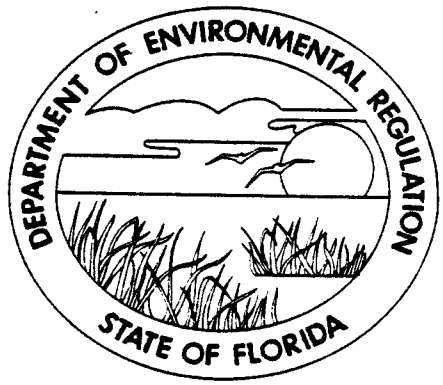


BIOASSAYS OF DESERET FARMS

MELBOURNE, BREVARD COUNTY, FLORIDA

NO NPDES PERMIT

SAMPLED 7/13/81

Biological Section
Bureau of Water Analysis
August 10, 1981

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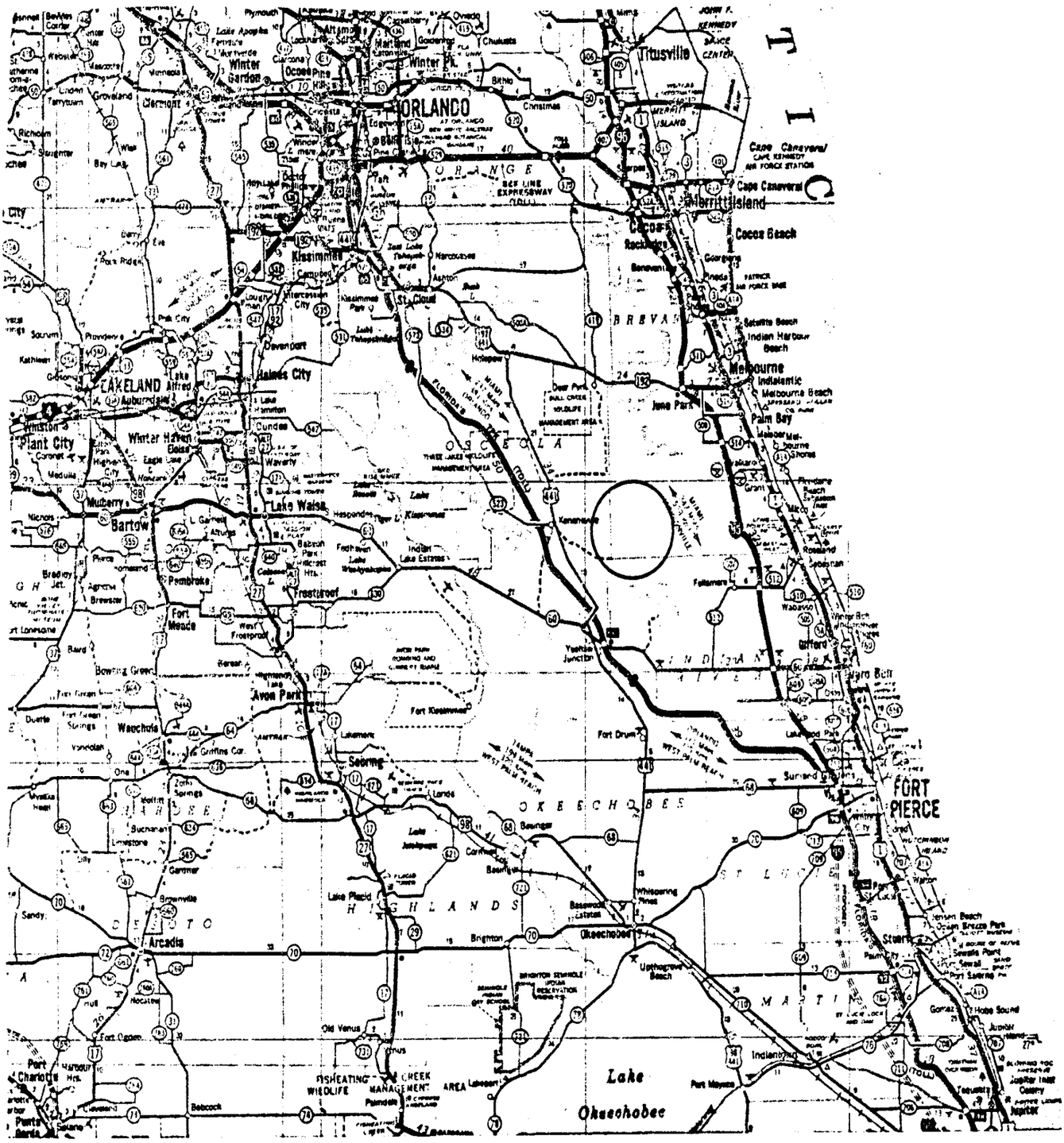
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INTRODUCTION

Deseret Farms is primarily a cattle operation located in three east-central Florida counties--Brevard, Osceola and Indian River (Fig. 1). Drainage of the predominately swamp land is accomplished through manmade canals, principally, the Bulldozer Canal. Runoff water contains high concentrations of nutrients and is sometimes highly colored. It is pumped into the St. Johns River as required.

Because Deseret Farms has no NPDES permit, and the impact of their discharge to the biota of the receiving waters is unknown, the St. Johns River District requested the Biological Section perform a bioassay on this potential source of pollution. Three separate static acute toxicity bioassays were performed on 14 to 16 July, 1981. The results of these tests are presented in this report.



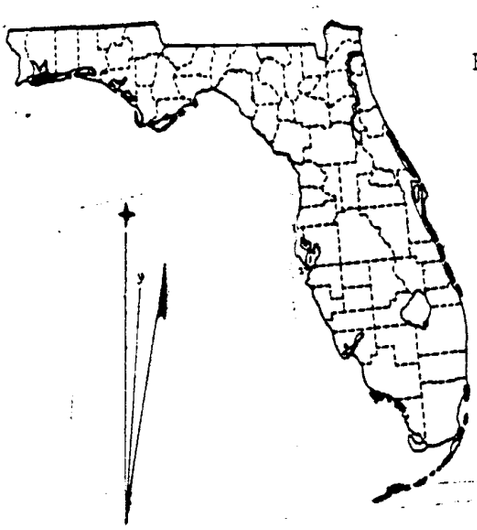


Figure 1. Portions of East-Central Florida, including approximate location of Deseret Farms.

METHODS AND MATERIALS

Test methods used to conduct these static bioassays are extensively described by Peltier (1978). The organisms selected for this study include species recommended by Peltier (1978) and the U.S. EPA (1978). Additionally, the Biological Section maintains cultures of several species of organisms indigenous to the State of Florida. Life histories of these test organisms and maintenance procedures used to culture them are detailed below.

History and Maintenance of Bioassay Organisms

Daphnia pulex (water flea) — A breeding culture of Daphnia pulex was obtained from the EPA laboratory in Athens, Georgia in March, 1979. This culture has been maintained since its arrival, in 2½ gallon all glass aquaria filled with unchlorinated DER well water, using a 16:8 hour light-dark cycle. Organisms are fed a liquified blend of Purina Trout Chow® and Cerophyl® twice daily, and are kept at a constant temperature of 22° ± 1°C. The aquaria are cleaned weekly by siphoning off half the water along with the detritus and excess daphnids. They are then refilled with fresh aerated well water. Additional measures are taken and/or new cultures started in the event of abnormal circumstances such as: declining populations, ephippia formation, or excessive fungal or bacterial growth.

Simocephalus serrulatus (water flea) — An indigenous breeding population of S. serrulatus was collected from Lake Jackson, Leon County, Florida, in March, 1980, by personnel from DER's Biological Section. Positive identification of the organism was performed by Mr. Jeff Foran of the Department of Environmental Engineering Sciences, University of Florida in Gainesville. The cultures are maintained in 2½ gallon all glass aquaria, filled with unchlorinated DER well water, under a 16:8 hour light-dark cycle. The organisms are fed a liquified blend of Purina Trout Chow® and Cerophyl® twice daily, and are kept at a constant temperature of 22° ± 1°C. The aquaria are cleaned weekly by siphoning off half the water along with the detritus and excess population. They are then refilled with fresh aerated well water. Additional measures are taken and/or new cultures started in the event of abnormal circumstances.

Heterandria formosa (least killifish) - Approximately 100 adult killifish were obtained from a wild population in the St. Marks Wildlife Refuge (Wakulla County, Florida) during August, 1980. The fish have been maintained in 2½ to 5 gallon all glass aquaria equipped with a flow-through water exchange system. Water for this system is unchlorinated and is pumped from a deep well near the DER laboratory. The fish have been reared at 22° ± 2°C under a 16:8 hour light-dark cycle and are fed freshly hatched Artemia (brine shrimp) twice daily. New born fish are initially maintained in the adult tanks, but are removed at weekly intervals, thereby segregating fish into even age groups. The fish used in this test were <2 weeks old.

To ensure the uniform sensitivity of these test organisms to toxic substances, the Biological Section conducts monthly Standard Reference Toxicant Bioassays using sodium lauryl sulfate as the reference toxicant.

Test Methods

Three separate 48 hour static bioassays were conducted from 1130 hours on 14 July, 1981, to 1130 hours on 16 July, 1981, on a grab sample of effluent from Deseret Farms' discharge canal. The sample was collected by Mr. Guy Hadley, of DER's St. Johns River District, at 1230 hours on 13 July, 1981, using standard wastewater sampling procedures. The sample was iced and transported to the DER laboratory in Tallahassee within 24 hours of collection.

Freshwater for dilution of the effluent sample was obtained from the same DER deep well that is used to culture the test organisms. The concentration series selected for this study (Table 1) is that recommended by APHA (1976).

Two replicates, each with six concentrations and a control, were used to test with Daphnia pulex and Simocephalus serrulatus. Flint glass jars of 250 ml capacity were used as test chambers, and 200 ml of the appropriate test concentration was placed in each chamber. Daphnia and Simocephalus were siphoned into separate large culture dishes through a stainless steel screen to isolate the proper size and age organisms (neonates). These neonates were then transferred individually by glass pipette and were loaded 10 per chamber, resulting in 20 per test concentration.

Two replicates, of six concentrations and a control, were used for the Heterandria formosa bioassay. The fish were transferred individually or by twos, by net, into wide mouth quart jars containing 500 ml each of the appropriate test concentration. Heterandria were loaded 5 per chamber resulting in 10 per concentration.

Dissolved oxygen, pH, temperature, and the number of live organisms were recorded for each test chamber at 0 hours, 24 hours, and 48 hours. Total alkalinity and total hardness were recorded at the beginning of the test for the controls and the 100% effluent concentration. Specific conductance was recorded for each test concentration at the beginning and end of the bioassays. Additionally, ammonia concentrations, including total (expressed as N) and unionized (expressed as NH_3) fractions were recorded for the control water and the 100% effluent at the beginning of the test. Ammonia measurements were performed using an Orion specific ion probe coupled with a Corning pH/millivolt meter. These values were recorded on the bioassay data forms and are presented in Tables 2 and 3. Data recorded during the Daphnia pulex bioassay are not reported since the 24 and 48 hour tests were invalidated due to excessive control mortality (>20%). Organisms were not fed during these tests.

Table 1. Concentration Series and Volumes Used for These Static Bioassays

Daphnia pulex and Simocephalus serrulatus (water fleas)

Concentration	Dilution Water	Effluent	Total Vol.
Control	200 ml	---	200 ml
5.6%	188.8 ml	11.2 ml	200 ml
10.0%	180 ml	20 ml	200 ml
18.0%	164 ml	36 ml	200 ml
32.0%	136 ml	64 ml	200 ml
56.0%	88 ml	112 ml	200 ml
100%	----	200 ml	200 ml

Heterandria formosa (least killifish)

Concentration	Dilution Water	Effluent	Total Vol.
Control	500 ml	---	500 ml
5.6%	472 ml	28 ml	500 ml
10.0%	450 ml	50 ml	500 ml
18.0%	410 ml	90 ml	500 ml
32.0%	340 ml	160 ml	500 ml
56.0%	220 ml	280 ml	500 ml
100%	---	500 ml	500 ml

Table 2. Data recorded during 48 hour, Simocephalus serrulatus, static acute toxicity bioassay of Deseret Farms, at Bulldozer Canal, Brevard County, Florida on 14 to 16 July, 1981.

Conc. or %	Number of Live Organisms			Dissolved Oxygen (mg/ℓ)			pH			Total Alkalinity (mg/ℓ as $CaCO_3$)		Total Hardness (mg/ℓ as $CaCO_3$)		Temperature (°C)			NH_3/NH_3+NH_4 (mg/ℓ)		Conductivity (μmhos)	
	0	24	48[a]	0	24	48	0	24	48	0	48	0	48	0	24	48	0	48	0	48
Control	10	8	7	8.4	9.6	8.4	7.9	8.2	8.3	117		117		21.6	20,8	20.6	0/.08	---		
Control	10	8	7	8.4	9.6	8.4	7.9	8.2	8.3										202	218
5.6%	10	7[b]	6	8.4	9.6	8.4	7.9	8.2	8.3					21.5	21.1	20.5				
5.6%	10	8	6	8.4	9.6	8.4	7.9	8.2	8.3										231	239
10%	10	7	7	8.4	9.6	8.4	8.0	8.2	8.2					21.4	20.9	20.6				
10%	10	9	8	8.5	9.6	8.4	8.0	8.2	8.2										253	260
18%	10	10	7	8.4	9.6	8.4	8.0	8.2	8.3					21.2	20.8	20.6				
18%	10	10	7	8.5	9.7	8.5	8.0	8.2	8.3										290	304
32%	10	10	9[c]	8.5	9.7	8.4	8.1	8.2	8.3					20.7	20.8	20.8				
32%	10	10	8	8.5	9.7	8.4	8.1	8.2	8.3										349	370
56%	10	10	9	8.5	9.7	8.5	8.3	8.3	8.3					19.8	20.9	20.9				
56%	10	10	10	8.5	9.7	8.5	8.3	8.3	8.3										447	480
100%	10	9	9	8.5	9.6	8.6	8.5	8.3	8.3					18.5	21.2	21.1	.01/.1	---		
100%	10	10	9	8.5	9.6	8.5	8.5	8.3	8.3	149		247							680	730

Remarks:

[a] Test invalidated at 48 hours due to excessive control mortality.
[b] Only 2 dead organisms found.
[c] Dead organism not found.
Oil film on surface of sample.

Table 3. Data recorded during 48 hour, Heterandria formosa, static acute toxicity bioassay of Deseret Farms, at Bulldozer Canal, Brevard County, Florida, on 14 to 16 July, 1981.

Conc. or %	Number of Live Organisms			Dissolved Oxygen (mg/ℓ)			pH			Total Alkalinity (mg/ℓ as $CaCO_3$)		Total Hardness (mg/ℓ as $CaCO_3$)		Temperature (°C)			NH_3/NH_3+NH_4 (mg/ℓ)		Conductivity (µmhos)		
	0	24	48	0	24	48	0	24	48	0	48	0	48	0	24	48	0	48	0	0	48
Control	5	5	5	8.4	9.1	8.1	7.9	8.1	8.2	117		117		22.0	20.7	20.8	0/.08	---			
Control	5	5	5	8.4	9.1	8.1	7.9	8.1	8.2										210	200	
5.6%	5	5	5	8.5	9.1	8.1	7.9	8.1	8.2					21.8	20.5	20.6					
5.6%	5	5	5	8.5	9.1	8.0	7.9	8.1	8.2										238	225	
10%	5	5	5	8.5	9.2	8.0	8.0	8.1	8.2					21.6	20.5	20.5					
10%	5	5	5	8.5	9.2	8.0	8.0	8.1	8.2										260	250	
18%	5	5	5	8.5	9.3	8.2	8.0	8.1	8.2					21.4	20.5	20.6					
18%	5	5	5	8.5	9.3	8.2	8.0	8.1	8.2										295	285	
32%	5	5	5	8.5	9.3	8.2	8.1	8.1	8.2					21.0	20.5	20.6					
32%	5	5	5	8.5	9.3	8.3	8.1	8.1	8.2										358	350	
56%	5	5	5	8.5	9.2	8.3	8.3	8.2	8.2					19.9	20.6	20.6					
56%	5	5	5	8.5	9.3	8.3	8.3	8.2	8.2										452	460	
100%	5	5	5	8.5	9.3	8.4	8.5	8.3	8.3	149		247		18.7	20.7	20.8	.01/.1	---			
100%	5	5	5	8.6	9.3	8.4	8.5	8.3	8.3										690	710	

Remarks: Weight of fish: 0.007g each (average of 10).
Oil film on surface of sample.

RESULTS AND DISCUSSION

Although random mortality was noted in the water flea tests, this particular grab sample from the Bulldozer Canal, Deseret Farms, was not acutely toxic to the test organisms. However, an oil film was noted on the water surface in each test chamber, which caused a majority of the water fleas to float. This may, or may not have helped the water fleas to survive the test. Although a significant number of water fleas died, particularly Simocephalus serrulatus (Table 2), the deaths appeared random, therefore LC_{50}'s could not be calculated. Additionally, the 24 and 48 hour Daphnia (data not reported) and the 48 hour Simocephalus tests were invalidated due to excessive control mortality. No fish died during this bioassay.

LITERATURE CITED

American Public Health Association. 1976. Standard Methods for the Examination of Water and Wastewater. 14th ed. 1193p.

Peltier, William. 1978. Methods for measuring the acute toxicity of effluents to aquatic organisms. Environmental Research Laboratory. Athens, Georgia. EPA-600/4-78-012 (Revised July 1978) 51p.

U.S. Environmental Protection Agency. 1978. Bioassay procedures for the Ocean Disposal Permit Program. Environmental Research Laboratory. Gulf Breeze, Florida. EPA-600/9-78-010.