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Chesapeake Bay Atmospheric Deposition Study Final Report

Chesapeake Bay Program

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Abstract

I. Introduction

I.1. Background. The Chesapeake Bay is the largest estuary in North America and one of the most productive aquatic ecosystems on the planet. Its 166,000 square kilometer watershed drains farmlands, forests, marshes, and urban areas in six states, and is home to 14.2 million people. Historically, the Chesapeake Bay has supported a large commercial fisheries. The wetlands surrounding the bay provide winter habitat for many migratory waterfowl. Dramatic decreases in natural habitat and water quality during the past four decades includes the virtual elimination of submerged aquatic vegetation and the substantial increase in seasonal anoxia in the Bay's main channel. This degradation has been attributed to increased erosion (with subsequent increases in turbidity) and enhanced external loadings of the nutrients phosphorus and, especially, nitrogen to the Bay's waters. Overharvesting of filter feeding oysters may have also altered the Bay's nutrient and energy cycles, amplifying eutrophication. In response to seasonal anoxia and the loss of submerged aquatic vegetation, stringent nutrient control strategies were adopted in 1987. To date, more that $400 million has been spent to reduce nutrient loadings to the Chesapeake Bay. Chemical contaminants enter the Chesapeake Bay from a wide variety of point and diffuse sources. Historically, readily-identifiable industrial and municipal point source discharges in the cities on the major tributaries of the Bay (*e.g.*, Baltimore, MD, Washington, D.C., Richmond and Norfolk, VA) have been the focus of nutrient control strategies. As these sources were controlled, and as our understanding of diffuse sources increased, contaminant inputs from run-off from the watershed became more important. More recent water quality strategies in the Chesapeake Bay region are based on controlling activities within the watershed and tributaries (1991 Amendments to the Chesapeake Bay Agreement).

In 1988, Fisher *et al.* suggested that the atmosphere is a significant source of nitrogen to the Chesapeake Bay ecosystem. Based on nitrogen loads by wet and dry deposition to the watershed, these authors estimated the fraction of deposited nitrogen which was tranported through the watershed to the surface waters of the Chesapeake Bay under differing land uses. Their calculations, which suggested that atmospheric deposition accounts for 25% of the external nitrogen entering the Bay, were throughly examined at an EPA-sponsored workshop in 1990. Despite considerable uncertainity in the `watershed transmission' term of their model, the consensus of the workshop was that the atmosphere supplies anywhere between one-quarter to one-third of nitrogen to the Chesapeake Bay (Hinga *et al.*, 1991). Jaworski and Linker (1990), using several approaches to model watershed export of nitrogen, conclude that atmospheric deposition contributes between 35 and 39% of the total nitrogen loading to the Potomac River watershed. Further, Fisher *et al.* (1988) argued that the atmosphere will become a relatively more important source of nitrogen during the next decades as point sources are controlled and emissions of nitrogen oxides into the Chesapeake Bay airshed increase.

Studies conducted in the southern Chesapeake Bay in the early 1980's suggested that the atmosphere is also a significant source of organic contaminants. Velinsky *et al.* (1986)

determined that organic carbon loadings in bulk atmospheric deposition were greater than the estimated tributary loadings of organic carbon to the bay. Anthropogenic hydrocarbons, including polycyclic aromatic hydrocarbons, were detected in bulk deposition samples, with calculated loadings estimated to be comparable to hydrocarbon loadings from the municipal wastewater discharges to the bay (Webber, 1993). While these earlier studies demonstrated the potential importance of the atmosphere in supplying contaminants to the Chesapeake Bay, they were limited by their methodologies (*i.e.*, bulk deposition sampling) and their relatively limited temporal and spatial scope. To further explore this issue, and to quantify the loadings of atmospheric contaminants to the Chesapeake Bay, we operated a network of three stations along the shoreline of the bay during 1990-92. In this chapter, the results of the Chesapeake Bay Atmospheric Deposition Study (CBADS) are presented and discussed relative to the issues raised by the U.S. Environmental Protection Agency's Great Waters Program.

I.2. Objectives. The primary objective of the CBADS network was to provide the best possible estimates of *total, annual* atmospheric loadings of a variety of trace elements and organic contaminants directly to the surface waters of the Chesapeake Bay. Accurate estimates of bay-wide annual loadings required that we characterize the spatial and temporal variability in contaminant inventories in the atmosphere and in depositional fluxes to the bay. Based on previous studies of wet deposition in the region (*e.g.*, Tyler, 1988) and given the resources available for the network, we selected three non-urban shoreline locations for sampling sites. In establishing this initial network, we purposefully avoided the influence of urban areas by locating our sites more that 50 kilometers from metropolitan areas. By minimizing possible urban influences, we insured that the resulting loading estimates are minimum values. Although it is most likely that some fraction of the materials deposited from the atmosphere to the considerable watershed of the Chesapeake Bay are ultimately transported to the surface waters, we did not attempt to characterize loadings to the watershed in this study. Because deposition to the various land surfaces are likely much different than that to the water surface, fluxes measured at our shore-based stations can not be extrapolated with confidence to the watershed. Additionally, the large uncertainty in our understanding of the fate of materials deposited to the land surface (*i.e.*, the fraction transmitted to the receiving water), preclude the simple estimation of the indirect atmospheric loading of contaminants to the Chesapeake Bay.

I.3. Project Description. The sampling strategy employed in CBADS is a compromise between the need to monitor all deposition events and our desire to understand sources of air masses and the processes of deposition. In order to capture all wet deposition during the study period at these relatively remote sites, automated, wet-only precipitation samplers were used to collect temporally integrated samples. Initially, weekly integrated aerosol samples were collected for trace elemental analysis in order to `smooth' the inherently variable atmospheric signal. However, because these weekly-integrated samples were collected under a wide variety of atmospheric conditions, they were of little use either in estimating air mass sources or in calculating dry aerosol depositional fluxes. Therefore, after the first six months of CBADS, we altered the aerosol sampling schedule to 12 hours every seven days. Similarly, while the integrated precipitation sampling provided the best measure to total wet depositional fluxes, any

information about the mechanism of contaminant incorporation into the precipitation was lost. To investigate the precipitation scavenging in detail, a series of rain storm were intensively sampled during the summer of 1993 (Poster and Baker, 1995; Poster and Baker, 1996 a;1996b).

Sampling was initiated at the mid-bay site in Summer, 1990, with the northern and southern stations beginning operation later in 1990 and in early 1991, respectively (Table II.1, Figure II.1). The three sites were operated continuously until the end of September, 1993. In this chapter, measurements made at the three sites during this period are used to calculate atmospheric depositional fluxes and loading of contaminants to the Chesapeake Bay region, to explore spatial and temporal variability in contaminant inventories and fluxes, and to compare contaminant levels and fluxes in the Chesapeake Bay region to those measured elsewhere.

II. Methods

II.1. Sampling. Sampling and analytical methods employed in the Chesapeake Bay Atmospheric Deposition Study are described in detail in a series of papers published elsewhere (Leister and Baker, 1994; Wu *et al.*, 1994; Scudlark *et al.*, 1994), and will be summarized here. Each of the three sampling sites were chosen to be as close as possible to the Chesapeake Bay in secured, open grassy fields away from local sources. The northern site is located at the University of Maryland's Wye Agricultural Research and Experimental Station on the shore of the Wye River in Queenstown, MD (38°53'N, 76°08'W). The northern site is located in a grassy field approximately 50 m from the road servicing the Wye Station and is a NADAP site. Land use in the area is largely agricultural. The mid-Bay site is located in a 75 x 75 m grassy clearing in a wooded area on the western shore of the Bay between the mouths of the Patuxent and Potomac Rivers (38°13'N, 76°23'W). This site is owned by the State of Maryland and is used for environmental educational activities. A dirt road which is very infrequently used is approximately 30 m from the mid-Bay site. The land use in the area is primarily agricultural and low density housing, and the Patuxent River Naval Air Station is 4.5 km to the north of this site. The southern site is located at Haven Beach in Mathews County, Virginia (37°26'N, 76°15'W). This site, which approximately 100 km due east of Richmond, VA, consists of a wooden platform in a salt marsh directly adjacent to the western shoreline of the bay.

Air samples were collected for elemental (aerosol particles) and organic contaminants (gaseous and aerosol particle-associated) as follows. Initially, 7 day (168 hour) air samples for elemental analysis were collected by drawing air at a flow rate of 10 liters/minute through a dichotomous sampler equipped with a single stage impactor to remove particles $>10\mu m$. Aerosol particles were collected on 2 μm-pore, 47-mm Gelman "Teflo" filters. A dry gas meter placed after the impactor was used to determine the sample volume and average flow rate for each sample. Beginning in 1992, the sampling protocol for elemental analysis was changed to 12 hours once every seven days. A high-volume air sampler was deployed to collect air samples for gaseous and particle-associated organic contaminants (Leister and Baker, 1994). Air is drawn through a 20.3 cm x 25.4 cm glass fiber filter to collect particles and through a polyurethane foam

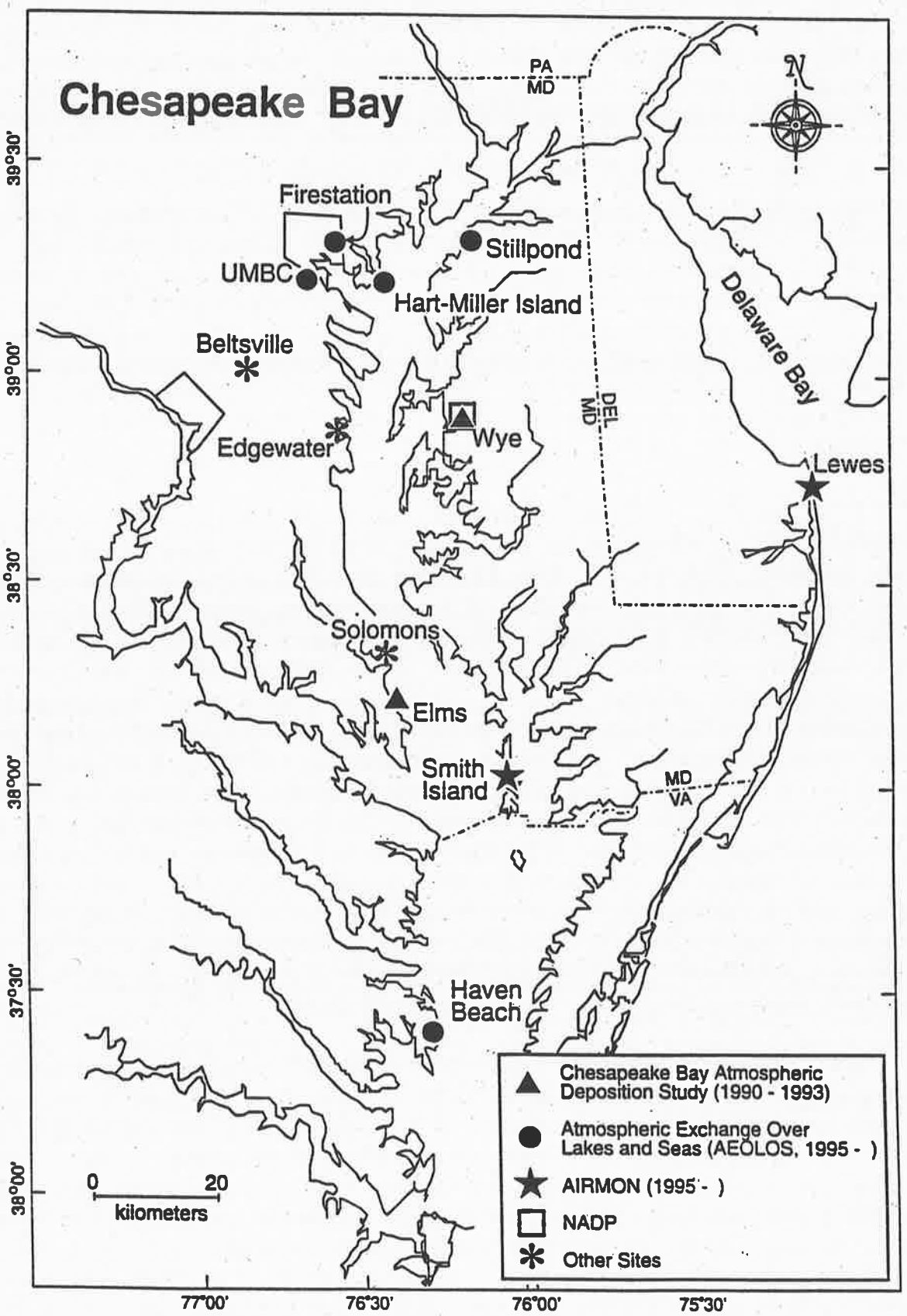

Figure II.1. Chesapeake Bay atmospheric deposition sampling sites.

Table II.1. Sampling schedule, Chesapeake Bay Atmospheric Deposition Study

	Date		Sampling	
	Start	End	Frequency	Interval
Wye				
Trace Elements-Precipitation	5 July 1990	28 September 1993	7 Days	7 Days
Trace Elements-Aerosols	5 June 1990	28 September 1993	6 Days	0.5[a] Days
Organics-Precipitation	14 July 1992	28 September 1993	14 Days	14 Days
Organics-Air	14 July 1992	28 September 1993	14 Days	0.5-1 Days
Elms				
Trace Elements-Precipitation	5 June 1990	28 September 1993	7 Days	7 Days
Trace Elements-Aerosols	5 June 1990	28 September 1993	7 Days	0.5[a] Days
Organics-Precipitation	26 June 1990	28 September 1993	14 Days	14 Days
Organics-Air	12 June 1990	28 September 1993	14 Days	0.5-1 Days
Haven Beach				
Trace Elements-Precipitation	4 December 1990	28 September 1993	7 Days	7 Days
Trace Elements-Aerosols	23 November 1990	28 September 1993	7 Days	0.5[a] Days
Organics-Precipitation	18 December 1990	28 September 1993	14 Days	14 Days
Organics-Air	18 December 1990	28 September 1993	14 Days	0.5-1 Days

[a]7 day interval in 1990-91.

plug to collect gaseous organic chemicals. Air sampling times ranged from 12 to 24 hours, depending upon season. Flow rates through the organics air sampler were estimated for each sample from the measured pressure drop across the sampling train. Ambient air samples were collected bi-weekly (*i.e.*, every other Tuesday) to correspond with the precipitation sampling schedule.

Weekly integrated precipitation samples were collected for elemental analysis using an automated wet-only collector which was specially modified for trace element sampling (Aerochem Metrics, Inc., Bushnell, FL). The rigorous trace element "clean" sampling, handling, and analytical procedures described by Tramontano *et al.* (1987) and Scudlark *et al.* (1992) were used. Precipitation collected in an acid-washed, clear high density polyethylene bucket was acidified with ultra-pure HCl to 0.4% v/v, leached for 24 hours, transferred to acid-washed low density polyethylene storage bottles and frozen (Scudlark *et al.*, 1994). Field blanks, consisting of acidified water rinses of buckets deployed during weeks when no precipitation fell were analyzed to assess the magnitude of contamination during sample processing. Organic contaminants in precipitation were collected with an automated sampler consisting of a 1 m^2 stainless steel funnel, and in-line glass fiber filter and resin cartridge to isolate particulate-associated and dissolved organic contaminants from the precipitation. A peristaltic pump downstream of the sampling train pulled rainwater through the filter and resin cartridge during each storm, minimizing potential analyte losses or repartitioning during sample storage (Leister and Baker, 1994). Precipitation samples for organic contaminant analyses were composited for fourteen days. Sampling and analytical details are described in Leister and Baker (1994). Concentrations of major ions in weekly precipitation samples were determined by separate sampling at each site, either as part of the NAPAP (Wye), the Maryland STAR network (Elms), or as part of this study (Haven). Precipitation intensities and amounts were measured using Belfort gauges or, when not available, estimated from the volume of precipitation collected for chemical analyses (Table II.2).

Sampling at the three Chesapeake Bay Atmospheric Deposition stations began during the second half of 1990 and continued through September 1993. During the Summer, 1993, an intensive sampling program, consisting of event-based precipitation sampling and daily air sampling for 28 days, was conducted in order to study sources of atmospheric contaminants and to better understand scavenging by precipitation. Some of the results of this intensive program are described by Poster and Baker (1995; 1996 a,b).

II.2. Analytical Techniques. Trace elements on aerosol particles were measured using the methods described in Wu *et al.* (1994). Each filter was divided into two equal parts, and one half was analyzed for up to forty elements, including aluminum, arsenic, chromium, iron, manganese, sulfur, selenium, and zinc by instrumental neutron activation analysis. Particles on the remaining half of each filter were digested and analyzed for copper, nickel and lead by inductively coupled plasma-atomic emission spectrometry and for cadmium (and sometimes nickel) by graphite furnace atomic adsorption spectrometry with Zeeman background correction. Precipitation samples were analyzed for elements using the methods of Scudlark *et al.* (1994). Aluminum, cadmium, copper, chromium, iron, manganese, nickel, lead and zinc were quantified

Table II.2. Monthly precipitation amounts (cm/month) at the three Chesapeake Bay Atmospheric Deposition Study sites, 1990-1993.

	Month	Wye	Elms	Haven Beach	Average
1990	June	NA	13.08	NA	13.08
	July	9.48	12.40	NA	10.94
	August	10.90	14.94	NA	12.92
	September	4.11	3.63	NA	3.87
	October	8.59	10.54	NA	9.57
	November	5.66	4.39	0.05	3.37
	December	7.80	9.32	9.51	13.32
1991	January	9.73	13.06	10.94	11.24
	February	4.98	5.49	3.83	4.76
	March	10.59	11.00	8.23	10.11
	April	11.53	8.36	16.92	12.27
	May	3.15	6.43	2.55	4.04
	June	3.40	6.91	23.47	11.26
	July	12.98	15.93	4.72	11.21
	August	9.50	13.11	17.22	13.27
	September	11.59	9.09	6.24	8.97
	October	3.66	7.39	10.08	7.04
	November	1.60	1.47	0.77	1.28
	December	11.93	10.59	7.97	10.16
1992	January	8.2	3.23	3.48	4.96
	February	6.3	5.58	6.36	6.08
	March	12.9	14.94	8.08	11.97
	April	3.3	3.2	6.58	6.53
	May	6.0	10.2	8.52	8.23
	June	4.6	9.525	9.37	7.83
	July	10.1	4.32	16.38	10.26
	August	15.1	24.15	29.87	23.04
	September	11.0	11.15	8.39	10.17
	October	5.4	6.93	10.50	7.61
	November	8.1	3.10	3.43	4.87
	December	8.8	10.92	11.35	10.36
1993	January	5.89	6.93	11.66	8.15
	February	6.27	6.84	4.97	6.02
	March	20.39	10.39	18.88	16.55
	April	7.57	5.17	7.94	6.89
	May	8.28	22.71	19.82	16.94
	June	4.77	4.22	5.44	4.81
	July	5.96	2.80	4.54	4.43
	August	10.25	7.38	6.09	7.90
	September	6.14	6.55	5.03	5.90
Totals	1991	94.6	108.8	112.9	105.5
	1992	99.8	107.3	122.3	109.8
	Overall	316.5	357.3	337.6	337.1

by graphite furnace atomic adsorption with a L'Vov platform to minimize matrix suppression. Citric acid was used as a matrix modifier for aluminum and iron measurements. Arsenic and selenium concentrations in precipitation were measured by hydride generation, cryogenic preconcentration, selective volatilization and detection *via* photoionization (arsenic) or atomic absorption spectrophotometry (selenium), using the methods of Cutter (1986) and Cutter *et al.* (1991). Elemental detection limits and other quality assurance information for these analyses are described in Wu *et al.* (1994) and Scudlark *et al.* (1994).

Organic contaminants in air and precipitation were identified and quantified using high resolution capillary gas chromatography with electron capture (organochlorines) and mass spectrometric (polycyclic aromatic hydrocarbons) detection, as described in detail in Leister and Baker (1994). Seventy-four chromatographic peaks containing one or more polychlorinated biphenyl (PCB) congener were quantified by comparison with a mixed Aroclor standard (Mullin, 1985; Mullin *et al.*, 1984), with operational method detection limits set equal to three times the level measured in the corresponding matrix blank (Leister and Baker, 1994). Fourteen unsubstituted polycyclic aromatic hydrocarbons (PAHs) were identified and quantified by isotope-dilution selected ion mass spectrometry, using perdeuterated PAHs as internal standards. As PAHs were generally present in matrix blanks at undetectable levels, operational detection limits were determined by the instrumental sensitivity. Quality assurance details for the organic contaminant analyses, including potential sampling artifacts and the procedures used to insure sufficiently low matrix blanks, are described in Leister and Baker (1994) and Leister (1994).

III. Results

III.1 Concentrations in Air. The elemental composition of aerosol particles less than 10 μm diameter was dominated by the crustal elements aluminum and iron, and by sulfur (in the form of sulfate). Concentrations of these three elements averaged over the three sampling sites during 1991 and 1992 were 119, 111, and 2123 ng/m^3, respectively (Table III.1). Trace element concentrations averaged over the same period ranged from 0.16 ng/m^3 for cadmium to 12.6 ng/m^3 for zinc (Figure III.1, Table III.1). The fraction of each element derived from non-crustal (*e.g.*, combustion) sources was estimated based on the average concentration of elements in the Earth's crust (Turekian and Wedepohl, 1961), and assuming all of the measured aluminum associated with aerosol particles is derived from erosion of soils,. In the Chesapeake Bay region, non-crustal sources supply greater than 95% of most of the elements measured on aerosol particles. Exceptions include iron, manganese, and chromium (Wu *et al.*, 1994). Arsenic, cadmium, lead, sulfur and selenium are almost exclusively non-crustal, and are likely introduced into the atmosphere as a result of combustion of fossil fuels and incineration of municipal wastes.

Not unexpectedly, concentration of elements on aerosol particles were highly variable throughout the more than three years of continuous sampling. Variations of more than one order of magnitude likely result not only from changes in the total suspended particulate concentrations in the air but also from temporal changes in regional emissions. For example, the concentration

Table III.1. Elemental composition of aerosol particles (ng/m3) collected at the three Chesapeake Bay Atmospheric Deposition Study sites, 1991 and 1992.

	Al	As	Br	Cd	Cr	Cu	Fe	Mn	Ni	Pb	S	Se	V	Zn
1991														
Wye	109	0.63	2.96	0.13	0.72	1.8	108	2.66	2.86	3.4	2548	1.8	3.5	14.4
Elms	147	0.56	3.31	0.12	0.60	1.5	149	2.74	2.41	2.7	2953	1.8	4.7	12.5
Haven Beach	133	0.47	3.55	0.11	0.46	2.0	120	2.87	2.81	2.3	2140	1.5	4.8	11.5
Bay Average	130	0.55	3.27	0.12	0.59	1.77	126	2.76	2.69	2.8	2547	1.7	4.33	12.8
1992														
Wye	108	0.66	2.65	0.22	0.88	1.73	113	2.90	4.42	5.8	1547	1.8	4.5	13.2
Elms	123	0.57	2.53	0.19	0.78	2.11	107	2.40	3.34	4.9	1779	1.6	5.0	13.1
Haven Beach	75	0.59	2.83	0.18	0.46	1.89	66	1.81	3.25	4.2	1772	1.4	4.75	10.7
Bay Average	102	0.61	2.67	0.20	0.71	1.91	95	2.37	3.67	5.0	1699	1.6	4.75	12.3
Overall														
Wye	108	0.65	2.81	0.18	0.80	1.77	110	2.78	3.64	4.6	2048	1.8	4.0	13.8
Elms	135	0.57	2.92	0.16	0.69	1.81	128	2.57	2.88	3.8	2366	1.7	4.9	12.8
Haven Beach	104	0.53	3.19	0.15	0.46	1.95	93	2.34	3.03	3.25	1956	1.5	4.8	11.1
Bay Average	116	0.58	2.97	0.16	0.65	1.84	110.3	2.56	3.18	3.88	2123	1.67	4.57	12.6

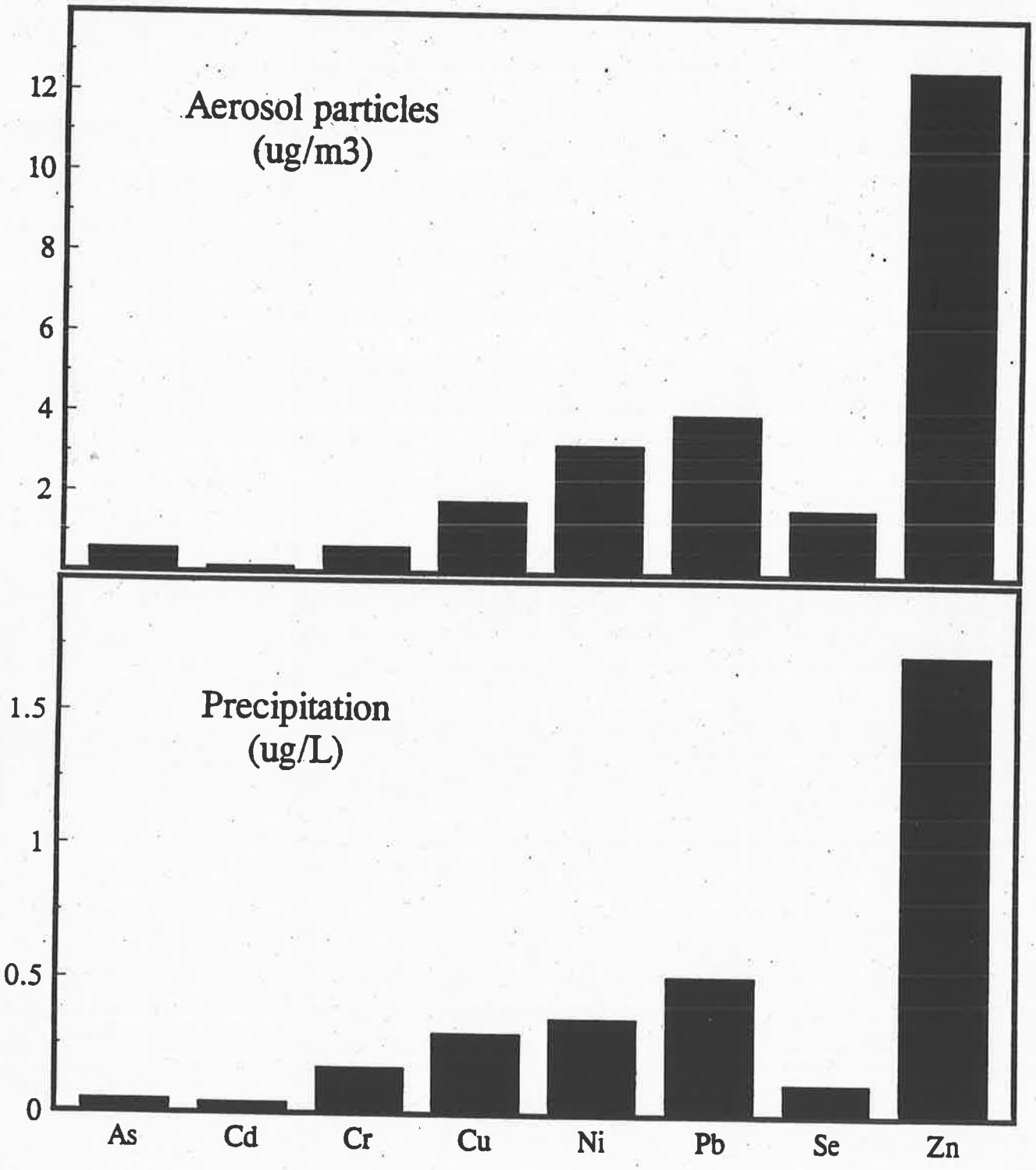

Figure III.1. Average elemental composition of aerosol particles and precipitation. Chesapeake Bay Atmospheric Deposition Study, Wye, 1991.

of selenium, a tracer of coal combustion, averaged 1.7 ng/m^3 during 1991 and 1992, and generally increased during winter months (Figure III.2). Spikes in particulate selenium in the atmosphere suggests that the sampling sites were occasionally impacted by power plants in the region. Concentrations of other combustion-related elements were also slightly higher in the winter, although clear trends are obscured by the inherent short term variability. Concentrations of particulate sulfur are elevated in the summer (Figure III.2), when more photochemical oxidants and sunlight are available to convert gaseous sulfur to sulfate (Gordon *et al.*, 1994).

To compare interannual variations in elemental concentrations, annual averages were calculated for each of the three sites for 1991 and 1992. Several measurements of extraordinarily high concentrations, likely caused by localized contamination, were not included in the annual averages. Concentrations of the crustal elements aluminum, iron, and manganese declined between 10 to 50% between 1991 and 1992, perhaps reflecting less soil erosion during the wetter 1992. The average annual sulfate concentration in 1992 was 60-80% of the 1991 average at the three sites. Conversely, concentrations of atmospheric cadmium, nickel, lead were higher by 60%, 35%, and 70% in 1992 than in 1991. Whether this reflects differences in meteorology or real changes is emissions of these elements to the regional atmosphere is unclear. Even though these data represent a large effort, it is obviously still difficult to argue for systematic trends in the concentrations of trace elements in the Chesapeake Bay atmosphere.

As shown in Figure III.2, the measured concentrations of trace elements are generally within a factor of two among the three sampling sites. On an average annual basis, concentrations slightly decrease from north (Wye) to south (Haven Beach), except sulfur, which is 15% higher at Elms (1991 and 1992) and Haven Beach (1992) than at the northernmost Wye site. The general decreasing trends observed from north to south, in light of increasing sulfate, may indicate higher levels of sulfur-depleted combustion sources (*e.g.*, incinerators, vehicles) in the northern reaches of the Chesapeake Bay. In general, spatial trends in the atmospheric concentrations of trace elements are substantially lower than corresponding temporal trends.

Semivolatile organic chemicals exist in the atmosphere as gases and associated with aerosol particles (Pankow, 1987). In this study, bay-wide annual average concentrations of polycyclic aromatic hydrocarbons ranged from 16 ng/m^3 for dibenz[*a,h*]anthracene to 2590 ng/m for phenanthrene (Tables III.2-4). Atmospheric concentrations were quite variable between the 12-24 hour samples collected semi-weekly, with individual measurements ranging from one tenth to ten times the annual average concentrations. These variations likely results from sampling air masses coming from differing directions, from changes in local and regional emissions, and from differences in atmospheric degradation and deposition rates. For example, increased concentrations of gas-phase PAHs such as pyrene during the summer months may reflect both higher temperatures (*i.e.*, enhanced volatilization) and increased coal and oil combustion to meet electrical demand for air conditioning (Figure III.3). Increases in particulate PAHs, such as benzo[*a*]pyrene, in the atmosphere may result from local burning of yard wastes and of wood for home heating. Some variation in atmospheric levels of organic chemicals may result from the efficient removal of particulate PAHs by precipitation (Poster and Baker, 1996a and b). In

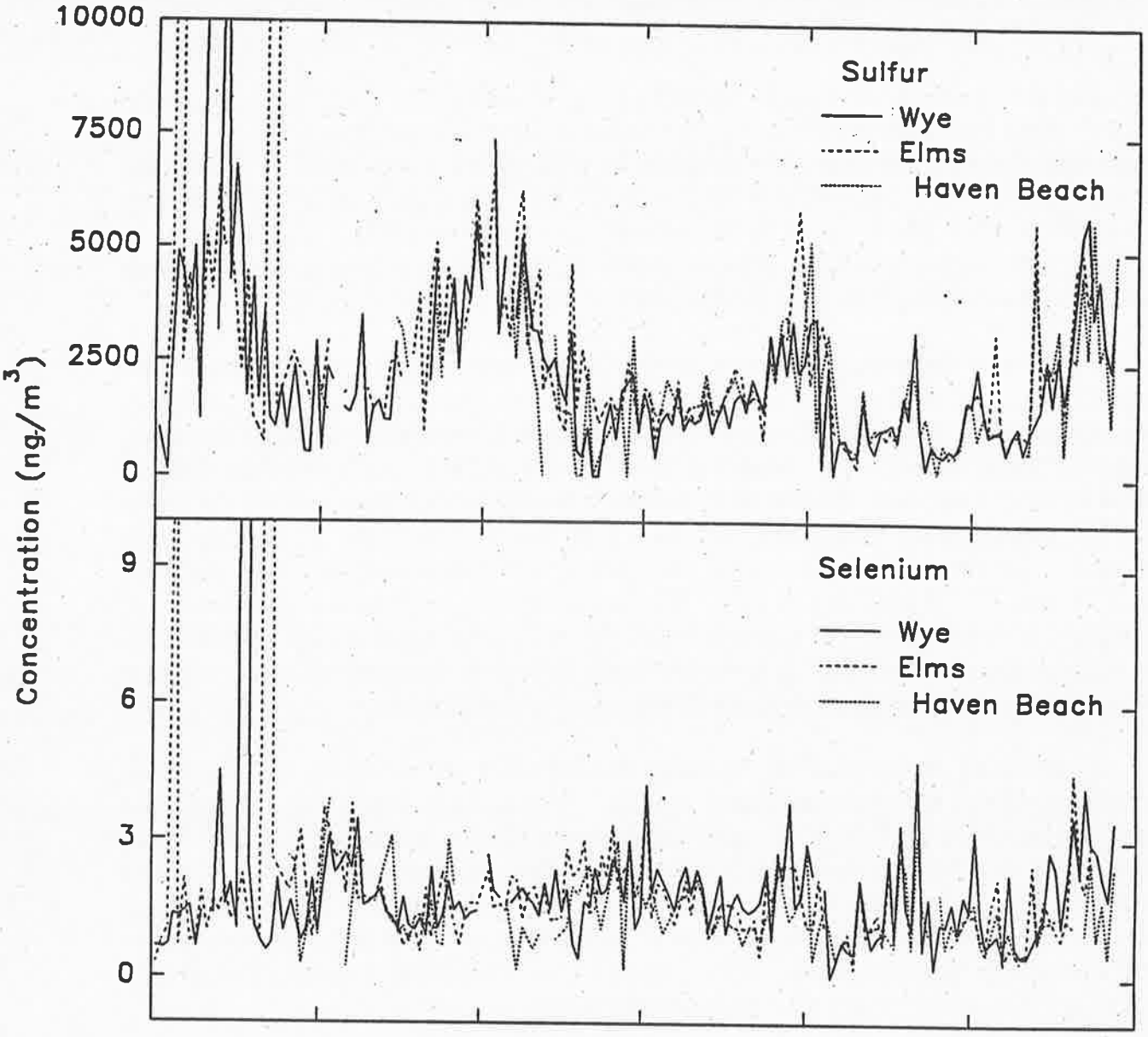

Figure III.2 Concentrations of particulate sulfur and selenium at three Chesapeake Bay sites, 1990–1992.

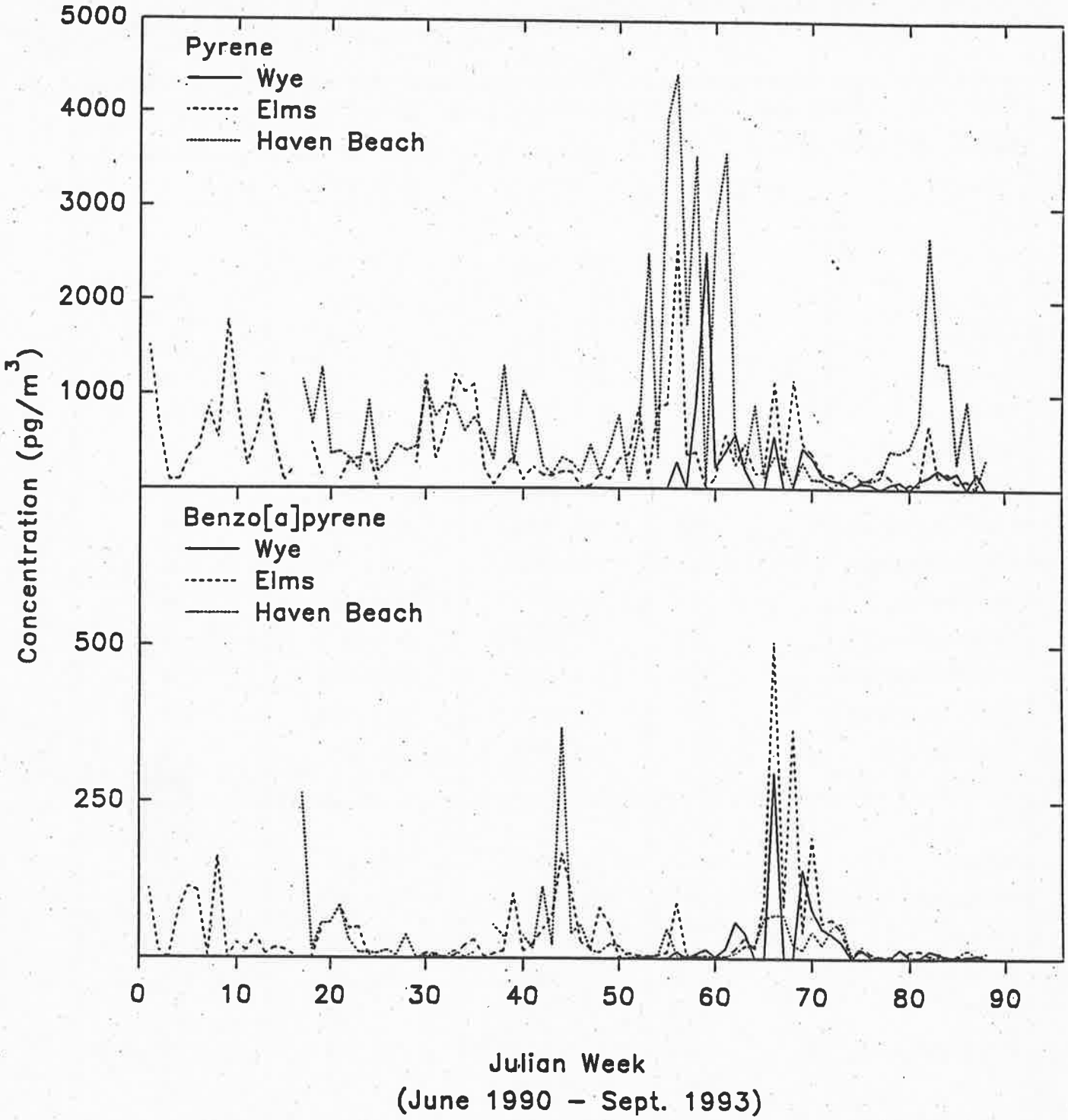

Figure III.3 Pyrene and Benzo[a]pyrene concentrations measured in air at the Wye, Elms, and Haven Beach sites.

Table III.2. Average annual concentrations of total (vapor plus particulate) organic contaminants in air (pg/m^3), Wye.

Compound	Mean Conc.	Range	Range % Part.	N
1992				
Fluorene	869.1	194.8 - 2645.4	0.0 - 1.7	26
Phenanthrene	3107.7	967.5 - 5361.9	0.4 - 14.0	26
Anthracene	36.8	9.0 - 272.1	6.6 - 98.6	26
Fluoranthene	646.1	188.3 - 1719.8	1.8 - 74.0	26
Pyrene	706.3	202.6 - 2512.7	1.2 - 71.5	26
Benz[a]anthracene	34.9	3.5 - 177.3	33.5 - 99.3	26
Chrysene	95.6	26.0 - 417.4	33.2 - 96.5	26
Benzo[b]fluoranthene	105.6	9.0 - 489.0	82.1 - 99.1	26
Benzo[k]fluoranthene	76.1	6.8 - 379.3	82.8 - 99	26
Benzo[e]pyrene	77.5	8.1 - 403.0	84.2 - 99.6	26
Benzo[a]pyrene	56.1	3.1 - 297.0	94.2 - 99.8	26
Indeno[123cd]pyrene	72.1	6.4 - 405.6	82.5 - 99.8	26
Dibenz[ah]anthracene	23.0	2.1 - 90.0	57.1 - 99.6	26
Benzo[ghi]perylene	85.1	1.6 - 442.0	89.7 - 100	26
Total PCB	n\a	n\a		
1993				
Fluorene	523.1	0.0 - 3090.1	0.0 - 100	21
Phenanthrene	1153.4	0.0 - 6239.2	0.0 - 100	21
Anthracene	19.8	0.0 - 239.8	0.0 - 100	21
Fluoranthene	152.6	0.0 - 591.4	0.0 - 100	21
Pyrene	114.5	0.0 - 432	0.0 - 100	21
Benz[a]anthracene	19.3	0.0. - 161.7	0.0 - 100	21
Chrysene	62.2	0.0 - 432.6	0.0 - 100	21
Benzo[b]fluoranthene	47.9	0.0 - 332.8	0.0 - 100	21
Benzo[k]fluoranthene	31.1	0.0 - 138.3	0.0 - 100	21
Benzo[e]pyrene	44.7	0.0 - 342.4	0.0 - 100	21
Benzo[a]pyrene	20.3	0.0 - 143.1	0.0 - 100	21
Indeno[123cd]pyrene	39.9	0.0 - 340.3	0.0 - 100	21
Dibenz[ah]anthracene	4.1	0.0 - 34.5	0.0 - 100	21
Benzo[ghi]perylene	41.1	0.0 - 377.3	0.0 - 100	21
Total PCB	n\a			

Table III.2. Average annual concentrations of total (vapor plus particulate) organic contaminants in air (pg/m^3), Wye.

Compound	Mean Conc.	Range	Range % Part.	N
Overall 1992-1993				
Fluorene	720.8	0.0 - 3090.1	0.0 - 100	47
Phenanthrene	2270.1	0.0 - 6239.2	0.0 - 100	47
Anthracene	29.5	0.0 - 272.1	0.0 - 100	47
Fluoranthene	434.6	0.0 - 1719.8	0.0 - 100	47
Pyrene	452.7	0.0 - 2512.7	0.0 - 100	47
Benz[a]anthracene	28.2	0.0 - 177.3	0.0 - 100	47
Chrysene	81.3	0.0 - 432.6	0.0 - 100	47
Benzo[b]fluoranthene	80.9	0.0 - 489	0.0 - 100	47
Benzo[k]fluoranthene	56.8	0.0 - 379.3	0.0 - 100	47
Benzo[e]pyrene	63.4	0.0 - 403	0.0 - 100	47
Benzo[a]pyrene	40.8	0.0 - 297	0.0 - 100	47
Indeno[123cd]pyrene	58.3	0.0 - 405.6	0.0 - 100	47
Dibenz[ah]anthracene	14.9	0.0 - 90	0.0 - 100	47
Benzo[ghi]perylene	66.3	0.0 - 442	0.0 - 100	47
Total PCB				

units are in pg/m^3

Table III.3. Average annual concentrations of total (vapor plus particulate) organic contaminants in air (pg/m^3), Elms.

Compound	Mean Conc.	Range	Range % Part.	N
1990-1991				
Fluorene	573.2.	56 - 2724.5	0.0 - 23	35
Phenanthrene	1779.3	357 - 5692.2	0.3 - 23	35
Anthracene	50.4	0.9 - 181.3	0.0 - 100	35
Fluoranthene	404.7	46.9 - 2274.9	1.0 - 100	35
Pyrene	482	34.4 - 1502.6	0.8 - 100	35
Benz[a]anthracene	40	1.9 - 152.8	0.0 - 100	35
Chrysene	96.9	13.9 - 537.5	0.0 - 100	35
Benzo[b]fluoranthene	100.5	2.4 - 463.8	0.0 - 100	35
Benzo[k]fluoranthene	58.3	3.1 - 214.1	12.2 - 100	35
Benzo[e]pyrene	64.8	3.2 - 325.5	0.0 - 100	35
Benzo[a]pyrene	33.9	3.3 - 162.1	0.0 - 100	35
Indeno[123cd]pyrene	58	6.8 - 304.5	7.3 - 100	35
Dibenz[ah]anthracene	33.9	7.3 - 58.9	6.0 - 100	35
Benzo[ghi]perylene	63.8	5.6 - 242.7	12.4 - 100	35
Total PCB	213.9	17.4 - 507.8	n\a	35
1992				
Fluorene	885.9	0 - 7853	0.0 - 100	25
Phenanthrene	2012.8	34 - 11959	0.3 - 100	25
Anthracene	53	340 - 611.7	1.0 - 100	25
Fluoranthene	309	160 - 1512.3	3.1 - 100	25
Pyrene	468.0	160 - 2599.6	0.7 - 100	25
Benz[a]anthracene	49.0	317.7 - 320	38 - 100	25
Chrysene	162.0	440 - 941.0	2.1 - 100	25
Benzo[b]fluoranthene	178.2	0 - 920.5	2.4 - 100	25
Benzo[k]fluoranthene	130.7	590 - 674.7	1.8 - 100	25
Benzo[e]pyrene	121.6	135 - 770.3	69.5 - 100	25
Benzo[a]pyrene	72.7	85 - 507.1	9.1 - 100	25
Indeno[123cd]pyrene	132.6	79 - 911	63.9 - 100	25
Dibenz[ah]anthracene	19.0	9 - 118	0.0 - 100	25
Benzo[ghi]perylene	142.4	152 - 1047.6	84.7 - 100	25
Total PCB	n\a		n\a	

Table III.3. Average annual concentrations of total (vapor plus particulate) organic contaminants in air (pg/m^3), Elms.

Compound	Mean Conc.	Range	Range % Part	N
1993				
Fluorene	675.3	0.0 - 3087.4	0.0 - 4.3	19
Phenanthrene	1702.5	0.0 - 5505.4	0.0 - 33.7	19
Anthracene	33.6	0.0 - 296.8	0.0 - 3.9	19
Fluoranthene	225.6	0.0 - 994.2	0.0 - 100	19
Pyrene	167.9	0.0 - 679.0	0.0 - 100	19
Benz[a]anthracene	17.4	0.0 - 53.6	0.0 - 100	19
Chrysene	61.3	0.0 - 324.8	0.0 - 100	19
Benzo[b]fluoranthene	58.2	0.0 - 378.4	0.0 - 98.7	19
Benzo[k]fluoranthene	48.3	0.0 - 311.0	0.0 - 100	19
Benzo[e]pyrene	51.4	0.0 - 297.2	0.0 - 100	19
Benzo[a]pyrene	27.2	0.0 - 194.6	0.0 - 100	19
Indeno[123cd]pyrene	56.2	0.3 - 133.6	95.6 - 100	19
Dibenz[ah]anthracene	5.2	0.0 - 45.5	0.0 - 100	19
Benzo[ghi]perylene	52.2	1.3 - 347.2	0.0 - 100	19
Total PCB	n\a	n\a	n\a	
Overall 1990-1993				
Fluorene	696.1	0.0 - 7853	0.0 - 100	79
Phenanthrene	1834.8	0.0 - 11959	0.0 - 100	79
Anthracene	47.2	0.0 - 611.7	0.0 - 100	79
Fluoranthene	332.1	0.0 - 2274.9	0.0 - 100	79
Pyrene	403.2	0.0 - 2599.6	0.0 - 100	79
Benz[a]anthracene	37.5	0.0 - 320	0.0 - 100	79
Chrysene	109	0.0 - 941	0.0 - 100	79
Benzo[b]fluoranthene	115	0.0 - 920.5	0.0 - 100	79
Benzo[k]fluoranthene	78.8	0.0 - 674.7	0.0 - 100	79
Benzo[e]pyrene	79.6	0.0 - 770.3	0.0 - 100	79
Benzo[a]pyrene	44.6	0.0 - 507.1	0.0 - 100	79
Indeno[123cd]pyrene	81.1	0.0 - 911	7.3 - 100	79
Dibenz[ah]anthracene	22.4	0.3 - 118	0.0 - 100	79
Benzo[ghi]perylene	85.9	0.0 - 1047.6	0.0 - 100	79
Total PCB				

Table III.4. Average annual concentrations of total (vapor plus particulate) organic contaminants (pg/m^3), Haven Beach

Compound	Mean Conc.	Range	Range % Part.	N
1991				
Fluorene	1653.8	298.7 - 3671.8	0.2 - 1.4	27
Phenanthrene	3506.7	1218.4 - 8285.6	0.4 - 10.0	27
Anthracene	48.9	1.1 - 140.0	1.4 - 100.0	25
Fluoranthene	558.0	202.3 - 1591.5	2.7 - 67.3	27
Pyrene	622.1	177.4 - 1302.4	2.2 - 74.1	27
Benz[a]anthracene	31.7	3.2 - 213.6	14.9 - 100	24
Chrysene	122.2	13.7 - 548.5	9.7 - 97.1	27
Benzo[b]fluoranthe	83.9	1.9 - 601.8	56.8 - 100	26
Benzo[k]fluoranthe	67.0	1.5 - 416.1	56.8 - 100	24
Benzo[e]pyrene	53.6	2.7 - 375.3	29.1 - 100	27
Benzo[a]pyrene	36.9	1.7 - 262.4	66.8 - 100	25
Indeno[123cd]pyre	92.1	7.1 - 443.3	27.8 - 100	22
Dibenz[ah]anthrace	19.4	8.8 - 51.0	38.5 - 100	9
Benzo[ghi]perylene	71.9	3.7 - 369.1	50.7 - 100	23
Total PCB	298.3	26 - 730	n\a	27
1992				
Fluorene	984.7	203.0 - 4722	0.0 - 100	26
Phenanthrene	2497.7	19 - 16509	0.0 - 100	26
Anthracene	14.7	1.6 - 175	1.1 - 100	26
Fluoranthene	567.7	11 - 2228	0.2 - 100	26
Pyrene	1095.6	11.2 - 4427	0.3 - 100	26
Benz[a]anthracene	24.6	0.6 - 206.2	9.7 - 100	26
Chrysene	112.9	13.7 - 850.3	8.5 - 100	26
Benzo[b]fluoranthe	67.1	5.9 - 407.7	26.1 - 100	26
Benzo[k]fluoranthe	53.1	4.9 - 375.1	24.4 - 100	26
Benzo[e]pyrene	59.5	6.4 - 356.6	15.0 - 100	26
Benzo[a]pyrene	34.8	2.1 - 368	10.8 - 100	26
Indeno[123cd]pyre	62.5	3.6 - 583	14.5 - 100	26
Dibenz[ah]anthrace	12.9	1.0 - 85.2	15.1 - 100	26
Benzo[ghi]perylene	67.8	4.5 - 502.8	7.4 - 100	26
Total PCB				

Table III.4. Average annual concentrations of total (vapor plus particulate) organic contaminants (pg/m^3), Haven Beach

Compound	Mean Conc.	Range	Range % Part.	N
1993				
Fluorene	562.8	147.5 - 1372.5	0.0 - 2.8	21
Phenanthrene	1684.7	36.1 - 3882.0	0.0 - 100	21
Anthracene	36.6	0.0 - 304.6	0.0 -100	21
Fluoranthene	258.1	14.0 - 1183.4	0.0 - 100	21
Pyrene	498.6	16.8 - 2681.1	0.0 - 100	21
Benz[a]anthracene	10.4	0.0 - 49.0	0.0 - 100	21
Chrysene	55.8	9.7 - 109.8	16.9 - 100	21
Benzo[b]fluoranthe	39.9	2.1 - 129.8	83.2 - 100	21
Benzo[k]fluoranthe	33.8	1.3 - 129.8	0.0 - 100	21
Benzo[e]pyrene	34.0	4.9 - 102.2	84.5 - 100	21
Benzo[a]pyrene	14.1	0.8 - 56.7	77.0 - 100	21
Indeno[123cd]pyre	29.5	0.7 - 116.4	100 - 100	21
Dibenz[ah]anthrace	3.3	0.0 - 12.9	0.0 - 100	21
Benzo[ghi]perylene	28.8	90.8 - 77	77.0 - 100	21
Total PCB	n\a	n\a	n\a	
Overall Average				
Fluorene	1106.4	147.5 - 4722	0.0 - 100	74
Phenanthrene	2642.9	19 - 16509	0.0 - 100	74
Anthracene	33.1	0.0 - 304.6	0.0 - 100	72
Fluoranthene	479.7	11.0 - 2228	0.0 - 100	74
Pyrene	760.6	11.2 - 4427	0.0 - 100	74
Benz[a]anthracene	23.1	0.0 - 213.6	0.0 - 100	71
Chrysene	100.7	9.7 - 850.3	8.0 - 100	74
Benzo[b]fluoranthe	65.8	1.9 - 601.8	261 - 100	73
Benzo[k]fluoranthe	52.9	1.3 - 416.1	0.0 - 100	71
Benzo[e]pyrene	50.4	2.7 - 375.3	15 - 100	74
Benzo[a]pyrene	29.9	0.8 - 368	10.8 - 100	72
Indeno[123cd]pyre	64.3	0.7 - 583	14.5 - 100	69
Dibenz[ah]anthrace	12.7	0.0 - 85.2	0.0 - 100	56
Benzo[ghi]perylene	58.7	1.8 - 502.8	7.4 - 100	70

general, the magnitude of fluctuations in atmospheric levels of organic chemicals is larger than the corresponding variations in trace elements and sulfur discussed above, suggesting the importance of local combustion sources.

Annual average concentrations of the more volatile PAHs fluorene, phenanthrene, anthracene, and fluoranthene changed less than 20% between 1991 and 1992 (Tables III.2-4). Conversely, atmospheric concentrations of particulate-dominated PAHs increased two to three fold at the mid-bay site between 1991 and 1992. No comparable increase was observed at the southern site, suggesting perhaps that the mid-bay site was impacted by increased local sources of combustion during 1992. Annual average concentrations of PAHs and t-PCB were approximately 20% higher in the southern Chesapeake Bay relative to the mid Bay in 1991. Conversely, we observed substantially higher concentrations of PAHs at the mid-bay site in 1992. Annual average particulate PAH concentrations in 1992 were approximately 200-250 percent and 20-70 percent higher at the mid-bay site than at the southern and northern sites, respectively. PAHs which occur predominately in the gas phase were less spatially variable than those associated with particles. Unfortunately, few air samples for organic contaminants were collected at the northern site in 1991. Nonetheless, higher concentrations of PAHs at the mid-bay site relative to the southern site are consistent with the trends observed for the atmospheric levels of trace elements.

III.2. Concentrations in Precipitation. The volume-weighted mean (VWM) concentrations of trace elements in precipitation collected at the three sites is summarized in Table III.5. Overall annual VWM concentrations range from 0.05 μg/L for arsenic at Wye to 16.8 μg/L for aluminum at Haven Beach. The relative proportion of trace elements in precipitation is nearly identical to that in Chesapeake Bay aerosol particles (Figure III.1), confirming that aerosol scavenging is the source of trace metals to wet deposition. Trace metal wet depositional fluxes are highly variable, changing more than ten-fold between consecutive months with little apparent seasonal dependence (Figure III.4). This variability, which was similar at each of the three sites, results not only from fluctuations in the atmospheric inventories of trace metals, but also from changes in the amount of precipitation. On an annual basis, the volume-weighted mean concentrations of most trace metals did not systematically vary between the Summer 1990 and Fall 1993 (Table III.5), again suggesting that these rural sites were most strongly influence by the same regional background signal throughout the study.

While individual precipitation events result in spikes in trace metal deposition at one site that are not observed at the other two locations (Figure III.4), these isolated events average out over the year. Annual volume-weighted mean concentrations of trace metals in precipitation are generally within a factor of two among the three sites, with no clear systematic spatial trend observed for all metals. Concentrations of soil component metals aluminum and iron in precipitation are only one half as high at Elms as at the northern and southern sites, perhaps reflecting less localized inputs from agricultural activities at this sites. The overall volume-weighted mean concentrations of copper, nickel, lead and zinc are 50-100% higher at the southern Haven Beach site relative to the other sites. This enrichment was not observed in aerosol particles. It should be noted that the Haven Beach trace metal measurements contained several

Table III.5. Volume-weighted mean concentrations of metals in precipitation, Chesapeake Bay Atmsopheric Deposition Study.

Compound	Jun 1990-Dec 1991	1991 VWM	1992 VWM	Jan 1993-Sept 1993	Overall VWM
Wye					
Aluminum	15.8	17.5	12	12.7	13.9
Arsenic	0.05	0.06	0.05	0.06	0.05
Cadmium	0.04	0.05	0.04	0.04	0.04
Chromium	0.14	0.11	0.25	0.13	0.17
Copper	0.28	0.23	0.30	0.35	0.30
Iron	13.2	13.4	11.9	12.5	12.6
Manganese	1.42	1.5	1.34	1.64	1.45
Nickel	0.29	0.29	0.42	0.40	0.36
Lead	0.64	0.69	0.43	0.43	0.52
Selenium	0.16	0.14	0.10	0.06	0.12
Zinc	1.58	1.47	1.89	1.8	1.73
Elms					
Aluminum	7.41	7.73	6.01	NA	6.86
Arsenic	0.05	0.05	0.05	NA	0.05
Cadmium	0.03	0.05	0.04	NA	0.04
Chromium	0.05	0.07	0.01	NA	0.04
Copper	0.23	0.2	0.49	NA	0.34
Iron	5.76	5.97	4.82	NA	5.39
Manganese	0.82	0.82	1.01	NA	0.89
Nickel	0.20	0.21	0.15	NA	0.18
Lead	0.54	0.57	0.27	NA	0.43
Selenium	0.12	0.11	0.07	NA	0.09
Zinc	1.17	1.26	1.79	NA	1.41
Haven Beach					
Aluminum	NA	21.3	12.06	18.1	16.8
Arsenic	NA	0.07	0.07	NA	0.07
Cadmium	NA	0.18	0.14	0.06	0.13
Chromium	NA	ND	ND	ND	ND
Copper	NA	0.82	0.51	0.37	0.57
Iron	NA	13.9	22.8	12.1	16.0
Manganese	NA	1.25	1.2	1.11	0.51
Nickel	NA	0.21	2.63	0.34	1.16
Lead	NA	0.69	0.4	0.49	1.03
Selenium	NA	0.13	0.17	NA	0.15
Zinc	NA	6.29	5.84	4.74	5.48

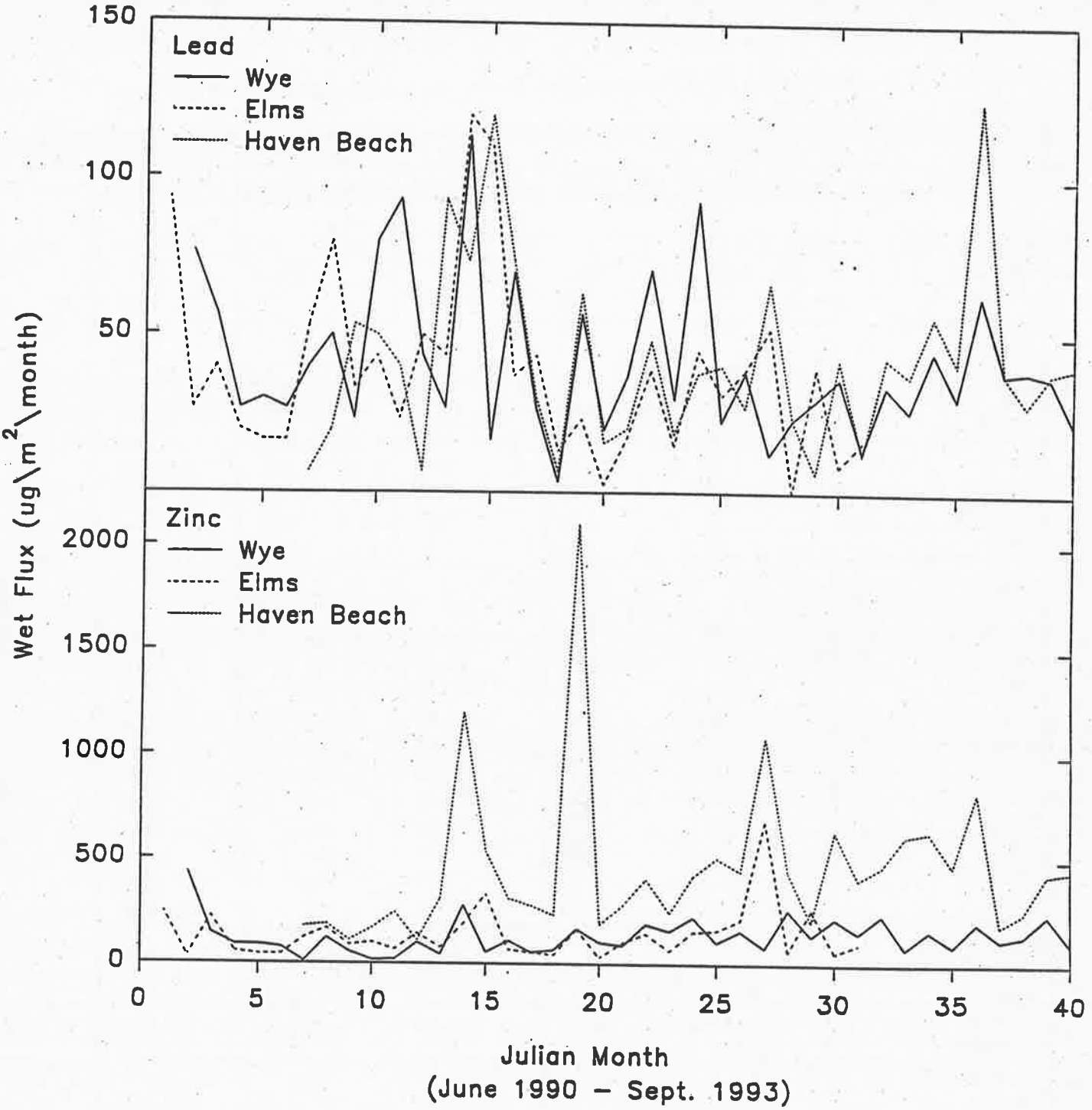

Figure III.4 Lead and zinc wet depositional fluxes at the Wye. Elms, and Haven Beach sites.

extremely high values which were included in these calculation. Whether these values reflect a local source of trace metals to the precipitation or an analytical artifact is unclear.

Overall volume-weighted mean concentrations of polycyclic aromatic hydrocarbons in precipitation ranged from 0.3 ng/L for anthracene and dibenz[*a,h*]anthracene at the Elms site to 9 ng/L for pyrene at the Wye site (Table III.6). Volume-weighted mean concentrations for total PCBs were 1.1 and 0.9 ng/L at the Wye and Elms sites, and for a shorter period of time, 0.35 ng/L at the Haven Beach site. As was observed for trace metals, wet depositional fluxes of organic contaminants varied considerable with time, dominated by episodic spikes at each location (Figure III.5). Extremely high concentrations of some analytes, including pyrene, that were measured in both air and precipitation at the Elms site in Summer, 1990 may have resulted from local vegetation burning. Unlike PAH and PCB levels in the atmosphere, concentrations in precipitation do not systematically vary with season. Based on the overall volume-weighted mean concentrations, levels of PAHs and PCBs are higher in precipitation collected at the mid-bay Elms site than at the northern or southern locations. While this trend is influenced by the few elevated concentrations measured at Elms during Summer 1990 when the other two sites were not operating, the same spatial variation is seen when comparing concentrations from the same period at the three sites (Table III.6). The enrichment at Elms is especially pronounced for higher molecular weight PAHs, implicating a local combustion source (*i.e.*, wood burning for residential heating).

Concentrations of organic contaminants in precipitation measured in this study are consistently lower than those observed in the Great Lakes region (Figure III.6). Polycyclic aromatic hydrocarbon concentrations are two to three times higher at the three Integrated Atmospheric Deposition Network (IADN) sites located at rural, shoreline sites on Lakes Ontario, Michigan, and Superior relative to the Chesapeake Bay data (Gatz *et al.*, 1994). In contrast, levels of the same PAHs in the atmosphere over the Great Lakes is equal to or perhaps less than those measured over the Chesapeake Bay. Whether the apparent enrichment in PAHs in Great Lakes precipitation relative to that in the Chesapeake Bay region shown in Figure III.6 is due to more efficient scavenging in the colder, relatively drier region, or simply reflects methodological differences between the two networks is unclear.

III.3 Wet and Dry Aerosol Depositional Fluxes. Annual wet depositional fluxes ($\mu g/m^2$-year) of each chemical were calculated at each sampling site as follows. Monthly volume weighted mean concentrations were calculated by dividing the total mass of the analyte measured in rainfall by the amount of precipitation collected for analysis each month. This monthly volume weighted mean concentration was then multiplied by the total amount of precipitation which fell at the site during the month, as determined by a Belfort gauge (northern and mid-bay sites) or by the total sample volume (southern site). In cases where the precipitation sampling period spanned the end of a month, the precipitation gauge record was used to partition the wet flux between two months. This method of calculating monthly fluxes accounts for missing samples (*e.g.* due to sampler malfunction or loss of sample during analysis) by assuming that the missing samples contained concentrations of analytes equal to the monthly volume weighted mean concentration.

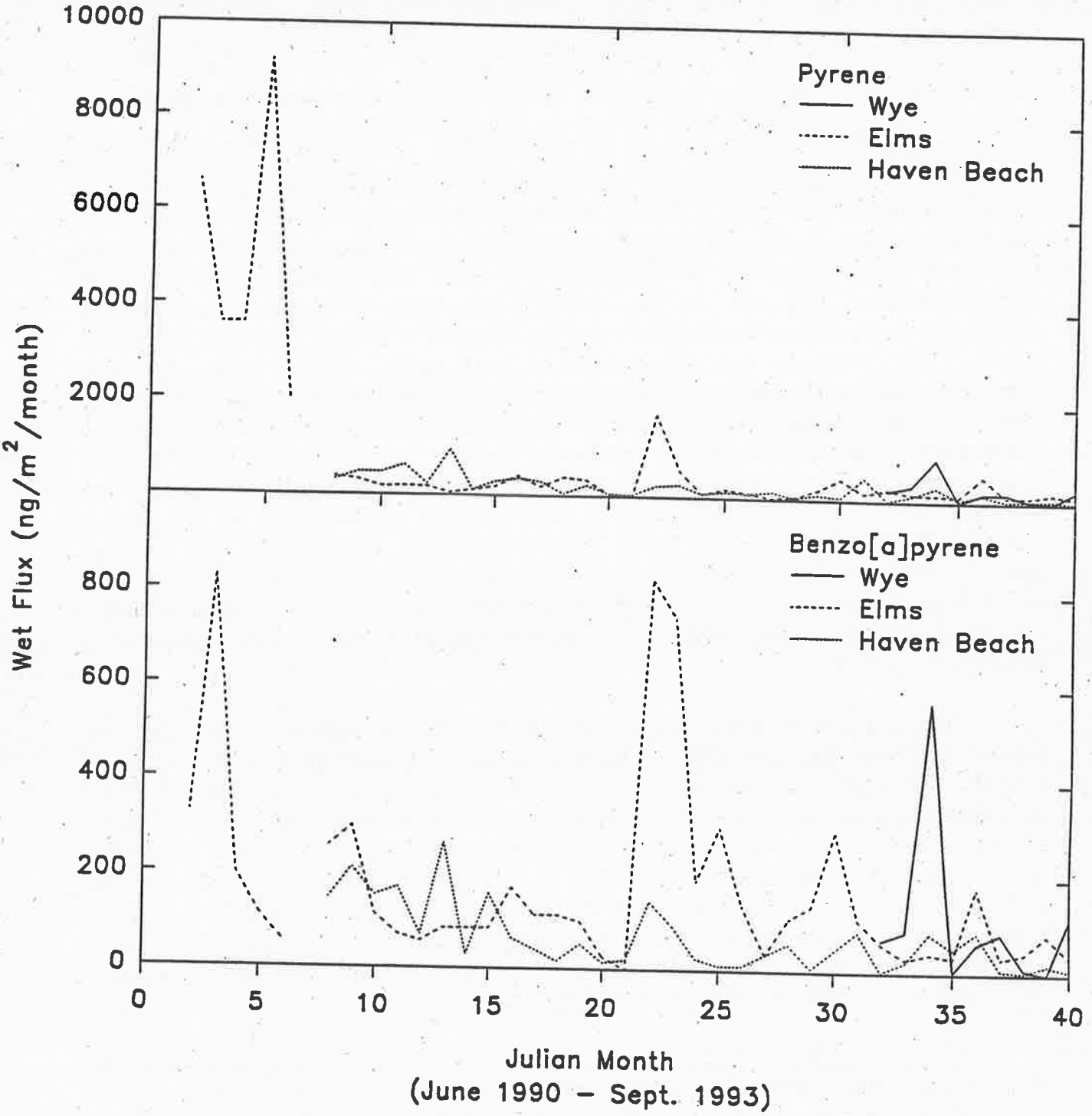

Figure III.5 Pyrene and Benzo[a]pyrene wet depositional fluxes measured at the Wye, Elms, and Haven Beach sites.

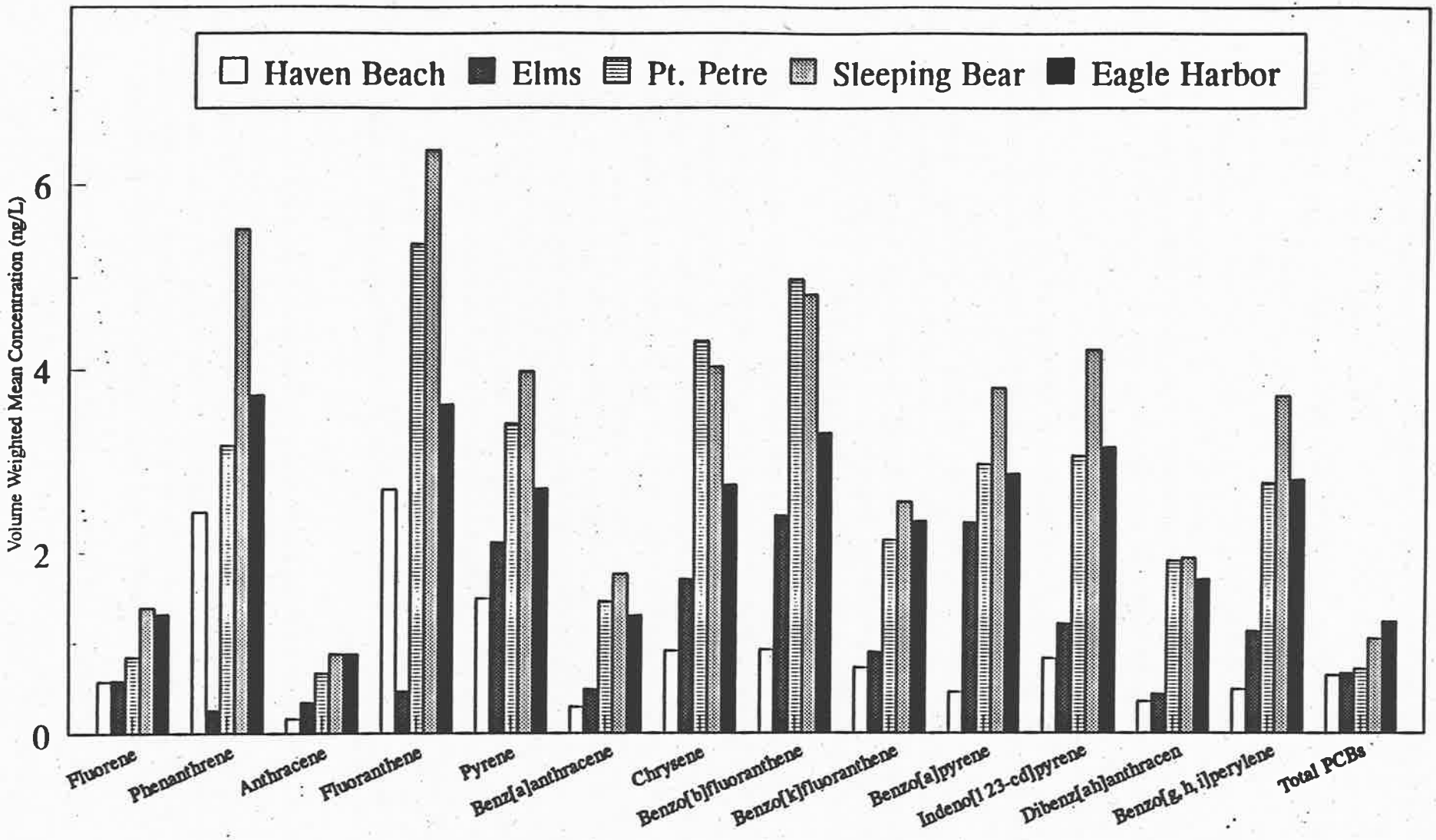

Figure III.6. Comparison of organic contaminants in precipitation in 1992 from the Chesapeake Bay (Haven Beach and Elms) and the Great Lakes (Pt. Petre, Sleeping Bear, and Eagle Harbor; Gatz *et al.*, 1994).

Annual wet depositional fluxes ($\mu g/m^2$-year) were calculated by summing the twelve monthly fluxes.

Dry aerosol depositional fluxes of particulate-borne contaminants were calculated as the product of the atmospheric concentration of each chemical and a depositional velocity (V_d) appropriate to water surfaces (Wu *et al.*, 1992; Wu *et al.*, 1994). The magnitude of the depositional flux depends directly on the value of V_d, which is highly uncertain. V_d depends upon the size distribution and composition of the aerosol particles, upon atmospheric stability and turbulence, and upon characteristics of the receiving surfaces. Aerosol deposition rates over water are likely lower than those over land because of less turbulence over the smooth water surface (Williams, 1982). Deposition to water may be enhanced during unstable conditions (*e.g.*, when the air is colder than the water), as mixing and vertical transport through the air-water boundary layer is rapid. Williams (1982) suggests that the formation of whitecaps during high wind stress greatly increases aerosol deposition to the water surface. Contaminant deposition velocities also depend upon the aerosol size distribution, as very large (*i.e.*, >1 μm) and very small (*i.e.*, < 0.1 μm) particles are rapidly deposited by gravitational settling and diffusional impaction, respectively, while particles in the `accumulation mode' (*i.e.*, between 0.1 and 1 μm) are poorly removed. Anthropogenically-mobilized elements and organic contaminants typically associate with aerosol particles with mass median diameters ranging from 0.2 to >0.5 μm, whereas crustal components (*e.g.*, wind-eroded soils) reside on particles larger than 1 μm.

In this study, a deposition velocity of 0.26 cm/sec was used to estimate the dry aerosol depositional flux of the non-crustal components of aerosol trace elements. This value, taken from the study in the North Sea by Dedeurwaerder *et al.* (1983), is on the lower end of elemental V_d's reported in the literature, likely resulting in conservative estimates of the true dry aerosol depositional fluxes. The crustal components of the aerosol were modeled using a depositional velocity of 1.4 cm/sec. Depositional fluxes of those elements that have both crustal and non-crustal components (*i.e.*, chromium, iron, manganese, vanadium) were estimated as linear combinations of the two fluxes, using the aluminum-normalized crustal abundances of Turekian and Wedepohl (1961). Actual deposition velocities likely change dramatically over space and time, especially driven by changing meteorological conditions and atmospheric stability. In this study, we did not have the necessary meteorological data (nor the fundamental understanding) to calculate site and time-specific V_d's. Because our primary goal is to estimate annual loadings to the Chesapeake Bay, we chose as a first approximation to use the single crustal and non-crustal deposition velocities described above and annual average aerosol concentrations in order to estimate annual dry aerosol fluxes at the three sites.

Wet, dry aerosol, and total depositional fluxes of trace elements at each of the three sites are summarized in Table III.7. Total fluxes in 1992 ranged from 0.07 mg/m^2-year for cadmium at Wye to 121 mg/m^2-year for aluminum at Elms. Not surprisingly, dry aerosol deposition comprises the majority of the total flux for the soil elements aluminum and iron which occur on coarse particles. Wet deposition contributes between one-third and one-half of the total depositional flux of the remaining trace elements. Naturally, spatial trends in total deposition

Table III.7. Trace metal depositional fluxes, Chesapeake Bay Atmospheric Deposition Study.

	Wet Flux (mg/m^2-year)				Dry Aerosol Flux (mg/m^2-year)			Total Annual Flux (mg/m^2-year)		
	Jun 1990-Dec 1991	1992	Jan. 1993-Sept 1993	Jun 1990-Sept 1993	Jun 1990-Dec 1991	1992	Jun 1990-Dec 1992	Jun 1990-Dec 1991	1992	Jun 1990-Dec 1992
Wye										
Aluminum	13.0	12.0	13.1	12.7	97.0	101	98.6	110	113	111.7
Arsenic	0.043	0.052	0.062	0.050	0.102	0.104	0.103	0.145	0.156	0.165
Cadmium	0.037	0.037	0.040	0.038	0.022	0.034	0.027	0.059	0.071	0.067
Chromium	0.103	0.247	0.132	0.154	0.190	0.211	0.199	0.293	0.458	0.331
Copper	0.201	0.296	0.357	0.266	0.355	0.299	0.331	0.556	0.595	0.688
Iron	10.4	11.9	12.9	11.4	53.5	55.4	54.3	63.9	67.3	67.2
Manganese	1.14	1.34	1.69	1.33	1.15	1.19	1.16	2.29	2.53	2.85
Nickel	0.231	0.416	0.415	0.330	0.508	0.729	0.599	0.739	1.15	1.01
Lead	0.521	0.425	0.445	0.474	0.617	0.912	0.739	1.14	1.34	1.18
Selenium	0.121	0.097	0.066	0.101	0.247	0.278	0.259	0.368	0.375	0.325
Zinc	1.21	1.88	1.82	1.56	2.15	2.09	2.12	3.36	3.97	3.94

Table III.7 (continued). Trace metal depositional fluxes, Chesapeake Bay Atmospheric Deposition Study.

	Wet Flux (mg/m²-year)			Dry Aerosol Flux (mg/m²-year)			Total Annual Flux (mg/m²-year)		
	Jun 1990-Dec 1991	1992	Jun 1990-Dec 1992	Jun 1990-Dec 1991	1992	Jun 1990-Dec 1992	Jun 1990-Dec 1991	1992	Jun 1990-Dec 1992
Elms									
Aluminum	7.05	6.86	6.96	131	114	124	138	121	131
Arsenic	0.047	0.054	0.050	0.098	0.090	0.094	0.145	0.144	0.144
Cadmium	0.037	0.046	0.041	0.022	0.029	0.024	0.059	0.075	0.065
Chromium	0.056	0.011	0.035	0.199	0.205	0.201	0.255	0.216	0.236
Copper	0.209	0.559	0.376	0.335	0.363	0.346	0.544	0.922	0.722
Iron	5.47	5.51	0.549	71.8	59.7	66.8	77.3	65.2	67.3
Manganese	0.582	1.15	0.851	1.37	1.21	1.31	1.95	2.36	2.16
Nickel	0.227	0.173	0.201	0.462	0.569	0.506	0.689	0.742	0.707
Lead	0.515	0.306	0.416	0.576	0.774	0.658	1.09	1.08	1.07
Selenium	0.108	0.079	94.2	0.266	0.251	0.260	0.374	0.33	94.5
Zinc	1.13	2.04	1.56	2.04	2.10	2.06	3.17	4.14	3.62

Table III.7 (continued). Atmospheric depostional fluxes of elements, Chesapeake Bay Atmospheric Deposition Study

	Wet Flux (mg/m²-year)				Dry Aerosol Flux (mg/m²-year)			Total Annual Flux (mg/m²-year)		
	1991	1992	Jan 93-Sept 1993	1991- 1993	1991	1992	1991-1992	1991	1992	1991- 1992
Haven Beach										
Aluminum	19.1	10.9	22.0	18.9	110	69.8	98.6	129	80.7	105
Arsenic	0.06	0.06	NA	0.04	0.083	0.092	0.10	0.14	0.15	0.15
Cadmium	0.16	0.13	0.069	0.13	0.022	0.028	0.027	0.18	0.16	0.17
Chromium	ND	ND	NA	NA	0.18	0.12	0.20	0.18[a]	0.12[a]	0.15
Copper	0.74	0.46	0.45	0.60	0.37	0.32	0.33	1.11	0.78	0.95
Iron	12.4	20.6	14.7	17.4	58.5	36.6	54.3	70.9	57.2	64.1
Manganese	1.12	1.08	1.35	1.29	1.22	0.79	1.16	2.34	1.87	2.11
Nickel	0.19	2.38	0.41	1.08	0.48	0.53	0.60	0.67	2.91	1.79
Lead	0.62	0.36	0.60	0.57	0.48	0.65	0.74	1.1	1.01	1.06
Selenium	0.12	0.16	NA	0.10	0.25	0.22	0.26	0.37	0.38	0.37
Zinc	5.63	5.28	5.78	6.07	1.77	1.69	2.12	7.40	6.97	7.2

[a]Dry deposition only

result from variation in precipitation chemistry and amount, and the trace element inventories associated with aerosol particles (given the considerable uncertainty in the dry aerosol deposition calculation, the same deposition velocity was used at each site). Although a distinct north to south trend in precipitation amount occurred in 1992 (100, 107, and 122 cm, respectively), total annual depositional fluxes were remarkably similar among the three stations. As shown in Table III.7, total depositional fluxes were also very similar between years, again indicating that the relatively rare spikes in concentration are dampened against the chronic regional background signal.

Depositional fluxes of hydrophobic organic chemicals are shown in Table III.8. It is important to remember that these flux estimates do not include passive exchange of gaseous organic contaminants across the air-water interface. Other recent studies have shown that this is the *dominant* atmospheric deposition process for volatile organic contaminants, including PCBs (Baker and Eisenreich, 1990; Achman *et al.*, 1993) and low molecular weight PAHs (Nelson *et al.*, 1995). In those studies, the net direction of exchange is often from the water to the air and diffusive gas exchange is large enough to offset wet deposition and dry aerosol deposition. Therefore, the depositional fluxes presented here (Table III.8) should be considered gross fluxes to the water surface, rather than net exchanges. Total fluxes for 1992 range from 0.8 $\mu g/m^2$-year for anthracene at Elms to 10.8 $\mu g/m^2$-year for benzo[*b*]fluoranthene at Elms (the precipitation sampling record at Wye is incomplete for 1992). Both wet deposition and dry aerosol deposition contribute to total PAH deposition, with dry aerosol deposition becoming relatively more important for the higher molecular weight, less volatile compounds (Table III.8). Because aerosol particle-associated PCBs were present below our analytical detection limits, estimates of PCB dry deposition were made using an aerosol PCB level calculated from the measured gaseous PCB concentration and the Junge-Pankow sorption model (Pankow, 1987; Leister and Baker, 1994). The total depositional flux of total PCBs is about 3.5 $\mu g/m^2$-year, with approximately equal contribution from wet and dry aerosol deposition. Total depositional fluxes of PAHs decrease with time during this study, with the lowest fluxes measured during the first nine months of 1993 (Table III.8). While some of this decrease is attributed to beginning with anomalously high measurement in Summer 1990, we continued to see decreases in both wet and dry aerosol fluxes between 1992 and 1993. Overall, total annual fluxes are generally within 50% among the sites, which given the uncertainity in the dry aerosol deposition estimates, indicates little spatial variability when integrating over annual cycles. One should remember, however, that this study did not specifically address the possible influences of urban areas on atmospheric deposition, and gradient near the cities of Baltimore, Washington, and Norfolk may be important.

To place the atmospheric deposition fluxes measured in this study in perspective, they are compared to similar estimates made for the Great Lakes region (Figure III.7; Eisenreich and Strachan, 1992). Annual Great Lakes fluxes were estimated for each lake based upon several sources of data, including the initial results of the IADN program, and were averaged in Figure III.7. Wet depositional fluxes of trace elements are up to three times higher to the Great Lakes than to the Chesapeake Bay, despite significantly less rainfall (80 *versus* 110 cm/year). In contrast, wet depositional fluxes of total PCBs and PAHs are remarkably similar between the two regions, as higher measured concentrations in the Great Lakes (Figure III.6) are offset by lower

Table III.8. Wet, dry aerosol, and total depositional fluxes of organic contaminants, Chesapeake Bay Atmospheric Deposition Study, 1990-1993.

	Wet Flux (μg/m²-year)				Dry Aerosol Flux (μg/m²-year)				Total Flux (μg/m²-year)			
	Jun 1990-Dec 1991	1992	Jan 1993-Sept 1993	Jun 1990-Sept 1993	Jun 1990-Dec 1991	1992*	Jan 1993-Sept 1993*	Jun 1990-Sept 1993	Jun 1990-Dec 1991	1992	Jan 1993-Sept 1993	Jun 1990-Sept 1993
Wye												
Fluorene	NA	NA	0.8		NA	0.3	0.4	0.4	NA	0.3	1.2	1.2
Phenanthrene	NA	NA	3.8		NA	2.2	4.6	3.6	NA	2.2	8.4	7.4
Anthracene	NA	NA	0.5		NA	0.2	0.6	0.4	NA	0.2	1.1	0.9
Fluoranthene	NA	NA	3.3		NA	2.0	3.9	3.2	NA	2.0	7.3	6.5
Pyrene	NA	NA	2.2		NA	2.0	3.4	2.8	NA	2.0	5.6	5.1
Benz[a]anthracene	NA	NA	0.6		NA	0.7	1.4	1.1	NA	0.7	1.09	1.8
Chrysene	NA	NA	1.5		NA	1.9	3.8	3.0	NA	1.9	5.24	4.5
Benzo[b]fluoranthene	NA	NA	1.7		NA	2.0	2.9	2.6	NA	2.0	4.63	4.3
Benzo[k]fluoranthene	NA	NA	0.9		NA	1.5	2.5	2.1	NA	1.5	3.34	2.9
Benzo[e]pyrene	NA	NA	2.3		NA	1.8	2.7	2.3	NA	1.8	4.97	4.5
Benzo[a]pyrene	NA	NA	1.0		NA	1.1	1.3	1.2	NA	1.1	2.29	2.2
Indeno[123cd]perylene	NA	NA	1.2		NA	1.1	2.1	1.7	NA	1.1	3.32	2.9
Dibenz[a,h]anthracene	NA	NA	0.4		NA	0.4	0.6	0.5	NA	0.4	1.03	0.9
Benzo[ghi]perylene	NA	NA	1.0		NA	1.2	2.4	1.9	NA	1.2	3.33	2.9
Total PCBs	NA	NA	0.2		NA	NA	NA	NA	NA	NA	0.24	0.2

*Calculated from geometric mean.

Table III.8 (continued). Wet, dry aerosol, and total depositional fluxes of organic contaminants, Chesapeake Bay Atmospheric Deposition Study, 1990-1993.

	Wet Flux (μg/m²-year)				Dry Aerosol Flux (μg/m²-year)				Total Flux (μg/m²-year)			
	Jun 1990-Dec 1991	1992	Jan 1993-Sept 1993	Jun 1990-Sept 1993	Jun 1990-Dec 1991	1992*	Jan 1993-Sept 1993*	Jun 1990-Sept 1993	Jun 1990-Dec 1991	1992	Jan 1993-Sept 1993	Jun 1990-Sept 1993
Elms												
Fluorene	2.6	0.6	0.9	1.6	1.6	0.8	0.6	1.1	4.2	1.4	1.5	2.7
Phenanthrene	8.9	2.4	4.1	5.7	12	7.0	6.2	9.1	21	9.4	10.2	14.8
Anthracene	1.3	0.4	0.3	0.8	0.9	0.5	0.5	0.7	2.2	0.8	0.8	1.4
Fluoranthene	15	2.6	3.2	8.3	16	6.0	5.0	10.2	31	8.6	8.2	18.5
Pyrene	20	2.3	2.3	10.2	15	5.8	4.4	9.6	35	8.0	6.8	19.8
Benz[a]anthracene	1.7	0.5	0.6	1.1	5.6	2.5	1.2	3.6	7.3	3.0	1.8	4.6
Chrysene	5.3	1.8	1.7	3.4	12	7.0	3.0	8.3	17	8.8	4.7	11.6
Benzo[b]fluoranthene	7.6	2.6	2.0	4.7	15	8.2	3.1	10.0	23	10.8	5.1	14.7
Benzo[k]fluoranthene	5	1.0	1.1	2.8	8.2	5.1	2.4	5.8	13	6.1	3.5	8.7
Benzo[e]pyrene	2.3	1.9	2.3	2.2	9	6.6	3.0	6.8	11	8.5	5.3	9.0
Benzo[a]pyrene	2.4	2.5	0.7	2.0	4.3	3.4	1.4	3.3	6.7	5.8	2.0	5.3
Indeno[123cd]perylene	2.1	1.3	2.4	1.9	9.6	5.5	2.3	6.6	12	6.8	4.6	8.5
Dibenz[a,h]anthracene	1.1	0.5	0.6	0.8	1.8	0.9	0.4	1.2	2.9	1.4	1.0	2.0
Benzo[ghi]perylene	2.4	1.2	2.3	2.0	1.7	6.4	3.2	3.5		7.6	5.5	5.5
Total PCBs	1.9	0.7	0.4	1.2	1.4	NA	NA	NA	3.3	NA	NA	NA

*Calculated from geometric mean.

Table III.8 (continued). Wet, dry aerosol, and total depositional fluxes of organic contaminants, Chesapeake Bay Atmospheric Deposition Study, 1990-1993.

	Wet Flux (μg/m²-year)				Dry Aerosol Flux (μg/m²-year)				Total Flux (μg/m²-year)			
	Jun 1990-Dec 1991	1992	Jan 1993-Sept 1993	Jun 1990-Sept 1993	Jun 1990-Dec 1991	1992*	Jan 1993-Sept 1993*	Jun 1990-Sept 1993	Jun 1990-Dec 1991	1992	Jan 1993-Sept 1993	Jun 1990-Sept 1993
Haven Beach												
Fluorene	1.8	0.7	0.6	1.1	1.5	0.6	0.7	1.0	3.3	1.3	1.3	2.0
Phenanthrene	8.0	3.0	3.0	4.8	12	5.1	4.0	7.3	20	8.1	7.1	12.1
Anthracene	0.4	0.2	0.3	0.3	0.74	0.2	0.2	0.4	1.2	0.4	0.4	0.7
Fluoranthene	5.4	3.3	2.1	3.7	21	3.5	2.4	9.6	26	6.8	4.5	13.3
Pyrene	4.3	1.8	1.2	2.6	18	4.4	2.4	8.8	22	6.2	3.6	11.4
Benz[a]anthracene	0.8	0.4	2.1	1.0	4.2	1.3	1.1	2.3	5	1.6	3.1	3.3
Chrysene	2.3	1.1	1.5	1.6	11	4.9	3.1	6.6	13	6.0	4.6	8.3
Benzo[b]fluoranthene	2.0	1.1	1.3	1.5	13	4.9	2.5	7.2	15	6.1	3.8	8.7
Benzo[k]fluoranthene	1.5	0.9	0.6	1.0	10	3.5	1.9	5.4	11	4.4	2.5	6.5
Benzo[e]pyrene	1.5	1.0	1.6	1.4	8	4.4	2.4	5.2	9.5	5.4	4.0	6.5
Benzo[a]pyrene	1.3	0.6	0.4	0.8	5.5	1.7	0.9	2.9	6.8	2.3	1.3	3.7
Indeno[123cd]perylene	2.2	1.0	1.1	1.5	14	3.2	1.7	6.7	16	4.2	2.8	8.2
Dibenz[a,h]anthracene	0.4	0.4	0.4	0.4	3	0.5	0.4	1.4	3.4	1.0	0.7	1.8
Benzo[ghi]perylene	2.2	0.6	0.7	1.2	10	3.9	2.2	5.6	12	4.5	2.9	6.8
Total PCBs	1.6	0.8	0.9	1.1	2.1	NA	NA	NA	3.7	NA	NA	NA

*Calculated from geometric mean.

Table III.6. Volume-weighted mean concentrations of organic contaminants in precipitation, Chesapeake Bay Atmospheric Deposition Study.

Compound	Jun 1990-Dec 1991	1991 VWM	1992 VWM	Jan 1993-Sept 1993	Overall VWM
Elms					
Fluorene	1.8	1.4	0.58	0.88	1.2
Phenanthrene	6.7	5.3	2.25	4.18	4.7
Anthracene	1.2	0.7	0.34	0.28	0.7
Fluoranthene	9	4.9	2.46	3.27	5.7
Pyrene	16.8	2.6	2.11	2.39	9.0
Benz[a]anthracene	1.3	0.9	0.48	0.59	0.9
Chrysene	3.4	2.7	1.71	1.76	2.5
Benzo[b]fluoranthene	5.7	3.1	2.40	2.05	3.9
Benzo[k]fluoranthene	3.1	1.5	0.89	1.17	2.0
Benzo[e]pyrene	2.4	2.1	1.74	2.32	2.2
Benzo[a]pyrene	1.9	1.2	2.32	0.69	1.8
Indeno[1,2,3-cd]perylene	2.1	2.4	1.21	2.42	1.9
Dibenz[a,h]anthracene	1.1	0.8	0.43	0.61	0.8
Benzo[g,h,i]perylene	2.3	2.4	1.13	2.36	1.9
Total PCBs	1.6	0.2	0.66	0.42	1.1
Haven Beach					
Fluorene	NA	1.78	0.57	0.53	1.0
Phenanthrene	NA	7.91	2.44	2.38	4.3
Anthracene	NA	0.42	0.16	0.22	0.3
Fluoranthene	NA	4.67	2.69	2.01	3.2
Pyrene	NA	3.57	1.49	1.28	2.1
Benz[a]anthracene	NA	0.68	0.29	0.36	0.4
Chrysene	NA	2.07	0.91	1.09	1.4
Benzo[b]fluoranthene	NA	1.77	0.92	1.24	1.3
Benzo[k]fluoranthene	NA	1.28	0.72	0.62	0.9
Benzo[e]pyrene	NA	1.29	0.83	1.63	1.2
Benzo[a]pyrene	NA	1.14	0.45	0.39	0.7
Indeno[1,2,3-cd]perylene	NA	1.9	0.82	1.06	1.2
Dibenz[a,h]anthracene	NA	0.33	0.35	0.34	0.3
Benzo[g,h,i]perylene	NA	1.8	0.48	0.78	1.0
Total PCBs	NA	1.12	0.64	0.87	0.9
Wye					
Fluorene	NA	NA	NA	0.65	0.65
Phenanthrene	NA	NA	NA	3.03	3.03
Anthracene	NA	NA	NA	0.50	0.50
Fluoranthene	NA	NA	NA	2.84	2.84
Pyrene	NA	NA	NA	1.94	1.94
Benz[a]anthracene	NA	NA	NA	0.56	0.56
Chrysene	NA	NA	NA	1.27	1.27
Benzo[b]fluoranthene	NA	NA	NA	1.49	1.49
Benzo[k]fluoranthene	NA	NA	NA	0.76	0.76
Benzo[e]pyrene	NA	NA	NA	1.92	1.92
Benzo[a]pyrene	NA	NA	NA	0.63	0.63
Indeno[1,2,3-cd]perylene	NA	NA	NA	1.03	1.03
Dibenz[a,h]anthracene	NA	NA	NA	0.35	0.35
Benzo[g,h,i]perylene	NA	NA	NA	0.82	0.82
Total PCBs	NA	NA	NA	0.35	0.35

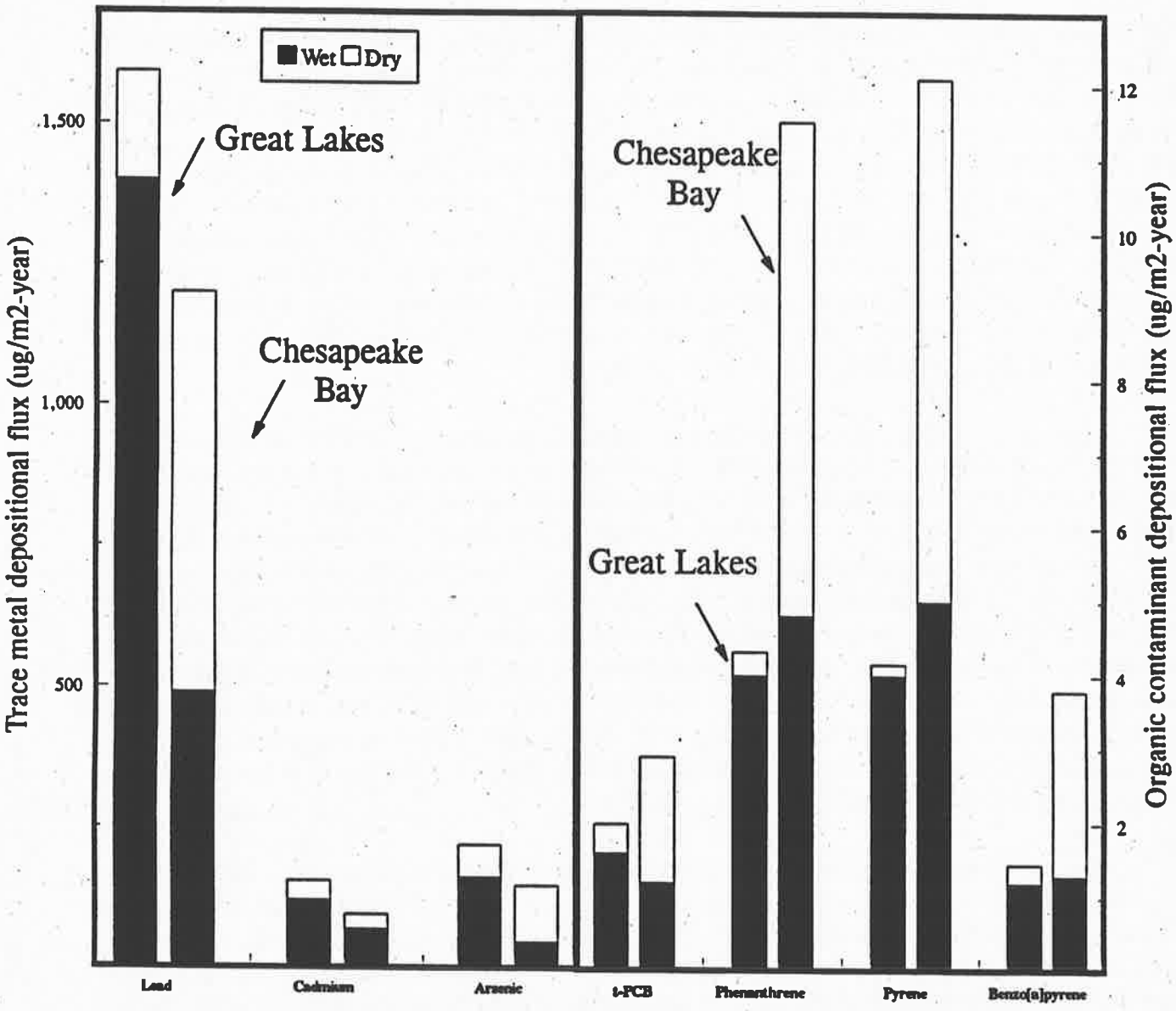

Figure III.7. Comparison of Chesapeake Bay (this study) and Great Lakes (Eisenreich and Strachan, 1992) atmospheric depositional fluxes.

precipitation amounts. Dry aerosol depositional flux estimates are higher in the Chesapeake region, especially for organic contaminants. This is due, in part, to the choice of deposition velocities used for the two estimates (0.2 cm/sec for all species in the Great Lakes, 0.26 cm/sec for elements and 0.49 cm/sec for organics in the Chesapeake Bay). While all of these values are within the generally accepted range for dry aerosol deposition velocities, the impact of this uncertainty can be seen in Figure III.7. In addition, measured aerosol-bound organic concentrations were generally higher than the values used in the Great Lakes dry aerosol deposition calculations (Eisenreich and Strachan, 1992). Despite the differences, estimated atmospheric depositional fluxes are generally within a factor of two between the Chesapeake Bay and Great Lakes regions, which, given the numerous opportunities for error in these measurements and calculations, is quite good agreement.

III.4. Annual Chesapeake Bay-Wide Atmospheric Loadings. To estimate the annual, bay-wide loading of elements and organic contaminants to the entire Chesapeake Bay, the annual site-specific wet and dry aerosol fluxes were averaged and these two average fluxes were multiplied by the surface area of the bay (1.15×10^{10} m^2). While we could have chosen the partition the area of the bay into three sections represented by each site, simply averaging the three fluxes provides approximately the same estimate, because of the nearly equal spacing of the three sites along the mainstem of the bay and the similar fluxes measured at the sites. Again, because of our inability to estimate dry aerosol loadings on a finer temporal resolution, bay-wide loadings are presented on an annual basis. Fluxes and loadings are presented for 1991 and 1992, and averaged over the entire study period (mid 1990 through mid 1993). While these loading estimates are presented with three significant figures, propagated uncertainties are likely on the order of a factor of two, due primarily to the dry aerosol deposition estimates.

Bay wide atmospheric loadings of aluminum and iron are 1,340,000 and 799,000 kg/year respectively (Table III.9). Loadings of trace elements range from 1110 kg/year for cadmium to 49,400 kg/year for nickel. Loading estimates are generally similar for 1991 and 1992, except for large nickel and zinc due elevated wet deposition measured at the Haven Beach site in 1992. Loadings of PAHs range from 13 kg/year for anthracene to 189 kg/year for fluroanthene. Total PCB loadings are estimated to be 37 kg/year. Interestingly, both wet deposition and dry aerosol depositional fluxes appear to decrease between 1991 and 1992. Whether this reflects a real interannual variation or simply results from aggregating measurements from different locations is unclear.

To place these loadings in perspective, they are compared to recent estimates of trace metal and organic contaminant loadings delivered to the Chesapeake Bay by the Susquehanna River in Table III.10 (Godfrey *et al.*, 1995; Foster, 1995; Conko, 1995). The Susquehanna River is the largest tributary to the Chesapeake Bay, supplying approximately 60% of the freshwater inflow to the estuary. Annual riverine loadings of dissolved and particulate trace metals and organic contaminants were determined by analyzing flow-weighted samples collected at Conowingo, Maryland between February, 1994 and January, 1995 (Foster, 1995; Conko, 1995). Atmospheric deposition directly to the surface waters of the Chesapeake Bay supplies loads of polycyclic

Table III.9. Annual loadings of trace metals and organic contaminants to the Chesapeake Bay

	Wet Deposition (kg/year)			Dry Deposition (kg/year)			Total Deposition (kg/year)		
	1991	1992	Overall	1991	1992	Overall	1991	1992	Overall
Fluorene	23	7	16	16	7	12	39	14	27
Phenanthrene	85	31	63	127	55	92	211	86	155
Anthracene	7.0	3	6	8.9	3	6	16	7	13
Fluoranthene	61	34	70	176	44	119	237	78	189
Pyrene	43	24	75	147	47	109	190	70	184
Benz[a]anthracene	10	5	9	47	17	34	57	22	44
Chrysene	31	17	29	116	53	85	146	70	114
Benzo[b]fluoranthene	31	21	36	138	58	98	169	79	134
Benzo[k]fluoranthene	18	11	22	99	39	65	117	50	88
Benzo[e]pyrene	21	17	21	90	49	67	111	66	88
Benzo[a]pyrene	18	18	17	52	24	36	70	42	53
Indeno[123cd]pyrene	27	13	20	141	38	78	168	51	98
Dibenz[ah]anthracene	6.7	5	7	27	7	16	34	12	22
Benzo[ghi]perylene	27	10	19	113	44	75	141	54	94
Total PCBs	17	9	13	20	NA	20	37	NA	37
Aluminum (x 10^{-3})	160	114	137	1300	1093	1200	1460	1207	1340
Arsenic	580	633	607	1000	1094	1050	1580	1727	1660
Cadmium	920	813	867	130	347	240	1050	1160	1110
Chromium	1100	951	1026	2000	2064	2030	3100	3020	3060
Copper	6100	5049	5575	3500	3745	3620	9600	8790	9200
Iron	120000	145600	132800	750000	582000	666000	870000	727000	799000
Manganese	12700	13700	13200	15000	12200	13600	27700	25900	26800
Nickel	3000	11370	7185	5300	7019	6160	8300	18400	13300
Lead	6700	4180	5440	5200	8960	7080	11900	13100	12500
Selenium	1500	1280	1390	3000	2860	2930	4500	4140	4320
Zinc	18000	35300	26600	23000	22600	22800	41000	57800	49400

Table III.10. Relative importance of sources of trace metals and organic contaminants to the Chesapeake Bay.

	Susquehanna River Load (kg/year)[1]		Atmospheric Deposition
	Dissolved	Particulate	Load (kg/year)[2]
Organics			
t-PCBs	97	68	37
Fluorene	37	85	27
Phenanthrene	63	388	155
Fluoranthene	108	1020	189
Pyrene	104	925	184
Benz[*a*]anthracene	12	364	44
Chrysene	15	316	114
Benzo[*a*]pyrene	5	436	53
Elements			
Aluminum (x 10^{-3})	2,560	64,800	1,340
Arsenic	12,600	ND	1,660
Cadmium	2,130	26,700	1,110
Chromium	4,130	111,000	3,060
Copper	47,800	151,000	9,200
Iron (x 10^{-3})	4,100	40,000	799
Manganese (x 10^{-3})	3,290	1,530	26.8
Nickel	121,000	65,200	13,300
Lead	6,530	38,600	12,500
Zinc	77,900	360,000	49,400

[1]Annual loads entering the Chesapeake Bay *via* the Susquehanna River, measured at Conowingo, Maryland between February, 1994 and January 1995 by Foster (1995; organics) and Conko (1995, elements).

[2]Total atmospheric deposition loads directly to the surface of the Chesapeake Bay below the fall lines (1.15 x 10^{10} m^2), as measured by the Chesapeake Bay Atmospheric Deposition Study, 1990-1991.

aromatic hydrocarbons which are comparable to (fluorene) or greater than the loads of *dissolved* PAHs delivered by the Susquehanna River (Table III.10). Dissolved total PCB loads from the river are approximately three times those from the atmosphere. Particulate-bound organic contaminants discharged from the river dominate the external loading of PAHs, with a large contribution from the high sediment burden carried by the river during high flows. Atmospheric depositional fluxes of several elements, including lead, cadmium, and chromium, are within a factor of two of the dissolved load from the Susquehanna River. Again, particulate metal loads from the river dominate over both dissolved riverine loads and atmospheric deposition.

While it is interesting to compare the relative importance of riverine and atmospheric sources of trace elements and organic contaminants to the Chesapeake Bay, one must take care not to overinterpret these results. While the Susquehanna River delivers large quantities of these species, much of this load is removed in the northern extreme of the bay (Helz and Huggett, 1987) and is delivered episodically during high river flows. Whether particulate-bound metals and organic contaminants are available to geochemically repartition within the bay's waters and to be taken up by aquatic organisms is quite unclear. In contrast, atmospheric deposition directly to the water's surface supplies these species directly to water column, without any comparable zone of efficient removal. However, it has recently been suggested that combustion-derived PAHs associated with aerosol particles washed into surface waters also may not be available for repartitioning (McGroddy *et al.*, 1995). Finally, one must remember that the distinction between riverine and atmospheric loadings is not clear. Some fraction of the chemical input from the tributaries results from deposition of atmospheric pollutants to the watershed, with subsequent transmission through the vegetation and soil layers into surface waters.

IV. Results of Intensive, Event-Based Study

Part IV.A. The Influence of Submicron Particles on Hydrophobic Organic Contaminants in Precipitation. 1. Concentrations and Distributions of Polycyclic Aromatic Hydrocarbons and Polychlorinated Biphenyls in Rainwater

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IVA.1 Abstract

Concentrations of non-filter retained, particle-associated organic contaminants in rain are estimated as the difference between measured filtrate concentrations and those supported by gas exchange into raindrops, using field data resulting from the simultaneous collection of air and precipitation. The distributions of organic contaminants in four discrete precipitation events are presented for several polychlorinated biphenyl congeners and for polycyclic aromatic hydrocarbons. These contaminants are up to 80% bound to non-filterable particulate material in rainwater and <9% "truly" dissolved, demonstrating that submicron particles significantly contribute to the overall removal of organic contaminants from the atmosphere by precipitation. In the precipitation events described in this paper, organic carbon-normalized filter-retained particle ($\sim > 0.5$ μm) partition coefficients for PCB congeners and PAHs are larger than those for non-filter-retained particles, suggesting that organic contaminants adsorb differently to large and small (*i.e.*, non-filter retained) particles. Partition coefficients to both large and submicron particles are weakly correlated with hydrophobicity, indicating that the speciation of PCBs and PAHs in rain is not predictable from these compounds' octanol-water partition coefficients. We attribute the poor correlation to slow desorption kinetics and to non-exchangeable fractions of contaminants within atmospheric particles.

IVA.2 Introduction

Hydrophobic organic contaminants (HOCs) exist in the atmosphere as gases and associated with liquid and solid particles (*1-4*). To predict the atmospheric residence times, deposition rates, and fates of HOCs requires that the mechanisms of HOCs incorporation into atmospheric liquid water and removal from the troposphere be understood. Both gaseous and particle-associated HOCs are deposited to the Earth's surface through dry depositional processes, (*e.g.* gas absorption, gravitational settling, eddy diffusion) or *via* precipitation scavenging, either during droplet formation (in-cloud scavenging) or as the drops fall through the air column (below-cloud scavenging) (*5-7*). Fogwater can also incorporate gaseous and particle-associated HOCs close to the ground or below clouds prior to rain or drizzle (*8-11*). Previous studies of the composition of rain- and fogwater have contributed to our understanding of the physical speciation, fate and transport of airborne HOCs (*8-16*). Murray and Andren (*17*) argue that the dissolution of gaseous polychlorinated biphenyls (PCBs) to rain is apparently larger than what is predicted by the congeners' air-water partition coefficients due to the presence of non-filter retained (< 0.7 μm), contaminant-laden particles in the operationally defined dissolved phase of their precipitation samples. Similarly, Schomburg *et al.*, (*9*) and others (*10, 18-20*) conclude from field studies that the enrichment of HOCs in fogwater is due to submicron particulate material in fogwater that is strongly sorptive, surface active, and not retained by standard glass fiber filters. Leuenberger *et al.*, (*16*) also suggest that the presence of insoluble *n*-alkanes in the filtered fraction (< 0.2 μm) of rainwater is likely due to clusters or aggregates in this phase.

The concept that submicron organic particulate matter influences the partitioning behavior of HOCs in rain- and fogwater is similar to that invoked to describe the sorption of HOCs to

particles in freshwater and estuarine environments (*21-23*). Evidence suggests that HOCs have a high affinity for substrates such as dissolved organic matter (*24-28*), including humic materials (*29,30*). These types of substrates may exist in rainwater and influence HOC partitioning, though the relative magnitude of HOC sorption to submicron material in rainwater has not been thoroughly examined. Since observed enhancements of HOCs in rain- and cloudwater (*i.e.*, beyond what is predicted by gas exchange) have been attributed to the presence of submicron particle associated HOCs in the operationally defined filtrate, HOC precipitation scavenging models which do not include submicron particle-associated concentrations may be in error and should be reexamined.

We recently carried out a detailed investigation of HOC speciation in rain in the Chesapeake Bay region. In this paper, we present concentrations (dissolved and particle-associated) of PCB congeners, polycyclic aromatic hydrocarbons (PAHs), organic carbon, and suspended particles in rain, along with HOC atmospheric concentrations (particle-associated and gaseous), all of which were measured during five discrete storm events that occurred adjacent to the Chesapeake Bay in late Summer, 1992. Estimates of submicron particle-associated HOC concentrations in rain are presented as the difference between measured filtrate concentrations and those supported by gaseous absorption. The resulting partitioning of HOCs between particles and rainwater is compared to similar fog studies. An accompanying paper (*31*) details an HOC scavenging model which includes the scavenging ratios of particle-associated, gaseous, and submicron PAHs.

IVA.3 Methods

Concentrations of 65 PCB congeners and 14 PAHs were measured in atmospheric and precipitation samples collected at a rural site adjacent to the Chesapeake Bay during late Summer 1992 (Table IV.A-1). This site is one of the Chesapeake Bay Atmospheric Deposition network sites where atmospheric (semi-weekly) and precipitation (integrated bi-weekly) samples were collected between July 1990 and September 1993 for HOC analysis (*32*). Sampling and analytical procedures are presented in detail elsewhere (*32, 33*) and are summarized here. Particle-associated and gaseous contaminants were isolated from the atmosphere by drawing air through a 20.3 x 25.4 glass fiber filter (Schleicher and Schuell #25) and a polyurethane foam plug (PUF; 8.5 cm x 10 cm) for about 16 hours at a flow rate of 0.8 m^3/min. Samples were collected before, during (when logistically possible), or immediately after each rain event. An additional high-volume air sampler was deployed for measuring total suspended particle (TSP) concentrations. Precipitation was collected for HOC analysis in an automated wet-only collector equipped with a 1 m^2 stainless steel collection funnel that drained precipitation through an *in situ* filtration system consisting of a glass fiber filter (mean pore size 2.9 μm, 144 mm, Schleicher and Schuell #25) and a column of Amberlite XAD-2 resin (*32*). To include small particles which adhered to the funnel surface rather than being washed onto the filter, the funnel was scrubbed with wetted glass wool and deionized water after each rain event. This funnel wash was combined with the corresponding precipitation filter sample. An additional automated wet-only precipitation collector (Aerochem Metrics, Bushnell, FL) was deployed to collect precipitation for the analysis of

Table IV.A-1. Storm Events, 1992, Chesapeake Bay, MD

Event	Date	Wind Direction[1]	Air Temp[2]	TSP[3]	DOC[4] mg/L	POC[4] mg/L	foc[4] %	Rain Vol mm	Duration hrs	Trigger Event[5]
rain storm #1	31 July	180	27	3.4 mg/L	3.7	0.9	20	13	< 1	pre-frontal trough[7]
air smp a	28 July	320	27	29 µg/m³	n/a[6]	n/a	n/a	n/a	n/a	
rain storm #2	11 August	200	33	n/a	n/a	n/a	n/a	34	no data	pre-frontal trough
air smp b	11 August	340	33	36 µg/m³	n/a	n/a	n/a	n/a	n/a	
rain storm #3	24 September	010	17	0.9 mg/L	2.1	0.2	9	31	16.8	tropical storm Danielle
air smp c	22 September	360	31	21 µg/m³	n/a	n/a	n/a	n/a	n/a	
rain storm #4[8]	27 September	210	22	2.8 mg/L	1.2	0.2	13	13	17.5	pre-frontal trough
rain storm #5	4 October	045	16	1.4 mg/L	9.7	0.6	6	15	12	coastal low pressure system
air smp d	6 October	040	16	14 µg/m³	n/a	n/a	n/a	n/a	n/a	

[1] at 18Z
[2] mean air temperature (°C) during rain storm or during air sample
[3] total suspended solids concentrations in rain (mg/L) or air (µg/m³)
[4] DOC = dissolved organic carbon; POC = particulate organic carbon; foc = fraction of organic particulate carbon in rain
[5] meteorological disturbance that brought about the precipitaiton event (ref *36*)
[6] not available
[7] pre-frontal atmospheric low pressure depression
[8] 27 September rain sample coupled to 22 September air sample

suspended solids and dissolved and particulate carbon concentrations.

Air and precipitation filter samples were extracted for 24 hours with methanol followed by 24 hours with dichloromethane in Soxhlet flasks. Air vapor samples (PUF) were extracted for 24 hours with petroleum ether and resin (XAD-2) samples were extracted for 24 hours with 1:1 (v/v) acetone:hexane. Laboratory blanks of each matrix were also extracted to account for contamination during processing. Extraction was followed by liquid-liquid partitioning into deionized water to remove the more polar solvent in the matrices that had solvent combinations. The remaining non-polar extracts were then concentrated to < 4 mL *via* rotary-evaporation and were further evaporated under a nitrogen stream. Dichloromethane extracts were exchanged for hexane during the rotary-evaporation process. A 25% subsample of each concentrated extract was taken for PAH analysis, concentrated, and analyzed by capillary gas chromatography-ion selective mass spectrometry. Individual PAHs were identified based on chromatographic retention times, confirmed by the abundance of a secondary mass fragment relative to the molecular ion, and quantified by isotope dilution using five perdeuterated PAHs internal standards (MSD Isotopes, Cambridge, MA; Supelco, Bellefonte, PA). The remaining sample extract was concentrated, fractionated on Florisil columns into two eluents (*23*), and analyzed by capillary gas chromatography with electron-capture (ECD) detection for PCBs. PCB congeners were identified and quantified by comparison to a mixed Aroclor standard (1232, 1248, 1262) by the procedure of Mullin (*34*), using two non-industrially synthesized PCB internal standards (*35*). In cases where two or more PCB congeners were not chromatographically resolved, the total concentration of the mixture is reported.

Recoveries of an analytical surrogate (PCB congener #14, 3,5 dichlorobiphenyl) spiked into each sample prior to extraction were 65-108% (N = 9), exclusive of two outliers at 15 and 40%. Recoveries of d_{12} chrysene and d_{12} fluoranthene were 73-108% (N = 13) with one outlier at 162%, and 43-70% (N = 5), respectively. Unusual surrogate recoveries likely result from chromatographic interferences with the specific surrogate compounds in individual samples. Laboratory blanks were generally free of contamination (*i.e.* below instrumental detection limits). In the limited cases where masses of sample analytes were less than three times those in the corresponding matrix blank, the field analytes were not included in the data set. Instrumental detection limits were calculated for each sample by assuming a minimum chromatographic area with a signal to noise ratio equal to three.

Total organic carbon was determined with an OF Corporation (College Station, TX) TO analyzer (Model 700) *via* persulfate wet-oxidation at 100°C and non-dispersive infrared detection. Particulate carbon was measured *via* combustion in pure oxygen under static conditions at 950 °C in a Leeman Laboratory, Inc. (#240-XA) elemental analyzer.

IVA.4 Results and Discussion

Storm descriptions. The duration of each storm sampled during July-October 1992 ranged from less than one hour to 17.5 hours, indicating that the storms were generally

convective, quick moving fronts rather than stationary systems (Table IV.A-1). Atmospheric pressure depressions in front of occluded frontal systems, commonly called troughs, moving toward the Atlantic Ocean triggered rapid precipitation events over the Chesapeake Bay region on 31 July, 11 August, and 27 September as the frontal systems passed over the Appalachian Mountains and the leeward coastal flood plain (*36*). In contrast, tropical storm Danielle, located off the mouth of the Chesapeake Bay on 24 September 1992, was responsible for the precipitation that fell on this date. An occluded low pressure system located in the Carolinas brought about precipitation to the Chesapeake Bay region on 4 October. Rain intensities ranged from 0.8 $mm \cdot hr^{-1}$ on 27 September to as high as 13 $mm \cdot hr^{-1}$ on 31 July.

Ancillary data. Suspended solids concentrations in rainwater ranged from 0.89 to 3.4 $mg \cdot L^{-1}$ (Table IV.A-1). The carbon content of the particles filtered from the precipitation ranged from 6 to 20% and was highest in the event with the highest suspended solids concentrations (31 July). Dissolved carbon ranges from 1.2 to 9.7 mg/L. Murray and Andren (*17*) report DOC ranging from 0.5 to 4.9 $mg \cdot L^{-1}$ in 10 storms in Madison, Wisconsin. Glotfelty *et al.* (*19*) report total organic carbon in fogwater ranging from 38 to 55 $mg \cdot L^{-1}$. High concentrations of organic carbon in rain and fog are thought to cause an enhancement in the equilibrium gas scavenging of HOCs due to the strong partitioning of contaminants to organic particles and DOC (*10*).

Atmospheric concentrations of HOCs. Average gaseous concentrations of PCB congeners measured during this study are shown in Figure IV.A-1. Air samples were taken as close as possible to or during each rain event. PCB congeners 19, 40, 119 and 193 (IUPAC numbers) were not detected above the analytical blank in any air sample. Total PCB concentrations (sum of 61 congeners) range from 304 to 542 $pg \cdot m^{-3}$ and are similar in magnitude to the mean total PCB concentration measured at the same site during 1990-1991 (210 $pg \cdot m^{-3}$; *32*). Particle-associated PCBs were not present in air samples above our operational detection limits ($\Sigma PCB \sim 2.1\ pg \cdot m^{-3}$) but are estimated to be <3% of the total atmospheric burden in the Chesapeake Bay region based on congener-specific vapor pressures, ambient temperatures, and the ambient TSP levels in the region (*3,32*).

Phenanthrene, pyrene, and fluorene, respectively, are the dominant PAH species in the gas phase and higher molecular weight compounds, such as indeno[*123-cd*]pyrene and benzo[*ghi*]perylene are predominantly particle-associated (Figure IV.A-1). The highest particle-associated PAH concentrations were observed on October 6th, while the highest gas phase PAH concentrations were observed two weeks earlier. Variations in organic contaminant gas-particle distributions result from changes in temperature and particle composition over relatively short temporal scales and are not unexpected. Similar variations in PAH speciation in the atmosphere were observed during 1990-1991 at the same site (*32*).

Concentrations of HOCs in rain events. In this study, total PCB concentrations (dissolved + particulate) ranged from 0.85 to 2.2 $ng \cdot L^{-1}$ and are similar to the volume weighted mean concentration of ΣPCBs measured during 1990-1991 at the same site (1.6 $ng \cdot L^{-1}$, *31;* Figure IV.A-2). Murray and Andren (*17*) report a total PCB volume weighted mean concentration

. measured in 10 storms in Madison, Wisconsin of 3.5 ng·L^{-1}, with the particulate-bound PCBs contributing up to 50% of the total. The particle-associated (*e.g.* filter-retained) PCBs in this study contribute less to the total, ranging from 7% to as high as 50% on one occasion. Total (dissolved + particulate concentrations of the individual PAHs) PAH concentrations in precipitation range from 0.5 to 6 ng·L^{-1} (Figure IV.A-3). PAH concentrations in the first storm event are nearly twice as high as those in the other four storms. Large temporal variability in HOC concentrations in precipitation were previously observed at this site, with relative standard deviations observed in semi-weekly integrated PAH concentrations measured at the same site from 1990 - 1991 greater than 100% (*32*). PAHs are predominantly associated with filter-retained particles in precipitation with the exception of fluorene and phenanthrene (Figure IV.A-3). Variable patterns of HOC speciation in rainfall imply that the mechanisms of wet deposition of HOCs (*e.g.*, wet scavenging) are highly variable. Differences in contaminant speciation in rain may result from differences in scavenging mechanisms among storms.

Interestingly, particle-associated PAH concentrations on a weight basis of particles (μg/g) measured in rain collected on 24 September are considerably higher than those observed in the atmosphere prior to the storm, perhaps due to dissolution of non-PAH enriched particles in the rain drops (*e.g.* soluble sulfate aerosol particles providing a higher TSP concentration in dry air relative to rain; Figure IV.A-4). The enhancement of PAHs on rain particles may also be due to selective removal of particles which are enriched in PAHs. The removal of particles from the atmosphere by precipitation has been shown to be a function of particle size (*38,39*). Slinn *et al.* (*38*) argue that particles much less than 0.1 μm are efficiently scavenged by raindrops. Accordingly, several workers suggest that PAHs are generally associated with atmospheric particles less than 0.1 μm (*40-43*). Hence, it is not unlikely that enhanced particle-associated PAH concentrations in rain (on a weight basis) relative to air are the result of selective scavenging of submicron particles which are enriched with PAHs. PAH concentrations observed in the next rain event are considerably lower than those observed in the earlier event (Figure IV.A-4), suggesting that the particles were effectively removed from the atmosphere *via* rain scavenging during the first storm.

Contaminant distributions in rain. Within raindrops, HOCs are either dissolved or associated with filter- and non-filter retained particles. Dissolved HOC concentrations in rain supported by equilibrium partitioning with the surrounding gas phase can be estimated from measured contaminant concentrations in the gas phase and temperature-corrected air-water partition coefficients (Henry's Law Constants, H; *12*), assuming the droplet reaches equilibrium with the surrounding air. Henry's Law describes the equilibrium distribution of a compound between the gas and liquid phases for dilute solutions as:

$$[[R \times T] / H] = C_d / C_g \qquad [1]$$

where R is the ideal gas constant (8.21 x 10^{-5} m^3·atm·mol^{-1}·K^{-1}), T is temperature (K), H is the compound specific Henry's Law constant (HLC, m^3·atm·mol^{-1}), C_d is the dissolved HOC concentration (ng·m^{-3}) and C_g is the gaseous HOC concentration (ng·m^{-3}). In order to accurately

predict gas/dissolved HOC distributions, it is necessary to know Henry's Law constants (H) at the ambient temperature. Generally, H values reported in the literature result from laboratory measurements at 25°C or are calculated from measurements taken at different temperatures. Tateya *et al.* (*44*) have demonstrated that the dependence of H on temperature for PCB congeners is given by $\ln H = 18.58 - 7859 \cdot T^{-1}$. Similar relationships have been reported for other HOC compounds (*4,45*) including mirex (*46*), hexachlorocyclohexane (*47*), and methoxylated phenols (*48*). For PAHs, a similar dependence of H on temperature as that for PCB congeners is generally assumed (*37*). In this study, H values for PCBs at ambient air temperatures were estimated at each air temperature measured during atmospheric sampling from the values at 25°C using the slope of Tateya et al. (*44*). Henry's Law constants for PAHs calculated at 25°C using published solubility and vapor pressure data (*49-51*) were corrected to ambient sample air temperatures using the slope of Tateya *et al.* (*44*) and compound specific intercepts (*37*).

In this study, aqueous PCB and PAH concentrations in rain, predicted from ambient gaseous concentrations and Henry's Law, are less than measured filtrate concentrations by an average factor of about 100, indicating that the rain is apparently supersaturated with respect to the ambient air concentrations (Figure IV.A-5). This apparent enrichment of HOCs in rainwater is similar to that reported for contaminants in rain and fogwater (*8,10,17*). Higher than predicted dissolved PCB levels in precipitation were observed by Murray and Andren (*17*). Capel *et al.* (*10*) report that less than 1% of PCBs, *n*-alkanes, PAHs, phenol, and many chlorinated dioxins and furan congeners are truly dissolved in the aqueous phase of fogwater. Pesticides in coastal fogwater collected near Monterey, California are also enriched relative to the gas phase (*8*).

Calculating dissolved HOC levels supported by gas exchange assumes that the raindrop reaches equilibrium with the surrounding air during its fall, and that our ground-level air measurements adequately characterize the gaseous phase. Scott (*7*) argued that gas exchange across the droplet surface is rapid and the time required to reach equilibrium is <1 second. There is some uncertainty in this estimate, largely resulting from the assumption that the droplet is well mixed and from errors in the air-water mass transfer coefficient. Using macroscopic-scale transfer coefficients, we estimate times to equilibrium of less than ten minutes, which is likely an upper bound to Scott's estimate. Schwartz and Frieberg (*52*) and Warneck (*53*) also conclude based on theoretical calculations that times to equilibrium are short. It is also conceivable that enrichment results from the raindrops passing through an air layer with higher gaseous HOC concentrations than those which we measured at ground level. A 10-100 fold increase in HOC concentrations at height relative to ground level would be required to quantitatively explain our observed enrichments. Knap and Binkley (*54*) measured chlorinated aromatic compounds at differing altitudes over the Western Atlantic, and observed no clear trends in concentration with altitude. Increases in gaseous HOC levels with altitude are unlikely for two reasons. First, the sources of HOCs are at ground level. Second, decreasing temperatures with altitude result in gaseous HOCs adsorbing onto aerosol particles. Finally, enrichment of HOCs in precipitation may result from the coincident scavenging of surface-active organic matter which creates organic surface films on raindrops. However, Gill *et al.* (*55*), using data from Likens *et al.* (*56*), demonstrated that there is insufficient surface-active organic material in raindrops to form a

cohesive film on drops less than 4 mm. They further conclude that for cloud and fog drops up to 1 μm, only about a 1% monolayer surface coverage will occur. Similarly, Ligocki *et al.* (*12*) argue that surface films do not control the rates of HOC gaseous sorption to rain drops. Hence, the observed enrichment of contaminants in the filtrate is probably not due to non-equilibrium, nor to vertical gradients in gaseous HOCs, nor to the presence of organic surface films on liquid drops, but rather results from the scavenging of HOC-enriched submicron particles.

This conclusion is consistent with that reported by Duinker and Bouchertall (*15*), who suggest that precipitation scavenging of particle-associated PCBs is the dominant mechanism for PCB removal from the atmosphere *via* rainfall despite a low ambient aerosol fraction in the atmosphere. Further, they conclude from Doskey and Andren's data (*57*) that submicron particles may be the main absorptive phase for particle-associated PCBs in the atmosphere. Similarly, Gonzales and Murr (*58*) determined based on electron micrographs of individual raindrops that the average particle diameter scavenged by a raindrop is ~0.2 μm, suggesting that submicron scavenging of HOCs contributes substantially to the overall wet removal of HOCs from the atmosphere rather than the presence of surface-active organic films on raindrops.

Contaminant partitioning to filter- and non-filter retained particles in rain. The speciation of HOCs in rainwater may be modeled by assuming that the dissolved and particulate phases achieve a sorptive equilibrium which can be predicted from the HOC's octanol-water partition coefficient (K_{ow}) and the carbon content of the particles (*21-30,59,60*). To evaluate whether this approach explains the observed PCB and PAH distributions in our event precipitation samples, we calculated partition coefficients to filter-retained and non-filter-retained particles as follows:

$$K_{oc,nf} = [C_{nf} * 10^6 / C_{d,p} * [DOC]] \qquad [2]$$

where $[C_{nf}]$ is the estimated concentration ($ng \cdot L^{-1}$) of HOC associated with non-filter retained particles, $[C_{d,p}]$ is the predicted equilibrium dissolved HOC concentration in rain ($ng \cdot L^{-1}$) and [DOC] is the concentration of dissolved organic carbon in rain ($mg \cdot L^{-1}$; *9*), and:

$$K_{oc,f} = [C_{p,f} * 10^6 / C_d * TSP_r] / [foc] \qquad [3]$$

where $C_{p,f}$ is the measured filter retained particle-associated HOC concentration in rain ($ng \cdot L^{-1}$), $C_{d,p}$ is the predicted equilibrium dissolved HOC concentration in rain ($ng \cdot L^{-1}$), TSP is the suspended solids concentration in rain ($mg \cdot L^{-1}$), and foc is the fraction of particulate organic carbon. Measured dissolved organic carbon concentrations were used as a surrogate measure of the quantity of non-filter-retained particles in the rainwater, as has been previously done for surface waters (*23*).

Partition coefficients for PCBs and PAHs in rainwater are generally much higher than those measured in surface waters (*61*), suggesting that atmospheric particles are more sorptive than solids in surface waters. Partition coefficients of PCB congeners to filter-retained particles

are approximately ten times larger than those to particles which pass through the glass fiber filter (Figure IV.A-6). In contrast, PAH partition coefficients to filter-retained particles, while very large, are approximately ten times lower than the partition coefficients to the non-filter-retained particles. This difference between the partitioning behavior of PCBs and PAHs may reflect their different atmospheric behaviors. PCBs are released as gases into the atmosphere primarily *via* volatilization from the Earth's surface, and subsequently adsorb onto aerosol particles, most likely through a reversible surface adsorption process. In contrast, PAHs emitted during combustion processes may be incorporated into the matrix of primary aerosols. A fraction of PAHs associated with particulate matter in the atmosphere, therefore, is likely bound within the particle matrix and not exchangeable with the surrounding gas phase (*62,63*). The extremely high PAH partition coefficients measured in rainwater are consistent with the idea that PAHs are tightly bound by atmospheric particles, and do not achieve sorptive equilibrium with the surrounding liquid within a raindrop.

If HOCs reached sorptive equilibrium within rainwater, their partition coefficients to both large (*i.e.* filter-retained) and small (*i.e.* non-filter-retained) particles should depend directly upon HOC hydrophobicity (as parameterized by their octanol-water partition coefficients). As shown in Figure IV.A-6, estimated organic carbon-normalized partition coefficients of PCBs and PAHs in rainwater are poorly correlated with K_{ow}. It is interesting to note that in previous studies Baker *et al.* (*23*) and others (*21,22*) have argued that the lack of dependence of K_d on K_{ow} observed in surface waters resulted from incomplete separation of particles and dissolved HOCs. However, in this study we have eliminated that artifact by calculating dissolved HOC concentrations from the surrounding gas phase concentrations, yet still observe partitioning behavior which is independent of HOC hydrophobicity. Based on this analysis, we conclude that these compounds are enriched in rainwater due to scavenging of contaminant-loaded submicron particles rather than the coincident scavenging of surface active organic matter which subsequently binds dissolved contaminants. In addition, we conclude that classic sorption models derived from studies of HOC associations with sediments and soils (*i.e.*, *59,60*) cannot be used to predict HOC speciation in precipitation.

Murray and Andren (*17*) report similar distributions of PCB congeners in precipitation events, although we observed a larger fraction of submicron particle-associated PCBs in our study. Several of Murray and Andren's precipitation samples were collected during the winter at 0°C when large (> 0.5 μm), filter-retained particles are likely present in rural Wisconsin air due to home heating and wood burning stoves. In order to compare our results to those of Murray and Andren's (*17*), we calculated observed partition coefficients as the ratio of HOC concentrations on the filterable particles to those in the filtrate:

$$K_d = C_{p,f} * 10^6 / (C_{d,r} * TSP_r) \qquad [4]$$

where $C_{p,f}$ is the measured filter retained particle-associated contaminant concentration in rain ($ng \cdot L^{-1}$), TSP_r is the suspended solids concentration (mg^1L), and $C_{d,r}$ is the observed field measured "dissolved" (*e.g.* dissolved + non-filter retained particle-associated contaminants)

contaminant concentration ($ng \cdot L^{-1}$). Our calculated distribution coefficients for PCB congeners in precipitation are very similar to those found by Murray and Andren (*17*) in ten precipitation events in Madison, Wisconsin. In both cases, weak relationships between K_d and K_{ow} are reported. The similarity between these two studies in both the magnitude of K_d and in the lack of dependence on K_{ow} suggests that both the contaminant speciation in precipitation and the type of atmospheric particulate matter in rainfall in both studies was similar.

To demonstrate the quantitative importance of small particles in the overall removal of HOCs from the atmosphere, the distribution of several HOCs in rain on 11 August 1992 are presented in Table IV.A-2. The gaseous HOC concentrations were measured during the rain event, thereby giving our best estimate of atmospheric HOC speciation. Most of the compounds, all with varying physicochemical properties, are ≤ 9% truly dissolved and the remaining fractions are associated with particles. The least volatile PAH (benzo[*ghi*]perylene) is not predicted to occur in the dissolved phase, as this compound is generally not detected in the ambient gas phase. Rather, the compound is mainly particle-associated due to its relatively low saturation vapor pressure and solubility. Interestingly, particle removal processes contribute a significant portion of PCBs to the total concentration in rain, even though the particle concentrations of these compounds in air are small relative to the total air burden (< 30%).

IVA.5 Summary

Non-filter-retained and filter-retained particulate matter in rainwater play an important role in the overall removal of contaminants from the atmosphere. Estimates of non-filter-retained, particle-associated contaminants in rain from Henry's Law suggest that this fraction comprises up to 80% of the total HOC burden in precipitation, depending on the compound, and that less than 9% of the total HOC concentration in precipitation is truly dissolved. Hence, small particles can significantly contribute to the overall removal of contaminants from the atmosphere *via* rain.

Using dissolved HOC concentrations predicted by gas exchange, we calculated filter retained and non-filter retained particle partition coefficients, utilizing dissolved organic carbon as a surrogate for the non-filter retained suspended solids concentrations. Organic carbon-normalized filter retained particle partition coefficients are larger than those for non-filter retained particles for PCB congeners, but the opposite was observed for PAHs, suggesting that the compounds do not sorb to filter retained and non-filter retained particles in the same way and that particles retained by a glass fiber filter are chemically different than those submicron particles that are able to pass through the filter.

Organic carbon-normalized partition coefficients of PCBs and PAHs in rainwater are poorly correlated with K_{ow}, suggesting that these compounds do not necessarily partition to surface active organic matter within raindrops. Rather, HOCs are mainly removed by the scavenging of contaminant-enriched particles of various sizes. In addition, the lack of dependence of the observed PAH and PCB partition coefficient suggest that HOC partitioning in rainwater does not reach sorptive equilibrium and that extrapolation of sorption models based on HOC binding with

Table IV.A-2. Distribution of Organic Contaminants in Rain, Chesapeake Bay, MD, 11 August 1992

		percent of total in rain			percent of total in air[2]		
Compound	Total Rain Concentration pg/L	Truly Dissolved	Non-filter Retained Particulate	Filter-retained Particulate	Total Air Concentration pg/m³	Gaseous	Particle-Associated
16/32[1]	40	1	71	28	14	99	1
32/28	22	0.7	27	72	13	98	2
33/21/53	70	0.6	95	4	5	97	3
41/64/71	16	0.6	58	41	7	96	4
66/95	36	0.3	45	54	9	92	8
70/76	29	0.5	77	22	13	92	8
118	17	0.6	73	27	5	77	23
146	20	3	64	33	13	73	27
153/132/105	56	1	49	50	11	72	28
174	15	3	35	62	3	80	20
187/182	18	0.4	25	75	4	70	30
phenanthrene	3600	5	59	36	1400	99	1
pyrene	900	8	17	75	400	98	2
chrysene	1900	0.1	22	78	40	69	31
benzo[*b*]fluoranthene	1400	0.09	25	75	15	24	76
benzo[*k*]fluoranthene	710	0.03	23	77	5	19	81
indeno[*123,cd*]pyrene	750	0.03	32	68	6	3	97
benzo[*ghi*]perylene	1000	< 0.1	31	69	8	< 2	98

[1] biphenyl compounds; IUPAC congener groups

[2] air sampled during rain storm; particle-associated concentrations of PCBs estimated from relationships of the gaseous concentration to subcooled liquid vapor pressures (ref *3*) at 30°C

sediments and soils cannot accurately predict HOC speciation in precipitation.

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IVA.7 Figure Captions

IV.A-1. Mean concentrations (N = 4 samples) of PCB congeners (*A*) and PAHs (*B*) in air collected during five storm events that occurred adjacent to Chesapeake Bay, late Summer, 1992. The total PCB concentration is given for the 61 PCB congeners shown in *A*. The standard deviation is given in parentheses. Note the scale difference between the lighter molecular weight PAHs and those that are less volatile (*B*).

IV.A-2. Concentrations and speciation of PCB congeners measured in five storm events that occurred adjacent to Chesapeake Bay in 1992.

IV.A-3. Concentrations and speciation of PAHs measured in five storm events. * = the compound was not quantifiable above the analytical blank.

IV.A-4. Particle-associated PAH concentrations (μg/g) on a weight basis of particulate material in the atmosphere (*A*) and in two sequential rain events (*B* and *C*).

IV.A-5. Observed enrichment of HOCs in rainwater relative to that predicted by gas exchange.

IV.A-6. Filter retained (*A*) and non-filter retained (*B*) particle partition coefficients of PAHs and PCBs in rain, as calculated by equations [2] and [3], which both take into account the presence of non-filter retained particles in the measured dissolved phase. (Log K_{ow} values from references *64,65*).

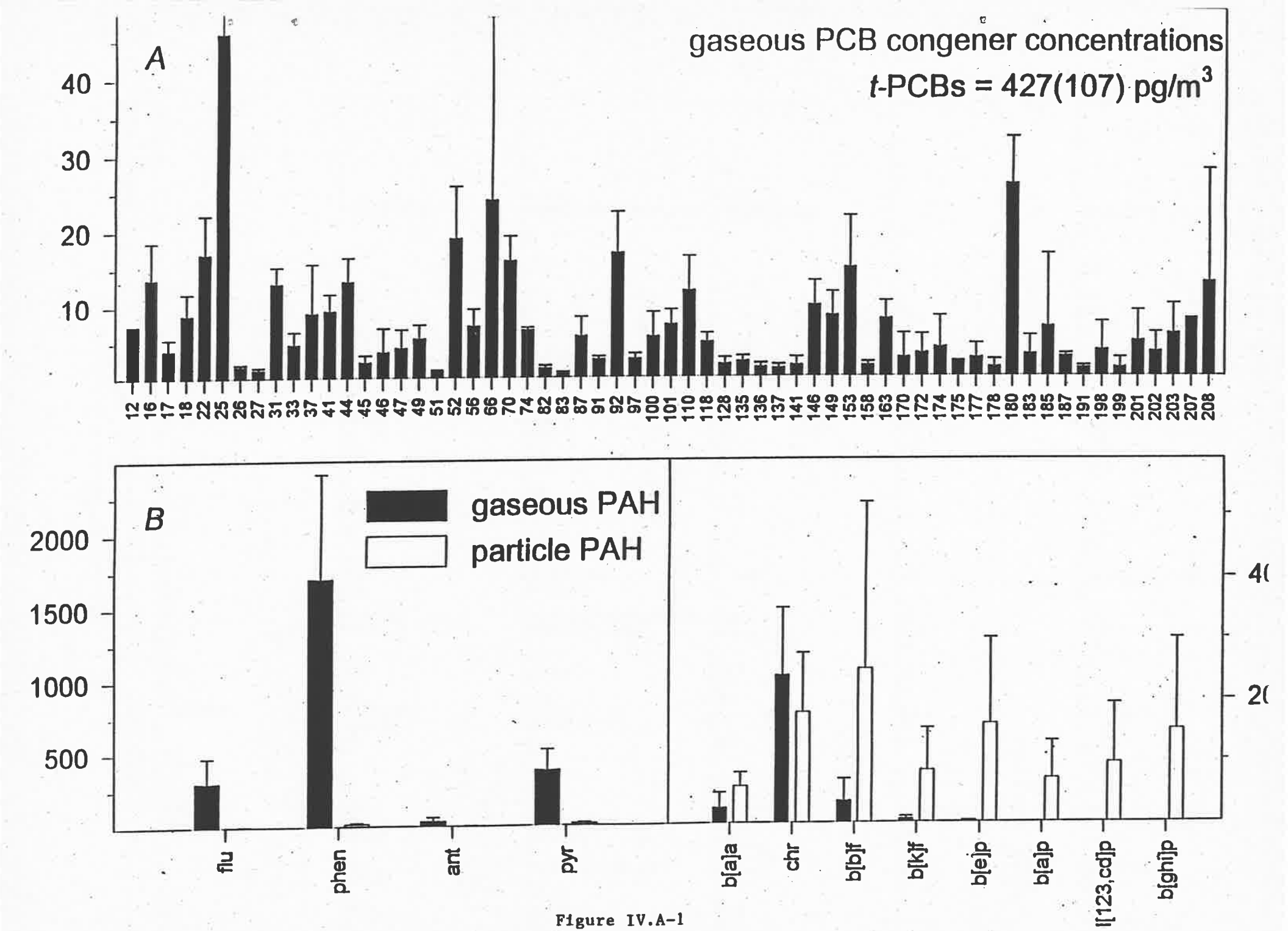
A
gaseous PCB congener concentrations
t-PCBs = 427(107) pg/m3
40
30
20
10
12 16 17 18 22 25 26 27 31 33 37 41 44 45 46 47 49 51 52 56 66 70 74 82 83 87 91 92 97 100 101 110 118 128 135 136 137 141 146 149 153 158 163 170 172 174 175 177 178 180 183 185 187 191 198 199 201 202 203 207 208
B
gaseous PAH
particle PAH
2000
1500
1000
500
flu
phen
ant
pyr
b[a]a
chr
b[b]f
b[k]f
b[e]p
b[a]p
I[123,cd]p
b[ghi]p

Figure IV.A-1

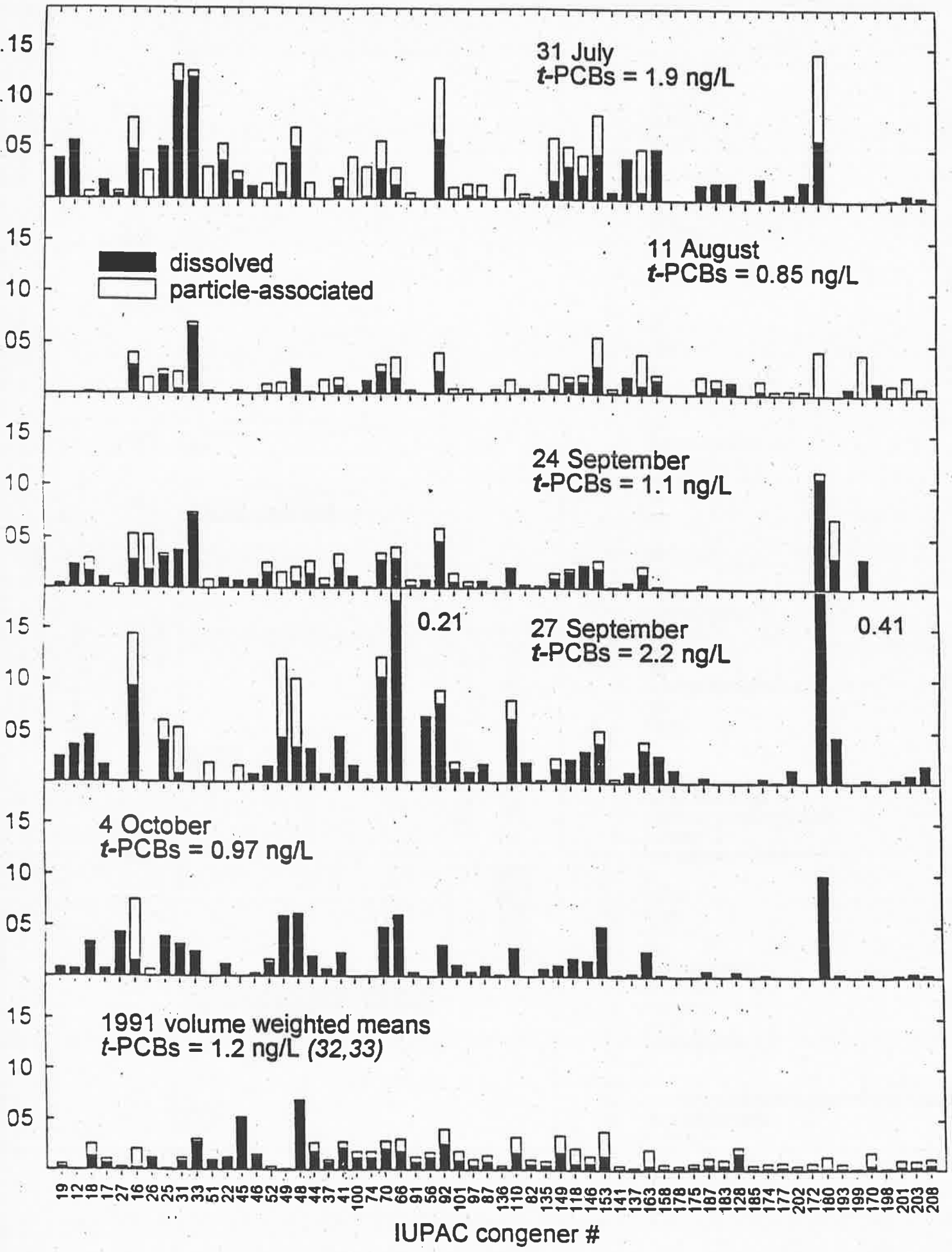
31 July
t-PCBs = 1.9 ng/L
dissolved
particle-associated
11 August
t-PCBs = 0.85 ng/L
24 September
t-PCBs = 1.1 ng/L
0.21
27 September
t-PCBs = 2.2 ng/L
0.41
4 October
t-PCBs = 0.97 ng/L
1991 volume weighted means
t-PCBs = 1.2 ng/L (32,33)
19 12 18 17 27 16 26 25 31 33 51 22 45 46 52 49 48 44 37 41 100 74 70 66 91 56 92 101 97 87 136 110 82 135 149 118 146 153 141 137 163 158 178 175 187 183 128 185 174 177 202 172 180 193 199 170 198 201 203 208
IUPAC congener #

Figure IV.A-2

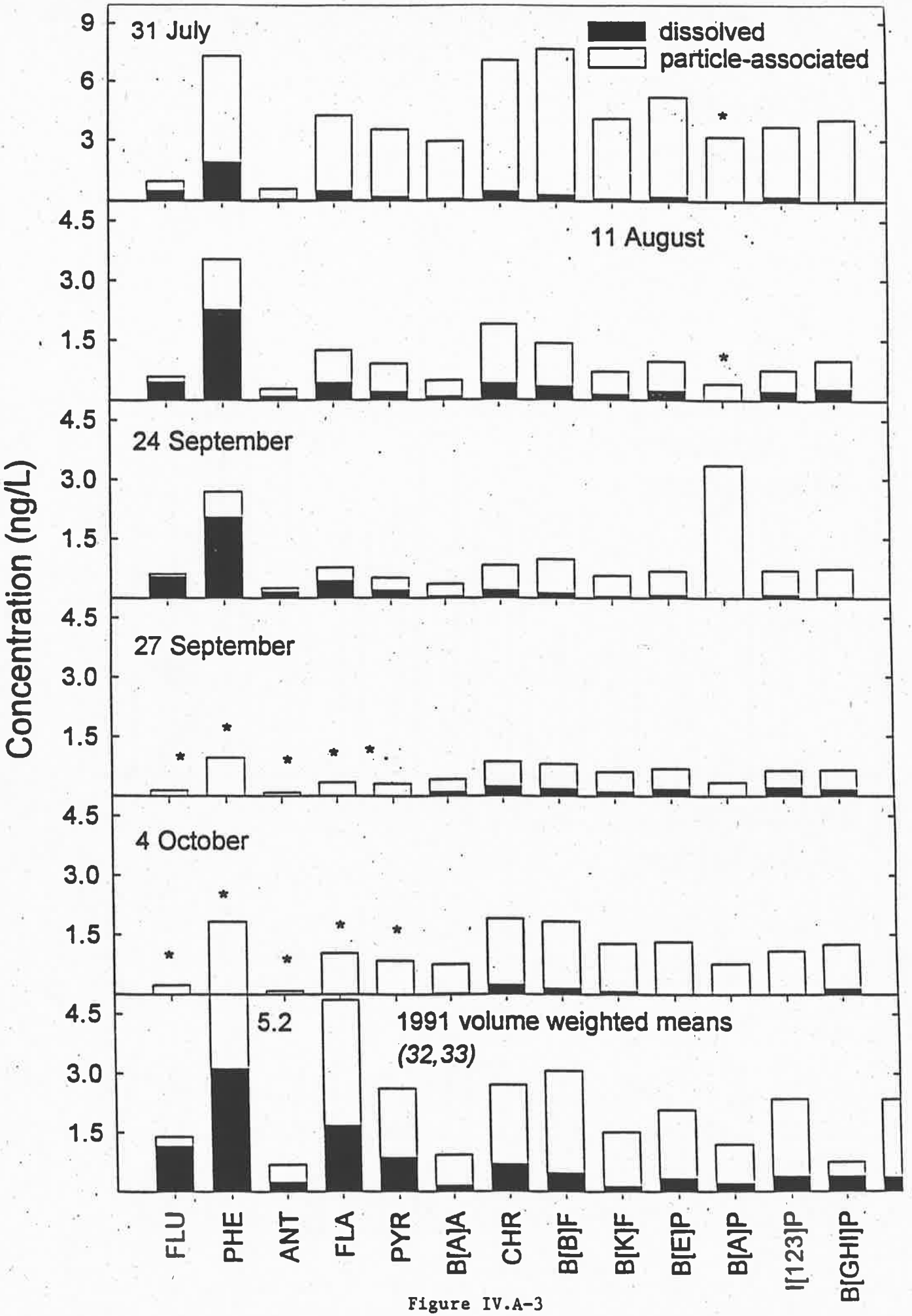
31 July
dissolved
particle-associated
11 August
24 September
27 September
4 October
5.2
1991 volume weighted means
(32,33)
Concentration (ng/L)
FLU
PHE
ANT
FLA
PYR
B[A]A
CHR
B[B]F
B[K]F
B[E]P
B[A]P
I[123]P
B[GHI]P

Figure IV.A-3

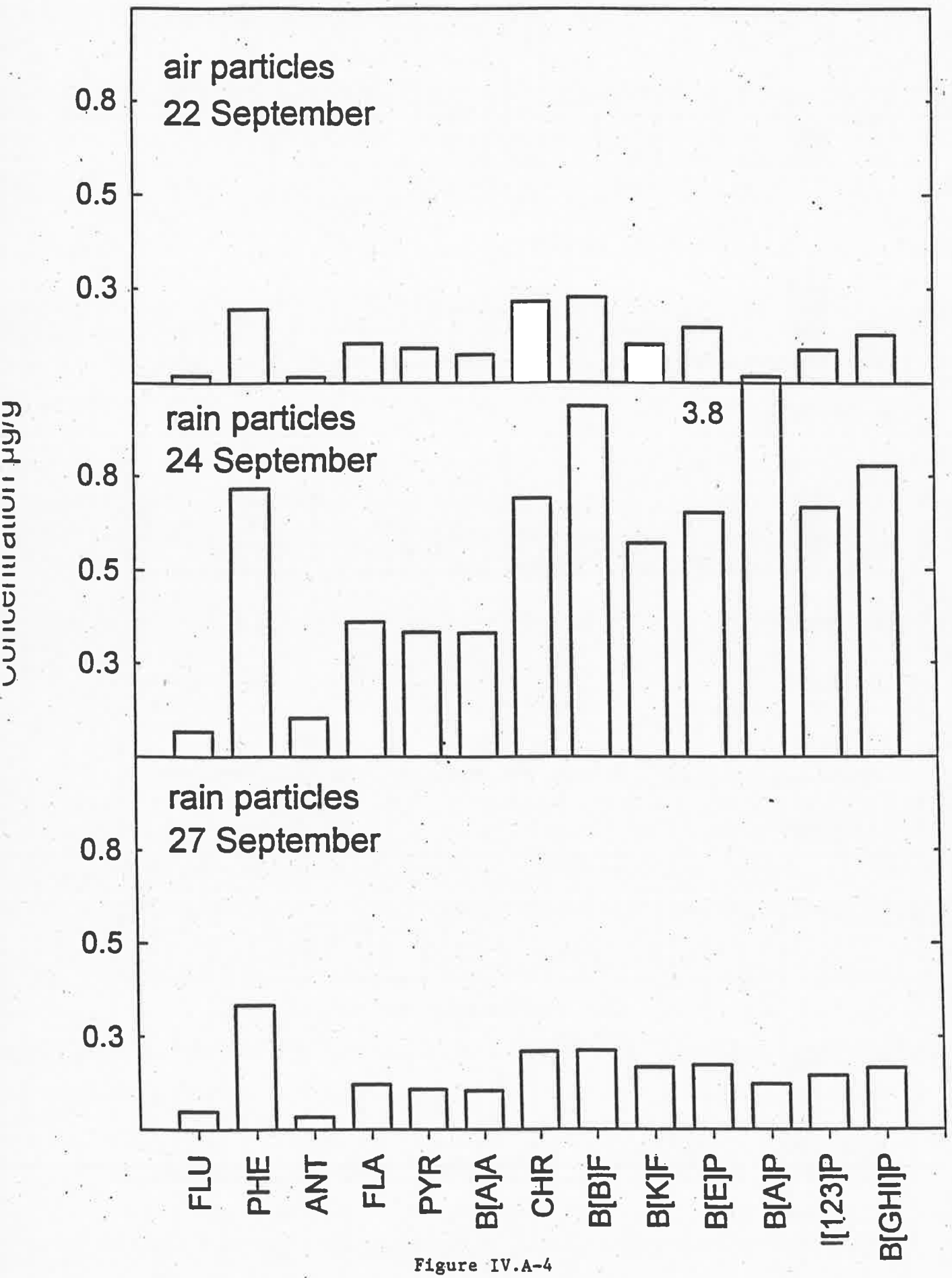
air particles
22 September
rain particles
24 September
3.8
rain particles
27 September
Concentration µg/g
0.8
0.5
0.3
FLU
PHE
ANT
FLA
PYR
B[A]A
CHR
B[B]F
B[K]F
B[E]P
B[A]P
I[123]P
B[GHI]P

Figure IV.A-4

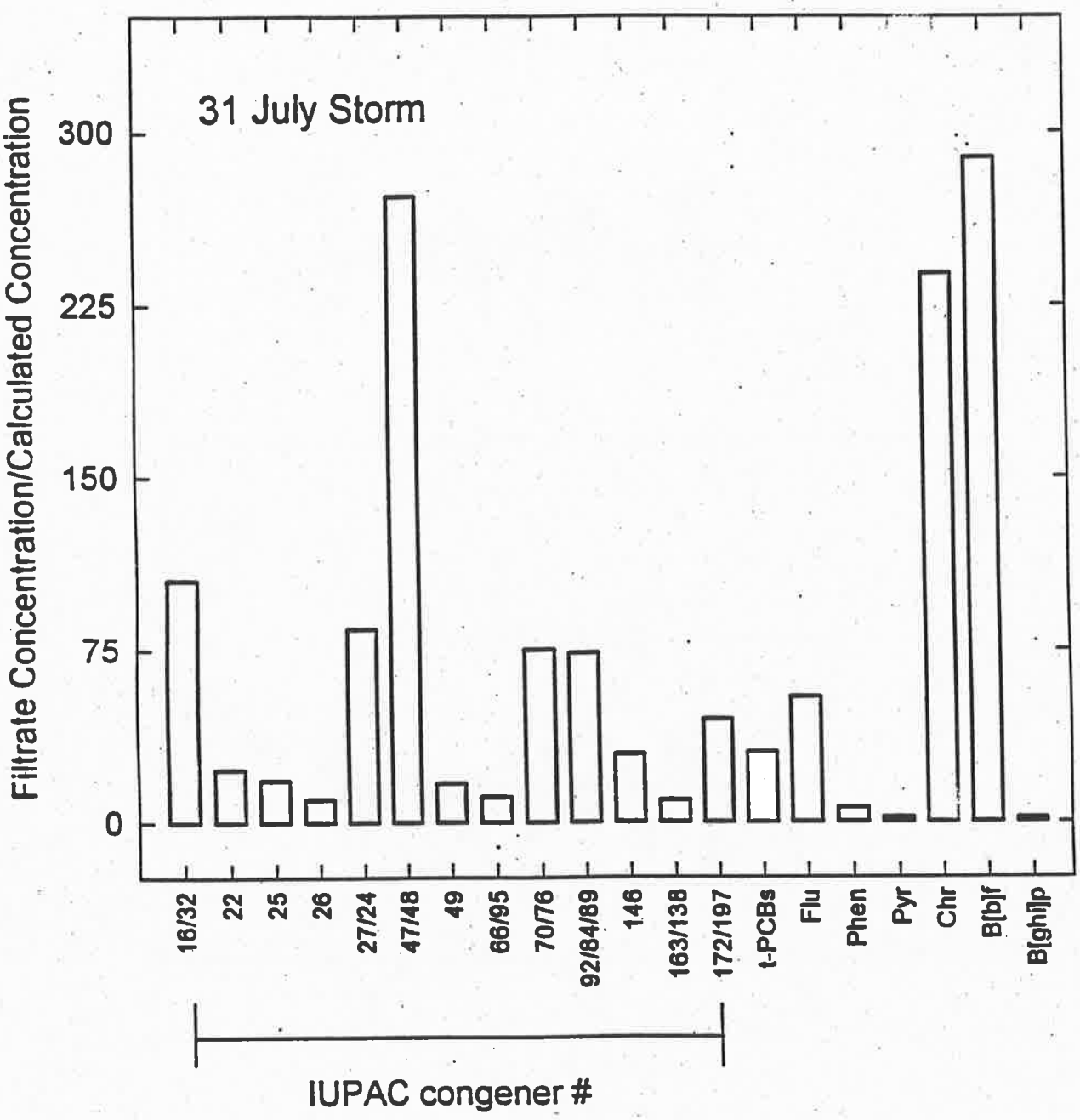
31 July Storm
Filtrate Concentration/Calculated Concentration
300
225
150
75
0
16/32
22
25
26
27/24
47/48
49
66/95
70/76
92/84/89
146
163/138
172/197
t-PCBs
Flu
Phen
Pyr
Chr
B[b]f
B[ghi]p
IUPAC congener #

Figure IV.A-5

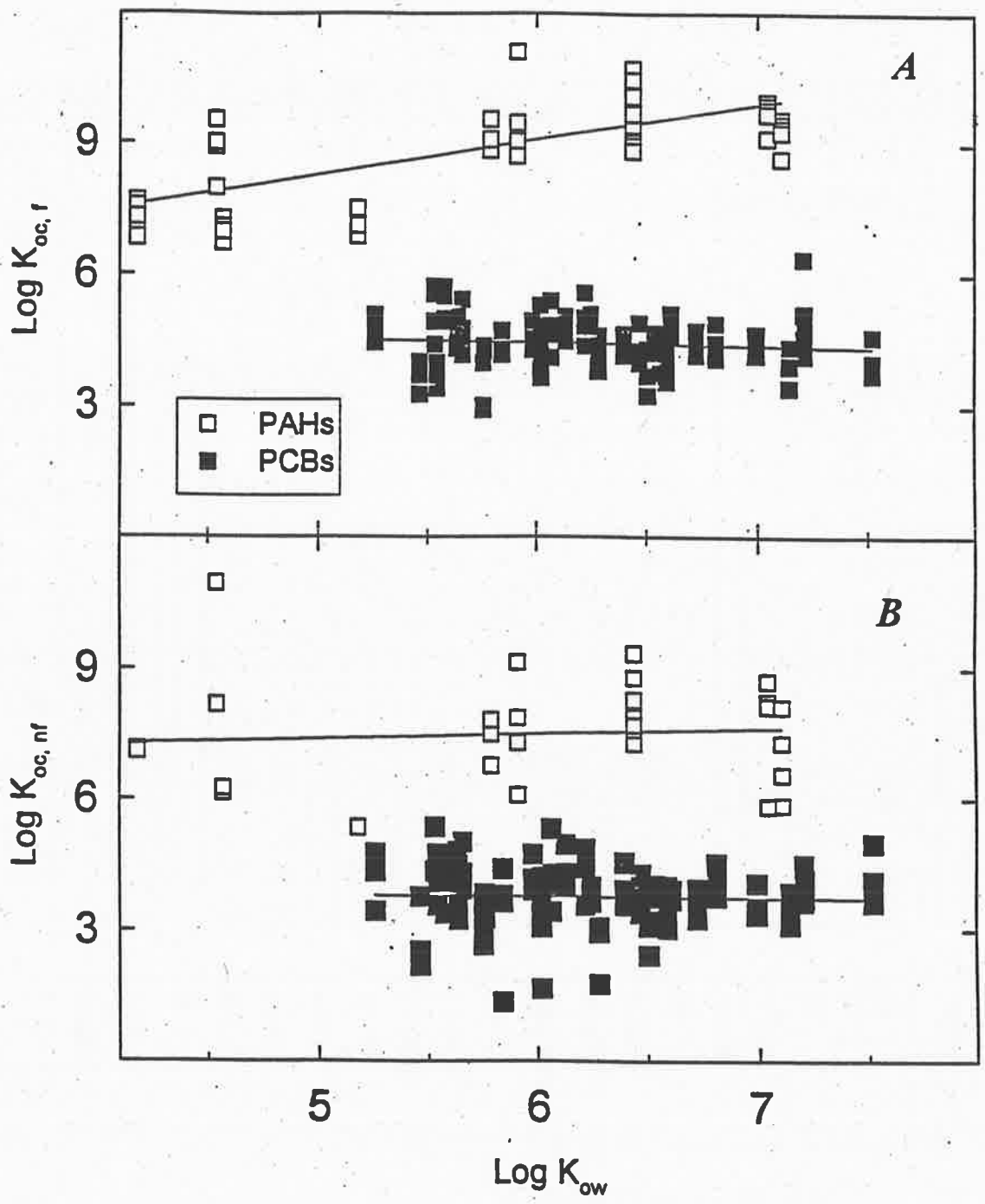

Figure IV.A-6

Part IV.B. The Influence of Submicron Particles on Hydrophobic Organic Contaminants in Precipitation. 2. Scavenging of Polycyclic Aromatic Hydrocarbons by Rain

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Key Words: PAHs, precipitation, submicron aerosols, scavenging

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IVB.1 Abstract

In the second of two papers documenting the importance of submicron particles in controlling the concentrations and distributions of organic contaminants in precipitation, we examine the precipitation scavenging of polycyclic aromatic hydrocarbons (PAHs) as a function of the size distribution of atmospheric particles. We argue that particle scavenging rather than gas scavenging is the dominant removal mechanism for PAHs from the atmosphere by precipitation, and that previously reported PAH gas scavenging ratios were overestimated due to the presence of submicron particles in the operationally-defined dissolved phase of precipitation samples. In a series of five storms in the Chesapeake Bay region during the Summer, 1992, dimensionless PAH scavenging ratios for submicron particles range from 10^4 - 10^5, while those for larger particles (>0.5 μm) range from 10^5 - 10^6. In contrast, gas scavenging ratios, as predicted from temperature-corrected Henry's Law constants, range from 10 to 500. The particle scavenging ratios of PAHs associated with large and small particles are similar to those measured for a variety of inorganic species and with those predicted for in-cloud scavenging of trace atmospheric species. Relative standard deviations of PAH particle scavenging ratios measured during the five storms are nearly 100%, suggesting that precipitation scavenging mechanisms are highly variable among the storms. This variability should be considered when using gas and particle scavenging ratios to model wet depositional fluxes of organic contaminants from the atmosphere.

IVB.2 Introduction

Polycyclic aromatic hydrocarbons (PAHs), often resulting from the incomplete combustion of fossil fuels and biomass, are emitted into the atmosphere either as vapors or associated with primary aerosol particles. Once in the atmosphere, the residence times and ultimate fates of these semi-volatile chemicals depend upon their distributions among vapor, particle, and droplet phases. This partitioning is in turn controlled by the vapor pressures, Henry's Law constants, and aqueous solubilities of the compounds, and by the concentrations and size distributions of particles and droplets in the atmosphere (*1-4*). Chemical transformations and wet and dry deposition remove gaseous and particle-associated PAHs from the atmosphere (*5*). Models used to estimate wet deposition of organic compounds generally distinguish between the scavenging of gaseous and particle-associated compounds (*6,7*). Atmospheric gases dissolve into droplets within clouds and into falling raindrops at rates driven by the diffusive gradient (*e.g.*, as determined by the equilibrium condition *via* Henry's Law) and by the mass transfer and mixing characteristics (*e.g.*, molecular diffusion and within-drop mixing). In contrast, particle scavenging results not from equilibrium partitioning, but rather from physical processes controlled by cloud microphysics, meteorological conditions, and the solubility, number density, and size of ambient aerosol particles (*7-9*). Particles greater than 1 μm are incorporated into falling drops by collisional capture and particles that escape capture *via* frontal collisions may become entrapped in standing eddies developed in the lee of falling water drops (*10*). On the other hand, submicron particles (< 0.05 μm) collide with water drops by Brownian motion and particles with radii in the range 0.05 and 1 μm are influenced by phoretic (*e.g.*, thermal) and coulombic forces (*11,12*). Slinn *et*

al. (*6*) demonstrated that particle scavenging, as described by the collision efficiency of a rain drop with a particle, is a sensitive function of particle size for particles with radii between 0.1 and 10 μm, with a minimum near 0.1 μm and maxima at much less than 0.1 μm and greater than 10 μm, respectively.

Although scavenging of atmospheric particles by precipitation is size-dependent, models describing wet deposition of organic contaminants have not incorporated size-dependent scavenging ratios because few reliable organic contaminant size distribution data were available. Using data gathered from a field study of the removal of PAHs from the atmosphere during five discrete rain events that occurred adjacent to the Chesapeake Bay during late Summer, 1992 (*13*), in this paper we present precipitation scavenging ratios for PAHs associated with small ($<0.5\mu$m) and large ($>0.5\mu$m) aerosol particles. Using temperature-corrected Henry's Law constants, measured concentrations and phase distributions of PAHs in the ambient air and in precipitation (*13*), and the size distribution of aerosol particle-associated PAHs (*14-16*), we suggest that gaseous scavenging coefficients previously reported in the literature (*17,18*) are likely overestimated and that the scavenging of large and small particles by rain is very efficient.

IVB.3 Background

Previous investigators have modeled the overall removal of semivolatile organic contaminants from the atmosphere resulting from the scavenging of gases and particles by precipitation by relating the measured total concentration of contaminant in precipitation (C_{rain}) to the contaminant concentration in the surrounding air (C_{air}) (*17,18*):

$$W_T = C_{rain}/C_{air} = W_g(1-\phi) + W_p\,\phi \qquad [1]$$

where W_T, W_g, and W_p are the total, gas, and particle scavenging ratios, respectively, and ϕ is the fraction of contaminant bound to particles in the atmosphere. The gas scavenging ratio (W_g) is defined as $[C_d] / [C_g]$, where C_d is the dissolved organic contaminant concentration in rainwater and C_g is the gaseous contaminant concentration in the interstitial air. Similarly, W_p in Equation [1] is defined as $[C_p] / [C_{p,air}]$, where C_p is the particle-associated concentration in rainwater and $C_{p,air}$ is the concentration of contaminant associated with aerosol particles. The fraction of contaminant bound to particles (ϕ) is defined as $C_{p,air}/ [C_g + C_{p,air}]$ (*17,18*). Atmospheric gases in true equilibrium with water droplets will be scavenged according to Henry's Law, and the gas scavenging ratio at equilibrium ($W_{g,eq}$) therefore equals RT/H where R is the universal gas constant (8.31×10^5 atm·m^3·mol^{-1}·K^{-1}) , T is absolute temperature, and H is the Henry's Law constant (atm·m^3·mol^{-1}). The relative importance of gas and particle scavenging in removing organic contaminants from the atmosphere during rainfall depends upon the relative magnitudes of $W_g(1-\phi)$ and $W_p\phi$ (*3*). Experimental values of W_p for organic contaminants range from 2000 to 10^6 (*3* and references within) and W_g values range from about 900 to 31,000 for neutral organic compounds (*18*). Particle scavenging is a complex and highly variable process affected both by meteorology and by the size spectra of particles and rain drops (*7,19,20*). Vapor scavenging of HOCs is influenced by their vapor-particle distribution, which is directly related to temperature,

and the surface area and chemical characteristics of the aerosol particles (*1,3*).

Accurate measurements of organic contaminant scavenging coefficients by precipitation are limited by the difficulties of separating particle-associated compounds from those that are truly dissolved in precipitation. Submicron-sized particles (generally less than 0.2 - 0.7 μm, refs *17, 21*) may not be collected quantitatively on glass fiber filters due to slow rates of particle diffusion in water and the presence of double layer charges (*17*). Observed enhancements of organic contaminants in the filtrate of precipitation relative to that supported by equilibrium absorption of ambient gaseous contaminants have been attributed to the presence of contaminant-laden submicron particles in the filtrate (*21-26*). Murphy and Rzeszutko (*22*) report that about 66% of the total polychlorinated biphenyls in rain collected in Chicago passed through a glass-fiber filter. Murray and Andren (*21*) report similar findings for rain samples collected in Madison, Wisconsin. Schomburg *et al.* (*23*) and others (*24-26*) conclude that the enrichment of organic contaminants in filtered fogwater is due to the presence of submicron particle-associated contaminants. We also conclude from our measurements of the speciation of PCBs and PAHs in rain collected adjacent to the Chesapeake Bay that as much as 80% of these compounds are bound to particles not retained by glass fiber filters, and that less than 9% of these hydrophobic chemicals are truly dissolved in rainwater (*13*). Therefore, reported estimates of particle and gas scavenging of organic compounds may be under- and overestimated, respectively, due to filtration inefficiencies.

IVB.4 Methods and Model Development

The distribution of PAHs between the gas and particulate phases in the atmosphere and between operationally-defined dissolved and particulate phases in precipitation were measured in five consecutive storms at a site on the shore-line of the Chesapeake Bay. Sampling and analytical details are described in the preceding paper (*13*), and estimates of wet and dry depositional fluxes of PAHs and other organic and inorganic species at this site are described elsewhere (*27-29*). Of particular relevance to the use of these field measurements to develop a PAH scavenging model are the possible artifacts inherent in any sampling procedures. PAH distributions between the gas and aerosol particle phases were determined by drawing ambient air through a dry glass fiber filter and a polyurethane foam (PUF) plug in series. While it has been suggested that adsorption of gases onto filters may bias this separation (*30*), PAHs were not detected in significant quantities on clean glass fiber filters placed in the sampling stream between the first filter and the PUF plug (*27*). Also, we evaluated the efficiency with which the glass fiber filters trapped submicron particles from the air by placing a five stage Berner impactor downstream of the filter (*14*). After sampling both urban and rural air for 12 hours each, no visible submicron particles were collected on the impactor stages, demonstrating the glass fiber filters efficiently retain atmospheric particles much smaller than their nominal pore sizes. We conclude from these studies that the PAHs measured on the filters and PUF plugs are unbiased estimates of particulate and gaseous concentrations, respectively.

Unlike air, glass fibers are relatively inefficient at separating small particles from rain water. In our studies, the rainwater was filtered during each precipitation event by drawing the

sample through a glass fiber filter and an Amberlite XAD-2 resin column in series. Evidence of small particles passing through the filter include a brown-black discoloration of the head of the resin column and unusually high dissolved organic carbon concentrations in the rainwater (*13*). Although small particles certainly passed through these wetted filters, there was no evidence that dissolved PAHs adsorbed to the filters, as determined by placing a second filter between the first filter and the resin column in the rain sampling train (*31*). Minor amounts of high molecular weight PAHs detected on the back-up filter in the precipitation sampler likely resulted from further trapping of very small particles which passed through the first filter.

Equation [1] can be modified to include scavenging of submicron particles present in the filtrate of precipitation samples:

$$W_T = C_{rain}/C_{air} = W_{g,eq}(1-\phi_T) + (W_{p,f}\phi_p) + (W_{p,nf}\phi_{nf}) \qquad [2]$$

where W_T is the total scavenging ratio, $W_{g,eq}$ is the equilibrium gas scavenging ratio, ϕ_T, ϕ_p, and ϕ_{nf} are the fractions of contaminant associated with all particles, with large, filter-retained particles, and with small particles not retained by filters, respectively. For the purposes of the analyses in this paper, we assume a particle size cut-off of 0.5 μm. Although this is somewhat arbitrary, the following discussion is rather insensitive to the exact cut-off. Murray and Andren (*21*) report a similar particle cut-off for the glass fiber filters used in their study of PCB distributions in Wisconsin precipitation. The particle scavenging ratio for particles greater than 0.5 μm ($W_{p,f}$) is defined as $[C_{p,r,\,>\,0.5\,\mu m}]/[C_{p,air,\,>\,0.5\,\mu m}]$, and the submicron particle scavenging ratio ($W_{p,nf}$) is defined as $[C_{p,r,<\,0.5\,\mu m}]/[C_{p,air,<\,0.5\,\mu m}]$. $C_{p,r,\,<\,0.5\,\mu m}$ can be estimated by taking the difference between measured precipitation filtrate concentrations and that supported by equilibrium gas exchange (*13*). $C_{p,r,\,>\,0.5\,\mu m}$ is the concentration of contaminant associated with particles retained by a glass fiber filter. Equation [2] shows that the relative contribution of gaseous or particle-associated compounds to rain depends upon the fraction of contaminant associated with large and small particles and upon the equilibrium distribution between the gaseous and dissolved phases. Equation [2] is similar to that suggested by Atlas and Giam (*32*), but here we modify their model to include ϕ as a function of large and small particles.

To estimate the fraction of each PAH associated with large and small atmospheric particles (ϕ_f and ϕ_{nf}), the total particulate PAH concentration measured on each date was proportioned according to PAH size distributions measured elsewhere. Recently, we have developed and employed a method using a Berner low pressure 5-stage particle impactor to measure PAH size distributions in rural and urban atmospheres (*14*). For the calculations here, the PAH size distributions measured in Egbert, Ontario during February 1993 were used to estimate the relative amount of each PAH on large ($>0.5\mu$m) and small ($<0.5\mu$m) particles for the five air samples collected in concert with precipitation sampling at the Chesapeake Bay station (*13*). For the samples taken at Egbert, Ontario, between 83 and 98% of the total particle-associated PAH concentration occurred on particles less than 0.5 μm. These distributions are very similar to those previously reported for PAHs and other organic compounds in a variety of atmospheres (*15,16,33,34*). While it would have been preferable to have measured PAH particle size

distributions coincident with our precipitation sampling, the relatively uniformity in organic contaminant size distributions reported in the literature supports this extrapolation. Mean values of ϕ_f and ϕ_{hf}, calculated utilizing our size distribution data and the ambient gaseous and total particle-associated PAH concentrations measured during our Chesapeake Bay field study, are listed in Table IV.B-1. As expected based on their properties, PAHs with vapor pressures $> 10^{-8}$ atm exist primarily as gases in the atmosphere and have particle fractions less than 0.5. Approximately 90% of the PAH which were associated with atmospheric particles occurred on particles $<0.5\mu$m, and there was no systematic difference in the relative amount of dependence of the PAH size distribution on vapor pressure (Table IV.B-1).

Equilibrium gas scavenging ratios were calculated for each PAH using the temperature-corrected Henry's Law constant and the measured gaseous concentration to estimate the truly dissolved PAH concentrations in the precipitation. Henry's Law constants for PAHs calculated at 25°C using published solubility and vapor pressure data (*35-37*) were corrected to the ambient air temperatures during sampling using the relationship developed by Tateya *et al.* (*38*) and compound-specific intercepts (*39*). The resulting Henry's Law constants are significantly higher than those calculated using an alternate relationship reported by ten Hulscher *et al.* (*40*). However, the ten Hulscher *et al.* relationship yields PAH Henry's Law constants at 25°C which differ greatly from values calculated from published PAH aqueous solubilities and vapor pressures (*35-37*). Based on this discrepancy and the limited number of PAHs studied by ten Hulscher *et al.* (*40*), we chose to correct the PAH Henry's Law constants for temperature using the Tateya *et al.* relationships. Using the ten Hulscher *et al.* temperature correction increases our calculated PAH gas scavenging ratios by a factor of 70. Nonetheless, the contribution of gas equilibration to the overall PAH scavenging is negligible (see below).

IVB.5 Results and Discussion

Measured concentrations and speciations (*i.e.*, filterable particles *versus* filtrate) of PAHs in five discrete rain events at a shoreline station near the Chesapeake Bay (see companion paper; *13*) were used to calculate PAH wet scavenging ratios. Total concentrations of PAHs and PCB congeners and their distributions between dissolved, gaseous, and particulate phases are presented in the preceding paper (*13*). Atmospheric gaseous concentrations of PAHs range from 0.2 pg/m^3 (benzo[*ghi*]perylene to 2700 pg/m^3 (phenanthrene). Particle-associated PAHs in ambient air range from <0.01 pg/m^3 (fluorene) to 65 pg/m (benzo[*b*]fluoranthene). Filter-retained particle associated PAH concentrations range from 0.08 ng/L (anthracene) to 5.4 ng/L (phenanthrene). Concentrations of PAHs in the dissolved phase of rain, calculated as that supported by equilibrium gas exchange, range from 0.0025 ng/L (anthracene) to 0.31 ng/L (phenanthrene). Submicron particle associated PAH concentrations, calculated as the difference between the measured filtrate concentrations and the truly dissolved concentrations predicted by Henry's Law, range from 0.06 ng/L (benz[*a*]anthracene) to 2.1 ng/L (phenanthrene).

Mean equilibrium gas scavenging ratios ($W_{g,eq}$) at the ambient sampling temperatures range from 13 (standard deviation (SD) = 11) for anthracene to 540 (SD = 420) for benz[*a*]anthracene

Table IV.B-1. Mean Values of ø for Total, Large, and Small Particles[1]

	Particle Fractions					
	ø T[2]	STD DEV	ø > 0.5 µm[3]	STD DEV	ø < 0.5 µm[4]	STD DEV
fluorene	0.0028	0.0017	0.0003	0.0002	0.0025	0.0016
phenanthrene	0.013	0.0070	0.0011	0.0006	0.011	0.0064
anthracene	0.28	0.4755	0.020	0.0335	0.26	0.4421
pyrene	0.045	0.0358	0.0037	0.0029	0.041	0.0328
benz[*a*]anthracene	0.78	0.2862	0.051	0.0188	0.73	0.2674
chrysene	0.43	0.2243	0.030	0.0154	0.40	0.2088
benzo[*b*]fluoranthene	0.79	0.2048	0.059	0.0153	0.73	0.1895
benzo[k]fluoranthene	0.91	0.0771	0.061	0.0052	0.85	0.0719
indeno[*123,cd*]pyrene	0.97	0.0212	0.050	0.0011	0.92	0.0201
benzo[*ghi*]perylene	0.98	0.0160	0.053	0.0009	0.92	0.0151

[1] $ø = C_p / [C_p + C_g]$ where C_p and C_g are the particle and gaseous PAH concentrations, respectively

[2] for all particles (large and small)

[3] for particles > 0.5 µm

[4] for particles < 0.5 µm

Table IV.B-2. Mean Precipitation Scavenging Ratios[1] of PAHs, Chesapeake Bay, MD 1992

PAH	Equilibrium Gas Scavenging Ratio: Wg eq	STD DEV	Large Particle Scavenging Ratio: Wp > 0.5	STD DEV	Submicron Particle Scavenging Ratio: Wp < 0.5	STD DEV
fluorene	64	46	920000	480000	750000	na
phenanthrene	250	180	1100000	660000	150000	78000
anthracene	13	11	1400000	650000	130000	140000
pyrene	390	280	850000	490000	14000	7900
benz[*a*]anthracene	540	420	1900000	2100000	21000	14000
chrysene	130	95	1500000	1400000	25000	10000
benzo[*b*]fluoranthene	460	100	1700000	2600000	20000	11000
benzo[k]fluoranthene	250	92	2600000	3500000	24000	14000
indeno[*123,cd*]pyrene	**[2]	**	3700000	5600000	50000	16000
benzo[*ghi*]perylene	**	**	2300000	2600000	22000	18000

[1] N = five storms; ratios given to two significant figures

[2] ** = gaseous compound not detected

(Table IV.B-2). Scavenging ratios for particles with radii greater than 0.5 μm ($W_{p,f}$) range from 850000 (SD = 490000) (pyrene) to 3700000 (SD = 5600000) (indeno[*123-cd*]pyrene). Particle scavenging ratios for particles less than 0.5 μm ($W_{p,nf}$) range from 20000 (SD = 11000) (benzo[*b*]fluoranthene) to 750000 (fluorene). In general, with the exception of fluorene, submicron particle scavenging ratios are much lower than large particle scavenging ratios. This is consistent with observations reported for fine-particle size elements such as Pb, Zn, As, and V, which have lower particle scavenging ratios than do the crustal elements (Fe, Al, Mn, and Mg) which have larger mass median effective diameters (*19*). Interestingly, large particle scavenging ratios are greater for the less volatile PAHs, while the submicron particle scavenging ratios decrease with volatility. This may imply subtle shifts in the particle-size distributions of the various PAHs. The large standard deviations associated with the PAH scavenging ratios demonstrate the variability in scavenging mechanisms among the storms.

Gas scavenging ratios observed in this work are ten to 100 times less than those reported previously for rain sampled in Portland, Oregon (*18*, Table IV.B-3). In that study, W_g was calculated as the ratio of the PAH concentrations measured in the filtrate (*e.g.*, truly dissolved *and* bound to submicron particles) and measured in the gas phase. Although Ligocki *et al.* conclude that their measured W_g values at 8°C are consistent with equilibrium gas scavenging and that gas scavenging predominates total PAH washout, the reported washout values are likely overestimated due to the inclusion of submicron particles in the dissolved phase. We recalculated $W_{g,eq}$ (RT/H) values from the original Portland data (*41*), using Henry's Law constants at 8°C estimated by the method used in this study (*13*). Using these values and the air concentration data reported for Portland, we calculate that up to 80% of the PAH concentrations measured in filtered rainwater in Portland are due to PAHs associated with submicron particles

Particle scavenging ratios for large particles measured in this study are one to three orders of magnitude greater than the particle scavenging ratios reported by Hart *et al.* (*42*) and Ligocki *et al.* (*17*). Hart *et al.* report that W_p for Σ-PAHs (N = 16) in rain in Dübendorf, Switzerland ranges from 1000 to 200000 and Ligocki *et al.* (*17*) found that W_p values for individual PAHs range from 2200 to 17000 in Portland, Oregon (Table IV.B-3). Interestingly, the submicron particle scavenging ratios estimated from our data agree well with the filter-retained particle scavenging ratios of these earlier studies. Differences among studies may result either from operational differences in filtration techniques or from actual variations in the amount and type of particles present in precipitation. Rain collected in Dübendorf, Switzerland and Portland, Oregon was filtered through 0.2 μm silver and Teflon membrane filters, respectively, to separate the particle-associated compounds from the dissolved phase, and filtration artifacts were not considered in those studies.

PAH particle scavenging ratios should be similar to the ratios of other compounds associated with atmospheric particles (*e.g.* trace metals, radionuclides; *43*). However, reported particle washout ratios for the below-cloud scavenging of clays, trace metals, and radionuclides range from 500 to 1500 (*44,45*). More recently, lower scavenging ratios for lead, cadmium and copper were reported (69, 129, and 67, respectively; ref. *46*). Scavenging ratios of Chernobyl

Table IV.B-3. Precipitation Scavenging Ratios Compared to Other Measurements

PAH	Wg,eq this work Mean[1]	Wg,eq Portland Oregon[2]	Wp Portland Oregon[2]	Total Washout, Wt		
				this study	Isle Royale[3]	Portland, OR[2]
fluorene	64	1500	15000	2200	n/a	1600
phenanthrene	248	3400	17000	3100	790	3500[2]
anthracene	13	1900	n/a	60000	6090	n/a
pyrene	390	5900	9300	4000	3300	6100
benz[*a*]anthracene	457	12000	1300	110000	51500	4000
chrysene	132	18000	2600	54000	32100	7000
benzo[*b*]fluoranthene	680	7400[2]	2200[2]	120000	n/a	2300[2]
benzo[k]fluoranthene	350	n/a	n/a	180000	n/a	n/a
indeno[*123,cd*]pyrene	2506	n/a	n/a	240000	174000	n/a
benzo[*ghi*]perylene	7218	n/a	3100	140000	248000	3100

[1] equilibrium gas scavenging coefficient; calculated as RT/H; N = 5; mean temperature 24.8°C

[2] rain at 8°C; ref *17,18*; benzo[*b*]- averaged with benzo[*k*]fluorathene; phenanthrene + anthracene

[3] ref *50*; measured values

radionuclides associated with particles between 0.5 and 1 μm were about 400, which is in good agreement with expected scavenging ratios for continental aerosols in this size range (*47*). All of these literature values are much lower than those observed for PAHs in this work, suggesting that PAHs are associated with particles of different sizes and composition than are these inorganic species. Gatz (*44*) and Hewitt and Rashad (*46*) report that washout ratios of many atmospheric compounds increase with distance from the emission sources. Jafferezo and Colin (*48*) and Tschiersch *et al.* (*49*) conclude that scavenging ratios likely increase with decreasing particle size. Therefore, the PAH particle scavenging ratios reported here suggest that PAHs associated with smaller particles may have traveled further from the emission source relative to aerosol particles enriched with trace elements and radionuclides. Alternatively, Gatz (*44*) reported inorganic particle scavenging ratios on the order of 10^5 to 10^6, which are consistent with particle scavenging ratios for in-cloud scavenging processes (*7*). Hence, the elevated ratios observed in this study may be evidence of in-cloud scavenging of PAHs rather than below cloud washout. In any event, the important observation is that particle-associated PAHs are removed from the atmosphere by rain scavenging with great efficiency for both large (> 0.5 μm) and small (< 0.5 μm) particles.

Total washout ratios (W_T) calculated from equation [2] of PAHs range from 2200 (SD = 1200) for fluorene to 240000 (SD = 290000) for indeno[*123-cd*]pyrene (Table IV.B-4). These values are larger than those reported by others who conducted similar field studies (Table IV.B-3; *17,50*), again suggesting either large spatial variability in scavenging or differences in sampling methodologies. The dominant scavenging process for each PAH depends on the relative magnitude of each process term in equation [2]. In this work, the product of $W_{g,cg}(1-\phi_T)$ is much less than 10% of either $W_p(\phi_p)$ or $W_{nf}(\phi_{nf})$, indicating that gas scavenging contribute a negligible amount of PAHs to precipitation, even for those PAHs that exist predominately in the gas phase in the atmosphere (Figure IV.B-1, Table IV.B-4). Submicron particle scavenging is more effective for removing fluorene, phenanthrene and anthracene from the atmosphere during these rain storms. The remaining PAHs are predominantly removed from the atmosphere by the rain scavenging of particles > 0.5 μm.

IVB.6 Summary

Based on the measured speciation of PAH in the atmosphere and in precipitation, we conclude that equilibrium gas scavenging is not an important removal processes for PAHs during precipitation events. In contrast, incorporation of both large (*i.e.*, filter-retained) and small (submicron) particles into rain drop is extremely efficient, leading to elevated concentration of particle-associated PAHs in precipitation. Because larger particles may be more efficiently scavenged by precipitation than small particles, subtle shifts in the particle size distributions of PAHs and other contaminants in the atmosphere may contribute to the exceptionally high interstorm variability in PAH levels in rainwater. Regardless of the mechanisms responsible, the observed variability in PAH scavenging observed during these five storms suggests that a single set of gas and particle scavenging coefficients is inadequate to accurately model the concentrations of organic contaminants in precipitation. Subsequent estimates of regional wet depositional fluxes of organic contaminants calculated by multiplying measured or modeled atmospheric contaminant

Table IV.B-4. Precipitation Scavenging of Particle-Associated and Gaseous PAHs

PAH	Total Scavenging Ratio: W_t	STD DEV	$W_{p>0.5} \cdot \phi > 0.5$	STD DEV	$W_{p<0.5} \cdot \phi < 0.5$	STD DEV	$W_{g\,eq} \cdot (1-\phi T)$	STD DEV	Dominant Scavenging Mechanism[1]
fluorene	2200	1200	280	222	1900	1163	63	46	s
phenanthrene	3100	1600	1200	994	1700	1289	242	175	s
anthracene	60000	82000	27000	47744	33000	67116	10	10	s
pyrene	4000	3100	3100	3088	580	562	368	267	p
benz[*a*]anthracene	110000	110000	98000	113641	16000	11871	118	180	p
chrysene	54000	49000	44000	48353	10000	6694	74	61	p
benzo[*b*]fluoranthene	120000	160000	103000	155868	15000	9131	96	96	p
benzo[k]fluoranthene	180000	220000	160000	215132	20000	12007	21	21	p
indeno[*123,cd*]pyrene	240000	290000	190000	282340	46000	14826	**	na	p
benzo[*ghi*]perylene	140000	140000	120000	140403	21000	16951	**	na	p

[1] s = submicron particle scavenging; p = large particle scavenging

inventories by constant scavenging coefficients likely contain unacceptable levels of error. Further characterization of meteorological parameters, including the intensity of precipitation and the size distributions of the rain drops, as well better measurements of aerosol particle size distributions and compositions are required in order to more accurately describe the removal of organic contaminant from the atmosphere by precipitation.

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IVB.8 Figure Caption:

IV.B-1. Relative scavenging (mean values) of submicron, filter-retained, and gaseous PAHs in rain. Data are presented in Table IV.B-4.

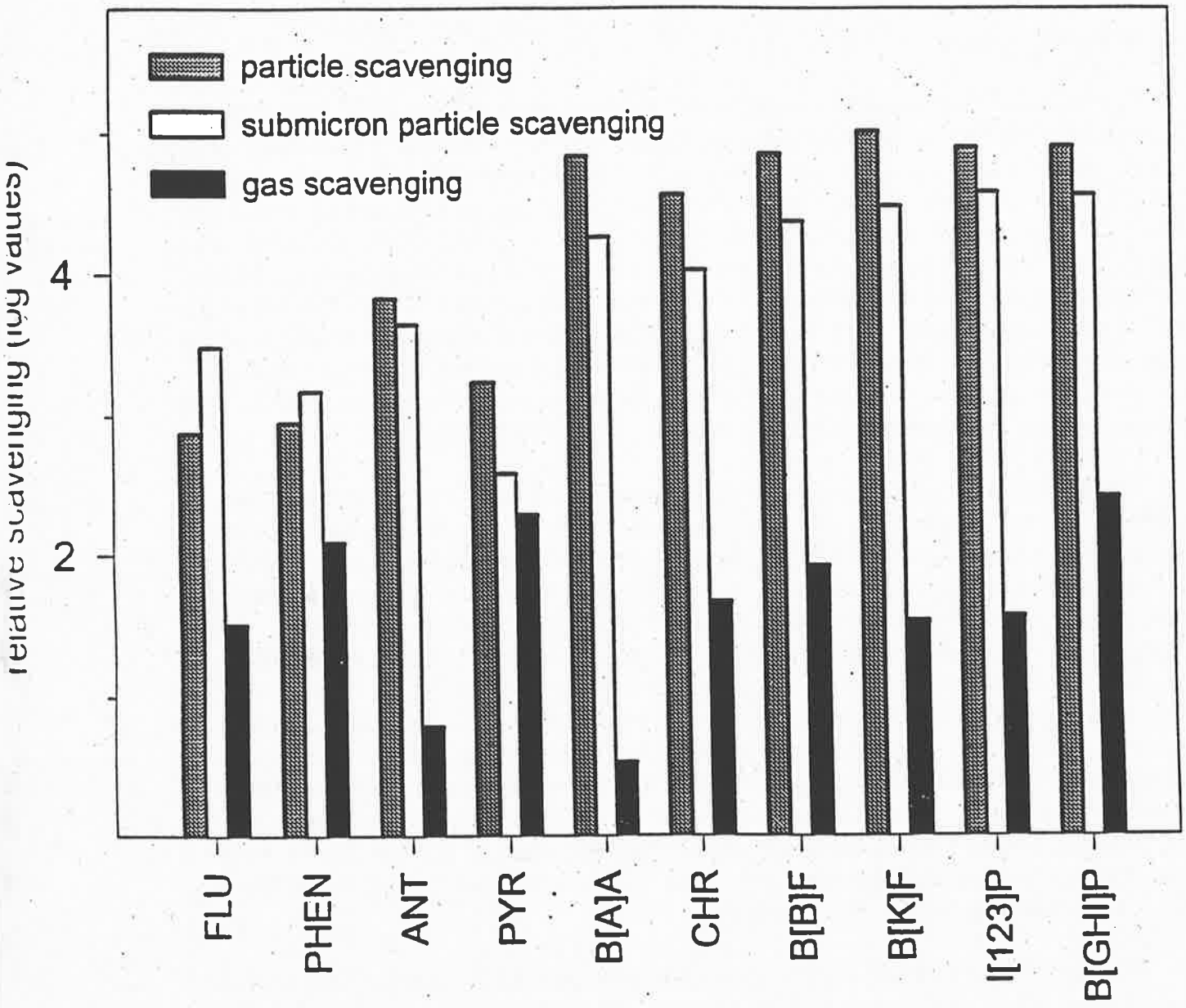
particle scavenging
submicron particle scavenging
gas scavenging
Relative scavenging (log values)
4
2
FLU
PHEN
ANT
PYR
B[A]A
CHR
B[B]F
B[K]F
I[123]P
B[GHI]P

Figure IV.B-1.

V. Conclusions

During 1990-1993, atmospheric deposition of trace elements and organic contaminants to the Chesapeake Bay was monitored at three shore-line locations. Estimates of wet depositional fluxes at a given location are likely precise to with 20-30%, driven by the analytical uncertainty in the precipitation analysis. Extrapolated bay-wide wet deposition loadings are less certain and in this study did not include possible near-field influences of urban areas. Dry aerosol deposition fluxes are much less certain (precision perhaps within a factor of two or three) due to the inexact modeling of aerosol deposition velocities. Diffusive exchange of gaseous organic chemicals across the air-water interface, which may be the dominant transport process for many important species, is not included in this study. As a result of assuming a constant dry aerosol deposition velocity with time and not including gas exchange, the results presented here likely understate the actual seasonal variation in atmospheric deposition to the Chesapeake Bay.

Concentrations of trace elements and organic contaminants in air over the rural Chesapeake Bay are similar at the three sites, and annual averages are influenced by occasional spikes in concentration at each of the sites. Although the highest concentrations in rainwater coincide with small precipitation events, monthly wet depositional fluxes of trace elements and organic contaminants do not significantly vary throughout the year. Concentrations and fluxes of PAHs appeared to decrease between 1990 and 1993, while those of most trace elements remained relatively constant. Concentrations of organic contaminants in rainwater in the Chesapeake Bay region are lower that comparable measurements in the Great Lakes, despite higher atmospheric inventories. Whether this interregional difference reflects more efficient wet scavenging process in the colder, drier Great Lakes, or simply results from methodological difference between the two studies is unclear. Estimates of total atmospheric deposition are within a factor of two between the Chesapeake Bay and the Great Lakes, suggesting that both regions share a common 'regional background' atmospheric deposition signal. The potential for elevated deposition near urban areas is not considered in this comparison.

Comparing the magnitude of atmospheric deposition relative to other possible sources of trace elements and organic contaminants to the Chesapeake Bay is complicated both by inconsistencies in the methods and study periods, and by fundamental differences in the speciation and geochemical reactivity of materials carried by each source. Atmospheric deposition directly to the surface waters of the Chesapeake Bay supplies loads of polycyclic aromatic hydrocarbons which are comparable to or greater than the loads of dissolved PAHs delivered by the Susquehanna River. In contrast, dissolved total PCB loads from the river are approximately three times those from the atmosphere. Particulate-bound organic contaminants discharged from the Susquehanna River are considerably larger, especially during high flows. Atmospheric depositional fluxes of several elements, including lead, cadmium, and chromium, are within a factor of two of the dissolved load from the Susquehanna River. Again, particulate metal loads from the river dominate over both dissolved riverine loads and atmospheric deposition.

In intensive, event-based sampling at the mid-bay Elms site during Summer, 1992,

scavenging of semivolatile organic contaminants by precipitation was studied. By comparing the measured levels of PAHs and PCBs in filtered rainwater to those concentrations predicted to be in equilibrium with the surrounding gas phase, an apparent over enrichment of these contaminants in rainwater was observed. Based upon the high levels of non-filter-retained organic carbon in these rainwater samples, and upon the observed blackening of the adsorption resin in the precipitation sampling train, we conclude that the very efficient washout of submicron particles by raindrops contributes a substantial portion of the overall wet depositional flux. In contrast, gaseous contaminants are not effectively scavenged by raindrops under summertime conditions, and contribute little to the wet depositional fluxes measured here.

The Chesapeake Bay Atmospheric Deposition Study has established annual atmospheric deposition loads to the surface waters of the Chesapeake Bay during the early 1990's. Spatial and temporal variability in atmospheric concentrations and deposition fluxes to rural areas of the bay have been documented. Future studies should address the several important areas not investigated here, including (1) the influence of urban areas on enhanced localized atmospheric deposition, (2) diffusive exchange of gaseous pollutants, including mercury, across the air-water interface, (3) the influence of meteorology, surface conditions, and aerosol size distributions on the dry aerosol deposition rates, (4) deposition rates to and subsequent transmission through the various types of land uses in the watershed, and (5) the fate and reactivity of atmospherically-deposited materials in estuarine waters.

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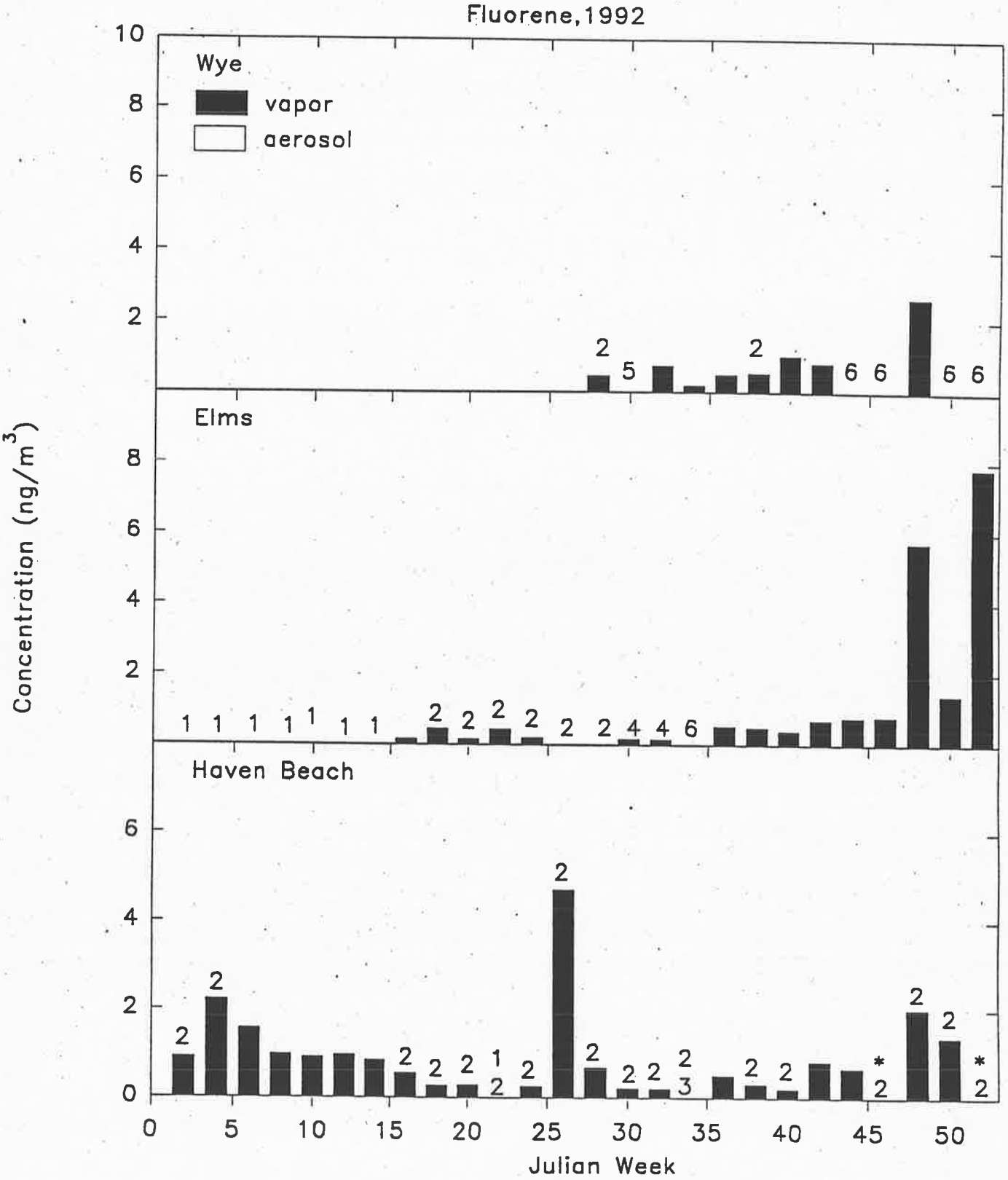
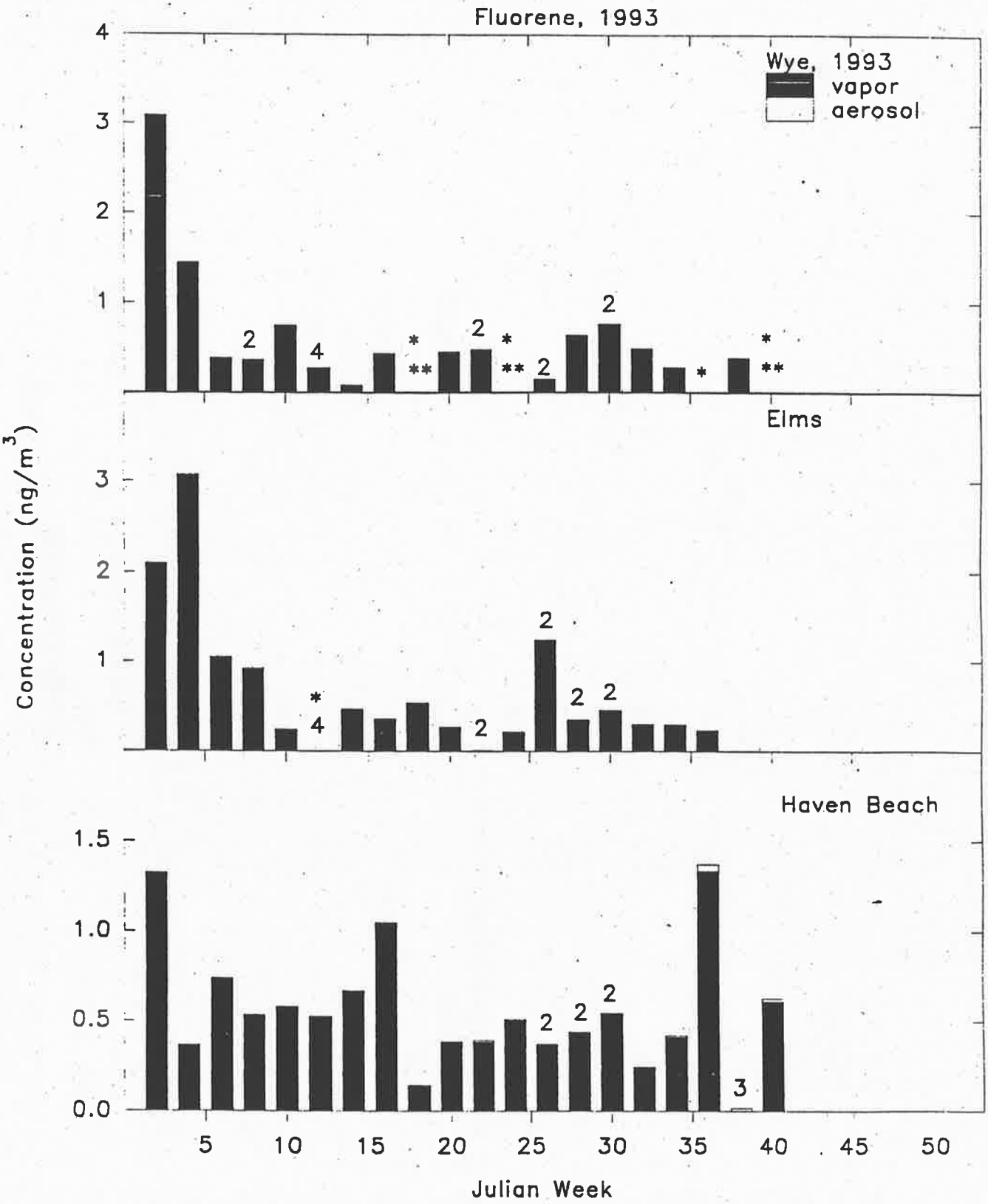
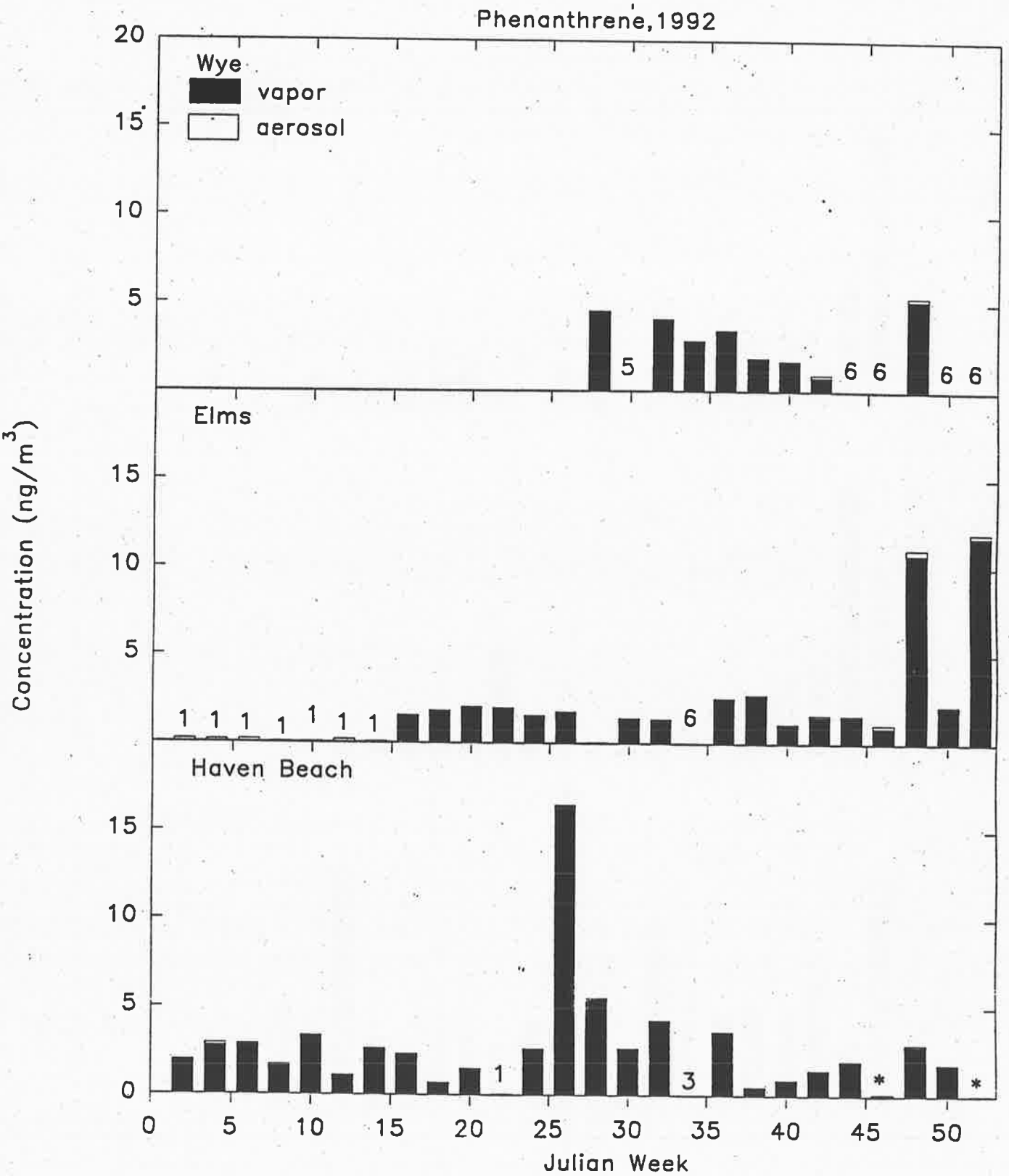
Appendix A1

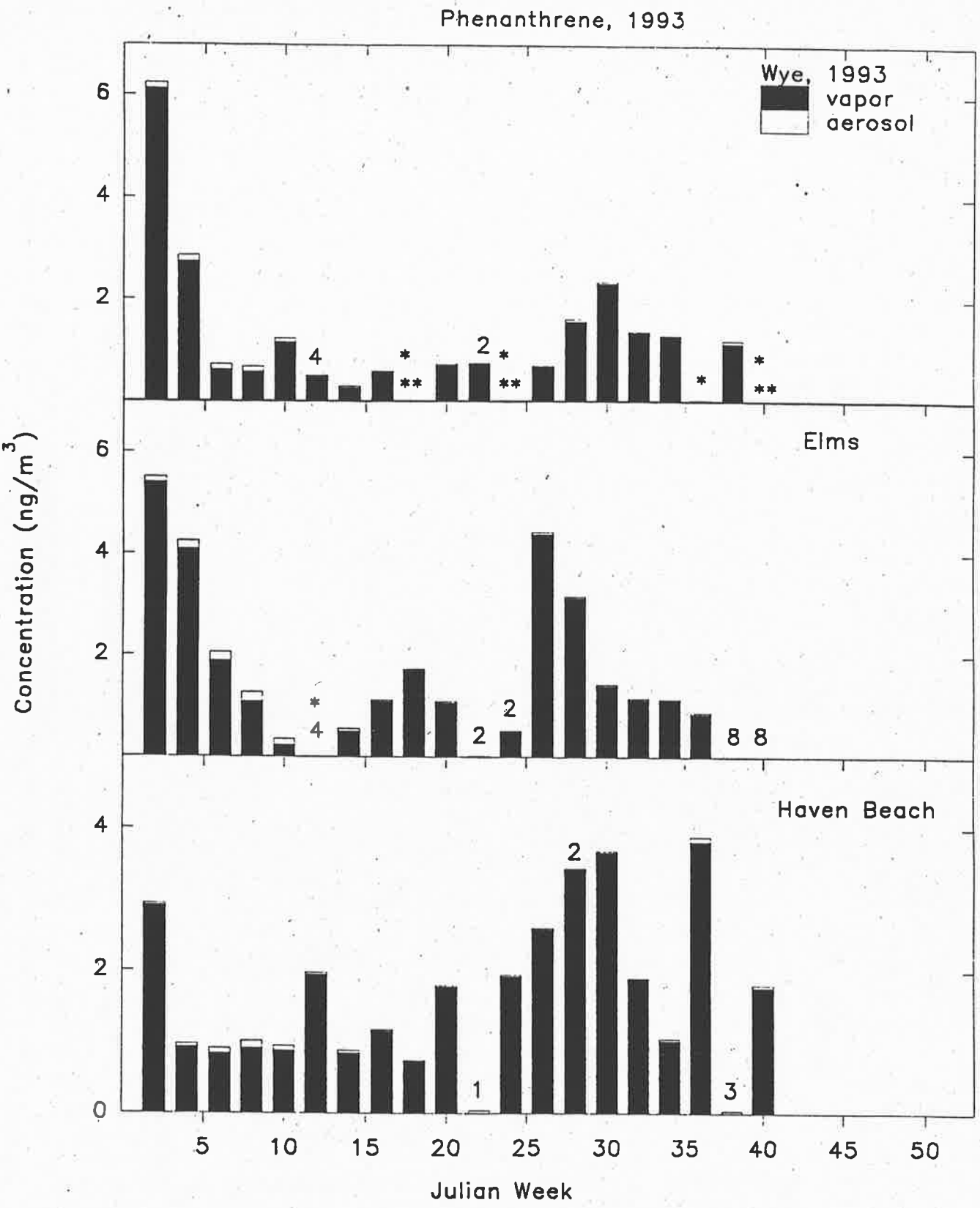


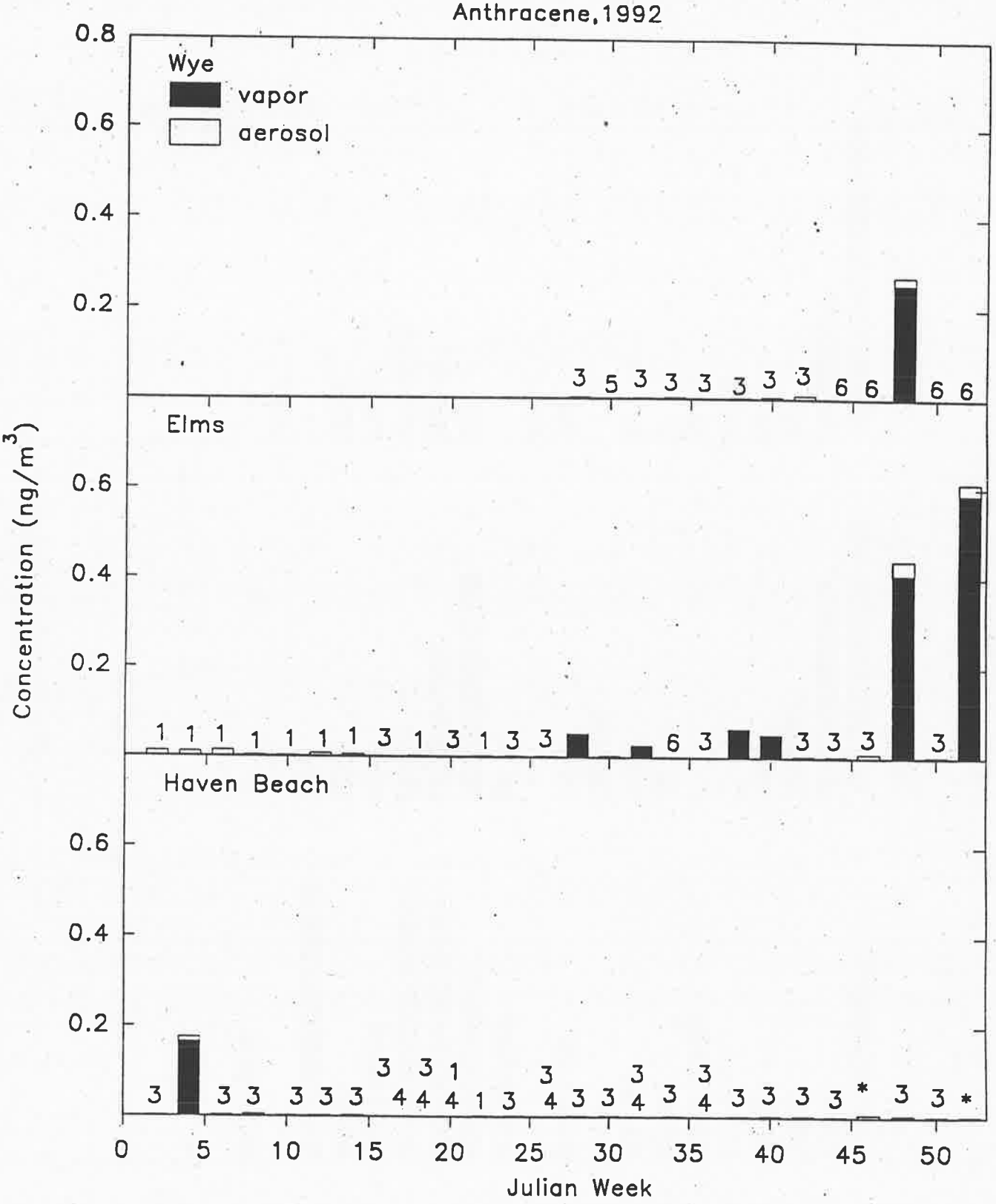
A1.1 Fluorene concentrations collected biweekly in air at the Wye,Elms, and Haven Beach sites.(1=not quantifiable in vapor phase, 2 = not quantifiable on filter, 3=not detected in vapor phase, 4 = not detected on filter, 5 =field blank, 6=no sample taken, *=lost vapor sample **= lost particulate sample).


Fluorene, 1993
Wye, 1993
vapor
aerosol
Elms
Haven Beach
Concentration (ng/m3)
Julian Week

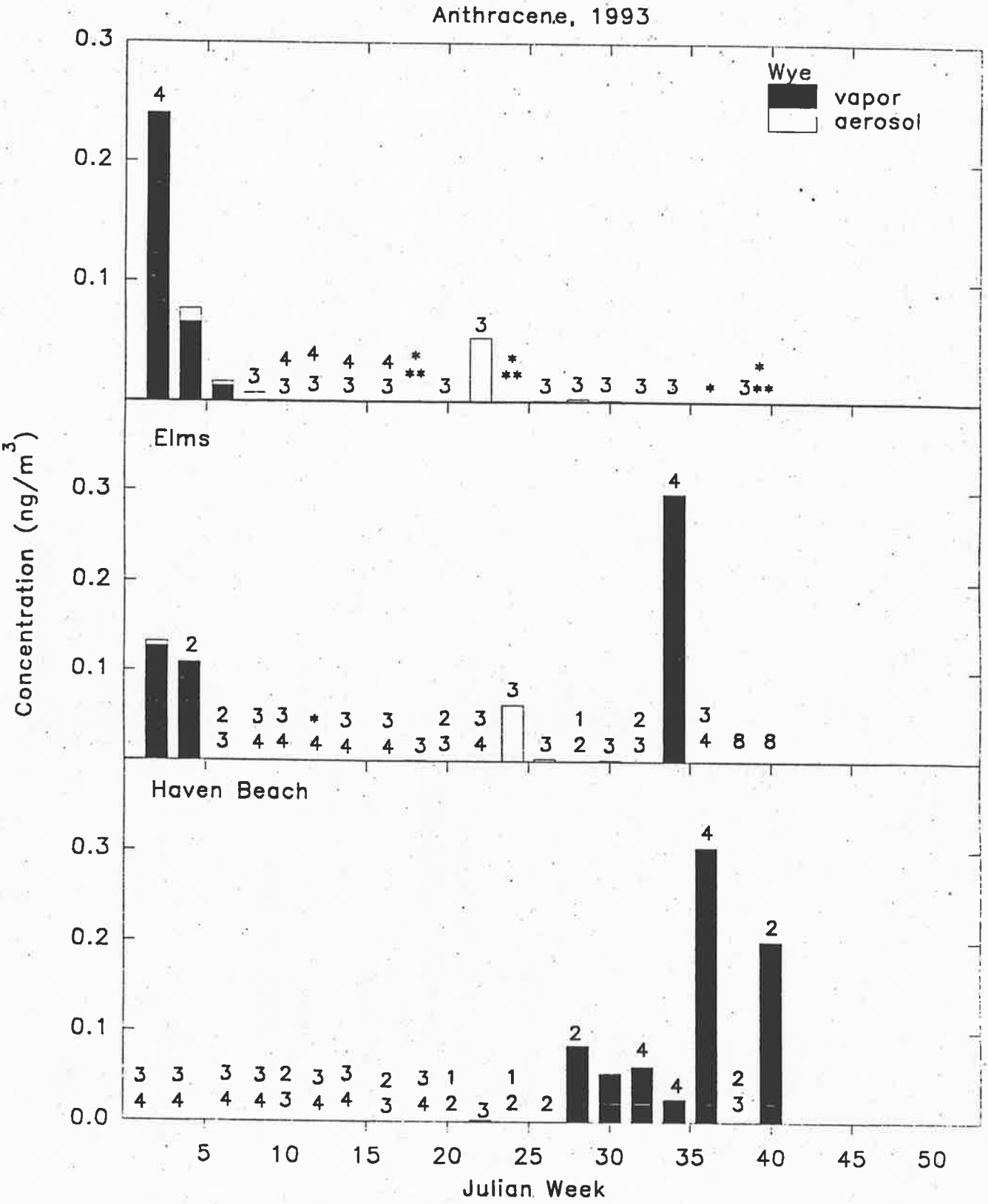


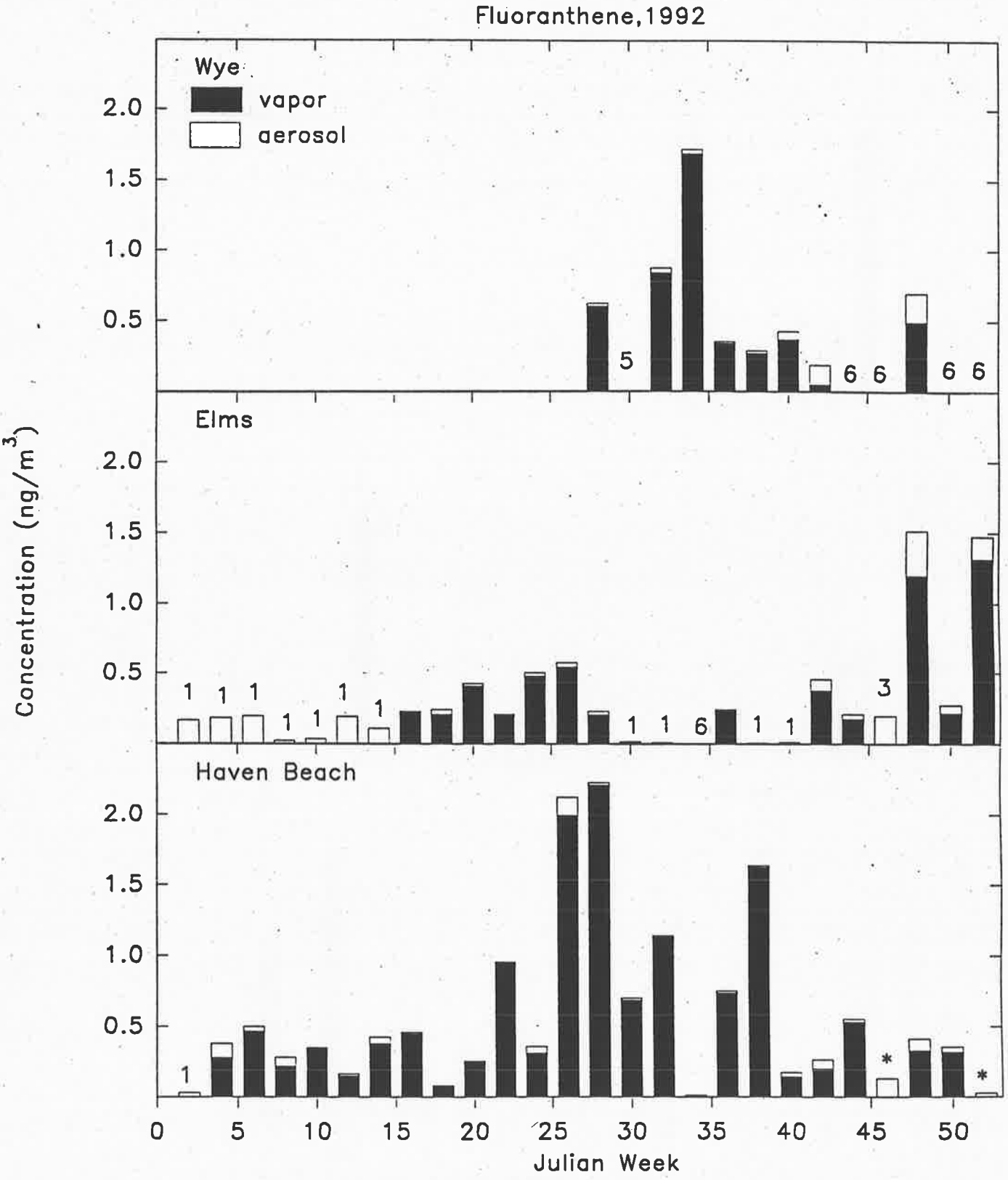
A1.2 Phenanthrene concentrations collected biweekly in air at the Wye,Elms, and Haven Beach sites.(1=not quantifiable in vapor phase, 2 = not quantifiable on filter, 3=not detected in vapor phase, 4 = not detected on filter, 5 =field blank, 6=no sample taken, *=lost vapor sample **= lost particulate sample).


Phenanthrene, 1993
Wye, 1993
vapor
aerosol
Elms
Haven Beach
Concentration (ng/m3)
Julian Week
0
2
4
6
5
10
15
20
25
30
35
40
45
50

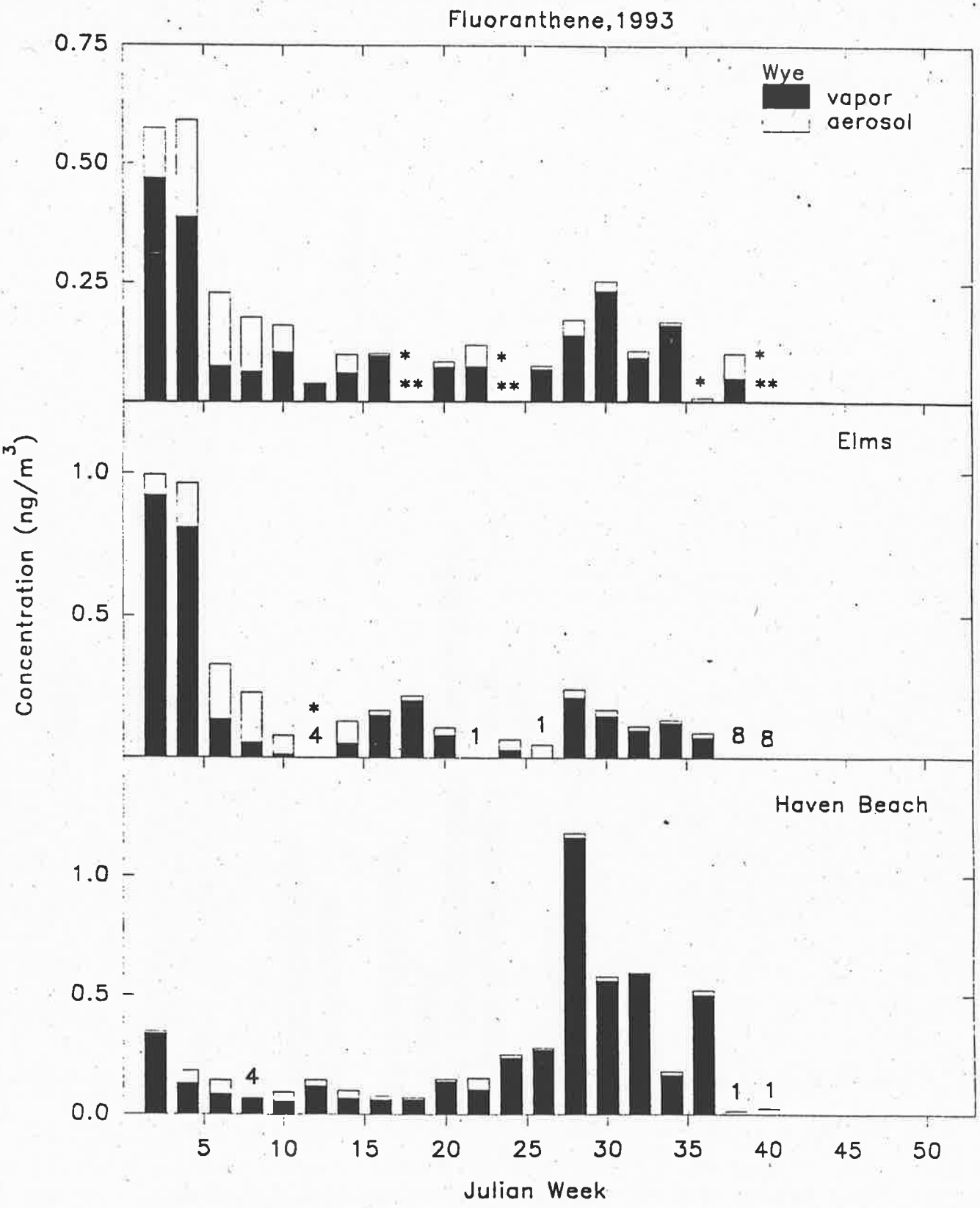


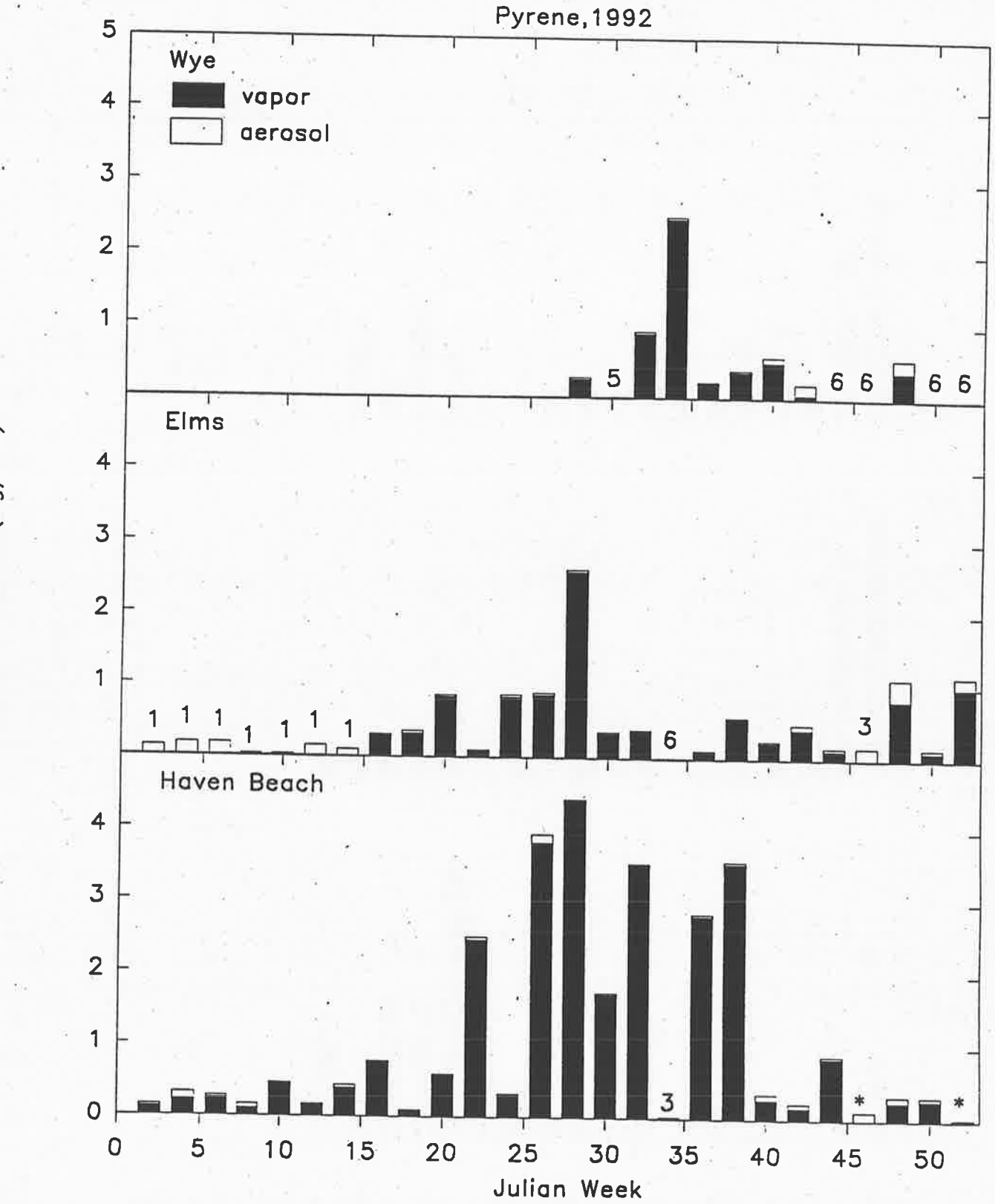
A1.3 Anthracene concentrations collected biweekly in air at Wye,Elms, and Haven Beach sites.(1=not quantifiable in vapor phase, 2 = not quantifiable on filter, 3=not detected in vapor phase, 4 = not detected on filter, 5 =field blank, 6=no sample taken, *=lost vapor sample **= lost particulate sample).


Anthracene, 1993
Wye
vapor
aerosol
Elms
Haven Beach
Concentration (ng/m3)
Julian Week
0.0
0.1
0.2
0.3
5
10
15
20
25
30
35
40
45
50

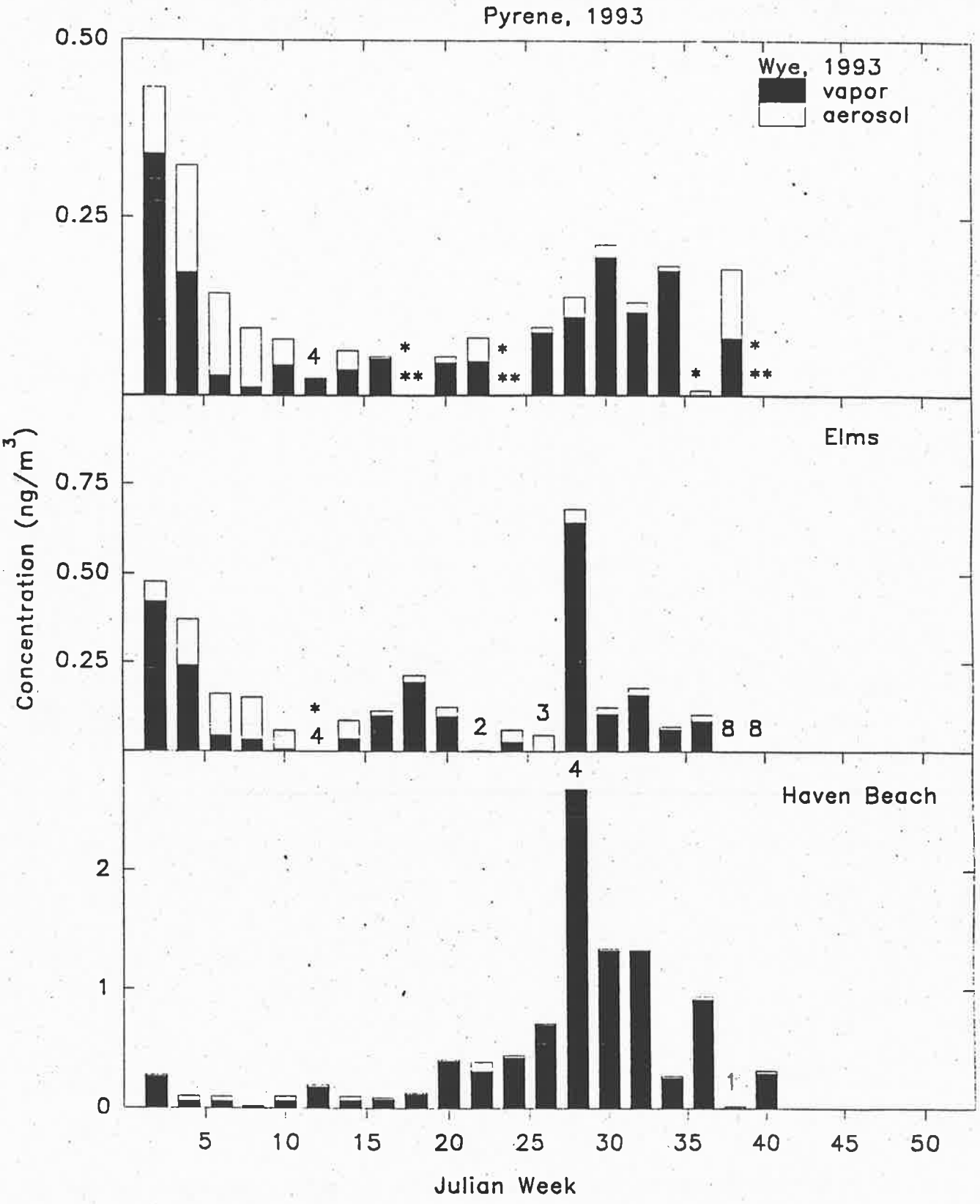


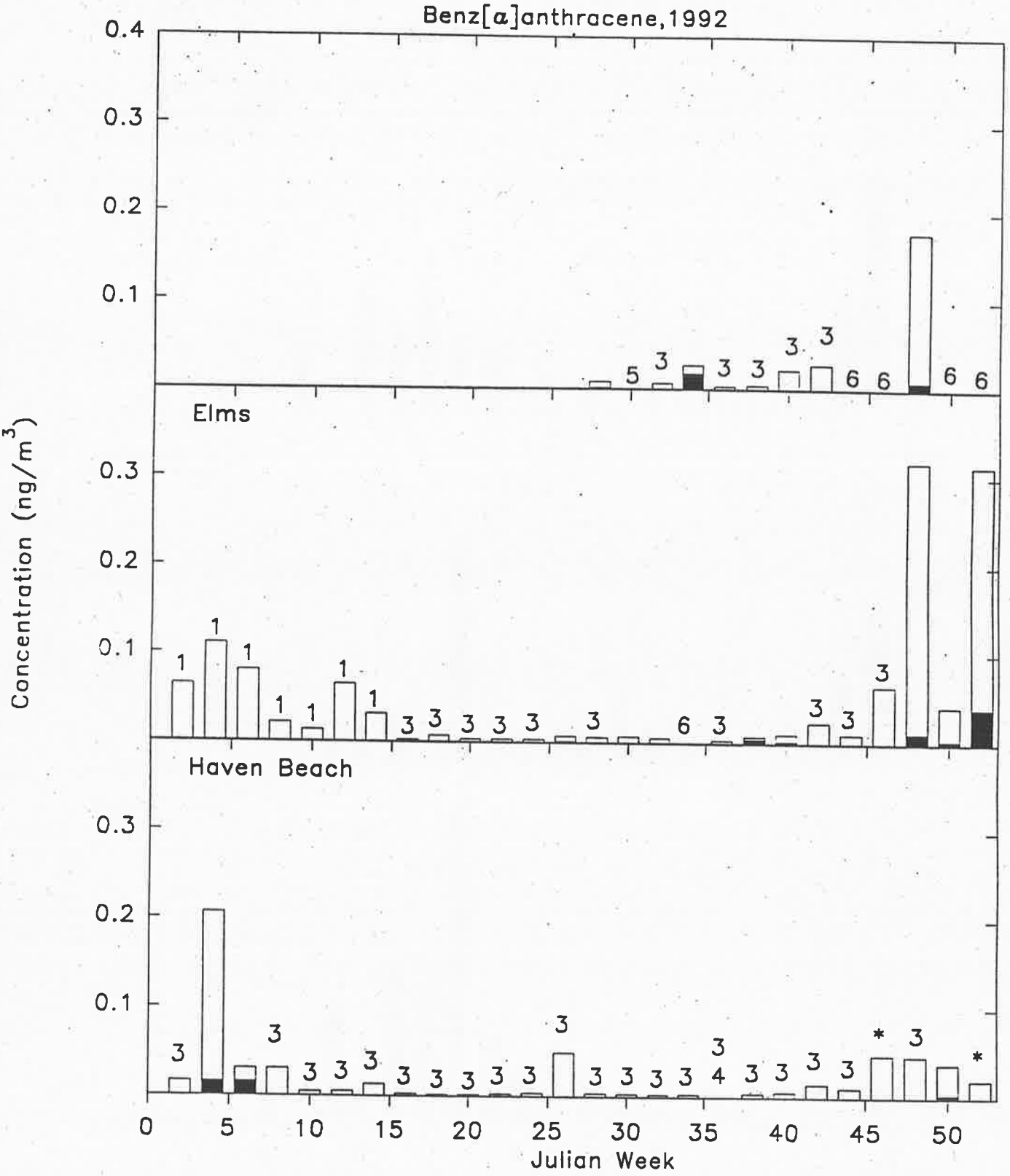
A1.4 Fluoranthene concentrations collected biweekly in air at the Wye,Elms, and Haven Beach sites.(1=not quantifiable in vapor phase, 2 = not quantifiable on filter, 3=not detected in vapor phase, 4 = not detected on filter, 5 =field blank, 6=no sample taken, *=lost vapor sample **= lost particulate sample).


Fluoranthene, 1993
Wye
vapor
aerosol
Elms
Haven Beach
Concentration (ng/m3)
Julian Week
0.75
0.50
0.25
1.0
0.5
0.0
5
10
15
20
25
30
35
40
45
50

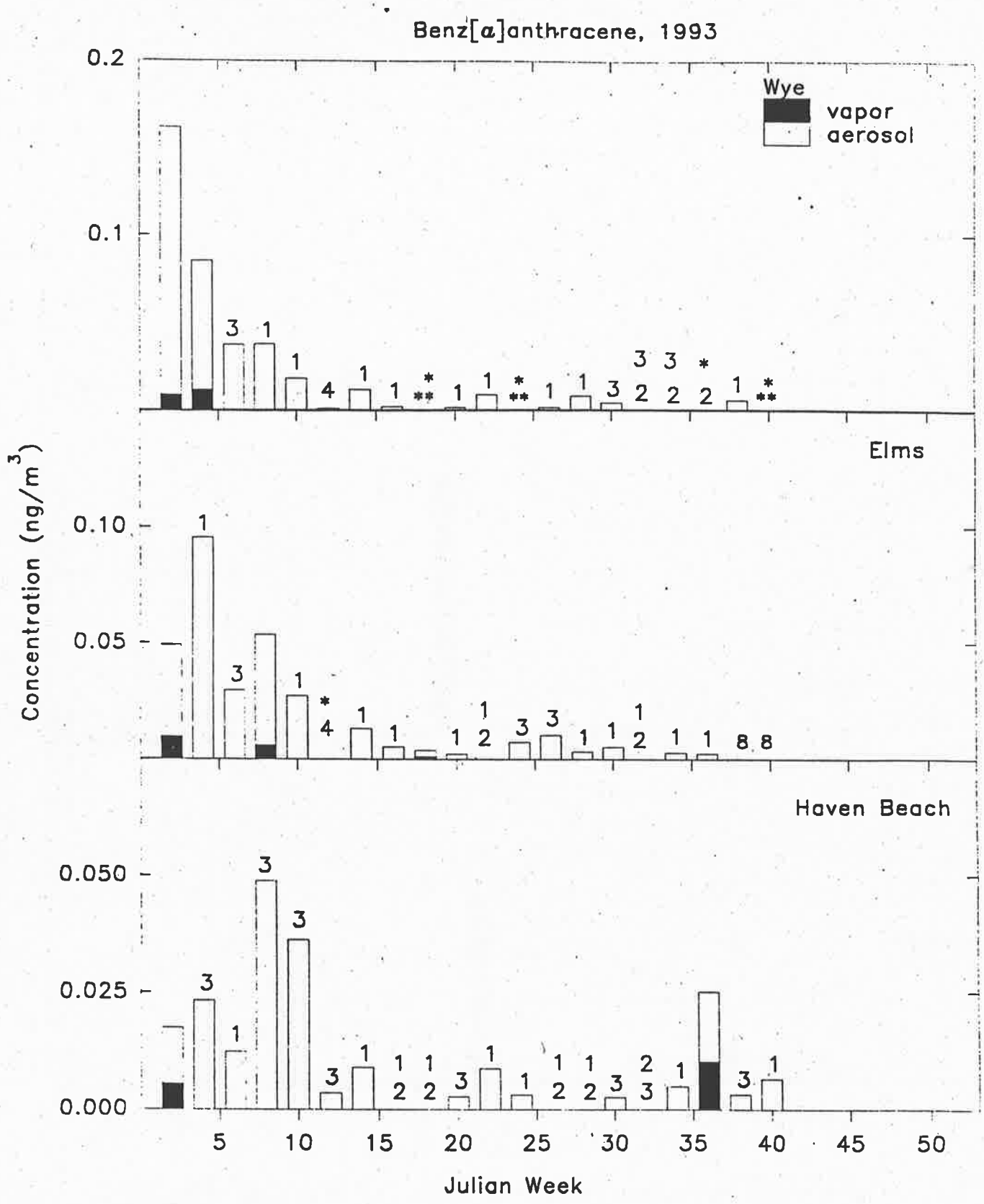


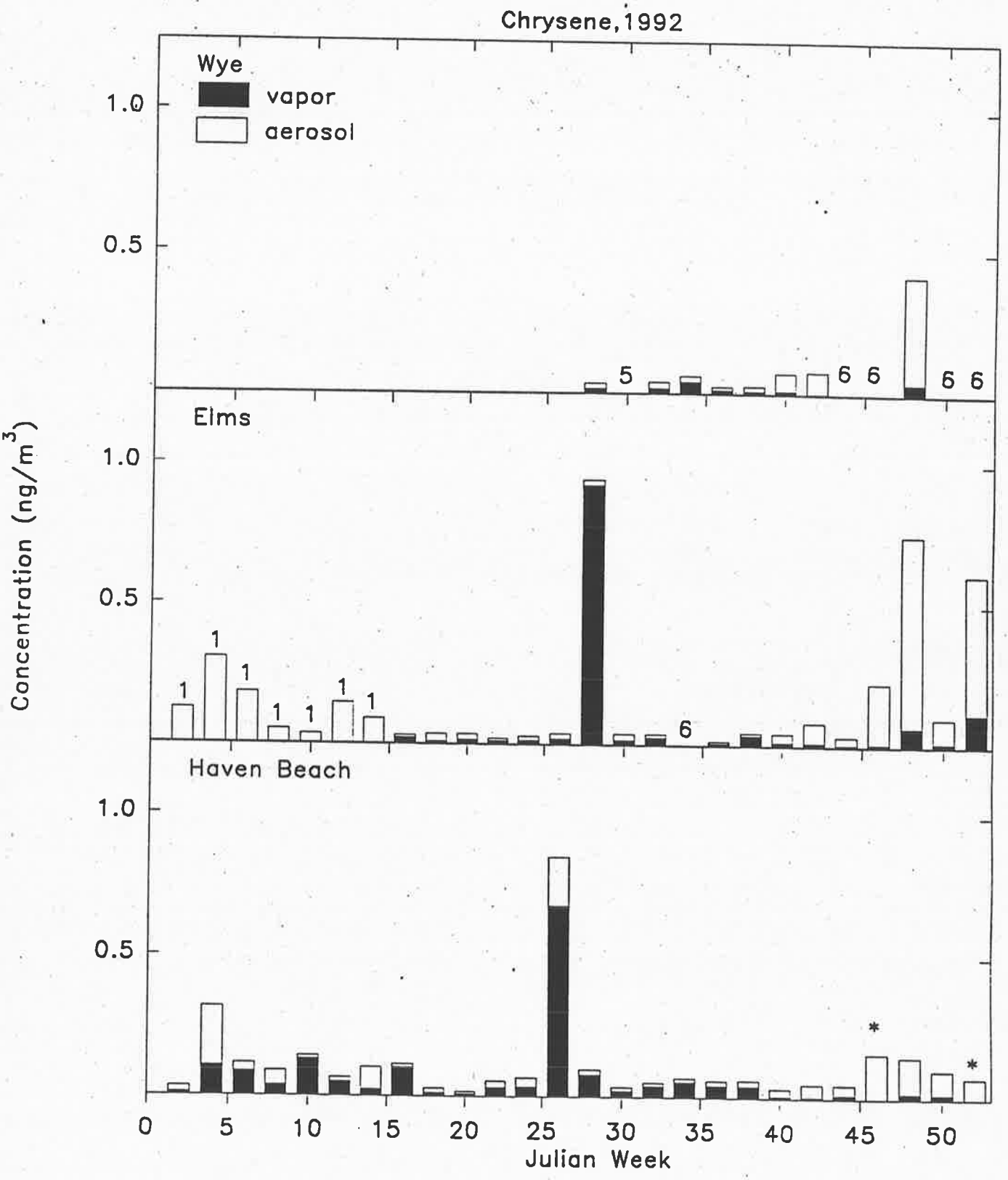
A1.5 Pyrene concentrations collected biweekly in air at the Wye,Elms, and Haven Beach sites.(1=not quantifiable in vapor phase, 2 = not quantifiable on filter, 3=not detected in vapor phase, 4 = not detected on filter, 5 =field blank; 6=no sample taken, *=lost vapor sample **= lost particulate sample).


Pyrene, 1993
Wye, 1993
vapor
aerosol
Elms
Haven Beach
Concentration (ng/m3)
Julian Week
0.50
0.25
0.75
0.50
0.25
2
1
0
5
10
15
20
25
30
35
40
45
50
4
*
**
2
3
8 8
1

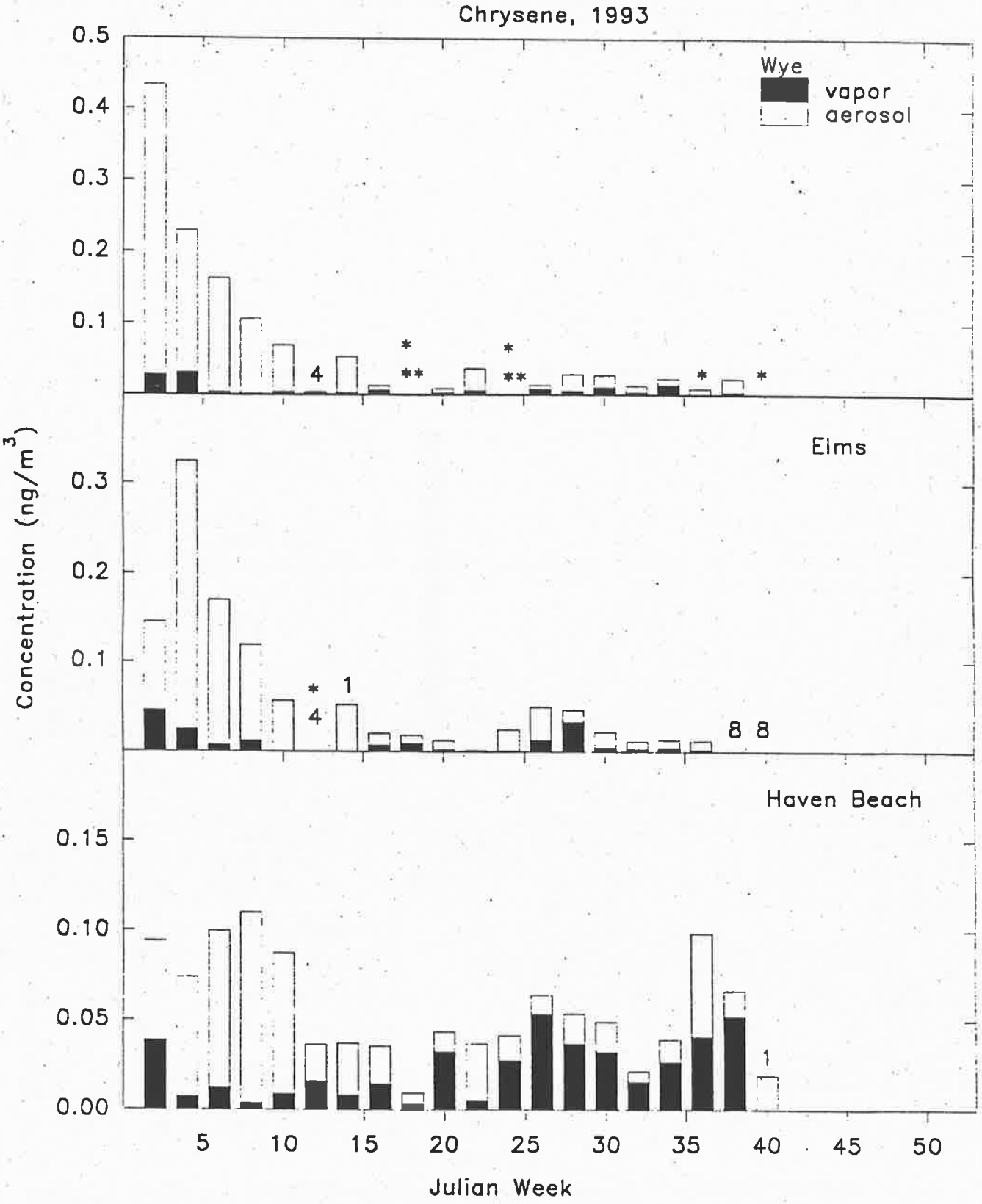


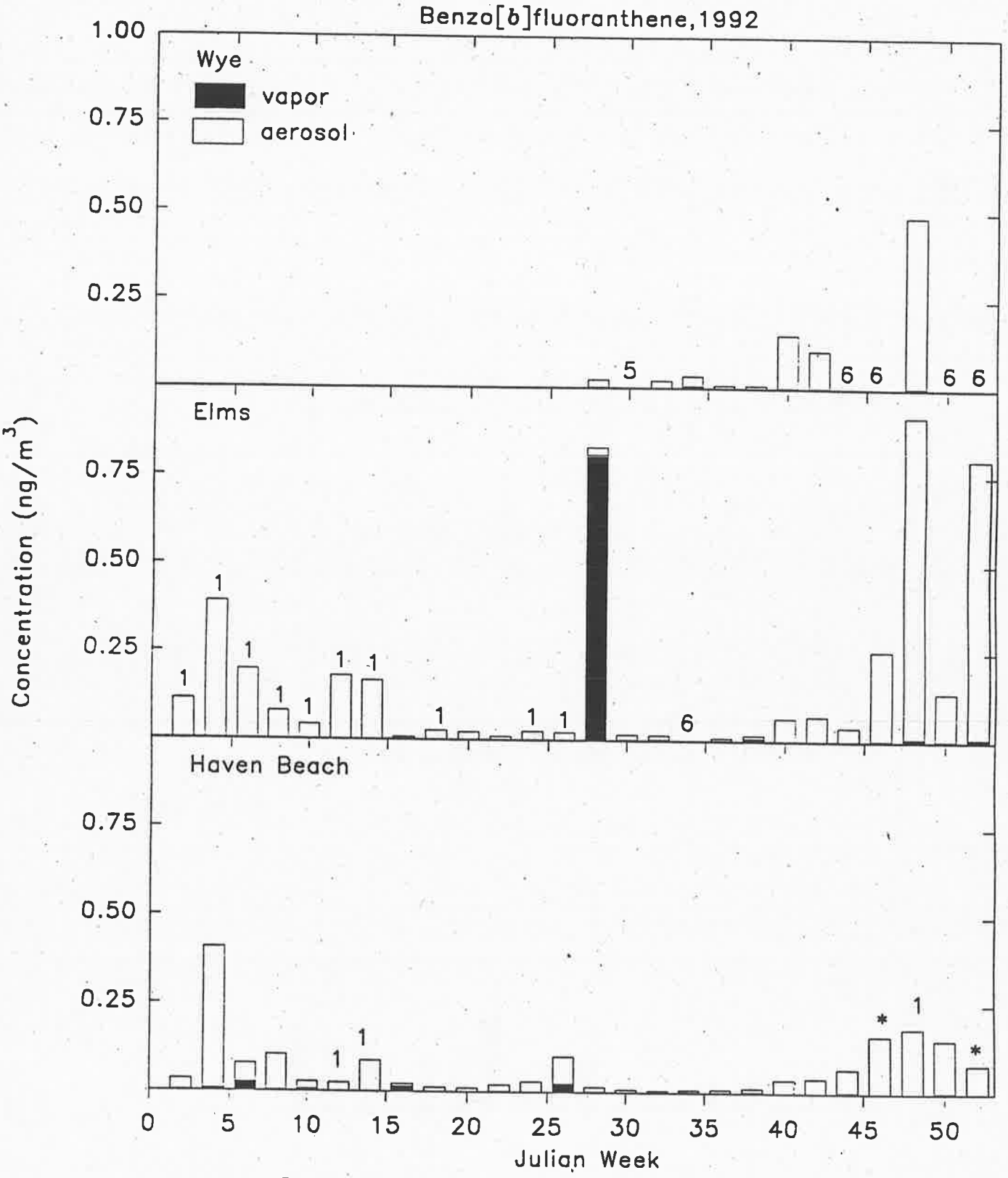
A1.6 Benz[a]anthracene concentrations collected biweekly in air at the Wye,Elms, and Haven Beach sites.(1=not quantifiable in vapor phase, 2 = not quantifiable on filter, 3=not detected in vapor phase, 4 = not detected on filter, 5 =field blank, 6=no sample taken, *=lost vapor sample **= lost particulate sample).


Benz[a]anthracene, 1993
Wye
vapor
aerosol
Elms
Haven Beach
Concentration (ng/m3)
0.2
0.1
0.10
0.05
0.050
0.025
0.000
5
10
15
20
25
30
35
40
45
50
Julian Week

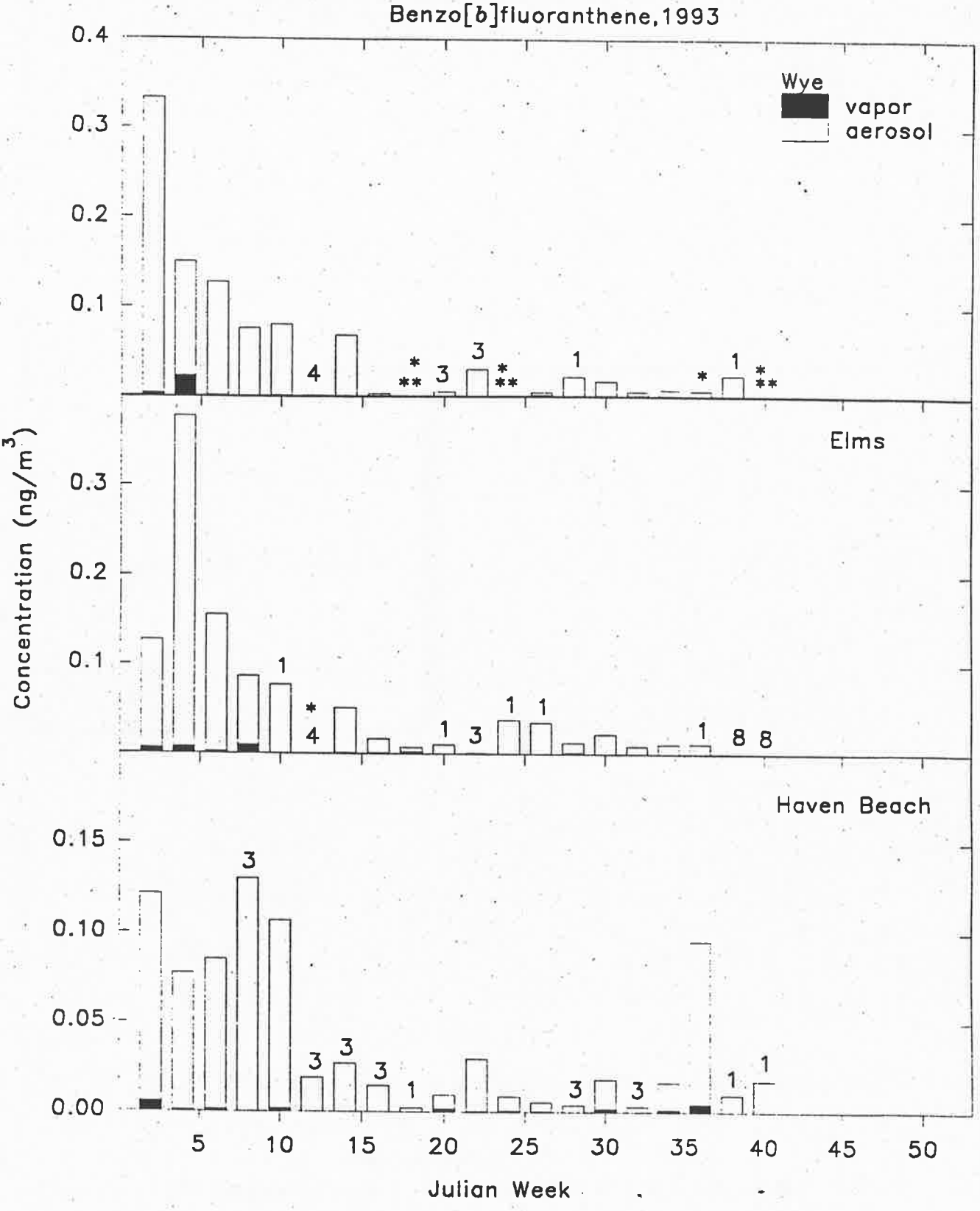


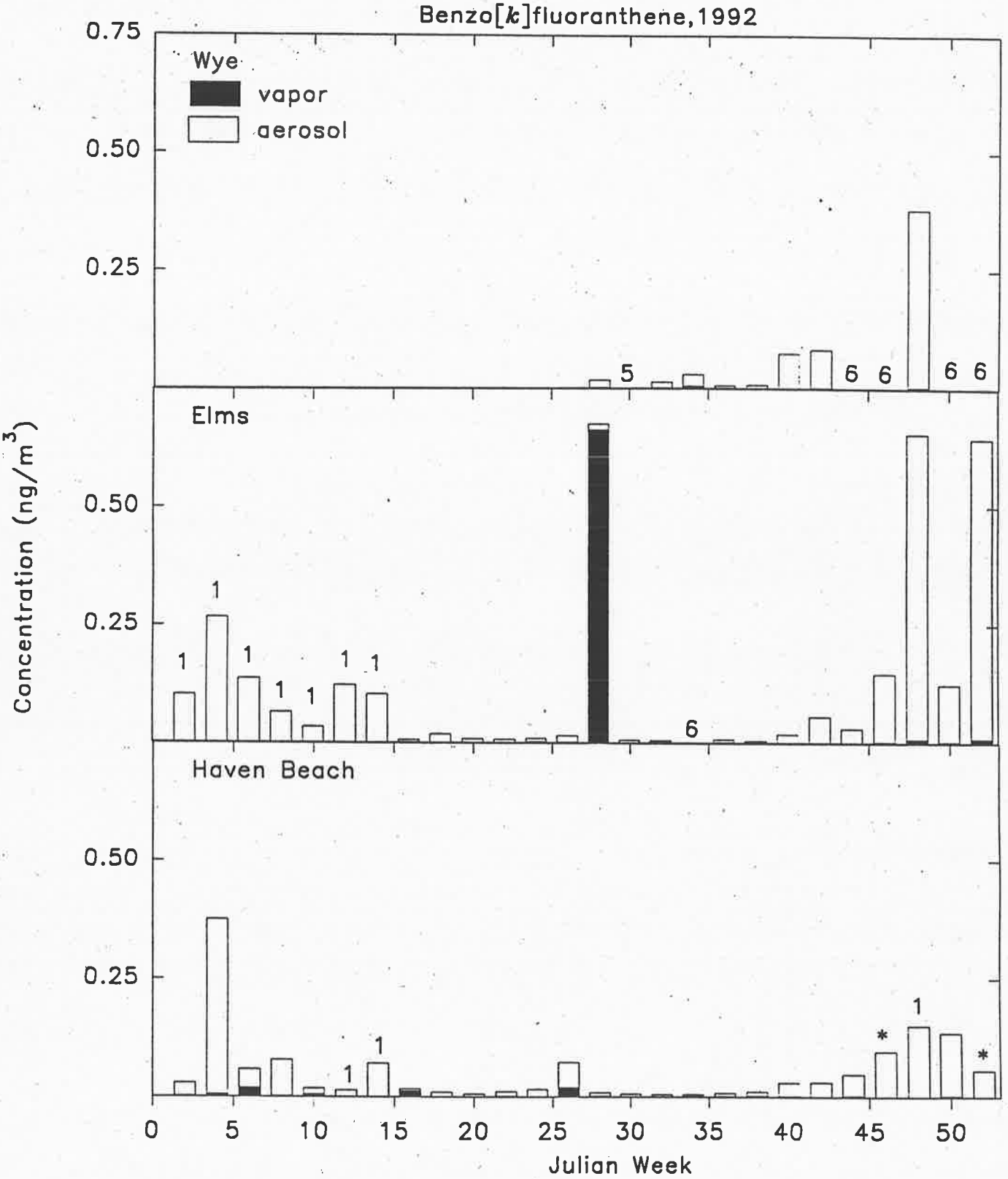
A1.7 Chrysene concentrations collected biweekly in air at the Wye,Elms, and Haven Beach sites.(1=not quantifiable in vapor phase, 2 = not quantifiable on filter, 3=not detected in vapor phase, 4 = not detected on filter, 5 =field blank, 6=no sample taken, *=lost vapor sample **= lost particulate sample).


Chrysene, 1993
Wye
vapor
aerosol
Elms
Haven Beach
Concentration (ng/m3)
Julian Week
0.5
0.4
0.3
0.2
0.1
0.15
0.10
0.05
0.00
5
10
15
20
25
30
35
40
45
50
4
1
8 8
1

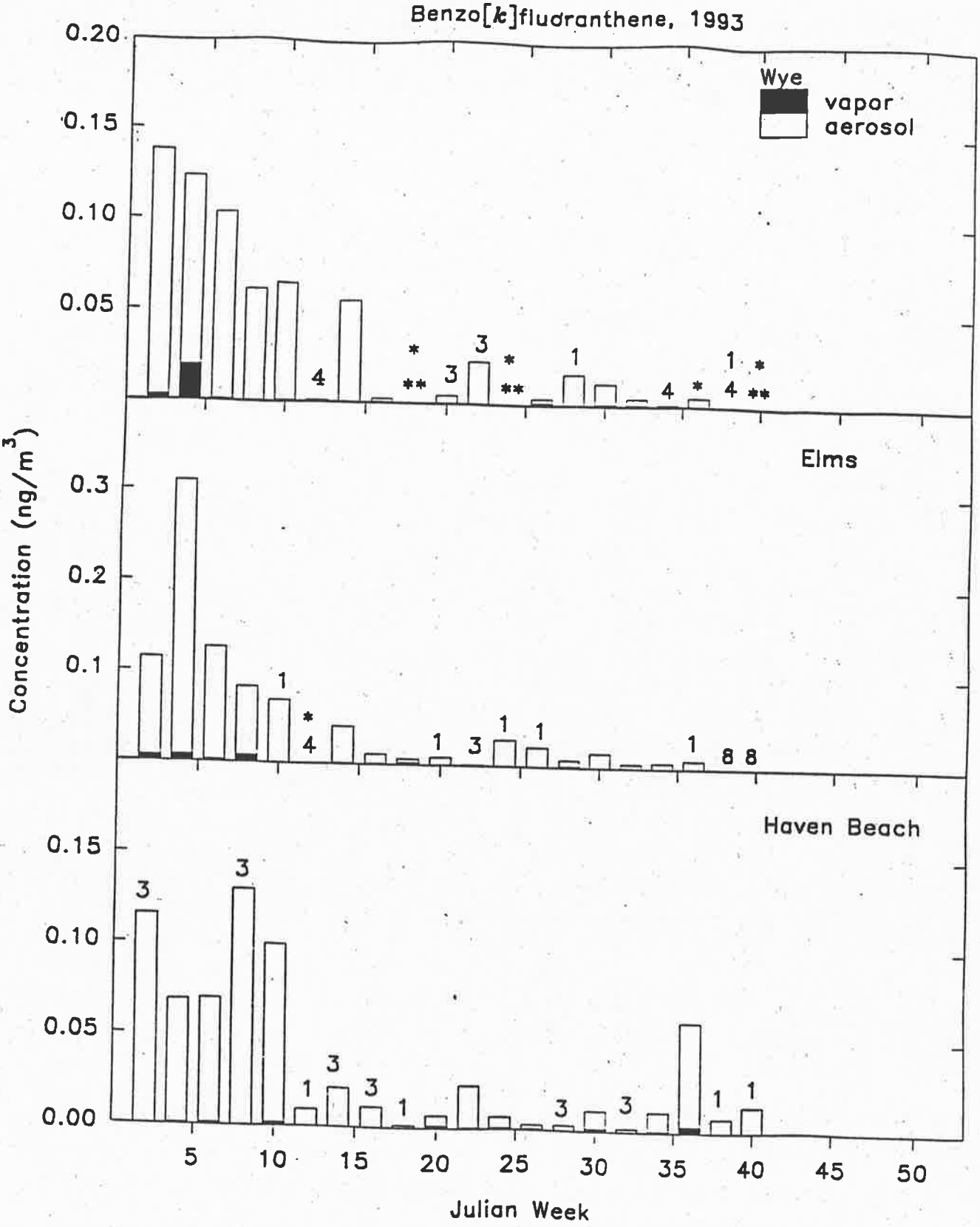


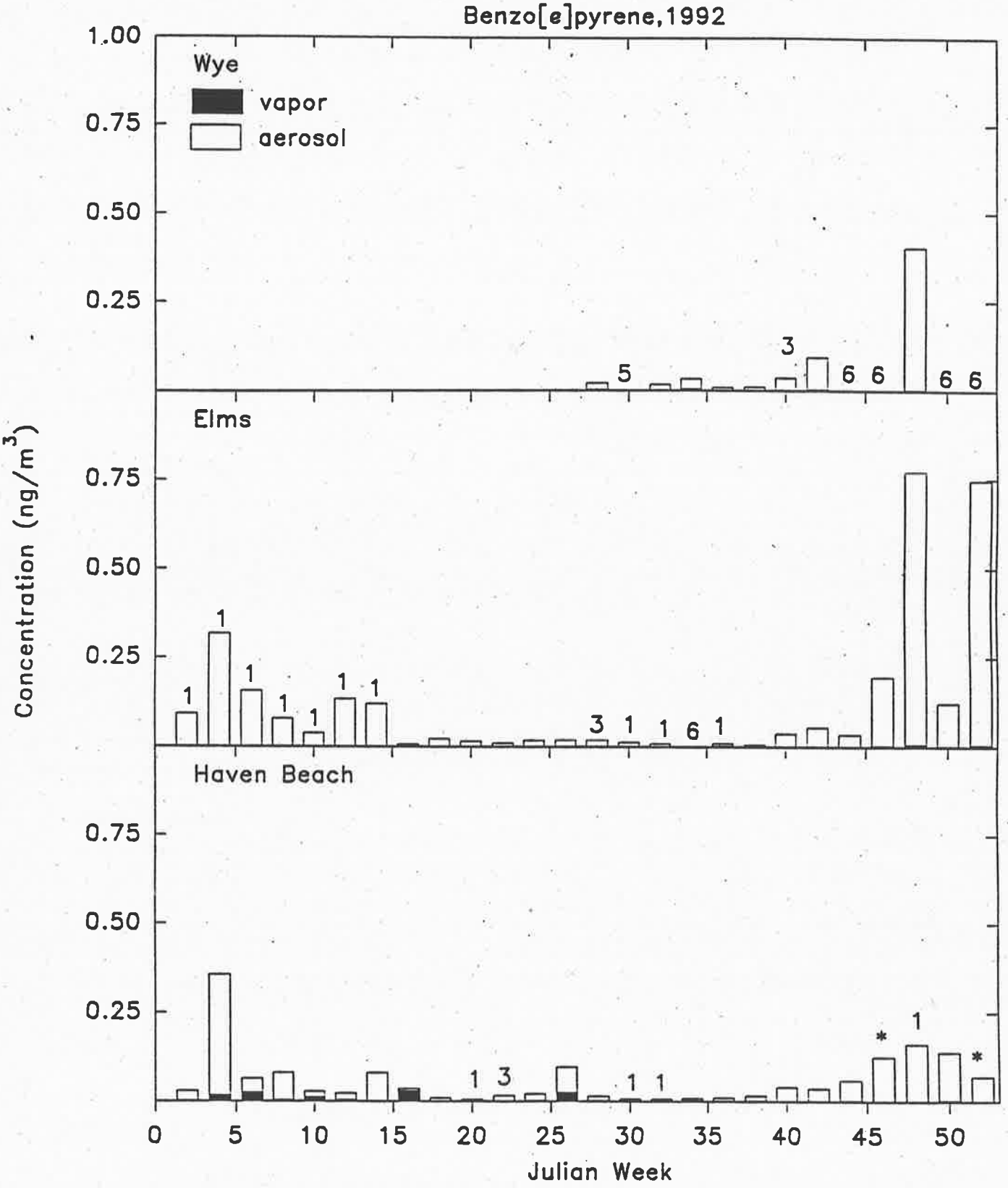
A1.8 Benzo[b]fluoranthene concentrations collected biweekly in air at the Wye,Elms, and Haven Beach sites.(1=not quantifiable in vapor phase, 2 = not quantifiable on filter, 3=not detected in vapor phase, 4 = not detected on filter, 5 =field blank, 6=no sample taken, *=lost vapor sample **= lost particulate sample).


Benzo[b]fluoranthene, 1993
Wye
vapor
aerosol
Elms
Haven Beach
Concentration (ng/m3)
Julian Week
0.4
0.3
0.2
0.1
0.15
0.10
0.05
0.00
5
10
15
20
25
30
35
40
45
50

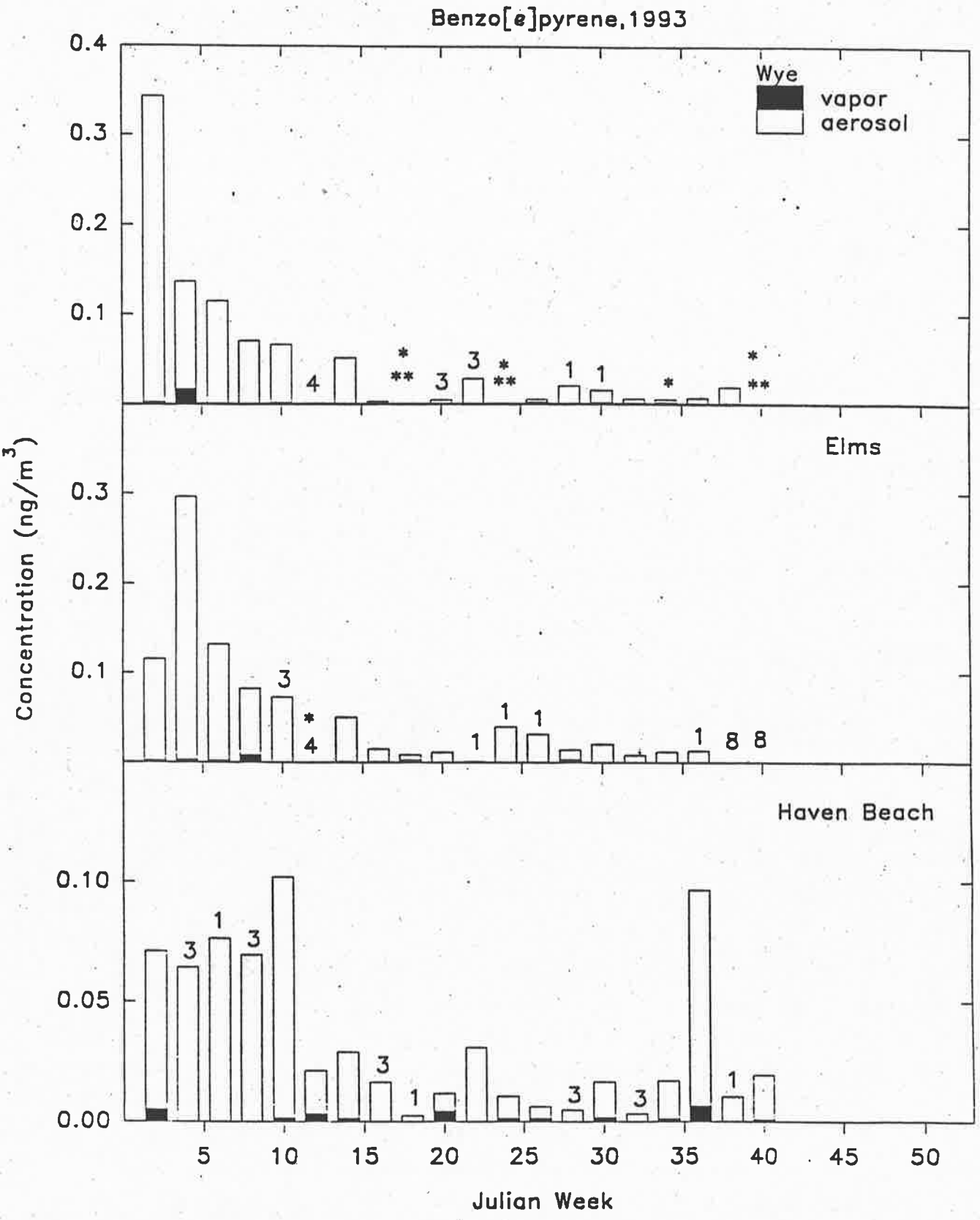


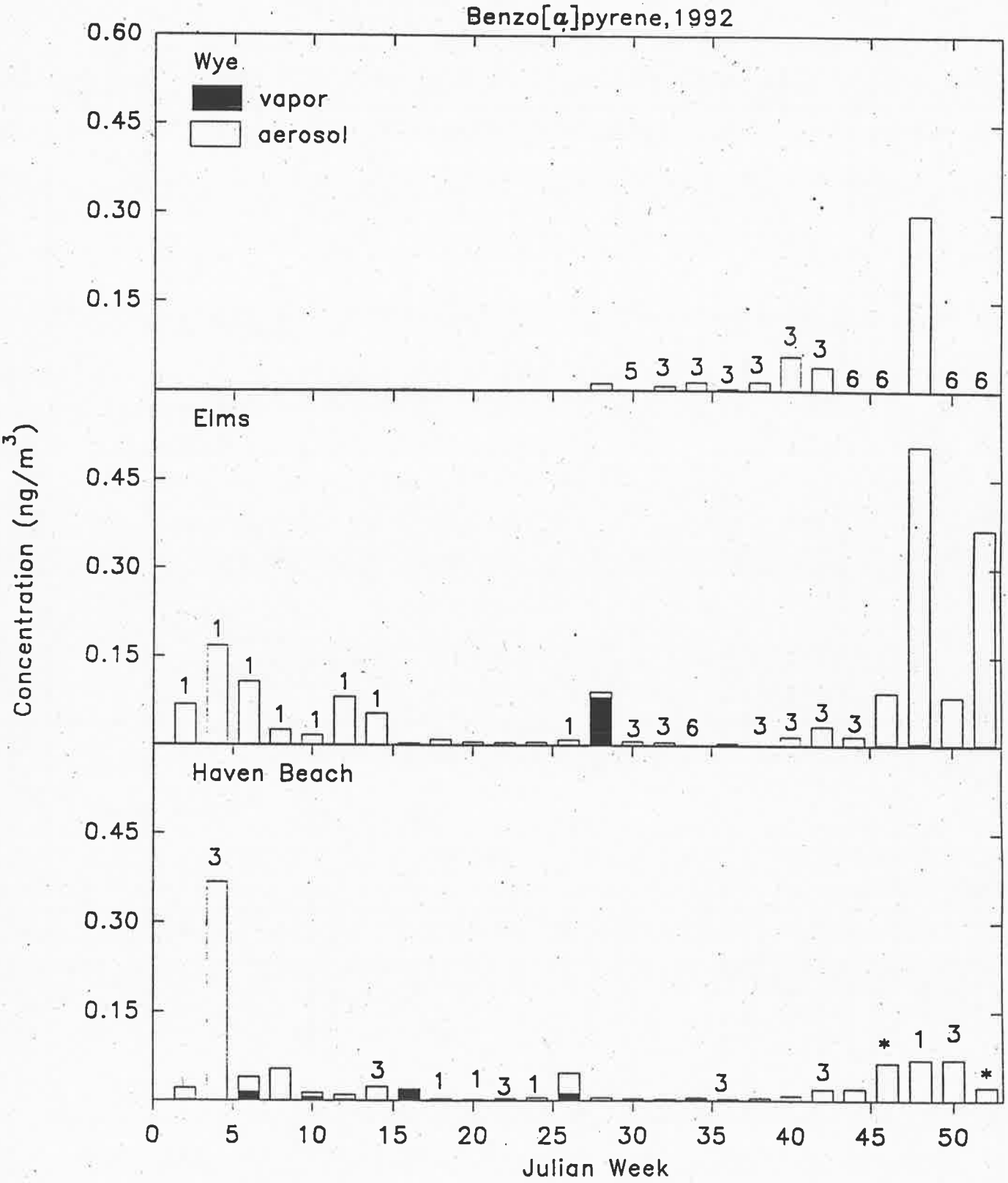
A1.9 Benzo[*k*]fluoranthene concentrations collected biweekly in air at the Wye,Elms, and Haven Beach sites.(1=not quantifiable in vapor phase, 2 = not quantifiable on filter, 3=not detected in vapor phase, 4 = not detected on filter, 5 =field blank, 6=no sample taken, *=lost vapor sample **= lost particulate sample).


Benzo[k]fluoranthene, 1993
Wye
vapor
aerosol
Elms
Haven Beach
Concentration (ng/m3)
Julian Week
0.20
0.15
0.10
0.05
0.3
0.2
0.1
0.00
5
10
15
20
25
30
35
40
45
50

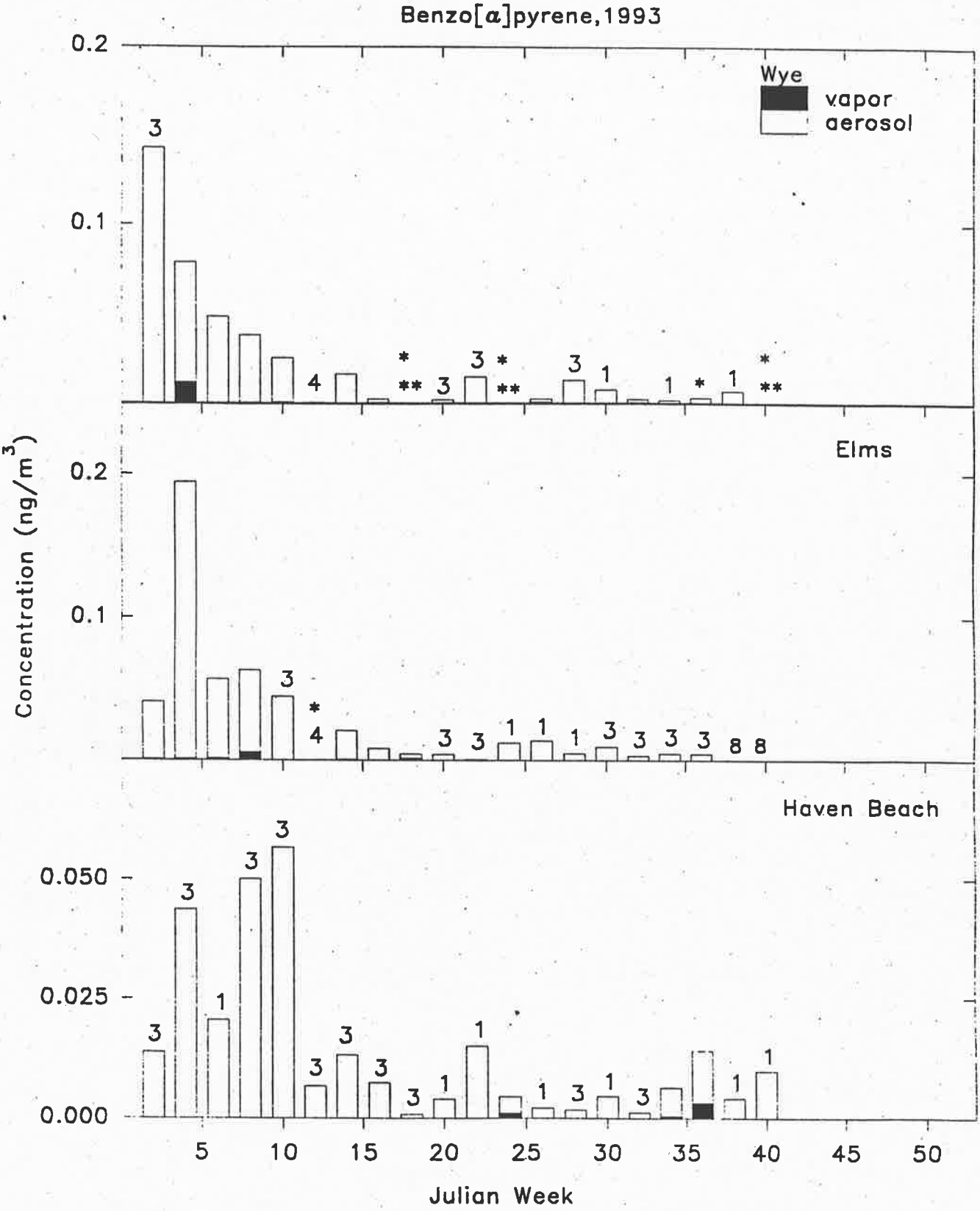


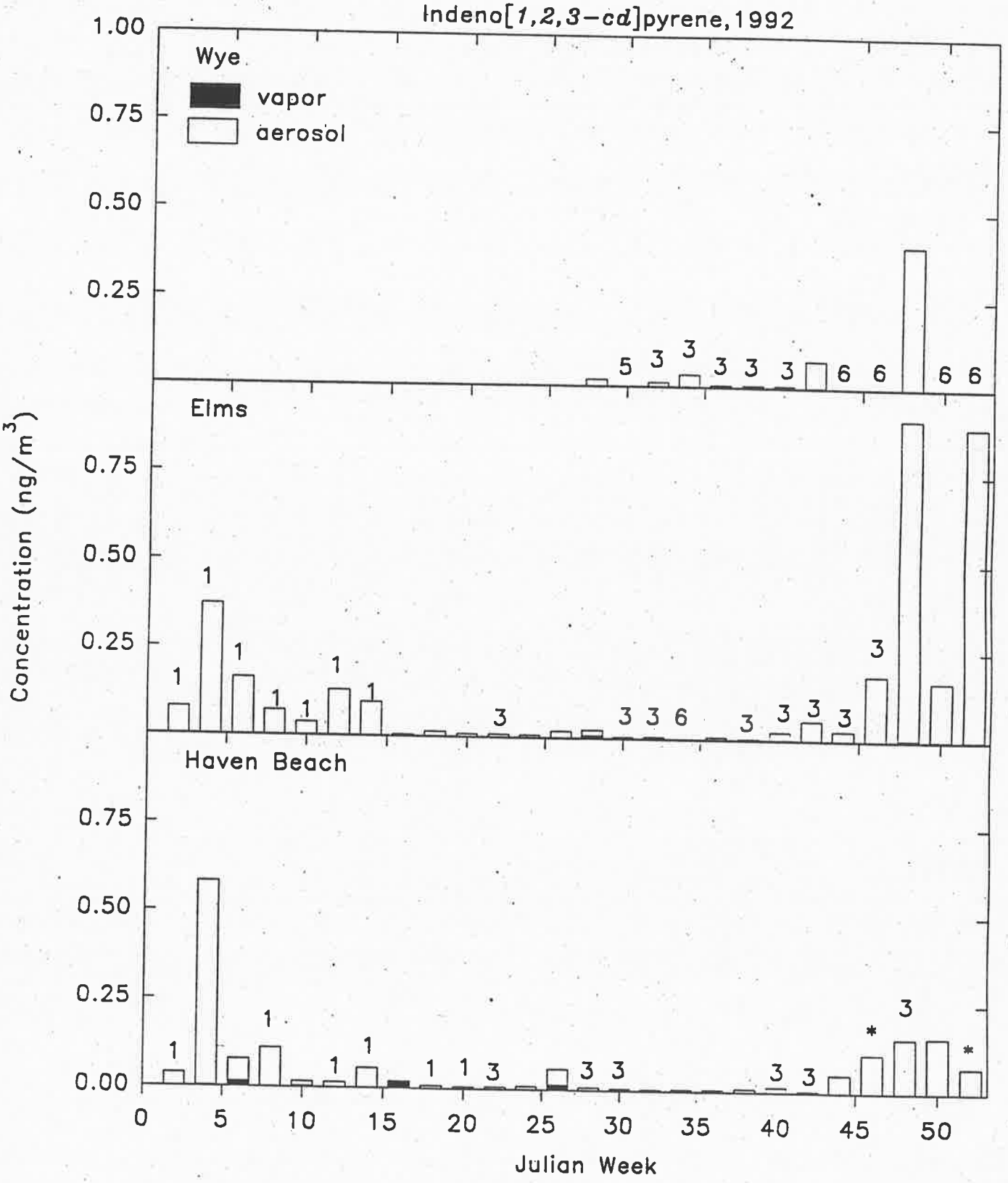
A1.10 Benzo[*e*]pyrene concentrations collected biweekly in air at the Wye,Elms, and Haven Beach sites.(1=not quantifiable in vapor phase, 2 = not quantifiable on filter, 3=not detected in vapor phase, 4 = not detected on filter, 5 =field blank, 6=no sample taken, *=lost vapor sample **= lost particulate sample).


Benzo[e]pyrene, 1993
Wye
vapor
aerosol
Elms
Haven Beach
Concentration (ng/m3)
Julian Week
0.4
0.3
0.2
0.1
0.10
0.05
0.00
5
10
15
20
25
30
35
40
45
50

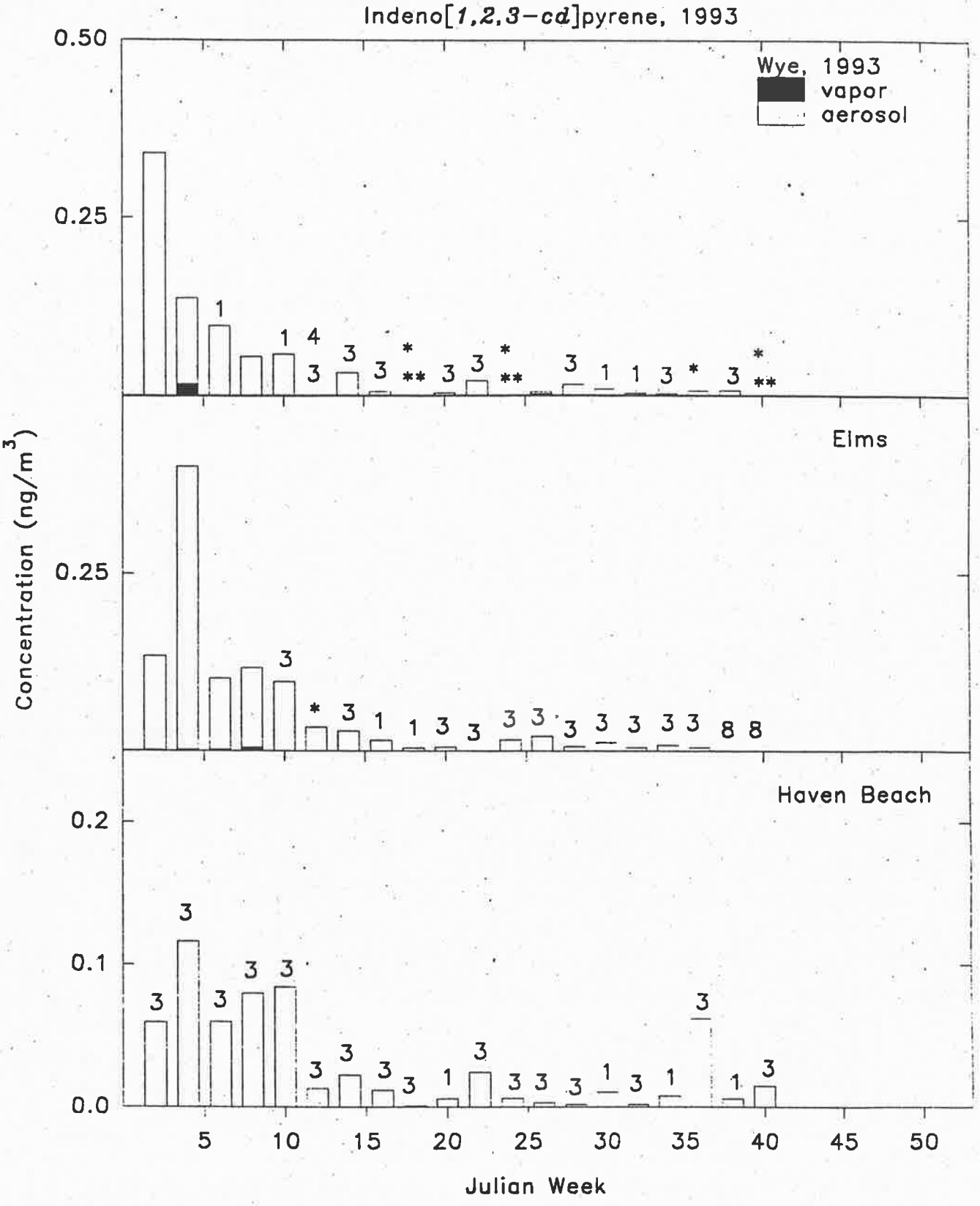


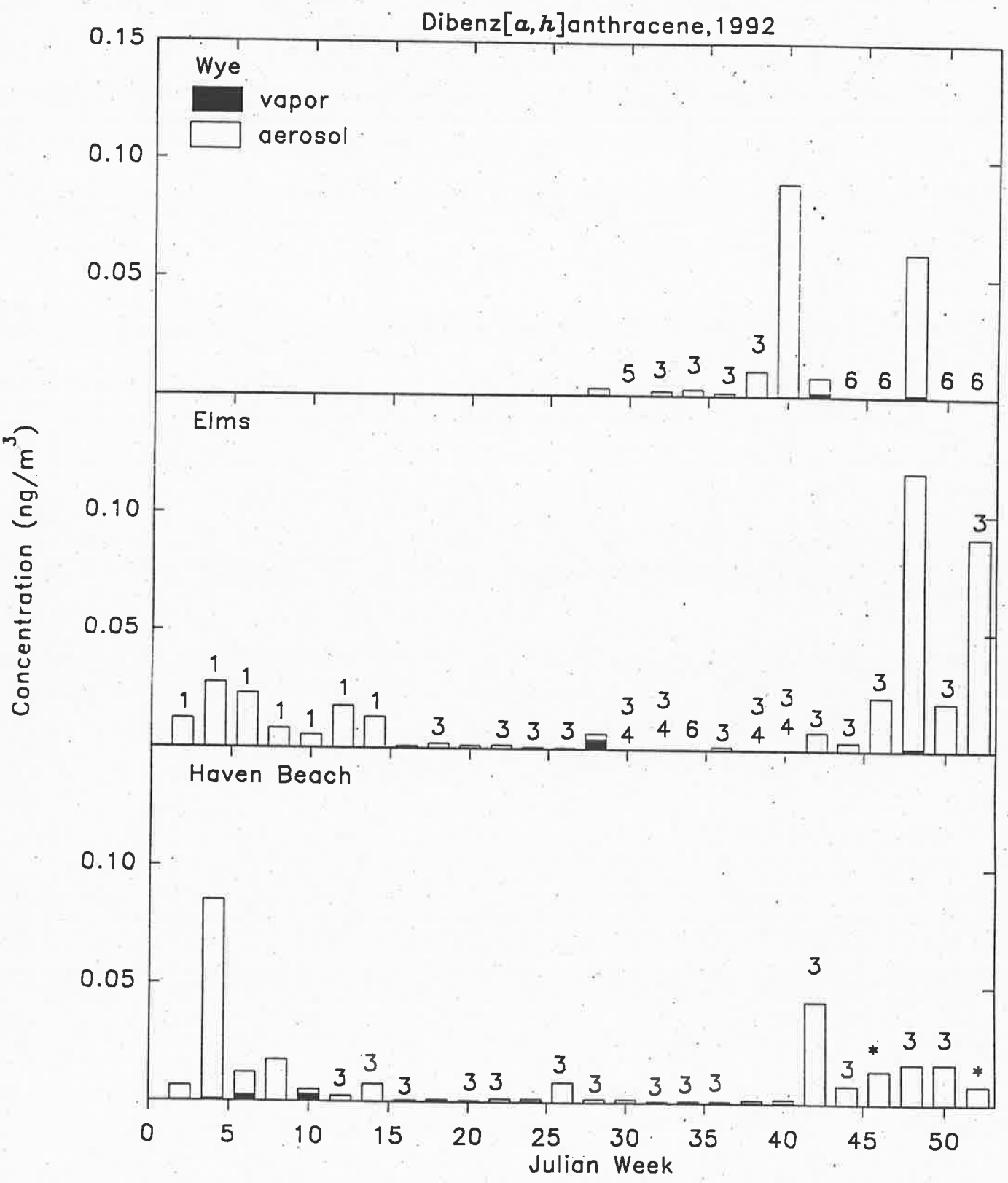
A1.11 Benzo[a]pyrene concentrations collected biweekly in air at the Wye,Elms, and Haven Beach sites.(1=not quantifiable in vapor phase, 2 = not quantifiable on filter, 3=not detected in vapor phase, 4 = not detected on filter, 5 =field blank, 6=no sample taken, *=lost vapor sample **= lost particulate sample).


Benzo[a]pyrene, 1993
Wye
vapor
aerosol
Elms
Haven Beach
Concentration (ng/m3)
0.2
0.1
0.050
0.025
0.000
5
10
15
20
25
30
35
40
45
50
Julian Week

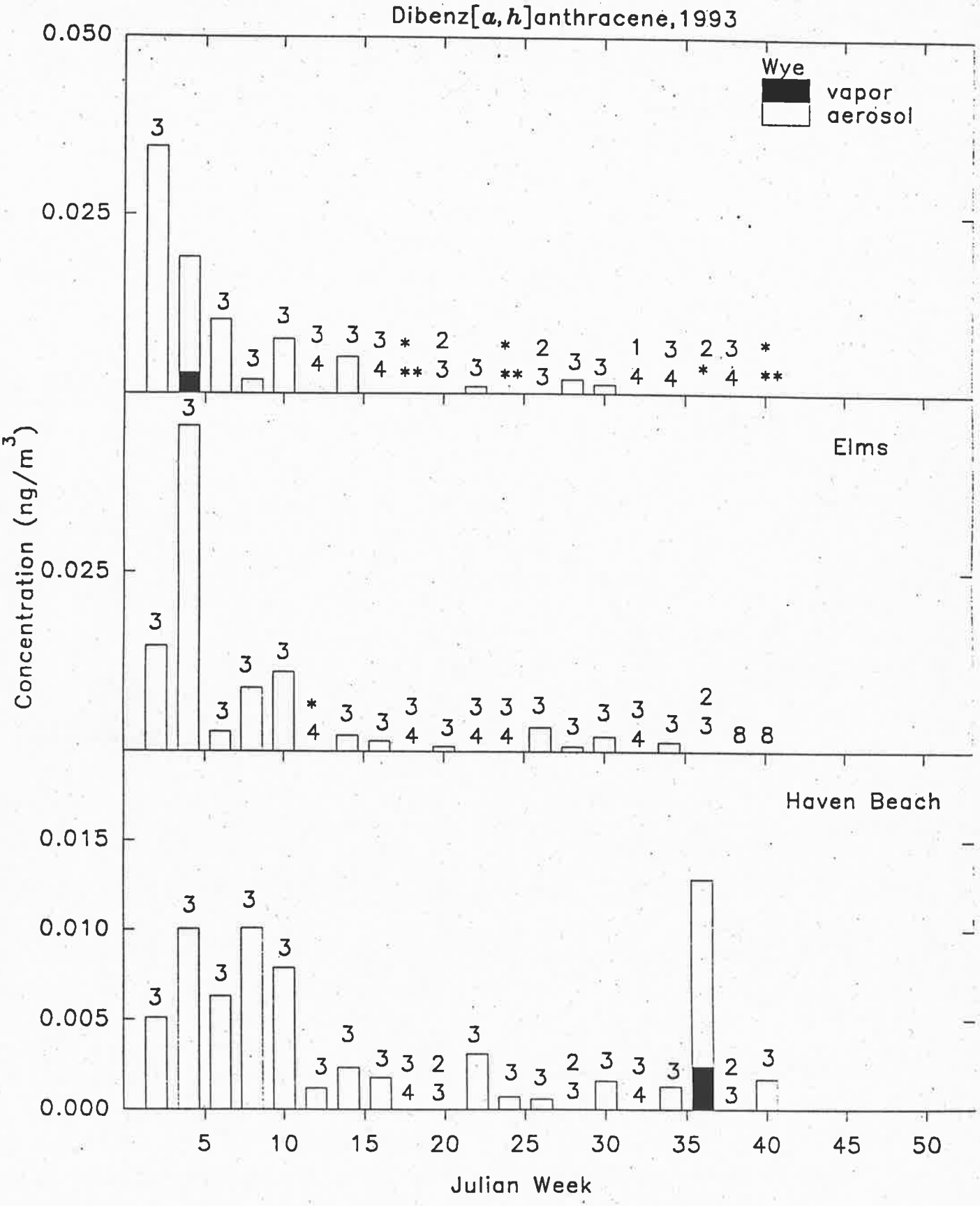


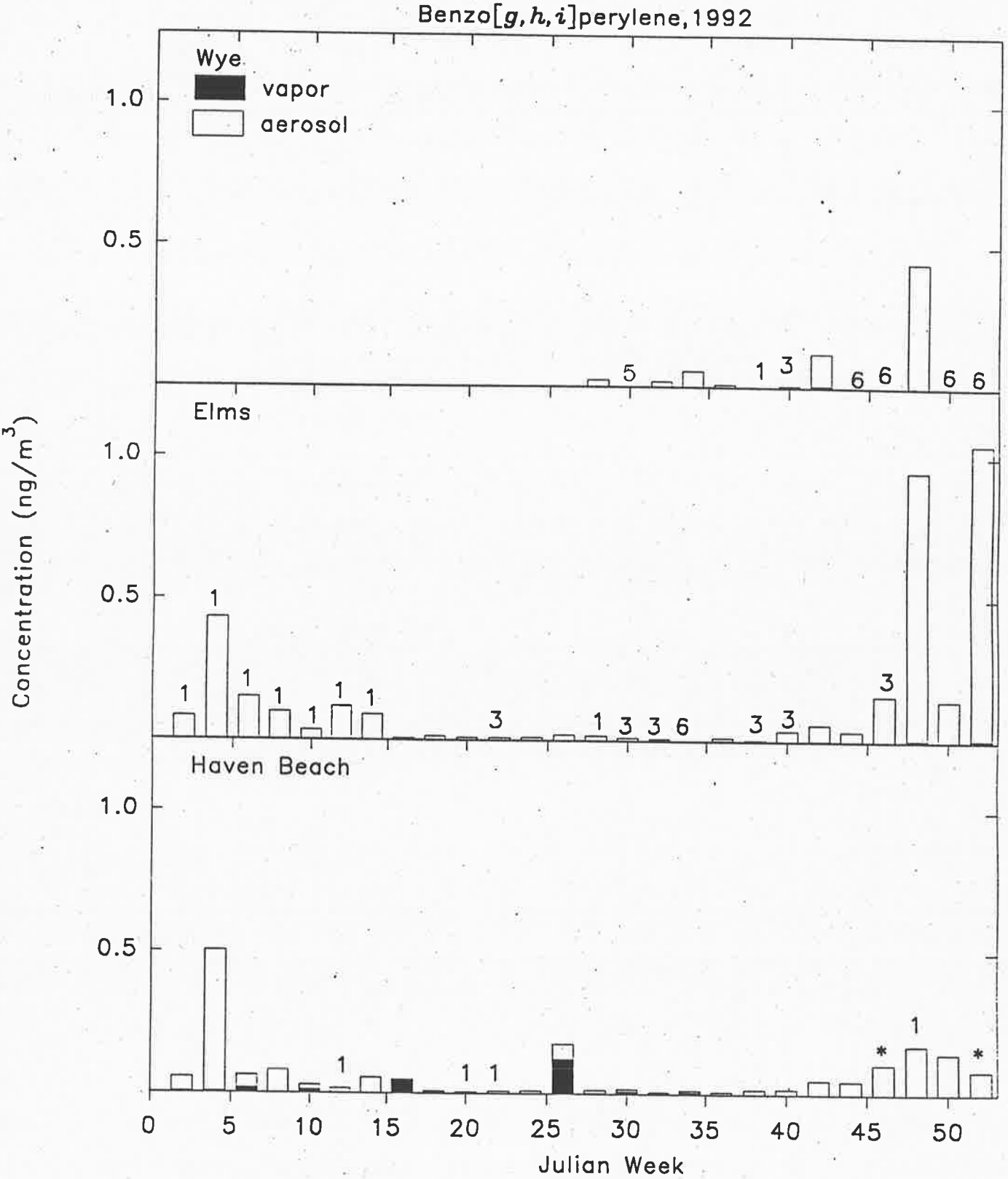
A1.12 Indeno[*1,2,3-cd*]pyrene concentrations collected biweekly in air at the Wye,Elms, and Haven Beach sites.(1=not quantifiable in vapor phase, 2 = not quantifiable on filter, 3=not detected in vapor phase, 4 = not detected on filter, 5 =field blank, 6=no sample taken, *=lost vapor sample **= lost particulate sample).


Indeno[1,2,3-cd]pyrene, 1993
Wye, 1993
vapor
aerosol
Elms
Haven Beach
Concentration (ng/m3)
Julian Week
0.50
0.25
0.25
0.2
0.1
0.0
5
10
15
20
25
30
35
40
45
50

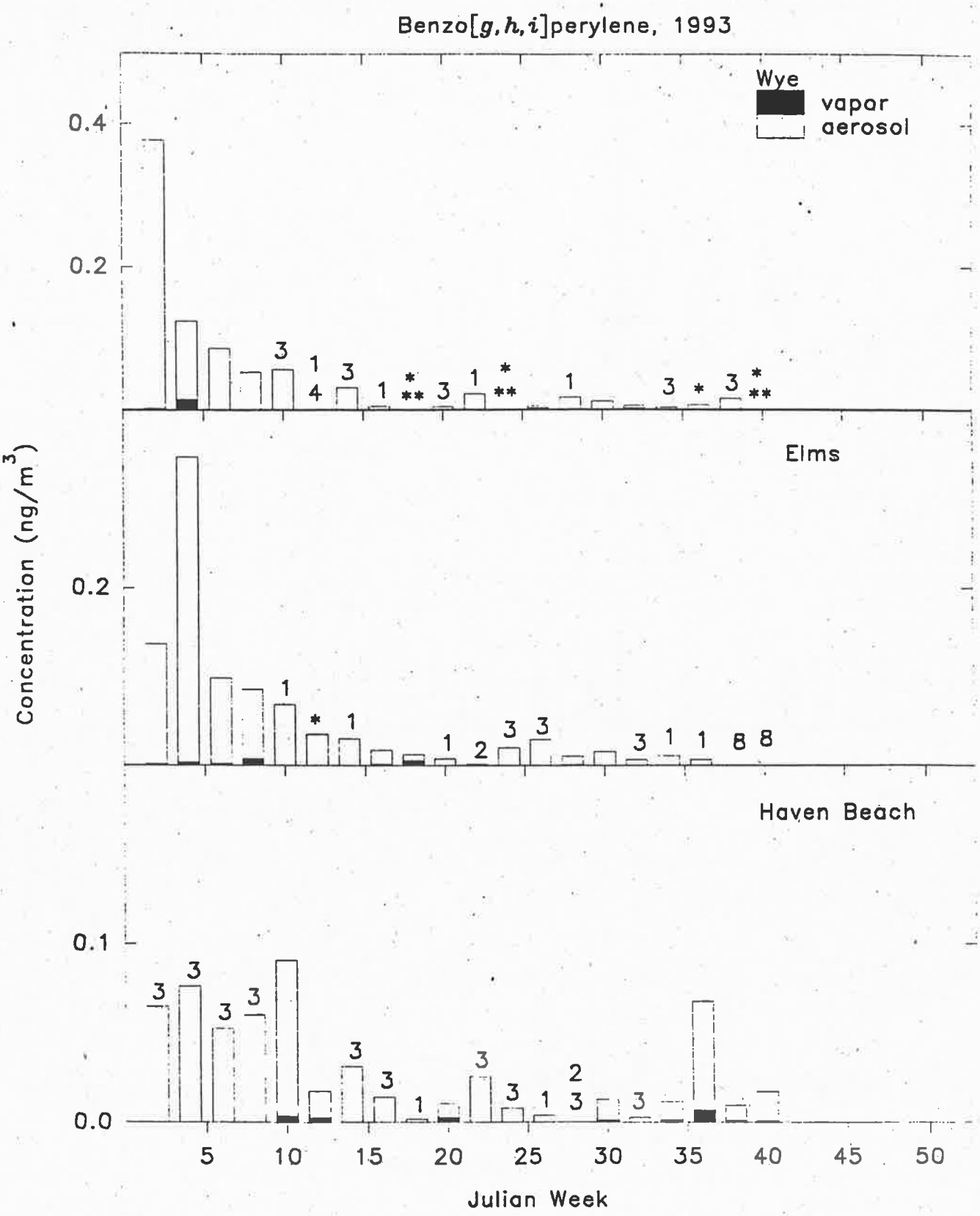


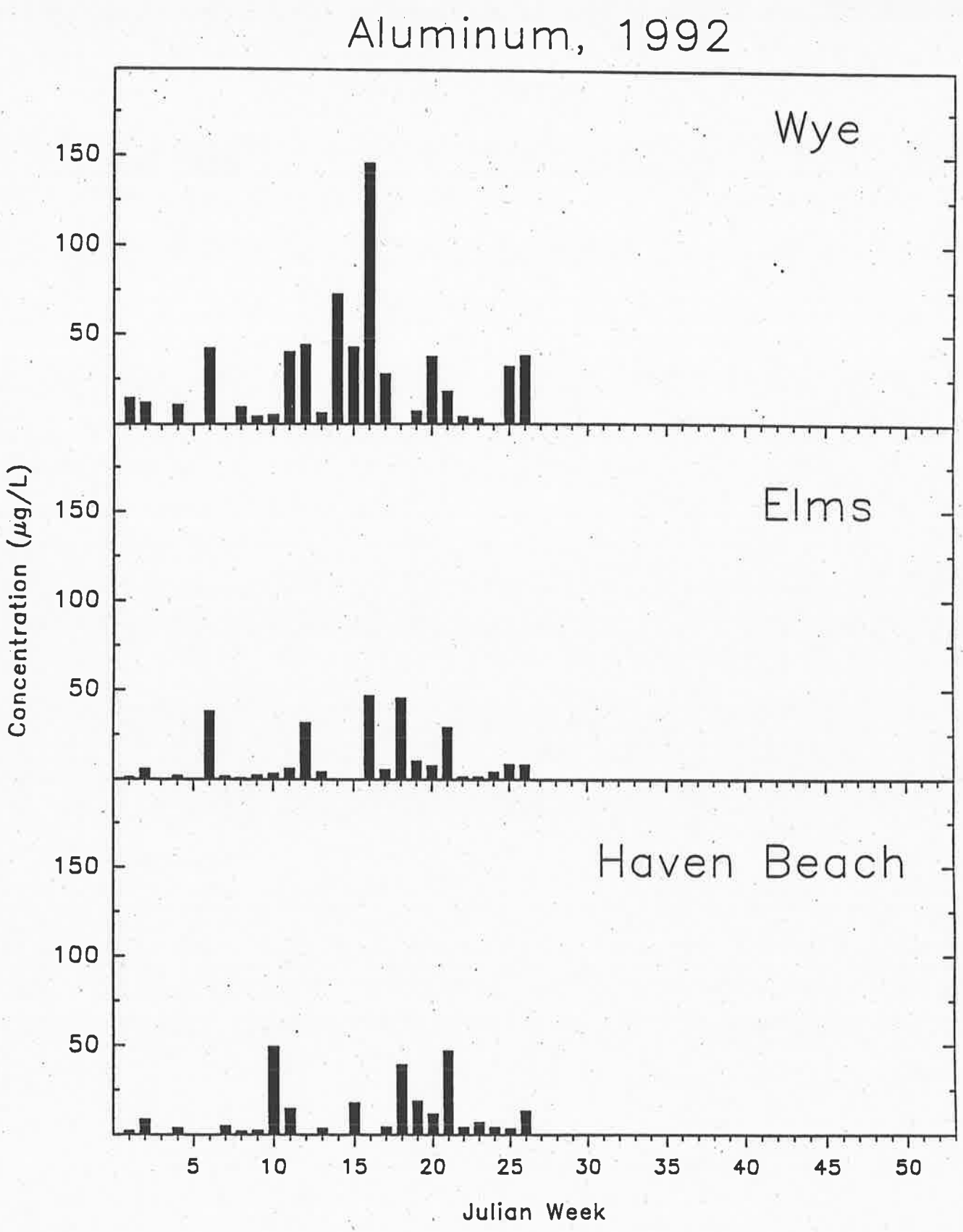
A1.13 Dibenz[*a,h*]anthracene concentrations collected biweekly in air at the Wye,Elms, and Haven Beach sites.(1=not quantifiable in vapor phase, 2 = not quantifiable on filter, 3=not detected in vapor phase, 4 = not detected on filter, 5 =field blank, 6=no sample taken, *=lost vapor sample **= lost particulate sample).


Dibenz[a,h]anthracene, 1993
Wye
vapor
aerosol
Elms
Haven Beach
Concentration (ng/m3)
0.050
0.025
0.025
0.015
0.010
0.005
0.000
5
10
15
20
25
30
35
40
45
50
Julian Week

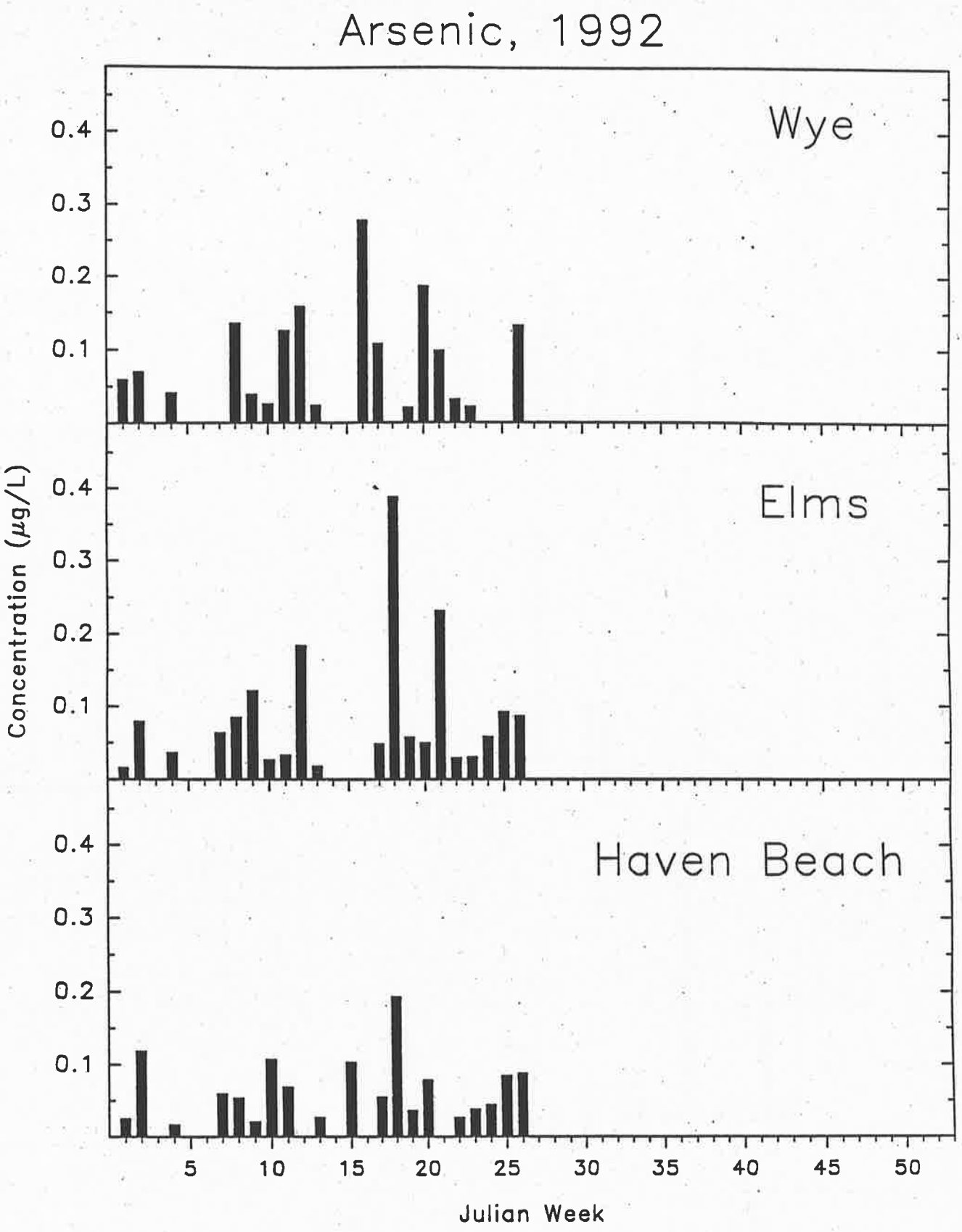


A1.14 Benzo[*g,h,i*]perylene concentrations collected biweekly in air at the Wye,Elms, and Haven Beach sites.(1=not quantifiable in vapor phase, 2 = not quantifiable on filter, 3=not detected in vapor phase, 4 = not detected on filter, 5 =field blank, 6=no sample taken, *=lost vapor sample **= lost particulate sample).

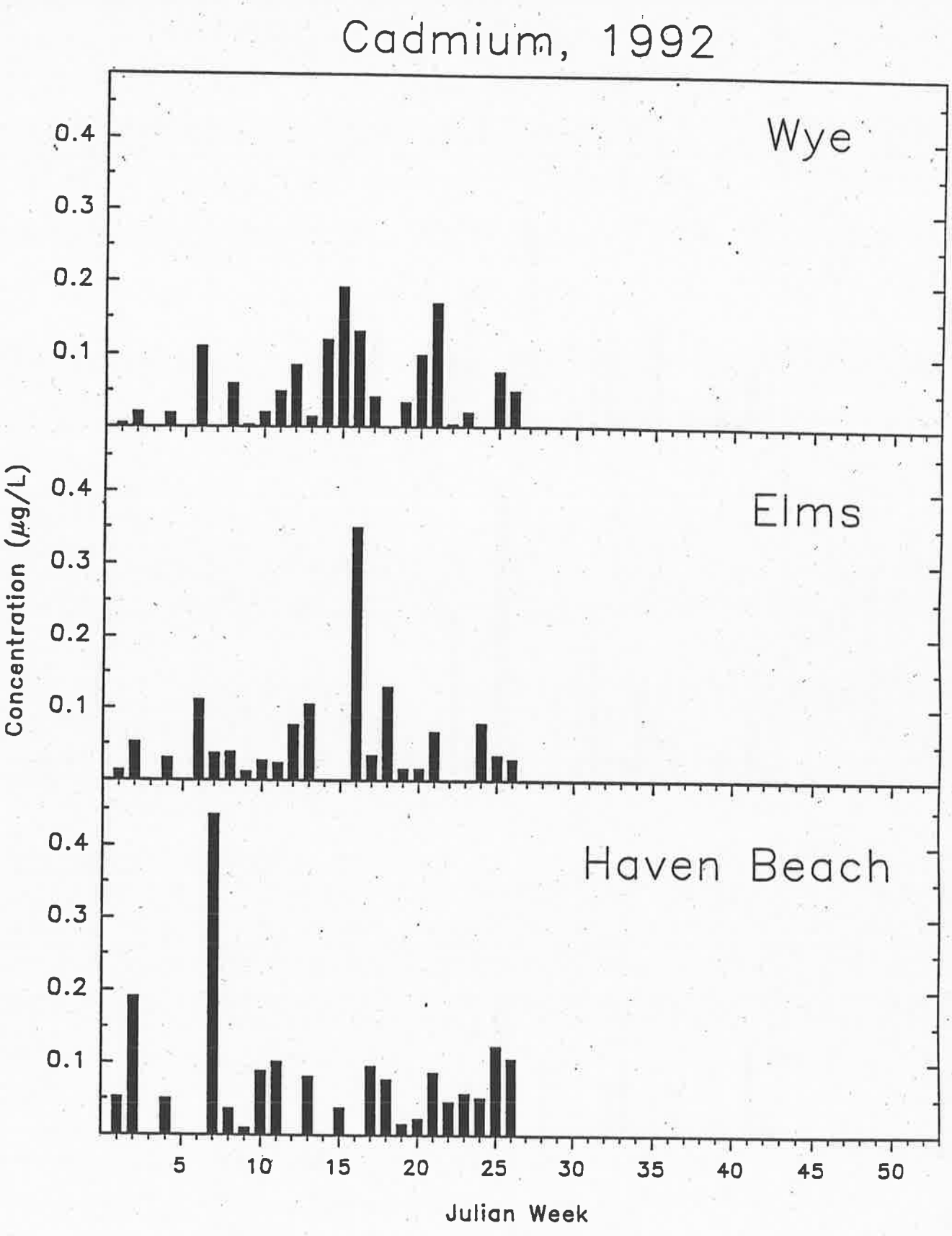

Benzo[g,h,i]perylene, 1993
Wye
vapor
aerosol
Elms
Haven Beach
Concentration (ng/m3)
0.4
0.2
0.2
0.1
0.0
5
10
15
20
25
30
35
40
45
50
Julian Week



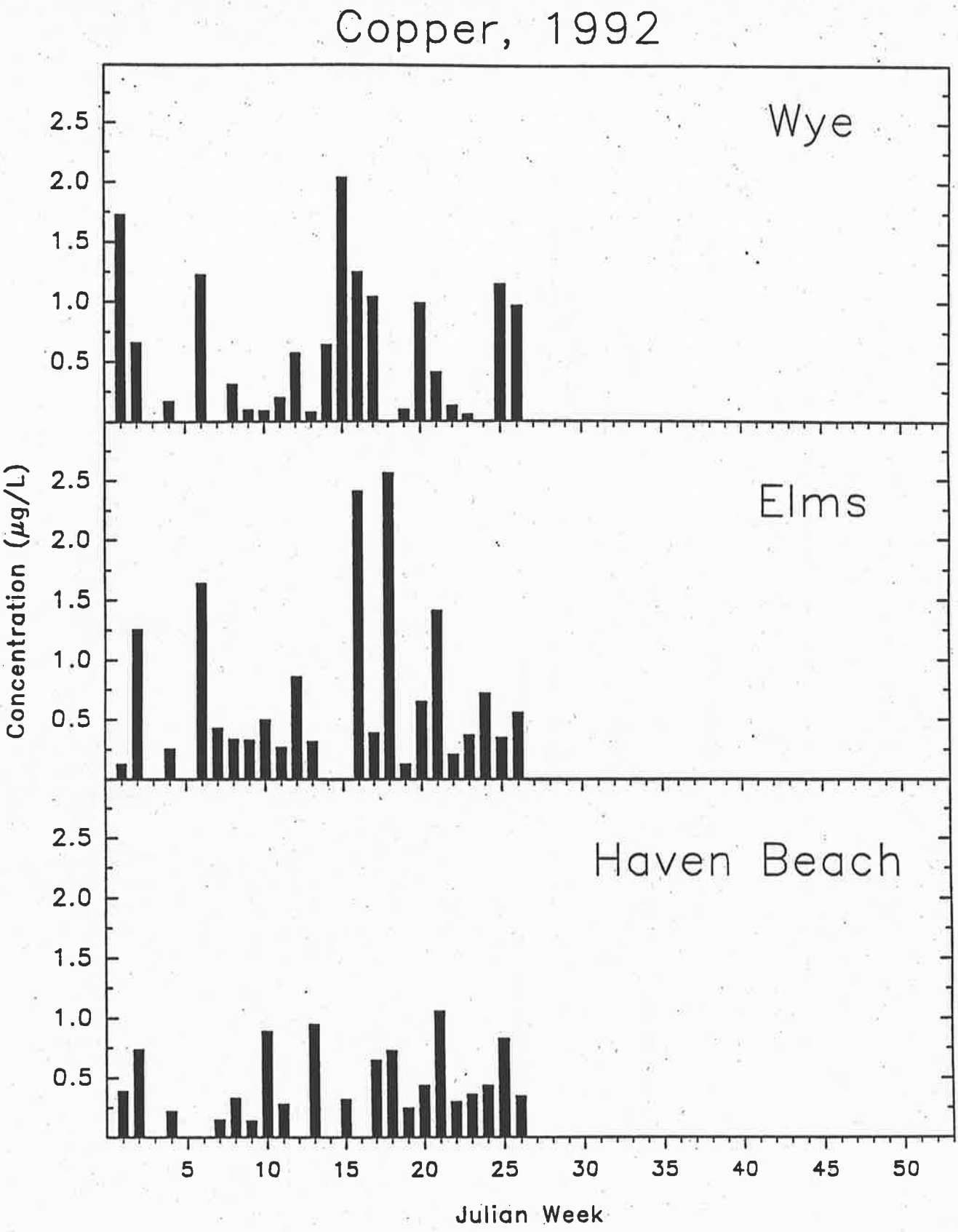
A1.15 Aluminum concentrations in precipitation, integrated at each CBAD site.



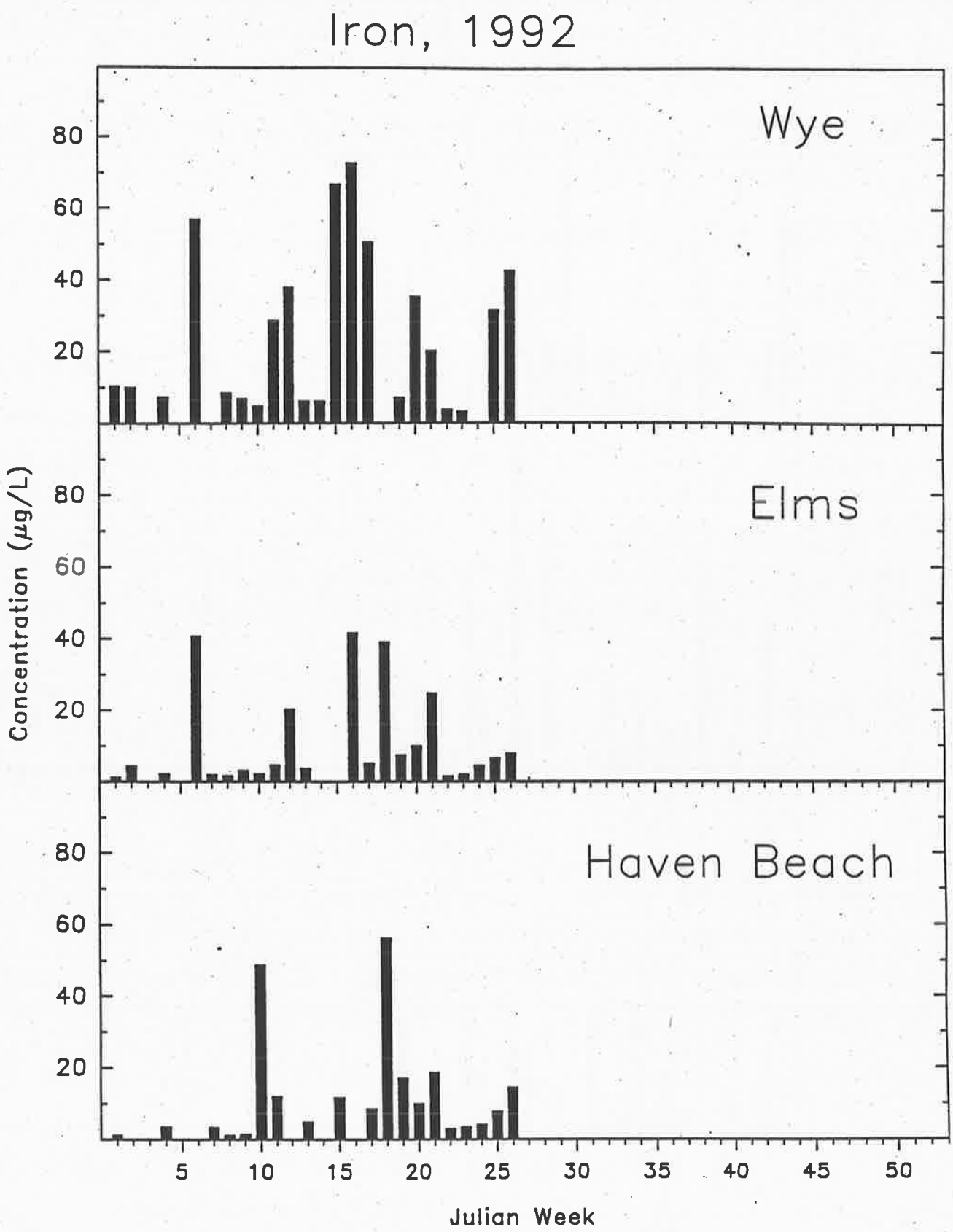
A1.16 Arsenic concentrations in precipitation, integrated at each CBAD site.



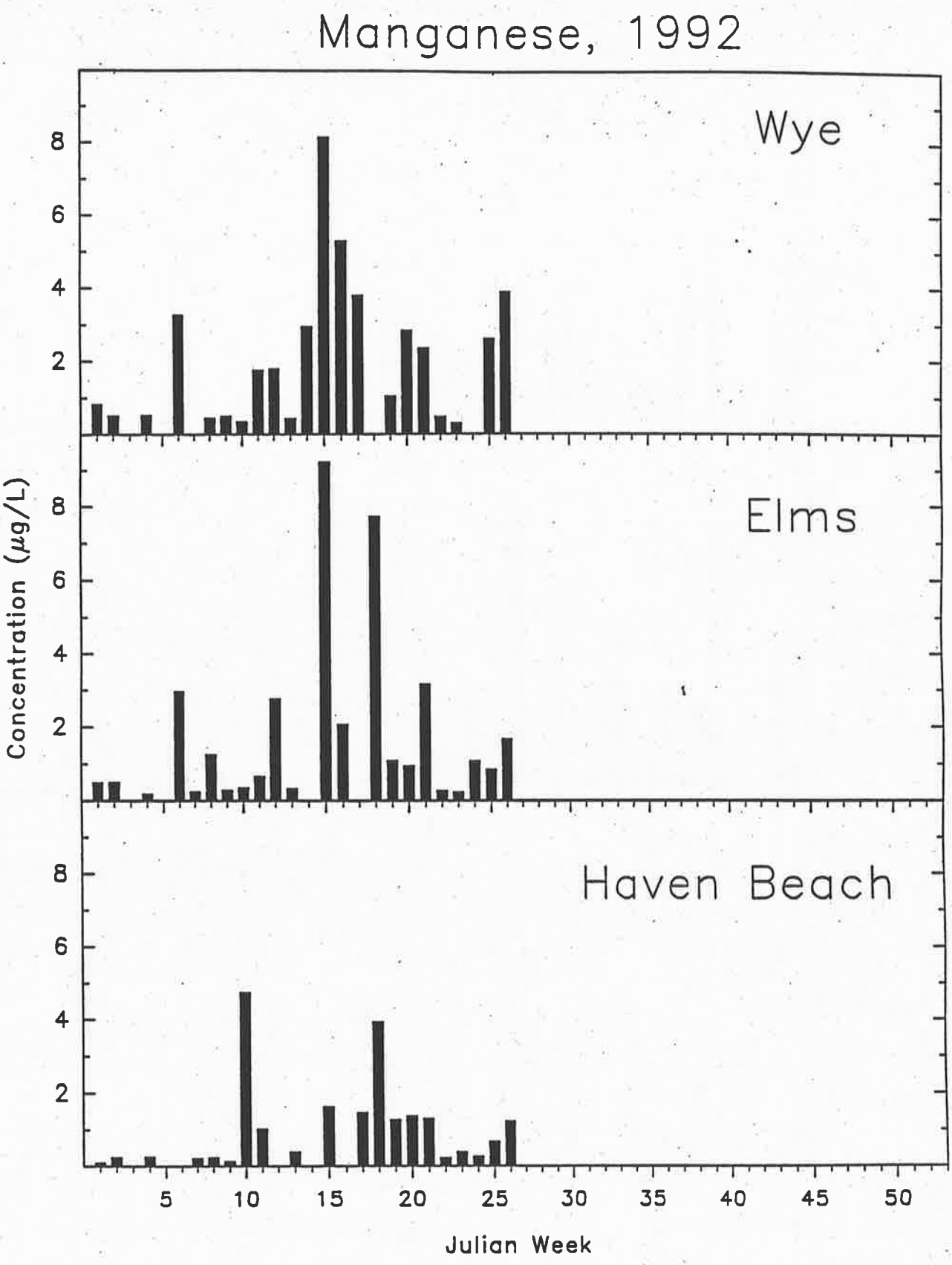
A1.17 Cadmium concentrations in precipitation, integrated at each CBAD site.



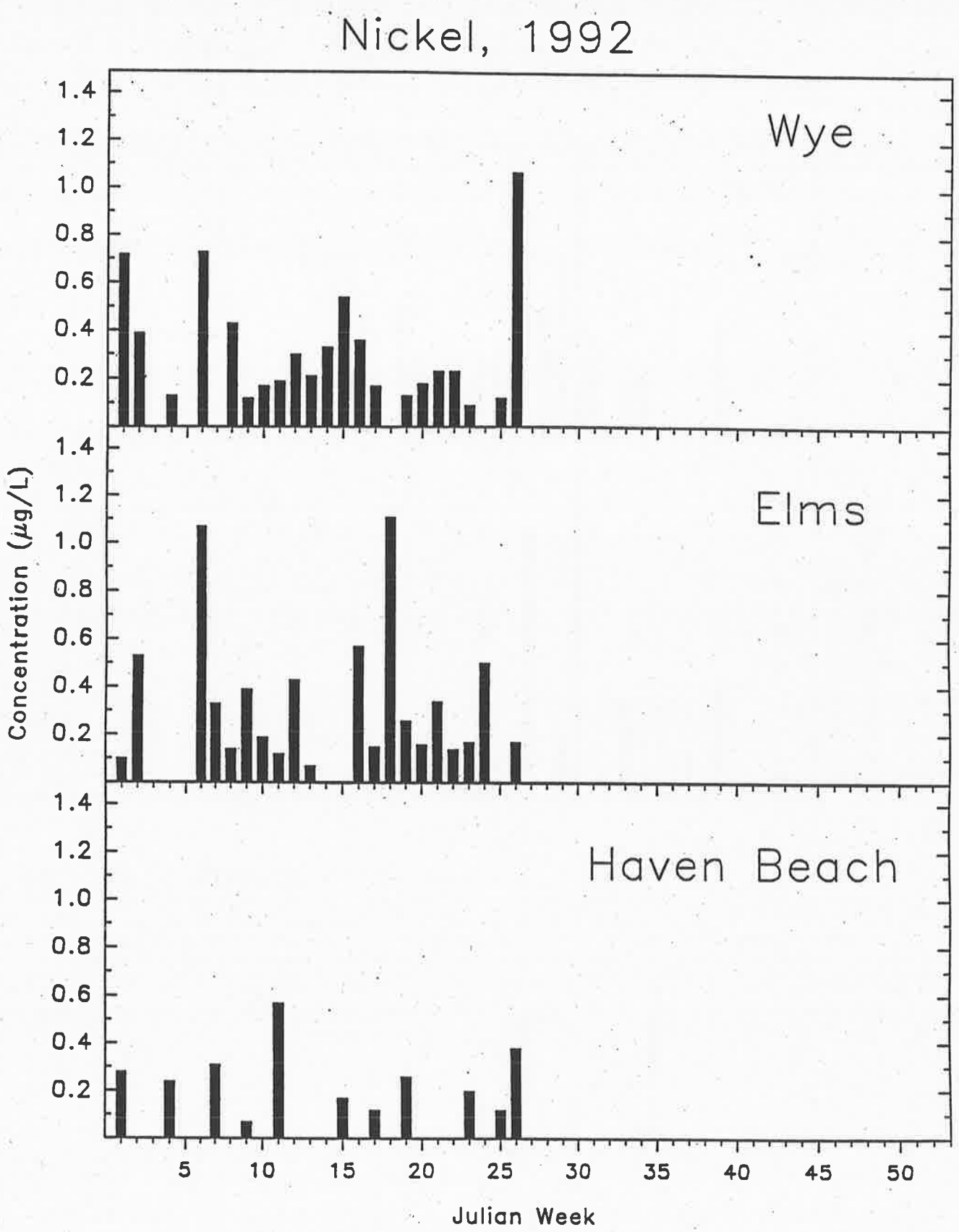
A1.18 Copper concentrations in precipitation, integrated at each CBAD site.



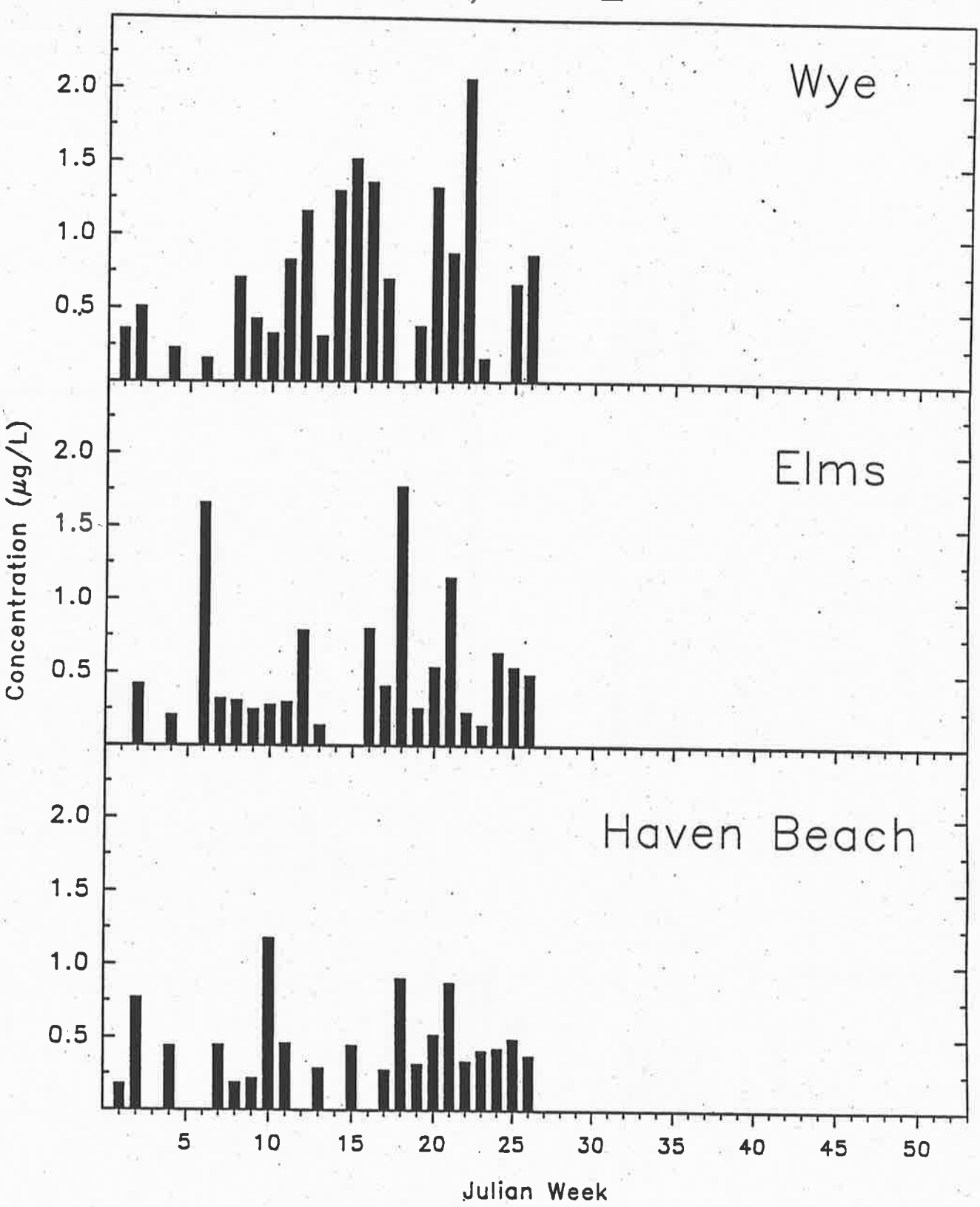
A1.19 Iron concentrations in precipitation, integrated at each CBAD site.



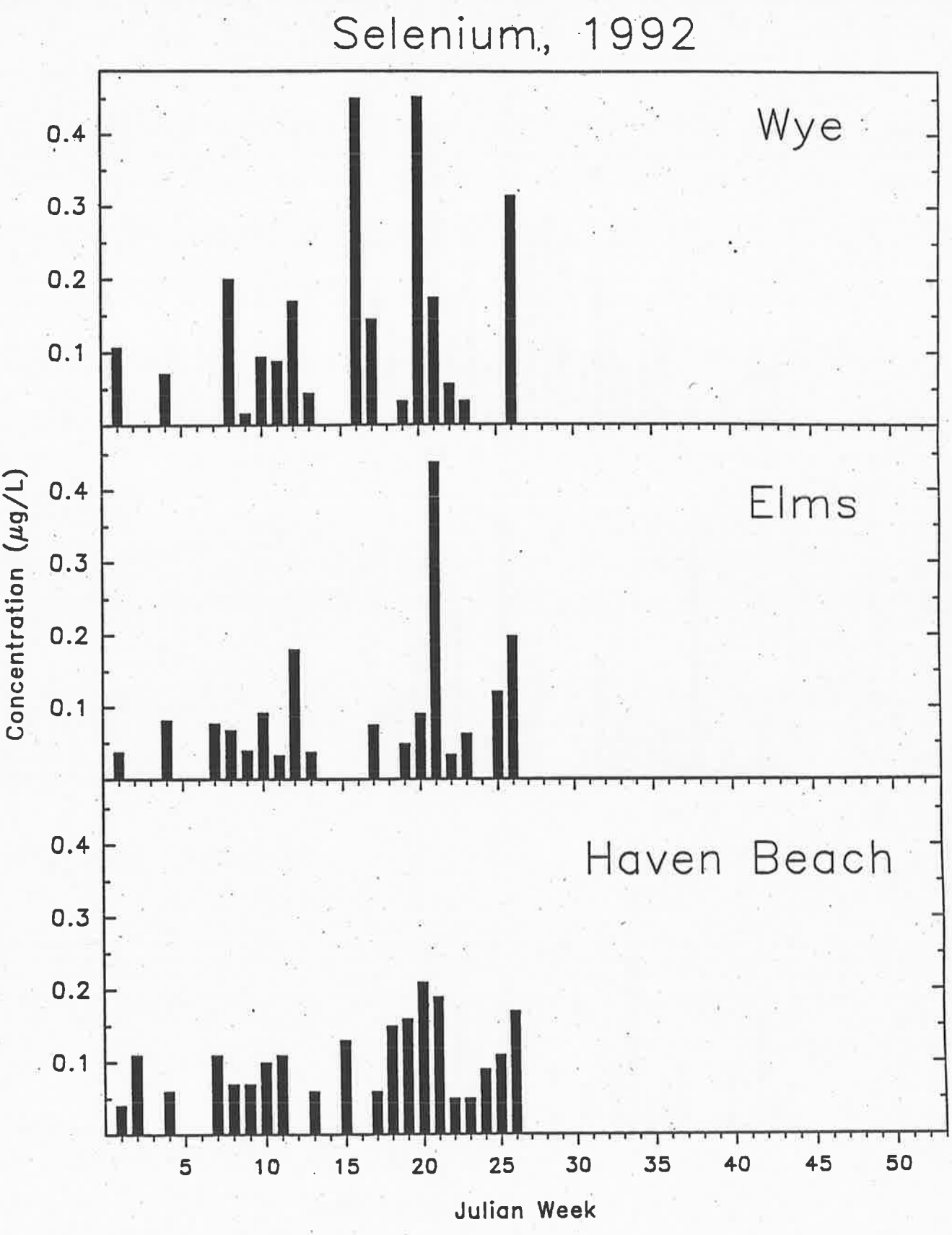
A1.20 Manganese concentrations in precipitation, integrated at each CBAD site.



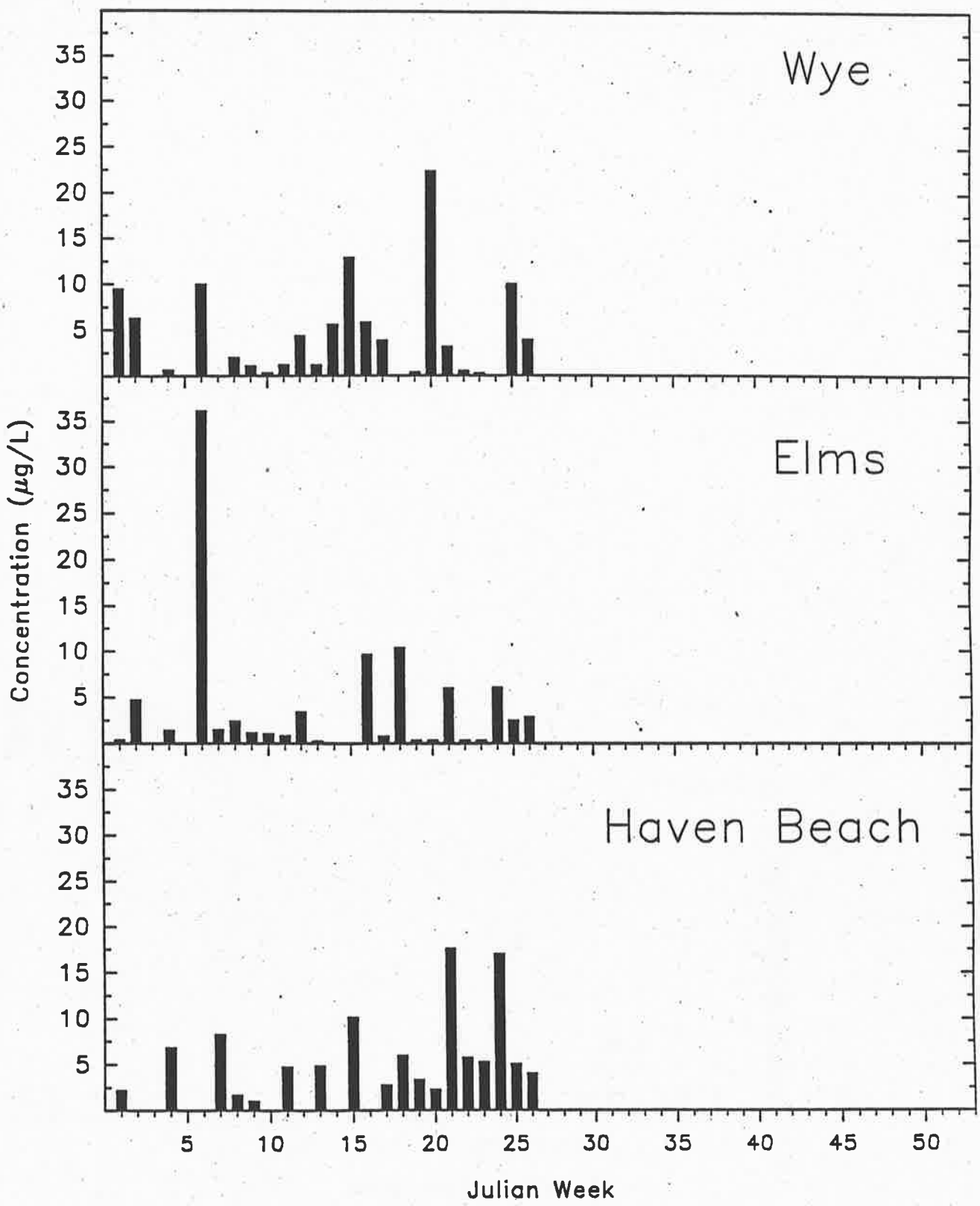
A1.21 Nickel concentrations in precipitation, integrated at each CBAD site.



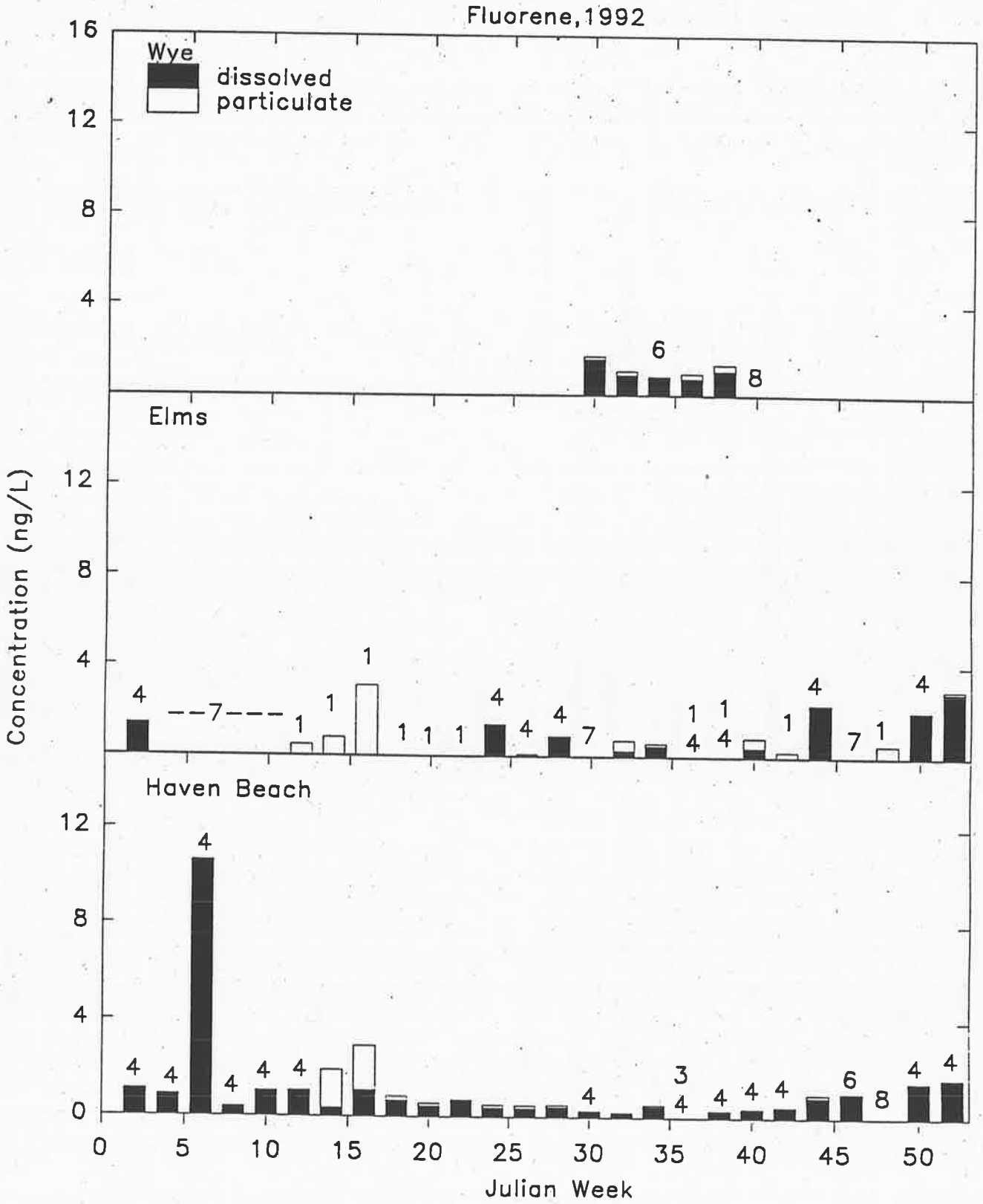
A1.22 Lead concentrations in precipitation, integrated at each CBAD site.



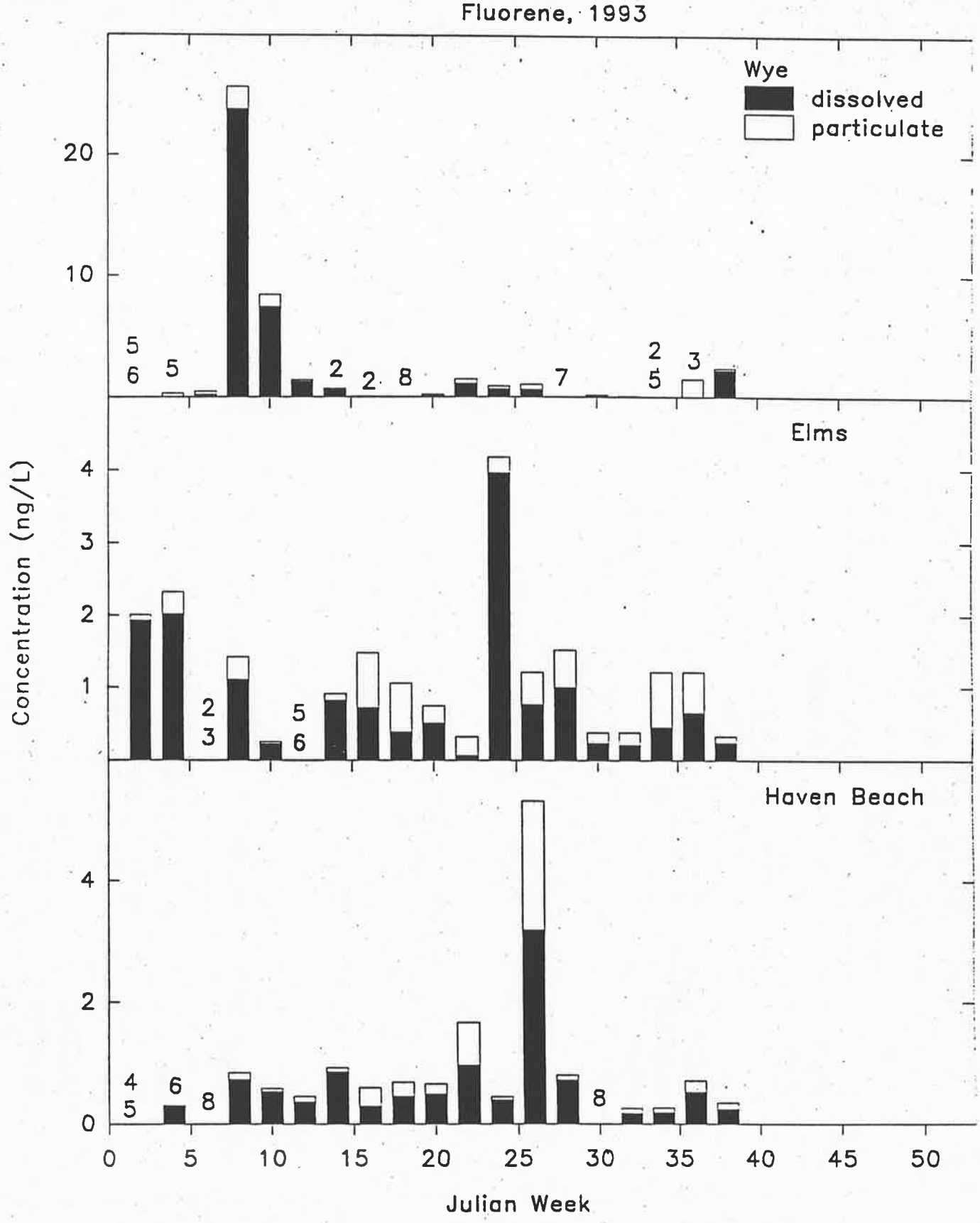
A1.23 Selenium concentrations in precipitation, integrated at each CBAD site.

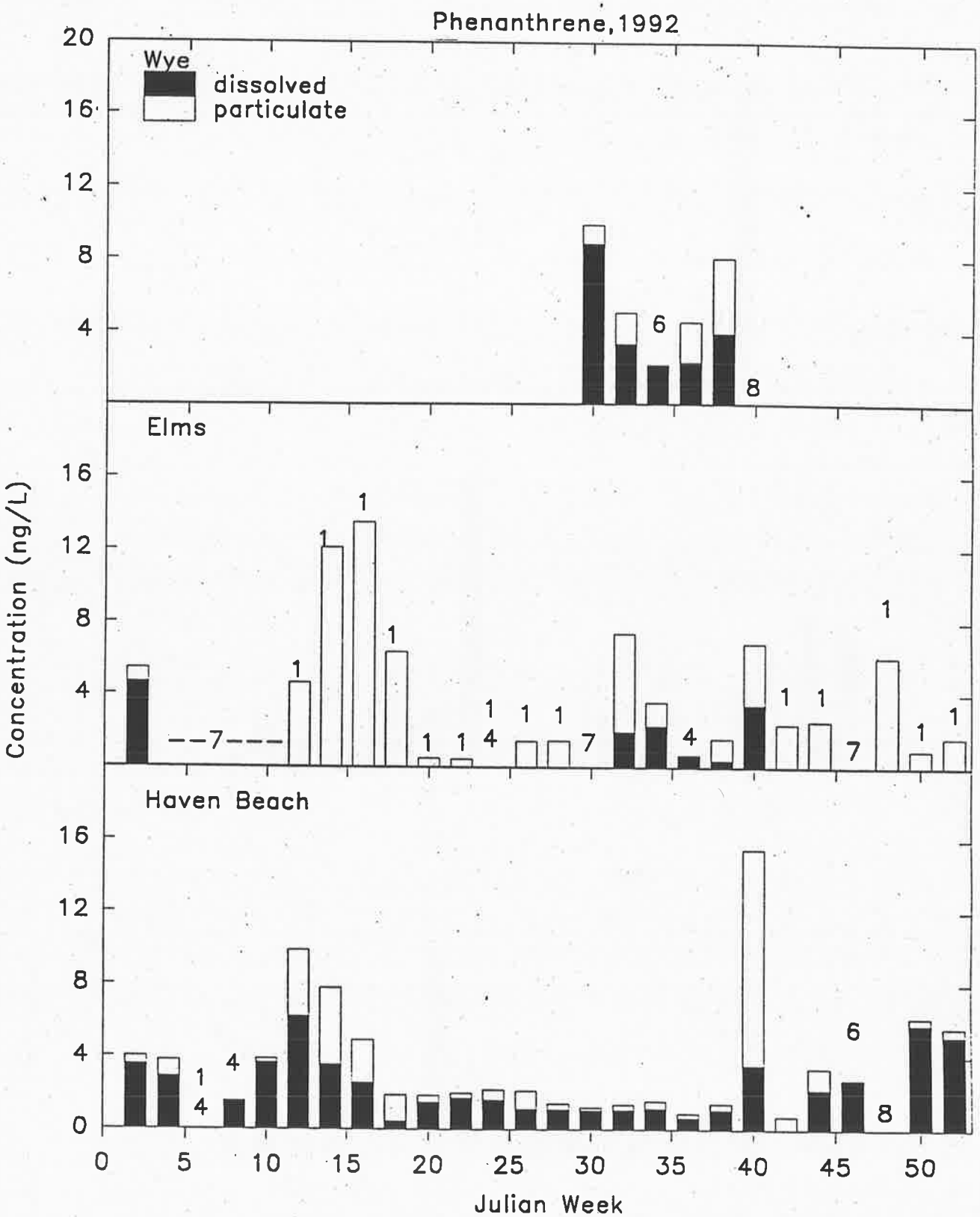


A1.24 Zinc concentrations in precipitation, integrated at each CBAD site.

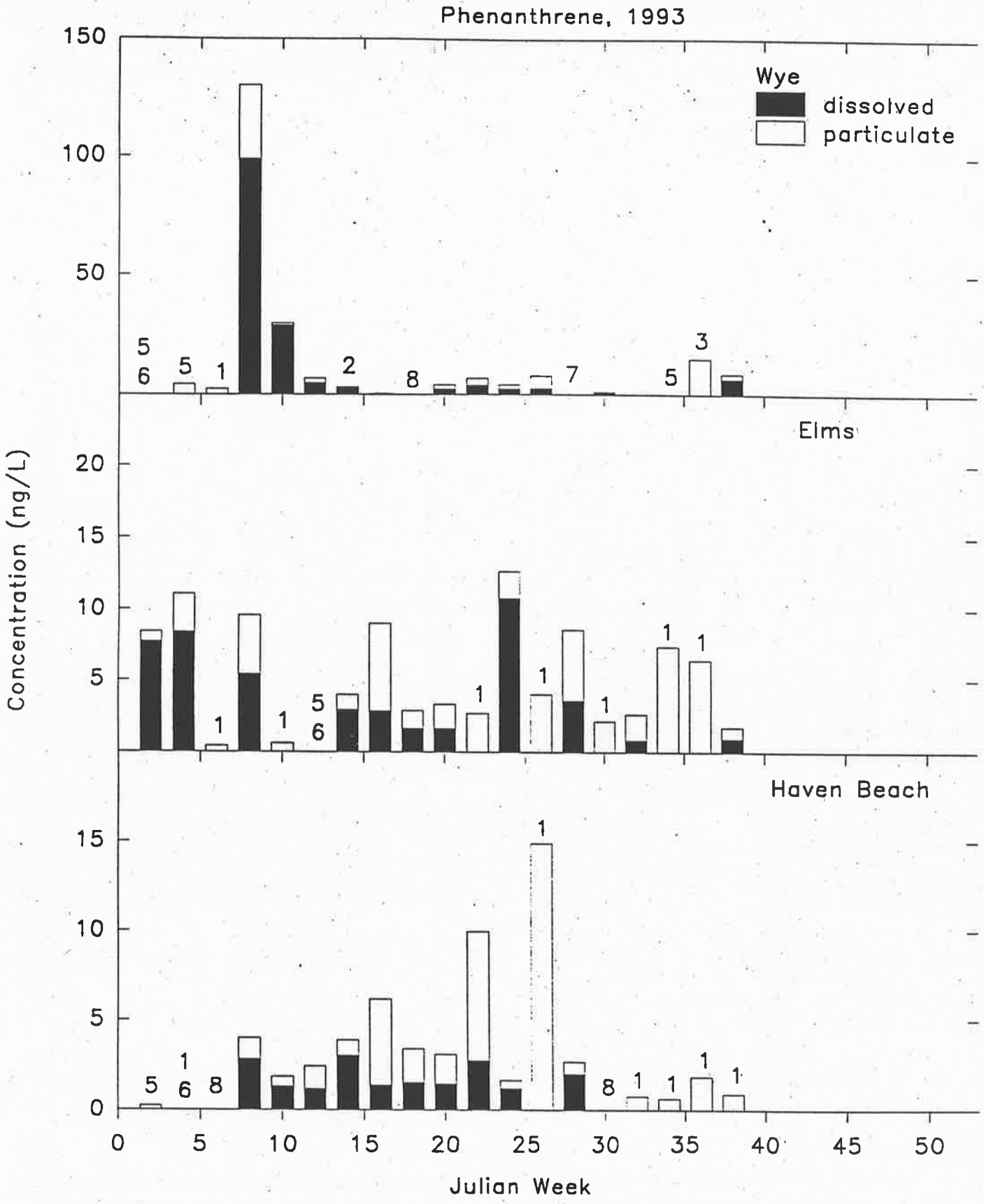


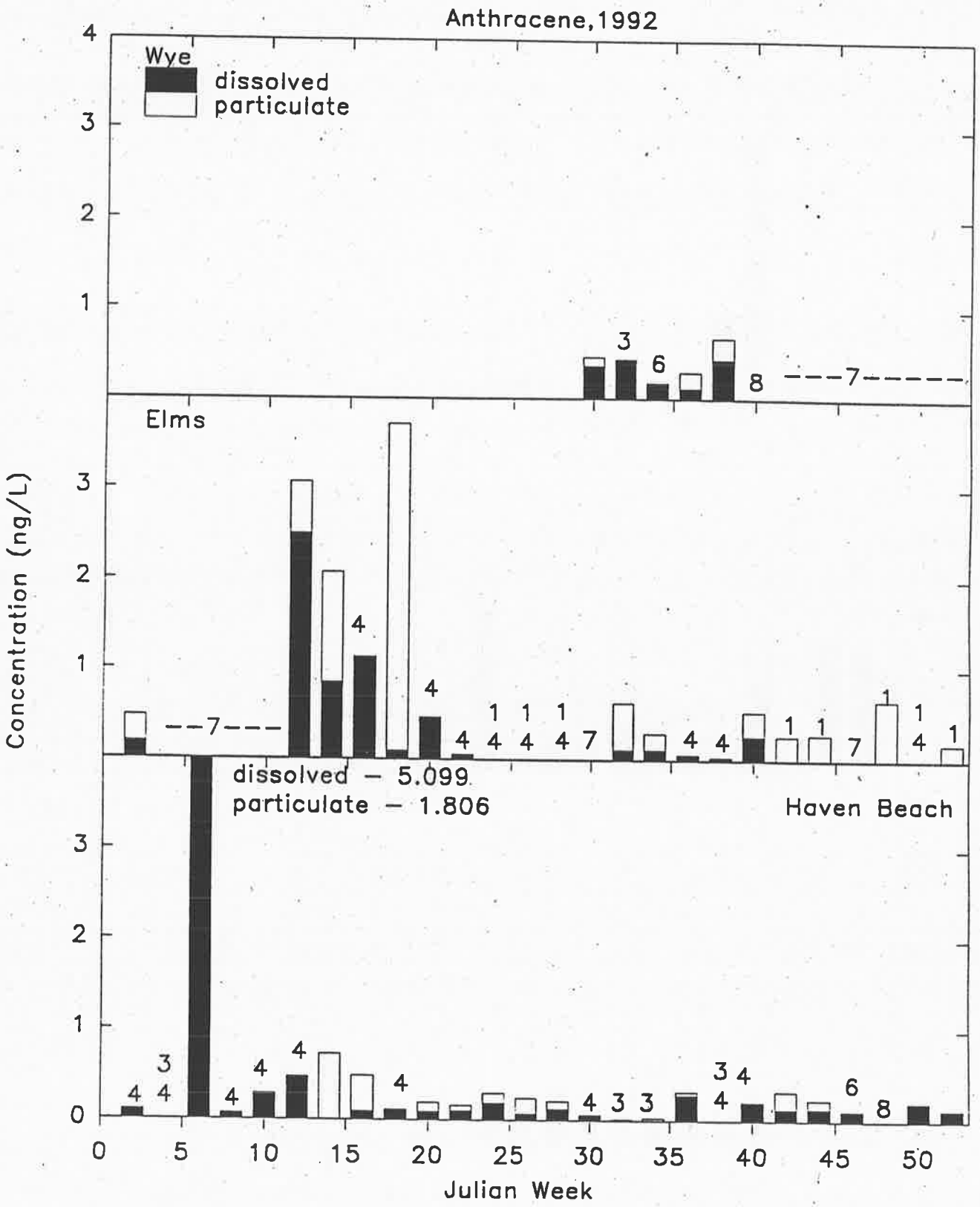
A1.25 Fluorene concentrations in precipitation integrated biweekly at the Wye, Elms and Haven Beach sites. (1=not quantifiable in dissolved phase, 2=not quantifiable on filter, 3=not detected in dissolved phase, 4=not detected on filter, 5=lost dissolved sample, 6=lost filter, 7=sampler down, 8=field blank).


Fluorene, 1993
Wye
dissolved
particulate
Elms
Haven Beach
Concentration (ng/L)
Julian Week
0
5
10
15
20
25
30
35
40
45
50
1
2
3
4
5
6
7
8

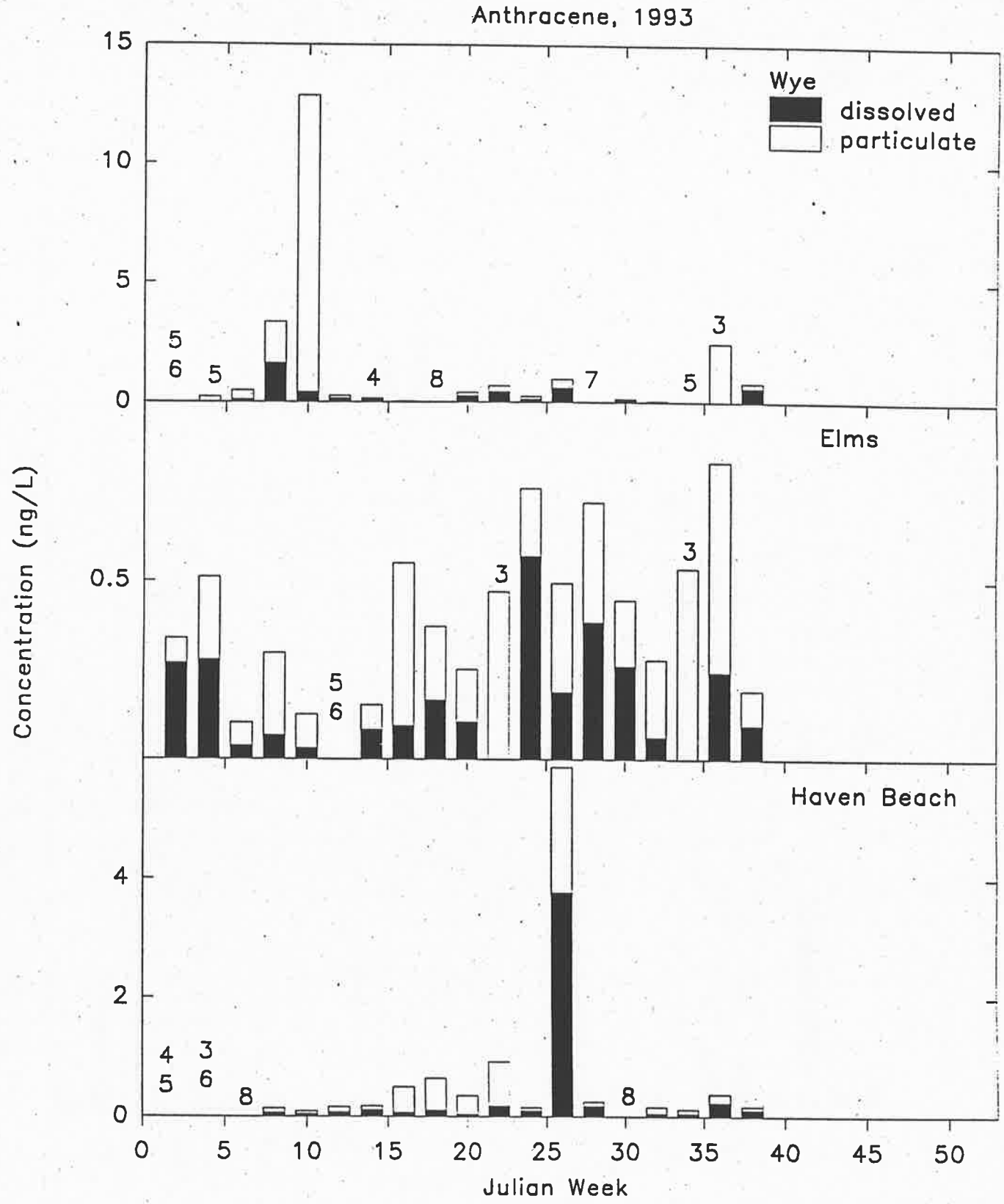


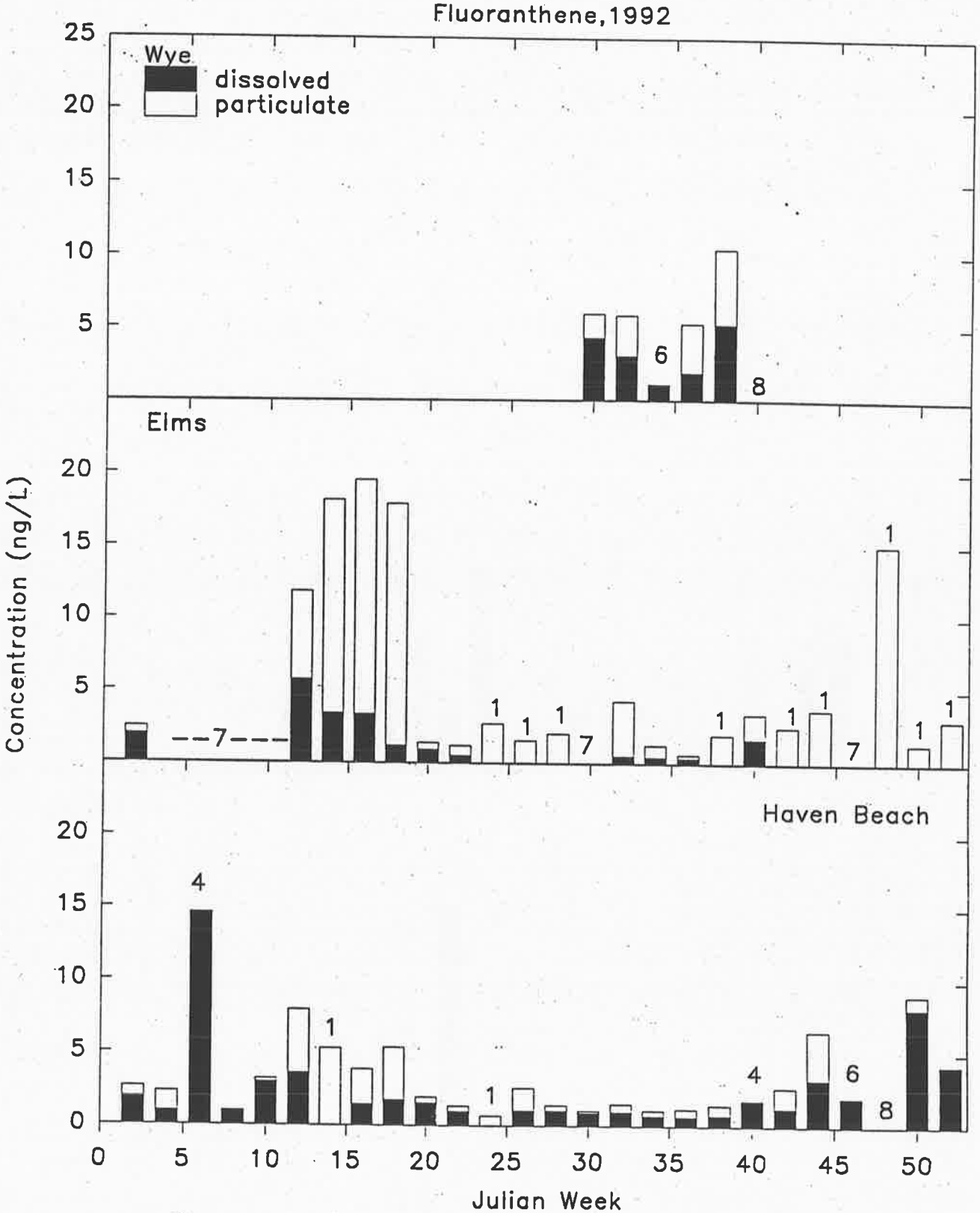
A1.26 Phenanthrene concentrations in precipitation integrated biweekly at the Wye,Elms and Haven Beach sites. (1=not quantifiable in dissolved phase, 2=not quantifiable on filter, 3=not detected in dissolved phase, 4=not detected on filter, 5=lost dissolved sample, 6=lost filter, 7=sampler down, 8=field blank).


Phenanthrene, 1993
Wye
dissolved
particulate
Elms
Haven Beach
Concentration (ng/L)
Julian Week
150
100
50
20
15
10
5
0
0
5
10
15
20
25
30
35
40
45
50

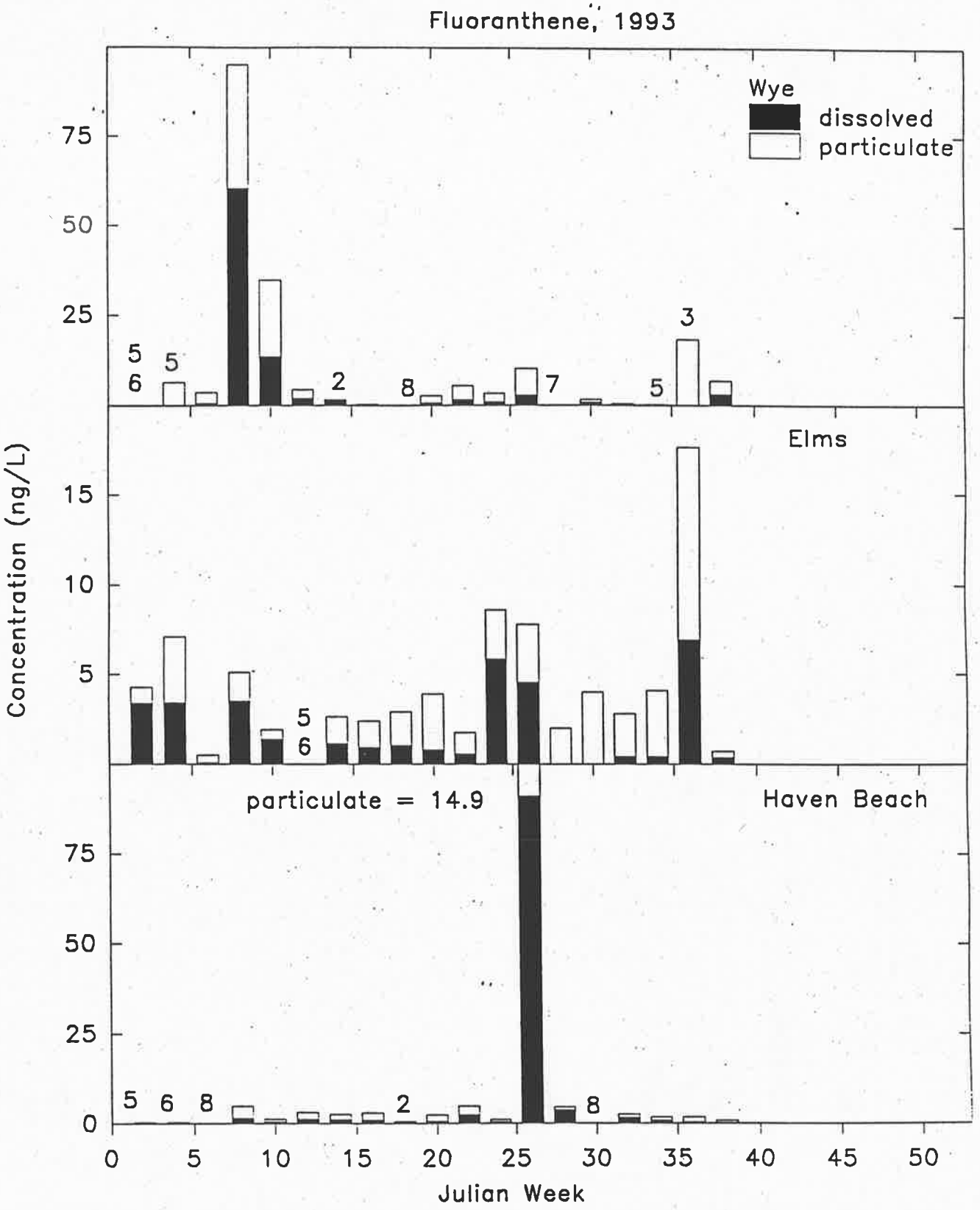


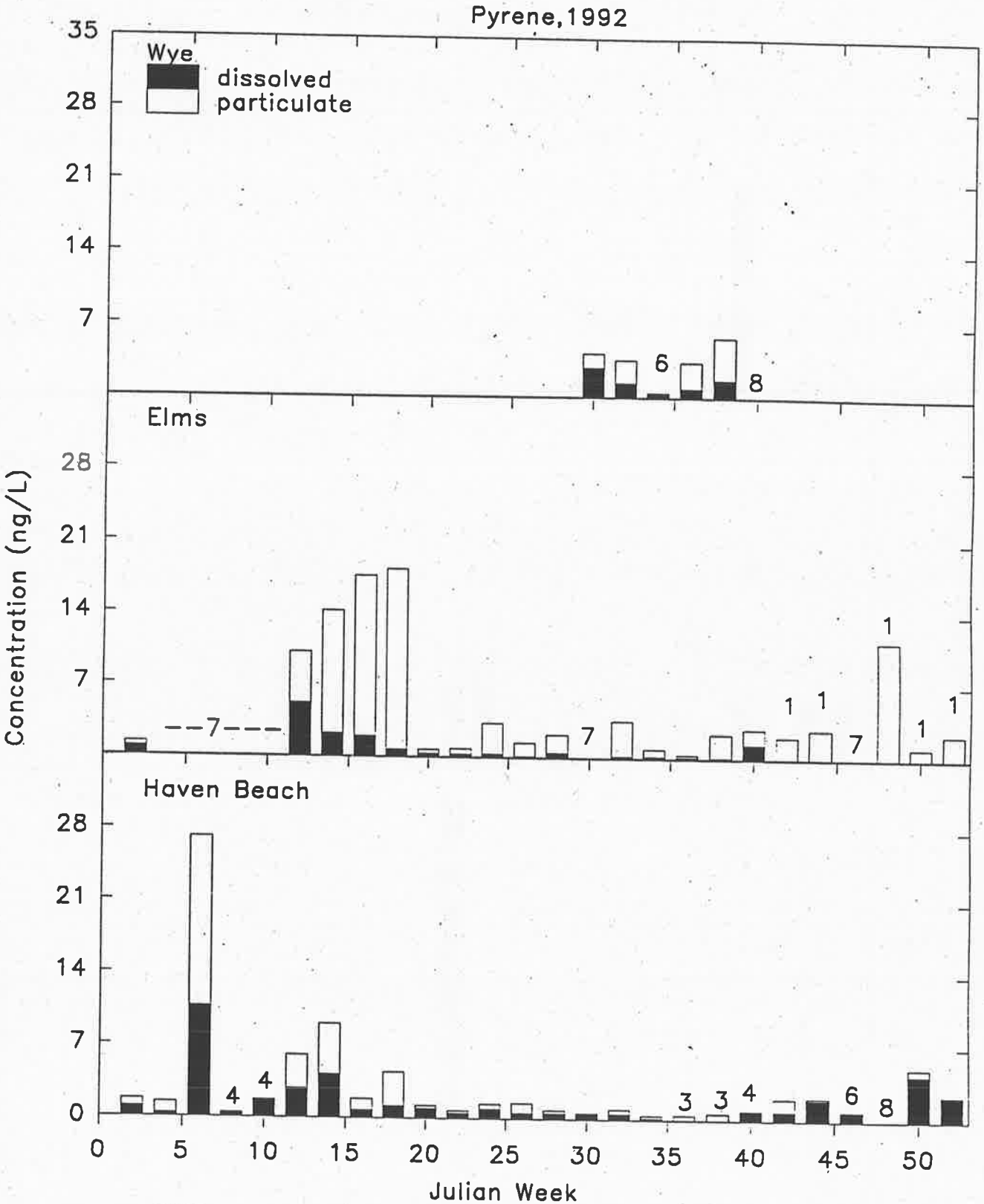
A1.27 Anthracene concentrations in precipitation integrated biweekly at the Wye, Elms and Haven Beach sites. (1=not quantifiable in dissolved phase, 2=not quantifiable on filter, 3=not detected in dissolved phase, 4=not detected on filter, 5=lost dissolved sample, 6=lost filter, 7=sampler down, 8= no ppt.).


Anthracene, 1993
Wye
dissolved
particulate
Elms
Haven Beach
Concentration (ng/L)
Julian Week
15
10
5
0
0.5
4
2
0
0
5
10
15
20
25
30
35
40
45
50
5 6
5
4
8
7
5
3
5 6
3
3
4 5
3 6
8
8

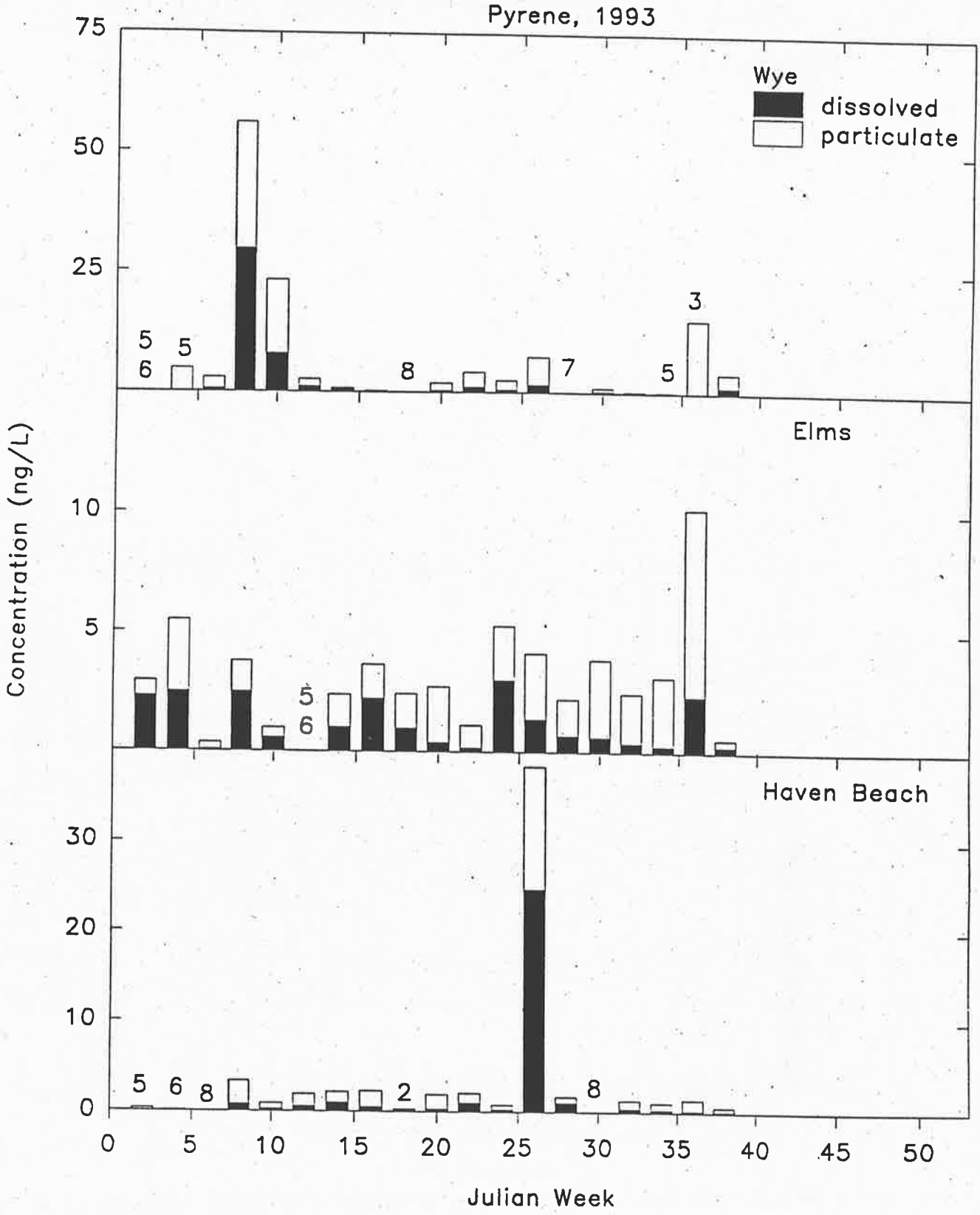


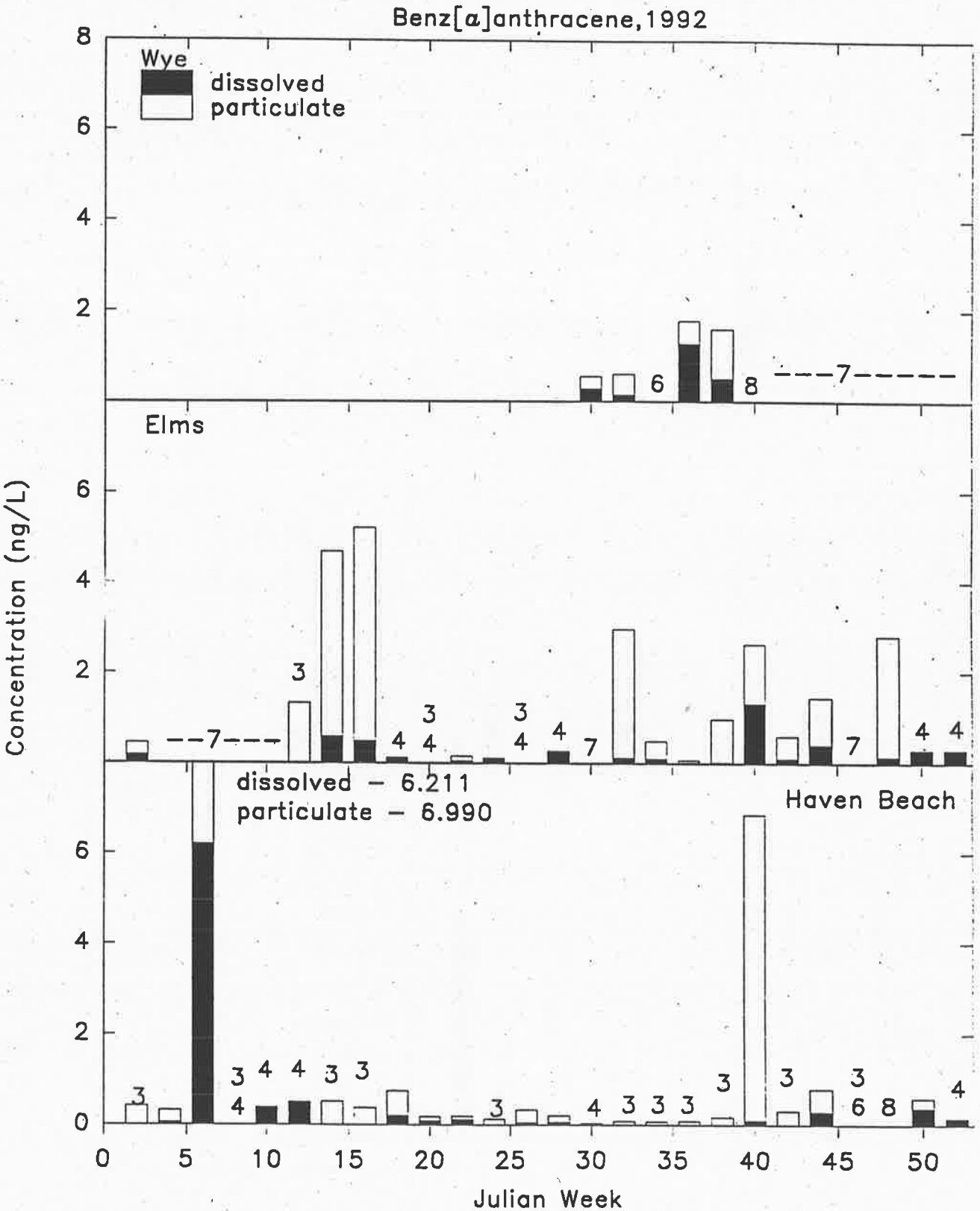
A1.28 Fluoranthene concentrations in precipitation integrated biweekly at the Wye, Elms and Haven Beach sites. (1=not quantifiable in dissolved phase, 2=not quantifiable on filter, 3=not detected in dissolved phase, 4=not detected on filter, 5=lost dissolved phase, 6=lost filter, 7=sampler down, 8=field blank).


Fluoranthene, 1993
Wye
dissolved
particulate
Elms
Haven Beach
particulate = 14.9
Concentration (ng/L)
Julian Week
0
5
10
15
20
25
30
35
40
45
50
25
50
75
5
10
15
5 6
5
2
8
7
5
3
5 6
5 6 8
2
8

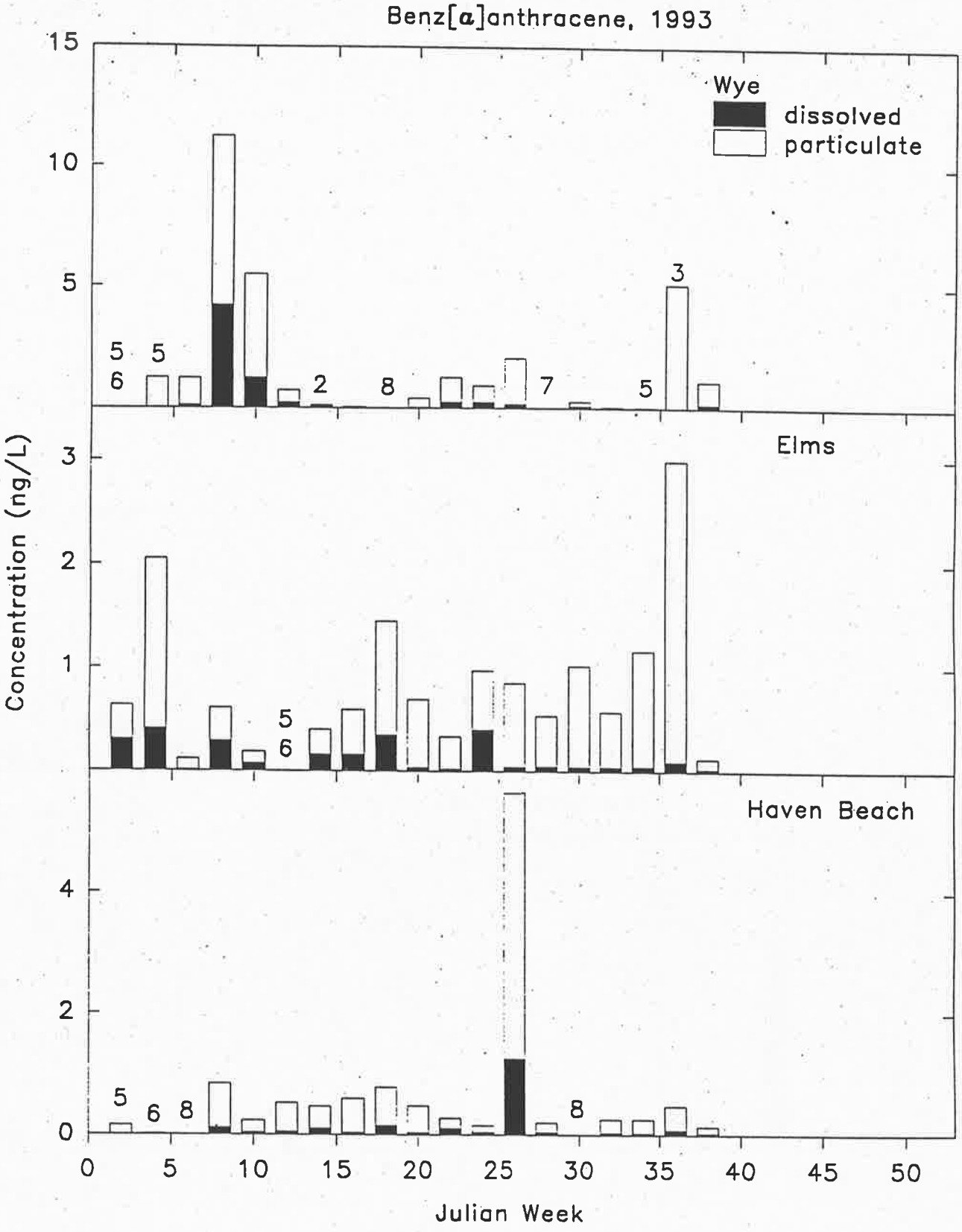


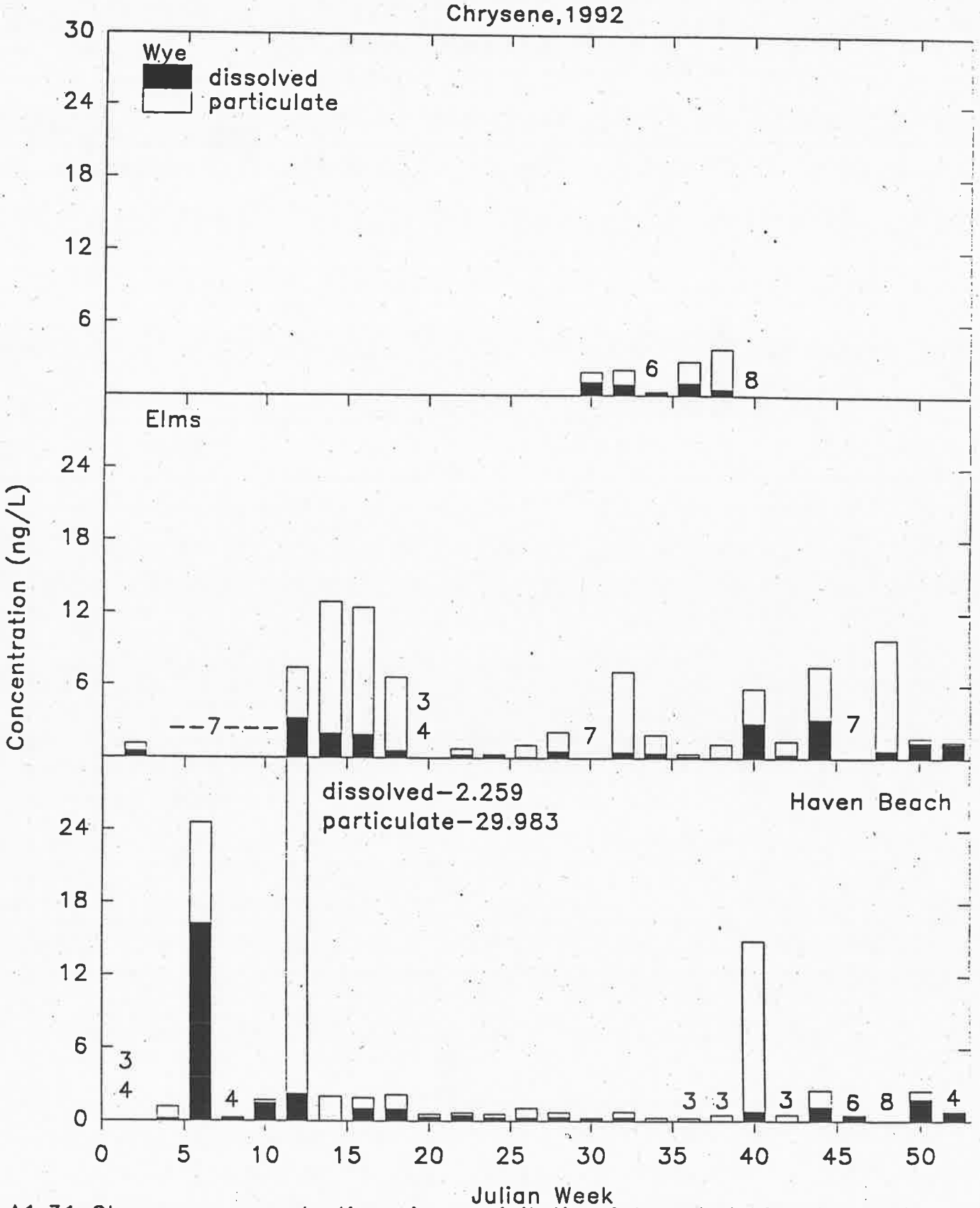
A1.29 Pyrene concentrations in precipitation integrated biweekly at the Wye, Elms and Haven Beach sites. (1=not quantifiable in dissolved phase, 2=not quantifiable on filter, 3=not detected in dissolved phase, 4=not detected on filter, 5=lost dissolved sample, 6=lost filter, 7=sampler down, 8=field blank).


Pyrene, 1993
Wye
dissolved
particulate
Elms
Haven Beach
Concentration (ng/L)
Julian Week
75
50
25
10
5
30
20
10
0
0
5
10
15
20
25
30
35
40
45
50
5 5 6
8
7
5
3
5 6
5 6 8
2
8

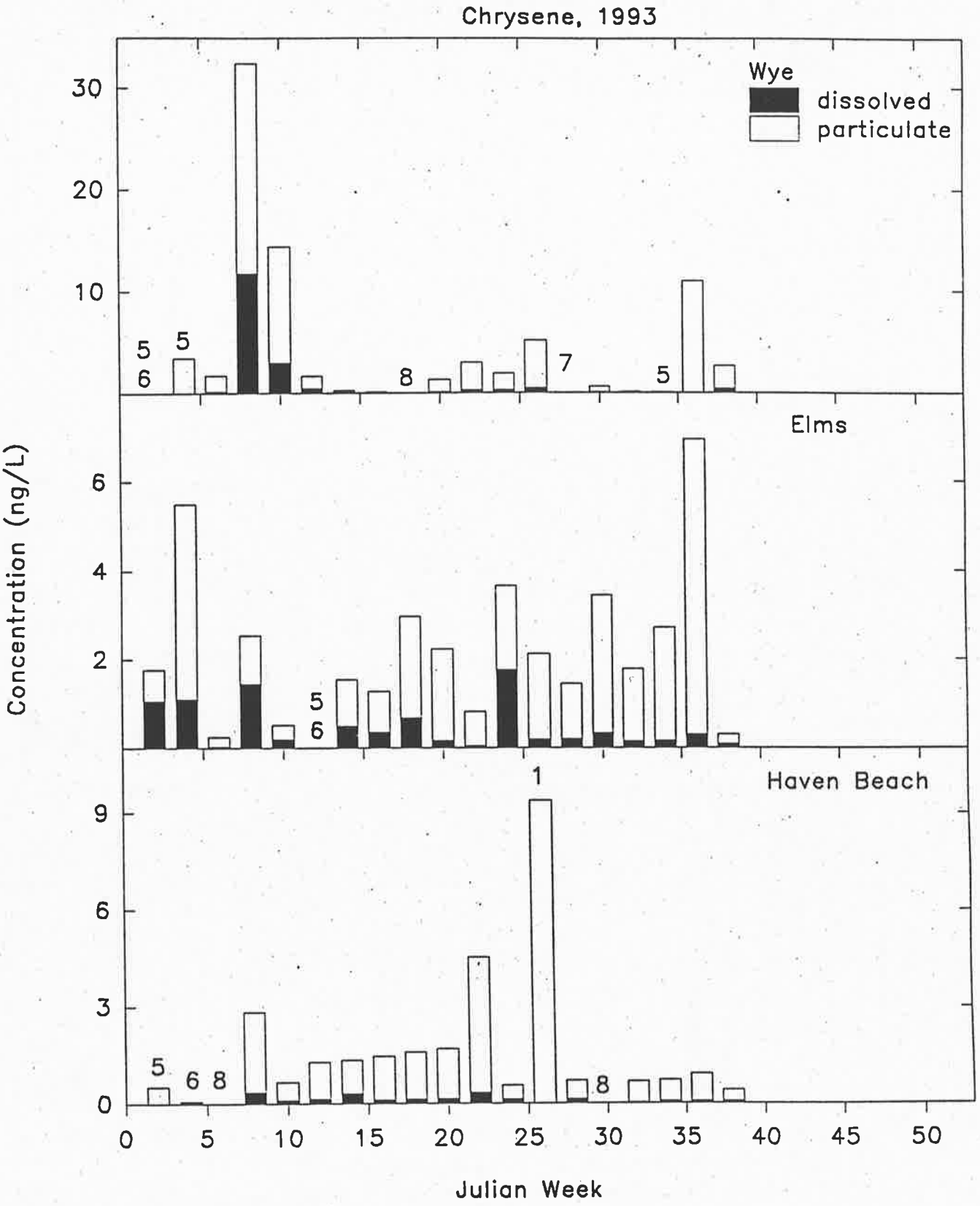


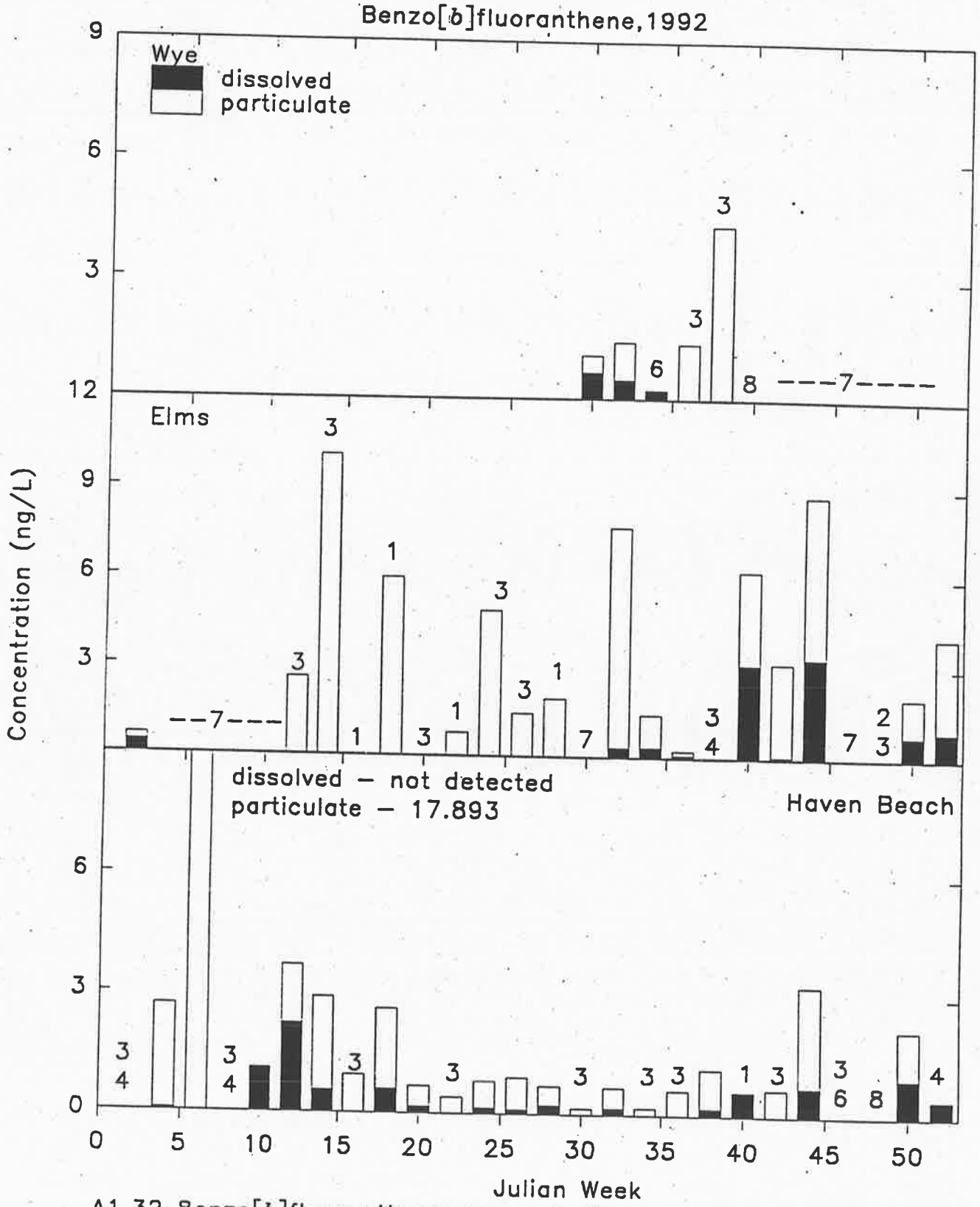
A1.30 Benz[a]anthracene concentrations in precipitation integrated biweekly at the Wye, Elms and Haven Beach sites. (1=not quantifiable in dissolved phase, 2=not quantifiable on filter, 3=not detected in dissolved phase, 4=not detected on filter, 5=lost dissolved sample, 6=lost filter, 7=sampler down, 8= no ppt.).


Benz[a]anthracene, 1993
Wye
dissolved
particulate
Elms
Haven Beach
Concentration (ng/L)
Julian Week
0
5
10
15
20
25
30
35
40
45
50
1
2
3
4
5
6
7
8

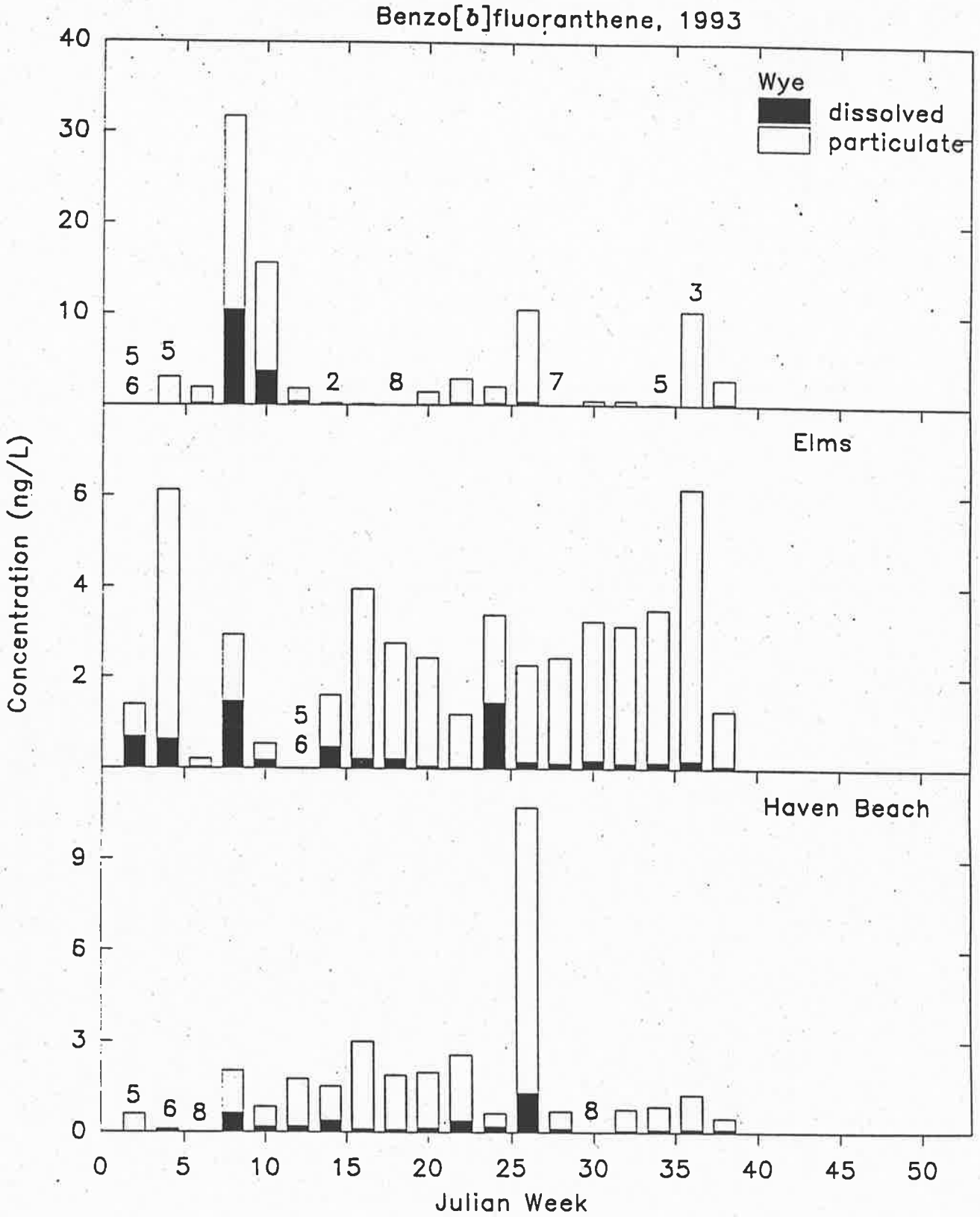


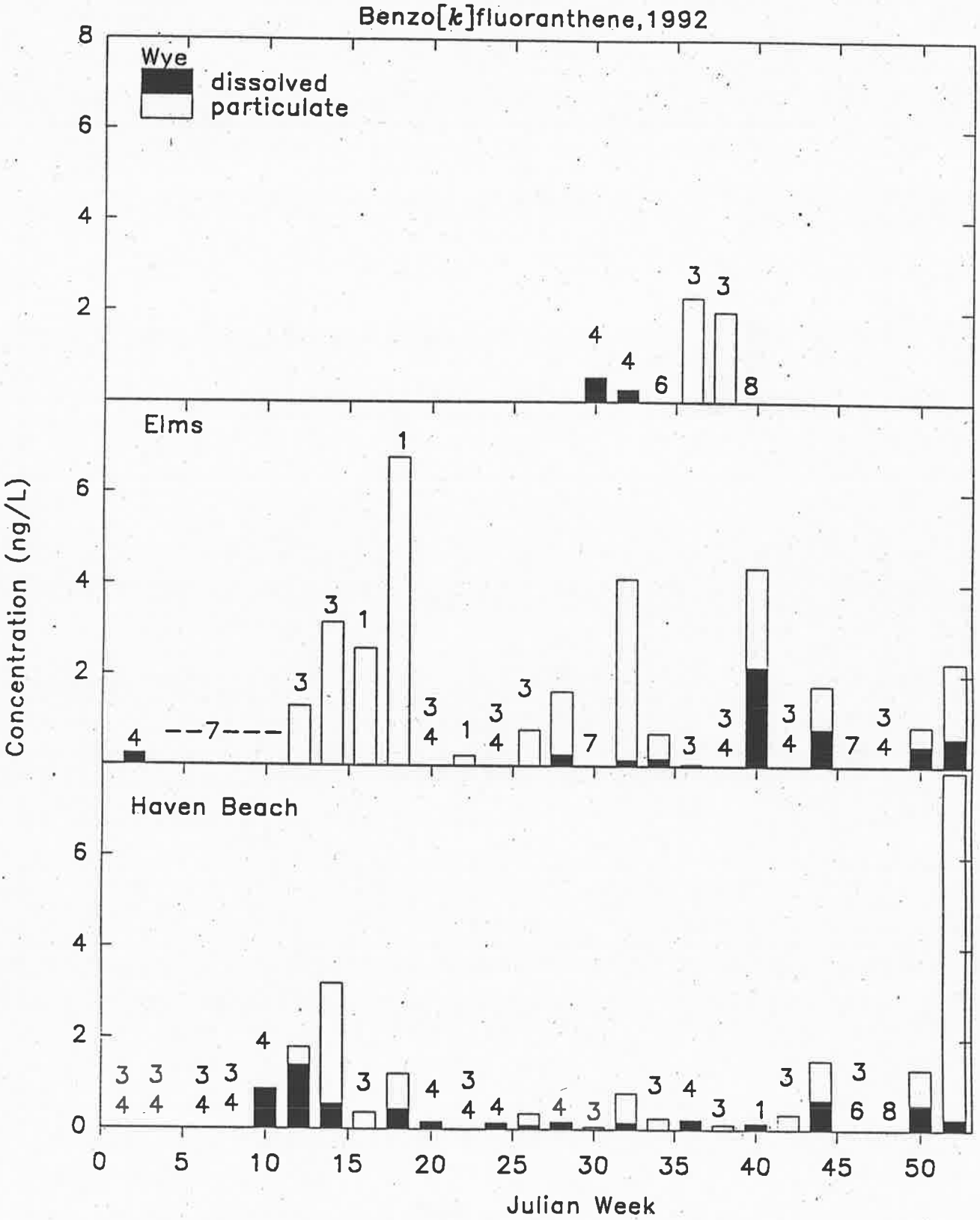
A1.31 Chrysene concentrations in precipitation integrated biweekly at the Wye, Elms and Haven Beach sites. (1=not quantifiable in dissolved phase, 2=not quantifiable on filter, 3=not detected in dissolved phase, 4=not detected on filter, 5=lost dissolved sample, 6=lost filter, 7=sampler down, 8= no ppt.).


Chrysene, 1993
Wye
dissolved
particulate
Elms
Haven Beach
Concentration (ng/L)
Julian Week
0
5
10
15
20
25
30
35
40
45
50
0
3
6
9
2
4
6
10
20
30
5
5
6
8
7
5
5
6
1
5
6
8
8

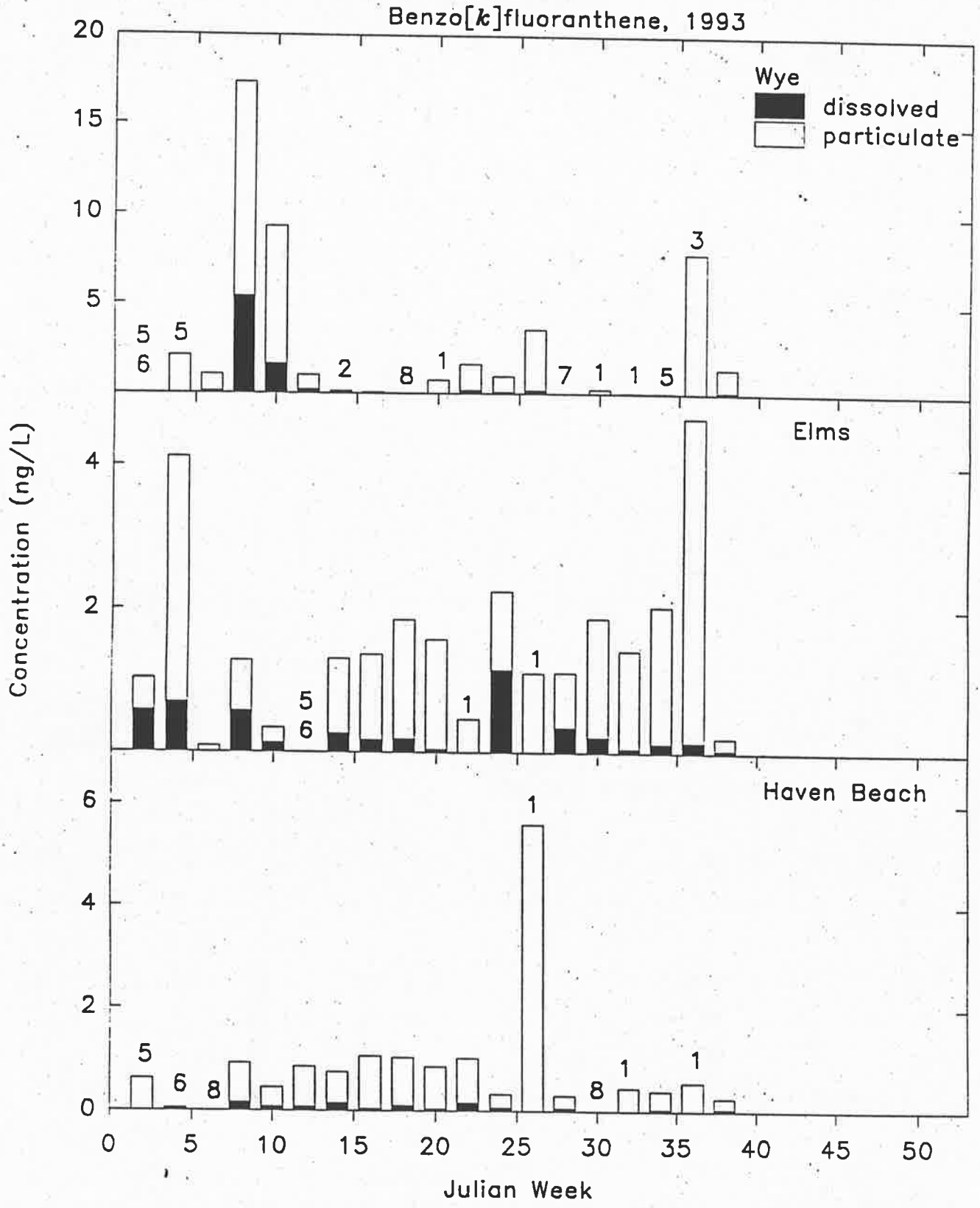


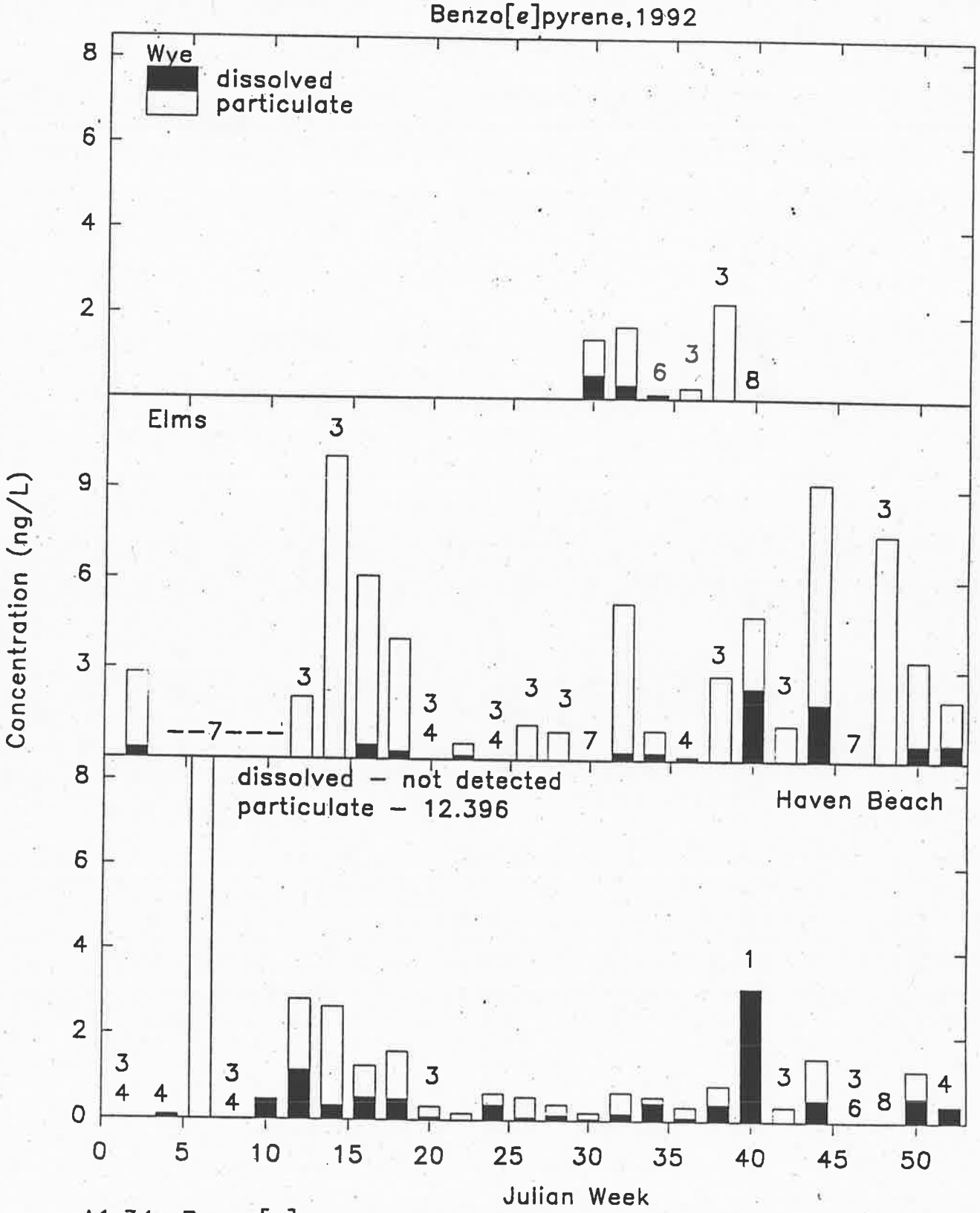
A1.32 Benzo[b]fluoranthene concentrations in precipitation integrated biweekly at the Wye, Elms and Haven Beach sites. (1=not quantifiable in dissolved phase, 2=not quantifiable on filter, 3= not detected in dissolved phase, 4=not detected on filter, 5= lost dissolved sample, 6=lost filter, 7=sampler down, 8= no ppt.).


Benzo[b]fluoranthene, 1993
Wye
dissolved
particulate
Elms
Haven Beach
Concentration (ng/L)
Julian Week
0
5
10
15
20
25
30
35
40
45
50

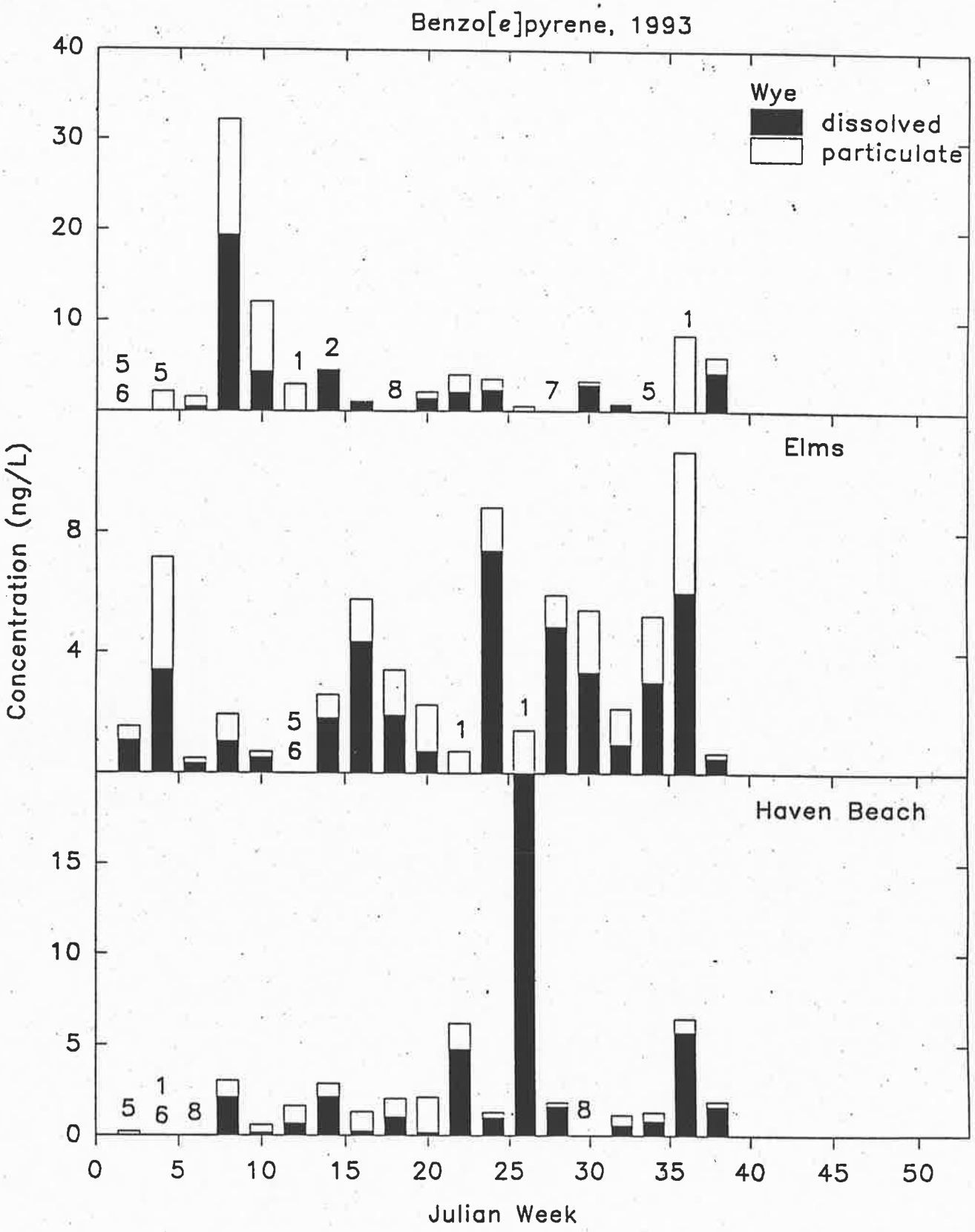


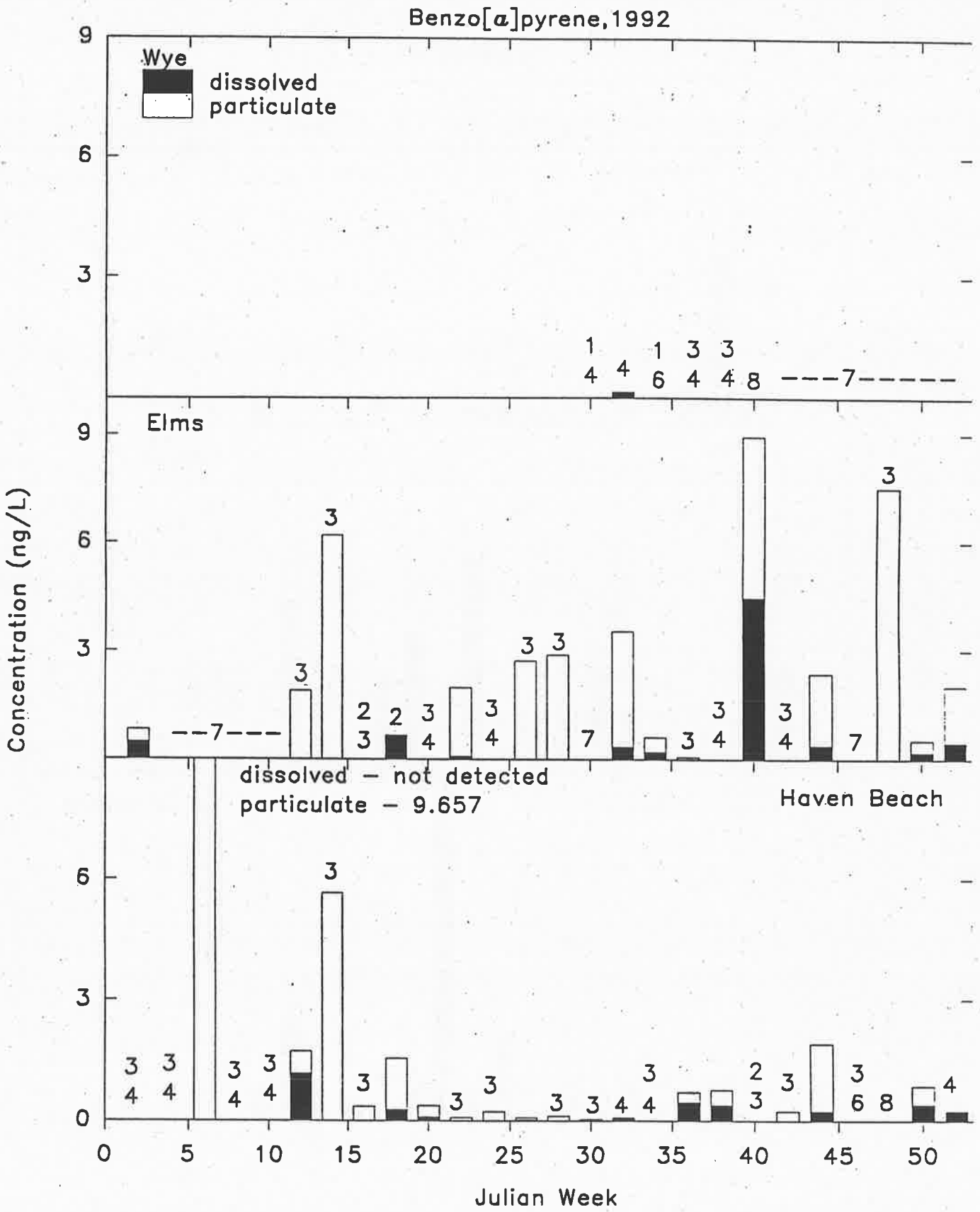
A1.33 Benzo[*k*]fluoranthene concentrations in precipitation integrated biweekl at the Wye, Elms and Haven Beach sites. (1=not quantifiable in dissolved phase, 2=not quantifiable on filter, 3=not detected in dissolved phase, 4=not detected on filter, 5=lost dissolved phase, 6=lost filter, 7=sampler down, 8= no ppt.).


Benzo[k]fluoranthene, 1993
Wye
dissolved
particulate
Elms
Haven Beach
Concentration (ng/L)
Julian Week
0
2
4
5
6
8
10
15
20
25
30
35
40
45
50

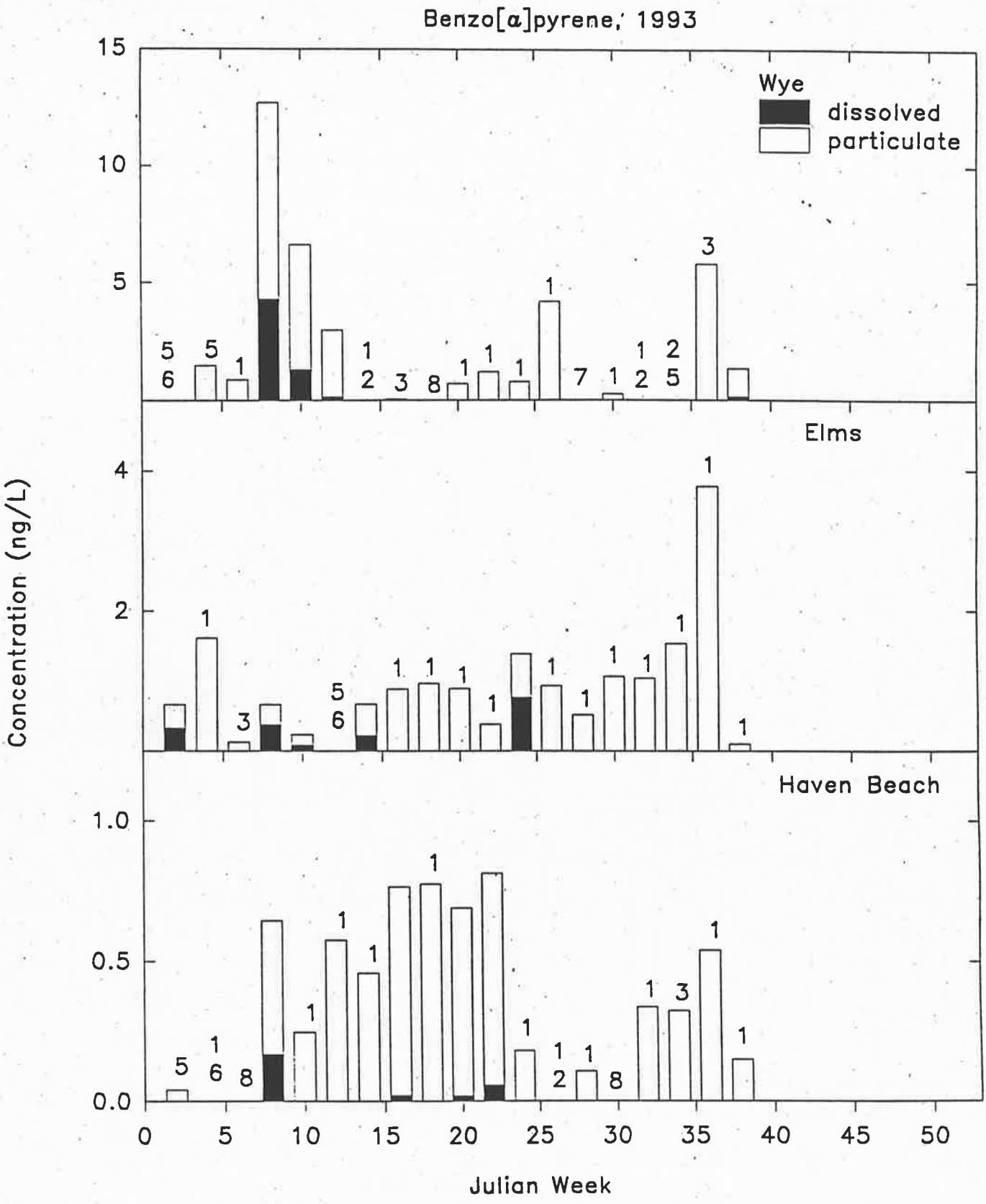


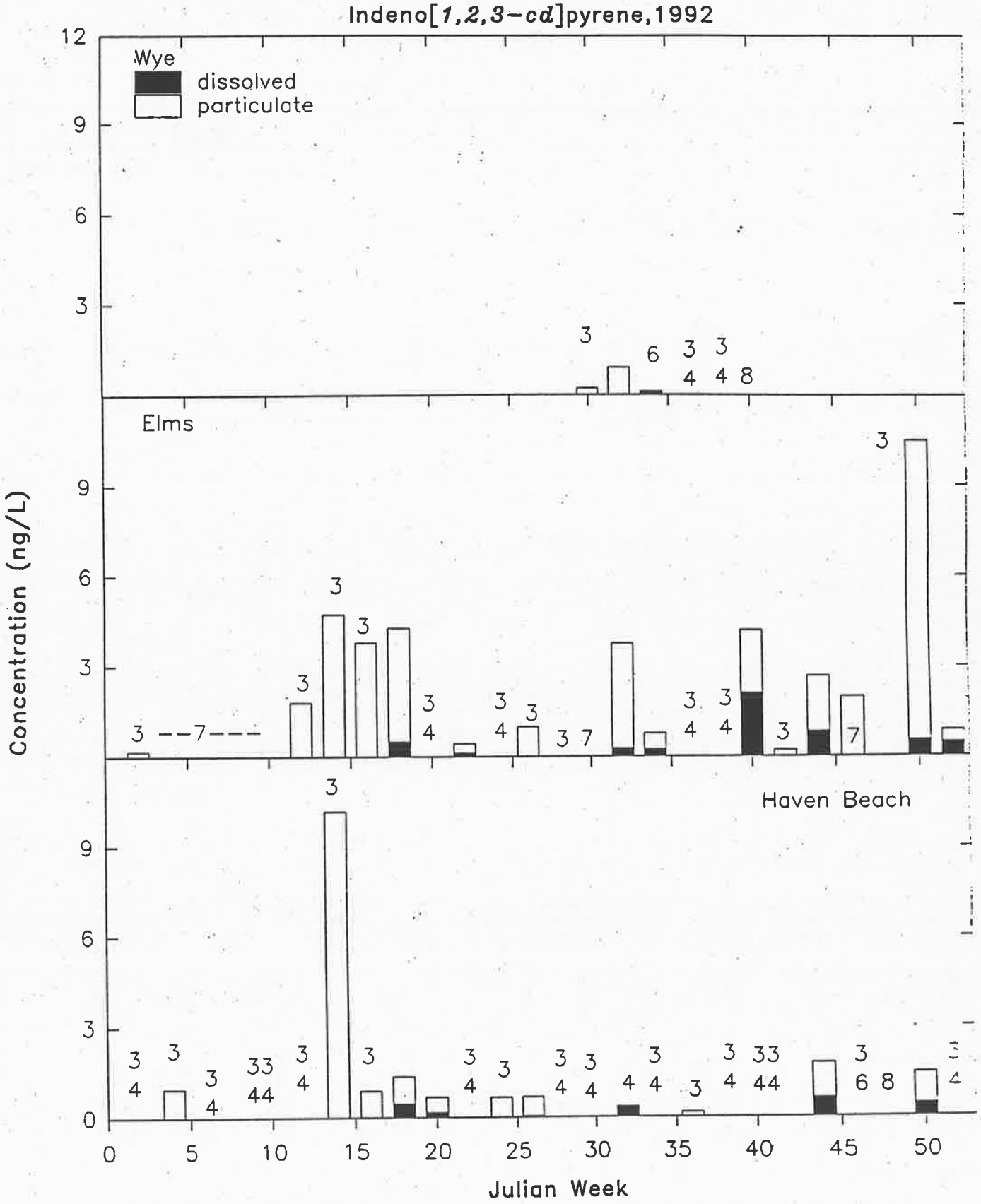
A1.34 Benzo[e]pyrene concentrations in precipitation integrated biweeki at the Wye, Elms and Haven Beach sites. (1=not quantifiable in dissolved phase, 2=not quantifiable on filter, 3=not detected in dissolved phase, 4=not detected on filter, 5=lost dissolved samp 6=lost filter, 7=sampler down, 8=field blank).


Benzo[e]pyrene, 1993
Wye
dissolved
particulate
Elms
Haven Beach
Concentration (ng/L)
Julian Week
0
5
10
15
20
25
30
35
40
45
50

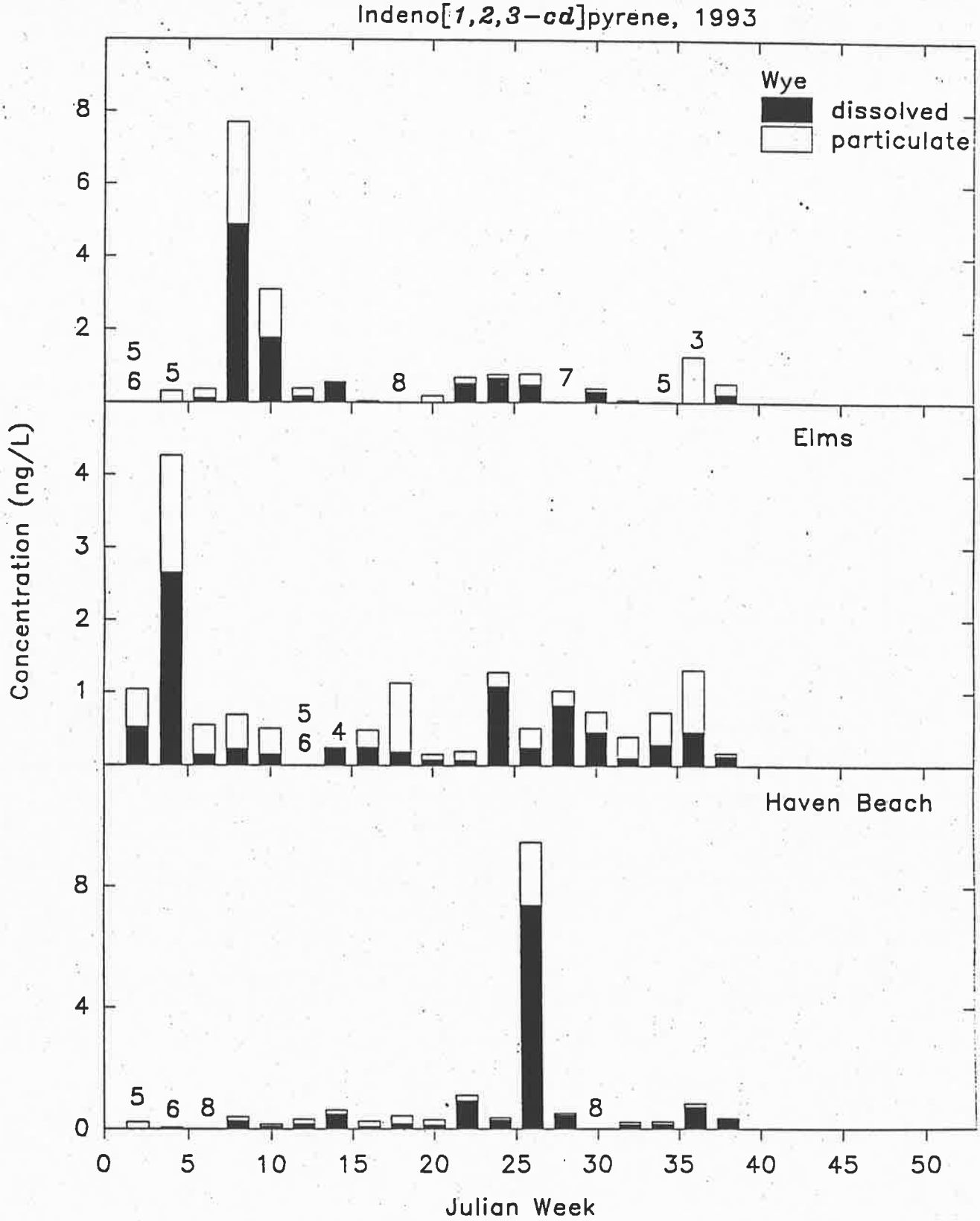


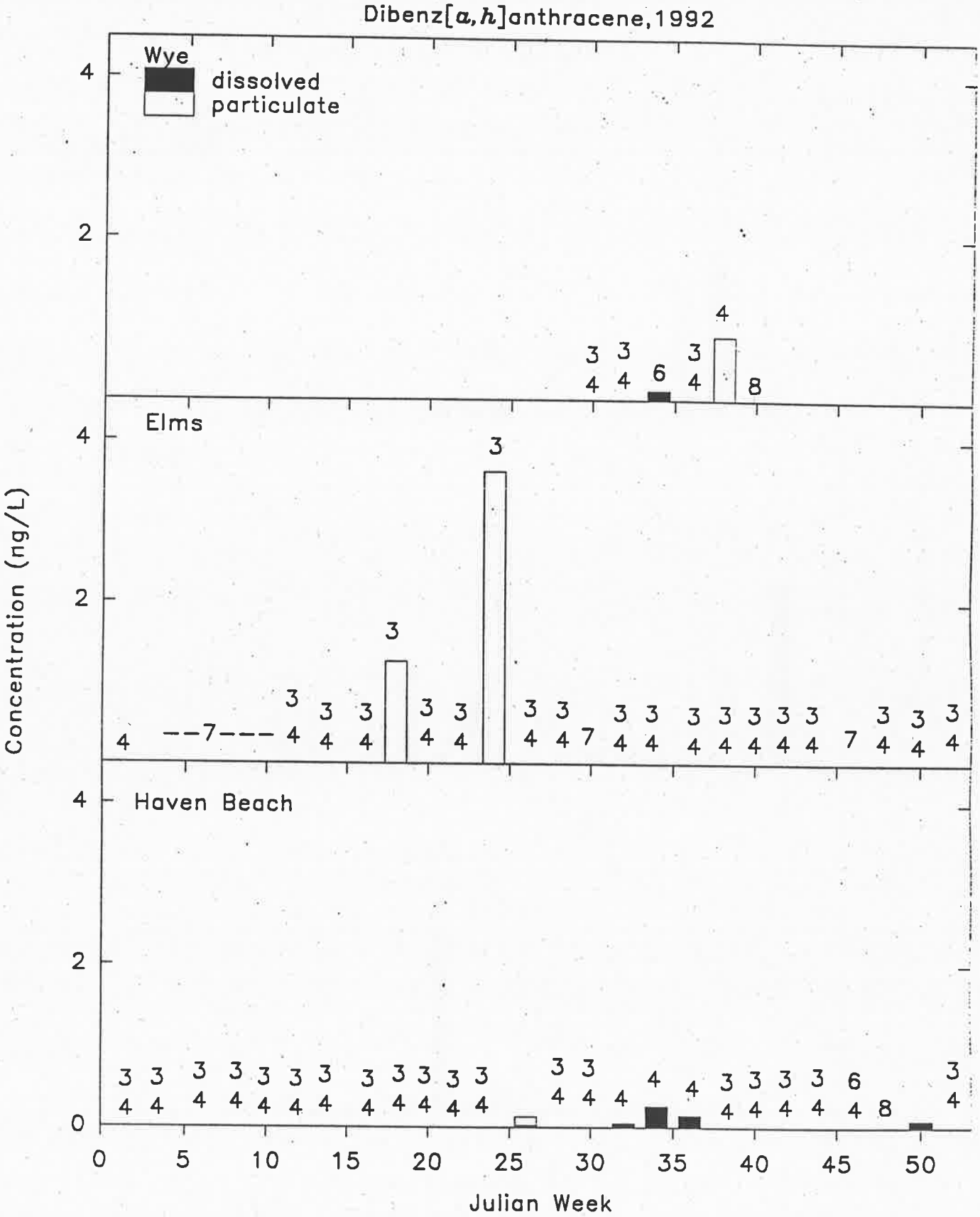
A1.35 Benzo[a]pyrene concentrations in precipitation integrated biweekly at the Wye, Elms and Haven Beach sites. (1=not quantifiable in dissolved phase, 2=not quantifiable on filter, 3=not detected in dissolved phase, 4=not detected on filter, 5=lost dissolved sample, 6=lost filter, 7=sampler down, 8= no ppt.).


Benzo[a]pyrene, 1993
Wye
dissolved
particulate
Elms
Haven Beach
Concentration (ng/L)
Julian Week
15
10
5
4
2
1.0
0.5
0.0
0
5
10
15
20
25
30
35
40
45
50

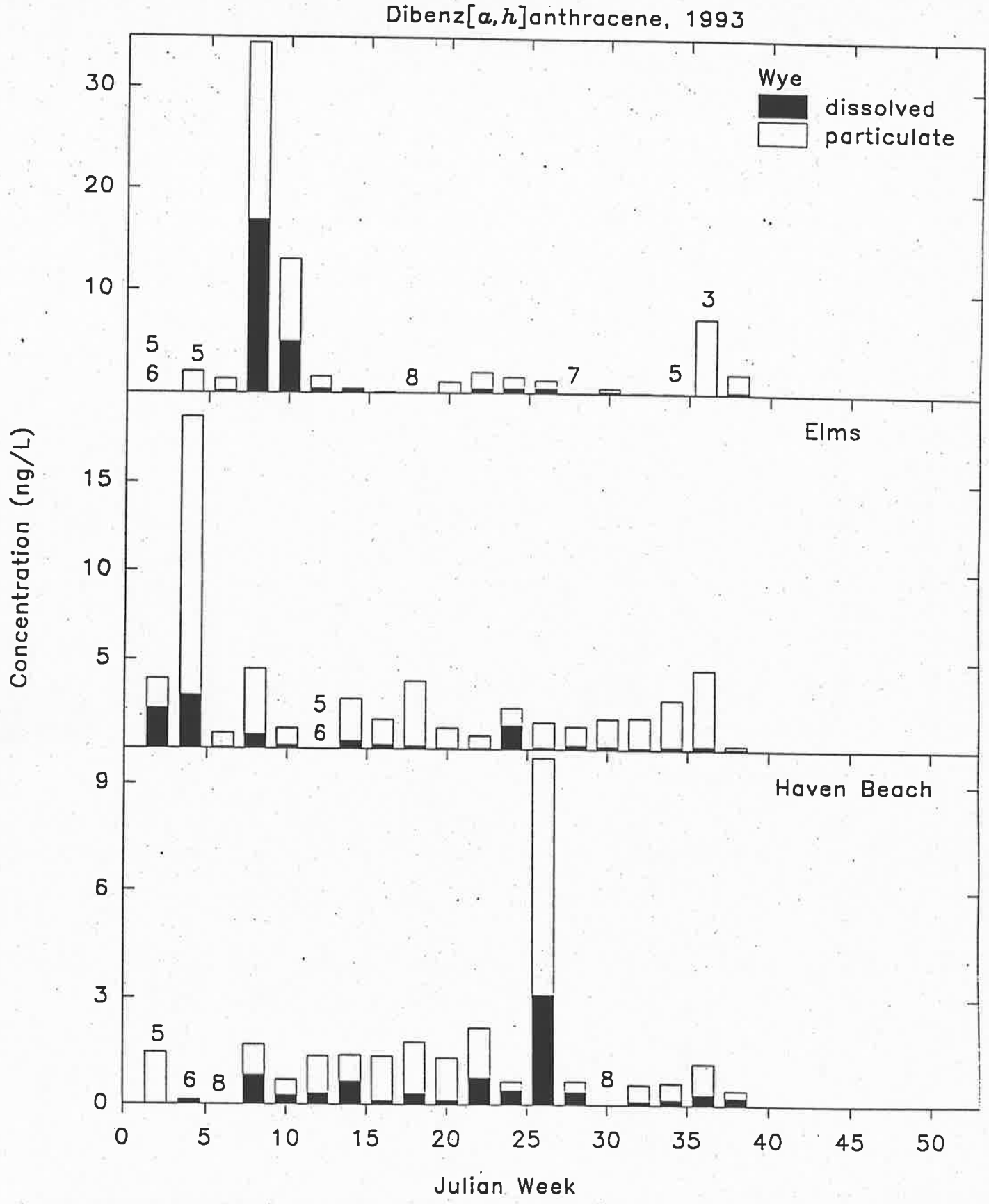


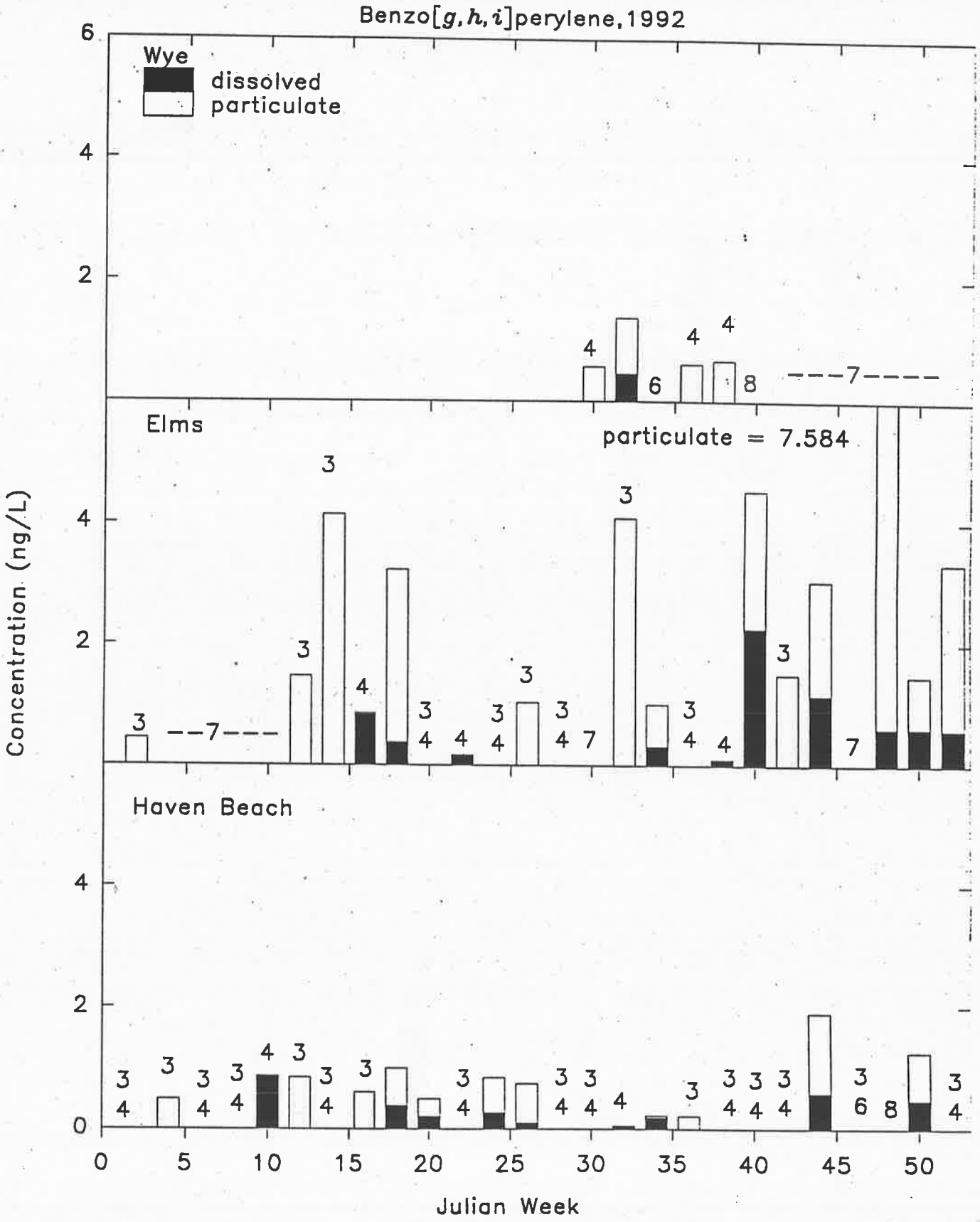
A1.36 Indeno[*1,2,3–cd*]pyrene concentrations in precipitation integrated biweekly at the Wye, Elms and Haven Beach sites. (1=not quantifiable in dissolved phase, 2=not quantifiable on filter, 3=not detected in dissolved phase, 4=not detected on filter, 5=lost dissolved sample, 6=lost filter, 7=sampler down, 8=field blank).


Indeno[1,2,3-cd]pyrene, 1993
Wye
dissolved
particulate
Elms
Haven Beach
Concentration (ng/L)
Julian Week
0
5
10
15
20
25
30
35
40
45
50
1
2
4
6
8
3
7

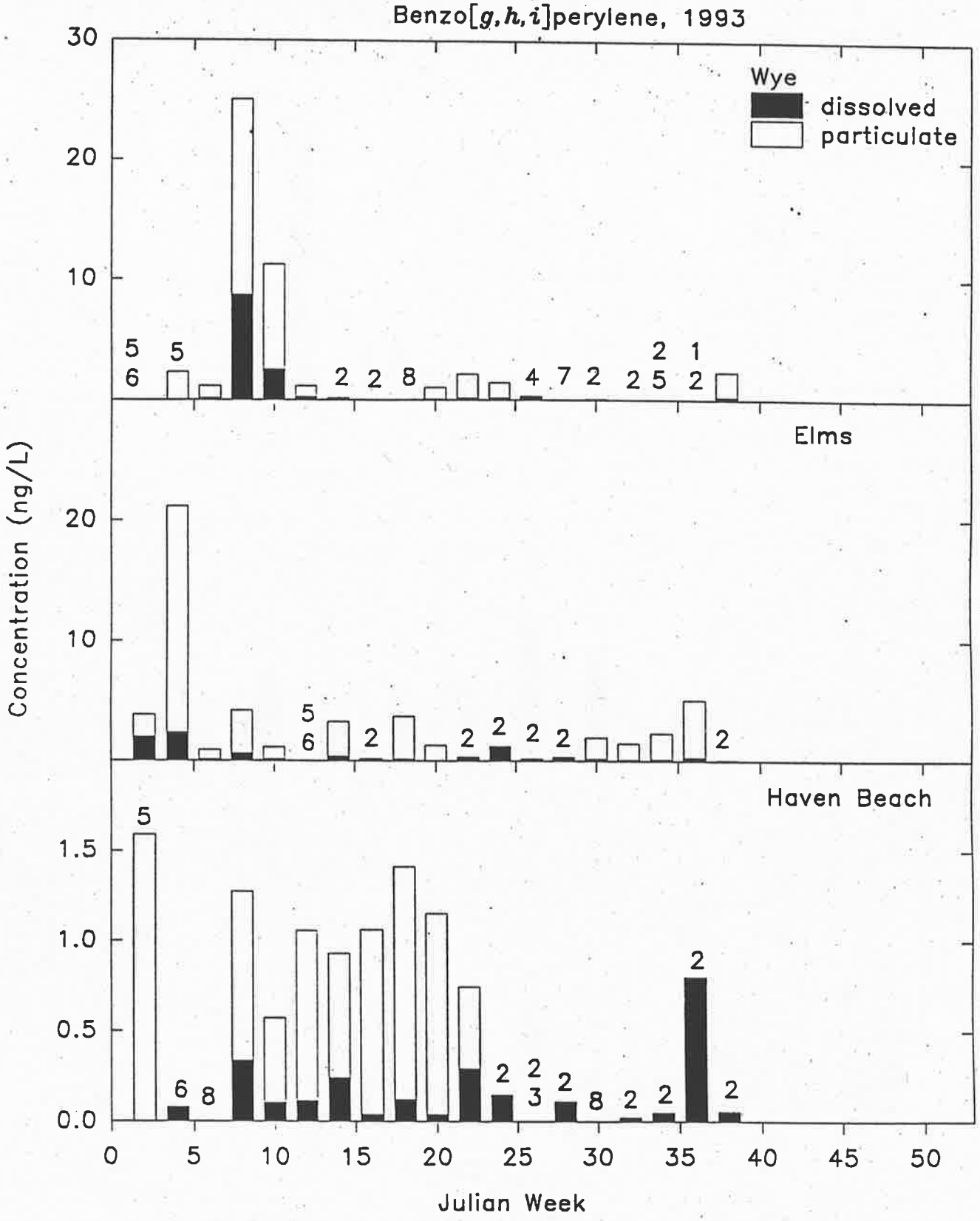


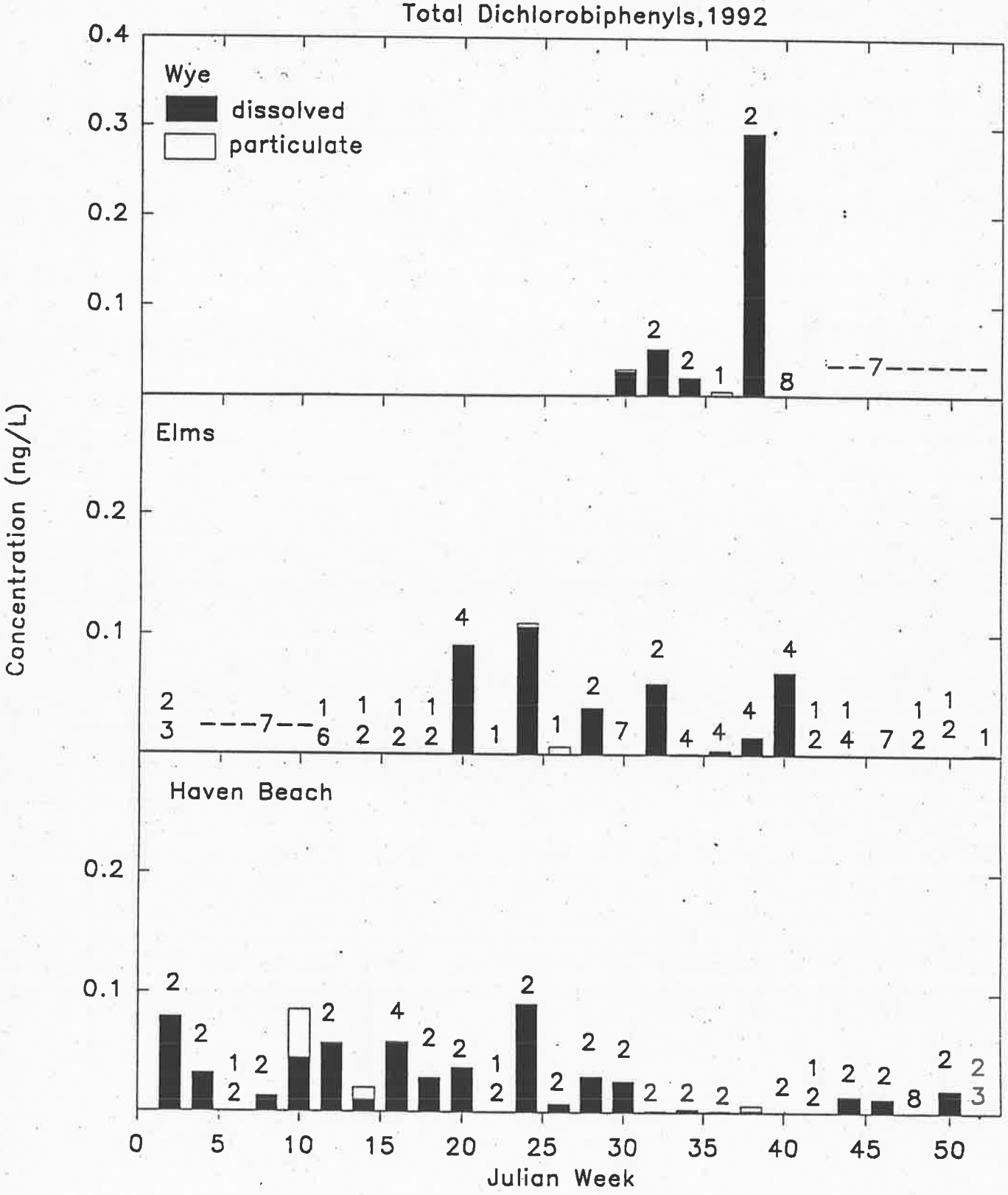
A1.37 Dibenz[*a*,*h*]anthracene concentrations in precipitation integrated biweekly at the Wye, Elms and Haven Beach sites. (1=not quantifiable in dissolved phase, 2=not quantifiable on filter, 3=not detected in dissolved phase, 4=not detected on filter, 5=lost dissolved sample, 6=lost filter, 7=sampler down, 8=field blank).


Dibenz[a,h]anthracene, 1993
Wye
dissolved
particulate
Elms
Haven Beach
Concentration (ng/L)
Julian Week
0
5
10
15
20
25
30
35
40
45
50
3
6
8

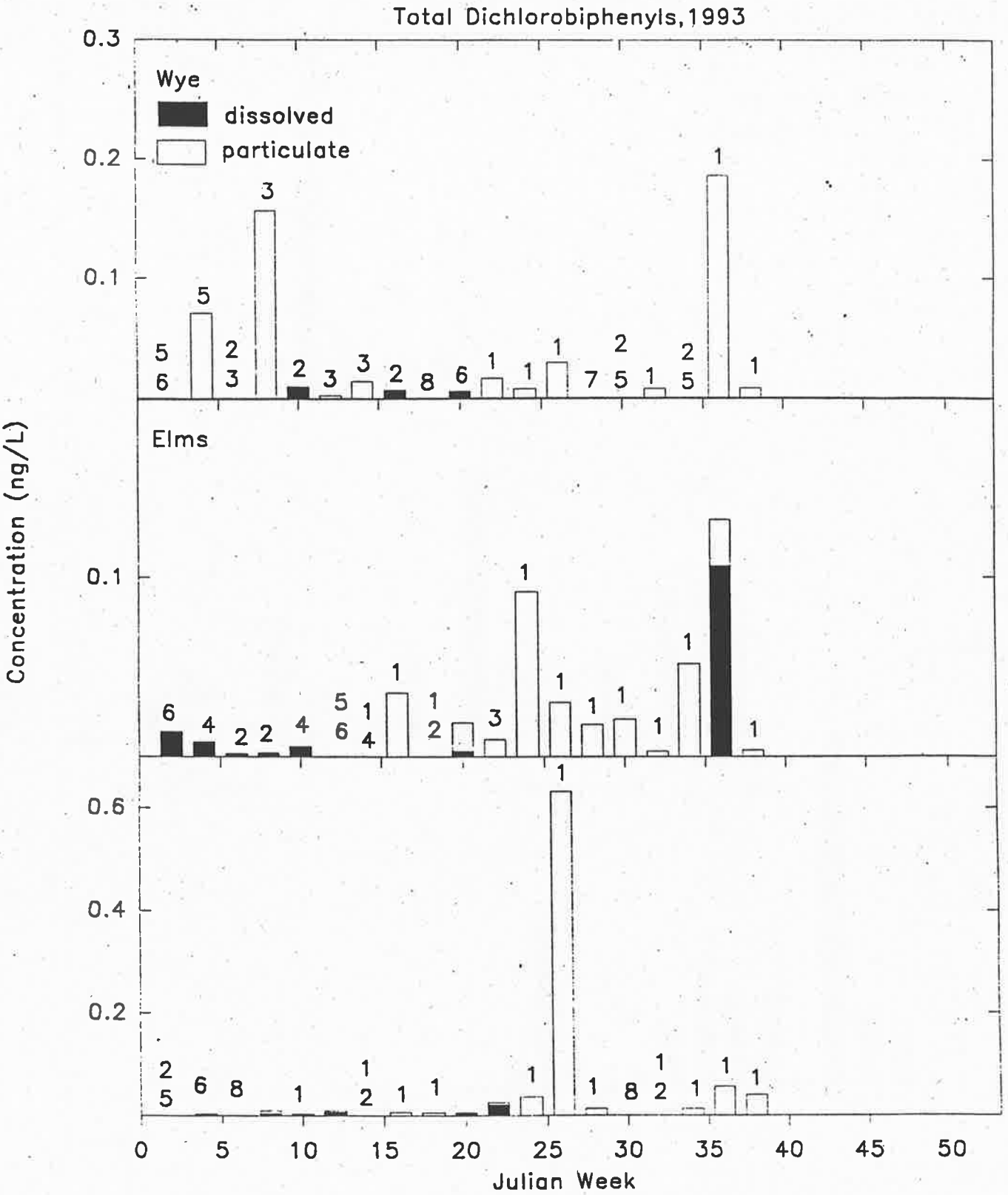


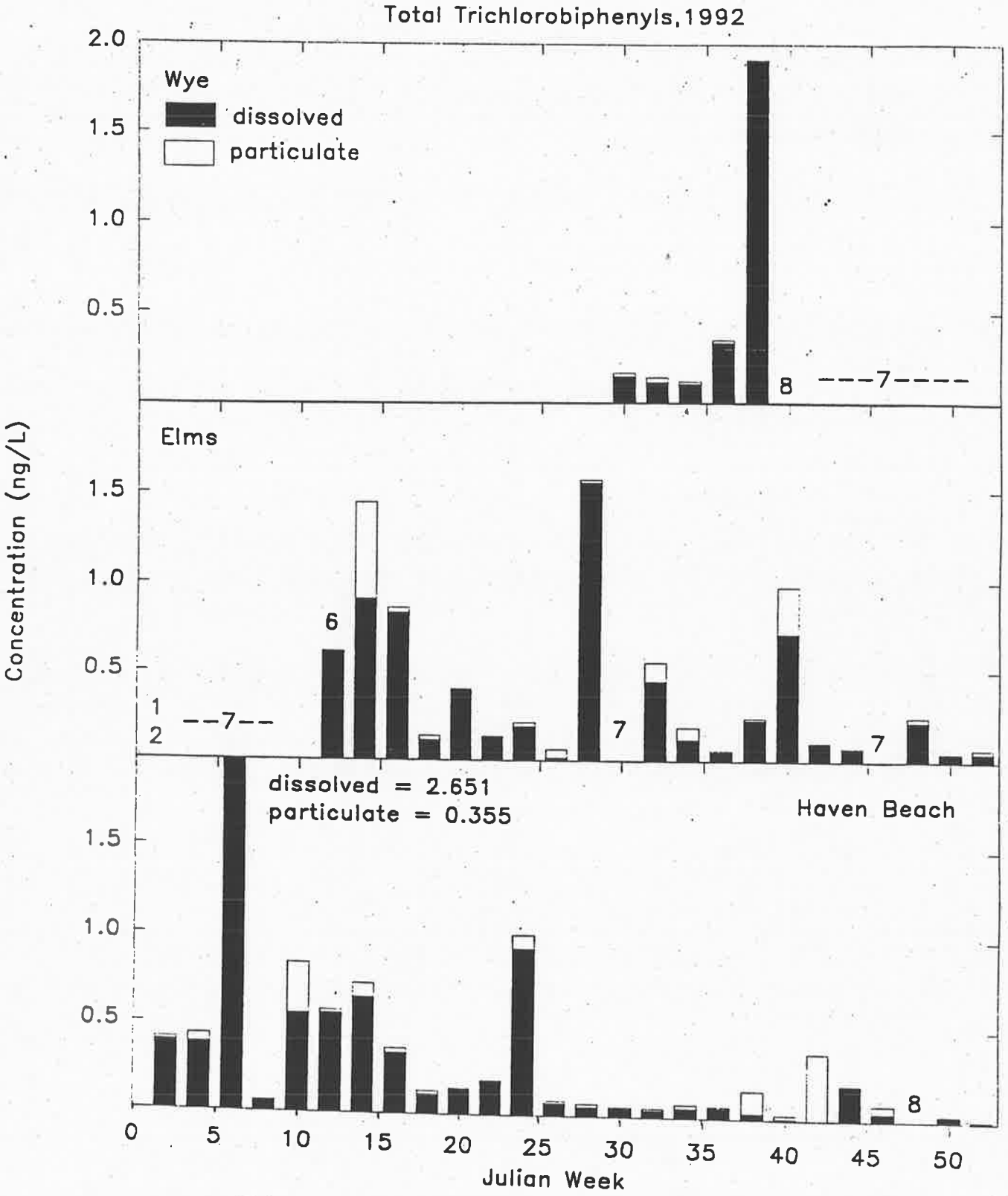
A1.38 Benzo[*g,h,i*]perylene concentrations in precipitation integrated biweekly at the Wye, Elms and Haven Beach sites. (1=not quantifiable in dissolved phase, 2=not quantifiable on filter, 3=not detected in dissolved phase, 4=not detected on filter, 5=lost dissolved sample, 6=lost filter, 7=sampler down, 8= no ppt.).


Benzo[g,h,i]perylene, 1993
Wye
dissolved
particulate
Elms
Haven Beach
Concentration (ng/L)
Julian Week
30
20
10
1.5
1.0
0.5
0.0
0
5
10
15
20
25
30
35
40
45
50

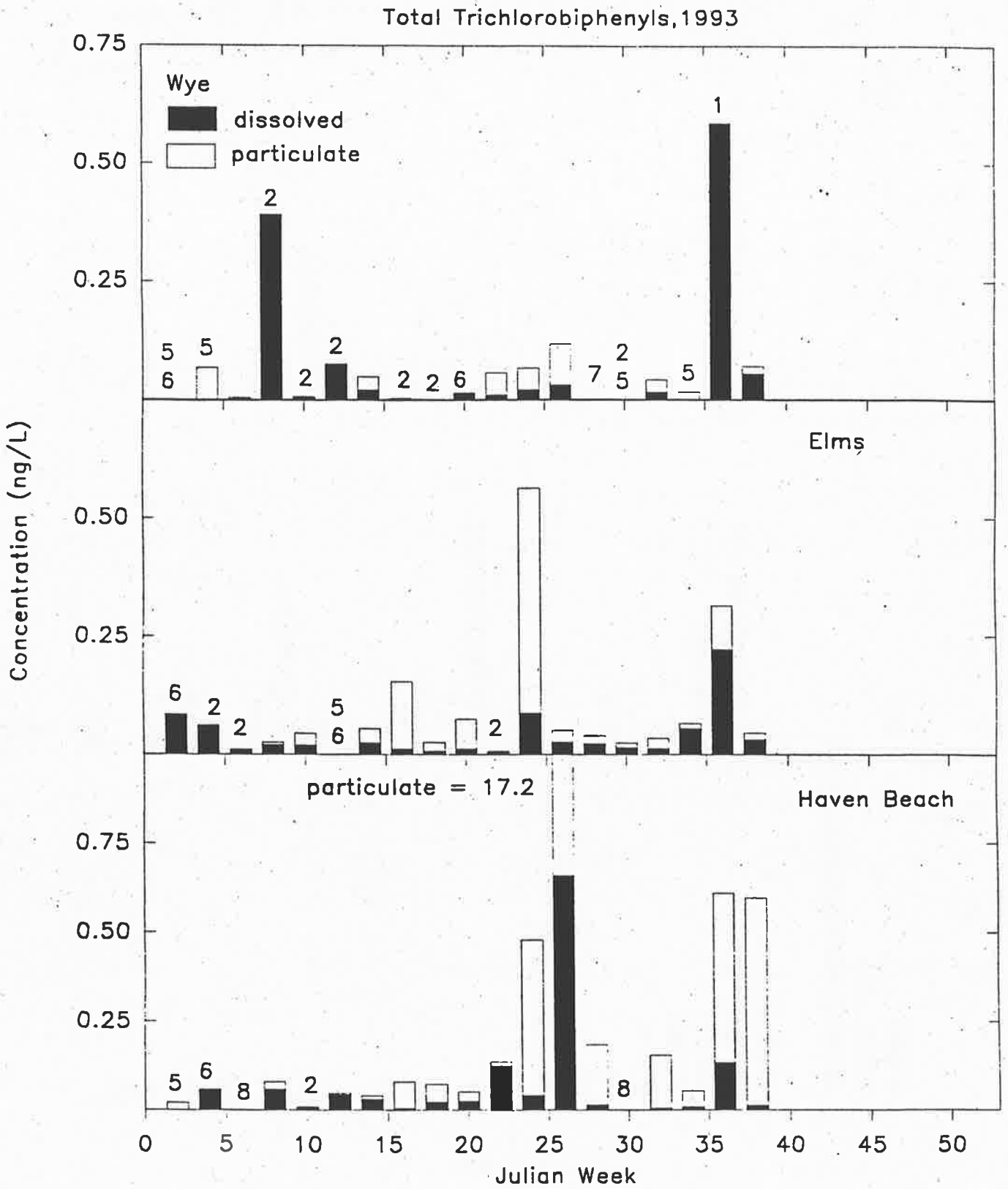


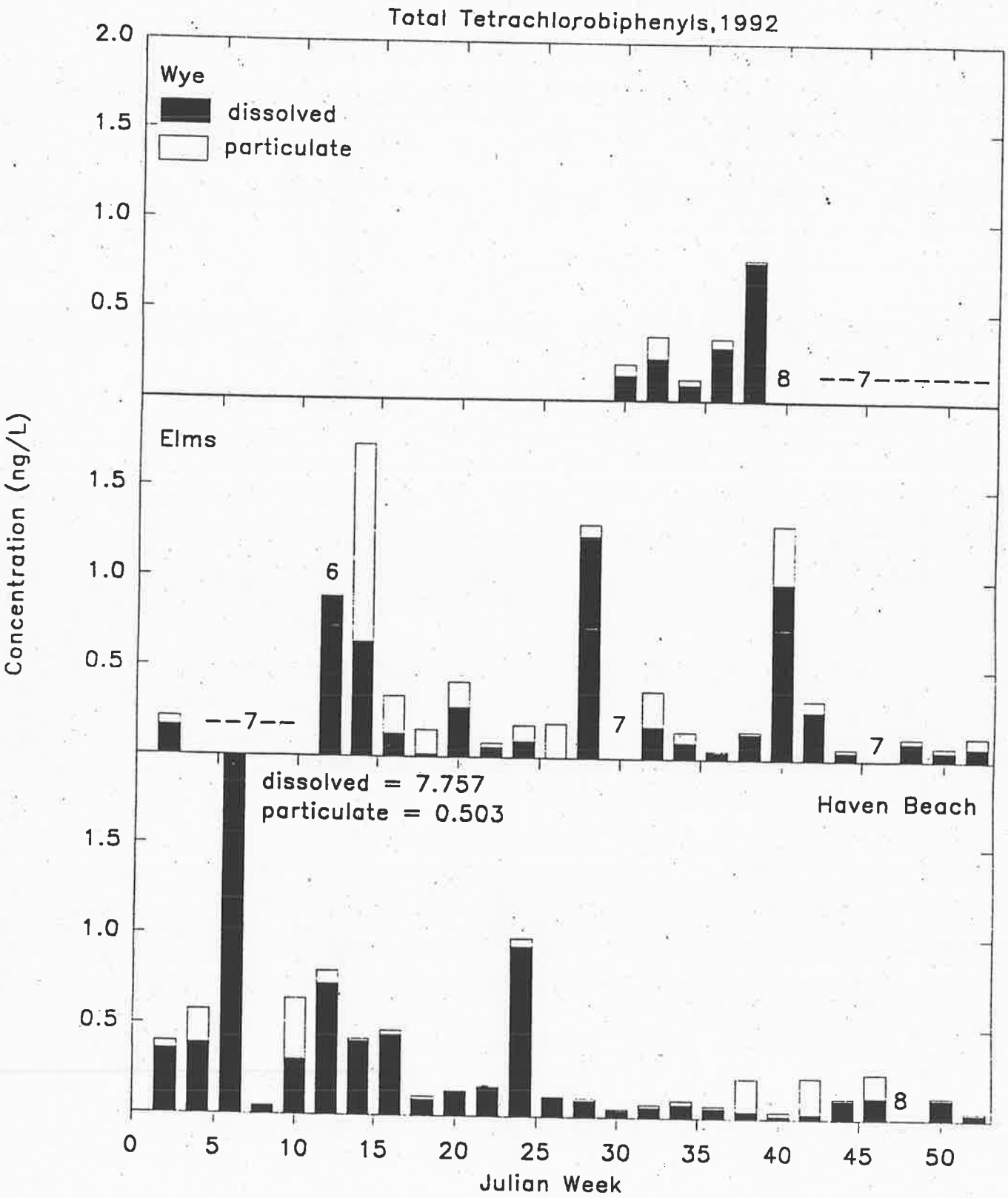
A1.39 Total dichlorobiphenyls collected in rain biweekly at the Wye, Elms, and Haven Beach sites. (1= not quantifiable in dissolved phase, 2= not quantifiable in particulate phase, 3=not detected in dissolved phase, 4= not detected in particulate phase, 5=lost dissolved sample, 6=lost particulate sample, 7=sampler down, 8= no ppt.).


Total Dichlorobiphenyls, 1993
Wye
dissolved
particulate
Elms
Concentration (ng/L)
Julian Week
0.3
0.2
0.1
0.6
0.4
0.2
0
5
10
15
20
25
30
35
40
45
50

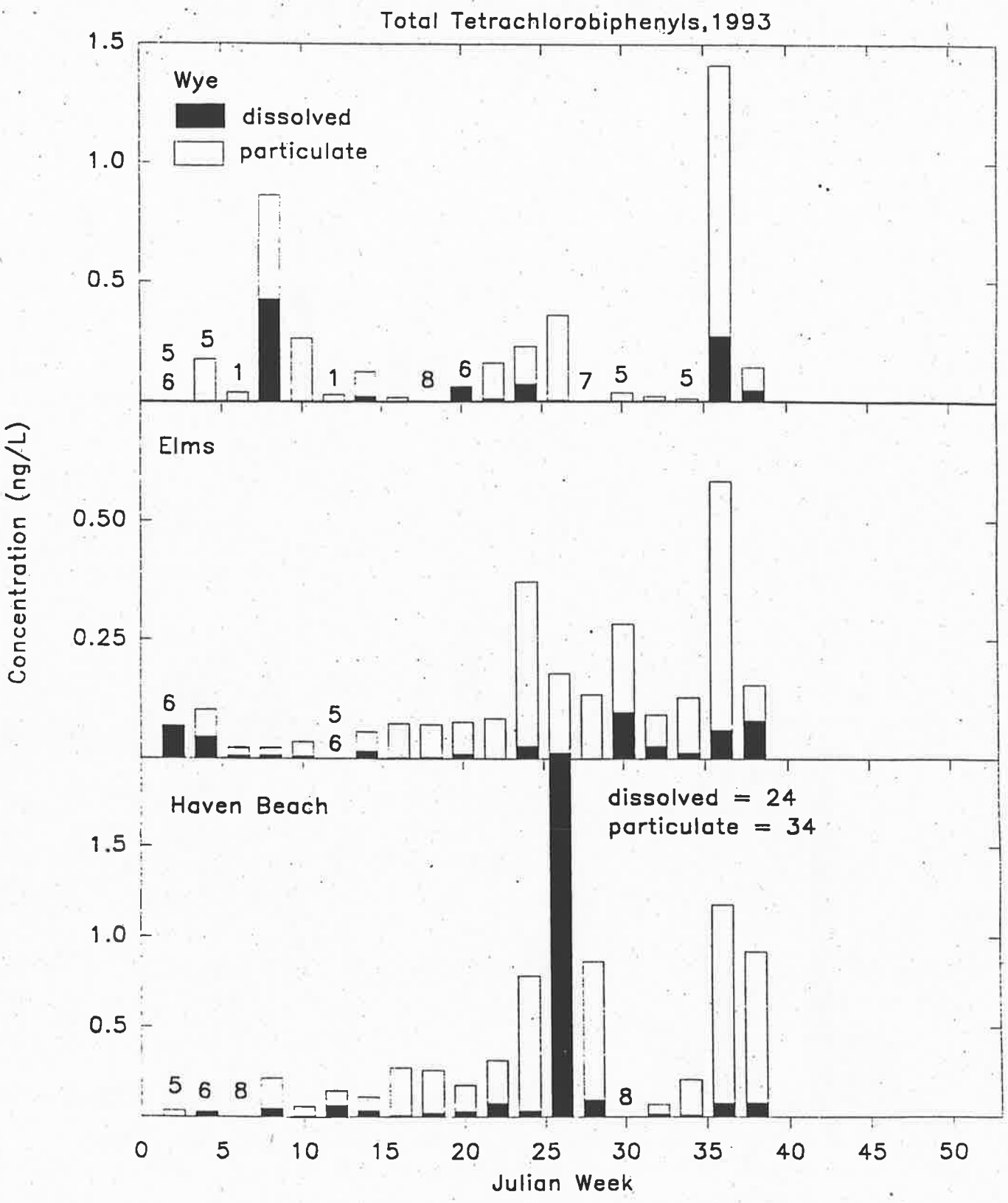


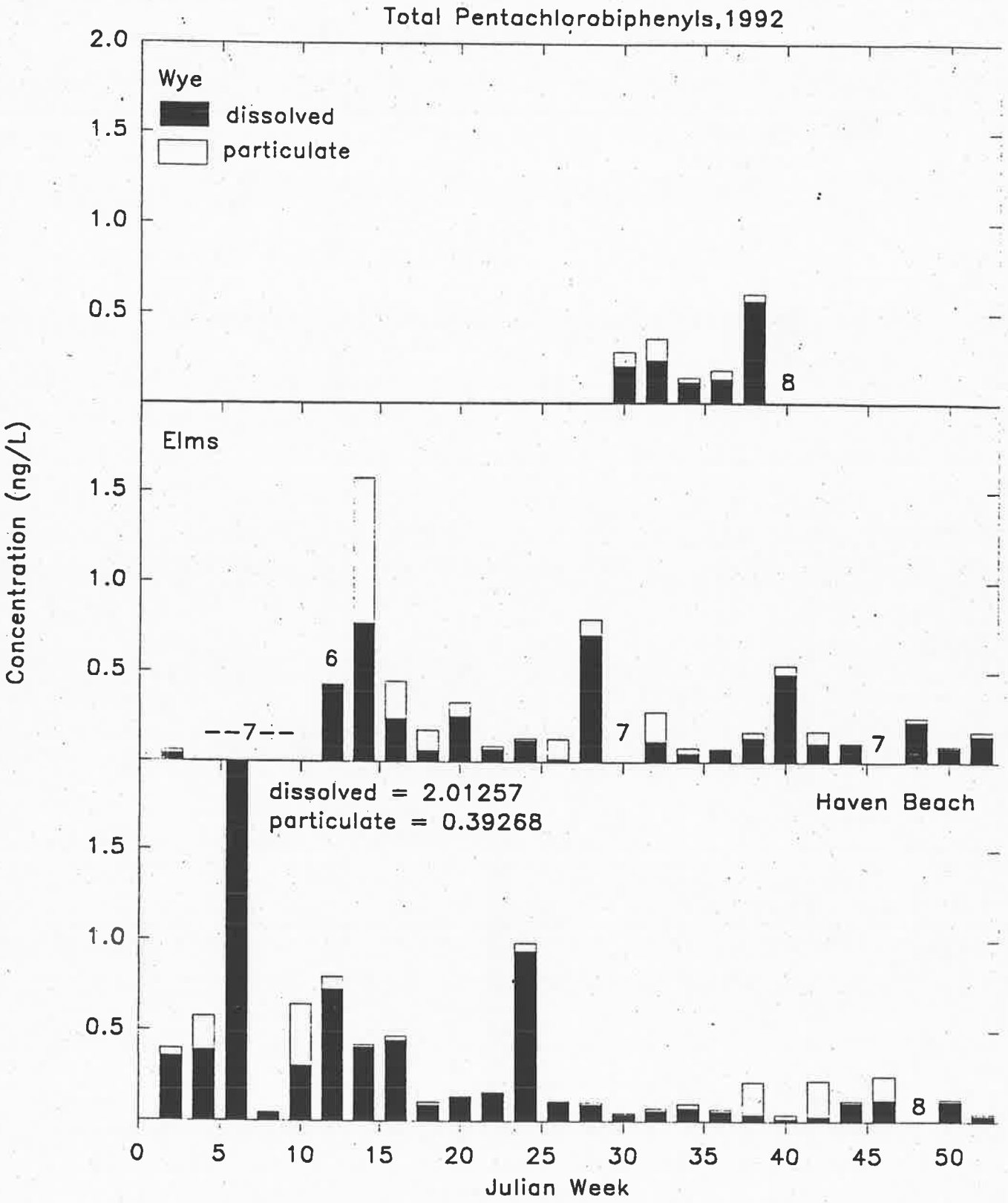
A1.40 Total trichlorobiphenyls collected in rain biweekly at the Wye, Elms, and Haven Beach sites. (1= not quantifiable in dissolved phase, 2= not quantifiable in particulate phase, 3=not detected in dissolved phase, 4= not detected in particulate phase, 5=lost dissolved sample, 6=lost particulate sample, 7=sampler down, 8= no ppt.).


Total Trichlorobiphenyls, 1993
Wye
dissolved
particulate
Elms
Haven Beach
particulate = 17.2
Concentration (ng/L)
Julian Week
0.75
0.50
0.25
0
5
10
15
20
25
30
35
40
45
50

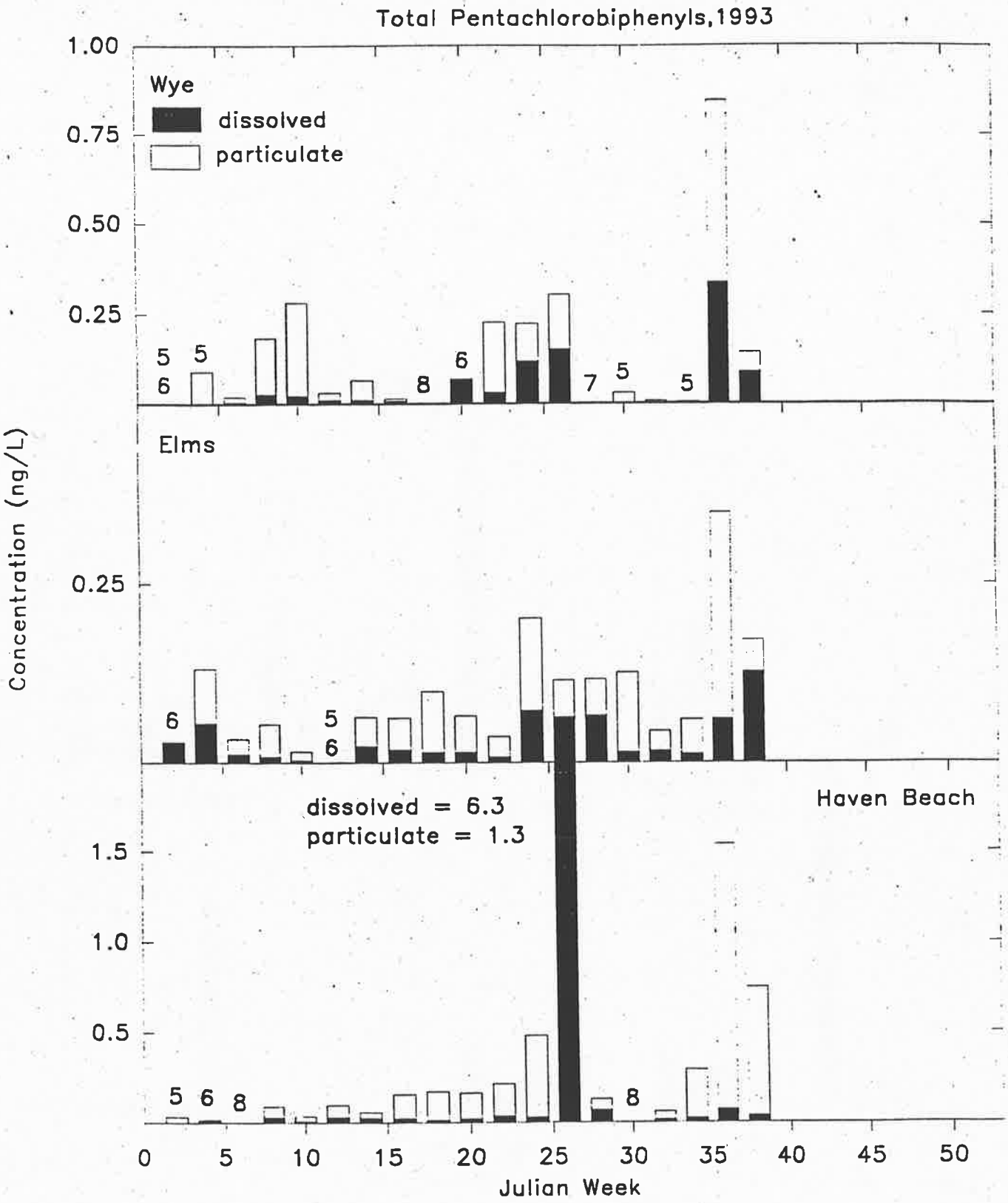


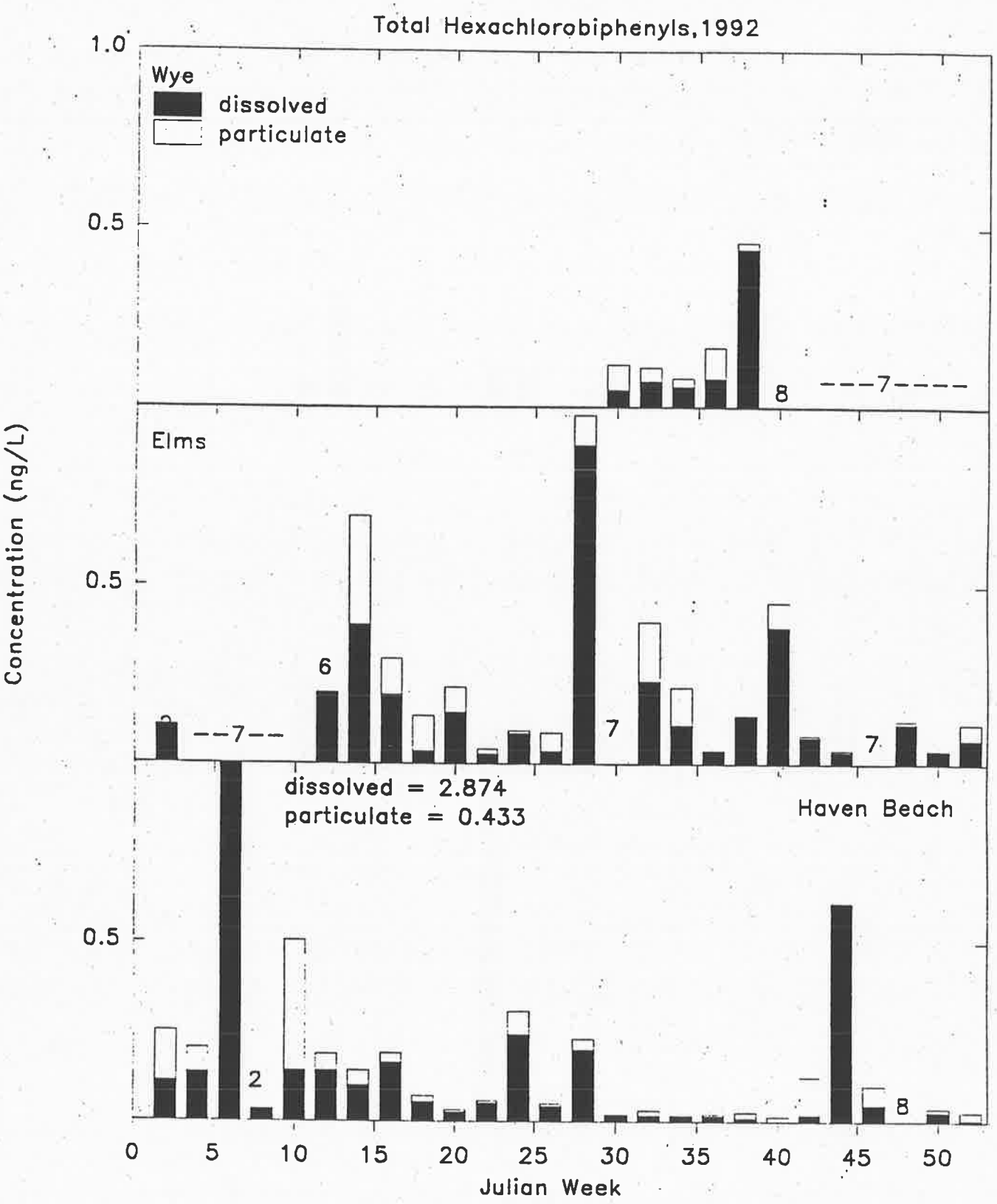
A1.41 Total tetrachlorobiphenyls collected in rain biweekly at the Wye, Elms, and Haven Beach sites. (1= not quantifiable in dissolved phase, 2= not quantifiable in particulate phase, 3=not detected in dissolved phase, 4= not detected in particulate phase, 5=lost dissolved sample, 6=lost particulate sample, 7=sampler down, 8= no ppt.).


Total Tetrachlorobiphenyls, 1993
Wye
dissolved
particulate
Elms
Haven Beach
dissolved = 24
particulate = 34
Concentration (ng/L)
Julian Week
1.5
1.0
0.5
0.50
0.25
0
5
10
15
20
25
30
35
40
45
50

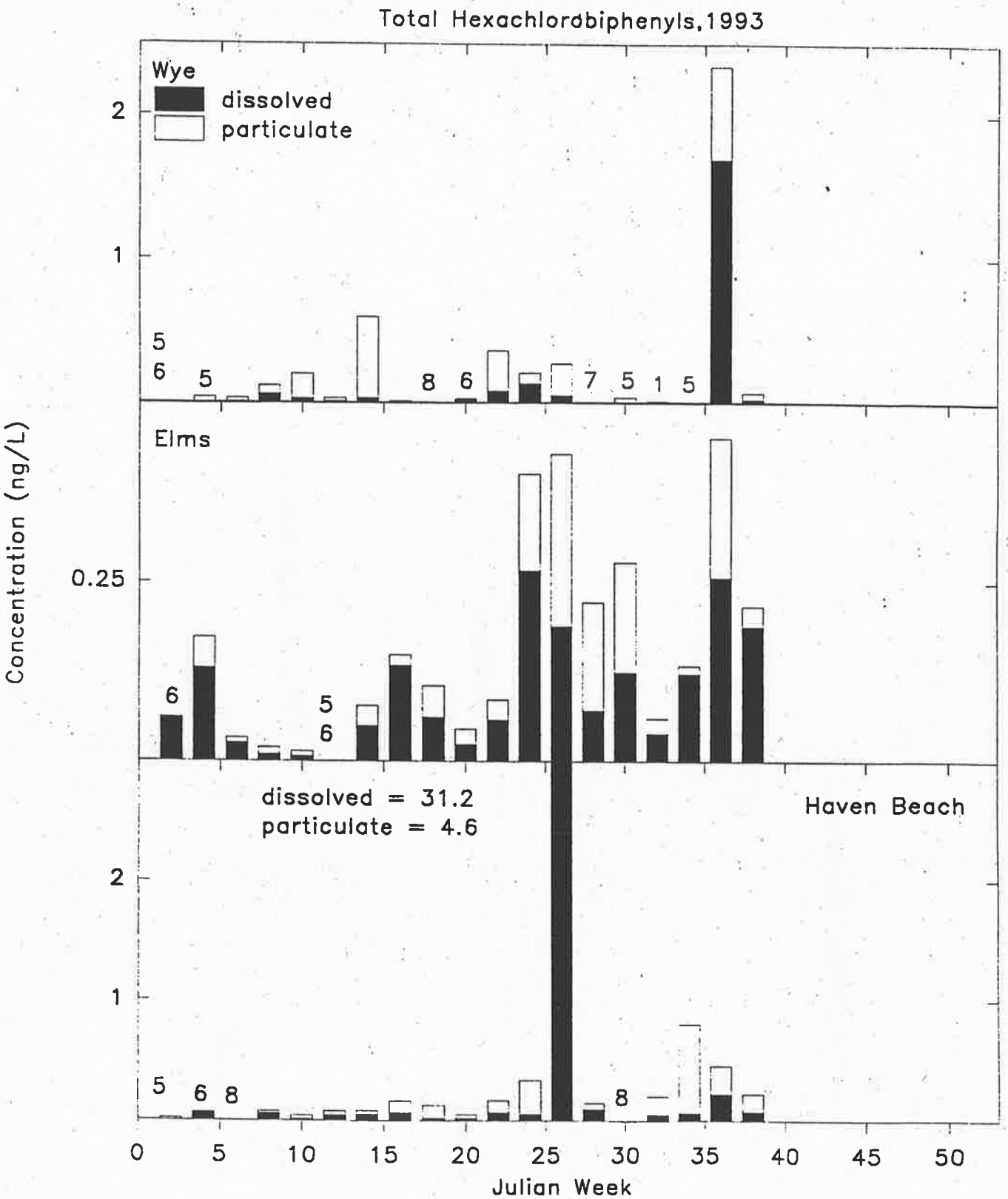


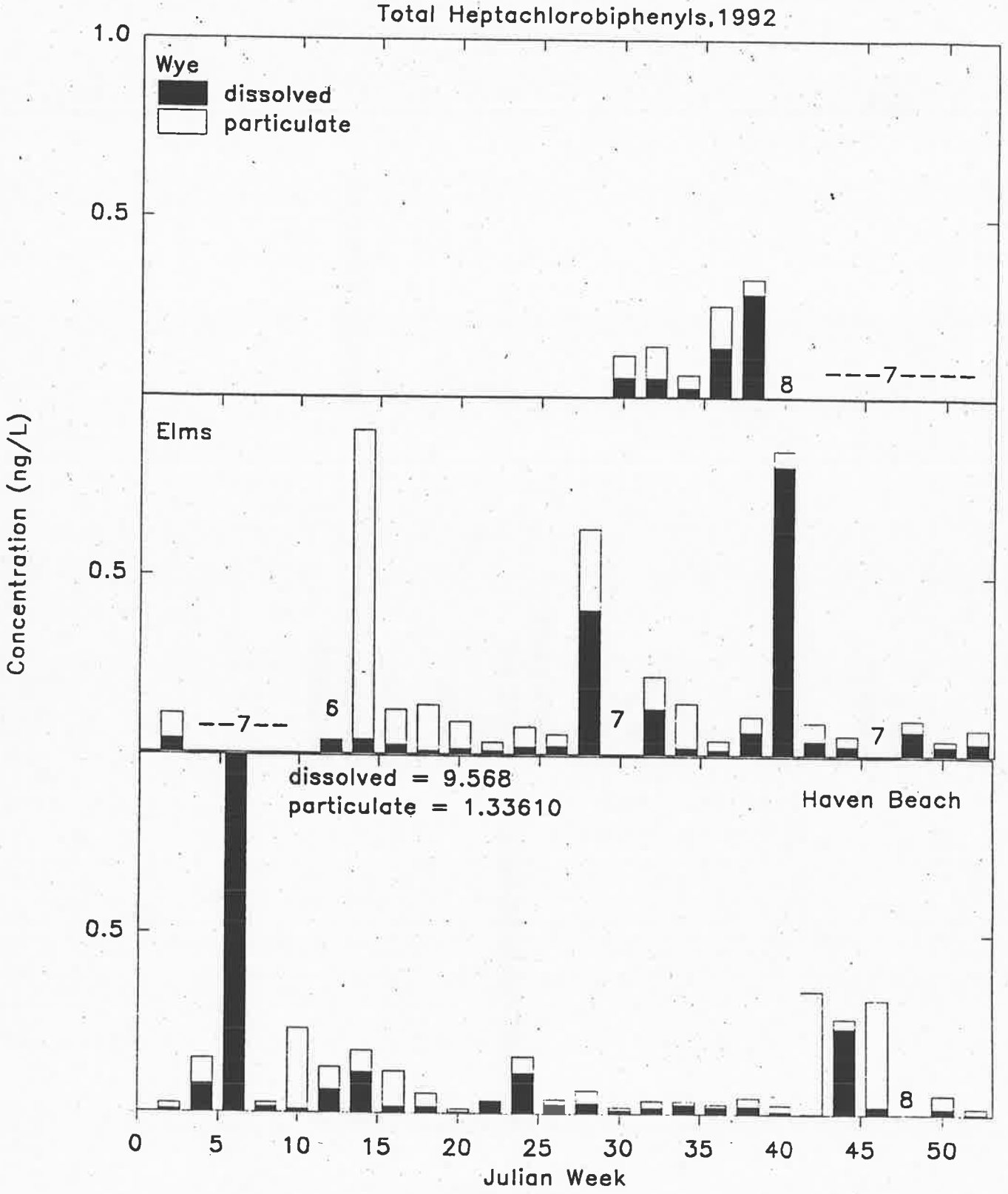
A1.42 Total pentachlorobiphenyls collected in rain biweekly at the Wye, Elms, and Haven Beach sites. (1= not quantifiable in dissolved phase, 2= not quantifiable in particulate phase, 3=not detected in dissolved phase, 4= not detected in particulate phase, 5=lost dissolved sample, 6=lost particulate sample, 7=sampler down, 8= no ppt.)


Total Pentachlorobiphenyls,1993
Wye
dissolved
particulate
Elms
Haven Beach
dissolved = 6.3
particulate = 1.3
Concentration (ng/L)
Julian Week
1.00
0.75
0.50
0.25
1.5
1.0
0.5
0
5
10
15
20
25
30
35
40
45
50

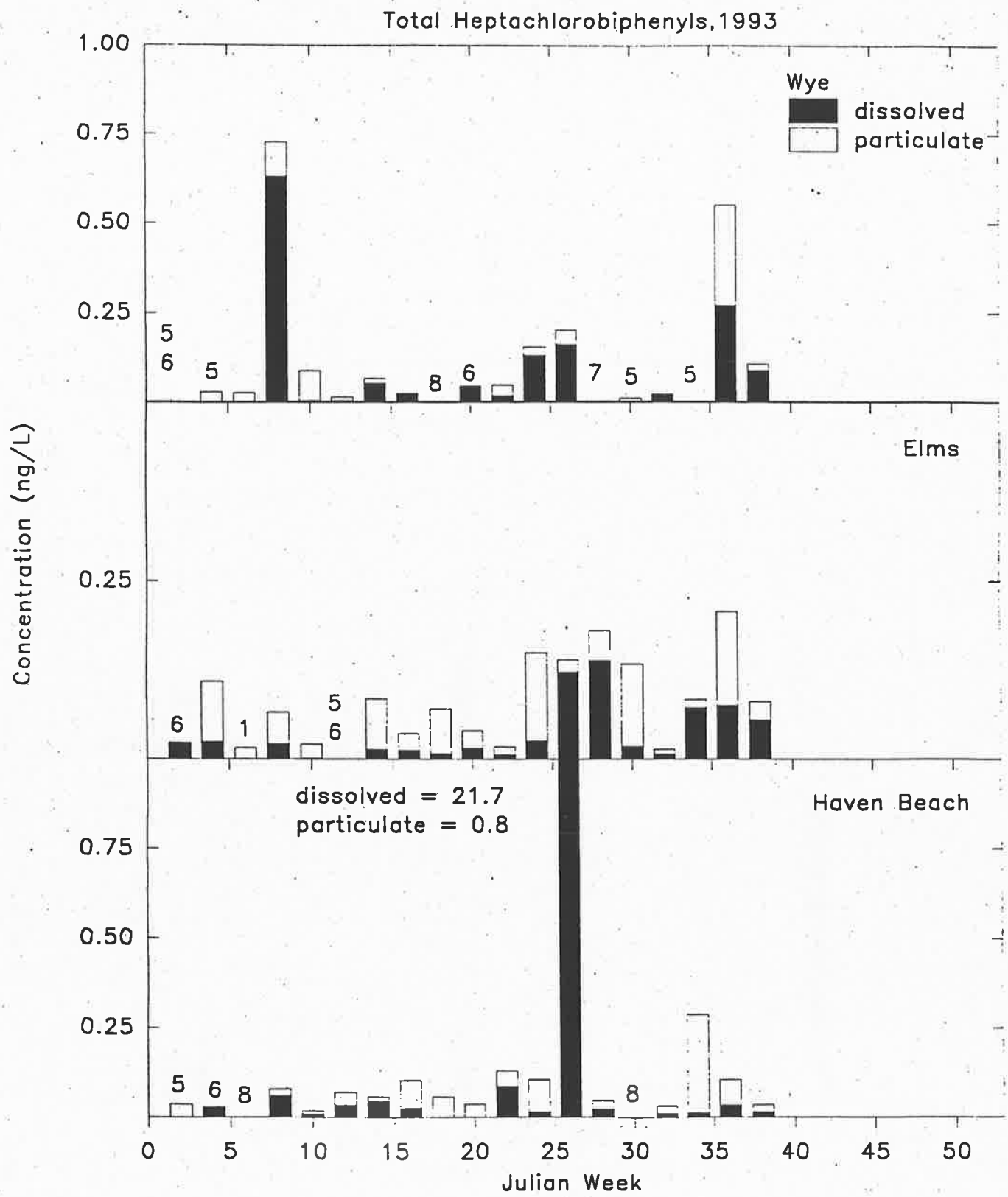


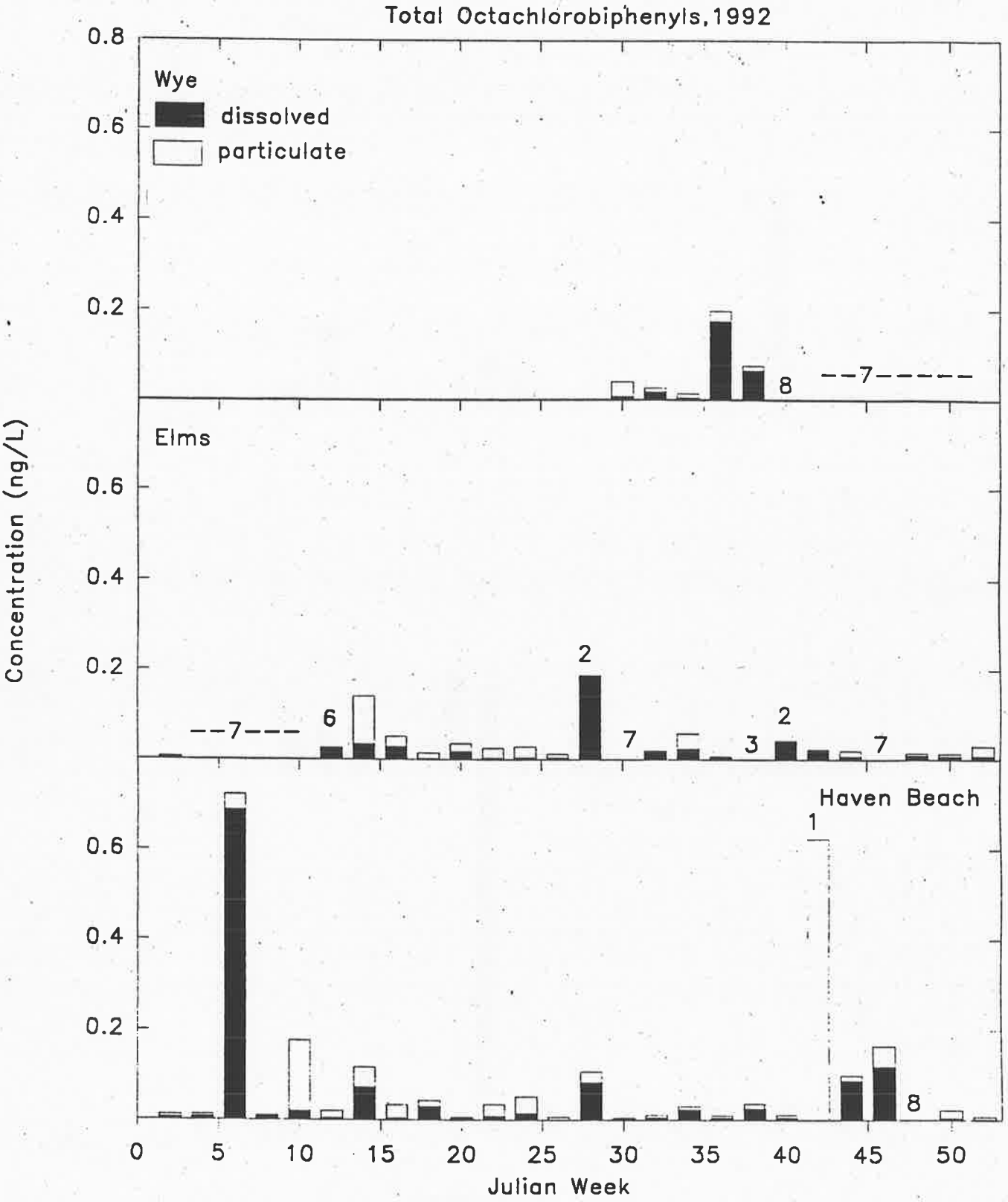
A1.43 Total hexachlorobiphenyls collected in rain biweekly at the Wye, Elms, and Haven Beach sites. (1= not quantifiable in dissolved phase, 2= not quantifiable in particulate phase, 3=not detected in dissolved phase, 4= not detected in particulate phase, 5=lost dissolved sample, 6=lost particulate sample, 7=sampler down, 8= no ppt.).


Total Hexachlorobiphenyls, 1993
Wye
dissolved
particulate
Elms
Haven Beach
dissolved = 31.2
particulate = 4.6
Concentration (ng/L)
Julian Week
2
1
0.25
0
5
10
15
20
25
30
35
40
45
50

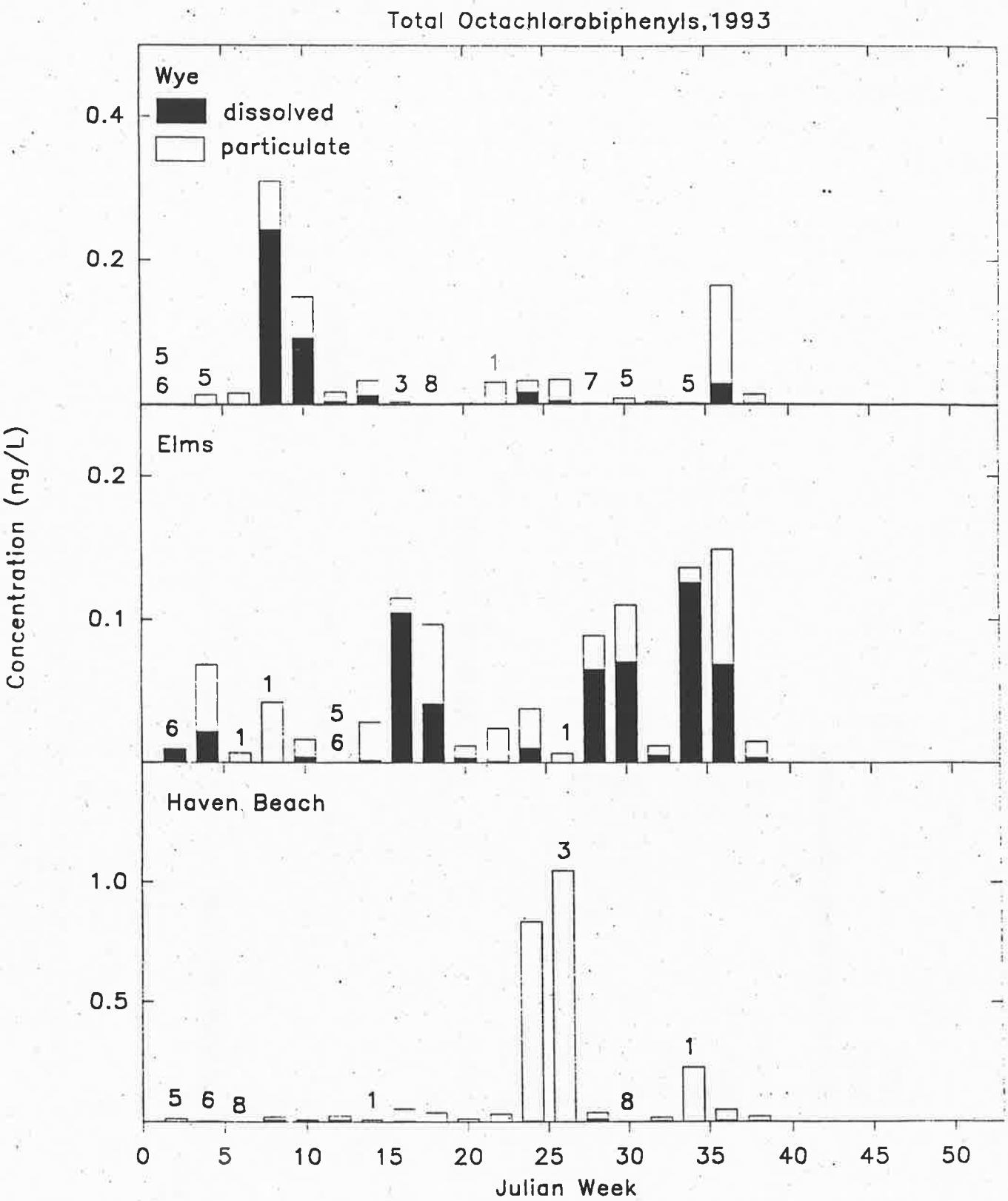


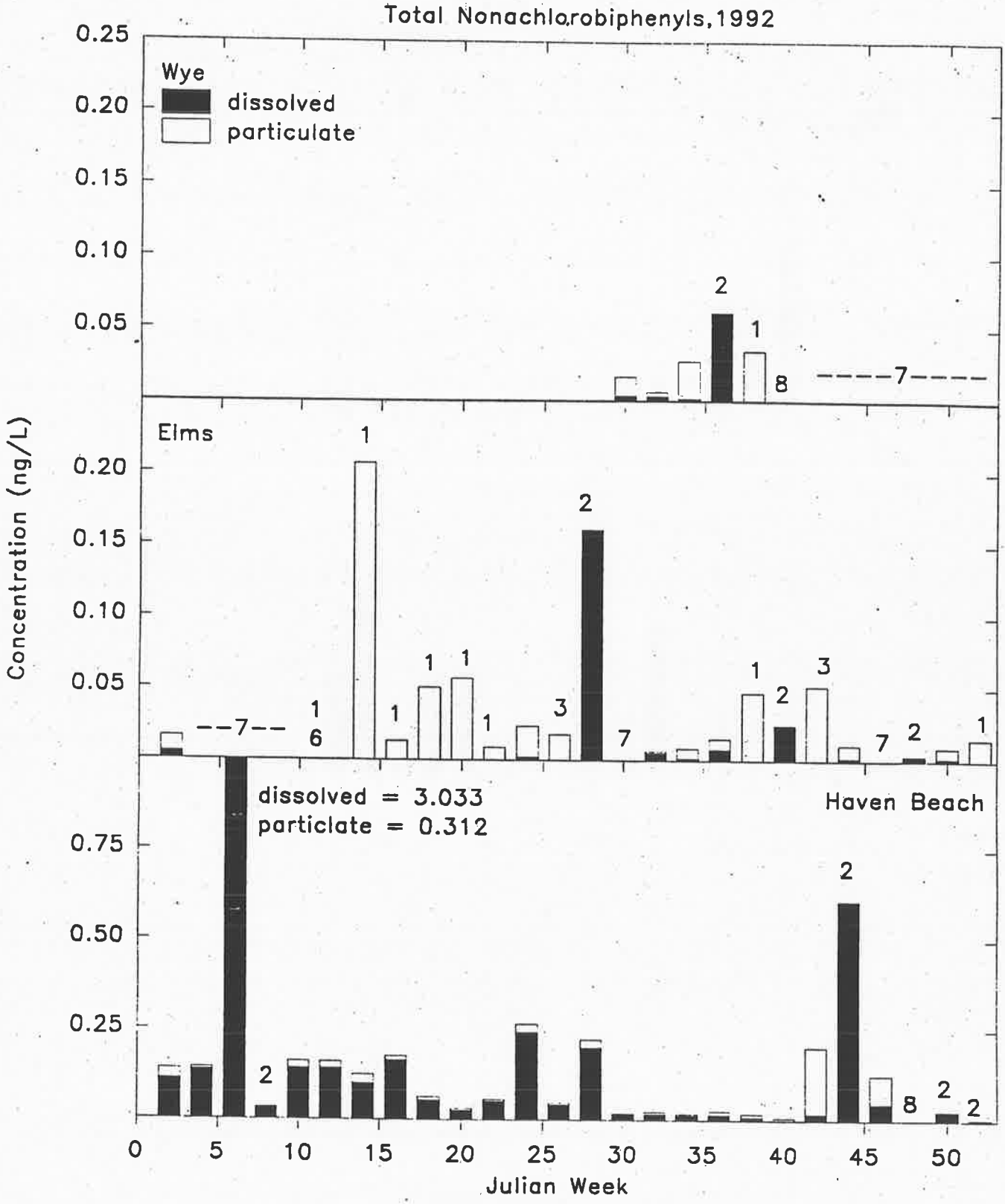
A1.44 Total heptachlorobiphenyls collected in rain biweekly at the Wye, Elms, and Haven Beach sites. (1= not quantifiable in dissolved phase, 2= not quantifiable in particulate phase, 3=not detected in dissolved phase, 4= not detected in particulate phase, 5=lost dissolved sample, 6=lost particulate sample, 7=sampler down, 8= no ppt.).


Total Heptachlorobiphenyls, 1993
Wye
dissolved
particulate
Elms
Haven Beach
dissolved = 21.7
particulate = 0.8
Concentration (ng/L)
Julian Week
1.00
0.75
0.50
0.25
0.25
0.75
0.50
0.25
0
5
10
15
20
25
30
35
40
45
50

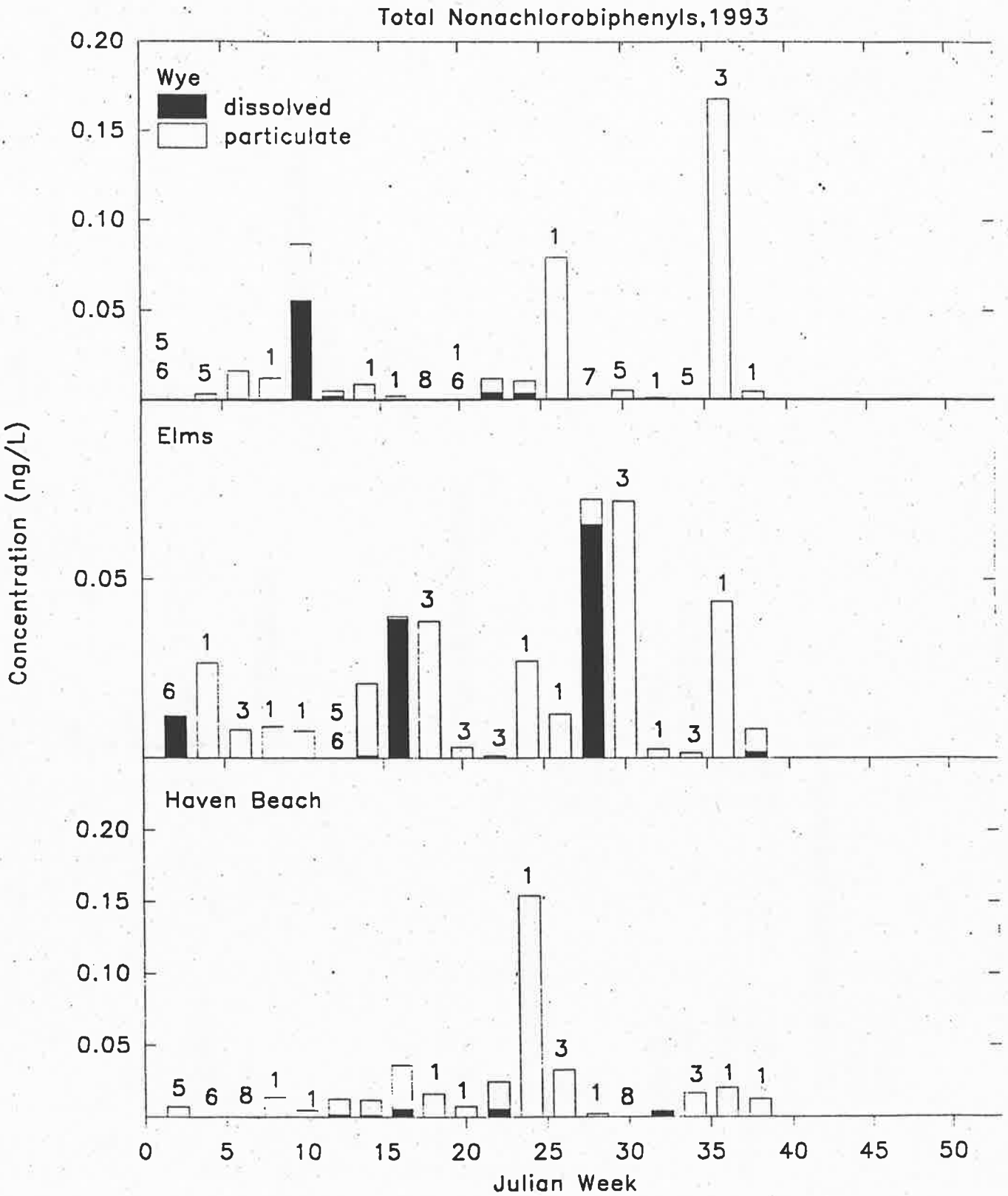


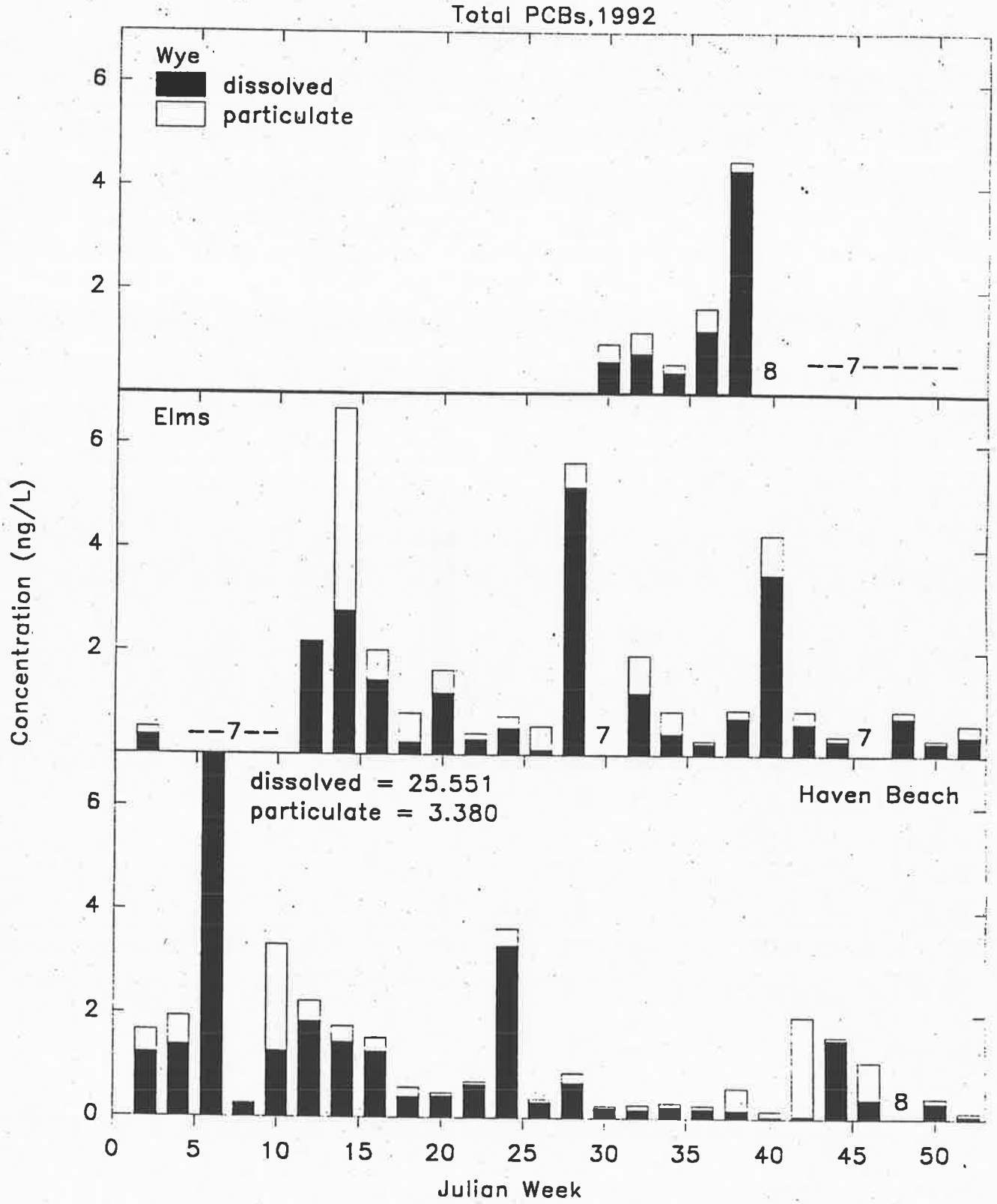
A1.45 Total octachlorobiphenyls collected in rain biweekly at the Wye, Elms, and Haven Beach sites. (1= not quantifiable in dissolved phase, 2= not quantifiable in particulate phase, 3=not detected in dissolved phase, 4= not detected in particulate phase, 5=lost dissolved sample, 6=lost particulate sample, 7=sampler down, 8= no ppt.).


Total Octachlorobiphenyls,1993
Wye
dissolved
particulate
0.4
0.2
5
6
5
3
8
1
7
5
5
Elms
0.2
0.1
6
1
1
5
6
1
Haven Beach
1.0
0.5
3
5
6
8
1
8
1
0
5
10
15
20
25
30
35
40
45
50
Julian Week
Concentration (ng/L)

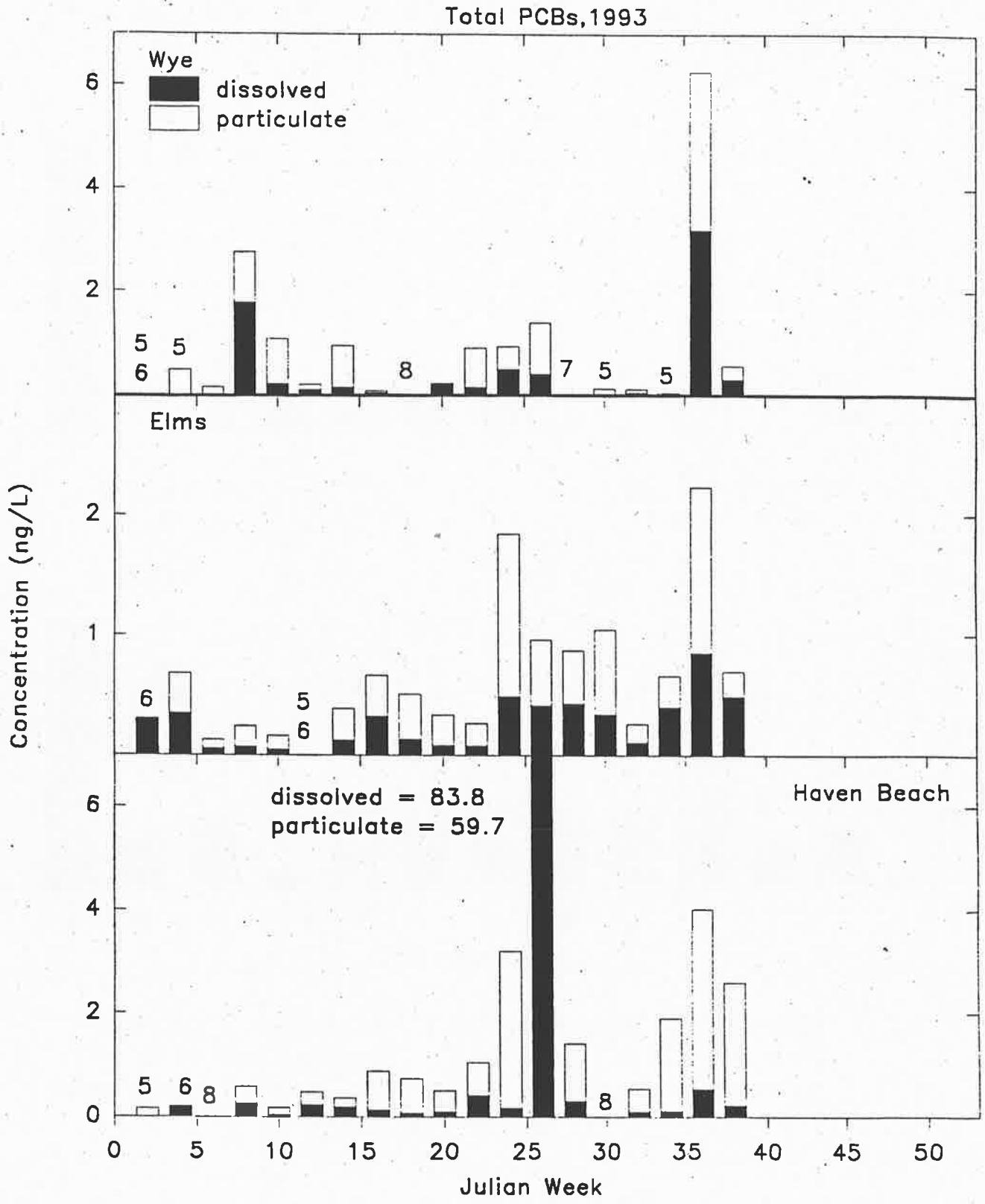


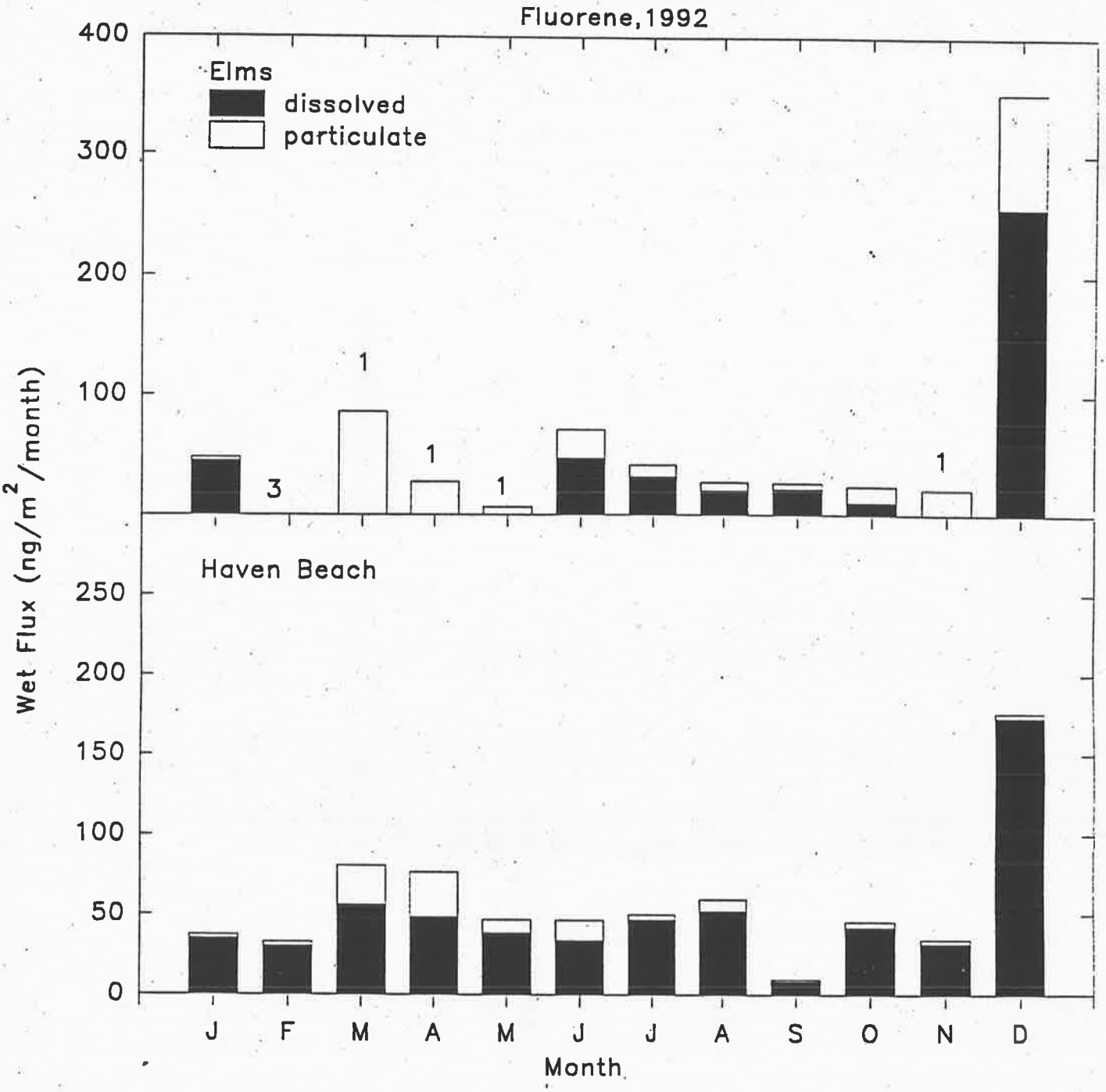
A1.46 Total nonachlorobiphenyls collected in rain biweekly at the Wye, Elms, and Haven Beach sites. (1= not quantifiable in dissolved phase, 2= not quantifiable in particulate phase, 3=not detected in dissolved phase, 4= not detected in particulate phase, 5=lost dissolved sample, 6=lost particulate sample, 7=sampler down, 8= no ppt.).


Total Nonachlorobiphenyls,1993
Wye
dissolved
particulate
Elms
Haven Beach
Concentration (ng/L)
0.20
0.15
0.10
0.05
0
5
10
15
20
25
30
35
40
45
50
Julian Week

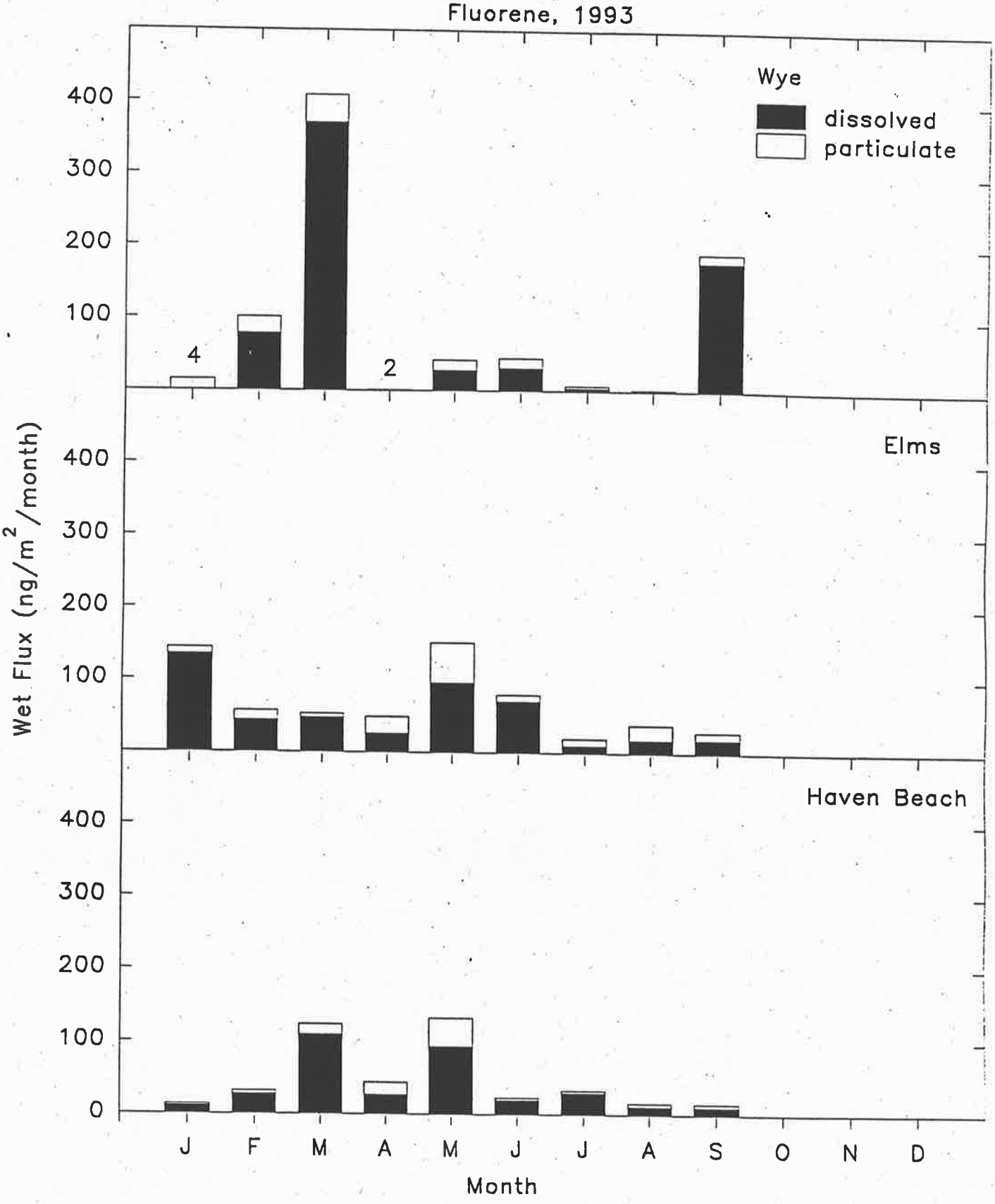


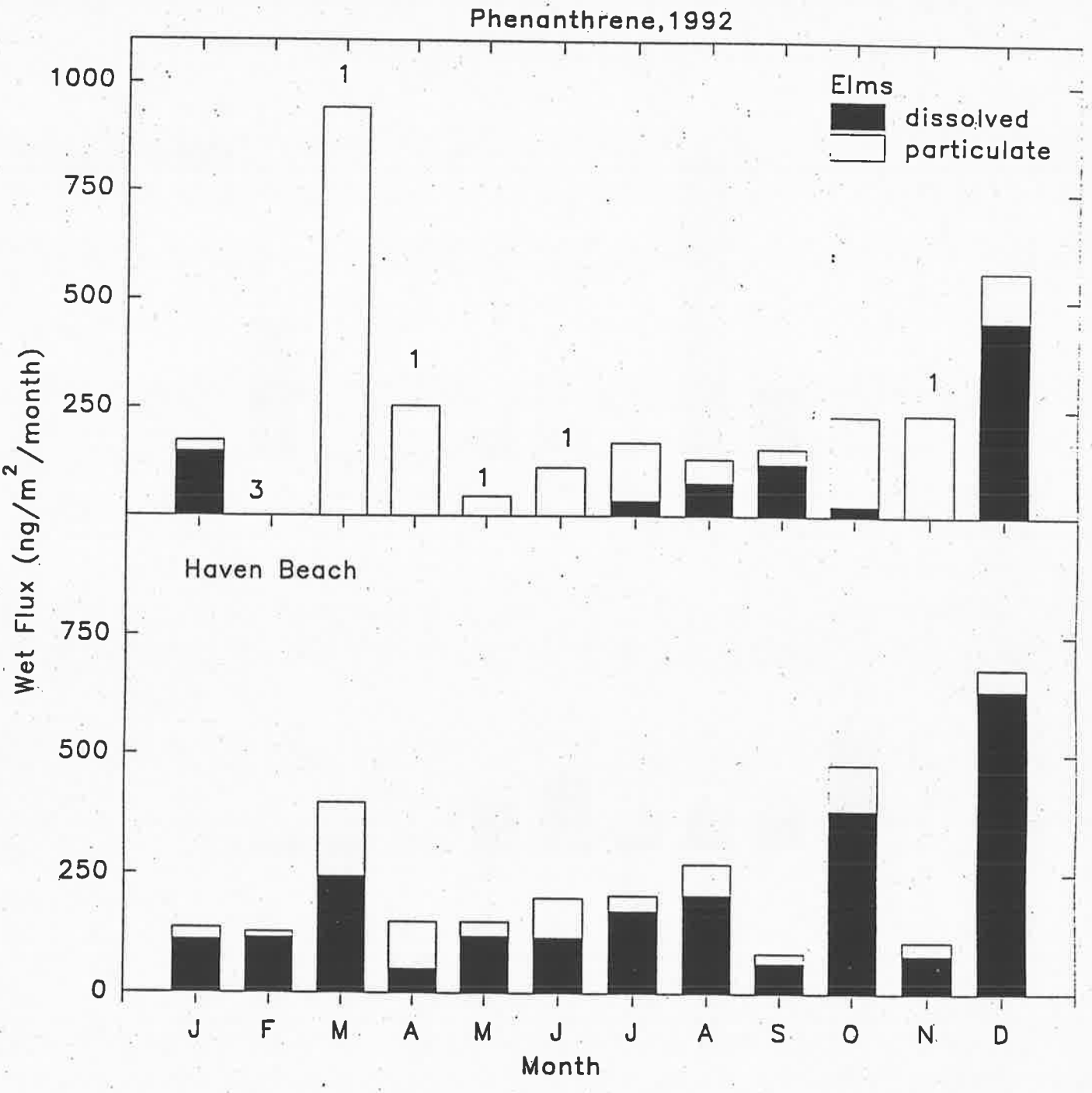
A1.47 Total PCBs collected in rain biweekly at the Wye, Elms, and Haven Beach sites. (1= not quantifiable in dissolved phase, 2= not qquantifiable in particulate 3 = not detected in dissolved phase, 4 = not detected on particulate sample, 5 = lost dissolved sample, 6=lost particulate sample, 7=sampler down,8 = no ppt.).


Total PCBs,1993
Wye
dissolved
particulate
Elms
Haven Beach
dissolved = 83.8
particulate = 59.7
Concentration (ng/L)
Julian Week
0
5
10
15
20
25
30
35
40
45
50
1
2
4
6
8

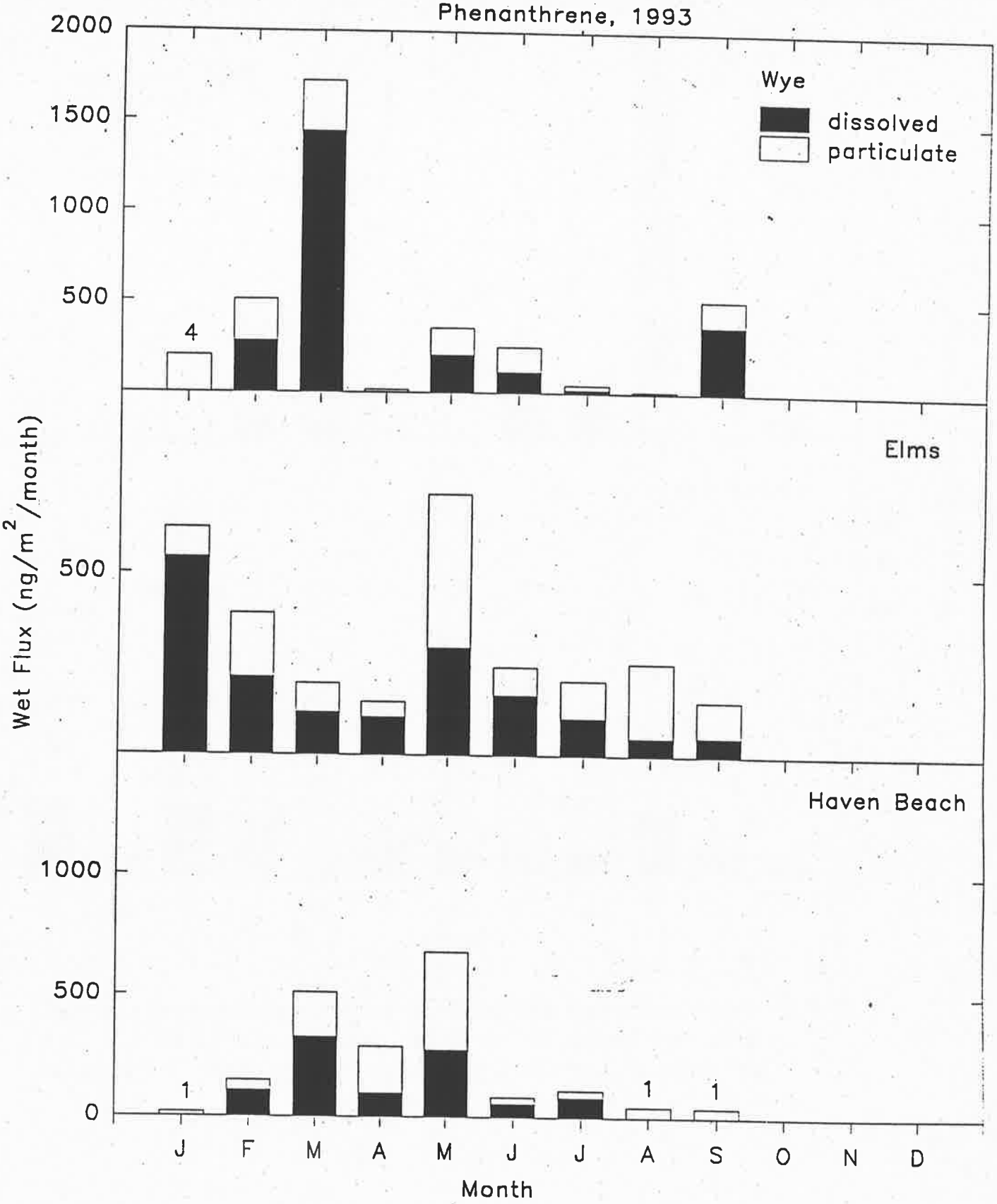


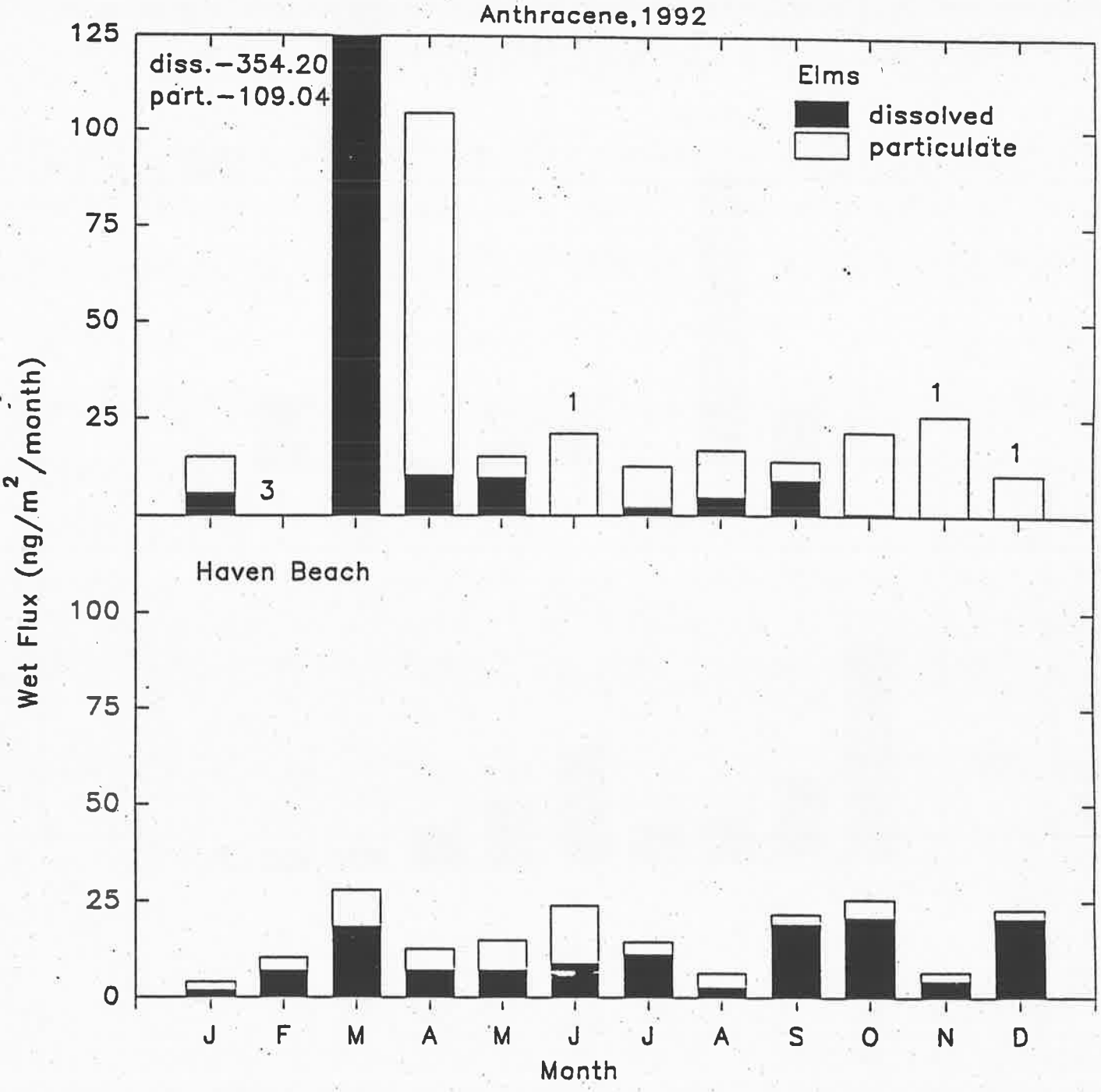
A1.48 Fluorene wet depositional fluxes measured at the Wye, Elms and Haven Beach sites. (1=not quantifiable in dissolved phase, 2=not quantifiable on filter, 3= sampler down, 4 = lost dissloved sample).


Fluorene, 1993
Wye
dissolved
particulate
Elms
Haven Beach
Wet Flux (ng/m2/month)
400
300
200
100
0
4
2
J
F
M
A
M
J
J
A
S
O
N
D
Month

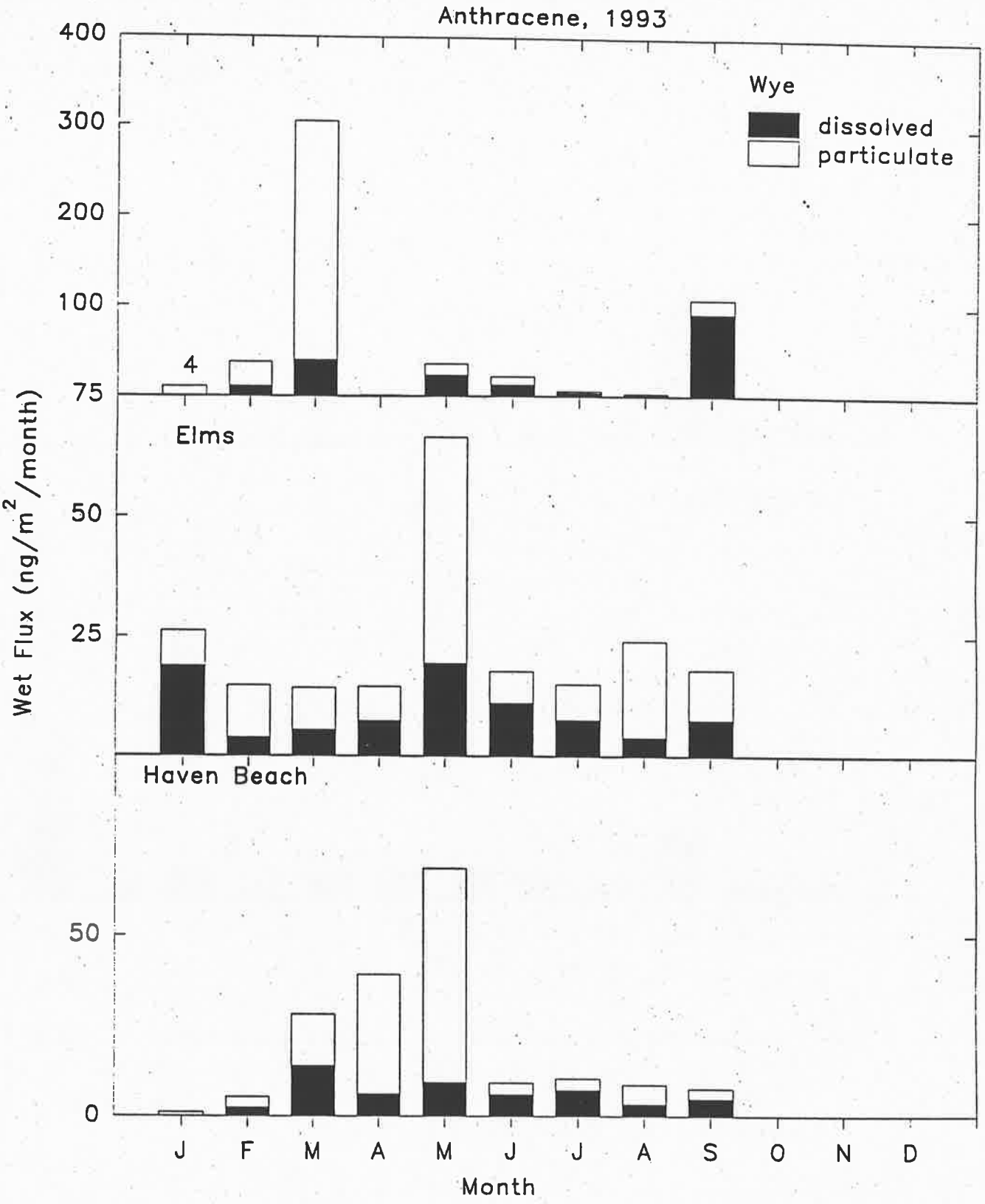


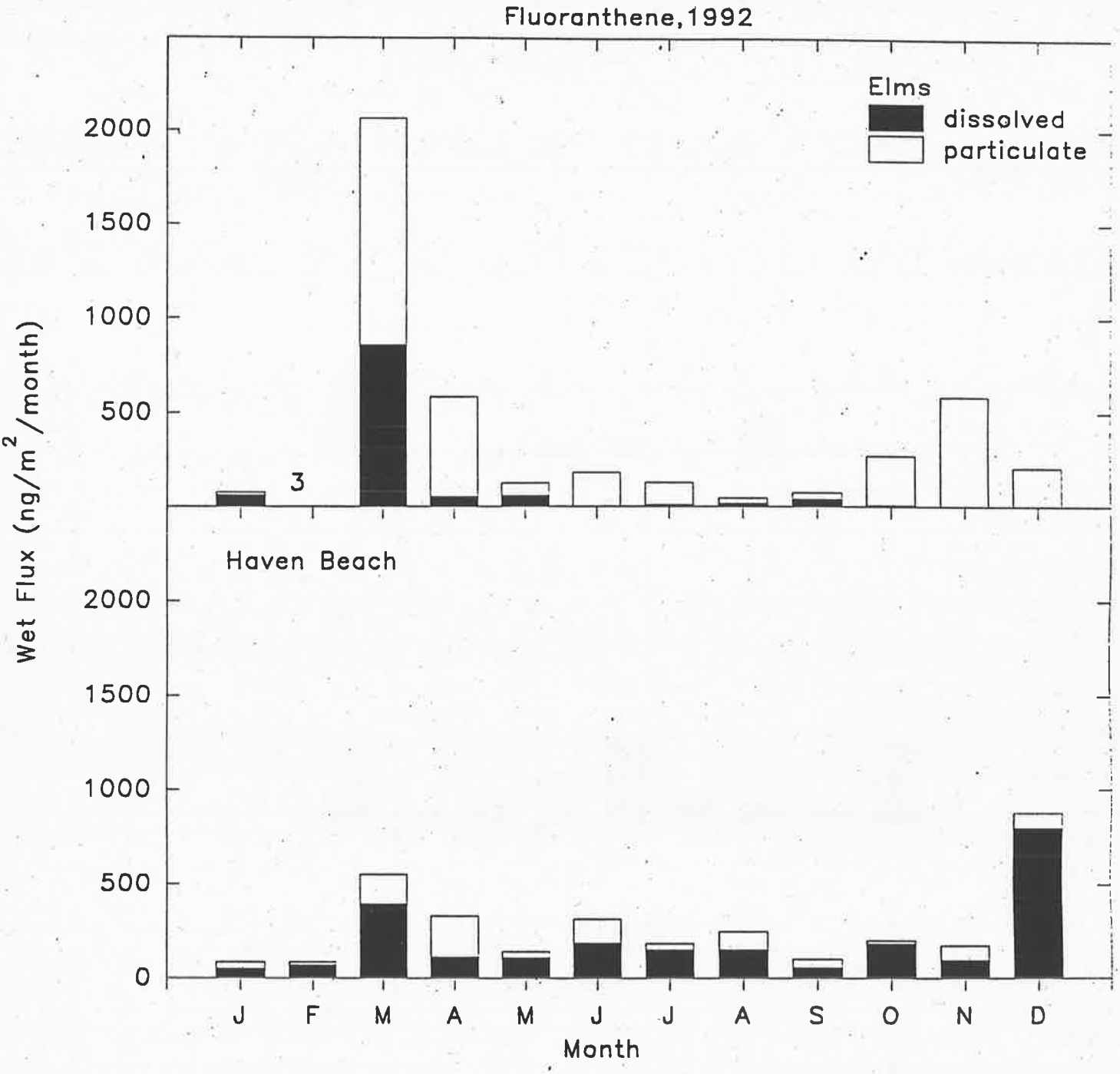
A1.49 Phenanthrene wet depositional fluxes measured at the Wye, Elms and Haven Beach sites. (1=not quantifiable in dissolved phase, 2=not quantifiable on filter, 3= sampler down, 4 = lost dissolved sample).


Phenanthrene, 1993
Wye
dissolved
particulate
Elms
Haven Beach
Wet Flux (ng/m²/month)
Month
2000
1500
1000
500
500
1000
500
0
4
1
1
1
J
F
M
A
M
J
J
A
S
O
N
D

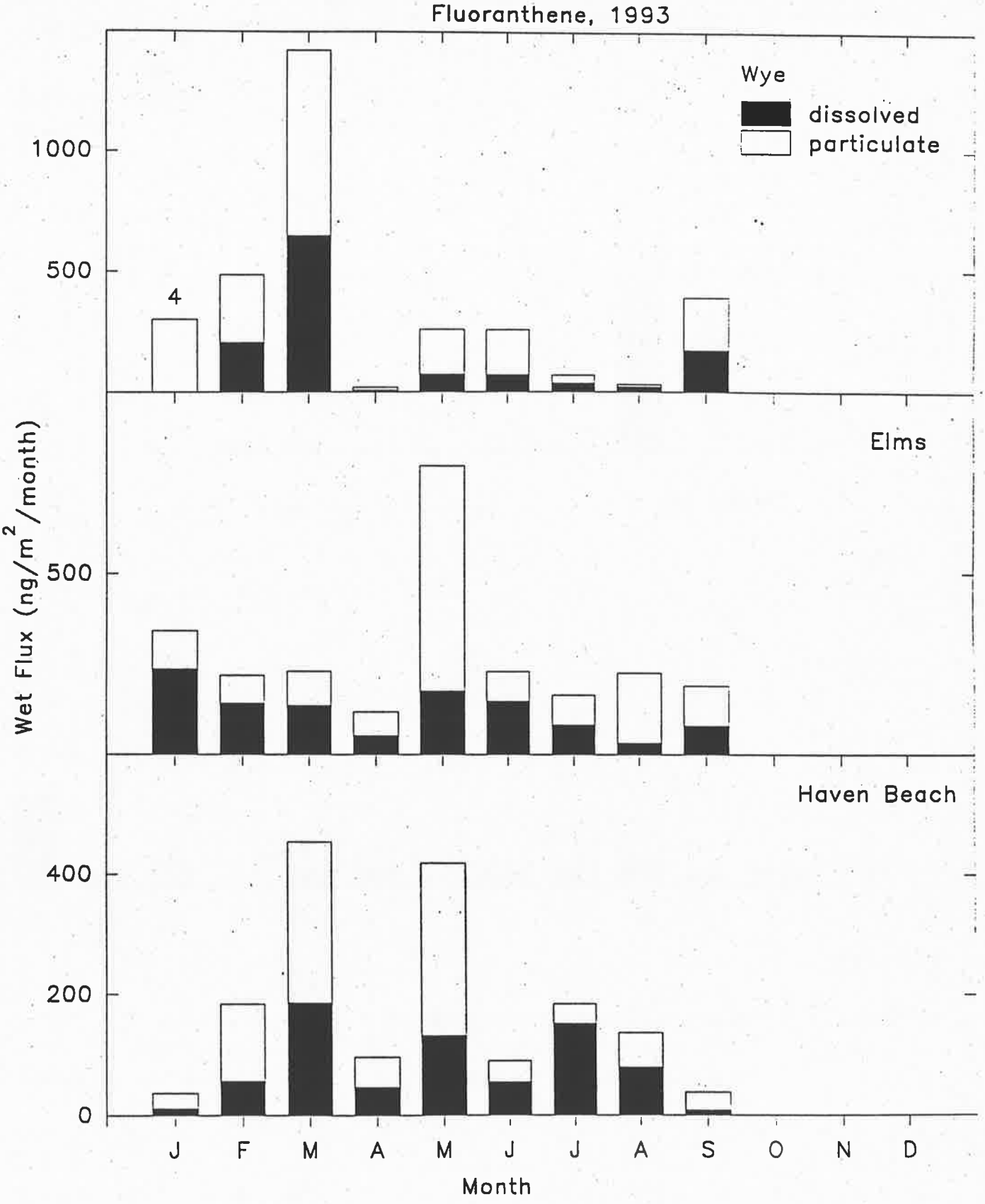


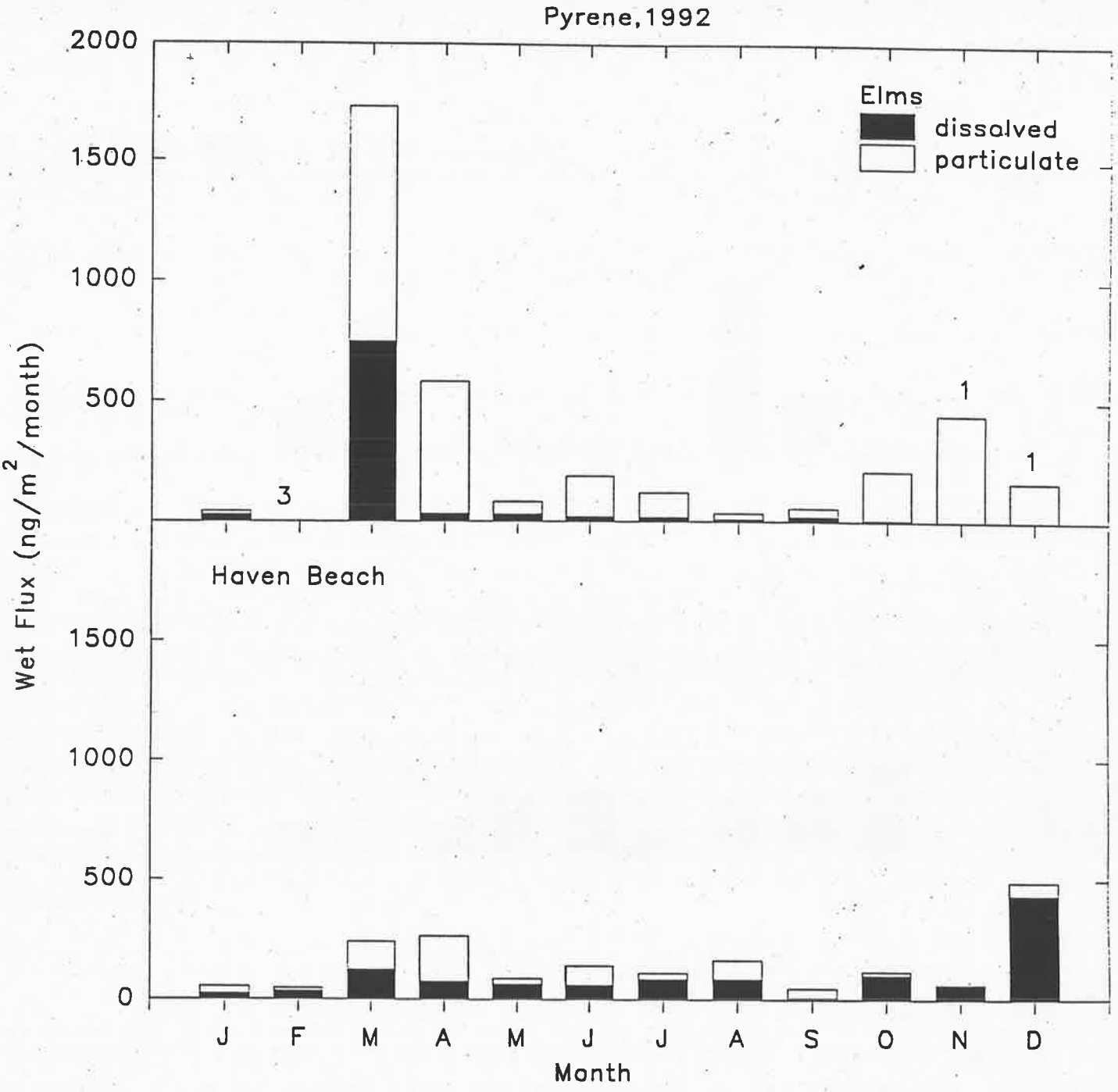
A1.50 Anthracene wet depositional fluxes measured at the Wye, Elms and Haven Beach sites. (1=not quantifiable in dissolved phase, 2=not quantifiable on filter, 3= sampler down, 4 = lost dissolved sample).


Anthracene, 1993
Wye
dissolved
particulate
400
300
200
100
75
4
Elms
50
25
Haven Beach
50
0
Wet Flux (ng/m^2/month)
J
F
M
A
M
J
J
A
S
O
N
D
Month

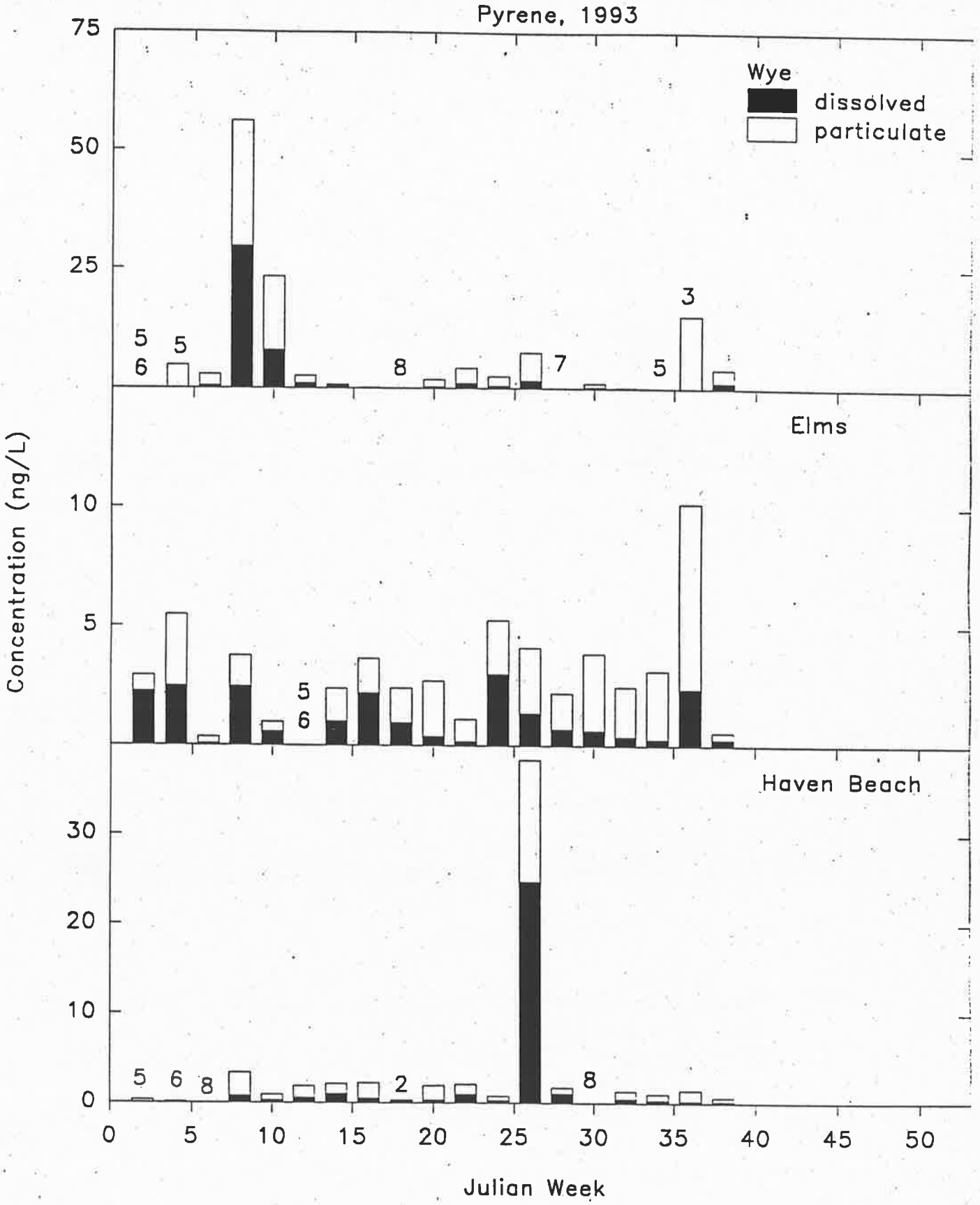


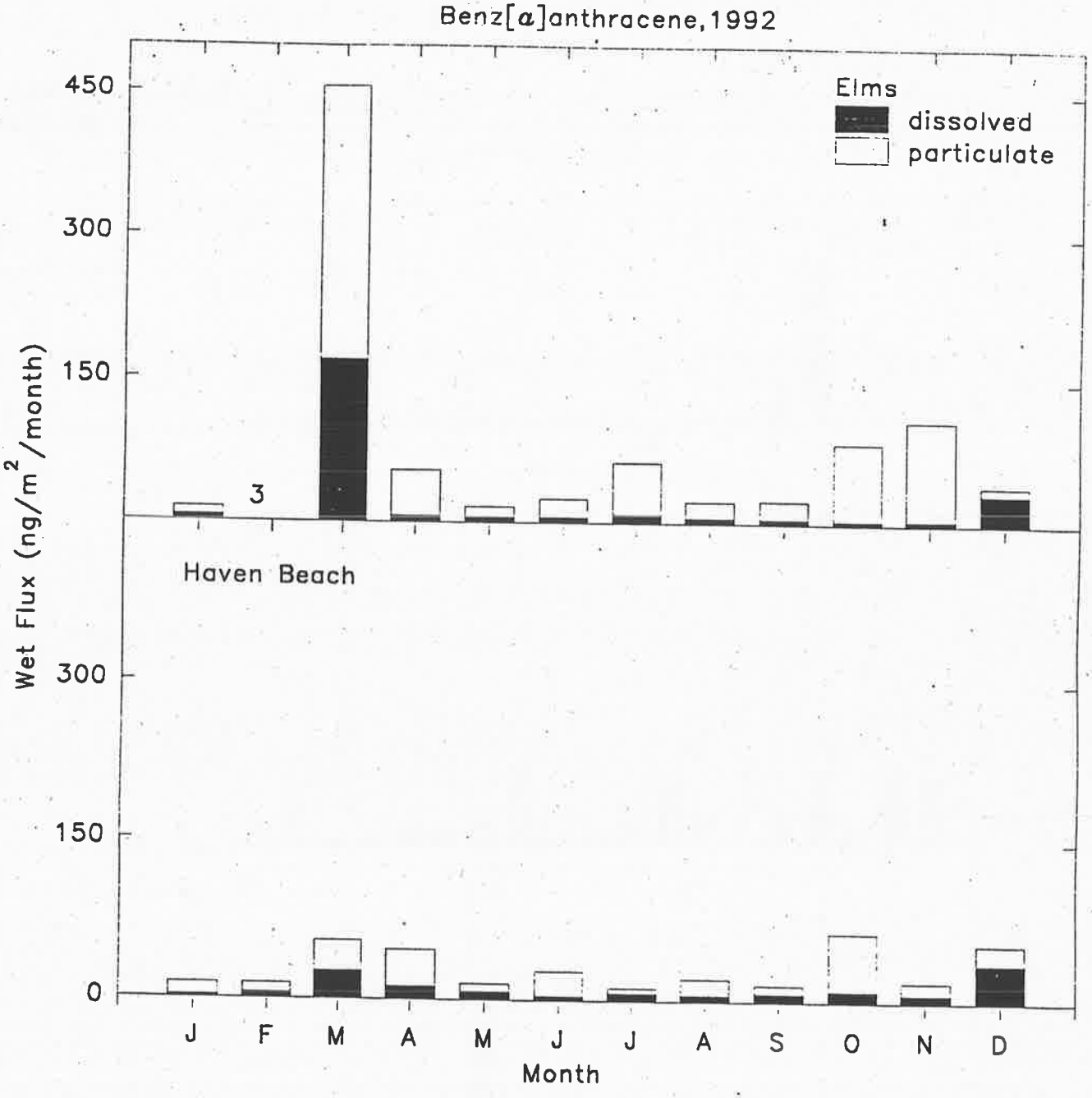
A1.51 Fluoranthene wet depositional fluxes measured at the Wye, Elms, and Haven Beach sites. (1=not quantifiable in dissolved phase, 2=not quantifiable on filter, 3=sampler down, 4 = lostm dissolved sample).


Fluoranthene, 1993
Wye
dissolved
particulate
1000
500
4
Elms
500
Haven Beach
400
200
0
Wet Flux (ng/m2/month)
J
F
M
A
M
J
J
A
S
O
N
D
Month

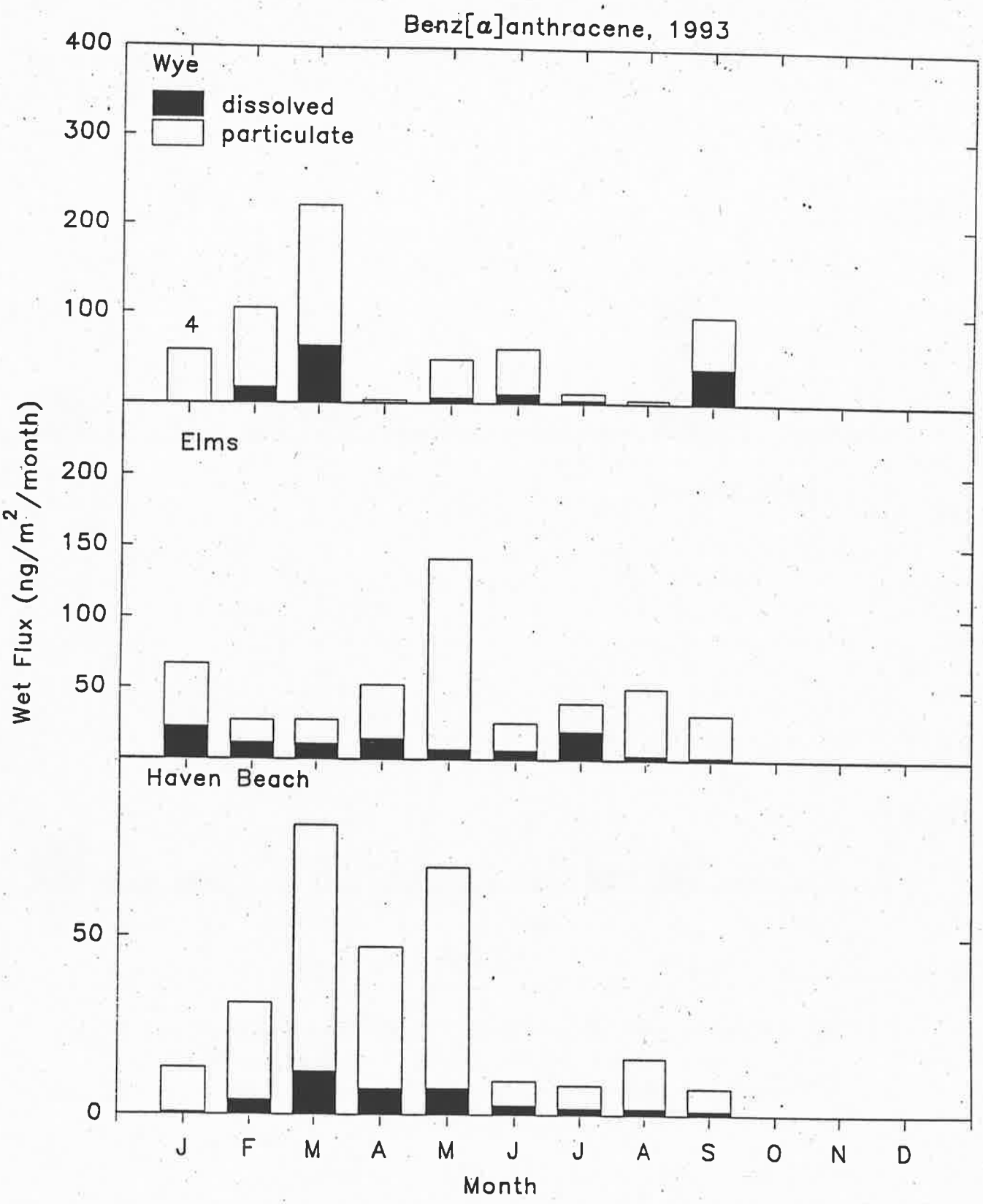


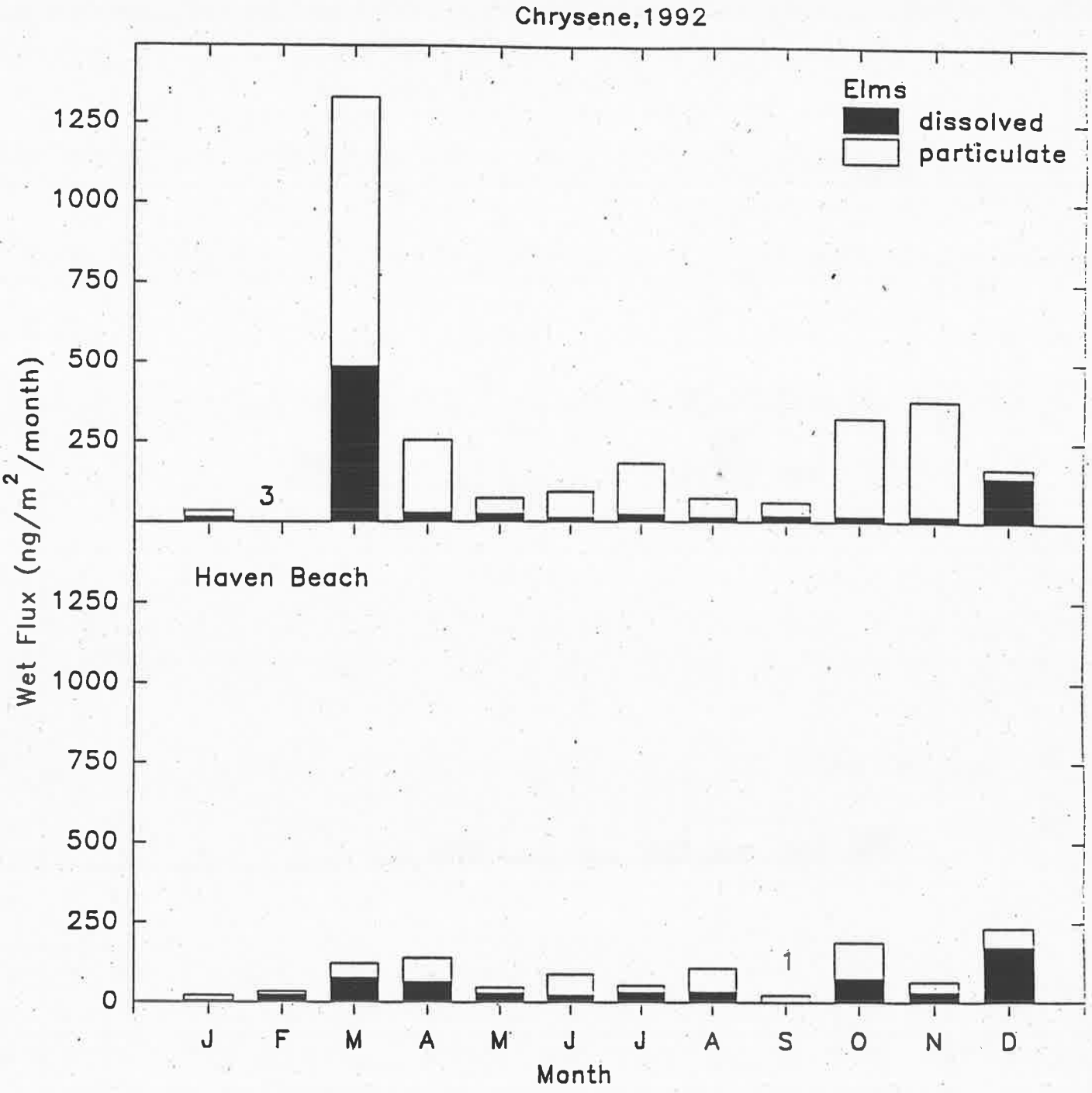
A1.52 Pyrene wet depositional fluxes measured at the Wye, Elms and Haven Beach sites. (1=not quantifiable in dissolved phase, 2=not quantifiable on filter, 3= sampler down, 4 = lost dissolved sample).


Pyrene, 1993
Wye
dissolved
particulate
Elms
Haven Beach
Concentration (ng/L)
Julian Week
75
50
25
10
5
30
20
10
0
0
5
10
15
20
25
30
35
40
45
50
5
6
5
8
7
5
3
5
6
5
6
8
2
8

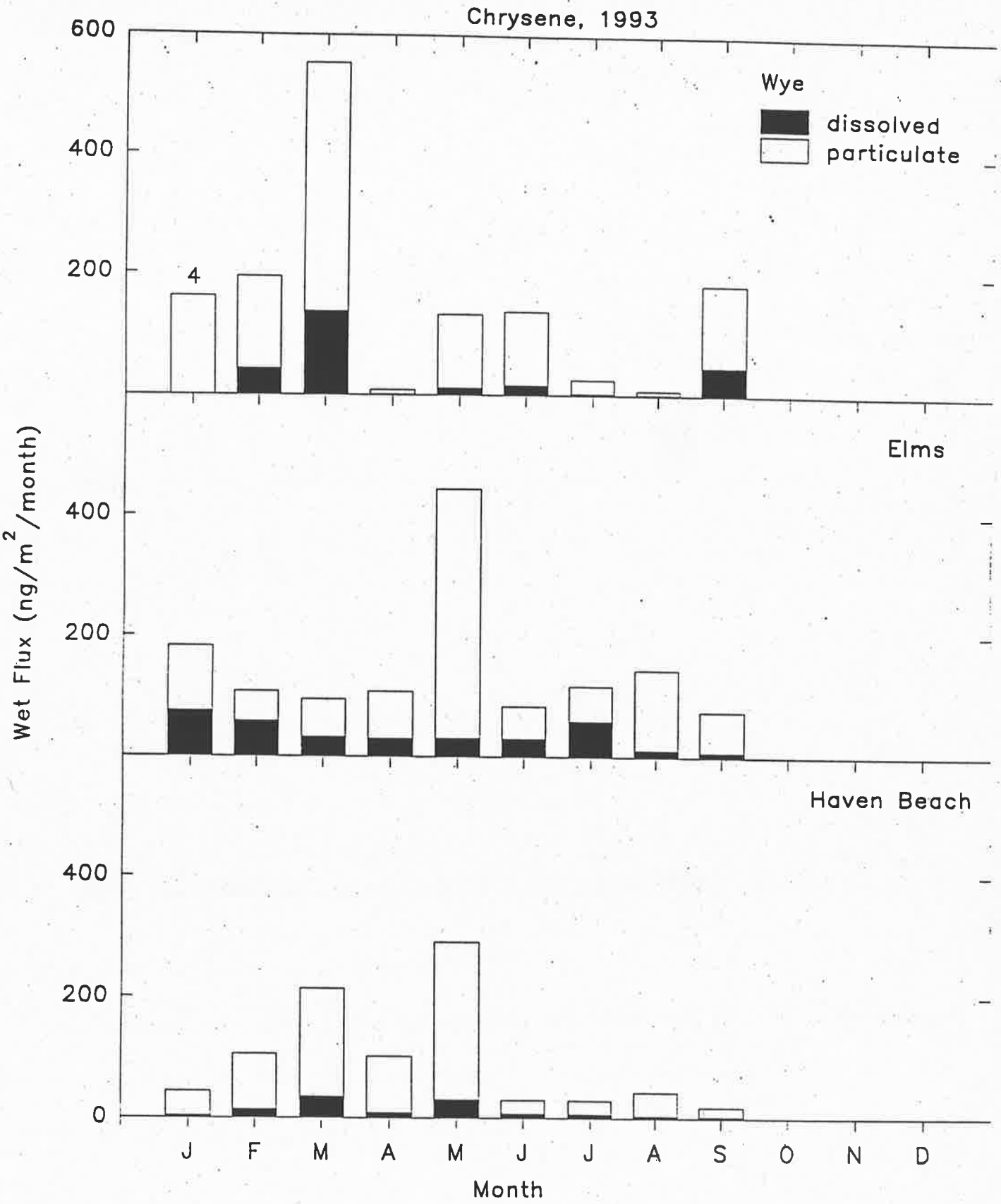


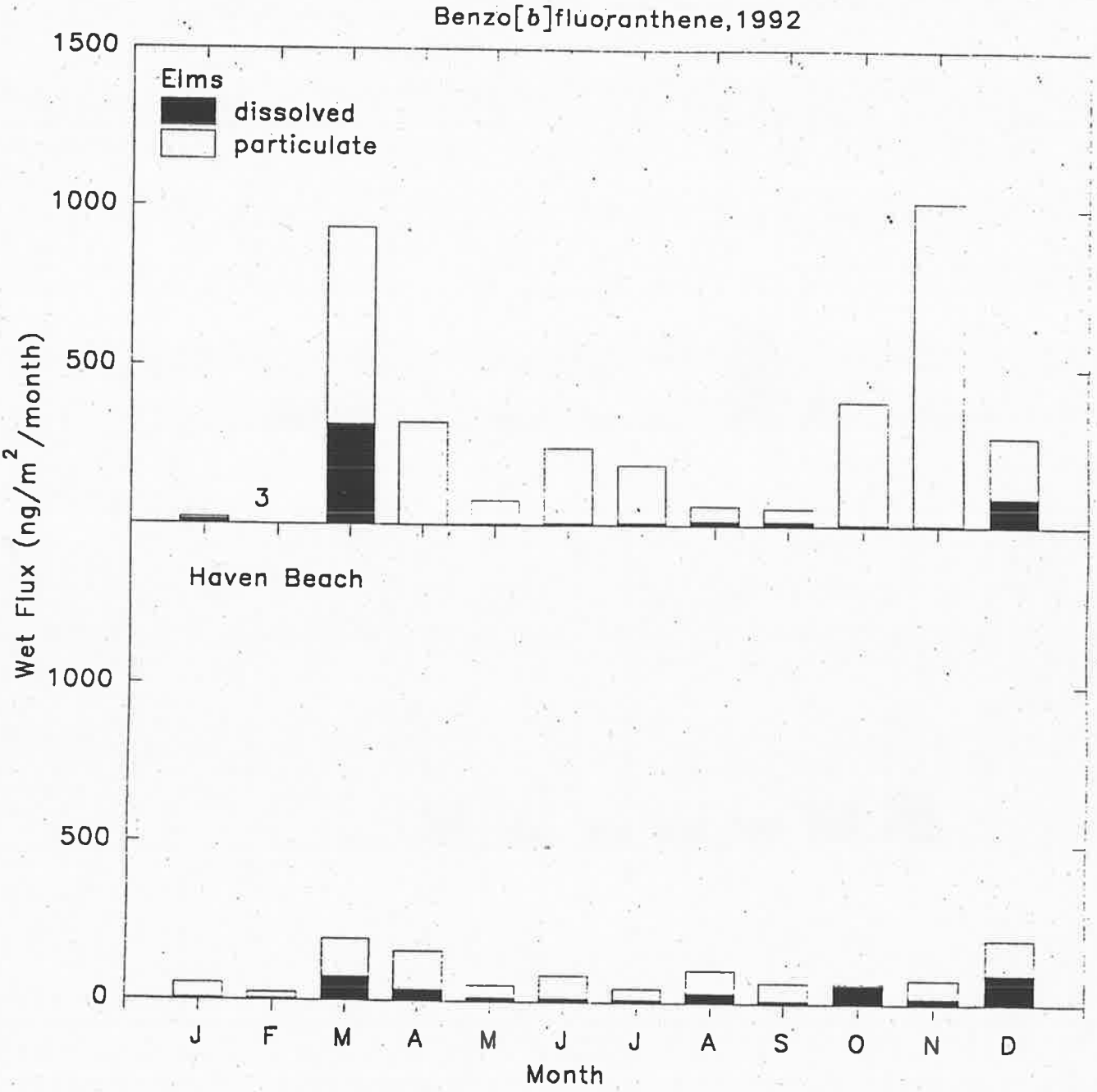
A1.53 Benz[a]anthracene wet depositional fluxes measured at the Wye, Elms and Haven Beach sites. (1=not quantifiable in dissolved phase, 2=not quantifiable on filter, 3= sampler down, 4 = lost dissolved sample).


Benz[a]anthracene, 1993
Wye
dissolved
particulate
400
300
200
100
4
Elms
200
150
100
50
Haven Beach
50
0
Wet Flux (ng/m²/month)
J
F
M
A
M
J
J
A
S
O
N
D
Month

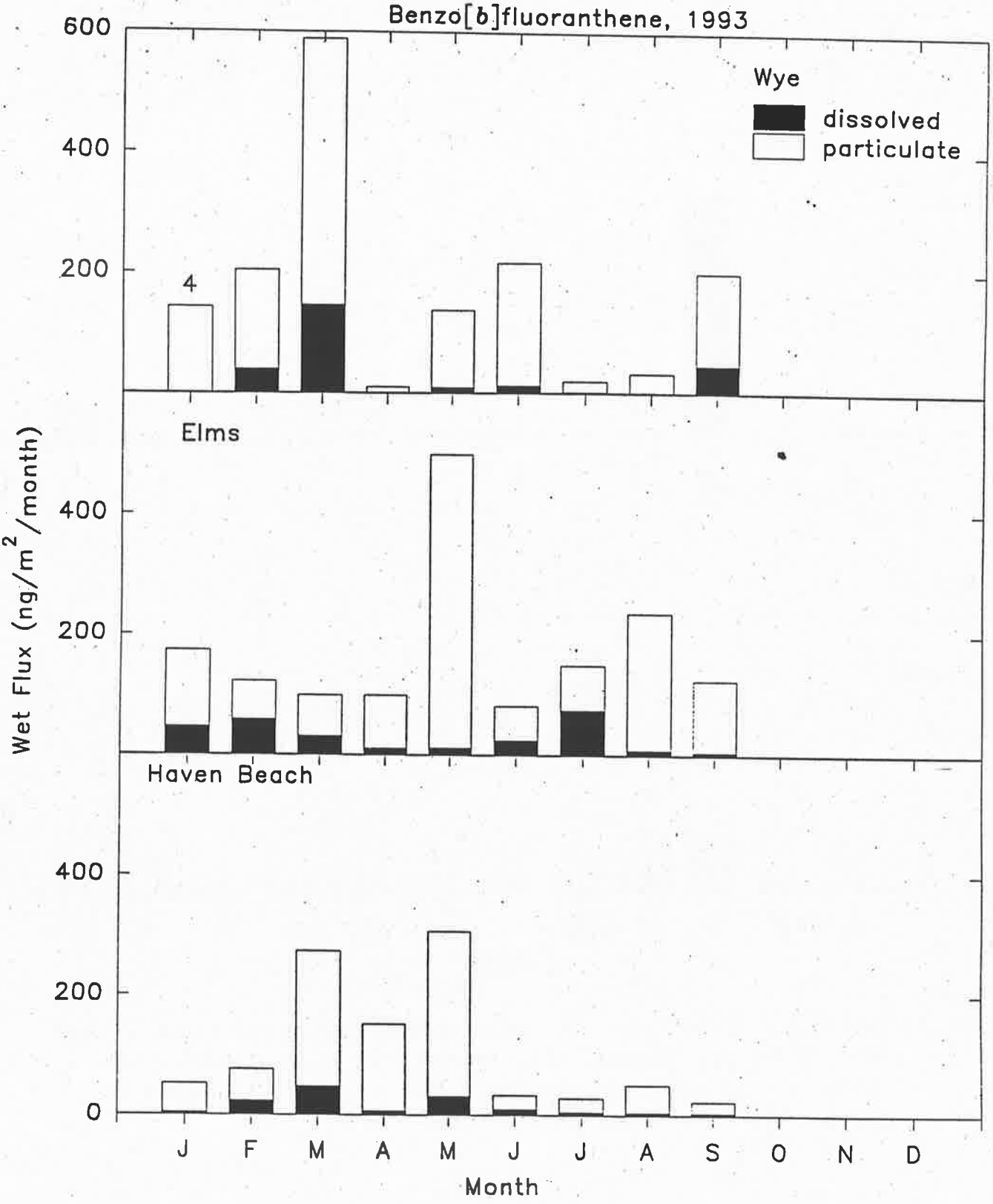


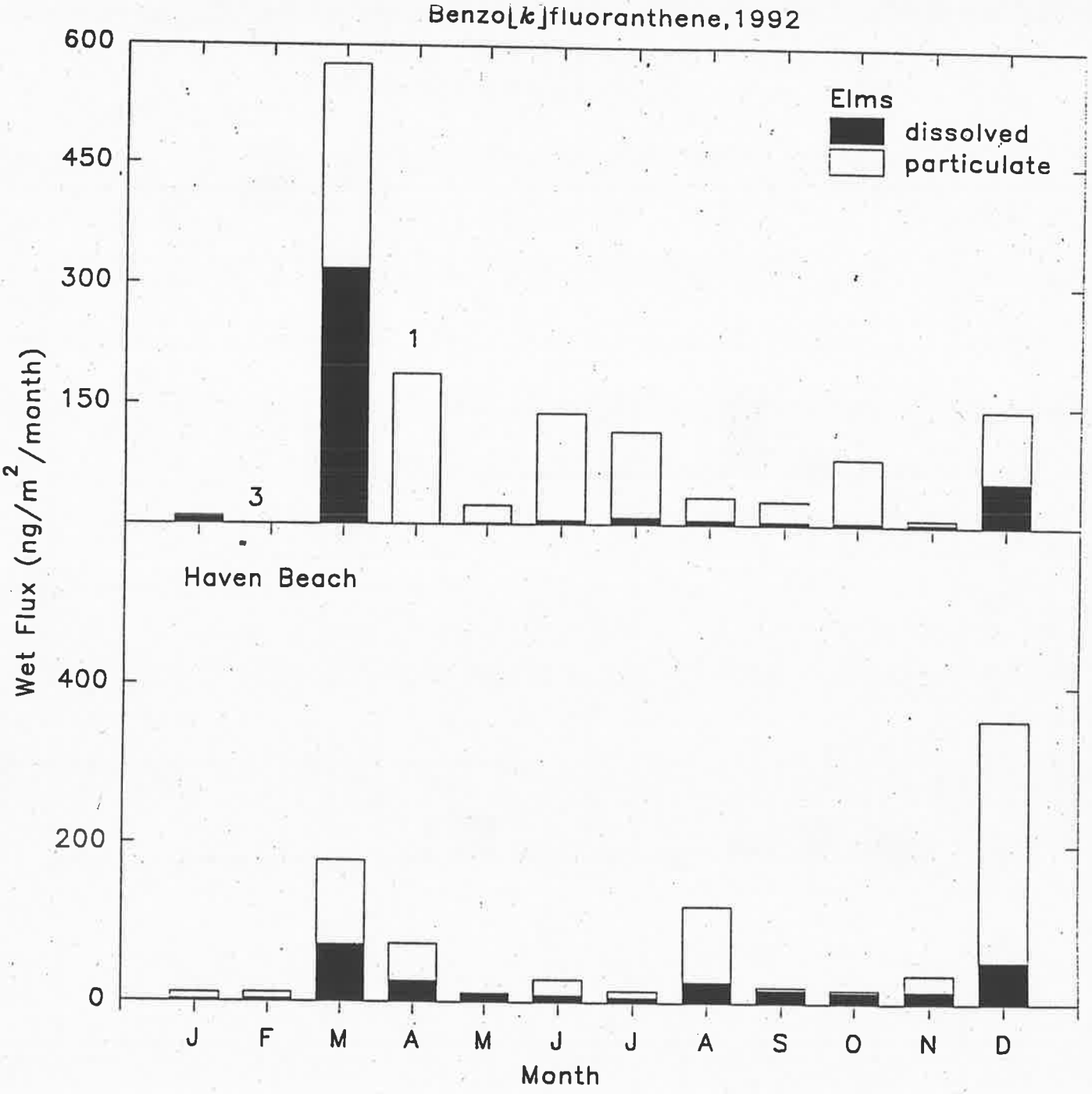
A1.54 Chrysene wet depositional fluxes measured at the Wye, Elms and Haven Beach sites. (1=not quantifiable in dissolved phase, 2=not quantifiable on filter, 3= sampler down, 4 = lost dissolved sample).


Chrysene, 1993
Wye
dissolved
particulate
4
Elms
Haven Beach
Wet Flux (ng/m^2/month)
600
400
200
400
200
400
200
0
J
F
M
A
M
J
J
A
S
O
N
D
Month

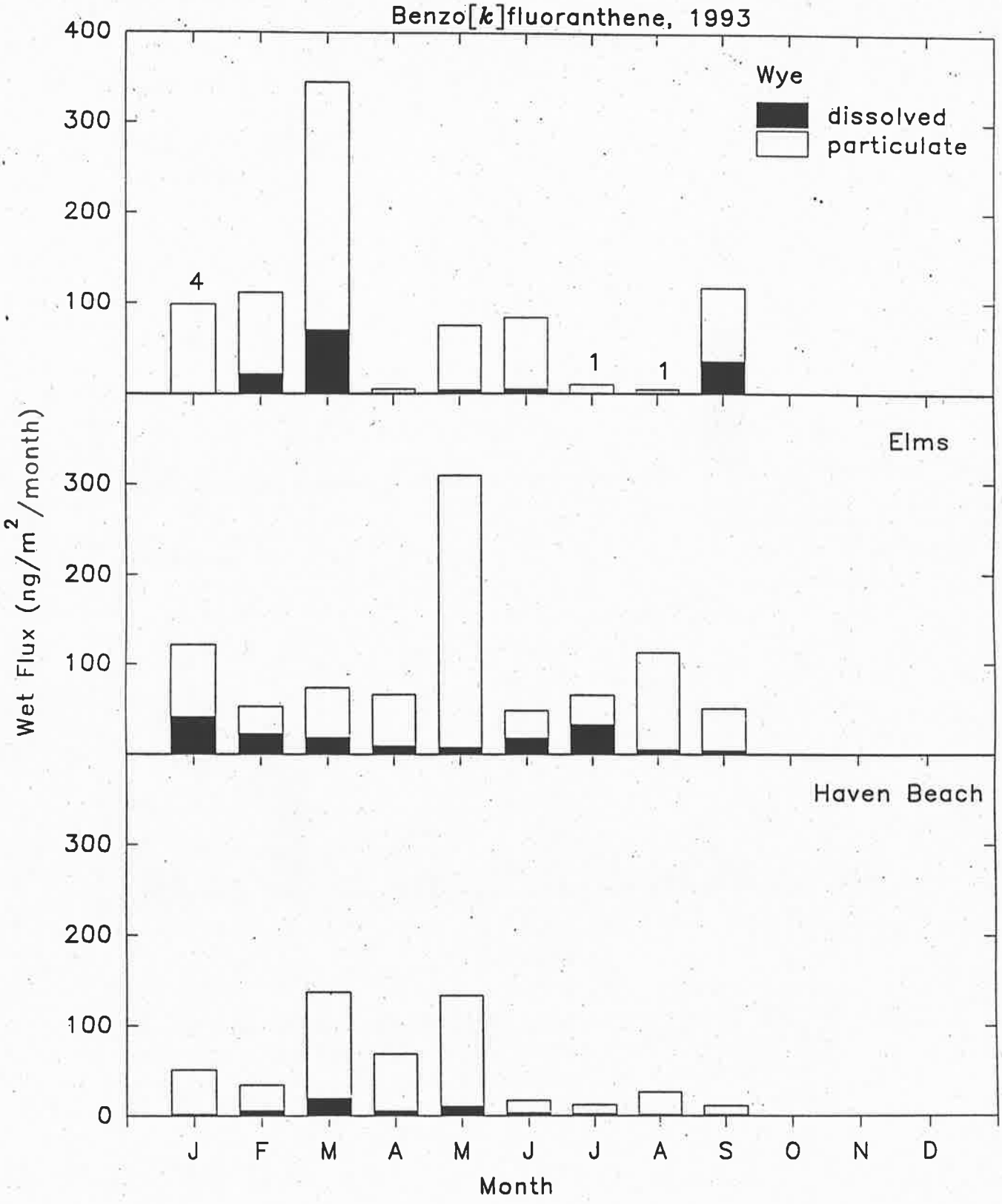


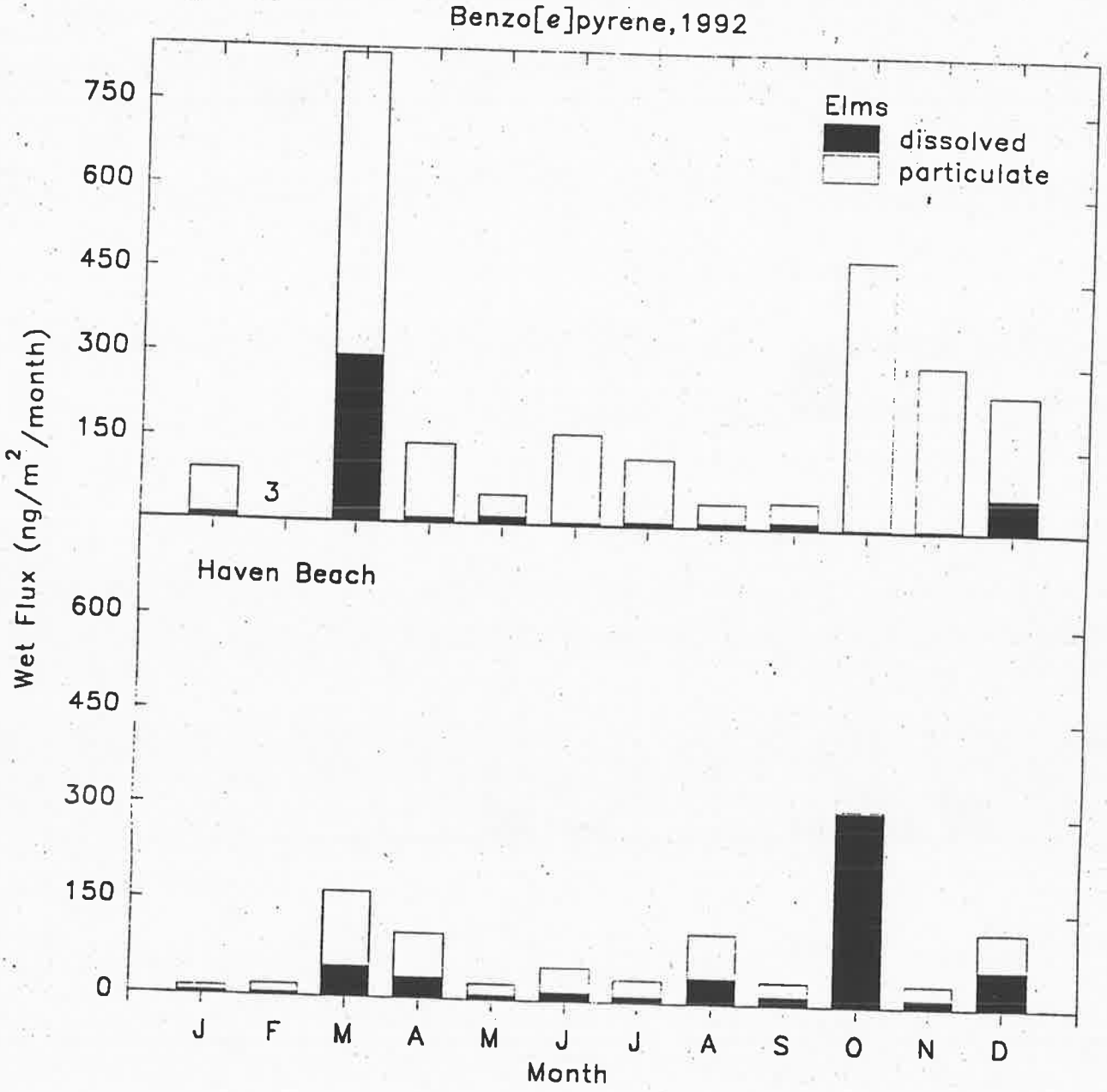
A1.55 Benzo[b]fluoranthene wet depositional fluxes measured at the Wye, Elms and Haven Beach sites. (1=not quantifiable in dissolved phase, 2=not quantifiable on filter, 3= sampler down, 4 = lost dissolved sample).


Benzo[b]fluoranthene, 1993
Wye
dissolved
particulate
600
400
200
4
Elms
400
200
Haven Beach
400
200
0
Wet Flux (ng/m2/month)
J
F
M
A
M
J
J
A
S
O
N
D
Month

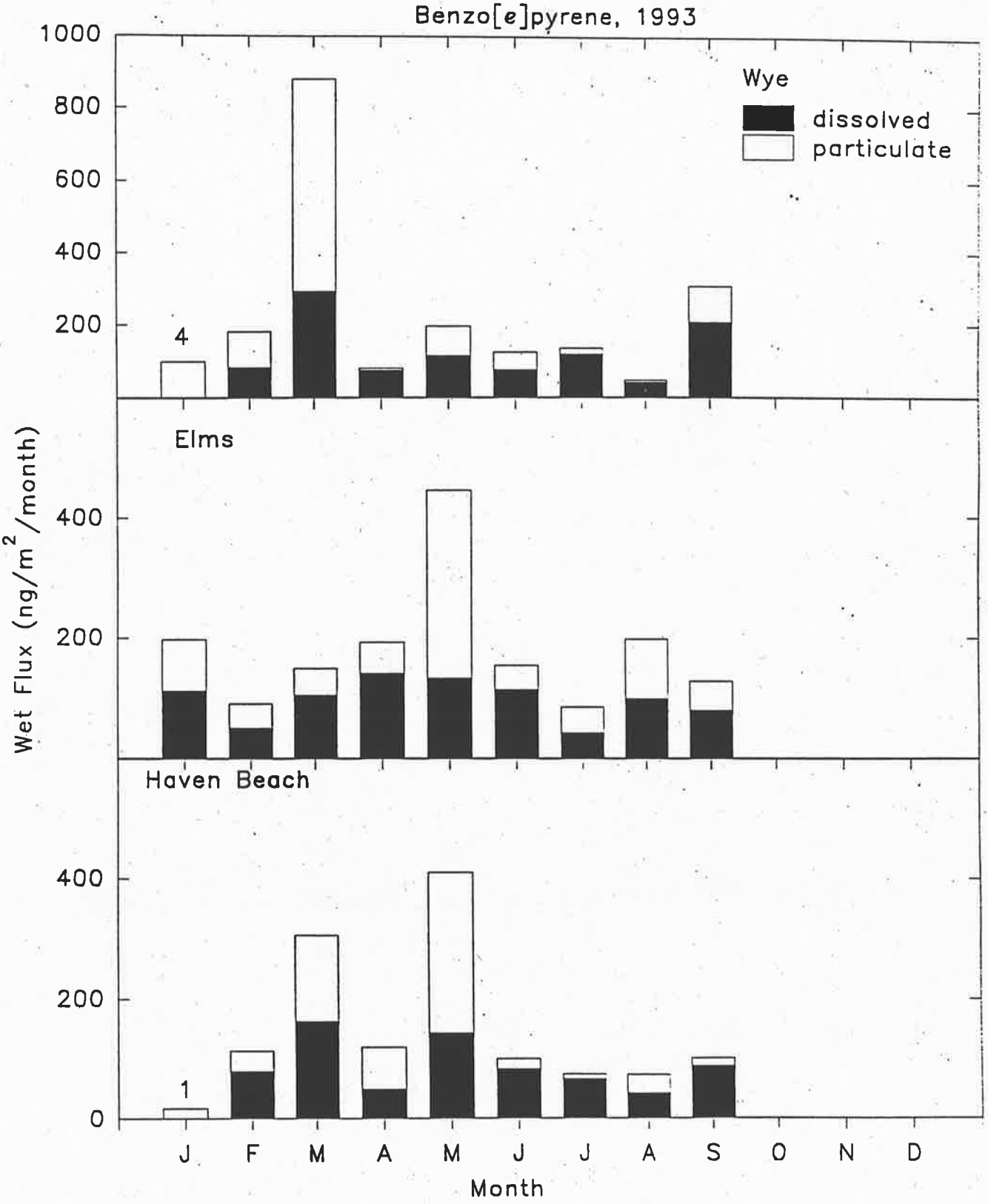


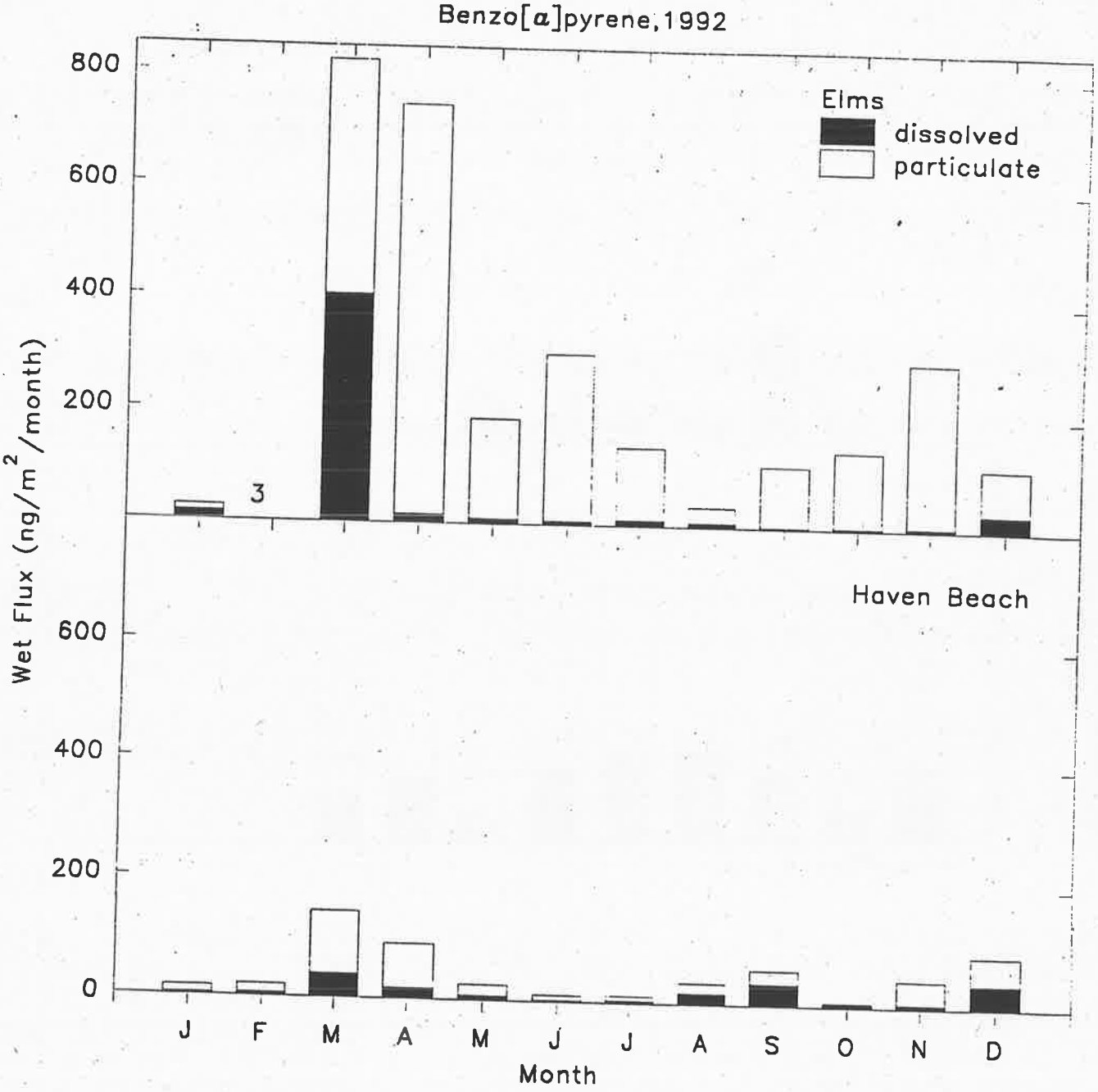
A1.56 Benzo[*k*]fluoranthene wet depositional fluxes measured at the Wye, Elms and Haven Beach sites. (1=not quantifiable in dissolved phase, 2=not quantifiable on filter, 3= sampler down, 4 = lost dissolved sample).


Benzo[k]fluoranthene, 1993
Wye
dissolved
particulate
Elms
Haven Beach
Wet Flux (ng/m²/month)
Month
J
F
M
A
M
J
J
A
S
O
N
D
0
100
200
300
400
4
1
1

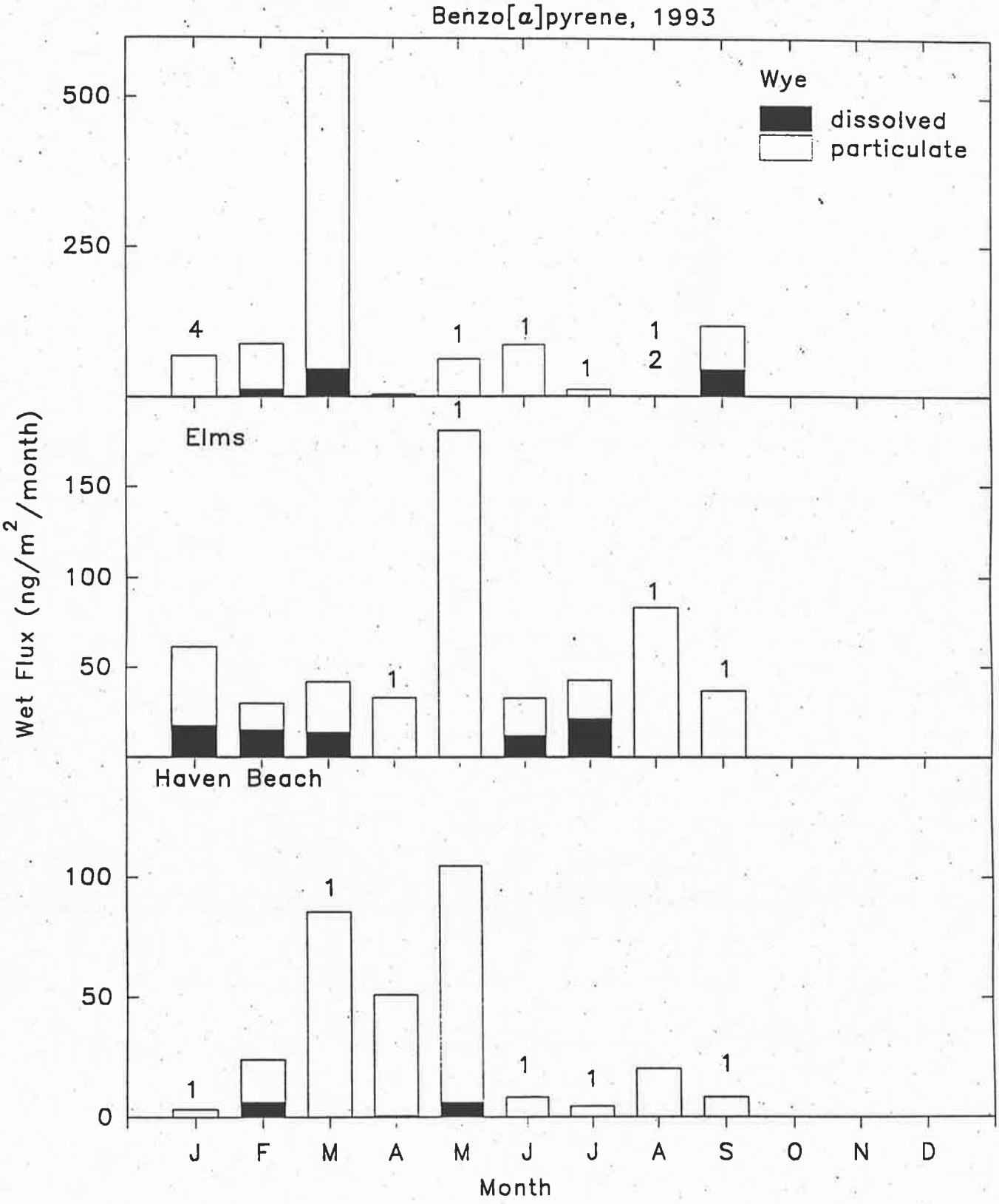


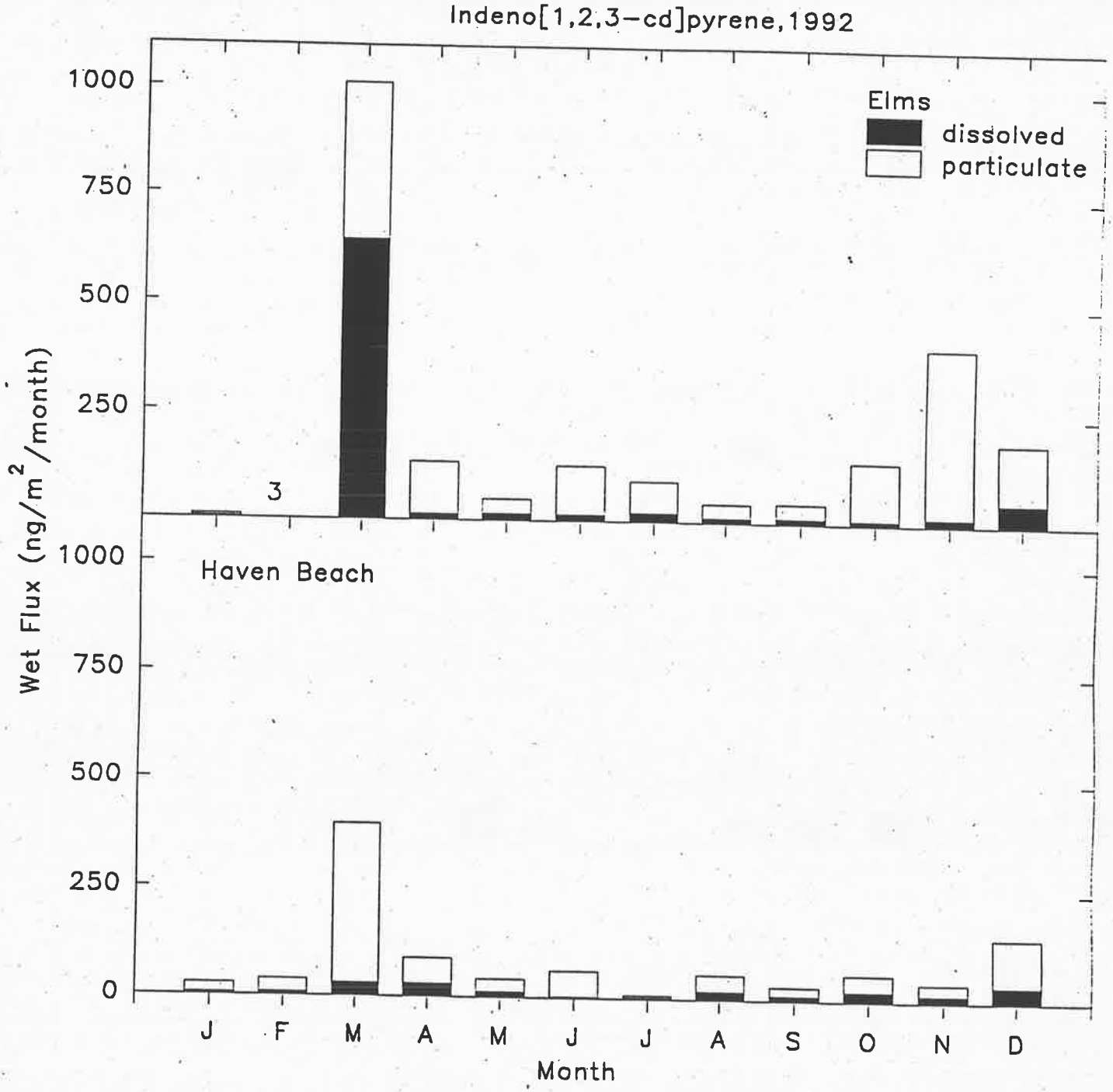
A1.57 Benzo[e]pyrene wet depositional fluxes measured at the Wye, Elms, and Haven Beach sites. (1=not quantifiable in dissolved phase, 2=not quantifiable on filter, 3= sampler down, 4 = lost dissolved sample.).


Benzo[e]pyrene, 1993
Wye
dissolved
particulate
1000
800
600
400
200
4
Elms
400
200
Haven Beach
400
200
0
1
Wet Flux (ng/m2/month)
J
F
M
A
M
J
J
A
S
O
N
D
Month

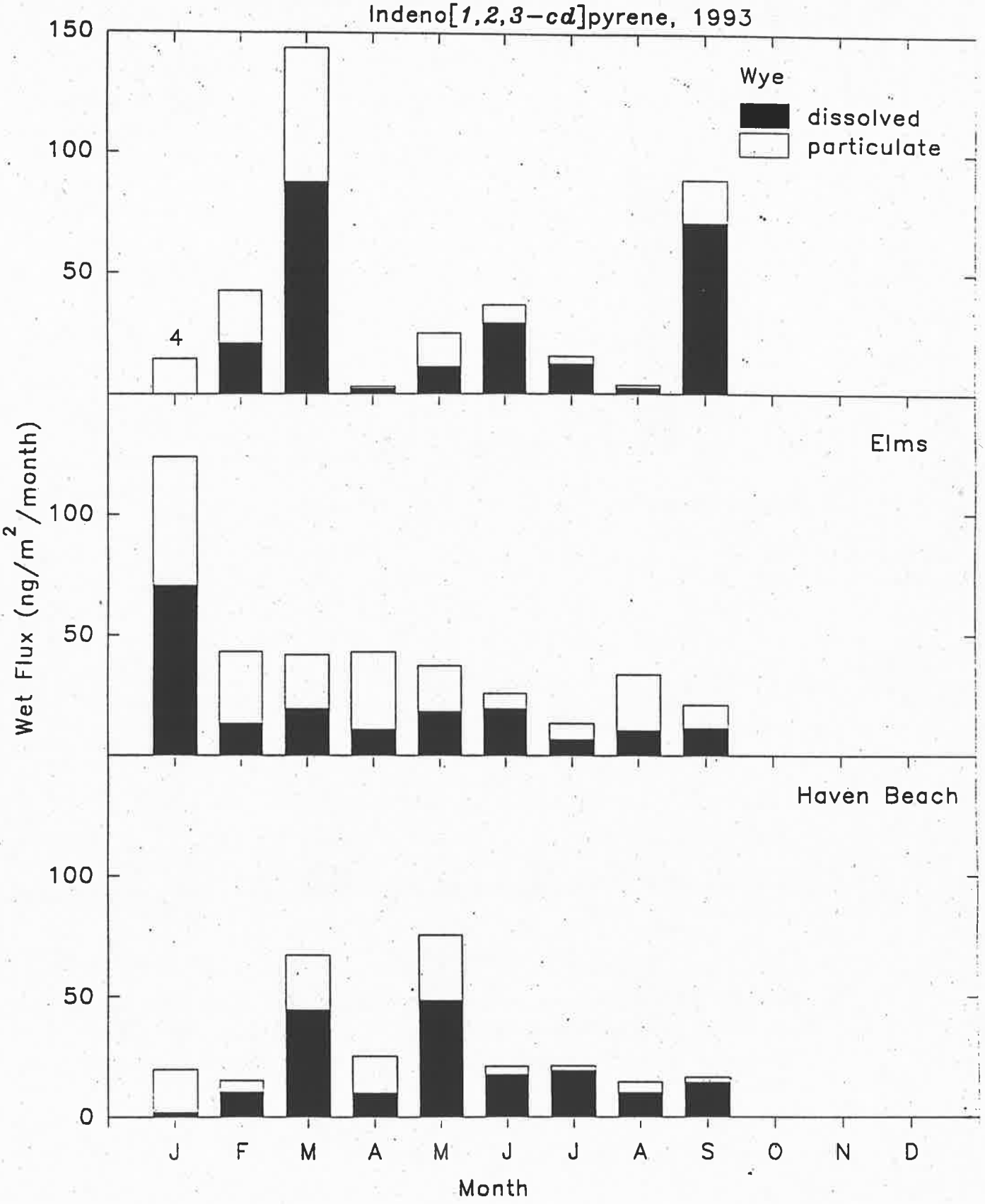


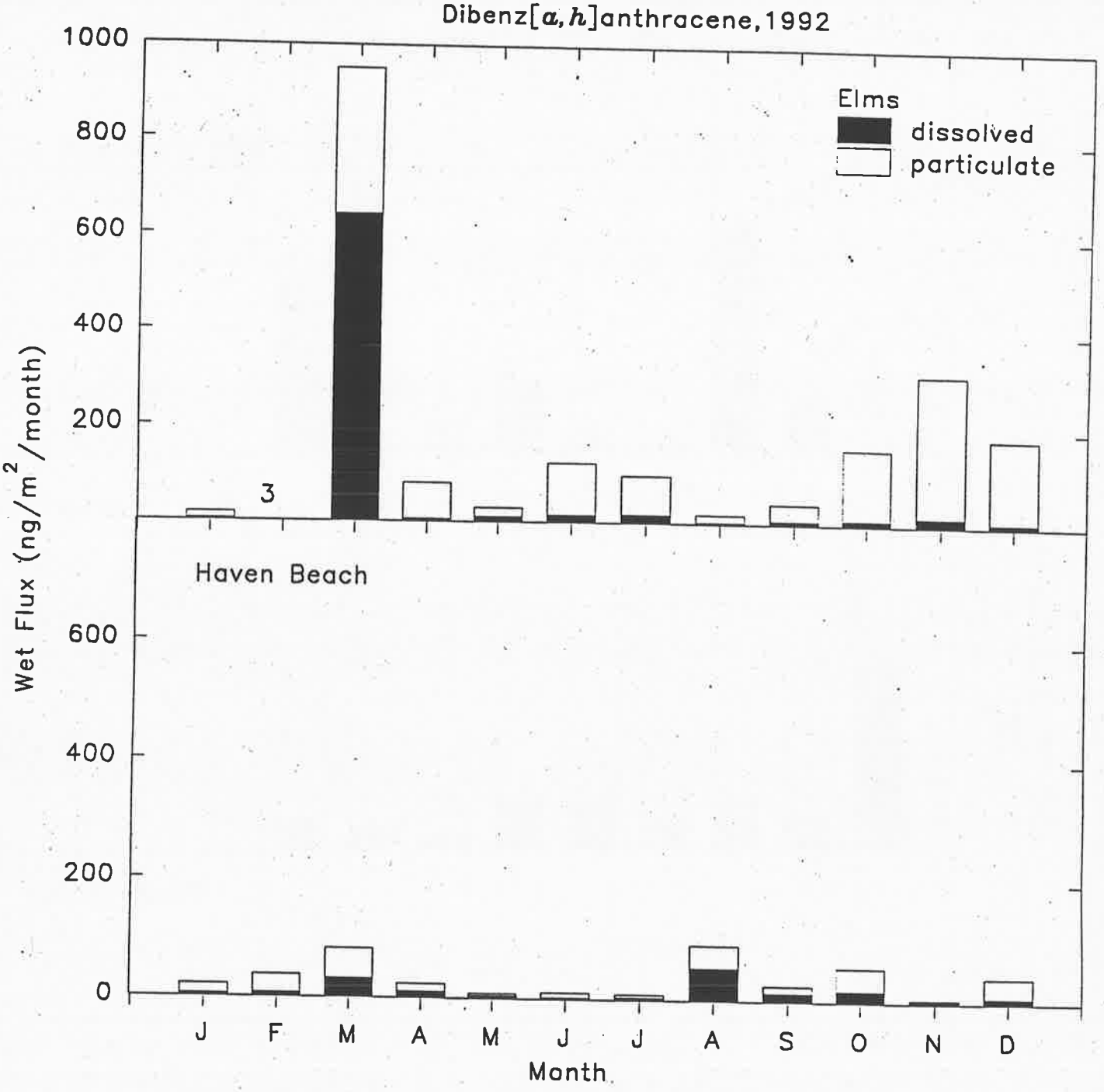
A1.58 Benzo[a]pyrene wet depositional fluxes measured at the Wye, Elms and Haven Beach sites. (1=not quantifiable in dissolved phase, 2=not quantifiable on filter, 3= sampler down, 4 = lost dissolved sample).


Benzo[a]pyrene, 1993
Wye
dissolved
particulate
Elms
Haven Beach
Wet Flux (ng/m2/month)
Month
J
F
M
A
M
J
J
A
S
O
N
D
0
50
100
150
250
500

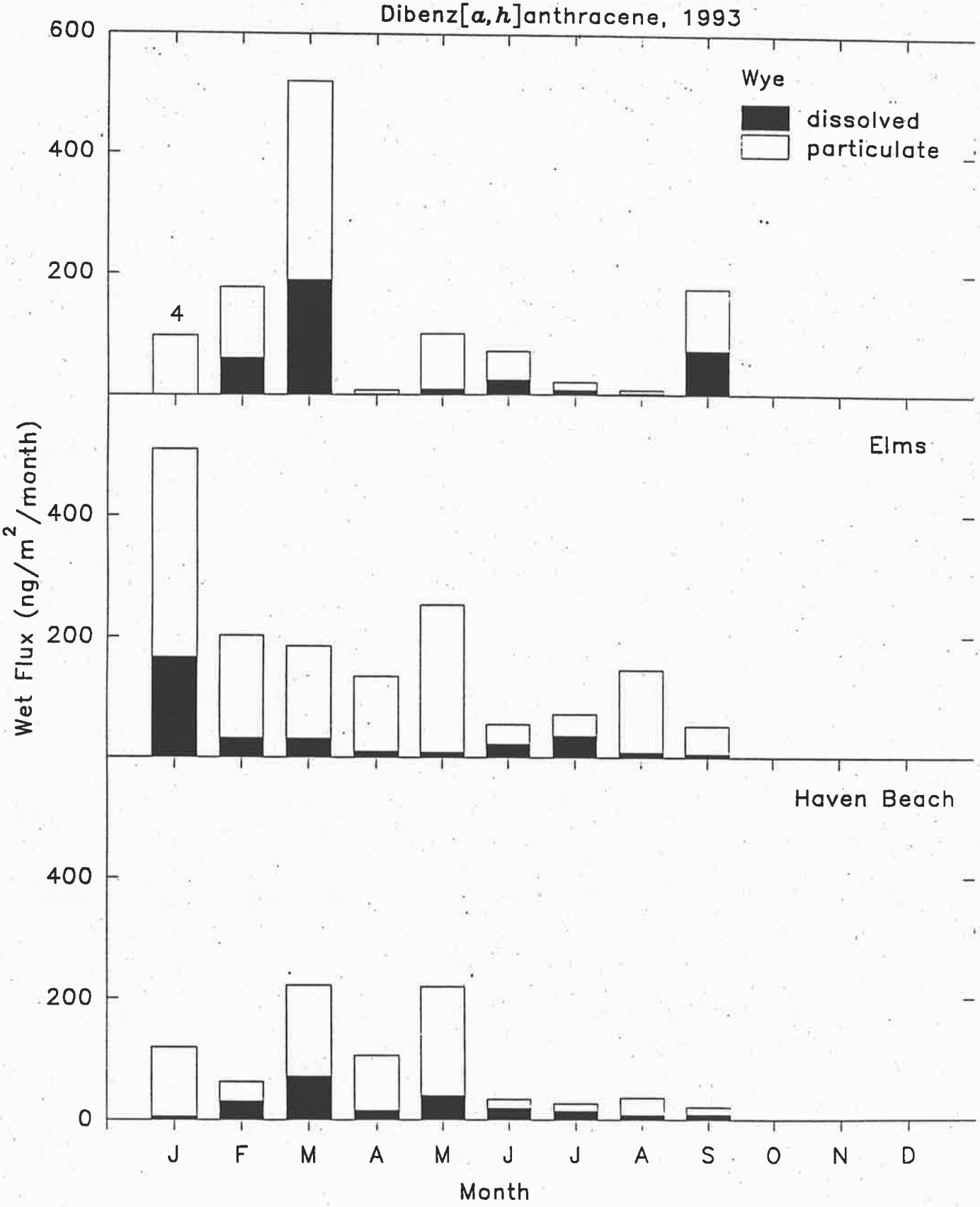


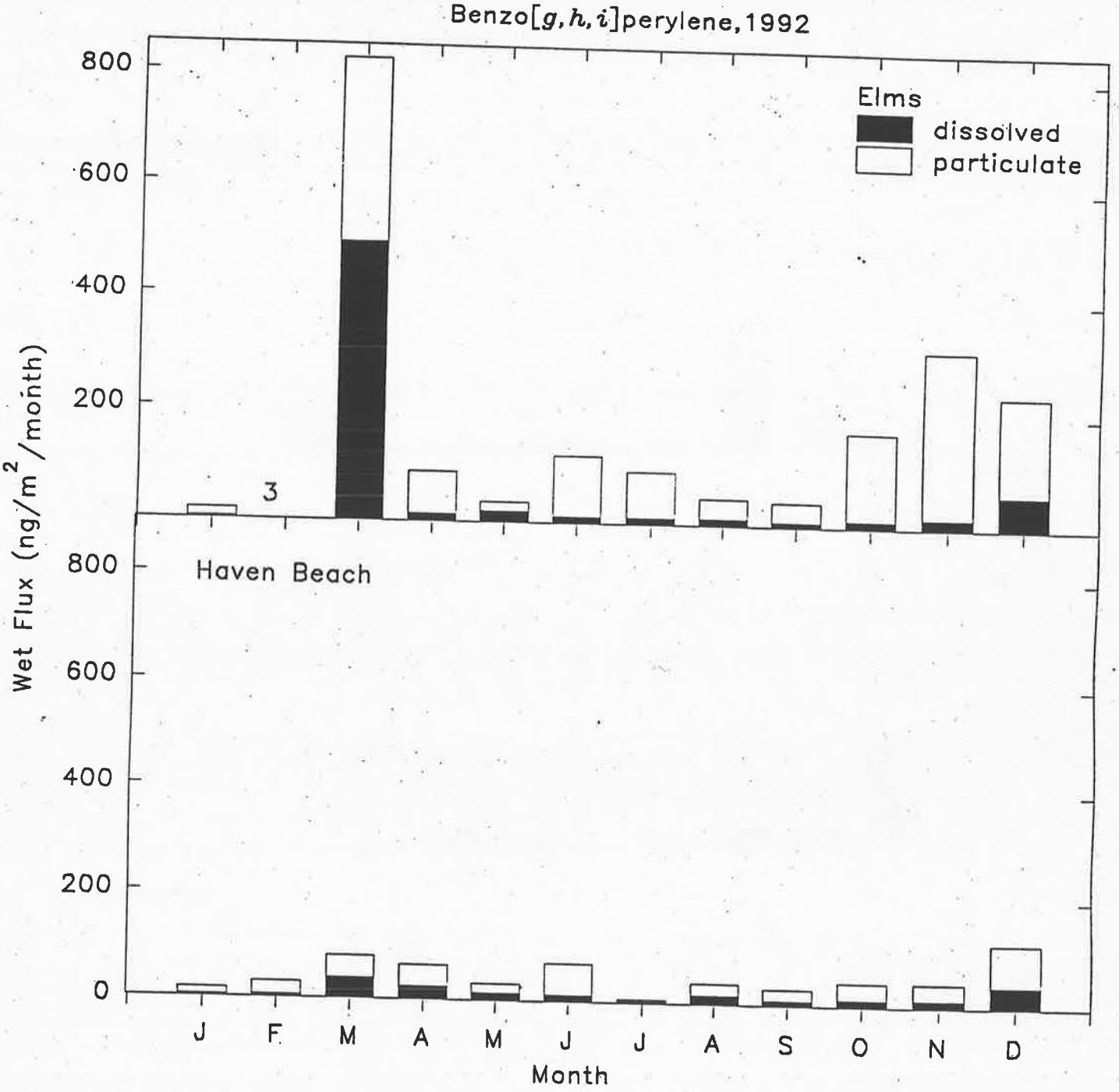
A1.59 Indeno[*1,2,3-cd*]pyrene wet depositional fluxes measured at the Wye, Elms and Haven Beach sites. (1=not quantifiable in dissolved phase, 2=not quantifiable on filter, 3 = sampler down, 4 = lost dissolved sample).


Indeno[1,2,3-cd]pyrene, 1993
Wye
dissolved
particulate
Elms
Haven Beach
4
150
100
50
100
50
100
50
0
Wet Flux (ng/m²/month)
J
F
M
A
M
J
J
A
S
O
N
D
Month

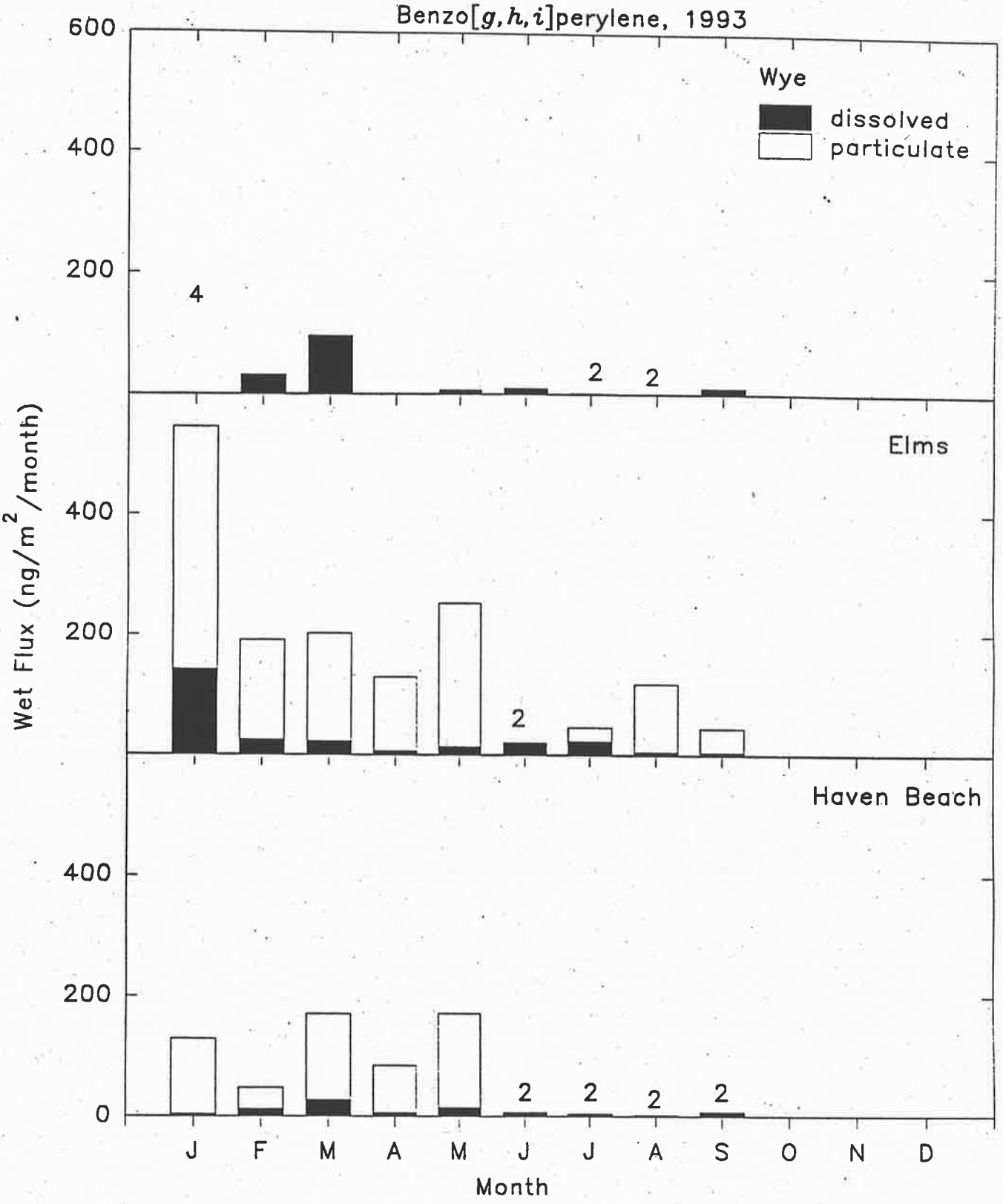


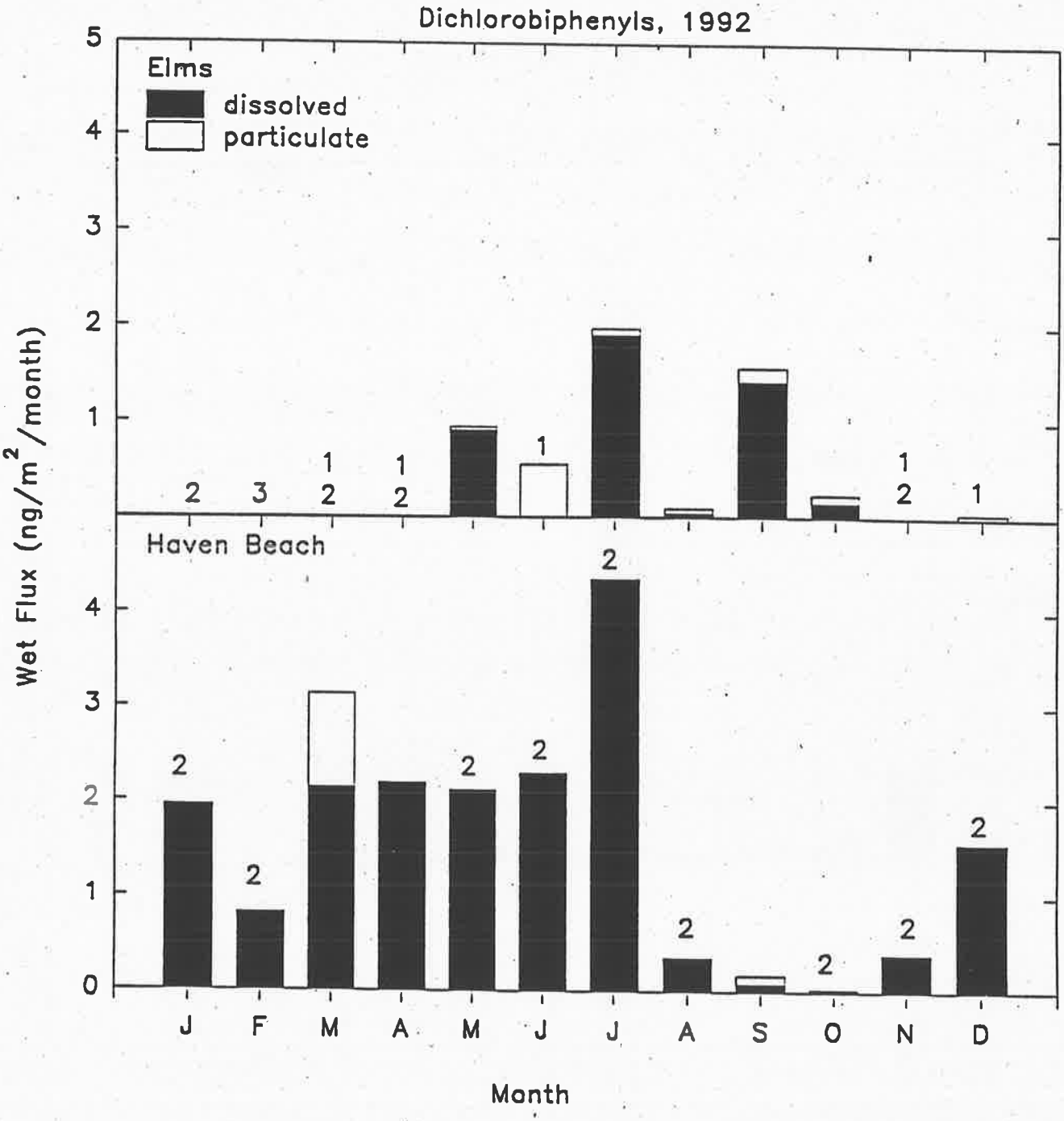
A1.60 Dibenz[a,h]anthracene wet depositional fluxes measured at the Wye, Elms and Haven Beach sites. (1=not quantifiable in dissolved phase, 2=not quantifiable on filter, 3= sample down, 4 = lost dissolved sample).


Dibenz[a,h]anthracene, 1993
Wye
dissolved
particulate
Elms
Haven Beach
Wet Flux (ng/m²/month)
600
400
200
400
200
400
200
0
4
J
F
M
A
M
J
J
A
S
O
N
D
Month

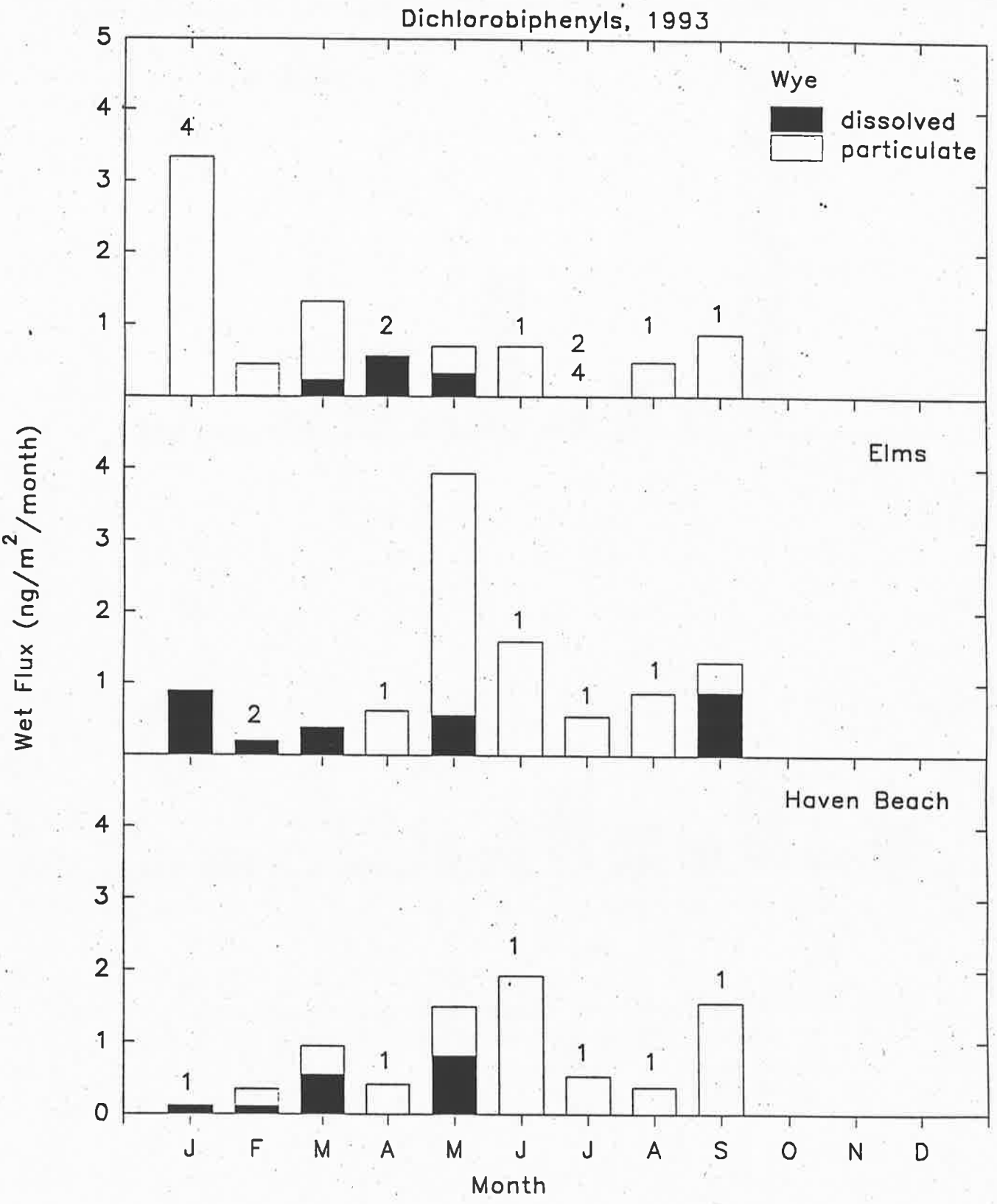


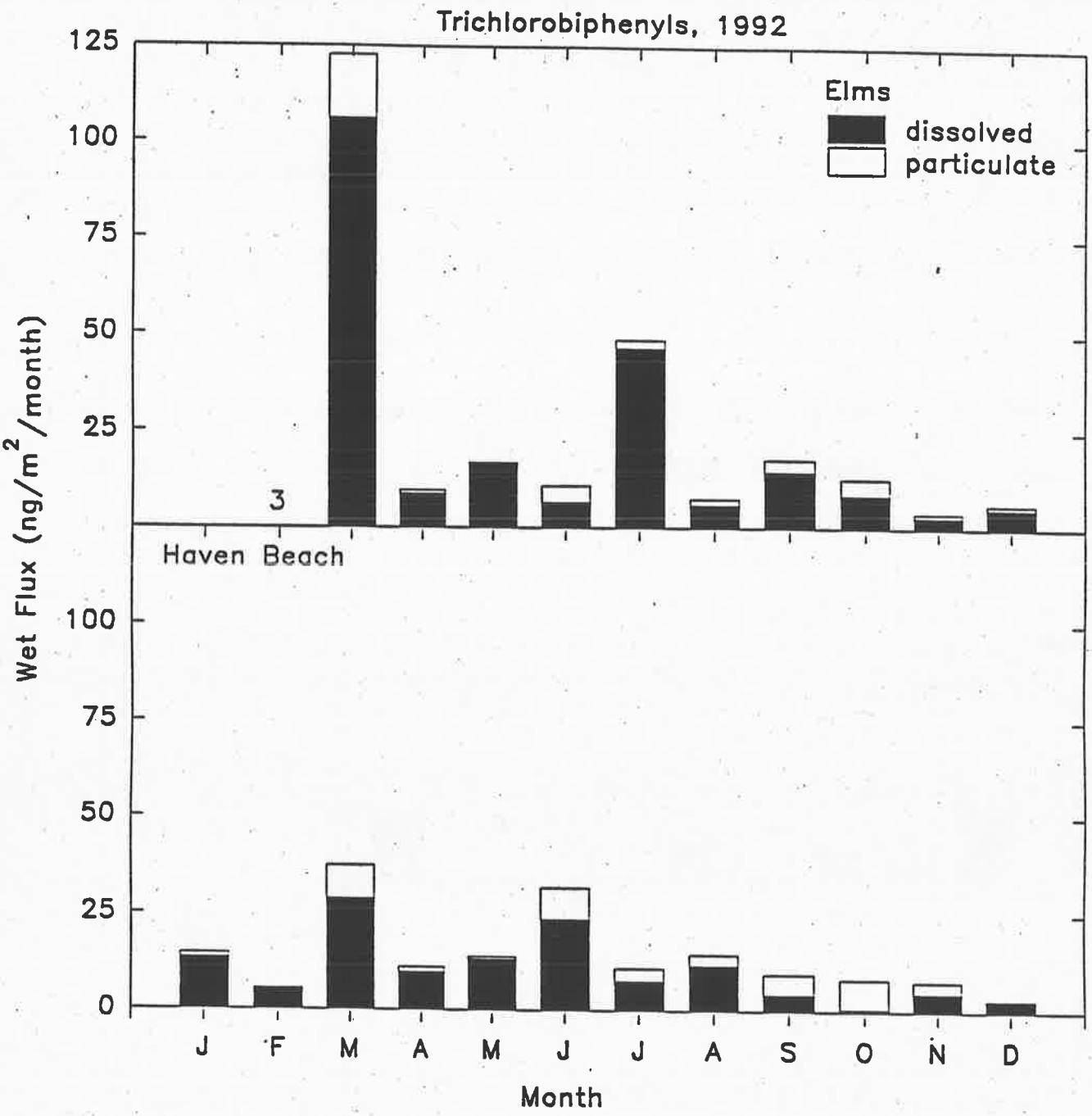
A1.61 Benzo[*g,h,i*]perylene wet depositional fluxes measured at the Wye,Elms, and Haven Beach sites. (1=not quantifiable in dissolved phase, 2=not quantifiable on filter, 3= sampler down, 4 = lost dissolved sample).


Benzo[g,h,i]perylene, 1993
Wye
dissolved
particulate
Elms
Haven Beach
Wet Flux (ng/m²/month)
600
400
200
400
200
400
200
0
4
2
2
2
2
2
2
2
J
F
M
A
M
J
J
A
S
O
N
D
Month

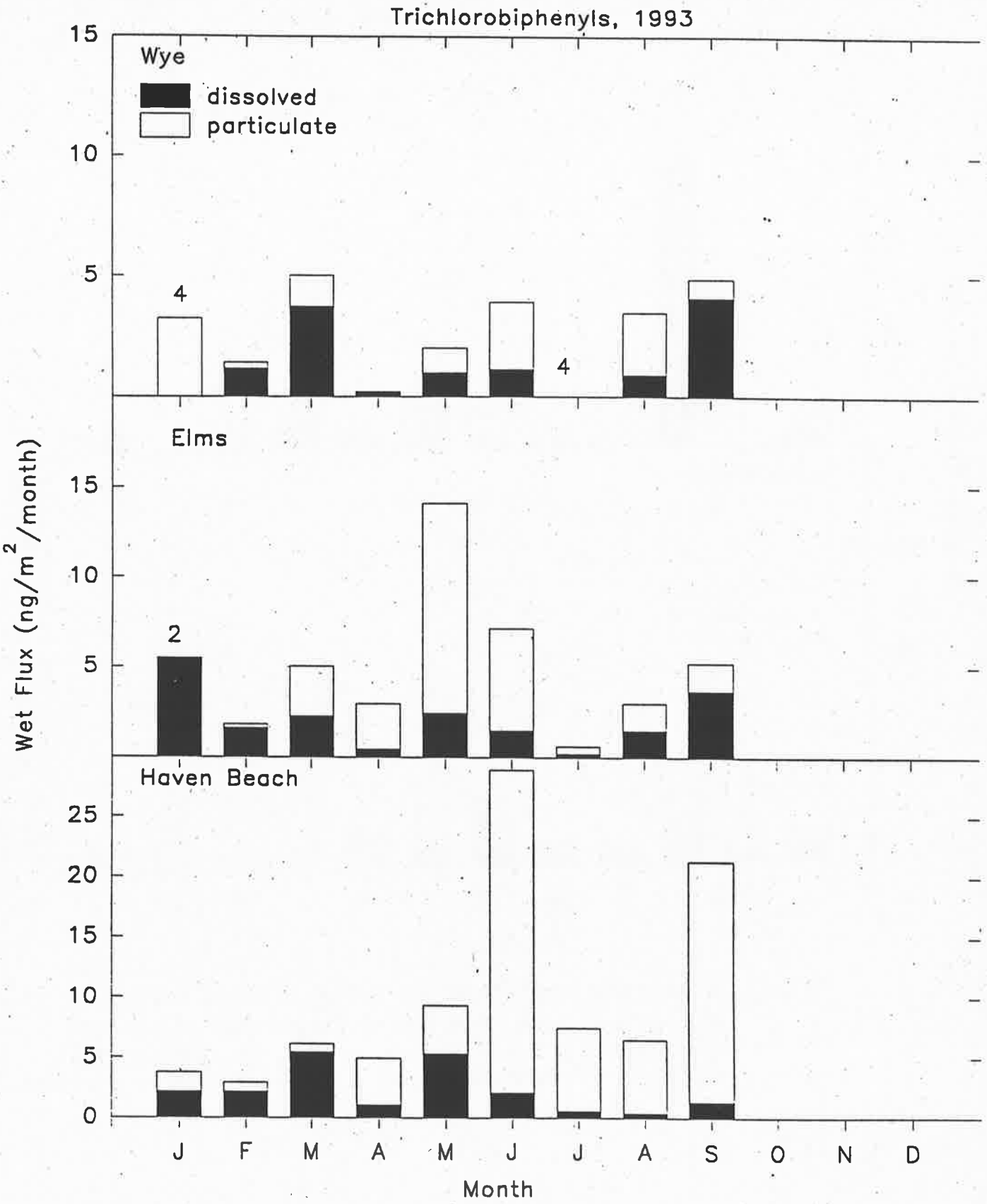


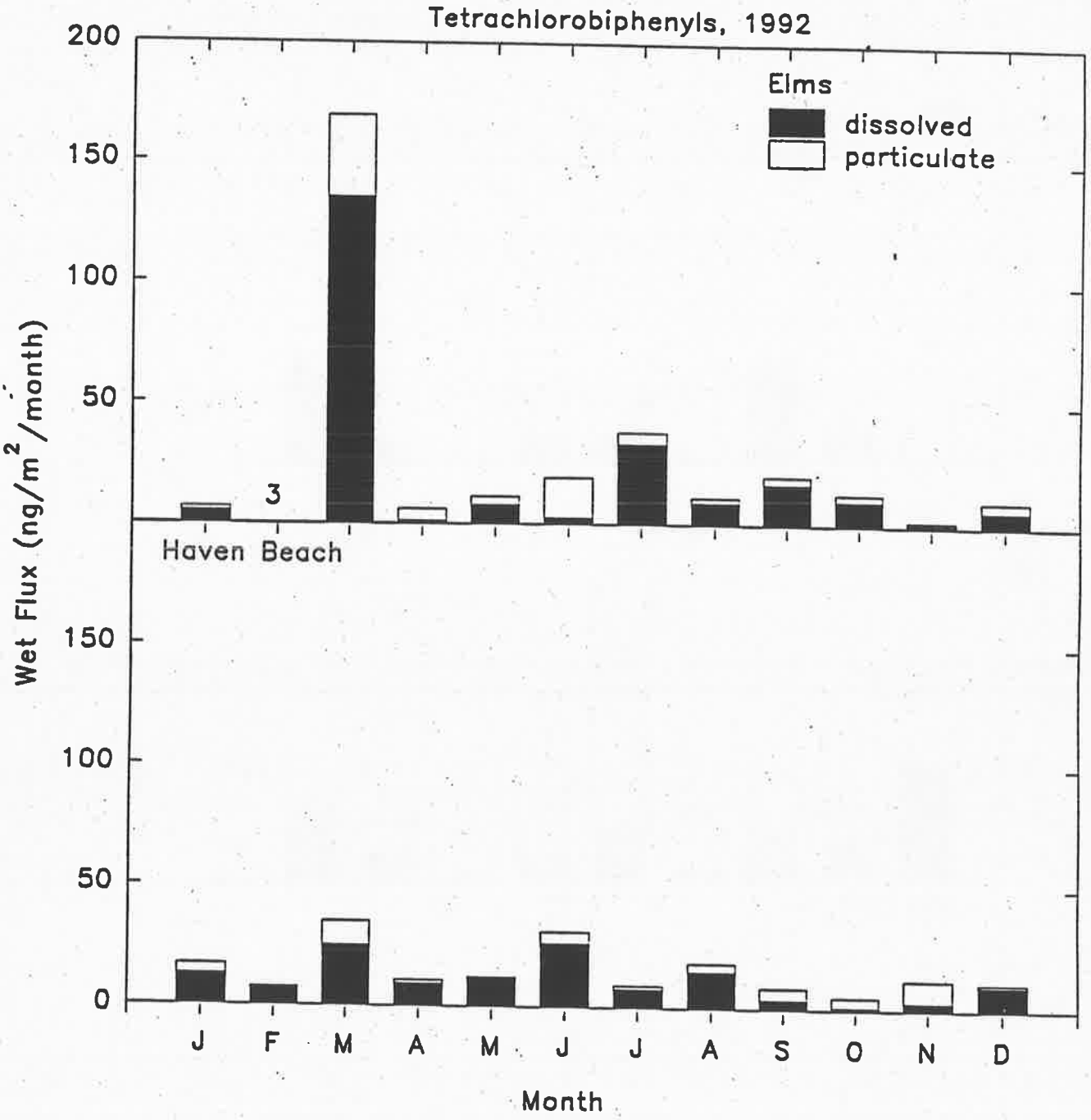
A1.62 Dichlorobiphenyl wet depositional fluxes measured at the Wye, Elms, and Haven Beach sites. (1 = not quantifiable in dissolved phase, 2= not quantifiable on filter, 3= sampler down, 4 = lost dissolved sample).


Dichlorobiphenyls, 1993
Wye
dissolved
particulate
Elms
Haven Beach
Wet Flux (ng/m2/month)
Month
J
F
M
A
M
J
J
A
S
O
N
D

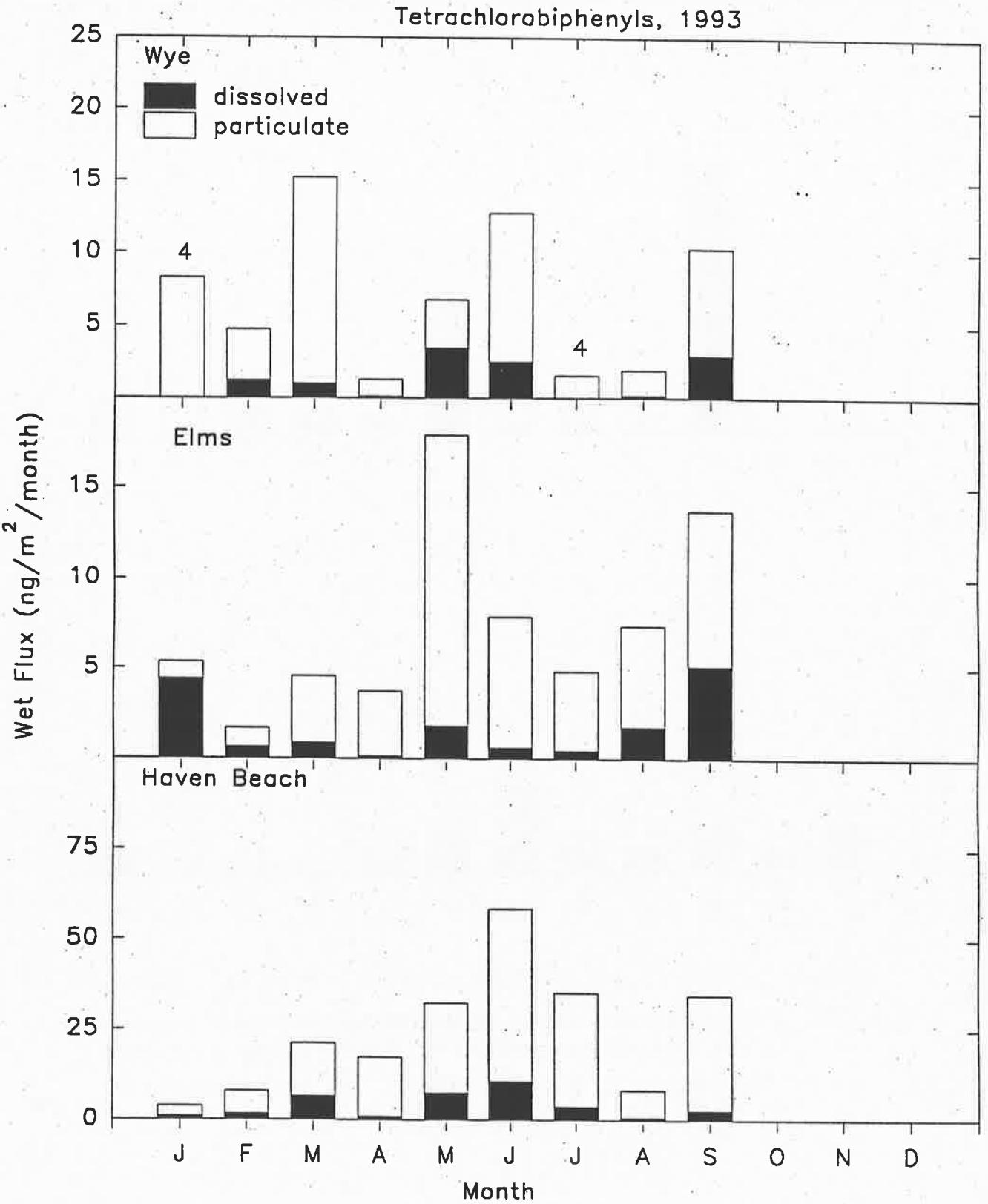


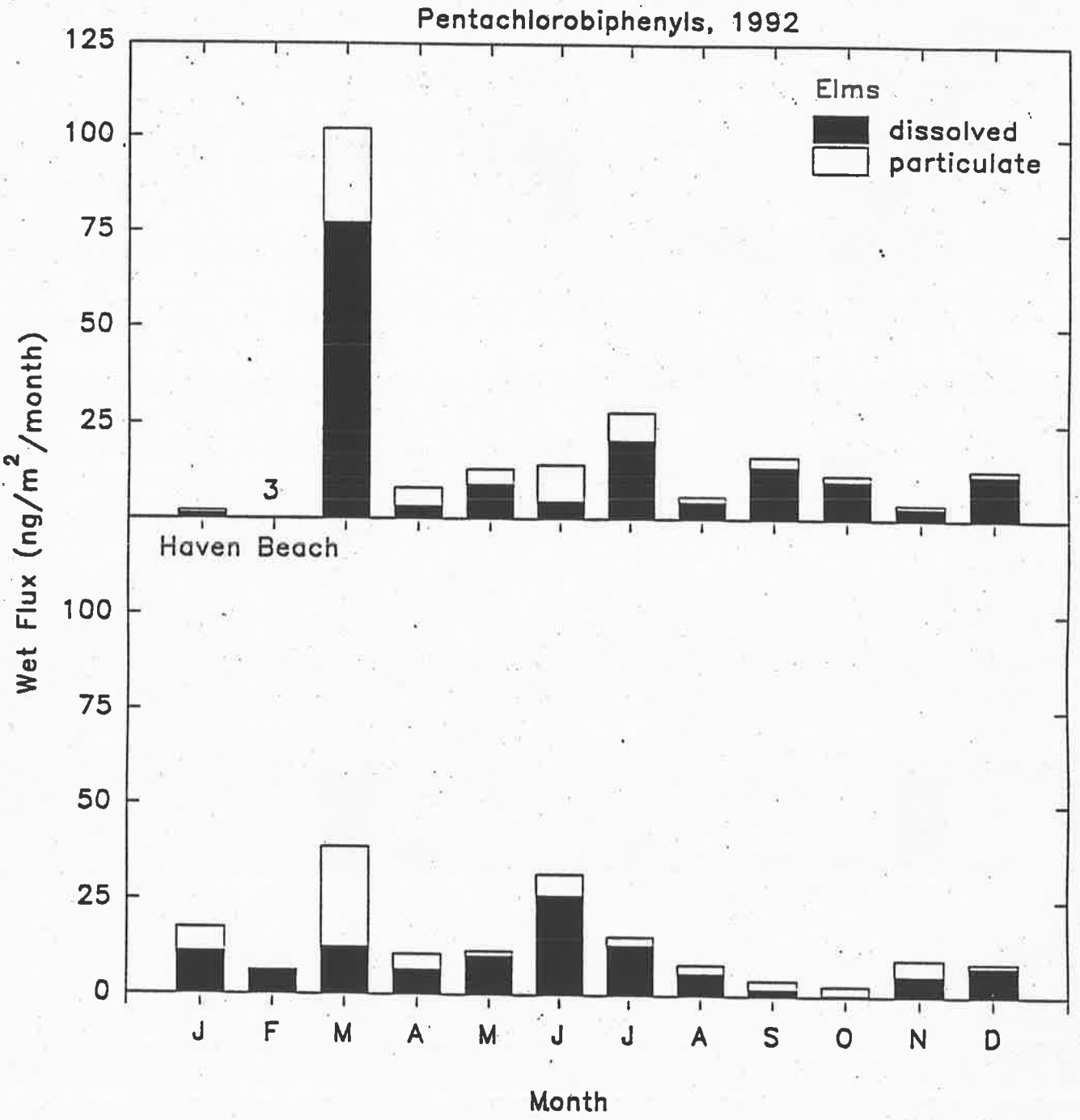
A1.63 Trichlorobiphenyl wet depositional fluxes measured at the Wye, Elms, and Haven Beach sites. (1 = not quantifiable in dissolved phase, 2= not quantifiable on filter, 3= sampler down, 4 = lost dissolved sample).


Trichlorobiphenyls, 1993
Wye
dissolved
particulate
4
4
Elms
2
Haven Beach
Wet Flux (ng/m²/month)
15
10
5
15
10
5
25
20
15
10
5
0
J
F
M
A
M
J
J
A
S
O
N
D
Month

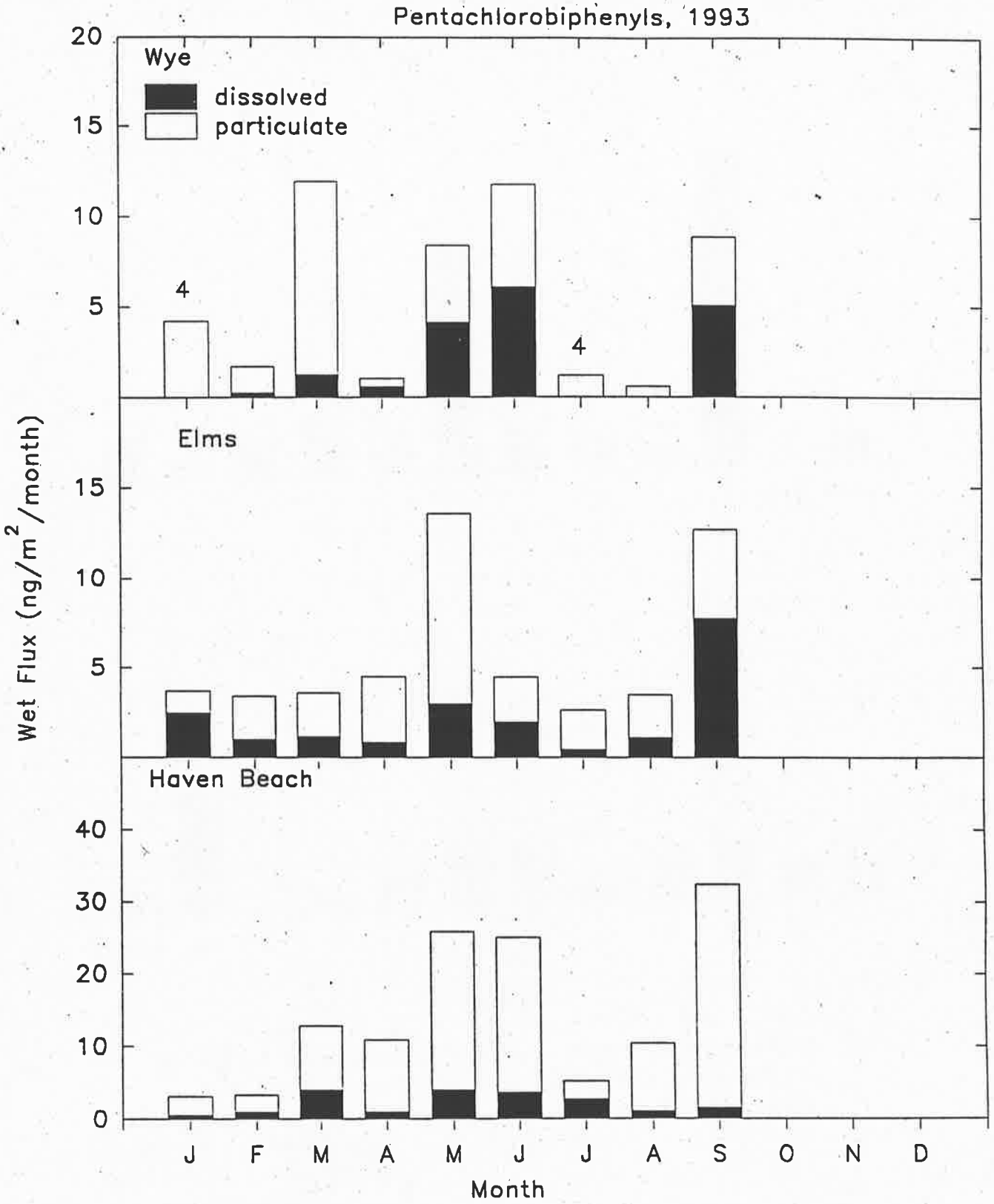


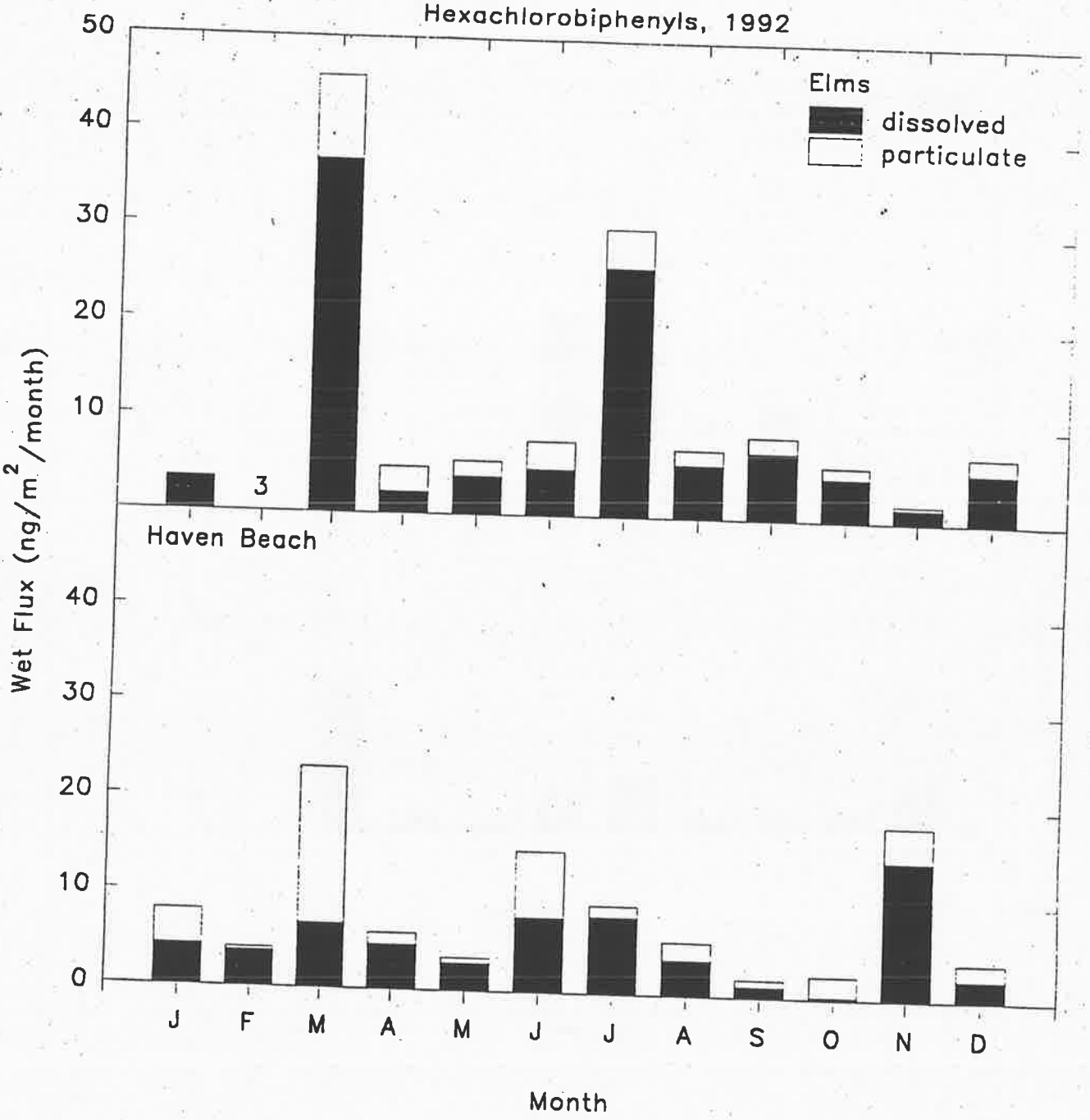
A1.64 Tetrachlorobiphenyl wet depositional fluxes measured at the Wye, Elms, and Haven Beach sites. (1 = not quantifiable in dissolved phase, 2= not quantifiable on filter, 3= sampler down, 4 = lost dissolved sample).


Tetrachlorobiphenyls, 1993
Wye
dissolved
particulate
4
4
Elms
Haven Beach
Wet Flux (ng/m²/month)
25
20
15
10
5
15
10
5
75
50
25
0
J
F
M
A
M
J
J
A
S
O
N
D
Month

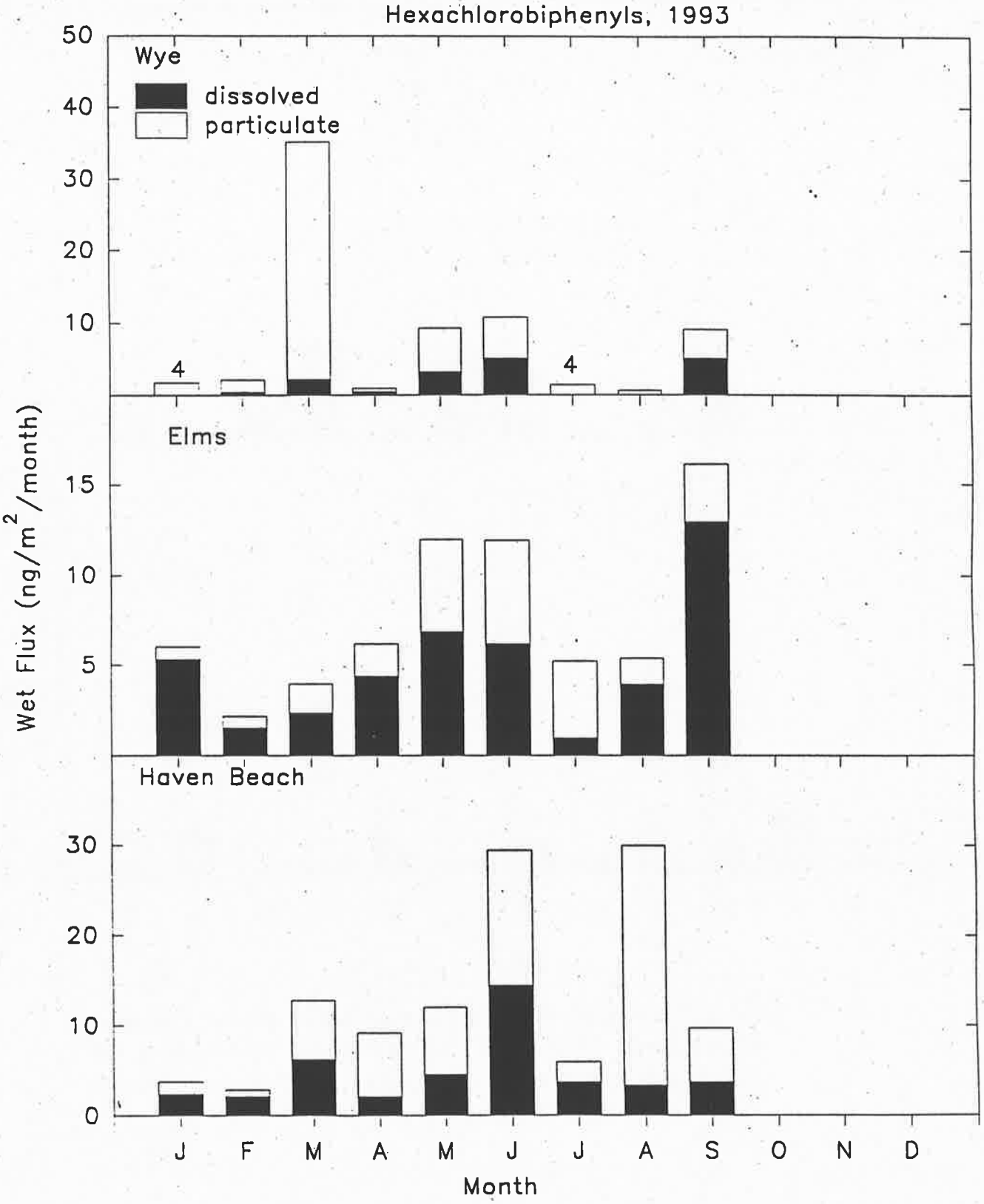


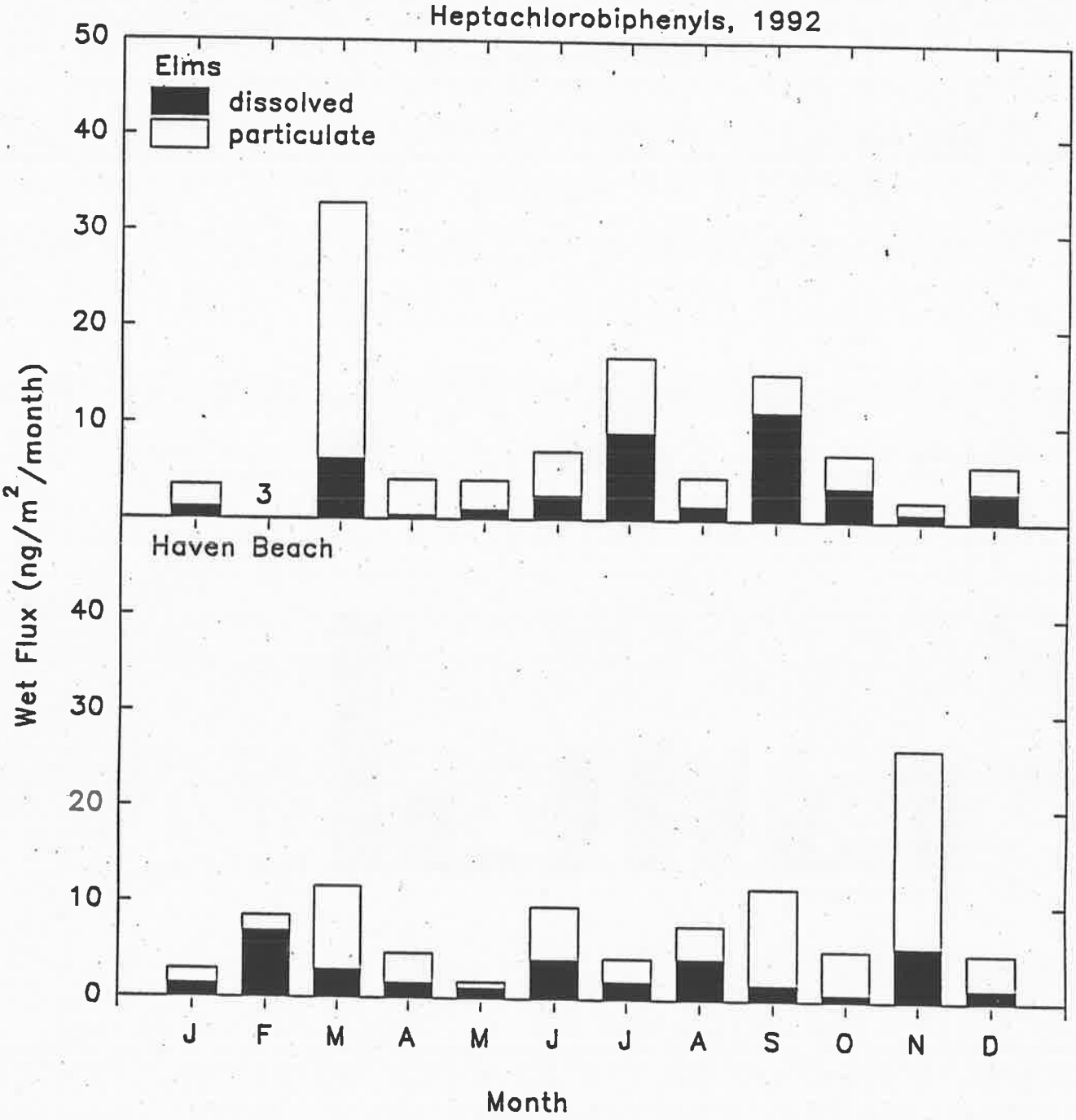
A1.65 Pentachlorobiphenyl wet depositional fluxes measured at the Wye, Elms, and Haven Beach sites. (1 = not quantifiable in dissolved phase, 2= not quantifiable on filter, 3= sampler down, 4 = lost dissolved sample)..


Pentachlorobiphenyls, 1993
Wye
dissolved
particulate
4
4
Elms
Haven Beach
Wet Flux (ng/m^2/month)
20
15
10
5
15
10
5
40
30
20
10
0
J
F
M
A
M
J
J
A
S
O
N
D
Month

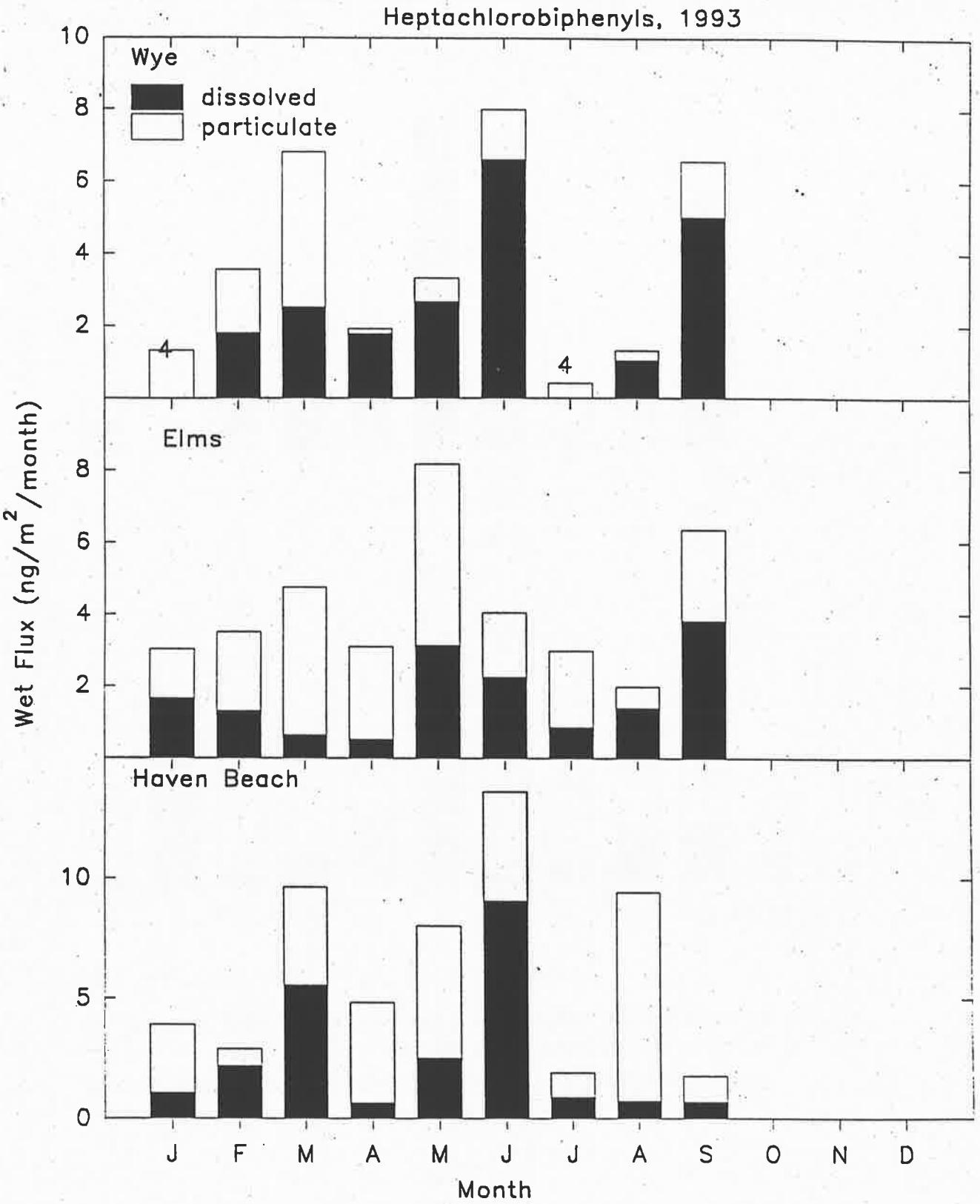


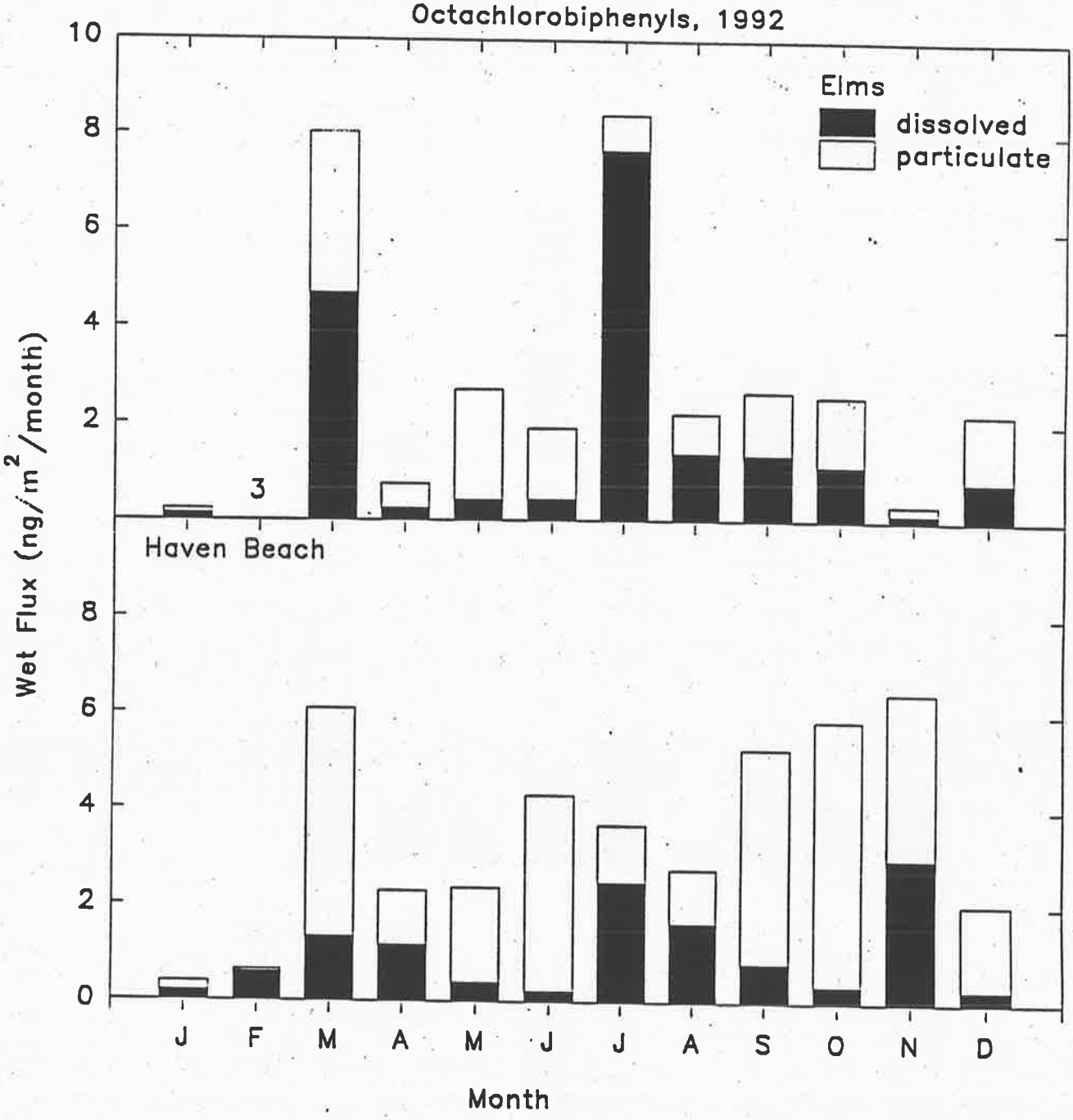
A1.66 Hexachlorobiphenyl wet depositional fluxes measured at the Elms and Haven Beach sites. (1=not quantifiable in dissolved phase, 2= not quantifiable on filter, 3= sampler down, 4 = lost dissolved sample).


Hexachlorobiphenyls, 1993
Wye
dissolved
particulate
4
4
Elms
Haven Beach
Wet Flux (ng/m^2/month)
50
40
30
20
10
15
10
5
30
20
10
0
J
F
M
A
M
J
J
A
S
O
N
D
Month

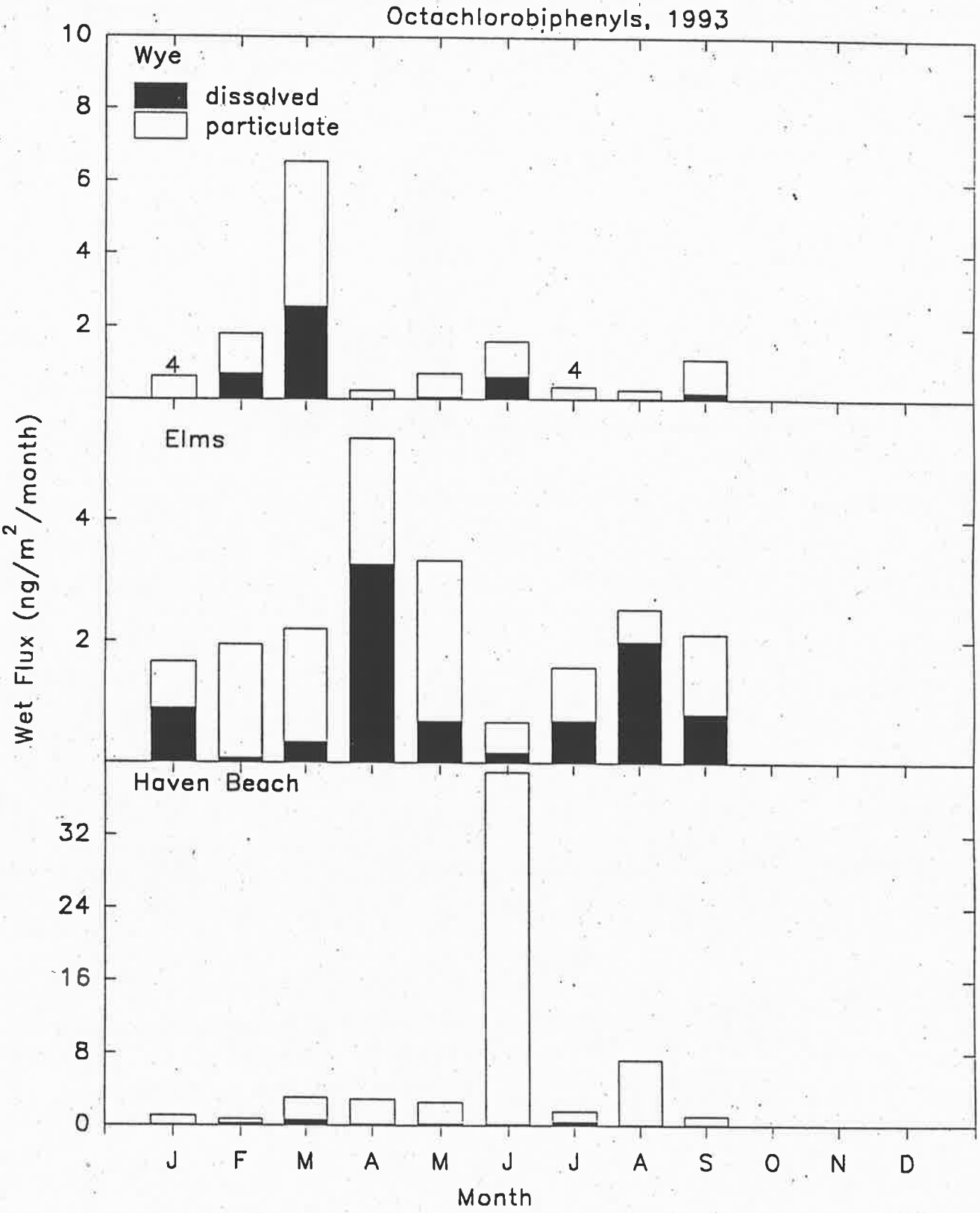


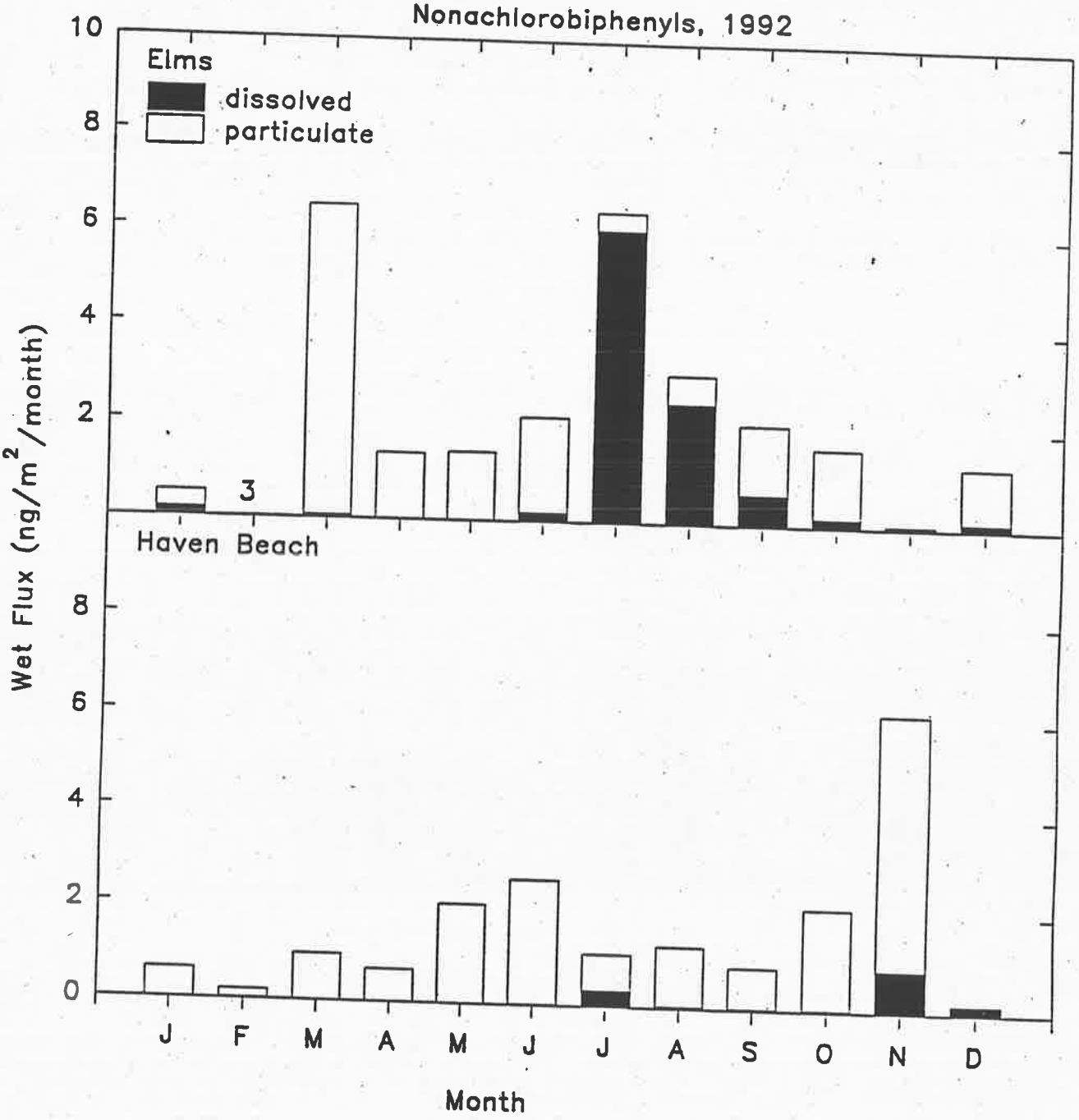
A1.67 Heptachlorobiphenyl wet depositional fluxes measured at the Wye, Elms, and Haven Beach sites. (1 = not quantifiable in dissolved phase, 2= not quantifiable on filter, 3= sampler down, 4 = lost dissolved sample).


Heptachlorobiphenyls, 1993
Wye
dissolved
particulate
4
4
Elms
Haven Beach
Wet Flux (ng/m2/month)
0
2
4
5
6
8
10
J
F
M
A
M
J
J
A
S
O
N
D
Month

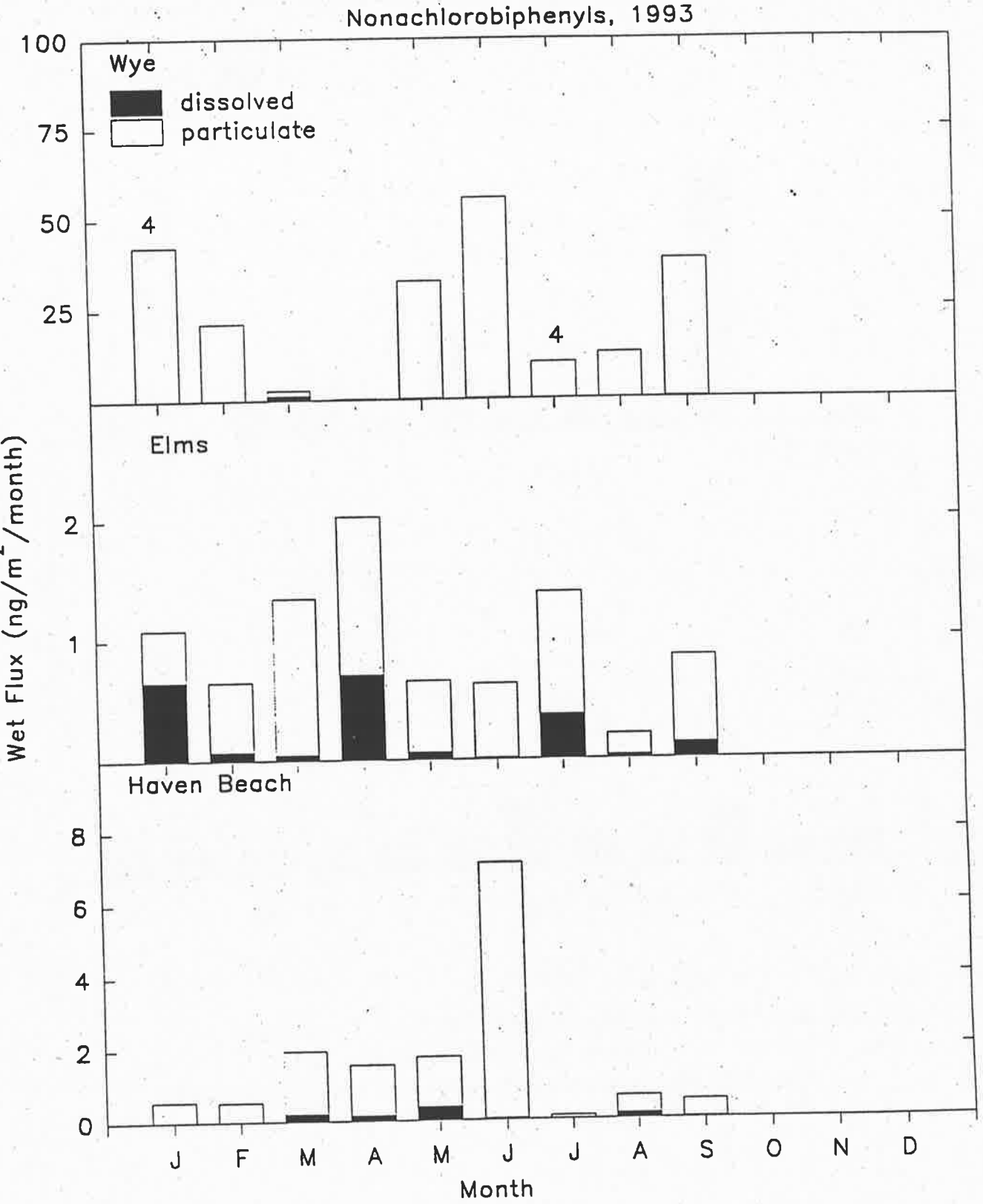


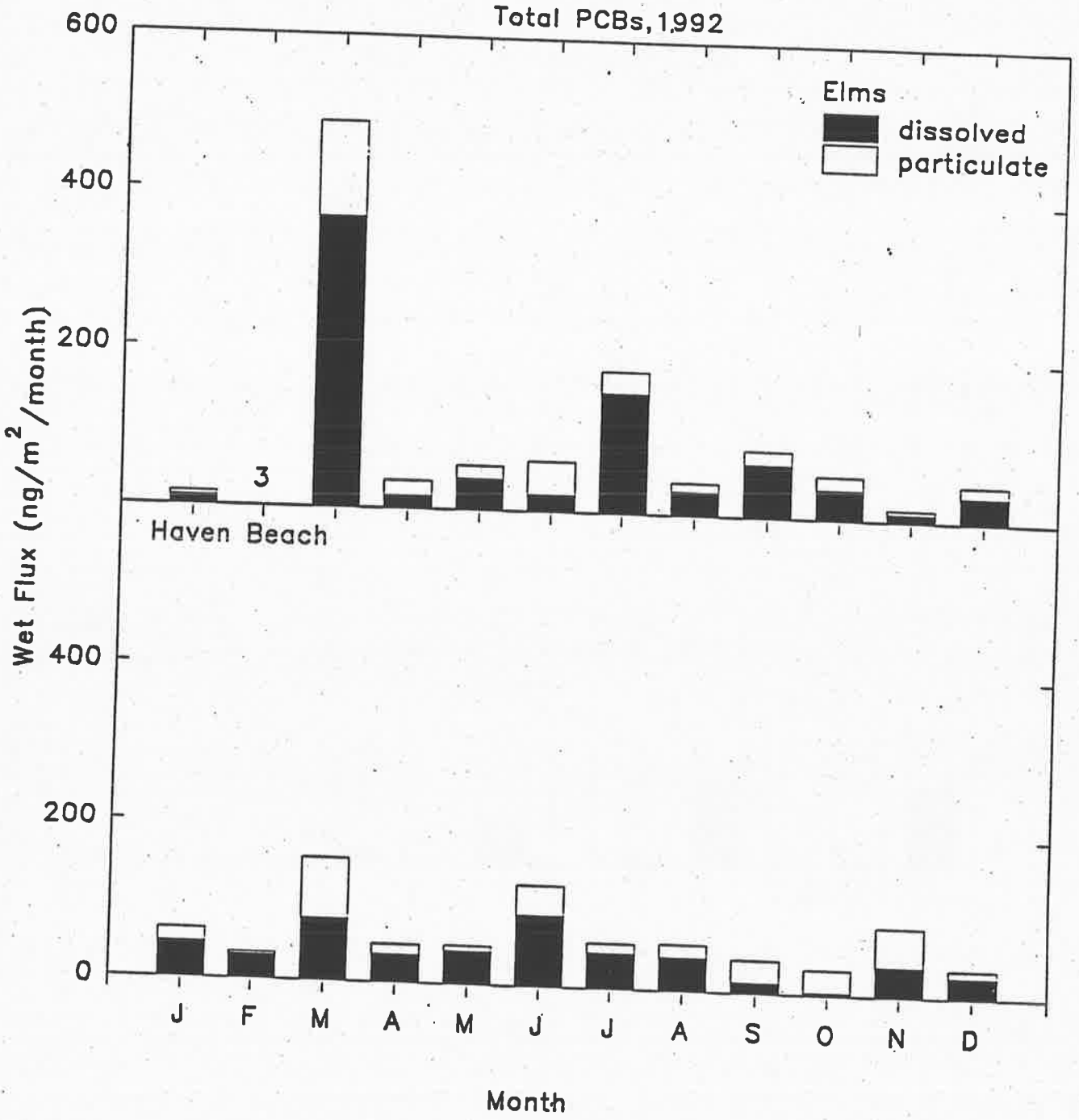
A1.68 Octachlorobiphenyl wet depositional fluxes measured at the Wye, Elms, and Haven Beach sites. (1 = not quantifiable in dissolved phase, 2= not quantifiable on filter, 3= sampler down, 4 = lost dissolved sample).


Octachlorobiphenyls, 1993
Wye
dissolved
particulate
Elms
Haven Beach
Wet Flux (ng/m^2/month)
Month
J F M A M J J A S O N D
4
4

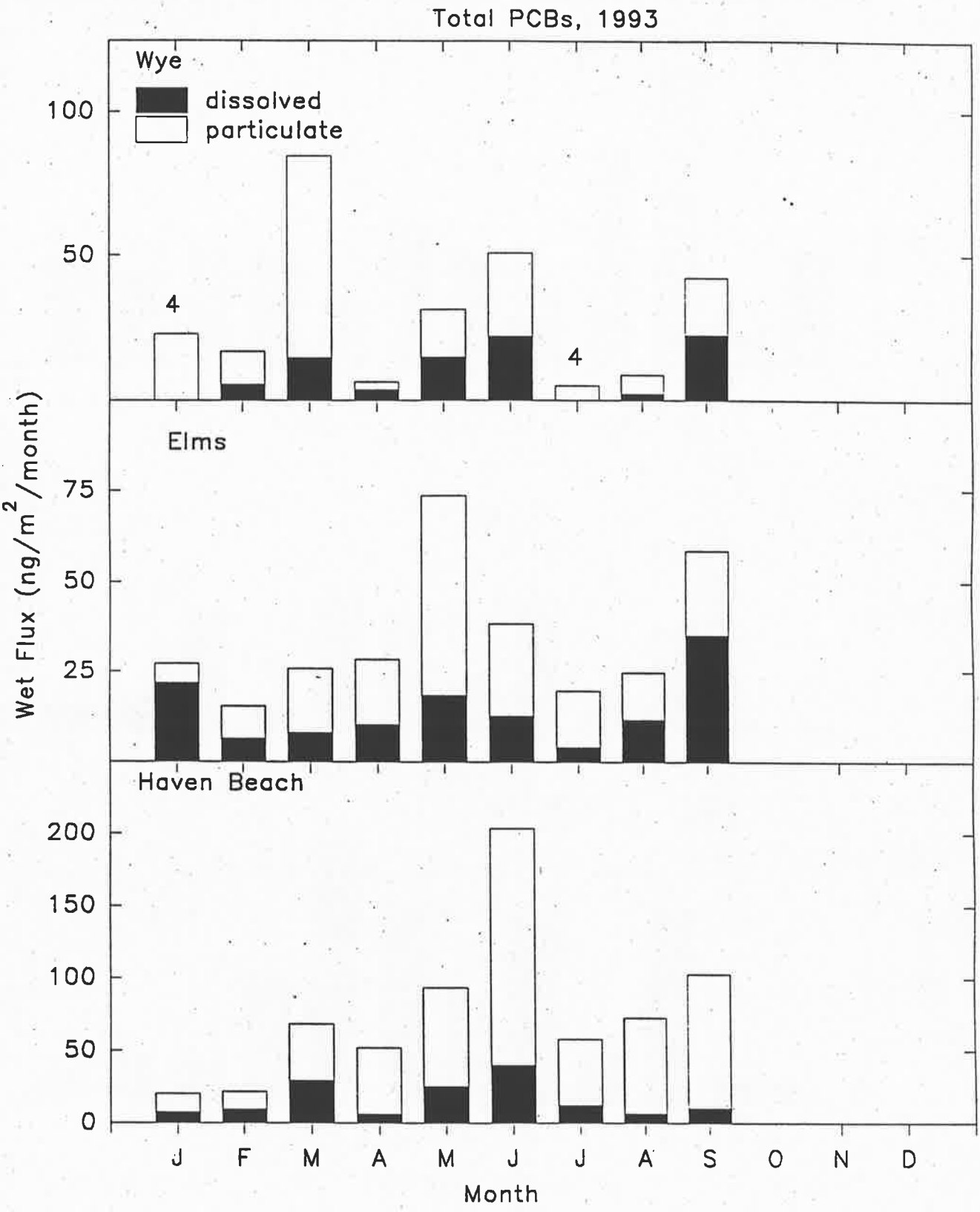


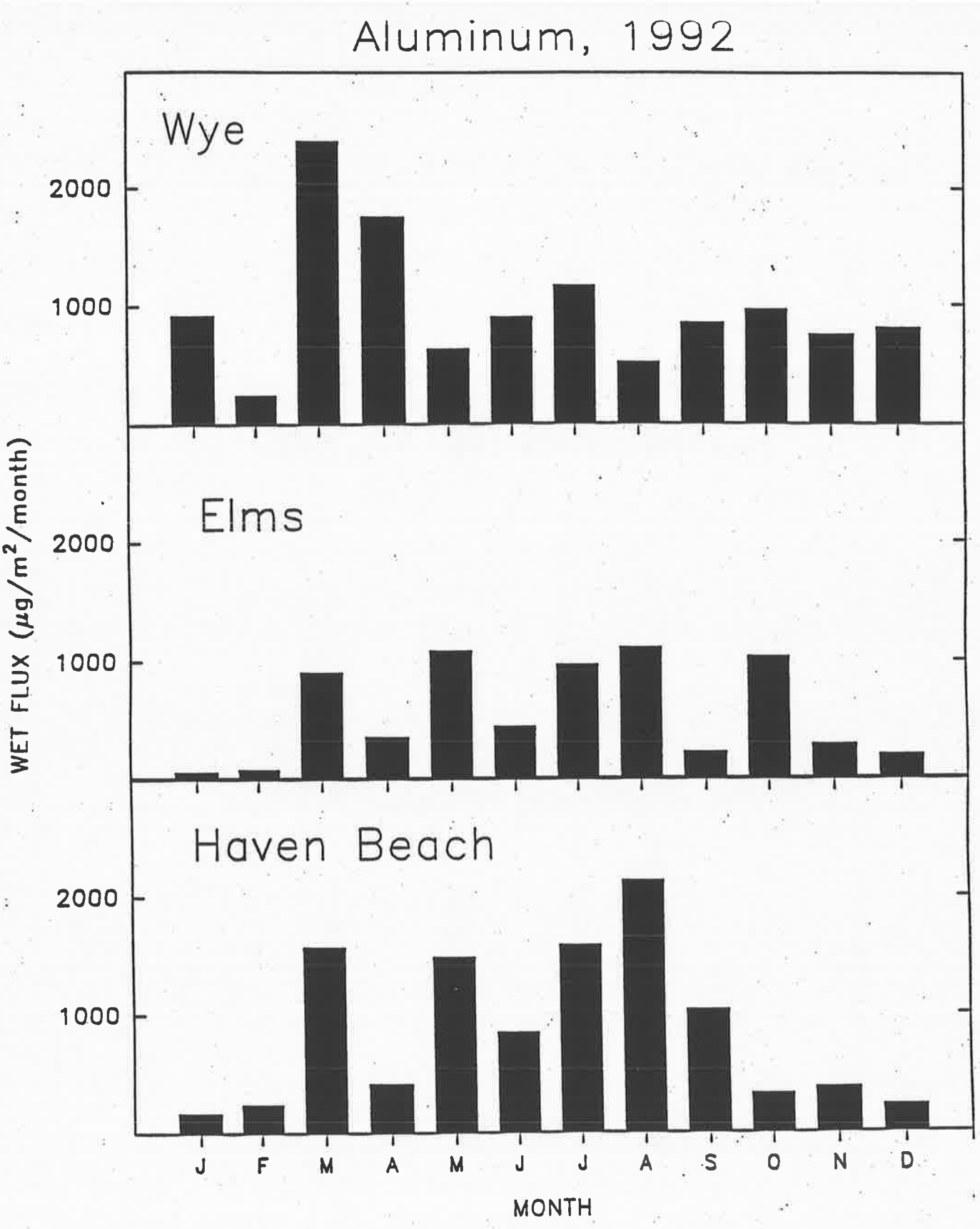
A1.69 Nonachlorobiphenyl wet depositional fluxes measured at the Wye, Elms, and Haven Beach sites. (1 = not quantifiable in dissolved phase, 2= not quantifiable on filter, 3= sampler down, 4 = lost dissloved sample).


Nonachlorobiphenyls, 1993
Wye
dissolved
particulate
100
75
50
25
4
4
Elms
2
1
Haven Beach
8
6
4
2
0
Wet Flux (ng/m2/month)
J
F
M
A
M
J
J
A
S
O
N
D
Month

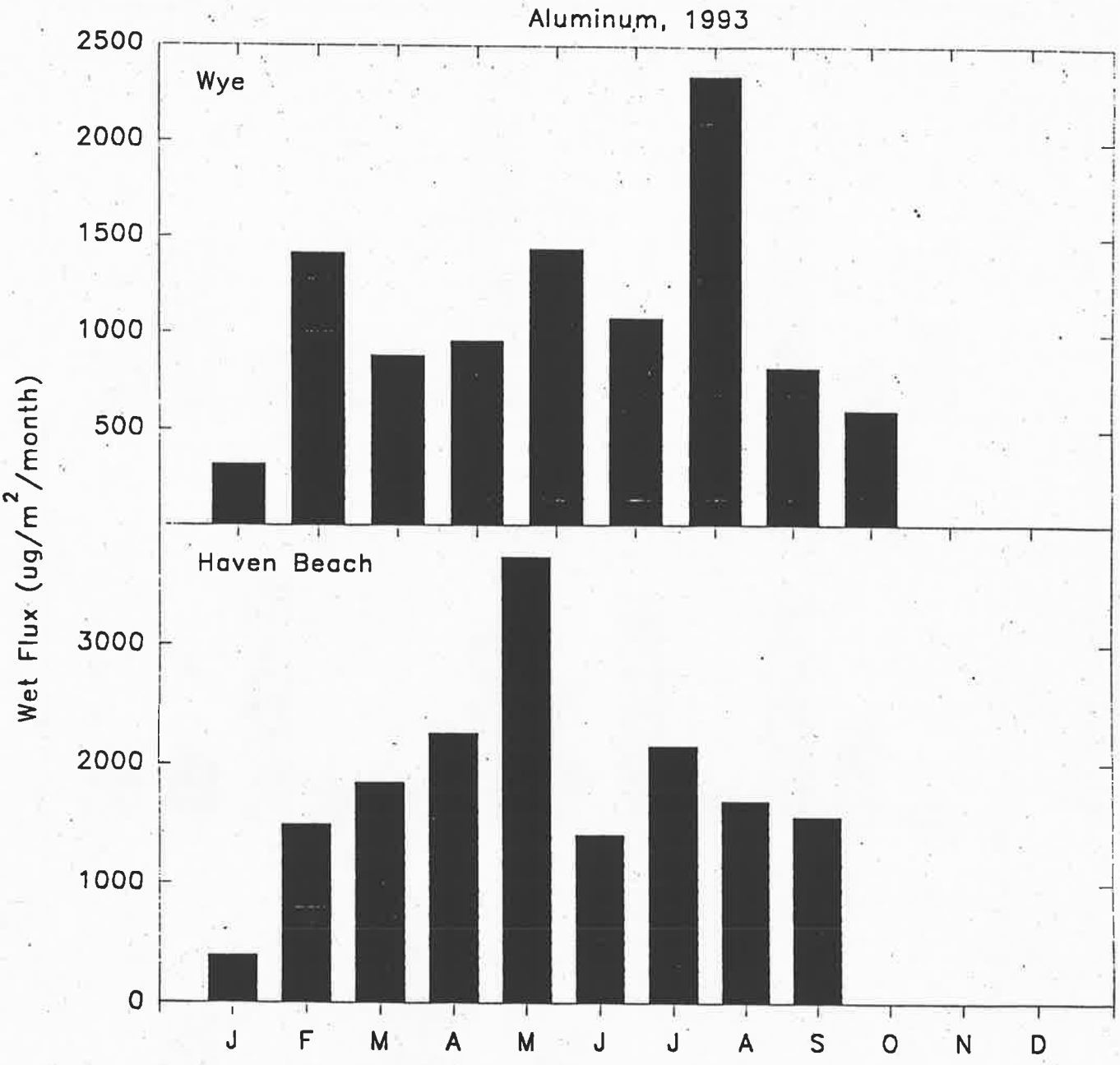


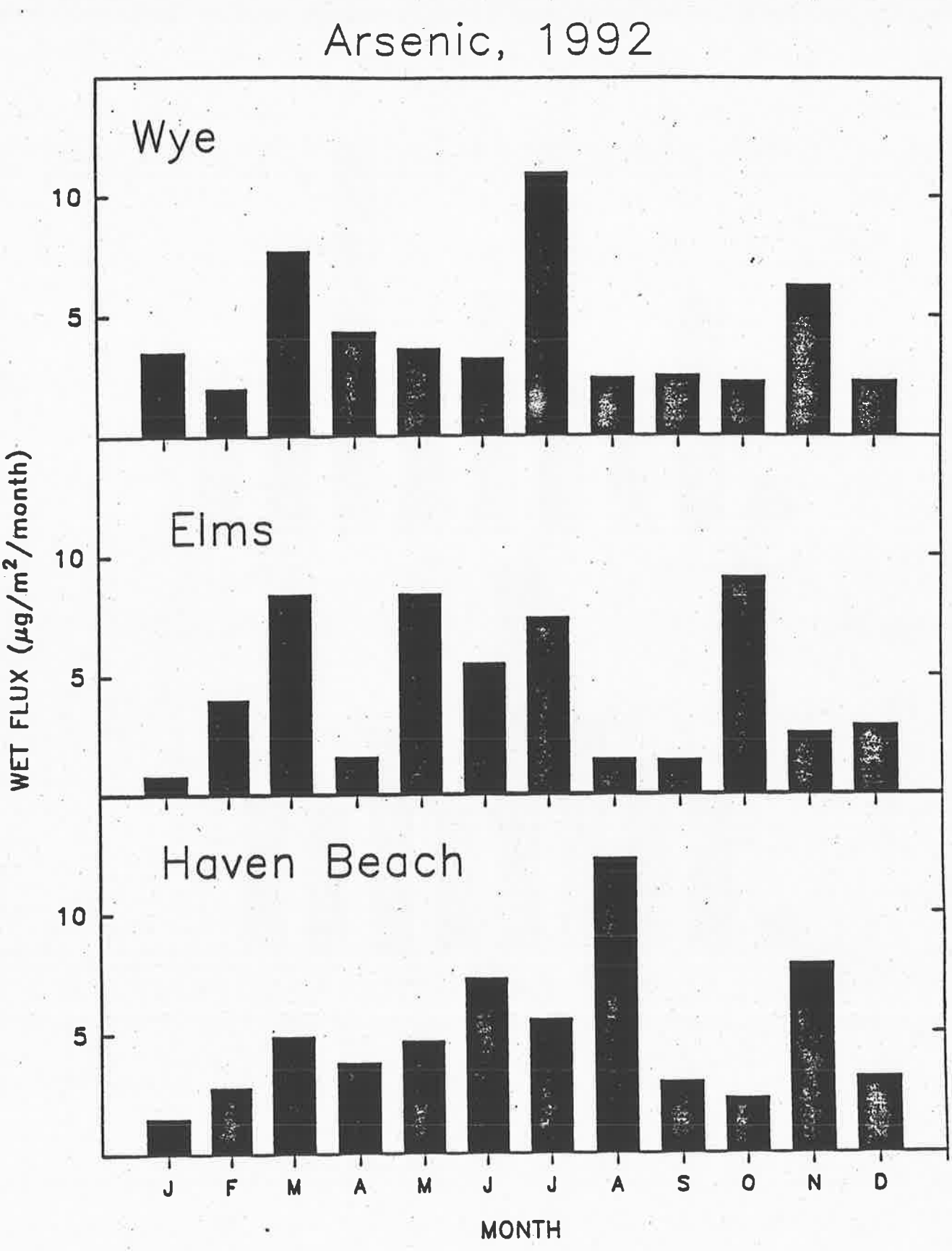
A1.70 Total PCB wet depositional fluxes measured at the Wye, Elms, and Haven Beach sites. (1 = not quantifiable in dissolved phase, 2= not quantifiable on filter, 3= sampler down, 4 = lost dissolved sample).


Total PCBs, 1993
Wye
dissolved
particulate
100
50
4
4
Elms
75
50
25
Haven Beach
200
150
100
50
0
Wet Flux (ng/m^2/month)
J
F
M
A
M
J
J
A
S
O
N
D
Month

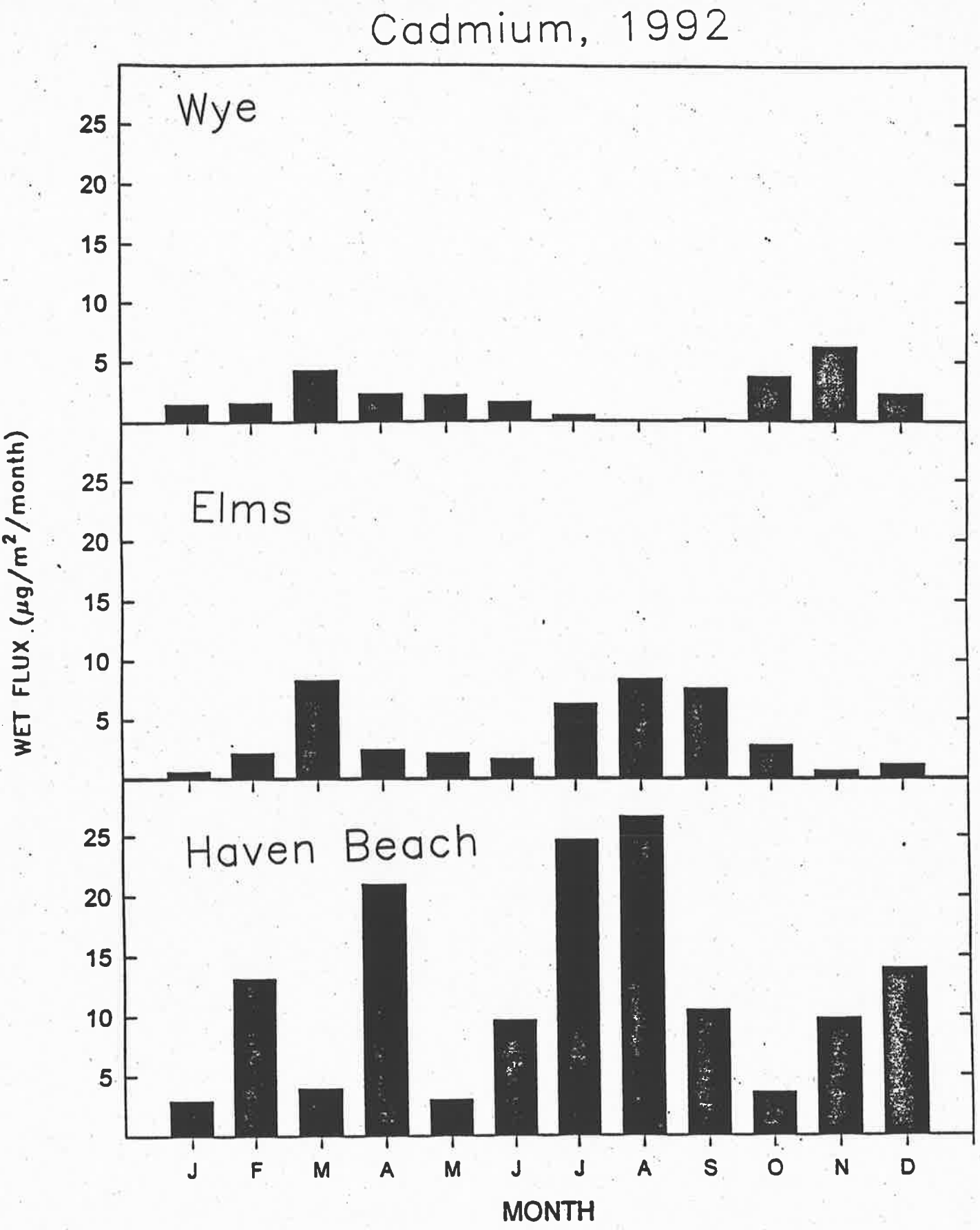


A 1.71 Monthly integrated wet deposition of Aluminum at each CBAD site.

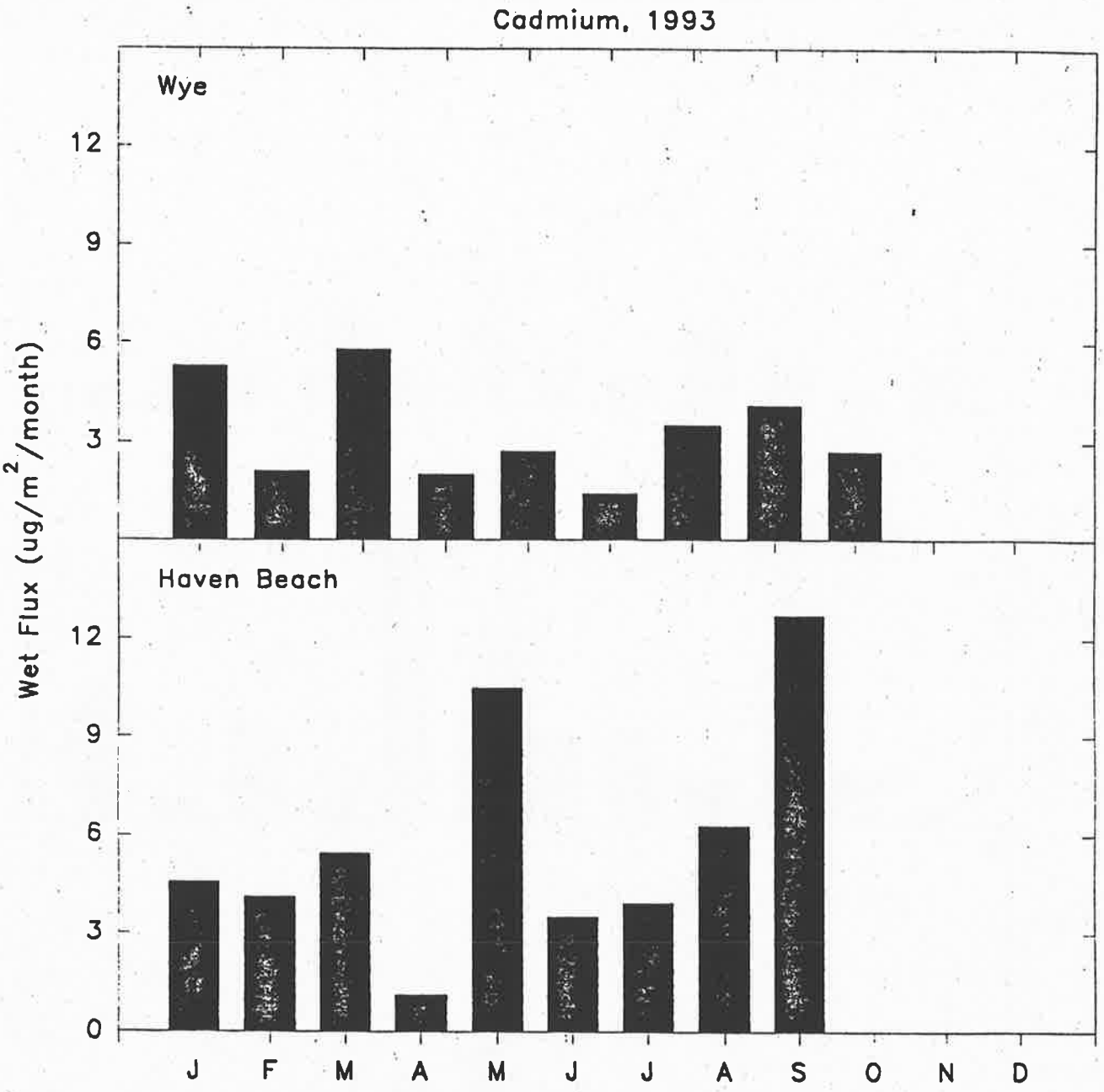

Aluminum, 1993
Wye
Haven Beach
Wet Flux (ug/m2/month)
2500
2000
1500
1000
500
3000
2000
1000
0
J
F
M
A
M
J
J
A
S
O
N
D

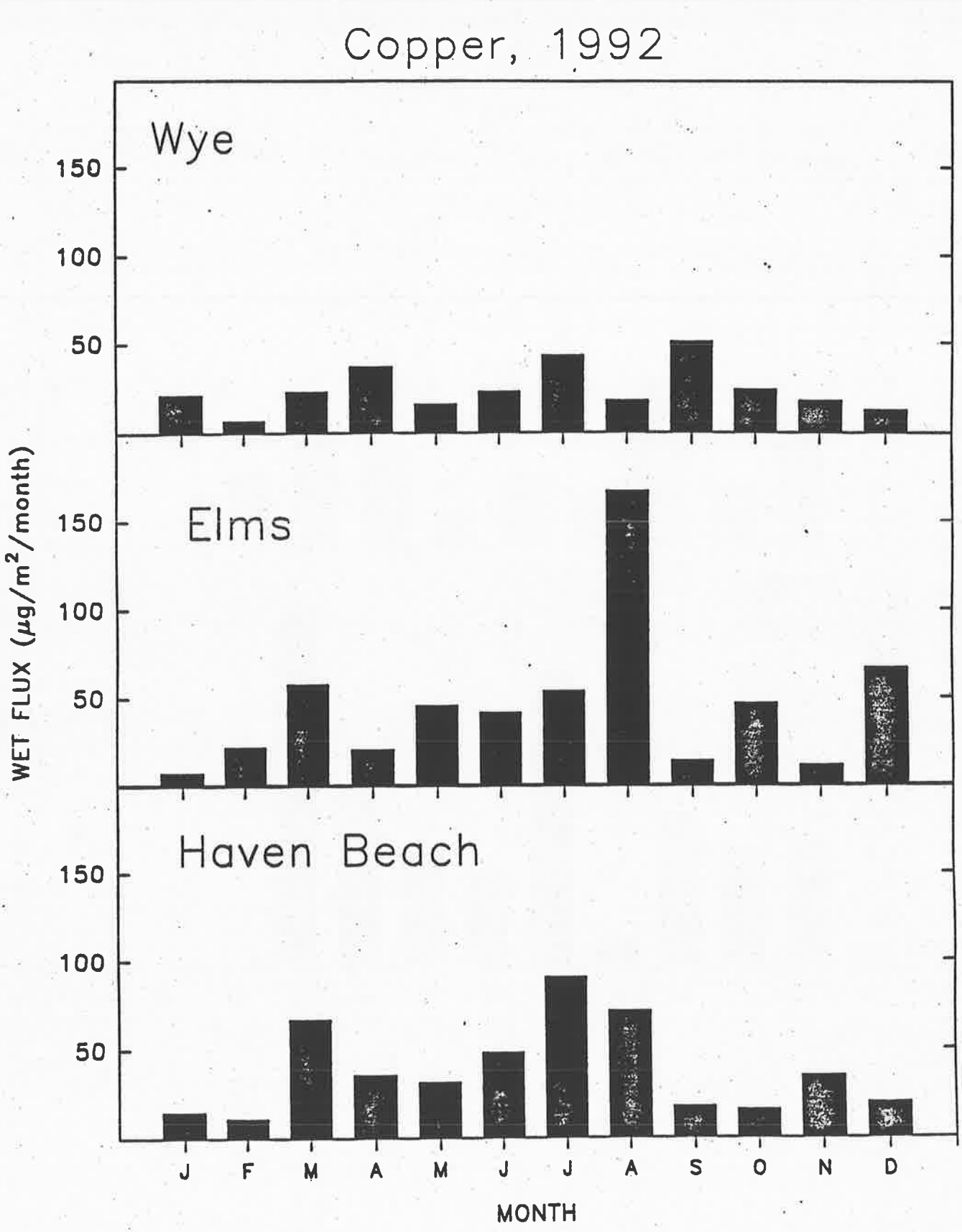


A1.72 Monthly integrated wet deposition of Arsenic at each CBAD site.

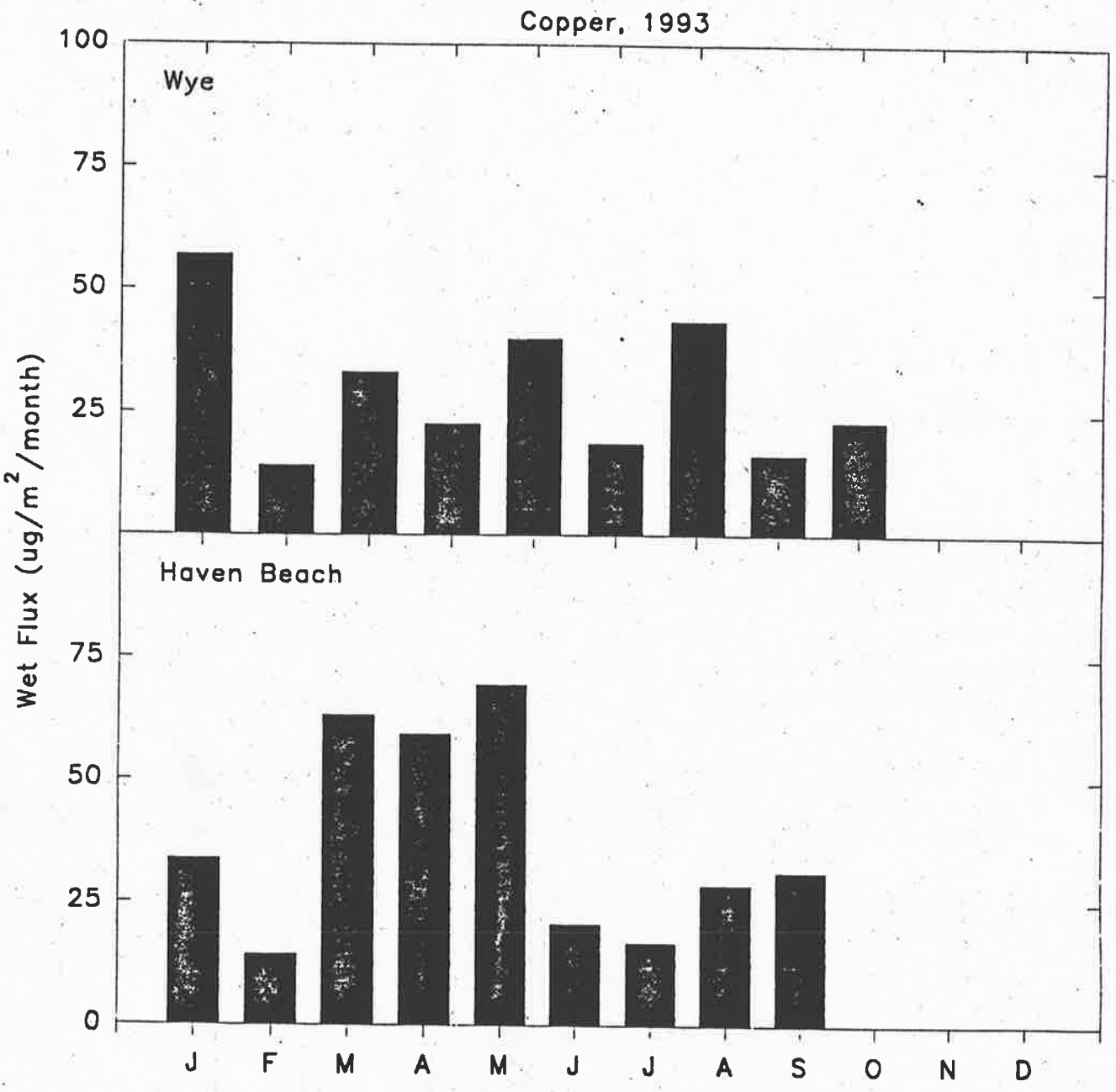


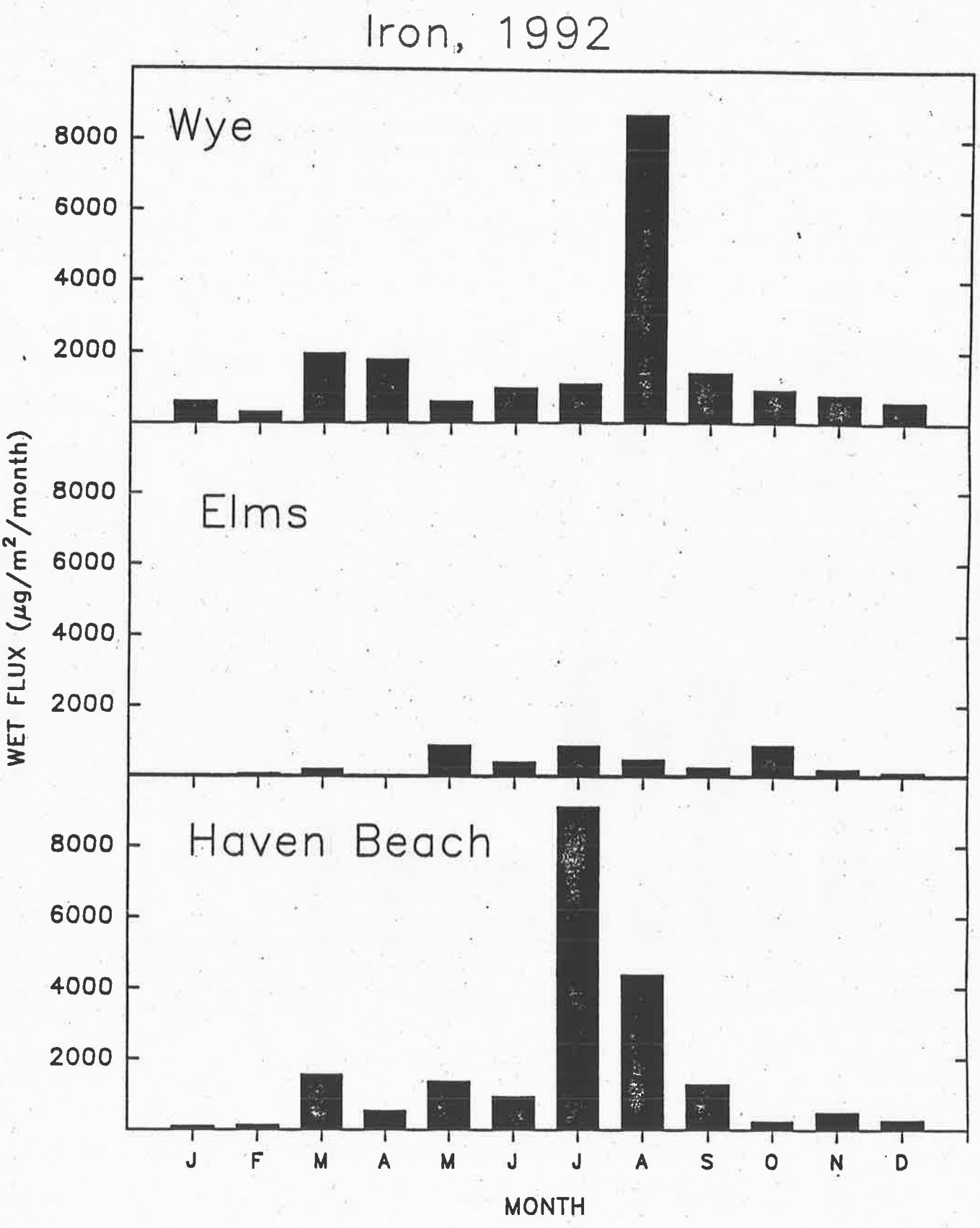
A1.73 Monthly integrated wet deposition of Copper at each CBAD site.


Cadmium, 1993
Wye
Haven Beach
Wet Flux (ug/m2/month)
0
3
6
9
12
J
F
M
A
M
J
J
A
S
O
N
D

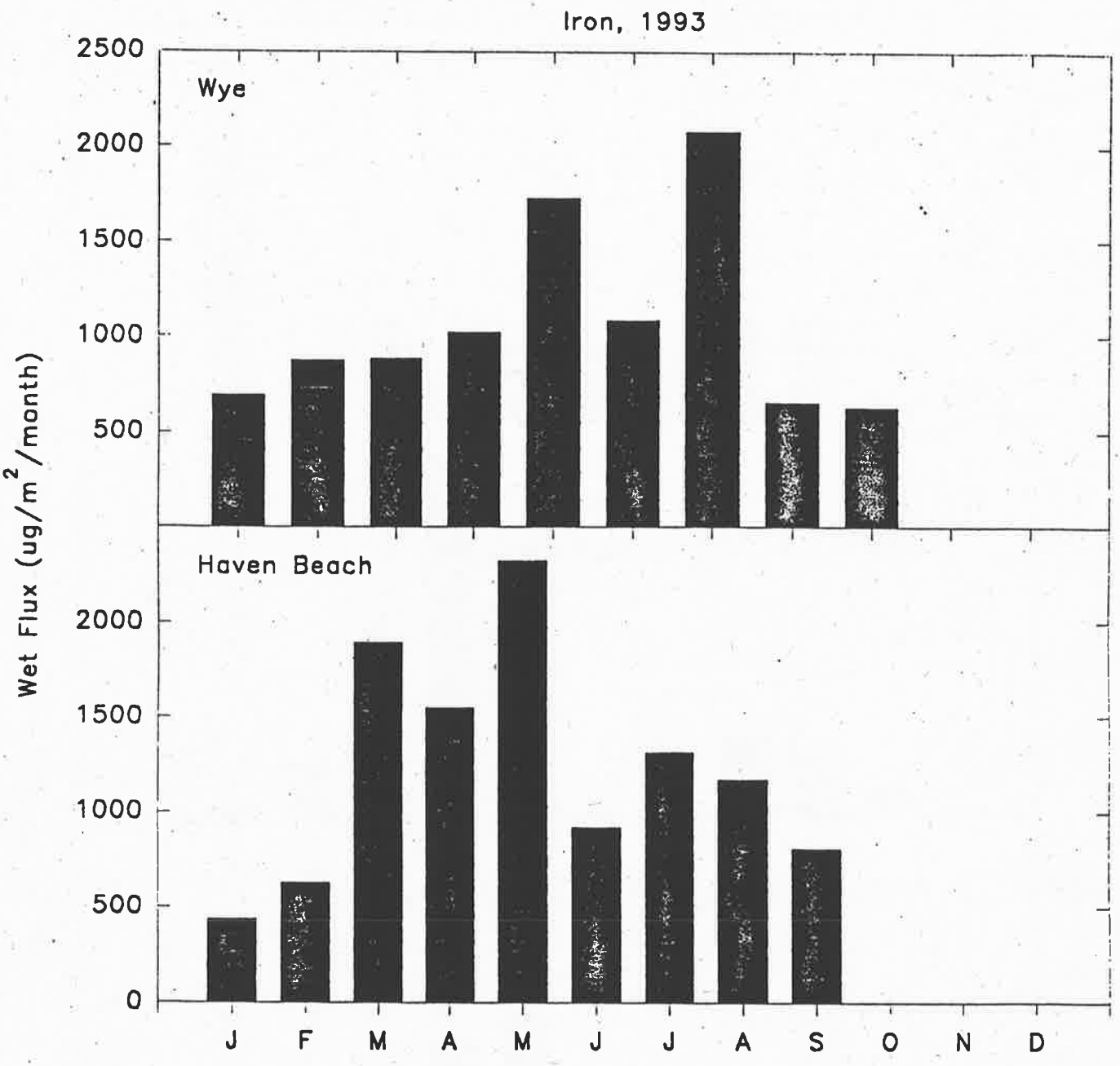


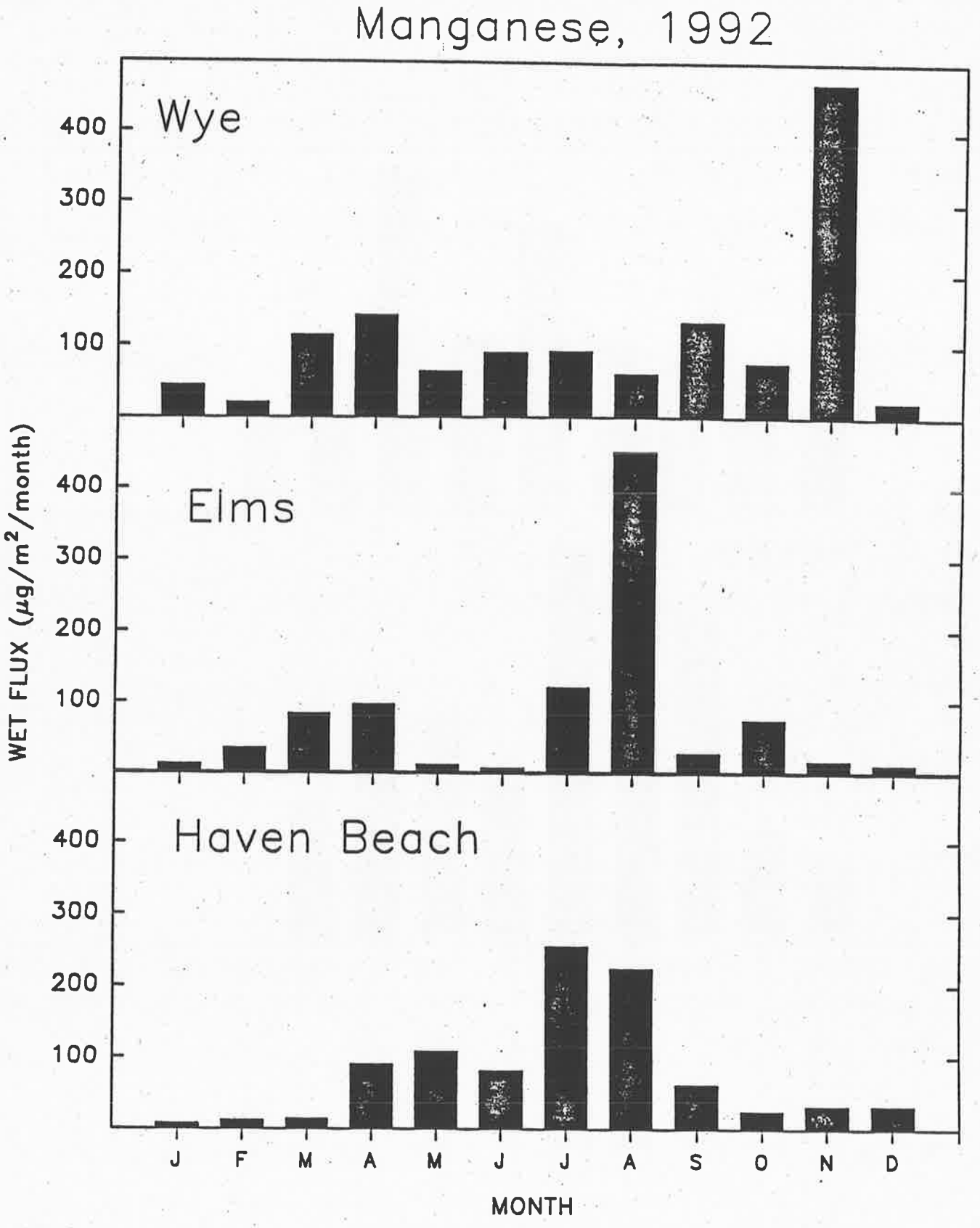
A1.74 Monthly integrated wet deposition of Copper at each CBAD site.


Copper, 1993
Wye
Haven Beach
Wet Flux (ug/m2/month)
100
75
50
25
75
50
25
0
J
F
M
A
M
J
J
A
S
O
N
D

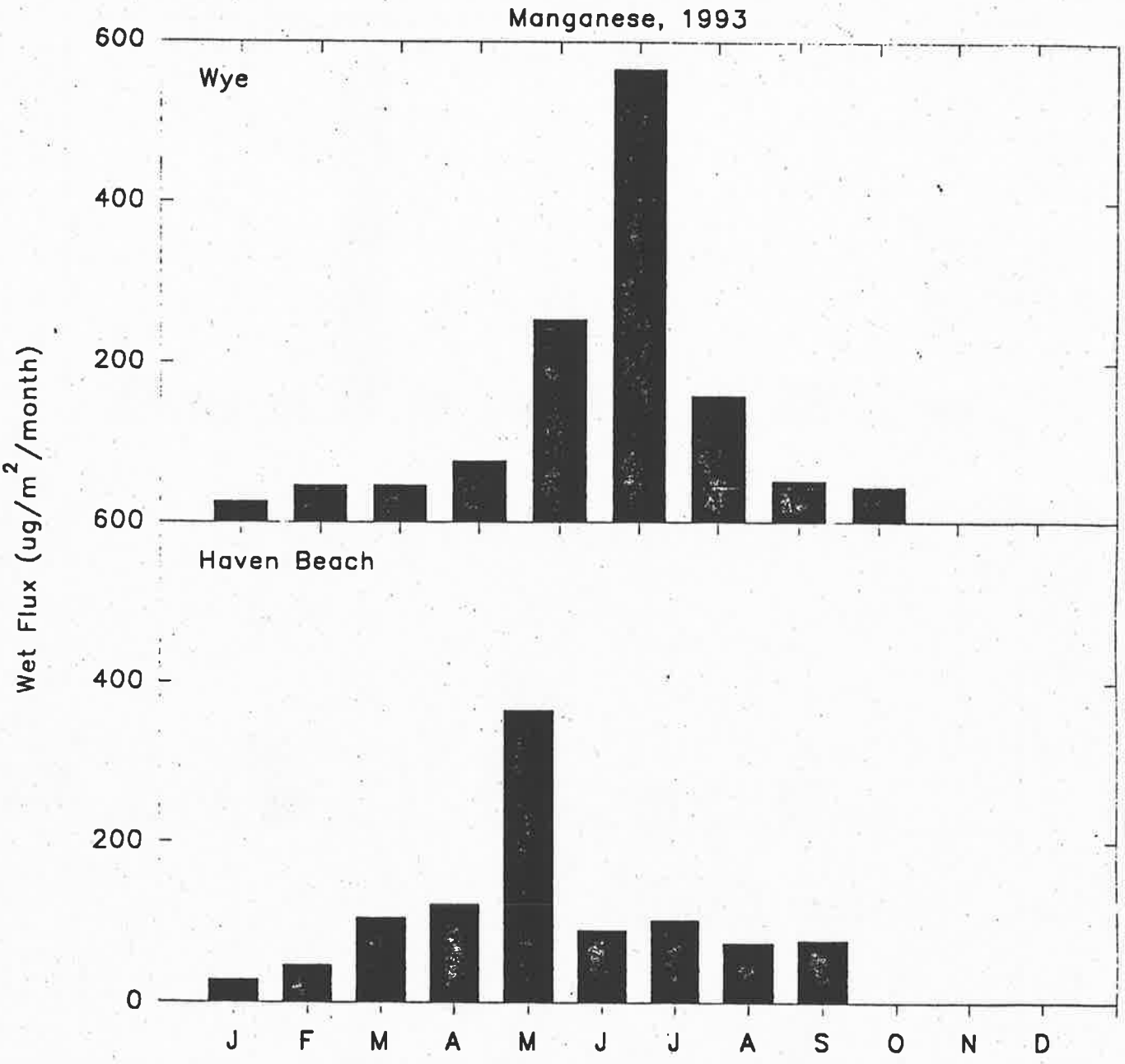


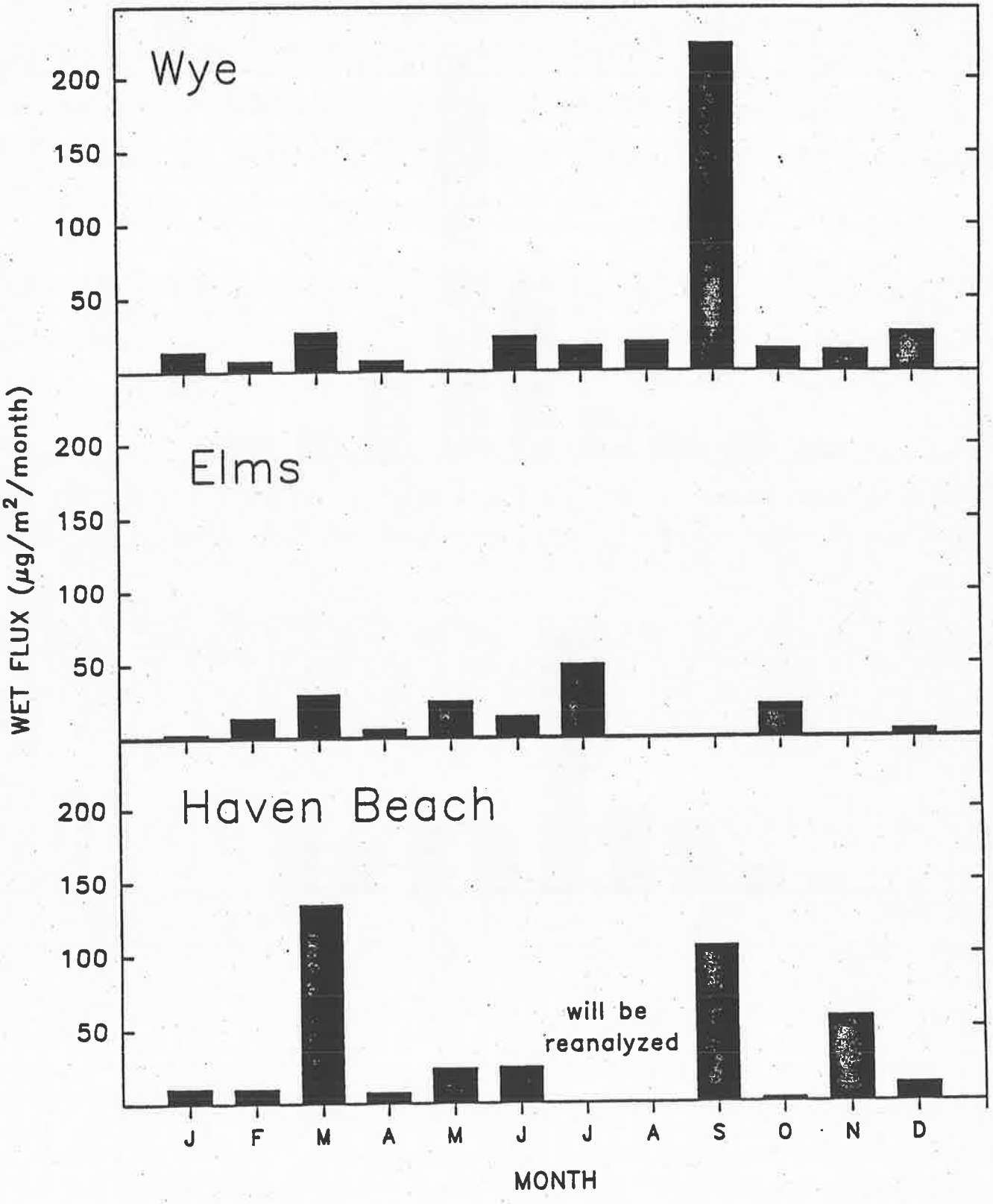
A1.75 Monthly integrated wet deposition of Iron at each CBAD site.


Iron, 1993
Wye
Haven Beach
Wet Flux (ug/m2/month)
2500
2000
1500
1000
500
0
J
F
M
A
M
J
J
A
S
O
N
D

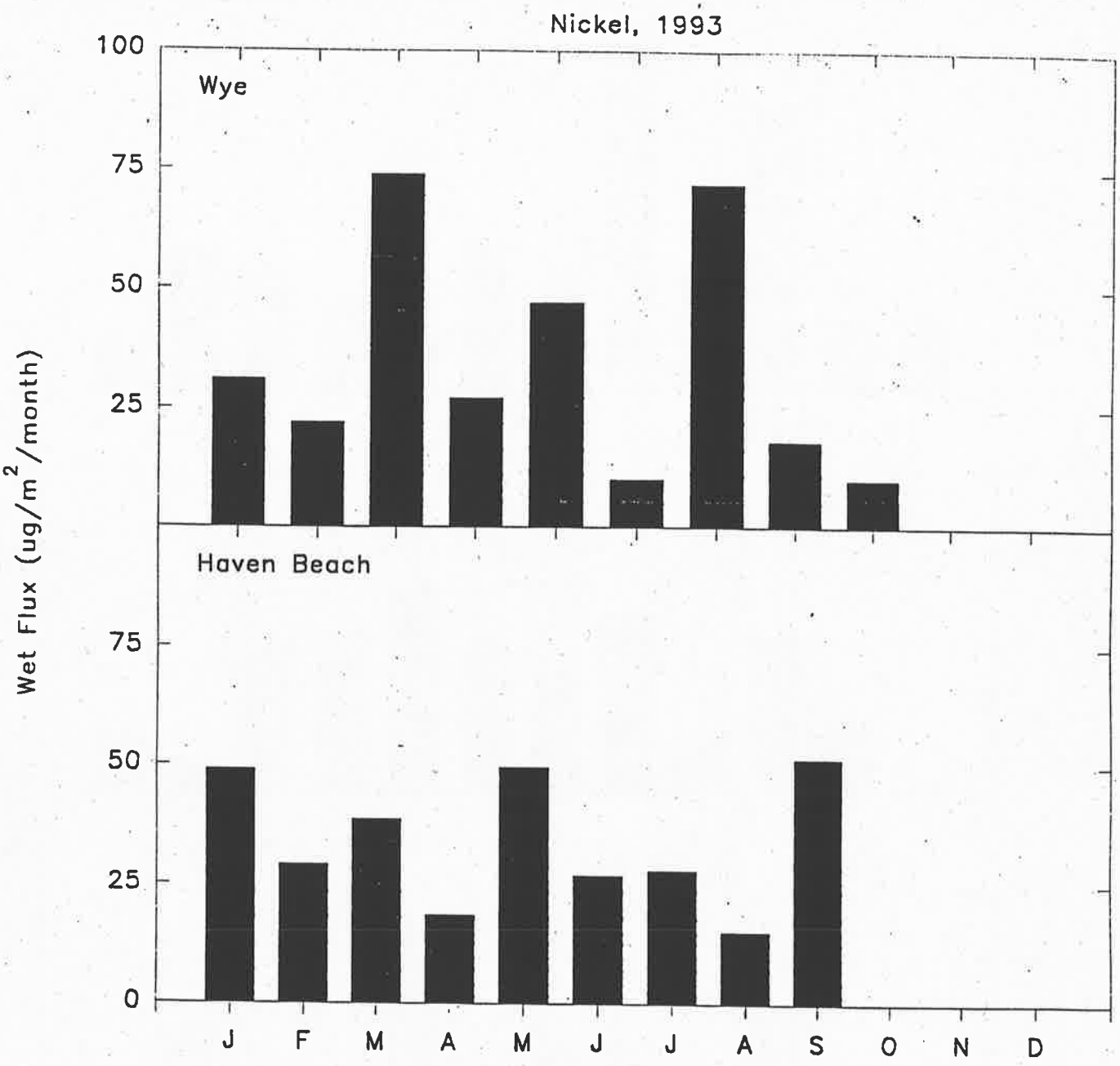


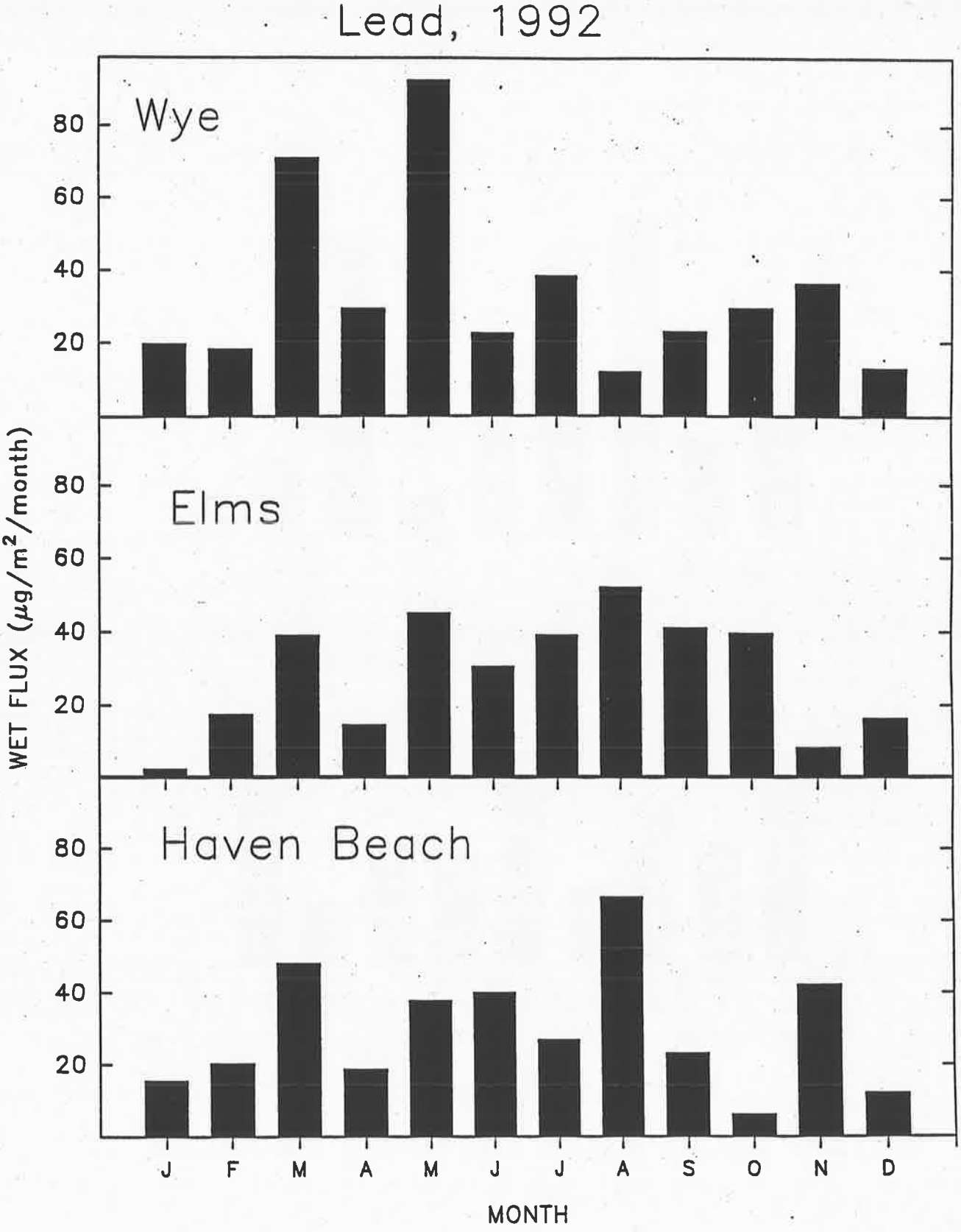
A1.76 Monthly integrated wet deposition of Manganese at each CBAD site.


Manganese, 1993
Wye
Haven Beach
Wet Flux (ug/m2/month)
600
400
200
600
400
200
0
J
F
M
A
M
J
J
A
S
O
N
D

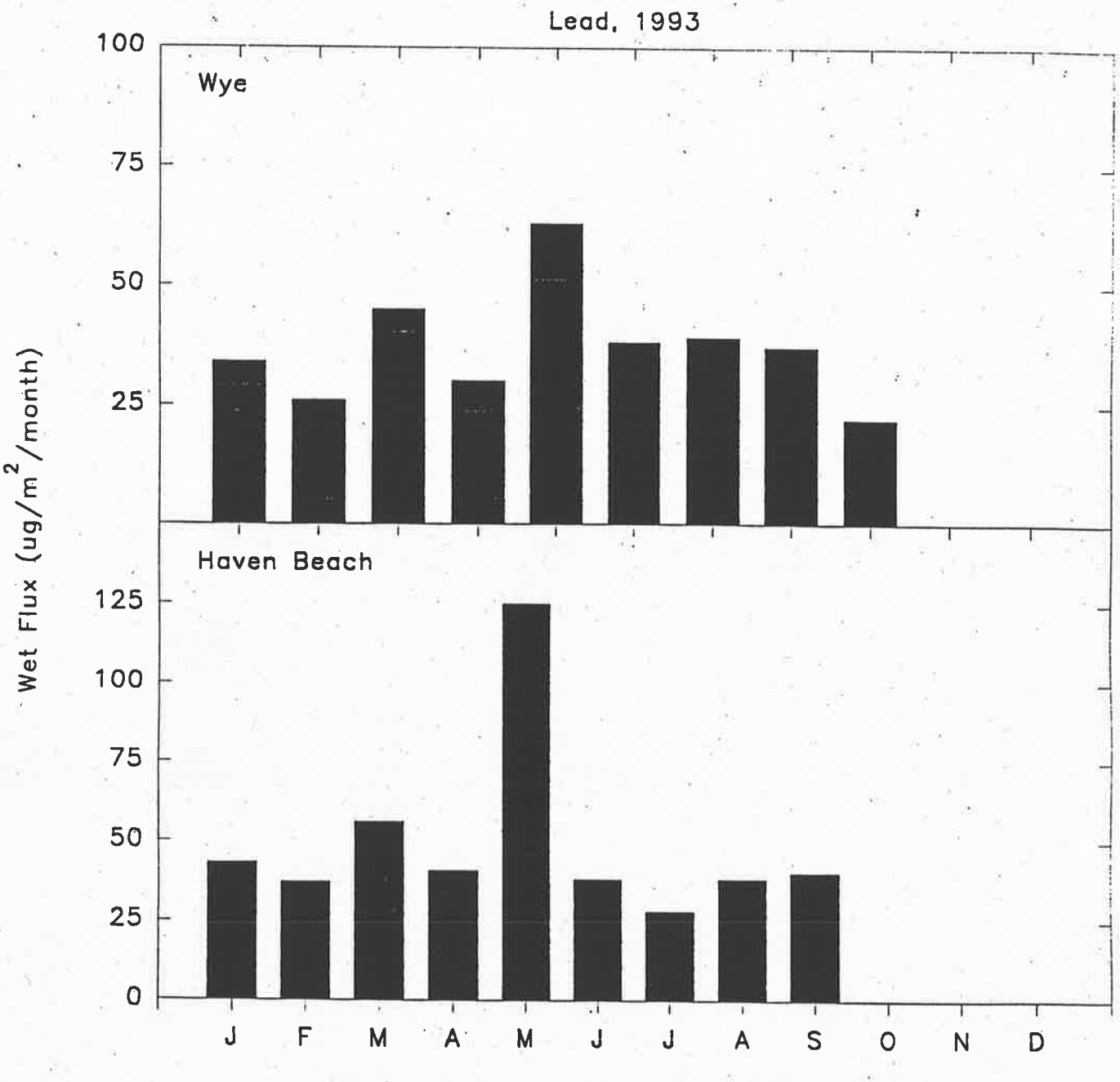


A1.77 Monthly integrated wet deposition of Nickel at each CBAD site.

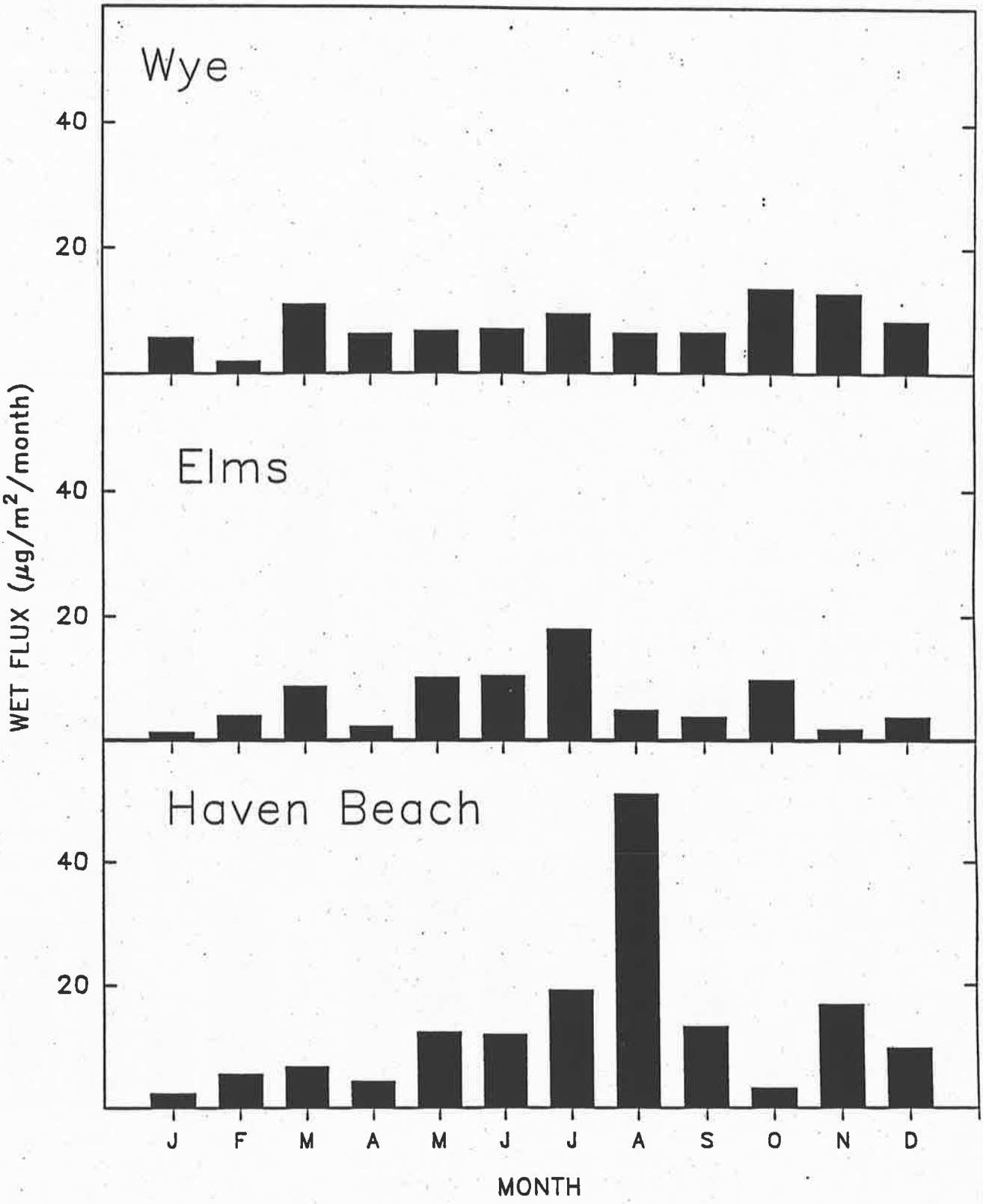

Nickel, 1993
Wye
Haven Beach
Wet Flux (ug/m2/month)
100
75
50
25
75
50
25
0
J
F
M
A
M
J
J
A
S
O
N
D



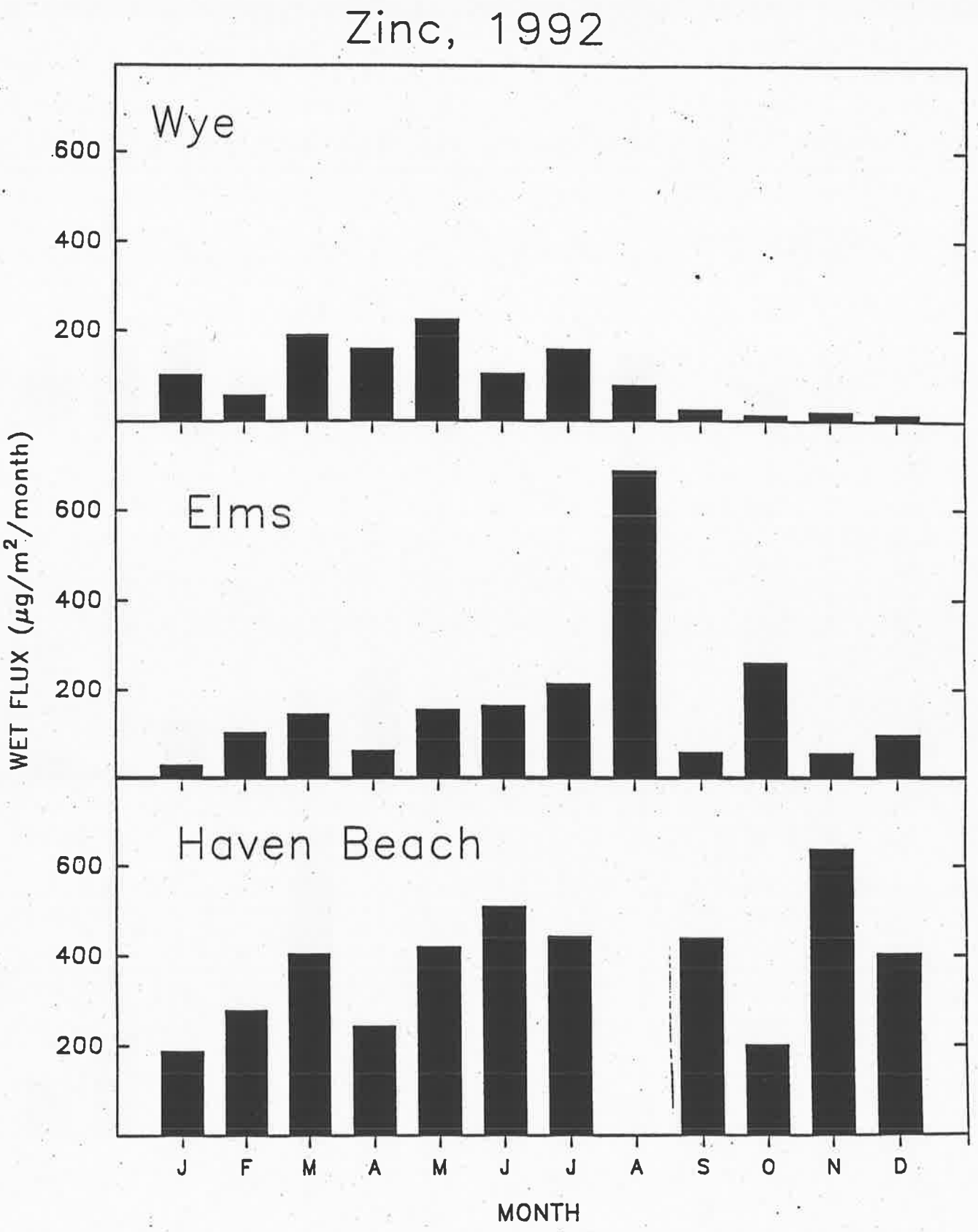
A1.78 Monthly integrated wet deposition of Lead at each CBAD site.


Lead, 1993
Wye
Haven Beach
Wet Flux (ug/m2/month)
100
75
50
25
125
100
75
50
25
0
J
F
M
A
M
J
J
A
S
O
N
D

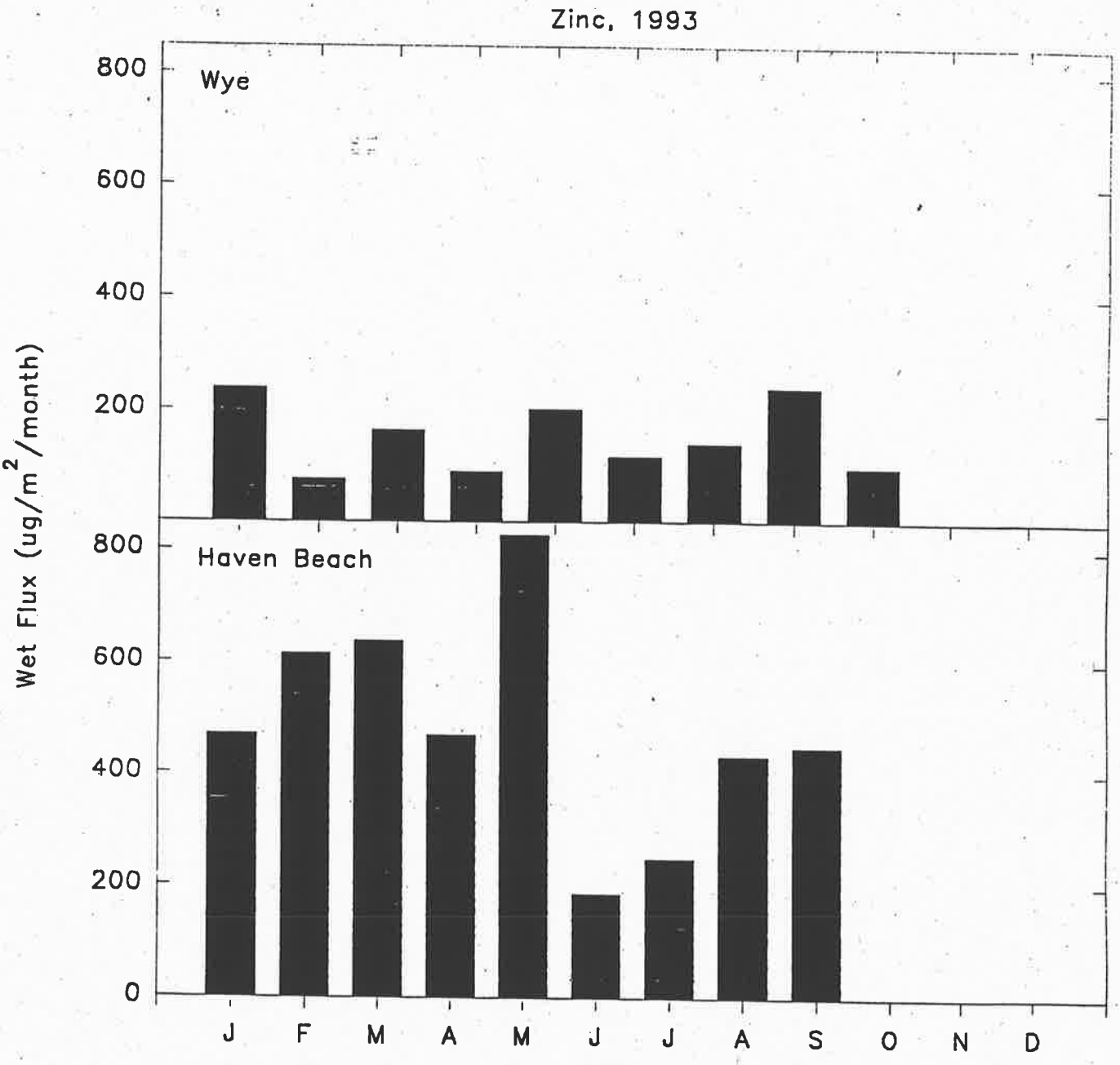
Selenium, 1992



A1.79 Monthly integrated wet deposition of Selenium at each CBAD site.



A1.80 Monthly integrated wet deposition of Zinc at each CBAD site.


Zinc, 1993
Wye
Haven Beach
Wet Flux (ug/m2/month)
800
600
400
200
0
J
F
M
A
M
J
J
A
S
O
N
D

Appendix A2

PAH Concentrations (ng/m^3) In Air PUF-Wye,1992

SampleID	Date	Week	Flu	Phen	Ant	Fla	Pyr	B[a]A	Chrysene	B[b]F	B[k]F	B[e]P	B[a]P	I[123]P	d[ah]A	B[ghi]P
	1/15/92	2														
	1/30/92	4														
	2/12/92	6														
	2/26/92	8														
	3/11/92	10														
	3/25/92	12														
	4/07/92	14														
	4/21/92	16														
	5/05/92	18														
	5/19/92	20														
	6/03/92	22														
	6/17/92	24														
	7/01/92	26														
CAP	7/14/92	28	0.4652195	4.504915	N.D.	0.6015826	0.2596928	0.0011819	0.0174322	0.0023619	0.0018489	0.0017651	0.0002922	0.0004499	0.000292	0.0007888
	7/28/92	30														
CBP	8/12/92	32	0.7388699	4.081613	N.D.	0.838785	0.6845526	N.D.	0.0184689	0.0011997	0.0009815	0.0011539	N.D.	N.D.	N.D.	0.0006987
CCP	8/25/92	34	0.1913829	2.809523	N.D.	1.689714	2.483287	0.0182049	0.0420384	0.0081574	0.0050378	0.0051113	N.D.	N.D.	N.D.	0.0007982
CDP	9/09/92	36	0.508793	3.434013	N.D.	0.3443263	0.2136822	N.D.	0.0146038	0.0012715	0.0010403	0.0012136	N.D.	N.D.	N.D.	0.0009584
CEP	9/22/92	38	0.5467039	1.855394	N.D.	0.2722389	0.3685444	N.D.	0.0116239	0.0005098	0.0004171	0.0005853	N.D.	N.D.	N.D.	N.D.
CFP	10/06/92	40	1.019493	1.695505	N.D.	0.3713723	0.4981658	N.D.	0.0127846	0.0017342	0.0007167	N.D.	N.D.	N.D.	0.000401	N.D.
CGP	10/21/92	42	0.8125299	0.8316019	N.D.	0.0490522	0.0576775	N.D.	0.0028531	0.0018551	0.0010041	0.0035503	N.D.	0.0027169	0.0017046	0.0082486
	11/03/92	44														
	11/17/92	46														
CHP	12/01/92	48	2.628402	5.181223	0.2542371	0.4937602	0.3629992	0.0092071	0.0416796	0.0046102	0.0040377	0.0021992	0.0007026	0.000917	0.0014462	0.0030482
	12/15/92	50														
	12/29/92	52														

PAH Concentrations (ng/m^3) in Air Filters-Wye,1992

SampleID	Date	Week	Flu	Phen	Ant	Fla	Pyr	B[a]A	Chrysene	B[b]F	B[k]F	B[e]P	B[a]P	I[123]P	d[ah]A	B[ghi]P
	1/15/92	2														
	1/30/92	4														
	2/12/92	6														
	2/28/92	8														
	3/11/92	10														
	3/25/92	12														
	4/07/92	14														
	4/21/92	16														
	5/05/92	18														
	5/19/92	20														
	6/03/92	22														
	6/17/92	24														
	7/01/92	26														
CAP	7/14/92	28	N.Q.	0.0304	0.0025	0.0204	0.0201	0.0072	0.0181	0.0208	0.0154	0.0195	0.0112	0.0191	0.0028	0.0235
	7/28/92	30														
CBP	8/12/92	32	0.0033	0.0292	0.0013	0.0343	0.0281	0.0085	0.0229	0.0189	0.0124	0.0158	0.0079	0.0129	0.0019	0.0185
CCP	8/25/92	34	0.0034	0.0329	0.0031	0.0301	0.0295	0.0092	0.0209	0.0282	0.0242	0.0271	0.0142	0.0356	0.0027	0.0553
CDP	9/09/92	36	0.0018	0.0125	0.0008	0.0092	0.0080	0.0034	0.0114	0.0077	0.0057	0.0069	0.0029	0.0056	0.0012	0.0063
CEP	9/22/92	38	N.Q.	0.0224	0.0015	0.0185	0.0218	0.0045	0.0151	0.0085	0.0070	0.0093	0.0150	0.0064	0.0107	0.0016
CFP	10/06/92	40	0.0044	0.0442	0.0037	0.0547	0.0735	0.0224	0.0615	0.1500	0.0733	0.0358	0.0581	0.0058	0.0898	0.0064
CGP	10/21/92	42	0.0138	0.1359	0.0060	0.1392	0.1450	0.0281	0.0775	0.1087	0.0807	0.0895	0.0408	0.0763	0.0065	0.1133
	11/03/92	44														
	11/17/92	46														
CHP	12/01/92	48	0.0170	0.1808	0.0179	0.2017	0.1778	0.1680	0.3757	0.4844	0.3753	0.4008	0.2963	0.4047	0.0593	0.4390
	12/15/92	50														
	12/29/92	52														

PAH Concentrations (ng/m^3) in Air PUF-Elms,1992

SampleID	Date	Week	Vol.		Flu	Phen	Ant	Fla	Pyr	B[a]A	Chrysene	B[b]F	B[k]F	B[e]P	B[a]P	I[123]P	d[ah]A	B[ghi]P
906044F	1/15/92		2		n.q.	n.q.	n.q.	n.q.	n.q.	n.q.	n.q.	n.q.	n.q.	n.q.	n.q.	n.q.	n.q.	n.q.
906045F	1/30/92		4		n.q.	n.q.	n.q.	n.q.	n.q.	n.q.	n.q.	n.q.	n.q.	n.q.	n.q.	n.q.	n.q.	n.q.
906046F	2/12/92		6		n.q.	n.q.	n.q.	n.q.	n.q.	n.q.	n.q.	n.q.	n.q.	n.q.	n.q.	n.q.	n.q.	n.q.
906047F	2/26/92		8		n.q.	n.q.	n.q.	n.q.	n.q.	n.q.	n.q.	n.q.	n.q.	n.q.	n.q.	n.q.	n.q.	n.q.
906048F	3/11/92		10		n.q.	n.q.	n.q.	n.q.	n.q.	n.q.	n.q.	n.q.	n.q.	n.q.	n.q.	n.q.	n.q.	n.q.
906049F	3/25/92		12		n.q.	n.q.	n.q.	n.q.	n.q.	n.q.	n.q.	n.q.	n.q.	n.q.	n.q.	n.q.	n.q.	n.q.
906050F	4/07/92		14	1101	n.q.	n.q.	n.q.	n.q.	n.q.	n.q.	n.q.	n.q.	n.q.	n.q.	n.q.	n.q.	n.q.	n.q.
906051F	4/21/92		16	879	0.1462	1.6552	N.D.	0.2211	0.3017	N.D.	0.0230	0.0016	0.0013	0.0014	0.0003	0.0004	0.0002	0.0007
906052F	5/05/92		18		0.4444	1.7960	N.Q.	0.2106	0.3238	N.D.	0.0085	N.Q.	0.0009	0.0011	0.0004	0.0004	N.D.	0.0005
906053F	5/19/92		20	1093	0.1480	2.0336	N.D.	0.4089	0.6372	N.D.	0.0152	0.0006	0.0007	0.0008	0.0003	0.0005	0.0002	0.0009
906054F	6/03/92		22	922	0.4300	1.9734	N.Q.	0.2035	0.0971	N.D.	0.0119	0.0009	0.0008	0.0012	0.0002	N.D.	N.D.	N.D.
906055F	6/17/92		24	1077	0.1977	1.5488	N.D.	0.4815	0.8405	N.D.	0.0136	N.Q.	0.0020	0.0011	0.0007	0.0005	N.D.	0.0006
906056F	7/01/92		26	924	N.Q.	1.7402	N.D.	0.5427	0.8682	0.0013	0.0205	N.Q.	0.0014	0.0010	N.Q.	0.0004	N.D.	0.0005
906057F	7/15/92		28	1109	N.Q.	0.0083	0.0499	0.2042	2.5737	N.D.	0.9217	0.8096	0.6624	N.D.	0.0818	0.0082	0.0044	N.Q.
906058F	7/29/92		30	728	0.1719	1.4184	0.0000	NQ	0.3352	0.0001	0.0173	0.0019	0.0006	NQ	ND	ND	ND	ND
906059	8/12/92		32	983	0.1510	1.3688	0.0237	NQ	0.3805	0.0001	0.0275	0.0035	0.0010	NQ	ND	ND	ND	ND
906061F	9/09/92		36	578	0.5227	2.5470	N.D.	0.2361	0.1150	N.D.	0.0084	0.0020	0.0016	0.0031	0.0004	0.0007	N.D.	0.0018
906062F	9/23/92		38	935	0.4926	2.7403	0.0630	NQ	0.5676	0.0049	0.0360	0.0084	0.0002	NQ	ND	ND	ND	ND
906063F	10/07/92		40	868	0.3968	1.0948	0.0496	NQ	0.2282	0.0024	0.0145	0.0003	0.0002	NQ	ND	ND	ND	ND
906064F	10/20/92		42	854	0.6905	1.5532	N.D.	0.3765	0.4106	N.D.	0.0116	0.0007	0.0006	0.0007	N.D.	N.D.	N.D.	0.0023
906065F	11/03/92		44	739	0.7656	1.5624	N.D.	0.1744	0.1296	N.D.	0.0060	0.0006	0.0007	0.0007	N.D.	N.D.	N.D.	0.0006
906066F	11/17/92		46	746	0.7778	0.9230	N.D.	N.D.	N.D.	N.D.	0.0100	0.0038	0.0031	0.0040	0.0016	N.D.	N.D.	N.D.
906067F	12/01/92		48	822	5.7105	10.7430	0.4071	1.1990	0.8223	0.0123	0.0676	0.0099	0.0084	0.0071	0.0043	0.0044	0.0014	0.0058
906068F	12/15/92		50	848	1.3794	2.0573	N.D.	0.2144	0.1143	0.0037	0.0136	0.0029	0.0023	0.0017	0.0010	0.0017	N.D.	0.0014
906069F	12/29/92		52	482	7.8361	11.7721	0.5868	1.3126	0.9982	0.0403	0.1165	0.0103	0.0099	0.0058	0.0016	0.0022	N.D.	0.0078

PAH Concentrations (ng/m^3) in Air Filters-Elms,1992

SampleID	Date	Week	Vol.	Flu	Phen	Ant	Fla	Pyr	B[a]A	Chrysene	B[b]F	B[k]F	B[e]P	B[a]P	I[123]P	d[ah]A	B[ghi]P
906044F	1/15/92	2		0.00876	0.16912	0.01133	0.16642	0.13167	0.06382	0.12358	0.11264	0.10153	0.09238	0.06767	0.07758	0.01221	0.08177
906045F	1/30/92	4		0.00734	0.15762	0.01014	0.18220	0.17470	0.11050	0.30520	0.39183	0.26872	0.31763	0.16735	0.37130	0.02769	0.43091
906046F	2/12/92	6		0.00393	0.17107	0.01359	0.19698	0.17520	0.07974	0.18152	0.19756	0.13590	0.15615	0.10746	0.16338	0.02335	0.14953
906047F	2/28/92	8		0.00283	0.03380	0.00272	0.02204	0.02076	0.02123	0.05146	0.07928	0.06471	0.07799	0.02554	0.07019	0.00808	0.09855
906048F	3/11/92	10		0.00334	0.03659	0.00175	0.03456	0.02699	0.01319	0.03387	0.04150	0.03342	0.03766	0.01621	0.03624	0.00552	0.03483
906049F	3/25/92	12		0.01047	0.17719	0.00734	0.19073	0.14752	0.06440	0.14536	0.16040	0.12231	0.13368	0.08137	0.12967	0.01770	0.11792
906050F	4/07/92	14	1101	0.00704	0.08025	0.00468	0.10963	0.09928	0.03118	0.09029	0.16684	0.10271	0.12023	0.05301	0.09569	0.01316	0.08967
906051F	4/21/92	16	879	0.00222	0.01319	0.00057	0.00814	0.00923	0.00234	0.00830	0.00614	0.00483	0.00528	0.00258	0.00404	0.00072	0.00492
906052F	5/05/92	18		N.Q.	0.02993	0.00123	0.03336	0.03554	0.00731	0.02758	0.02677	0.01740	0.02055	0.00892	0.01348	0.00203	0.01371
906053F	5/19/92	20	1093	N.Q.	0.01802	0.00089	0.01878	0.02215	0.00340	0.02014	0.02113	0.00801	0.01487	0.00457	0.00778	0.00105	0.00912
906054F	6/03/92	22	922	N.Q.	0.01586	0.00144	0.00704	0.00853	0.00329	0.00812	0.00932	0.00733	0.00870	0.00415	0.00893	0.00151	0.00868
906055F	6/17/92	24	1077	N.Q.	0.02651	0.00111	0.02317	0.02602	0.00365	0.01621	0.02545	0.00803	0.01722	0.00474	0.00730	0.00089	0.00942
906056F	7/01/92	26	924	N.Q.	0.02720	0.00205	0.03070	0.02490	0.00620	0.01924	0.02143	0.01468	0.01901	0.00939	0.01860	0.00053	0.01970
906057F	7/15/92	28	1109	N.Q.	0.02774	0.00192	0.02435	0.02588	0.00598	0.01936	0.02021	0.01228	0.01918	0.00822	0.01457	0.00216	0.01727
906058F	7/29/92	30	728	nd	0.02490	0.00320	0.01470	0.02240	0.00710	0.02250	0.01470	0.00830	0.01230	0.00660	0.00460	nd	0.01030
906059	8/12/92	32	983	nd	0.01640	0.00230	0.00760	0.00970	0.00540	0.01250	0.01130	0.00420	0.00830	0.05400	0.00600	nd	0.00800
906061F	9/09/92	36	575	0.00204	0.01592	0.00101	0.00766	0.00576	0.00358	0.00743	0.00715	0.00585	0.00717	0.00302	0.00717	0.00126	0.01019
906062F	9/23/92	38	935	0.00080	0.00780	0.00060	0.00420	0.00370	0.00300	0.00860	0.00910	0.00410	0.00590	0.00070	0.00350	nd	0.00510
906063F	10/07/92	40	868	0.00160	0.02030	0.00140	0.01350	0.02130	0.00800	0.02970	0.06460	0.01870	0.03600	0.01530	0.02410	nd	0.03710
906064F	10/20/92	42	854	0.00424	0.06087	0.00313	0.08109	0.06836	0.02319	0.07177	0.06948	0.05549	0.05393	0.03273	0.05510	0.00768	0.05722
906065F	11/03/92	44	739	0.00812	0.04394	0.00266	0.03544	0.03321	0.01069	0.02873	0.03860	0.03007	0.03319	0.01538	0.02769	0.00357	0.03577
906066F	11/17/92	46	746	0.01048	0.16223	0.00945	0.19695	0.16991	0.06405	0.21293	0.25101	0.14288	0.19029	0.08742	0.18416	0.02271	0.15920
906067F	12/01/92	48	822	0.02160	0.30146	0.03174	0.31439	0.29776	0.30536	0.68042	0.91054	0.64585	0.76319	0.50273	0.90859	0.11659	0.94448
906068F	12/15/92	50	648	0.00535	0.06206	0.00314	0.05721	0.04101	0.03768	0.08672	0.13370	0.12056	0.11915	0.08150	0.16471	0.02037	0.14228
906069F	12/29/92	52	482	0.01692	0.18731	0.02497	0.15908	0.15482	0.27291	0.49413	0.78695	0.63486	0.73999	0.36327	0.88825	0.09063	1.03982

PAH Concentrations (ng/m^3) in Air PUF-Haven Beach, 1992

SampleID	Date	Week	Flu	Phen	Ant	Fla	Pyr	B[a]A	Chrysene	B[b]F	B[k]F	B[e]P	B[a]P	I[123]P	d[ah]A	B[ghi]P
AB	1/15/92	2	0.9122	1.9132	N.D.	N.Q.	0.1205	N.D.	0.0101	0.0017	0.0010	0.0014	0.0009	0.0009	0.0002	0.0031
AC	1/30/92	4	2.2102	2.7781	0.1653	0.2795	0.2226	0.0157	0.1058	0.0061	0.0050	0.0180	N.D.	0.0011	0.0009	0.0033
AD	2/12/92	6	1.5622	2.8462	N.D.	0.4667	0.2499	0.0158	0.0861	0.0244	0.0191	0.0261	0.0144	0.0153	0.0026	0.0170
AE	2/28/92	8	0.9747	1.6140	N.D.	0.2180	0.1053	N.D.	0.0367	0.0020	0.0017	0.0025	0.0004	N.Q.	0.0002	0.0007
AF	3/11/92	10	0.9070	3.3298	N.D.	0.3377	0.4530	N.D.	0.1313	0.0084	0.0052	0.0119	0.0060	0.0024	0.0030	0.0127
AG	3/25/92	12	0.9828	1.0912	N.D.	0.1519	0.1578	N.D.	0.0514	N.Q.	N.Q.	0.0047	0.0021	N.Q.	N.D.	N.Q.
AH	4/08/92	14	0.8457	2.5839	N.D.	0.3779	0.3962	N.D.	0.0234	N.Q.	N.Q.	0.0009	N.D.	N.Q.	N.D.	0.0007
AI	4/22/92	16	0.5613	2.3036	N.D.	0.4518	0.7636	N.D.	0.1029	0.0156	0.0128	0.0311	0.0176	0.0177	N.D.	0.0452
AJ	5/06/92	18	0.2839	0.6868	N.D.	0.0725	0.0856	N.D.	0.0123	0.0010	0.0004	0.0009	N.Q.	N.Q.	0.0003	0.0041
AK	5/21/92	20	0.2954	1.4995	N.Q.	0.2476	0.5880	N.D.	0.0096	0.0007	0.0004	N.Q.	N.Q.	N.Q.	N.D.	N.Q.
AL	6/03/92	22	N.Q.	N.Q.	N.Q.	0.9521	2.4629	N.D.	0.0327	0.0012	0.0010	N.D.	N.D.	N.D.	N.D.	N.Q.
AM	6/17/92	24	0.2648	2.5962	N.D.	0.3119	0.3260	N.D.	0.0359	0.0008	0.0007	0.0013	N.Q.	0.0005	0.0004	0.0010
AN	7/02/92	26	4.7220	16.5090	N.D.	1.9960	3.6196	N.D.	0.6790	0.0249	0.0204	0.0262	0.0120	0.0154	N.D.	0.1218
AO	7/15/92	28	0.6861	5.5090	N.D.	2.2109	4.4042	N.D.	0.0794	0.0016	0.0013	0.0015	0.0004	N.D.	N.D.	0.0018
AP	7/29/92	30	0.2135	2.6522	N.D.	0.6874	1.7166	N.D.	0.0223	0.0007	0.0006	N.Q.	0.0003	N.D.	0.0003	0.0093
AQ	8/12/92	32	0.2025	4.2525	N.D.	1.1349	3.5277	N.D.	0.0403	0.0007	0.0008	N.Q.	0.0003	0.0002	N.D.	0.0015
AR	8/26/92	34	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	0.0548	0.0015	0.0012	0.0026	0.0016	0.0017	N.D.	0.0068
AS	9/09/92	36	0.5003	3.6096	N.D.	0.7393	2.6130	N.D.	0.0437	0.0011	0.0009	0.0012	N.D.	0.0004	N.D.	0.0009
AT	9/25/92	38	0.3065	0.4652	N.D.	1.6266	3.5475	N.D.	0.0429	0.0024	0.0019	0.0019	0.0006	0.0007	0.0005	0.0013
AU	10/07/92	40	0.2036	0.6581	N.D.	0.1446	0.2733	N.D.	0.0065	0.0010	0.0008	0.0008	0.0002	0.0003	0.0004	0.0006
AV	10/21/92	42	0.8304	1.3920	N.D.	0.2029	0.1667	N.D.	0.0046	0.0005	0.0004	0.0009	N.D.	N.D.	N.D.	0.0004
AW	11/04/92	44	0.6751	1.9566	N.D.	0.5325	0.6571	N.D.	0.0129	0.0026	0.0021	0.0022	0.0005	0.0007	N.D.	0.0010
AX	11/18/92	46	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
AY	12/02/92	48	2.0124	2.6378	N.D.	0.3302	0.2559	N.D.	0.0206	N.Q.	N.Q.	N.Q.	N.Q.	N.D.	N.D.	N.Q.
AZ	12/16/92	50	1.3721	1.7732	N.D.	0.3181	0.2845	0.0039	0.0178	0.0029	0.0024	0.0024	N.D.	0.0003	N.D.	0.0009
AA	12/31/92	52	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
			21.81	65.06	0.17	13.79	27.60	0.04	1.66	0.10	0.08	0.14	0.08	0.08	0.01	0.23
			0.8272	2.5022	0.0064	0.5304	1.0615	0.0014	0.0640	0.0038	0.0031	0.0053	0.0022	0.0022	0.0003	0.0090

PAH Concentrations (ng/m^3) in Air Filters Haven Beach 1992

SampleID	Date	Week	Flu	Phen	Ant	Fla	Pyr	B[a]A	Chrysene	B[b]F	B[k]F	B[e]P	B[a]P	I[123]P	d[ah]A	B[ghi]P
AB	1/15/92	2	N.Q.	0.03659	0.00169	0.03052	0.02686	0.01607	0.02270	0.03207	0.02880	0.02781	0.02020	0.03724	0.00630	0.05193
AC	1/30/92	4	0.00740	0.12110	0.00971	0.09853	0.10115	0.19083	0.20965	0.40161	0.37015	0.33853	0.36749	0.58186	0.08431	0.49947
AD	2/12/92	6	0.00297	0.03748	0.00192	0.03473	0.02766	0.01480	0.02970	0.05361	0.03950	0.03855	0.02515	0.06323	0.00962	0.04498
AE	2/28/92	8	0.00534	0.07817	0.00438	0.06252	0.05395	0.03069	0.05229	0.10112	0.07648	0.07778	0.05300	0.11037	0.01745	0.08073
AF	3/11/92	10	0.00315	0.02193	0.00146	0.01119	0.00954	0.00493	0.01220	0.02124	0.01255	0.01654	0.00695	0.01408	0.00211	0.01609
AG	3/25/92	12	0.00353	0.02456	0.00163	0.01256	0.01070	0.00553	0.01368	0.02379	0.01411	0.01853	0.00779	0.01567	0.00237	0.01802
AH	4/08/92	14	0.00401	0.05142	0.00254	0.04735	0.04115	0.01374	0.07833	0.08782	0.07185	0.08009	0.02325	0.05680	0.00753	0.05519
AI	4/22/92	16	N.Q.	0.02001	N.D.	0.00709	0.01213	0.00263	0.01083	0.00551	0.00413	0.00550	0.00213	0.00300	0.00066	0.00362
AJ	5/06/92	18	N.Q.	0.01503	N.D.	0.00816	0.00731	0.00154	0.01597	0.01207	0.00987	0.00929	0.00281	0.00855	0.00075	0.00538
AK	5/21/92	20	N.Q.	N.Q.	N.D.	0.00722	0.01245	0.00154	0.00815	0.01040	0.00597	0.00638	0.00208	0.00566	0.00062	0.00453
AL	6/03/92	22	N.Q.	0.02470	0.00100	0.00180	0.04069	0.00280	0.02301	0.01903	0.01050	0.01597	0.00314	0.00717	0.00147	0.00922
AM	6/17/92	24	N.Q.	0.03069	0.00088	0.04923	0.00379	0.00393	0.03119	0.02905	0.01543	0.02018	0.00501	0.00889	0.00111	0.00959
AN	7/02/92	26	N.Q.	N.Q.	N.D.	0.12867	0.11517	0.04962	0.17127	0.07542	0.05353	0.07091	0.03488	0.04399	0.00852	0.05410
AO	7/15/92	28	N.Q.	0.02636	0.00157	0.01731	0.02251	0.00412	0.01721	0.01301	0.00839	0.01314	0.00490	0.00876	0.00142	0.01196
AP	7/29/92	30	N.Q.	0.01890	0.00107	0.01250	0.02156	0.00334	0.01361	0.00822	0.00575	0.00730	0.00312	0.00570	0.00112	0.00722
AQ	8/12/92	32	N.Q.	0.01924	N.D.	0.00823	0.01095	0.00274	0.01145	0.00524	0.00429	0.00666	0.00251	0.00347	0.00060	0.00499
AR	8/26/92	34	N.Q.	0.01885	0.00103	0.01092	0.02363	0.00339	0.01500	0.00713	0.00446	0.00718	0.00305	0.00472	0.00078	0.00668
AS	9/09/92	36	0.00273	0.01629	N.D.	0.01213	0.02740	N.D.	0.01685	0.00836	0.00684	0.00986	0.00234	0.00513	0.00085	0.00844
AT	9/25/92	38	N.Q.	0.02416	0.00120	0.01275	0.02371	0.00435	0.01925	0.01194	0.00908	0.01471	0.00384	0.00896	0.00103	0.01635
AU	10/07/92	40	N.Q.	0.04189	0.00208	0.02663	0.06489	0.00584	0.02736	0.03645	0.02962	0.03925	0.00823	0.01492	0.00138	0.01853
AV	10/21/92	42	N.Q.	0.05239	0.00273	0.06252	0.06577	0.01528	0.04554	0.04142	0.03131	0.03802	0.01991	0.00408	0.04356	0.04960
AW	11/04/92	44	N.Q.	0.02219	0.00110	0.02001	0.03185	0.01091	0.03684	0.06593	0.04681	0.05725	0.01963	0.05053	0.00799	0.04559
AX	11/18/92	46	N.Q.	0.11601	0.00698	0.13289	0.11971	0.04809	0.16020	0.16207	0.09693	0.12449	0.06349	0.10829	0.01410	0.10565
AY	12/02/92	48	N.Q.	0.09344	0.00449	0.08213	0.08055	0.04653	0.12625	0.18435	0.15083	0.16173	0.08950	0.15517	0.01704	0.17351
AZ	12/16/92	50	N.Q.	0.03125	0.00189	0.03670	0.04139	0.03419	0.06288	0.14859	0.13321	0.13544	0.06913	0.15658	0.01723	0.14393
AA	12/31/92	52	N.Q.	0.03048	0.00198	0.02710	0.02885	0.01979	0.07310	0.08048	0.05670	0.07051	0.02279	0.07205	0.00800	0.08297

Concentrations (ng/m^3) of PAHs in Air - Vapor - Haven Beach, 1993

Sample ID	Date	Week	Flu	Phen	Ant	Fla	Pyr	B[a]A	Chry	B[b]F	B[k]F	B[e]P	B[a]P	I[123]P	D[ah]A	B[ghi]P
AC	1/12/93	2	1.32116	2.90879	N.D.	0.33687	0.26431	0.00547	0.03842	0.00547	N.D.	0.00504	N.D.	N.D.	N.D.	N.D.
AD	1/26/93	4	0.38082	0.92511	N.D.	0.12965	0.05787	N.D.	0.00710	0.00062	0.00057	N.D.	N.D.	N.D.	N.D.	N.D.
AE	2/08/93	6	0.73512	0.83014	N.D.	0.08420	0.05564	N.Q.	0.01172	0.00121	0.00099	N.Q.	N.Q.	N.D.	N.D.	N.D.
AF	2/23/93	8	0.52785	0.90568	N.D.	0.06814	0.01310	N.D.	0.00343	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
AG	3/09/93	10	0.57703	0.86840	N.D.	0.05450	0.05985	N.D.	0.00865	0.00172	0.00172	0.00148	N.D.	N.D.	N.D.	0.00350
AH	3/23/93	12	0.52210	1.94445	N.D.	0.11853	0.17595	N.D.	0.01573	N.D.	N.Q.	0.00330	N.D.	N.D.	N.D.	0.00241
AI	4/07/93	14	0.66502	0.84078	N.D.	0.06598	0.06437	N.Q.	0.00818	N.D.	N.D.	0.00127	N.D.	N.D.	N.D.	N.D.
AJ	4/20/93	16	1.04386	1.15126	N.D.	0.06096	0.07182	N.Q.	0.01427	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
AK	5/04/93	18	0.13953	0.72174	N.D.	0.06262	0.11563	N.Q.	0.00358	N.Q.	N.Q.	N.Q.	N.D.	N.D.	N.D.	N.Q.
AL	5/18/93	20	0.38358	1.77861	N.D.	0.13805	0.39638	N.D.	0.03207	0.00157	0.00128	0.00421	N.Q.	N.Q.	N.D.	0.00237
AM	6/01/93	22	0.38753	N.Q.	N.Q.	0.10465	0.31088	N.Q.	0.00475	0.00020	0.00016	N.Q.	N.Q.	N.D.	N.D.	N.D.
AN	6/15/93	24	0.50680	1.92341	N.D.	0.23792	0.42805	N.Q.	0.02742	0.00065	0.00054	0.00116	0.00099	N.D.	N.D.	N.D.
AO	6/29/93	26	0.37327	2.58224	N.Q.	0.27121	0.70049	N.Q.	0.05327	0.00033	0.00027	0.00112	N.Q.	N.D.	N.D.	N.Q.
AP	7/13/93	28	0.44019	3.43886	0.08450	1.16613	2.68110	N.Q.	0.03673	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
AQ	7/27/93	30	0.54408	3.66606	0.05294	0.56347	1.32502	N.D.	0.03205	0.00163	0.00133	0.00163	N.Q.	N.Q.	N.D.	0.00087
AR	8/11/93	32	0.24235	1.88810	0.06116	0.59235	1.32557	N.D.	0.01561	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
AS	8/24/93	34	0.41416	1.02106	0.02493	0.16433	0.25872	N.Q.	0.02644	0.00105	0.00041	0.00105	0.00039	N.Q.	N.D.	0.00106
AT	9/07/93	36	1.33433	3.60746	0.30456	0.50363	0.91434	0.01023	0.04071	0.00430	0.00351	0.00647	0.00327	N.D.	0.00241	0.00686
AU	9/21/93	38	N.D.	N.D.	N.D.	N.Q.	N.Q.	N.D.	0.05208	N.Q.	N.Q.	N.Q.	N.Q.	N.Q.	N.D.	0.00090
AV	10/05/93	40	0.60979	1.78156	0.20053	N.Q.	0.29283	N.Q.	N.Q.	N.Q.	N.Q.	0.00062	N.Q.	N.D.	N.D.	0.00055

Concentrations (ng/m^3) of PAHs in Air - Filter - Haven Beach, 1993

Sample ID	Date	Week	Flu	Phen	Ant	Fla	Pyr	B[a]A	Chry	B[b]F	B[k]F	B[e]P	B[a]P	I[123]P	D[ah]A	B[ghi]P
AC	1/12/93	2	0.00325	0.02605	N.D.	0.01211	0.01280	0.01199	0.05571	0.11577	0.11577	0.06585	0.01387	0.05930	0.00509	0.06476
AD	1/26/93	4	0.00357	0.05003	N.D.	0.05389	0.04230	0.02329	0.06666	0.07684	0.06800	0.06426	0.04370	0.11637	0.01005	0.07619
AE	2/08/93	6	0.00315	0.07150	N.D.	0.05935	0.04274	0.01236	0.08782	0.08372	0.06850	0.07617	0.02063	0.05975	0.00629	0.05228
AF	2/23/93	8	0.00495	0.10891	N.D.	N.D.	0.00166	0.04895	0.10639	0.12979	0.12979	0.06942	0.05013	0.07973	0.01010	0.05996
AG	3/09/93	10	0.00254	0.07513	N.Q.	0.04001	0.04017	0.03632	0.07875	0.10461	0.09833	0.10070	0.05673	0.08414	0.00789	0.08729
AH	3/23/93	12	0.00266	0.02662	N.D.	0.02539	0.01983	0.00353	0.02049	0.01875	0.00915	0.01794	0.00676	0.01265	0.00119	0.01507
AI	4/07/93	14	0.00605	0.03560	N.D.	0.03428	0.03884	0.00904	0.02889	0.02682	0.02150	0.02793	0.01326	0.02253	0.00233	0.03119
AJ	4/20/93	16	0.00507	0.02166	N.Q.	0.01617	0.01569	N.Q.	0.02119	0.01458	0.01136	0.01653	0.00740	0.01174	0.00178	0.01395
AK	5/04/93	18	0.00293	0.01309	N.D.	0.00756	0.01293	N.Q.	0.00608	0.00209	0.00133	0.00246	0.00080	0.00072	N.D.	0.00175
AL	5/18/93	20	0.00348	0.01644	N.Q.	0.00982	0.01285	0.00274	0.01143	0.00774	0.00580	0.00761	0.00399	0.00583	N.Q.	0.00792
AM	6/01/93	22	0.00631	0.03861	0.00144	0.04903	0.07874	0.00877	0.03193	0.02919	0.02331	0.03118	0.01515	0.02449	0.00310	0.02548
AN	6/15/93	24	0.00537	0.02100	N.Q.	0.01342	0.01785	0.00308	0.01378	0.00792	0.00626	0.00947	0.00352	0.00607	0.00071	0.00765
AO	6/29/93	26	N.Q.	0.01739	N.Q.	0.00871	0.01359	N.Q.	0.01066	0.00493	0.00230	0.00512	0.00211	0.00298	0.00057	0.00379
AP	7/13/93	28	N.Q.	N.Q.	N.Q.	0.01724	N.D.	N.Q.	0.01682	0.00365	0.00299	0.00491	0.00173	0.00156	N.Q.	N.Q.
AQ	7/27/93	30	N.Q.	0.01838	0.00118	0.01685	0.01943	0.00264	0.01717	0.01644	0.01005	0.01513	0.00462	0.01035	0.00160	0.01179
AR	8/11/93	32	0.00236	0.00874	N.D.	0.00456	0.00849	N.Q.	0.00576	0.00304	0.00197	0.00313	0.00117	0.00182	N.D.	0.00260
AS	8/24/93	34	0.00644	0.02669	N.D.	0.01553	0.01511	0.00489	0.01274	0.01535	0.01072	0.01608	0.00605	0.00787	0.00129	0.01059
AT	9/07/93	36	0.03818	0.07449	N.D.	0.01834	0.02801	0.01501	0.05802	0.09116	0.05681	0.09044	0.01092	0.06200	0.01046	0.06091
AU	9/21/93	38	0.01475	0.03609	N.Q.	0.01399	0.01680	0.00320	0.01453	0.00950	0.00778	0.01047	0.00408	0.00575	N.Q.	0.00850
AV	10/05/93	40	0.01554	0.04196	N.Q.	0.02563	0.02410	0.00651	0.01908	0.01749	0.01431	0.01881	0.00986	0.01473	0.00171	0.01689

Concentrations (ng/m^3) of PAHs in Air - Vapor - Elms, 1993

Sample ID	Date	Week	Flu	Phen	Ant	Fla	Pyr	B[a]A	Chry	B[b]F	B[k]F	B[e]P	B[a]P	I[123]P	D[ah]A	B[ghi]P
BV	1/12/93	2	2.09083	5.40199	0.12677	0.92196	0.42157	0.00966	0.04580	0.00572	0.00581	0.00193	0.00035	0.00072	N.D.	0.00111
BW	1/26/93	4	3.07978	4.08630	0.10641	0.80952	0.24210	N.Q.	0.02502	0.00727	0.00738	0.00282	0.00092	0.00131	N.D.	0.00350
BX	2/08/93	6	1.04211	1.89077	N.D.	0.13371	0.04529	N.D.	0.00734	0.00200	0.00184	0.00169	0.00103	0.00129	N.D.	0.00163
BY	2/23/93	8	0.91688	1.08182	N.D.	0.05308	0.03233	0.00611	0.01179	0.00945	0.00773	0.00805	0.00538	0.00516	N.D.	0.00786
BZ	3/09/93	10	0.23327	0.23311	N.D.	0.01037	0.00587	N.Q.	0.00042	N.Q.	N.Q.	N.D.	N.D.	N.D.	N.D.	N.Q.
BAA	3/23/93	12	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
BAB	4/07/93	14	0.46276	0.49600	N.D.	0.05018	0.03467	N.Q.	N.Q.	0.00067	0.00055	0.00069	0.00034	N.D.	N.D.	N.Q.
BAC	4/20/93	16	0.35717	1.09244	N.D.	0.14962	0.10038	N.Q.	0.00742	0.00083	0.00068	0.00072	0.00030	N.Q.	N.D.	0.00113
BAD	5/04/93	18	0.53656	1.72129	N.D.	0.20099	0.19482	0.00102	0.00903	0.00258	0.00211	0.00308	0.00157	N.Q.	N.D.	0.00555
BAE	5/18/93	20	0.26584	1.06102	N.D.	0.07933	0.09786	N.Q.	0.00218	N.Q.	N.Q.	0.00045	N.D.	N.D.	N.D.	N.Q.
BAF	6/01/93	22	0.00670	0.01468	N.D.	0.00124	0.00134	N.Q.	0.00037	N.D.	N.D.	N.Q.	N.D.	N.D.	N.D.	0.00129
BAG	6/15/93	24	0.20949	0.51127	N.D.	0.02803	0.02652	N.D.	0.00094	N.Q.	N.Q.	N.Q.	N.Q.	N.D.	N.D.	N.D.
BAH	6/29/93	26	1.24248	4.37940	N.D.	N.Q.	N.D.	N.D.	0.01312	N.Q.	N.Q.	N.Q.	N.Q.	N.D.	N.D.	N.D.
BAI	7/13/93	28	0.35137	3.13315	N.Q.	0.21195	0.64272	N.Q.	0.03350	0.00147	0.00120	0.00347	N.Q.	N.D.	N.D.	0.00072
BAJ	7/27/93	30	0.45931	1.39715	N.D.	0.14603	0.10491	N.Q.	0.00445	0.00042	0.00034	0.00047	N.D.	N.D.	N.D.	0.00028
BAK	8/10/93	32	0.30038	1.13248	N.D.	0.09540	0.15857	N.Q.	0.00309	0.00043	0.00035	0.00048	N.D.	N.D.	N.D.	N.D.
BAL	8/24/93	34	0.29680	1.11817	0.29680	0.12231	0.08263	N.Q.	0.00430	0.00038	0.00031	0.00043	N.D.	N.D.	N.D.	N.Q.
BAM	9/07/93	36	0.22731	0.84791	N.D.	0.07106	0.08428	N.Q.	0.00173	N.Q.	N.Q.	N.Q.	N.D.	N.D.	N.D.	N.Q.

Concentrations (ng/m^3) of PAHs in Air - Filter - Elms, 1993

Sample ID	Date	Week	Flu	Phen	Ant	Fla	Pyr	B[a]A	Chry	B[b]F	B[k]F	B[e]P	B[a]P	I[123]P	D[ah]A	B[ghi]P
BV	1/12/93	2	0.00972	0.10342	0.00514	0.07228	0.05546	0.03971	0.09949	0.12162	0.10880	0.11358	0.04047	0.13289	0.01463	0.13578
BW	1/26/93	4	0.00781	0.16086	N.Q.	0.15567	0.12943	0.09543	0.29973	0.37110	0.30363	0.29438	0.19364	0.39949	0.04545	0.34372
BX	2/08/93	6	0.00998	0.16771	N.Q.	0.19328	0.11588	0.02983	0.16248	0.15354	0.12563	0.13003	0.05559	0.10084	0.00272	0.09679
BY	2/23/93	8	0.00928	0.18942	N.D.	0.17445	0.11899	0.04751	0.10776	0.07699	0.07578	0.07457	0.05765	0.11184	0.00878	0.07757
BZ	3/09/93	10	0.01041	0.11856	N.D.	0.06657	0.05318	0.02732	0.05674	0.07879	0.06908	0.07305	0.04458	0.09752	0.01101	0.06835
BAA	3/23/93	12	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	0.03345	N.D.	0.03494
BAB	4/07/93	14	0.00410	0.05786	N.D.	0.07815	0.05275	0.01338	0.05212	0.05014	0.04103	0.04986	0.02068	0.02858	0.00222	0.02996
BAC	4/20/93	16	0.00252	0.02223	N.D.	0.01618	0.01357	0.00526	0.01293	0.01588	0.01068	0.01443	0.00779	0.01488	0.00145	0.01633
BAD	5/04/93	18	0.00282	0.01943	0.00097	0.01675	0.01804	0.00291	0.00935	0.00477	0.00460	0.00590	0.00299	0.00394	N.D.	0.00672
BAE	5/18/93	20	0.00425	0.03294	N.Q.	0.02708	0.02726	0.00232	0.01014	0.01030	0.00856	0.01082	0.00400	0.00588	0.00069	0.00777
BAF	6/01/93	22	N.Q.	N.Q.	N.D.	N.Q.	N.Q.	N.Q.	0.00065	0.00083	0.00063	0.00074	0.00038	0.00034	N.D.	N.Q.
BAG	6/15/93	24	0.00646	N.Q.	0.06229	0.03640	0.03394	0.00748	0.02413	0.03753	0.02889	0.03974	0.01221	0.01553	N.D.	0.02030
BAH	6/29/93	26	N.Q.	0.04608	0.00273	0.04588	0.04595	0.01060	0.03710	0.03527	0.02186	0.03196	0.01374	0.02132	0.00338	0.02926
BAI	7/13/93	28	N.Q.	0.02741	N.Q.	0.02835	0.03630	0.00328	0.01369	0.01118	0.00714	0.01068	0.00478	0.00647	0.00068	0.00959
BAJ	7/27/93	30	N.Q.	0.02878	0.00145	0.02240	0.01823	0.00540	0.01787	0.02148	0.01594	0.02011	0.00967	0.01206	0.00210	0.01525
BAK	8/10/93	32	0.00301	0.02276	N.Q.	0.01622	0.01949	N.Q.	0.00856	0.00811	0.00436	0.00764	0.00307	0.00507	N.D.	0.00852
BAL	8/24/93	34	0.00225	0.01744	N.D.	0.00982	0.00790	0.00290	0.00884	0.01045	0.00641	0.01136	0.00472	0.00810	0.00131	0.01099
BAM	9/07/93	36	0.00320	0.03117	N.D.	0.01715	0.01978	0.00257	0.01048	0.01121	0.00917	0.01277	0.00437	0.00512	N.Q.	0.00642

Concentrations (ng/m^3) of PAHs in Air - Vapor - Wye, 1993

Sample ID	Date	Week	Flu	Phen	Ant	Fla	Pyr	B[a]A	Chry	B[b]F	B[k]F	B[e]P	B[a]P	I[123]P	D[ah]A	B[ghi]P
CK	1/12/93	2	3.085092	6.131426	0.239768	0.469666	0.339322	0.008871	0.027736	0.003343	0.002736	0.002211	N.D.	N.D.	N.D.	0.0018
CL	1/26/93	4	1.444491	2.728189	0.065535	0.387437	0.172486	0.011849	0.031338	0.022459	0.019715	0.017049	0.011766	0.016748	0.00292	0.014865
CM	2/08/93	6	0.382623	0.622843	0.012607	0.074315	0.028192	N.D.	0.002743	0.000664	0.000653	0.000253	0.000199	N.Q.	N.D.	0.000364
CN	2/23/93	8	0.363346	0.574504	N.D.	0.062758	0.012621	N.Q.	0.000886	0.000377	0.000245	0.000355	0.000229	0.000367	N.D.	0.000428
CO	3/09/93	10	0.739217	1.154033	N.D.	0.103974	0.042866	N.Q.	0.003299	0.000816	0.000668	0.000999	0.000615	N.Q.	N.D.	N.D.
CP	3/20/93	12	0.272204	0.502942	N.D.	0.037931	0.024442	0.000959	0.003406	0.000918	0.000751	0.000828	0.000446	N.D.	N.D.	N.Q.
CQ	4/07/93	14	0.081663	0.263448	N.D.	0.060918	0.036248	N.Q.	0.002473	0.00007	0.000057	0.000145	0.000065	N.D.	N.D.	N.D.
CR	4/18/93	16	0.435808	0.575648	N.D.	0.097071	0.051385	N.Q.	0.006309	0.000572	0.000468	0.000542	0.000404	N.D.	N.D.	N.Q.
CS	5/04/93	18	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
CT	5/18/93	20	0.447608	0.717264	N.D.	0.073145	0.045977	N.Q.	0.002228	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
CU	6/01/93	22	0.479078	0.738058	N.D.	0.073424	0.047785	N.Q.	0.005338	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.Q.
CV	6/15/93	24	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
CW	6/29/93	26	0.143972	0.677406	N.D.	0.067964	0.068097	N.Q.	0.007345	0.001392	0.001139	0.00162	0.000716	0.002104	N.D.	0.002292
CX	7/13/93	28	0.636951	1.562283	N.D.	0.139186	0.109577	N.Q.	0.004893	N.Q.	N.Q.	N.Q.	N.D.	N.D.	N.D.	N.Q.
CY	7/27/93	30	0.760226	2.311337	N.D.	0.232639	0.194056	N.D.	0.009993	0.000703	0.000575	0.001022	N.Q.	N.Q.	N.D.	0.000446
CZ	8/10/93	32	0.488099	1.344699	N.D.	0.091979	0.116366	N.D.	0.002678	0.000747	0.000592	0.000722	0.000388	N.Q.	N.Q.	0.001654
CAA	8/24/93	34	0.278278	1.277878	N.D.	0.160047	0.175032	N.D.	0.013383	0.000912	0.000748	0.00126	N.Q.	N.D.	N.D.	N.D.
CAB	9/07/93	36	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
CAC	9/21/93	38	0.380366	1.133014	N.D.	0.049839	0.080685	N.Q.	0.002688	0.000309	N.Q.	0.00041	N.Q.	N.D.	N.D.	N.D.
CAD	10/05/93	40	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.

Concentrations (ng/m^3) of PAHs in Air Filter - Wye 1993

Sample ID	Date	Week	Flu	Phen	Ant	Fla	Pyr	B[a]A	Chry	B[b]F	B[k]F	B[e]P	B[a]P	I[123]P	D[ah]A	B[ghi]P
CK	1/12/93	2	0.00505	0.10778	N.D.	0.10352	0.09272	0.15285	0.40484	0.32950	0.13553	0.34023	0.14314	0.34031	0.03449	0.37550
CL	1/26/93	4	0.00510	0.12772	0.01130	0.20399	0.15070	0.07354	0.19697	0.12798	0.10470	0.11907	0.06674	0.12026	0.01612	0.10966
CM	2/08/93	6	0.00413	0.10519	0.00365	0.15444	0.11438	0.03753	0.15977	0.12669	0.10368	0.11411	0.04803	0.09818	0.01029	0.08521
CN	2/23/93	8	N.Q.	0.10096	0.00644	0.11419	0.08223	0.03783	0.10432	0.07543	0.06112	0.07009	0.03783	0.05466	0.00195	0.05205
CO	3/09/93	10	0.00733	0.07161	N.D.	0.05620	0.03623	0.01830	0.06552	0.07934	0.06491	0.06517	0.02481	0.05869	0.00760	0.05662
CP	3/20/93	12	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
CQ	4/07/93	14	0.00252	0.03164	N.D.	0.03833	0.02703	0.01192	0.05031	0.06795	0.05559	0.05171	0.01629	0.03230	0.00511	0.03102
CR	4/18/93	16	0.00105	0.00990	N.D.	0.00386	0.00320	0.00205	0.00595	0.00208	0.00170	0.00257	0.00219	0.00548	N.D.	0.00484
CS	5/04/93	18	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
CT	5/18/93	20	0.00203	0.01453	N.Q.	0.01062	0.00838	0.00158	0.00626	0.00510	0.00434	0.00465	0.00190	0.00329	N.Q.	0.00445
CU	6/01/93	22	N.Q.	N.Q.	0.05277	0.04564	0.03259	0.00883	0.03119	0.03020	0.02345	0.02795	0.01493	0.02113	0.00101	0.02242
CV	6/15/93	24	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
CW	6/29/93	26	N.Q.	0.01559	0.00071	0.00701	0.00732	0.00139	0.00548	0.00291	0.00242	0.00316	0.00183	0.00261	N.Q.	0.00278
CX	7/13/93	28	0.00381	0.04451	0.00194	0.03209	0.02777	0.00814	0.02279	0.02182	0.01694	0.01971	0.01292	0.01592	0.00201	0.01701
CY	7/27/93	30	N.Q.	0.02274	0.00108	0.02011	0.01710	0.00415	0.01637	0.01593	0.01168	0.01392	0.00768	0.00917	0.00128	0.01088
CZ	8/10/93	32	0.00279	0.01600	N.Q.	0.01376	0.01398	N.Q.	0.00974	0.00443	0.00362	0.00489	0.00194	0.00265	N.D.	0.00417
CAA	8/24/93	34	0.00154	0.01111	N.Q.	0.00729	0.00661	N.Q.	0.00926	0.00840	N.D.	0.00393	0.00182	0.00210	N.D.	0.00282
CAB	9/07/93	36	0.00237	0.01239	N.D.	0.00771	0.00688	N.Q.	0.00815	0.00603	0.00493	0.00652	0.00309	0.00600	N.Q.	0.00634
CAC	9/21/93	38	0.00515	0.06135	N.Q.	0.05119	0.09719	0.00572	0.01988	0.02285	N.D.	0.01877	0.00672	0.00672	N.D.	0.01539
CAD	10/05/93	40	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.

PAH Concentrations (ng/L) in Resins-Wye,1992

SampleID	Date	Week	Vol. (L)		Flu	Phen	Ant	Fla	Pyr	B[a]A	Chrysene	B[b]F	B[k]F	B[e]P	B[a]P	I[123]P	di[ah]A	B[ghi]P
072892WR	7/14/92-7/28/92	30		38	1.585	8.804	0.369	4.315	2.897	0.287	1.100	0.673	0.541	0.550	NQ~	nd	nd	nd
081192WR	7/28/92-8/11/92	32		28.5	0.885	3.297	0.441	3.055	1.446	0.148	0.917	0.495	0.274	0.330	0.156	0.126	nd	0.449
082592WR	8/11/92-8/25/92	34		50.5	0.834	2.147	0.181	1.119	0.483	0.004	0.308	0.240	nd	0.107	NQ	0.131	0.120	nd
090892WR	8/25/92-9/08/92	36		16.8	0.740	2.289	0.122	1.932	0.933	1.266	1.036	nd	nd	nd	nd	nd	nd	nd
092292WR	9/08/92-9/22/92	38		2.794	1.063	3.897	0.440	5.253	1.773	0.515	0.529	nd	nd	nd	nd	nd	nd	nd
WMFBR*	9/22/92-10/06/92	40			nd~~	0.1060	nd	0.1390	0.0577	nd	nd	nd	nd	nd	nd	nd	nd	nd
JEB blk^					0.51	nd	nd	4.38	nd	nd	nd	nd	nd	nd	4.52	nd	nd	nd
JKR blk^					1.01	5.79	nd	1.06	0.81	0.31	0.58	1.40	0.44	nd	16.29	1.09	nd	2.19

^ lab blank, ng
* field blank, no precipitation, assume 50 L
~ not quantifiable, i.e. blank mass > 33% sample mass
~ ~ not detected, i.e. no peak

PAH Concentrations (ng/L) in Filters-Wye,1992

SampleID	Date	Week	Vol.(L)		Flu	Phen	Ant	Fla	Pyr	B[a]A	Chrysene	B[b]F	B[k]F	B[e]P	B[a]P	I[123]P	di[ah]A	B[ghi]P
072892WF	7/14/92-7/28/92	30		38	0.106	1.038	0.097	1.642	1.349	0.269	0.805	0.423	0.000	0.841	ND	0.217	ND	0.565
081192WF	7/28/92-8/11/92	32		28.5	0.184	1.733	ND	2.784	2.189	0.458	1.197	0.934	ND	1.356	ND	0.908	ND	0.928
090892WF	8/25/92-9/8/92	36		16.8	0.206	2.223	0.173	3.357	2.496	0.506	1.762	1.398	2.291	0.259	0.000	0.000	0.000	0.616
092292WF	9/08/92-9/22/92	38		2.794	0.278	4.119	0.238	5.198	4.081	1.075	3.306	4.347	1.976	2.252	0.000	0.000	0.784	0.678
7040B1F^					ND~~	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
7040B2F^					ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
7040FFB^					ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND

^lab blank, ng
~ ~ not detected, i.e. no peak

PAH Concentrations (ng/L) in Filters-Haven Beach,1992

SampleID	Date	Week	Vol.(L)		Flu	Phen	Ant	Flu	Pyr	B[a]A	Chrysene	B[b]F	B[k]F	B[e]P	B[a]P	I[123]P	di[ah]A	B[ghi]P
NH001F	1/1/92-1/14/92	2	16		ND	0.451	ND	0.700	0.691	0.425	ND	ND	ND	ND	ND	ND	ND	ND
NH002F	1/14/92-1/29/92	4	16.82		ND	0.911	0.000	1.330	1.075	0.270	0.965	2.646	ND	ND	ND	0.944	ND	0.488
NH003F	1/29/92-2/11/92	6	0.6		ND	15.722	1.806	20.072	16.457	6.990	8.359	17.893	ND	12.396	9.657	ND	ND	ND
NH004F	2/11/92-2/27/92	6	63		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
NH005F	2/27/92-3/10/92	10	22.8		ND	0.215	ND	0.239	ND	ND	0.242	ND	ND	ND	ND	ND	ND	ND
NH006F	3/10/92-3/24/92	12	16.33		ND	3.67	ND	4.36	3.21	ND	29.98	1.48	0.40	1.67	0.55	ND	ND	0.85
NH006EF	3/24/92-3/27/92	14	32.85		0.395	1.976	0.000	1.344	0.900	0.519	0.934	2.344	2.648	2.320	1.985	10.173	0.000	0.000
NH007F	3/27/92-4/07/92		6.82		1.189	2.263	0.724	3.976	3.942	ND	1.092	ND	ND	ND	3.671	ND	ND	ND
NH008F	4/07/92-4/21/92	16	10.18		1.839	1.828	0.396	1.514	1.051	0.381	0.691	0.948	0.371	0.750	0.355	0.878	0.000	0.606
NH009F	4/21/92-5/05/92	18	55.6		0.168	1.437	ND	3.625	3.229	0.554	1.186	2.025	0.777	1.116	1.279	0.894	ND	0.617
NH010F	5/05/92-5/20/92	20	57.27		0.122	0.374	0.105	0.398	0.293	0.095	0.227	0.517	ND	0.250	0.298	0.498	ND	0.288
NH011F	5/20/92-6/02/92	22	27.90		0.051	0.280	0.059	0.374	0.239	0.072	0.172	0.409	ND	0.166	0.080	ND	ND	ND
NH012F	6/02/92-6/16/92	24	19.71		0.117	0.556	0.107	0.666	0.468	0.126	0.304	0.680	ND	0.258	0.228	0.652	ND	0.580
NH013F	6/16/92-6/30/92	26	74		0.138	0.970	0.175	1.529	0.945	0.290	0.805	0.805	0.261	0.472	0.052	0.641	0.113	0.648
NH014F	6/30/92-7/14/92	28	28.57		0.085	0.301	0.088	0.364	0.287	0.143	0.349	0.492	ND	0.251	0.108	ND	ND	ND
NH015F	7/14/92-7/28/92	30	135.3		ND	0.173	ND	0.147	0.118	ND	0.080	0.160	0.061	0.142	0.034	ND	ND	ND
NH016F	7/28/92-8/11/92	32	113.9		0.015	0.298	0.010	0.551	0.456	0.085	0.468	0.507	0.643	0.493	ND	ND	ND	ND
NH016EF	8/11/92-8/12/92	34	42.535		0.043	0.241	0.016	0.207	0.155	0.050	0.153	0.105	0.130	0.053	0.000	0.000	0.000	0.000
NH017F	8/12/92-8/28/92		142.24		0.026	0.146	0.013	0.164	0.139	0.026	0.087	0.079	0.115	0.082	ND	ND	ND	0.027
NH018F	8/28/92-9/08/92	36	63		ND	0.220	0.033	0.532	0.483	0.084	0.224	0.627	ND	0.243	0.250	0.147	ND	0.212
NH019F	9/08/92-9/22/92	38	20.85		ND	0.332	ND	0.723	0.671	0.170	0.483	0.980	0.113	0.428	0.380	ND	ND	ND
NH020F	9/22/92-10/06/92	40	97.3		0.000	11.948	0.000	0.000	0.000	6.770	14.124	NQ~	NQ	NQ	NQ	ND	ND	ND
NH021F	10/06/92-10/20/92	42	7.67		ND	0.725	0.190	1.408	1.191	0.314	0.516	0.675	0.331	0.343	0.242	ND	ND	ND
NH022F	10/20/92-11/03/92	44	23.12		0.114	1.192	0.100	3.334	0.134	0.501	1.355	2.555	0.872	0.975	1.680	1.152	ND	1.327
NH024F*	11/17/92-12/01/92				ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
NH025F	12/01/92-12/15/92	50	82.1		ND	0.374	ND	0.929	0.837	0.205	0.711	1.218	0.777	0.636	0.464	1.021	ND	0.790
NH026F	12/15/92-12/30/92	52	31.445		ND	0.458	ND	0.090	0.096	ND	ND	ND	7.844	ND	ND	ND	ND	ND
NHBF^					ND--	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND

^ lab blank, ng
*field blank, no precipitation, assume 50 L
~ not quantifiable, i.e. blank mass > 33% sample mass
-- not detected, i.e. no peak

PAH Concentrations (ng/L) in Resins-Haven Beach,1992

SampleID	Date	Week	Vol.(L)	Flu	Phen	Ant	Fla	Pyr	B[a]A	Chrysene	B[b]F	B[k]F	B[e]P	B[a]P	I[123]P	d[ah]A	B[ghi]P
NH001R	1/1/92-1/14/92	2	18	1.112	3.556	0.100	1.911	1.017	nd	nd	nd	nd	nd	nd	nd	nd	nd
NH002R	1/14/92-1/29/92	4	18.82	0.893	2.874	nd~ ~	0.949	0.327	0.056	0.157	0.049	nd	0.092	nd	nd	nd	nd
NH003R	1/29/92-2/11/92	6	0.6	10.613	NQ~	5.099	14.625	10.707	6.211	16.242	nd	nd	nd	nd	nd	nd	nd
NH004R	2/11/92-2/27/92	8	63	0.379	1.536	0.064	0.974	0.441	nd	0.236	nd	nd	nd	nd	nd	nd	nd
NH005R	2/27/92-3/10/92	10	22.8	1.050	3.665	0.284	2.937	1.685	0.391	1.459	1.101	0.870	0.465	nd	nd	nd	0.874
NH006R	3/10/92-3/24/92	12	18.33	1.068	6.206	0.471	3.593	2.814	0.507	2.259	2.232	1.397	1.155	1.166	nd	nd	nd
NH006ER	3/24/92-3/27/92	14	32.85	0.341	0.861	nd	NQ	nd	nd	NQ	0.562	0.551	0.335	nd	nd	nd	nd
NH007R	3/27/92-4/07/92	14	6.82	nd	2.681	nd	NQ	4.203	nd	nd	nd	nd	nd	nd	nd	nd	nd
NH008R	4/07/92-4/21/92	16	10.18	1.097	2.550	0.090	1.430	0.776	nd	1.019	nd	nd	0.522	nd	nd	nd	nd
NH009R	4/21/92-5/05/92	18	55.6	0.671	0.446	0.112	1.750	1.187	0.200	0.967	0.605	0.441	0.491	0.265	0.460	nd	0.383
NH010R	5/05/92-5/20/92	20	57.27	0.446	1.493	0.090	1.562	0.931	0.092	0.327	0.170	0.161	0.074	0.083	0.167	nd	0.206
NH011R	5/20/92-6/02/92	22	27.90	0.659	1.712	0.104	0.966	0.542	0.125	0.486	nd	nd	nd	nd	nd	nd	nd
NH012R	6/02/92-6/16/92	24	19.71	0.388	1.623	0.186	NQ	0.937	nd	0.275	0.145	0.139	0.369	nd	nd	nd	0.267
NH013R	6/16/92-6/30/92	26	74	0.356	1.137	0.070	1.060	0.571	0.041	0.239	0.109	0.085	0.075	0.019	0.020	0.019	0.099
NH014R	6/30/92-7/14/92	28	28.57	0.422	1.116	0.122	1.042	0.585	0.060	0.349	0.226	0.160	0.131	nd	nd	nd	nd
NH015R	7/14/92-7/28/92	30	135.3	0.259	1.038	0.058	0.907	0.514	0.039	0.185	nd	nd	0.039	nd	nd	nd	nd
NH016R	7/28/92-8/11/92	32	113.9	0.194	1.030	nd	0.935	0.560	nd	0.304	0.178	0.149	0.170	0.072	0.345	0.052	0.050
NH016ER	8/11/92-8/12/92	34	42.535	0.357	0.775	nd	0.560	nd	nd	NQ	nd	nd	0.403	nd	nd	0.209	0.159
NH017R	8/12/92-8/28/92	34	142.24	0.106	0.384	nd	0.158	0.133	nd	NQ	nd	nd	0.025	nd	nd	0.054	0.030
NH018R	8/28/92-9/08/92	36	63	nd	0.663	0.282	0.655	nd	nd	NQ	nd	0.222	0.087	0.455	nd	0.146	nd
NH019R	9/08/92-9/22/92	38	20.85	0.308	1.084	nd	0.737	nd	nd	NQ	0.192	nd	0.404	0.384	nd	nd	nd
NH020R	9/22/92-10/06/92	40	97.3	0.396	3.554	0.204	1.785	0.973	0.103	0.775	0.617	0.144	3.139	nd	nd	nd	nd
NH021R	10/06/92-10/20/92	42	7.67	0.457	NQ	0.131	1.232	0.926	nd	nd	nd	nd	nd	nd	nd	nd	nd
NH022R	10/20/92-11/03/92	44	23.12	0.875	2.193	0.133	3.227	2.075	0.295	1.187	0.733	0.658	0.520	0.235	0.628	nd	0.587
NH023R	11/3/92-11/17/92	46	11.19	1.043	2.751	0.116	1.993	0.945	nd	0.476	nd	nd	nd	nd	nd	nd	nd
NH024R*	11/17/92-12/01/92	48		0.142	0.083	0.008	0.1370	0.0385	0.0304	0.0252	nd	nd	nd	nd	nd	nd	nd
NH025R	12/01/92-12/15/92	50	82.1	1.483	5.791	0.204	8.131	4.417	0.383	1.815	0.965	0.558	0.578	0.395	0.423	0.085	0.472
NH026R	12/15/92-12/30/92	52	31.445	1.642	5.142	0.125	4.155	2.364	0.152	0.772	0.464	0.246	0.389	0.242	nd	nd	nd
NHBR^				nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd

^ lab blank, ng
* field blank, np precipitation, assume 50 L
~ not quantifiable, i.e. blank mass > 33% sample mass
~ ~ not detected, i.e. no peak

PAH Concentrations (ng/L) in Filters-Elma, 1992

SampleID	Date	Week	Vol.(L)		Flu	Phen	Ant	Fla	Pyr	B[a]A	Chrysene	B[b]F	B[k]F	B[e]P	B[a]P	I[123]P	di[ah]A	B[ghi]P
704043F	1/1/92-1/14/92		2	24.8	ND~~	0.757	0.285	0.508	0.438	0.269	0.595	0.230	nd	2.499	0.351	0.164	nd	0.434
704046F	3/11/92-3/24/92		12	12.6	0.483	4.624	0.572	6.087	4.979	1.327	4.167	2.602	1.297	2.035	1.891	1.787	nd	1.469
704047F	3/24/92-4/07/92		14	41.91	0.799	12.084	1.221	14.716	11.939	4.101	10.884	10.087	3.144	10.040	6.188	4.729	nd	4.127
704048F	4/07/92-4/21/92		16	8.37	3.091	13.460	ND	16.139	15.601	4.715	10.527	NQ~	2.571	5.607	NQ	3.788	ND	ND
704049F	4/21/92-5/05/92		18	5.0	ND	6.335	3.621	18.635	17.563	ND	6.038	5.964	6.775	3.727	NQ	3.768	1.258	2.857
704050F	5/05/92-5/19/92		20	10.918	0.000	0.508	0.000	0.484	0.373	0.000	nd	nd	nd	nd	nd	nd	nd	nd
704051F	5/19/92-6/02/92		22	100.584	ND	0.445	ND	0.872	0.630	0.109	0.608	0.775	0.221	0.395	1.914	0.315	ND	ND
704052F	6/02/92-6/17/92		24	18.288	nd	nd	nd	2.686	2.938	nd	nd	4.873	nd	nd	nd	nd	3.615	nd
704053F	6/17/92-6/30/92		26	41.91	ND	1.443	ND	1.585	1.302	ND	0.993	1.444	0.787	1.148	2.731	0.968	ND	1.029
704054F	6/30/92-7/14/92		28	18	ND	1.449	ND	2.033	1.711	ND	1.551	1.933	1.375	0.921	2.890	ND	ND	ND
704056F	7/28/92-8/01/92		32	13.2	0.447	5.356	0.486	3.752	3.346	2.836	6.569	7.345	3.973	4.936	3.194	3.472	ND	4.068
704057F	8/01/92-8/11/92		32	207.62	ND	0.081	0.029	ND	ND	ND	0.044	ND	ND	ND	ND	ND	ND	ND
704058F	8/11/92-8/12/92		34	34	0.116	1.262	0.176	0.802	0.677	0.386	1.467	1.071	0.550	0.729	0.414	0.507	ND	0.684
704059F*	8/12/92-8/25/92		34		0.0000	0.4221	0.0764	0.6269	0.3818	0.2113	0.3240	1.0091	0.4568	0.3733	0.2579	0.3248	ND	0.2915
704060F	8/25/92-9/08/92		36	66.6	ND	ND	ND	0.215	0.229	0.049	0.186	0.137	0.041	ND	0.059	ND	ND	ND
704061F	9/08/92-9/22/92		38	7.00	nd	1.190	nd	2.143	2.268	0.950	1.059	nd	nd	2.807	nd	nd	nd	nd
704062F	9/22/92-9/24/92		40	30.6	0.059	0.837	0.091	0.321	0.296	0.294	0.614	0.832	0.508	0.580	3.359	0.593	ND	0.692
704063F	9/24/92-9/27/92		40	13.2	0.137	0.934	0.093	0.339	0.302	0.290	0.588	0.592	0.468	0.485	0.342	0.407	ND	0.463
704064F	9/27/92-10/06/92		40	15	0.231	1.838	0.082	1.033	0.847	0.731	1.667	1.694	1.202	1.330	0.769	1.091	ND	1.102
704065F	10/06/92-10/20/92		42	7.00	0.237	2.379	0.264	2.504	2.125	0.485	1.115	3.113	ND	1.168	ND	0.212	ND	1.495
704066F	10/20/92-11/03/92		44	50.546	0.000	2.531	0.283	3.888	2.851	1.043	4.371	5.426	0.950	7.306	1.983	1.830	0.000	1.885
704068F	11/17/92-12/01/92		48	17.27	0.645	6.061	0.861	15.013	11.402	2.670	9.173	NQ	ND	7.508	7.497	9.955	ND	7.584
704069F	12/01/92-12/15/92		50	64.6	0.000	0.961	0.000	1.369	1.105	0.000	0.355	1.245	0.414	2.776	0.333	0.399	0.000	0.863
704070F	12/15/92-12/30/92		52	37.4	0.084	1.654	0.180	2.980	2.366	ND	0.122	3.133	1.652	1.418	1.557	2.725	ND	2.750
7040B1F^					ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
7040B2F^					ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
7040FFB^					ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND

^lab blank, ng
*field blank, no precipitation, assume 50 L
~not quantifiable, i.e. blank mass > 33% sample mass
- - not detected, i.e. no peak

PAH Concentrations (ng/L) in Resins-Elms,1992

SampleID	Date	Week	Vol.(L)	Flu	Phen	Ant	Fla	Pyr	B[a]A	Chrysene	B[b]F	B[k]F	B[e]P	B[a]P	I[123]P	di[ah]A	B[ghi]P
704043R	1/1/92-1/14/92	2	24.8	1.3916	4.6555	0.1660	1.9118	0.8656	0.1748	0.4972	0.4055	0.2446	0.3239	0.4638	nd	ND	nd
704046R	3/11/92-3/24/92	12	12.6	NQ~	NQ	2.4930	5.7598	5.1545	ND	3.2438	ND	ND	ND	ND	ND	ND	nd
704047R	3/24/92-4/07/92	14	41.91	NQ	NQ	0.8493	3.3855	2.2492	0.5798	1.9759	nd	nd	nd	nd	nd	nd	nd
704048R	4/07/92-4/21/92	16	6.37	NQ	NQ	1.1340	3.3253	2.0025	0.4859	1.8838	NQ	NQ	0.4700	ND	ND	ND	0.8504
704049R	4/21/92-5/05/92	18	5.0	NQ	NQ	0.0937	1.1980	0.7049	0.1208	0.5945	NQ	NQ	0.2708	0.6548	0.5031	ND	0.3708
704050R	5/05/92-5/19/92	20	10.918	NQ	NQ	0.4613	0.9089	0.3469	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
704051R	5/19/92-6/02/92	22	100.584	NQ	NQ	0.0562	0.5243	0.2902	0.0496	0.2803	NQ	NQ	0.1350	0.0758	0.1142	ND	0.1652
704052R	6/02/92-6/17/92	24	16.288	1.4014	NQ	NQ	NQ	0.3440	0.1158	0.2813	ND	ND	ND	ND	ND	ND	ND
704053R	6/17/92-6/30/92	26	41.91	0.1032	NQ	NQ	NQ	0.1318	ND	0.0763	ND	ND	ND	ND	ND	ND	ND
704054R	6/30/92-7/14/92	28	18	0.8853	NQ	NQ	NQ	0.5070	0.2692	0.5803	NQ	0.2574	ND	ND	ND	ND	ND
704056R	7/28/92-8/01/92	32	13.2	0.5419	1.9392	0.1145	0.5151	0.2200	0.1239	0.4904	0.3284	0.1383	0.2585	0.3433	0.2645	ND	ND
704057R	8/1/92-8/11/92	32	207.52	0.0217	NQ	0.0044	NQ	NQ	0.0087	NQ	ND	ND	ND	ND	ND	ND	ND
704058R	8/11/92-8/12/92	34	34	0.4705	2.2744	0.1155	0.4460	0.2291	0.1014	0.4235	0.3500	0.1607	0.2437	0.1983	0.2438	ND	0.3119
704059R*	8/12/92-8/25/92	34		0.510	1.653	0.039	0.632	0.297	0.001	0.146	0.104	0.035	0.077	0.032	0.083	0.000	0.091
704060R	8/25/92-9/08/92	36	66.6	NQ	0.6721	0.0631	0.3943	0.1636	0.0203	0.1441	0.0900	ND	0.1130	ND	ND	ND	ND
704061R	9/08/92-9/22/92	38	7.00	NQ	0.3808	0.0370	NQ	0.0992	0.0202	0.0627	ND	ND	ND	ND	ND	ND	0.0938
704062R	9/22/92-9/24/92	40	30.5	0.5501	2.0533	0.1679	0.4469	0.2111	0.0613	0.2121	0.1480	0.0626	0.0939	ND	0.1057	ND	0.0494
704063R	9/24/92-9/27/92	40	13.2	0.4700	1.3437	0.0000	0.2155	0.1363	0.1248	0.2499	0.1949	0.1254	0.1849	ND	0.2242	ND	0.1745
704064R	9/27/92-10/06/92	40	15	0.5787	1.3728	0.0317	0.2988	0.2003	0.0324	0.2435	0.1576	0.0857	ND	ND	ND	ND	0.1550
704065R	10/06/92-10/20/92	42	7.00	NQ	NQ	NQ	NQ	NQ	0.1087	0.2764	0.0682	ND	ND	ND	ND	ND	ND
704066R	10/20/92-11/03/92	44	50.546	2.3262	NQ	NQ	NQ	NQ	0.3988	3.1786	3.3489	0.8150	1.8850	0.3847	0.8184	ND	1.1549
704068R	11/17/92-12/01/92	48	17.27	NQ	NQ	NQ	NQ	NQ	0.1467	0.6382	ND	ND	ND	ND	ND	ND	0.6081
704069R	12/01/92-12/15/92	50	64.5	2.0323	NQ	NQ	NQ	NQ	0.2994	1.3181	0.7794	0.4532	0.5580	0.1839	0.5355	ND	0.6053
704070R	12/15/92-12/30/92	52	37.4	2.8835	NQ	NQ	NQ	NQ	0.2920	1.2570	0.9198	0.6237	0.5910	0.4536	0.4589	ND	0.5844
Lot51XAD^				18.22	80.39	10.82	203.70	56.06	nd~~	nd	nd	nd	nd	nd	nd	nd	nd
699010R^				10.41	29.85	nd	nd	nd	nd	nd	40.04	34.00	nd	nd	nd	nd	nd
XAD1013^				nd~ ~	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
DLL #22^				nd	38.41	60.06	169.89	nd	nd	nd	471.08	nd	nd	282.71	nd	nd	nd
JKR blk^				1.01	5.79	nd	1.06	0.81	0.31	0.58	1.40	0.44	nd	16.29	1.09	nd	2.19
JEB blk^				0.51	nd	nd	4.38	nd	nd	nd	nd	nd	nd	4.52	nd	nd	nd

^lab blank, ng
*field blank, no precipitation, assume 50 L
~not quantifiable, i.e. blnek mass > 33% sample mass
~ ~ not detected, i.e. no peak

Concentration (ng/L) of PAHs in Precipitation Rocks - Wye Institute, 1993

Sample	Date	Vol. (L)	Week	Flu	Phen	Ant	Flt	Pyrene	B[a]A	Chrysene	B[b]F	B[k]F	B[e]P	B[a]P	D[ah]A	B[123cd]P	B[ghi]P
011393WR	12/28/92-01/12	38.062	2	0.04	2.05	0.06	1.06	0.85	0.07	0.20	0.14	0.11	0.44	NQ	0.10	0.12	0.10
	01/12/93-01/27		4														
020993WR	01/27/93-02/09	31.75	6	0.10	NQ	0.11	0.88	0.81	0.10	0.17	0.10	0.10	0.48	NQ	0.21	0.12	0.12
022393WR	02/09/93-02/23	1.934	8	23.78	99.00	1.83	99.89	20.74	4.23	11.75	10.61	5.41	19.43	4.31	10.83	4.91	8.74
030993WR	02/23/93-03/09	7.874	10	7.46	28.88	0.43	13.62	7.04	1.26	3.02	2.74	1.63	4.33	1.31	3.03	1.77	2.52
032393WR	03/09/93-03/23	87.912	12	1.29	4.88	0.10	2.04	1.12	0.23	0.46	0.41	0.21	NQ	0.13	0.47	0.16	0.20
040693WR	03/23/93-04/06	16	14	0.00	2.14	0.10	1.07	0.74	0.12	0.23	0.22	0.14	0.61	NQ	0.42	0.58	0.17
042093WR	04/06/93-04/20	98.000	16	0.01	0.08	0.01	0.07	0.02	0.01	0.01	0.01	0.01	1.00	0.00	0.02	0.03	0.01
050493WRFB	04/20/93-05/04	0	18														
051893WR	05/04/93-05/18	52	20	0.00	2.42	0.20	0.73	0.30	0.02	0.10	0.00	NQ	1.30	NQ	0.00	0.00	0.00
060193WR	05/18/93-06/01	22	22	1.13	3.82	0.45	1.88	1.13	0.23	0.30	0.27	0.16	2.07	NQ	0.44	0.52	0.16
061593WR	06/01/93-06/15	23	24	0.00	2.43	0.12	0.92	0.84	0.24	0.26	0.21	0.00	2.31	NQ	0.52	0.57	0.17
062993WR	06/15/93-06/29	8.852	26	0.02	2.48	0.01	2.01	1.02	0.17	0.47	0.41	0.19	NQ	NQ	0.53	0.48	0.33
	06/29/93-07/14		28														
072793WR	07/14/93-07/28	20.80	30	0.10	0.48	0.00	0.00	0.20	0.00	0.07	0.03	NQ	2.00	NQ	0.10	0.30	0.03
081293WR	07/28/93-08/12	67.13	32	0.03	0.08	0.04	0.37	0.00	0.01	0.01	0.01	NQ	0.74	NQ	0.03	0.04	0.01
	08/12/93-08/26		34														
090793WR	08/26/93-09/08	1.03	36	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	183.00	0.00	0.00	0.00	00.43
092093WR	09/08/93-09/20	20.70	38	2.10	0.00	0.00	3.10	1.30	0.17	0.43	0.21	0.11	4.20	0.16	0.23	0.22	0.22

Concentration (ng/L) of PAHs in Precipitation Filters - Wye Institute, 1993

Sample	Date	Vol. (L)	Week	Flu	Phen	Ant	Fla	Pyrene	B[a]A	Chrysene	B[b]F	B[k]F	B[e]P	B[a]P	D[ah]A	I[123cd]P	B[ghi]P
	12/29/92-01/12	35.852	2														
012793WF	01/12/93-01/27		4	0.31	4.33	0.33	0.48	4.90	1.25	3.45	3.05	2.10	2.13	1.48	2.00	0.21	2.34
022993WF	01/27/93-02/09	31.75	6	0.29	2.38	0.37	3.10	2.44	1.14	1.50	1.70	0.95	1.05	0.89	1.14	0.24	1.06
022393WF	02/09/93-02/23	1.524	8	1.00	31.10	1.72	34.64	20.39	7.91	20.71	21.32	11.90	12.71	8.37	17.50	2.80	14.25
030993WF	02/23/93-03/09	7.974	10	0.99	9.79	12.40	21.11	15.31	4.20	11.34	11.82	7.88	7.60	5.30	8.63	1.32	8.74
032393WF	03/09/93-03/23	13.51	12	0.124	1.790	0.190	2.360	1.844	0.483	1.263	1.397	0.910	2.035	2.040	1.142	0.160	0.994
040693WF	03/23/93-04/06	18	14	ND	ND	ND	ND	0.05	ND	0.04	ND	ND	ND	ND	0.04	0.01	ND
042093WF	04/06/93-04/20	50.899	16	ND	0.1950	0.0663	0.1787	0.1427	0.0300	0.1010	0.1234	0.0607	0.0742	0.0453	0.0025	0.0000	ND
050493WFFB	04/20/93-05/04	0	18														
051093WF	05/04/93-05/18	52	20	0.14	1.61	0.14	1.98	1.52	0.38	1.31	1.38	0.78	0.74	0.71	1.00	0.10	0.88
060193WF	05/18/93-06/01	22	22	0.33	2.99	0.24	3.92	3.07	1.04	2.71	2.63	1.40	1.01	1.20	1.50	0.17	1.89
061593WF	06/01/93-06/15	23	24	0.22	1.74	0.13	2.45	1.98	0.68	1.67	1.84	0.99	1.17	0.79	1.07	0.10	1.27
062993WF	06/15/93-06/29	0.852	26	0.44	5.20	0.36	7.37	6.04	1.91	4.66	10.83	3.30	0.57	4.10	0.73	0.30	0.66
	06/29/93-07/14		28														
072793WF	07/14/93-07/28	0.19	30	0.07	0.62	0.04	0.06	0.79	0.19	0.54	0.45	0.23	0.30	0.26	0.31	0.06	ND
081293WF	07/28/93-08/12	67.15	32	0.01	0.09	0.01	0.06	0.09	0.03	0.06	0.08	0.04	0.05	ND	0.05	0.01	ND
082393WF	08/12/93-08/26		34	ND	0.0589	0.0036	0.0795	0.0671	0.0258	0.0489	0.0421	0.0355	0.0410	ND	0.0511	0.0061	ND
090793WF	08/26/93-09/09		36	1.46	15.00	2.45	19.20	15.14	5.10	11.00	10.32	7.00	0.35	5.70	7.40	1.20	ND
092093WF	09/09/93-09/20	2.19	38	0.17	2.16	0.20	3.03	2.70	0.69	2.25	2.04	1.20	1.65	1.10	1.73	0.31	2.12

Concentration (ng/L) of PAHs in Precipitation Filters - Elms, 1993

Sample	Date	Vol. (L)	Flu	Phen	Ant	Fla	Pyrene	B[a]A	Chrysene	B[b]F	B[k]F	B[e]P	B[a]P	D[ah]A	I[123cd]P	B[ghi]P
704071F	12/26/92-01/12	95.9	0.08	0.72	0.07	0.89	0.80	0.33	0.78	0.71	0.45	0.40	0.33	1.07	0.82	1.83
704072F	01/12/93-01/27	17.10	0.31	2.96	0.23	3.86	3.02	1.86	4.40	8.40	3.42	3.74	1.81	15.89	1.81	10.85
	01/27/93-02/09															
704074F	02/09/93-02/23	56.642	0.31	4.15	0.23	1.81	1.30	0.32	1.08	1.47	0.71	0.89	0.26	3.70	0.46	3.89
704075F	02/23/93-03/09	84.282	0.03	0.81	0.09	0.83	0.41	0.11	0.32	0.35	0.20	0.20	0.18	0.94	0.35	1.00
	03/09/93-03/23															
704077F	03/23/93-04/06	40.12														
704078F	04/06/93-04/20	18	0.78	0.17	0.46	1.47	1.44	0.43	0.93	3.73	1.29	1.40	0.89	1.41	0.23	ND
704079F	04/20/93-05/04	28.6	0.67	1.22	0.21	1.07	1.45	1.10	2.29	2.64	1.00	1.01	0.96	3.05	0.84	3.98
704080F	05/04/93-05/18	104.8	0.24	1.67	0.15	3.11	2.33	0.65	2.07	2.37	1.53	1.83	0.89	1.16	0.67	1.30
704081F	05/18/93-06/01	24.6	0.26	2.66	0.47	1.21	0.95	0.31	0.78	1.18	0.48	0.73	0.36	0.72	0.12	ND
704082F	06/01/93-06/15	11	0.22	1.86	0.19	2.74	2.28	0.67	1.90	1.93	1.06	1.42	0.82	0.99	0.19	ND
704083F	06/15/93-06/21	7.85	0.3252	3.1569	0.2353	2.2493	1.0569	0.5144	1.2907	1.4224	0.7775	0.9561	0.6554	1.0251	0.1581	ND
704084F	06/21/93-06/29	11.2	0.12	0.86	0.07	0.98	0.89	0.29	0.84	0.70	0.33	0.45	0.28	0.39	0.10	ND
704085F	06/29/93-07/14	15	0.62	4.96	0.33	2.00	1.52	0.49	1.24	2.31	0.70	1.05	0.51	1.05	0.28	ND
704086F	07/14/93-07/28	12.5	0.15	2.12	0.10	4.01	3.23	0.97	3.11	3.05	1.85	2.08	1.07	1.55	0.29	1.00
704087F	07/28/93-08/12	62.95														
704088F	08/12/93-08/26	13.51	0.78	7.36	0.83	3.05	2.87	1.11	2.98	3.38	1.91	2.21	1.93	2.81	0.44	2.16
704089F	08/26/93-09/08	7.223	0.57	6.41	0.59	10.70	7.70	2.90	6.65	8.87	4.51	4.60	3.76	4.27	0.85	4.75
704090F	09/08/93-09/20	48.9	0.09	0.79	0.10	0.30	0.28	0.10	0.22	1.20	0.10	0.10	0.10	0.10	0.04	ND
704091F	09/21/93-09/24	10.8														

Concentration (ng/L) of PAHs in Precipitation Resins - Elmo, 1993

Sample	Date	Vol. (L)	Flu	Phen	Ant	Fla	Pyrene	B[a]A	Chrysene	B[b]F	B[k]F	B[e]P	B[a]P	D[ah]A	I[123cd]P	B[ghi]P
704071R	12/26/92-01/12	85.9	1.827	7.696	0.268	3.301	2.258	0.302	1.065	0.696	0.875	1.067	0.332	2.226	0.520	1.906
704072R	01/12/93-01/27	17.16	2.018	8.362	0.278	3.436	2.469	0.402	1.106	0.831	0.890	3.408	NQ	2.972	2.659	2.347
	01/27/93-02/09															
704074R	02/09/93-02/23	56.842	1.104	5.397	0.068	3.509	2.485	0.286	1.447	1.496	0.572	1.044	0.378	0.769	0.230	0.586
704075R	02/23/93-03/09	64.262	0.227	NQ	0.032	1.399	0.559	0.070	0.197	0.185	0.130	0.511	0.081	0.200	0.154	0.112
	03/09/93-03/23															
704077R	03/23/93-04/06	40.12	0.821	2.934	0.063	1.139	1.004	0.159	0.489	0.473	0.259	1.006	0.217	0.455	0.241	0.368
704078R	04/06/93-04/20	15	0.716	2.611	0.095	0.839	2.200	0.181	0.351	0.213	0.173	4.360	NQ	0.238	0.250	0.175
704079R	04/20/93-05/04	29.5	0.389	1.821	0.165	1.051	0.980	0.349	0.679	0.213	0.187	1.007	NQ	0.160	0.190	0.094
704080R	05/04/93-05/18	104.8	0.507	1.812	0.105	0.811	0.380	0.034	0.158	0.058	0.043	0.721	NQ	0.034	0.082	0.002
704081R	05/18/93-06/01	24.8	0.064	NQ	0.009	0.568	0.159	0.020	0.040	0.026	NQ	NQ	NQ	0.048	0.074	0.305
704082R	06/01/93-06/15	11	3.958	10.741	0.569	5.867	3.001	0.398	1.757	1.451	1.150	7.382	0.767	1.338	1.088	1.205
704083R	06/15/93-06/21	7.95	0.573	NQ	0.152	3.415	1.018	0.045	0.161	0.127	NQ	NQ	NQ	0.098	0.244	0.125
704084R	06/21/93-06/29	17.2	0.193	NQ	0.036	1.132	0.344	NQ	0.032	0.026	NQ	NQ	NQ	0.000	NQ	0.044
704085R	06/29/93-07/14	15	0.998	3.556	0.364	0.000	0.886	0.048	0.206	0.119	0.349	4.861	NQ	0.238	0.624	0.304
704086R	07/14/93-07/28	12.5	0.230	NQ	0.269	0.000	0.630	0.041	0.333	0.181	0.212	3.341	NQ	0.180	0.452	0.150
704087R	07/28/93-08/12	62.85	0.208	0.810	0.062	0.420	0.372	0.041	0.185	0.110	0.053	0.966	NQ	0.098	0.110	0.000
704088R	08/12/93-08/26	13.51	0.449	NQ	0.000	0.433	0.265	0.047	0.187	0.134	0.125	3.021	NQ	0.169	0.291	0.111
704089R	08/26/93-09/06	7.223	0.648	NQ	0.242	0.948	2.357	0.096	0.301	0.177	0.149	8.006	NQ	0.215	0.466	0.292
704090R	09/06/93-09/20	49.9	0.239	0.907	0.090	0.363	0.265	0.025	0.086	0.060	0.043	0.508	NQ	0.062	0.133	0.038
704091R	09/21/93-09/24	18.6	0.244	NQ	0.051	1.491	0.496	0.037	0.106	0.090	0.078	1.503	NQ	0.069	0.134	0.074

Concentration (ng/L) of PAHs in Precipitation Filters - Haven Beach, 1993

Sample	Date	Vol. (L)	Week	Flu	Phen	Ant	Flt	Pyrene	B[a]A	Chrysene	B[b]F	B[k]F	B[e]P	B[a]P	D[ah]A	I[123cd]P	B[ghi]P
HI-027F	12/29/92-01/12	74.63	2	0.0000	0.2150	0.0000	0.2244	0.2719	0.1004	0.5222	0.5004	0.6203	0.2152	0.0402	1.4492	0.2255	1.5098
HI-028F	01/12/93-01/27		4														
HI-028FFB	01/27/93-02/09	0	6														
HI-030F	02/09/93-02/23	33.858	8	0.1992	1.1834	0.0771	3.4307	2.5833	0.7301	2.4020	1.4110	0.7071	0.8166	0.4757	0.0412	0.1201	0.8364
HI-031F	02/23/93-03/09	73.15	10	0.05	0.55	0.05	0.00	0.63	0.20	0.55	0.05	0.37	0.42	0.25	0.43	0.07	0.47
HI-032F	03/09/93-03/23	74.17	12	0.0014	1.2702	0.0037	1.7000	1.3420	0.4008	1.1330	1.5588	0.7775	0.9751	0.5757	1.0070	0.1445	0.9450
HI-033F	03/23/93-04/06	41.33	14	0.0485	0.8757	0.0017	1.4157	1.1427	0.3020	1.0302	1.1200	0.6019	0.7263	0.4582	0.7304	0.1343	0.6803
HI-034F	04/06/93-04/20	23.52	16	0.3000	4.7065	0.4317	2.0702	1.7591	0.5540	1.35	2.0024	1.0170	1.0020	0.7420	1.2540	0.1830	1.0232
HI-035F	04/20/93-05/04		18	0.24	1.08	0.54	ND	ND	0.83	1.40	1.80	0.93	1.04	0.78	1.40	0.20	1.20
HI-036F	05/04/93-05/18		20	0.17	1.07	0.32	1.90	1.91	0.45	1.55	1.84	0.82	1.07	0.87	1.20	0.18	1.12
HI-036EF	05/18/93-05/18	12.3	22	0.5002	8.0735	0.5214	1.7107	0.5978	ND	3.0752	1.4025	0.5189	0.9772	0.5198	0.9318	0.1065	ND
HI-037F	05/18/93-06/01	00.00		0.1077	2.1461	0.2318	0.5537	0.5618	0.1700	0.5288	0.6888	0.3499	0.4508	0.2372	0.4829	0.0728	0.4521
HI-038F	06/01/93-06/15	43.48	24	0.0513	0.4495	0.0520	0.0440	0.5905	0.1111	0.4352	0.4299	0.2911	0.3148	0.1915	0.2828	0.0577	ND
HI-039F	06/15/93-06/29	0.345	26	2.1343	14.0000	2.1837	14.0120	13.0590	4.3977	0.3795	0.4197	0.5951	0.4078	ND	0.6573	2.0021	ND
HI-040F	06/29/93-07/14	30.345	28	0.0029	0.7196	0.0700	0.0057	0.0423	0.1502	0.5764	0.5999	0.2429	0.2949	0.1999	0.3025	0.0599	ND
HI-041FFB	07/14/93-07/28	0	30														
HI-042F	07/28/93-08/12	31.13	32	0.0024	0.7856	0.1964	0.9599	0.9749	0.2209	0.6635	0.7188	0.4572	0.5468	0.3367	0.4661	0.0661	ND
HI-043F	08/12/93-08/26	20.68	34	0.0727	0.6238	0.0663	0.0224	0.7496	0.2307	0.6614	0.7761	0.3623	0.4791	0.3232	0.4727	0.0779	ND
HI-044F	08/26/93-09/09	7.00	36	0.1909	1.0622	0.1448	1.4310	1.2144	0.3955	0.9907	1.1297	0.5540	0.7851	0.5404	0.6702	0.1258	ND
HI-045F	09/09/93-09/29	27.18	38	0.1906	0.8871	0.0584	0.8870	0.8750	0.1150	0.3585	0.3447	0.2110	0.2581	0.1499	0.1985	0.0429	ND

Concentration (ng/L) of PAHs in Resins - Haven Beach - 1993

Sample	Date	Vol (L)	Week		Flu	Phen	Ant	Flu	Pyrene	B[a]A	Chrysene	B[b]F	B[k]F	B[e]P	B[a]P	D[ah]A	B[123cd]P	B[ghi]P
			2		bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl
NI-R26R	01/12/93-01/27	35 41	4		0 36	ND	ND	0 70	0 19	0 01	0 00	0 10	0 05	ND	ND	0 13	0 05	0 00
			6	lb	lb	lb	lb	lb	lb	lb	lb	lb	lb	lb	lb	lb	lb	lb
NI-R30R	02/09/93-02/23	33 656	8		0 73	2 63	0 07	1 51	0 77	0 11	0 30	0 02	0 10	2 11	0 17	0 01	0 27	0 34
NI-R31R	02/23/93-03/09	73 18	10		0 54	1 30	0 04	0 42	0 29	0 04	0 11	0 18	0 00	0 17	ND	0 25	0 10	0 10
NI-R32R	03/09/93-03/23	74 17	12		0 37	1 17	0 07	1 32	0 54	0 05	0 10	0 20	0 00	0 00	ND	0 30	0 10	0 11
NI-R33R	03/23/93-04/06	41 33	14		0 00	3 03	0 12	1 11	1 00	0 11	0 31	0 30	0 15	2 15	ND	0 65	0 50	0 24
NI-R34R	04/06/93-04/20	23 52	16		0 30	1 37	0 07	0 00	0 49	0 04	0 11	0 10	0 04	0 24	0 02	0 10	0 00	0 04
NI-R35R	04/20/93-05/04	42 25	18		0 45	1 53	0 11	0 57	0 31	0 15	0 14	0 00	0 11	1 02	ND	0 30	0 10	0 12
NI-R36R	05/04/93-05/18	196 33	20		0 50	1 43	0 03	0 53	0 30	0 03	0 16	0 15	0 04	0 16	0 02	0 11	0 13	0 04
NI-R36ER	05/18/93-06/18	12 3	22		0 53	1 32	0 12	1 00	0 62	0 06	0 18	0 22	0 00	3 70	ND	0 65	0 54	0 18
NI-R37R	05/18/93-06/01	66 94			0 44	1 42	0 00	0 00	0 35	0 05	0 10	0 16	0 07	1 00	0 06	0 30	0 30	0 11
NI-R38R	06/01/93-06/15	43 46	24		0 46	1 20	0 10	0 42	0 25	0 05	0 13	0 20	0 07	0 00	ND	0 39	0 32	0 15
NI-R39R	06/15/93-06/29	0 365	26		3 26	ND	3 77	91 24	24 74	1 20	ND	1 31	ND	97 35	ND	3 00	7 40	0 00
NI-R40R	06/29/93-07/13	30 345	28		0 73	1 99	0 18	3 74	1 00	0 05	0 14	0 12	0 00	1 02	ND	0 35	0 47	0 11
			30	lb	lb	lb	lb	lb	lb	lb	lb	lb	lb	lb	lb	lb	lb	lb
NI-R42R	07/27/93-08/12	31 13	32		0 17	ND	0 00	1 00	0 42	0 04	0 02	0 05	ND	0 58	ND	0 13	0 10	0 02
NI-R43R	08/12/93-08/26	29 68	34		0 19	ND	0 00	0 00	0 27	0 02	0 00	0 00	0 04	0 82	ND	0 14	0 17	0 05
NI-R44R	08/26/93-09/07	7 00	36		0 52	ND	0 24	0 31	0 19	0 00	0 00	0 11	ND	0 72	ND	0 30	0 72	0 00
NI-R45R	09/07/93-09/21	37 16	38		0 24	ND	0 11	0 20	0 12	0 02	0 04	0 10	0 05	1 02	ND	0 22	0 32	0 05

HAVEN 1992 DATA

End Date	ODU ID	Type	grams	cm	Al ug/L	As ug/L	Cd ug/L	Cu ug/L	Fe ug/L	Pb ug/L	Mn ug/L	Ni ug/L	Se ug/L	Zn ug/L	Ca ug/L	K ug/L	Mg ug/L	Na ug/L	Cl ug Cl/L	NO3 ug N/L	SO4 ug S/L
10792	260		1232	1.74	2.52	0.026	0.053	0.39	1.43	0.18	0.11	0.28	0.04	2.25	0.0	173.8	473.5	4522.0	5511.41	42.56	335.62
11492	264		415	0.59	8.95	0.119	0.191	0.74	ISA	0.77	0.26	ISA	0.11	ISA	50.6	39.3	35.3	215.5	474.68	423.77	805.55
12192		NS			NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
12892	265		1271	1.80	4.09	0.017	0.051	0.22	3.61	0.44	0.27	0.24	0.06	6.88	70.1	49.3	171.2	1302.0	2607.70	145.46	414.79
20492	300	FB			FB	FB	FB	FB	FB	FB	FB	FB	FB	FB	FB	FB	FB	FB	36.51	0.00	0.00
21192		NS		0.07	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	2209.95	2029.94	1429.02
21892	271		1957	2.77	5.21	0.060	0.443	0.15	3.51	0.45	0.23	0.31	0.11	8.32	36.9	25.2	46.1	319.6	621.79	282.93	636.62
22592	275		737	1.04	2.25	0.054	0.037	0.33	1.32	0.19	0.25	<0.12	0.07	1.70	25.9	12.2	20.8	136.7	196.04	105.84	406.78
30392	278		1826	2.58	2.67	0.021	0.011	0.14	1.57	0.22	0.15	0.07	0.07	1.09	19.8	10.8	17.8	90.4	252.76	126.70	300.04
31092	282		1572	2.22	63.45	0.107	0.089	0.89	48.91	1.18	4.75	ISA	0.10	ISA	419.3	96.7	201.5	1366.0	2189.75	207.47	431.78
31792	285		1132	1.60	17.83	0.069	0.102	0.28	12.01	0.46	1.03	0.57	0.11	4.83	156.1	73.2	62.6	474.5	961.05	166.88	522.50
32492		NS		0.46	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	2039.44	1057.81	1594.43
33192	290	289	2920	4.13	5.66	0.027	0.082	0.95	4.93	0.29	0.40	<0.12	0.06	4.85	81.4	50.8	141.1	1116.0	2004.70	87.36	225.67
40792		NS	54	0.08	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	1266.98	2117.72	2213.41
41492	294		718	1.02	14.63	0.103	0.038	0.32	11.61	0.45	1.64	0.17	0.13	10.16	101.6	130.9	147.3	1061.0	1775.34	417.89	1116.80
42192		NS	46	0.07	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	2540.70	1994.94	4148.27
42892	298		3459	4.89	7.10	0.055	0.096	0.65	8.55	0.28	1.48	0.12	0.06	2.76	75.8	88.9	101.1	724.1	1296.76	293.99	611.29
50592	303		472	0.67	48.24	0.193	0.078	0.73	56.29	0.91	3.95	0.23	0.15	5.99	217.3	42.4	62.8	259.6	494.53	910.53	1018.71
51292	306		3150	4.46	19.26	0.037	0.016	0.25	17.17	0.32	1.29	0.26	0.16	3.42	277.4	258.0	688.0	6824.0	**********	199.91	1479.35
51992	310		818	1.16	10.77	0.079	0.023	0.44	10.06	0.52	1.38	<0.12	0.21	2.31	67.3	22.1	26.9	124.9	508.71	526.52	1266.18
52692	312		145	0.21	30.20	ISA	0.087	1.06	18.75	0.88	1.31	ISA	0.19	17.68	159.2	178.8	205.0	2157.0	2967.52	696.34	1970.76
60292	315		2018	2.85	7.20	0.027	0.047	0.30	3.10	0.34	0.24	<0.12	0.05	5.76	59.0	47.7	116.6	871.8	1768.25	135.80	332.41
60997	318		1097	1.55	3.71	0.039	0.058	0.36	3.68	0.41	0.40	0.20	0.05	5.34	45.0	31.6	65.5	485.9	842.29	184.93	446.53
61692	320		396	0.56	4.87	0.045	0.052	0.44	4.26	0.43	0.28	<0.12	0.09	17.07	46.2	74.4	15.8	136.6	313.38	224.55	467.04
62392	323		2150	3.04	3.93	0.085	0.124	0.83	7.90	0.49	0.68	0.12	0.11	5.07	72.4	39.0	78.3	589.0	1244.30	397.45	1141.49
63092	326		3080	4.36	10.27	0.088	0.106	0.35	14.45	0.38	1.23	0.38	0.17	4.09	90.8	82.1	40.4	257.3	610.80	403.47	1229.00
July Comp				19.27	8.26	0.029	0.128	0.47	47.40	0.14	1.33	7.55	0.10	2.31	40.0	29.8	55.7	494.6	1284	184.7	607.7
Aug Comp				25.60	8.34	0.048	0.104	0.28	17.22	0.26	0.88	2.07	0.20	4.24	51.4	31.6	49.8	411.9	1575	232.9	807.4
Sep Comp				16.63	6.29	0.018	0.063	0.11	7.80	0.14	0.38	0.64	0.08	2.66	79.0	72.0	191.5	1304.0	1029	144.8	438.9
Oct Comp				2.50	13.23	0.093	0.144	0.65	10.20	0.25	1.01	0.10	0.13	8.14	136.4	80.3	197.5	1399.0	4021	133.1	484.6
Nov Comp				14.11	2.68	0.056	0.069	0.25	3.56	0.30	0.23	0.41	0.12	4.53	33.6	31.9	61.2	491.9	2609	537.4	1081.1
Dec Comp				12.20	1.86	0.026	0.114	0.16	2.35	0.10	0.27	0.10	0.08	3.33	70.5	67.5	191.5	1437.0	2428	170.7	467.3

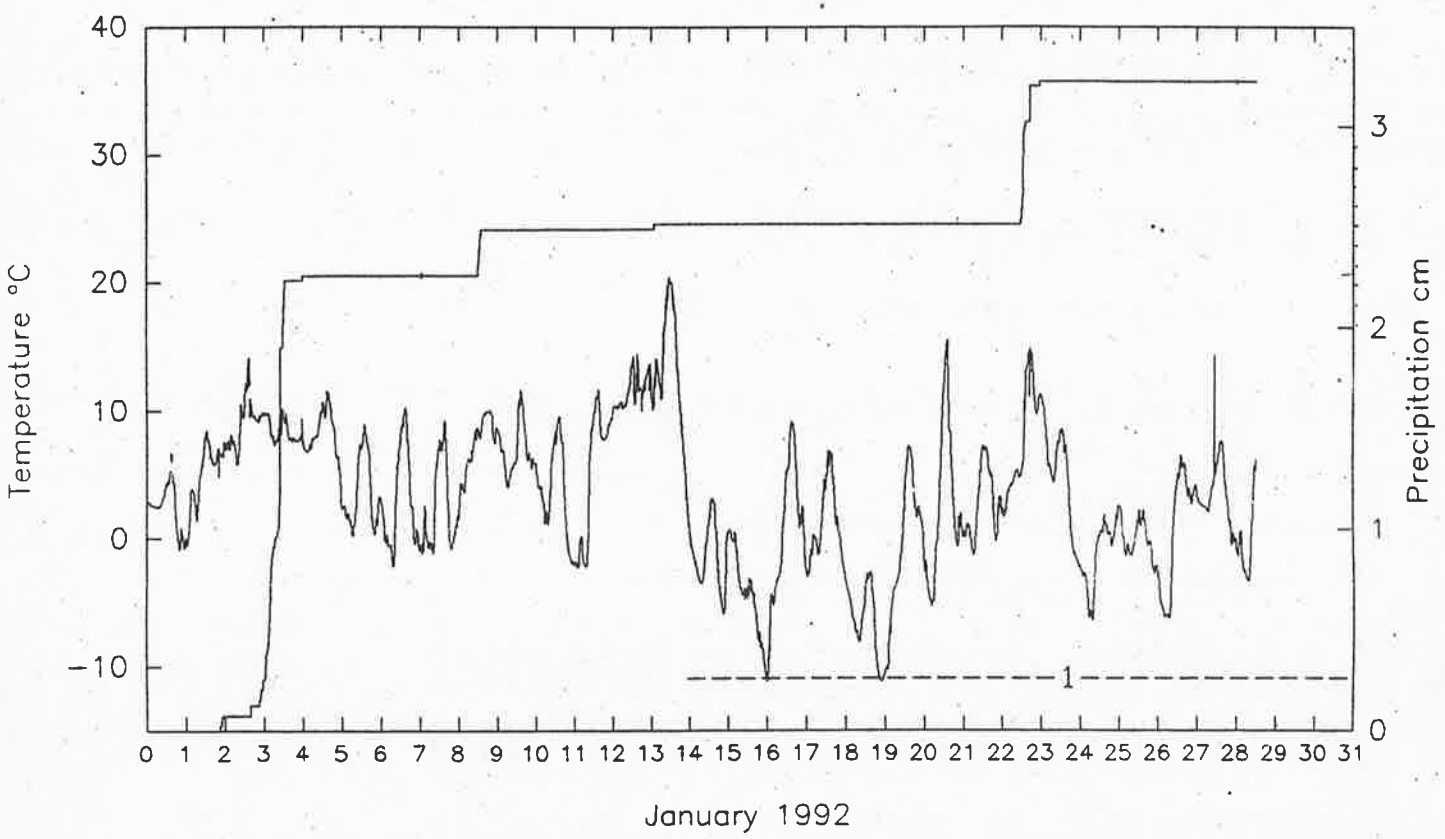
WYE 1992

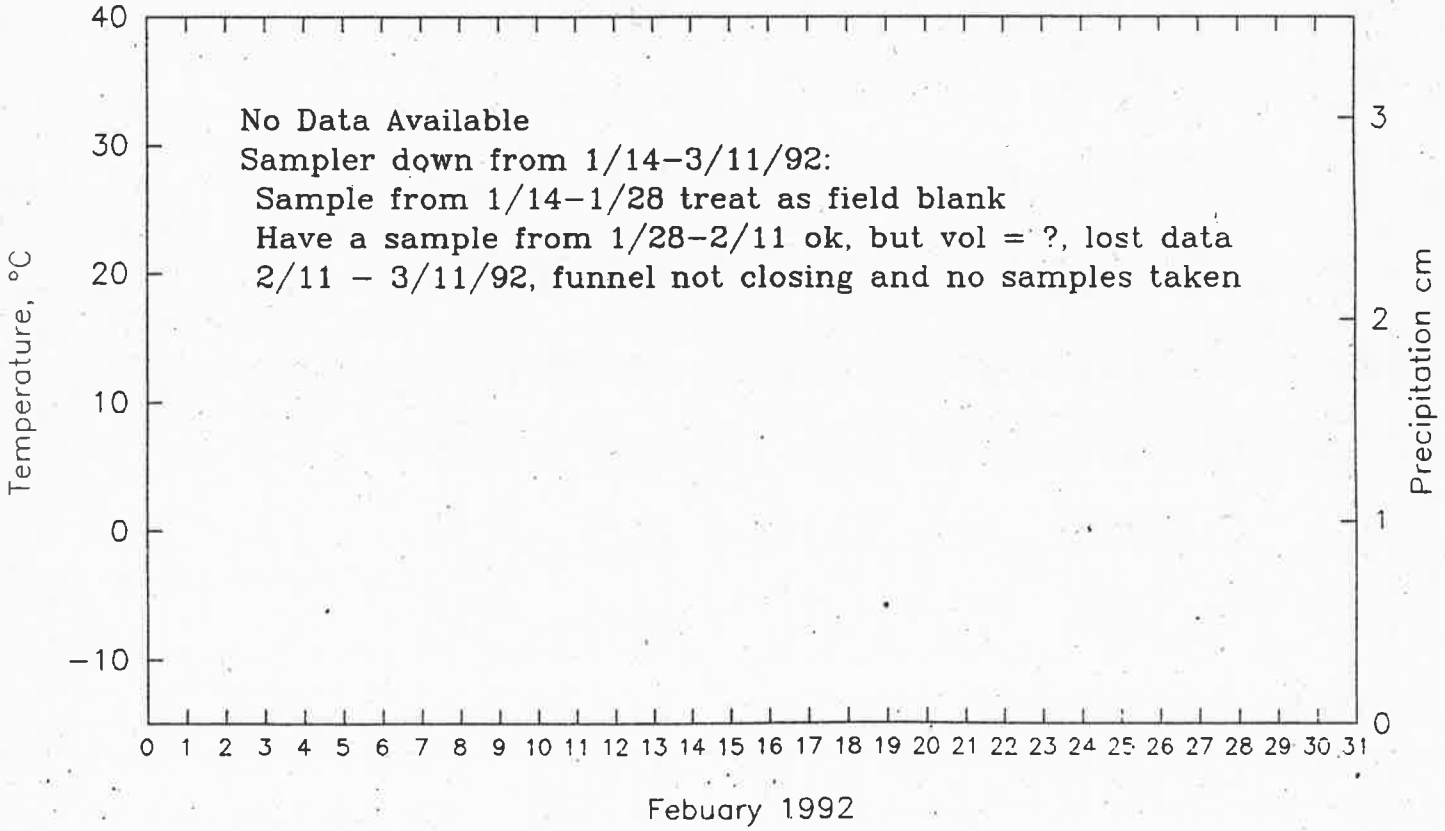
DATE start	DATE stop	CMS ID	# EV	RAIN in	RAIN g	RAIN cm	Al ug/L	As ug/L	Cd ug/L	Cr ug/L	Cu ug/L	Fe ug/L	Mn ug/L	Ni ug/L	Pb ug/L	Se ug/L	Zn ug/L	Ca mg/L	Mg mg/L	K mg/L	Na mg/L	NH4 mg/L	NO3 mg/L	Cl mg/L	SO4 mg/L
123191	10792	78	1	0.16	420	0.41	14.56	0.060	0.005	0.34	1.73	10.56	0.837	0.72	0.36	0.107	9.54	0.163	0.389	0.128	3.240	0.21	0.84	5.76	2.09
10792	11492	79	1	0.08	317	0.20	12.14	0.07	0.021	0.23	0.66	10.17	0.515	0.39	0.51		6.34	0.047	0.015	0.014	0.100	0.16	1.85	0.23	2.10
11492	12192	80	0	FB	FB	FB	FB	FB	FB	FB	FB	FB	FB	FB	FB	FB	FB	miss							
12192	12892	81	3	3.00	932	7.62	10.99	0.041	0.019	0.04	0.17	7.49	0.533	0.13	0.23	0.071	0.69	0.061	0.052	0.016	0.386	0.08	1.51	0.71	1.37
12892	20492	82	0	FB	FB	FB	FB	FB	FB	FB	FB	FB	FB	FB	FB	FB	FB	miss							
20492	21192	83	1	0.06	142	0.15	42.22	ISA	0.111	0.23	1.23	57.00	3.283	0.73	1.58	ISA	10.01	0.290	0.075	0.021	0.350	0.58	10.76	0.90	2.20
21192	21892	84	3	1.16	2376	2.95	1.63	ISA	0.029	0.04	0.06	1.92	0.178	0.23	0.63	ISA	1.03	0.012	0.008	0.003	0.065	0.15	1.05	0.15	1.55
21892	22592	85	2	0.32	539	0.81	9.62	0.136	0.060	0.04	0.31	8.51	0.448	0.43	0.71	0.2	2.02	0.072	0.044	0.020	0.326	0.32	1.76	0.48	3.72
22592	30392	86	1	0.94	1682	2.39	4.32	0.039	0.003	0.04	0.10	6.95	0.502	0.12	0.43	0.016	1.12	0.042	0.006	0.003	0.017	0.06	0.67	0.07	1.07
30392	31092	87	1	1.42	2703	3.61	5.36	0.026	0.020	0.03	0.09	4.95	0.353	0.17	0.33	0.094	0.37	0.058	0.930	0.035	0.782	0.22	0.70	1.31	1.22
31092	31792	88	1	1.00	1829	2.54	40.33	0.126	0.049	0.07	0.20	28.68	1.759	0.19	0.83	0.088	1.21	0.141	0.032	0.020	0.206	0.21	0.72	0.35	1.40
31792	32492	89	4	0.79	1590	2.01	44.11	0.159	0.085	0.08	0.57	37.83	1.805	0.30	1.16	0.17	4.38	0.152	0.029	0.017	0.117	0.55	2.73	0.23	3.43
32492	33192	90	2	1.87	~4000	4.75	6.31	0.024	0.014	0.08	0.08	6.25	0.441	0.21	0.31	0.044	1.24	0.017	0.017	0.003	0.147	0.08	0.52	0.22	0.73
33192	40792	91	1	0.05	151	0.13	72.77	ISA	0.120	0.21	0.64	6.25	2.958	0.33	1.30	ISA	5.60	0.692	0.093	0.029	0.278	1.35	7.96	0.67	6.01
40792	41492	92	2	0.07	148	0.18	42.85	ISA	0.192	0.20	2.04	66.71	8.166	0.54	1.52	ISA	12.92	0.612	0.116	0.176	0.394	1.92	7.84	0.55	11.00
41492	42192	93	2	0.25	507	0.64	146.19	0.278	0.132	0.26	1.25	72.76	5.310	0.36	1.36	0.452	5.87	0.423	0.166	0.168	0.954	1.26	6.14	1.07	8.04
42192	42892	94	6	0.93	1718	2.36	28.00	0.108	0.042	0.08	1.04	50.63	3.810	0.17	0.70	0.145	3.90	0.185	0.076	0.098	0.461	0.40	2.35	0.86	2.80
42892	50592	95	1	ISA	ISA	ISA	ISA	ISA	ISA	ISA	ISA	ISA	ISA	ISA	ISA	ISA	ISA	2.193	0.404	0.543	0.573	2.53	16.11	1.71	12.20
50592	51292	96	3	0.45	1026	1.14	7.14	0.021	0.034	0.02	0.10	7.18	1.037	0.13	0.38	0.033	0.41	0.042	0.026	0.021	0.234	0.11	0.31	0.35	0.49
51292	51992	97	1	0.32	582	0.81	37.85	0.187	0.099	0.09	0.99	35.37	2.852	0.18	1.33	0.454	22.46	0.231	0.047	0.054	0.169	1.03	4.92	0.30	9.00
51992	52692	98	1	0.21	653	0.53	18.44	0.099	0.171	0.03	0.41	20.17	2.364	0.23	0.88	0.147	3.21	0.090	0.034	0.015	0.132	0.43	2.14	0.23	3.61
52692	60292	99	3	1.38	2473	3.51	4.09	0.032	0.004	0.00	0.13	3.86	0.485	0.23	2.08	0.056	0.58	0.033	0.041	0.021	0.329	0.23	0.90	0.51	1.19
60292	60992	100		*cm est	1785	2.41	3.07	0.022	0.020	0.01	0.06	3.30	0.304	0.09	0.16	0.033	0.29	0.009	0.008	0.005	0.089	0.10	0.35	0.13	0.57
60992	61692	101		*cm est	>10	<.01		ISA	ISA	ISA	ISA	ISA	ISA	ISA	ISA	ISA	ISA	0.548	<.050	0.088	1.555	3.89	6.01	1.41	7.95
61692	62392	102		*cm est	132	0.18	32.17	ISA	0.076	0.12	1.15	31.41	2.629	0.12	0.67	ISA	10.07	0.152	0.089	0.067	0.609	0.56	2.35	0.95	3.09
62392	63092	103		*cm est	1483	2.00	38.34	0.133	0.050	0.13	0.97	42.51	3.912	1.07	0.87	0.316	3.97	0.214	0.053	0.060	0.219	0.68	2.95	0.42	6.03
63092	70792	104	2	0.54	979	1.37	28.49	0.446	0.033	0.02	2.26	29.35	3.079	0.21	0.53	0.314	6.94	0.133	0.069	0.059	0.407	0.57	3.26	0.72	5.14
70792	71492	105	0	ISA	ISA	ISA	ISA	ISA	ISA	ISA	ISA	ISA	ISA	ISA	ISA	ISA	ISA	0.488	0.053	0.106	1.201	0.40	5.28	0.92	4.22
71492	72192	106	1	0.10	186	0.25	31.15	ISA	0.034	0.12	0.92	26.67	3.662	1.32	0.74	ISA	3.74	0.291	0.116	0.077	0.505	0.63	3.60	0.74	5.67
72192	72892	107	6	1.87	~3500	4.75	6.31	0.029	0.008	0.01	0.11	5.12	0.483	0.00	0.31	0.095	0.30	0.042	0.054	0.328	0.132	0.63	1.76	0.26	3.31
72892	80492	108	2	1.46	2695	3.71	14.15	0.048	0.000	0.05	0.29	11.62	0.791	0.09	0.48	0.191	1.50	0.058	0.018	0.017	0.102	0.43	1.65	0.21	3.40
JUL COMP							11.61	0.109	0.015	0.03	0.43	11.08	0.917	0.17	0.38	0.095	1.59	0.067	0.044	0.171	0.168	0.55	1.97	0.32	3.65
AUG COMP							3.44	0.016	0.013	0.13	0.12	3.83	0.401	0.13	0.08	0.043	0.52	0.050	0.019	0.009	0.140	0.10	0.80	0.21	1.28
SEPT COMP							7.72	0.023	0.074	1.57	0.46	12.96	1.217	2.03	0.21	0.06	2.37	0.035	0.021	0.011	0.147	0.14	0.81	0.27	1.44
OCT COMP							17.98	0.042	0.069	0.24	0.45	17.92	1.409	0.29	0.55	0.253	2.57	0.175	0.051	0.023	0.295	0.37	2.39	0.54	2.54
NOV COMP							9.33	0.078	0.077	0.10	0.22	10.04	5.820	0.18	0.45	0.159	2.73	0.091	0.066	0.027	0.480	0.22	1.95	0.87	1.94
DEC COMP							9.21	0.026	0.026	0.07	0.15	7.10	0.247	0.31	0.15	0.098	1.73	0.045	0.069	0.028	0.556	0.11	1.08	1.01	1.29

Elms 1992

DATE start	DATE stop	CMS ID	Al ug/L	As ug/L	Cd ug/L	Cr ug/L	Cu ug/L	Fe ug/L	Mn ug/L	Ni ug/L	Pb ug/L	Se ug/L	Zn ug/L	Ca uM/L	Mg uM/L	K uM/L	Na uM/L	NH4 uM/L	NO3 uM/L	Cl uM/L	SO4 uM/L
10192	10792	084	1.58	0.017	0.014	<0.10	0.13	1.36	0.50	0.10	<0.12	0.038	0.46								
10792	11492	085	6.08	0.080	0.053	<0.10	1.26	4.54	0.52	0.53	0.42	ISA	4.80	1.32	0.95	5.14	100.92	18.77	30.15	11.11	35.44
11492	12192	086	ISA	ISA	ISA	ISA	ISA	ISA	ISA	ISA	ISA	ISA	ISA								
12192	12892	087	2.19	0.037	0.031	<0.10	0.26	2.28	0.20	<0.12	0.21	0.082	1.48								
12892	20492	088																			
20492	21192	089	38.29		0.112	0.26	1.64	40.91	2.98	1.07	1.66	ISA	36.14								
21192	21892	090	1.94	0.064	0.038	<0.10	0.43	2.04	0.26	0.33	0.32	0.077	1.52	0.49	0.79	0.47	12.27	10.94	19.65	8.30	17.83
21892	22592	091	0.85	0.085	0.040	<0.10	0.34	1.79	1.26	0.14	0.31	0.068	2.43	0.37	0.65	0.37	9.56	11.15	9.79	7.86	12.38
22592	30392	092	2.58	0.122	0.013	<0.10	0.33	3.31	0.30	0.39	0.25	0.040	1.22	0.31	0.28	0.09	3.49	5.85	12.67	3.41	15.15
30392	31092	093	3.50	0.027	0.028	<0.10	0.50	2.34	0.37	0.19	0.28	0.092	1.09	1.8	6.63	1.59	74.86	8.15	13.85	70.63	15.74
31092	31792	094	6.30	0.034	0.025	<0.10	0.27	4.71	0.68	0.12	0.30	0.033	0.90	0.83	0.59	0.52	6.08	12.32	9.88	5.62	15.19
31792	32492	095	31.86	0.184	0.077	<0.10	0.86	20.45	2.77	0.43	0.79	0.180	3.47	7.49	4.42	1.81	38.02	29.9	76.78	35.41	48.21
32492	33192	096	4.40	0.019	0.106	<0.10	0.32	3.88	0.34	0.07	0.14	0.038	0.30	0.71	1.32	0.43	14.06	2.67	8.12	13.26	7.07
33192	40792	097		ISA	ISA	ISA	ISA	ISA	ISA	ISA	ISA	ISA	ISA	ISA	ISA	ISA	ISA	ISA	ISA	ISA	ISA
40792	41492	098		ISA	ISA	ISA	ISA	ISA	ISA	ISA	ISA	ISA	ISA	ISA	ISA	ISA	ISA	ISA	ISA	ISA	ISA
41492	42192	099	47.03	ISA	0.350	0.12	2.41	41.63	9.24	0.57	0.80	ISA	9.69	9.81	4.89	4.81	30.31	64.12	70.85	16.82	71.98
42192	42892	100	5.78	0.049	0.035	<0.10	0.39	5.34	2.08	0.15	0.41	0.075	0.81	2.54	2.64	3.34	16.6	19.73	41.92	20.77	27.42
42892	50592	101	45.72	0.388	0.130	0.15	2.56	39.10	7.76	1.11	1.77	ISA	10.45	10.67	6.47	13.9	148.77	64.24	138.76	49.33	63.78
50592	51292	102	10.41	0.058	0.017	<0.10	0.13	7.55	1.11	0.26	0.26	0.049	0.39	2.16	5.95	2.08	54.11	7.68	8.26	63.46	16.04
51292	51992	103	7.89	0.050	0.017	<0.10	0.65	10.06	0.95	0.16	0.54	0.091	0.39	1.01	0.71	0.92	129.08	14.74	51.69	11.25	31.01
51992	52692	104	29.26	0.231	0.068	0.10	1.41	24.74	3.18	0.34	1.15	0.438	6.08	4.43	4	1.57	42.2	66.87	97.51	35.96	123.9
52692	60292	105	1.59	0.030	<0.006	<0.10	0.21	1.72	0.29	0.14	0.23	0.034	0.42	0.73	2.51	0.63	40.57	6.39	11.11	25.98	13.19
60292	60992	106	1.61	0.031	<0.006	<0.10	0.37	2.14	0.25	0.17	0.14	0.063	0.42	0.47	0.86	0.28	10.16	3.79	10.73	10.14	11.09
60992	61692	107	4.50	0.059	0.080	<0.10	0.72	4.59	1.09	0.50	0.64	ISA	6.13	1.41	0.52	0.5	5.94	26.45	54.29	7.45	62.22
61692	62392	108	8.55	0.093	0.035	<0.10	0.35	6.61	0.86	<0.12	0.54	0.121	2.56	2.01	3.08	1.16	34.14	20.66	29.91	42.37	43.75
62392	63092	109	8.27	0.087	0.030	<0.10	0.56	7.93	1.68	0.17	0.49	0.198	2.91	2.9	2.5	1.09	20.57	25.3	34.41	25.76	38.7
JULY COMP			5.21	0.040	0.034	<0.10	0.29	4.79	0.651	0.27	0.21	0.097	1.15								
72892	80192	114	27.93	0.058	ISA	ISA	ISA	18.41	2.68	ISA	ISA	0.160	4.96	1.81	0.69	0.33	13.14	13.69	32.19	6.85	33.77
80192	81192	115	60.68	ISA	ISA	ISA	ISA	33.05	ISA	ISA	ISA	ISA	21.22								
81192	81292	116	6.54	0.043	0.067	ND	0.64	6.42	ISA	ISA	0.41	0.136	4.52								
81292	81892	117	3.40	0.002	0.048	ND	0.28	0.61	ISA	ISA	0.30	0.009	3.37								
81892	82592	118	ISA	ISA	ISA	ISA	ISA	ISA	ISA	ISA	ISA	ISA	ISA								
82592	90192	119	ISA	ISA	ISA	ISA	ISA	ISA	ISA	ISA	ISA	ISA	ISA								
SEPT COMP			2.67	0.013	0.068	<0.10	0.13	2.52	0.261	<0.12	<0.12	0.035	0.53								
OCT COMP			14.92	0.131	0.041	<0.10	0.68	13.08	1.087	0.33	0.57	0.142	3.75								
NOV COMP			9.49	0.084	0.055	<0.10	0.38	7.74	0.59		0.27	0.061	1.84								
DEC COMP			1.89	0.027	0.011	<0.10	0.61	1.31	0.119	0.05	0.15	0.035	0.90								

Elms Climatographic Data





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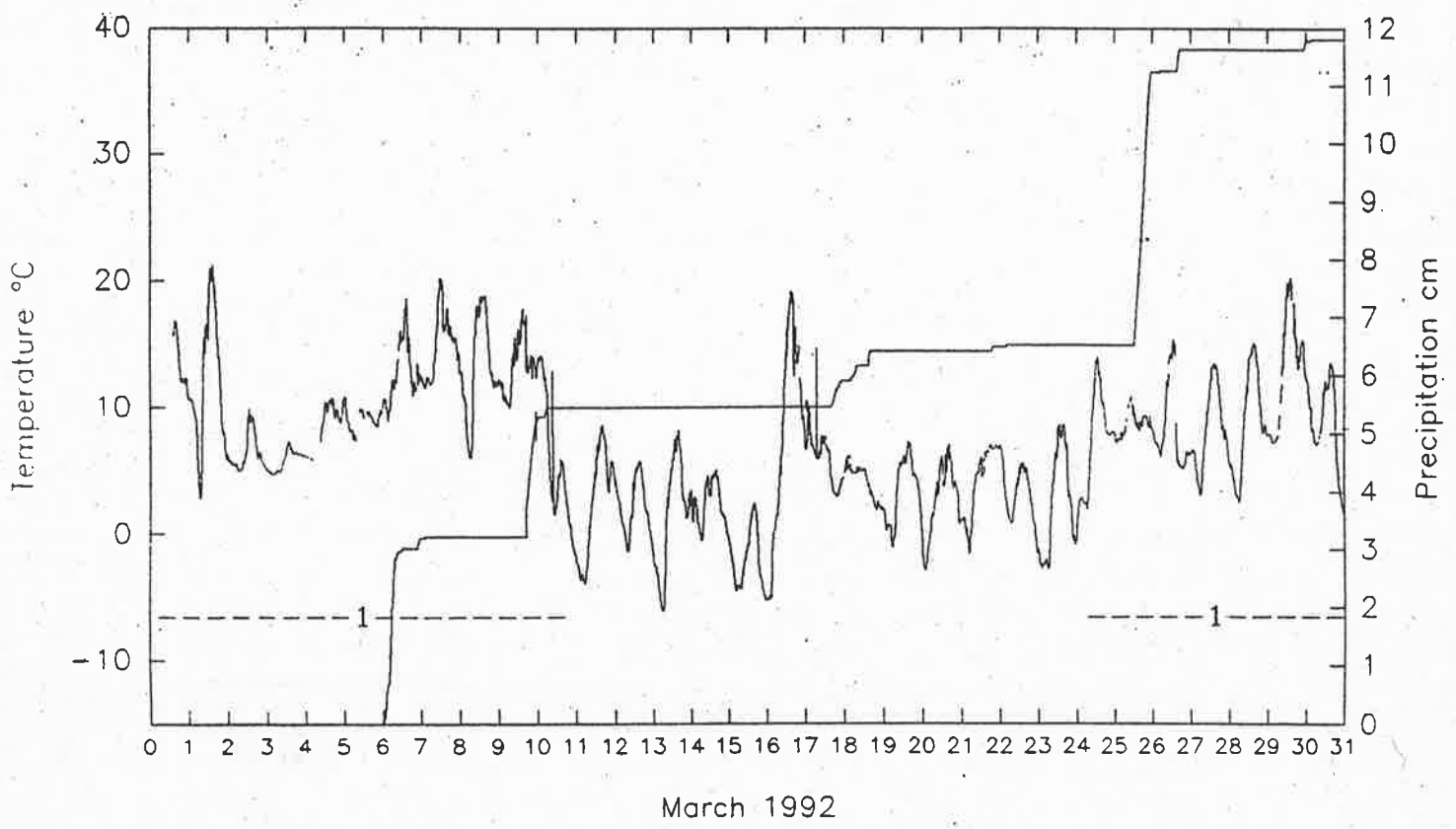
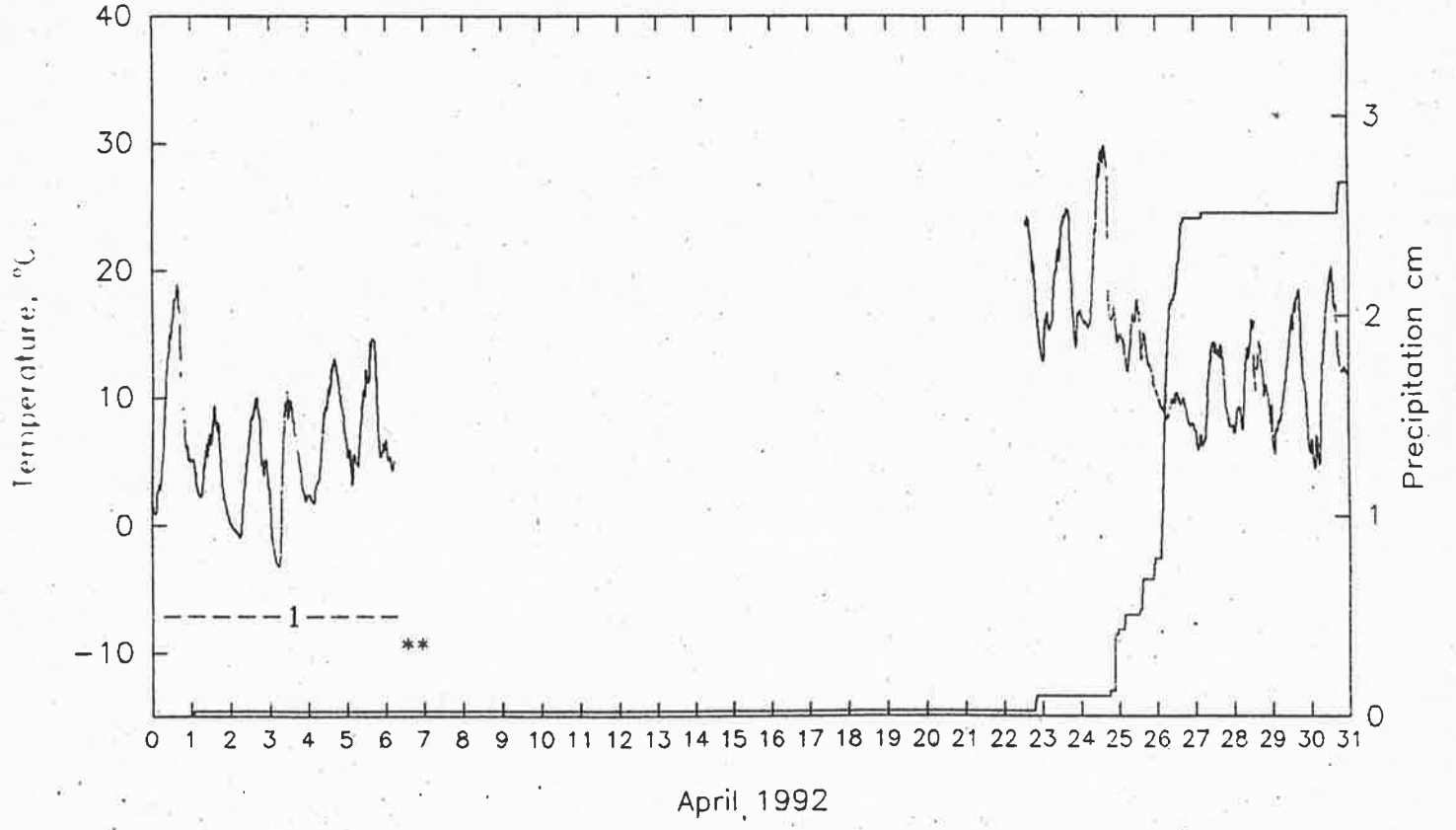
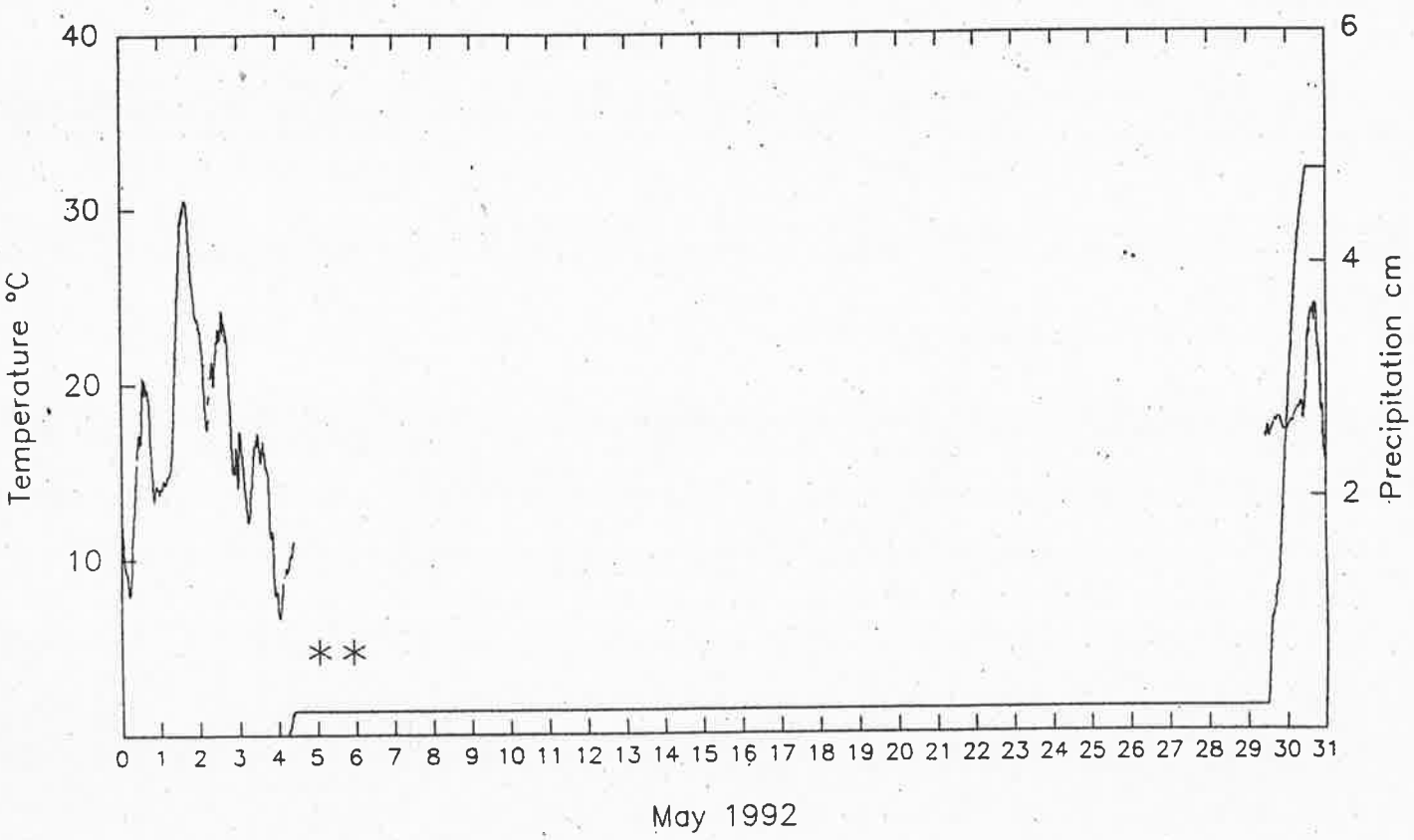


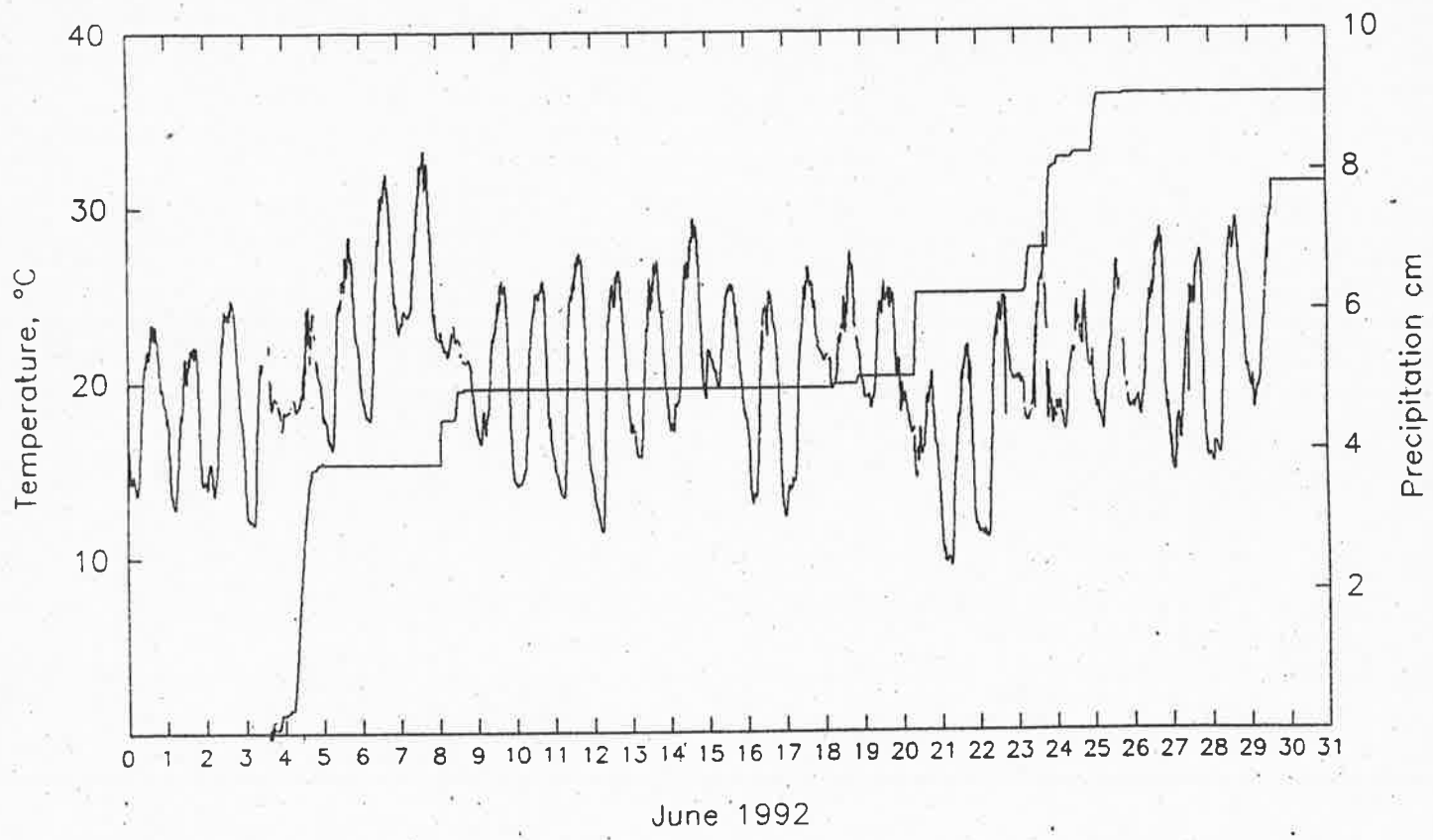


1 = sampler down

** lost data from 4/7 – 4/21

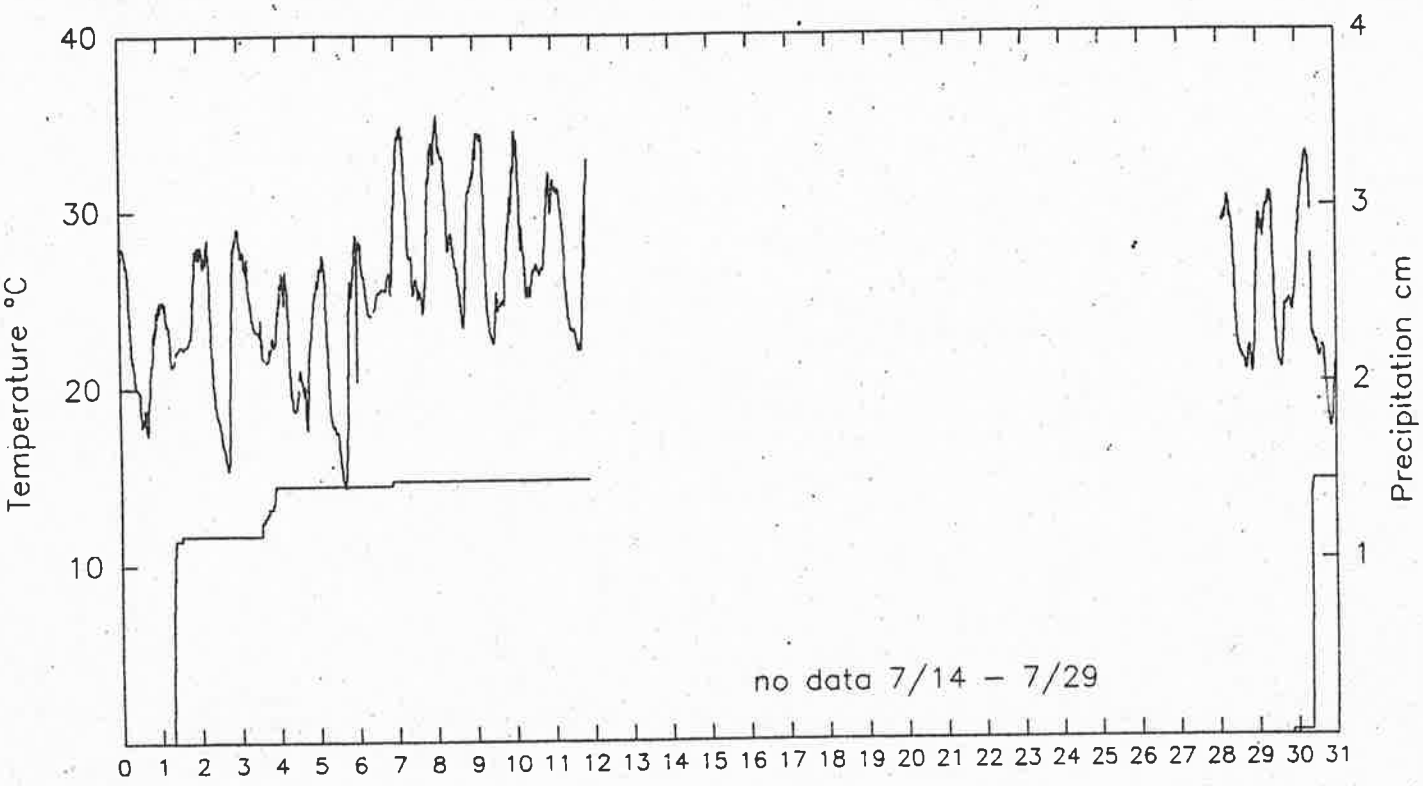
Elms Climatographic Data

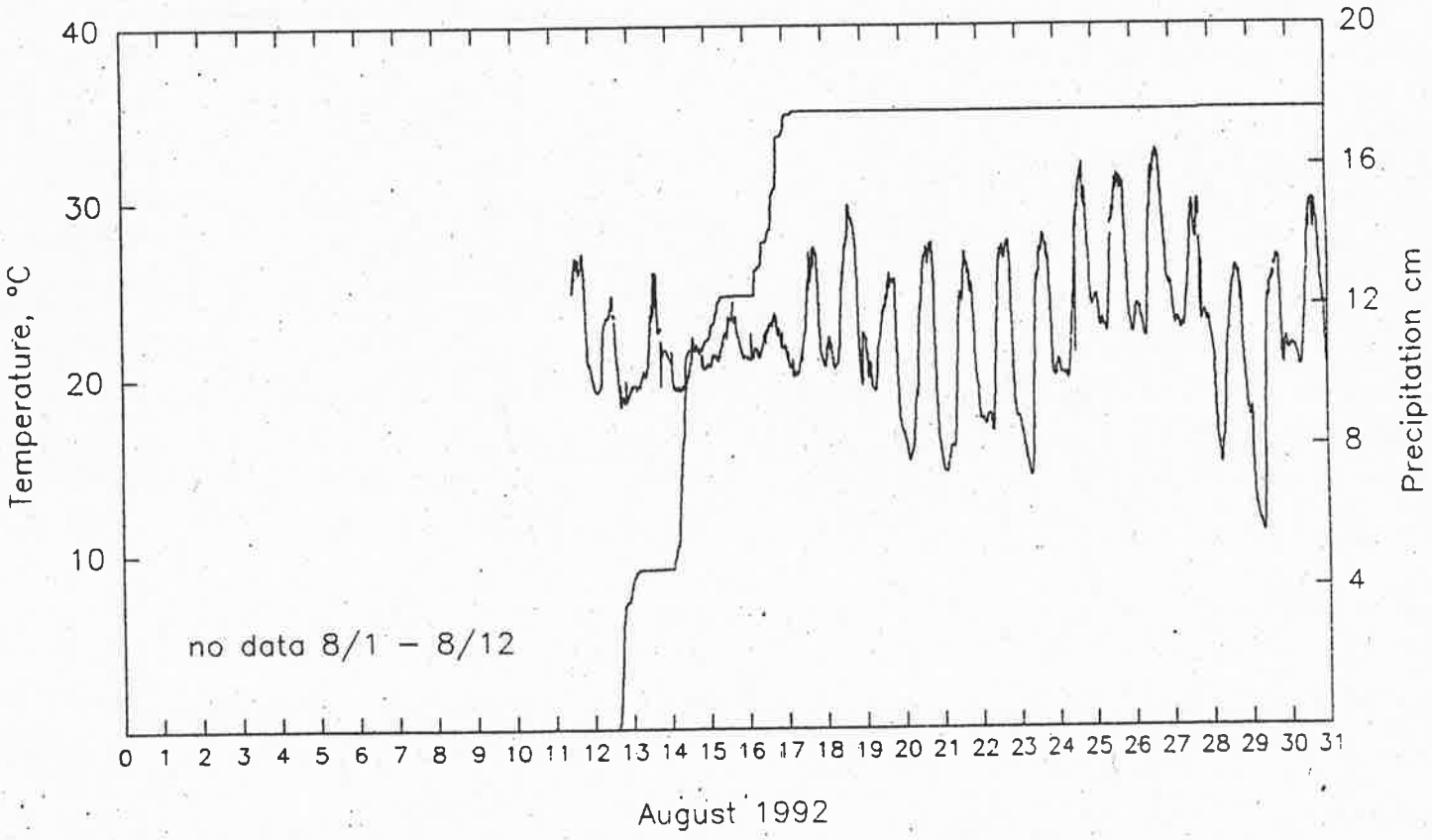




** lost data from 5/6 – 5/30

Elms Climatographic Data





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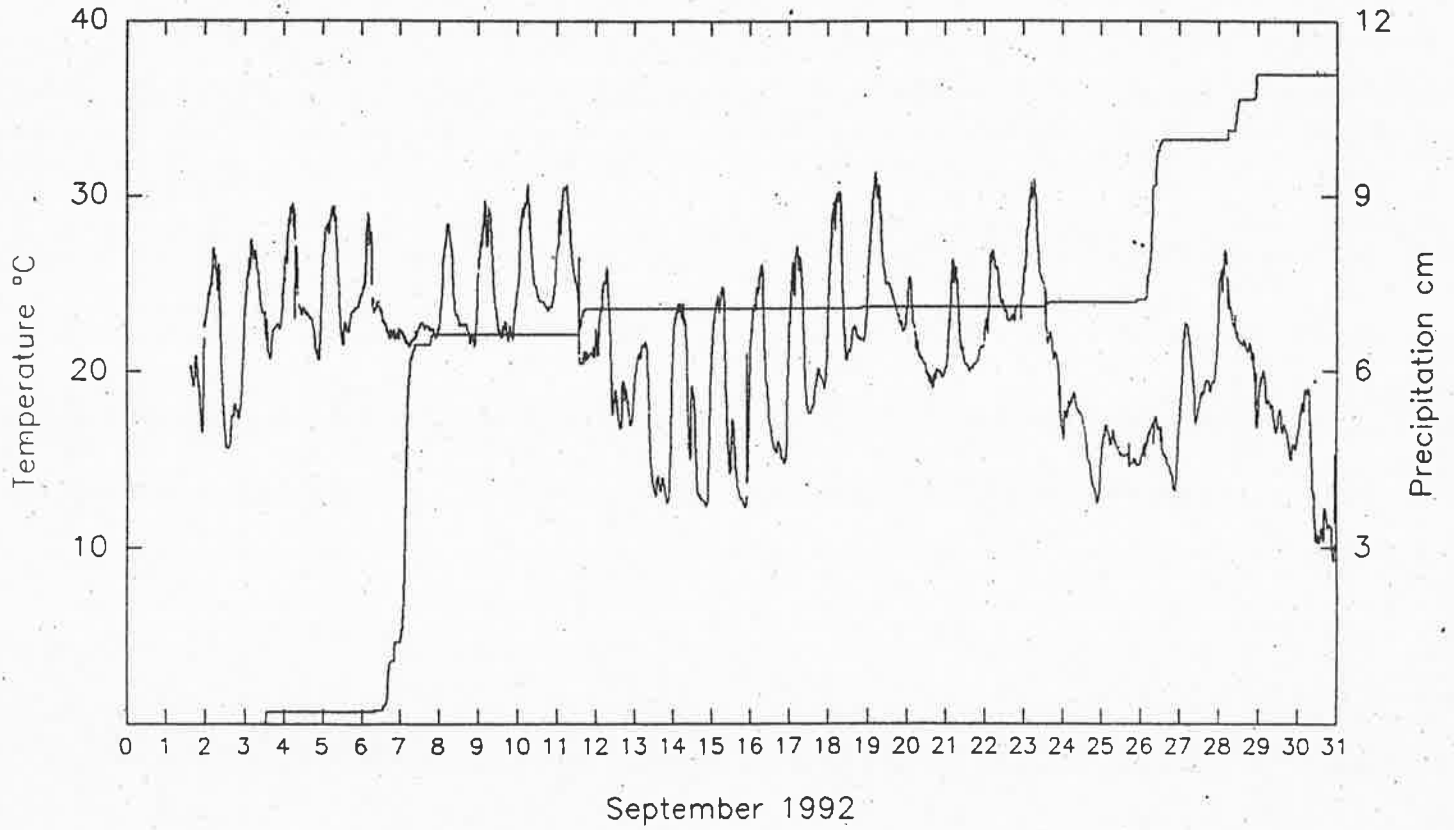

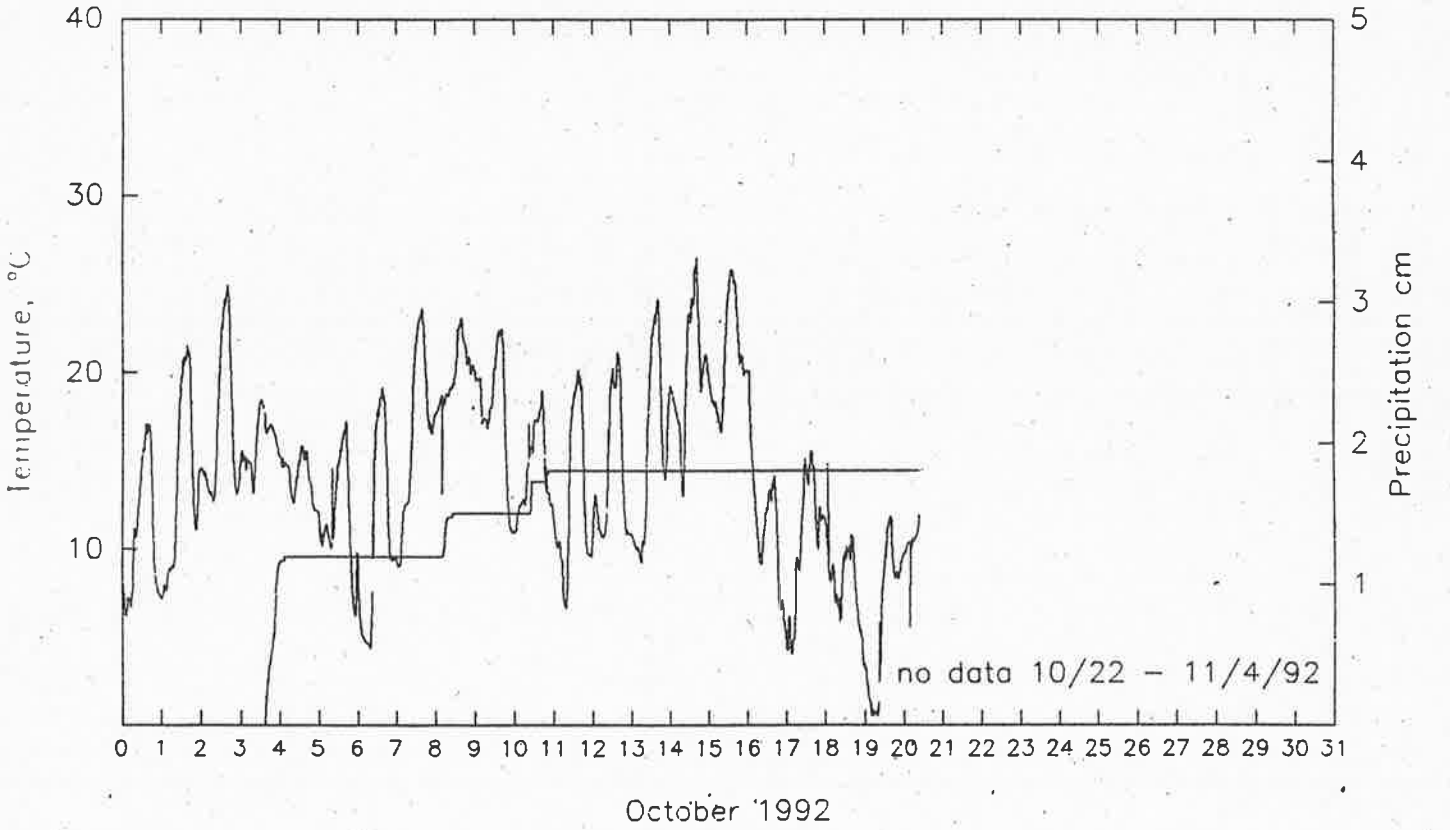

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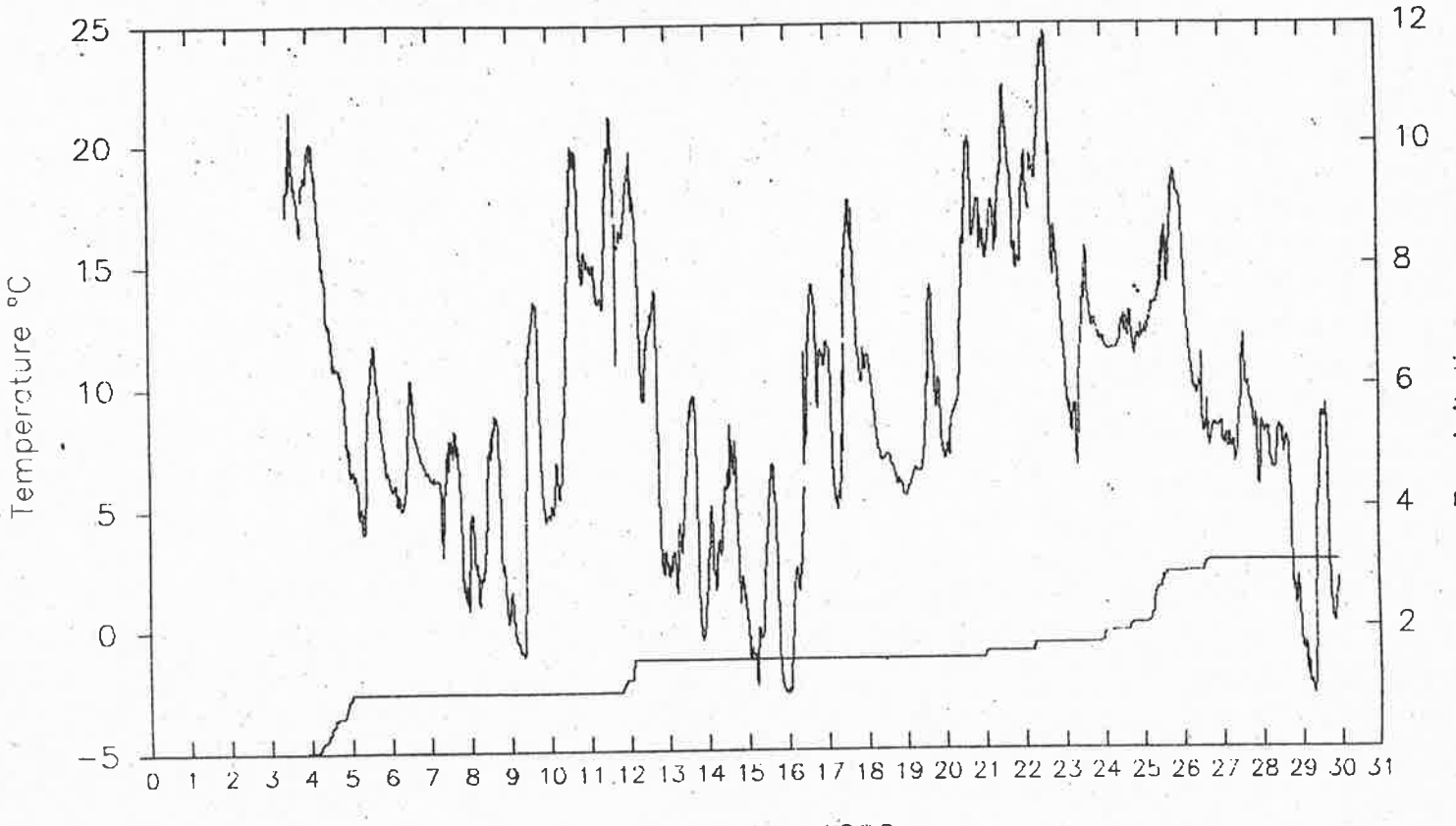
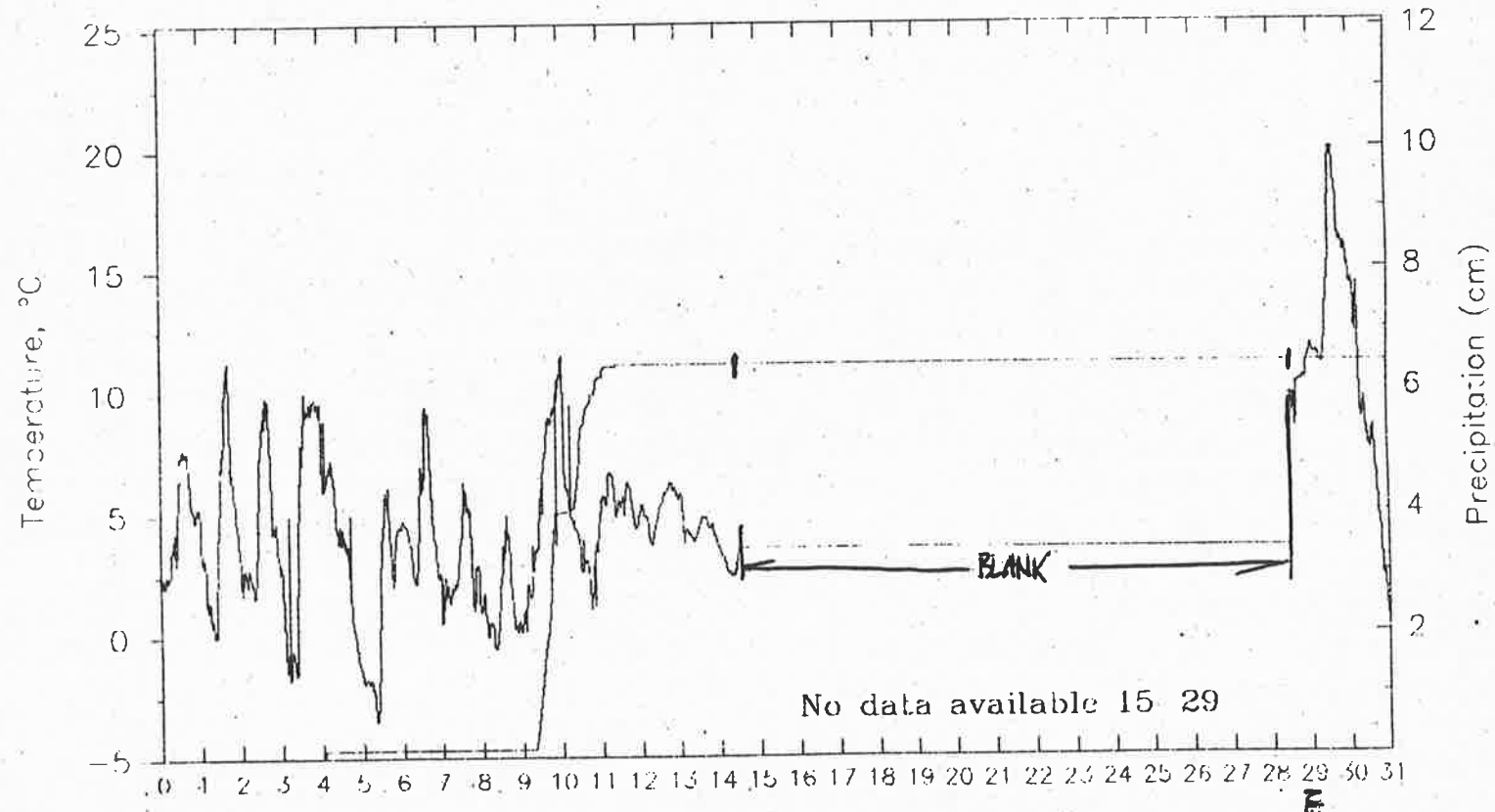


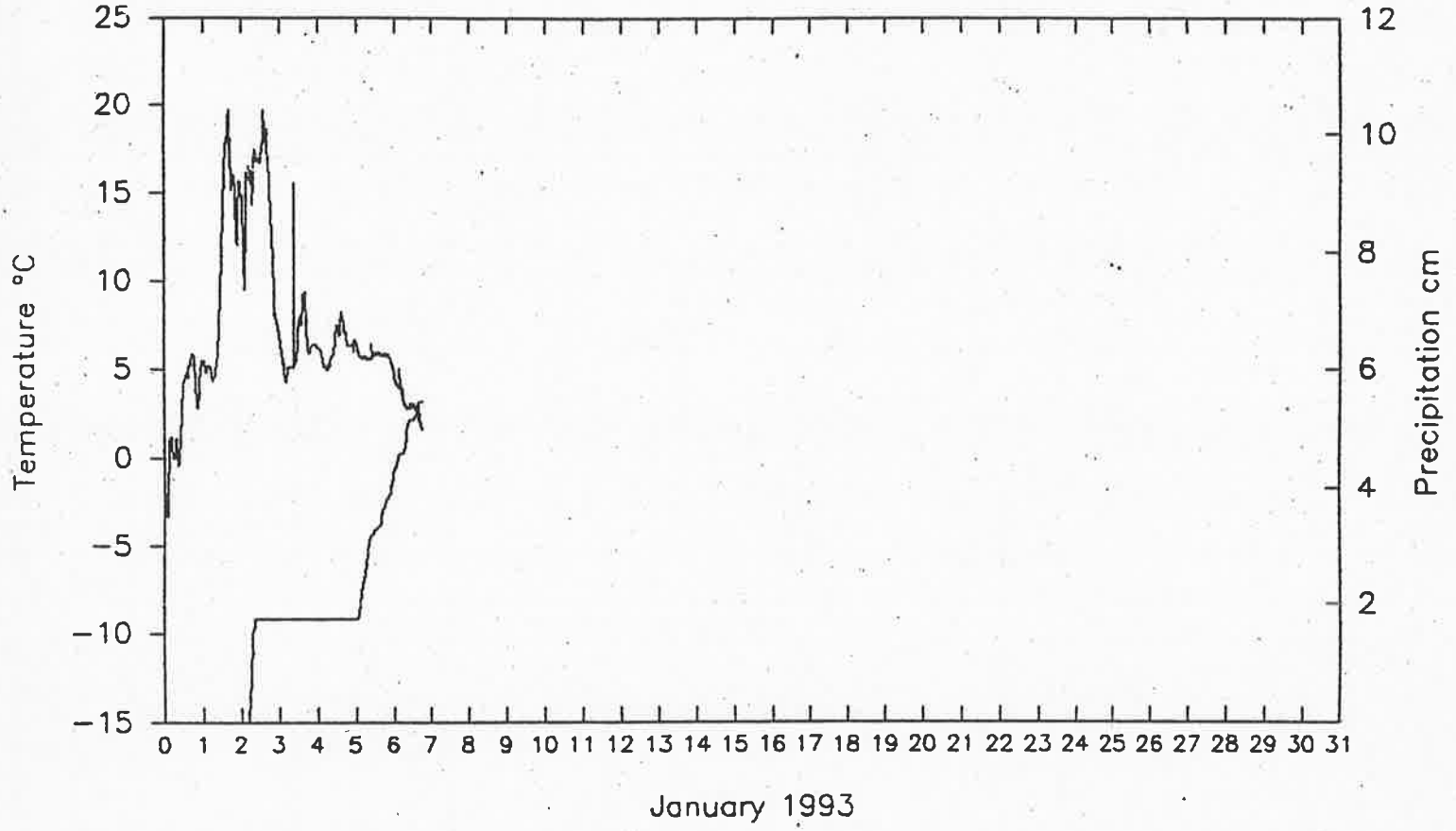
November 1992



December 1992

ELMS TEMP & PRECIP DATA

NEED CONT RNG DATA FOR PRECIP TO DEC '29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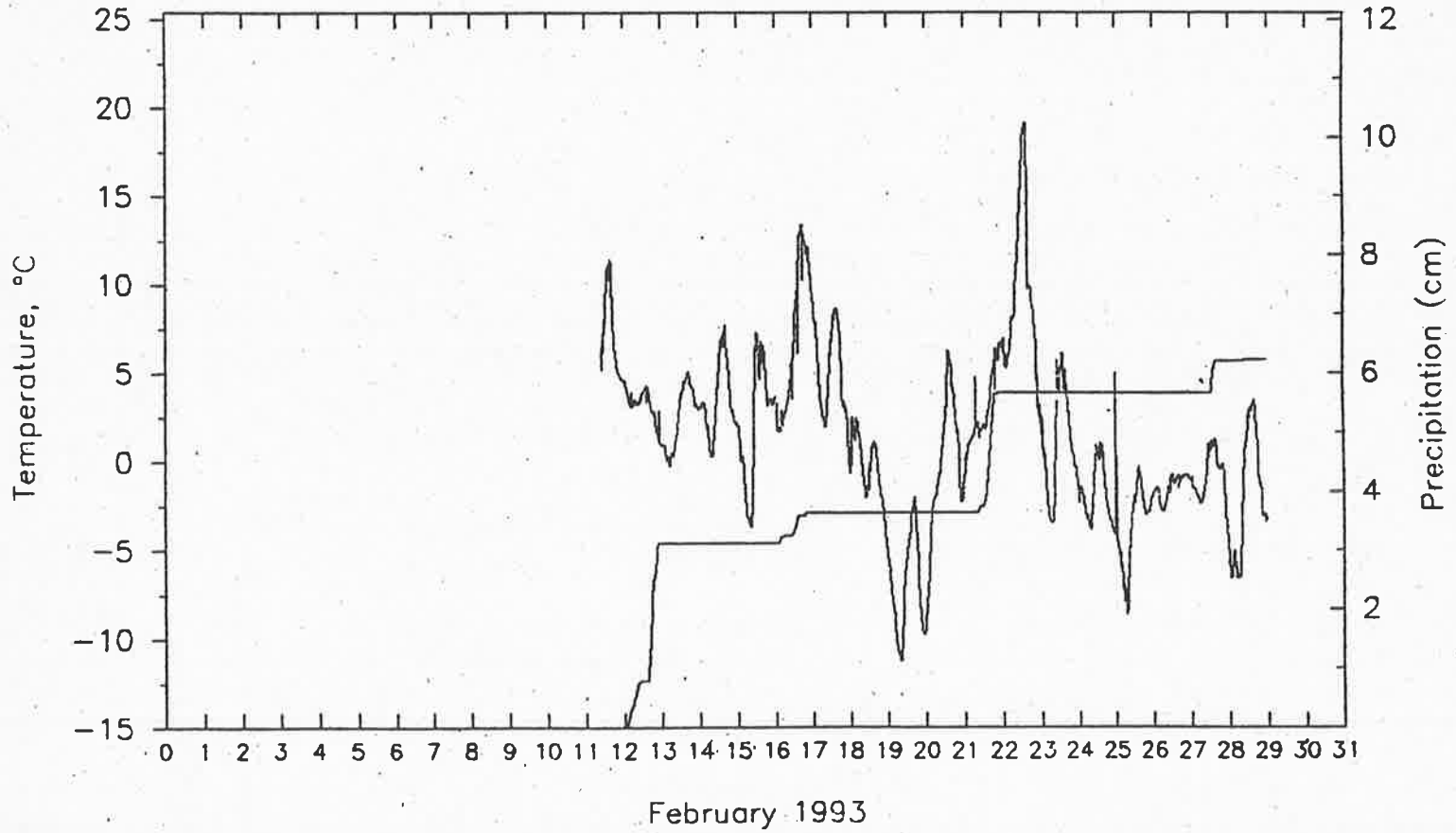
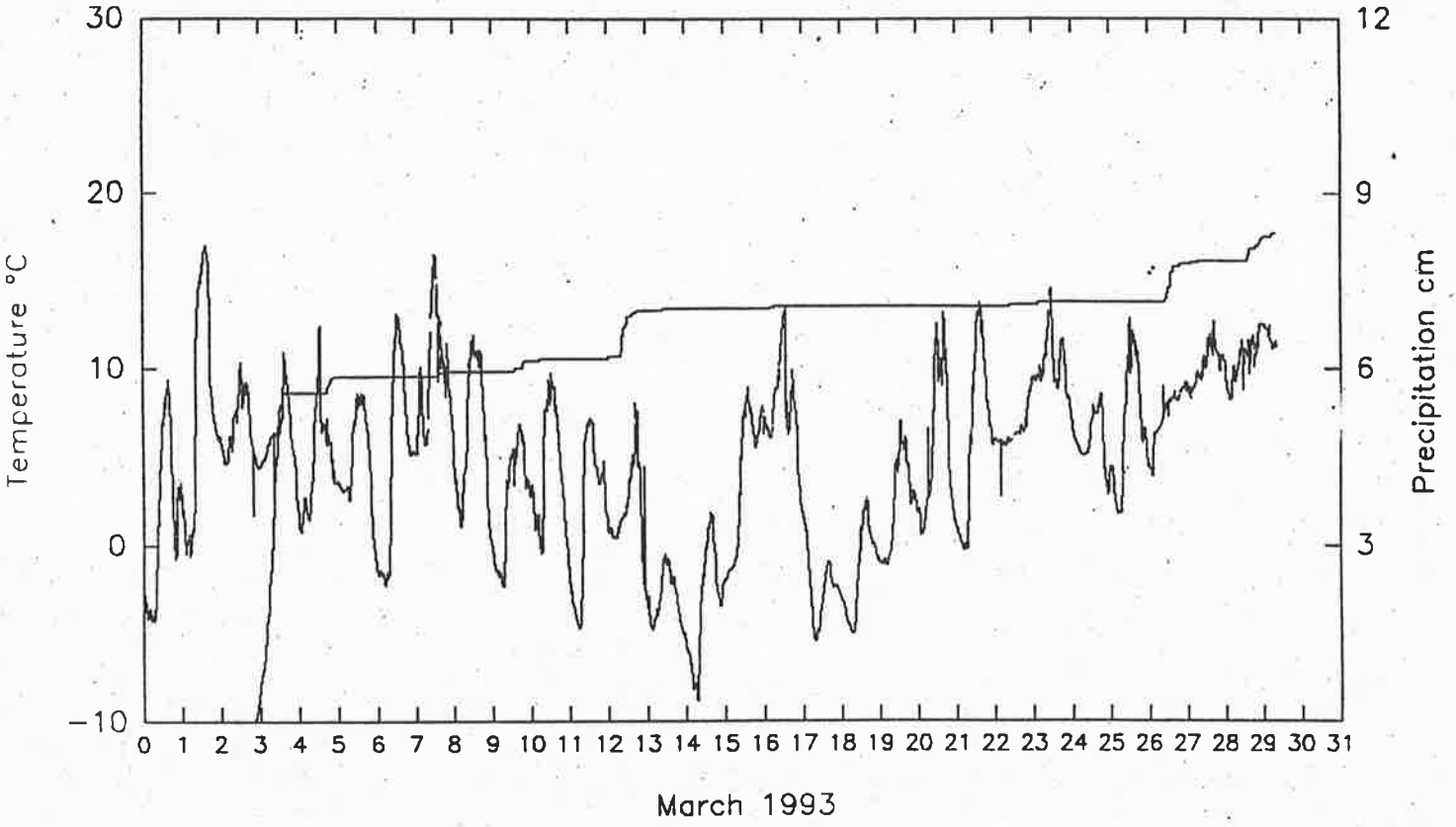
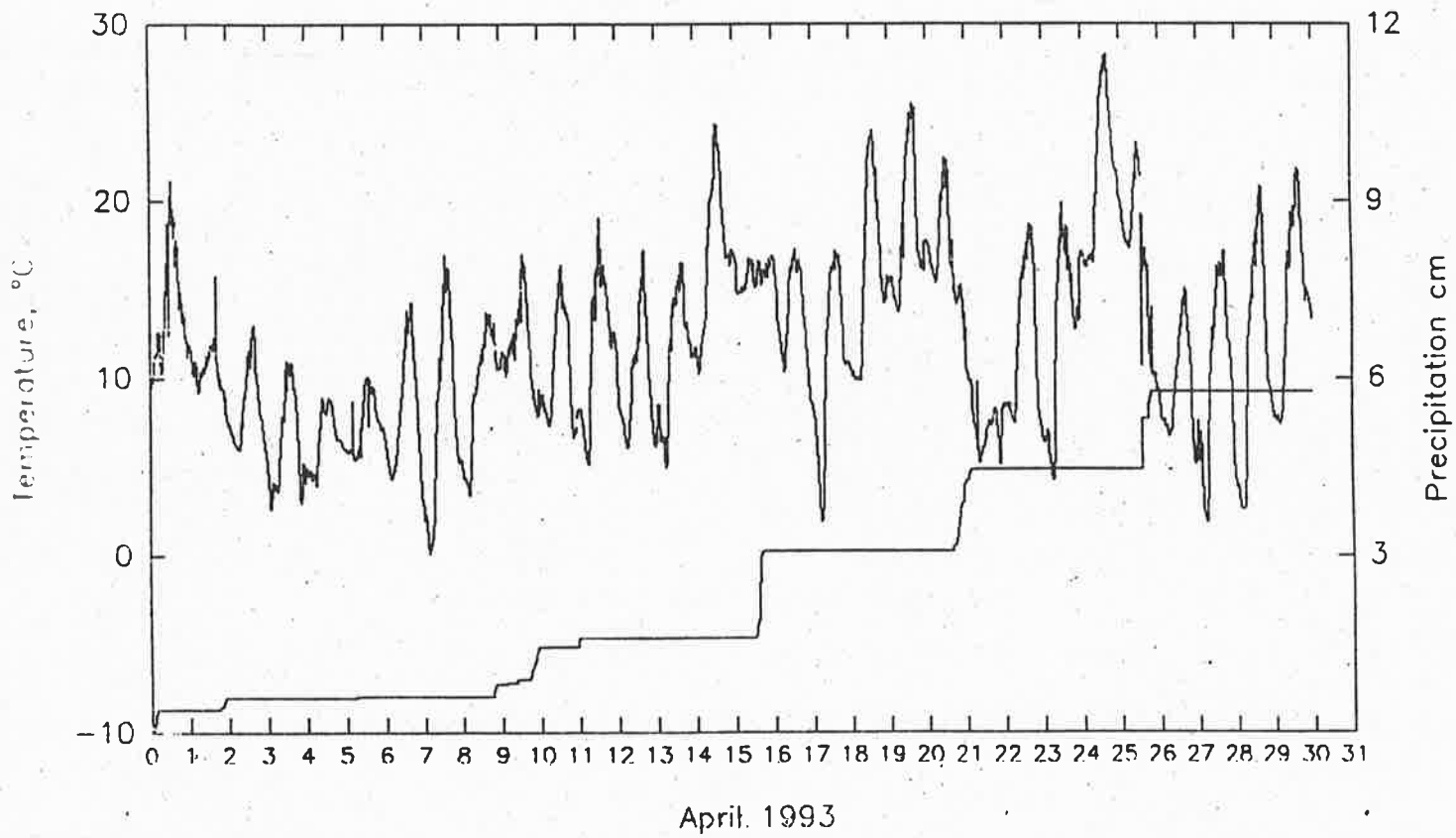
Precipitation cm
25
20
15
10
5
0
−5
−10
−15
12
10
8
6
4
2
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31
January 1993

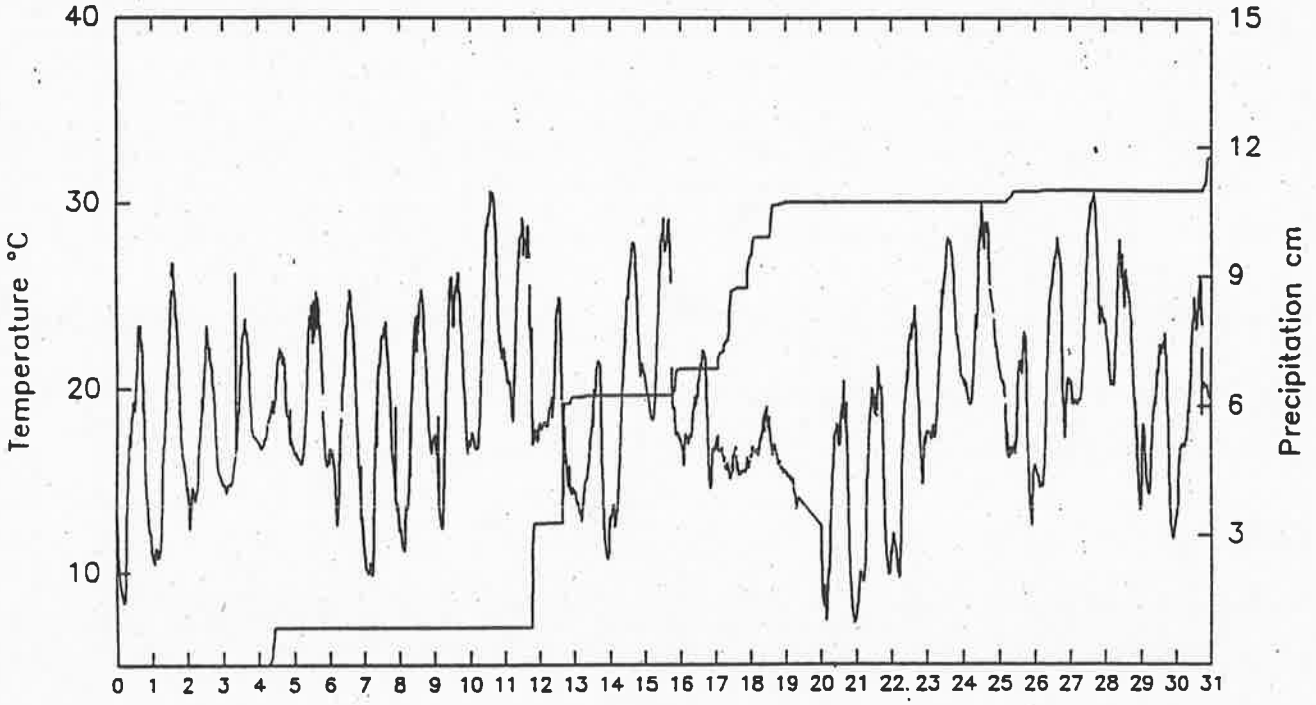

Temperature, °C
Precipitation (cm)
25
20
15
10
5
0
−5
−10
−15
12
10
8
6
4
2
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31
February 1993

Elms Climatographic Data

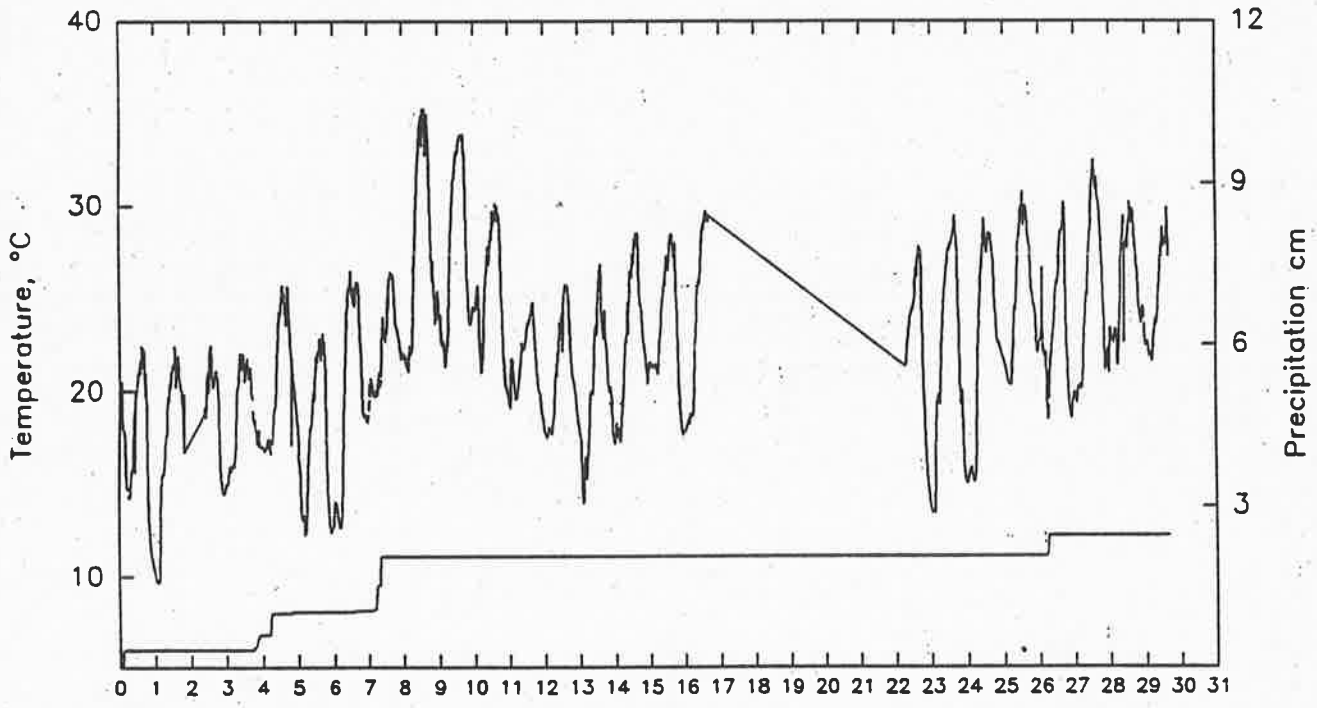




Elms Climatographic Data

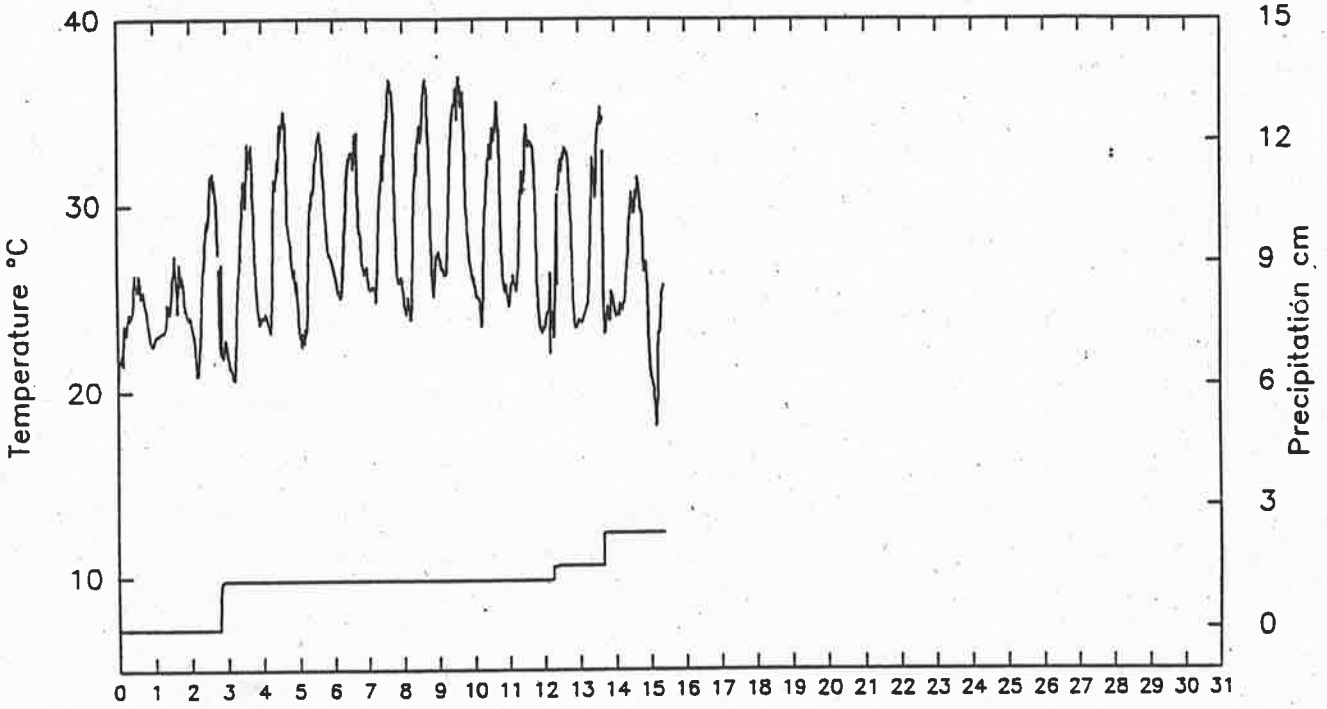


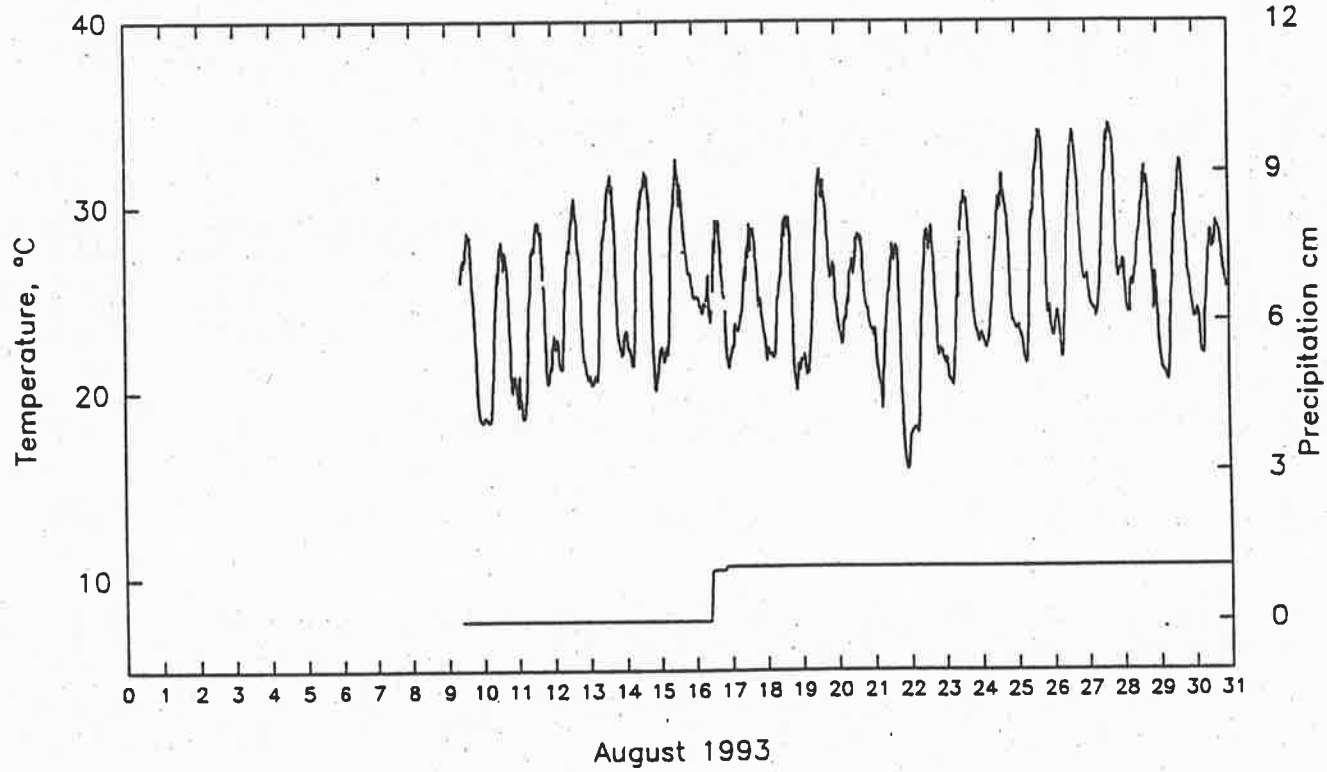
May 1993



June 1993

Elms Climatographic Data





Sample ID			Al		As		Cd		Cr		Cu		Ni		Pb		S		
			ng/m³	Sigma	ng/m³	Sigma	ng/m³	Sigma	ng/m³	Sigma	ng/m³	Sigma	ng/m³	Sigma	ng/m³	Sigma	ng/m³	Sigma	ng/m³
Year 1	W1	06/05/90 06/12/90	49.7 ±	3.5	0.482 ±	0.063	0.0119 ±	0.0051	1.10 ±	0.097	0.763 ±	0.09	4.48 ±	0.39	< 0.158 ±	0.158	1020 ±	133	0.666
	W2	06/15/90 06/19/90	107 ±	13	0.339 ±	0.099	0.109 ±	0.028	< 0.221 ±	0.221	9.24 ±	0.71	11.4 ±	0.83	8.07 ±	0.78	101 ±	31	0.633
	W3	06/21/90 06/26/90	160 ±	20	0.513 ±	0.079	0.038 ±	0.018	< 0.197 ±	0.197	3.06 ±	0.35	1.22 ±	0.31	< 0.242 ±	0.242	2786 ±	792	0.716
	W4	06/26/90 07/03/90	146 ±	18	0.750 ±	0.094	0.0699 ±	0.0094	0.692 ±	0.12	2.94 ±	0.23	6.11 ±	0.39	2.91 ±	0.49	4896 ±	540	1.37
	W5	07/03/90 07/10/90	212 ±	26	0.819 ±	0.108	< 0.0085 ±	0.0085	1.01 ±	0.17	0.484 ±	0.19	1.45 ±	0.19	0.925 ±	0.40	4445 ±	521	1.34
	W6	07/10/90 07/17/90	155 ±	13	0.475 ±	0.071	0.150 ±	0.016	0.479 ±	0.13	5.86 ±	0.39	9.19 ±	0.60	5.09 ±	0.42	3356 ±	589	1.44
	W7	07/17/90 07/24/90	160 ±	14	0.699 ±	0.090	0.108 ±	0.014	0.597 ±	0.16	1.89 ±	0.23	4.70 ±	0.31	4.24 ±	0.56	4990 ±	683	1.56
	W8	07/24/90 07/31/90	89.6 ±	11	0.384 ±	0.062	0.190 ±	0.018	0.540 ±	0.17	1.28 ±	0.21	2.06 ±	0.20	5.11 ±	0.54	1224 ±	167	0.648
	W9	07/31/90 08/07/90	(6400 ±	384)	0.717 ±	0.093	0.141 ±	0.013	0.775 ±	0.13	2.43 ±	0.22	1.92 ±	0.15	5.11 ±	0.40	(1362 ±	1979)	1.42
	W10[1]	08/07/90 08/14/90																	
	W11	08/14/90 08/21/90	75.1 ±	5.4	0.337 ±	0.022	0.154 ±	0.016	< 0.331	0.331	< 0.185 ±	0.185	1.17 ±	0.19	3.14 ±	0.62	3123 ±	403	1.38
	W12	08/21/90 08/28/90	(237 ±	29)	(1.20 ±	0.16)	(0.545 ±	0.05)	(2.86 ±	0.27)	(5.30 ±	0.42)	(19.6 ±	1.2)	(18.7 ±	1.5)	(1526 ±	1485)	(4.51
	W13	08/28/90 09/04/90	148 ±	18	0.800 ±	0.11	0.135 ±	0.019	0.828 ±	0.17	(27 ±	1.7)	10.9 ±	0.70	4.91 ±	0.42	4254 ±	530	1.56
	W14	09/04/90 09/11/90	197 ±	24	0.807 ±	0.13	0.145 ±	0.024	2.03 ±	0.22	1.73 ±	0.25	2.27 ±	0.24	3.98 ±	0.60	6783 ±	955	2.03
	W15	09/11/90 09/18/90	69.7 ±	8.5	0.487 ±	0.084	0.051 ±	0.018	0.528 ±	0.24	2.90 ±	0.35	1.96 ±	0.27	3.69 ±	0.48	5149 ±	719	1.06
	W16	09/18/90 09/25/90	(98.7 ±	16.2)	(49.5 ±	6.9)	(16.4 ±	2.4)	(78 ±	6.2)	(1889 ±	118)	(739 ±	48)	(417 ±	.44)	(1721 ±	719)	(108
	W17	09/25/90 10/02/90	196 ±	24	0.999 ±	0.13	0.267 ±	0.028	1.14 ±	0.21	3.06 ±	0.32	2.65 ±	0.33	5.81 ±	0.66	4305 ±	474	2.44
	W18	10/02/90 10/09/90	131 ±	16	0.561 ±	0.081	0.131 ±	0.022	0.589 ±	0.17	2.28 ±	0.25	0.845 ±	0.14	3.01 ±	0.45	1681 ±	325	1.11
	W19	10/09/90 10/16/90	147 ±	18	0.501 ±	0.097	0.213 ±	0.023	0.638 ±	0.15	3.15 ±	0.27	1.89 ±	0.19	4.78 ±	0.57	3637 ±	******	0.814
	W20	10/16/90 10/23/90	64.1 ±	7.8	0.653 ±	0.082	0.201 ±	0.023	0.592 ±	0.15	1.54 ±	0.22	3.65 ±	0.32	4.61 ±	0.86	1264 ±	402	0.592
	W21	10/23/90 10/30/90	61.8 ±	7.6	0.699 ±	0.081	0.213 ±	0.022	0.896 ±	0.15	2.20 ±	0.23	2.05 ±	0.19	6.38 ±	0.68	1060 ±	190	0.747
	W22	10/30/90 11/06/90	303 ±	37	1.34 ±	0.159	0.431 ±	0.044	1.34 ±	0.18	4.93 ±	0.37	2.65 ±	0.25	13.6 ±	0.98	1926 ±	372	2.15
	W23	11/06/90 11/13/90	86.6 ±	11	0.623 ±	0.080	0.178 ±	0.030	0.650 ±	0.15	1.68 ±	0.23	1.24 ±	0.15	4.54 ±	0.57	1015 ±	186	1.02
	W24	11/15/90 11/27/90	171 ±	21	1.40 ±	0.17	0.220 ±	0.017	1.06 ±	0.11	1.66 ±	0.16	1.43 ±	0.12	5.69 ±	0.38	2400 ±	344	1.67
	W25	11/27/90 12/04/90	54.7 ±	6.7	0.540 ±	0.078	0.086 ±	0.013	0.589 ±	0.15	0.801 ±	0.20	1.03 ±	0.17	3.29 ±	0.46	540 ±	139	0.807
	W26	12/04/90 12/11/90	90.2 ±	8.2	0.369 ±	0.023	0.105 ±	0.014	< 0.209 ±	0.209	2.28 ±	0.25	1.37 ±	0.15	4.03 ±	0.46	509 ±	119	1.06
	W27	12/11/90 12/18/90	173 ±	15	1.04 ±	0.084	0.172 ±	0.018	0.878 ±	0.35	5.85 ±	0.43	2.57 ±	0.20	7.76 ±	0.83	2916 ±	512	2.15
	W28	12/18/90 12/25/90	24.8 ±	3.2	0.355 ±	0.026	0.116 ±	0.016	< 0.322 ±	0.322	1.38 ±	0.25	1.56 ±	0.28	4.77 ±	0.50	< 578 ±	578	1.01
	W29	12/25/90 01/01/91	41.9 ±	3.9	0.501 ±	0.032	0.249 ±	0.027	< 0.187 ±	0.187	2.38 ±	0.27	3.56 ±	0.26	8.47 ±	0.82	2372 ±	394	2.14
	W30	01/01/91 01/08/91	111 ±	13	1.96 ±	0.23	0.255 ±	0.034	2.28 ±	0.24	4.40 ±	0.37	9.68 ±	0.65	6.76 ±	0.97	2081 ±	412	3.10
	W31	01/08/91 01/15/91	37.0 ±	3.4	0.698 ±	0.045	0.193 ±	0.018	2.18 ±	0.37	2.59 ±	0.29	3.45 ±	0.32	6.68 ±	0.63	ND		2.28
	W32	01/15/91 01/22/91	55.5 ±	4.9	0.496 ±	0.032	0.0879 ±	0.015	1.39 ±	0.35	1.04 ±	0.24	1.42 ±	0.32	2.50 ±	0.55	1488 ±	241	2.47
	W33	01/22/91 01/29/91	95.1 ±	8.2	0.867 ±	0.058	0.160 ±	0.017	1.07 ±	0.33	5.23 ±	0.39	10.9 ±	0.31	5.70 ±	0.58	1382 ±	243	2.71
	W34	01/29/91 02/05/91	130 ±	11	1.18 ±	0.073	0.162 ±	0.017	1.92 ±	0.35	1.84 ±	0.25	2.33 ±	0.31	4.20 ±	0.44	1774 ±	436	2.37
	W35	02/05/91 02/12/91	103 ±	9.0	1.43 ±	0.091	0.238 ±	0.023	1.57 ±	0.35	4.80 ±	0.38	2.71 ±	0.32	< 0.256 ±	0.256	3505 ±	600	3.47
	W36	02/12/91 02/19/91	48.2 ±	4.2	0.414 ±	0.027	0.106 ±	0.015	< 0.263 ±	0.263	1.01 ±	0.23	5.26 ±	0.31	2.29 ±	0.44	691 ±	143	1.57
	W37	02/19/91 02/26/91	76.6 ±	6.6	1.31 ±	0.084	0.105 ±	0.014	< 0.254 ±	0.254	2.09 ±	0.25	2.43 ±	0.30	4.97 ±	0.54	1450 ±	406	1.65
	W38	02/26/91 03/05/91	91.0 ±	7.9	0.559 ±	0.036	0.039 ±	0.014	0.648 ±	0.32	0.497 ±	0.22	< 0.27 ±	0.27	1.49 ±	0.33	1636 ±	307	1.76
	W39	03/05/91 03/12/91	87.5 ±	7.6	0.707 ±	0.048	0.058 ±	0.013	0.869 ±	0.32	< 0.168 ±	0.168	< 0.18 ±	0.18	< 0.175 ±	0.175	1231 ±	218	1.91
	W40	03/12/91 03/19/91	51.4 ±	4.5	0.427 ±	0.027	0.113 ±	0.015	< 0.235 ±	0.235	1.94 ±	0.24	4.56 ±	0.30	3.94 ±	0.40	1212 ±	179	1.42
	W41	03/19/91 03/26/91	121 ±	10	0.874 ±	0.056	0.152 ±	0.017	< 0.233 ±	0.233	2.46 ±	0.27	2.40 ±	0.31	5.19 ±	0.63	2926 ±	433	1.32
	W42	03/26/91 04/02/91	120 ±	10	0.598 ±	0.038	0.0868 ±	0.014	< 0.187 ±	0.187	0.783 ±	0.22	1.40 ±	0.30	2.64 ±	0.39	ND		1.04
	W43	04/02/91 04/09/91	141 ±	12	0.685 ±	0.045	0.141 ±	0.016	0.756 ±	0.33	1.16 ±	0.24	1.66 ±	0.31	3.63 ±	0.56	2866 ±	417	1.75
	W44	04/09/91 04/16/91	147 ±	13	0.704 ±	0.046	0.0308 ±	0.013	0.684 ±	0.32	1.55 ±	0.24	0.96 ±	0.30	1.27 ±	0.49	ND		1.14
	W45	04/16/91 04/23/91	67.7 ±	5.9	0.375 ±	0.028	0.0545 ±	0.015	< 0.168	0.168	≤ 0.155 ±	0.155	0.78 ±	0.31	2.23 ±	0.35	2005 ±	299	1.04
	W46	04/23/91 04/30/91	113 ±	9.9	0.581 ±	0.041	0.0662 ±	0.014	< 0.228 ±	0.228	0.798 ±	0.23	1.02 ±	0.32	2.38 ±	0.56	ND		1.30
	W47	04/30/91 05/07/91	117 ±	10	1.19 ±	0.076	0.0526 ±	0.015	< 0.176 ±	0.176	1.26 ±	0.26	0.90 ±	0.33	2.51 ±	0.38	2073 ±	377	0.909
	W48	05/07/91 05/14/91	190 ±	16	0.675 ±	0.043	0.147 ±	0.017	1.27 ±	0.37	1.75 ±	0.28	1.47 ±	0.35	5.51 ±	0.87	4674 ±	528	2.40
	W49	05/14/91 05/21/91	169 ±	15	0.358 ±	0.028	0.093 ±	0.017	< 0.221 ±	0.221	1.42 ±	0.28	1.66 ±	0.36	4.25 ±	0.55	ND		1.07
	W50	05/21/91 05/28/91	272 ±	23	0.416 ±	0.029	0.0716 ±	0.017	< 0.314 ±	0.314	0.813 ±	0.28	1.13 ±	0.37	0.927 ±	0.42	3011 ±	******	1.36
	W51	05/28/91 06/04/91	154 ±	13	0.561 ±	0.036	0.164 ±	0.019	< 0.362 ±	0.362	4.79 ±	0.40	3.20 ±	0.37	5.63 ±	0.85	4300 ±	492	2.09
Year 2	W52	6/04/91 6/11/91	172 ±	15	0.657 ±	0.041	0.135 ±	0.015	1.08 ±	0.32	1.92 ±	0.24	1.82 ±	0.30	5.55 ±	0.60	2330 ±	348	1.47
	W53	6/11/91 6/18/91	211 ±	18	0.558 ±	0.035	0.110 ±	0.019	1.21 ±	0.27	1.31 ±	0.20	1.50 ±	0.25	3.22 ±	0.46	4371 ±	540	1.64
	W54	6/18/91 6/25/91	68.3 ±	5.9	0.390 ±	0.025	0.107 ±	0.014	< 0.176 ±	0.176	(7.24) ±	(0.49)	2.93 ±	0.29	4.35 ±	0.54	3870 ±	482	1.28
	W55	6/25/91 7/02/91	140 ±	12	0.410 ±	0.028	0.0845 ±	0.013	< 0.071 ±	0.071	1.00 ±	0.22	1.76 ±	0.28	2.77 ±	0.79	5570 ±	703	1.41
	W56	7/02/91 7/09/91	95.1 ±	8.3	0.422 ±	0.029	0.0543 ±	0.013	< 0.020 ±	0.020	1.73 ±	0.24	1.28 ±	0.29	2.82 ±	0.42	4073 ±	534	1.46
	W57[1]	7/10/91 7/16/91																	

Sample ID			Al		As		Cd		Cr		Cu		Ni		Pb		S		
			ng/m³	Sigma	ng/m³	Sigma	ng/m³	Sigma	ng/m³	Sigma	ng/m³	Sigma	ng/m³	Sigma	ng/m³	Sigma	ng/m³	Sigma	ng/m³
	W58	7/16/91	7/23/91	264 8 ± 16 3	0 63 ± 0 01	0 1037 ± 0 0338	1 07 ± 0 04	3 75 ± 0 17	8 30 ± 0 22	1 80 ± 0 14	7386 ± 574	2 68
	W59	7/23/91	7/30/91	138.7 ± 8.5	0 18 ± 0.005	±	0 68 ± 0 04	1 66 ± 0 16	3 25 ± 0 27	5 65 ± 0 45	3096 ± 327	1.90
	W60	7/30/91	8/06/91	113.1 ± 6.9	0 40 ± 0 01	0.1724 ± 0 0210	0 50 ± 0 04	1 61 ± 0 16	2 16 ± 0 22	1 14 ± 0 20	4816 ± 349	1.75
	W61'	8/09/91	8/13/91									
	W62	8/13/91	8/20/91	264 0 ± 16 3	0 43 ± 0 01	0 0944 ± 0 0208	0 76 ± 0 04	0 35 ± 0 16	< 0 17 ± 0 17	2 27 ± 0 34	3448 ± 362	1.62
	W63	8/20/91	8/27/91	73.6 ± 4 5	0 51 ± 0 02	0 1153 ± 0 0152	0 79 ± 0 04	1 79 ± 0 16	2 14 ± 0 21	4 68 ± 0 54	5211 ± 442	1.79
	W64	8/27/91	9/03/91	115 5 ± 7 1	0 39 ± 0 02	0 2604 ± 0 0240	0 64 ± 0 04	1 25 ± 0 16	2 95 ± 0 26	2 51 ± 0 39	4150 ± 415	1.95
	W65	9/03/91	9/10/91	61.9 ± 3 8	0 48 ± 0 01	0 1947 ± 0 0177	0 94 ± 0 04	2 42 ± 0 16	2 64 ± 0 20	6 81 ± 0 58	3194 ± 320	1.75
	W66	9/10/91	9/17/91	131 6 ± 8 0	0 56 ± 0 01	0 1961 ± 0 0122	0 45 ± 0 03	3 66 ± 0 16	3 17 ± 0 22	5 80 ± 0 52	3177 ± 290	1.62
	W67	9/17/91	9/24/91	84.0 ± 5 2	0 49 ± 0 01	0 1359 ± 0 0127	0 26 ± 0 03	1 50 ± 0 16	2 53 ± 0 22	3 32 ± 0 26	2555 ± 284	1.35
	W68	9/24/91	10/01/91	74.5 ± 4.6	0 51 ± 0 01	0 1716 ± 0 0167	0 75 ± 0 04	1 81 ± 0 16	7 81 ± 0 23	6 46 ± 0 43	2299 ± 300	2.05
	W69	10/01/91	10/08/91	75.7 ± 4.6	0.30 ± 0.01	0.1584 ± 0.0195	0 41 ± 0 04	1.22 ± 0.15	1.74 ± 0.18	2.99 ± 0.16	2580 ± 284	1.48
	W70	10/08/91	10/15/91	83.7 ± 5.1	0.56 ± 0.00	0.1752 ± 0.0106	0.86 ± 0.04	1.44 ± 0.15	2.30 ± 0.21	5.47 ± 0.15	1982 ± 246	2.35
	W71	10/15/91	10/22/91	71.9 ± 4.4	0.38 ± 0.00	0.0674 ± 0.0118	0.95 ± 0.04	0.95 ± 0.16	< 0.08 ± 0.08	< 0.05 ± 0.05	1644 ± 201	1.44
	W72	10/22/91	10/29/91	105.3 ± 6.5	0.84 ± 0.01	0.1566 ± 0.0024	0.46 ± 0.04	1.68 ± 0.15	2.72 ± 0.34	4.11 ± 0.24	3164 ± 293	1.92
	W73	10/29/91	11/05/91	62.4 ± 3.8	0.18 ± 0.01	0.1921 ± 0.0375	1.10 ± 0.04	1.58 ± 0.16	3.74 ± 0.26	5.63 ± 0.14	567 ± 106	0.75
	W74	11/05/91	11/12/91	53.1 ± 3.3	0.11 ± 0.003	0.1332 ± 0.0159	0.71 ± 0.04	1.71 ± 0.19	2.92 ± 0.29	1.32 ± 0.21	444 ± 79	0.42
	W75	11/12/91	11/19/91	67.8 ± 4.2	0.46 ± 0.005	0.1127 ± 0.0201	0.41 ± 0.03	0.61 ± 0.24	1.91 ± 0.31	1.39 ± 0.14	1071 ± 141	1.66
	W76	11/19/91	11/26/91	59.3 ± 3.7	0.45 ± 0.02	0.1475 ± 0.0149	0.47 ± 0.05	1.59 ± 0.16	3.19 ± 0.36	2.07 ± 0.19	< 14 ± 14	1.53
	W77	11/26/91	12/03/91	103.2 ± 6.3	0.63 ± 0.01	0.2023 ± 0.0197	0.49 ± 0.06	(4.51 ± 0.20)	3.91 ± 0.28	3.84 ± 0.52	< 14 ± 14	2.39
	W78	12/03/91	12/10/91	71.7 ± 4.4	0.47 ± 0.01	0.2081 ± 0.0338	(2.15) ± (0.076)	2.17 ± 0.28	3.78 ± 0.42	2.69 ± 0.53	1058 ± 226	1.82
	W79	12/10/91	12/17/91	60.7 ± 4.0	1.50 ± 0.01	0.1033 ± 0.0104	0.69 ± 0.03	2.27 ± 0.13	4.28 ± 0.22	2.56 ± 0.29	1586 ± 201	1.93
	W80	12/17/91	12/24/91	87.6 ± 5.6	0.84 ± 0.01	0.1656 ± 0.0139	1.37 ± 0.04	2.37 ± 0.14	3.57 ± 0.32	4.97 ± 0.34	813 ± 204	2.60
	W81	12/24/91	12/31/91	44.0 ± 3.0	0.93 ± 0.01	0.1218 ± 0.0126	0.83 ± 0.03	0.86 ± 0.13	4.40 ± 0.34	< 0.22 ± 0.22	1878 ± 276	2.35
	W82	12/31/91	1/07/92	33.0 ± 2.4	0.53 ± 0.02	0.1124 ± 0.0164	0.79 ± 0.03	1.88 ± 0.14	5.59 ± 0.18	4.09 ± 0.47	2040 ± 507	1.67
	W83	1/07/92	1/14/92	58.0 ± 3.8	0.63 ± 0.01	0.1251 ± 0.0138	1.26 ± 0.04	0.98 ± 0.14	3.42 ± 0.28	2.90 ± 0.58	2243 ± 197	3.01
	W84	1/14/92	1/21/92	84.7 ± 5.4	0.51 ± 0.01	0.1805 ± 0.0241	0.34 ± 0.03	1.57 ± 0.14	(11.96) ± (0.437)	4.42 ± 0.20	963 ± 215	1.07
	W85	1/21/92	1/28/92	75.8 ± 5.0	0.76 ± 0.01	0.2110 ± 0.0391	0.47 ± 0.03	(4.29) ± (0.20)	8.69 ± 0.76	4.09 ± 0.41	1840 ± 313	1.39
	W86	1/28/92	2/04/92	71.44 ± 3.50	1.494 ± 0.016	0.288 ± 0.002	1.165 ± 0.063	3.2 ± 0.4	5.67 ± 0.04	13 ± 1.3	1421 ± 107	4.232
	W87	2/04/92	2/11/92	45.95 ± 2.24	0.720 ± 0.012	0.191 ± 0.008	1.477 ± 0.065	1 ± 0.2	6.65 ± 0.84	3.7 ± 0.5	417 ± 32	1.890
	W88	2/11/92	2/18/92	49.87 ± 2.43	0.964 ± 0.011	0.196 ± 0.003	0.764 ± 0.060	2.4 ± 0.3	3.01 ± 0.03	6.9 ± 0.8	1192 ± 90	2.386
	W89	2/18/92	2/25/92	56.40 ± 2.66	0.842 ± 0.014	0.217 ± 0.002	(3.50) ± (0.077)	1.7 ± 0.2	3.05 ± 0.04	5.4 ± 0.6	1399 ± 106	2.098
	W90	2/25/92	3/03/92	52.30 ± 2.59	0.354 ± 0.013	0.206 ± 0.003	0.866 ± 0.061	1.3 ± 0.2	2.11 ± 0.05	4.7 ± 0.6	1143 ± 87	1.829
	W91	3/03/92	3/10/92	42.50 ± 2.07	0.529 ± 0.023	0.198 ± 0.008	0.398 ± 0.063	1 ± 0.2	3.14 ± 0.06	4.7 ± 0.6	1931 ± 152	1.471
	W92	3/10/92	3/17/92	89.87 ± 4.23	0.340 ± 0.009	0.136 ± 0.006	0.771 ± 0.061	0.9 ± 0.2	1.54 ± 0.05	5.3 ± 0.6	1022 ± 81	2.099
	W93	3/17/92	3/24/92	92.66 ± 4.33	0.948 ± 0.012	0.114 ± 0.011	1.828 ± 0.073	1.7 ± 0.2	3.73 ± 0.03	7.8 ± 0.9	1298 ± 103	2.435
	W94	3/24/92	3/31/92	101.30 ± 4.75	0.722 ± 0.012	0.190 ± 0.019	0.944 ± 0.069	1.4 ± 0.2	8.34 ± 0.05	4.8 ± 0.6	1185 ± 94	1.829
	W95	3/31/92	4/07/92	109.10 ± 5.07	0.672 ± 0.005	0.136 ± 0.003	0.928 ± 0.064	2 ± 0.3	7.81 ± 0.06	6.9 ± 0.8	1268 ± 100	2.374
	W96	4/07/92	4/14/92	217.81 ± 10.12	1.558 ± 0.021	0.258 ± 0.002	1.105 ± 0.067	2.4 ± 0.3	3.76 ± 0.04	9 ± 1	1699 ± 134	2.001
	W97	4/14/92	4/21/92	105.87 ± 4.93	0.813 ± 0.017	0.136 ± 0.009	0.493 ± 0.066	1.1 ± 0.2	2.85 ± 0.10	6.2 ± 0.7	969 ± 77	1.085
	W98	4/21/92	4/28/92	92.51 ± 4.37	0.360 ± 0.012	0.168 ± 0.017	0.562 ± 0.065	1.5 ± 0.2	1.78 ± 0.12	4.3 ± 0.5	1349 ± 106	1.600
	W99	4/28/92	5/05/92	319.78 ± 14.65	0.521 ± 0.011	0.216 ± 0.009	1.229 ± 0.072	1.5 ± 0.2	3.89 ± 0.10	5.3 ± 0.6	1603 ± 127	2.258
	W100	5/05/92	5/12/92	66.25 ± 3.19	0.487 ± 0.021	0.078 ± 0.011	0.398 ± 0.068	0.7 ± 0.2	4.96 ± 0.04	2.8 ± 0.4	1095 ± 86	0.974
	W101	5/12/92	5/19/92	117.89 ± 5.48	0.674 ± 0.011	0.102 ± 0.008	0.982 ± 0.067	1.5 ± 0.2	3.88 ± 0.16	5.2 ± 0.6	1681 ± 133	1.570
	W102	5/19/92	5/26/92	251.50 ± 11.59	0.815 ± 0.018	0.085 ± 0.005	(4.37) ± (0.0899)	1.6 ± 0.3	7.82 ± 0.15	7.8 ± 0.9	1831 ± 145	1.862
	W103	5/26/92	6/02/92	79.89 ± 3.74	1.088 ± 0.013	0.199 ± 0.003	(2.37) ± (0.087)	1.2 ± 0.2	(13.9) ± (0.40)	6.1 ± 0.7	1422 ± 112	1.538
	W104	6/02/92	6/09/92	52.45 ± 2.55	0.434 ± 0.006	0.128 ± 0.006	0.403 ± 0.067	1.1 ± 0.2	(17.0) ± (0.766)	2.7 ± 0.4	2135 ± 168	1.439
Year 3	W105	6/09/92	6/16/92	154 19 ± 7.16	0 583 ± 0 020	0 51 ± 0 006	±	1 90 ± 0 30	11.71 ± 0 14	7 00 ± 0 60	1805 ± 142	1.517
	W106	6/16/92	6/24/92	98 20 ± 4 60	0 428 ± 0 016	0 28 ± 0 005	±	1 30 ± 0 20	3.34 ± 0 04	3 60 ± 0 50	1421 ± 112	1.667
	W107	6/24/92	6/30/92	73 16 ± 3 46	0 550 ± 0 008	0 56 ± 0 016	±	2 00 ± 0 30	(20.67 ± 0.549)	7 10 ± 0 80	3105 ± 245	2.390
	W108	6/30/92	7/07/92	94 68 ± 4 45	0 548 ± 0 012	0 35 ± 0 013	±	2 80 ± 0 30	6 42 ± 0 07	4 60 ± 0 60	2314 ± 183	0 832
	W109	7/07/92	7/14/92	(801 7 ± 36.7)	0 591 ± 0 009	0 37 ± 0 005	±	1 80 ± 0 30	13 00 ± 0 59	4 40 ± 0 60	3157 ± 249	2 543
	W110	7/14/92	7/15/92	(3507.5 933.6)	0 73 0 04	0 193 0 004	3 82 0 16	2 2 0 4	6 32 0 45	5 1 0 8	2235 176	2 17
	W111	7/21/92	7/22/92		0 58 0 02	0 174 0 008	3 21 0 16	2 1 0 4	5 60 0 19	5 9 0 8	3403 268	3 86
	W112	7/28/92	7/29/92		0 49 0 02	0 128 0 008	1 10 0 13	2 2 0 3	2 07 0 22	7 8 0 9	2277 180	1 55
	W113	8/04/92	8/05/92		0 42 0 02	0 143 0 011	1 07 0 13	1 1 0 3	1 61 0 17	4 6 0 6	2495 197	1 75
	W114	8/11/92	8/12/92	156.1 51.9	1 23 0 04	0 187 0 006	0 94 0 13	1 5 0 3	3 42 0 24	5 8 0 8	3413 269	2 96
	W115	8/18/92	8/19/92		0 81 0 03	0 407 0 009	0 50 0 13	1 9 0 3	2 25 0 28	4 1 0 6	3501 276	2 25
	W116	8/25/92	8/26/92		0 11 0 01	0 085 0 017	< 0 09 0 09		4 31 0 22	2 5 0 5	210 17	
	W117	9/01/92	9/02/92		0 70 0 03	0 324 0 015	1 33 0 13	1 8 0 3	2 85 0 19	7 0 9	2388 188	1 97
	W118	9/08/92	9/09/92		0 10 0 01	0 107 0 005	< 0 13 0 13		2 35 0 38		54 5	< 0 02
	W119	9/15/92	9/16/92		0 31 0 01	0 064 0 004	0 25 0 13		0 48 0 19		788 62	0 34
	W120	9/22/92	9/24/92		0 31 0 01	0 153 0 002	0 47 0 06	1 1 0 2	1 01 0 14	3 5 0 4	831 66	0 80
	W121	9/29/92	9/30/92		0 29 0 02	1 113 0 005	0 87 0 12	0 8 0 2	3 14 0 43	1 6 0 4	460 37	0 63
	W122	10/06/92	10/07/92		0 41 0 02	0 082 0 004	0 63 0 12	1 9 0 3	3 64 0 18	4 9 0 7	476 38	0 54

Sample ID			Al		As		Cd		Cr		Cu		Ni		Pb		S		
			ng/m³	Sigma	ng/m³	Sigma	ng/m³	Sigma	ng/m³	Sigma	ng/m³	Sigma	ng/m³	Sigma	ng/m³	Sigma	ng/m³	Sigma	ng/m³
W123	10/13/92	10/14/92	180.4	56.9	0.84	0.03	0.312	0.005	1.21	0.13	2.9	0.4	4.09	0.20	12.2	1.3	1627	129	2.16
W124	10/20/92	10/21/92	165.2	50.2	0.53	0.02	0.180	0.016	0.67	0.12	1.2	0.3	4.58	0.17	4	0.6	772	61	1.27
W125	10/27/92	10/28/92	124.1	39.6	0.50	0.02	0.202	0.004	0.58	0.12	4.3	0.5	4.81	0.17	6.1	0.8	541	43	0.66
W126	11/03/92	11/04/92			0.38	0.02	0.109	0.003	0.34	0.12	1.7	0.3	2.41	0.20	2.7	0.5	1024	81	0.91
W127	11/10/92	11/11/92			0.75	0.03	0.259	0.003	0.63	0.12	2.2	0.3	7.08	0.19	7.4	0.9	1085	86	0.97
W128	11/17/92	11/18/92	160.1	50.9	1.27	0.04	0.204	0.003	0.91	0.12	1.5	0.3	4.12	0.16	7.7	0.9	1186	94	2.70
W129	11/24/92	11/25/92			0.31	0.03	0.247	0.003	0.42	0.11	0.9	0.2	1.89	0.16	3.1	0.5	781	62	0.81
W130	12/01/92	12/02/92			1.21	0.05	0.030	0.006	0.87	0.13	3.2	0.4			14.4	1.6	1741	138	3.39
W131	12/08/92	12/09/92			0.79	0.03	0.227	0.002	1.15	0.12	1.5	0.3	1.17	0.16	6.9	0.8	1297	103	1.55
W132	12/15/92	12/16/92			0.56	0.06	0.249	0.002	0.25	0.11	1.1	0.3	5.04	0.19	3.4	0.6	3233	255	1.10
W133	12/22/92	12/23/92			1.41	0.05	0.268	0.004	0.49	0.11	2.1	0.3	1.53	0.18	7.8	0.9	1017	81	4.77
W134	12/29/92	12/30/92			0.48	0.02	0.188	0.004	0.51	0.13	2	0.3	10.31	0.19	12.5	1.4	189	16	0.63
W135	1/05/93	1/06/93			0.42	0.02	0.062	0.005	1.27	0.12	1.1	0.3			3.3	0.5	736	58	1.76
W136	1/12/93	1/13/93	< 2.525	2.525	0.83	0.02	0.066	0.002	< 0.06	0.06			< 0.15	0.15	< 0.25	0.25	536	41	0.22
W137	1/19/93	1/20/93	55.9	13.6	0.48	0.01	0.117	0.003	0.63	0.13	1.1	0.3	0.44	0.15	4.1	0.7	478	36	1.22
W138	1/26/93	1/27/93	< 3.3	3.3	0.75	0.03	0.161	0.008	0.98	0.12	2.2	0.4	3.85	0.19	6.9	1	637	49	1.18
W139	2/02/93	2/03/93	37.6	13.9	0.92	0.03	0.447	0.010	0.62	0.10	1	0.3	1.36	0.17	5.1	0.8	565	42	1.65
W140	2/09/93	2/10/93	< 3.825	3.825	0.68	0.04	0.150	0.004	0.54	0.12	2.4	0.4	4.51	0.16	5.5	0.9	840	64	1.01
W141	2/16/93	2/17/93	17	3	0.60	0.03	0.167	0.005	0.69	0.12	< 0.25	0.25	1.00	0.17	4	0.7	1672	128	1.81
W142	2/23/93	2/24/93	35.6	13.2	0.82	0.02	0.209	0.007	0.41	0.11	1.3	0.3	1.05	0.15	5.2	0.8	1621	122	1.48
W143	3/02/93	3/03/93	55.9	16.2	1.02	0.03	0.167	0.008	0.75	0.12	2.5	0.5	2.22	0.18	8.9	1.1	2423	185	3.24
W144	3/09/93	3/10/93	< 3.225	3.225	0.64	0.02	0.176	0.009	0.92	0.11	1.4	0.4	1.38	0.16	5.7	0.9	1496	113	1.35
W145	3/16/93	3/17/93	35.5	12.9	0.43	0.03	0.055	0.005	0.21	0.11	< 0.15	0.15	1.67	0.21	2.8	0.6	957	73	0.69
W146	3/30/93	3/31/93	< 3.35	3.35	0.53	0.02	0.034	0.004	0.61	0.12	1.1	0.4	0.46	0.18	7.8	1.1	1095	86	0.98
W147	4/06/93	4/07/93	104.8	17.4	0.50	0.04	0.111	0.006	0.62	0.10	1.2	0.3	3.08	0.16	3.7	0.7	556	42	0.48
W148	4/13/93	4/15/93	41.8	14.4	0.55	0.02	0.139	0.008	0.84	0.11	1.9	0.4	2.88	0.17	7.8	1	918	70	2.30
W149	4/20/93	4/21/93	94.1	18.2	0.39	0.05	0.072	0.007	0.53	0.12	< 0.3	0.3	0.66	0.17	3	0.7	1151	88	0.72
W150	4/27/93	4/28/93	85.4	17	0.60	0.02	0.204	0.022	0.92	0.12	2.4	0.5	2.39	0.18	5.3	0.9	575	45	0.52
W151	5/04/93	5/05/93	47.5	15.9	0.25	0.02	0.006	0.006	0.29	0.11			< 0.08	0.08	1.4	0.6	999	78	0.49
W152	5/18/93	5/19/93	38.6	14.4	0.66	0.02	0.081	0.004	0.37	0.12	1.1	0.4	0.80	0.17	4	0.8	1535	120	1.04
W153	5/25/93	5/26/93	113.8	20.4	0.46	0.02	0.137	0.003	0.83	0.12	< 0.2	0.2	0.93	0.18	3.9	0.8	2565	200	1.36
W154	6/01/93	6/02/93	51.5	15.5	0.46	0.01	0.134	0.005	1.14	0.12	1.7	0.4	0.62	0.18	6	0.9	1627	126	2.81
W155	6/08/93	6/09/93	59.5	17.8	1.13	0.03	0.147	0.005	0.42	0.13	< 0.4	0.4	0.52	0.18	4.5	0.8	2708	217	2.42
W156	6/15/93	6/16/93	77.5	17.9	0.33	0.03			0.62	0.13	1	0.4			2.3	0.7	1667	132	1.16
W157	6/22/93	6/23/93	63.8	18.2	0.70	0.03			1.27	0.14	1.4	0.4			11.9	1.5	2627	210	2.30
W158	6/29/93	6/30/93	92.6	20.8	1.29	0.03			1.38	0.14	6	0.8			11.6	1.5	3932	311	3.54
W159	7/06/93	7/07/93	235.1	32.1	1.06	0.04			1.06	0.14	2.1	0.5			6.3	1	5369	425	2.29
W160	7/13/93	7/14/93	259.7	34.8	0.73	0.03			3.46	0.15	1.3	0.4			6.9	1.1	5780	466	4.24
W161	7/20/93	7/21/93	69.7	18.6	0.83	0.03			2.20	0.13	1.8	0.4			10.8	1.4	3552	280	2.97
W162	7/27/93	7/28/93	123.9	23.5	0.72	0.03			1.24	0.13	1.9	0.4			5.3	0.9	4418	351	2.80
W163	8/3/93	8/4/93	98.9	19.5	0.67	0.02			1.28	0.13	1.3	0.4			3.5	0.8	2937	231	2.21
W164	8/10/93	8/11/93	< 3.675	3.675	0.58	0.02			0.57	0.12	< 0.15	0.15			2.9	0.7	2396	186	1.74
W165	8/17/93	8/18/93	72.5	18.7	0.99	0.03			1.09	0.14	2.6	0.5			7.4	1	4338	337	3.45
166	8/24/93	8/25/93																	
167	8/31/93	9/1/93																	
168	9/7/93	9/8/93																	
169	9/14/93	9/15/93																	
170	9/21/93	9/22/93																	
171	9/28/93	9/29/93																	

Wye
Year 1

First 12 months statistics

ave			119		0.713		0.14		0.744		2.31		3.023		4.2		2491		1.5
STD			59		0.342		0.08		0.549		1.80		2.830		2.5		1538		0.7
avg error			12.2		0.071		0.02		0.232		0.27		0.308		0.5		428		0.2
count			47		48		48		48		47		48		48		42		48
min			25		0.337		0.01		0.168		0.15		0.182		0.2		101		0.6
max			303		1.963		0.43		2.279		9.24		11.391		13.6		6783		3.5
median			107		0.611		0.12		0.595		1.74		1.939		4.1		2005		1.4
max/mean			2.5		2.8		3.2		3.1		4.0		3.8		3.3		2.7		2.3

Sample ID		Al ng/m³	Sigma	As ng/m³	Sigma	Cd ng/m³	Sigma	Cr ng/m³	Sigma	Cu ng/m³	Sigma	Ni ng/m³	Sigma	Pb ng/m³	Sigma	S ng/m³	Sigma	ng/m³
1st 18 mos		First 18 months statistics																
	ave	114		0.643		0.14		0.718		2.09		3.001		3.9		2586		1.6
	STD	59		0.328		0.07		0.485		1.54		2.491		2.3		1637		0.6
	avg error	10		0.050		0.02		0.171		0.24		0.290		0.5		379		0.1
	count	75		76		75		75		73		76		76		70		76
	min	25		0.105		0.01		0.020		0.15		0.080		0.1		14		0.4
	max	303		1.963		0.43		2.279		9.24		11.391		13.6		7386		3.5
	median	95		0.558		0.13		0.639		1.67		2.285		3.9		2299		1.5
	max/mean	2.7		3.1		3.1		3.2		4.4		3.8		3.5		2.9		2.2
Year 2		Year 2 statistics																
	ave	102		0.616		0.15		0.751		1.62		3.638		4.4		2147		1.8
	STD	63		0.306		0.05		0.373		0.69		2.106		2.3		1485		0.6
	avg error	6		0.013		0.01		0.061		0.19		0.216		0.5		232		0.1
	count	51		51		50		47		48		48		51		51		51
	min	33		0.105		0.05		0.020		0.35		0.080		0.1		14		0.4
	max	320		1.558		0.29		1.828		3.75		8.685		13.0		7386		4.2
	median	84		0.527		0.15		0.706		1.50		3.052		4.3		1699		1.8
	max/mean	3.1		2.5		1.9		2.4		2.3		2.4		3.0		3.4		2.3
		Year 3 statistics																
Year 3	ave	82		0.644		0.21		0.898		1.68		3.137		5.7		1828		1.7
	STD	62		0.287		0.17		0.734		0.98		2.834		2.9		1301		1.1
	avg error	18		0.026		0.01		0.121		0.34		0.196		0.8		144		0.1
	count	39		61		51		56		56		48		59		61		60
	min	3		0.095		0.01		0.065		0.15		0.075		0.3		54		0.0
	max	260		1.411		1.11		3.822		6.00		13.003		14.4		5780		4.8
	median	70		0.584		0.17		0.681		1.60		2.348		5.2		1535		1.6
	max/mean	3.2		2.2		5.4		4.3		3.6		4.1		2.5		3.2		2.8

[1] Sampler malfunction, either no sample was collected or the air volume was inaccurate, values (when reported) are ng/filter, but not included in averages or flux estimates.
[2] Value not included in average.
ND = not detected.

Notes: December, 1994, pfc

Analyze data for final submittal to J.Baker - Detection limits handled as follows:

If value/sigma <= 2, then value taken as value/2, and sigma = value/2
If value/sigma > 2, then left as is

If value >6 times avg, then remove from average - place in parentheses

Se		Zn		V		Br		Fe		Mn	
ng/m³	Sigma	ng/m³	Sigma	ng/m³	Sigma	ng/m³	Sigma	ng/m³	Sigma	ng/m³	Sigma
					(Wye Site)						
Se		Zn		V		Br		Fe		Mn	
ng/m³	Sigma	ng/m³	Sigma	ng/m³	Sigma	ng/m³	Sigma	ng/m³	Sigma	ng/m³	Sigma
±	0.091	5.57	± 0.76	0.564	± 0.044	1.43	± 0.13	91	± 4.6	3.44	± 0.03
±	0.10	17.5	± 2.4	3.80	± 0.23	2.68	± 0.28	127	± 12.4	1.53	± 0.08
±	0.11	5.37	± 0.79	1.74	± 0.14	1.89	± 0.22	91	± 7.8	2.90	± 0.15
±	0.19	10.0	± 1.4	3.36	± 0.26	3.03	± 0.24	115	± 6.7	4.09	± 0.20
±	0.18	9.68	± 1.4	4.51	± 0.35	2.77	± 0.29	167	± 9.7	4.71	± 0.24
±	0.20	7.10	± 1.0	4.09	± 0.35	1.54	± 0.16	116	± 7.3	3.25	± 0.16
±	0.21	7.68	± 1.1	5.08	± 0.43	2.54	± 0.23	129	± 8.1	1.84	± 0.09
±	0.11	48.2	± 6.7	1.81	± 0.14	1.84	± 0.18	283	± 16.0	3.55	± 0.18
±	0.22	9.73	± 1.2	(26.5	± 2.25)	3.00	± 0.29	162	± 7.4	4.05	± 0.20
±	0.12	9.97	± 0.99	3.12	± 0.24	1.89	± 0.17	85	± 3.1	2.10	± 0.02
±	0.66)	(37.9	± 4.8)	(14.0	± 1.1)	ND		(292	± 15)	< 0.55	
±	0.23	13.0	± 1.6	3.22	± 0.25	1.11	± 0.20	149	± 7.6	4.24	± 0.21
±	0.30	12.2	± 1.5	4.43	± 0.35	4.38	± 0.37	183	± 9.1	6.69	± 0.33
±	0.18	10.7	± 1.3	2.72	± 0.21	2.09	± 0.14	96	± 11.2	3.15	± 0.16
±	17)	(92	± 114)	(1.3	± 0.61)	(1.69	± 0.13)	(10100	± 560)	(2.94	± 0.15)
±	0.38	20.0	± 2.5	3.47	± 0.22	4.97	± 0.34	160	± 9.5	5.81	± 0.29
±	0.17	6.79	± 0.89	1.51	± 0.10	2.48	± 0.18	109	± 8.1	3.67	± 0.18
±	0.082	5.94	± 0.75	1.95	± 0.15	6.85	± 0.57	101	± 5.1	3.21	± 0.16
±	0.056	8.88	± 1.1	1.97	± 0.15	2.45	± 0.19	70	± 4.4	3.15	± 0.16
±	0.078	18.4	± 2.2	1.59	± 0.10	1.90	± 0.16	100	± 4.7	4.44	± 0.22
±	0.22	23.9	± 2.9	3.49	± 0.27	5.36	± 0.36	277	± 12.5	8.20	± 0.41
±	0.11	9.75	± 1.2	1.61	± 0.13	2.09	± 0.18	95	± 4.8	4.14	± 0.21
±	0.16	15.0	± 1.9	3.17	± 0.25	3.23	± 0.27	148	± 6.2	3.84	± 0.19
±	0.081	9.16	± 1.1	1.43	± 0.11	2.21	± 0.19	63	± 3.5	2.40	± 0.12
±	0.089	14.9	± 1.4	1.89	± 0.12	1.58	± 0.15	65	± 2.0	1.03	± 0.08
±	0.18	23.9	± 2.2	3.62	± 0.23	4.52	± 0.38	154	± 4.3	1.75	± 0.13
±	0.089	10.2	± 1.0	2.46	± 0.16	2.67	± 0.24	33	± 2.7	0.81	± 0.08
±	0.18	18.0	± 1.7	3.82	± 0.24	ND		89	± 3.3	1.40	± 0.11
±	0.34	35.7	± 4.5	7.03	± 0.55	0.064	± 0.006	160	± 7.9	< 0.03	± 0.03
±	0.20	16.1	± 1.5	4.02	± 0.34	4.36	± 0.35	93	± 3.8	2.86	± 0.11
±	0.21	12.7	± 1.3	4.40	± 0.37	3.50	± 0.28	73	± 3.3	2.38	± 0.09
±	0.24	25.1	± 2.4	5.44	± 0.44	3.43	± 0.23	169	± 6.0	4.98	± 0.10
±	0.20	15.1	± 1.4	3.83	± 0.32	4.10	± 0.33	103	± 3.2	3.01	± 0.12
±	0.29	27.1	± 2.5	6.68	± 0.56	8.43	± 0.68	118	± 4.0	5.32	± 0.21
±	0.13	9.16	± 0.9	3.26	± 0.26	2.75	± 0.18	50	± 2.3	1.18	± 0.02
±	0.14	12.3	± 1.2	2.95	± 0.25	2.98	± 0.24	78	± 3.1	2.43	± 0.09
±	0.15	13.8	± 1.3	2.58	± 0.22	3.71	± 0.30	76	± 3.3	2.24	± 0.09
±	0.17	14.0	± 1.4	2.39	± 0.19	2.53	± 0.17	115	± 4.4	3.06	± 0.06
±	0.12	13.5	± 1.3	3.87	± 0.33	2.78	± 0.23	72	± 2.4	2.14	± 0.08
±	0.11	12.6	± 1.2	3.20	± 0.27	3.16	± 0.26	86	± 3.1	2.73	± 0.11
±	0.089	8.67	± 0.86	3.81	± 0.31	2.80	± 0.19	83	± 2.8	2.44	± 0.05
±	0.15	12.2	± 1.2	3.67	± 0.31	4.06	± 0.34	105	± 4.0	3.05	± 0.12
±	0.10	12.0	± 1.2	2.72	± 0.23	4.60	± 0.40	138	± 5.1	3.40	± 0.13
±	0.10	7.21	± 0.77	2.41	± 0.19	2.39	± 0.17	60	± 2.9	1.22	± 0.03
±	0.11	12.3	± 1.2	3.04	± 0.26	4.67	± 0.41	95	± 3.0	2.30	± 0.09
±	0.079	6.32	± 0.69	1.42	± 0.12	1.68	± 0.14	88	± 3.3	3.26	± 0.13
±	0.20	21.4	± 2.0	3.39	± 0.27	3.20	± 0.22	177	± 5.1	4.43	± 0.09
±	0.095	9.20	± 1.0	2.95	± 0.25	2.83	± 0.28	120	± 4.2	2.99	± 0.12
±	0.12	5.91	± 0.73	3.47	± 0.29	3.45	± 0.31	171	± 5.9	3.31	± 0.13
±	0.18	13.6	± 1.3	4.53	± 0.36	2.60	± 0.18	142	± 4.4	4.53	± 0.09
±	0.12	13.8	± 1.3	2.73	± 0.22	2.66	± 0.18	194	± 5.5	3.76	± 0.08
±	0.14	10.9	± 1.0	2.50	± 0.21	2.81	± 0.24	158	± 4.3	3.68	± 0.14
±	0.11	12.8	± 1.2	4.73	± 0.40	2.81	± 0.24	72	± 2.6	2.02	± 0.08
±	0.12	7.20	± 0.74	3.66	± 0.30	2.99	± 0.21	92	± 3.0	2.52	± 0.06
±	0.13	4.70	± 0.56	3.55	± 0.30	2.13	± 0.19	69	± 3.0	1.74	± 0.07

Se		Zn		V		Br		Fe		Mn	
	Sigma	ng/m³	Sigma	ng/m³	Sigma	ng/m³	Sigma	ng/m³	Sigma	ng/m³	Sigma
±	0.15	14.49 ±	1.06	4.909	± 0.265	3.146 ±	0.113	225 ±	5.4	3.821	± 0.079
±	0.11	13.18 ±	0.97	3.734	± 0.222	1.897 ±	0.120	164 ±	4.2	2.884	± 0.113
±	0.10	8.33 ±	0.66	2.195	± 0.119	2.350 ±	0.084	86 ±	3.0	2.924	± 0.060
±	0.10	12.75 ±	0.94	2.478	± 0.136	1.975 ±	0.083	216 ±	5.1	3.231	± 0.067
±	0.10	19.40 ±	1.36	2.795	± 0.166	2.381 ±	0.143	118 ±	3.4	2.421	± 0.095
±	0.11	9.14 ±	0.71	4.622	± 0.248	2.987 ±	0.115	103 ±	3.3	2.487	± 0.052
±	0.10	12.01 ±	0.89	2.625	± 0.156	2.715 ±	0.158	151 ±	4.0	2.306	± 0.090
±	0.09	13.81 ±	0.99	4.101	± 0.219	2.121 ±	0.078	68 ±	2.5	3.034	± 0.061
±	0.08	10.02 ±	0.75	3.284	± 0.195	1.867 ±	0.105	55 ±	2.2	1.822	± 0.071
±	0.12	15.68 ±	1.15	2.137	± 0.114	2.978 ±	0.111	96 ±	3.9	3.044	± 0.062
±	0.09	7.69 ±	0.64	2.077	± 0.123	2.120 ±	0.118	80 ±	3.2	1.865	± 0.073
±	0.14	16.61 ±	1.19	2.286	± 0.122	3.883 ±	0.126	116 ±	3.6	3.206	± 0.065
±	0.09	27.34 ±	1.89	1.683	± 0.100	2.116 ±	0.118	89 ±	3.1	2.388	± 0.093
±	0.11	21.50 ±	1.51	5.692	± 0.305	3.421 ±	0.112	103 ±	3.4	2.116	± 0.044
±	0.05	31.75 ±	2.18	0.845	± 0.051	1.336 ±	0.078	75 ±	2.8	2.103	± 0.082
±	0.03	6.47 ±	0.55	2.613	± 0.140	1.035 ±	0.035	65 ±	2.8	1.269	± 0.026
±	0.10	12.77 ±	0.93	3.453	± 0.205	1.870 ±	0.102	71 ±	2.7	1.572	± 0.061
±	0.10	9.07 ±	0.74	4.886	± 0.262	2.727 ±	0.116	58 ±	3.3	1.368	± 0.029
±	0.14	12.63 ±	1.01	4.104	± 0.244	4.193 ±	0.236	85 ±	4.3	2.480	± 0.097
±	0.11	22.06 ±	1.63	2.799	± 0.150	2.276 ±	0.103	102 ±	5.1	2.336	± 0.048
±	0.11	15.66 ±	1.11	4.742	± 0.281	3.101 ±	0.168	89.08 ±	2.96	1.636	± 0.066
±	0.15	20.31 ±	1.42	4.806	± 0.258	4.109 ±	0.136	137.07 ±	3.85	3.282	± 0.069
±	0.14	19.87 ±	1.39	4.465	± 0.267	4.050 ±	0.225	93.19 ±	3.28	2.489	± 0.101
±	0.10	(51.31	± 46.95)	5.777	± 0.314	4.174 ±	0.179	67.63 ±	2.51	1.613	± 0.040
±	0.17	< 8.6 ±	8.6	3.485	± 0.209	3.930 ±	0.219	114.54 ±	3.17	2.878	± 0.117
±	0.06	< 11.5 ±	11.5	2.545	± 0.138	2.667 ±	0.092	55.90 ±	2.20	2.694	± 0.060
±	0.08	< 5.7 ±	5.7	4.220	± 0.228	3.439 ±	0.113	75.57 ±	2.80	2.300	± 0.052
±	0.237	29.275 ±	1.975	11.21	± 0.21	< 0.010 ±	0.010	128.30 ±	4.40	2.5 ±	0.3
±	0.108	14.273 ±	0.978	3.84	± 0.07	2.151 ±	0.016	74.99 ±	3.66	1.3 ±	0.2
±	0.135	17.640 ±	1.198	5.86	± 0.11	2.665 ±	0.015	62.29 ±	3.41	2 ±	0.2
±	0.118	19.218 ±	1.308	5.43	± 0.09	1.841 ±	0.019	79.54 ±	3.77	1.8 ±	0.2
±	0.103	19.296 ±	1.313	3.69	± 0.08	< 0.006 ±	0.006	74.36 ±	3.70	1.7 ±	0.2
±	0.083	15.211 ±	1.041	5.03	± 0.09	2.698 ±	0.029	63.76 ±	3.68	0.9 ±	0.2
±	0.121	13.917 ±	0.956	1.97	± 0.04	1.928 ±	0.012	103.22 ±	3.91	2.9 ±	0.3
±	0.138	19.199 ±	1.329	6.73	± 0.12	3.305 ±	0.020	111.12 ±	4.49	3.3 ±	0.3
±	0.109	11.599 ±	0.844	4.51	± 0.09	2.102 ±	0.016	106.02 ±	4.39	2.7 ±	0.3
±	0.133	21.119 ±	1.438	2.74	± 0.05	2.573 ±	0.011	145.43 ±	4.65	3.9 ±	0.4
±	0.113	22.380 ±	1.525	6.37	± 0.13	3.587 ±	0.028	182.66 ±	5.27	3.7 ±	0.4
±	0.062	14.978 ±	1.035	5.23	± 0.09	2.648 ±	0.024	101.61 ±	4.23	1.1 ±	0.2
±	0.091	11.663 ±	0.817	2.52	± 0.05	1.395 ±	0.013	104.99 ±	4.16	2.7 ±	0.3
±	0.131	15.728 ±	1.096	3.33	± 0.07	1.956 ±	0.014	260.27 ±	6.41	6.1 ±	0.5
±	0.057	5.930 ±	0.463	2.92	± 0.06	1.055 ±	0.020	57.71 ±	3.84	1.4 ±	0.2
±	0.091	17.285 ±	1.180	5.76	± 0.10	1.623 ±	0.014	137.88 ±	4.79	2.6 ±	0.3
±	0.105	17.817 ±	1.222	4.06	± 0.09	< 0.009 ±	0.009	384.81 ±	8.72	8.2 ±	0.7
±	0.090	13.653 ±	0.988	3.47	± 0.06	1.599 ±	0.014	195.24 ±	6.24	4.4 ±	0.4
±	0.083	6.739 ±	0.491	3.39	± 0.06	1.593 ±	0.010	54.91 ±	3.87	0.9 ±	0.2
±	0.088	15.806 ±	1.131	5.01	± 0.09	2.138 ±	0.021	156.51 ±	5.58	3.8 ±	0.4
±	0.094	14.239 ±	0.779	2.14	± 0.05	< 0.007 ±	0.007	99.89 ±	3.67	2.2 ±	0.2
±	0.135	15.591 ±	1.076	3.20	± 0.06	3.345 ±	0.015	104.05 ±	4.60	2.3 ±	0.3
±	0.077	< 0.008 ±	0.008	2.88	± 0.06	2.408 ±	0.017	103.50 ±	4.57	2.2 ±	0.3
±	0.143	12.327 ±	0.934	4.46	± 0.11	< 0.003 ±	0.003	551.32 ±	11.82	8.5 ±	0.7
	0.15	12.1	1.4	7.2	1.2	3.92	0.11	(1786.6	41.9)	(26.4	2.2)
	0.24	15.1	1.2	8.6	1	4.56	0.09	171	7	4.4	0.5
	0.10	9.6	0.7	1.6	0.5	2.40	0.07	106	5	3.1	0.4
	0.11	10.2	0.8			2.91	0.08	84	5	2.5	0.3
	0.18	15.2	1.1	3.7	0.6	4.20	0.09	111	5	2.1	0.3
	0.14	9.5	0.7	3.3	0.6	3.57	0.08	101	5	1.4	0.3
		2.8	0.4			0.73	0.07	45	4		
	0.13	18.4	1.3	2.2	0.5	4.08	0.09	154	6	4.1	0.5
	0.02	2.0	0.5			0.49	0.11	27	6		
	0.04	4.5	0.5			0.95	0.07	25	4		
	0.05	8.9	0.6	1.9	0.3	1.64	0.04	54	3	1.8	0.2
	0.05	6.9	0.6			1.30	0.06	66	4	2.4	0.3
	0.06	12.2	0.9	6.8	0.8	2.25	0.07	95	5	2	0.3

Se		Zn		V		Br		Fe		Mn	
Sigma		ng/m³	Sigma	ng/m³	Sigma	ng/m³	Sigma	ng/m³	Sigma	ng/m³	Sigma
0.13		26.9	1.9	2.4	0.6	4.38	0.08	175	6	7.3	0.7
0.09		8.9	0.7	3.6	0.6	2.76	0.06	97	5	2.3	0.3
0.06		10.0	0.8	5	0.7	1.55	0.06	80	5	2.1	0.3
0.06		9.0	0.7	3.2	0.5	2.29	0.07	43	4	0.9	0.2
0.07		17.9	1.3	7.6	0.9	4.52	0.09	68	5	1.4	0.3
0.17		14.0	1.1	4.9	0.7	4.73	0.08	134	6	2.7	0.3
0.06		9.5	0.7	3.7	0.5	2.97	0.09	35	4	0.6	0.2
0.21		26.9	1.9	4.8	0.7	12.11	0.18	111	6	9.7	0.9
0.10		18.0	1.3	3.1	0.5	3.09	0.07	113	5	3.3	0.4
0.08		6.2	0.5	14.8	1.6	4.58	0.11	44	4	0.8	0.2
0.28		13.0	1.0	4.4	0.7	5.77	0.11	89	5	1.8	0.3
0.06		8.6	0.7	3.7	0.6	1.70	0.07	69	5		
0.11		8.8	0.7	1.5	0.4	1.63	0.07	57	4	2.2	0.3
0.03		1.0	0.2	1.3	0.5	0.27	0.06	7	3		
0.08		9.1	0.7	1.4	0.5	2.83	0.06	74	5	2.5	0.3
0.08		14.4	1.0	6.7	0.9	4.31	0.07	68	4	1.9	0.3
0.10		9.9	0.7	2	0.5	3.62	0.06	85	4	1.4	0.3
0.07		12.1	0.9	8.7	1	6.19	0.08	53	4	1.5	0.3
0.11		9.6	0.7	1.2	0.5	3.32	0.09	35	4	1.3	0.02
0.09		9.1	0.7	1.4	0.5	2.88	0.06	61	4	2.5	0.3
0.19		17.4	1.3	3.5	0.6	5.50	0.09	103	5	3	0.4
0.09		12.6	0.9	1.5	0.6	2.96	0.06	74	4	3.2	0.4
0.05		3.6	0.4	5	0.7	2.36	0.07	41	4	1.6	0.3
0.07		9.5	0.7	5.6	0.8	1.78	0.06	60	4	2.2	0.3
0.04		8.7	0.7	5.6	0.7	3.48	0.08	100	4	2.2	0.3
0.14		11.7	0.9	5.3	0.7	3.83	0.07	99	5	3.9	0.4
0.05		4.5	0.5	2.6	0.6	4.38	0.12	99	4	2.4	0.4
0.06		11.9	0.9	4.1	0.7	3.10	0.07	84	5	2.5	0.4
0.04		4.1	0.4	5.2	0.7	2.87	0.07	63	4	1.1	0.3
0.08		6.0	0.5	3.8	0.6	3.29	0.07	40	4	1.5	0.3
0.09		9.7	0.8	< 0.6	0.6	3.07	0.08	116	5	3.4	0.4
0.16		14.2	1.0	1.2	0.5	2.54	0.06	112	5	3.1	0.4
0.15		8.7	0.7	2.4	0.6	5.33	0.07	78	5	1.7	0.3
0.08		4.9	0.5	3.2	0.6	3.41	0.08	66	4	2.2	0.3
0.15		16.6	1.2	1.9	0.6	3.51	0.09	121	6	4.5	0.5
0.21		22.4	1.6	2.7	0.7	5.07	0.07	147	6	5.8	0.6
0.15		9.0	0.7	6.3	0.9	4.42	0.10	224	8	3.2	0.4
0.25		13.1	1.1	8.3	1.1	5.40	0.08	278	9	6.8	0.7
0.18		26.4	1.9	4.1	0.7	4.51	0.14	236	8	6.7	0.7
0.18		11.5	1.0	7.5	1	4.26	0.14	233	9	4.4	0.5
0.13		18.4	1.3	4.5	0.7	4.25	0.07	116	5	2.8	0.4
0.11		6.2	0.5	6.6	0.9	2.29	0.07	52	4	1.5	0.3
0.21		17.3	1.3	11.5	1.3	4.86	0.08	150	6	2.4	0.4

13.9	3.2	3.076	117	3.127	
8.0	1.3	1.446	50	1.535	
1.6	0.3	0.256	6	0.135	
48	47	47	48	49	
5.4	0.6	0.064	33	0.027	
48.2	7.0	8.429	283	8.202	
12.2	3.2	2.778	102	3.054	
3.5	2.2	2.7	2.4	2.6	

Se		Zn		V		Br		Fe		Mn	
Sigma	ng/m³	Sigma	ng/m³	Sigma	ng/m³	Sigma	ng/m³	Sigma	ng/m³	Sigma	
	14.1		3.3		2.915		114		2.897		
	7.4		1.3		1.260		48		1.331		
	1.4		0.2		0.212		5		0.112		
	76		75		75		76		77		
	4.7		0.6		0.064		33		0.027		
	48.2		7.0		8.429		283		8.202		
	12.6		3.2		2.738		98		2.871		
	3.4		2.1		2.9		2.5		2.8		
	14.7		3.9		2.412		113		2.616		
	5.9		1.7		1.000		61		1.241		
	1.6		0.2		0.093		4		0.159		
	50		51		51		51		51		
	4.7		0.8		0.006		55		0.900		
	31.8		11.2		4.193		385		8.200		
	13.8		3.7		2.381		96		2.487		
	2.2		2.9		1.7		3.4		3.1		
	11.4		4.3		3.328		104		2.929		
	5.8		2.7		1.834		79		1.868		
	0.9		0.6		0.075		5		0.369		
	61		56		61		60		55		
	0.0		0.6		0.003		7		0.600		
	26.9		14.8		12.108		551		9.700		
	10.0		3.7		3.291		89		2.350		
	2.4		3.4		3.6		5.3		3.3		

Appendix E-2. Concentrations of Elements in Chesapeake Bay Aerosol (Elms Site)

Sample ID			Al ng/m³ Sigma	As ng/m³ Sigma	Cd ng/m³ Sigma	Cr ng/m³ Sigma	Cu ng/m³ Sigma	Ni ng/m³ Sigma	Pb ng/m³ Sigma	S ng/m³ Sigma
Year 1	E1[1]	06/05/90 06/12/90								
	E2	06/12/90 06/20/90	29.4 ± 2.6	0.323 ± 0.045	< 0.017 0.017	< 0.052 ± 0.052	< 0.160 0.160	1.10 ± 0.45	<0.76	ND
	E3	06/20/90 06/26/90	354 ± 30	0.379 ± 0.053	0.0968 ± 0.012	0.706 ± 0.14	(8.65 ± 0.55)	(11.1 ± 0.68)	3.08 ± 0.32	1726 ± 531
	E5	06/26/90 07/03/90	293 ± 25	0.410 ± 0.026	0.0894 ± 0.0087	0.733 ± 0.17	(7.99 ± 0.51)	(11.2 ± 0.67)	3.31 ± 0.31	4026 ± 477
	E6	07/03/90 07/10/90	(10380 ± 902)[1]	(2.95± 0.31)[1]	(2.59± 1.1)[1]	ND	(30.3± 18)[1]	(104± 44)[1]	(90.4± 45)[1]	(8224 ±16426 [1]
	E7	07/10/90 07/17/90	184 ± 16	0.294 ± 0.044	0.0654 ± 0.0078	0.185 ± 0.082	7.41 ± 0.47	7.91 ± 0.50	2.28 ± 0.26	2490 ± 444
	E8	07/17/90 07/24/90	286 ± 25	0.674 ± 0.089	0.139 ± 0.012	1.05 ± 0.13	2.13 ± 0.20	3.81 ± 0.42	5.77 ± 0.52	4384 ± 598
	E9	07/24/90 07/31/90	87.9 ± 7.7	0.472 ± 0.069	0.145 ± 0.017	0.852 ± 0.18	2.17 ± 0.28	1.65 ± 0.23	4.96 ± 0.80	3262 ± 563
	E10	07/31/90 08/07/90	160 ± 14	0.482 ± 0.072	0.0902 ± 0.012	0.730 ± 0.15	1.21 ± 0.20	1.48 ± 0.18	2.10 ± 0.58	2468 ± 378
	E11	08/07/90 08/14/90	152 ± 13	1.04 ± 0.13	0.223 ± 0.020	0.913 ± 0.18	3.09 ± 0.31	(6.05 ± 0.55)	9.24 ± 0.94	5202 ± 642
	E12	08/14/90 08/21/90	147 ± 13	0.540 ± 0.084	0.130 ± 0.015	0.520 ± 0.17	2.59 ± 0.27	(7.44 ± 0.50)	5.42 ± 0.89	4050 ± 703
	E13	08/21/90 08/28/90	85.2 ± 7.4	0.832 ± 0.12	0.158 ± 0.015	0.623 ± 0.18	2.18 ± 0.24	7.27 ± 0.46	5.85 ± 0.53	6324 ± 734
	E14	08/28/90 09/04/90	309 ± 27	0.688 ± 0.10	0.168 ± 0.016	0.889 ± 0.19	1.94 ± 0.23	0.862 ± 0.12	6.40 ± 0.52	5001 ± 864
	E15	09/04/90 09/11/90	435 ± 37	0.805 ± 0.13	0.142 ± 0.015	0.972 ± 0.23	1.94 ± 0.24	0.677 ± 0.14	5.22 ± 0.68	5182 ± 983
	E16	09/11/90 09/18/90	246 ± 21	0.857 ± 0.12	0.151 ± 0.021	0.946 ± 0.20	2.23 ± 0.23	0.665 ± 0.16	5.65 ± 1.1	3904 ± 502
	E17	09/18/90 09/25/90	118 ± 10	0.888 ± 0.12	0.178 ± 0.019	0.417 ± 0.14	1.96 ± 0.22	3.75 ± 0.26	5.87 ± 0.51	2303 ± 297
	E18	09/25/90 10/02/90	274 ± 24	1.56 ± 0.18	0.435 ± 0.031	1.407 ± 0.23	3.91 ± 0.33	5.14 ± 0.39	14.2 ± 1.1	4439 ± 653
	E19	10/02/90 10/09/90	173 ± 15	0.697 ± 0.10	0.120 ± 0.014	0.611 ± 0.19	1.36 ± 0.22	0.564 ± 0.15	3.84 ± 0.56	1302 ± 407
	E20	10/09/90 10/16/90	82.1 ± 7.2	< 0.085 ± 0.085	0.0630 ± 0.013	0.501 ± 0.18	0.555 ± 0.20	0.714 ± 0.14	2.23 ± 0.44	1035 ± 416
	E21	10/16/90 10/24/90	78.7 ± 6.8	0.601 ± 0.085	0.120 ± 0.012	0.440 ± 0.12	3.69 ± 0.28	5.38 ± 0.48	4.84 ± 0.61	736 ± 228
	E22	10/24/90 10/30/90	(3438 ± 302)[1]	(45.5± 5.5)[1]	(13.4± 1.4)[1]	(58 ± 4.0)[1]	(178± 21)[1]	(281± 72)[1]	(526± 79)[1]	(8206 ±14657 [1]
	E23	11/13/90 11/20/90	141 ± 12	1.43 ± 0.16	0.230 ± 0.020	0.857 ± 0.12	2.69 ± 0.22	3.20 ± 0.27	11.5 ± 0.75	1535 ± 291
	E24	11/20/90 11/27/90	266 ± 23	1.42 ± 0.16	0.394 ± 0.032	0.681 ± 0.13	3.00 ± 0.27	(61.2 ± 4.3)[2]	11.9 ± 0.97	2682 ± 529
	E25	11/27/90 12/04/90	89.4 ± 7.7	0.924 ± 0.060	0.189 ± 0.015	0.825 ± 0.23	2.42 ± 0.21	1.09 ± 0.19	7.21 ± 0.55	2380 ± 605
	E26	12/04/90 12/11/90	97.1 ± 8.4	0.811 ± 0.053	0.235 ± 0.017	1.070 ± 0.23	8.28 ± 0.52	5.86 ± 0.43	9.32 ± 0.61	2183 ± 373
	E27	12/11/90 12/18/90	93.0 ± 8.0	1.009 ± 0.063	0.181 ± 0.023	0.553 ± 0.22	2.49 ± 0.21	1.00 ± 0.14	6.53 ± 0.58	1627 ± 247
	E28	12/18/90 12/25/90	23.4 ± 2.1	0.376 ± 0.025	0.091 ± 0.009	< 0.102 ± 0.102	2.94 ± 0.22	1.45 ± 0.15	2.54 ± 0.29	ND
	E29	12/26/90 01/01/91	42.7 ± 3.8	0.710 ± 0.047	0.150 ± 0.013	0.423 ± 0.20	1.82 ± 0.18	4.07 ± 0.34	5.85 ± 0.41	1730 ± 280
	E30	01/09/91 01/15/91	52.5 ± 4.7	0.765 ± 0.052	0.200 ± 0.017	1.34 ± 0.31	2.23 ± 0.25	5.48 ± 0.42	7.27 ± 0.93	2944 ± 427
	E31	01/15/91 01/22/91	64.4 ± 5.6	0.721 ± 0.046	0.139 ± 0.015	1.32 ± 0.33	1.97 ± 0.25	1.30 ± 0.19	4.27 ± 0.78	ND
	E32	01/22/91 01/29/91	102 ± 8.9	0.730 ± 0.045	0.149 ± 0.016	1.13 ± 0.32	2.16 ± 0.25	2.19 ± 0.20	4.12 ± 0.39	1789 ± 288
	E33	01/29/91 02/05/91	143 ± 12	0.592 ± 0.037	0.148 ± 0.017	1.30 ± 0.35	6.19 ± 0.45	4.72 ± 0.36	3.57 ± 0.50	1923 ± 412
	E34	02/05/91 02/12/91	106 ± 9.3	0.916 ± 0.057	0.124 ± 0.016	1.27 ± 0.34	1.81 ± 0.26	2.44 ± 0.28	3.13 ± 0.37	ND
	E35	02/12/91 02/19/91	101 ± 8.8	0.413 ± 0.028	0.101 ± 0.016	< 0.302 ± 0.302	3.04 ± 0.29	1.61 ± 0.21	2.26 ± 0.44	ND
	E36	02/19/91 02/26/91	78.7 ± 6.8	0.449 ± 0.032	0.072 ± 0.013	0.668 ± 0.29	1.98 ± 0.24	2.14 ± 0.26	2.26 ± 0.41	1884 ± 520
	E37	02/26/91 03/05/91	58.6 ± 5.1	0.495 ± 0.032	0.069 ± 0.012	< 0.217 ± 0.217	1.05 ± 0.20	0.84 ± 0.26	2.01 ± 0.36	1504 ± 287
	E38	03/05/91 03/12/91	102 ± 8.8	0.571 ± 0.036	0.122 ± 0.015	< 0.275 ± 0.275	1.31 ± 0.22	4.22 ± 0.28	4.12 ± 0.43	ND
	E39	03/12/91 03/19/91	59.1 ± 5.2	0.446 ± 0.029	0.072 ± 0.015	< 0.070 0.070	1.24 ± 0.25	2.43 ± 0.23	2.96 ± 0.43	1314 ± 336
	E40	03/19/91 03/26/91	125 ± 11	0.674 ± 0.043	0.113 ± 0.017	< 0.178 ± 0.178	2.57 ± 0.30	4.19 ± 0.31	5.52 ± 0.72	2438 ± 329
	E41	03/26/91 04/02/91	144 ± 12	0.455 ± 0.031	0.110 ± 0.014	< 0.144 ± 0.144	2.50 ± 0.26	1.65 ± 0.22	3.59 ± 0.39	2603 ± 403
	E42	04/02/91 04/09/91	142 ± 12	0.473 ± 0.032	0.062 ± 0.010	0.724 ± 0.24	< 0.160 0.160	< 0.082 ± 0.082	1.08 ± 0.25	2059 ± 321
	E43	04/09/91 04/16/91	161 ± 14	0.542 ± 0.039	< 0.010 ± 0.010	< 0.194 ± 0.194	1.59 ± 0.23	2.27 ± 0.18	1.59 ± 0.38	ND
	E44	04/16/91 04/23/91	64.8 ± 5.7	0.327 ± 0.023	0.187 ± 0.026	< 0.077 ± 0.077	0.74 ± 0.21	2.89 ± 0.40	3.61 ± 0.37	2647 ± 439
	E45	04/23/91 04/30/91	207 ± 18	0.600 ± 0.039	0.0816 ± 0.019	< 0.165 ± 0.165	1.94 ± 0.24	1.67 ± 0.19	3.87 ± 0.68	3988 ± 689
	E46	04/30/91 05/07/91	11.8 ± 2.2	0.108 ± 0.007	< 0.012 0.012	ND	< 0.200 0.200	0.616 ± 0.14	< 0.262 ± 0.262	989 ± 96
	E47	05/07/91 05/14/91	30.7 ± 3.8	0.399 ± 0.027	0.052 ± 0.018	< 0.035 0.035	< 0.148 ± 0.148	1.10 ± 0.18	3.69 ± 0.61	4127 ± 414
	E48	05/14/91 05/21/91	180 ± 16	0.285 ± 0.024	< 0.005 0.005	< 0.206 ± 0.206	< 0.280 0.280	0.513 ± 0.14	< 0.19 ± 0.19	5099 ± 1280
	E49	05/21/91 05/29/91	566 ± 49	0.671 ± 0.059	0.066 ± 0.012	1.16 ± 0.29	1.14 ± 0.21	1.77 ± 0.19	4.14 ± 0.53	2343 ± 1111
	E50	05/29/91 06/04/91	369 ± 32	0.802 ± 0.050	0.266 ± 0.032	0.885 ± 0.38	0.932 ± 0.27	1.77 ± 0.21	6.12 ± 0.76	4550 ± 721
Year 2	E51	6/04/91 6/11/91	295 ± 25	0.340 ± 0.021	< 0.012 ± 0.012	< 0.238 ± 0.238	< 0.150 ± 0.150	< 0.06 ± 0.06	< 0.18 ± 0.18	3146 ± 498
	E52	6/11/91 6/18/91	350 ± 30	0.665 ± 0.042	0.0957 ± 0.019	< 0.060 ± 0.060	< 0.330 ± 0.330	< 0.139 ± 0.139	1.77 ± 0.48	3205 ± 569
	E53	6/18/91 6/25/91	55.8 ± 4.9	0.309 ± 0.021	0.172 ± 0.024	< 0.295 ± 0.295	1.31 ± 0.26	3.27 ± 0.26	4.75 ± 0.62	3943 ± 489
	E54	6/25/91 7/02/91	395 ± 34	0.316 ± 0.025	0.146 ± 0.017	0.909 ± 0.37	< 0.37 ± 0.37	0.820 ± 0.16	2.86 ± 0.64	6040 ± 930
	E55	7/02/91 7/09/91	128 ± 11	0.424 ± 0.027	0.219 ± 0.054	< 0.108 ± 0.108	3.910 ± 0.340	2.24 ± 0.21	4.55 ± 0.67	4806 ± 546
	E56	7/09/91 7/16/91	117 ± 10	0.483 ± 0.030	0.112 ± 0.016	0.797 ± 0.35	1.59 ± 0.26	3.11 ± 0.33	4.33 ± 0.47	4644 ± 534
	E57	7/16/91 7/23/91	531.9 ± 32.8	0.43 ± 0.01	0.1849 ± 0.0721	1.15 ± 0.06	0.90 ± 0.19	4.31 ± 0.23	1.27 ± 0.30	6638 ± 690
	E58	7/23/91 7/30/91	178.1 ± 11.1	0.52 ± 0.02	ND	0.52 ± 0.04	< 0.09 ± 0.09	ND	±	3308 ± 355

Sample ID			Al	As	Cd	Cr	Cu	Ni	Pb	S
			ng/m³ Sigma	ng/m³ Sigma	ng/m³ Sigma	ng/m³ Sigma	ng/m³ Sigma	ng/m³ Sigma	ng/m³ Sigma	ng/m³ Sigma
E59	7/30/91	8/06/91	108 5 ± 6 9	0 34 ± 0 01	0 1420 ± 0 0414	0 43 ± 0 03	1 05 ± 0 16	0 79 ± 0 19	1 44 ± 0 15	3885 ± 330
E60	8/06/91	8/13/91	232 3 ± 14 4	0 39 ± 0 01	0 1816 ± 0 0427	1 03 ± 0 04	0 91 ± 0 15	0 77 ± 0 17	1 85 ± 0 41	3043 ± 463
E61	8/13/91	8/20/91	189 1 ± 11 8	0 66 ± 0 03	0 0560 ± 0 0244	0 73 ± 0 05	< 0 11 ± 0 11	< 0 09 ± 0 09	< 0 21 ± 0 21	5534 ± 506
E62	8/20/91	8/27/91	162 5 ± 10.3	0.70 ± 0 05	0 0950 ± 0 0031	0.70 ± 0 05	0 90 ± 0 18	3 96 ± 0 28	1 48 ± 0 36	6249 ± 631
E63	8/27/91	9/03/91	216 3 ± 13 5	0 36 ± 0 03	< 0 1342 ± 0 1342	0 69 ± 0 04	3 32 ± 0 18	1 51 ± 0 30	1 19 ± 0 33	2878 ± 699
E64	9/03/91	9/10/91	132 5 ± 8 4	0 77 ± 0 02	0 2664 ± 0 0785	0 91 ± 0 04	2 74 ± 0 18	2 70 ± 0 24	6 34 ± 0 44	3594 ± 463
E65	9/11/91	9/17/91	195 0 ± 12 2	0 57 ± 0 04	(0 649) ± (0 100)	0 80 ± 0 05	2 12 ± 0 19	1 01 ± 0 21	< 0 49 ± 0 49	4530 ± 472
E66	9/17/91	9/24/91	82 1 ± 5 3	0 50 ± 0 02	0 0397 ± 0 0031	0 67 ± 0 04	0 44 ± 0 15	< 0 14 ± 0 14	0 55 ± 0 15	1897 ± 171
E67	9/24/91	10/02/91	93 6 ± 6 0	0 49 ± 0 02	0 0749 ± 0 0023	0 63 ± 0 03	0 66 ± 0 15	0 62 ± 0 18	1 21 ± 0 40	2403 ± 394
E68	10/02/91	10/08/91	51 2 ± 3 6	0 46 ± 0 02	0 0777 ± 0 0036	0 30 ± 0 04	0 78 ± 0 21	ND	0 55 ± 0 18	1708 ± 237
E69	10/08/91	10/15/91	47 3 ± 3 2	0 34 ± 0 01	0 0702 ± 0 0025	0 29 ± 0 03	0 37 ± 0 15	ND	< 0 29 ± 0 29	1278 ± 187
E70	10/15/91	10/22/91	57 3 ± 3 8	0 56 ± 0 01	0 0910 ± 0 0034	0 42 ± 0 03	0 73 ± 0 16	0 78 ± 0 19	2 08 ± 0 46	1001 ± 177
E71	10/22/91	10/29/91	142 8 ± 9 7	0 75 ± 0 02	0 2213 ± 0 0085	0 59 ± 0 08	1 30 ± 0 42	< 0 52 ± 0 52	3 04 ± 0 79	4664 ± 506
E72	10/29/91	11/05/91	153 2 ± 9 6	0 86 ± 0 01	0 1024 ± 0 0172	1 24 ± 0 04	1 26 ± 0 13	6 32 ± 0 23	2 41 ± 0 17	1488 ± 281
E73	11/05/91	11/12/91	179 9 ± 11 3	0 71 ± 0 01	< 0 0731 ± 0 0731	1 04 ± 0 05	1 28 ± 0 14	(8 78) ± (0 201)	1 76 ± 0 49	2766 ± 375
E74	11/12/91	11/19/91	114 1 ± 7 2	0 70 ± 0 01	0 1739 ± 0 0020	0 52 ± 0 04	2 45 ± 0 13	(8 21) ± (0 166)	5 30 ± 0 26	1862 ± 265
E75	11/19/91	11/26/91	45 7 ± 3 1	0 27 ± 0 01	< 0 1268 ± 0 1268	0 30 ± 0 03	1 75 ± 0 14	(12 2) ± (0 279)	< 0 26 ± 0 26	1691 ± 365
E76	11/26/91	12/04/91	72 4 ± 4 7	0 50 ± 0 01	0 2659 ± 0 0092	0 42 ± 0 03	3 09 ± 0 15	(10 36) ± (0 179)	1 44 ± 0 13	1178 ± 221
E77	12/04/91	12/10/91	84 9 ± 5 5	0 73 ± 0 01	0 1749 ± 0 0749	0 59 ± 0 04	2 64 ± 0 14	7 20 ± 0 21	2 92 ± 0 62	1571 ± 218
E78	12/10/91	12/17/91	69 2 ± 4 5	1 05 ± 0 01	0 3539 ± 0 0813	0 54 ± 0 03	2 75 ± 0 14	4 93 ± 0 23	1 93 ± 0 22	1724 ± 272
E79	12/17/91	12/24/91	119 2 ± 7 5	1 01 ± 0 01	< 0 0560 ± 0 0560	0 88 ± 0 03	0 76 ± 0 13	5 95 ± 0 21	ND	1459 ± 241
E80	12/24/91	1/01/92	34 9 ± 2 4	0 75 ± 0 01	< 0 0317 ± 0 0317	0 40 ± 0 02	2 03 ± 0 12	9 10 ± 0 21	6 36 ± 0 23	1507 ± 292
E81	1/01/92	1/09/92	33 5 ± 2 4	0 78 ± 0 02	0 1144 ± 0 0541	0 49 ± 0 04	2 49 ± 0 13	3 74 ± 0 15	5 61 ± 0 28	2478 ± 353
E82	1/09/92	1/14/92	35 5 ± 2 7	0 66 ± 0 01	0 0652 ± 0 0028	0 46 ± 0 05	1 19 ± 0 18	0 67 ± 0 22	1 25 ± 0 27	1611 ± 165
E83	1/14/92	1/21/92	108 6 ± 6 9	0 54 ± 0 01	< 0 0818 ± 0 0818	0 53 ± 0 03	1 38 ± 0 12	0 95 ± 0 19	3 42 ± 0 37	975 ± 191
E84	1/21/92	1/28/92	56 0 ± 3 7	0 78 ± 0 01	0 1153 ± 0 0172	0 65 ± 0 03	1 14 ± 0 14	1 43 ± 0 21	3 45 ± 0 39	1924 ± 287
E85	1/28/92	2/04/92	±	1 90 ± 0 01	0 135 ± 0 006	1 46 ± 0 06	4 1 ± 0 5	3 69 ± 0 15	11 6 ± 1 2	1864 ± 144
E86	2/04/92	2/11/92	51 20 ± 2 44	0 19 ± 0 00	0 140 ± 0 009	0 79 ± 0 06	1 7 ± 0 2	3 32 ± 0 12	5 3 ± 0 6	847 ± 65
E87	2/11/92	2/18/92	52 09 ± 2 56	1 02 ± 0 01	0 257 ± 0 008	1 22 ± 0 06	1 3 ± 0 2	3 39 ± 0 04	5 8 ± 0 7	1478 ± 114
E88	2/18/92	2/25/92	36 98 ± 1 84	0 30 ± 0 00	0 187 ± 0 003	0 39 ± 0 06	1 3 ± 0 2	2 59 ± 0 12	4 9 ± 0 6	1411 ± 109
E89	2/25/92	3/03/92	55 08 ± 2 68	0 57 ± 0 01	0 438 ± 0 005	0 55 ± 0 05	1 6 ± 0 2	2 91 ± 0 05	4 6 ± 0 5	1324 ± 103
E90	3/03/92	3/10/92	27 77 ± 1 43	0 26 ± 0 01	0 147 ± 0 003	0 33 ± 0 06	0 8 ± 0 2	2 89 ± 0 05	4 7 ± 0 6	2100 ± 166
E91	3/10/92	3/17/92	111 10 ± 5 24	0 43 ± 0 01	0 129 ± 0 002	0 63 ± 0 06	1 1 ± 0 2	3 11 ± 0 04	4 2 ± 0 5	1110 ± 88
E92	3/17/92	3/24/92	97 29 ± 4 58	0 41 ± 0 00	0 078 ± 0 004	1 40 ± 0 07	1 8 ± 0 3	2 31 ± 0 03	8 1 ± 0 9	1532 ± 121
E93	3/24/92	3/31/92	134 31 ± 6 32	0 27 ± 0 00	0 210 ± 0 002	1 00 ± 0 06	1 3 ± 0 2	2 68 ± 0 07	5 ± 0 6	1169 ± 92
E94	3/31/92	4/07/92	148 36 ± 6 89	0 72 ± 0 01	0 152 ± 0 004	1 58 ± 0 06	1 5 ± 0 2	2 34 ± 0 04	5 2 ± 0 6	1394 ± 110
E95	4/07/92	4/14/92	268 33 ± 12 34	0 87 ± 0 01	0 227 ± 0 003	1 05 ± 0 06	2 3 ± 0 3	3 14 ± 0 04	6 2 ± 0 7	2018 ± 159
E96	4/14/92	4/21/92	123 73 ± 5 83	0 50 ± 0 01	0 106 ± 0 007	0 41 ± 0 06	0 9 ± 0 2	2 13 ± 0 04	2 5 ± 0 4	1388 ± 110
E97	4/21/92	4/28/92	94 66 ± 4 51	0 21 ± 0 01	0 117 ± 0 006	0 35 ± 0 06	1 2 ± 0 2	4 66 ± 0 04	3 ± 0 4	1374 ± 108
E98	4/28/92	5/05/92	300 64 ± 13 87	0 95 ± 0 01	0 213 ± 0 003	0 83 ± 0 06	1 6 ± 0 2	2 18 ± 0 05	5 6 ± 0 7	1725 ± 136
E99	5/12/92	5/17/92	169 30 ± 7 95	0 35 ± 0 01	0 207 ± 0 007	0 84 ± 0 08	2 6 ± 0 3	7 59 ± 0 08	5 3 ± 0 7	2349 ± 185
E100	5/20/92	5/26/92	312 96 ± 14 42	0 87 ± 0 01	0 143 ± 0 009	0 99 ± 0 08	1 4 ± 0 2	5 17 ± 0 05	5 5 ± 0 7	2218 ± 175
E101	5/26/92	[illegible]	62 07 ± 2 97	0 43 ± 0 01	0 058 ± 0 003	0 78 ± 0 06	0 7 ± 0 2	0 98 ± 0 05	3 5 ± 0 5	1491 ± 118
E102	6/02/92	[illegible]	65 51 ± 3 11	0 37 ± 0 01	0 045 ± 0 003	0 89 ± 0 06	(6 2) ± (0 7)	4 15 ± 0 17	2 6 ± 0 4	1734 ± 137
Year 3 E103	6/09/92	6/16/92	180 52 ± 8 44	0 63 ± 0 01	0 43 ± 0 013	0 84 ± 0 06	1 50 ± 0 20	15 55 ± 0 38	5 30 ± 0 60	1733 ± 137
E104	6/16/92	6/24/92	71 33 ± 3 38	0 08 ± 0 00	0 23 ± 0 003	0 31 ± 0 06	0 70 ± 0 20	(32 48 ± 0 74)	1 70 ± 0 30	814 ± 64
E105	6/24/92	6/30/92	74 98 ± 3 59	0 73 ± 0 01	0 51 ± 0 030	0 70 ± 0 06	1 90 ± 0 30	10 13 ± 0 19	4 80 ± 0 60	3073 ± 242
E106	6/30/92	7/07/92	105 41 ± 4 92	0 34 ± 0 01	0 32 ± 0 007	0 57 ± 0 06	1 70 ± 0 20	6 63 ± 0 03	3 70 ± 0 50	2118 ± 167
E107	7/07/92	7/14/92	(1378 158) ± (63 978)	0 33 ± 0 01	0 34 ± 0 006	1 98 ± 0 10	1 50 ± 0 30	17 16 ± 0 15	4 80 ± 0 60	3170 ± 250
E108	7/14/92	7/15/92	(3623 964 7)	0 79 0 04	0 144 0 005	3 98 0 21	4 9 0 6	1 82 0 23	3 4 0 7	3039 240
E109	7/28/92	7/29/92	ND	0 66 0 03	0 174 0 003	0 64 0 13	1 0 3	2 84 0 36	6 2 0 8	5862 462
E110	8/11/92	8/12/92	ND	ND	0 173 0 002	0 70 0 12	1 4 0 3	1 89 0 17	5 3 0 7	2032 160
E111	8/18/92	8/19/92	ND	0 48 0 02	0 027 0 002	< 0 06 0 06	0 6 0 2	2 21 0 16	ND	2907 229
E112	8/25/92	8/26/92	198 6 60 3	0 85 0 03	0 120 0 003	0 40 0 11	7 2 0 8	1 32 0 20	3 2 0 5	3341 263
E113	9/01/92	9/02/92	ND	0 60 0 04	0 126 0 009	< 0 40 0 40	ND	1 86 0 66	8 3 1 8	2579 204
E114	9/08/92	9/09/92	ND	0 21 0 03	0 256 0 030	ND	ND	7 40 0 84	ND	1037 83
E115	9/15/92	9/16/92	ND	0 64 0 07	0 099 0 010	ND	ND	< 0 22 0 22	5 8 1 6	870 70
E116	9/29/92	9/30/92	ND	0 26 0 01	0 129 0 018	0 97 0 15	4 1 0 5	1 05 0 21	6 8 0 9	485 39
E117	10/06/92	10/07/92	ND	0 12 0 01	0 037 0 013	< 0 05 0 05	1 7 0 3	0 98 0 18	ND	205 16
E118	10/13/92	10/14/92	152 8	0 74 0 03	0 184 0 004	0 51 0 14	2 0 4	1 26 0 27	5 5 0 8	1867 147
E119	10/20/92	10/21/92	233 6 68 8		0 396 0 014	0 45 0 13	2 1 0 4	1 54 0 22	3 4 0 6	799 63
E120	11/03/92	11/04/92	ND	0 35 0 02	0 104 0 019	0 64 0 16	7 2 0 8	0 98 0 23	2 9 0 7	1084 86
E121	11/10/92	11/11/92	ND	0 70 0 03	0 156 0 006	0 59 0 14	2 5 0 4	3 63 0 24	6 9 0 9	830 66
E122	11/17/92	11/18/92	212 2 65 3	0 94 0 03	0 176 0 008	0 62 0 15	3 3 0 5	0 47 0 20	4 9 0 7	1138 90
E123	11/24/92	11/25/92	ND	0 32 0 04	0 147 0 003	0 38 0 14	1 5 0 3	2 57 0 21	2 9 0 6	966 76

Sample ID			Al		As		Cd		Cr		Cu		Ni		Pb		S	
			ng/m³	Sigma	ng/m³	Sigma	ng/m³	Sigma	ng/m³	Sigma	ng/m³	Sigma	ng/m³	Sigma	ng/m³	Sigma	ng/m³	Sigma
E124	12/01/92	12/02/92		ND	1.29	0.06	0.462	0.021	0.72	0.14	4.4	0.6	1.44	0.23	7.4	0.9	1779	141
E125	12/08/92	12/09/92		ND	0.76	0.02	0.110	0.004	0.97	0.08	1.7	0.3	0.82	0.13	6.8	0.8	1526	121
E126	12/15/92	12/16/92		ND	0.50	0.04	0.136	0.005	< 0.10	0.10	2.5	0.4	2.97	0.24	3.3	0.7	3071	242
E127	12/22/92	12/23/92		ND	< 0.02	0.02	0.359	0.028		ND		ND	< 0.69	0.69		ND		ND
E128	12/29/92	12/30/92		ND		ND	0.177	0.037		ND		ND		ND		ND		ND
E129	1/05/93	1/06/93		ND	< 0.04	0.04	0.849	0.068		ND		ND		ND		ND		ND
E130	1/19/93	1/20/93	< 3.4	3.4		ND	0.139	0.024		ND		ND		ND	< 0.5	0.5		ND
E131	1/26/93	1/27/93	25.9	10.3		ND	(2.73	0.066)		ND		ND	9.46	1.69		ND		ND
E132	2/02/93	2/03/93	88.6	17.7	0.75	0.02	0.068	0.005	0.75	0.15	0.9	0.3	0.44	0.18	7.8	1.1	474	37.6
E133	2/09/93	2/10/93	< 6.8	6.8	0.50	0.03	0.129	0.007	0.56	0.12	2.8	0.5	2.94	0.27	5.5	0.9	780	61.4
E134	2/16/93	2/17/93	< 13.6	13.6	0.29	0.02	0.090	0.003	0.27	0.12	0.7	0.3	0.77	0.17	3.8	0.8	1650	129
E135	3/02/93	3/03/93	78.1	16.6	0.54	0.02	0.068	0.003	0.44	0.14	1	0.4	0.48	0.17	3.6	0.7	1890	146
E136	3/09/93	3/10/93	< 12.75	12.8	0.40	0.02	0.059	0.010	0.65	0.12	1.1	0.4	0.79	0.17	3.4	0.7	1547	119
E137	3/16/93	3/17/93	57.7	14.6	0.34	0.02	0.066	0.006	0.34	0.17	< 0.15	0.15	2.67	0.18	1.6	0.6	983	75.8
E138	3/23/93	3/24/93	< 7	7	0.38	0.02	0.136	0.003	0.53	0.13	2.3	0.5	2.05	0.19	4.6	0.9	3180	257
E139	3/30/93	3/31/93	38.7	15.1	0.35	0.01	< 0.005	0.005	0.60	0.13	1.8	0.4		ND	6.2	1	1327	106
E140	4/06/93	4/07/93	64.9	17	0.40	0.03	0.092	0.005	0.43	0.12	< 0.3	0.3	1.96	0.18	2.7	0.7	554	43.9
E141	4/13/93	4/15/93	44.1	13.7	0.30	0.01	0.122	0.018	0.47	0.11	0.8	0.3	2.32	0.17	3.2	0.7	896	69.5
E142	4/20/93	4/21/93	132.8	21.8	0.36	0.02	0.073	0.007	0.46	0.12	< 0.4	0.4	1.45	0.18	2	0.7	1124	88
E143	5/04/93	5/05/93	48.6	16	0.26	0.03	0.036	0.005	< 0.08	0.08		ND	1.03	0.19	1.5	0.6	850	69.2
E144	5/11/93	5/12/93	294.5	38.3	1.07	0.03	0.260	0.005	1.21	0.14	1.7	0.4	1.14	0.19	8	1.2	5647	458
E145	5/18/93	5/19/93	< 12.35	12.4	0.31	0.02	0.102	0.005	0.54	0.13	< 0.3	0.3	1.26	0.22	2.6	0.7	1692	137
E146	5/25/93	5/26/93	245.3	30.8	0.67	0.03	0.127	0.003	0.90	0.12	1.6	0.4	0.90	0.18	4.6	0.8	2623	200
E148	6/01/93	6/02/93	49.8	15.9	0.52	0.02	0.089	0.008	0.65	0.12	1.3	0.4	2.68	0.22	4.6	0.8	2245	178
E149	6/08/93	6/09/93	190.9	27.4	0.44	0.02	0.055	0.004	0.79	0.13	< 0.3	0.3	0.46	0.19	3.4	0.8	2711	217
E150	6/15/93	6/16/93	68.3	16.9	0.44	0.03		ND	0.77	0.12	< 0.2	0.2		ND	3.2	0.7	1317	105
E151	6/22/93	6/23/93	70.9	18.9	0.65	0.02		ND	0.92	0.13	1.2	0.4		ND	8.4	1.2	2985	240
E152	6/29/93	6/30/93	59.3	20.4	1.21	0.04		ND	1.25	0.13	3.1	0.6		ND	9.3	1.3	4586	382
E153	7/06/93	7/07/93	239	32.9	0.55	0.02		ND	0.88	0.14	< 0.25	0.25		ND	4	0.9	4964	398
E154	7/13/93	7/14/93	164.7	25.3	0.57	0.02		ND	2.20	0.14	2.7	0.5		ND	< 0.7	0.7	3882	309
E155	7/20/93	7/21/93	96.5	21.1	1.05	0.03		ND	1.51	0.13	2.9	0.5		ND	6.4	1	4590	363
156	7/27/93	7/28/93																
157	8/3/93	8/4/93																
158	8/10/93	8/11/93																
159	8/17/93	8/18/93																
160	8/24/93	8/25/93																
161	8/31/93	9/1/93																
162	9/7/93	9/8/93																
163	9/14/93	9/15/93																
164	9/21/93	9/22/93																
165	9/28/93	9/29/93																

Elms

Year 1 — First 12 months statistics

ave	155	0.646	0.13	0.638	2.21	2.52	4.77	2876
STD	115	0.308	0.08	0.403	1.67	1.93	2.91	1399
avg error	13	0.065	0.02	0.197	0.25	0.26	0.56	508
count	46	46	46	45	44	41	45	39
min	.12	0.085	0.01	0.035	0.15	0.08	0.19	736
max	566	1.555	0.43	1.407	8.28	7.91	14.15	6324
median	112	0.596	0.12	0.645	1.95	1.63	4.00	2438
max/mean	3.7	2.4	3.2	2.2	3.7	3.1	3.0	2.2

18 mos — First 18 months statistics

ave	155	0.614	0.13	0.626	1.88	2.56	3.80	2983
STD	114	0.275	0.08	0.365	1.50	2.17	2.82	1508
avg error	12	0.047	0.02	0.150	0.23	0.24	0.49	467
count	76	76	74	75	74	64	73	69
min	12	0.085	0.01	0.035	0.09	0.06	0.18	736
max	566	1.555	0.43	1.407	8.28	9.10	14.15	6638
median	118	0.565	0.12	0.617	1.67	1.48	3.10	2490
max/mean	3.7	2.5	3.2	2.2	4.4	3.6	3.7	2.2

Sample ID	Al		As		Cd		Cr		Cu		Ni		Pb		S	
	ng/m³	Sigma	ng/m³	Sigma	ng/m³	Sigma	ng/m³	Sigma	ng/m³	Sigma	ng/m³	Sigma	ng/m³	Sigma	ng/m³	Sigma
Year 2	2nd year statistics															
ave	137		0.583		0.14		0.689		1.48		2.81		3.40		2484	
STD	104		0.289		0.08		0.340		0.93		2.11		2.33		1469	
avg error	9		0.015		0.03		0.070		0.20		0.16		0.46		300	
count	51		52		50		52		51		45		50		52	
min	28		0.187		0.01		0.060		0.09		0.06		0.18		847	
max	532		1.903		0.44		1.576		4.10		9.10		11.60		6638	
median	111		0.515		0.13		0.637		1.30		2.34		3.02		1863	
max/mean	3.9		3.3		3.1		2.3		2.8		3.2		3.4		2.7	
Year 3	3rd year statistics															
ave	101		0.526		0.18		0.750		1.93		2.93		4.55		2103	
STD	81		0.286		0.16		0.647		1.62		3.77		2.12		1392	
avg error	20		0.025		0.01		0.127		0.38		0.28		0.81		167	
count	33		47		45		45		43		41		45		47	
min	3		0.016		0.01		0.050		0.15		0.22		0.50		205	
max	295		1.291		0.85		3.977		7.20		17.16		9.30		5862	
median	71		0.497		0.13		0.620		1.60		1.49		4.60		1733	
max/mean	2.9		2.5		4.7		5.3		3.7		5.9		2.0		2.8	

[1] Sampler malfunction, either no sample was collected or the air volume was inaccurate, values (when reported) are ng/filter, but not included in averages or flux estimates.
[2] Value not included in average.
ND = not detected.

Se		Zn		V		Br		Fe		Mn	
ng/m³	Sigma	ng/m³	Sigma	ng/m³	Sigma	ng/m³	Sigma	ng/m³	Sigma	ng/m³	Sigma

(Elms site)

Se		Zn		V		Br		Fe		Mn	
ng/m³	Sigma	ng/m³	Sigma	ng/m³	Sigma	ng/m³	Sigma	ng/m³	Sigma	ng/m³	Sigma
0.310	± 0.039	4.48	± 0.58	1.20	± 0.10	0.699	± 0.067	42.2	± 3.4	0.65	± 0.03
0.767	± 0.093	4.04	± 0.51	1.96	± 0.17	1.07	± 0.10	325	± 14	2.36	± 0.09
1.08	± 0.091	35.9	± 3.3	3.26	± 0.28	1.45	± 0.12	416	± 10	2.99	± 0.12
(15.4	± 1.6)[1]	(335	± 40)[1]	(66.	± 4.3)[1]	(0.409	± 0.048)[1]	(105	± 3.6)[1]	(1.15	± 0.048)[1]
0.693	± 0.075	3.59	± 0.43	1.85	± 0.16	1.17	± 0.12	108	± 4.9	1.76	± 0.07
2.16	± 0.21	15.6	± 1.8	4.74	± 0.40	2.26	± 0.20	282	± 12	3.06	± 0.12
0.770	± 0.092	34.0	± 4.0	4.52	± 0.38	1.53	± 0.16	127	± 7.2	2.67	± 0.11
0.852	± 0.096	9.13	± 1.2	2.44	± 0.21	1.88	± 0.17	177	± 8.3	2.40	± 0.09
1.87	± 0.20	18.2	± 2.2	5.16	± 0.44	3.15	± 0.28	175	± 9.1	3.20	± 0.13
1.02	± 0.11	9.72	± 1.1	4.39	± 0.37	1.99	± 0.20	152	± 7.8	2.25	± 0.09
1.67	± 0.28	9.02	± 1.2	3.93	± 0.33	3.53	± 0.30	90.2	± 11	2.45	± 0.10
1.43	± 0.25	6.93	± 1.1	3.89	± 0.33	2.81	± 0.25	223	± 16	4.30	± 0.17
1.95	± 0.30	7.87	± 1.1	4.18	± 0.36	3.80	± 0.32	359	± 21	4.15	± 0.16
1.26	± 0.22	6.94	± 0.94	3.03	± 0.26	2.26	± 0.20	225	± 16	3.22	± 0.13
1.45	± 0.22	6.35	± 0.88	1.36	± 0.12	2.40	± 0.20	79.4	± 8.1	2.41	± 0.09
2.23	± 0.36	16.9	± 2.3	7.77	± 0.66	4.52	± 0.38	< 12.0	± 12.0	4.93	± 0.19
1.25	± 0.22	7.47	± 1.01	2.41	± 0.21	2.38	± 0.21	131	± 11	2.78	± 0.11
1.20	± 0.23	3.81	± 0.69	2.77	± 0.24	2.02	± 0.26	76.3	± 12	1.67	± 0.07
0.86	± 0.09	7.89	± 0.87	3.12	± 0.26	2.69	± 0.23	80.7	± 4.0	2.50	± 0.10
(6	± 7.2)[1]	(780	± 93)[1]	(154	± 13)[1]	(165	± 15)[1]	(5800	± 370)[1]	(193	± 7.6)[1]
2.60	± 0.23	17.0	± 2.0	4.81	± 0.41	4.82	± 0.39	122	± 5.7	3.14	± 0.12
1.91	± 0.18	15.9	± 1.8	5.81	± 0.49	4.67	± 0.38	189	± 8.6	4.21	± 0.16
2.36	± 0.20	19.9	± 1.9	2.67	± 0.23	5.39	± 0.44	109	± 3.8	3.14	± 0.12
3.22	± 0.28	24.0	± 2.3	6.29	± 0.53	4.92	± 0.40	115	± 4.2	3.67	± 0.14
1.98	± 0.17	13.5	± 1.3	3.31	± 0.28	4.11	± 0.33	72.9	± 2.2	2.14	± 0.08
0.876	± 0.076	5.80	± 0.57	3.44	± 0.29	2.47	± 0.20	30.2	± 1.3	1.10	± 0.04
2.01	± 0.17	20.3	± 1.9	5.44	± 0.46	4.24	± 0.34	81.7	± 3.1	1.90	± 0.07
3.71	± 0.32	17.3	± 1.7	6.75	± 0.57	6.17	± 0.50	89.7	± 4.1	2.37	± 0.09
2.61	± 0.22	18.3	± 1.7	4.69	± 0.38	3.45	± 0.23	82.3	± 2.8	2.00	± 0.04
2.74	± 0.23	22.9	± 2.1	6.34	± 0.54	5.56	± 0.46	103	± 3.2	3.28	± 0.13
1.82	± 0.15	12.0	± 1.2	3.33	± 0.28	4.64	± 0.39	72.9	± 2.6	2.34	± 0.09
3.80	± 0.32	20.5	± 1.9	8.35	± 0.68	4.85	± 0.33	142	± 4.5	4.58	± 0.10
1.70	± 0.15	8.99	± 0.95	2.80	± 0.24	3.54	± 0.29	94.0	± 3.9	1.93	± 0.08
1.76	± 0.16	13.1	± 1.3	4.36	± 0.37	3.14	± 0.27	114	± 4.8	2.01	± 0.08
1.69	± 0.14	14.6	± 1.4	2.65	± 0.21	2.49	± 0.17	63.1	± 2.4	1.76	± 0.04
1.74	± 0.15	12.6	± 1.2	4.78	± 0.40	3.78	± 0.31	110	± 3.3	3.02	± 0.12
2.11	± 0.18	7.40	± 0.77	5.10	± 0.43	3.28	± 0.28	52.7	± 2.2	1.56	± 0.06
1.50	± 0.13	17.4	± 1.7	4.67	± 0.38	2.57	± 0.18	115	± 3.7	2.82	± 0.06
1.20	± 0.11	13.2	± 1.3	3.48	± 0.29	3.40	± 0.28	102	± 3.8	2.49	± 0.10
1.17	± 0.10	9.31	± 0.94	2.11	± 0.18	2.85	± 0.24	146	± 5.5	2.12	± 0.08
0.700	± 0.063	5.17	± 0.58	2.71	± 0.22	2.67	± 0.19	114	± 3.6	2.39	± 0.05
0.907	± 0.077	8.53	± 0.84	2.42	± 0.21	2.63	± 0.23	53.8	± 1.8	1.30	± 0.05
1.11	± 0.094	9.08	± 0.90	3.96	± 0.34	3.63	± 0.31	111	± 3.3	2.51	± 0.10
0.562	± 0.050	3.25	± 0.41	1.10	± 0.09	1.05	± 0.07	13.9	± 1.3	0.55	± 0.01
1.94	± 0.17	7.69	± 0.84	4.34	± 0.37	4.39	± 0.35	27.9	± 2.4	1.08	± 0.04
0.887	± 0.085	5.78	± 0.66	4.17	± 0.35	4.10	± 0.37	141	± 5.6	3.04	± 0.12
1.60	± 0.14	7.56	± 0.85	4.41	± 0.36	6.07	± 0.47	465	± 12	12.65	± 0.26
2.30	± 0.19	15.7	± 1.5	4.17	± 0.35	3.02	± 0.26	332	± 8.6	4.05	± 0.16
1.17	± 0.10	7.13	± 0.74	3.19	± 0.27	2.42	± 0.23	183	± 5.1	3.34	± 0.13
0.708	± 0.066	4.67	± 0.57	3.22	± 0.26	3.25	± 0.23	174	± 5.0	4.48	± 0.09
1.45	± 0.13	9.82	± 1.0	5.30	± 0.45	2.86	± 0.24	83.1	± 3.7	1.84	± 0.07
1.63	± 0.15	5.92	± 0.81	4.45	± 0.38	3.60	± 0.33	400	± 15	2.82	± 0.11
1.58	± 0.13	8.65	± 0.88	4.17	± 0.35	2.58	± 0.22	172	± 4.8	2.51	± 0.10
1.95	± 0.16	10.6	± 1.0	6.75	± 0.57	3.80	± 0.33	102	± 3.4	2.92	± 0.12
2.32	± 0.14	8.45	± 0.127	3.682	± 0.89	2.177	± 0.221	447	± 10.2	4.255	± 0.170
1.53	± 0.09	9.21	± 0.094	3.443	± 0.76	2.358	± 0.186	138	± 4.1	2.713	± 0.058

Se		Zn		V		Br		Fe		Mn	
ng/m³	Sigma	ng/m³	Sigma	ng/m³	Sigma	ng/m³	Sigma	ng/m³	Sigma	ng/m³	Sigma
1.62 ±	0.09	7.93 ±	0.102	2.126 ±	0.64	1.828 ±	0.127	117 ±	3.4	1.608 ±	0.066
1.46 ±	0.09	11.99 ±	0.094	3.193 ±	0.90	2.539 ±	0.171	283 ±	6.3	2.735 ±	0.057
2.20 ±	0.13	22.27 ±	0.137	3.560 ±	1.58	2.182 ±	0.212	506.7 ±	11.1	4.436 ±	0.176
2.15 ±	0.13	11.90 ±	0.143	4.176 ±	0.95	3.086 ±	0.226	180 ±	5.1	2.354 ±	0.052
1.31 ±	0.08	8.26 ±	0.155	4.328 ±	0.70	2.238 ±	0.258	249 ±	5.9	2.312 ±	0.094
1.81 ±	0.11	27.10 ±	0.118	4.721 ±	1.88	3.176 ±	0.253	158 ±	4.3	2.876 ±	0.061
1.98 ±	0.12	13.55 ±	0.147	4.681 ±	1.04	2.449 ±	0.278	183 ±	5.0	2.686 ±	0.108
1.60 ±	0.10	11.98 ±	0.086	2.242 ±	0.91	2.103 ±	0.120	151 ±	4.1	2.698 ±	0.057
1.84 ±	0.11	13.26 ±	0.03	3.271 ±	0.96	2.3 ±	0.194	118 ±	3.4	(26.23) ±	(1.025)
1.26 ±	0.08	8.64 ±	0.02	3.601 ±	0.70	2.3 ±	0.192	64 ±	3.0	(14.76) ±	(0.299)
1.28 ±	0.08	7.81 ±	0.113	3.327 ±	0.63	2.061 ±	0.198	68 ±	2.9	1.362 ±	0.057
1.29 ±	0.08	10.92 ±	0.081	2.072 ±	0.83	2.301 ±	0.112	75 ±	2.9	2.274 ±	0.051
2.82 ±	0.17	17.30 ±	0.250	13.100 ±	1.41	4.593 ±	0.781	158 ±	6.4	2.244 ±	0.099
2.24 ±	0.13	21.95 ±	0.151	5.678 ±	1.52	4.765 ±	0.305	195 ±	4.6	4.246 ±	0.091
2.34 ±	0.14	21.52 ±	0.286	10.886 ±	1.54	5.085 ±	0.651	222 ±	5.8	4.134 ±	0.166
3.01 ±	0.18	16.97 ±	0.139	9.897 ±	1.23	4.432 ±	0.530	113 ±	3.8	2.695 ±	0.058
1.42 ±	0.08	10.38 ±	0.156	5.474 ±	0.77	2.627 ±	0.327	59 ±	2.5	1.187 ±	0.050
1.48 ±	0.09	11.76 ±	0.092	6.058 ±	0.85	2.844 ±	0.326	67 ±	2.4	1.558 ±	0.035
2.68 ±	0.15	14.52 ±	0.205	4.298 ±	1.05	3.684 ±	0.258	72 ±	2.7	2.009 ±	0.083
2.23 ±	0.13	13.56 ±	0.115	7.631 ±	0.97	3.670 ±	0.410	70 ±	2.5	2.075 ±	0.046
3.34 ±	0.19	20.98 ±	0.262	5.475 ±	1.46	4.813 ±	0.328	156 ±	3.8	2.791 ±	0.113
1.94 ±	0.11	17.83 ±	0.096	6.700 ±	1.23	3.152 ±	0.361	68 ±	2.1	1.356 ±	0.031
2.39 ±	0.14	19.39 ±	1.36	6.485 ±	0.386	4.207 ±	0.235	87 ±	3	2.329 ±	0.094
2.45 ±	0.15	22.37 ±	1.59	4.134 ±	0.221	4.062 ±	0.130	267 ±	7	2.837 ±	0.061
1.77 ±	0.10	11.61 ±	0.85	2.772 ±	0.166	2.331 ±	0.128	123 ±	3	1.951 ±	0.080
2.27 ±	0.13	18.51 ±	1.29	6.804 ±	0.370	4.423 ±	0.140	76 ±	3	2.012 ±	0.048
3.96 ±	0.22	28.95 ±	1.95	±		5.680 ±	0.026	119.68 ±	4.13	2.6 ±	0.3
1.31 ±	0.07	13.73 ±	0.93	8.12 ±	0.14	0.553 ±	0.004	61.60 ±	3.18	1.6 ±	0.2
2.06 ±	0.12	17.91 ±	1.21	6.51 ±	0.12	3.379 ±	0.014	73.03 ±	3.39	2.1 ±	0.2
1.97 ±	0.11	15.17 ±	1.04	8.95 ±	0.16	1.805 ±	0.008	42.74 ±	3.25	1.2 ±	0.2
1.61 ±	0.09	13.11 ±	0.89	6.20 ±	0.12	2.479 ±	0.013	61.88 ±	3.16	1.5 ±	0.2
1.18 ±	0.07	15.05 ±	1.03	5.84 ±	0.11	2.525 ±	0.021	35.54 ±	3.35	0.6 ±	0.2
1.57 ±	0.09	11.73 ±	0.81	4.62 ±	0.09	3.151 ±	0.013	105.07 ±	3.85	2.3 ±	0.3
2.14 ±	0.12	21.35 ±	1.46	7.74 ±	0.14	2.486 ±	0.009	111.49 ±	4.44	3.3 ±	0.3
1.39 ±	0.08	16.97 ±	1.15	6.29 ±	0.12	0.779 ±	0.004	113.21 ±	3.99	2.3 ±	0.3
2.17 ±	0.12	17.28 ±	1.17	5.34 ±	0.10	4.066 ±	0.020	149.91 ±	4.46	3.1 ±	0.3
1.87 ±	0.11	16.16 ±	1.11	6.44 ±	0.12	2.125 ±	0.018	235.97 ±	5.99	2.6 ±	0.3
0.89 ±	0.05	9.43 ±	0.66	5.54 ±	0.11	1.878 ±	0.017	103.24 ±	3.99	1 ±	0.2
1.15 ±	0.07	7.43 ±	0.55	2.96 ±	0.06	1.297 ±	0.010	69.53 ±	3.91	1.6 ±	0.2
1.63 ±	0.09	13.98 ±	0.96	3.91 ±	0.08	< 0.004 ±	0.004	240.22 ±	6.00	4.6 ±	0.4
1.61 ±	0.09	17.31 ±	1.18	9.76 ±	0.18	0.757 ±	0.005	167.89 ±	5.54	2.4 ±	0.3
1.47 ±	0.09	14.60 ±	1.02	3.33 ±	0.08	2.752 ±	0.017	252.32 ±	7.02	3.2 ±	0.3
1.08 ±	0.06	8.16 ±	0.57	2.52 ±	0.05	1.990 ±	0.014	67.84 ±	3.53	1.4 ±	0.2
1.11 ±	0.06	7.76 ±	0.55	4.40 ±	0.08	< 0.001 ±	0.001	62.99 ±	3.57	0.6 ±	0.2
1.28 ±	0.07	14.59 ±	1.00	7.40 ±	0.14	2.905 ±	0.019	183.60 ±	5.13	2.000 ±	0.200
0.49 ±	0.03	5.91 ±	0.42	1.36 ±	0.03	0.263 ±	0.004	67.32 ±	3.27	0.900 ±	0.200
2.12 ±	0.12	17.01 ±	1.16	4.80 ±	0.09	< 0.005 ±	0.005	91.46 ±	3.96	2.100 ±	0.200
1.71 ±	0.10	9.92 ±	0.70	2.74 ±	0.05	1.475 ±	0.011	107.85 ±	4.08	1.600 ±	0.200
2.20 ±	0.13	8.37 ±	0.65	5.11 ±	0.24	1.351 ±	0.014	(826.1 ±	17.85)	11.800 ±	1.000
2.49	0.18	11.4	1.6	5	1.2	3.82	0.12	(2018	51.6)	(27	2.2)
2.42	0.15	10.2	0.8	2.2	0.5	4.19	0.09	130	6	3.1	0.4
1.15	0.08	14.5	1.1	1.7	0.4			62	4	2.1	0.3
1.07	0.07	3.3	0.4	3.4	0.5	2.26	0.07	38	3	0.8	0.2
2.18	0.13	6.4	0.6	2.8	0.5	4.02	0.08	130	5	1.5	0.3
1.08	0.14	14.7	1.7	ND		3.27	0.23	305	16	4.9	1
ND		< 0.8	0.8	ND		1.16	0.27	< 15	15	ND	
0.43	0.09	3.1	0.9	ND		2.21	0.25	67	13	ND	
0.99	0.09	(153.3	10.32)	ND		1.62	0.07	172	6	3.6	0.4
0.22	0.04	4.2	0.4	2.1	0.5	0.78	0.07	35	4	1	0.3
2.12	0.13	12.7	1.0	5.61	0.11	3.94	0.10	145	6	3.1	0.4
0.91	0.06	8.6	0.7	3.9	0.6			100	5	1.8	0.3
1.41	0.10	21.5	1.6	5.5	0.8	2.54	0.09	75	6	2.5	0.4
0.71	0.06	34.2	2.5	6.7	0.9	3.72	0.13	78	6	1.7	0.3
2.46	0.10	12.2	1.0	3.8	0.7	3.89	0.10	131	7	2.4	0.4
0.86	0.06	7.3	0.6	4.1	0.7	3.21	0.13	37	5	ND	

Se		Zn		V		Br		Fe		Mn	
ng/m³	Sigma	ng/m³	Sigma	ng/m³	Sigma	ng/m³	Sigma	ng/m³	Sigma	ng/m³	Sigma
3 29	0 21	19 8	1 5	1 9	0 6	8 60	0 24	119	6	1.9	0 3
1 66	0 10	17 5	1 2	4 8	0 6	3 98	0 06	94	4	2 6	0 3
0 77	0 07	5 2	0 5	13 2	1 5	3 50	0 12	29	5	ND	
ND		< 1 7	1 7	ND		< 0 35	0 35	88	33	ND	
ND		ND		ND		< 0 43	0 43	< 13	13	ND	
ND		ND		ND		< 0 55	0 55	ND		ND	
ND		ND		< 0 15	0 15	ND		ND		ND	
ND		ND		< 0 15	0 15	ND		ND		ND	
0 75	0 05	17.6	1.2	2 6	0.6	2.28	0 07	108	6	2.4	0.4
0 92	0 07	7.4	0.6	7.5	0.9	5.17	0.08	41	4	1.2	0.3
1.31	0.08	6.1	0.5	1.5	0.6	2.08	0.07	21	3	< 0.25	0.25
1 42	0.09	43.3	3.0	5.6	0.8	3.08	0 07	80	5	2	0.3
0 91	0 06	4.2	0.4	1.6	0.5	1.79	0.07	32	4	0.8	0.3
0 75	0 06	4.9	0.4	9.8	1.1	2.17	0.08	52	5	2.6	0.4
1.64	0 10	55.8	3.8	3.6	0.7	3.87	0.09	70	5	2	0.4
2.20	0.14	37.2	2.6	4.7	0.7	2.69	0.07	83	5	4.3	0.5
0 33	0 04	32.6	2.3	3 5	0.7	3.68	0.09	93	5	1.8	0.3
0 69	0 04	4.4	0.4	6.3	0.8	1.51	0.06	23	3	0.7	0.3
0 54	0 05	42.4	2.9	2.8	0.6	3.17	0.07	137	5	2.1	0.4
0.56	0 05	6.9	0.6	5.1	0.8	2.00	0.08	51	4	1.1	0.3
2.49	0.16	34.7	2.4	4.8	0.8	4.10	0.08	277	8	7	0.7
0.80	0.05	4.9	0.4	2.3	0.6	2.37	0.08	26	4	1.1	0.3
1.76	0.11	11.4	0.9	2.9	0.6	3.50	0.07	256	8	4.3	0.5
1.40	0.09	8.4	0.7	< 0.25	0.25	3.02	0.08	73	5	1.4	0.3
1.09	0.07	10.3	0.8	2.4	0.6	2.74	0.07	164	6	3	0.4
0.88	0.06	5.2	0.5	5.8	0.8	2.80	0.08	76	4	1.1	0.3
1.43	0.09	17.4	1.3	2.3	0.6	2.59	0.07	116	5	2.7	0.4
4.52	0.26	21.5	1.5	2.4	0.7	6.77	0.11	216	7	5.4	0.6
2.28	0.14	9.3	0.9	9.4	1.2	3.69	0.07	232	8	4.1	0.5
1.93	0.12	5.2	0.6	4	0.7	3.11	0.08	161	6	2.3	0.4
2.92	0.17	17.8	1.3	6.5	0.9	4.42	0.07	202	8	4.6	0.5

1.6	12.5	3.9	3.250	138	2.802
0.8	7.3	1.6	1.340	101	1.759
0.2	1.3	0.3	0.271	7	0.100
46	46	46	46	46	46
0.3	3.2	1.1	0.699	12	0.551
3.8	35.9	8.4	6.168	465	12.651
1.6	9.2	3.9	3.084	110	2.430
2.3	2.9	2.1	1.9	3.4	4.5

1.7	12.7	4.4	3.168	150	2.749
0.7	6.7	2.1	1.197	106	1.502
0.1	0.9	0.6	0.277	6	0.094
76	76	76	76	76	74
0.3	3.2	1.1	0.699	12	0.551
3.8	35.9	13.1	6.168	507	12.651
1.6	- 10.8	4.2	2.853	114	2.469
2.2	2.8	3.0	1.9	3.4	4.6

Se		Zn		V		Br		Fe		Mn	
ng/m³	Sigma	ng/m³	Sigma	ng/m³	Sigma	ng/m³	Sigma	ng/m³	Sigma	ng/m³	Sigma
1.8		13.9		5.3		2.769		147		2.433	
0.6		5.4		2.3		1.227		99		0.965	
0.1		0.6		0.6		0.182		5		0.146	
52		52		51		52		52		50	
0.7		4.7		2.1		0.001		36		0.600	
4.0		28.9		13.1		5.680		507		4.600	
1.6		13.4		4.7		2.532		117		2.320	
2.2		2.1		2.5		2.1		3.4		1.9	
1.5		14.3		4.1		2.847		104		2.611	
0.9		12.3		2.6		1.590		71		2.005	
0.1		1.2		0.6		0.111		6		0.385	
46		47		45		48		47		42	
0.2		0.8		0.2		0.005		13		0.250	
4.5		55.8		13.2		8.603		305		11.800	
1.3		10.0		3.8		2.854		83		2.100	
3.1		3.9		3.2		3.0		2.9		4.5	

Appendix E-3 Concentrations of Elements in Chesapeake Bay Aerosol

(Haven Beach Site)

Sample ID				Al ng/m³ Sigma	As ng/m³ Sigma	Cd ng/m³ Sigma	Cr ng/m³ Sigma	Cu ng/m³ Sigma	Ni ng/m³ Sigma	Pb ng/m³ Sigma	S ng/m³ Sigma
Year 1	V2	11/13/90	11/20/90	172 ± 15	1.28 ± 0.082	0.187 ± 0.019	1.17 ± 0.36	3.20 ± 0.31	(12.95 ± 0.94)	5.86 ± 0.49	ND
	V3	11/20/90	11/27/90	158 ± 14	1.45 ± 0.089	0.424 ± 0.033	1.58 ± 0.35	3.35 ± 0.31	(13.35 ± 0.94)	11.0 ± 1.3	2584 ± 590
	V4	11/27/90	12/04/90	(223 ± 19)	(3.97± 0.24)	(0.203± 0.046)	(9.77± 1.25)	(17.23± 1.30)	(39.7± 2.4)	(12.7± 2.0)	ND
	V5	12/11/90	12/18/90	80.9 ± 7.2	0.827 ± 0.052	0.149 ± 0.020	1.22 ± 0.44	(7.21) ±0.535)	(8.13 ± 0.52)	5.10 ± 0.87	2513 ± 483
	V6	12/18/90	12/25/90	37.8 ± 5.7	0.285 ± 0.026	< 0.017 ± 0.017	< 0.143 ± 0.143	(5.98 ± 0.61)	(91.1± 5.6)	ND	1765 ± 509
	V7	12/25/90	1/01/91	77.3 ± 8.9	0.341 ± 0.035	0.179 ± 0.039	< 0.88 ± 0.88	2.74 ± 0.65	< 0.377 ± 0.377	5.22 ± 0.95	1446 ± 240
	V8	1/01/91	1/08/91	67.1 ± 6.1	0.891 ± 0.057	0.261 ± 0.032	1.90 ± 0.69	2.45 ± 0.49	1.61 ± 0.38	(12.06 ± 1.12)	ND
	V9 [1]	1/08/91	1/15/91								
	V10 [1]	1/15/91	1/22/91								
	V11	1/22/91	1/29/91	10.8 ± 2.0	0.040 ± 0.003	< 0.007 ± 0.007	< 0.57 0.57	<0.37	<0.136	<0.3	ND
	V12	2/05/91	2/12/91	(215± 19)	(1.43± 0.094)	(0.424± 0.052)	(2.61± 1.1)	(6.74± 0.86)	(1.42± 0.68)	(7.65± 1.26)	ND
	V13	2/12/91	2/19/91	102 ± 12	0.526 ± 0.036	0.257 ± 0.051	< 0.29 ± 0.29	(7.09 ± 0.92)	3.81 ± 0.79	< 1.16 ± 1.16	ND
	V14 [1]	2/19/91	2/26/91								
	V15	2/26/91	3/05/91	83.3 ± 7.4	0.645 ± 0.040	0.071 ± 0.029	< 0.16 ± 0.16	(11.59 ± 0.83)	(25.4± 2.1)	5.05 ± 0.76	ND
	V16	3/19/91	3/26/91	(164± 14)	(0.86± 0.06)	(0.383± 0.05)	(0.957± 1.06)	(12.8± 1.1)	(7.01± 0.62)	(6.72± 1.1)	(3440± 621)
	V17	3/26/91	4/02/91	347 ± 30	0.548 ± 0.036	<0.036	< 0.23 ± 0.23	<0.74	<0.6	<0.1	3160 ± 882
	V18	4/02/91	4/09/91	127 ± 11	0.692 ± 0.044	0.183 ± 0.016	< 0.261 ± 0.261	4.08 ± 0.31	(8.84 ±0.567)	4.08 ± 0.47	2348 ± 331
	V19	4/09/91	4/16/91	193 ± 17	0.543 ± 0.037	0.114 ± 0.021	< 0.164 ± 0.164	3.05 ± 0.36	2.21 ± 0.37	2.97 ± 1.1	ND
	V20	4/16/91	4/23/91	136 ± 12	0.581 ± 0.042	0.214 ± 0.051	< 0.020 ± 0.020	(8.68 ± 0.97)	< 1.26 ± 1.26	ND	ND
	V21	4/23/91	4/30/91	93.6 ± 8.2	0.560 ± 0.039	0.128 ± 0.021	< 0.101 ± 0.101	2.04 ± 0.36	3.88 ± 0.40	4.26 ± 0.59	4564 ± 760
	V22	4/30/91	5/07/91	157 ± 14	0.630 ± 0.039	0.098 ± 0.021	< 0.211 ± 0.211	(8.07 ± 0.59)	3.33 ± 0.29	1.22 ± 0.59	ND
	V23	5/07/91	5/14/91	136 ± 12	0.548 ± 0.035	0.130 ± 0.021	< 0.258 ± 0.258	4.64 ± 0.43	(8.79 ±0.769)	4.72 ± 0.54	3723 ± 575
	V24	5/14/91	5/21/91	67.9 ± 5.9	0.371 ± 0.034	0.087 ± 0.012	< 0.161 ± 0.161	2.68 ± 0.24	2.76 ± 0.28	2.44 ± 0.51	2085 ± 486
	V25	5/21/91	5/28/91	540 ± 46	0.355 ± 0.028	0.131 ± 0.016	0.827 ± 0.26	0.836 ± 0.18	2.67 ± 0.30	0.85 ± 0.33	ND
	V26	5/28/91	6/04/91	325 ± 28	0.840 ± 0.052	0.074 ± 0.017	1.01 ± 0.40	(10.6 ± 0.69)	3.35 ± 0.50	1.81 ± 0.52	(7369± 981)
Year 2	V27	6/04/91	6/11/91	(435± 37)	(0.926± 0.059)	(0.241± 0.046)	(1.39± 0.96)	(8.67± 0.85)	(9.07± 1.02)	(3.96± 1.15)	(7352± 1096)
	V28'	6/11/91	6/18/91								
	V29'	6/18/91	6/25/91								
	V30'	6/25/91	7/02/91								
	V31	8/07/91	8/13/91	270.0 ± 16.8	0.442 ± 0.008	0.093 ± 0.023	0.92 ± 0.05	1.723 ± 0.217	0.910 ± 0.268	0.982 ± 0.184	4097 ± 510
	V32	8/13/91	8/20/91	59.2 ± 9.0	0.27 ± 0.01	< 0.0792 ± 0.0792	0.27 ± 0.03	< 0.82 ± 0.82	3.86 ± 1.37	5.82 ± 1.64	2568 ± 343
	V33	8/20/91	8/27/91	55.5 ± 3.9	0.03 ± 0.01	< 0.0192 ± 0.0192	0.20 ± 0.04	2.01 ± 0.24	6.23 ± 0.44	0.98 ± 0.31	4681 ± 529
	V34	8/27/91	9/03/91	64.4 ± 4.1	0.42 ± 0.02	< 0.0078 ± 0.0078	0.62 ± 0.03	0.74 ± 0.10	1.64 ± 0.13	1.29 ± 0.20	3080 ± 556
	V35	9/10/91	9/17/91	67.0 ± 4.2	0.19 ± 0.00	0.0881 ± 0.0112	0.31 ± 0.02	0.99 ± 0.10	1.38 ± 0.12	1.58 ± 0.28	1798 ± 243
	V36	9/17/91	9/24/91	90.3 ± 6.3	0.20 ± 0.02	< 0.014 ± 0.014	0.35 ± 0.06	< 0.216 ± 0.216	2.246 ± 0.390	< 0.372 ± 0.372	< 27 ± 27
	V37'	9/24/91	10/01/91								
	V38	10/01/91	10/08/91	43.0 ± 3.7	0.15 ± 0.01	(1.05) ± (0.238)	0.178 ± 0.036	< 0.87 ± 0.87	(10.8) ± (2.94)	< 0.68 ± 0.68	3072 ± 519
	V40	10/08/91	10/15/91	48.3 ± 3.4	0.28 ± 0.01	0.1904 ± 0.0306	0.28 ± 0.04	1.24 ± 0.18	1.65 ± 0.29	2.85 ± 0.22	1448 ± 209
	V41	10/22/91	10/29/91	118.9 ± 7.6	0.43 ± 0.02	< 0.0594 ± 0.0594	0.39 ± 0.06	2.95 ± 0.23	5.83 ± 0.27	4.03 ± 1.35	1365 ± 199
	V42	10/29/91	11/05/91	98.4 ± 6.4	0.58 ± 0.02	< 0.1145 ± 0.1145	0.78 ± 0.04	1.27 ± 0.20	2.374 ± 0.24	< 0.12 ± 0.12	< 17 ± 17
	V43	11/05/91	11/12/91	94.7 ± 6.6	0.95 ± 0.04	< 0.1310 ± 0.1310	0.88 ± 0.06	1.01 ± 0.23	2.087 ± 0.27	< 1.29 ± 1.29	< 43 ± 43
	V44	11/12/91	11/19/91	119.5 ± 7.8	0.78 ± 0.01	< 0.0012 ± 0.0012	0.47 ± 0.06	< 0.17 ± 0.17	< 0.27 ± 0.27	1.10 ± 0.36	2336 ± 365
	V45	11/19/91	11/26/91	168.5 ± 10.8	1.02 ± 0.04	0.1732 ± 0.0199	0.69 ± 0.06	3.56 ± 0.26	(8.464) ± (0.3)	1.71 ± 0.72	< 33 ± 33
	V46	12/03/91	12/10/91	65.7 ± 4.4	< 0.0001 ± 0.0001	< 0.0665 ± 0.0665	0.32 ± 0.04	4.04 ± 0.19	5.728 ± 0.23	< 0.28 ± 0.28	781 ± 241
	V47	12/24/91	12/31/91	114.2 ± 7.5	0.02 ± 0.001	(0.605) ±(0.0429)	(17.1) ±(0.249)	(23.4) ±(0.387)	(8.467) ± (0.34)	5.17 ± 0.51	1578 ± 484
	V48	12/31/91	1/07/92	17.9 ± 1.8	0.72 ± 0.00	< 0.0972 ± 0.0972	0.65 ± 0.04	4.25 ± 0.20	5.39 ± 0.23	2.53 ± 0.27	7 ± 0
	V49	1/07/92	1/14/92	41.6 ± 3.0	0.82 ± 0.01	< 0.1478 ± 0.1478	0.72 ± 0.05	0.64 ± 0.17	1.11 ± 0.20	ND	3063 ± 440
	V50	1/14/92	1/21/92	67.9 ± 4.5	ND	0.0822 ± 0.0277	0.30 ± 0.03	1.06 ± 0.17	0.95 ± 0.21	< 0.63 ± 0.63	1132 ± 175
	V51	1/21/92	1/28/92	39.5 ± 3.0	ND	(0.741) ± (0.602)	0.49 ± 0.04	ND		1.95 ± 0.62	1567 ± 217
	V52	1/28/92	2/04/92	33.7 ± 2.4	0.48 ± 0.01	0.1071 ± 0.0440	0.25 ± 0.03	1.73 ± 0.14	5.63 ± 0.17	1.69 ± 0.28	1799 ± 288
	V53	2/04/92	2/11/92	11.13 ± 0.62	0.577 ± 0.014	0.121 ± 0.006	0.481 ± 0.062	1.2 ± 0.2	5.16 ± 0.11	5 ± 0.6	1351 ± 98
	V54	2/11/92	2/18/92	60.53 ± 2.95	0.259 ± 0.005	0.219 ± 0.006	0.317 ± 0.079	1.8 ± 0.3	3.35 ± 0.09	4.1 ± 0.6	1381 ± 107
	V56	2/18/92	2/25/92	21.81 ± 1.18	0.057 ± 0.005	0.132 ± 0.006	0.246 ± 0.076	0.6 ± 0.2	3.46 ± 0.20	3.6 ± 0.5	2114 ± 165
	V57	3/10/92	3/17/92	77.95 ± 3.75	0.546 ± 0.012	0.146 ± 0.008	0.426 ± 0.078	0.9 ± 0.2	4.16 ± 0.08	4.4 ± 0.6	1240 ± 98
	V58	3/17/92	3/24/92	74.78 ± 3.50	0.850 ± 0.008	0.158 ± 0.002	0.718 ± 0.040	1.7 ± 0.2	2.73 ± 0.03	6.4 ± 0.7	1519 ± 120
	V60	3/31/92	4/07/92	93.86 ± 4.48	0.672 ± 0.010	0.197 ± 0.003	0.543 ± 0.056	4.7 ± 0.5	4.88 ± 0.08	5.9 ± 0.7	1581 ± 125
	V61	4/07/92	4/14/92	144.60 ± 6.74	0.680 ± 0.028	0.228 ± 0.004	0.624 ± 0.059	1.8 ± 0.2	3.38 ± 0.04	7.1 ± 0.8	2240 ± 177

Sample ID			Al		As		Cd		Cr		Cu		Ni		Pb		S	
			ng/m³	Sigma	ng/m³	Sigma	ng/m³	Sigma	ng/m³	Sigma	ng/m³	Sigma	ng/m³	Sigma	ng/m³	Sigma	ng/m³	Sigma
	V62	4/14/92	4/21/92	90 59 ±	4 28	0 409 ±	0 026	0 106 ±	0 007	0 608 ±	0 060	0 8 ±	0 2	4 18 ±	0 07	3 ±	0 4	1498 ±	118
	V63	4/21/92	4/28/92	64 58 ±	3 14	0 335 ±	0 028	0 096 ±	0 005	0 261 ±	0 061	2 3 ±	0 3	1 96 ±	0 21	2 7 ±	0 4	1453 ±	115
	V64	4/28/92	5/05/92	218 22 ±	10 11	0 694 ±	0 016	0 206 ±	0 009	0 570 ±	0 063	1 5 ±	0 2	2 13 ±	0 07	4 7 ±	0 6	1683 ±	133
	V66	5/12/92	5/19/92	63 59 ±	3 04	0 438 ±	0 011	0 115 ±	0 007	0 452 ±	0 061	1 9 ±	0 3	3 97 ±	0 05	3 8 ±	0 5	2199 ±	173
	V67	5/19/92	5/26/92	161 27 ±	7 57	0 546 ±	0 018	0 111 ±	0 005	0 569 ±	0 062	0 9 ±	0 2	1 93 ±	0 08	4 6 ±	0 6	1816 ±	143
	V68	5/26/92	6/02/92	40 73 ±	1 97	0 351 ±	0 019	0 092 ±	0 011	0 226 ±	0 061	0 4 ±	0 1	3 23 ±	0 05	2 6 ±	0 4	1625 ±	128
	V69	6/02/92	6/09/92	61 56 ±	3 01	0 108 ±	0 009	0 107 ±	0 004	0 434 ±	0 060	0 7 ±	0 2	2 45 ±	0 07	2 5 ±	0 4	1910 ±	151
Year 3	V70	6/09/92	6/16/92	121 49 ±	5 71	0 579 ±	0 009	ND	±	0 435 ±	0 060	1 10 ±	0 20	ND	±	3 70 ±	0 50	1805 ±	142
	V71	6/16/92	6/24/92	74 61 ±	3 56	0 402 ±	0 014	0 44 ±	0 006	0 440 ±	0 064	1 40 ±	0 20	13 34 ±	0 27	2 90 ±	0 40	1511 ±	119
	V72	6/24/92	6/30/92	69 72 ±	3 33	0 490 ±	0 022	0 40 ±	0 011	0 312 ±	0 061	1 20 ±	0 20	10 65 ±	0 12	3 30 ±	0 40	2577 ±	203
	V73	6/30/92	7/07/92	85 38 ±	4 02	0 665 ±	0 015	0 22 ±	0 004	0 416 ±	0 062	1 20 ±	0 20	4 64 ±	0 12	3 60 ±	0 50	2088 ±	165
	V74	7/07/92	7/14/92	(1679 4 ±	78 0)	0 682 ±	0 018	0 42 ±	0 013	(2 59 ±	0 085)	2 50 ±	0 30	8 91 ±	0 11	4 60 ±	0 60	3440 ±	271
	V075	7/14/92	7/15/92	(3568 2	950 1)	0 96	0 05	0 144	0 004	(3 863	0 185)	2 7	0 4	3 58	0 32	4 5	0 7	3527	278
	V076	7/21/92	7/22/92			0 54	0 03	0 100	0 005	0 70	0 14			2 21	0 31	2 5	0 5	2530	200
	V077	7/28/92	7/29/92			0 52	0 02	0 139	0 003	0 59	0 13	3 1	0 4	1 81	0 19	4 6	0 7	1692	134
	V078	8/04/92	8/05/92			0 60	0 05	0 096	0 029	(2 925	0 607)	5 5	1 3	(24 13	1 08)			3497	277
	V079	8/11/92	8/12/92			0 79	0 04	0 126	0 024	0 63	0 28	3 1	0 6	5 60	0 77	6 5	1 2	5174	408
	V080	8/18/92	8/19/92			0 19	0 01	0 024	0 004					1 71	0 19	2 2	0 5	1045	83
	V081	8/25/92	8/26/92			0 88	0 03	0 126	0 004	< 0 13	0 13	2 3	0 4	2 61	0 20	3 4	0 6	2310	182
	V082	9/01/92	9/02/92			0 31	0 01	0 169	0 003	0 81	0 15			3 66	0 25	5 6	0 8	3127	247
	V083	9/15/92	9/16/92			0 53	0 03	0 072	0 002					1 60	0 15	2 2	0 4	918	73
	V084	9/22/92	9/24/92	67	5	0 36	0 05	0 047	0 009	< 0 10	0 10	2 1	0 4	< 0 08	0 08			751	60
	V085	9/29/92	9/30/92			0 32	0 01	0 087	0 008	0 29	0 14	1 3	0 3	0 59	0 21	3 6	0 6	626	50
	V086	10/06/92	10/07/92			0 27	0 04	0 808	0 023	< 0 08	0 08	1 5	0 3	1 78	0 20	2 8	0 6	542	43
	V087	10/13/92	10/14/92			1 15	0 03	0 247	0 002	0 36	0 07	1 5	0 2	1 75	0 10	6 9	0 8	1928	152
	V088	10/20/92	10/21/92			0 62	0 02	0 161	0 001	0 33	0 06	0 8	0 1	0 91	0 09	3 2	0 4	844	67
	V089	10/27/92	10/28/92			0 52	0 03	0 486	0 016	0 47	0 15	1 9	0 4	1 24	0 22	5 1	0 7	1048	83
	V090	11/03/92	11/04/92			0 30	0 02	0 140	0 007	0 32	0 14	2 2	0 4	1 27	0 23	3	0 6	1039	82
	V091	11/10/92	11/11/92			0 94	0 04	0 268	0 005	1 16	0 11	2	0 3	4 68	0 15	5	0 6	1104	87
	V092	11/24/92	11/25/92			0 26	0 03	0 187	0 003	0 25	0 12	0 8	0 2	1 48	0 21	1 7	0 5	810	64
	V093	12/01/92	12/02/92			1 83	0 05	0 048	0 004	0 37	0 14	3	0 4			7 9	1	1508	119
	V094	12/08/92	12/09/92			0 87	0 03	0 102	0 005	1 08	0 17	2 4	0 4	< 0 14	0 14	11 6	1 4	2182	172
	V095	12/15/92	12/16/92			0 74	0 05	0 107	0 004	< 0 09	0 09	1 6	0 3	0 60	0 19	3 8	0 6	2177	172
	V096	12/22/92	12/23/92			0 93	0 03	0 350	0 008	0 84	0 14	2 8	0 4	2 91	0 19	6 9	0 9	972	77
	V097	12/29/92	12/30/92			0 59	0 02	0 208	0 010	< 0 08	0 08	2 7	0 4	1 69	0 21	4 5	0 7	1328	105
	V098	1/05/93	1/06/93			0 45	0 02	0 119	0 005	0 41	0 13	1 4	0 3	1 89	0 20	4 5	0 7	707	56
	V099	1/12/93	1/13/93			0 04	0 00	0 045	0 004	< 0 07	0 07	3 4	0 4	1 71	0 12	1	0 3	124	10
	V100	1/19/93	1/20/93	40	3	0 57	0 03	0 192	0 006	0 78	0 10	1 5	0 3	1 64	0 14	4 8	0 6	752	60
	V101	1/26/93	1/27/93	< 3 5	3 5	0 46	0 02	0 099	0 003	0 47	0 09	2	0 4	1 39	0 15	3 7	0 6	456	33 1
	V102	2/02/93	2/03/93	52 3	13 3	0 71	0 02	0 167	0 005	0 66	0 10	1 3	0 3	3 37	0 16	3 7	0 6	578 2	41 4
	V103	2/09/93	2/10/93	26 1	12 1	0 75	0 04	0 146	0 003	0 35	0 11	1 6	0 4	3 09	0 15	4 9	0 8	695 2	50 6
	V104	2/16/93	2/17/93			0 37	0 02	0 128	0 005	0 20	0 09	0 9	0 3	1 25	0 13	3	0 6	1573 4	113
	V105	2/23/93	2/24/93	26 6	12 2	0 64	0 03	0 111	0 007	0 28	0 10	1 3	0 3	0 52	0 14	4 1	0 7	1682 8	123
	V106	3/02/93	3/03/93			0 85	0 02	0 133	0 003	0 43	0 12	2 2	0 4	2 63	0 17	2 8	0 7	864 3	62 2
	V108	3/09/93	3/10/93	< 6 45	6 45	1 81	0 05	0 045	0 006	0 24	0 10	1 5	0 3	< 0 09	0 09	3 5	0 7	1352 1	97 7
	V110	3/16/93	3/17/93	39 9	12 5	0 44	0 02	0 386	0 002	0 29	0 10	1 2	0 3	3 51	0 14	4 2	0 7	1036	75 3
	V111	3/30/93	3/31/93	< 6 2	6 2	0 47	0 02	0 122	0 006	0 33	0 09	0 8	0 3	1 92	0 13	6 4	0 9	1033 2	74
	V112	4/06/93	4/07/93	48 5	13	0 43	0 02	0 094	0 002	0 47	0 10	2 7	0 4	3 26	0 16	5	0 7	561 4	40 6
	V113	4/13/93	4/15/93	39 6	11 6	0 46	0 01	0 071	0 004	0 27	0 10	3	0 5	1 90	0 16	4	0 7	886 9	64 1
	V114	4/20/93	4/21/93	88 9	18 6	0 36	0 05			0 55	0 11	1 2	0 4			2 1	0 7	1001	73 4
	V115	4/27/93	4/28/93	38	12 2	0 33	0 01	0 116	0 005	0 50	0 10	1 4	0 3	3 07	0 16	3 8	0 6	647 4	47 1
	V116	5/04/93	5/05/93	38 1	13 3	0 19	0 04	< 0 007	0 007	< 0 04	0 04			1 80	0 15	1 1	0 5	593	43 4
	V117	5/11/93	5/12/93	186 8	25 3	0 62	0 02	0 153	0 004	1 33	0 10	1 8	0 4	1 92	0 14	5 4	0 8	4695 8	340
	V119	5/18/93	5/19/93	48 5	16 3	0 65	0 02	0 065	0 002	< 0 07	0 07	< 0 4	0 4	1 07	0 18	3 1	0 7	2478 4	198
	V120a	5/25/93	5/26/93	99 2	18 2	0 47	0 02	0 107	0 002	0 52	0 11	< 0 25	0 25	1 10	0 18	4 7	0 8	2256 6	169
	V121	6/01/93	6/02/93	29	3	0 50	0 03	0 081	0 002	0 36	0 12	< 0 25	0 25	0 50	0 19	3 4	0 7	2415	181
	V122	6/08/93	6/09/93	110	19 5	0 80	0 02	0 159	0 008	0 52	0 10	2	0 4	2 13	0 15	3 3	0 7	3289	246
	V123	6/15/93	6/16/93	< 9 65	9 65	0 19	0 02			0 44	0 12					< 0 45	0 45	564 1	42 5
	V124	6/22/93	6/23/93	61 1	15 8	0 48	0 02			0 47	0 11	1 6	0 4			3 9	0 7	2745 4	205
	V125	6/29/93	6/30/93	75 8	17 2	0 77	0 02			0 49	0 12	0 8	0 3			2 4	0 7	2583 5	194
	V126	7/06/93	7/07/93	247 1	30 9	0 81	0 03			0 76	0 12	0 9	0 3			3 3	0 7	4505 7	338
	V127	7/13/93	7/14/93	92 7	19 4	0 51	0 02			1 25	0 13	1 1	0 4			2 1	0 7	2672 6	200
	V128	7/20/93	7/21/93	107 3	20 5	0 99	0 03			1 31	0 11	1 5	0 4			8 5	1 1	5627 4	422
	V129	7/27/93	7/28/93	73 2	17 1	0 49	0 02			0 79	0 11	1 1	0 4			2 5	0 7	2651 7	199
	V130	8/3/93	8/4/93	115 3	19 8	0 41	0 02			0 50	0 11	< 0 25	0 25			2	0 6	3030 2	228

Sample ID				Al		As		Cd		Cr		Cu		Ni		Pb		S	
				ng/m³	Sigma	ng/m³	Sigma	ng/m³	Sigma	ng/m³	Sigma	ng/m³	Sigma	ng/m³	Sigma	ng/m³	Sigma	ng/m³	Sigma
V131	8/10/93	8/11/93	<	7.95	7.95	0.35	0.05			0.32	0.11	0.8	0.3						
V132	8/17/93	8/18/93		41.8	16.9	0.79	0.03			0.61	0.11	0.8	0.3			1.5	0.6	1182.5	88.8
133	8/24/93	8/25/93														4.8	0.8	4949.7	369
134	8/31/93	9/1/93																	
135	9/7/93	9/8/93																	
136	9/14/93	9/15/93																	
137	9/21/93	9/22/93																	
138	10/5/93	10/6/93																	
Vims																			
Year 1				First 12 months statistics															
	ave			153		0.629		0.15		0.587		2.90		2.527		4.0		2687	
	STD			124		0.323		0.10		0.545		1.00		1.098		2.6		927	
	avg error			14		0.042		0.02		0.313		0.37		0.495		0.7		540	
	count			19		19		18		19		10		10		14		9	
	min			11		0.040		0.01		0.020		0.84		0.377		0.9		1446	
	max			540		1.446		0.42		1.904		4.64		3.878		11.0		4564	
	median			98		0.548		0.12		0.244		0.00		0.000		2.1		2348	
	max/mean			3.5		2.3		2.8		3.2		1.6		1.5		2.8		1.7	
18 mos.				First 18 months statistics															
	ave			129		0.521		0.12		0.540		2.11		2.703		2.9		2130	
	STD			103		0.341		0.09		0.447		1.28		1.636		2.4		1352	
	avg error			11		0.030		0.03		0.199		0.32		0.420		0.6		382	
	count			34		34		31		33		24		22		29		24	
	min			11		0.000		0.00		0.020		0.17		0.270		0.1		17	
	max			540		1.446		0.42		1.904		4.64		6.231		11.0		4681	
	median			92		0.438		0.09		0.286		0.85		1.085		1.3		1798	
	max/mean			4.2		2.8		3.5		3.5		2.2		2.3		3.8		2.2	
Year 2																			
	ave			84		0.447		0.11		0.471		1.58		3.143		2.9		1709	
	STD			55		0.276		0.06		0.200		1.15		1.654		1.9		1060	
	avg error			5		0.014		0.03		0.051		0.25		0.210		0.5		214	
	count			34		32		31		33		32		30		33		34	
	min			11		0.000		0.00		0.178		0.17		0.270		0.1		7	
	max			270		1.016		0.23		0.925		4.70		6.231		7.1		4681	
	median			66		0.434		0.11		0.434		1.13		2.414		2.6		1578	
	max/mean			3.2		2.3		2.0		2.0		3.0		2.0		2.5		2.7	
Year 3																			
	ave			66		0.600		0.17		0.479		1.70		2.592		4.0		1871	
	STD			51		0.320		0.14		0.310		0.95		2.564		1.9		1297	
	avg error			13		0.027		0.01		0.108		0.35		0.183		0.7		143	
	count			33		60		48		55		54		46		58		60	
	min			4		0.044		0.01		0.036		0.25		0.083		0.5		124	
	max			247		1.835		0.81		1.333		5.50		13.343		11.6		5627	
	median			49		0.526		0.13		0.422		1.50		1.790		3.7		1510	
	max/mean			3.7		3.1		4.7		2.8		3.2		5.1		2.9		3.0	

[1] Sampler malfunction, either no sample was collected or the air volume was inaccurate, values (when reported) are ng/filter, but not included in averages or flux estimates.

[2] Value not included in average.

ND = not detected.

Se ng/m³	Sigma	Zn ng/m³	Sigma	V ng/m³	Sigma	Br ng/m³	Sigma	Fe ng/m³	Sigma	Mn ng/m³	Sigma
						(Haven Beach Site)					
Se ng/m³	**Sigma**	**Zn** ng/m³	**Sigma**	**V** ng/m³	**Sigma**	**Br** ng/m³	**Sigma**	**Fe** ng/m³	**Sigma**	**Mn** ng/m³	**Sigma**
2.65	0.23	(39.3	3.7)	3.89	0.33	5.38	0.45	129	4.4	4.08	0.16
2.52	0.21	(104	9.5)	5.21	0.44	5.58	0.46	144	4.0	3.90	0.15
(0.285	0.06)	(166	15)	(1.19	0.10)	(0.43	0.066)	(175	6.7)	(1.16	0.027)
1.61	0.14	(116	11)	4.71	0.40	4.12	0.35	104	3.6	2.39	0.10
0.937	0.09	(51.4	4.8)	2.49	0.21	2.67	0.23	28.2	3.0	0.896	0.038
2.98	0.27	(33.9	3.3)	3.86	0.31	3.98	0.27	67.4	5.0	1.54	0.034
3.90	0.33	(35.5	3.6)	7.39	0.62	7.05	0.57	89.5	4.6	3.14	0.12
0.240	0.02	2.33	0.32	0.419	0.04	0.259	0.026	6.30	0.91	< 0.075	0.075
(2.83	0.26)	(279	26)	(18.2	1.5)	(7.5	0.63)	(155	8.6)	(6.8	0.27)
2.46	0.23	21.5	2.4	6.89	0.56	3.31	0.23	110	7.5	3.26	0.070
1.65	0.14	17.9	1.8	5.71	0.48	3.41	0.28	80.5	3.2	2.32	0.092
(3.09	0.27)	(28.1	2.8)	(8.48	0.68)	(2.94	0.21)	(203	8.6)	(4.28	0.09)
0.959	0.088	12.7	1.5	4.28	0.36	3.89	0.33	225	7.3	3.91	0.15
1.13	0.10	12.3	1.2	3.99	0.32	2.65	0.18	107	3.4	2.33	0.05
0.768	0.072	7.48	0.86	3.35	0.29	4.10	0.35	108	4.4	3.04	0.12
1.30	0.13	6.98	1.3	6.59	0.56	3.17	0.27	81.7	5.7	2.45	0.10
1.36	0.12	11.2	1.1	9.08	0.73	2.31	0.17	73.3	3.0	2.75	0.06
1.09	0.10	9.57	1.0	2.69	0.23	2.88	0.24	130	3.9	3.11	0.12
1.67	0.14	10.8	1.1	3.59	0.30	3.79	0.32	141	4.4	4.02	0.16
0.748	0.068	11.4	1.1	3.06	0.26	3.35	0.31	136	4.7	2.66	0.10
0.710	0.067	4.19	0.62	5.17	0.44	2.26	0.30	300	8.5	6.22	0.24
3.00	0.25	15.1	1.5	5.59	0.47	5.35	0.45	187	4.9	4.00	0.16
(2.03	0.18)	(29.3	2.9)	(6.48	0.55)	(8.30	0.68)	(361	10)	(7.19	0.28)
1.67	0.10	28.02	1.97	4.05	0.24	1.626	0.129	234.7	5.7	3.66	0.15
0.98	0.06	5.54	0.46	5.17	0.28	1.873	0.083	77.2	2.6	1.05	0.09
0.18	0.03	1.50	0.33	3.71	0.22	2.318	0.152	11.1	2.6	1.83	0.08
1.09	0.07	8.45	0.63	4.03	0.22	2.351	0.154	82.8	2.5	1.78	0.04
0.62	0.04	5.05	0.40	2.36	0.14	1.070	0.068	56.5	1.9	1.09	0.04
0.95	0.07	8.04	0.80	5.82	0.32	1.356	0.084	113.5	5.1	1.36	0.04
±		6.253	0.551	4.26	0.23	3.866	0.177	31.7	2.6	1.32	0.04
0.85	0.06	15.06	1.10	2.50	0.13	2.202	0.089	233.1	5.8	2.49	0.05
1.10	0.08	14.13	1.10	4.61	0.27	4.473	0.251	91.7	4.0	3.82	0.15
1.99	0.12	27.97	1.95	4.85	0.26	8.393	0.335	125.5	4.1	6.93	0.15
1.81	0.11	(117)	±(7.92)	5.18	0.31	6.500	0.436	182.8	5.2	< (8.81)	±
2.18	0.13	(48.2)	±(3.32)	8.40	0.45	4.595	0.162	142.2	5.0	2.99	0.07
2.45	0.16	(62.4)	±(4.27)	9.63	0.57	5.484	0.341	111.2	5.2	3.16	0.13
1.07	0.07	(40.28)	±(2.75)	4.09	0.22	2.403	0.350	96.2	3.5	(14.8)	±(0.308
2.97	0.20	(358)	± (24)	2.89	0.17	6.696	0.404	(644)	±(14.9)	(9.43)	±(0.37)
0.17	0.02	6.25	0.54	0.68	0.04	0.962	0.041	49.5	2.7	0.67	0.02
2.97	0.17	25.44	1.77	5.33	0.32	4.596	0.260	(448)	±(9.73)	3.80	0.16
1.76	0.10	11.19	0.83	4.15	0.22	2.569	0.087	69.9	2.8	1.80	0.04
1.94	0.11	12.66	0.94	3.99	0.24	2.837	0.156	54.3	2.9	1.23	0.05
1.55	0.09	9.36	0.70	4.11	0.22	3.728	0.123	38.3	2.2	1.48	0.04
1.98	0.11	13.35	0.91	3.46	0.06	3.353	0.020	44.4	3.4	1.2	0.2
1.44	0.08	10.58	0.75	6.62	0.13	1.354	0.008	44.0	4.3	1	0.2
1.00	0.06	8.84	0.62	4.54	0.08	0.375	0.006	25.0	4.1	0.7	0.2
1.72	0.10	10.64	0.75	3.15	0.07	1.434	0.018	75.7	4.5	2	0.3
1.80	0.10	15.32	1.03	5.25	0.10	2.849	0.011	84.6	2.9	2.4	0.2
2.17	0.12	13.68	0.93	7.09	0.14	2.464	0.018	95.1	3.6	2.6	0.3
1.81	0.10	19.50	1.32	4.68	0.09	3.801	0.034	113.8	4.0	2.4	0.3

Se		Zn		V		Br		Fe		Mn	
ng/m³	Sigma	ng/m³	Sigma	ng/m³	Sigma	ng/m³	Sigma	ng/m³	Sigma	ng/m³	Sigma
0 91 ±	0.05	8 00 ±	0 57	5 39 ±	0 10	1 554 ±	0 027	79 0 ±	3 6	1 3 ±	0 2
1 04 ±	0 06	9 36 ±	0 65	2 81 ±	0 06	1 396 ±	0 030	48 9 ±	3 4	1 ±	0 2
1 39 ±	0 08	22 43 ±	1 52	4 02 ±	0 08	2 895 ±	0 026	135 6 ±	4 5	3 7 ±	0 4
1 15 ±	0 07	8 53 ±	0 60	7 14 ±	0 12	2 086 ±	0 017	55 9 ±	3 5	1 1 ±	0 2
1 10 ±	0 06	7 67 ±	0 55	3 86 ±	0 08	2 779 ±	0 032	ND		2 4 ±	0 3
0 73 ±	0 04	5 39 ±	0 41	2 89 ±	0 05	1 484 ±	0 024	38 2 ±	3 5	0 9 ±	0 2
1 08 ±	0 06	9 50 ±	0 66	5 50 ±	0 11	0 601 ±	0 018	52 5 ±	3 4	0 8 ±	0 2
1 11 ±	0.06	11.78 ±	0.81	6.26 ±	0.12	2 511 ±	0.017	115.5 ±	4 0	2 20 ±	0.30
0 82 ±	0.05	6.43 ±	0.48	2.48 ±	0 05	2.178 ±	0.019	66.9 ±	3.8	1.70 ±	0.20
1 39 ±	0 08	8.16 ±	0.58	3 67 ±	0.07	2 165 ±	0.027	56.3 ±	3.5	1 30 ±	0.20
1 41 ±	0 08	8.35 ±	0.59	2 82 ±	0.05	1.872 ±	0.020	78.3 ±	3.8	1.10 ±	0.20
2.76 ±	0.16	12.03 ±	0.85	7.10 ±	0.27	2.364 ±	0.025	(1050.4 ±	21.38)	(13.1 ±	1.1)
1.90	0.15	13.8	1.6	7.2	1.2	3.93	0.10	(1615.28	37.41)	(24.1	2)
1.28	0.09	6.8	0.6	4.8	0.7	3.08	0.09	94	5	2.1	0.3
1.45	0.09	11.2	0.8	5.3	0.7	3.00	0.08	84	4	2.4	0.3
1.84	0.17	10.0	1.6			2.81	0.31	138	18		
2.79	0.20	12.8	1.3			3.93	0.16	154	10	3.4	0.6
0.40	0.05	2.2	0.3	2.7	0.5	0.48	0.06	20	4		
1.03	0.08	5.0	0.5	2.8	0.7	2.99	0.08	64	5	1.3	0.3
1.58	0.11	14.2	1.1	1.7	0.5	2.13	0.08	101	6	3.7	0.5
0.40	0.04	2.2	0.3	3.3	0.5	2.53	0.08	14	3		
0.73	0.06	6.2	0.5	2.7	0.6	1.65	0.12	49	5	1.2	0.3
0.86	0.06	6.7	0.6	2.2	0.5	1.47	0.07	55	4	1.5	0.3
0.45	0.04	6.4	0.5	2.9	0.6	2.82	0.10	39	4	1.4	0.3
2.03	0.12	12.0	0.9	9.7	1	5.06	0.07	87	3	2.2	0.2
1.10	0.07	6.4	0.5	3.9	0.5	2.79	0.05	44	2	2	0.2
1.07	0.09	10.7	0.9	4	0.6	2.92	0.09	61	5	1.9	0.3
1.16	0.08	12.3	0.9	5.8	0.8	2.65	0.08	42	4	1.7	0.3
1.10	0.08	13.5	1.0	10.6	1.2	4.96	0.11	114	5	2	0.3
0.70	0.05	6.2	0.5	4	0.6	5.00	0.12	24	4		
2.65	0.17	12.2	0.9	2.8	0.6	6.16	0.09	48	5	1.3	0.3
2.36	0.15	26.5	1.9	3.1	0.6	4.76	0.12	93	6	2.8	0.4
0.66	0.05	11.4	0.8	4.8	0.7	5.01	0.13	27	4	1.2	0.3
3.12	0.19	10.4	0.8	13.1	1.4	5.85	0.11	52	5		
1.50	0.11	8.4	0.7	9.5	1.1	2.72	0.08	29	5	1.7	0.3
0.99	0.07	13.5	1.0	2.4	0.5	1.55	0.08	58	5	1.5	0.3
		4.0	0.4	1.9	0.3	0.20	0.04	10	3		
1.85	0.11	13.5	1.0	4.2	0.6	4.45	0.09	58	3	1.9	0.3
0.68	0.05	9.1	0.7	3.2	0.5	3.82	0.10	34	3	1.1	0.2
1.24	0.08	8.8	0.7	6	0.7	2.88	0.06	79	4	2.3	0.3
0.94	0.07	9.5	0.7	5.4	0.7	7.03	0.15			1	0.2
1.22	0.07	7.1	0.5	2.5	0.5	3.11	0.07	25	3	1.1	0.2
1.46	0.10	7.3	0.6	< 0.4	0.4	2.19	0.07	48	4	1.3	0.3
1.66	0.10	12.8	0.9	7.1	0.9	4.31	0.07	37	4	1.9	0.3
0.81	0.06	4.2	0.4	2.4	0.5	1.51	0.06	16	3	0.5	0.2
0.55	0.04	4.2	0.4	13	1.3	2.17	0.06	31	3	3.6	0.4
1.49	0.09	9.0	0.7	3.8	0.6	2.71	0.06	32	3	1.9	0.3
0.70	0.05	13.2	1.0	6.8	0.8	3.28	0.06	57	4	1.5	0.3
1 06	0 07	6.9	0 6	7.5	0.9	2 14	0.06	36	3	0 9	0.2
0 60	0.05	5.6	0.5	3.2	0.7	3.45	0.13	100	4	2 1	0.4
0 37	0.04	10.2	0.8	2.8	0.5	2.72	0.06	61	4	1 6	0.3
		1.2	0.3	7.2	0.9	1.58	0.08	30	3	0 6	0.2
2.12	0.13	10.3	0.8	5.9	0.8	2.58	0.06	161	5	4 2	0.4
0.80	0.06	3.8	0.4	2.9	0.6	1.23	0.07	28	4	1 4	0.3
1 27	0.08	7.5	0.6	1.9	0.5	3.66	0.06	100	4	1 8	0.3
1 27	0 09	6 8	0 6	0.84	0.03	3 08	0 08	47	4	0 7	0 3
1 34	0 08	9.0	0.7	6.1	0.8	4 25	0 08	84	4	3 2	0 4
		2.6	0.3	3.7	0.6	2.03	0.08	32	4	1 2	0.3
1.27	0.09	9.3	0.7	1.3	0.5	1.78	0.08	89	4	2 2	0.3
1.17	0.07	4.8	0.4	4.1	0.7	2.18	0.06	39	4	1.1	0.3
		8.0	0.8	4	0.8	3.26	0.08	191	7	4	0.5
1.02	0.07	3.1	0.4	3.3	0.7	3.13	0.08	106	5	1 5	0.3
2 61	0 15	13.2	1.0	4.9	0.7	4.09	0.07	144	5	4 2	0 5
0 87	0 06	5 8	0.5	3.8	0 6	2 82	0.08	75	4	2	0 3
1 68	0 10	8.2	0.7	8.3	1	2.93	0.06	97	4	2 1	0.3

Se		Zn		V		Br		Fe		Mn	
ng/m³	Sigma	ng/m³	Sigma	ng/m³	Sigma	ng/m³	Sigma	ng/m³	Sigma	ng/m³	Sigma
0.51	0.04	2.2	0.3	3.4	0.6	2.37	0.08	24	4	0.5	0.2
2.45	0.15	14.8	1.1	5.1	0.7	4.73	0.07	75	4	2.1	0.3

First 12 months statistics

1.7	11.0	4.6	3.659	118	2.952
1.0	5.1	1.9	1.451	65	1.302
0.1	1.2	0.4	0.305	5	0.111
19	13	19	19	19	19
0.2	2.3	0.4	0.259	6	0.075
3.9	21.5	9.1	7.045	300	6.224
1.2	5.6	3.9	3.330	105	2.702
2.3	1.9	2.0	1.9	2.5	2.1
1.6	11.5	4.7	3.668	116	2.824
0.9	7.0	1.9	1.606	65	1.437
0.1	1.1	0.3	0.265	4	0.101
33	23	34	34	33	31
0.2	1.5	0.4	0.259	6	0.075
3.9	28.0	9.6	8.393	300	6.932
1.1	5.3	4.1	3.239	100	2.422
2.5	2.4	2.1	2.3	2.6	2.5
1.4	12.0	4.6	2.892	87	2.062
0.7	6.7	1.7	1.814	54	1.313
0.1	0.9	0.2	0.123	4	0.153
33	29	34	34	31	31
0.2	1.5	0.7	0.375	11	0.669
3.0	28.0	9.6	8.393	235	6.932
1.3	8.8	4.1	2.403	73	1.355
2.1	2.3	2.1	2.9	2.7	3.4
1.3	8.7	4.6	3.050	66	1.867
0.7	4.2	2.7	1.320	40	0.903
0.1	0.7	0.6	0.082	4	0.304
58	60	58	60	57	52
0.4	1.2	0.4	0.203	10	0.500
3.1	26.5	13.1	7.027	191	4.200
1.2	8.4	3.9	2.816	56	1.700
2.4	3.0	2.8	2.3	2.9	2.2

Appendix A3

Table A3.1. Mean field measured vapor concentrations, pg/m^3, and mean analytical detection limits for PAHs, Chesapeak Bay, 1992.

Polycyclic Aromatic Hydrocarbon	Mean Vapor Concentration WYE	Mean Analytical Detection Limits WYE	Mean Vapor Concentration ELMS	Mean Analytical Detection Limits ELMS	Mean Vapor Concentration HAVEN BEACH	Mean Analytical Detection Limits HAVEN BEACH
Fluorene	863.7	0.2	810.4	0.13	832.1	0.37
Phenanthrene	3046.7	0.2	1937.3	0.13	2460.2	0.37
Anthracene	31.8	0.2	47.2	0.13	12.2	0.37
Fluoranthene	582.6	0.3	231.4	0.26	530.7	0.73
Pyrene	643.3	0.3	397.8	0.26	1055.4	0.73
Benzo[a]anthracene	3.6	0.3	2.6	0.26	3.3	0.73
Chrysene	20.2	0.3	53.8	0.26	62.0	0.73
Benzo[b]fluoranthene	2.5	0.3	34.3	0.26	3.8	0.73
Benzo[k]fluoranthene	1.9	0.3	27.9	0.26	3.3	0.73
Benzo[e]pyrene	1.9	0.3	1.2	0.26	5.2	0.73
Benzo[a]pyrene	0.1	0.3	3.7	0.26	2.1	0.73
Indeno[123-cd]pyrene	0.5	1.5	0.8	1.28	2.2	3.56
Dibenz[ah]anthracene	0.5	1.5	0.2	1.28	0.3	3.56
Benzo[ghi]perylene	1.8	0.6	0.9	0.53	9.0	1.46

Table A3.2 Summary of Laboratory Surrogate Compounds for Chesapeake Bay Atmospheric Deposition Samples, Elms Site, 1992

Deuterated PAH	Sample Matrix	Mean% Recovery	Relative* STD dev (%)	N**	70%<N N < 130%
d-10 Fluoranthene	Rain Dissolved	60.6	5.45	5	0
d-12 Chrysene		84.7	28.83	18	15
d-10 Anthracene	Rain Filter	53.6	32.29	17	1
d-10 Fluoranthene		51.6	39.9	18	4
d-12 Chrysene		80	25.47	23	9
Non-Commercial (PCB)	**Sample Matrix**	**Mean% Recovery**	**Relative* STD dev (%)**	**N****	**70% < N N < 130%**
3,5-dichlorobiphenyl	Rain Dissolved	73.3	46.53	22	10
3,5-dichlorobiphenyl	Rain Filter	63.8	54.33	22	12

Relative STD DEV = STD DEV 100/[Mean].
**Number of samples.

Table A3.3 Summary of Laboratory Surrogate Compounds for Chesapeake Bay Atmospheric Deposition Samples, Haven Beach, 1992

Deuterated PAH	Matrix	Mean% Recovery	Relative* STD dev (%)	N**	70%<N N < 130%
d-10 Anthracene	Rain Dissolved	51.7	32.45	22	4
d-10 Fluoranthene		76	58.71	21	11
d-12 Chrysene		90.97	42.59	28	16
d-10 Anthracene	Rain Filter	32.74	76.51	25	2
d-10 Fluoranthene		53.84	93.01	25	3
d-12 Chrysene		42.57	87.62	25	2
Non-Commercial (PCB)	**Matrix**	**Mean% Recovery**	**Relative* STD dev (%)**	**N****	**70% < N N < 130%**
3,5-dichlorobiphenyl	Rain Dissolved	59.7	43.22	28	12
3,5-dichlorobiphenyl	Rain Filter	52.22	45.22	28	6

Table A3.4. Mean Mass (ng) Summary of Polycyclic Hydrocarbons and Polychlorinated Biphenyls in Laboratory and Field Blan Matrices, Chesapeake Bay Atmospheric Deposition Project, Elms, 1992.

Polycyclic Aromatic Hydrocarbon	LABORATORY				FIELD			
	Mean Resin (N=6)	%Rel STD^	Mean Filter (N=3)	%Rel STD^	Mean Resin (N=1)	%Rel STD^	Mean Filter (N=1)	%Rel STD^
Fluorene	5.02	138	ND	--	25.52	--	ND	--
Phenanthrene	25.74	111	ND	--	82.67	--	21.11	--
Anthracene	11.81	186	ND	--	1.95	--	3.82	--
Fluoranthene	63.17	139	ND	--	31.59	--	31.34	--
Pyrene	9.48	220	ND	--	14.83	--	19.09	--
Benzo[a]anthracene	0.05	224	ND	--	0.06	--	10.57	--
Chrysene	0.10	224	ND	--	7.30	--	16.20	--
Benzo[b]fluoranthene	85.42	203	ND	--	5.21	--	50.46	--
Benzo[k]fluoranthene	5.74	220	ND	--	1.77	--	22.84	--
Benzo[e]pyrene	ND	0	ND	--	3.84	--	18.66	--
Benzo[a]pyrene	47.25	204	ND	--	1.60	--	12.89	--
Indeno[123-cd]pyrene	0.18	224	ND	--	4.16	--	16.24	--
Dibenz[ah]anthracene	ND	0	ND	--	0.00	--	0.00	--
Benzo[ghi]perylene	0.36	224	ND	--	4.55	--	14.57	--
Total PCB*	4.66	30.56	8.44	37.26	20.87	--	29.26	--

Relative STD DEV = STD dev* 100/mean.
*N = 5 for lab resins.

Table A3.5. Mean Mass (ng) Summary of Polycyclic Hydrocarbons and Polychlorinatted Biphenyls in Laboratory and Field Blan Matrices, Chesapeake Bay Atmospheric Deposition Project, Haven Beach, 1992.

Polycyclic Aromatic Hydrocarbon	LABORATORY				FIELD			
	Mean Resin (N=1)	%Rel STD^	Mean Filter (N=1)	%Rel STD^	Mean Resin (N=1)	%Rel STD^	Mean Filter (N=1)	%Rel STD^
Fluorene	ND	--	ND	--	7.09	--	ND	--
Phenanthrene	ND	--	ND	--	4.17	--	ND	--
Anthracene	ND	--	ND	--	0.39	--	ND	--
Fluoranthene	ND	--	ND	--	6.85	--	ND	--
Pyrene	ND	--	ND	--	1.92	--	ND	--
Benzo[a]anthracene	ND	--	ND	--	1.52	--	ND	--
Chrysene	ND	--	ND	--	1.26	--	ND	--
Benzo[b]fluoranthene	ND	--	ND	--	ND	--	ND	--
Benzo[k]fluoranthene	ND	--	ND	--	ND	--	ND	--
Benzo[e]pyrene	ND	--	ND	--	ND	--	ND	--
Benzo[a]pyrene	ND	--	ND	--	ND	--	ND	--
Indeno[123-cd]pyrene	ND	--	ND	--	ND	--	ND	--
Dibenz[ah]anthracene	ND	--	ND	--	ND	--	ND	--
Benzo[ghi]perylene	ND	--	ND	--	ND	--	ND	--
Total PCB	6.47	--	6.81	--	13.07	--	10.2	--

Relative STD DEV = STD dev* 100/mean.