	195 ; 208	<1.5		
Benzo(a)pyrene	<3	206 ;	<1.5		
Perylene	<3	209 ;	<1.5		
Indeno(123cd)pyrene	<4				
Dibenzo(ah)anthrace	<4				
Benzo(ghi)perylene	<2				

TABLE A-2. 2001 Metal Methods Detection Limits (µg/g dry wt.)

Ag	Cd	Cr	Cu	Fe	Ni	Pb	Zn	Hg	Al
0.1	0.2	0.3	3	22	0.2	0.5	25	0.1	8

APPENDIX B Summary of Trace Metal Analysis Quality Assurance/Quality Control

B.1 ACCURACY

B.1.1 Standard Reference Materials

Accuracy refers to the agreement between the amount of a component measured by the test method and the amount actually present. The quality assurance protocol for the Gulfwatch project sets the accuracy criteria of ±25% for trace metals of the certified value of a standard reference material (SRM). Certified values are reported by the NRC (National Research Council) or NIST (National Institute of Standards and Technology). Standard reference materials with values >10 times the detection limits were used to verify the accuracy of the analytical methods. The NRC standard, DORM-2 (dogfish muscle and liver tissue), and NIST standards 1974a and 2976 (blue mussel tissue) were used to certify accuracy in the metals analysis. Overall mean SRM recoveries for the metals analyzed ranged from 35-379% (Table B.1.1). For all metals, only 14 of the 27 SRM recoveries that were within the ±25% of the certified value criteria. All of the SRM analysis for Al, Ni, and Pb were outside Gulfwatch data quality objectives (DQO). Low recoveries were observed for Ag and Al. For Hg, NIST 1974a was near the reported MDL.

TABLE B.1.1 Analysis of standard reference materials for trace metals (ug/g) .

	Ag	Cd	Cr	Cu	Fe	Ni	Pb	Zn	Al	Hg
NIST 1974a	0.0589	0.14	0.228	1.16	54.20	0.094	1.38	11.60	54.6	0.22
Recovered.	0.0400	0.12	0.180	0.89	31.97	0.220	0.67	8.43	7.7	0.22
% Recov.	70	84	78	76	59	231	49	73	14	101
NRC DORM	0.041	0.043	34.7	2.34	142	19.4	0.065	25.6	10.9	4.64
Recovered.	0.049	0.049	24	2.184	126	13.8	0.48	20.9	2.597	3.45
% Recov.	118	113	69	93	89	71	747	82	24	74.3
NIST 2976	0.011	0.82	0.5	4.02	171	0.93	1.19	137	134	NA
Recovered.	0	0.84	0.48	4.07	172	1.67	1.67	130	91	
% Recov.	0	102	96	101	101	160	141	95	68	
Mean Recovery (%)	**63**	**100**	**81**	**90**	**83**	**154**	**312**	**83**	**35**	**87**
(RSD):	(59)	(15)	(14)	(13)	(22)	(80)	(379)	(11)	(29)	

NIST 1974a and 2976, respectively: National Institute of Standards and Technology Trace Organics and,Trace elements and methylmercury in Mussel Tissue (*Mytilus edulis*); DORM: Trace elements in Dogfish (*Squalus acanthias*) mussel from the National Research Council of Canada.

B.1.2 Matrix Spikes

Matrix spikes are another prescribed measurement of accuracy of the Gulfwatch Program. Matrix spikes recoveries between 75 -125% are considered as meeting the DQO of the Program. Matrix spikes ranged from 96-109% and averaged 100 (+/- 4)% over all the batches. All matrix spike results were all within acceptable criteria (Table B.1.2).

Table B.1.2. Matrix spike analysis 2001 Gulfwatch (µg/g)

	Ag	Cd	Cr	Cu	Fe	Ni	Pb	Zn	Al	Hg
sample	0.13	0.885	0.67	5.50	329	1.68	1.14	69	124	(0.002)
spike	1.30	1.300	3.91	6.52	261	1.30	1.30	130	261	0.48
samp+spike	1.36	2.050	4.30	11.60	591	2.74	2.35	186	369	0.52
sample	0.13	1.26	2.81	5.96	697	2.24	2.30	92	283	(0.017)
spike	1.27	1.27	3.82	6.37	255	1.27	1.27	127	255	0.545
samp+spike	1.25	2.51	6.51	13.36	952	3.57	3.57	224	553	0.54
sample	0.13	1.26	2.81	5.96	697	2.24	2.30	92	283	(0.035)
spike	1.27	1.27	3.80	6.33	253	1.27	1.27	127	253	0.60
samp+spike	1.25	2.51	6.51	13.36	952	3.57	3.57	224	553	0.59
Mean Recoveries (RSD)	96 (1)	96 (2)	96 (2)	109 (10)	99 (1)	100 (7)	98 (1)	100 (6)	102 (5)	98 (2)

B.2 PRECISION

Precision refers to the reproducibility of a method when it is repeated under controlled conditions. For this assessment, the Gulfwatch Program uses the relative percent difference (RPD) of duplicate samples as a test of precision. The RPD of laboratory and matrix spike duplicates should be less than 25% for all metals. Results of duplicate comparisons are listed in Tables B.2.1. The RPD between laboratory duplicates ranged from 0.0-38%, with a mean of 7.6%. The RPDs of two duplicates, with the exception of Cu for one of the duplicates (shaded), were within acceptable limits. All Hg duplicates were below the MDL.

Table B.2.1. Replicate analysis (µg/g)

	Ag	Cd	Cr	Cu	Fe	Ni	Pb	Zn	Al	Hg
Replicate Analysis	0.13	0.87	0.67	5.5	325	1.61	1.21	68.6	125	(0.00)
	0.13	0.9	0.67	5.49	334	1.74	1.07	70.1	123	(0.01)
% RSD	0.1	2.9	0.0	0.1	2.7	7.9	11.9	2.2	1.2	
Replicate Analysis	0.13	1.28	2.91	4.82	776	2.28	2.28	95.5	306	(0.02)
	0.12	1.24	2.72	7.11	618	2.2	2.33	89.3	260	(0.01)
% RSD	8	2.9	6.9	38	23	3.5	2.2	6.6	16	
Replicate Analysis	----	----	----	----	----	----	----	----	----	(0.03)
										(0.04)

B.3 BLANKS

115 digestion procedure blanks were reported for trace metal analysis, except n=7 for Hg. Most of the blanks, with the exception of Al, were non-detectable. Table B.3.1 summarizes percent of non-detectable blanks and presents the mean (and RSD) of the blanks observed above the reported instrumental detection limit.

TABLE B.3.1. Analysis of mussel preparation blanks. Means and RSD computed from the percentage of detectable blanks.

	Ag	Cd	Cr	Cu	Ni	Pb	Fe	Zn	Al	Hg
Mean:	0.0005	0.0005	0.002	0.006	0.005	0.004	0.02	0.010	0.08	ND 0.1
RSD (%)	11	---	74	---	---	25	18	89	86	---
% ND	97	98	83	99	99	86	90	83	22	100

ND – non-detectable

B.4 COMPLETENESS

The data on 68 of 68 samples (100%) were completed successfully. Approximately ½ of the SRMs met the data quality objectives of the Program. All matrix spikes were within control limits. All the RPDs for laboratory duplicates were within precision limits, with the exception of one Cu analysis.

APPENDIX C Summary of 2001 Organic Contaminant Analysis Assurance/Quality Control

C.1 ACCURACY

C.1.1 Standard Reference Materials

The quality assurance protocol for the Gulfwatch project sets the accuracy criteria of ±30% for organic contaminants certified value of a standard reference material (SRM). Certified values are reported by the NIST (National Institute of Standards and Technology). Standard reference materials with values >10 times the detection limits were used to verify the accuracy of the analytical methods. The NIST standard 1946 (Lake Superior Fish Tissue) and a "Fish V" homogenate were used to certify accuracy of PCB and pesticide analyses. These data are from Gulfwatch's participation in the 2002 NIST Intercomparison Exercise Program for Organic Contaminants (Schantz et al., 2005). *No PAH SRM data were reported for Gulfwatch 2001.* Accuracy was assessed by NIST using a z-score index:

$$\text{z-score [25\%]} = (x-X)/\sigma$$

where:

x – individual laboratory result

X – certified/assigned value of SRM/Fish Homogenate

σ – 25% of target value (X) substituted for standard deviation (σ = 0.025 X, see Schantz et al., 2005).

The z-score groups the results into three categories: satisfactory ($|z| \leq 2$) , questionable ($2<|z| \leq 3$) and unsatisfactory ($|z| \geq 3$).

Table C.1.1a and C.1.1b list the analytical results of SRM 1946 and the Fish Homogenate V from the NIST 2002 Intercalibration exercise. Performance for organic contaminant accuracy and precision are summarized in Table C.1.1c.

TABLE C.1.1a PCB Standard Reference Material Recovery from the National Institute for Standards and Technology 2002 Intercomparison Exercise for PCB contaminants. (Schantz et. al, 2005)

Fish Homogenate V (ng/g wet wt.)						SRM 1946 (ng/g wet wt.)				
	Replicates S1	Replicates S2	Replicates S3	Assigned value	95% CL	Replicates S1	Replicates S2	Replicates S3	SRM1946 Target Value	95% CL
PCB 8	<3	<3	<3	no Assigned value		<3	<3	<3	no target	
PCB 18	2.11	2.20	2.31	2.46	0.36	<1.5	<1.5	<1.5	0.84	0.11
PCB 28	11.8	12.1	12.4	13.8	1.4	3.13	<3	<3	2.00	0.24
PCB 31	NA	NA	NA	10.9	1.4	NA	NA	NA	1.46	0.2
PCB 44	15.5	15.4	16.5	20.7	2.6	4.49	3.56	<3	4.46	0.84
PCB 49	NA	NA	NA	25.0	2.9	NA	NA	NA	3.00	0.39
PCB 52	49.1	49.8	51.5	33.3	3.5	7.34	5.95	7.52	8.1	1.0
PCB 66	112	114	121	70.2	6.1	8.83	8.05	7.85	10.0	1.9
PCB 95	NA	NA	NA	43.4	10.4	NA	NA	NA	11.4	1.3
PCB 99	NA	NA	NA	75.0	8.9	NA	NA	NA	25.6	2.3
PCB 101	127	122	143	88.8	6.9	52.4	59.1	60.2	34.6	2.6
PCB 105	76.9	77.0	87.4	60.8	4.7	22.7	24.0	28.4	19.9	0.9
PCB 118	131	139	149	114	10	84.1	89.6	102	52.1	1.4
PCB 128	57.4	59.0	57.8	31.4	3.3	33.3	37.7	44.0	22.8	1.9
PCB 138	240	246	274	174	12	172	198	223	115	13
PCB 149	NA	NA	NA	63.5	7.6	NA	NA	NA	26.3	1.3
PCB 151	242	245	274	201	14	209	223	263	178	9
PCB 156	NA	NA	NA	15.4	1.9	NA	NA	NA	9.52	0.51
PCB 170	44.6	44.2	50.2	31.2	2.1	36.6	40.1	45.6	25.2	2.2
PCB 180	94.6	94.8	107	81.0	7.2	83.6	91.2	105	74.4	4
PCB 187	68.7	68.8	78	54.0	4.6	63.5	68.7	82.0	55.2	2.1
PCB 194	NA	NA	NA	12.6	1.2	NA	NA	NA	13.0	1.3
PCB 195	4.02	3.95	4.55	5.21	0.68	7.56	7.32	7.35	5.30	0.45
PCB 205	4.26	4.58	4.63	5.51	0.5	5.02	4.98	4.86	5.00	0.43
PCB 209	<2	<2	2.22	2.25	0.21	3.29	3.21	3.17	1.30	0.21

TABLE C.1.1b Pesticide Standard Reference Material Recovery from the National Institute for Standards and Technology 2002 Intercomparison Exercise for PCB contaminants. (Schantz et al., 2005)

Fish Homogenate V (ng/g wet wt.)				SRM 1946 (ng/g wet wt.)			Material Reference values			
	S1	S2	S3	S1	S2	S3	Fish V Assigned value	95% CL	SRM1946 Target Value	95% CL
alpha-HCH	<3	<3	<3	5.94	5.68	6.06	1.22	0.33	5.72	0.65
hexachlorobenzene	4.77	5.06	5.16	5.73	5.77	5.76	6.11	0.53	7.25	0.83
gamma-HCH	<3	<3	<3	<3	<3	<3	0.467	0.12	1.14	0.18
Beta-HCH	NA	NA	NA	NA	NA	NA	<2		no target	
heptachlor	<3	<3	<3	<3	<3	<3	<2		no target	
aldrin	<3	<3	<3	<3	<3	<3	<2		no target	
heptachlor epoxide	14.7	15.1	14.7	7.69	7.5	7.5	13.2	1.3	5.5	0.23
oxychlordane	NA	NA	NA	NA	NA	NA	21.2	2.2	18.9	1.5
trans-chlordane	<3	<3	<3	13.8	13.2	12.1	11.2	1.1	8.36	0.91
2,4'-DDE	<9	<9	<9	<9	<9	<9			1.04	0.29
endosulfan I	<3	<3	<3	<3	<3	<3	<2		no target	
cis-chlordane	40	45.4	69.4	36.9	25.2	28.7			32.5	1.8
trans-nonachlor	145	147	175	132	133	148			99.6	7.6
dieldrin	84.4	93.8	107.6	52.5	43	45.6			32.5	3.5
4,4'-DDE	846	864	968	428	467	553			373	48
2,4'-DDD	<10	<10	<10	<10	<10	<10			2.2	0.25
endrin	NA	NA	NA	NA	NA	NA			no target	
endosulfan II	<5	<5	<5	<5	<5	<5	no assigned value		no target	
4,4'-DDD	31.3	35.7	35.8	18.4	16.8	17.3			17.7	2.8
2,4'-DDT	29.9	30.4	46.1	22.7	28.7	28.1			22.3	3.2
cis-nonachlor	NA	NA	NA	NA	NA	NA			59.1	3.6
4,4'-DDT	23.2	26.1	18.7	20.5	12.4	12.6			37.2	3.5
mirex	3.86	3.81	4.04	5.98	6.41	4.73			6.47	0.77
endosulfan sulfate	NA	NA	NA	NA	NA	NA	no assigned value		no target	
chlorpyrifos	NA	NA	NA	NA	NA	NA	<2		no target	

TABLE C.1.1c. SRM accuracy (z-scores, z[s]) and precision (p[15%]) performances summary from the 2002 NIST intercomparison exercise for organic contaminants in the marine environment (Schantz, et al., 2005).

PCB SRM Performance	No. of Analytes	%	NIST Category	NIST Score	z (25%)	z(s)	p(15%)
Quantitative	16	64	Satisfactory	<2	14	12	16
Qualitative	2	8	Questionable	2 to 3	2	3	0
Not Determined	7	28	Unsatisfactor y	>3	1	2	0
Pesticide SRM Performance							
Quantitative	10	40	Satisfactory	<2	6	7	9
Qualitiative	9	36	Questionable	2 to 3	1	3	1
Not Determined	6	24	Unsatisfactor y	>3	1	0	0

No PAH standard reference material were provided to Gulfwatch for the 2001 sampling period

C.1.2 Matrix Spikes

The acceptable range for matrix spike recovery is 40-120%. The matrix spikes of organic compounds monitored by Gulfwatch are summarized in Table C.1.2

PAH: In general, matrix spike recoveries met expectations (40-120%). Analytes for each batch that exceed the QA thresholds are highlighted in grey in Table C-1. Four of the PAHs (anthracene, fluorene, phenanthrene, and perylene were analytically problematic; having spike recoveries greater than 120%. Anthracene exceeded 120% in all batch analyses. 18.9% of analyses fell outside of the targeted QA range, the majority of which exceeded 120%. Surrogate recovery was generally low for Napthalene-d8.

PCB: Recovery of matrix spikes ranged from 63-117% for all matrix spikes and met targeted performance criteria of 40-120% (Table C-2). Recoveries of 60-70% were observed in only 7 of the 240 analysis and were mostly observed in 4 of the 10 batches for BZ# 8,5. Surrogate recoveries for BZ#103 and BZ#198 were 89 and 98%, respectively and were <5% in relative standard deviation for all batch analyses (n=10).

OC: Recovery of matrix spikes ranged from 66-132% (Table C-3). Only two analyses where outside the targeted performance criteria of 40-120% and these exceeded 120%. Surrogate recoveries for g-Chlordene averaged 72% (± 9%, n=10).

TABLE C.1.2.1 Percent recovery of 2001 Gulfwatch PAH matrix spikes

Spiked Mussel Tissue **PAH**											Mean	RSD
Naphthalene	0%	86%	71%	83%	15%	4%	87%	4%	104%	93%	55%	79%
1-Methylnaphthalene	66%	66%	65%	78%	34%	12%	86%	83%	87%	97%	67%	39%
2-Methylnaphthalene	54%	65%	59%	72%	28%	9%	76%	69%	77%	80%	59%	39%
Biphenyl	79%	70%	68%	84%	42%	25%	86%	92%	89%	82%	72%	31%
2,6-Dimethylnaphthalene	84%	78%	72%	93%	50%	42%	89%	96%	90%	90%	78%	24%
Acenaphthylene	91%	84%	80%	98%	66%	57%	100%	107%	107%	113%	90%	21%
Acenaphthene	107%	101%	100%	115%	82%	74%	114%	120%	117%	120%	105%	15%
2,3,5-Trimethylnaphthalene	93%	89%	77%	101%	86%	98%	92%	89%	94%	96%	92%	7%
Fluorene	132%	139%	112%	129%	109%	120%	133%	132%	131%	132%	127%	8%
Phenanthrene	134%	146%	99%	95%	121%	120%	103%	110%	107%	252%	129%	36%
Anthracene	139%	149%	123%	138%	139%	133%	129%	141%	135%	206%	143%	16%
1-Methylphenanthracene	107%	102%	106%	100%	102%	103%	99%	104%	102%	102%	103%	3%
Fluoranthene	121%	119%	117%	113%	117%	116%	116%	118%	Int	122%	118%	2%
Pyrene	109%	105%	110%	105%	108%	108%	109%	117%	72%	112%	106%	12%
Benzo(a)Anthracene	133%	133%	108%	103%	107%	102%	112%	107%	78%	109%	109%	14%
Chrysene	125%	121%	106%	104%	102%	98%	112%	109%	86%	102%	106%	10%
Benzo(b)Fluoranthene	115%	108%	104%	100%	96%	93%	110%	100%	94%	113%	103%	8%
Benzo(k)Fluoranthene	103%	98%	99%	96%	90%	91%	106%	102%	87%	101%	97%	6%
Benzo(e)Pyrene	105%	100%	105%	100%	94%	95%	113%	110%	99%	118%	104%	8%
BatBenzo(a)Pyrene	119%	114%	119%	114%	107%	106%	123%	120%	112%	84%	112%	10%
Perylene	113%	112%	137%	137%	139%	133%	145%	161%	164%	143%	138%	12%
Indeno(1,2,3,4-cd)Pyrene	99%	100%	95%	96%	84%	77%	94%	14%	56%	102%	82%	34%
Dibenz(a,h)Anthracene	92%	114%	97%	96%	104%	104%	92%	81%	97%	93%	97%	9%
Benzo(ghi)Perylene	77%	96%	82%	81%	87%	87%	77%	68%	82%	78%	82%	9%
Mean:	100%	104%	96%	101%	88%	84%	104%	98%	99%	114%		
Surrogate Recovery												
Napthalene-d8	1%	52%	58%	57%	9%	1%	61%	7%	76%	73%	40%	79%
Acenaphthene-d10	85%	80%	77%	95%	63%	57%	86%	86%	91%	91%	81%	15%
Phenanthrene-d10	100%	98%	95%	92%	95%	95%	92%	90%	97%	104%	96%	4%
Fluoranthene-d10	104%	102%	102%	98%	102%	102%	97%	120%	Int	101%	103%	6%
Chrysene-d12	102%	103%	99%	91%	92%	92%	103%	100%	88%	107%	98%	6%
Benzo(a)pyrene-d12	100%	99%	100%	95%	90%	92%	102%	101%	100%	111%	99%	6%

Figures shaded grey indicate samples outside of target QC range (40-120%)

% Samples outside of QC range: 18.9%

RSD: Relative Standard Deviation = (Mean/STD) x 100

Int = Interferences

TABLE C.1.2.2. Gulfwatch 2001 PCB Matrix Spike Recoveries (%)

PCB											Mean	RSD
BZ#8,5	82%	82%	66%	64%	67%	58%	78%	87%	77%	82%	74%	13.1%
BZ#18,15	78%	97%	78%	88%	79%	74%	98%	93%	83%	90%	86%	9.9%
BZ#29	102%	91%	92%	90%	89%	89%	105%	105%	117%	110%	99%	10.1%
BZ#28	90%	97%	96%	85%	83%	85%	97%	97%	88%	96%	92%	6.3%
BZ#52	77%	88%	84%	67%	100%	76%	75%	81%	75%	91%	81%	11.9%
BZ#50	89%	93%	79%	82%	83%	77%	85%	85%	82%	84%	84%	5.7%
BZ#44	99%	98%	92%	90%	87%	75%	95%	98%	98%	94%	93%	7.9%
BZ#66,95	106%	104%	102%	99%	95%	94%	103%	106%	108%	102%	102%	4.6%
BZ#101,90	104%	100%	98%	102%	100%	103%	106%	107%	110%	105%	103%	3.5%
BZ#87	94%	91%	91%	89%	89%	84%	90%	96%	94%	94%	91%	3.7%
BZ#77	94%	96%	86%	91%	92%	84%	101%	106%	106%	104%	96%	8.2%
BZ#118	96%	104%	103%	94%	103%	97%	111%	105%	87%	113%	101%	7.8%
BZ#153,132	84%	89%	94%	85%	89%	91%	82%	81%	82%	80%	86%	5.4%
BZ#105	87%	85%	94%	93%	91%	86%	100%	105%	109%	101%	95%	8.6%
BZ#138	85%	77%	86%	72%	91%	86%	85%	88%	88%	85%	84%	6.7%
BZ#126	71%	63%	67%	83%	83%	73%	75%	77%	78%	77%	75%	8.8%
BZ#187	70%	86%	72%	85%	93%	82%	83%	81%	82%	83%	82%	8.2%
BZ#128	96%	98%	98%	90%	89%	83%	94%	104%	106%	98%	96%	7.1%
BZ#180	101%	105%	102%	96%	91%	94%	95%	105%	102%	99%	99%	4.8%
BZ#169	90%	97%	93%	89%	90%	103%	103%	111%	103%	92%	97%	7.6%
BZ#170,190	100%	105%	100%	97%	92%	90%	99%	99%	110%	102%	100%	5.8%
BZ#195,208	90%	97%	98%	94%	87%	92%	91%	94%	97%	95%	93%	3.8%
BZ#206	100%	106%	101%	100%	91%	100%	98%	95%	99%	97%	99%	4.0%
BZ#209	100%	103%	102%	103%	83%	90%	94%	86%	95%	82%	94%	8.7%
Surrogate Recovery												
BZ#103	97%	90%	86%	87%	86%	84%	88%	87%	92%	89%	89%	4.1%
BZ#198	95%	99%	96%	96%	92%	103%	101%	101%	101%	96%	98%	3.5%

TABLE C.1.2.3 Quality Control Results for 2001 Organic Contaminant Analysis

Pesticide											Mean:	RSD
a_BHC	94%	85%	99%	95%	95%	104%	88%	97%	103%	105%	96%	6.8%
HCB	79%	89%	67%	66%	69%	66%	80%	80%	70%	83%	75%	10.9%
g-HCH(Lindane)	93%	97%	101%	104%	104%	97%	87%	98%	103%	105%	99%	5.8%
Heptachlor	82%	91%	71%	78%	79%	75%	79%	74%	100%	80%	81%	10.6%
Aldrin	132%	117%	112%	89%	102%	101%	105%	104%	117%	109%	109%	10.8%
HeptachlorEpoxide	100%	99%	99%	98%	101%	106%	82%	76%	107%	91%	96%	10.5%
g-Chlordane	112%	115%	129%	98%	88%	117%	100%	97%	79%	143%	108%	17.8%
o,p'-DDE	83%	90%	78%	60%	90%	81%	68%	93%	98%	107%	85%	16.4%
a-Endosulfan	102%	98%	109%	106%	127%	104%	93%	105%	101%	113%	106%	8.8%
cis-Chlordane	103%	109%	105%	97%	109%	106%	102%	88%	99%	91%	101%	7.2%
t-Nonachlor	110%	101%	107%	95%	110%	87%	109%	99%	105%	97%	102%	7.4%
p,p'_DDE	94%	99%	95%	83%	109%	100%	98%	97%	103%	110%	99%	7.7%
Dieldrin	110%	108%	108%	109%	94%	107%	99%	83%	97%	90%	101%	9.3%
o,p'-DDD	109%	95%	87%	94%	83%	105%	81%	87%	81%	86%	91%	10.7%
Endrin	104%	102%	97%	96%	98%	86%	87%	80%	92%	103%	94%	8.7%
b-Endosulfan	102%	104%	103%	92%	90%	96%	87%	99%	90%	100%	96%	6.3%
p,p'-DDD	86%	102%	81%	75%	72%	77%	94%	95%	70%	85%	84%	12.7%
o,p'-DDT	91%	94%	79%	72%	97%	106%	101%	75%	80%	90%	89%	13.0%
p,p'-DDT	109%	92%	91%	70%	111%	96%	84%	86%	89%	90%	92%	12.7%
Metoxychlor	107%	102%	101%	101%	96%	103%	87%	75%	81%	91%	95%	11.2%
Mirex	102%	111%	99%	104%	98%	98%	82%	89%	100%	99%	98%	8.0%
Surrogate Recovery												
g-Chlordene	77%	84%	61%	66%	68%	76%	77%	71%	67%	76%	72%	9.3%

C.2 PRECISION

Relative Percent Differences for Duplicate Analyses

The relative percent difference for duplicate analyses on samples is another quality assurance exercise (Table C.2.1). In some cases where samples are near the method detection limit one analysis would have a detectable value but the other duplicate would not. In these cases, the RPD was determined to be 0% since the actual RPD could not be determined. The analysis of duplicates should agree to within 25% of each other.

TABLE C.2.1 PAH Duplicate analysis 2001 Gulfwatch mussel tissue concentrations (ng/g dry wt.)

Site	Sample no	Naphthalene	2-Me naphthalene	1-Me naphthalene	Biphenyl	2,6-Dime naphthalen	Acenaphthylene
NHFP	1N	5.7	3.4	<3	<3	<4	<4
NHFP	1N	<4	<3	<3	<3	<4	<4
NBHI	2N	5.3	<3	<3	<3	<4	<4
NBHI	2N	4.8	<3	<3	<3	<4	<4
NBHI	4N	6.5	<3	<3	<3	<4	<4
NBHI	4N	8.4	<3	<3	<3	<4	<4

Site	Sample no	Acenaphthene	2,3,5-Trime naphthal	Fluorene	Phenanthrene	Anthracene	1-Me phenanthrene
NHFP	1N	<4	<3	<4	8.6	4.8	<4
NHFP	1N	<4	<3	<4	8.0	4.7	<4
NBHI	2N	<4	<3	<4	6.0	3.8	<4
NBHI	2N	<4	<3	<4	5.6	4.2	<4
NBHI	4N	<4	<3	<4	2.3	<2	Int
NBHI	4N	<4	<3	<4	2.6	<2	Int

Site	Sample no	Fluoranthene	Pyrene	Benzo(a)anthracene	Chrysene	Benzo(b)fluoranthene	Benzo(k)fluoranthene
NHFP	1N	34.8	31.8	22.9	23.6	17.0	14.0
NHFP	1N	32.6	29.9	21.8	21.7	16.3	13.9
NBHI	2N	3.7	Int	<2	3.3	<8	3.2
NBHI	2N	3.9	Int	<2	2.9	<8	2.9
NBHI	4N	Int	Int	Int	<2	<8	2.7
NBHI	4N	Int	Int	Int	<2	<8	3.3

Site	Sample no	Benzo(e)pyrene	Benzo(a)pyrene	Perylene	Indeno(123cd)pyren	Dibenzo(ah)anthrace	Benzo(ghi)perylene
NHFP	1N	22.9	7.0	17.3	8.7	<4	10.3
NHFP	1N	23.4	6.8	16.0	8.2	<4	9.8
NBHI	2N	3.3	<3	3.9	<4	<4	<2
NBHI	2N	<3	<3	3.8	<4	<4	<2
NBHI	4N	3.9	<3	7.3	<4	<4	<2
NBHI	4N	4.3	<3	9.2	<4	<4	<2

TABLE C.2.2. Replicate analysis of PCB Congeners, 2001 Gulfwatch mussel tissue concentrations (ng/g dry wt.)

Site Code	Sample No	8 ; 5	18 ; 15	28 ;	29 ;	44 ;	50 ;
NBHI	2N	<2	<2	<2	<1	<2	<2
NBHI	2N	<2	<2	<2	<1	<2	<2
NBHI	4N	<2	<2	<2	<1	<2	<2
NBHI	4N	<2	<2	<2	<1	<2	<2
NHDP	3N	<2	<2	<2	<1	<2	<2
NHDP	3N	<2	<2	<2	<1	<2	<2
NHFP	1N	<2	<2	<2	<1	<2	<2
NHFP	1N	<2	<2	<2	<1	<2	<2
NHPI	1N	<2	<2	<2	<1	<2	<2
NHPI	1N	<2	<2	<2	<1	<2	<2
Site Code	**Sample No**	**52 ;**	**66 ; 95**	**77 ;**	**87 ;**	**101 ; 90**	**105 ;**
NBHI	2N	<2	<1.5	<1.5	<1.5	<1.5	<1
NBHI	2N	<2	<1.5	<1.5	<1.5	<1.5	<1
NBHI	4N	<2	<1.5	<1.5	<1.5	<1.5	<1
NBHI	4N	<2	<1.5	<1.5	<1.5	<1.5	<1
NHDP	3N	<2	<1.5	<1.5	<1.5	3.2	1.4
NHDP	3N	<2	<1.5	<1.5	<1.5	3.7	<1
NHFP	1N	<2	<1.5	<1.5	<1.5	5.6	1.9
NHFP	1N	<2	<1.5	<1.5	<1.5	5.0	1.7
NHPI	1N	<2	<1.5	<1.5	<1.5	5.6	1.9
NHPI	1N	<2	<1.5	<1.5	<1.5	5.0	1.7
Site Code	**Sample No**	**118 ;**	**128 ;**	**138 ;**	**153 ; 132**	**170 ; 190**	**180 ;**
NBHI	2N	<1	<1	<1.5	<1.5	<1.5	<1
NBHI	2N	<1	<1	<1.5	<1.5	<1.5	<1
NBHI	4N	<1	<1	<1.5	1.6	<1.5	<1
NBHI	4N	<1	<1	<1.5	2.1	<1.5	<1
NHDP	3N	4.5	2.3	7.5	9.4	<1.5	1.2
NHDP	3N	4.5	2.3	6.9	8.6	<1.5	1.2
NHFP	1N	7.1	1.2	7.6	11.7	<1.5	<1
NHFP	1N	5.9	1.4	8.8	10.6	<1.5	<1
NHPI	1N	7.1	1.2	7.6	11.7	<1.5	<1
NHPI	1N	5.9	1.4	8.8	10.6	<1.5	<1
Site Code	**Sample No**	**187 ;**	**195 ; 208**	**206 ;**	**209 ;**		
NBHI	2N	<1	<1.5	<1.5	<1.5		
NBHI	2N	<1	<1.5	<1.5	<1.5		
NBHI	4N	<1	<1.5	<1.5	<1.5		
NBHI	4N	<1	<1.5	<1.5	<1.5		
NHDP	3N	3.1	<1.5	<1.5	<1.5		
NHDP	3N	2.7	<1.5	<1.5	<1.5		

NHFP	1N	2.4	<1.5	<1.5	<1.5
NHFP	1N	2.9	<1.5	<1.5	<1.5
NHPI	1N	2.4	<1.5	<1.5	<1.5
NHPI	1N	2.9	<1.5	<1.5	<1.5

TABLE C.2.3. Replicate analysis of organic pesticides, 2001 Gulfwatch mussel tissue concentrations (ng/g dry wt.)

Year	Site Code	Sample No	Lindane	HCB	a-Endosulfan	b-Endosulfan	cis-Chlordane	trans-Nonachlor
2001	NHDP	3N	<1.2	<1.2	<1.2	<2.0	<1.0	<1.0
2001	NHDP	3N	<1.2	<1.2	<1.2	<2.0	<1.0	<1.0
2001	NHFP	1N	<1.2	<1.2	<1.2	<2.0	<1.0	<1.0
2001	NHFP	1N	<1.2	<1.2	<1.2	<2.0	<1.0	<1.0
2001	NBHI	2N	<1.2	<1.2	<1.2	<2.0	1.9	<1.0
2001	NBHI	2N	<1.2	<1.2	<1.2	<2.0	<1.0	<1.0
2001	NBHI	4N	<1.2	<1.2	<1.2	<2.0	<1.0	<1.0
2001	NBHI	4N	<1.2	<1.2	<1.2	<2.0	<1.0	<1.0

Year	Site Code	Sample No	Heptachlor	Hepta epoxide	Dieldrin	Aldrin	Mirex	o,p'-DDD
2001	NHDP	3N	<1.0	<1.2	<1.2	<1.5	<1.5	<1.0
2001	NHDP	3N	<1.0	<1.2	<1.2	<1.5	<1.5	<1.0
2001	NHFP	1N	<1.0	<1.2	<1.2	<1.5	<1.5	<1.0
2001	NHFP	1N	<1.0	<1.2	<1.2	<1.5	<1.5	<1.0
2001	NBHI	2N	<1.0	<1.2	1.7	<1.5	<1.5	<1.0
2001	NBHI	2N	<1.0	<1.2	1.3	<1.5	<1.5	<1.0
2001	NBHI	4N	<1.0	<1.2	1.4	<1.5	<1.5	<1.0
2001	NBHI	4N	<1.0	<1.2	1.9	<1.5	<1.5	<1.0

Year	Site Code	Sample No	p,p'-DDD	o,p'-DDE	p,p'-DDE	o,p'-DDT	p,p'-DDT
2001	NHDP	3N	2.1	<1.2	3.9	<2.0	<1.0
2001	NHDP	3N	1.8	<1.2	3.9	<2.0	<1.0
2001	NHFP	1N	3.9	<1.2	6.9	<2.0	<1.0
2001	NHFP	1N	2.8	<1.2	6.0	<2.0	<1.0
2001	NBHI	2N	<1.5	<1.2	2.5	<2.0	<1.0
2001	NBHI	2N	<1.5	<1.2	2.6	<2.0	<1.0
2001	NBHI	4N	<1.5	<1.2	2.9	<2.0	<1.0
2001	NBHI	4N	1.6	<1.2	4.2	<2.0	<1.0

C.3 BLANKS

Blank analyses (Table C.3.1) should ideally recover no detectable amounts of target compounds. For 2001, no discernible signal was observed for PAHs, PCBs, and PEST.

C.4 COMPLETENESS

The data on 67 of 68 samples (99%) were completed successfully.

Appendix D 2001 Trace Metal Data

TABLES D. Selected Metals concentration (ug/g dry wt.) observed in Mussel tissue collected by Gulfwatch, 2001.

Table D.1 Blue mussel tissue metal concentrations (µg/g dry wt.) in Massachusetts Cape Cod Bay Benchmark site, Sandwich, MA (MASN); 41.7645°N, 70.4840°W

MASN	(µg/g dry wt.)			
Replicate	*1N*	*2N*	*3N*	*4N*
Ag	0.1	0.1	0.1	0.1
Cd	1.4	1.1	1.3	1.3
Cr	0.5	0.6	0.6	0.6
Cu	7	6	6	6
Fe	160	190	220	250
Ni	0.7	0.7	0.8	0.7
Pb	1.9	1.4	1.8	1.5
Zn	70	80	100	90
Al	47	57	73	84
Hg	0.18	ND 0.1	0.11	0.13
Solid	17.2	17.2	16.6	17

Table D.2 Blue mussel tissue metal concentrations (µg/g dry wt.) in Massachusetts inner Boston Harbor station (MAIH); 42.3637°N, 71.0284°W

MAIH	(µg/g dry wt.)			
Replicate	*1N*	*2N*	*3N*	*4N*
Ag	ND 0.1	ND 0.1	ND 0.1	0.1
Cd	2.6	1.6	1.8	2.3
Cr	2.1	1.3	1.5	2
Cu	27	18	20	21
Fe	610	460	550	560
Ni	1	0.8	1	1.3
Pb	38	26	29	26
Zn	150	160	120	190
Al	170	110	160	170
Hg	0.59	0.40	0.42	0.39
Solid	17.7	18.5	18.8	10.5

Table D.3 Blue mussel tissue metal concentrations (µg/g dry wt.) in Massachusetts Pines River site, Saugus, MA (MAPR); 42.4312^{o}N, 70.9793^{o}W

MAPR	(µg/g dry wt.)			
Replicate	*1N*	*2N*	*3N*	*4N*
Ag	ND 0.1	ND 0.1	ND 0.1	ND 0.1
Cd	1.9	1.6	1.8	1.6
Cr	3.4	2.4	2.2	2.1
Cu	8	7	9	9
Fe	320	420	430	470
Ni	0.9	1.1	1.4	1.1
Pb	5.6	5.5	6.3	6.3
Zn	80	80	100	80
Al	120	150	150	140
Hg	0.49	0.43	0.36	0.34
Solid	16	16.4	15.8	15.1

Table D.4 Blue mussel tissue metal concentrations (µg/g dry wt.) in New Hampshire Hampton/Seabrook Harbor (NHHS); 42.8972^{o}N, 70.8163^{o}W

NHHS	(µg/g dry wt.)			
Replicate	*1N*	*2N*	*3N*	*4N*
Ag	ND 0.1	ND 0.1	ND 0.1	ND 0.1
Cd	1.6	1.7	1.9	1.7
Cr	2	1.8	1.6	0.8
Cu	7	7	7	6
Fe	330	260	250	70
Ni	0.9	0.8	1	0.9
Pb	2.8	1.9	2	1.6
Zn	100	90	90	80
Al	150	110	100	190
Hg	0.52	0.33	0.22	0.15
Solid	17.8	19.7	19.8	19.3

Table D.5 Blue mussel tissue metal concentrations (µg/g dry wt.) in New Hampshire Little Harbor (NHLH); 43.0581°N, 70.0581°W

NHLH	(µg/g dry wt.)			
Replicate	*1N*	*2N*	*3N*	*4N*
Ag	ND 0.1	0.1	0.1	ND 0.1
Cd	1.5	1.4	1.3	1.2
Cr	3.6	3.5	6.9	24
Cu	6	6	7	7
Fe	340	350	300	500
Ni	1	1	1.1	1.4
Pb	3.1	2.5	2.6	2.8
Zn	90	90	80	90
Al	95	96	778	110
Hg	0.66	0.86	0.80	0.74
Solid	15.5	15.4	15.6	15.3

Table D.6 Blue mussel tissue metal concentrations (µg/g dry wt.) in New Hampshire Pierce Island (expanded Gulfwatch) site (NHPI); 43.0717°N, 70.7433°W.

NHPI	(µg/g dry wt.)			
Replicate	*1N*	*2N*	*3N*	*4N*
Ag	0.1	0.1	0.1	0.1
Cd	1.7	1.6	1.5	1.6
Cr	2.5	2	1.9	1.8
Cu	9.2	7.9	7.8	7.3
Fe	440	340	340	400
Ni	2.4	2.4	2.4	2.4
Pb	4.3	4	3.7	3.8
Zn	140	140	130	130
Al	160	85	100	140
Hg	0.71	0.82	0.75	0.64
Solid	15.2	14.4	15.4	17

Table D.7 Blue mussel tissue metal concentrations (µg/g dry wt.) in New Hampshire South Mill Pond (expanded Gulfwatch) site (NHSM); 43.0727°N, 70.7489°W

NHSM	(µg/g dry wt.)			
Replicate	*1N*	*2N*	*3N*	*4N*
Ag	0.8	0.1	0.1	0.1
Cd	1.2	1	1	1.3
Cr	2.9	2.7	2.3	2.7
Cu	7.9	6.5	8.2	10
Fe	640	590	510	490
Ni	2.5	2.6	2.2	2.5
Pb	7.8	6.6	6.1	7.4
Zn	100	85	73	110
Al	220	190	190	190
Hg	0.78	0.76	0.57	0.74
Solid	14.4	14.4	14.5	14.1

Table D.8 Blue mussel tissue metal concentrations (µg/g dry wt.) New Hampshire Schiller Station (expanded Gulfwatch) site (NHSS); 43.1017°N, 70.7883°W

NHSS	(µg/g dry wt.)			
Replicate	*1N*	*2N*	*3N*	*4N*
Ag	ND 0.1	ND 0.1	ND 0.1	0.1
Cd	1.4	1.7	1.5	2
Cr	1.1	1.3	1	1.7
Cu	6	7	6	7
Fe	270	270	220	330
Ni	1	0.9	0.8	0.9
Pb	2.2	2.4	1.8	2.9
Zn	80	90	80	120
Al	83	93	72	94
Hg	0.68	0.77	1.32	0.96
Solid	16.7	16.1	16.4	16.4

Table D.9 Blue mussel tissue metal concentrations (µg/g dry wt.) in New Hampshire Dover Point site (NHDP); 43.1196°N, 70.8267°W. #N-Dup represents duplicate analysis of site replicate.

NHDP	(µg/g dry wt.)				
Replicate	*1N*	*2N*	*3N-Dup*	*3N-Dup*	*4N*
Ag	ND 0.1	ND 0.1	ND 0.1	0.1	ND 0.1
Cd	2.2	1.8	1.9	2	2.2
Cr	3.4	2.7	2.1	2.2	3.4
Cu	7	7	6	6	7
Fe	400	300	320	350	400
Ni	1.1	1	1.1	1.3	1.1
Pb	2.9	2.3	1.9	2.6	2.9
Zn	110	90	90	110	110
Al	140	100	120	140	140
Hg	0.29	0.30	0.89	NA	0.69
Solid	13.5	14.9	14.9	13.4	13.5

Table D.10 Blue mussel tissue metal concentrations (µg/g dry wt.) in New Hampshire Fox Point (expanded Gulfwatch) site (NHFP); 43.1201°N, 70.8389°W. #N-Dup represents duplicate analysis of site replicate.

NHFP	(µg/g dry wt.)			
Replicate	*1N*	*2N*	*3N*	*4N*
Ag	0.1	0.1	0.1	0.1
Cd	1.3	1.7	1.3	1.7
Cr	2.9	3.1	2.6	3.3
Cu	4.8	6.5	6.9	7.4
Fe	780	840	530	690
Ni	2.3	2.5	2.1	2.5
Pb	2.3	3.2	2.2	2.7
Zn	95	120	97	130
Al	310	310	190	250
Hg	0.90	0.63	0.79	0.71
Solid	15.4	15	14.7	15.5

Table D.11 Blue mussel tissue metal concentrations (µg/g dry wt.) in Maine Benchmark site, Clark's Cove (MECC); 43.0774°N, 70.7244°W

MECC	(µg/g dry wt.)			
Replicate	*1N*	*2N*	*3N*	*4N*
Ag	ND 0.1	ND 0.1	ND 0.1	ND 0.1
Cd	1.4	1.5	3.6	1.1
Cr	1.9	2.8	1.4	2.7
Cu	5	5	5	8
Fe	370	460	590	470
Ni	1.1	1.2	1.5	1.1
Pb	2.1	2.5	3	2.5
Zn	70	90	90	80
Al	130	160	230	190
Hg	0.52	0.58	0.79	0.96
Solid	16.9	15.9	13.9	14.2

Table D.12 Blue mussel tissue metal concentrations (µg/g dry wt.) in Maine Damariscotta site (MEDM); 43.9383°N, 69.5817°W

MEDM	(µg/g dry wt.)			
Replicate	*1N*	*2N*	*3N*	*4N*
Ag	0.1	ND 0.1	0.1	ND 0.1
Cd	1.3	1	1.1	1.5
Cr	1.5	1.1	1.2	1.1
Cu	6.7	6	5.4	5.7
Fe	580	360	370	270
Ni	2	1.6	1.8	1.7
Pb	3.1	1.7	1.9	2.5
Zn	64	62	59	51
Al	200	120	130	110
Hg	0.15	ND 0.10	ND 0.10	0.12
Solid	12.1	13.5	12.8	12.8

Table D.13 Blue mussel tissue metal concentrations (µg/g dry wt.) in New Brunswick Niger Reef site (NBNR); 45.0663°N, 67.0680°W

NBNR	(µg/g dry wt.)			
Replicate	*1N*	*2N*	*3N*	*4N*
Ag	0.2	0.2	0.3	0.1
Cd	1.1	0.9	1	0.9
Cr	1	0.8	1	0.7
Cu	7.6	5.8	6.4	5.5
Fe	580	350	430	330
Ni	1.8	1.8	1.9	1.6
Pb	1.8	1.3	1.6	1.2
Zn	87	81	83	69
Al	260	150	180	120
Hg	ND 0.10	ND 0.10	ND 0.10	ND 0.10
Solid	15.2	14.3	14	14.9

Table D.14 Blue mussel tissue metal concentrations (µg/g dry wt.) in New Brunswick Hospital Island site (NBHI); 45.1205°N, 67.0082°W. #N-Dup represents duplicate analysis of site replicate.

NBHI	(µg/g dry wt.)			
Replicate	*1N*	*2N*	*3N*	*4N*
Ag	0.1	0.1	0.1	0.1
Cd	1.3	1.1	1.2	1.1
Cr	0.9	0.7	0.7	0.9
Cu	8.6	5.4	7.1	7.7
Fe	380	260	280	380
Ni	1.6	1.5	1.4	1.6
Pb	1	0.8	0.8	1.1
Zn	67	64	62	72
Al	170	130	120	170
Hg	ND 0.10	ND 0.10	ND 0.10	ND 0.10
Solid	17.8	17.5	21.4	19.9

Table D.15 Blue mussel tissue metal concentrations (µg/g dry wt.) in Nova Scotia Cornwallis site (NSCW); 44.6447°N, 65.6480°W

NSCW	(µg/g dry wt.)			
Replicate	*1N*	*2N*	*3N*	*4N*
Ag	ND 0.1	ND 0.1	ND 0.1	ND 0.1
Cd	0.7	0.9	0.7	0.9
Cr	0.4	0.5	0.4	0.4
Cu	6	6	6	7
Fe	340	310	290	360
Ni	0.7	0.8	0.7	0.8
Pb	1.3	1.3	1.3	1.5
Zn	50	40	40	40
Al	140	120	120	120
Hg	ND 0.10	ND 0.10	ND 0.10	ND 0.10
Solid	19.3	20.4	21.7	20.4

Table D.16 Blue mussel tissue metal concentrations (µg/g dry wt.) in Nova Scotia Digby site (NSDI); 44.6170°N, 65.7523°W

NSDI	(µg/g dry wt.)			
Replicate	*1N*	*2N*	*3N*	*4N*
Ag	ND 0.1	ND 0.1	ND 0.1	ND 0.1
Cd	1.7	1.2	1	1.2
Cr	0.9	0.7	0.5	0.7
Cu	8	6	6	6
Fe	320	340	270	300
Ni	1.2	0.8	0.8	0.8
Pb	2.7	2	1.5	2
Zn	60	50	50	60
Al	130	130	100	110
Hg	ND 0.10	ND 0.10	0.12	ND 0.10
Solid	16.3	16.2	17.2	15.6

Table D.17 Blue mussel tissue metal concentrations (µg/g dry wt.) in Nova Scotia Grosse Coques (occasionally sampled) site (NSGC); 44.3728°N, 66.0950°W

NSGC	(µg/g dry wt.)			
Replicate	*1N*	*2N*	*3N*	*4N*
Ag	ND 0.1	ND 0.1	ND 0.1	ND 0.1
Cd	1.4	1.4	1.4	1.4
Cr	0.7	0.9	0.8	0.9
Cu	5	5	6	6
Fe	370	440	370	400
Ni	1.1	1.3	1.2	1.3
Pb	1.4	1.6	1.4	1.4
Zn	50	60	60	60
Al	120	140	120	140
Hg	ND 0.10	ND 0.10	ND 0.10	ND 0.10
Solid	15.5	15.2	14.8	15.1

Appendix E Organic Contaminants in 2001 Gulfwatch Mussel Samples

TABLES E.1 PAH concentration (ng/g dry wt.) observed in Mussel tissue collected by Gulfwatch, 2001. “Int.” indicates the presence of interferences during analysis.

Table E.1.1 PAH blue mussel tissue concentrations (ng/g dry wt.) in Massachusetts Cape Cod Bay Benchmark site, Sandwich, MA (MASN); 41.7645°N, 70.4840°W

MASN		(ng/g dry wt.)		
Replicate	*1N*	*2N*	*3N*	*4N*
Naphthalene	4.3	<4	4.3	<4
2-Me naphthalene	<3	<3	<3	<3
1-Me naphthalene	<3	<3	<3	<3
Biphenyl	<3	<3	<3	<3
2,6-Dime naphthalen	<4	<4	<4	<4
Acenaphthylene	<4	<4	<4	<4
Acenaphthene	<4	<4	<4	<4
2,3,5-Trime naphthal	<3	<3	<3	<3
Fluorene	<4	<4	<4	<4
Phenanthrene	6.1	6.0	6.6	6.4
Anthracene	<2	<2	<2	<2
1-Me phenanthrene	<4	<4	<4	<4
Fluoranthene	<2	9.2	8.3	12.6
Pyrene	5.7	6.1	6.6	8.2
Benzo(a)anthracene	2.2	<2	<2	2.8
Chrysene	4.8	4.4	4.6	4.9
Benzo(b)fluoranthene	<8	<8	<8	<8
Benzo(k)fluoranthene	2.9	2.2	2.5	3.1
Benzo(e)pyrene	8.7	8.5	7.9	7.9
Benzo(a)pyrene	<3	<3	<3	<3
Perylene	16.5	16.2	14.9	13.0
Indeno(123cd)pyren	<4	<4	<4	<4
Dibenzo(ah)anthrace	<4	<4	<4	<4
Benzo(ghi)perylene	2.2	<2	2.1	2.5

Table E.1.2 PAH blue mussel tissue concentrations (ng/g dry wt.) in Massachusetts inner Boston Harbor station (MAIH); 42.3637°N, 71.0284°W

MAIH	(ng/g dry wt.)			
Replicate	*1N*	*2N*	*3N*	*4N*
Naphthalene	7.2	22.9	20.4	6.9
2-Me naphthalene	4.4	13.3	9.6	7.3
1-Me naphthalene	Int	Int	Int	Int
Biphenyl	Int	Int	Int	Int
2,6-Dime naphthalen	7.1	11.8	11.1	10.5
Acenaphthylene	Int	Int	Int	Int
Acenaphthene	Int	Int	Int	Int
2,3,5-Trime naphthal	8.5	10.7	10.3	11.0
Fluorene	20.2	20.3	20.3	18.2
Phenanthrene	117.6	119.3	115.1	117.8
Anthracene	44.5	39.6	33.8	37.1
1-Me phenanthrene	25.1	32.3	30.8	33.8
Fluoranthene	633.4	561.6	545.1	696.0
Pyrene	569.2	521.9	530.0	619.9
Benzo(a)anthracene	170.4	167.7	156.0	162.2
Chrysene	412.6	384.5	364.9	448.8
Benzo(b)fluoranthene	232.3	231.2	236.5	223.3
Benzo(k)fluoranthene	163.1	210.4	190.5	159.2
Benzo(e)pyrene	311.4	301.3	300.3	333.6
Benzo(a)pyrene	90.1	120.5	93.3	76.1
Perylene	26.6	33.6	27.7	24.0
Indeno(123cd)pyren	61.3	83.3	70.9	50.4
Dibenzo(ah)anthrace	13.0	17.6	15.8	12.2
Benzo(ghi)perylene	79.5	106.7	92.8	86.2

Table E.1.3 PAH blue mussel tissue concentrations (ng/g dry wt.) in Massachusetts Pines River site, Saugus, MA (MAPR); 42.4312°N, 70.9793°W

MAPR	(ng/g dry wt.)			
Replicate	*1N*	*2N*	*3N*	*4N*
Naphthalene	9.0	7.2	9.3	8.9
2-Me naphthalene	6.0	5.2	5.6	5.4
1-Me naphthalene	3.3	<3	<3	<3
Biphenyl	<3	<3	<3	<3
2,6-Dime naphthalen	4.7	4.4	4.4	4.2
Acenaphthylene	<4	<4	<4	<4
Acenaphthene	12.5	11.3	11.7	11.4
2,3,5-Trime naphthal	<3	<3	<3	<3
Fluorene	18.1	15.1	15.3	15.8
Phenanthrene	56.8	45.5	48.8	43.6
Anthracene	15.1	11.2	11.7	11.0
1-Me phenanthrene	9.5	7.7	7.7	8.7
Fluoranthene	151.5	119.6	131.1	143.5
Pyrene	120.4	104.5	105.4	103.4
Benzo(a)anthracene	34.6	23.8	23.5	21.9
Chrysene	71.7	56.9	55.1	55.6
Benzo(b)fluoranthene	52.7	39.6	39.6	34.2
Benzo(k)fluoranthene	38.8	28.5	27.4	23.8
Benzo(e)pyrene	64.5	53.7	53.8	51.3
Benzo(a)pyrene	24.3	18.6	17.7	12.9
Perylene	22.9	16.3	15.1	18.1
Indeno(123cd)pyren	19.8	15.8	13.9	11.6
Dibenzo(ah)anthrace	4.1	<4	<4	<4
Benzo(ghi)perylene	22.9	20.5	21.0	16.5

Table E.1.4 PAH blue mussel tissue concentrations (ng/g dry wt.) in New Hampshire Hampton/Seabrook Harbor (NHHS); 42.8972°N, 70.8163°W

NHHS	(ng/g dry wt.)			
Replicate	*1N*	*2N*	*3N*	*4N*
Naphthalene	5.1	6.4	5.6	7.2
2-Me naphthalene	4.5	4.2	5.2	5.8
1-Me naphthalene	<3	<3	<3	<3
Biphenyl	<3	<3	<3	<3
2,6-Dime naphthalen	4.1	<4	4.7	4.8
Acenaphthylene	<4	<4	<4	<4
Acenaphthene	<4	<4	<4	<4
2,3,5-Trime naphthal	3.2	<3	3.4	3.4
Fluorene	<4	<4	<4	<4
Phenanthrene	11.6	10.0	10.6	11.9
Anthracene	4.1	3.3	3.5	5.3
1-Me phenanthrene	<4	<4	<4	<4
Fluoranthene	17.3	16.5	16.6	18.1
Pyrene	12.6	12.0	11.9	12.1
Benzo(a)anthracene	9.1	8.0	8.0	8.3
Chrysene	10.0	8.5	9.4	9.2
Benzo(b)fluoranthene	<8	<8	<8	<8
Benzo(k)fluoranthene	3.4	3.7	<2	3.6
Benzo(e)pyrene	5.4	5.4	5.6	5.7
Benzo(a)pyrene	<3	<3	<3	<3
Perylene	<3	<3	5.1	<3
Indeno(123cd)pyren	<4	<4	<4	<4
Dibenzo(ah)anthrace	<4	<4	<4	<4
Benzo(ghi)perylene	3.1	3.1	<2	3.0

Table E.1.5 PAH blue mussel tissue concentrations (ng/g dry wt.) in New Hampshire Little Harbor (NHLH); 43.0581°N, 70.0581°W

NHLH	(ng/g dry wt.)			
Replicate	*1N*	*2N*	*3N*	*4N*
Naphthalene	<4	<4	6.0	6.4
2-Me naphthalene	<3	<3	<3	<3
1-Me naphthalene	<3	<3	<3	<3
Biphenyl	<3	<3	<3	<3
2,6-Dime naphthalen	<4	<4	<4	<4
Acenaphthylene	<4	<4	<4	<4
Acenaphthene	<4	<4	<4	<4
2,3,5-Trime naphthal	<3	<3	<3	<3
Fluorene	<4	<4	<4	<4
Phenanthrene	9.1	7.0	7.5	7.6
Anthracene	4.3	3.4	3.4	4.0
1-Me phenanthrene	<4	<4	<4	<4
Fluoranthene	26.6	22.3	25.3	23.6
Pyrene	19.7	16.2	18.9	17.3
Benzo(a)anthracene	Int	Int	Int	Int
Chrysene	13.4	12.6	14.0	13.0
Benzo(b)fluoranthene	8.4	<8	8.9	<8
Benzo(k)fluoranthene	6.9	6.6	7.5	6.5
Benzo(e)pyrene	10.5	9.2	10.4	9.4
Benzo(a)pyrene	3.7	3.7	3.8	3.8
Perylene	3.3	3.5	4.1	3.5
Indeno(123cd)pyren	4.1	4.6	4.6	4.7
Dibenzo(ah)anthrace	<4	<4	<4	<4
Benzo(ghi)perylene	5.5	5.7	6.4	5.8

Table E.1.6 PAH blue mussel tissue concentrations (ng/g dry wt.) in New Hampshire Pierce Island (expanded Gulfwatch) site (NHPI); 43.0717°N, 70.7433°W

NHPI		(ng/g dry wt.)		
Replicate	*1N*	*2N*	*3N*	*4N*
Naphthalene	6.4	8.0	<4	<4
2-Me naphthalene	3.7	3.8	<3	<3
1-Me naphthalene	<3	<3	<3	<3
Biphenyl	<3	<3	<3	<3
2,6-Dime naphthalen	4.2	<4	<4	<4
Acenaphthylene	<4	<4	<4	<4
Acenaphthene	<4	<4	<4	<4
2,3,5-Trime naphthal	3.0	<3	<3	<3
Fluorene	<4	<4	<4	<4
Phenanthrene	14.6	14.6	19.0	11.8
Anthracene	5.7	5.3	5.9	4.9
1-Me phenanthrene	5.2	4.4	4.4	<4
Fluoranthene	54.7	54.9	49.6	45.1
Pyrene	50.9	49.7	44.6	41.1
Benzo(a)anthracene	<2	25.7	<2	22.4
Chrysene	28.5	29.9	20.9	23.4
Benzo(b)fluoranthene	16.4	16.5	15.5	14.1
Benzo(k)fluoranthene	13.3	13.3	11.9	11.3
Benzo(e)pyrene	24.5	25.8	19.5	20.5
Benzo(a)pyrene	6.3	<3	<3	<3
Perylene	7.8	7.2	<3	6.6
Indeno(123cd)pyren	<4	<4	<4	<4
Dibenzo(ah)anthrace	<4	<4	<4	<4
Benzo(ghi)perylene	8.5	8.6	7.8	7.7

Table E.1.7 PAH blue mussel tissue concentrations (ng/g dry wt.) in New Hampshire South Mill Pond (expanded Gulfwatch) site (NHSM); 43.0727°N, 70.7489°W

NHSM	(ng/g dry wt.)			
Replicate	*1N*	*2N*	*3N*	*4N*
Naphthalene	<4	5.6	<4	4.5
2-Me naphthalene	<3	<3	<3	<3
1-Me naphthalene	<3	<3	<3	<3
Biphenyl	<3	<3	<3	<3
2,6-Dime naphthalen	<4	<4	<4	<4
Acenaphthylene	4.2	4.0	4.1	5.9
Acenaphthene	<4	<4	<4	<4
2,3,5-Trime naphthal	<3	<3	<3	<3
Fluorene	<4	<4	<4	<4
Phenanthrene	15.4	20.7	18.7	21.1
Anthracene	6.2	6.2	6.1	6.9
1-Me phenanthrene	4.6	6.2	5.4	5.6
Fluoranthene	108.7	141.1	120.8	134.8
Pyrene	95.7	119.2	108.0	119.3
Benzo(a)anthracene	26.7	28.1	31.6	32.9
Chrysene	58.0	74.4	66.4	71.4
Benzo(b)fluoranthene	64.5	64.5	72.1	76.1
Benzo(k)fluoranthene	50.3	47.5	57.2	57.5
Benzo(e)pyrene	63.6	72.5	68.7	76.5
Benzo(a)pyrene	26.2	23.3	30.1	37.9
Perylene	13.1	16.2	14.2	<3
Indeno(123cd)pyren	<4	<4	<4	<4
Dibenzo(ah)anthrace	<4	<4	<4	<4
Benzo(ghi)perylene	24.3	24.6	29.9	31.5

Table E.1.8 PAH blue mussel tissue concentrations (ng/g dry wt.) New Hampshire Schiller Station (expanded Gulfwatch) site (NHSS); 43.1017°N, 70.7883°W

NHSS	(ng/g dry wt.)			
Replicate	*1N*	*2N*	*3N*	*4N*
Naphthalene	<4	<4	<4	<4
2-Me naphthalene	3.3	<3	3.6	3.8
1-Me naphthalene	<3	<3	<3	<3
Biphenyl	<3	<3	<3	<3
2,6-Dime naphthalen	<4	4.6	<4	<4
Acenaphthylene	<4	<4	<4	<4
Acenaphthene	<4	<4	<4	<4
2,3,5-Trime naphthal	<3	3.1	3.1	<3
Fluorene	<4	6.5	6.4	5.5
Phenanthrene	21.0	25.4	30.3	23.4
Anthracene	7.4	7.6	10.8	7.7
1-Me phenanthrene	4.8	4.9	6.9	5.0
Fluoranthene	45.0	47.1	57.2	45.7
Pyrene	37.4	38.2	51.5	39.5
Benzo(a)anthracene	22.0	23.0	30.9	22.4
Chrysene	23.3	23.5	32.0	23.7
Benzo(b)fluoranthene	14.2	14.4	16.2	14.7
Benzo(k)fluoranthene	11.6	9.5	13.2	9.0
Benzo(e)pyrene	19.1	19.2	24.9	19.0
Benzo(a)pyrene	6.3	3.8	7.6	<3
Perylene	9.7	8.1	11.0	7.2
Indeno(123cd)pyren	<4	6.1	7.6	<4
Dibenzo(ah)anthrace	<4	<4	<4	<4
Benzo(ghi)perylene	<2	6.7	9.3	<2

Table E.1.9 PAH blue mussel tissue concentrations (ng/g dry wt.) in New Hampshire Dover Point site (NHDP); 43.1196^{o}N, 70.8267^{o}W

NHDP	(ng/g dry wt.)			
Replicate	*1N*	*2N*	*3N*	*4N*
Naphthalene	<4	<4	<4	<4
2-Me naphthalene	5.5	<3	5.3	<3
1-Me naphthalene	<3	<3	<3	<3
Biphenyl	<3	<3	<3	<3
2,6-Dime naphthalen	<4	<4	<4	<4
Acenaphthylene	<4	<4	<4	<4
Acenaphthene	<4	<4	<4	<4
2,3,5-Trime naphthal	<3	<3	<3	<3
Fluorene	<4	<4	<4	<4
Phenanthrene	12.0	9.7	9.7	9.7
Anthracene	6.4	5.6	5.9	6.2
1-Me phenanthrene	4.3	<4	4.0	4.2
Fluoranthene	31.9	29.0	29.4	30.8
Pyrene	31.1	27.4	29.5	31.2
Benzo(a)anthracene	22.3	20.0	20.7	21.6
Chrysene	22.9	21.0	21.5	22.5
Benzo(b)fluoranthene	18.3	15.1	17.2	19.1
Benzo(k)fluoranthene	14.6	10.6	14.2	15.8
Benzo(e)pyrene	21.5	16.8	21.0	22.1
Benzo(a)pyrene	6.7	4.9	6.0	8.0
Perylene	11.4	9.6	12.4	13.6
Indeno(123cd)pyren	9.1	6.7	7.9	9.4
Dibenzo(ah)anthrace	<4	<4	<4	<4
Benzo(ghi)perylene	10.0	7.6	8.8	11.2

Table E.1.10 PAH blue mussel tissue concentrations (ng/g dry wt.) in New Hampshire Fox Point (expanded Gulfwatch) site (NHFP); 43.1201°N, 70.8389°W. #N-Dup represents duplicate analysis of site replicate.

NHFP	(ng/g dry wt.)				
Replicate	*1N -Dup.*	*1N -Dup.*	*2N*	*3N*	*4N*
Naphthalene	5.7	<4	6.6	5.4	9.1
2-Me naphthalene	3.4	<3	3.2	3.2	3.6
1-Me naphthalene	<3	<3	<3	<3	<3
Biphenyl	<3	<3	<3	<3	<3
2,6-Dime naphthalen	<4	<4	<4	<4	<4
Acenaphthylene	<4	<4	<4	<4	<4
Acenaphthene	<4	<4	<4	<4	<4
2,3,5-Trime naphthal	<3	<3	<3	<3	<3
Fluorene	<4	<4	<4	<4	<4
Phenanthrene	8.6	8.0	9.5	8.7	10.8
Anthracene	4.8	4.7	4.5	4.7	5.7
1-Me phenanthrene	<4	<4	<4	<4	<4
Fluoranthene	34.8	32.6	34.9	35.8	40.7
Pyrene	31.8	29.9	31.3	35.0	36.8
Benzo(a)anthracene	22.9	21.8	22.2	22.6	24.9
Chrysene	23.6	21.7	23.7	22.5	26.3
Benzo(b)fluoranthene	17.0	16.3	17.3	20.4	18.3
Benzo(k)fluoranthene	14.0	13.9	14.9	16.8	16.4
Benzo(e)pyrene	22.9	23.4	22.8	23.8	25.5
Benzo(a)pyrene	7.0	6.8	7.8	7.2	9.2
Perylene	17.3	16.0	15.5	20.6	18.6
Indeno(123cd)pyren	8.7	8.2	9.4	8.2	9.0
Dibenzo(ah)anthrace	<4	<4	<4	<4	<4
Benzo(ghi)perylene	10.3	9.8	10.7	10.0	11.7

Table E.1.11 PAH blue mussel tissue concentrations (ng/g dry wt.) in Maine Benchmark site, Clark's Cove (MECC); 43.0774°N, 70.7244°W

MECC	(ng/g dry wt.)			
Replicate	*1N*	*2N*	*3N*	*4N*
Naphthalene	6.4	5.6	<4	7.1
2-Me naphthalene	<3	<3	<3	<3
1-Me naphthalene	<3	<3	<3	<3
Biphenyl	<3	<3	<3	<3
2,6-Dime naphthalen	<4	<4	<4	<4
Acenaphthylene	<4	<4	<4	<4
Acenaphthene	<4	<4	<4	<4
2,3,5-Trime naphthal	<3	<3	<3	<3
Fluorene	<4	<4	<4	<4
Phenanthrene	11.0	10.8	10.3	11.0
Anthracene	4.6	3.9	3.4	4.1
1-Me phenanthrene	<4	<4	<4	<4
Fluoranthene	24.7	27.1	25.3	26.7
Pyrene	20.6	23.5	22.1	23.7
Benzo(a)anthracene	Int	Int	Int	Int
Chrysene	14.2	16.6	16.0	16.3
Benzo(b)fluoranthene	9.4	13.5	12.8	12.3
Benzo(k)fluoranthene	7.9	11.3	11.0	11.1
Benzo(e)pyrene	13.8	16.1	15.7	17.0
Benzo(a)pyrene	4.6	9.1	6.7	6.3
Perylene	6.3	7.8	7.7	7.4
Indeno(123cd)pyren	5.9	7.5	7.4	7.1
Dibenzo(ah)anthrace	<4	<4	<4	<4
Benzo(ghi)perylene	7.7	9.7	9.5	8.9

Table E.1.12 PAH blue mussel tissue concentrations (ng/g dry wt.) in Maine Damariscotta site (MEDM); 43.9383°N, 69.5817°W

MEDM	(ng/g dry wt.)			
Replicate	*1N*	*2N*	*3N*	*4N*
Naphthalene	4.7	<4	<4	<4
2-Me naphthalene	<3	<3	<3	<3
1-Me naphthalene	<3	<3	<3	<3
Biphenyl	<3	<3	<3	<3
2,6-Dime naphthalen	<4	<4	<4	<4
Acenaphthylene	<4	<4	<4	<4
Acenaphthene	<4	<4	<4	<4
2,3,5-Trime naphthal	<3	<3	<3	<3
Fluorene	<4	<4	<4	<4
Phenanthrene	2.7	<2	3.2	2.6
Anthracene	2.4	2.5	<2	<2
1-Me phenanthrene	Int	Int	Int	Int
Fluoranthene	Int	Int	Int	Int
Pyrene	Int	Int	Int	Int
Benzo(a)anthracene	Int	Int	Int	Int
Chrysene	<2	<2	<2	<2
Benzo(b)fluoranthene	<8	<8	<8	<8
Benzo(k)fluoranthene	5.2	5.2	5.1	5.2
Benzo(e)pyrene	9.3	8.9	10.5	9.7
Benzo(a)pyrene	<3	4.1	4.5	3.8
Perylene	7.5	7.3	8.2	7.6
Indeno(123cd)pyren	<4	<4	<4	<4
Dibenzo(ah)anthrace	<4	<4	<4	<4
Benzo(ghi)perylene				

Table E.1.13 PAH blue mussel tissue concentrations (ng/g dry wt.) in New Brunswick Niger Reef site (NBNR); 45.0663°N, 67.0680°W

NBNR	(ng/g dry wt.)			
Replicate	*1N*	*2N*	*3N*	*4N*
Naphthalene	15.0	16.0	26.1	15.0
2-Me naphthalene	<3	<3	<3	<3
1-Me naphthalene	<3	<3	<3	<3
Biphenyl	<3	<3	<3	<3
2,6-Dime naphthalen	<4	<4	<4	<4
Acenaphthylene	<4	<4	<4	<4
Acenaphthene	<4	<4	<4	<4
2,3,5-Trime naphthal	<3	<3	<3	<3
Fluorene	<4	<4	<4	<4
Phenanthrene	6.7	6.6	6.1	7.1
Anthracene	3.8	3.1	3.4	4.0
1-Me phenanthrene	Int	Int	Int	Int
Fluoranthene	Int	Int	Int	Int
Pyrene	Int	Int	Int	Int
Benzo(a)anthracene	Int	Int	Int	Int
Chrysene	<2	<2	<2	<2
Benzo(b)fluoranthene	<8	<8	<8	<8
Benzo(k)fluoranthene	5.5	5.0	5.3	4.2
Benzo(e)pyrene	5.4	5.5	5.9	4.8
Benzo(a)pyrene	4.7	4.8	4.0	4.1
Perylene	10.4	8.9	13.0	17.1
Indeno(123cd)pyren	<4	<4	<4	<4
Dibenzo(ah)anthrace	<4	<4	<4	<4
Benzo(ghi)perylene	<2	<2	<2	<2

Table E.1.14 PAH blue mussel tissue concentrations (ng/g dry wt.) in New Brunswick Hospital Island site (NBHI); 45.1205°N, 67.0082°W. #N-Dup represents duplicate analysis of site replicate.

NBHI	(ng/g dry wt.)					
Replicate	*1N*	*2N-Dup*	*2N-Dup*	*3N*	*4N-Rep*	*4N-Rep*
Naphthalene	<4	5.3	4.8	6.4	6.5	8.4
2-Me naphthalene	<3	<3	<3	<3	<3	<3
1-Me naphthalene	<3	<3	<3	<3	<3	<3
Biphenyl	<3	<3	<3	<3	<3	<3
2,6-Dime naphthalen	<4	<4	<4	<4	<4	<4
Acenaphthylene	<4	<4	<4	<4	<4	<4
Acenaphthene	<4	<4	<4	<4	<4	<4
2,3,5-Trime naphthal	<3	<3	<3	<3	<3	<3
Fluorene	<4	<4	<4	<4	<4	<4
Phenanthrene	8.0	6.0	5.6	4.2	2.3	2.6
Anthracene	5.5	3.8	4.2	<2	<2	<2
1-Me phenanthrene	<4	<4	<4	Int	Int	Int
Fluoranthene	5.5	3.7	3.9	Int	Int	Int
Pyrene	Int	Int	Int	Int	Int	Int
Benzo(a)anthracene	2.3	<2	<2	Int	Int	Int
Chrysene	4.3	3.3	2.9	<2	<2	<2
Benzo(b)fluoranthene	<8	<8	<8	<8	<8	<8
Benzo(k)fluoranthene	3.6	3.2	2.9	3.4	2.7	3.3
Benzo(e)pyrene	4.2	3.3	<3	5.0	3.9	4.3
Benzo(a)pyrene	<3	<3	<3	<3	<3	<3
Perylene	4.9	3.9	3.8	7.7	7.3	9.2
Indeno(123cd)pyren	<4	<4	<4	<4	<4	<4
Dibenzo(ah)anthrace	<4	<4	<4	<4	<4	<4
Benzo(ghi)perylene	<2	<2	<2	<2	<2	<2

Table E.1.15 PAH blue mussel tissue concentrations (ng/g dry wt.) in Nova Scotia Cornwallis site (NSCW); 44.6447°N, 65.6480°W

NSCW	(ng/g dry wt.)			
Replicate	*1N*	*2N*	*3N*	*4N*
Naphthalene	5.6	4.6	4.0	5.3
2-Me naphthalene	<3	<3	<3	<3
1-Me naphthalene	<3	<3	<3	<3
Biphenyl	<3	<3	<3	<3
2,6-Dime naphthalen	<4	<4	<4	<4
Acenaphthylene	<4	<4	<4	<4
Acenaphthene	<4	<4	<4	<4
2,3,5-Trime naphthal	<3	<3	<3	<3
Fluorene	<4	<4	<4	<4
Phenanthrene	7.0	8.4	7.2	5.6
Anthracene	2.7	3.1	2.7	2.1
1-Me phenanthrene	Int	Int	Int	Int
Fluoranthene	Int	Int	Int	Int
Pyrene	Int	Int	Int	Int
Benzo(a)anthracene	Int	Int	Int	Int
Chrysene	<2	<2	<2	<2
Benzo(b)fluoranthene	<8	<8	<8	<8
Benzo(k)fluoranthene	2.3	2.5	<2	<2
Benzo(e)pyrene	4.4	5.1	3.3	<3
Benzo(a)pyrene	<3	<3	<3	<3
Perylene	8.5	9.6	8.9	6.4
Indeno(123cd)pyren	<4	<4	<4	<4
Dibenzo(ah)anthrace	<4	<4	<4	<4
Benzo(ghi)perylene	<2	<2	<2	<2

Table E.1.16 PAH blue mussel tissue concentrations (ng/g dry wt.) in Nova Scotia Digby site (NSDI); 44.6170°N, 65.7523°W

NSDI	(ng/g dry wt.)		
Replicate	*1N*	*2N*	*3N*
Naphthalene	5.5	4.2	5.2
2-Me naphthalene	<3	<3	<3
1-Me naphthalene	<3	<3	<3
Biphenyl	<3	<3	<3
2,6-Dime naphthalen	<4	<4	<4
Acenaphthylene	<4	<4	<4
Acenaphthene	<4	<4	<4
2,3,5-Trime naphthal	<3	<3	<3
Fluorene	<4	<4	<4
Phenanthrene	10.0	9.3	11.8
Anthracene	3.2	2.8	3.4
1-Me phenanthrene	Int	Int	Int
Fluoranthene	Int	Int	Int
Pyrene	Int	Int	Int
Benzo(a)anthracene	Int	Int	Int
Chrysene	Int	Int	Int
Benzo(b)fluoranthene	<8	<8	<8
Benzo(k)fluoranthene	3.4	2.2	2.4
Benzo(e)pyrene	9.1	5.2	5.3
Benzo(a)pyrene	<3	<3	<3
Perylene	17.8	6.9	7.9
Indeno(123cd)pyren	<4	<4	<4
Dibenzo(ah)anthrace	<4	<4	<4
Benzo(ghi)perylene	<2	<2	<2

Table E.1.17 PAH blue mussel tissue concentrations (ng/g dry wt.) in Nova Scotia Grosse Coques (occasionally sampled) site (NSGC); 44.3728°N, 66.0950°W

NSGC	(ng/g dry wt.)			
Replicate	*1N*	*2N*	*3N*	*4N*
Naphthalene	5.3	4.4	5.1	4.5
2-Me naphthalene	<3	<3	<3	<3
1-Me naphthalene	<3	<3	<3	<3
Biphenyl	<3	<3	<3	<3
2,6-Dime naphthalen	<4	<4	<4	<4
Acenaphthylene	<4	<4	<4	<4
Acenaphthene	<4	<4	<4	<4
2,3,5-Trime naphthal	<3	<3	<3	<3
Fluorene	<4	<4	<4	<4
Phenanthrene	5.3	<2	4.3	3.3
Anthracene	<2	<2	<2	<2
1-Me phenanthrene	Int	Int	Int	Int
Fluoranthene	Int	Int	Int	Int
Pyrene	Int	Int	Int	Int
Benzo(a)anthracene	Int	Int	Int	Int
Chrysene	<2	<2	<2	<2
Benzo(b)fluoranthene	<8	<8	<8	<8
Benzo(k)fluoranthene	<2	<2	<2	<2
Benzo(e)pyrene	4.3	5.1	4.6	4.7
Benzo(a)pyrene	<3	<3	5.5	<3
Perylene	9.1	14.3	12.2	12.1
Indeno(123cd)pyren	<4	<4	<4	<4
Dibenzo(ah)anthrace	<4	<4	<4	<4
Benzo(ghi)perylene	<2	<2	<2	<2

TABLES E.2 PCB concentration (ng/g dry wt.) observed in Mussel tissue collected by Gulfwatch, 2001. "Int." indicates the presence of interferences during analysis.

Table E.2.1 PCB blue mussel tissue concentrations (ng/g dry wt.) in Massachusetts Cape Cod Bay Benchmark site, Sandwich, MA (MASN); 41.7645^{o}N, 70.4840^{o}W

MASN	(ng/g dry wt.)			
Replicate	*1N*	*2N*	*3N*	*4N*
8 ; 5	<2	<2	<2	<2
18 ; 15	<2	<2	<2	<2
28 ;	<2	<2	<2	<2
29 ;	<1	<1	<1	<1
44 ;	<2	<2	<2	<2
50 ;	<2	<2	<2	<2
52 ;	<2	<2	<2	<2
66 ; 95	<1.5	<1.5	<1.5	<1.5
77 ;	12.4	<1.5	<1.5	<1.5
87 ;	<1.5	<1.5	<1.5	<1.5
101 ; 90	3.6	4.4	4.5	4.1
105 ;	1.4	<1	<1	<1
118 ;	5.9	6.0	6.0	5.6
128 ;	1.6	1.4	1.1	1.4
138 ;	9.9	8.1	7.1	8.1
153 ; 132	10.1	9.4	8.0	8.5
170 ; 190	<1.5	<1.5	<1.5	<1.5
180 ;	1.1	1.2	<1	<1
187 ;	3.5	2.9	2.3	2.8
195 ; 208	<1.5	<1.5	<1.5	<1.5
206 ;	<1.5	<1.5	<1.5	<1.5
209 ;	<1.5	<1.5	<1.5	<1.5

Table E.2.2 PCB blue mussel tissue concentrations (ng/g dry wt.) in Massachusetts inner Boston Harbor station (MAIH); 42.3637°N, 71.0284°W

MAIH	(ng/g dry wt.)			
Replicate	*1N*	*2N*	*3N*	*4N*
8 ; 5	<2	<2	<2	<2
18 ; 15	2.1	2.9	3.2	3.6
28 ;	8.6	9.3	8.7	9.9
29 ;	<1	<1	<1	<1
44 ;	11.8	8.8	12.9	15.3
50 ;	<2	<2	<2	<2
52 ;	24.9	28.5	28.0	32.5
66 ; 95	21.9	24.8	25.2	28.9
77 ;	18.2	21.0	18.5	22.1
87 ;	23.0	28.4	26.3	31.4
101 ; 90	63.6	72.5	71.2	75.8
105 ;	20.9	27.3	25.0	28.9
118 ;	60.8	72.3	72.5	77.5
128 ;	12.4	14.6	13.7	15.3
138 ;	84.1	102.4	99.9	110.5
153 ; 132	87.9	101.8	99.6	103.4
170 ; 190	<1.5	<1.5	<1.5	<1.5
180 ;	14.2	17.7	16.2	21.3
187 ;	35.0	37.6	38.5	44.8
195 ; 208	<1.5	<1.5	<1.5	<1.5
206 ;	<1.5	<1.5	<1.5	<1.5
209 ;	<1.5	<1.5	<1.5	<1.5

Table E.2.3 PCB blue mussel tissue concentrations (ng/g dry wt.) in Massachusetts Pines River site, Saugus, MA (MAPR); 42.4312°N, 70.9793°W

MAPR	(ng/g dry wt.)			
Replicate	*1N*	*2N*	*3N*	*4N*
8 ; 5	<2	<2	<2	<2
18 ; 15	<2	<2	<2	<2
28 ;	2.7	2.8	2.0	2.9
29 ;	<1	<1	<1	<1
44 ;	2.7	3.0	2.1	3.4
50 ;	<2	<2	<2	<2
52 ;	5.2	5.3	4.0	6.1
66 ; 95	6.1	6.7	4.9	7.7
77 ;	5.3	5.4	3.9	6.3
87 ;	4.3	5.5	3.7	6.1
101 ; 90	12.9	14.8	10.3	16.2
105 ;	5.7	6.2	3.9	7.1
118 ;	16.5	19.4	14.2	21.2
128 ;	4.4	4.5	3.0	5.2
138 ;	29.7	32.0	22.2	35.5
153 ; 132	26.5	29.5	20.8	30.8
170 ; 190	<1.5	<1.5	<1.5	<1.5
180 ;	6.0	5.6	4.3	5.4
187 ;	13.0	14.5	10.2	17.0
195 ; 208	<1.5	<1.5	<1.5	<1.5
206 ;	<1.5	<1.5	<1.5	<1.5
209 ;	<1.5	<1.5	<1.5	<1.5

Table E.2.4 PCB blue mussel tissue concentrations (ng/g dry wt.) in New Hampshire Hampton/Seabrook Harbor (NHHS); 42.8972°N, 70.8163°W

NHHS	(ng/g dry wt.)			
Replicate	*1N*	*2N*	*3N*	*4N*
8 ; 5	<2	<2	<2	<2
18 ; 15	<2	<2	<2	<2
28 ;	<2	<2	<2	<2
29 ;	1.3	<1	<1	1.3
44 ;	<2	<2	<2	<2
50 ;	<2	<2	<2	<2
52 ;	<2	<2	<2	<2
66 ; 95	<1.5	<1.5	<1.5	<1.5
77 ;	<1.5	<1.5	<1.5	<1.5
87 ;	<1.5	<1.5	<1.5	<1.5
101 ; 90	<1.5	<1.5	<1.5	1.7
105 ;	<1	<1	<1	<1
118 ;	2.1	1.9	1.3	1.7
128 ;	<1	<1	<1	1.1
138 ;	2.7	2.6	2.6	3.8
153 ; 132	4.2	4.1	4.0	4.8
170 ; 190	<1.5	<1.5	<1.5	<1.5
180 ;	<1	<1	<1	<1
187 ;	<1	<1	<1	<1
195 ; 208	<1.5	<1.5	<1.5	<1.5
206 ;	<1.5	<1.5	<1.5	<1.5
209 ;	<1.5	<1.5	<1.5	<1.5

Table E.2.5 PCB blue mussel tissue concentrations (ng/g dry wt.) in New Hampshire Little Harbor (NHLH); 43.0581°N, 70.0581°W

NHLH	(ng/g dry wt.)			
Replicate	*1N*	*2N*	*3N*	*4N*
8 ; 5	<2	<2	<2	<2
18 ; 15	<2	<2	<2	<2
28 ;	<2	<2	<2	<2
29 ;	<1	<1	<1	<1
44 ;	<2	<2	<2	<2
50 ;	<2	<2	<2	<2
52 ;	<2	<2	<2	<2
66 ; 95	<1.5	<1.5	<1.5	<1.5
77 ;	<1.5	<1.5	<1.5	<1.5
87 ;	<1.5	<1.5	<1.5	<1.5
101 ; 90	2.8	2.6	3.2	2.2
105 ;	<1	<1	<1	<1
118 ;	3.9	3.4	4.0	3.5
128 ;	<1	<1	<1	<1
138 ;	6.2	5.6	7.2	4.8
153 ; 132	7.3	6.5	7.5	6.7
170 ; 190	<1.5	<1.5	<1.5	<1.5
180 ;	<1	<1	<1	<1
187 ;	2.8	2.3	2.7	2.0
195 ; 208	<1.5	<1.5	<1.5	<1.5
206 ;	<1.5	<1.5	<1.5	<1.5
209 ;	<1.5	<1.5	<1.5	<1.5

Table E.2.6 PCB blue mussel tissue concentrations (ng/g dry wt.) in New Hampshire Pierce Island (expanded Gulfwatch) site (NHPI); 43.0717°N, 70.7433°W. #N-Dup represents duplicate analysis of site replicate.

NHPI	(ng/g dry wt.)				
Replicate	*1N-Dup*	*1N-Dup*	*2N*	*3N*	*4N*
8 ; 5	<2	<2	<2	<2	<2
18 ; 15	<2	<2	<2	<2	<2
28 ;	<2	<2	<2	<2	<2
29 ;	<1	<1	<1	<1	<1
44 ;	<2	<2	<2	<2	<2
50 ;	<2	<2	<2	<2	<2
52 ;	<2	<2	<2	<2	<2
66 ; 95	<1.5	<1.5	<1.5	<1.5	<1.5
77 ;	<1.5	<1.5	<1.5	<1.5	<1.5
87 ;	<1.5	<1.5	<1.5	<1.5	<1.5
101 ; 90	5.6	5.0	5.1	5.6	5.1
105 ;	1.9	1.7	1.7	1.6	1.9
118 ;	7.1	5.9	6.8	7.3	6.8
128 ;	1.2	1.4	1.7	1.6	1.7
138 ;	7.6	8.8	10.4	8.9	8.7
153 ; 132	11.7	10.6	11.7	12.9	13.2
170 ; 190	<1.5	<1.5	<1.5	<1.5	<1.5
180 ;	<1	<1	<1	<1	<1
187 ;	2.4	2.9	3.7	3.5	3.6
195 ; 208	<1.5	<1.5	<1.5	<1.5	<1.5
206 ;	<1.5	<1.5	<1.5	<1.5	<1.5
209 ;	<1.5	<1.5	<1.5	<1.5	<1.5

Table E.2.7 PCB blue mussel tissue concentrations (ng/g dry wt.) in New Hampshire South Mill Pond (expanded Gulfwatch) site (NHSM); 43.0727°N, 70.7489°W

NHSM	(ng/g dry wt.)			
Replicate	*1N*	*2N*	*3N*	*4N*
8 ; 5	2.0	<2	<2	<2
18 ; 15	<2	<2	<2	<2
28 ;	<2	<2	<2	<2
29 ;	<1	<1	<1	<1
44 ;	<2	<2	<2	<2
50 ;	<2	<2	<2	<2
52 ;	<2	<2	<2	<2
66 ; 95	<1.5	2.8	<1.5	2.0
77 ;	<1.5	<1.5	<1.5	<1.5
87 ;	<1.5	1.7	<1.5	<1.5
101 ; 90	5.5	8.1	4.3	6.4
105 ;	1.8	5.2	1.4	4.1
118 ;	5.6	8.6	5.3	6.3
128 ;	1.4	2.2	2.3	2.1
138 ;	8.3	11.4	11.2	9.0
153 ; 132	10.4	13.8	10.7	9.4
170 ; 190	<1.5	<1.5	<1.5	<1.5
180 ;	<1	<1	<1	<1
187 ;	3.2	4.5	4.2	4.7
195 ; 208	<1.5	<1.5	<1.5	<1.5
206 ;	<1.5	<1.5	<1.5	<1.5
209 ;	<1.5	<1.5	<1.5	<1.5

Table E.2.8 PCB blue mussel tissue concentrations (ng/g dry wt.) New Hampshire Schiller Station (expanded Gulfwatch) site (NHSS); 43.1017^{o}N, 70.7883^{o}W

NHSS	(ng/g dry wt.)			
Replicate	*1N*	*2N*	*3N*	*4N*
8 ; 5	<2	<2	<2	<2
18 ; 15	<2	<2	<2	<2
28 ;	<2	<2	<2	<2
29 ;	<1	<1	<1	<1
44 ;	<2	<2	<2	<2
50 ;	<2	<2	<2	<2
52 ;	<2	<2	<2	<2
66 ; 95	<1.5	<1.5	<1.5	<1.5
77 ;	<1.5	<1.5	<1.5	<1.5
87 ;	<1.5	<1.5	<1.5	<1.5
101 ; 90	3.9	5.0	4.1	3.3
105 ;	1.2	2.0	1.4	1.3
118 ;	5.1	6.5	4.8	4.6
128 ;	1.9	2.3	2.0	2.5
138 ;	7.5	8.6	7.3	9.3
153 ; 132	9.7	11.5	9.2	9.4
170 ; 190	<1.5	<1.5	<1.5	<1.5
180 ;	1.2	1.2	1.1	1.1
187 ;	2.8	3.6	3.0	4.2
195 ; 208	<1.5	<1.5	<1.5	<1.5
206 ;	<1.5	<1.5	<1.5	<1.5
209 ;	<1.5	<1.5	<1.5	<1.5

Table E.2.9 PCB blue mussel tissue concentrations (ng/g dry wt.) in New Hampshire Dover Point site (NHDP); 43.1196°N, 70.8267°W. #N-Dup represents duplicate analysis of site replicate.

NHDP	(ng/g dry wt.)				
Replicate	*1N*	*2N*	*3N-Dup*	*3N-Dup*	*4N*
8 ; 5	<2	<2	<2	<2	<2
18 ; 15	<2	<2	<2	<2	<2
28 ;	<2	<2	<2	<2	<2
29 ;	<1	<1	<1	<1	<1
44 ;	<2	<2	<2	<2	<2
50 ;	<2	<2	<2	<2	<2
52 ;	<2	<2	<2	<2	<2
66 ; 95	<1.5	<1.5	<1.5	<1.5	<1.5
77 ;	<1.5	<1.5	<1.5	<1.5	<1.5
87 ;	<1.5	<1.5	<1.5	<1.5	<1.5
101 ; 90	3.1	3.3	3.2	3.7	3.7
105 ;	1.6	<1	1.4	<1	1.2
118 ;	4.3	4.2	4.5	4.5	4.7
128 ;	2.4	1.8	2.3	2.3	1.9
138 ;	7.2	6.2	7.5	6.9	7.4
153 ; 132	9.0	7.4	9.4	8.6	9.4
170 ; 190	<1.5	<1.5	<1.5	<1.5	<1.5
180 ;	1.1	1.2	1.2	1.2	1.4
187 ;	3.2	2.7	3.1	2.7	2.7
195 ; 208	<1.5	<1.5	<1.5	<1.5	<1.5
206 ;	<1.5	<1.5	<1.5	<1.5	<1.5
209 ;	<1.5	<1.5	<1.5	<1.5	<1.5

Table E.2.10 PCB blue mussel tissue concentrations (ng/g dry wt.) in New Hampshire Fox Point (expanded Gulfwatch) site (NHFP); 43.1201°N, 70.8389°W. #N-Dup represents duplicate analysis of site replicate.

NHFP	(ng/g dry wt.)				
Replicate	*1N-Dup.*	*1N-Dup.*	*2N*	*3N*	*4N*
8 ; 5	<2	<2	<2	<2	<2
18 ; 15	<2	<2	<2	<2	<2
28 ;	<2	<2	<2	<2	<2
29 ;	<1	<1	<1	<1	<1
44 ;	<2	<2	<2	<2	<2
50 ;	<2	<2	<2	<2	<2
52 ;	<2	<2	<2	<2	<2
66 ; 95	<1.5	<1.5	<1.5	<1.5	<1.5
77 ;	<1.5	<1.5	<1.5	<1.5	<1.5
87 ;	<1.5	<1.5	<1.5	<1.5	<1.5
101 ; 90	5.6	5.0	5.1	5.6	5.1
105 ;	1.9	1.7	1.7	1.6	1.9
118 ;	7.1	5.9	6.8	7.3	6.8
128 ;	1.2	1.4	1.7	1.6	1.7
138 ;	7.6	8.8	10.4	8.9	8.7
153 ; 132	11.7	10.6	11.7	12.9	13.2
170 ; 190	<1.5	<1.5	<1.5	<1.5	<1.5
180 ;	<1	<1	<1	<1	<1
187 ;	2.4	2.9	3.7	3.5	3.6
195 ; 208	<1.5	<1.5	<1.5	<1.5	<1.5
206 ;	<1.5	<1.5	<1.5	<1.5	<1.5
209 ;	<1.5	<1.5	<1.5	<1.5	<1.5

Table E.2.11 PCB blue mussel tissue concentrations (ng/g dry wt.) in Maine Benchmark site, Clark's Cove (MECC); 43.0774°N, 70.7244°W

MECC	(ng/g dry wt.)			
Replicate	*1N*	*2N*	*3N*	*4N*
8 ; 5	<2	<2	<2	<2
18 ; 15	<2	<2	<2	<2
28 ;	<2	<2	<2	<2
29 ;	<1	<1	1.0	<1
44 ;	<2	<2	<2	<2
50 ;	<2	<2	<2	<2
52 ;	<2	<2	<2	<2
66 ; 95	<1.5	<1.5	<1.5	<1.5
77 ;	<1.5	<1.5	<1.5	<1.5
87 ;	<1.5	<1.5	<1.5	<1.5
101 ; 90	2.8	3.0	2.5	3.5
105 ;	<1	<1	<1	<1
118 ;	3.5	3.9	2.7	4.5
128 ;	<1	<1	<1	<1
138 ;	5.7	6.5	4.9	7.0
153 ; 132	7.0	8.4	7.0	9.4
170 ; 190	<1.5	<1.5	<1.5	<1.5
180 ;	1.1	1.6	<1	1.8
187 ;	2.6	3.2	2.2	3.3
195 ; 208	<1.5	<1.5	<1.5	<1.5
206 ;	<1.5	<1.5	<1.5	<1.5
209 ;	<1.5	<1.5	<1.5	<1.5

Table E.2.12 PCB blue mussel tissue concentrations (ng/g dry wt.) in Maine Damariscotta site (MEDM); 43.9383°N, 69.5817°W

MEDM	(ng/g dry wt.)			
Replicate	*1N*	*2N*	*3N*	*4N*
8 ; 5	<2	<2	<2	<2
18 ; 15	<2	<2	<2	<2
28 ;	<2	<2	<2	<2
29 ;	<1	<1	<1	<1
44 ;	<2	<2	<2	<2
50 ;	<2	<2	<2	<2
52 ;	<2	<2	<2	<2
66 ; 95	<1.5	<1.5	<1.5	<1.5
77 ;	<1.5	<1.5	<1.5	<1.5
87 ;	<1.5	<1.5	<1.5	<1.5
101 ; 90	<1.5	<1.5	<1.5	<1.5
105 ;	<1	<1	<1	<1
118 ;	<1	<1	<1	<1
128 ;	<1	<1	<1	<1
138 ;	2.1	2.1	2.4	3.1
153 ; 132	2.6	2.3	3.4	3.6
170 ; 190	<1.5	<1.5	<1.5	<1.5
180 ;	<1	<1	<1	<1
187 ;	<1	<1	<1	1.3
195 ; 208	<1.5	<1.5	<1.5	<1.5
206 ;	<1.5	<1.5	<1.5	<1.5
209 ;	<1.5	<1.5	<1.5	<1.5

Table E.2.13 PCB blue mussel tissue concentrations (ng/g dry wt.) in New Brunswick Niger Reef site (NBNR); 45.0663°N, 67.0680°W

NBNR	(ng/g dry wt.)			
Replicate	*1N*	*2N*	*3N*	*4N*
8 ; 5	<2	<2	<2	<2
18 ; 15	<2	<2	<2	<2
28 ;	<2	<2	<2	<2
29 ;	<1	<1	<1	<1
44 ;	<2	<2	<2	<2
50 ;	<2	<2	<2	<2
52 ;	<2	<2	<2	<3
66 ; 95	<1.5	<1.5	<1.5	<1.5
77 ;	<1.5	<1.5	<1.5	<1.5
87 ;	<1.5	<1.5	<1.5	<1.5
101 ; 90	<1.5	<1.5	<1.5	<1.5
105 ;	<1	<1	<1	<1
118 ;	<1	<1	<1	<1
128 ;	<1	<1	<1	<1
138 ;	2.3	2.5	2.7	3.5
153 ; 132	2.8	2.7	3.2	3.2
170 ; 190	<1.5	<1.5	<1.5	<1.5
180 ;	<1	<1	<1	<1
187 ;	<1	<1	<1	<1
195 ; 208	<1.5	<1.5	<1.5	<1.5
206 ;	<1.5	<1.5	<1.5	<1.5
209 ;	<1.5	<1.5	<1.5	<1.5

Table E.2.14 PCB blue mussel tissue concentrations (ng/g dry wt.) in New Brunswick Hospital Island site (NBHI); 45.1205°N, 67.0082°W. #N-Dup represents duplicate analysis of site replicate.

NBHI	(ng/g dry wt.)					
Replicate	*1N*	*2N-Dup*	*2N-Dup*	*3N*	*4N-Dup*	*4N-Dup*
8 ; 5	<2	<2	<2	<2	<2	<2
18 ; 15	<2	<2	<2	<2	<2	<2
28 ;	<2	<2	<2	<2	<2	<2
29 ;	<1	<1	<1	<1	<1	<1
44 ;	<2	<2	<2	<2	<2	<2
50 ;	<2	<2	<2	<2	<2	<2
52 ;	<2	<2	<2	<2	<2	<2
66 ; 95	<1.5	<1.5	<1.5	<1.5	<1.5	<1.5
77 ;	<1.5	<1.5	<1.5	<1.5	<1.5	<1.5
87 ;	<1.5	<1.5	<1.5	<1.5	<1.5	<1.5
101 ; 90	<1.5	<1.5	<1.5	<1.5	<1.5	<1.5
105 ;	<1	<1	<1	<1	<1	<1
118 ;	<1	<1	<1	<1	<1	<1
128 ;	<1	<1	<1	<1	<1	<1
138 ;	<1.5	<1.5	<1.5	<1.5	<1.5	<1.5
153 ; 132	1.7	<1.5	<1.5	2.4	1.6	2.1
170 ; 190	<1.5	<1.5	<1.5	<1.5	<1.5	<1.5
180 ;	<1	<1	<1	<1	<1	<1
187 ;	<1	<1	<1	<1	<1	<1
195 ; 208	<1.5	<1.5	<1.5	<1.5	<1.5	<1.5
206 ;	<1.5	<1.5	<1.5	<1.5	<1.5	<1.5
209 ;	<1.5	<1.5	<1.5	<1.5	<1.5	<1.5

Table E.2.15 PCB blue mussel tissue concentrations (ng/g dry wt.) in Nova Scotia Cornwallis site (NSCW); 44.6447^{o}N, 65.6480^{o}W

NSCW	(ng/g dry wt.)			
Replicate	*1N*	*2N*	*3N*	*4N*
8 ; 5	<2	<2	<2	<2
18 ; 15	<2	<2	<2	<2
28 ;	<2	<2	<2	<2
29 ;	<1	<1	<1	<1
44 ;	<2	<2	<2	<2
50 ;	<2	<2	<2	<2
52 ;	<2	<2	<2	<2
66 ; 95	<1.5	<1.5	<1.5	<1.5
77 ;	<1.5	<1.5	<1.5	<1.5
87 ;	<1.5	<1.5	<1.5	<1.5
101 ; 90	<1.5	<1.5	<1.5	<1.5
105 ;	<1	<1	<1	<1
118 ;	<1	<1	<1	<1
128 ;	<1	<1	<1	<1
138 ;	<1.5	<1.5	<1.5	<1.5
153 ; 132	<1.5	<1.5	2.0	<1.5
170 ; 190	<1.5	<1.5	<1.5	<1.5
180 ;	<1	<1	<1	<1
187 ;	<1	<1	<1	<1
195 ; 208	<1.5	<1.5	<1.5	<1.5
206 ;	<1.5	<1.5	<1.5	<1.5
209 ;	<1.5	<1.5	<1.5	<1.5

Table E.2.16 PCB blue mussel tissue concentrations (ng/g dry wt.) in Nova Scotia Digby site (NSDI); 44.6170°N, 65.7523°W

NSDI	(ng/g dry wt.)		
Replicate	*1N*	*2N*	*3N*
8 ; 5	<2	<2	<2
18 ; 15	<2	<2	<2
28 ;	<2	<2	<2
29 ;	<1	<1	<1
44 ;	<2	<2	<2
50 ;	<2	<2	<2
52 ;	<2	<2	<2
66 ; 95	<1.5	<1.5	<1.5
77 ;	<1.5	<1.5	<1.5
87 ;	<1.5	<1.5	<1.5
101 ; 90	<1.5	<1.5	<1.5
105 ;	<1	<1	<1
118 ;	<1	<1	<1
128 ;	<1	<1	<1
138 ;	<1.5	<1.5	<1.5
153 ; 132	1.6	1.8	<1.5
170 ; 190	<1.5	<1.5	<1.5
180 ;	<1	<1	<1
187 ;	<1	<1	<1
195 ; 208	<1.5	<1.5	<1.5
206 ;	<1.5	<1.5	<1.5
209 ;	<1.5	<1.5	<1.5

Table E.2.17 PCB blue mussel tissue concentrations (ng/g dry wt.) in Nova Scotia Grosse Coques (occasionally sampled) site (NSGC); 44.3728°N, 66.0950°W

NSGC	(ng/g dry wt.)			
Replicate	*1N*	*2N*	*3N*	*4N*
8 ; 5	<2	<2	<2	<2
18 ; 15	<2	<2	<2	<2
28 ;	<2	<2	<2	<2
29 ;	<1	<1	<1	<1
44 ;	<2	<2	<2	<2
50 ;	<2	<2	<2	<2
52 ;	<2	<2	<2	<2
66 ; 95	<1.5	<1.5	<1.5	<1.5
77 ;	<1.5	<1.5	<1.5	<1.5
87 ;	<1.5	<1.5	<1.5	<1.5
101 ; 90	<1.5	<1.5	<1.5	<1.5
105 ;	<1	<1	<1	<1
118 ;	<1	<1	<1	<1
128 ;	<1	<1	<1	<1
138 ;	<1.5	<1.5	<1.5	<1.5
153 ; 132	<1.5	2.4	<1.5	<1.5
170 ; 190	<1.5	<1.5	<1.5	<1.5
180 ;	<1	<1	<1	<1
187 ;	<1	<1	<1	<1
195 ; 208	<1.5	<1.5	<1.5	<1.5
206 ;	<1.5	<1.5	<1.5	<1.5
209 ;	<1.5	<1.5	<1.5	<1.5

TABLES E.3 Selected Pesticide (PEST) concentration (ng/g dry wt.) observed in Mussel tissue collected by Gulfwatch, 2001. "Int." indicates the presence of interferences during analysis.

Table E.3.1 Pesticide blue mussel tissue concentrations (ng/g dry wt.) in Massachusetts Cape Cod Bay Benchmark site, Sandwich, MA (MASN); 41.7645°N, 70.4840°W

MASN	(ng/g dry wt.)			
Replicate	*1N*	*2N*	*3N*	*4N*
Lindane	<1.2	<1.2	<1.2	<1.2
HCB	<1.2	<1.2	<1.2	<1.2
a-Endosulfan	<1.2	<1.2	<1.2	<1.2
b-Endosulfan	<2.0	<2.0	<2.0	<2.0
cis-Chlordane	1.2	1.1	1.3	<1.0
trans-Nonachlor	<1.0	<1.0	<1.0	<1.0
Heptachlor	<1.0	<1.0	<1.0	<1.0
Hepta epoxide	<1.2	<1.2	<1.2	<1.2
Dieldrin	1.3	1.8	2.1	1.7
Aldrin	<1.5	<1.5	<1.5	<1.5
Mirex	<1.5	<1.5	<1.5	<1.5
o,p'-DDD	<1.0	<1.0	<1.0	<1.0
p,p'-DDD	3.1	3.7	3.8	3.3
o,p'-DDE	<1.2	<1.2	<1.2	<1.2
p,p'-DDE	5.6	5.3	5.5	5.2
o,p'-DDT	<2.0	<2.0	<2.0	<2.0
p,p'-DDT	4.7	6.6	6.0	16.6

Table E.3.2 PEST blue mussel tissue concentrations (ng/g dry wt.) in Massachusetts inner Boston Harbor station (MAIH); 42.3637°N, 71.0284°W

MAIH	(ng/g dry wt.)			
Replicate	*1N*	*2N*	*3N*	*4N*
Lindane	<1.2	<1.2	<1.2	<1.2
HCB	<1.2	<1.2	<1.2	<1.2
a-Endosulfan	<1.2	<1.2	<1.2	<1.2
b-Endosulfan	<2.0	<2.0	<2.0	<2.0
cis-Chlordane	6.2	9.5	8.8	10.5
trans-Nonachlor	10.1	9.8	7.5	11.0
Heptachlor	2.2	2.6	<1.0	3.5
Hepta epoxide	<1.2	<1.2	<1.2	<1.2
Dieldrin	8.1	4.1	6.2	5.8
Aldrin	<1.5	<1.5	<1.5	<1.5
Mirex	<1.5	<1.5	<1.5	<1.5
o,p'-DDD	25.6	19.9	12.9	26.5
p,p'-DDD	92.3	71.2	53.0	96.6
o,p'-DDE	<1.2	<1.2	<1.2	<1.2
p,p'-DDE	21.5	23.7	22.7	25.2
o,p'-DDT	<2.0	<2.0	3.0	<2.0
p,p'-DDT	<1.0	<1.0	<1.0	<1.0

Table E.3.3 PEST blue mussel tissue concentrations (ng/g dry wt.) in Massachusetts Pines River site, Saugus, MA (MAPR); 42.4312°N, 70.9793°W

MAPR	(ng/g dry wt.)			
Replicate	*1N*	*2N*	*3N*	*4N*
Lindane	<1.2	<1.2	<1.2	<1.2
HCB	<1.2	<1.2	<1.2	<1.2
a-Endosulfan	<1.2	<1.2	<1.2	<1.2
b-Endosulfan	<2.0	<2.0	<2.0	<2.0
cis-Chlordane	5.9	7.0	5.4	7.3
trans-Nonachlor	5.1	4.9	3.7	6.4
Heptachlor	<1.0	<1.0	<1.0	<1.0
Hepta epoxide	<1.2	<1.2	<1.2	<1.2
Dieldrin	2.5	2.4	2.0	<1.2
Aldrin	<1.5	<1.5	<1.5	<1.5
Mirex	<1.5	<1.5	<1.5	<1.5
o,p'-DDD	2.8	5.2	11.8	10.8
p,p'-DDD	18.3	20.4	30.9	28.6
o,p'-DDE	<1.2	<1.2	<1.2	<1.2
p,p'-DDE	14.6	15.3	11.0	20.8
o,p'-DDT	<2.0	<2.0	<2.0	<2.0
p,p'-DDT	<1.0	<1.0	<1.0	<1.0

Table E.3.4 PEST blue mussel tissue concentrations (ng/g dry wt.) in New Hampshire Hampton/Seabrook Harbor (NHHS); 42.8972°N, 70.8163°W

NHHS	(ng/g dry wt.)			
Replicate	*1N*	*2N*	*3N*	*4N*
Lindane	<1.2	<1.2	<1.2	<1.2
HCB	<1.2	<1.2	<1.2	<1.2
a-Endosulfan	<1.2	<1.2	<1.2	<1.2
b-Endosulfan	<2.0	<2.0	<2.0	<2.0
cis-Chlordane	<1.0	<1.0	<1.0	<1.0
trans-Nonachlor	<1.0	<1.0	<1.0	<1.0
Heptachlor	<1.0	<1.0	<1.0	<1.0
Hepta epoxide	<1.2	<1.2	<1.2	<1.2
Dieldrin	<1.2	<1.2	<1.2	<1.2
Aldrin	<1.5	<1.5	<1.5	<1.5
Mirex	<1.5	<1.5	<1.5	<1.5
o,p'-DDD	<1.0	<1.0	<1.0	<1.0
p,p'-DDD	2.7	2.1	2.5	2.4
o,p'-DDE	<1.2	<1.2	<1.2	<1.2
p,p'-DDE	4.4	3.6	4.2	4.7
o,p'-DDT	<2.0	<2.0	<2.0	<2.0
p,p'-DDT	<1.0	<1.0	<1.0	<1.0

Table E.3.5 PEST blue mussel tissue concentrations (ng/g dry wt.) in New Hampshire Little Harbor (NHLH); 43.0581°N, 70.0581°W

NHLH	(ng/g dry wt.)			
Replicate	*1N*	*2N*	*3N*	*4N*
Lindane	<1.2	<1.2	<1.2	<1.2
HCB	<1.2	<1.2	<1.2	<1.2
a-Endosulfan	<1.2	<1.2	<1.2	<1.2
b-Endosulfan	<2.0	<2.0	<2.0	<2.0
cis-Chlordane	<1.0	<1.0	<1.0	<1.0
trans-Nonachlor	<1.0	<1.0	<1.0	<1.0
Heptachlor	<1.0	<1.0	<1.0	<1.0
Hepta epoxide	<1.2	<1.2	<1.2	<1.2
Dieldrin	<1.2	<1.2	<1.2	<1.2
Aldrin	<1.5	<1.5	<1.5	<1.5
Mirex	<1.5	<1.5	<1.5	<1.5
o,p'-DDD	<1.0	<1.0	<1.0	<1.0
p,p'-DDD	<1.5	<1.5	<1.5	<1.5
o,p'-DDE	<1.2	<1.2	<1.2	<1.2
p,p'-DDE	4.8	3.9	4.5	3.7
o,p'-DDT	<2.0	<2.0	<2.0	<2.0
p,p'-DDT	<1.0	<1.0	<1.0	<1.0

Table E.3.6 PEST blue mussel tissue concentrations (ng/g dry wt.) in New Hampshire Pierce Island (expanded Gulfwatch) site (NHPI); 43.0717°N, 70.7433°W.

NHPI	(ng/g dry wt.)			
Replicate	*1N*	*2N*	*3N*	*4N*
Lindane	<1.2	<1.2	<1.2	<1.2
HCB	<1.2	<1.2	<1.2	<1.2
a-Endosulfan	<1.2	<1.2	<1.2	<1.2
b-Endosulfan	<2.0	<2.0	<2.0	<2.0
cis-Chlordane	<1.0	<1.0	<1.0	<1.0
trans-Nonachlor	1.8	<1.0	<1.0	<1.0
Heptachlor	<1.0	<1.0	<1.0	<1.0
Hepta epoxide	<1.2	<1.2	<1.2	<1.2
Dieldrin	<1.2	<1.2	<1.2	<1.2
Aldrin	<1.5	<1.5	<1.5	<1.5
Mirex	<1.5	<1.5	<1.5	<1.5
o,p'-DDD	2.1	1.9	<1.0	<1.0
p,p'-DDD	<1.5	<1.5	<1.5	<1.5
o,p'-DDE	<1.2	<1.2	<1.2	<1.2
p,p'-DDE	5.6	4.4	4.2	4.9
o,p'-DDT	<2.0	<2.0	<2.0	<2.0
p,p'-DDT	<1.0	<1.0	<1.0	<1.0

Table E.3.7 PEST blue mussel tissue concentrations (ng/g dry wt.) in New Hampshire South Mill Pond (expanded Gulfwatch) site (NHSM); 43.0727°N, 70.7489°W

NHSM	(ng/g dry wt.)			
Replicate	*1N*	*2N*	*3N*	*4N*
Lindane	<1.2	<1.2	<1.2	<1.2
HCB	2.4	3.0	2.4	3.1
a-Endosulfan	<1.2	<1.2	<1.2	<1.2
b-Endosulfan	<2.0	<2.0	<2.0	<2.0
cis-Chlordane	2.1	3.0	1.8	2.2
trans-Nonachlor	1.9	2.9	2.0	2.1
Heptachlor	<1.0	<1.0	<1.0	<1.0
Hepta epoxide	<1.2	<1.2	<1.2	<1.2
Dieldrin	<1.2	1.5	<1.2	1.6
Aldrin	<1.5	<1.5	<1.5	<1.5
Mirex	<1.5	<1.5	<1.5	<1.5
o,p'-DDD	2.9	3.6	2.2	3.4
p,p'-DDD	7.5	11.1	8.7	9.3
o,p'-DDE	<1.2	<1.2	<1.2	<1.2
p,p'-DDE	10.6	15.7	10.7	11.7
o,p'-DDT	<2.0	<2.0	<2.0	<2.0
p,p'-DDT	<1.0	<1.0	<1.0	<1.0

Table E.3.8 PEST blue mussel tissue concentrations (ng/g dry wt.) New Hampshire Schiller Station (expanded Gulfwatch) site (NHSS); 43.1017°N, 70.7883°W

NHSS	(ng/g dry wt.)			
Replicate	*1N*	*2N*	*3N*	*4N*
Lindane	<1.2	<1.2	<1.2	<1.2
HCB	<1.2	<1.2	<1.2	<1.2
a-Endosulfan	<1.2	<1.2	<1.2	<1.2
b-Endosulfan	<2.0	<2.0	<2.0	<2.0
cis-Chlordane	1.5	<1.0	1.5	<1.0
trans-Nonachlor	<1.0	<1.0	<1.0	<1.0
Heptachlor	<1.0	<1.0	<1.0	<1.0
Hepta epoxide	<1.2	<1.2	<1.2	<1.2
Dieldrin	<1.2	<1.2	<1.2	<1.2
Aldrin	<1.5	<1.5	<1.5	<1.5
Mirex	<1.5	<1.5	<1.5	<1.5
o,p'-DDD	<1.0	<1.0	<1.0	<1.0
p,p'-DDD	1.5	2.2	2.6	1.9
o,p'-DDE	<1.2	<1.2	<1.2	<1.2
p,p'-DDE	4.7	5.2	4.1	4.3
o,p'-DDT	<2.0	<2.0	<2.0	<2.0
p,p'-DDT	<1.0	<1.0	<1.0	<1.0

Table E.3.9 PEST blue mussel tissue concentrations (ng/g dry wt.) in New Hampshire Dover Point site (NHDP); 43.1196°N, 70.8267°W. #N-Dup represents duplicate analysis of site replicate.

NHDP			(ng/g dry wt.)		
Replicate	*1N*	*2N*	*3N-Dup*	*3N-Dup*	*4N*
Lindane	<1.2	<1.2	<1.2	<1.2	<1.2
HCB	<1.2	<1.2	<1.2	<1.2	<1.2
a-Endosulfan	<1.2	<1.2	<1.2	<1.2	<1.2
b-Endosulfan	<2.0	<2.0	<2.0	<2.0	<2.0
cis-Chlordane	<1.0	1.3	<1.0	<1.0	1.0
trans-Nonachlor	<1.0	<1.0	<1.0	<1.0	<1.0
Heptachlor	<1.0	<1.0	<1.0	<1.0	<1.0
Hepta epoxide	<1.2	<1.2	<1.2	<1.2	<1.2
Dieldrin	<1.2	<1.2	<1.2	<1.2	<1.2
Aldrin	<1.5	<1.5	<1.5	<1.5	<1.5
Mirex	<1.5	<1.5	<1.5	<1.5	<1.5
o,p'-DDD	<1.0	<1.0	<1.0	<1.0	2.0
p,p'-DDD	2.5	2.9	2.1	1.8	2.0
o,p'-DDE	<1.2	<1.2	<1.2	<1.2	<1.2
p,p'-DDE	4.1	4.1	3.9	3.9	4.5
o,p'-DDT	<2.0	<2.0	<2.0	<2.0	<2.0
p,p'-DDT	<1.0	<1.0	<1.0	<1.0	<1.0

Table E.3.10 PEST blue mussel tissue concentrations (ng/g dry wt.) in New Hampshire Fox Point (expanded Gulfwatch) site (NHFP); 43.1201°N, 70.8389°W. #N-Dup represents duplicate analysis of site replicate.

NHFP	(ng/g dry wt.)				
Replicate	*1N-Dup.*	*1N-Dup.*	*2N*	*3N*	*4N*
Lindane	<1.2	<1.2	<1.2	<1.2	<1.2
HCB	<1.2	<1.2	<1.2	<1.2	<1.2
a-Endosulfan	<1.2	<1.2	<1.2	<1.2	<1.2
b-Endosulfan	<2.0	<2.0	<2.0	<2.0	<2.0
cis-Chlordane	<1.0	<1.0	<1.0	<1.0	<1.0
trans-Nonachlor	<1.0	<1.0	<1.0	<1.0	<1.0
Heptachlor	<1.0	<1.0	<1.0	<1.0	<1.0
Hepta epoxide	<1.2	<1.2	<1.2	<1.2	<1.2
Dieldrin	<1.2	<1.2	<1.2	<1.2	<1.2
Aldrin	<1.5	<1.5	<1.5	<1.5	<1.5
Mirex	<1.5	<1.5	<1.5	<1.5	<1.5
o,p'-DDD	<1.0	<1.0	<1.0	<1.0	<1.0
p,p'-DDD	3.9	2.8	3.0	4.9	4.8
o,p'-DDE	<1.2	<1.2	<1.2	<1.2	<1.2
p,p'-DDE	6.9	6.0	7.2	7.7	7.4
o,p'-DDT	<2.0	<2.0	<2.0	<2.0	<2.0
p,p'-DDT	<1.0	<1.0	<1.0	<1.0	<1.0

Table E.3.11 PEST blue mussel tissue concentrations (ng/g dry wt.) in Maine Benchmark site, Clark's Cove (MECC); 43.0774°N, 70.7244°W

MECC	(ng/g dry wt.)			
Replicate	*1N*	*2N*	*3N*	*4N*
Lindane	<1.2	<1.2	<1.2	<1.2
HCB	<1.2	<1.2	<1.2	<1.2
a-Endosulfan	<1.2	<1.2	<1.2	<1.2
b-Endosulfan	<2.0	<2.0	<2.0	<2.0
cis-Chlordane	<1.0	<1.0	<1.0	<1.0
trans-Nonachlor	<1.0	<1.0	<1.0	<1.0
Heptachlor	<1.0	<1.0	<1.0	<1.0
Hepta epoxide	<1.2	<1.2	<1.2	<1.2
Dieldrin	<1.2	<1.2	<1.2	<1.2
Aldrin	<1.5	<1.5	<1.5	<1.5
Mirex	<1.5	<1.5	<1.5	<1.5
o,p'-DDD	<1.0	<1.0	<1.0	<1.0
p,p'-DDD	<1.5	<1.5	<1.5	<1.5
o,p'-DDE	<1.2	<1.2	<1.2	<1.2
p,p'-DDE	3.9	3.4	2.0	4.0
o,p'-DDT	<2.0	<2.0	<2.0	<2.0
p,p'-DDT	<1.0	<1.0	<1.0	<1.0

Table E.3.12 PEST blue mussel tissue concentrations (ng/g dry wt.) in Maine Damariscotta site (MEDM); 43.9383°N, 69.5817°W

MEDM	(ng/g dry wt.)			
Replicate	*1N*	*2N*	*3N*	*4N*
Lindane	<1.2	<1.2	<1.2	<1.2
HCB	<1.2	<1.2	<1.2	<1.2
a-Endosulfan	<1.2	<1.2	<1.2	<1.2
b-Endosulfan	<2.0	<2.0	<2.0	<2.0
cis-Chlordane	<1.0	<1.0	<1.0	<1.0
trans-Nonachlor	<1.0	<1.0	<1.0	<1.0
Heptachlor	<1.0	<1.0	<1.0	<1.0
Hepta epoxide	<1.2	<1.2	<1.2	<1.2
Dieldrin	<1.2	<1.2	<1.2	<1.2
Aldrin	<1.5	<1.5	<1.5	<1.5
Mirex	<1.5	<1.5	<1.5	<1.5
o,p'-DDD	<1.0	<1.0	<1.0	<1.0
p,p'-DDD	<1.5	<1.5	2.0	2.4
o,p'-DDE	<1.2	<1.2	<1.2	<1.2
p,p'-DDE	2.9	2.3	2.7	3.8
o,p'-DDT	<2.0	<2.0	<2.0	<2.0
p,p'-DDT	<1.0	<1.0	<1.0	1.6

Table E.3.13 PEST blue mussel tissue concentrations (ng/g dry wt.) in New Brunswick Niger Reef site (NBNR); 45.0663°N, 67.0680°W

NBNR	(ng/g dry wt.)			
Replicate	*1N*	*2N*	*3N*	*4N*
Lindane	1.3	1.5	1.3	<1.2
HCB	<1.2	<1.2	<1.2	<1.2
a-Endosulfan	<1.2	<1.2	<1.2	<1.2
b-Endosulfan	<2.0	<2.0	<2.0	<2.0
cis-Chlordane	<1.0	<1.0	<1.0	<1.0
trans-Nonachlor	<1.0	1.0	<1.0	1.0
Heptachlor	<1.0	<1.0	<1.0	<1.0
Hepta epoxide	<1.2	1.5	<1.2	<1.2
Dieldrin	2.3	2.2	1.9	2.1
Aldrin	<1.5	<1.5	<1.5	<1.5
Mirex	<1.5	<1.5	<1.5	<1.5
o,p'-DDD	<1.0	<1.0	<1.0	<1.0
p,p'-DDD	<1.5	<1.5	1.6	<1.5
o,p'-DDE	<1.2	<1.2	<1.2	<1.2
p,p'-DDE	4.0	3.7	4.1	3.8
o,p'-DDT	<2.0	<2.0	<2.0	<2.0
p,p'-DDT	<1.0	<1.0	<1.0	<1.0

Table E.3.14 PEST blue mussel tissue concentrations (ng/g dry wt.) in New Brunswick Hospital Island site (NBHI); 45.1205°N, 67.0082°W. #N-Dup represents duplicate analysis of site replicate.

NBHI	(ng/g dry wt.)					
Replicate	*1N*	*2N-Dup*	*2N-Dup*	*3N*	*4N-Dup*	*4N-Dup*
Lindane	<1.2	<1.2	<1.2	<1.2	<1.2	<1.2
HCB	<1.2	<1.2	<1.2	<1.2	<1.2	<1.2
a-Endosulfan	<1.2	<1.2	<1.2	<1.2	<1.2	<1.2
b-Endosulfan	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
cis-Chlordane	1.5	1.9	<1.0	<1.0	<1.0	<1.0
trans-Nonachlor	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Heptachlor	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Hepta epoxide	<1.2	<1.2	<1.2	<1.2	<1.2	<1.2
Dieldrin	1.6	1.7	1.3	2.1	1.4	1.9
Aldrin	<1.5	<1.5	<1.5	<1.5	<1.5	<1.5
Mirex	<1.5	<1.5	<1.5	<1.5	<1.5	<1.5
o,p'-DDD	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
p,p'-DDD	<1.5	<1.5	<1.5	<1.5	<1.5	1.6
o,p'-DDE	<1.2	<1.2	<1.2	<1.2	<1.2	<1.2
p,p'-DDE	2.3	2.5	2.6	2.4	2.9	4.2
o,p'-DDT	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
p,p'-DDT	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0

Table E3.15 PEST blue mussel tissue concentrations (ng/g dry wt.) in Nova Scotia Cornwallis site (NSCW); 44.6447°N, 65.6480°W

NSCW	(ng/g dry wt.)			
Replicate	*1N*	*2N*	*3N*	*4N*
Lindane	1.8	1.6	1.5	2.2
HCB	<1.2	<1.2	<1.2	<1.2
a-Endosulfan	<1.2	<1.2	<1.2	<1.2
b-Endosulfan	<2.0	<2.0	<2.0	<2.0
cis-Chlordane	<1.0	<1.0	<1.0	<1.0
trans-Nonachlor	<1.0	<1.0	<1.0	<1.0
Heptachlor	<1.0	<1.0	<1.0	<1.0
Hepta epoxide	<1.2	<1.2	<1.2	<1.2
Dieldrin	2.0	1.2	1.3	2.4
Aldrin	<1.5	<1.5	<1.5	<1.5
Mirex	<1.5	<1.5	<1.5	<1.5
o,p'-DDD	<1.0	<1.0	<1.0	<1.0
p,p'-DDD	<1.5	<1.5	<1.5	<1.5
o,p'-DDE	<1.2	<1.2	<1.2	<1.2
p,p'-DDE	1.4	1.5	1.7	1.4
o,p'-DDT	<2.0	<2.0	<2.0	<2.0
p,p'-DDT	<1.0	<1.0	<1.0	<1.0

Table E.3.16 PEST blue mussel tissue concentrations (ng/g dry wt.) in Nova Scotia Digby site (NSDI); 44.6170°N, 65.7523°W

NSDI	(ng/g dry wt.)		
Replicate	*1N*	*2N*	*3N*
Lindane	<1.2	<1.2	<1.2
HCB	<1.2	<1.2	<1.2
a-Endosulfan	<1.2	<1.2	<1.2
b-Endosulfan	<2.0	<2.0	<2.0
cis-Chlordane	<1.0	<1.0	<1.0
trans-Nonachlor	<1.0	<1.0	<1.0
Heptachlor	<1.0	<1.0	<1.0
Hepta epoxide	<1.2	<1.2	<1.2
Dieldrin	1.8	2.3	1.9
Aldrin	<1.5	<1.5	<1.5
Mirex	<1.5	<1.5	<1.5
o,p'-DDD	<1.0	<1.0	<1.0
p,p'-DDD	<1.5	<1.5	<1.5
o,p'-DDE	<1.2	<1.2	<1.2
p,p'-DDE	1.9	2.1	2.2
o,p'-DDT	<2.0	<2.0	<2.0
p,p'-DDT	<1.0	<1.0	<1.0

Table E.3.17 PEST blue mussel tissue concentrations (ng/g dry wt.) in Nova Scotia Grosse Coques (occasionally sampled) site (NSGC); 44.3728°N, 66.0950°W

NSGC	(ng/g dry wt.)			
Replicate	*1N*	*2N*	*3N*	*4N*
Lindane	1.3	<1.2	<1.2	<1.2
HCB	<1.2	<1.2	<1.2	<1.2
a-Endosulfan	<1.2	<1.2	<1.2	<1.2
b-Endosulfan	<2.0	<2.0	<2.0	<2.0
cis-Chlordane	<1.0	<1.0	<1.0	<1.0
trans-Nonachlor	<1.0	1.0	<1.0	<1.0
Heptachlor	<1.0	<1.0	<1.0	<1.0
Hepta epoxide	<1.2	<1.2	<1.2	<1.2
Dieldrin	1.3	<1.2	1.4	1.3
Aldrin	<1.5	<1.5	<1.5	<1.5
Mirex	<1.5	<1.5	<1.5	<1.5
o,p'-DDD	<1.0	<1.0	<1.0	<1.0
p,p'-DDD	<1.5	<1.5	<1.5	<1.5
o,p'-DDE	<1.2	<1.2	<1.2	<1.2
p,p'-DDE	1.5	2.1	1.4	<1.2
o,p'-DDT	<2.0	<2.0	<2.0	<2.0
p,p'-DDT	<1.0	<1.0	<1.0	<1.0