In cooperation with the

NATIONAL PARK SERVICE

Resurvey of Quality of Surface Water and Bottom Material of the Barataria Preserve of Jean Lafitte National Historical Park and Preserve, Louisiana, 1999-2000

WATER-RESOURCES

INVESTIGATIONS REPORT

03-4038

U.S. Department of the Interior
U.S. Geological Survey

Front cover photographs

Upper left: Close-up of *Panicum hemitomon* floating marsh, Jean Lafitte National Historical Park and Preserve, Louisiana
(Photograph by author)

Center: Orchid growing in floating marsh, Jean Lafitte National Historical Park and Preserve, Louisiana
(Photograph by Thomas Hargis, Coastal Monitoring, Inc.)

Lower right: Pipeline Canal near Segnette Waterway, Jean Lafitte National Historical Park and Preserve, Louisiana
(Photograph by author)

RESURVEY OF QUALITY OF SURFACE WATER AND BOTTOM MATERIAL OF THE BARATARIA PRESERVE OF JEAN LAFITTE NATIONAL HISTORICAL PARK AND PRESERVE, LOUISIANA, 1999-2000

By Christopher M. Swarzenski

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U.S. DEPARTMENT OF THE INTERIOR

GALE A. NORTON, Secretary

U.S. GEOLOGICAL SURVEY

Charles G. Groat, Director

For additional information contact:

District Chief
U.S. Geological Survey
3535 S. Sherwood Forest Blvd., Suite 120
Baton Rouge, LA 70816
E-mail: dc_la@usgs.gov
Fax: (225) 298-5490
Telephone: (225) 298-5481
Home Page: http://la.water.usgs.gov

Copies of this report can be purchased from:

U.S. Geological Survey
Branch of Information Services
Box 25286
Denver, CO 80225
E-mail: infoservices@usgs.gov
Fax: (303) 202-4693
Telephone (toll free): 1-888-ASK-USGS

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RESURVEY OF QUALITY OF SURFACE WATER AND BOTTOM MATERIAL OF THE BARATARIA PRESERVE OF JEAN LAFITTE NATIONAL HISTORICAL PARK AND PRESERVE, LOUISIANA, 1999-2000

By **Christopher M. Swarzenski**

ABSTRACT

The quality of water and bottom material in the Barataria Preserve of Jean Lafitte National Historical Park and Preserve, Louisiana, was surveyed from March 1999 to May 2000. Organochlorine, chlorophenoxy acid, and organophosphorus pesticides; polychlorinated biphenyls (PCB's); and trace elements were analyzed in surface water and bottom material from three sites previously sampled in a 1981-82 survey. Surface water at six sites was sampled and analyzed for selected nutrients and major inorganic ions based on their importance to human health, the health of the marshes of the Barataria Preserve, or their usefulness in tracking the circulation of Mississippi River water in the Barataria Preserve.

Southern Louisiana was in a moderate to severe drought during most of the sampling period, which elevated salinity in the Barataria Preserve for at least 8 months. Specific conductance values were less than 3,000 μS/cm (microsiemens per centimeter at 25 degrees Celsius) in surface water throughout the Barataria Preserve from March through September 1999. Specific conductance values increased over the next 2 months and then remained between 5,000 and 6,000 μS/cm.

The herbicide 2,4-D was detected in water at the two sites sampled in August 1999 but not at any site during the two other sampling times. Iron, manganese, and the trace elements copper, nickel, and zinc were detected in dissolved and whole-water samples at all three sites. Nitrite+nitrate, as nitrogen, concentrations ranged from less than 0.002 to 0.19 mg/L (milligrams per liter). Ammonia, as nitrogen, concentrations ranged from less than 0.01 to 0.16 mg/L. Orthophosphate, as phosphorus, concentrations ranged from less than 0.002 to 0.14 mg/L. Calcium, magnesium, potassium, sulfate, and chloride concentrations in surface water were elevated due to the marine influence on the composition of surface water in the Barataria Preserve during the sampling period. Sulfate and chloride concentrations reached 379 and 2,830 mg/L, respectively.

Polychlorinated biphenyls, chlordane, and DDT were detected in bottom material. Trace elements were detected in bottom material at all three of the sampled sites. Arsenic concentrations ranged from 4 to 9 μg/g (micrograms per gram) and lead concentrations from 20 to 31 μg/g. Mercury concentrations also were above laboratory reporting levels (LRL's) for bottom material at all three sites.

The herbicide 2,4-D was detected in surface water during both surveys. Other organic compounds were not detected in surface water. Mercury and chromium were detected in surface water at all three sites during the 1981-82 survey but were below LRL's during the 1999-2000 survey.

Changes in chemical characteristics of bottom material occurred during the years between the 1981-82 and 1999-2000 surveys. DDT decreased in the bottom material at Bayou Segnette near Barataria. DDE, a degradation product, increased at this site, indicating that over

time, DDT concentrations are decreasing in bottom material. PCB's were present in similar concentrations (Bayou Segnette near Barataria) or increased (Bayou Segnette 4.6 miles below Westwego) from 1981-82 to 1999-2000.

Cadmium concentrations consistently decreased by half or more at all three sites from 1981-82 to 1999-2000. Mercury concentrations were consistently lower at all three sites in the 1999-2000 survey, but the differences from the 1981-82 survey were small. Chromium concentrations increased at two of the three sites from 1981-82 to the present survey. At the third site, no chromium value was available for the earlier survey. Concentrations of copper and nickel increased in bottom material at the two sites on Bayou Segnette, but decreased at Kenta Canal northwest of Westwego.

Probable Effects Levels (PEL's) and Interim Sediment Quality Guidelines (ISQG's) concentrations, as tabulated by the Canadian Council of Ministers of the Environment, were used to assess the probability of biological impairment in the Barataria Preserve. PEL's are concentrations of a chemical at or above which some biological impairment is likely. ISQG concentrations are those at or below which biological impairment is unlikely. Concentrations of 2,4-D and trace elements, when detected in surface water, were substantially lower than levels at which biological impairment could be expected. Concentrations of organic compounds in bottom material were at most less than 25 percent of PEL's, and usually much lower. Arsenic, cadmium, copper, and lead concentrations in bottom material were generally slightly above or lower than ISQG concentrations in both surveys, although arsenic was as high as 53 percent of PEL's at one site in the 1999-2000 survey. All other trace elements in bottom material were present in concentrations lower than ISQG concentrations.

INTRODUCTION

The Barataria Preserve of Jean Lafitte National Historical Park and Preserve is located about 10 mi (miles) southwest of New Orleans, Louisiana (fig. 1). The proximity of the preserve to a large metropolitan area and the easy access to water make it a popular fishing and boating area. Regularly updated information on water quality in the preserve is needed to safeguard both the health of those visitors who use the waterways and that of the Preserve's aquatic resources. The most recent survey of surface-water and bottom-material quality of the Barataria Preserve was done during 1981-82 (Garrison, 1982).

Many natural and anthropogenic forces affect water quality of the Barataria Preserve (Garrison, 1982). During 1981-82, the U.S. Geological Survey (USGS) analyzed physical and biological properties and chemical constituents of surface water and bottom material at six sites within the Barataria Preserve (Garrison, 1982). The analyses included major inorganic ions and related physical and chemical characteristics, trace elements, nutrients, pesticides, and polychlorinated biphenyls (PCB's). Data from the survey indicated that water from several sources was entering the survey area, including Lake Salvador, Segnette Waterway, Bayou Villars, and fresh stormwater runoff from suburban areas. Segnette Waterway and Bayou Villars are located at the southern end of the Barataria Preserve. Water from Lake Salvador and Bayou Villars occasionally becomes elevated in salinity with maximum concentrations reaching 8 ppt (parts per thousand) (Swarzenski, 1992).

By January 2003, water from a new source will be influencing water quality of the Barataria Preserve. Mississippi River water will be introduced through the Davis Pond Freshwater Diversion structure into Lake Cataouatche, about 5 mi northwest of the preserve. Water will be diverted from the Mississippi River primarily from January through June. Because of the magnitude of the design flow for the diversion (as much as 10,650 cubic feet per second) (U.S. Army Corps of Engineers, 1998) and the proximity to the Barataria Preserve, water from the diversion probably will dominate the preserve during the periods the diversion is operating. Currently (2000), little if any water from the Mississippi River enters the preserve.

In 1999, the USGS, in cooperation with the National Park Service, began a survey of the quality of surface water and bottom material of the Barataria Preserve. The goal of the survey was to characterize current conditions of the Barataria Preserve and to determine whether changes had occurred since the 1981-82 survey.

Figure 1. Location of the Barataria Preserve, Jean Lafitte National Historical Park and Preserve, Louisiana.

Purpose and Scope

This report describes the quality of surface water and bottom material at selected sites within the Barataria Preserve of Jean Lafitte National Historical Park and Preserve in 1999 and 2000 and discusses changes that occurred from an earlier survey done in 1981-82 (Garrison, 1982). Organochlorine, chlorophenoxy acid, and organophosphorus pesticides; PCB's; and trace elements were analyzed in surface water and bottom material at three sites that were sampled in the earlier survey. These constituents were of concern because of human health issues. Selected nutrients and inorganic ions important to the ecological integrity of the peat marshes were sampled at six surface-water sites in the Barataria Preserve. The data are presented in graphs and tables with a discussion of their significance. The report will provide a baseline for evaluating changes to the quality of water and bottom material that may occur in the Barataria Preserve after the Davis Pond Diversion Structure becomes operational.

Description of Study Area

The Barataria Preserve is a healthy 20,600-acre wetland complex comprised of swamp forests and large expanses of freshwater peat marshes, with interconnected canals and waterways. Peat marshes in a subtropical coastal setting are a unique natural resource. Coastal Louisiana is one of the few locations worldwide where this wetland type covers large areas (Swarzenski, 1992). Because its substrate is made of organic material produced by plant growth and roots rather than accreting clay and silt, peat marshes are vulnerable to changes in water quality which could affect the production and decomposition of organic matter.

Approach and Methods

Organic compounds and trace metals were sampled three times in water and once in bottom material at three sites that were sampled during the 1981-82 survey. This sampling focused on constituents important to human health and aquatic life in waterways. Major nutrients and inorganic ions were sampled between 6 and 11 times at 6 sites newly established for the current survey. This sampling was concerned more with constituents important to the integrity of the wetlands of the preserve.

Organic Compounds and Trace Elements

Water and bottom material were collected at three sites, Bayou Segnette near Barataria, Bayou Segnette 4.6 miles south of Westwego, and Kenta Canal northwest of Crown Point, and analyzed for organic compounds and trace elements (fig. 2) to determine if quality had changed over time. These sites originally were sampled in the 1981-82 survey (Garrison, 1982). The samples collected were analyzed for a diverse group of pesticides, including historically used organochlorine insecticides (such as DDT and its metabolites DDD and DDE, chlordane, and dieldrin), some currently used organophosphorus and chlorophenoxy acid pesticides (such as diazinon and 2,4-D, respectively) and some industrial chemicals (PCB's and polychlorinated naphthalenes or PCN's). These man-made, persistent organic compounds were produced and used in great quantities over many years (Larsen and others, 1997; U.S. Environmental Protection Agency, 1994). They have been introduced into streams and rivers from direct discharges, atmospheric deposition, and runoff from the land surface. In general, these organic compounds tend to sorb readily to particles, which can settle out of the water column onto bed material and remain for long periods of time. Organochlorine pesticides and PCB's also bioaccumulate within the tissues of aquatic biota. Their persistence in the environment, accumulation in living tissue, and toxicity make them a concern to aquatic organisms and human health.

Concentrations of iron, manganese, and eight of the nine trace elements of environmental concern--arsenic, cadmium, chromium, copper, lead, mercury, nickel, and zinc--that are on the U.S. Environmental Protection Agency (USEPA) list of 126 Priority Pollutants (U.S. Environmental Protection Agency, 1994) were determined for the bottom-material samples, and, with the exception of arsenic, for surface-water samples at the three sites. Arsenic, cadmium, copper, lead, mercury, and zinc can be toxic to aquatic life. Some of the more toxic trace elements, such as mercury, cadmium, and lead, tend to bioaccumulate

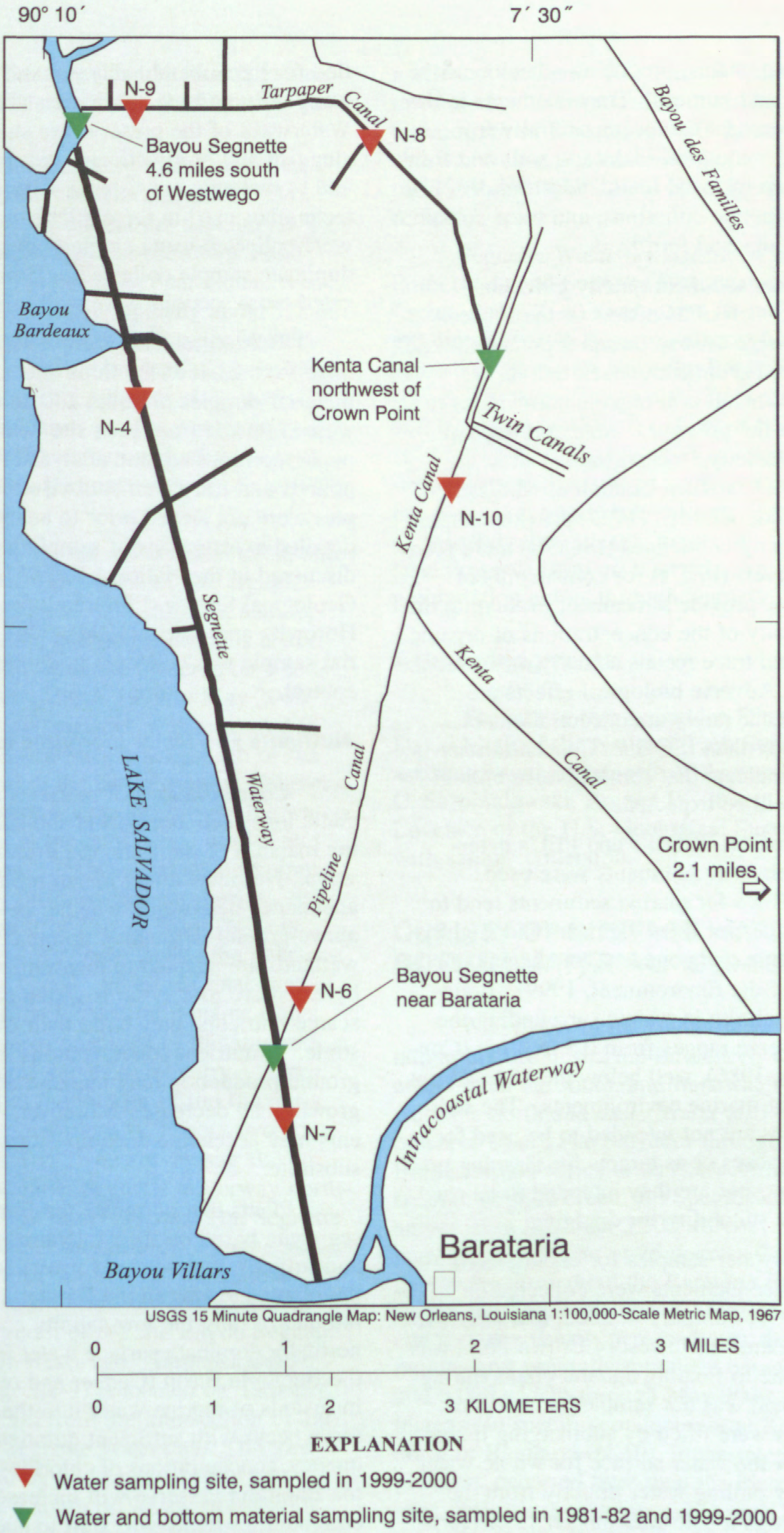

Figure 2. Sampling sites in the Barataria Preserve, Jean Lafitte National Historical Park and Preserve, Louisiana.

in aquatic food chains, producing a health risk to aquatic biota and humans. Trace elements in the aquatic environment can occur naturally from weathering of mineral in rocks and soils and from the combustion of fossil fuels, industrial discharges, automobile emissions, and trace constituents in pesticides and fertilizers.

Canadian sediment quality guidelines (Canadian Council of Ministers of the Environment, 1999) were used to interpret potential toxicity of measured sediment concentrations of selected trace metals and organic compounds to aquatic life at the preserve. State and Federal standards have not yet been established in the United States. Canadian Council of Ministers of the Environment (CCME) (1999) provides Interim Sediment Quality Guidelines (ISQG's) and Probable Effects Levels (PEL's) for constituents of interest. These provide a means of evaluating the potential toxicity of the concentrations of organic compounds and trace metals actually measured at the preserve. Adverse biological effects are expected to occur rarely at concentrations of chemicals lower than ISQG's. Concentrations above PEL's indicate that some adverse biological effects could be expected.

In this report, ISQG's and PEL's determined for freshwater sediments were used. ISQG's and PEL's for marine sediments tend to be slightly higher for trace elements and slightly lower for organic compounds (Canadian Council of Ministers of the Environment, 1999). Long-term average salinity in waters surrounding the Barataria Preserve ranges from 0.5 to 4 ppt (Conner and others, 1986), well below the 15 to 25 ppt more typical of marine environments. The sediment guidelines are not intended to be used for regulatory purposes or as targets for cleaning up an environment, nor are they intended to be used to evaluate the suitability for dredging.

Surface-water samples for organic compounds and trace elements were collected on August 25, 1999, February 4, 2000, and May 31, 2000. Kenta Canal northwest of Crown Point was inaccessible due to floating aquatic plants during August 1999 and was not sampled at that time. Sample bottles were filled by submerging them 6 inches below the water surface for whole water analyses, or by pulling water directly from the waterway through a 0.45-micrometer filter (certified for trace-metal analyses) and into bottles using teflon tubing and a peristaltic pump. Waterways of the preserve are shallow; flow is sluggish and bi-directional. For these reasons, and to maintain consistency with the sampling techniques used in the earlier survey, samples were collected using single-grab samples. A duplicate sample collected in February 2000 indicated cross sections were well mixed.

Bottom-material samples were collected once from each of the three sites. Five bottom-material samples of about 130 cubic inches each were collected from each site with a teflon-coated ponar, composited, and analyzed for organic compounds and trace elements. Bottom-material samples were not sieved prior to analysis. More detailed explanations of sampling procedures are discussed in the National Field Manual (U.S. Geological Survey, 1997) and, for trace elements, Horowitz and others (1994). One bottom-material sample was collected in duplicate for quality control.

Nutrients and Major Inorganic Ions

Concentrations of nutrients and major inorganic ions such as chloride and sulfate may affect the marshes of the Barataria Preserve in several ways. Nutrients affect marsh productivity. Their abundance determines whether below-ground or above-ground production dominates. Peat-based wetlands are adapted to low-nutrient conditions by extensive root systems which can capture the scarce nutrients; they build their own (peat) substrate. If nutrient concentrations increase, above-ground production may increase and substrate growth may decrease. Moreover, elevated nutrients may accelerate decomposition of the peat substrate.

Plants that dominate the Barataria Preserve segregate based on their tolerance to chlorides and sulfides, the reduced form of sulfate. Most of the plants growing in the Barataria Preserve are tolerant of only the low-salinity conditions that normally dominate surface water in this part of the Barataria Basin (Conner and others, 1986). If intrusions of marine water into the Barataria Preserve occur with sufficient duration and frequency, concentrations of chlorides and sulfates in the Barataria Preserve will increase, and plant communities likely will shift to species that are not able to build the peat substrate that is essential to the long-term stability of the Barataria Preserve marshes.

Surface-water sampling to determine calcium and magnesium concentrations will allow tracking of river water circulation through Barataria Preserve waterways after the Davis Pond Freshwater Diversion becomes operational. Calcium:magnesium ratios are typically about 1:1 or less in water not affected by Mississippi River water. Ratios of the same inorganic ions in Mississippi River water generally are closer to 3:1. In this report, brackish is used as a relative term to indicate water with some marine influence, but it does not refer to a particular salinity or specific conductance value.

Water samples were collected, filtered, and analyzed for ammonia, nitrite+nitrate, organic nitrogen, orthophosphate, and chloride, sulfate, calcium, magnesium, and potassium ions at six newly established sites in the preserve on 4-to-6 week intervals from March 1999 to May 2000 (fig. 2). Specific conductance was measured in the field. The six new sites bracket each of the three sites sampled in the earlier survey. Whereas the earlier sites were selected to sample the water-quality conditions at the confluence of different waterways, the new sites were selected to represent water quality of individual waterways. Segnette Waterway west of Crown Point (N-7) is located in Segnette Waterway below the intersection with Pipeline Canal. Pipeline Canal west of Crown Point (N-6) is located on Pipeline Canal several hundred yards northeast of this intersection. Pipeline Canal serves as an entry and exit point of water from the interior of the Barataria Preserve to Segnette Waterway. These two sites bracket the original 1981-82 survey site Bayou Segnette near Barataria. Segnette Waterway northwest of Crown Point (N-4) is located on Segnette Waterway, but several mi north of Segnette Waterway west of Crown Point (N-7). This site is located south of several non-sewered rural residences, and also south of the site Bayou Segnette 4.6 miles south of Westwego. Tarpaper Canal south of Westwego (N-9) is located on Tarpaper Canal, just upstream from the intersection of Tarpaper Canal and Segnette Waterway. This site also is surrounded by non-sewered rural residences. Keyhole 6 south of Westwego (N-8) is near the original 1981-82 survey site Kenta Canal northwest of Crown Point and is located on an interior canal surrounded by marshes. Kenta Canal north of Barataria (N-10) is on Kenta Canal and was frequently inaccessible for sampling during 1999 and 2000 due to blockage by hyacinth rafts.

Segnette Waterway northwest of Crown Point (N-4) and Segnette Waterway west of Crown Point (N-7) are located on the north-south trending Segnette Waterway, through which water can quickly enter or leave the Barataria Preserve. Tarpaper Canal south of Westwego (N-9) and Pipeline Canal west of Crown Point (N-6), as well as Keyhole 6 south of Westwego (N-8), are collectively referred to as interior sites. Most of the water entering Pipeline Canal, Tarpaper Canal, and other interior waterways in the Barataria Preserve from an external source other than precipitation enters through Segnette Waterway.

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The author thanks Sandee Dingmann and David Muth of the National Park Service for their assistance with all aspects of the survey. Stanley C. Skrobialowski, Roland W. Tollett, and John K. Lovelace of the U.S. Geological Survey assisted with sample collection.

QUALITY OF SURFACE WATER AND BOTTOM MATERIAL, 1999-2000

Waterways in the Barataria Preserve contain a mixture of marine-influenced water that enters from the south, and freshwater that enters from the north and east. Water also enters the preserve from Lake Salvador through Bayou Bardeaux and varies in its characteristics from fresh to slightly brackish. Specific conductance values were less than 3,000 μS/cm (microsiemens per centimeter at 25 degrees Celsius) in surface water throughout the Barataria Preserve from March through September 1999 (fig. 3). Specific conductance values increased over the next 2 months and generally remained between 5,000 and 6,000 μS/cm through May 2000. The increase in specific conductance at Kenta Canal north of Barataria (N-10), in the interior of the preserve, occurred later than the increase at other sites. Specific conductance remained low during the fall and winter.

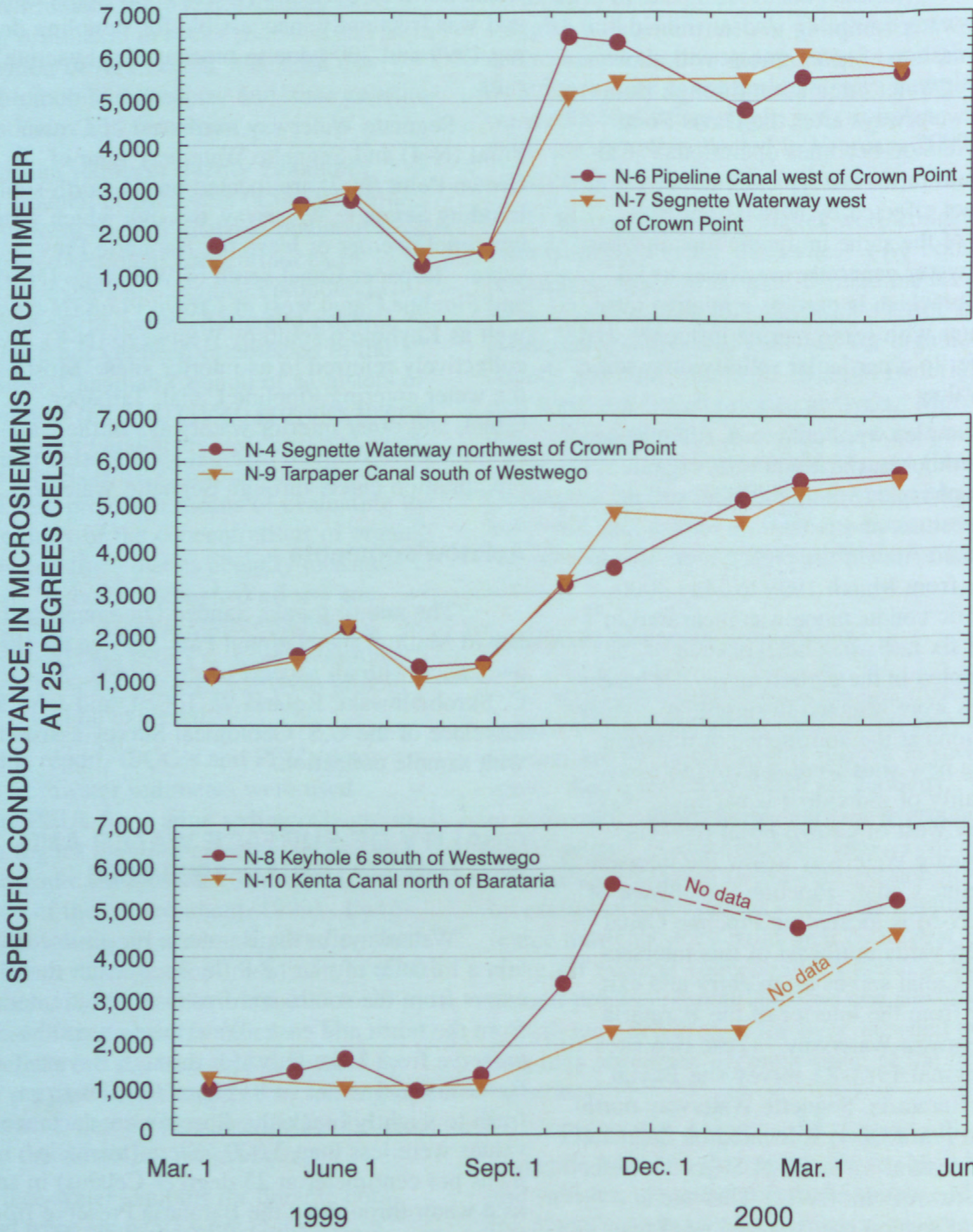

Figure 3. Specific conductance in surface water of the Barataria Preserve, Jean Lafitte National Historical Park and Preserve, Louisiana, March 1999 to April 2000.

Salinity for this area of Barataria basin typically is at its annual high during the fall (Byrne and others, 1976; Swarzenski 1992, p. 39). Fall salinity peaks are usually followed by annual lows in late winter. However, southern Louisiana experienced a drought that started during the fall of 1999 and became progressively more severe into the summer of 2000 (E.M. Swenson, Louisiana State University Coastal Ecology Institute, written commun., 2001). Salinity in the Barataria Preserve was elevated for at least 8 months.

Surface Water

Of the 32 different organic compounds analyzed in the whole-water samples, the only organic compound detected in surface water was 2,4-D (2,4-dichlorophenoxy acetic acid) (table 1), which is an aquatic herbicide commonly sprayed on floating aquatic plants that clog many waterways in south Louisiana, including those in the Barataria Preserve. It was detected at the two sites sampled in August 1999 but was not detected at any sites during subsequent sampling trips. The hydrophobic organochlorine pesticides and PCB's were not detected in surface water during the period of sampling (table 1). This is expected because these pesticides tend to bind to sediments and are more likely to be detected in bottom material.

Iron, manganese, and three of the nine trace elements of environmental concern--copper, nickel, and zinc--were detected in dissolved and whole-water samples at the three sites (table 2). Concentrations were substantially less than values at which aquatic life would be impaired (Canadian Council of Ministers of the Environment, 1999; U.S. Environmental Protection Agency, 2002). Beryllium, cadmium, chromium, lead, and mercury were not detected in any samples at the three sites.

Results of the sampling for nutrients are listed in table 3 and shown in figure 4. Laboratory reporting levels (LRL's) for nitrite+nitrate and orthophosphate were 0.002 mg/L (milligrams per liter) with the exception of samples collected at Keyhole 6 south of Westwego (N-8) from March through September 1999. The LRL's were 0.05 mg/L for these samples due to differences in analytical techniques. Means for constituents which had concentrations below the LRL were calculated by substituting the LRL as the value. This approach resulted in somewhat higher means than would have occurred if other methods had been used. A mean for nitrite+nitrate at site Keyhole 6 south of Westwego (N-8) was not calculated because of the different LRL's.

Nitrite+nitrate, as nitrogen, concentrations ranged from less than 0.002 to 0.19 mg/L (table 3). Highest concentrations were at the two southernmost sites in the Barataria Preserve, Pipeline Canal west of Crown Point (N-6) and Segnette Waterway west of Crown Point (N-7). Ammonia, as nitrogen, values ranged from less than 0.01 to 0.16 mg/L. Organic nitrogen concentrations ranged from 0.49 to 1.3 mg/L; the highest concentration was detected at Keyhole 6 south of Westwego (N-8). Segnette Waterway northwest of Crown Point (N-4) and Tarpaper Canal south of Westwego (N-9), closest to the non-sewered rural residences, and Keyhole 6 south of Westwego (N-8), had slightly lower mean organic nitrogen concentrations than Pipeline Canal west of Crown Point (N-6) and Segnette Waterway West of Crown Point (N-7). Orthophosphate, as phosphorus, concentrations ranged from less than 0.002 to 0.14 mg/L. Orthophosphate concentrations were highest in late summer to fall at all sites (fig. 4), and they were generally low from November to March. Ammonia concentrations were low in samples collected earlier in the survey but tended to increase with time. Organic nitrogen concentrations were slightly higher at Pipeline Canal west of Crown Point (N-6) and Kenta Canal north of Barataria (N-10).

Minimum concentrations of inorganic ions at the two sites on Segnette Waterway, Segnette Waterway northwest of Crown Point (N-4) and Segnette Waterway west of Crown Point (N-7), tended to be similar and somewhat higher than those for Tarpaper Canal south of Westwego (N-9), Pipeline Canal west of Crown Point (N-6), and Keyhole 6 south of Westwego (N-8) (table 4). The marine influence on water quality became more dominant after September 1999 (figs. 5, 6). Concentrations of inorganic ions increased at all sampling sites in the preserve at this time. Calcium, magnesium, and potassium concentrations would be expected to be somewhat lower when conditions are dominated more by freshwater inflow.

Table 1. Whole-water (total recoverable) pesticide and polychlorinated biphenyl concentrations in surface water of the Barataria Preserve, Jean Lafitte National Historical Park and Preserve, Louisiana, August 1999 to May 2000

[Concentrations are in micrograms per liter. <, less than; --, not determined]

Constituent	Bayou Segnette near Barataria			Kenta Canal northwest of Crown Point[1]		Bayou Segnette 4.6 miles south of Westwego		
	08-25-99	02-04-00	05-31-00	02-04-00	05-31-00	08-25-99	02-04-00	05-31-00
2,4-DP (2,4-dichloro-phenoxy butanioc acid)	<0.01	<0.04	<0.04	<0.04	<0.04	<0.01	<0.04	<0.04
2,4,5-T (2,4,5-trichloro-phenoxy acetic acid)	<.01	<.03	<.03	<.03	<.03	<.01	<.03	<.03
2,4-D (2,4-dichloro-phenoxy acetic acid)	.12	<.05	<.05	<.05	<.05	0.13	<.05	<.05
Aldrin	<.013	<.013	<.013	<.013	<.013	<.013	<.013	<.013
Carbophenothion	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01
Chlordane	<.1	<.1	<.1	<.1	<.1	<.1	<.1	<.1
Chlorpyrifos	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01
DEF (5,5,5-tributyl-phosphorotrithioate)	<.01	<.02	<.02	<.02	<.02	<.01	<.02	<.02
Diazinon	<.01	<.02	<.02	<.02	<.02	<.01	<.02	<.02
Dieldrin	<.009	<.009	<.009	<.009	<.009	<.009	<.009	<.009
Disulfoton	<.01	<.03	<.03	<.03	<.03	<.01	<.03	<.03
Endosulfan I	<.015	<.015	<.015	<.015	<.015	<.015	<.015	<.015
Endrin	<.014	<.014	<.014	<.014	<.014	<.014	<.014	<.014
Ethion	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01
Fonofos (dyfonate)	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01
Heptachlor epoxide	<.009	<.009	<.009	<.009	<.009	<.009	<.009	<.009
Heptachlor	<.011	<.011	<.011	<.011	<.011	<.110	<.011	<.011
Lindane	<.012	<.012	<.012	<.012	<.012	<.012	<.012	<.012
Malathion	<.01	<.03	<.03	<.03	<.03	<.01	<.03	<.03
Methoxychlor	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01
Methyl parathion	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01
Mirex	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01
P,P′-DDD (para, para-DDD)	<.014	<.014	<.014	<.014	<.014	<.014	<.014	<.014
P, P′-DDE	<.016	<.016	<.016	<.016	<.016	<.016	<.016	<.016
P, P′-DDT	<.017	<.017	<.017	<.017	<.017	<.017	<.017	<.017
Parathion	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01
PCB's	<.1	<.1	<.1	<.1	<.1	<.1	<.1	<.1
PCN's	<.1	<.1	--	<.1	--	<.1	<.1	--
Perthane	<.1	<.1	--	<.1	--	<.1	<.1	--
Phorate	<.01	<.02	<.02	<.02	<.02	<.01	<.02	<.02
2,4,5-TP (2,4,5-Trichloro-phenoxyproprionic acid)	<.01	<.03	<.03	<.03	<.03	<.01	<.03	<.03
Toxaphene	<1	<1	<1	<1	<1	<1	<1	<1

[1]Site was inaccessible on August 25, 1999.

Table 2. Whole-water (total recoverable) and dissolved trace-element, iron, and manganese concentrations in surface water of the Barataria Preserve, Jean Lafitte National Historical Park and Preserve, Louisiana, August 1999 to May 2000

[Concentrations are in micrograms per liter. <, less than; --, not determined; E, estimated; M, presence verified, not quantified]

Constituent	Bayou Segnette near Barataria			Kenta Canal northwest of Crown Point[1]		Bayou Segnette 4.6 miles south of Westwego		
	08-25-99	02-04-00	05-31-00	02-04-00	05-31-00	08-25-99	02-04-00	05-31-00
Beryllium, total recoverable	<4.00	<5.00	<4.00	<5.00	<3.00	<4.00	<5.00	<4.00
Beryllium, dissolved	<1.60	<6.40	<1.60	<4.80	<1.60	<1.60	<4.80	<1.60
Cadmium, total recoverable	<10.0	<.11	<4.00	<.11	<3.00	<10.0	<.11	<4.00
Cadmium, dissolved	<1.00	<2.00	<.28	<.14	<.14	<1.00	<2.00	<.28
Chromium, total recoverable	<1	<5	<1	<2	<1	<1	<5	<1
Chromium, dissolved	<1.0	<5.0	<.8	<2.0	<.8	<1.0	<5.0	<.8
Copper, total recoverable	<12.0	E.9	<4.0	E.9	<3.0	<12.0	E.8	<4.0
Copper, dissolved	<1.0	<2.0	<2.6	<1.3	<1.3	1.3	<2.0	<2.6
Iron, total recoverable	180	200	<20	310	140	190	170	110
Iron, dissolved	M	<40	<100	60	140	M	<30	<50
Lead, total recoverable	<1	M	<4	<1	<3	<1	M	<4
Manganese, total recoverable	96	35	274	207	586	102	27	409
Manganese, dissolved	57.7	14.2	281	171	571	15.6	11.8	288
Mercury, total recoverable	--	<.30	<.30	<.30	<.30	--	<.30	<.30
Mercury, dissolved	<.10	<.23	<.23	<.23	<.23	<.10	<.23	<.23
Nickel, total recoverable	<50	<2	8	<2	5	<50	E1	7
Selenium, total	<1.0	<2.6	<4.0	<2.6	<3.0	<1.0	<2.6	<4.0
Zinc, total recoverable	<40	E19	<17	E21	10	<40	<31	<17
Zinc, dissolved	<20	E12	<200	20	<100	<20	E15	<100

[1]Site was inaccessible on August 25, 1999.

Table 3. Concentrations of dissolved nutrients in surface water of the Barataria Preserve, Jean Lafitte National Historical Park and Preserve, Louisiana, March 1999 to May 2000

[Data for Kenta Canal north of Barataria (N-10) are not summarized. mg/L, milligrams per liter; <, less than; --, not determined]

Site name (number in fig. 2)	Nitrogen, nitrite+nitrate (mg/L as N)			Nitrogen, ammonia (mg/L as N)		
	Mean± standard deviation	Minimum	Maximum	Mean±standard deviation	Minimum	Maximum
Pipeline Canal west of Crown Point (N-6)	0.01±0.03	<0.002	0.10	0.04±0.06	<0.01	0.16
Segnette Waterway west of Crown Point (N-7)	.04±07	<.002	.19	.06±.06	<.01	.14
Segnette Waterway northwest of Crown Point (N-4)	.01±.02	<.002	.05	.03±.01	<.01	.09
Tarpaper Canal south of Westwego (N-9)	.01±.01	<.002	.03	.03±.01	<.01	.09
Keyhole 6 south of Westwego (N-8)	--	<.002	.10	.04±.01	<.01	.12

Site name (number in fig. 2)	Nitrogen, organic (mg/L as N)			Orthophosphate (mg/L as P)		
	Mean±standard deviation	Minimum	Maximum	Mean± standard deviation	Minimum	Maximum
Pipeline Canal west of Crown Point (N-6)	0.84±0.24	0.56	1.2	0.04±0.03	<0.002	0.10
Segnette Waterway west of Crown Point (N-7)	.89±.16	.49	1.10	.04±.05	<.002	.14
Segnette Waterway northwest of Crown Point (N-4)	.72±.15	.49	1.00	.05±.06	<.002	.14
Tarpaper Canal south of Westwego (N-9)	.73±.13	.60	.95	.06±.05	<.002	.13
Keyhole 6 south of Westwego (N-8)	.73±.24	.54	1.3	.05±.03	<.02	.11

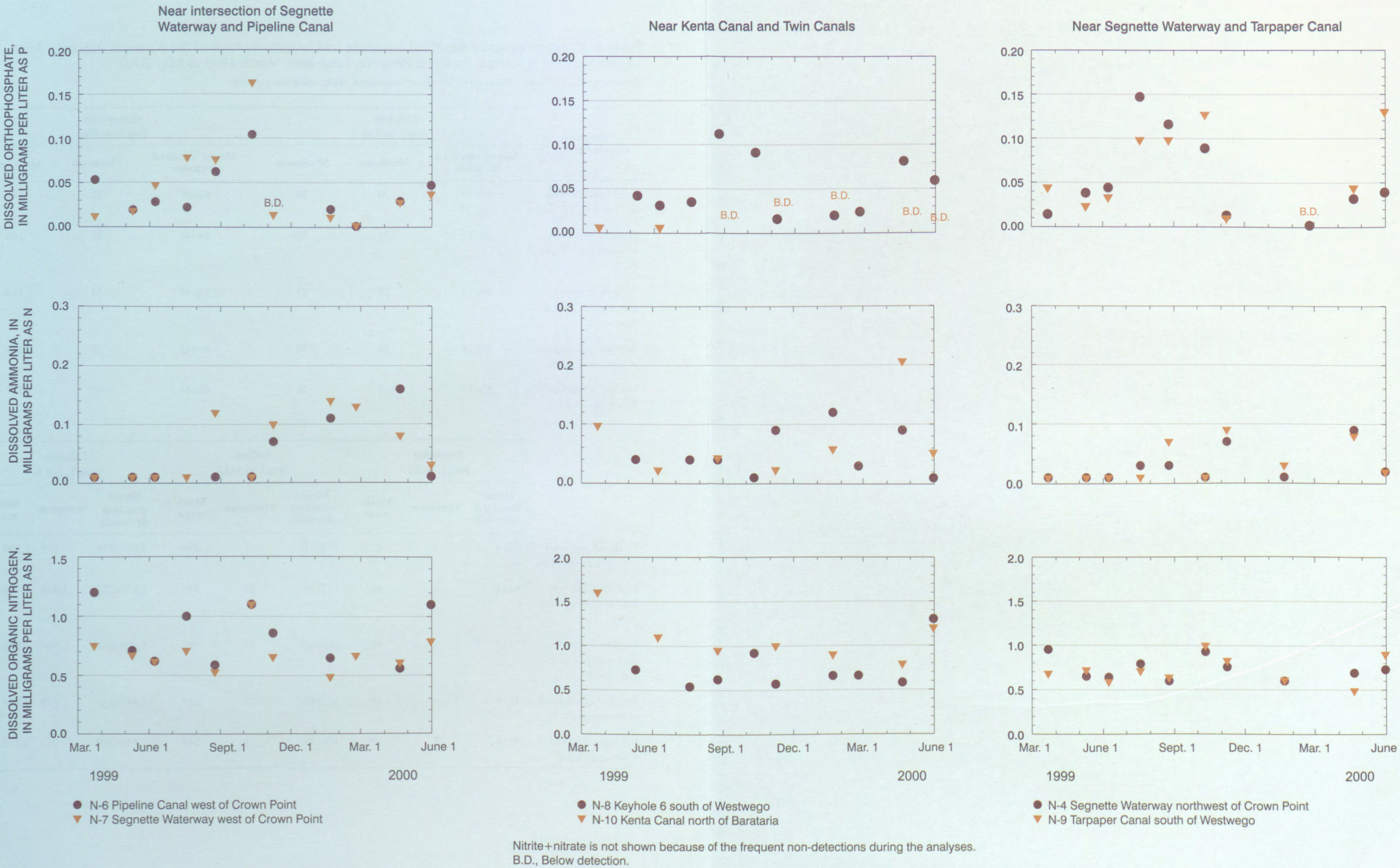

Figure 4. Dissolved orthophosphate, ammonia, and organic nitrogen concentrations in surface water of the Barataria Preserve, Jean Lafitte National Historical Park and Preserve, Louisiana, March 1999 to May 2000.

Table 4. Concentrations of dissolved inorganic ions in surface water of the Barataria Preserve, Jean Lafitte National Historical Park and Preserve, Louisiana, March 1999 to May 2000

[Data for Kenta Canal north of Barataria (N-10) are not summarized. mg/L, milligrams per liter]

Site name (number in fig. 2)	Calcium (mg/L as Ca)			Magnesium (mg/L as Mg)		
	Mean± standard deviation	Minimum	Maximum	Mean± standard deviation	Minimum	Maximum
Pipeline Canal west of Crown Point (N-6)	50±19	20	78	82±45	22	140
Segnette Waterway west of Crown Point (N-7)	50±17	28	78	84±48	26	166
Segnette Waterway northwest of Crown Point (N-4)	46±17	29	83	74±49	24	169
Tarpaper Canal south of Westwego (N-9)	48±18	24	79	66±42	20	150
Keyhole 6 south of Westwego (N-8)	43±19	19	76	62±44	17	137

Site name (number in fig. 2)	Potassium (mg/L as K)			Sulfate (mg/L as SO_4)			Chloride (mg/L as Cl)		
	Mean± standard deviation	Minimum	Maxi-mum	Mean± standard deviation	Minimum	Maxi-mum	Mean± standard deviation	Minimum	Maxi-mum
Pipeline Canal west of Crown Point (N-6)	24±14	4	42	173±116	23	236	1,690±544	695	2,290
Segnette Waterway west of Crown Point (N-7)	26±14	8	50	177±99	52	349	1,850±512	1,450	2,740
Segnette Waterway northwest of Crown Point (N-4)	23±15	8	51	161±106	45	379	1,700±628	904	2,830
Tarpaper Canal south of Westwego (N-9)	21±13	4	44	123±82	22	283	1,440±676	679	2,420
Keyhole 6 south of Westwego (N-8)	19±14	3	40	118±89	11	249	846±709	252	2,210

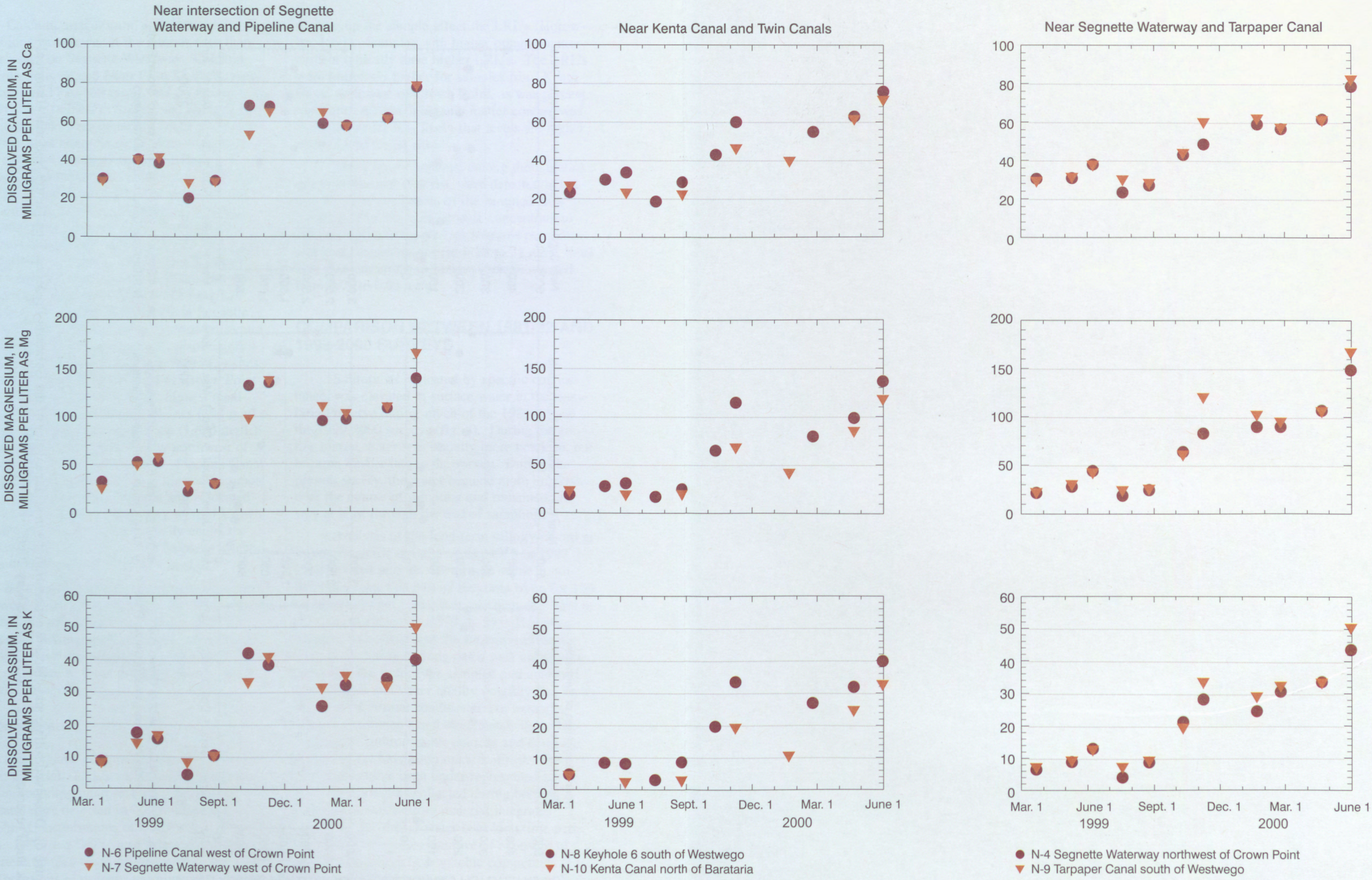

Figure 5. Dissolved calcium, magnesium, and potassium concentrations in surface water of the Barataria Preserve, Jean Lafitte National Historic Park and Preserve, Louisiana, March 1999 to May 2000.

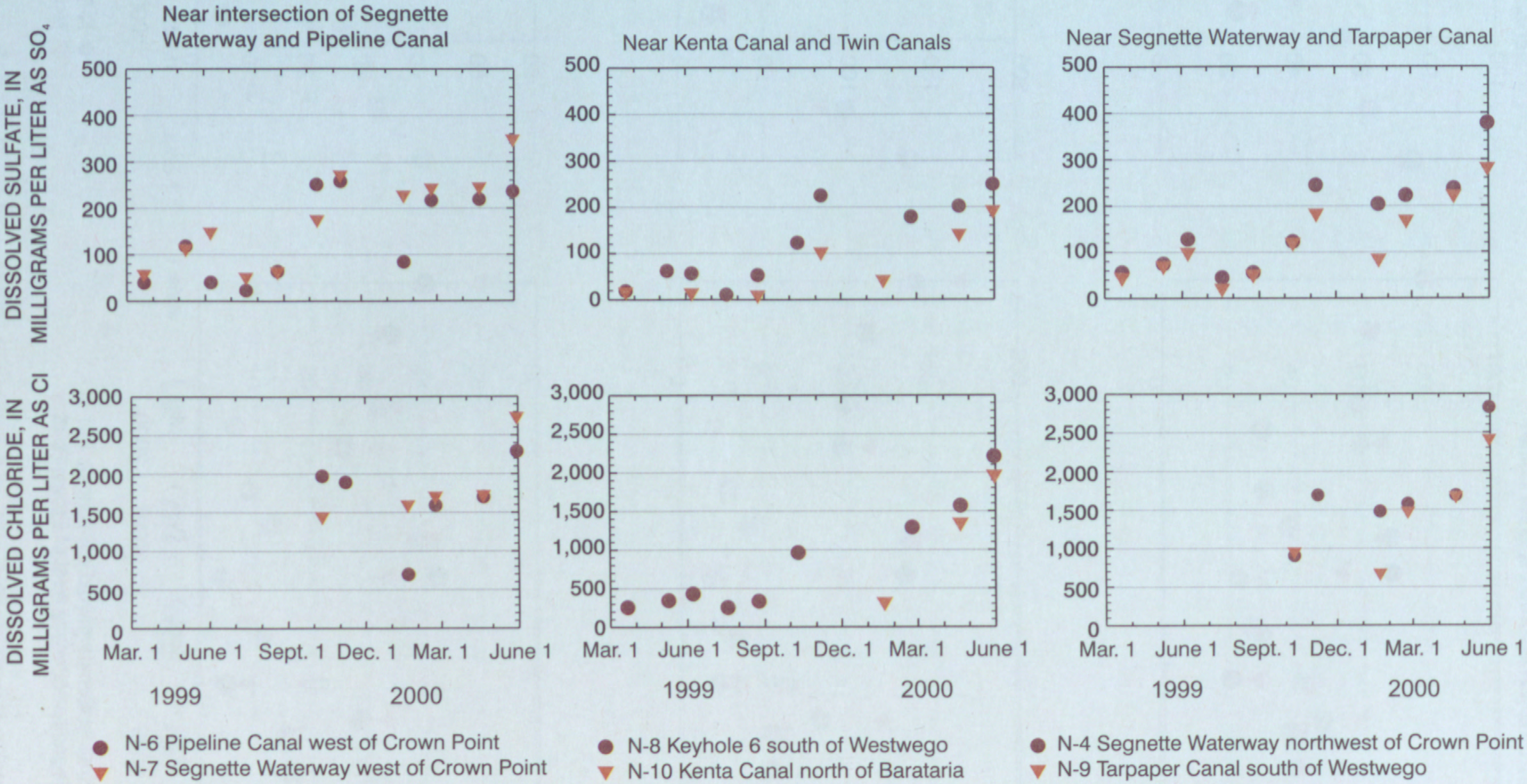

Figure 6. Dissolved sulfate and chloride concentrations in surface water of the Barataria Preserve, Jean Lafitte National Historical Park and Preserve, Louisiana, March 1999 to May 2000.

Calcium, magnesium, and potassium concentrations were lower at the interior sites than the two sites on Segnette Waterway. Calcium concentrations ranged from 19 to 83 mg/L, magnesium from 17 to 169 mg/L, and potassium from 3 to 51 mg/L (table 4). Sulfate and chloride concentrations also were generally lower in interior sites than sites along Segnette Waterway. Maximum sulfate concentrations were 379 and 349 mg/L and maximum chloride concentrations were 2,830 and 2,740 mg/L at Segnette Waterway northwest of Crown Point (N-4) and Segnette Waterway west of Crown Point (N-7), respectively (table 2). At two interior sites Keyhole 6 south of Westwego (N-8) and Tarpaper Canal south of Westwego (N-9), maximum sulfate concentrations were 249 and 283 mg/L, respectively – over 60 mg/L less than Segnette Waterway sites and maximum chloride concentrations were 2,210 and 2,420 mg/L, respectively – over 300 mg/L less than Segnette Waterway sites. Interior site Pipeline Canal west of Crown Point (N-6) was an exception with the highest maximum sulfate concentration of all sites (398 mg/L) and a mean chloride concentration (1,690 mg/L) similar to site Segnette Waterway northwest of Crown Point (N-4) (1,700 mg/L). Pipeline Canal west of Crown Point (N-6) is in the southernmost portion of the Barataria Preserve and is located fairly close to Segnette Waterway west of Crown Point (N-7). Marine water typically enters the preserve from the south through Segnette Waterway and can flow into Pipeline Canal.

Ratios of calcium to magnesium concentrations were about 1:1 or less (fig. 7). The ratio of the same ion concentrations in water from the Mississippi River was closer to 3:1, and concentrations in the river ranged over a much smaller range compared to those in surface water of the Barataria Preserve.

Bottom Material

Few organic compounds were detected in bottom material. LRL's varied spatially, somewhat confounding interpretations. PCB's and chlordane were detected in bottom material (table 5). Concentrations of DDD were below LRL's. DDT and DDE were detected at Bayou Segnette 4.6 miles south of Westwego. The relative proportions of organic and mineral sediment making up the sample affect the LRL's (Horowitz, 1991). Samples with higher organic matter content typically have higher LRL's. The LRL's were uniformly higher for samples from Kenta Canal northwest of Crown Point, as was percent moisture. Although organic matter content was not determined, it is likely that levels are higher at the Kenta Canal site.

Many trace elements, among them metals of environmental concern, were detected in bottom material at all three of the sampled sites (table 6). For example, arsenic concentrations ranged from 4 to 9 μg/g (micrograms per gram) and lead concentrations from 20 to 31 μg/g. Mercury concentrations in bottom material ranged from 0.01 to 0.03 μg/g.

COMPARISON BETWEEN 1981-82 AND 1999-2000 SURVEYS

Salinity, as indicated by specific conductance, was elevated in surface water in the Barataria Preserve during much of the 1981-82 and the 1999-2000 surveys (fig. 8). During the earlier survey, water was initially more brackish, but became fresher late in the survey. During the present survey, the water became more brackish over the course of sampling and remained this way at least through the end of sampling.

Analysis of the long-term salinity record at Bayou Barataria at Lafitte from 1955 to 1987 indicates that periods when more saline conditions dominate this part of Barataria basin for 100 or more days per year occur less than one-third of the time (Swarzenski, 1992, p. 39). However, because both surveys at the Barataria Preserve were done during periods when such conditions prevailed, the water type sampled and analyzed was atypical and water quality possibly less representative of normal conditions. For example, organic constituents and trace metals that may come from anthropogenic sources and enter the preserve may have been missed. Freshwater inflow may have been under-represented in surface-water samples collected during both surveys. However, bottom material integrates conditions of surface water over long time periods and is more representative of exposure of park waterways to hydrophobic compounds (Horowitz, 1991).

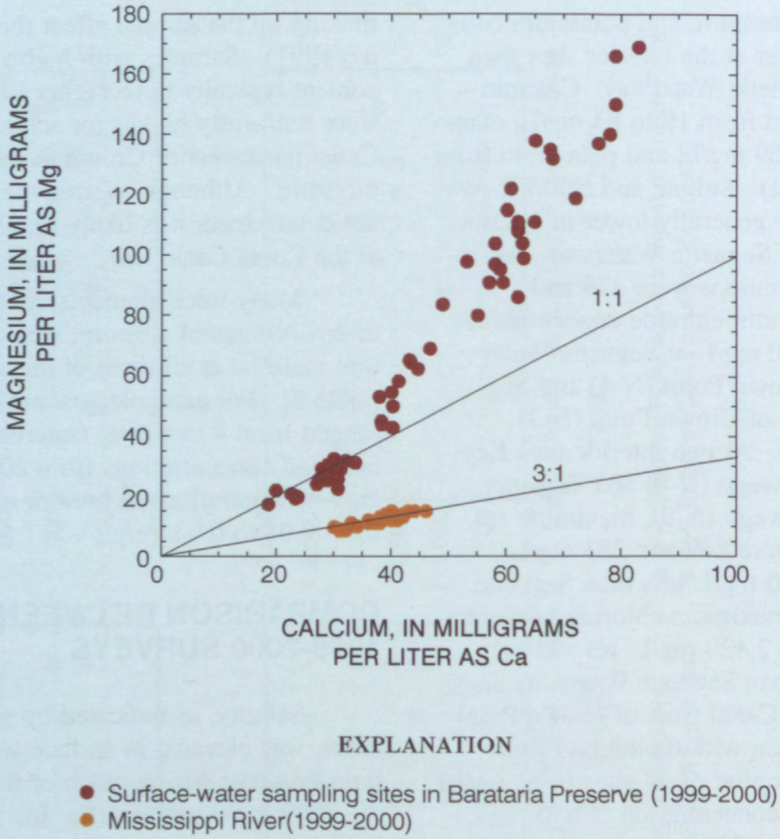

Figure 7. Ratio of dissolved calcium to magnesium in the Mississippi River and surface water of the Barataria Preserve, Jean Lafitte National Historical Park and Preserve, Louisiana, 1999-2000.

Surface Water

The herbicide 2,4-D was detected in surface water during the 1981-82 survey (Garrison, 1982) and during the 1999-2000 survey. Diazinon also was detected in surface-water samples during the 1981-82 survey (Garrison, 1982) but not in the 1999-2000 survey. Total recoverable and dissolved mercury concentrations at all three sites were below LRL's of 0.3 µg/L in the 1999-2000 survey. Dissolved mercury concentrations as high as 1.1 and 1.7 µg/L had been reported from Bayou Segnette near Barataria and Bayou Segnette 4.6 miles south of Westwego for the 1981-82 survey (Garrison, 1982). Similarly, dissolved chromium concentrations at all three sites were below LRL's of 5 µg/L during the 1999-2000 survey, but were between 10 and 20 µg/L at the same sites during the 1981-82 survey.

Nitrite+nitrate and organic nitrogen concentrations apparently were higher in the 1981-82 survey than in the 1999-2000 survey (fig. 9). It is difficult to interpret the differences in nitrogen between the two surveys. Reasons for the large differences are not clear, and could be due to an artifact of sampling or analytical methods. Calcium, magnesium, and potassium concentrations were similar between the two surveys (fig. 10). Mean and median concentrations generally were slightly lower at Keyhole 6 south of Westwego (N-8), Kenta Canal north of Barataria (N-10), and Kenta Canal northwest of Crown Point than at the other four sites sampled.

Sulfate and chloride concentrations were similar during the two surveys among bracketed locations in the preserve (fig. 11), but concentrations at the interior sites Keyhole 6 south of Westwego (N-8), Kenta Canal north of Barataria

Table 5. Pesticide and polychlorinated biphenyl concentrations in bottom material of the Barataria Preserve, Jean Lafitte National Historical Park and Preserve, Louisiana

[Concentrations are in micrograms per kilogram. <, less than; E, estimated; --, not determined]

Constituent	Bayou Segnette near Barataria	Kenta Canal northwest of Crown Point	Bayou Segnette 4.6 miles south of Westwego
	08-25-99	02-04-00	08-25-99
2, 4-DP, total	<0.1	<0.1	<0.1
2, 4, 5-T, total	<.1	<.1	<.1
2, 4-D, total	<.1	<.1	<.1
Aldrin, total	<.4	<1.0	<.2
Chlordane, total	<6	<15	E2
Diazinon, total	<.4	<1.0	<.4
Dieldrin, total	<.4	<1.0	<.2
Endosulfan, total	<.4	<1.0	<.2
Endrin, total	<.4	<1.0	<.2
Ethion, total	<.4	<1.0	<.4
Heptachlor epoxide, total	<.4	<1.0	<.2
Heptachlor, total	<.4	<1.0	<.2
Lindane, total	<.4	<1.0	<.2
Malathion, total	<.4	<1.0	<.4
Methoxychlor, total	<5	<12	<2
Methyl parathion, total	<.4	<1.0	<.4
Mirex, total	<.4	<1.0	<.2
P,P'-DDD, recoverable (para, para-DDD)	<1.0	<2.5	<.5
P,P'-DDE, recoverable	<.4	<1.0	.9
P,P'-DDT, recoverable	<1.0	<2.5	E.2
Parathion, total	<.4	<1.0	<.4
PCB's, total	15	<25	9
Silvex, total	<.1	<.1	<.1
Toxaphene, total	<100	<250	<50
Trithion, total	<.4	--	<.4

Table 6. Trace-element, iron, and manganese concentrations in bottom material of the Barataria Preserve, Jean Lafitte National Historical Park and Preserve, Louisiana
[Concentrations are in micrograms per gram.]

Constituent	Bayou Segnette near Barataria	Kenta Canal northwest of Crown Point	Bayou Segnette 4.6 miles south of Westwego
	08-25-99	02-04-00	08-25-99
Arsenic, total	7	4	9
Cadmium, recoverable	0.5	0.4	0.5
Chromium, recoverable	21	12	16
Copper, recoverable	26	21	24
Iron	20,000	18,000	20,000
Lead, recoverable	26	20	31
Manganese, recoverable	510	380	510
Mercury, recoverable	.03	.01	.03
Nickel, recoverable	28	17	27
Zinc, recoverable	100	80	10

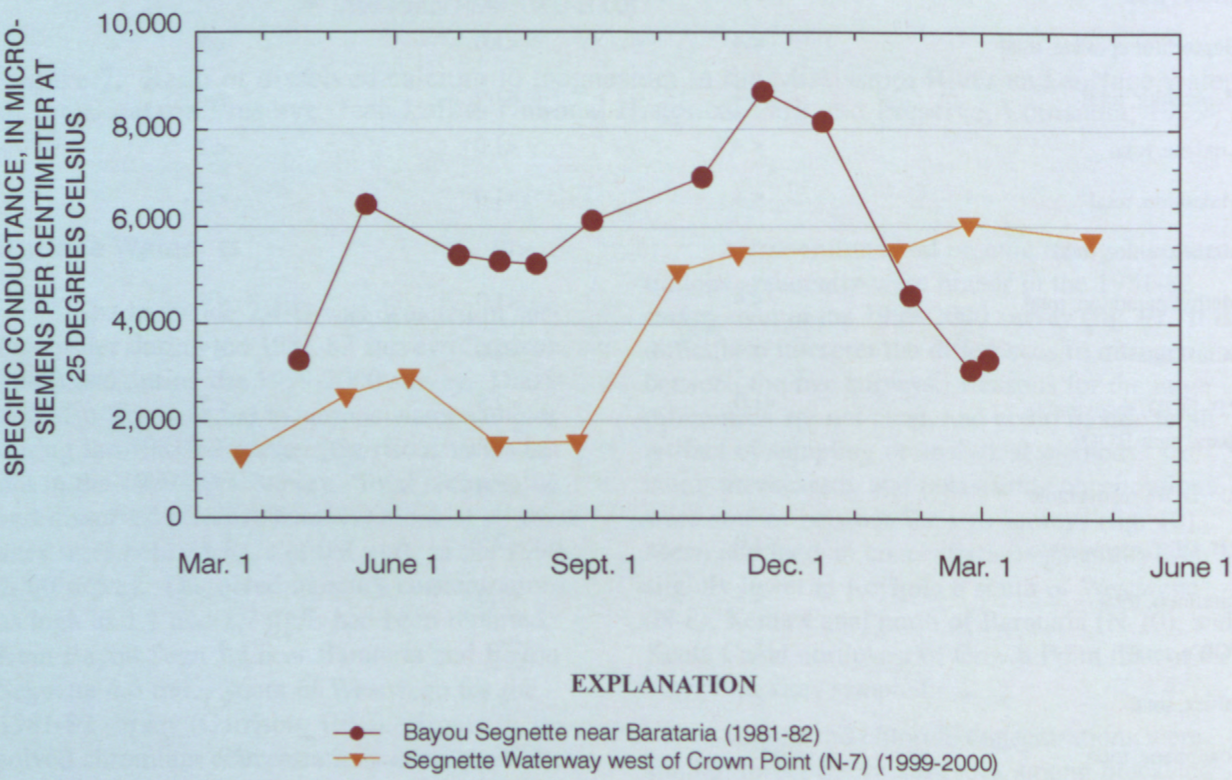

Figure 8. Specific conductance at Bayou Segnette near Barataria, April 1981 to March 1982, and Segnette Waterway west of Crown Point, March 1999 to April 2000.

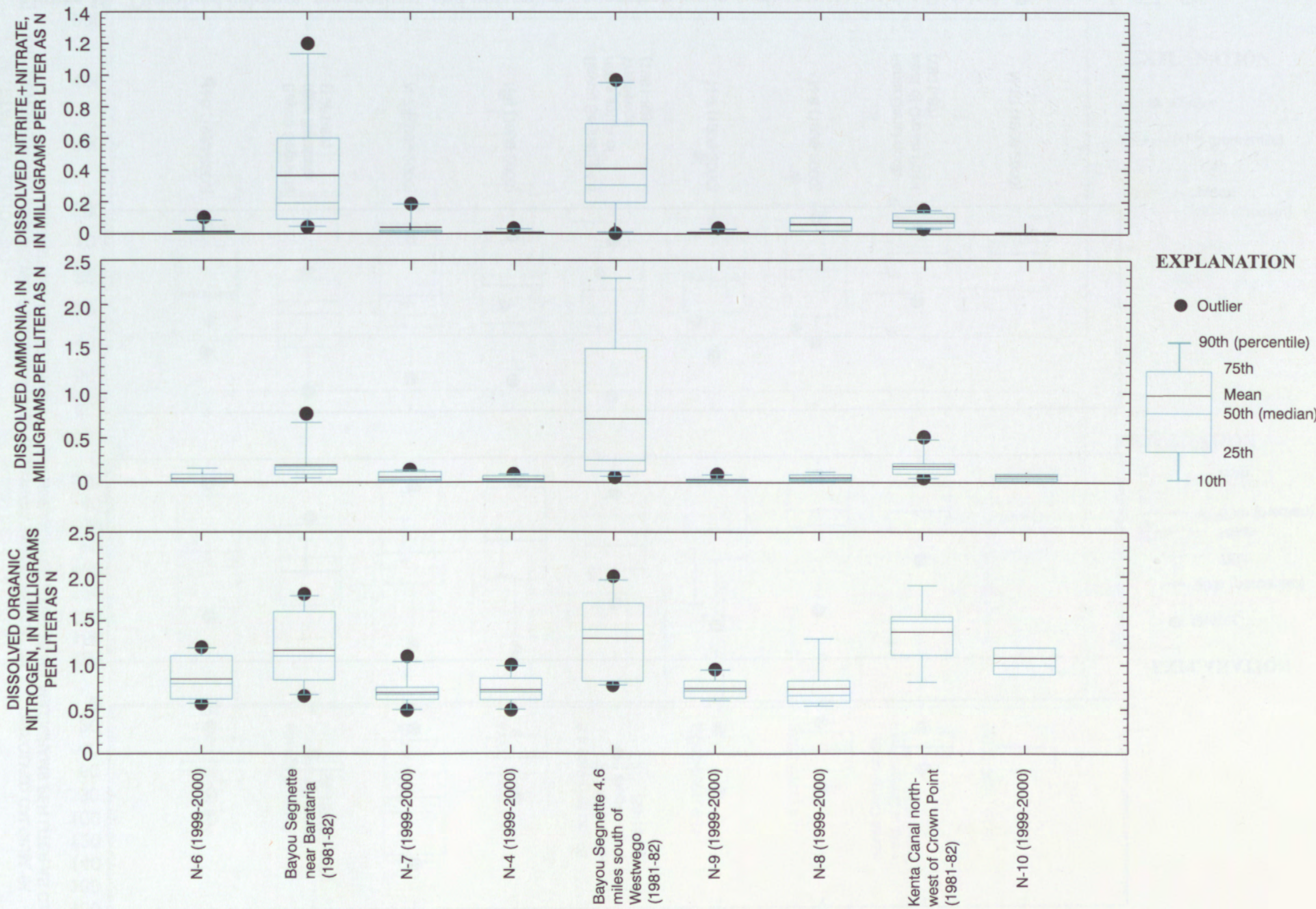

Figure 9. Dissolved nitrite+nitrate, ammonia, and organic nitrogen concentrations in surface water of the Barataria Preserve, Jean Lafitte National Historical Park and Preserve, Louisiana, March 1981 to March 1982 and March 1999 to May 2000.

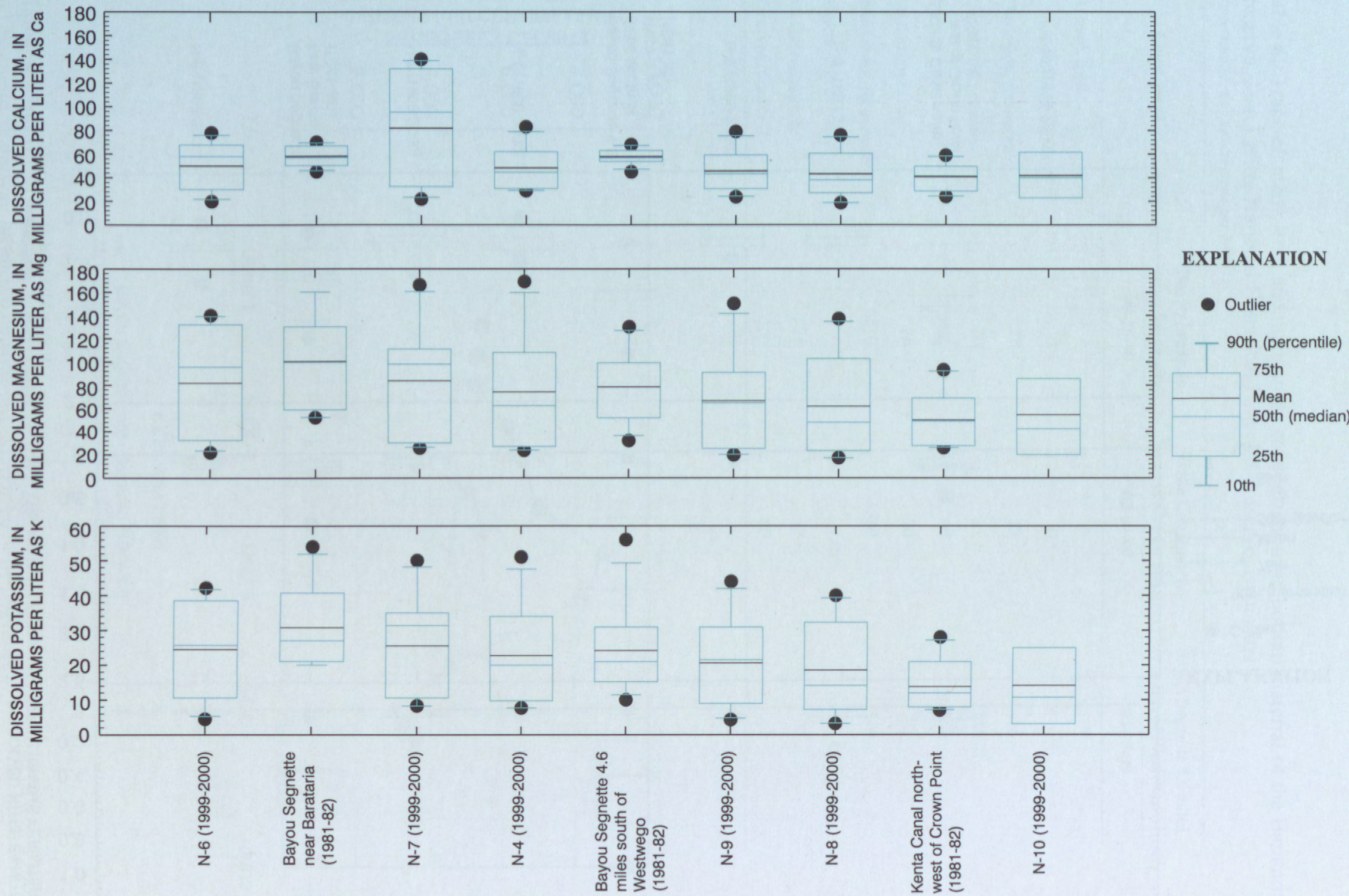

Figure 10. Dissolved calcium, magnesium, and potassium concentrations in surface water of the Barataria Preserve, Jean Lafitte National Historical Park and Preserve, Louisiana, March 1981 to March 1982 and March 1999 to May 2000.

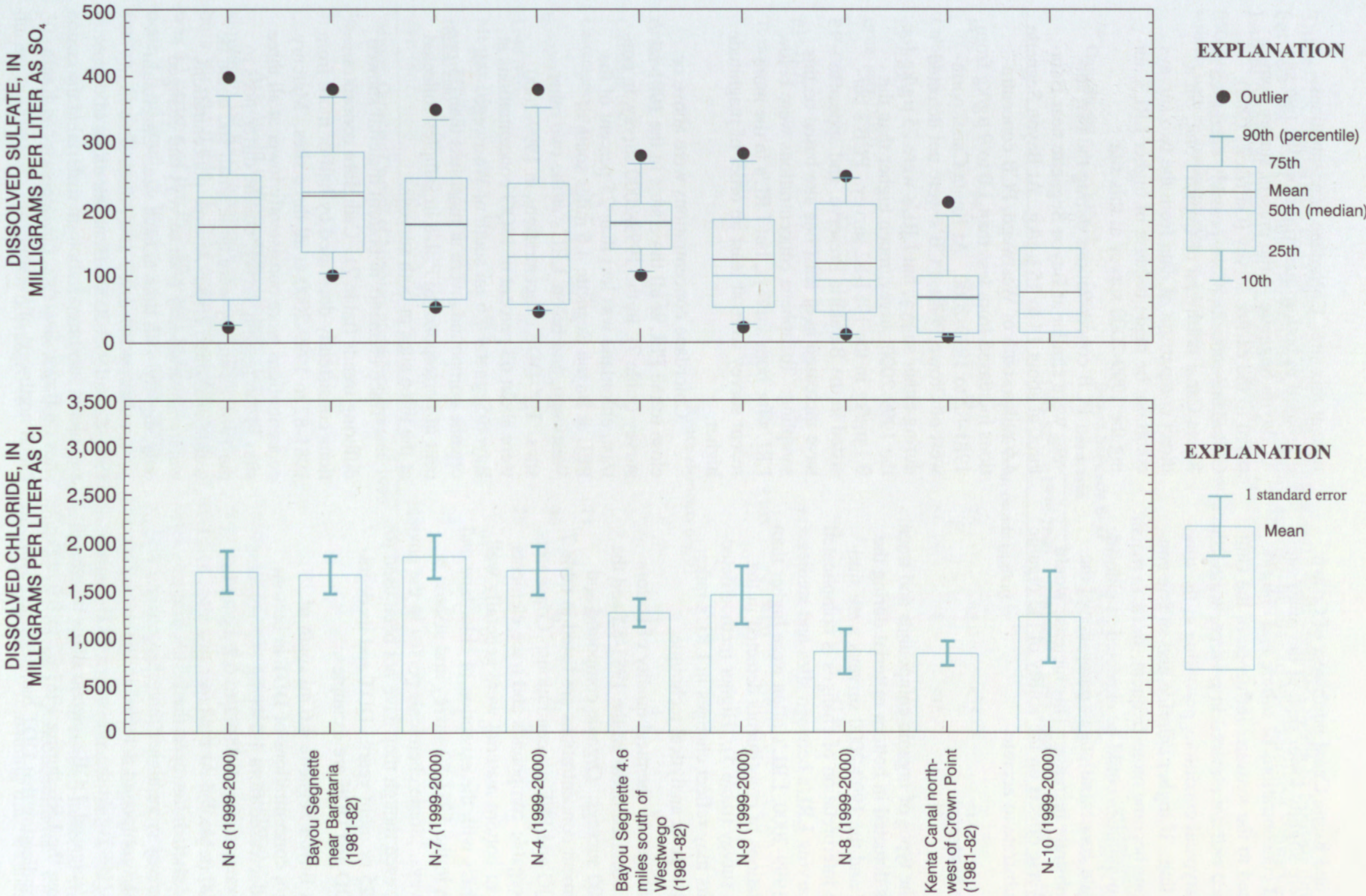

Figure 11. Dissolved sulfate and chloride concentrations in surface water of the Barataria Preserve, Jean Lafitte National Historical Park and Preserve, Louisiana, March 1981 to March 1982 and March 1999 to May 2000.

(N-10), and Kenta Canal northwest of Crown Point were slightly lower than at the other sites. Elevated concentrations of sulfate and chloride are related to the seawater influence of the Gulf of Mexico and are elevated in preserve water during the atypical conditions prevailing at the time of sampling. If higher chloride and sulfate concentrations become more frequent, shifts in marsh plant communities could be expected as chloride and sulfate concentrations in porewater of the marsh substrate increase. This increase would have adverse effects on the ability of the organic marsh substrate to accrete.

Bottom Material

The types of organic compounds and trace elements detected in bottom material during the 1981-82 and the 1999-2000 surveys were similar. The interpretation of changes is complicated by the varying LRL's between sites and studies. During 1999-2000, LRL's often were higher than concentrations of constituents detected in the 1981-82 survey (table 5). Higher method detection limits may reflect changes in LRL's rather than a change in analytical technique.

Changes in chemical quality of bottom material occurred between the 1981-82 and the 1999-2000 surveys. Organic compound and trace-element concentrations are listed in table 7 with ISQG and PEL concentrations. Concentrations of organic compounds and trace elements detected in bottom material were generally well below PEL's with the exception of chlordane and cadmium in the 1981-82 survey and arsenic in both surveys. Some chemicals persist in the environment, even though they have not been used for the past 25 or more years. DDT and its degradates DDD and DDE are examples.

At Bayou Segnette 4.6 mi south of Westwego, concentrations of DDT in bottom material decreased from 1.2 μg/kg (micrograms per kilogram) during 1981-82 to 0.2 μg/kg in 1999-2000 (table 7). At the other two sites, DDT was not detected; however, the LRL's in the present survey were higher than the concentrations of the compound detected in the survey by Garrison (1982). At the site where DDT concentrations decreased, DDE concentrations increased from below the LRL during 1981-82 to 0.9 μg/kg in 2000, indicating that DDT has degraded over time at this site. Chlordane concentrations decreased in bottom material from the two sites on Bayou Segnette in the present survey compared to the earlier survey (Garrison, 1982). Chlordane concentrations possibly decreased at Kenta Canal northwest of Crown Point, but a direct comparison of data from the two surveys could not be made because of higher LRL's during the 1999-2000 survey at this site.

PCB concentrations during the two surveys were similar at Bayou Segnette near Barataria, at about 14 to 15 μg/kg. At Bayou Segnette 4.6 miles south of Westwego, PCB concentrations increased from less than 1.0 to 9 μg/kg from 1981-82 to 1999-2000. At Kenta Canal northwest of Crown Point, PCB's were not detected during either survey, but LRL's were 25 μg/kg for the 1999-2000 survey, much higher than the 0.1 μg/kg in the 1981-82 survey. PCB's persisted in the Barataria Preserve, and appear to have increased in at least one site based on this sampling. Toxaphene concentrations were below LRL's for both surveys, but LRL's in the more recent survey were at least an order of magnitude higher.

Chlordane concentrations were above or close to the PEL at all three sites in the 1981-82 survey (table 7). In the 1999-2000 survey, in contrast, chlordane was less than 25 percent of the PEL at Bayou Segnette 4.6 miles south of Westwego, and below LRL's at the two other sites. P,P′-DDE concentrations in 1999-2000 were about 63 percent of ISQG concentrations at Bayou Segnette 4.6 mi south of Westwego. All organic compounds were at most less than 25 percent of corresponding PEL's in samples collected at the three sites in both surveys.

Trace elements in bottom material showed differing trends (table 7). Cadmium concentrations consistently decreased by half or more from 1981-82 to 1999-2000 at all three sites. Mercury concentrations were consistently lower at all three sites in the present survey, but the differences to the 1981-82 survey were quite small and could be within analytical error. Arsenic concentrations were comparable for both surveys and changed only slightly with time at each site. Chromium concentrations increased at all three sites from 1981-82 to 1999-2000. Concentrations of copper and nickel increased in bottom material at the two sites on Bayou Segnette, but decreased at Kenta Canal northwest of Westwego.

Table 7. Comparison of organic compound and trace-element concentrations in bottom material between the 1981-82 and 1999-2000 water-quality surveys at sites of the Barataria Preserve, Jean Lafitte National Historical Park and Preserve, Louisiana

[ISQG, Interim Sediment Quality Guideline; PEL, Probable Effects Level; µg/kg, micrograms per kilogram; <, less than; E, estimated; na, not available; µg/g, micrograms per gram; ns, not sampled]

Constituent	ISQG[1]	PEL[1]	Bayou Segnette near Barataria		Kenta Canal northwest of Crown Point		Bayou Segnette 4.6 miles south of Westwego	
			1981-82[2]	1999-2000	1981-82[2]	1999-2000	1981-82[2]	1999-2000
Organic compounds (µg/kg)								
PCB's	34.1	277	14	15	<1.0	<25	<1.0	9
Chlordane	4.5	8.87	8	<6	8	<15	13	E2
P,P′-DDD (para, para-DDD)	3.54	8.51	2.7	<1.0	<.1	<2.5	1.5	<.5
P,P′-DDE	1.42	6.75	<.1	<.4	.2	<1.0	<.1	.9
P,P′-DDT	1.19	4.77	<.1	<1.0	<.1	<2.5	1.2	E.2
Toxaphene	na	na	<1.0	<100	<1.0	<250	<1.0	<50
Trace elements (µg/g)								
Arsenic (As)	5.9	17.0	9	7	5	4	9	9
Cadmium (Cd)	.6	3.5	1	.5	2	.4	2	.5
Chromium (Cr)	37.3	90	7	21	10	12	ns	16
Copper (Cu)	35.7	197	21	26	29	21	21	24
Lead (Pb)	35	91.3	20	26	20	20	30	31
Mercury (Hg)	.17	.486	.04	.03	.05	.01	.04	.03
Nickel (Ni)	na	na	20	28	30	17	20	27
Zinc (Zn)	123	315	96	100	85	80	100	10

[1]Source: Canadian Council of Ministers of the Environment, 1999.

[2]Source: Garrison, 1982.

Arsenic in bottom material was above or similar to ISQG concentrations at all sites during both surveys (table 7). The arsenic concentration was 53 percent of the PEL (9 µg/g) at Bayou Segnette 4.6 mi south of Westwego in the 1999-2000 survey. Cadmium, copper, and lead concentrations in bottom material also ranged around ISQG concentrations. Cadmium concentrations were 50 percent or more above ISQG concentrations during the 1981-82 survey, but decreased to below ISQG concentrations in the 1999-2000 survey. Although chromium in bottom material increased at both sites for which comparative data were available, the concentrations at all three sites in this survey are about 20 percent or less of ISQG concentrations. No biological impairment to aquatic resources is expected below ISQG concentrations. Mercury in bottom material was less than 25 percent of ISQG concentrations for both surveys, as were the remaining trace elements.

SUMMARY AND CONCLUSIONS

The quality of water and bottom material in the Barataria Preserve of Jean Lafitte National Historical Park and Preserve, near New Orleans, was surveyed from March 1999 to May 2000. Organochlorine, chlorophenoxy acid, and organophosphate pesticides; polychlorinated biphenyls (PCB's); and trace elements were analyzed in surface water and bottom materials at three sites previously sampled in 1981-82, and changes over time were evaluated. Surface water at six additional sites was sampled and analyzed for selected nutrients and major inorganic ions based on their importance to human health, the health of the marshes of the Barataria Preserve, or their usefulness in tracking the circulation of Mississippi River water in the Barataria Preserve.

Southern Louisiana was in a moderate to severe drought during most of the sampling period, which elevated salinity in the Barataria Preserve for at least 8 months. Specific conductance values were less than 3,000 μS/cm (microsiemens per centimeter at 25 degrees Celsius) in surface water throughout the Barataria Preserve from March through September of 1999. Specific conductance values increased over the next 2 months and then generally remained between 5,000 and 7,000 μS/cm.

The herbicide 2,4-D was detected in water at both sites sampled in August 1999, but not at any site during the two later sampling periods. Iron, manganese, and the trace elements copper, nickel, and zinc were detected in dissolved and whole-water samples at all three sites. Concentrations of 2,4-D and the trace elements were substantially lower than values at which biological impairment would be likely.

Nitrite+nitrate, as nitrogen, concentrations ranged from less than 0.002 to 0.19 mg/L (milligrams per liter). Highest concentrations were found at the two southernmost sites in the Barataria Preserve, Segnette Waterway west of Crown Point (N-7) and Pipeline Canal west of Crown Point (N-6). Ammonia, as nitrogen, concentrations ranged from less than 0.01 to 0.16 mg/L. Organic nitrogen concentrations ranged from 0.49 to 1.3 mg/L. Orthophosphate, as phosphorus, concentrations ranged from less than 0.002 to 0.14 mg/L. Minimum concentrations of inorganic ions at the two sites on Segnette Waterway, Segnette Waterway northwest of Crown Point (N-4) and Segnette Waterway west of Crown Point (N-7), tended to be similar and somewhat higher than those for Tarpaper Canal south of Westwego (N-9), Pipeline Canal west of Crown Point (N-6), and Keyhole 6 south of Westwego (N-8). Calcium, magnesium, and potassium concentrations usually were lower at the interior sites than the two sites along the Segnette Waterway. Calcium concentrations ranged from 19 to 83 mg/L, magnesium from 17 to 169 mg/L, and potassium from 3 to 51 mg/L. Ratios of calcium to magnesium were about 1:1 or less. Sulfate and chloride concentrations reached 379 and 2,830 mg/L, respectively, at Segnette Waterway northwest of Crown Point (N-4). They were generally lower at interior sites than sites along Segnette Waterway.

PCB's and chlordane, as well as DDT, were detected in bottom material. Trace elements, among them metals of environmental concern, were detected in bottom material at all three of the sampled sites. Arsenic concentrations ranged from 4 to 9 μg/g (micrograms per gram), and lead concentrations ranged from 20 to 31 μg/g. Mercury concentrations in bottom material ranged from 0.01 to 0.03 μg/g.

There were some similarities and some differences in water quality between the 1981-82 and 1999-2000 surveys. Water was atypically more brackish in the Barataria Preserve for several continuous months both during the 1981-82 and the 1999-2000 surveys. Periods when specific conductance remains high for 100 or more days per year occur less than one-third of the time in this part of the Louisiana coast. The water sampled during both surveys probably was more representative of marine influences than freshwater runoff. Sulfate and chloride concentrations, both of which are present in seawater in much larger concentrations than in freshwater, were elevated. Calcium, magnesium, and potassium concentrations also were detected during both surveys and would be expected to be somewhat lower when conditions are dominated more by freshwater inflow.

The herbicide 2,4-D was detected in surface water during both surveys. Other organic compounds were not detected in surface water.

Mercury and chromium were detected in surface water at all three sites during the 1981-82 survey, but were below laboratory reporting levels (LRL's)'s during the 1999-2000 survey. In bottom material, chlordane, PCB's, DDT, and DDE were detected. DDT concentrations decreased in the bottom material at Bayou Segnette near Barataria from 1981-82 to 1999-2000. DDE, a degradate product, increased at this site, indicating that over time, DDT concentrations are decreasing in bottom material of the Barataria Preserve. PCB's were similar in unchanged concentrations (Bayou Segnette near Barataria) or increased (Bayou Segnette 4.6 miles below Westwego) from 1981-82 to 1999-2000.

Trace elements in bottom material exhibited differing trends. Cadmium concentrations consistently decreased by half or more at all three sites. Mercury concentrations were consistently lower at all three sites in the present survey, but the differences from the 1981-82 survey were quite small. Arsenic concentrations were comparable for both surveys and did not appear to change with time at each site. Chromium concentrations increased at two of the three sites from 1981-82 to the present survey. At the third site, no value was available for the earlier survey. Concentrations of copper and nickel increased in bottom material at the two sites on Bayou Segnette, but decreased at Kenta Canal northwest of Westwego.

Probable Effects Levels (PEL's) and Interim Sediment Quality Guidelines (ISQG's) concentrations, as tabulated by the Canadian Council of Ministers of the Environment, were used to assess the probability of biological impairment in the Barataria Preserve. PEL's are concentrations of a chemical at or above which some biological impairment is likely. ISQG concentrations are those at or below which biological impairment is unlikely. Concentrations of 2,4-D and trace elements, when detected in surface water in the 1981-82 and 1999-2000 surveys, were substantially lower than levels at which biological impairment could be expected. Concentrations of organic compounds in bottom material in both surveys were at most less than 25 percent of PEL's, and usually much lower.

Arsenic, cadmium, copper, and lead concentrations in bottom material were generally slightly above or lower than ISQG concentrations in both surveys, although arsenic was as high as 53 percent of PEL's at one site in the 1999-2000 survey. All other trace elements in bottom material collected in both surveys were present in concentrations lower than ISQG concentrations.

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