BIOLOGICAL INVESTIGATIONS INTO THE CONDITION OF SEVERAL CALOOSAHATCHEE RIVER OXBOWS

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INTRODUCTION

Several individuals owning land adjacent to the Caloosahatchee River (C-43) and some of the associated oxbows have requested that certain alterations be made. Some have suggested filling of the oxbows to provide access to the islands, while others have requested that the oxbows be dredged to facilitate navigation. It is this pressure which has initiated a biological investigation of the conditions of these oxbows.

An initial survey on July 19 and 20, 1973 indicated that some of the oxbows between Ortona Locks (S-78) and the Franklin Locks (S-79) were filling in with sediment and/or aquatic vegetation. Of 38 oxbows investigated, 10 were blocked by vegetation. Five of the oxbows were too shallow for navigation and one was completely blocked by sediment buildup. Seventeen of the oxbows were open and navigable while the remaining five were not classified because of artificial obstructions (pipes, fill, etc.)

Biological investigations were conducted on October 24 and 25, 1973 and were limited to the portion of C-43 between the towns of LaBelle and Alva.

DESCRIPTION

In the section of the river where this investigation was confined, the canal was about 500 feet wide and approximately 30 feet deep in the center. The banks of the canal were very steep, and the lack of adequate slope on these sides had produced some very serious erosion problems. Evidence of recent land loss and severe undercutting was prominent.

Littoral vegetation in the canal per se was non existent, because the topographic conditions which would have provided adequate area were limited in most cases to a rocky or sandy shelf, about five feet in width, at a depth of one to two feet along the canal bank. This area was also extensively subject to wave action, which would restrict the growth of littoral vegetation.

Natural littoral area was limited to the oxbow side of the "islands" created by the canal. It was in these shallow areas, suitable for emergent and submergent vegetation where most aquatic invertebrates and fishes would be expected.

Three basic type oxbows were considered for sampling purposes, and insofar as we could determine, there would not be significant differences between those oxbows of similar types, so intensive sampling of all oxbows on this trip was unnecessary. Several factors which should be considered in a more exhaustive study would include depth of water, distance from C-43, and surrounding vegetation types.

The oxbow types we considered were:· 1) oxbows physically blocked by sediment and/or vegetation, 2) oxbows which were open to some waterflow, but not passable by boat and 3) oxbows open and navigable. We ignored those oxbows which had been purposely filled or otherwise obstructed with pipes, dams, etc.

Vegetation was quite diverse, and included many exotic species which had escaped from private gardens in the area. Some species were unidentifiable by either Bob Brown or myself, and certain types were only identifiable to genus. Terrestrial vegetation on either the islands or river banks included:

oaks	Quercus spp.
slash pine	Pinus elliotti
cabbage palm	Sabal palmetto
strangler fig	Ficus aurea
brazilian pepper	Schinus sp.
royal palm	Roystonea elata
guava	Psidium sp.
willow	Salix sp.
myrtle	Myrica sp.
banana	Musa sp.
bamboo	Bambusia sp.
papaya	Carica papaya
saw palmetto	Serenoa repens
wild orchid	Habanaria sp.
boston fern	Nephrolepis exaltata
broom sedge	Andropogan sp.
dog fennel	Eupatorium sp.
green briar	Smilax sp.
bromeliad	Bromeliaceae

Aquatic forms of vegetation included:

alligator weed	Alternanthera philoxeroides
water hyacinth	Eichhornia crassipes
smart weed	Polygonum sp.
maidencane	Panicum hemitomen
Arrow arum	Peltandra sp.
coontail	Ceratophyllum sp.
naiad	Najas guadalupensis
reed	Phragmites sp.
arrow	Sagittaria latafolia
arrow	Sagittaria lancifolia
pennywort	Hydrocotyle sp.
water lettuce	Pistia stratiotes
primrose willow	Jussiaea peruviana
cattail	Typha sp.
bonnet	Nymphaea sp.
swamp lily	Crinum americanum
	Scirpus cubensis
	Chara sp.

METHODS

We selected those sites to be sampled after surveying all of the oxbows within the specified area. By reviewing notes of our observations, we were able to choose sites which we felt were representative of a particular type oxbow.

Because of the brevity of this investigation, quantitative sampling was limited to the benthic fauna, but other pertinent qualitative observations were made and recorded. The Ekman dredge used to sample the benthos measured six inches on a side (0.25 ft^2). Samples were washed in a #20 sieve and preserved in 10 per cent formalin in the field. The laboratory procedure included separation of organisms from the debris, species identification and total individual counts.

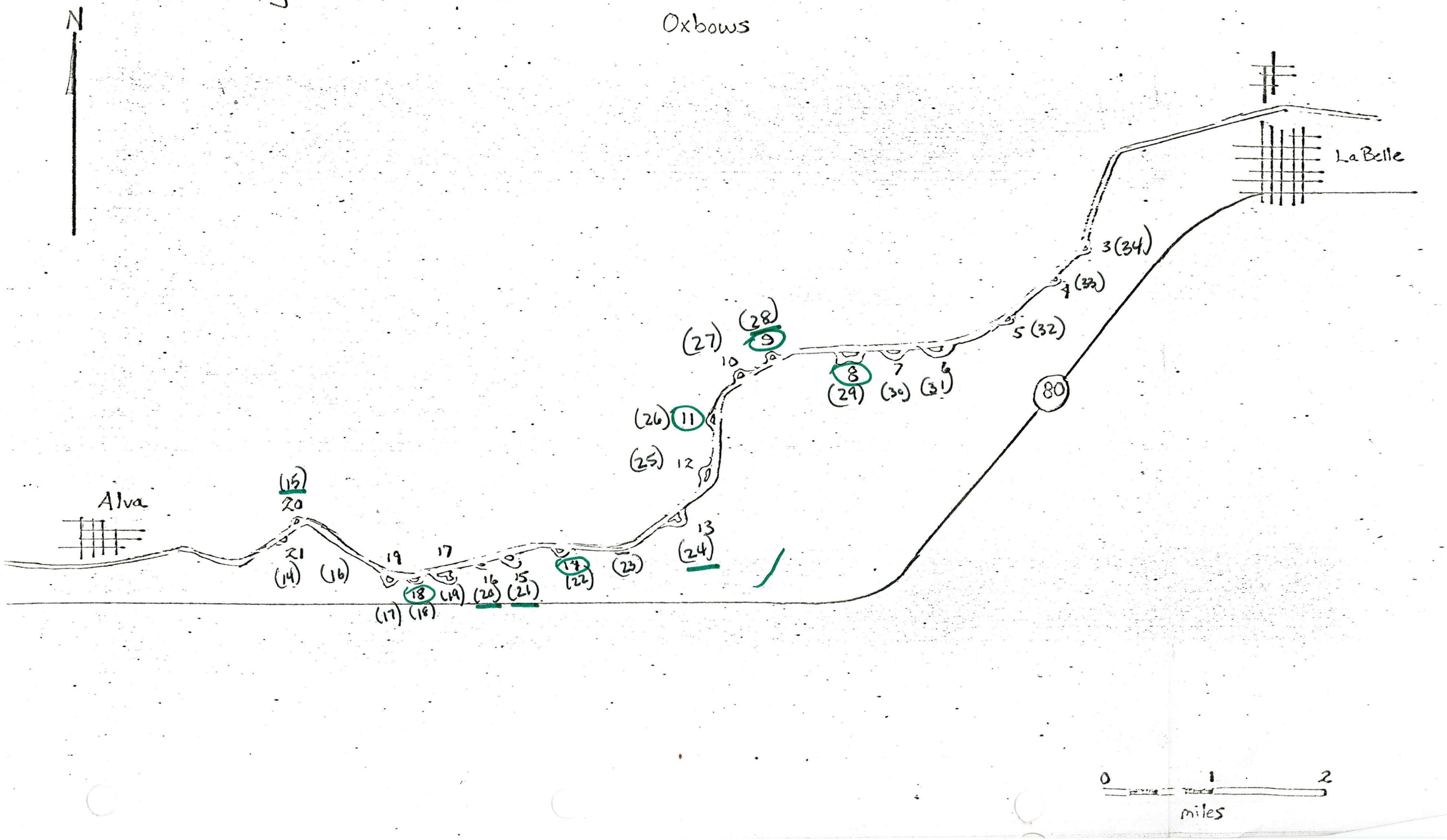
RESULTS OF INVESTIGATION

1) Blocked Oxbows

a) Oxbow 18 (see Figure 1 for location) was blocked from the east side by a very dense band of both aquatic and terrestrial vegetation, including willow, primrose willow and smartweed. There was, however, water movement under this vegetation, as evidenced by wakes in the oxbow when boats passed in the canal. Mullet were observed in the oxbows, and a 6-foot alligator was sighted near the vegetation block. The first Ekman sample (C-3) was taken about 20 feet west of the vegetation block in about three

Figure 1. Caloosahatchee River

Oxbows



feet of water. Dense naiad covered the bottom and Gambusia affinis were abundant. The second Ekman sample (C-4) was taken about 100 yards west of the first in 3 feet of water. Submergent vegetation was less dense and forage size fish were not noticed. The third benthic grab (C-5) came from the point of intersection of the oxbow and C-43 on the west side in 6 feet of water. The bottom in this location was covered with a rank growth of two types of filamentous algae, Lyngbya sp. and Oscillilatoria sp. and a globular form, Aphonothece sp.

The abundance of vegetative cover and apparent density of forage fish decreased from C-3 to C-5. This same trend was evident in the number of species present in the Ekman samples.

		C-3	C-4	C-5
AMPHIPODA	Hyalellidae			
	Hyalella (Amphitoe aztecus)	20		
ANNELIDA	Tubificidae			42
MYSIDACEA	Mysidae			
	Taphromysis louisianae	1		
PELECYPODA	Corbiculidae			
	Corbicula leanus		7	
DIPTERA	Chironomidae			
	Chironomus (Chironomus) sp.	10	1	
	Chironomus (Cryptochironomus) nais	2		
	Chironomus (Cryptochironomus) sp.	3		
	Chironomus (Dicrotendipes) sp.	6		
	Pentaneurini sp.	5		
	Procladius sp.	1	1	
ODONATA	Libellulidae			
	Pachydiplax longipennis	4		
	Total # species	9	3	1

This was the trend which would be expected in a situation like this because as depth increased and the vegetative cover decreased, the number of benthic species adapted to these conditions should decline.

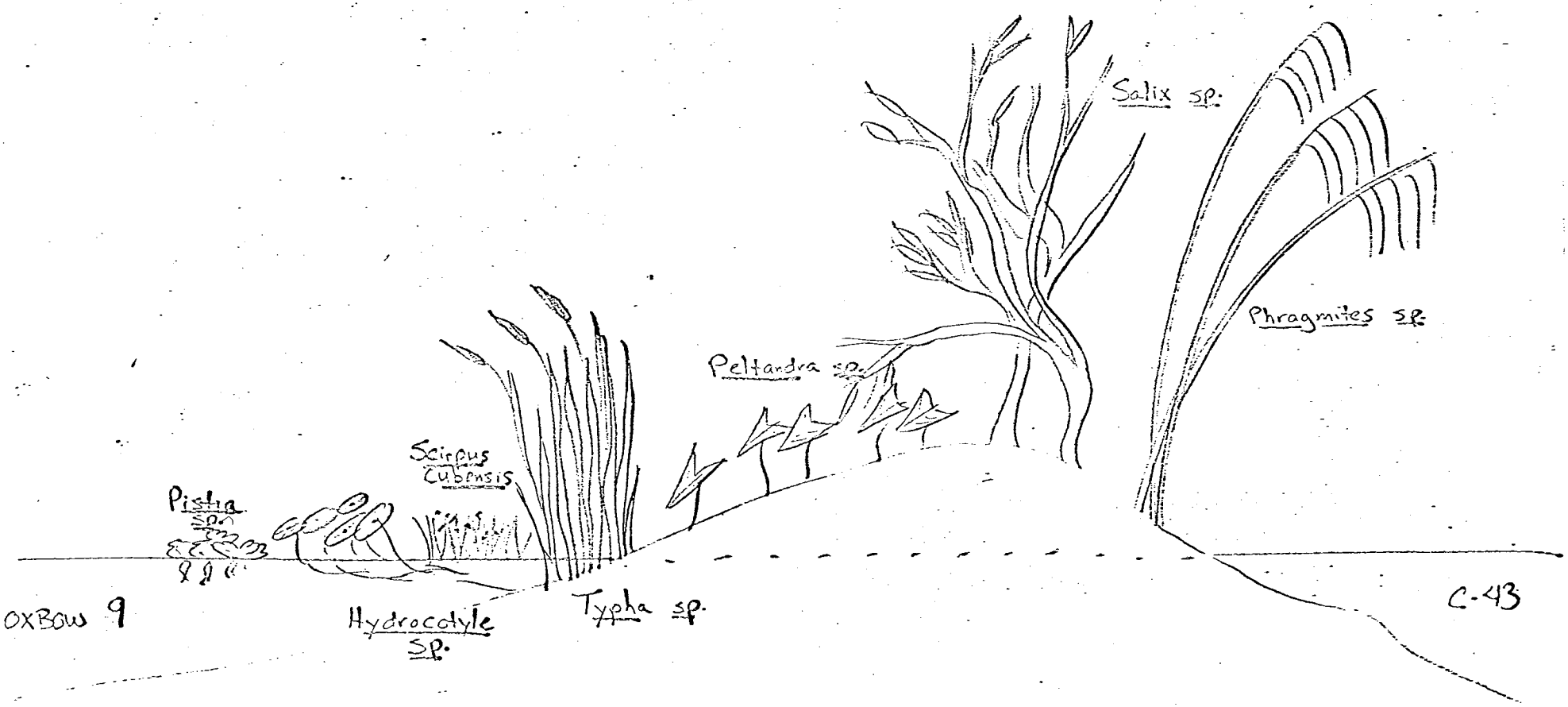
More than one Ekman grab should be taken in the future at each location. In addition, tub sampling within the shallow, submerged and emergent vegetation would most likely provide a better indication of the aquatic life inhabiting this area.

b) Oxbow 9 was also blocked from the east side, but there was no flow of water because the sediment height exceeded the water level. Figure 2 is a schematic drawing of this block. The Ekman samples taken from this oxbow were similar in location to those from Oxbow 18. C-6 was secured in the eastern part of the oxbow about 20 feet from the vegetation block. A dip net sample among the abundant forage fish in the area revealed approximately 95% Gambusia affinis and 5% Lucania goodei. Submergent vegetation was sparce but the bottom was covered with organic detritus. C-7 was secured about 100 feet from C-43 in the west end of the canal, in about 5 feet of water. Bottom sediments here were vastly different from C-6, and composed primarily of the filamentous algae mats of Lyngbya sp. and Oscillilatoria sp. The Ekman results were:

		C-6	C-7
ANNELIDA	Tubificidae	10	8
DIPTERA	Chironomidae		
	Procladius sp.	4	
	Culicidae		
	Chaoborus punctipennis	7	70
	Total # species	3	2

Again, further sampling is necessary in the form of more Ekman grabs, and tub sampling in the shallows.

Figure 2. Diagramatic Illustration of Oxbow Blockage



2) Shallow Oxbows

Sand has been deposited in the east end of Oxbow 8 so that the water depth was only about 18 inches deep. There was no vegetation in the center of the oxbow, but cattails were growing along the edges. Two Ekman grabs, were combined in Sample C-1, to give the following results:

ANNELIDA	Tubificidae	29
AMPHIPODA	Hyalellidae *Hyalella* (*Amphitoe aztecus*)	4
DIPTERA	Chironomidae *Tanytarsus sp.*	1
	Total # species	3

It should be reiterated that this was only an indicator of the benthic fauna in the middle of the oxbow. A higher diversity of organisms would be expected in the vegetated areas.

3) Open Oxbows

Oxbow 11 was open and navigable by boat. Its eastern end was directly in line with C-43 so that it probably experienced some induced flow during periods of discharge. Sample C-10 was secured from the east end, about 50 feet from the intersection with the canal. The depth was 8 feet, and there was some of the filamentous algae on the bottom, but not in the amounts secured in samples C-5 or C-7. *Chara sp.* was also present. Sample C-11, from the west end of the oxbow, was in 9 feet of water, and the bottom was mainly mud and tree litter. Results were as follows:

		C-10	C-11
ANNELIDA	Tubificidae		2
PELECYPODA	Corbiuclidae		
	Corbicula leanus	6	
DIPTERA	Chironomidae		
	Chironomus (Cryptochironomus) sp.	3	
	Pentaneurini sp.		2
	Procladius sp.		3
ODONATA	Libellulidae		
	Somatochlora sp.	1	
	Total # species	3	3

Littoral area in this oxbow was very limited.

Oxbow 14 was also open and navigable, but not subject to the direct flow like Oxbow 11. Only one sample was secured from this oxbow, in 9 feet of water. The bottom here was also covered with dense filamentous algae, like stations C-5 and C-7.

		C-12
ANNELIDA	Tubificidae	2
DIPTERA	Chironomidae	
	Chironomus (Chironomus) sp.	1
	Total # species	2

4) Dredged Oxbows

Since the west end of Oxbow 8 had been dredged out to provide entrance for a large dredge to be docked there, benthic sampling allowed comparison between naturally open oxbows, and those which were not closed, but might be subject to dredging. Sample C-2 consisted of 2 Ekman grabs, approximately 150 feet from the canal. Water depth was thirteen feet and the bottom consisted of hyacinth roots and organic detritus.

		C-2
ANNELIDA	Tubificidae	3
AMPHIPODA	Hyalellidae	
	Hyalella (Amphitoe aztecus)	9
GASTROPODA	Ampullariidae	
	Pomacea paludosa	1
OSTRACODA	Cypridae	
	Candona sp.	4
DIPTERA	Chironomidae	
	Chironomus (Chironomus) sp.	5
	Polypedilium sp.	1
	Culicidae	
	Chaoborus punctipennis	8
ODONATA	Libellulidae	
	Somatochlora sp.	2
	Total # species	8

Finally, as a means of further comparison, benthic samples were secured from the canal. C-8 was taken about 50 feet from the shoreline in the vicinity of Oxbow 9 in about 6 feet of water. C-9 was secured from a point about 20 feet from the blocked end of Oxbow 9 in 5 feet of water.

		C-8	C-9
ANNELIDA	Tubificidae	11	3
PELECYPODA	Corbiculidae		
	Corbicula leanus	22	3
DIPTERA	Chironomidae		
	Chironomus (Cryptochironomus) sp.		1
	Tanytarsus sp.		2
	Pentaneurini sp.	3	
	Culicidae		
	Chaoborus punctipennis	14	
	Total # species	4	4

DISCUSSION

From the results and observations of the present biological condition of the Caloosahatchee River Canal and associated oxbows, several important factors become evident.

1) Nearly all of the littoral area in the Caloosahatchee system is in the oxbows. It is here where the water is sufficiently shallow and protected to permit growth of various types of submerged and emergent aquatic plants. This vegetation provides oxygen from photosynthesis and energy input into the system in terms of organic matter through detritus. The increased surface area provides protection for the various invertebrates and small fishes which utilize this area. This is evident by the large number of forage fish, primarily Gambusia affinis, seen in the blocked oxbows.

2) The closing of the oxbows is a dynamic process. As evidenced by our observations, once an oxbow is blocked from stream flow, detritus from aquatic and terrestrial vegetation rapidly accumulates on the bottom and provides more substrate suitable for emergent aquatic vegetation. In addition, in the fairly stagnant water, some of the creeping herbaceous plants such as alligator weed and Panicum paludivagum grow out into the center of the oxbows on the water surface. These plants serve as traps for algae or floating aquatics such as water hyacinth, or water lettuce. The block becomes even more complete when Scirpus cubensis or Hydrocotyle sp. invade. This extensive water cover, in addition to supplying

organic detritus to the bottom, blocks out sunlight and prevents photosynthesis of either the phytoplankton or submerged aquatics. The result is an increased oxygen demand with little oxygen production and unsuitable habitat for most aquatic species.

3) It is our feeling that this successional process would continue under the present conditions and eventually eliminate nearly all of the littoral area of the system.

4) In the deep portions of those oxbows where flow is reduced a thick filamentous algae mat covers the bottom (Samples C-5, C-7 and C-12). The only organisms found in this type habitat were Tubificid worms and a few Chironomids. Physical measurements would probably reveal very low dissolved oxygen levels. However, where there is probably some water flow (C-10 and C-11) or where conditions on the bottom have been altered by dredging (C-2) the diversity of organisms increases.

CONCLUSIONS

1. We were unable to determine the real cause or causes which initiate oxbow blockage. Since all of the affected oxbows were blocked on the eastern side, it appeared that the initial step is probably the sediment load dropped as water entered the oxbow while flowing from east to west. The source of this sediment could either be erosion along the straight cut banks of the Caloosahatchee River Canal, or siltation which accompanied channel dredging.
2. Our sampling indicated that the benthic fauna was most diverse in the deep, dredged oxbow. Those shallow oxbows which were blocked by sediment or vegetation did not have as high of a diversity of benthic species, but other qualitative observations such as the presence of numerous forage sized fish, wading birds, larger fish and alligators indicated that these may support a more diverse community.
3. The vegetational succession should be monitored in the blocked oxbows to assure that corrective measures can be taken to avoid loss of this littoral area. In addition, much further study is needed on the various biological and chemical aspects of the Caloosahatchee River ecosystems to determine what effect past changes had, and how future alterations can be expected to influence the system.