UNITED STATES DEPARTMENT OF THE INTERIOR

GEOLOGICAL SURVEY

WATER RESOURCES DIVISION

PRELIMINARY DETERMINATIONS OF HYDROBIOLOGICAL AND CHEMICAL CONDITIONS IN THE VICINITY OF THE PROPOSED JETPORT AND OTHER AIRPORTS IN SOUTH FLORIDA

by

Benjamin F. McPherson

PROGRESS REPORT

Prepared by
the U. S. Geological Survey
in cooperation with
the Dade County Port Authority
and the U. S. National Park Service

Tallahassee, Florida
August 1969

PROVISIONAL DATA


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INTRODUCTION

The Dade County Port Authority began construction on a Jetport located 36 miles due west of Miami, in September 1968. The Jetport will be used as a flight training center, taking this burden from the Miami International Airport. Initial construction is confined to the southern part of the 39-square mile Jetport land but the Port Authority believes that the new Jetport will be expanded into a commercial facility between 1975 and 1980. There is room on the land purchased by the Port Authority for six east-west runways. Training facilities, including a runway, taxiway, apron and access roads are expected to be completed in the fall of 1969. The Jetport is located in the Big Cypress Swamp just north of U. S. Highway 41, in Collier and Dade Counties. Its eastern edge borders Conservation Area 3, of the Central and Southern Florida Flood Control District, and its southern edge is a few miles from Everglades National Park (fig. 1).

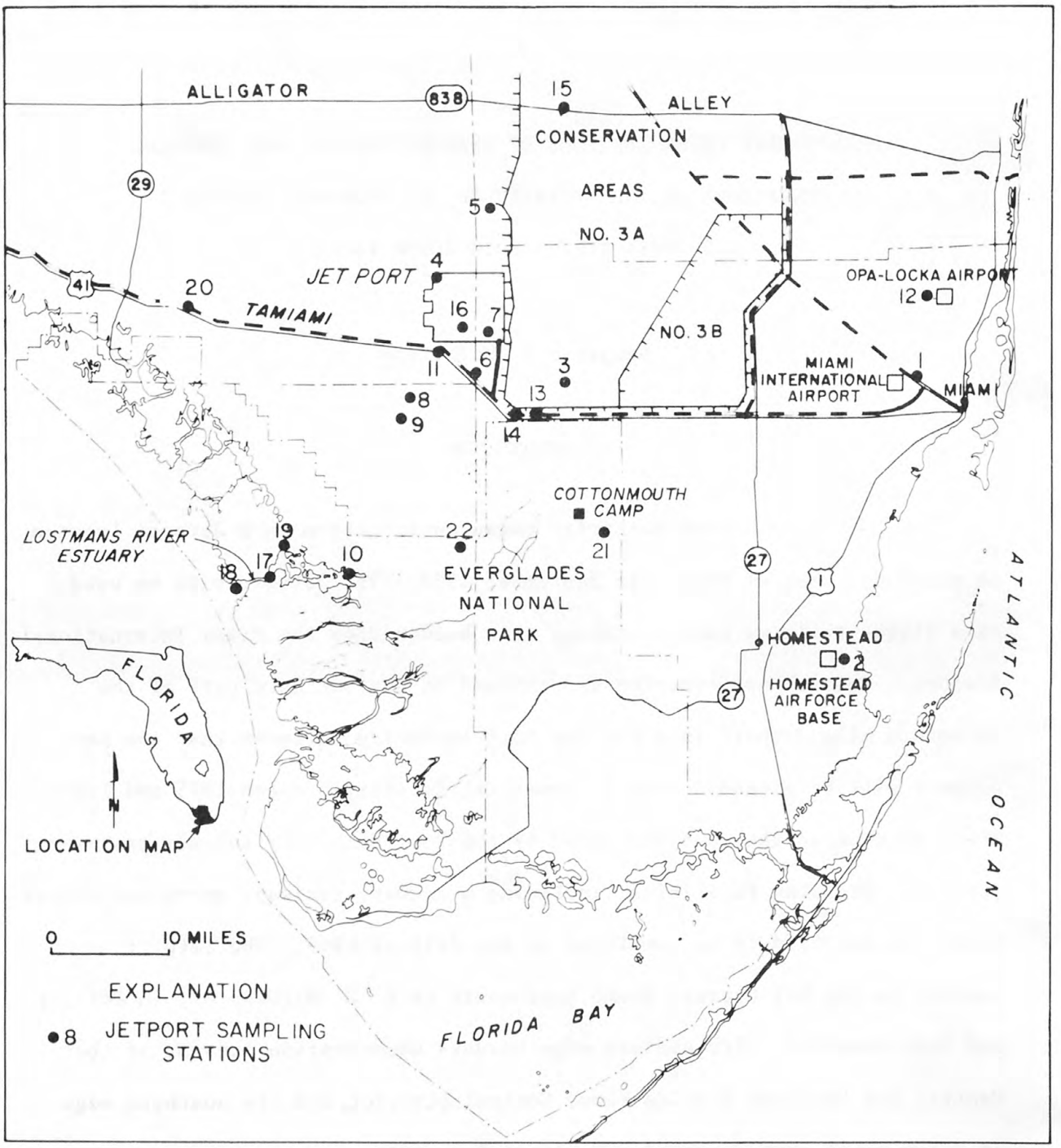

Figure 1.--Map of South Florida with Jetport sampling stations.

Individuals and groups have expressed concern over the possible hazards posed by the Jetport for Everglades National Park and the surrounding environment of south Florida. One concern is the effect this facility might have on the biology, water quality, and flow in south Florida. At present the flow of water through Big Cypress Swamp and into Everglades National Park is essentially natural. The nearly completed airstrip is provided with culverts to maintain the north to south flow. Since the Park depends on a natural seasonal flow of unpolluted water, knowledge of the natural flow and quality conditions are needed so that development to the north can include methods whereby flows would not be altered to the extent of causing ecological damage. Before any assessment of biological or water-quality changes can be made, pre-flight conditions thus must be known.

At the request of the Dade County Port Authority and the National Park Service, the Geological Survey undertook to obtain background information on the hydrobiological conditions in the south Florida area prior to and immediately following the first scheduled training flights set for December 1969. Twenty-two stations were selected to be sampled at three times prior to December 1969; that is, April, July, and October-November. Three of the stations were at canals near existing commercial airports (fig. 1). The three stations near existing airports, Miami International, Homestead Air Force Base, and Opa-Locka were selected as representative of conditions prevailing under full-scale commercial operations.

This report gives the results of the first set of sampling which was done in April 1969. Surface water was sampled at all stations except number 16, where ground water was taken from an observation well.

METHODS

Samples of water were collected at 20 stations for determination of phenolic materials, and at 10 of these stations for determination of physical characteristics, common chemical constituents, trace elements, heavy metals, nutrients, pesticides, total organic carbon (TOC), chemical oxygen demand (COD), and other organics including oil and grease. Table 1 lists the parameters that were measured, and Table 2 lists the collection procedure. Samples of sediment and fish were also collected at some stations and analyzed for pesticides. Analyses for common chemical constituents, trace elements, heavy metals, and nutrients, were made at the Geological Survey, Water Quality Laboratory in Ocala, Florida, in accordance with currently recommended procedures (M. Beard, written communications, 1969). Temperature, specific conductance, hydrogen ion concentration (pH) and dissolved oxygen (D.O.) were measured in the field. Dissolved oxygen was measured by the Alsterberg modification of the Winkler method. Quantitative analyses for pesticides were made at the Geological Survey, Water Quality Laboratory in Washington, D. C. The methods used were those described by Lamar, Goerlitz and Law (1964) and Goerlitz and Lamar (1967). Chlorinated hydrocarbon compounds can be detected using these methods in as low a concentration as 0.001-0.1 μg/l, depending on the specific sensitivity level of each compound. Analyses for TOC, COD and other organics were performed by the Federal Water Pollution Control Administration Laboratory in Athens, Georgia. The method used for analysis of TOC are given by Hall and Stenger (1967) and that for COD by FWPCA (1968). Infrared, gas chromatographic and mass spectral analyses were performed on samples to determine if there were potential organic pollutants in these waters that could be detected and measured by these methods.

Table 1. Parameters measured for complete analyses of surface water at 10 stations in south Florida.

Chemical constituents	Chemical constituents (cont'd)	Pesticides
Aluminum (Al)	Organic Nitrogen (as N)	Aldrin
Ammonia Nitrogen (as NH_4)	Orthophosphate (PO_4)	DDT, DDD, DDE
Arsenic (As)	Phenolic Materials	Dieldrin
Boron (B)	Potassium (K)	Endrin
Bromide (Br)	Silica (SiO_2)	Heplochlor
Calcium (Ca)	Sodium (Na)	Hextachlor
Chloride (Cl)	Strontium (Sr)	Epoxide
Chromium (Cr)	Sulfate (SO_4)	Lindane
Copper (Cu)	Tannin and Lignin	2,4-D
Dissolved Oxygen (DO)	Total Organic Carbon	2,4,5-T
Dissolved Solids		Silvex
Fluoride (F)	Physical parameters	Toxaphene
Iodide (I)	Temperature	
Iron (Fe)	pH	
Lead (Pb)	Specific conductance	
Lithium (Li)	Turbidity	
Magnesium (Mg)		
Nitrate (NO_3)		
Nitrite (NO_2)		
Oil and grease		

Table 2.--Field water-quality collection procedure.

Name of analysis or constituent	Volume Collected, Liters	Procedure	Preservative
Common chemical constituents	2	Unfiltered	None
Heavy Metals and trace elements	1	0.45μ Filter	HNO_3
Total Phosphorus	1	0.45μ Filter	NONE
Nitrogen Cycle	1	0.45μ Filter	Hg Cl_2
Turbidity	0.25	Unfiltered	Hg Cl_2
Pesticides	2	Unfiltered	Cooled
Total Carbon	1	Unfiltered	Hg Cl_2
Oil and grease	1	Unfiltered	Hg Cl_2
Phenolic Materials	1	Unfiltered	Cu SO_4

Biological samples were collected with a number 2 (0.37 mm aperture) and a number 20 (0.08 mm aperture) plankton net, a 6-foot throw net, (9.6 mm aperture), and a 12-foot seine (3.2 mm aperture). The number 2 plankton net (1/2 meter diameter) was used in Lostmans River estuary, in Everglades National Park, being pulled at the surface behind a boat. Five-minute plankton tows were made after dark at each station. The velocity of the boat towing the net was measured with a Price current meter. Because the time of each plankton tow was measured, the linear dimension of the water sampled could be computed. Volume of the water passing through the net was then determined by multiplying the known area of the net by this linear dimension. The number 20 plankton net was used at seven stations to collect smaller organisms. A measured volume of water (between 6 and 10 liters) was poured through this net. Samples were collected during the day. The throw-net and seine were used to collect fishes for pesticide analysis. Twelve species of fish, from five stations, were collected for these analyses.

Plankton samples were preserved in 2-5 percent formalin and returned to the laboratory for examination and counting. Quantitative determinations of the plankton species present in the samples were made following the method outlined by Welch (1948).

RAINFALL AND WATER LEVEL

The amount of rainfall in southern Florida in April 1969 was above average as indicated by the records at 40-mile Bend Ranger Station on U.S. Highway 41 and at Homestead.

	Inches of Rainfall in April	
Station	29-year Average	1969
Homestead	3.11	3.40
40-mile Bend	2.64	3.48

Water depth was also above average in this area as indicated by the record at Bridge 105 on U.S. Highway 41. The mean water depth at this site was 7.14 feet above mean sea level; this is 1.05 feet above the 18-year average depth for April at this station.

DISSOLVED OXYGEN, pH AND TEMPERATURE

Sites near airports-Measurements of dissolved oxygen (D.O.), temperature and pH made in canals near Miami International Airport (Station 1) and Homestead Air Force Base (Station 2) on April 21, 1969 gave the following results:

	Time	D.O.(mg/l)	Temperature(°C)	pH
Station 1	1000	3.7	26	7.7
Station 2	1000	6.8	28	6.6

Monthly values for these parameters at station 1 and 2 are listed in Table 3. Between December 1967 and December 1968, concentrations of dissolved oxygen ranged from 1.6 to 5.0 mg/l, with a mean value of 3.1 mg/l at Station 1 and from 1.2 to 4.8 mg/l, with a mean value of 2.9 mg/l at Station 2. Monthly measurements of temperature ranged from 19°C to 29°C at Station 1 and from 17°C to 30°C at Station 2. The ranges for pH were 7.1 to 8.0 at Station 1 and 7.2 to 7.8 at station 2 (Data from Dade County Pollution Control).

Sites remote from operating airports - Dissolved oxygen, pH, and temperature of water fluctuate diurnally. Because these parameters were measured at different times of day in April, values from one station cannot be compared with those from another unless the time of day is considered. In Table 4 the dissolved oxygen, pH and temperature are listed by time of day. Dissolved oxygen measured at nine stations ranged from 1.6 to 11.6 mg/l (18 to 150 percent saturation), indicating that large diurnal variations can be expected at that time of year. Temperature ranged from 23°C to 31°C and pH ranged from 6.4 to 7.9.

Table 3.--Monthly values for dissolved oxygen (D.O.), biochemical oxygen demand (B.O.D.), orthophosphate (PO_4) most probable number of coliform bacteria (MPN), pH, and temperature at Stations 1 (near Miami International Airport) and 2 (Homestead Air Force Base). Data from Dade County Pollution Control.

DATE	DEC. 1967	JAN. 1968	FEB. 1968	MAR. 1968	APR. 1968	MAY 1968	JUNE 1968	JULY 1968	AUG. 1968	SEPT. 1968	OCT. 1968	NOV. 1968	DEC. 1968
TAMIAMI CANAL						STATION 1							
D.O. mg/l	1.6	1.6	2.2	5.0	2.8	2.0	4.0	4.6	2.8	1.6	3.6	4.0	4.0
B.O.D. mg/l	4.8	0.4	1.6	6.4	0.0	0.8	3.2	3.2	4.8	2.4	4.0	4.0	2.4
PO_4 mg/l	0.00	0.00	0.00	<0.04	0.00	0.00	0.00	<0.04	0.00	0.06	0.06	0.12	0.40
MPN per 100 ml	1,700	2,300	79,000	13,000	2,200	13,000	33,000	490	2,300	4,600	130,000	4,900	3,300
pH	7.7	7.8	7.8	7.6	7.7	7.1	7.4	7.5	7.4	7.6	7.5	8.0	7.6
Temp. °C	22	21	19	23	24	26	27	28	29	28	26	22	19
MILITARY CANAL						STATION 2							
D.O. mg/l	1.6	2.2	1.6	2.0	4.0	1.2	4.8	1.6	4.0	3.2	1.2	2.4	4.8
B.O.D. mg/l	5.6	7.6	10.8	12.0	8.0	10.0	4.0	12.0	6.0	8.0	20.0	4.0	12.0
PO_4 mg/l	7.20	3.72	7.20	8.36	3.36	0.84	0.24	4.00	1.52	0.04	6.64	2.60	0.44
MPN per 100 ml	23,000,000	2,300,000	1,700,000	790,000	330,000	79,000	130,000	490,000	230,000	170,000	3,500,000	3,500,000	1,300,000
pH	7.6	7.5	7.2	7.4	7.2	7.4	7.3	7.3	7.3	7.5	7.6	7.8	7.8
Temp. °C	23	22	23	26	28	27	28	30	28	26	24	22	17

Table 4.--Dissolved oxygen, pH, and temperature measured at nine stations in southern Florida in April 1969.

Station	Brief Description	Time	pH	Temp. °C	Dissolved Oxygen, mg/l	Percent Oxygen Saturation
11	Tamiami Canal at Jetport	0600	---	23	1.6	18
6	Tamiami Canal at Bridge 115	0930	6.9	28	2.0	25
4	Cypress pond, Jetport	0940	6.8	26	4.7	56
7	Borrow Pit 4, Jetport	1030	6.8	26	7.4	90
5	L-28 tieback Canal	1100	7.7	30	8.6	110
11	Tamiami Canal at Jetport	1200	6.7	--	5.9	-
4	Cypress pond, Jetport	1300	---	26	7.3	88
9	Borrow Canal off State Road 94	1600	7.4	27	2.3	28
10	Lostmans Creek	1600	6.4	27	5.3	65
8	Alligator pond, south	1630	7.8	30	11.6	150
3	Conservation Area 3	1700	7.9	31	8.6	115

BIOCHEMICAL OXYGEN DEMAND, B.O.D.

Monthly values for B.O.D. in 1967-68 ranged from 0.0 to 6.4 mg/l at Station 1 and from 4.0 to 20.0 mg/l at Station 2 (Table 3).

COLIFORM ORGANISMS

Monthly values for the most probable number (MPN) of coliform organisms in 1967-68 ranged from 490 to 130,000 per 100 ml at Station 1 and from 79,000 to 23,000,000 per 100 ml at Station 2 (Table 3). The MPN at both stations exceeds the recommended permissible number of coliform organisms (10,000 per 100 ml) for public water supplies. The high values for MPN, as well as B.O.D., at Station 2 resulted from sewage in canal near the sampling site.

COMMON CHEMICAL CONSTITUENTS

Common chemical constituents tended to be in greater concentration in two samples collected near airports (Station 1 and 2) than in seven samples collected in an area around the new Jetport (Table 5). Higher concentrations would be expected near the existing airports because of their location near the coast, possible influences of sea water, and effects of pollution. Station 10, in Lostmans River estuary, had concentrations of most common chemical constituents many times greater than those of the fresh water stations.

Table 5.--The range of concentration for some chemical constituents and turbidity at nine stations in southern Florida, April 1969.

Chemical Constituents	Stations near airports (Nos. 1 and 2) mg/l	Stations remote from airports (Nos. 3 - 9) mg/l
Calcium	82-83	38-77
Chloride	77-142	23-35
Dissolved solids (residue)	410-527	165-290
Fluoride	0.3	0.1-0.3
Iron (total)	0.06-0.08	0.00-0.34
Magnesium	2.5-12	2.2-9.2
Potassium	3.1-4.7	0.5-1.9
Silica (SiO_2)	3.2-5.3	1.5-4.6
Sodium	42-79	13-25
Strontium	0.70-1.3	0.24-0.83
Sulfate	18-26	0.0-17
Tannin and Lignin	0.1-0.9	0.1-1.8
Turbidity (as SiO_2)	5.3-28	15-45

NUTRIENTS AND ORGANIC CARBON

Sites near airports. Large concentrations of ammonia nitrogen (1.1 mg/l), total phosphorus as PO_4 (3.20 mg/l), and total organic carbon (410 mg/l) were noted in Military Canal (Station 2) on April 21.

The concentrations of nutrients and organic carbon recorded in Tamiami Canal near Miami International Airport (Station 1) on April 21 were within the range of those observed at eight other stations in April (Table 6).

Sites remote from operating airports. Concentrations of nutrients and organic carbon observed at the remaining eight stations sampled in April are listed in Table 6. The median value for nitrate was 0.1 mg/l, however Station 7, a borrow pit on the new Jetport site, had a concentration of 1.4 mg/l. The median value for ammonia nitrogen was 0.04 mg/l, but concentrations were considerably higher at Station 6 (0.26 mg/l) and 9 (0.56 mg/l). At the latter station a number of dead Florida spotted gar were observed in the canal when the water sample was collected. The gar were apparently killed by a dynamite blast according to a National Park Ranger. The dead gar in the canal probably accounts for the relatively high concentrations of ammonia at this station.

Table 6.--Nutrients, total organic carbon and chemical oxygen demand (mg/l) in surface waters of southern Florida, April 1969.

Near Airports

Stations	Nitrate NO_3	Nitrite NO_2	Ammonia NH_4	Organic Nitrogen-N (Kjeldahl)	Orthophosphate PO_4	Total Phosphorus (as PO_4)	Total Organic Carbon TOC	Chemical Oxygen Demand COD
1	0.6	0.03	0.18	0.72	.00	0.21	18	--
2	0.4	0.02	1.1	0.96	--	3.20	420	--

Remote from operating airports

Stations	NO3	NO2	NH4	Organic-N	PO4	Total-PO4	TOC	COD
3	0.2	0.00	0.03	0.74	--	0.01	9	--
4	0.0	0.01	0.04	1.0	0.00	0.08	16	--
5	0.1	0.01	0.20	0.93	0.02	0.12	12	--
6	0.1	0.01	0.26	0.97	0.23	0.33	6	76
7	1.4	0.03	0.01	0.30	0.00	0.09	4	31
8	0.1	0.01	0.02	0.87	--	0.08	27	--
9	0.2	0.01	0.56	0.74	0.02	0.31	9	47
10	0.0	0.01	0.04	0.84	--	0.14	7	59

TRACE ELEMENTS AND HEAVY METALS

Concentrations of trace elements and heavy metals at fresh-water stations were below levels that are listed by the California State Water Quality Control Board (1963) and the Federal Water Pollution Control Administration (1968) as dangerous or indicative of pollution (Table 7).

Table 7.--The range of concentration in mg/l for trace elements and heavy metals at nine stations in southern Florida, April 1969.

Constituent	Stations near airports (Nos. 1-2) mg/l	Stations remote from airports (Nos. 3-9) mg/l	Recommended upper limit mg/l [1/]
Aluminum	0.00-0.10	0.00-0.20	-
Arsenic	0.01	0.00-0.01	1.0
Boron	0.08-0.09	0.05-0.10	-
Bromide	0.00-2.3	0.00-0.6	-
Chromium	0.00-0.02	0.00	-
Copper	0.00	0.00-0.01	0.02
Iodide	0.00-0.4	0.00-0.5	-
Lead	0.00	0.00-0.02	0.1
Lithium	0.00	0.00	-
Manganese	0.01	0.00-0.14	-
Zinc	0.02	0.00-0.03	0.1-1.0

1/ For Fish and Wildlife, McKee and Wolf, 1963.

PESTICIDES

Sites near airports - The DDT family (DDT, DDD, DDE), dieldrin, heptachlor epoxide and 2, 4, 5-T were detected in the water or sediments of canals near airports in April, 1969 (Table 8). The concentrations of the DDT family in water totaled 0.04 μg/l at Station 1 and 0.26 μg/l at Station 2. The currently recommended maximum level of chlorinated hydrocarbons in waters that support fish and aquatic life is 0.05 μg/l (FWPCA, 1968). Concentrations of the DDT family in sediments were several orders of magnitude greater than those in water (24.78 μg/kg at Station 1 and 38.43 μg/kg at Station 2). These values were larger than those recorded at other sites in south Florida in April (Table 8).

Sites remote from operating airports - The DDT family was detected in four of the eight water samples collected in the non-urban areas in April 1969 (Table 8). Highest concentrations occurred at Station 6 (0.69 μg/l). At the other three stations the concentrations were below 0.03 μg/l. Concentrations of the DDT family were detected in three out of seven sediment samples. Total concentrations ranged from 0.00 to 16.39 μg/kg.

Concentrations of the DDT family were found in fish tissue in amounts that ranged from 11.50 to 326.2 μg/kg. Table 9 lists the species in order of their total concentrations of the DDT family. In general, the marine fish from Lostmans River estuary (Station 18) had lower concentrations than most of the fresh-water fish, with a few exceptions. Dieldrin in concentrations ranging from 1.77 and 3.27 μg/kg was detected in two species.

Table 8.--Concentrations of pesticides in samples collected in April 1969.

Stations	Water µg/l DDD	DDE	DDT	Others	Sediment µg/kg DDD	DDE	DDT	Others
				Canals near airports				
1	0.01	0.01	0.02	[1]	16.38	8.40	0.00	[2]
2	.07	.00	.19	.00	9.90	8.32	20.21	[3] [4]
				Bodies of water remote from operating airports				
3	.00	.00	.00	.00	.00	.00	.00	.00
4	.00	.00	.00	.00	.00	.00	.00	.00
5	.00	.00	.00	.00	.00	.00	.00	.00
6	.11	.00	.58	.00	2.43	1.79	.00	.00
7	.00	.00	.00	.00	.00	.00	.00	.00
8	.00	.00	.01	.00	3.69	4.74	7.96	.00
9	.00	.00	.02	.00	-	-	-	-
10	.00	.00	.02	.00	0.81	0.37	.00	.00

[1] 0.02 µg/l 2,4,5-T

[2] 2.28 µg/kg Dieldrin

[3] 2.42 µg/kg Heptachlor epoxide

[4] 5.07 µg/kg Dieldrin

Table 9.--Concentrations of insecticides (µg/kg) in fish collected in April 1969

Common name	Scientific name	Number	Station	DDD	DDE	DDT	Dieldrin
Mosquitofish	Gambusia affinis	Many	7	46.00	134.7	145.5	0.00
Golden shiner	Notemigonus crysoleucas	5	13	100.7	81.60	58.75	.00
Florida spotted gar	Lepisosteus platyrhincus	3	8	21.45	35.68	101.1	3.27
Warmouth	Chaenobryttus gulosus	3	13	26.92	38.49	74.34	1.77
Bluegill	Lepomis macrochirus	3	14	56.87	47.27	30.21	.00
Spanish mackerel	Scomberomorus maculatus	1	18	5.80	25.50	20.00	.00
Redear sunfish	Lepomis microlophus	3	8	46.72	.00	.00	.00
Ladyfish	Elops saurus	1	18	5.00	22.00	.00	.00
Spanish mackerel	Scomberomorus maculatus	1	18	.00	18.30	7.50	.00
Yellow bullhead	Ictalurus natalis	1	8	.00	22.04	.00	.00
Spotted seatrout	Cynoscion nebulosus	1	18	4.50	11.50	4.30	.00
Sailfin molly	Mollienesia latipinna	1	8	.00	18.96	.00	.00
Crevalle jack	Caranx hippos	1	18	.00	11.50	3.20	.00

PHENOLIC MATERIALS

Sites near airports - Phenolic materials were detected in one out of three samples collected from canals near airports in April 1969. The sample collected near Miami International Airport (Station 1 fig. 2) contained 0.012 mg/l of phenolic materials.

Sites remote from operating airports - Concentrations of phenolic materials at the remaining 17 stations ranged from 0.000 to 0.015 mg/l (fig. 2). Highest concentrations (0.008-0.015 mg/l) were recorded at stations near the new Jetport. Concentrations at all stations were below levels considered harmful to fish and wildlife (0.2 mg/l; McKee and Wolf, 1963).

ORGANIC ANALYSIS

Samples of water, collected from stations 1-10, manifested no significant differences in organic components, when analysed by mass spectral, infrared and gas chromatographic methods. No organic pollutants from jet fuels were detected using these techniques.

Pollutants might be detected by using a larger volume of water for analysis, or by increasing the sensitivity of the tests. In these tests, the sensitivities of the gas chromatographic and infrared methods for organic pollutants, such as jet fuels, were about 0.1 and 1.0 mg/l respectively.

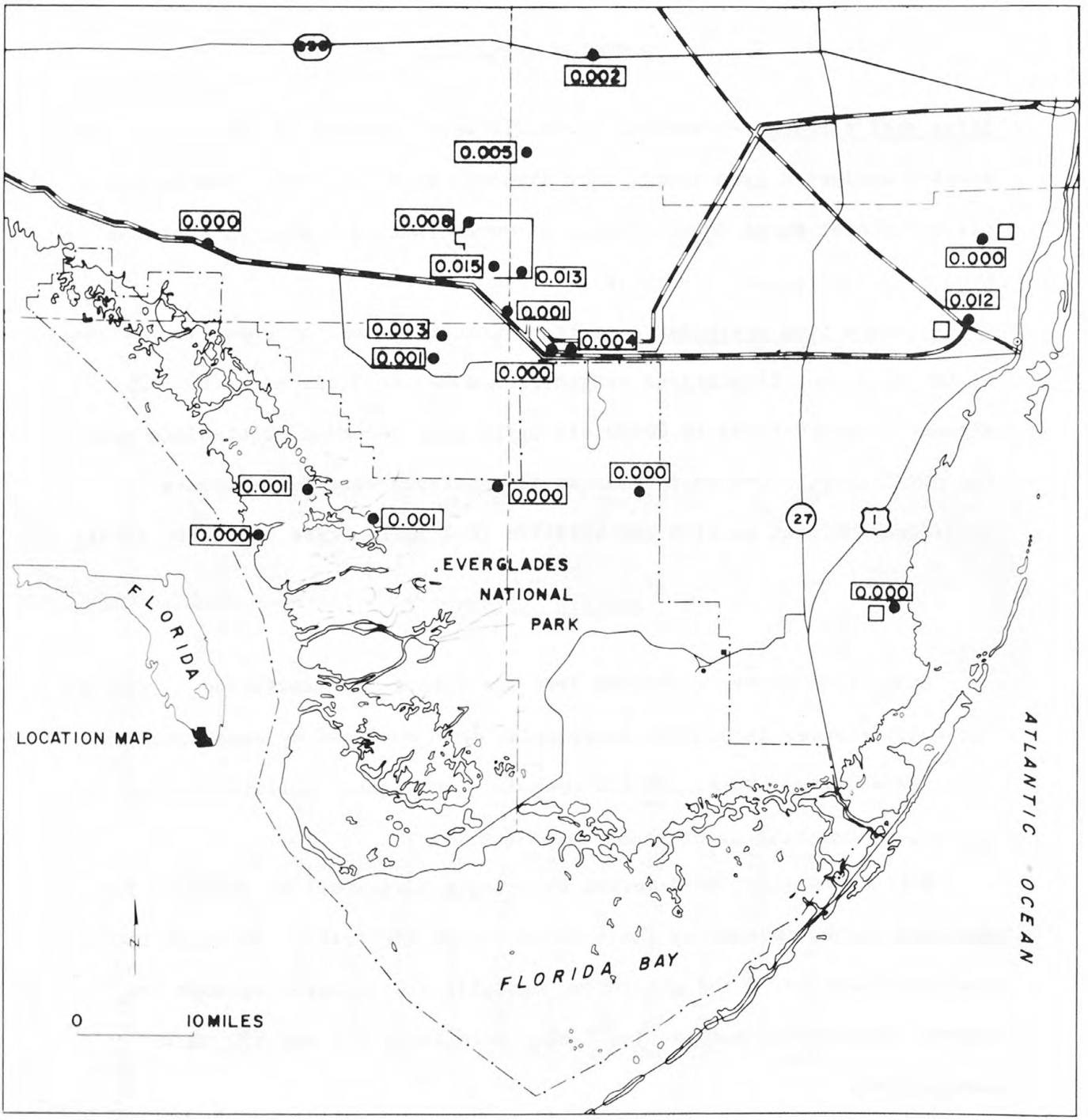

Figure 2.--Concentrations of phenolic materials (mg/l) in south Florida in April 1969.

PLANKTON

Sites near airports - One plankton sample was collected near an airport (Station 2) in April 1969. The phytoplankton in this sample consisted primarily of unidentified blue-green and other algae (125 million cells per m^3). There were about 5 million diatoms per cubic meter. The sample was characterized by the large number of rotifers (94×10^4 per m^3) including Keratella sp., Kellicottia sp. and Brachionus sp. It also contained copepod nauplii in numbers of 25×10^4 per cubic meter (Table 10).

Sites remote from operating airports - Phytoplankton, collected at six other stations, ranged in numbers from 200 million cells per cubic meter to 32,000 cells per cubic meter (Table 10). These included diatoms, desmids, filamentous algae and other unidentified algae. Diatoms were the most abundant forms (except at Station 7). The microzooplankton in these samples included rotifers, crustacean nauplii and juvenile copepods. The former group was observed at two fresh water stations and the latter forms were observed at the two estuarine stations (Table 10).

Table 10.--Number of common microorganisms per cubic meter collected with a number 20 plankton net at selected stations in South Florida in April 1969.

STATION NUMBER	2	14	7	4	20	10	17
BRIEF DESCRIPTION	Military Canal, Homestead	Tamiami Canal S-14	Borrow Pit #4, Jetport	Cypress pond, Northwest Jetport	Turner River Canal	Lostmans Cr. ENP	Lostmans Riv. Sta., ENP
TIME	0930	0730	1000	1300	0900	1630	1230
TEMPERATURE, °C	28	26	25	26	27	27	25
SPECIFIC CONDUCTANCE, MICROMHOS @ 25°C	590		442	180	560	19,500	43,000
pH	6.6		6.8			6.4	
D. O. mg/l	6.8		7.4	7.3		5.3	
Phytoplankton							
unidentified, spherical algae	125.4×10^6	1.2×10^6	3.2×10^4	39.3×10^6	1.9×10^6		
unidentified filamentous algae		3.7×10^6		0.1×10^6	4.7×10^4		
diatoms	4.7×10^6	61.2×10^6		140.2×10^6	7.4×10^4	2.5×10^6	1.3×10^6
Ankistrodesmus sp.				5.6×10^6			
Pediastrum sp.				0.3×10^6			
Micrasterias sp.				5.6×10^6	0.9×10^4		
Staurastrum sp.		1.0×10^4					
Ceratium sp.						2.5×10^4	
Rotifers							
Brachionus sp.	49.8×10^4						
Kellicottia sp.	30.1×10^4						
Keratella sp.		1.2×10^4					
Other rotifers	15.0×10^4	3.6×10^4		5.5×10^4			
Crustaceans							
copepod nauplii	25.5×10^4					10.0×10^4	4.6×10^4
other nauplii							17.0×10^4
juvenile copepods						1.3×10^4	8.1×10^4

Zooplankton was sampled at four stations in Lostmans Estuary in April. Table 11 lists the estimated number or organisms per cubic meter. Copepods were the dominant group at all the stations, with Acartia, the most abundant genus, occurring in numbers up to 823 per cubic meter in Lostmans River. Labidocera aestiva and Pseudodiaptomus coronatus occurred in smaller numbers, and were absent from the headwaters of the estuary at Lostmans Creek (Station 10). Larval crabs were second in abundance in the estuary, occurring at all stations, with numbers ranging from 36 to 200 individuals per cubic meter. Specimens collected from Lostmans Creek resembled the larvae of certain brachyuran crabs in the family Dorippidae. Cumaceans, larval shrimp and chaetognaths were relatively abundant at all stations except Lostmans Creek. Amphipods were collected only in Lostmans River and off the Ranger Station, and mysids and larval fish were collected only at the former station. Both total number of zooplankton specimens and number of species were greatest in Lostmans River (Station 17) and least in Lostmans Creek (Station 10).

The species of zooplankton in Lostmans Estuary in mid-April 1969 were marine or brackish water forms, reflecting the relatively high salinities there at that time. Salinity, estimated from specific conductance, ranged from about 24 g/l on high tide off Lostmans Ranger Station to about 12 g/l in Lostmans Creek. Salinity in the estuary, however may become nearly "fresh" during the rainy season. Arthur Marshall, U.S. Fish and Wildlife Service, (written communication) reported salinities as low as 4 g/l at the mouth of the estuary, 1 g/l in Onion Key Bay, and less than 1 g/l in Lostmans Creek.

Table 11.--Number of common planktonic animals per cubic meter collected with a number two net in Lostmans River Estuary, Everglades National Park on April 14-15, 1969.

STATION	LOSTMANS CREEK(10) [1]	ONION KEY BAY(19)	LOSTMANS RIVER(17)		OFF LOSTMANS RANGER STATION(18)
TIME	1903	1910	2130	1944	2100
TIDE	Ebbing	Ebbing	Flooding	Ebbing	Flooding
TEMPERATURE, °C	27	27	25	26	26
SPECIFIC CONDUCTANCE, MICROMHOS @ 25°C	2.13×10^4	3.35×10^4	3.57×10^4	4.0×10^4	2.95×10^4
VOLUME OF SESTON, ml	100	260	170	150	80
Crustaceans					
Ostracods	4				
Copepods					
Pseudodiaptomus coronatus			16	12	15
Labidocera aestiva		7	225	76	30
Acartia sp.*	31	180	823	364	159
Mysids					
Gastrosaccus dissimilis			5		
Cumaceans					
Cyclaspis sp.		18	242	59	32
Amphipods					
Corophium sp.			84	5	
Other amphipods			28	3	4
Larval shrimp		6	53	62	4
Larval crabs	53	41	178	200	36
Chaetognaths					
Sagitta hispida		24	28	11	2
Larval fish			8	9	

* Some individuals from each station were identified as *Acartia tonsa*.

[1] Number in parenthesis is station number.

FISH-KILL

A fish-kill occurred in the Tamiami Canal near the entrance gate to the Jetport on April 7. Roughly 100 dead and dying sunfish (family Centrarchidae) and a few catfish (Ictalurus sp.) were observed in the early morning in a 100-meter section of the canal. The dying fish were swimming sluggishly at the surface. The dissolved oxygen in the canal at the time was 1.64 mg/l . It increased to 5.92 mg/l by noon.

Fish-kills occur periodically in canals in south Florida. Clugston (1962) reported a heavy fish-kill in the Miami Canal and the South New River Canal in June, 1961. Dr. Burton Hunt, University of Miami, observed spring fish-kills in the Tamiami Canal. These usually began in the area of 50-mile bend, U. S. Highway 41, and often spread both east and west for a number of miles (Burton Hunt, oral communication). These kills occurred during periods of low dissolved oxygen.

RECOMMENDATIONS

The purpose of the initial hydrobiological study was to gain background information before flight operations began at the Jetport, so that comparisons could be made with subsequent hydrobiological conditions. A second purpose of this initial study was to obtain information for planning a more comprehensive investigation. In relation to the second purpose, it is recommended that the area of study be reduced to 3 or 4 locations and that a more thorough analysis be conducted within each of these locations.

At least two reasons may be given for making the analyses more thorough in a given location. First, it is important to sample parameters, such as dissolved oxygen, pH, temperature and possibly plankton and nutrients over a 24-hour cycle. Diurnal variations of these can be quite large, and measurements made at different stations are not comparable unless made at the same time of day. Second, the absence of clear indications of pollution from oils and associated organic compounds in the several water samples collected near existing airports, points to the need for a more thorough sampling near these installations and at several control sites.

It is important to select at least three areas for more extensive investigations. One location should be a busy jetport, such as Miami International Airport. Studies here will indicate what pollutants are associated with this type of environment, and what biological populations will tolerate these conditions. Emphasis should be placed on sediments as indicators of pollution, because pollutants tend to be concentrated here in amounts greater than in water. Some organic pollutants such as oils and greases settle on the sediments and may be detectable there but not in the water. A second location should be near the new Jetport. If ecological changes occur as a result of operations of this installation, they will probably be detected in the immediate area before they spread to surrounding areas, such as Everglades National Park. A third location should be in a relatively unpolluted and protected area, and should serve as a control. Probably the area around Cottonmouth Camp in Everglades National Park would be the best location. It may also be desirable to sample in an estuarine environment, such as Lostmans River, because this area receives water that passes through and near the Jetport.

Cause and effect between various biologic, hydrologic, and chemical aspects of the environment need to be evaluated. To do this more data are needed, and it is recommended that more intensive sampling at these three or four stations be conducted. Sampling should be carried out at least four times a year to obtain information on seasonal variation in the environment.

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APPENDIX

STATION AT WHICH WATER OR BIOLOGICAL SAMPLES WERE COLLECTED IN APRIL 1969

1 Tamiami Canal at LeJuene Road in Miami.

Location: Lat 25°47'35", long 80°15'52", sec.32, T.53 S., R.41 E., just east of Miami International Airport.

Samples collected for: Complete chemical analysis.

Date and time: Apr. 21, 1969; 0930.

2 Military Canal at South Allapattah Road, nr. Homestead.

Location: Lat 25°29'20", long 80°21'49", sec.8, T.57 S., R.40 E., on the eastern edge of Homestead Air Force Base.

Samples collected for: Complete chemical analysis; plankton.

Date and time: Apr. 21, 1969; 0930.

3 Conservation Area 3, Corp. of Engineers Water level Station 3-30.

Location: Lat 25°46'05", long 80°43'00", sec.15, T.54 S., R.36 E., about ½-mile north of U.S. 41.

Samples collected for: Complete chemical analysis.

Date and time: Apr. 22, 1969; 1730.

4 Cypress pond, northwest corner of Jetport.

Location: Lat 25°55'20", long 80°56'22", sec. 21, T.52 S., R.34 E.

Samples collected for: Complete chemical analysis, plankton.

Date and time: Apr. 22, 1969, 1000.

Remarks: This pond is located about four and one half miles north of the training runway on the Jetport. There are no roads near the pond, however several swamp buggy trails pass nearby. The pond is located in the center of a large circular area where cypress trees (Taxodium) are reduced in number (fig. 3). The vegetation in this circular area consists of such forms as pickerel weed (Pontederia sp.), sawgrass (Mariscus jamacensis), and fire flag (Thalia geniculata). There are some custard apple (Annova glabra) and cypress trees adjacent to the deepest part of the pond.

5 L-28 tie back canal.

Location: Lat 26°00'50", long 80°53'20", sec.24, T.51 S. R.34 E. on western edge of Conservation Area 3.

Samples collected for: Complete chemical analysis.

Date and time: Apr. 22, 1969; 1100.

Remarks: There was a plankton bloom at this station. Filtration of the water samples was very slow because plankton clogged the 0.45μ filter.

6 2-2889 Tamiami Canal at bridge 115.

Location: Lat 25°49'45", long 80°53'30" sec.24, T.53 S., R.34 E.

Samples collected for: Complete chemical analysis.

Date and time: Apr. 22, 1969; 1000.

7 Borrow pit number 4 at Jetport.

Location: Lat 25°52'30", long 80°52'20", sec.18, T.52 S., R.35 E.

Samples Collected for: Complete chemical analysis, plankton, pesticides in fishes (Gambusia affinis).

Date and time: Apr. 22, 1969; 1130.

Remarks: This pit was dug during the winter of 1969. It is about 330 meters long, 25 meters wide and 10 meters deep.

8 Alligator pond near Pinecrest.

Location: Lat 25°44'50", long 80°56'50", sec.20, T.54 S., R.34 E.

Samples collected for: Complete chemical analysis, pesticides in fishes.

Date and time: Apr. 22, 1969; 1530.

Remarks: Dr. Oscar Owre, University of Miami, has been collecting ecological information, particularly in reference to bird populations, in the area of this pond since 1952. Two of his students, Barry Michaels and Jim Kushlan, have carried out biological studies in the vicinity of this pond. Mr. Michaels investigated fluctuations in fish populations, and the predation of birds on fishes. He began this work in March, 1967. Mr. Kushlan is studying the movement of animal populations in and around the pond. He began work in February, 1969. Figure 3 shows the pond.

9 Borrow Canal off State Highway 94, near Pinecrest.

Location: Lat 25°44'50", long 80°57'00", sec.20, T.54 S., R.34 E., approximately 15 miles from U.S. Highway 41 at Monroe Station.

Samples collected for: Complete chemical analysis.

Date and time: April 22, 1969; 1630.

10 2-2908.03 Lostmans Creek near Everglades, Fla.

Location: Lat 25°33'40", long 81°01'40", sec.28, T.56 S., R.33 E.

Samples collected for: Complete chemical analysis; plankton.

Date and time: Apr. 14, 1969; 1630.

11 Tamiami Canal at Jetport entrance.

Location: Lat 25°50'45", long 80°56'00", sec.16, T.53 S., R.34 E.

Samples collected for: Common chemical constituents.

Date and time: Apr. 7 and 8, 1969.

Remarks: Fish-kill occurred here on 6 and 7 April. This included mostly sunfish.

12 2-2863.2 Biscayne Canal at Red Road, near Opa-Locka.

Location: Lat 25°54'47", long 80°17'37", in NE¼ sec.24, T.52 S., R.40 E. Near Opa Locka Airport.

Samples collected for: Phenolic materials.

Date and time: Apr. 21, 1969; 1630.

13 L-29 Borrow Canal at Control Structure S-12A.

Location: Lat 25°45'50", long 80°49'20", sec.15, T.54 S., R.35 E.

Samples collected for: Phenolic materials; pesticides in fish.

Date and time: Apr. 22, 1969; 1100.

14 Tamiami Canal above Control Structure 14.

Location: Lat 25°45'45", long 80°49'50", sec. 16, T.54 S., R.35 E.

Samples collected for: Phenolic materials; plankton; pesticides in fish.

Date and time: Apr. 22, 1969; 1130.

15 Conservation Area No. 3A at Alligator Alley, Bridge 49.

Location: Lat 26°08'30", long 80°45'40", R.36 E., T.50 S., in Conservation Area 3.

16 Well C-463 on Jetport.

Location: Lat 25°52'00", long 80°54'00", sec.10, T.53 S., R.34 E.

Samples collected for: Phenolic materials.

Date and time: Apr. 22, 1969; 1030.

17 2909.2 Lostmans River.

Location: Lat 25°33'30", long 81°10'25", sec.26, T.56 S., R.31 E.

Samples collected for: Plankton.

18 Gulf of Mexico at Lostmans Ranger Station.

Location: 25°32'51", long 81°12'45", sec.33, T.56 S., R.31 E.

Samples collected for: Phenolic materials; plankton; pesticides in fish.

Dates: Apr. 15, 1969, 0800.

19 Onion Key Bay.

Location: 25°36'24", long 81°08'07", sec.8, T.56 S., R.32 E.

Samples collected for: Phenolic materials; plankton.

Date and time: Apr. 15, 1969; 1700.

20 2-2888 Tamiami Canal outlets Monroe to Carnestown at Bridge 84 on U.S. Highway 41 (Turner River Canal)

Location: Lat 25°53°10", long 81°15'30", in NW¼ sec.6, T.53 S., R.31 E.

Samples collected for: Phenolic materials; plankton

Dates and time: Apr. 22, 1969; 0930.

Remarks: This canal connects with the Turner River about a mile south of the sample site.

21 2-2908.15 Everglades P-33.

Location: Lat 25°36'30", long 80°41'30", sec.11, T.56 S., R.36 E.

Samples collected for: Phenolic materials.

Date and time: Apr. 22, 1969; 1700.

22 2-2908.70 Everglades P-34.

Location: Lat 25°36'30", long 80°55'30", sec.9, T.56 S., R.34 E.

Samples collected for: Phenolic materials.

Date and time: Apr. 22, 1969; 1615.

Remarks: Temperature of water was 38°C.

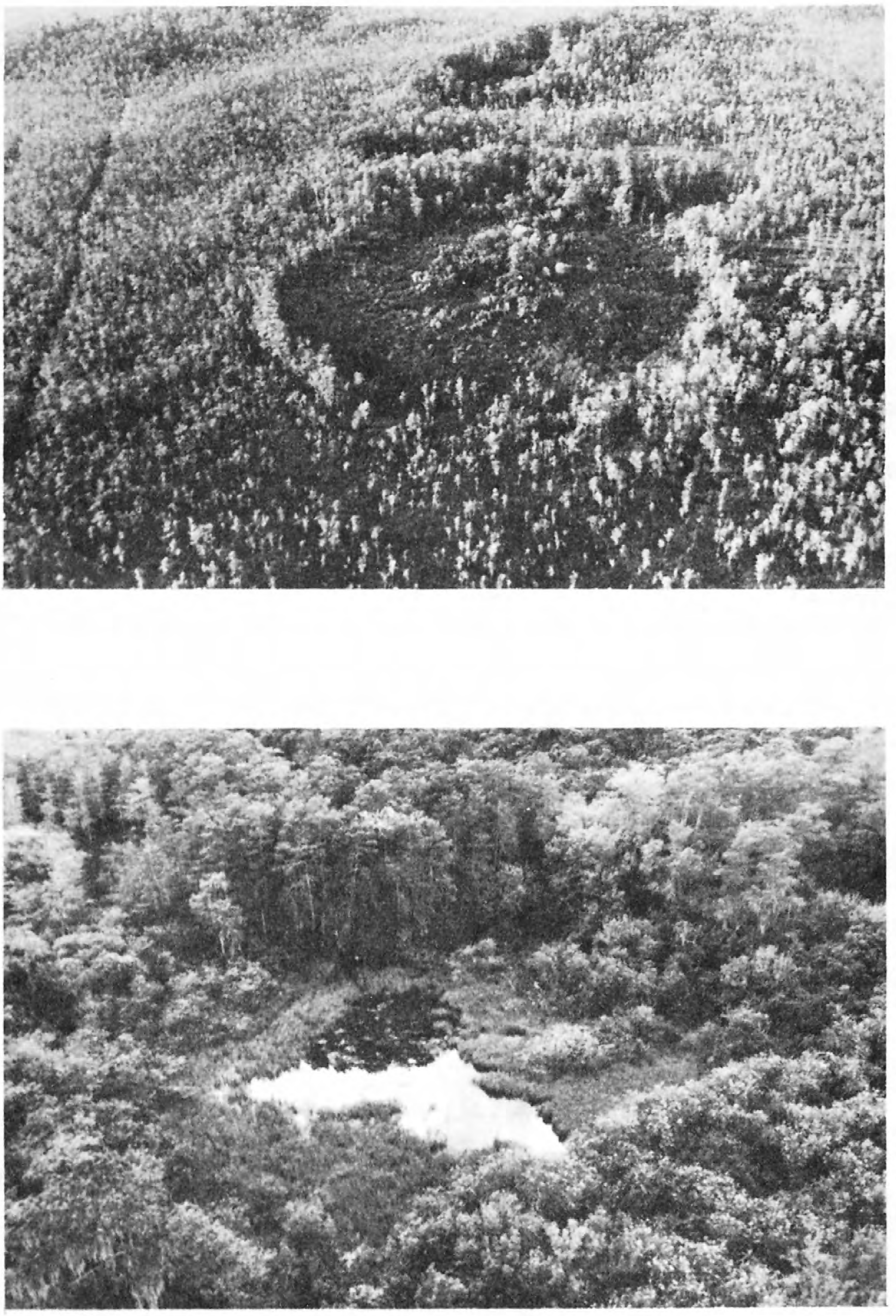

Figure 3. Selected photographs. Stations 4 (top) and 8 (bottom)

Invertebrates collected in Lostmans River estuary,
Everglades National Park, 14-15 April 1969
Lostmans Creek (10); Onion Key Bay (19); Lostmans River (17);
Lostmans Ranger Station (18)

	STATION
Coelenterates	10
medusa[1]	
Ctenophores	
Beroe sp.	19
Anthropods	
Chelicerates	
Xiphosura polyphemus[2]	17, 18
Crustaceans	
Cumaceans	
Cyclaspis sp.	17, 18
Ostracods	
Cypridopsis sp.	18
Copepods	
Pseudodiaptomus coronatus Williams	17, 18
Labidocera aestiva Wheeler	17, 18, 19
Acartia tonsa Dana	10, 17, 18, 19
Mysids	
Gastrosaccus dissimilis[3]	17, 18
Isopods	
Edotea montosa (Stimpson)	17, 18
Amphipods[4]	17, 18
Ampelisca abdita Mills	17, 18
Corophium louisianum Shoemaker	17, 18
Decapods	
Larval shrimp	17, 18, 19
Lucifer faxoni Borradaile	18, 19
Brachyuran crab larvae[5]	10, 17, 18, 19
Leptodius sp.	19
Chaetognaths	
Sagitta hispida Conant	17, 18, 19

1 medusa abundant in plankton
2 juvenile horseshoe crabs in plankton
3 Dr. M. Bacescu has transferred the mysid *Gastrosaccus dissimilis* Coifmann to a new genus, *Coifmanniella*. The new name will be valid after Bacescu's paper is published.
4 several other species of amphipods observed
5 several different larvae present