U.S. DEPARTMENT OF THE INTERIOR
U.S. GEOLOGICAL SURVEY

Prepared in cooperation with the
LOUISIANA DEPARTMENT OF TRANSPORTATION AND DEVELOPMENT

Nutrients

The nutrients data (tables 4 and 5) indicate that in the upper parts of the Barataria basin, especially along Bayou Segnette (sites 5-7), there are relatively large amounts of nutrients, especially dissolved nitrogen and phosphorus, available for plant growth. Nutrient enrichment is to be expected in a swamp-marsh estuary, where productivity and decomposition rates are high. However, sites 4-8 and 10 have concentrations of nutrients in the water high enough to cause excessive algal growth (Taylor and others, 1980). Site 5 had concentrations of 0.31 mg/L of total nitrite plus nitrate and 0.71 mg/L of total phosphorus. Locally, high concentrations of nitrite plus nitrate, such as the 0.89 mg/L concentration at site 10, may be due to direct sewage inputs. This is supported by the fact that high nutrient concentrations at some sites were accompanied by high concentrations of fecal-coliform bacteria (fig. 5). The fecal-coliform bacteria concentration at site 5 was 2,800 cols/100 mL.

The high nutrient concentrations in water in the upper basin can cause problems such as algal blooms. Persistent algal blooms under certain conditions can deplete the oxygen in a stream or estuary in the early morning hours and cause fish kills. Although significant quantities of algae were present during the study period as evidenced by the green color of the water, no severe blooms were observed.

Population growth and agricultural activity are adding to the naturally large amount of nutrients produced by this swamp-marsh estuary (Conner and Day, 1987). The large amount of nutrients in bottom material, especially ammonia plus organic nitrogen, detected throughout the study area may be another indication of nutrient enrichment.

Table 4.--Nutrients in water, August 30, 1988

[Constituents are reported as nitrogen and phosphorus; concentrations in milligrams per liter; <, less than]

Site no.	Ammonia, dissolved	Ammonia, total	Nitrite plus nitrate, dissolved	Nitrite plus nitrate, total	Phosphorus, dissolved	Phosphorus, total
2	0.06	0.04	0.73	0.72	0.13	0.22
4	.03	.02	.80	.79	.22	.45
5	.14	.14	.31	.31	.65	.71
6	.09	.09	.02	.02	.24	.34
7	.04	.04	.03	.05	.16	.35
8	.03	.03	.02	.02	.12	.26
9	.04	.04	<.02	<.02	.12	.32
10	.04	.04	.89	.89	.20	.33
14	.02	.02	<.02	<.02	.07	.16
15	.06	.03	.03	.02	.06	.11
16	.05	.04	<.02	<.02	.04	.10

Table 5.--Nutrients in bottom material, August 30, 1988

[Constituents are reported as nitrogen and phosphorus; concentrations in milligrams per kilogram; --, not analyzed]

Site no.	Ammonia	Ammonia plus organic nitrogen	Nitrate plus nitrate	Phosphorus
2	46	1,800	2.0	1,100
4	130	2,500	2.0	1,400
5	260	1,900	2.0	940
7	360	8,700	2.0	670
8	90	5,800	--	450
9	140	2,800	3.0	520
14	98	4,500	2.0	510
16	95	2,600	2.0	310

Trace Elements

During the study period, the concentrations of trace elements in water (table 6) did not exceed any criteria for domestic water supply. However, the concentration of mercury in water in Lake Salvador (site 9) did exceed the 0.025 μg/L (micrograms per liter) criterion of the U.S. Environmental Protection Agency (1976, 1986) for marine aquatic life (table 2). The source of the mercury is unknown.

The levels of trace elements in bottom material generally were significantly higher in the Harvey Canal (sites 1-3) than at the other sites. The elevated copper, lead, and zinc concentrations may be associated with marine activities such as boat refitting, painting, and fueling. Mercury also was found in detectable concentrations in the bottom material of the Harvey Canal. Mercury is used in many industrial processes, and the presence of mercury in this canal may be due to the large amount of industrial and commercial activity along the canal.

Table 6.--Trace elements in water and bottom material, August 30, 1988

[Dissolved and total, concentrations in water are in milligrams per liter; bottom, concentrations in bottom material are in micrograms per gram; <, less than; --, not collected]

Trace elements	Site number 1	2	3	4	5	6	7	8	9	10	14	16
Arsenic												
dissolved..	2	2	--	2	4	1	2	--	2	2	2	1
total......	2	3	--	3	5	1	2	--	2	3	2	1
bottom.....	16	10	9	7	--	6	6	7	9	45	10	6
Barium												
dissolved..	100	100	--	100	100	100	100	--	100	100	200	200
total......	100	200	--	100	100	100	100	--	100		200	200
Cadmium												
dissolved..	1	<1	--	1	1	<1	<1	--	<1	<1	<1	<1
total......	1	4	--	1	1	<1	1	--	<1	<1	<1	<1
bottom.....	1	2	<1	1	<10	10	<10	1	1	1	<10	<10
Chromium												
dissolved..	<10	<10	--	<10	<10	<10	<10	--	<10	<10	<10	20
total......	<10	<10	--	<10	<10	<10	<10	--	<10	<10	<10	20
bottom.....	40	20	20	20	20	8	20	10	20	20	10	10
Cobalt												
dissolved..	<1	<1	--	2	1	3	2	--	1	1	<1	<1
total......	2	2	--	4	2	3		--	4	2	<1	<1
Copper												
dissolved..	6	4	--	4	9	3	4	--	5	9	3	2
total......	8	7	--	10	13	5	8	--	6	10	6	5
bottom.....	80	40	30	30	30	10	30	20	30	20	20	10
Iron												
dissolved..	20	20	--	10	40	100	30	--	<10	<10	30	60
total......	450	690	--	1,900	640	490	350	--	340	1,800	940	290
bottom.....	15,000	15,000	12,000	11,000	15,000	5,400	15,000	13,000	15,000	11,000	11,000	8,500
Lead												
dissolved..	<5	<5	--	<5	<5	<5	<5	--	<5	<5	<5	<5
total......	5	9	--	6	<5	6	5	--	<5	8	6	<5
bottom.....	90	110	20	30	30	20	30	100	40	20	10	10
Manganese												
dissolved..	<10	80	--	10	190	700	<10	--	20	70	<10	70
total......	50	160	--	120	300	970	50	--	40	130	80	150
bottom.....	690	780	360	380	420	180	530	370	560	540	440	190
Mercury												
dissolved..	<0.1	<0.1	--	<0.1	<0.1	<0.1	<0.1	--	0.9	<0.1	<0.1	<0.1
total......	<.1	<.1	--	<.1	<.1	<.1	.2	--	.8	<0.1	<.1	<.1
bottom.....	.70	.25	0.12	.10	.07	.06	.05	0.05	.08	0.08	.06	.04
Selenium												
dissolved..	<1	<1	--	<1	<1	<1	<1	--	<1	<1	<1	<1
total......	<1	<1	--	<1	<1	<1	<1	--	<1	<1	<1	<1
Silver												
dissolved..	<1	<1	--	<1	<1	<1	<1	--	<1	<1	<1	<1
total......	1	1	--	1	<1	<1	<1	--	<1	<1	<1	<1
Zinc												
dissolved..	<10	<10	--	10	10	<10	10	--	10	10	10	20
total......	90	40	--	100	40	30	30	--	20	50	20	30
bottom.....	380	300	250	50	170	40	110	50	120	270	80	60

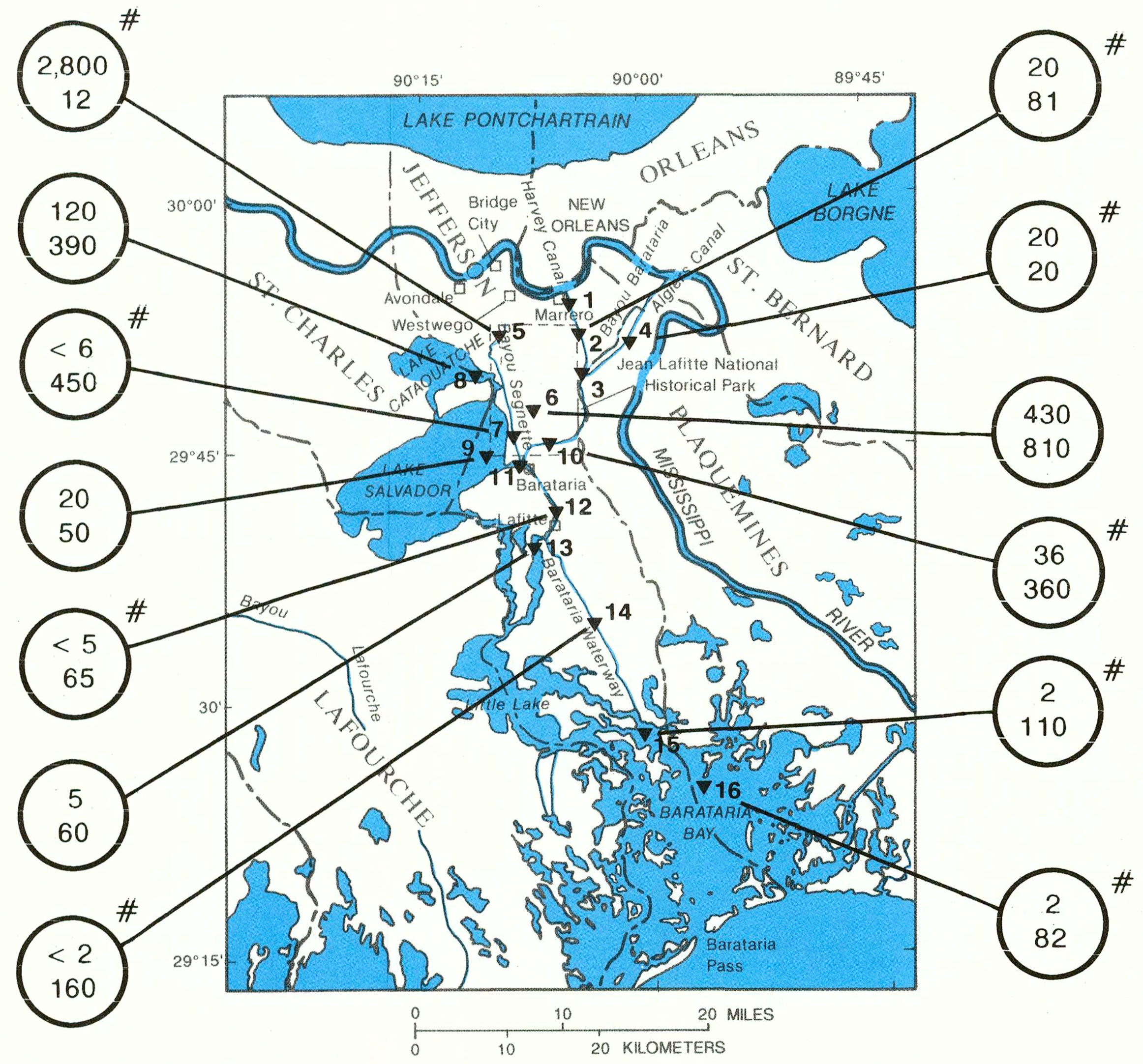
Synthetic Organic Compounds

The synthetic organic compounds analyzed are listed in table 7. Although the basin does show some effects of industrial activity, especially in the Harvey Canal area, the organic compounds detected were few and concentrations were near the limits of detection. The 12 synthetic organic compounds detected from over 1,200 analytical determinations are shown in figure 6.

The organic compounds, toluene, benzene, and ethylbenzene, which are components of various fuels, were detected in very low concentrations in water at several sites in the industrial or commercial areas of the basin. However, an insecticide DDT and its breakdown products DDD and DDE were not detected in the water or bottom material. These insecticides were routinely found in bottom material in the basin during the 1970's (Demas, 1976; Dupuy and Couvillion, 1979). The herbicide atrazine, widely used in agriculture as a broad leaf herbicide, warrants further study, as it was detected at the four sites (8-10, and 15) sampled for organic compounds. The Mississippi River may be a source of the atrazine. U.S. Geological Survey investigators detected this herbicide in comparable concentrations in water from the river in 1987 (W.E. Pereira, U.S. Geological Survey, written commun., 1988).

The bottom material at site 1 had 1,300 μg/kg (micrograms per kilogram) of fluoranthene and 1,500 μg/kg of phenanthrene. The lowest level of detection for these compounds was 520 μg/kg at this site. The detection limits ranged from 490 to 1,400 μg/kg at different sites. This wide range of detection limits is caused by such factors as percentage of moisture and organic carbon present in the samples, which interfere with extraction and detection efficiencies. Also, triplicate analyses have shown that a 100 percent variation in analytical results are common for synthetic organic compounds in bottom material from fine-grained and organic-rich Calcasieu River sediments (Demas and Demcheck, 1989a). For these reasons, the concentrations of fluoranthene and phenanthrene, although apparently high, are considered to be near the lowest level of detection.

Analysis of oyster tissue (table 8) indicated no evidence of uptake of toxic organic compounds or trace elements. This supports similar findings by other researchers who reported oyster samples with very low levels of trace elements (Presley and Boothe, 1987). The fact that no synthetic organic com-pounds were detected in oyster tissue indicates that the Barataria Bay probably is not significantly affected by synthetic organic compounds. Wade and others (1987) also found little indication of synthetic organic compound contamination in Barataria Bay in an earlier study.



EXPLANATION

BACTERIA CONCENTRATION, IN COLONIES PER 100 MILLILITERS

20 Fecal coliform
30 Fecal streptococcus

Sample analyzed for pathogenic bacteria

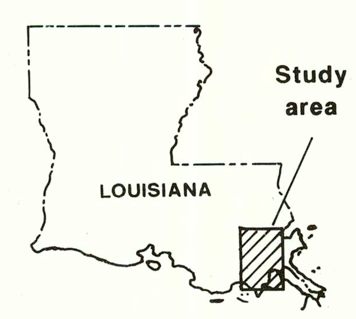


Figure 5.--Distribution of fecal bacteria concentrations, August 30, 1988.

Oysters are well-suited as indicators of long-term organics and trace elements contamination, because they spend their adult lives in one place and tend to incorporate any toxic compounds in the environment into their tissues. A study using clams in the Calcasieu River estuary (Demas and Demcheck, 1989b) has shown that bivalve mollusks can concentrate organic compounds in their tissues even when the compounds are below analytical detection limits in the water. Additional oysters, sampled March 21, 1989, as a quality-control check, also were found to be uncontaminated. (It is emphasized that this conclusion does not apply to the opening or closing of oyster beds due to fecal-bacteria contamination.)

Fecal Bacteria

Fecal-bacteria concentrations are useful indicators of the sanitary condition of water, and fecal coliform to fecal streptococcus (FC:FS) ratios can indicate whether sewage inputs are of human or nonhuman origin. A FC:FS ratio less than 0.7 is evidence that wastes are of nonhuman origin; a ratio greater than 4.0 can be considered as strong evidence that wastes are of human origin (Geldreich and Kenner, 1969). These conclusions, however, are valid for only the first 24 hours after input into the system.

Site 5, near and downstream from a municipal sewage treatment plant, had a fecal-coliform concentration of 2,800 cols/100 mL (fig. 5) and a FC:FS ratio of 233, strongly indicating human sewage inputs. Fecal-coliform concentrations of 430 and 120 cols/100 mL at sites 6 and 8 also were higher than concentrations at other sites in the basin. Fecal-coliform concentrations were generally lower in the more downstream parts of the basin, probably due to a combination of dilution and die-off.

The fecal-coliform concentrations at sites 15 and 16 in the northern part of Barataria Bay were 2 cols/100 mL at both sites. Although this concentration is well below the 14 cols/100 mL maximum criteria for a shellfish propagation area, the results of these 2 analyses cannot be regarded as conclusive evidence of the absence of contamination.

The bacteria data indicate that human sewage inputs were adversely affecting the water quality in the northern part of the basin during the study. This agrees with nutrient data that suggest that organic enrichment is occurring in that area. In an earlier study, Wade and others (1987) detected high levels of coprostanol (an indicator of human sewage) in Barataria Bay.

Tests were made to determine the presence of pathogenic (disease-causing) enteric bacteria in water at nine sites. Results indicate that Salmonella, which can cause mild to severe diarrheal disease, may have been present at sites 2 and 4. Vibrio parahemolyticus, which can cause a mild form of food poisoning, may have been present at site 7. Further tests would be necessary to confirm these results. Overall, the tests did not indicate widespread or unusually hazardous pathogenic enteric bacteria in the basin.

SUMMARY

A water-quality survey of the Barataria basin, Louisiana, was conducted from August 26, to September 2, 1988, a period of high water temperature and low freshwater inflow. Water samples were collected at 16 sites and analyzed for major inorganic constituents, nutrients, trace elements, and synthetic organic compounds; bottom-material samples were collected and analyzed for nutrients, trace elements, and synthetic organic compounds. Oyster tissue was collected at two sites and analyzed for trace elements and synthetic organic compounds. Water-quality monitors recorded temperature, DO, pH, and specific conductance at 4 sites hourly before, during, and after sampling.

The concentrations of inorganic constituents were typical of those in an estuary. Chloride concentrations ranged from 50 mg/L in freshwater in the northern part of the study area to 5,200 mg/L in Barataria Bay in the southern part of the study area.

The nutrient data for the water and bottom material indicate that in the upper parts of the study area, especially along Bayou Segnette, organic enrichment is occurring as a result of natural processes and sewage inputs. Nutrient concentrations (0.31 mg/L of total nitrite plus nitrate as nitrogen and 0.71 mg/L of total phosphorus) at site 5 are high enough to cause excessive algal growth.

Concentrations of trace elements and synthetic organic compounds in water generally were low or below limits of detection. Trace elements concentrations in water in the Barataria basin were below the U.S. Environmental Protection Agency criteria for domestic water supply. Concentrations of trace elements in bottom material generally were higher in the Harvey Canal (sites 1-3), probably as a result of the long-term industrial activity there. The Harvey Canal was the only area where the localized presence of trace elements such as mercury may be a cause for concern.

Twelve synthetic organic compounds were detected in the study area. All concentrations were near the level of detection. Seven of the 12 synthetic organic compounds were detected in the Harvey Canal (sites 1-3). Analyses of oyster tissue from the northern part of Barataria Bay (site 16) indicated no contamination by either trace elements or synthetic organic compounds.

An insecticide DDT and its breakdown products, which were commonly detected in bottom material in the study area in the 1970's, were not detected during this study. However, atrazine and some other synthetic organic compounds were detected in water and bottom material.

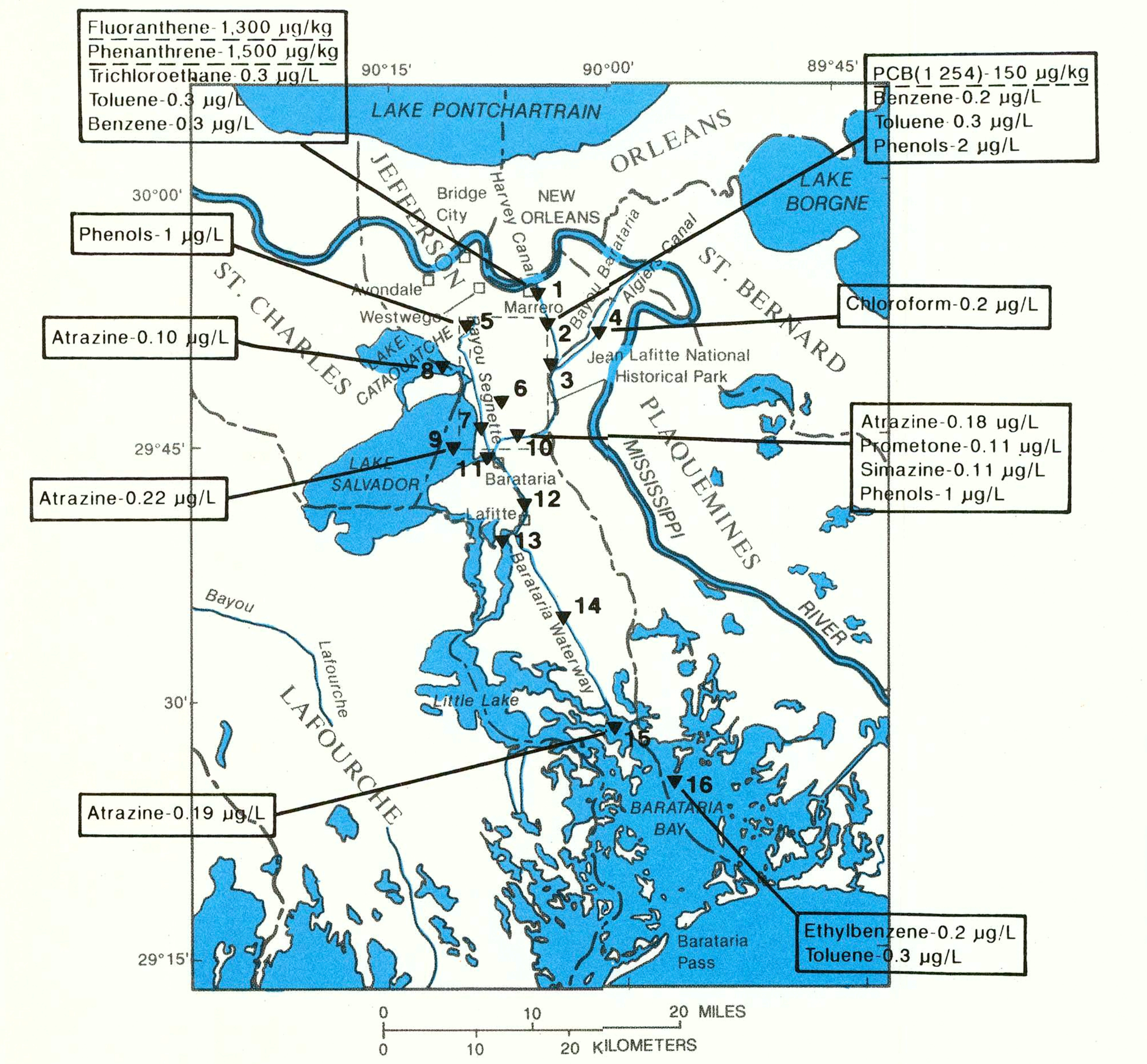
The fecal-coliform bacteria concentrations (2,800 cols/100 mL at site 5) and FC:FS ratios indicate that human sewage inputs are adversely affecting the water quality in the northern part of the study area. However, tests for pathogenic bacteria at nine sites did not indicate widespread or hazardous pathogens in the basin

Table 7.--Detection limits for synthetic organic compounds analyzed

[Level of detection in water is in micrograms per liter; level of detection in bottom material is in micrograms per kilogram; NA, not analyzed]

Compound	Lowest level of detection	Compound	Lowest level of detection	Compound	Lowest level of detection
	Volatile organic compounds in water				
Benzene	0.2	Methylene chloride	0.2	1,2 Dichloroethane	0.2
Bromoform	.2	Styrene	.2	1,2-Dichloropropane	.2
Carbon tetrachloride	.2	Tetrachloroethylene	.2	1,3-Dichloropropene	.2
Chlorobenzene	.2	Toluene	.2	1,2-Transdichloroethylene	.2
Chloroethane	.2	Trichloroethylene	.2	2-Chloroethyl vinyl ether	.2
Chloromethane	.2	Trichlorofluoromethane	.2	1,2-Dichlorobenzene	.2
Dibromochloromethane	.2	1,1-Dichloroethylene	.2	Dichlorobromomethane	.2
1,1-Dichloroethane	.2	1,2-Dibromoethylene	.2	Cis-1,3-Dichloropropene	.2
Ethylbenzene	.2	1,1,2-Trichloroethane	.2	Trans-1,3-Dichloropropene	.2
Methyl bromide	.2	1,1,2,2-Tetrachloroethane	.2	1,3-Dichlorobenzene	.2
1,1,1-Trichloroethane	.2	Dichlorodifluoromethane	.2	Vinyl chloride	.2
Chloroform	.2				

Compound	Lowest level of detection, Water	Lowest level of detection, Bottom material	Compound	Lowest level of detection, Water	Lowest level of detection, Bottom material
	Acid-base/neutral extractable (semivolatile) organic compounds				
Acenaphthene	5.0	490	4-Chloro-3-methylphenol	30.0	2,900
Acenaphthylene	5.0	490	Chrysene	10.0	980
Anthracene	5.0	490	Di-n-Butyl phthalate	5.0	490
Benzo(a)anthracene	5.0	490	Di-n-Octyl phthalate	10.0	980
3,4-Benzofluoranthene	5.0	980	Diethyl phthalate	5.0	490
Benzo(a)pyrene	10.0	980	Dimethyl phthalate	5.0	490
Benzo(b)fluoranthene	10.0	980	4,6-Dinitro-2-methylphenol	30.0	2,900
Benzo(ghi)perylene	10.0	980	Fluoranthene	5.0	490
Benzo(k)fluoranthene	10.0	980	Fluorene	5.0	490
Butyl benzyl phthalate	5.0	490	Hexachlorobenzene	5.0	490
Hexachlorobutadiene	5.0	490	1,4-Dichlorobenzene	5.0	490
Hexachlorocyclopentadiene	5.0	490	Bis(2-chloroethoxy)methane	5.0	490
Hexachloroethane	5.0	490	Bis(2-chloroethyl)ether	5.0	490
Indeno(1,2,3-CD)pyrene	10.0	980	Bis(2-ethylhexyl)phthalate	5.0	490
Naphthalene	5.0	490	2-Nitrophenol	5.0	490
Nitrobenzene	5.0	490	2,4-Dichlorophenol	5.0	490
N-nitrosodimethylamine	5.0	490	2,4-Dimethylphenol	5.0	490
Phenanthrene	5.0	490	2,4-Dinitrophenol	20.0	520
Pentachlorophenol	5.0	2,900	2,4-Dinitrotoluene	5.0	490
Phenol	5.0	490	2,4,6-Trichlorophenol	20.0	800
Pyrene	5.0	490	2,6-Dinitrotoluene	5.0	490
1,2-Dichlorobenzene	5.0	490	4-Bromophenyl phenyl ether	5.0	490
1,2,4-Trichlorobenzene	5.0	490	4-Chlorophenyl phenyl ether	5.0	490
1,3-Dichlorobenzene	5.0	490	4-Nitrophenol	30.0	2,900
Isophorone	5.0	490	2-Chloronaphthalene	5.0	490
N-nitrosodi-N-propylamine	5.0	490	2-Chlorophenol	5.0	490
	Pesticides				
2,4-DP	0.10	NA	P'P'DDE	0.01	10
2,4-D	.10	NA	O'P'DDD	.01	10
2,4,5-TP	.10	NA	Endrin	.01	10
Atrazine	.10	NA	P'P'DDT	.01	10
2,4,5-T	.10	NA	Methoxychlor	.01	10
Diazinon	.01	NA	Mirex	.01	10
Ethion	.01	NA	Prometryne	.1	NA
Malathion	.01	NA	P'P'DDD	.01	10
Methyl Parathion	.01	NA	O'P'DDT	.01	10
Methyl Trithion	.01	NA	beta-Endosulfan	.01	10
Parathion	.01	NA	Perthane	.01	10
Trithion	.01	NA	Prometone	.1	NA
Chlordane	.01	10	Propazine	.1	NA
Toxaphene	.50	500	Simazine	.1	NA
Dieldrin	.01	10	Simetryne	.1	NA
gamma-BHC	.01	10	Alachlor	.1	NA
Heptachlor	.01	10	Metolachlor	.1	NA
Aldrin	.01	10	Metribuzin	.1	NA
Heptachlor epoxide	.01	10	Trifluralin	.1	NA
O'P'DDE	.01	10	Ametryne	.1	NA
Alpha Endosulfan	.01	10	Cyanazine	.1	NA
	Polychlorinated Biphenyls (PCB's)				
PCB-1016	0.10	100	PCB-1248	0.10	100
PCB-1221	.10	100	PCB-1254	.10	100
PCB-1232	.10	100	PCB-1260	.10	100
PCB-1242	.10	100			



EXPLANATION

— — — Detected in bottom material
μg/kg Micrograms per kilogram
μg/L Micrograms per liter

Figure 6.--Distribution and concentration of synthetic organic compounds detected at study sites, August 30, 1988.

OYSTER SAMPLES

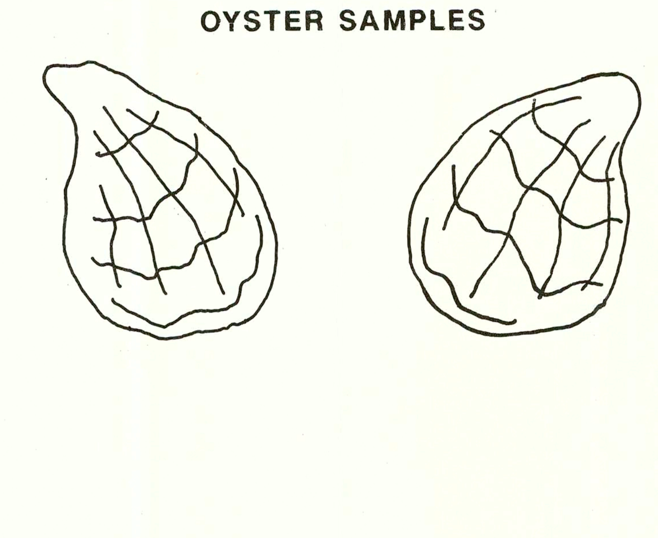


Table 8.--Synthetic organic compounds and trace elements in oyster (Crassostrea virginica tissue collected from an oyster bed at site 16 and from oysters attached to pilings of an oil production platform 0.25 mile from site 16, August 30, 1988

[Concentrations in milligrams per kilogram (mg/kg); ND, not detected; lowest level of detection is 0.01 mg/kg, except for toxaphene, PCB, and chromium, which have a detection level of 0.05 mg/kg]

Compound	Oysters from bed at site 16	Oysters from platform near site 16	Compound	Oysters from bed at site 16	Oysters from platform near site 16
	Synthetic organic compounds				
Naphthalene	ND	ND	Hexachlorobenzene	ND	ND
Fluorene	ND	ND	Hexachlorobutadiene	ND	ND
Phenanthrene	ND	ND	Oxychlordane	ND	ND
Anthracene	ND	ND	Heptachlor epoxide	ND	ND
Fluoranthene	ND	ND	Chlordane	ND	ND
Pyrene	ND	ND	Nonachlor	ND	ND
1,2-Benzanthracene	ND	ND	Toxaphene	ND	ND
Chrysene	ND	ND	Total PCB	ND	ND
Benzo(b)fluoranthene	ND	ND	Total DDT	ND	ND
Benzo(k)fluoranthene	ND	ND	Total DDD	ND	ND
Benzo(e)pyrene	ND	ND	Total DDE	ND	ND
Benzo(a)pyrene	ND	ND	Dieldrin	ND	ND
1,2,5,6-Dibenzanthracene	ND	ND	Endrin	ND	ND
Benzo(g,h,i)perylene	ND	ND	Mirex	ND	ND
Bromoform	ND	NA	Octachlorostyrene	ND	ND
Chloroform	ND	NA	Octachloronaphthalene	ND	ND
1,2-Dichloroethane	ND	NA			
	Trace elements				
Cadmium	<0.02	0.37	Lead	0.4	0.4
Cobalt	.3	.3	Mercury	.02	.02
Copper	18	16	Nickel	1.0	.9
Chromium	ND	ND	Zinc	460	1,600

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