THE MARINE LABORATORY
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A PRELIMINARY SURVEY OF THE EFFECTS OF RELEASING WATER FROM LAKE OKEECH0BEE THROUGH THE ST. LUCIE & CALOOSAHATCHEE ESTUARIES

to

Corps of Engineers, U. S. Army

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SUMMARY

1. The results and conclusions here reported are based upon a preliminary survey of the periodic release of water from Lake Okeechobee through the Caloosahatchee River and the St. Lucie Canal and its effects upon the marine life of the estuaries.

2. Stations are listed and observations presented, with notes on conditions encountered. Anecdotal evidence is included which notes some of the complaints lodged by people in these areas.

3. The release of lake water westward through the Caloosahatchee River is considered in Section (A) while the eastward discharge through the St. Lucie Canal is considered in Section (B).

SECTION (A): Caloosahatchee River

1. Evidence is presented that the release of water from the lake caused changes in the salinity, oxygen content, hydrogen ion concentration and turbidity of the estuarine waters. Oxygen content and hydrogen ion concentration changes are of minor importance.

2. These conditions are sufficiently severe during conditions at or near maximum release to cause temporary movements of marine life from the lower river, the southern part of Matlacha Pass, and sections of San Carlos Bay. These conditions are also severe enough to cause the death of some forms unable to move from these areas.

3. The sports fishery is hampered in the areas mention in (2). This is minimized by the fact that anglers may make good catches by traveling short distances into areas adjacent to those mentioned.

4. Businesses engaged in renting boats and selling live bait to the sport fisherman on the lower river and at Punta Rassa suffer. Changing water conditions, due to the water releases, cause them to lose their live bait at times.

5. Commercial fishermen using hook and line are forced to travel out of the area mentioned in (2) to make good catches during conditions of maximum or near maximum water release.

6. Commercial crabbers appear to be affected by the water releases which force them to travel further in order to make their catches. This fishery is at present being studied by this laboratory under an agreement with the State Board of Conservation.

7. The scallop fishery is not directly affected by the water releases.

8. The major commercial net fisheries are not affected to any degree by the water releases.

9. The offshore charter boat fishery is not affected by the water releases.

10. Sediments are being deposited in the Caloosahatchee River but do not affect to any degree the fisheries of the estuary.

11. The continuing high rate of water release from the Caloosahatchee River may be a contributing cause of Red Tide outbreaks. On the other hand, since Red Tide outbreaks show a general correlation with the cumulative monthly rainfall of the peninsula, it is probable that the

contributions of the Peace River and other drainage systems are sufficiently greater that a reduction of flow in the Caloosahatchee would have little, if any, effect upon the probability of Red Tide outbreaks.

12. Large numbers of water hyacinths create unfavorable conditions.

13. Complaining parties in this area are unaware of the seriousness of the situation at St. Lucie Inlet and are under the impression that they are receiving the bulk of the water releases. It is recommended that they be informed of the actual circumstances.

14. It is also recommended that control measures be taken to minimize the water hyacinth damage.

SECTION (B): St. Lucie Inlet

1. Evidence is presented that the release of water from the lake caused changes in the salinity, oxygen content, hydrogen ion concentration and turbidity of the estuarine waters. Oxygen content and hydrogen ion concentration change are of minor importance.

2. Sediments are being deposited in the estuary due to water releases.

3. Other tributaries entering the estuary are contributing factors to the conditions described in (1) and (2).

4. The damage to navigation, boating, and recreation caused by the sediments is the most serious problem. The permanent ecological effects of the sediments also present a serious problem which cannot be properly assessed without more detailed studies.

5. The severe and rapid changes in salinity which occur as a result of lake water releases cause immediate harm to the sports fishery in the river and to some extent in the estuary.

6. An examination of the commercial fish landings of Martin County and a comparison of these landings with adjacent counties indicates that the water releases have not significantly affected commercial fish landings in Martin County. Although the salinity changes in the estuary certainly influence the commercial fisheries, the net effect is apparently small.

7. A small crab fishery carried on in this area is probably influenced to some extent by the water releases, in particular by the salinity changes.

8. The offshore charter boat fishery is not significantly affected except that at times of high water release they may travel further to make their catch.

9. Since it is absolutely necessary to release certain volumes of water through the St. Lucie inlet the only possible means of alleviating the ill effects is to reduce the rate of flow and to increase its duration. This might be expected to limit the range of sediment transport and to bring about some improvement in the salinity characteristics of the area. It is, therefore., recommended that a careful study be made of these possibilities, as well as of the general nature of the ecological effects of the silt and the permanent effects of the salinity changes. Since the release of water might well be continued for a considerable number of years, and since many of the effects are relatively permanent it is considered of great importance that these effects be determined as fully as possible. In this way, the continuing effects of sediment may be estimated and an attempt made to forecast their long range effects on the ecology and fisheries of the St. Lucie.

INTRODUCTION

1. This report embodies the results of a preliminary study, carried out for the U. S. Army Corps of Engineers, on the effects caused by the release of water from Lake Okeechobee through the Caloosahatchee River and the St. Lucie Canal. Work began on this project July 1, 1953. The purpose of this survey was (a) to establish the general character of the problem, (b) to determine the general nature and extent of the fishing in the two estuaries and the nature of the effects produced by water releases upon these fisheries, (c) to determine insofar as was possible, that, if any, detailed investigations might usefully be made with a view to improving conditions.

2. Lake Okeechobee is roughly a circular body of water with an area of 730 square miles and a watershed of about 5,500 square miles. The main outlets are the Caloosahatchee River, extending from the southwest side of the lake to the Gulf of Mexico near Fort Myers, and the St. Lucie Canal which extends from the east side of the lake to the Atlantic Ocean near Stuart.

3. The Caloosahatchee River rises in Lake Okeechobee, has a drainage area of 1,040 square miles, and flows about 77 miles. The river follows a natural course although it has been dredged and straightened to provide a navigable channel. The water level is controlled by a lock at Moore Haven near the lake, and one at Ortona about 15.5 miles downstream. Releases of about 4,000 cubic feet per second are made through the Caloosahatchee River, when excess water must be released from Lake Okeechobee if storm run-off is not occurring from the natural drainage area of the river.

4. The St. Lucie Canal extends in an easterly direction from Lake Okeechobee for a distance of 28 miles and empties into the south fork of the St. Lucie River. The canal was dredged through sand land underlain by marl, and the water level is controlled by the St. Lucie lock which is 23 miles from the lake. When water must be released from the lake as per the present schedule of maintaining a safe lake level the releases through the St. Lucie Canal ray approach 10,000 cubic feet per second.

5. These results are offered as a basis upon which to judge the validity of complaints and to aid in delimiting further, more detailed investigations.

6. The results are considered in two sections (A) Caloosahatchee and (B) St. Lucie.

METHODS

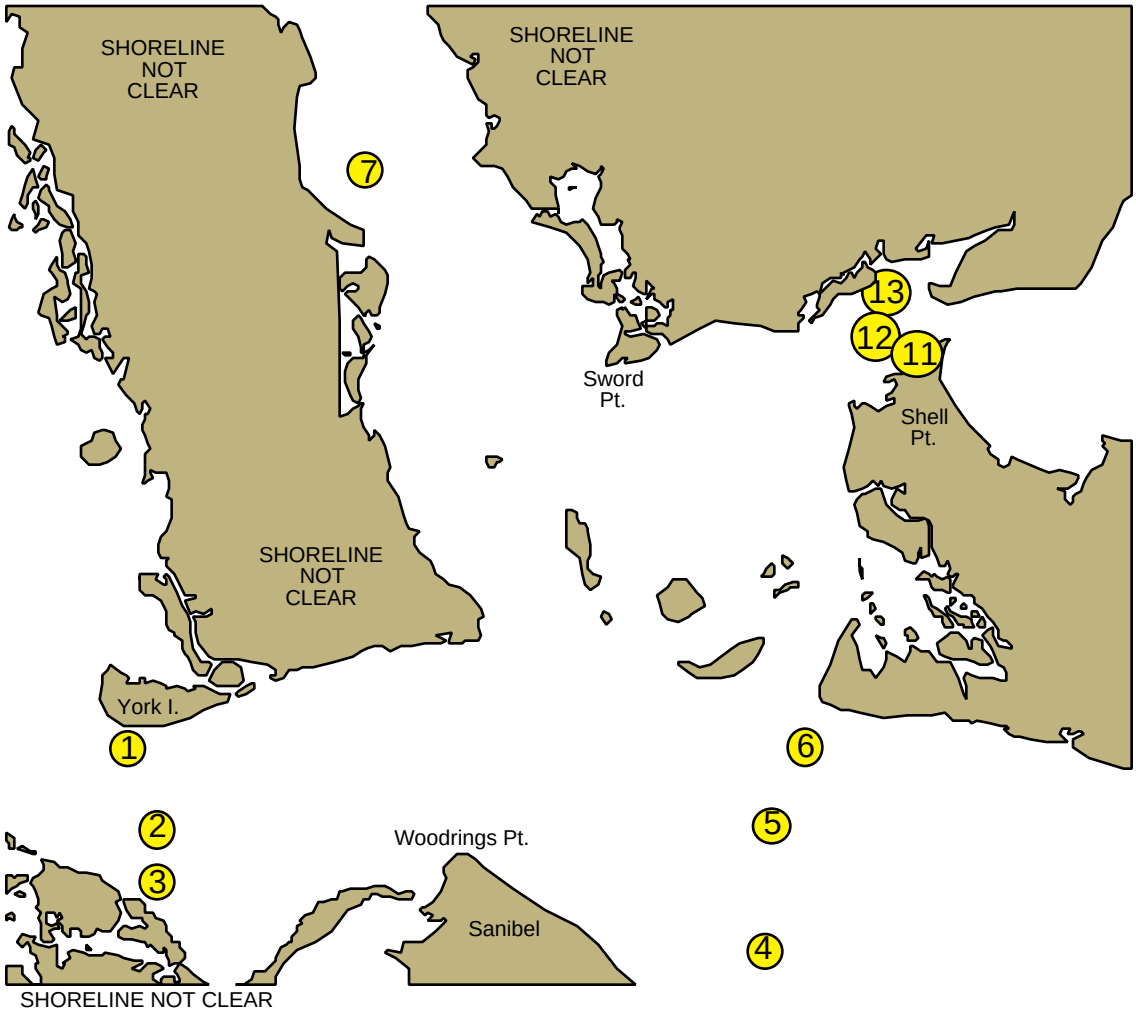
A field survey was made to determine the locations and the number of stations at which observations were to be made. Eight stations were selected in the Stuart area with further observations made along the upper river. Ten stations were selected in the Fort Myers area with further observations made along the Caloosahatchee River. Observations were made from high water to low water except at the locations further upstream where tidal effects were less noticeable.

Salinity was determined by hydrometer, pH was determined by use of a Fisher portable pH meter; dissolved oxygen was determined by a modification of the Winkler method; turbidity was determined by secchi disc readings; sediment traps consisted of wide mouth pint sized bottles secured to stakes nailed to existing pilings; anecdotal evidence was secured through interviews.

SECTION A

CALOOSAHATCHEE RIVER AND

FORT MYERS AREA AND ESTUARY



Map showing the location of stations near the mouth of the Caloosahatchee River. [NOTE: LARGE PORTIONS OF THE COMPLEX SHORELINE WERE NOT CLEAR IN ARCHIVE COPY.]

STATION #1

Southern shore of York Island. Depth 9 feet, July 20, 1953. Locks closed.

OBSERVATIONS

TIDAL STAGE	TEMPERATURE °C	SECCHI DISC Ft.	In.	pH	DISSOLVED OXYGEN % Saturation	SALINITY °/oo
			Surface			
H. W.	30.1	8	00	8.5	88.0	29.2
0.1 Ebb						
0.2 Ebb	30.8	6	09	8.3	89.1	29.3
0.3 Ebb						
0.4 Ebb						
0.5 Ebb						
0.6 Ebb						
0.7 Ebb						
0.8 Ebb	32.1	7	00	8.5	112.3	28.2
			Bottom			
H. W.	30.1			8.5	85.5	28.6
0.1 Ebb						
0.2 Ebb	31.8			8.4	91.3	28.3
0.3 Ebb						
0.4 Ebb						
0.5 Ebb						
0.6 Ebb						
0.7 Ebb						
0.8 Ebb	32.5			8.5	109.9	29.3

September 2, 1953. Lock open.

OBSERVATIONS

TIDAL STAGE	TEMPERATURE °C	SECCHI DISC Ft.	In.	pH	DISSOLVED OXYGEN % Saturation	SALINITY °/oo
			Surface			
0.8 Flood	29.0	5	08	8.1	68.7	13.7
0.9 Flood	29.0					13.5
H. W.						
0.1 Ebb	30.4	5	06	8.3	76.3	13.9
0.2 Ebb						
0.3 Ebb						
0.4 Ebb						
0.5 Ebb						
0.6 Ebb	31.5	5	00	8.3	112.4	15.3
0.7 Ebb						
0.9 Ebb	31.4	4	00	8.3	119.9	17.4
			Bottom			
0.8 Flood	29.0			8.1	41.8	28.8
0.9 Flood	29.0					
H. W.						
0.1 Ebb	31.0			8.1	73.2	25.1
0.2 Ebb						
0.3 Ebb						
0.4 Ebb						
0.5 Ebb						
0.6 Ebb	30.5			8.1	75.9	25.6
0.7 Ebb						
0.8 Ebb						
0.9 Ebb	30.4			8.1	69.9	25.1

NOTES:

Temperature: The temperatures recorded at this station were those which might be expected at the time of observations.

Secchi Disc Readings: At all stages of tide the water was clearer before the locks were opened.

pH: At all stages of tide the pH was a few tenths higher before the locks were opened. This change is not critical to fish.

Dissolved Oxygen: There is great fluctuation in the dissolved oxygen content. These fluctuations might be correlated with tidal changes. Both before and during the time the locks were open the higher values were recorded during the latter half of the ebb tide. However, the lower values recorded at or near high water are not critical to the fish.

Salinity: There is not much change in the salinities during any period due to the tidal. influence. There is, however, a reduction in salinity when the locks are open. This reduction is slight at the bottom; the greater reduction is in the surface water.

Fishing: During July and September, when these observations were made, fishing in this area was mainly for mullet and trout. Fishermen made good catches of both species in this general area during this tine.

During July the water from the Caloosahatchee River did not flow across San Carlos Bay as far as Pine Island or the northern shore of Sannibel Island. On the flood tide water from the Gulf would flow by Pt. Ybel end Woodrings Pt. on Sanibel Island and then into Pine Island Sound. The flow reversed itself during the ebb tide.

During September, after the locks were opened, the volume of flow from the Caloosahatchee River was greater. The seaward flow of the river water was diverted from its normal channel as the flood tide advanced across San Carlos Bay. The resulting flow was in a southeasterly direction toward Woodrings Point on Sanibel Island. As the flood tide advanced further into Pine Island Sound it carried with it the river water which had reached the area between St. James City and Woodrings Point. This accounts for the lowering of the salinity of the surface water.

STATION #2

By marker #10 Pine Island Sound. Depth 12 feet. July 20, 1953. Locks closed.

OBSERVATIONS

TIDAL STAGE	TEMPERATURE °C	SECCHI DISC Ft.	In.	pH	DISSOLVED OXYGEN % Saturation	SALINITY °/oo
			Surface			
0.9 Flood	29.8	9	04	8.5	85.5	29.5
H. W.						
0.1 Ebb						
0.2 Ebb	30.6	10	04	8.5	86.4	29.1
0.2 Ebb						
0.3 Ebb						
0.4 Ebb	31.0	10	00	8.3	84.4	28.5
0.5 Ebb						
0.6 Ebb						
0.7 Ebb						
0.8 Ebb						
0.9 Ebb	31.4	10	00	8.5	98.3	28.8
			Bottom			
0.9 Flood	29.2			8.5	75.9	29.5
H. W.						
0.1 Ebb						
0.2 Ebb	31.2			8.5	87.0	28.8
0.3 Ebb						
0.4 Ebb	30.6			8.3	81.9	28.6
0.5 Ebb						
0.6 Ebb						
0.7 Ebb						
0.8 Ebb						
0.9 Ebb	31.9			8.5	88.1	28.5

September 2, 1953. Locks open.

OBSERVATIONS

TIDAL STAGE	TEMPERATURE °C	SECCHI DISC Ft.	In.	pH	DISSOLVED OXYGEN % Saturation	SALINITY °/oo
			Surface			
H. W.						
0.1 Ebb	29.3	5	08	8.3	73.3	19.0
0.2 Ebb						
0.3 Ebb	31.0	5	10	8.3	68.8	21.3
0.4 Ebb						
0.5 Ebb						
0.6 Ebb	31.4	5	06	8.3	108.3	21.2
0.7 Ebb	31.0	5	00	8.3	105.4	20.8
Bottom						
H. W.						
0.1 Ebb	29.0			8.3	66.9	28.8
0.2 Ebb						
0.3 Ebb	30.0			8.1	57.8	29.3
0.4 Ebb						
0.5 Ebb						
0.6 Ebb	29.6			8.1	73.7	28.0
0.7 Ebb	29.2			8.1	66.7	27.7

STATION #3

Northeast shore of Sanibel Island near marker #10. Depth 6 feet. July 20, 1953. Locks closed,

OBSERVATIONS

TIDAL STAGE	TEMPERATURE °C	SECCHI DISC Ft.	In.	pH	DISSOLVED OXYGEN % Saturation	SALINITY °/oo
			Surface			
H.W.	30.0	6	00	8.5	81.0	28.6
			(Bottom)			
0.1 Ebb						
0.2 Ebb						
0.3 Ebb	30.8	6	00	8.4	106.3	28.8
			(Bottom)			
0.4 Ebb						
0.5 Ebb	31.8	6	00	8.4	114.3	28.6
			(Bottom)			
0.6 Ebb						
0.7 Ebb						
0.8 Ebb						
0.9 Ebb	31.8	6	00	8.5	131.6	28.1
			(Bottom)			
L.W.						28.3
			Bottom			
H. W.	29.5			8.5		28.2
0.1 Ebb						
0.2 Ebb						
0.3 Ebb	31.2				106.8	28.8
0.4 Ebb						
0.5 Ebb				8.4		28.9
0.6 Ebb						
0.7 Ebb						
0.8 Ebb						
0.9 Ebb	31.4			8.5	105.3	28.9
L. W.						

September 20, 1953. Locks open

OBSERVATIONS

TIDAL STAGE	TEMPERATURE °C	SECCHI DISC Ft.	In.	pH	DISSOLVED OXYGEN % Saturation	SALINITY °/oo
			Surface			
H. W.	29.6	5	10	8.2	76.6	20.9
0.1 Ebb						
0.2 Ebb						
0.3 Ebb						
0.4 Ebb	31.5	5	06	8.3	93.7	19.9
0.5 Ebb						
0.6 Ebb						
0.7 Ebb						
0.8 Ebb	31.4	5	02	8.3	128.9	20.6
0.9 Ebb						
L. W.	33.6	4	06	8.3	129.7	21.4
			Bottom			
H. W.	29.6			8.3	70.4	25.2
0.1 Ebb						
0.2 Ebb						
0.3 Ebb						
0.4 Ebb	31.0			8.1	71.3	27.7
0.5 Ebb						
0.6 Ebb						
0.7 Ebb						
0.8 Ebb	30.5			8.1	133.2	25.9
0.9 Ebb						
L. W.	30.8			8.3	134.9	22.4

NOTES:

Temperature: The Temperatures recorded at this station are those which might be expected at the time of observations.

Secchi Disc Readings: There is very little difference in the clarity of the water before and after the locks were opens.

pH: At all stages of the tide the pH was a few tenths higher before the locks were open. This small change is not critical to the fish.

Dissolved Oxygen: The conditions observed in this area were not critical.

Salinity: There was a small reduction in the salinities when the locks were open, This reduction is not severe or critical to the fish.

Fishing. See comments under Station #1.

STATION #6

Off Ferry Landing near Pt. Ybel, Sanibel Island. Depth 21 feet. July 21, 1953. Locks closed.

OBSERVATIONS

TIDAL STAGE	TEMPERATURE °C	SECCHI DISC Ft.	In.	pH	DISSOLVED OXYGEN % Saturation	SALINITY °/oo
			Surface			
H. W.	30.2	6	09	8.7	90.7	33.5
0.1 Ebb						
0.2 Ebb	30.8	4	02	8.7	93.1	32.7
0.3 Ebb						
0.4 Ebb						
0.5 Ebb						
0.6 Ebb						
0.7 Ebb						
0.8 Ebb	32.1	6	02	8.4	98.2	30.1
0.9 Ebb						
L. W.	32.0	6	02		102.6	27.1
			Bottom			
0.9 Flood						
H. W.	30.0			8.7	88.3	34.0
0.1 Ebb						
0.2 Ebb						
0.3 Ebb	30.6			8.7	85.2	34.0
0.4 Ebb						
0.5 Ebb						
0.6 Ebb						
0.7 Ebb						
0.8 Ebb	31.6			8.4	98.2	30.8
0.9 Ebb						
L. W.	31.5				95.3	30.6

September 5, 1953. Locks open.

OBSERVATIONS

TIDAL STAGE	TEMPERATURE °C	SECCHI DISC Ft.	In.	pH	DISSOLVED OXYGEN % Saturation	SALINITY °/oo
			Surface			
0.9 Flood	29.6	5	00	8.1	76.6	21.2
H. W.						
0.1 Ebb						
0.2 Ebb						
0.3 Ebb						
0.4 Ebb	30.6	5	06	8.1	99.6	29.1
0.5 Ebb	32.0	5	00	8.1	101.3	28.0
0.6 Ebb						
0.7 Ebb						
0.8 Ebb						
0.9 Ebb	30.6	3	03	8.2	97.1	21.6
			Bottom			
0.9 Flood	29.6			8.1	85.5	29.5
H. W.						
0.1 Ebb						
0.2 Ebb						
0.3 Ebb						
0.4 Ebb	30.6			8.1	96.7	31.5
0.5 Ebb	30.2			8.0	92.9	30.1
0.6 Ebb						
0.7 Ebb						
0.8 Ebb						
0.9 Ebb	30.0			8.1	81.6	25.5
L. W.						

NOTES:

Temperatures: The temperatures recorded at this station were those which might be expected at the time of observations.

Secchi Disc Readings: The water was generally clearer before the locks

pH: At all stages of the tide the pH was a few tenths higher before the locks were open. This small change is not critical to fish.

Dissolved oxygen: The conditions observed in this are not critical to fish.

Salinity: There is a small reduction in the surface salinities at times when the river water flow is great enough to reach this point. This reduction is not severe or critical for the fish especially since the salinity of the bottom water remains relatively unchanged,

General: There is mixing of water continually in the estuary, but the amount of river water which reaches this station does not appear to be excessive.

STATION #6

Off Punta Rassa by Ref. #12. Depth 12 feet. July 21, 1953. Locks closed.

OBSERVATIONS

TIDAL STAGE	TEMPERATURE °C	SECCHI DISC Ft.	In.	pH	DISSOLVED OXYGEN % Saturation	SALINITY °/oo
Surface						
H. W.						
0.1 Ebb						
0.2 Ebb	30.5	6	00	8.5	85.3	31.2
0.3 Ebb						
0.4 Ebb						
0.5 Ebb	31.8	5	06	8.5	91.3	26.8
0.6 Ebb						
0.7 Ebb	32.0	4	08	8.5	100.0	25.5
0.8 Ebb						
0.9 Ebb	32.4	3	08	8.5	103.4	20.0
Bottom						
H. W.						
0.1 Ebb						
0.2 Ebb	31.0			8.5	73.3	32.5
0.3 Ebb						
0.4 Ebb						
0.5 Ebb	31.5			8.5	88.1	29.8
0.6 Ebb						
0.7 Ebb	32.0			8.5	93.9	26.3
0.8 Ebb						
0.9 Ebb	31.8			8.5	100.9	24.8

September 5. 1953. Locks open.

OBSERVATIONS

TIDAL STAGE	TEMPERATURE °C	SECCHI DISC Ft.	In.	pH	DISSOLVED OXYGEN % Saturation	SALINITY °/oo
			Surface			
H. W.	30.0	4	08	8.1	89.0	27.6
0.1 Ebb						
0.2 Ebb						
0.3 Ebb						
0.4 Ebb	32.0	3	04	8.0	81.5	12.3
0.5 Ebb						
0.6 Ebb						
0.7 Ebb	31.8	2	08	8.1	69.4	12.6
0.8 Ebb						
0.9 Ebb						
L. W.	29.7	3	00	7.9	56.0	7.9
			Bottom			
H. W.						
0.1 Ebb	30.0			8.1	89.0	27.8
0.2 Ebb						
0.3 Ebb						
0.4 Ebb	32.0			8.1	87.6	23.4
0.5 Ebb						
0.6 Ebb						
0.7 Ebb	31.0			8.1	72.9	17.8
0.8 Ebb						
0.9 Ebb						
L. W.	29.6			8.0	61.2	12.6

NOTES:

Temperatures: The temperatures recorded at this station were those which might be expect at the time of observations.

Secchi Disc Readings: At all stages of the tide the water was clearer before locks were opened.

pH: At all stages of the tide the pH was a few tenths higher before the locks were opened. This magnitude of change is not critical to the fish.

Dissolved oxygen: The conditions observed in this area are not critical to the fish, although the values for the dissolved oxygen were generally lower during the time that the looks were open. The lowest value obtained for a surface sample taken at low tide when the locks were open was 56.0% saturation.

Salinity: There were changes in salinity at this station due to tidal action. These changes became more pronounced after the locks were opened than they had been before the locks were opened. When the volume of water flowing from the river is great the salinity at or near low water becomes a critical factor for some of the marine habitants. Near low water the salinity before the locks were opened was 20.0 $^{o}/_{oo}$ at the surface and 24.8 $^{o}/_{oo}$ on the bottom; when the locks were open the surface salinity was 7.9 $^{o}/_{oo}$ and the bottom salinity was 12.6 $^{o}/_{oo}$

Fishing: Fishing is considered to be poorer here when the locks are open, The commercial fishermen who catch trout by using trolling gear are not able to make catches in this area when the locks are open. They have been successful when they crossed the bay and fished the area around St. James City. These experiences suggest that such species as trout move from this area when the salinity of the water falls below that which they prefer.

The death of live bait such as minnows and shrimp which are held in tanks at this point is additional evidence that the influx of fresh water is great enough to cause mortalities or movements of marine forms from this area.

STATION #5

Between Punta Rassa and Sanibel Islands Depth 9 feet. July 21, 1953. Locks closed.

OBSERVATIONS

TIDAL STAGE	TEMPERATURE °C	SECCHI DISC Ft.	In.	pH	DISSOLVED OXYGEN % Saturation	SALINITY °/oo
			Surface			
H. W.	30.5	3	04	8.5	88.9	33.5
0.1 Ebb	30.3	4	02	8.5	85.5	32.3
0.2 Ebb						
0.3 Ebb	31.4	5	03	8.5	96.0	32.0
0.4 Ebb						
0.5 Ebb						
0.6 Ebb						
0.7 Ebb	32.4	5	10	8.5	108.8	28.1
0.8 Ebb						
0.9 Ebb	32.2	4	00	6.5	109.0	22.9
			Bottom			
H.W.	30.6			8.5	88.9	33.2
0.1 Ebb	30.3			8.5	88.1	33.1
0.2 Ebb						
0.3 Ebb	31.4			8.5	107.4	32.5
0.4 Ebb						
0.5 Ebb						
0.6 Ebb						
0.7 Ebb	32.3			8.5	117.7	26.9
0.8 Ebb						
0.9 Ebb	32.1			8.5	108.0	21.6

September 5, 1953. Locks open.

OBSERVATIONS

TIDAL STAGE	TEMPERATURE °C	SECCHI DISC Ft.	In.	pH	DISSOLVED OXYGEN % Saturation	SALINITY °/oo
			Surface			
H. W.	29.5	6	00	8.1	84.7	29.3
0.1 Ebb						
0.2 Ebb						
0.3 Ebb	29.8	5	00	8.2	98.3	29.5
0.4 Ebb						
0.5 Ebb						
0.6 Ebb	32.0	3	03	8.1	88.7	14.9
0.7 Ebb						
0.8 Ebb						
L. W.	30.0	3	06	8.3	103.9	15.6
			Bottom			
H. W.	29.6			8.1	85.1	29.5
0.1 Ebb						
0.2 Ebb				8.1	98.5	29.8
0.3 Ebb	29.8					
0.4 Ebb						
0.5 Ebb				8.1	102.1	22.7
0.6 Ebb	32.0					
0.7 Ebb						
0.8 Ebb						
0.9 Ebb				8.2	100.4	19.7
L. W.	30.0					

NOTES:

Temperature: The temperatures recorded at this station were those which might be expected at the time of observations.

Secchi Disc Readings: There is no reduction in the clarity of the water here due to the locks being open except at times during ebb tide when a surface layer of river water flows by this area.

pH: At all stages of tide the pH was a few tenths higher before the locks were open. This small change is not critical to fish.

Dissolved Oxygen: The conditions observed in this area are not critical to fish.

Salinity: There is a lowering of the salinity of the water during the latter part of the ebb tide due to the greater amount of river water present in the estuary after the locks were open. At no time was the bottom salinity greater than 7 $^{o}/_{oo}$ lower when the locks were open than it was before they were opens This change is not severe or critical in this area.

General: See comments under Station A.

STATION #7

Matlacha Pass of Reckems Point. Depth 7 feet. July 22,1953. Locks closed.

OBSERVATIONS

TIDAL STAGE	TEMPERATURE °C	SECCHI DISC Ft.	In.	pH	DISSOLVED OXYGEN % Saturation	SALINITY °/oo
			Surface			
H. W.	31.0	7	00	8.5	70.5	21.6
				(bottom)		
0.1 Ebb	31.5	7	00	8.5	87.9	21.6
				(bottom)		
0.2 Ebb	31.7	7	00	8.5	81.6	20.8
				(bottom)		
0.3 Ebb	31.5	7	00	8.5	79.5	21.6
				(bottom)		
0.4 Ebb	32.8	7	00	8.5	117.5	20.9
				(bottom)		
			Bottom			
H. W.	31.0			8.5	70.5	21.6
0.1 Ebb	31.7			8.5	81.6	20.8
0.2 Ebb	31.2			8.5	58.8	21.3
0.3 Ebb	32.0			8.5	75.0	21.2
0.4 Ebb	31.8			8.5	115.5	21.3

September 11, 1953. Locks open.

OBSERVATIONS

TIDAL STAGE	TEMPERATURE °C	SECCHI DISC Ft.	In.	pH	DISSOLVED OXYGEN % Saturation	SALINITY °/oo
			Surface			
0.9 Flood	29.0	2	11	7.8	59.9	4.8
H. W.	29.5	2	10		52.7	3.7
0.1 Ebb						
0.2 Ebb						
0.3 Ebb						
0.4 Ebb						
0.5 Ebb	27.2	3	02	7.8	44.3	5.8
0.6 Ebb	27.5	3	02	7.6	30.1	5.1
0.7 Ebb						
0.8 Ebb	27.8	3	02	7.8	48.4	6.3
0.9 Ebb						
L. W.	28.0	4	00	7.8	44.8	5.2
			Bottom			
0.9 Flood	29.0			7.9	49.0	4.8
H. W.	29.0				43.7	3.8
0.1 Ebb						
0.2 Ebb						
0.3 Ebb						
0.4 Ebb						
0.5 Ebb	27.2			7.8	47.9	5.8
0.6 Ebb	26.7			7.6	26.2	5.1
0.7 Ebb						
0.8 Ebb	27.6			7.8	50.0	6.2
0.9 Ebb						
L. W.	27.8			7.8	44.6	5.5

September 11, 1953. Locks open.

OBSERVATIONS

TIDAL STAGE	TEMPERATURE °C	SECCHI DISC Ft.	In.	pH	DISSOLVED OXYGEN % Saturation	SALINITY °/oo
			Surface			
0.9 Flood	29.0	2	11	7.8	59.9	4.8
H. W.	29.5	2	10		52.7	3.7
0.1 Ebb						
0.2 Ebb						
0.3 Ebb						
0.4 Ebb						
0.5 Ebb	27.2	3	02	7.8	44.3	5.8
0.6 Ebb	27.5	3	02	7.6	30.1	5.1
0.7 Ebb	27.8	3	02	7.8	48.4	6.3
0.8 Ebb						
0.9 Ebb						
L. W.	28.0	4	00	7.8	44.8	5.2
			Bottom			
0.9 Flood	29.0			7.9	49.0	4.8
H. W.	29.0				48.7	3.8
0.1 Ebb						
0.2 Ebb						
0.3 Ebb						
0.4 Ebb	27.2					
0.5 Ebb				7.8	47.9	5.8
0.6 Ebb	26.7			7.6	26.2	5.1
0.7 Ebb						
0.8 Ebb	27.6			7.8	50.0	6.2
0.9 Ebb						
L. W.	27.8			7.8	44.6	5.5

NOTES:

Temperature: The temperatures recorded at this station were those which might be expected at the time of observations,

Secchi Disc Readings: At all stages of tide the water was clearer before the lock were opened.

pH: The pH before the locks were open ranged from 8.5 to 8.7. The pH during the period when the locks were open ranged from 7.6 to 7.9. This change is not critical to the fish.

Dissolved Oxygen: The dissolved oxygen content was noticeably lower during the period when the locks were open. At all stages of tide the values recorded when the locks were open are suboptimal for most fish. The values varied from 26.2% to 59.9% saturation during different stages of the tide. This is in contrast with values of from 70.5% to 117.5% saturation measured before the locks were opened,

Salinity: The salinity of this area does not vary greatly during the tidal cycles. Salinities of from 20.3 ^{o}/oo to 21.6 ^{o}/oo were recorded before the locks were opened. After the locks were open the salinities had dropped ranging from 3.7 ^{o}/oo to 6.3 ^{o}/oo. This drop in salinity is severe enough to cause the species of fish preferring a more saline habitat to temporarily leave this area. It is also severe enough to cause the death of forms unable to migrate from this areas.

Fishing: Fishing in this area for such species as mullet and snook was good both before the locks were opened and during the time that they were open. The fishing for trout was good in this area before the locks were open but during the time that the locks were open the trout were not caught here.

General: The dividing line separating the tidal influences felt in Matlacha Pass is in the vicinity of McCardle Island. To the south of this island the tide comes in through San Carlos Bay. To the north of this island the tide comes in through Charlotte Harbor. This dividing line may be forced in either direction by unusual conditions of wind and weather.

As has been stated under general notes for Station #12, the full flood tide forces the river water back into Matlacha Pass. For this reason the salinities measured at this station show a lower salinity during, the period of high water than they do during the period of low water. The water flowing past this point on the ebb tide shows little change in salinity.

STATION #11

Caloosahatchee River by marker #11. Depth 8 feet. July 23, 1953. Locks closed.

OBSERVATIONS

TIDAL STAGE	TEMPERATURE °C	SECCHI DISC Ft.	In.	pH	DISSOLVED OXYGEN % Saturation	SALINITY °/oo
			Surface			
H. W.	30.5	5	06	8.5	69.9	31.0
0.1 Ebb						
0.2 Ebb	30.6	6	00		73.3	28.6
0.3 Ebb						
0.4 Ebb	30.0	5	00		66.0	23.5
0.5 Ebb						
0.6 Ebb						
0.7 Ebb	29.0	3	08			17.0
			Bottom			
H.W.	30.5			8.5	68.3	32.1
0.1 Ebb						
0.2 Ebb	30.5				56.5	30.4
0.3 Ebb						
0.4 Ebb	29.8				66.7	25.5
0.5 Ebb						
0.6 Ebb						
0.7 Ebb	29.0				50.1	17.2

September 3. 1953. Locks open.

OBSERVATIONS

TIDAL STAGE	TEMPERATURE °C	SECCHI DISC Ft.	In.	pH	DISSOLVED OXYGEN % Saturation	SALINITY °/oo
			Surface			
H. W.	30.5	3	04	8.0	60.8	13.9
0.1 Ebb						
0.2 Ebb						
0.3 Ebb						
0.4 Ebb						
0.5 Ebb	31.5	3	00	7.9	52.0	4.5
0.6 Ebb						
0.7 Ebb	29.8					4.3
			Bottom			
H. W.	30.2			8.0	57.0	26.5
0.1 Ebb						
0.2 Ebb						
0.3 Ebb						
0.4 Ebb						
0.5 Ebb	30.5			7.9	55.9	22.6
0.6 Ebb						
0.7 Ebb	28.5					3.9

NOTES:

Temperature: The temperatures recorded at this station were those which might be expected at the time of observation.

Secchi Disc Reading: At all stages of tide the water was dearer before the locks were opened,

pH: The pH was a few tenths higher before the locks were opened. This small change is not critical to the fish.

Dissolved Oxygen: There is little difference noted in the dissolved oxygen content at this point in the river during the times of sampling. At or near the end of the ebb tide the values of from 50 to 55% saturation are suboptimal but do not reach the critical stage for most fish.

Salinity: When the rate of flow of the river is slow this area is well flushed with gulf water during most of the tidal cycle. When the rate and volume of flow becomes great, as it is during periods of flood or during periods when the locks are open, the flood tide is still able to penetrate to this area, but to a lesser degree. During the periods of low tides there is a severe lowering of the salinity to about 4 $^{o}/_{oo}$ which probably causes a temporary exodus from this area of the species of fish preferring a more saline habitat. This lowered salinity could also cause the death of those forms of marine life unable to migrate from this environment.

Fishing: This area is fished both commercially and by the sport fisherman. Fishermen continue to catch crabs in this area. Sport fishermen have erratic success in fishing for bottom fish. Both sport and commercial fishermen have noted an absence of trout from this area during periods when the locks are open. The trout apparently move from this area,

STATION #12

Caloosahatchee River between Shell Point and Jewfish Creek. Depth 12 feet. July 23, 1953 . Locks closed.

OBSERVATIONS

TIDAL STAGE	TEMPERATURE °C	SECCHI DISC Ft.	In.	pH	DISSOLVED OXYGEN % Saturation	SALINITY °/oo
			Surface			
H. W.						
0.1 Ebb	30.2	6	00	8.4	67.2	25.5
0.2 Ebb						
0.3 Ebb	30.6	6	02		64.4	27.8
0.4 Ebb						
0.5 Ebb						
0.6 Ebb						
0.7 Ebb	29.0					17.3
			Bottom			
H. W.						
0.1 Ebb	30.5			8.4	65.2	30.2
0.2 Ebb						
0.3 Ebb	30.2				62.0	26.0
0.4 Ebb						
0.5 Ebb						
0.6 Ebb						
0.7 Ebb	29.0					18.1

September 3, 1953. Locks open.

OBSERVATIONS

TIDAL STAGE	TEMPERATURE °C	SECCHI DISC Ft.	In.	pH	DISSOLVED OXYGEN % Saturation	SALINITY °/oo
			Surface			
H. W.						
0.1 Ebb						
0.2 Ebb	30.6	3	04	7.9	48.6	12.3
0.3 Ebb						
0.4 Ebb						
0.5 Ebb	30.8	2	09	7.8	52.4	5.2
			Bottom			
H. W.						
0.1 Ebb						
0.2 Ebb	30.2			7.9	51.7	23.0
0.3 Ebb						
0.4 Ebb						
0.5 Ebb	30.5			7.8	55.0	14.1

NOTES:

Temperature: The temperatures recorded at this station were those which might be expect at the time of observations.

Secchi Disc Readings: At all stages of tide the water was clearer before the locks were open.

pH: At all stages of tide the pH was a few tenths higher before the locks were opened. This small change is not critical to the fish.

Dissolved Oxygen: The dissolved oxygen content was slightly lower after the locks were opened. Dissolved oxygen values from 48.6% to 55% saturation were recorded when the locks were open. These values are suboptimal but not critical for most fish.

Salinity and Fishing: See comments under Station #11.

STATION #13

Caloosahatchee River, north shore, opposite Shell Point. Depth 10 feet. July 23, 1953. Locks closed.

OBSERVATIONS

TIDAL STAGE	TEMPERATURE °C	SECCHI DISC Ft.	In.	pH	DISSOLVED OXYGEN % Saturation	SALINITY °/oo
			Surface			
H. W.						
0.1 Ebb	30.4	5	04	8.3	62.0	21.8
0.2 Ebb						
0.3 Ebb	30.3	5	00		65.6	21.4
0.4 Ebb						
0.5 Ebb						
0.6 Ebb						
0.7 Ebb						
			Bottom			
H. W.						
0.1 Ebb	30.5			8.3	57.0	25.6
0.2 Ebb						
0.3 Ebb	30.3				59.4	26.8

September 3s 1953. Locks open.

OBSERVATIONS

TIDAL STAGE	TEMPERATURE °C	SECCHI DISC Ft.	In.	pH	DISSOLVED OXYGEN % Saturation	SALINITY °/oo
			Surface			
0.3 Ebb	30.2	3	02	7.9	47.3	8.8
0.4 Ebb						
0.5 Ebb						
0.6 Ebb	29.9	3	00	7.7		6.0
			Bottom			
0.3 Ebb	30.0			7.9	49.6	11.1
0.4 Ebb						
0.5 Ebb						
0.6 Ebb	29.8			7.7		8.4

NOTES:

Temperature: The temperatures recorded at this station were those which might be expect at the time of observations.

Secchi Disc Readings: At all stages of the tide the water was clearer before the locks were opened.

pH: The pH was a few tenths higher before the locks were opened. This small change is not critical to the fish.

Dissolved Oxygen: The dissolved oxygen content was slightly lower after the locks were opened. Dissolved oxygen values from 47.3% to 49.6% saturation were recorded when the locks were open. These values are suboptimal but not critical for most fish.

Salinity: There is less penetration of gulf water here than there is along the southern shore of the river by Shell Point. This is because the flood tide enters the river from the south. For additional comments see notes under Station #11.

Fishing: See comments under Station #11.

General: As the tide floods at Shell Point the direction of flow of the water emptying from the river is diverted to the westward. During periods when the locks are not open, or when the rate of flow is slow, the volume of water that flows westward across the flats toward Pine Island is small. The volume of water leaving the river is great when large amounts of water are released from the lake or during times of flood. This water flows into the northeastern part of San Carlos Bay on the ebb tide. On the incoming flood tide part of the river water is diverted to flow in the direction of Pine Island covering the intervening 1lats with river water. The full flood tide then forces this water back into Matlacha Pass as far north as McCardle Island.

Caloosahatchee River Observations

Date	Location	Temperature	Secchi Disc			Dissolved Oxygen	Salinity
		°C	Ft.	In.	pH	% Saturation	o/oo
July 29, '53	La Belle	28.3	2	05	7.2	30.6	1.1
	La Belle	28.3			7.2	29.2	1.1
	Olga	28.2	2	04	7.2	38.3	1.1
	Olga	28.2			7.2	36.0	1.1
July 30, '53	Edison Br.	29.8	2	03	7.4		0.9
Sept 10, '53	La Belle	29.0	1	08	7.2	26.2	0.6
	La Belle	28.9			7.2	26.0	0.6
	Olga	28.9	1	08	7.3	27.6	O.6
	Olga	28.7			7.2		0.4
July 24,'53	Edison Br.	27.2	2	06	8.0	58.8	1.5
	Edison Br.	27.5			7.9	40.1	2.0
	Edison Br.	27.2	2	06	7.9	58.6	0.9
	Edison Br.	27.2			7.9	50.2	1.2
	Edison Br.	27.2	2	06	7.9	56.9	0.9
	Edison Br.	27.0			7.9	56.7	0.9
	Edison Br.	26.9	2	04	7.9	54.9	0.8
	Edison Br.	26.9			7.9	60.0	0.8
Sept 10, '53	Edison Br.	29.8	2	04	7.4	40.1	0.9
	Edison Br.	29.8			7.4	38.2	0.9

NOTES:

Temperature: The temperatures recorded along the river are those which might be expected at the time of observations.

Secchi Disc Readings: There was little difference in the readings.

pH: The pH decreases going upstream, when the locks are open the waters with lower pH extend further toward the mouth of the river. The lower pH values of 7.2 to 7.4 are not critical factors alone, and are found in the river independent of Lake water releases.

Dissolved Oxygen: The dissolved oxygen content of the river waters was low during the time of observations. The release of lake water extended this area of lower oxygen water further downstream.

Salinity: Some Gulf of Mexico water is able to penetrate as far as the Edison Bridge in Fort Myers during periods when the river flow is not excessive. At times when the locks are open the flow of river water prevents the tides from penetrating to this point.

Fishing: There is a commercial crab fishery located in the Caloosahatchee River from the vicinity of the Edison Bridge at Fort Myers to the river's mouth, when water is released from the lake the fishermen are forced to conduct operations closer to the mouth of the river. This fishery is at present being studied to determine the normal migration of the crab in this area. A full evaluation of this situation cannot be made at present, however, despite the tolerance of the crab for low salinities it is believed that the totally "fresh water" connected with maximum discharge would restrict the limit of the crabs penetration into the river during these times.

SEDIMENT SAMPLES

Samples were taken during the period after the locks were opened on August 1, 195?? [NOTE: LINE CUT OFF IN ARCHIVE COPY.]

Sample No.	Location	Depth	Days Out	Dates	Dry Wt.
1	Olga Bridge	3	42	July 30-Sept 10	67.09
2	Marker #23 Matlacha Pass	6	12	July 31-Sept.11	11.83
3	Marker #23 1,1atlacha Pass	1	42	July 31-Sept.11	3.08
4	Bay Marker #11 Cal. R.	6	33	July 31-Sept. 2	19.25
5	Bay Marker #11 Cal. R.	1	33	July 31-Sept. 2	2.73
6	Edison Br. Cal. R.	6	40	Aug. 1-Sept. 10	0.49

DESCRIPTION OF WET SAMPLES

Sample No.	
1	Organic ooze - small amount of plant fibers
2	Organic ooze and shell fragments
3	Organic ooze - small amount of shell fragments
h	Organic ooze and shell fragments
5	Organic ooze and shell fragments
6	Organic ooze.

ANECDOTAL EVIDENCE

Name: Mr. and Mrs. Ainsworth
Location: Fort Myers Beach
Occupation: Operate a tackle and live bait shop at Snug Harbor; they also have boat docks and are agents for charter boat fishermen.
Statement: The opening of the locks does not affect their business. They feel that they are far enough away from the influence of any of the water coming from the Caloosahatchee river. They are, however, affected by outbreaks of Red Tide and wonder if that is caused by the quantities of river water entering the gulf.

Name: Captain Walter Bostick
Location: Fort Myers Beach
Occupation Charter boat captain operating out of Snug Harbor
Statement: He says that he is unaffected.

Name: Mr. Peed
Location: Fort Myers Beach
Occupation Manager of the Bonita Fish Company
Statement: His fishermen do not complain to him about the conditions and he thinks he is unaffected.

Name: Mr. Snodgrass
Location: Fort Myers Beach
Occupation Manager of the Dixie Fish Company
Statement: Same as Mr. Peed

Name: S. C. Williams and C. R. Collier
Location: Punta Rassa
Occupation They rent boats and sell live bait to sport fishermen. They also are purchasing agents for a wholesale fish company.
Statement: They complain that when the locks are open the water by their place becomes fresh instead of its normally brackish condition. They have their live bait tanks set up using a continual flow of this water. When the water becomes fresh they lose their bait which consists of minnows and shrimp, The only way they can keep bait is in the open gulf water. They have had a loss of several hundred dollars worth of bait during 1951 and 1952. They further complain that the trout fishing about two and one half miles north of their camp in the Caloosahatchee River is good except when the locks are open.
They also remark about a dark green moss which fouls up the nets of the commercial fishermen during late summer.
On July 30, 1953 they lost all their live bait. Prior to this date they were not having any trouble keeping fish and shrimp alive in the tanks.

Name : Mel and Thelma Waite
Location: Iona Cove
Occupation: Operate a fish camp and have docks and a marine way for hauling and repair work. They also sell live bait to fishermen.
Statement: They complain that they lose their live bait, which consists of minnows and shrimp, when the locks are open. The opening of the locks also causes the fresh water to kill the oysters in Iona Cove and on the bars in the mouth of the Caloosahatchee River. They say these oysters are at times gathered commercially by fishermen from Sarasota. They also complain that the East Coast politicians use their influence to have all the water from Lake Okeechobee

emptied out on the West Coast and have none on the East Coast. Their estimated loss for 1952 was about five hundred dollars.

Name: Mr. Thomas Smoot
Location: Fort Myers
Occupation Owner and operator of the South Fish Company, a wholesale fish company. They own several smaller houses in this area.
Statement: He does not think the opening of the locks affects his business which is concerned with the commercial fisheries in this areas.

Name: Mr. Guy H. Gourley
Location: St. James City, Pine Island
Occupation Retired
Statement: He knows little about any damage being done in this area because of the locks being open.

Name: P.A. Barnhill
Location: St. James City, Pine Island
Occupation Operator of a boat rental and live bait business at St. James City. He is also a commercial fisherman. In September 1953 he leased out his rental and bait business and now devotes all his time to commercial fishing.
Statement: He doesn't think the opening of the locks hurts his business. He says that mullet fishing in September 1953 has been very good. During the early part of the month of September 1953 they were shut off on mullet several times. Two men caught 2,000 lbs of mullet and trout during two days in September 1953.

Name: Harrison and Samuel Woodring
Location: Sanibel Island
Occupation: Commercial Fishermen
Statement: They do not have much to complain about except that the water gets dirty when the locks are open. They do not know how much this hurts the trout fishing.

Name: J. B. De Shazo
Location: Fort Myers
Occupation: Crabber
Statement: They do not complain but remark that with all the rain at this time of the year they have to move further down the river, toward the mouth, in order to catch their crabs. As of the first of September 1953 they were doing their crabbing near Shell Point on the Caloosahatchee River and for a little way up the river.

Name: J.W. Airriwood
Location: Lives aboard his cruiser, he sometimes ties up at St. James City
Occupation: Commercial fisherman
Statement: He has noticed the change in the color of the water when the locks are open but does not think this affects the mullet which are the principal fish.

Name: Manuel Tomilson
Location: St. James City, Pine Island
Occupation: Commercial Fisherman and construction worker
Statement: His mullet catches nave been good throughout September however his wife has complained that the dirty water has affected her trout fishing adversely.

Name: Clyde Dampier
Location: St. James City, Pine Island.

Occupation: Manager of a commercial fish wholesale house
Statement: They have bean landing plenty of mullet at his fish house.

Name: Mr. L.C. Piner
Location: Pine Island
Occupation: Owner and operator of a wholesale scallop and crab house.
Statement: He does not think the opening of the locks hurts his business.

Name: James K. Keene
Location: Pine Island
Occupation: Operates a wholesale fish house on Pine Island
Statement: Mr. Keene states that during the winter the water of Matlacha Pass is usually very clear. This he opines is not the most favorable condition for fishing. During the spring the water becomes less transparent and with some runoff from the land of fresh water the conditions of fishing are at their best. The fish seem to swarm toward the area of brackish water. However as more fresh water is poured from the rivers the salt water species are driven further out to seaward. and the fishermen have to travel further to make their catch, At this time many fresh water species appear in what is normally a salt water environment. They are eventually killed as the water becomes more saline. He concludes that the opening of the locks on the river causes an abnormal freshening of the water which is detrimental to the fisheries.

Name: Mr. Daniel Jursik
Location: Fort Myers
Occupation: Owner and operator of Daniels Seafood Company, dealers in crabs and scallops.
Statement: During February 1952 this company reported that 2670 shedding crabs they were holding were killed by fresh water when the Army Engineers opened the locks to lower the water in Lake Okeechobee. At this time of year, September 1953 his men have to go further down the river toward its mouth before they can catch any crabs. A few months before this they were catching crabs a few miles further up the river.

Name: Frank Richards
Location: Punta Rassa
Occupation: Fisherman
Statement: He caught 146 lb. of trout on September 5, 1953 over at the St. James cutoff by St. James City. The trout move around; usually he does not have to go across the bay but that is where the trout are now.

Numerous people complained of the water hyacinths in the river during the spring of 1954.

DISCUSSION

TEMPERATURES

The temperatures recorded from this area were those which might be expected at the time of observations. Observed temperatures were in many instances above 30 °C. These high temperatures were due to seasonal climatic changes and not caused by the release of water from Lake Okeechobee.

HYDROGEN ION CONCENTRATION (pH)

The pH of the water in tile Caloosahatchee River and its tributaries is lower than the pH of the water in the estuary, or in the Gulf of Mexico, or in Lake Okeechobee. When the rate of flow of the river is increased by rainfall or of the release of water from the lake the net effect, as affects the hydrogen ion concentration, is a lowering of the pH in the estuary.

At various locations in the estuary the pH range was from 8.3 to 8.7 before the water releases. During the time that water was being released the pH range was from 7.6 to 8.3. In most cases the pH was lowered a small amount due to the water releases but still remained above 8.0. A pH of 7.2 was measured in the upper river both before and during the time that water was being released. Near the mouth of the river the lowest pH measured during the that water was being released was 7.8, in Matlacha Pass during this period the lowest pH measured was 7.6. In other areas the effect was not large or critical.

DISSOLVED OXYGEN

Dissolved oxygen values taken before and during the release of water from Lake Okeechobee show that the effect of the water release is to lower the dissolved oxygen content of water in the estuary. This effect is most pronounced in Matlacha Pass where dissolved oxygen values from 68.8% to 117.5% saturation were recorded on July 22, before the release of water from Lake Okeechobee; on September 3-11 during the period when water was being released from the lake, the dissolved oxygen values in this area ranged from 26.2% to 59.91% saturation. In other areas the effect is noticeable but not large or critical. In the river there were only small differences in the dissolved oxygen measurements made before and during the periods of water releases. Lower values were obtained upriver both before and during the period of water releases.

SALINITY AND TIDAL EFFECTS

Changes in the conditions measured in the estuary were closely linked With the opening of the locks which released water from Lake Okeechobee through the Caloosahatchee River. The magnitude of the charges in the different areas was Proportional to the amount of river water which reached the various locations in the estuary.

Seasonal climatic changes contribute to some of these differences, however, it is believed that at the time of sampling the water being released from the lake was mainly responsible.

The river water, which includes water being released from the lake, is easily distinguished from the ocean or estuarine water. It is characterized by its freshness, low pH, low oxygen content and visibly by its color.

When the flow of the river was increased by the release of lake water the incoming tide did not penetrate as far up the river. The effect was to change the river, from near its mouth to Fort

Myers, from an estuarine to a riparian situation. It is believed that this change would occur although to a lesser extent, as a result of the increased amount of rainfall during the autumn.

In San Carlos Bay and the approach to Pine Island Sound the effects of the greater volume of river water, which enters this area when the locks are open, were more noticeable in the eastern part of the bay. At Punta Rassa the salinity was measured during a tidal cycle before the locks were opened. Near high water the surface salinity was 31.2°/oo, the bottom salinity was 32.5°/oo. Near low water the surface salinity was 20.0°/oo and the bottom salinity was 24.8°/oo. During the period that the locks were open the salinities measured at this station were 27.6°/oo at the surface and 27.8°/oo on the bottom at high water. At law water the surface salinity was 7.9°/oo and the bottom salinity was 12.6°/oo.

The following conditions cause changes to occur in the Matlacha Pass area from McCardle Island south to Merwin Key. As the tide floods at Shell Point the direction of flow of the water emptying from the river is diverted to the westward. During periods when the looks are not open, or when the rate of flow is low, the volume of water that flows westward across the flats toward Pine Island is small. The volume of water leaving the river is great when large amounts of water are released from the lake or during times of flood. This water flows into the northeastern part of San Carlos Bay on the ebb tide. On the incoming flood tide part of the river water is diverted to flow in the direction of Pine Island covering the intervening flats with river water. The full flood tide then forces this water back in Matlacha Pass. These effects are felt in Matlacha Pass as far north as McCardle Island. To the north of this point the tide comes in through Charlotte Harbor unless this situation is changed by unusual conditions of wind and weather.

The salinity of the Matlacha Pass area did not vary greatly during the tidal cycles. Salinities from 20.3°/oo to 21.6°/oo were recorded in this area during a tidal cycle before the locks were open. Salinities measured during the period that the locks were open measured form 3.7°/oo to 6.3°/oo. This drop in salinity is severe enough to cause the species of fish which prefer a more saline habitat to temporarily leave this area. It is also severe enough to cause the death of forms unable to migrate from this area. Oysters, on bars in Matlacha Pass, did survive during these conditions.

The area around St. James Point on Pine Island is not seriously affected by the increase in the river flow when large amounts of water are released from the lake or during times of flood. At these times the greatest difference occurs in the salinity of the surface water. Measurements of the surface salinity before the locks were opened were from 28.2°/oo to 29.3°/oo during the tidal cycle. During the Period that the locks were open the surface salinities measured from 13.5°/oo to 17.4°/oo. Bottom salinities measured from 28.3°/oo to 29.3°/oo before the locks were open and from 25.1°/oo to 28.9°/oo when the locks were open. This condition is not critical.

SEDIMENTS

All of the sediment samples collected from the Fort Myers area consisted mainly of black organic ooze. A small amount of plant fibers and detritus was found in Sample #1 taken from the upper river at Olga. A small amount of shell fragments was found in the samples taken from the estuary. None of the samples contained any amount of quartz.

Sample #1, taken at the bridge at Olga during the month of August, 1953 contained the greatest amount of sediment. It appears that greater amounts of organic ooze are deposited in the river

than in the estuary. The sediment transported beyond the mouth of the river was widely dispersed and was not deposited in any amount critical to the fisheries in the area investigated,

Deposition of sediments in the river and navigation channels is a damage being caused by water release which does not directly affect the fisheries of this area.

FISHERIES

Only a part of the commercial and sport fishing carried out in Lee County occurs in waters which are directly affected by the releases of water from Lake Okeechobee. No statistics are available which could validly be employed to evaluate the effects of the water releases upon this part of the Lee County Fishery .

The commercial net fishermen active in the area affected by the water releases do not complain of direct damages for these reasons:

(1) They are not solely dependent upon the area affected by the water releases from which to make their catch.

(2) Areas not directly affected by the water releases are readily accessible to them.

(3) The areas affected by the water releases are not the major fishing grounds.

(4) Good catches of mullet are made in areas affected by the water releases.

(5) Fishing is generally good during the autumn when the mullet runs occur. Because of economic factors the fishermen often are forced to cease fishing. Production is not a problem during this season. This is coincidental with the major portion of the water releases. (This statement is not meant to imply that the water releases benefit the fishery.)

Commercial fishermen using trolling gear do fish the area affected by the water releases. The species fished is the sea trout. They cannot successfully fish this species near the mouth of the Caloosahatchee River or in the southern half of Matlacha Pass when the flow of water from the river is great enough to so reduce the salinity that this species of fish moves from this area. They cannot successfully catch this species when using surface trolling rigs in the vicinity of St. James City when a surface layer of discolored water of low salinity is present. Sea trout are caught commercially at this time in the vicinity of St. James City in water not directly affected by the lake water releases. The effect, therefore, upon the fishermen is that they must travel further in order to make a successful catch.

Crabbers fishing the Caloosahatchee River claim to be similarly affected when lake water releases decrease the salinity in the Caloosahatchee River near Fort Myers, During the autumn season they have to travel further toward the mouth of the river for their catch. This is coincident with lake water releases but is also coincident with the rainy season and the time of the year when the blue crab may normally be migrating from this area. At present an investigation of this fishery is being conducted by this laboratory under an agreement with the State Board Of Conservation.

The scallop fishery located in Pine Island Sound is not directly affected by lake water releases.

The sport fishermen in this area have ready access to many areas not directly affected by the lake water releases. Sport fishermen who could not easily reach areas unaffected by the water releases may have reason for complaint if the outflow of fresh water has driven the fish from the locations easily accessible to them.

The offshore charter boat fishery is not affected by the water releases.

Damages might justly be claimed. by the owners of boat rental and live bait dealers in the area near the mouth of the river. Excessive fresh water outflow from the river drives the fish from their vicinity and also is at times responsible for killing their live bait.

HYACINTHS

Large numbers of water hyacinths are brought down by the river. Their presence, floating in the river, decomposing along the shores or forming dense growths in protected coves, is objectionable. This is particularly true near the city of Fort Myers where accumulations of hyacinths seriously hinder small boat movements.

RED TIDE

The phenomena causing the most damage to west coast interests during the past few years has been the "Red Tide". At present a study is being made by this laboratory of the factors which might operate to bring about a "Red Tide". It is suspected that these factors would be more likely to be found originating from inshore than from offshore waters. The alteration of the natural drainage features of south and central Florida by the work carried on by the U. S. Army Engineers is one of the, factors being investigated. The data collected and analyzed to date does not eliminate the possibility that a continuing high rate of water release may be a contributory cause of Red Tide outbreaks. On the other hands since Red Tide outbreaks show a general correlation with the cumulative monthly rainfall of the peninsula, it is probable that the contributions of the Peace River and other drainage systems are sufficiently greater that a reduction of flow in the Caloosahatchee River would have little if any effect upon the probability of a Red Tide outbreak.

CONCLUSIONS AND RECOMMENDATIONS

ln view of the nature of the overall problem concerning the South and Central Florida Flood Control Program it is concluded that the damage resulting from the release of lake water through the Caloosahatchee River is small,

The lower river and estuary are affected by the water releases. Such changes which do occur are not believed to be serious and would occur during periods of heavy run-offs independent of lake water releases.

Fishing interests do not suffer any considerable damage with the possible exception of the crab fishery in "he lower river and a few fishing camps near the mouth of the river. Si-nee this laboratory is at present studying the crab fishery of the state under an agreement with the State Board of Conservation, it has been recommended that particular attention be paid to this area to determine the effects of water releases upon the crab fishery in the lower Caloosahatchee River.

Large numbers of water hyacinths float down river. After long periods of water release many become trapped in enclosed areas dry docks and impair the movements of small craft.

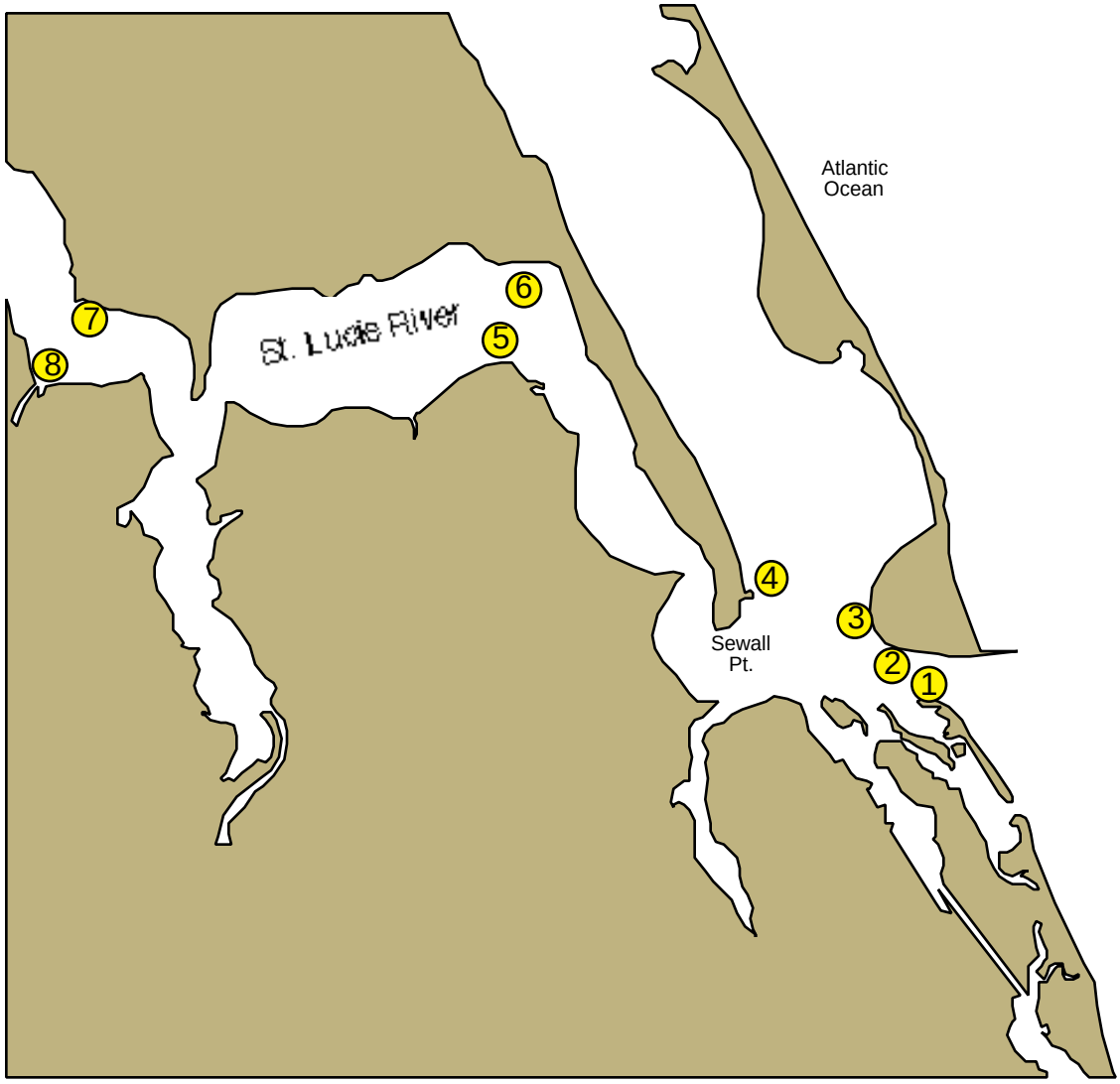
Sediments are being deposited in the river. The extent of the damage from these sediments is not known) however, no serious harm is being done to the fisheries of the estuary by these sediments.

Complaining parties in this area are unaware of the seriousness of the situation at St. Lucie Inlet and are under the impression that they are receiving the bulk of the water releases. It is recommended that they be informed of the actual circumstances.

It is also recommended that control measures be taken to minimize the water hyacinth damage.

SECTION B

ST. LUCIE INTLET AND STUART AREA



Map showing the locations of Stations in the St. Lucie Inlet and River.

STATION #1

Located near the south shore of the St. Lucie Inlet between the ocean and the inland waterway. Depth of water seven feet. August 11, 1953. Locks open.

OBSERVATIONS

TIDAL STAGE	TEMPERATURE °C	SECCHI DISC Ft.	In.	pH	DISSOLVED OXYGEN % Saturation	SALINITY °/oo
			Surface			
0.8 Flood	28.7	2	07	8.3		22.7
0.9 Flood	28.7	2	08	8.3	78.9	24.1
H. W.						
0.1 Ebb	29.8	3	00	8.3	93.7	25.1
0.2 Ebb						
0.3 Ebb						
0.4 Ebb	30.0	2	00	8.1	75.3	8.8
0.5 Ebb						
0.6 Ebb	30.6	2	04	8.1	74.9	5.8
0.7 Ebb						
0.8 Ebb						
0.9 Ebb	30.6	2	00	8.1	69.1	3.8
L. W.						
			Bottom			
0.8 Flood						
0.9 Flood	28.7			8.3	75.5	25.8
H . W.						
0.1 Ebb	29.0			8.3	87.1	27.2
0.2 Ebb						
0.3 Ebb						
0.4 Ebb	30.0			8.3	86.0	18.2
0.5 Ebb						
0.6 Ebb	30.6			8.1	83.3	11.9
0.7 Ebb						
0.8 Ebb						
0.9 Ebb	30.6			8.1	70.8	10.2
L . W.						

NOTES:

Temperature: The temperatures recorded at this station are those which might be expected at this time of the year.

Secchi Disc Readings: These readings indicate an increase in light absorption as the tide ebbs.

pH: There is a slight lowering of the pH from 8.3 during the high water period to 8.1 during the low water period.

Dissolved Oxygen: There is a slight decrease in the dissolved oxygen content of the water during the period of low water. This decrease is probably too slight to affect the fish adversely.

Salinity: The changes in salinity are rapid and severe.

Fishing Conditions: On the day of these observations sport fishermen caught a few catfish during the daylight hours. Fishing was considered poor. Sport fishing in this area during the evening, night and early morning hours produced good catches of snook and bottom fish.

General Observations: When water was being released through the St. Lucie Locks at maximum or near maximum capacity the effects of the incoming tide are strong enough to stop the seaward flow of the river water in the St. Lucie lnlet. The resultant flow of water during the flood tide is to the westward. The maximum effect of the inflow of seawater is felt at or near high water. As the tide ebbs the flow reverses to seaward and increases in velocity until the maximum effects of the river water are felt at or near low water.

There is a sand bar running in an east - west direction through the inlet. One to three feet of water flow over this bar. It, is an effective barrier to free flow of water and it makes conditions on the southern side of the inlet different from those on the northern side. The effect of the river water is felt more strongly on the southern side of this bar.

March 24 and 27, 1954. Locks closed.

OBSERVATIONS

TIDAL STAGE	TEMPERATURE °C	SECCHI DISC Ft.	In.	pH	DISSOLVED OXYGEN % Saturation	SALINITY °/oo
			Surface			
0.8 Flood	22.5	3	05	8.3	95.5	36.0
0.9 Flood						
H. W.	23.0	6	00	8.3	87.0	36.6
0.1 Ebb						
0.2 Ebb						
0.3 Ebb	23.5	6	00	8.3	87.0	36.2
0.4 Ebb						
0.5 Ebb						
0.6 Ebb	23.5	3	00	8.2	125.1	35.8
0.7 Ebb	24.5	3	05	8.2	99.0	35.1
0.8 Ebb						
0.9 Ebb	24.0	3	05	8.2	93.3	34.0
L. W.						
			Bottom			
0.8 Flood	22.5			8.3	94.7	36.2
0.9 Flood						
H. W.	23.0			8.3	96.0	36.8
0.1 Ebb						
0.2 Ebb						
0.3 Ebb	22.5			8.3	B6. 4	36.4
0.4 Ebb						
0.5 Ebb						
0.6 Ebb	23.0			8.2	83.8	35.7
0.7 Ebb	24.5			8.2	99.2	36.1
0.8 Ebb						
0.9 Ebb	24.0			8.2	94.0	35.0

NOTES:

Temperature: At this station the temperatures recorded are those which might be expected at the time of observations.

Secchi Disc Readings: The comparative readings show that at all stages of the tide the water was clearer with the locks closed. Near high water the disc could be seen at greater depth of from 1'04" to 3'00", while the locks were closed. Near low water the depth of the visibility of the disc was 1'05" greater while the locks were closed.

The water color was also different. A brownish color being present while the locks were open with a greenish color prevailing when they were closed.

pH: There was no difference in the pH during the high water periods at which times it was 8.3. During low water periods the pH was 8.2 when the locks were closed and 3.1 when they were open. This is not a significant difference.

Dissolved Oxygen: The values recorded when the locks were closed ranged from 8.3% to 125.1% saturation. These values are in general higher than those recorded when the locks were open when values ranged from 69.1% to 93.7% saturation. This decrease in dissolved oxygen when the locks were open is probably not great enough to affect the fish adversely.

Salinity: The salinity at this station remained fairly constant never falling below $34^{o}/oo$ during the period of observations while the locks were closed. When they were open, however, the salinity drop was quite rapid and severe as the tide ebbed. Surface salinities fell from $25.1^{o}/oo$ to $3.8^{o}/oo$; bottom salinity fell from $27.2^{o}/oo$ to $10.2^{o}/oo$.

STATION #2

Near the north shore of the St. Lucie Inlet between the ocean and the Indian River. Depth of water 13 feet. August 11, 1953. Locks open.

OBSERVATIONS

TIDAL STAGE	TEMPERATURE °C	SECCHI DISC Ft.	In.	pH	DISSOLVED OXYGEN % Saturation	SALINITY °/oo
			Surface			
H. W.	28.5	5	08	8.3	89.2	28.6
0.1 Ebb						
0.2 Ebb	30.5	4	00	8.3	86.5	11.4
0.3 Ebb	30.2					8.8
0.4 Ebb						
0.5 Ebb	30.4	2	08	8.1	76.7	6.3
0.6 Ebb						
0.8 Ebb	30.6	2	08	8.1	88.8	4.3
0.9 Ebb						
L. W.	20.6	1	11	8.2	72.4	5.0
			Bottom			
H. W.	28.0			8.3	90.3	31.9
0.1 Ebb						
0.2 Ebb	29.0			8.3	98.2	31.8
0.3 Ebb						
0.4 Ebb						
0.5 Ebb	30.2			8.5	113.9	26.3
0.6 Ebb						
0.7 Ebb	30.6			8.5	100.8	25.1
0.8 Ebb						
0.9 Ebb						
L. W.	30.4			8.5	114.5	23.5

NOTES:

Temperature: The temperatures recorded at this station are those which might be expected at this time of the year.

Secchi Disc Readings: The strong inflow of ocean water in this area during flood tide is responsible for the increased clarity of the water. During ebb tide, however, the depth at which the secchi disc disappeared from sight was much the same as that found along the southern shore of the inlet. This is because the surface water at this station consists of river water which has gradually passed over the bar to form a surface layer several feet deep.

pH: The changes in pH are not extreme.

Dissolved oxygen: The lowest value obtained (72.4% Saturation) was from a surface sample taken during low water. This is not critical to the fish.

Salinity: The changes in the salinity of the water comprising the surface layer are rapid and severe. This condition did not extend through the whole water column. With surface salinity measured at 11.4^{o}/oo at 0.2 ebb, the salinity at a depth of three feet was 27.7^{o}/oo at a depth of six feet it was 30.4^{o}/oo on the bottom it was 31.8^{o}/oo At 0.7 ebb, with the surface salinity measuring 4.3^{o}/oo, the salinity at a depth of three feet was 12.2^{o}/oo.

Fishing: Several snort fishermen were seen fishing this area; none met with success.

General: As noted previously, the bar dividing the northern part of the inlet from the southern part is responsible for most of the differences in the observations recorded for this station as compared with those at Station #1. The outward flow of river water pass this area is confined almost entirely to the surface layer. The flow of bottom water past this area on the ebb tide is water from the Indian River. The ebb flow is of a lesser velocity here than it is along the southern shore of the inlet so that resistance to the inflow of ocean water on the flooding tide is less. Because of the decreased influence of the river water at this point the tide floods earlier and ebbs later than it does at a point directly opposite, on the southern part of the inlet.

March 24 and 27, 1954. Locks closed.

TIDAL STAGE	TEMPERATURE °C	SECCHI DISC Ft.	In.	pH	DISSOLVED OXYGEN % Saturation	SALINITY °/oo
			Surface			
0.9 Flood	23.0	13	00	8.3	92.5	36.1
H. W.	23.0	13	00	8.3	92.8	36.6
0.1 Ebb						
0.2 Ebb						
0.3 Ebb						
0.4 Ebb	22.5	13	00	8.3	91.3	37.0
0.5 Ebb						
0.6 Ebb						
0.7 Ebb						
0.8 Ebb	25.0	9	00	8.3	105.2	36.3
Bottom						
0.9 Flood	23.0			8.3	93.3	36.2
H. W.	23.0			8.3	85.7	36.6
0.1 Ebb						
0.2 Ebb						
0.3 Ebb						
0.4 Ebb	21.5			8.3	85.7	36.6
0.5 Ebb						
0.6 Ebb						
0.7 Ebb						
0.8 Ebb	24.0			8.3	102.8	36.8

NOTES:

Temperatures; The temperatures recorded at this station are those which might be expected at the time of the observations.

Secchi Disc Readings: A comparison of readings at this station shows that at all stages of the tide the water was clearer when the locks were closed. During high water the disc was visible at a depth of 5'04" when the locks were open and 13'00" when they were closed. During low water the disc was visible at a depth of 1'11" when the locks were open and 9'00" when they were closed.

pH: The pH was 8.3 during all observations when the locks were closed. A wider range of pH values from 8.1 to 8.5 were measured when the locks were open. These changes are not extreme.

Dissolved Oxygen: The dissolved oxygen content at this station is not considered to be a critical factor to the fish.

Salinity: The salinity at this station remained fairly constant never being below 36$^{o}/_{oo}$ during the period of observation while the locks were closed. When the locks were open the changes in the salinity of the water comprising the surface layer were rapid and severe. This condition did not extend throughout the whole water column. With surface salinity measured at 114$^{o}/_{oo}$ at 0.2 ebb, the salinity at a depth of three feet was 27.7$^{o}/_{oo}$; at a depth of six feet it was 30.4$^{o}/_{oo}$; on the bottom, it was 31.8$^{o}/_{oo}$. at 0.7 ebb, with the surface salinity measuring 4.3$^{o}/_{oo}$, the salinity, at a depth of three feet was 12.2$^{o}/_{oo}$ and at the bottom it was 25$^{o}/_{oo}$.

$^{o}/_{oo}$

STATION #3

Near the eastern shore of the Indian River where it joins the St. Lucie River. Depth of water 10 feet. August 14, 1953. Locks open.

OBSERVATIONS

TIDAL STAGE	TEMPERATURE °C	SECCHI DISC Ft.	In.	pH	DISSOLVED OXYGEN % Saturation	SALINITY °/oo
			Surface			
H. W.	29.5	8	00	8.3	92.7	35.1
0.1 Ebb						
0.2 Ebb						
0.3 Ebb	31.2	3	00	8.3	98.7	23.4
0.4 Ebb	30.8	2	10		98.7	24.7
			Bottom			
H. W.	29.5			8.3	95.1	35.4
0.1 Ebb						
0.2 Ebb						
0.3 Ebb	30.4			8.3	100.0	27.1
0.4 Ebb	30.3					24.7

NOTES:

Temperature: The temperatures recorded at this station are those which might be expected at this time of year.

Secchi Disc Readings: This area is well flushed with ocean water at high tide, which accounts for the much higher readings obtained at this time.

pH: The pH is almost constant.

Dissolved Oxygen: Values obtained at this station were slightly higher than those obtained at the other stations.

Salinity: Salinity values show a definite increase during high tide, due to the inflow of ocean water. At other times they are lower but do not reach critical values.

Fishing: Several sport fishermen were observed fishing this area without success.

General: Very little of the river water penetrates to this point. The inflow of ocean water during the flood tide is considerable. On the ebb tide the river water slowly penetrates a short distance up the Indian River.

March 24 and 27, 1254. Locks closed.

OBSERVATIONS

TIDAL STAGE	TEMPERATURE °C	SECCHI DISC Ft.	In.	pH	DISSOLVED OXYGEN % Saturation	SALINITY °/oo
			Surface			
H. W.	23.0	8	00	8.3	94. 4	36.5
0.1 Ebb						
0.2 Ebb						
0.3 Ebb						
0.4 Ebb	23.0	7	00	8.3	86.7	35.1
0.5 Ebb						
0.6 Ebb						
0.7 Ebb						
0.8 Ebb	24.5	4	00	8.3	112.2	35.7
			Bottom			
H. W.	23.0			8.3	93.6	36.6
0.1 Ebb						
0.2 Ebb						
0.3 Ebb						
0.4 Ebb	22.0			8.3	126.8	36.6
0.5 Ebb						
0.6 Ebb						
0.7 Ebb	24.5			8.3	109.7	35.7

NOTES:

Near the eastern shore of the Indian River where it joins the St. Lucie River. Depth of water ten feet. Observations made August 14, 1953, at which time the St. Lucie locks were open, and March 2h and 27, 1954, at which time the locks were closed.

Temperature: The temperatures recorded are those might be expected at the time of the observations.

Secchi Disc Readings: This area was well flushed with ocean water at high tide doing all observations. During the ebb tide the water was clearer when the locks were closed.

pH: The pH is almost constant.

Dissolved Oxygen: Values obtained at this station were high during all observations.

Salinity: Salinity values taken when the locks were closed were higher than were open, however, the lower values obtained are not critical to the fish.

STATION #4

On the Indian River by Marker #315. Depth ten feet. August 14, 1953. Locks open.

OBSERVATIONS

TIDAL STAGE	TEMPERATURE °C	SECCHI DISC Ft.	In.	pH	DISSOLVED OXYGEN % Saturation	SALINITY °/oo
			Surface			
H. W.						
0.1 Ebb	30.2	7	00	8.3	96.9	29.5
0.2 Ebb						
0.3 Ebb						
0.4 Ebb						
0.5 Ebb						
0.6 Ebb	30.5	3	06	8.3	86.5	17.8
			Bottom			
H. W.						
0.1 Ebb	30.2			8.3	101.3	33.3
0.2 Ebb						
0.3 Ebb						
0.4 Ebb						
0.5 Ebb						
0.6 Ebb	29.3			8.3	89.5	27.5

N0TES:

Temperature: The temperatures recorded at this station are those which might be expected ant this time of the year,

Secchi Disc Readings: The area is well flushed with ocean water during high tide which accounts for the higher readings during this time. Although the values are lower as the tide ebbs they are not as low as those found in the St. Lucie River. On the ebb tide the water mass is mostly composed of Indian River water.

pH: The pH is almost constant.

Dissolved 0xygen: Values obtained at this station were slightly higher than these obtained at the other stations.

Salinity: Salinity values show an increase during high tide. The values obtained during the ebb were somewhat lower.

Fishing: Several sportsmen were fishing in this area; none appeared to be successful,

March 24 and ?7, 1954. Locks closed.

OBSERVATIONS

TIDAL STAGE	TEMPERATURE °C	SECCHI DISC Ft.	In.	pH	DISSOLVED OXYGEN % Saturation	SALINITY °/oo
			Surface			
H. W.	23.5	8	00	8.3	97.2	36.2
0.1 Ebb						
0.2 Ebb						
0.3 Ebb						
0.4 Ebb	24.0	4	05	8.3	102.4	35.4
0.5 Ebb						
0.6 Ebb	23.5	4	00	8.2	87.3	35.8
			Bottom			
H. W.	23.0			8.3	96.0	36.3
0.1 Ebb						
0.2 Ebb						
0.3 Ebb						
0.4 Ebb	24.0			8.3	102.6	35.6
0.5 Ebb						
0.6 Ebb	24.0			8.2	87.3	35.4

NOTES:

Temperature. The temperatures are those which might be expected during the time of the observations.

Secchi Disc Reading: The water was slightly clearer when the locks were closed with a difference in the readings for comparative periods of one foot or less.

pH: The pH remained at 8.2 or 8.3 during both periods.

Dissolved Oxygen: These values were high during both periods.

Salinity: The salinity remained above 35^{o}/oo during the time observations were made with the locks closed. When the locks were open the surface salinity fell to 17.8^{o}/oo on the ebb tide; at that time the bottom salinity was 27.5^{o}/oo.

STATION #5

On the St. Lucie River near Marker #23x. Depth 7.5 feet. August 12, 1953. Locks open.

OBSERVATIONS

TIDAL STAGE	TEMPERATURE °C	SECCHI DISC Ft.	In.	pH	DISSOLVED OXYGEN % Saturation	SALINITY °/oo
			Surface			
0.9 Flood	29.4	1	06	8.1	64.9	1.6
H. W.						
0.1 Ebb	29.8	1	06	7.9	70.9	2.8
0.2 Ebb						
0.3 Ebb	29.8	1	04	7.9	70.3	1.2
0.4 Ebb						
0.5 Ebb	30.2	1	03	7.9	72.4	0.7
0.6 Ebb	30.0	1	02	7.9	70.3	0.7
0.7 Ebb						
0.8 Ebb						
0.9 Ebb	29.8	0	11	7.9	73.8	0.7
			Bottom			
0.9 Flood	29.4			8.1	66.4	1.6
H. W.						
0.1 Ebb	29.8			7.9	70.3	1.5
0.2 Ebb						
0.3 Ebb	29.8			7.9	72.2	1.5
0.4 Ebb						
0.5 Ebb	30.2			7.9	72.4	0.7
0.6 Ebb	30.0			7.9	74.0	0.7
0.7 Ebb						
0.8 Ebb	29.8			7.9	77.3	0.7

NOTES:

Temperature: The temperatures recorded at this station are those which might be expected at this time of the year.

Secchi Disc Readings: These readings indicate, at the light absorption at this station, even at high tide, is greater than at the stations further down the estuary.

pH: The pH values than those recorded for further down the estuary but not marked so.

Dissolved Oxygen: These values are above the critical level for fish.

March 25 and 30, 1954. Locks closed.

OBSERVATIONS

TIDAL STAGE	TEMPERATURE °C	SECCHI DISC Ft.	In.	pH	DISSOLVED OXYGEN % Saturation	SALINITY °/oo
			Surface			
0.9 Flood	2?.?	1	08	8.2	134.7	29.9
0.2 Ebb						
0.3 Ebb						
0.4 Ebb	24.5	2	06	8.2	93.5	27.5
0.5 Ebb						
0.6 Ebb						
0.7 Ebb						
0.8 Ebb						
0.9 Ebb						
L. W.	27.0	2	09	8.1	87.0	27.0
			Bottom			
0.9 Flood	24.5			8.2	83.h	30.1
H. W.						
0.1 Ebb						
0.2 Ebb						
0.3 Ebb						
0.4 Ebb	24.5			8.2	132.1	27.7
0.5 Ebb						
0.6 Ebb						
0.7 Ebb						
0.8 Ebb						
0.9 Ebb						
L. W.	27.0			8.1	85.4	27.0

Temperature: The temperatures recorded at this station were those that might be expected at the time of observation.

Secchi Disc Readings: The water was clearer when the locks were closed. During low water the disc was visible at a depth of 2'09" when the locks were closed and 0'11" when the locks were open.

pH: There was a slight lowering of the pH when water was being released but the values did not go below 7.9.

Dissolved Oxygen: The values obtained during the time water was being released were lower at all stages of the tide but were above the critical level for fish.

Salinity: Values from 27°/oo to 30.1°/oo were recorded at the station when were closed. This differs greatly from the values recorded when the locks were open and the salinity did not measure above 2.8°/oo.

STATION #6

St. Lucie River Marker #21. Depth 7.5 feet. August 12. 1953. Locks open.

OBSERVATIONS

TIDAL STAGE	TEMPERATURE °C	SECCHI DISC Ft.	In.	pH	DISSOLVED OXYGEN % Saturation	SALINITY °/oo
			Surface			
H. W.	29.6	1	06	8.1	66.3	1.3
0.1 Ebb						
0.2 Ebb	30.0	1	06	7.9	66.7	1.1
0.3 Ebb						
0.4 Ebb	30.2	1	04	7.9	67.0	0.9
0.5 Ebb	30.2	1	04	7.9	67.0	0.9
0.6 Ebb	30.2	1	02	7.9	70.6	0.7
0.7 Ebb						
0.8 Ebb						
0.9 Ebb	30.0	1	00	7.9	72.2	0.7
			Bottom			
H. W.	29.6			8.1	59.7	2.8
0.1 Ebb						
0.2 Ebb	30.0			7.9	56.3	2.2
0.3 Ebb						
0.4 Ebb	30.0			7.9	65.4	2.2
0.5 Ebb	30.0			7.9	65.4	2.2
0.6 Ebb	30.0			7.9	70.9	2.0
0.7 Ebb						
0.8 Ebb						
0.9 Ebb	29.8			7.9	72.4	2.0

March 25 and 30, 1954. Locks closed.

OBSERVATIONS

TIDAL STAGE	TEMPERATURE °C	SECCHI DISC Ft.	In.	pH	DISSOLVED OXYGEN % Saturation	SALINITY °/oo
			Surface			
H. W.	24.0	3	00	8.2	95.0	28.6
0.1 Ebb						
0.2 Ebb						
0.3 Ebb						
0.4 Ebb						
0.5 Ebb						
0.6 Ebb	24.0	2	06	8.2	133.1	27.4
			Bottom			
H. W.	24.0			8.2	104.0	28.8
0.1 Ebb						
0.2 Ebb						
0.3 Ebb						
0.4 Ebb						
0.5 Ebb						
0.6 Ebb	24.0			8.2	80.2	27.6

N0TES:

Temperature: The temperature recorded at this station are those which night be expected at the of the observations.

Secchi Disc Readings: The water was clearer when the locks were closed. At high water the disc was visible at a depth of 3'00" when the locks were closed and 1'06" when they were open,

pH: There was a slight lowering of the pH when the locks were open but the values did not go below 7.9.

Dissolved Oxygen: The values obtained during the time water was being released were lower at all stages of the tide. Values of 56.3 and 59.7% saturation, which are considered below the optimum for most fish were recorded while the locks were open. With the locks closed the values measured did not fall below 80.2% saturation.

Salinity: Values of from 21.4°/oo to 28.8°/oo were recorded when the locks wee closed. This differs greatly from the values recorded when the locks were open and the salinity did not nearer above

STATION #7

Near the eastern shore of the North Fork of the St. Lucie River opposite the point where Bessie Creek enters the North Fork. Depth nine feet. August 13, 1953. Locks open

OBSERVATIONS

TEMPERATURE	SECCHI DISC			DISSOLVED OXYGEN	SALINITY
°C	Ft.	In.	pH	% Saturation	°/oo
			Surface		
30.5	2	04	7.5	47.2	0.8
30.0	2	01	7.5	54.1	0.9
			Bottom		
29.9			7.5	43.1	0.7
29.8			7.5	50.3	0.9

NOTES:

Temperatures: The temperatures recorded at this station are those which might be expected at this time of the year.

Secchi Disc Readings: The slight differences obtained might be attributed to the fact that at the tine of the second observation the weather was cloudy with a storm brewing.

pH: The pH is noticeably lower here than at other points in the river or the estuary.

Dissolved Oxygen: The dissolved oxygen content of these waters is below the optimum level for most species of fish.

Salinity: The water at this station might be considered fresh water.

Fishing: Several mullet were seen jumping in this area. However, the commercial fishermen say that it is not profitable to fish in this area at this time. The sport fishermen claim that they meet with no success in this area when the locks are open.

General: The water in this area has a different coloration, being a yellow-brown. There is no mixing of waters here during the tidal cycle.

March 25 and 30, 1954. Locks closed.

OBSERVATIONS

TIDAL STAGE	TEMPERATURE °C	SECCHI DISC Ft.	In.	pH	DISSOLVED OXYGEN % Saturation	SALINITY °/oo
			Surface			
N.H.W.	24.5	4	O4	8.2	97.2	22.5
			Bottom			
N.H.W.	24.5			8.2	95.1	22.5

NOTES:

Temperature: The temperatures recorded at this station are those which might be expected at the time of observation.

Secchi Disc Readings: The water was clearer w1hen the locks were closed.

pH: The pH was 8.2 when the locks were closed and 7.5 when they were open.

Dissolved Oxygen: The dissolved oxygen content of these waters was below the optimum level for most fish when the locks were open. The values were increased, approximately doubled, when the locks were closed.

Salinity: When the locks were open this was "fresh" water, however salinities of 22.5^{o}/oo were recorded. when the locks were closed.

STATION #8

At the point where Bessie Greek enters the North Fork of the St. Lucie River. Depth three feet. August 13, 1953. Locks open.

TEMPERATURE	SECCHI DISC			DISSOLVED OXYGEN	SALINITY
°C	Ft.	In.	pH	% Saturation	°/oo
30.3	2	04	7.3	43.4	0.7
30.9	1	07	7.1	38.4	1.2

NOTES:

Temperature: The recorded at station are those which might be expected at this time of the year.

Secchi Disc Readings: The slight differences obtained might be attributed to the fact that at the time the second of observation the weather was cloudy with a storm brewing.

pH: The pH here is noticeably lower.

Dissolved Oxygen: The dissolved oxygen content of these waters is below the optimal level for most species of fish.

Salinity: The water at this station might be considered fresh water.

Fishing and General Observations: See comments under Station #7.

March 25, 1954. Locks closed.

TIDAL STAGE	TEMPERATURE °C	SECCHI DISC Ft.	In.	pH	DISSOLVED OXYGEN % Saturation	SALINITY °/oo
N.H.W.	25.0	3	00	8.1	122.6	22.5

NOTES:

Temperature: The temperatures recorded at this station are those which might be expected at the tine of observations.

Secchi Disc Readings: The water was clearer when the locks were closed.

pH: The pH here was noticeably lower while the locks were open.

Dissolved Oxygen: The dissolved oxygen content of these waters was below the optimum level for most species of fish while the locks were open (34.8% to 43.4% saturation.) The oxygen content was much higher and highly desirable during March (122.6% saturation.)

Salinity: The salinity was 22.5^{o}/oo during the March sampling. When the locks were open in August this right be considered fresh water.

OTHER OBSERVATIONS

Along the South Fork of the St. Lucie River. August 13, 1953. Locks open.

LOCATION	DEPTH	TEMPERATURE °C	SECCHI DISC Ft.	SECCHI DISC In.	pH	DISSOLVED OXYGEN % Saturation	SALINITY °/oo
			Surface				
Marker #27	11'	30.5	1	07	7.9	70.9	0.8
Marker #33	13'	30.6	0	11	7.9	67.2	0.8
Marker #40	10'	30.2	1	00	7.9	70.5	0.7
Orig. River Branch	10'	31.2	3	08	7.1	20.1 [?]	0.8
			Bottom				
Marker #27	11'	30.1			7.9	61.9	0.7
Marker #33	13'	29.4			7.9	69.6	0.4
Marker #40	10'	29.2			7.9	69.2	0.3

NOTES:

Temperature: The temperatures recorded here were those which might be expected at this time of the year.

Secchi Disc Readings: The readings are lower in the upper reaches of the river and canal than they are further downstream and in the estuary. A higher reading was obtained in the old original branch of the St. Lucie River which feeded into the St. Lucie Canal.

pH: The pH values are generally the same as those found elsewhere with the exception of that found in the original branch of the St. Lucie River. The value of 7.1 found here is much the same as that found by Bessie Greek and is lower than any other recorded values.

Dissolved Oxygen: The only place where the dissolved oxygen content was low (20.1% saturation) was in the original branch of the St. Lucie River.

Salinity: The waters here might be considered fresh water.

Fishing: Several sport fishermen, were seen fishing this area. There have been a few catches reported.

General: The velocity of flow changes with the tidal cycle. On a flood tide the flow is retarded but not stopped. The water coming down the South Fork of the St. Lucie River does not penetrate into the North Fork on the ebb tide and only penetrates into the North Fork to a slight extent during the period of high water.

March 30, 1954. Locks closed.

LOCATION	TEMPERATURE °C	SECCHI DISC Ft.	In.	pH	DISSOLVED OXYGEN % Saturation	SALINITY °/oo
			Surface			
Orig. So. Fork	27.0	4	03	7.4	62.2	14.4
Orig. So. Fork	27.0	4	03	7.7	65.2	14.4
Marker #42	27.0	3	08	7.6	80.3	15.0
Marker #34	27.5	3	00	7.8	77.4	16.4
Marker #27	28.5	2	09	8.0	81.4	20.0
Marker #24	27.5	2	09	8.1	85.7	20.8
Bottom						
Orig. So. Fork	27.0			7.4	60.7	14.4
Orig. So. Fork	27.0			7.7	46.9	14.4
Marker #42	27.0			7.6	29.0	15.0
Marker #34	27.5			7.8	75.8	16.4
Marker #27	28.5			8.0	80.4	20.0
Marker #24	27.5			8.1	81.9	20.8

NOTES:

Temperature: The temperatures recorded are those which might be expected during the time of the observations.

Secchi Disc Readings: The river was clearer at all points of observation after the locks were closed.

pH: There was not much change in pH at the various points of observation during the two periods.

Dissolved Oxygen: Values were slightly higher when the locks were closed with the except on of one bottom sample taken by Marker #42 which was 29% saturated when the locks were closed. The original south fork, above the confluence showed the same characteristics, having lower oxygen values during August due to changes caused in part by natural drainage and in part by the decrease in tidal flushing due to releases.

Salinity: At all points of observation the salinity was higher when the locks were closed. Salinities from 14.4^{o}/oo to 20.8^{o}/oo were recorded during March at stations where the water was fresh while the locks were open.

SEDIMENT SAMPLES

The samples were taken at the same locations during August when the locks were open and during March when the locks were closed. Samples taken when the locks were closed have the letter "a" added to the sample number.

SAMPLE NO.	LOCATION OUT	DEPTH FEET	DAYS OUT	DATES	DRY WEIGHT GRAMS
1	Marker #34	5	19	Aug 7-26	430.89
1a	Marker #34	5	18	Mar 26-Apr 13	70.79
2	(Flat South of)	3	19	Aug 7-26	1.35
2a	(Palm City Br.)	3	18	Mar 26-Apr 13	16.80
3	Marker #27	5	19	Aug 7-26	0.80
3a	Marker #27	5	18	Mar 26-Apr 13	22.05
4	Marker #24	6	19	Aug 7-26	0.23
4a	Marker #24	6	18	Mar 26-Apr 13	6.61
5	Marker #23X	4.5	18	Aug 8-26	39.64
5a	Marker #23X	4.5	18	Mar 26-Apr 13	12.03
6	(Range Marker)	4.5	18	Aug 8-26	87.93
6a	(Indian River Ent.)	4.5	18	Mar 26-Apr 13	41.07
7	(Inter Water Ent.)	2	13	Aug 13-26	24.24
7a	(So. of Indian Ri.)	2	18	Mar 26-Apr 13	38.98
8	Marker #22	6	13	Aug 13-26	0.24
8a	Marker #22	6	18	Mar 26-Apr 13	0.36
9	East Shore North	5	13	Aug 13-26	3.26
9a	Fork Ent.	5	18	Mar 26-Apr 13	7.53

SAMPLE NO. 1: Fine sand, in layers of brown, grey, black organic, rich, black laminae alternating with gray and brown sand. Micro examination revealed that the majority of the sample consisted of angular sorted quartz grains with some calcareous shell and limestone fragments. A small fraction was blackish organic matter. A surface fraction consisted of fluffy organic ooze with particles of plant debris.

SAMPLE NO. 1a: Much the same as Sample No. 1; organic ooze and sand.

SAMPLE NO. 2: Organic rich black ooze with a small amount of sand particles. Micro examination on revealed organic ooze with plant fibers and detritus with some fine silt size quartz and carbonate.

SAMPLE NO. 2a: Black organic ooze.

SAMPLE NO. 3: Sand similar to No. 1 sample with a thin surface lamina of rich flocculant organic ooze.

SAMPLE NO. 3a: Organic ooze with a small amount of sand and shell.

SAMPLE NO. 4: Sand particles.

SAMPLE NO. 4a: Organic ooze and shell fragments.

SAMPLE NO. 5: Black organic silt with dead shell and debris on surface. Micro examination revealed that the sample was mostly of a brownish flocculant organic ooze with some poorly sorted, medium size, angular quartz and carbonate.

SAMPLE NO. 5a: Organic ooze with some shell fragment.

SAMPLE NO. 6: Sandy black silt with surface lamina of brown flocculant organic ooze and shell fragments. Micro examination revealed a brownish flocculant organic material and plant detritus with poorly sorted angular quartz about the size of Sample No. 1, with a few larger grains and some mica grains. A small part of the sediment was carbonate.

SAMPLE NO. 6a: Organic ooze and sand.

SAMPLE NO. 7: Sandy black soil with a surface lamina of brown flocculant organic ooze. Micro examination revealed the surface lamina to consist of organic ooze and detritus. The remainder was of this composition with a quartz which was finer than the other samples.

SAMPLE NO. 7a: Organic ooze, and shell fragments.

SAMPLE NO. 8: Few grains of sand and particles of dead shell.

SAMPLE NO. 8a: Organic ooze and shell fragments.

SAMPLE NO. 9: Black organic ooze. Micro examination revealed practically no quartz and little carbonate. Mostly all organic matter and finer plant detritus.

SAMPLE NO. 9a: Organic ooze and shell fragments.

Some heavy accessory minerals were observed in most samples.

SIZE ANALYSIS

Sieving time 10 minutes

SAMPLE NO. 1
(Fraction)

Sieve Size Microns	Weight Retained (gram)	% Weight	Cumulative %
1000	0.21	0.44	0.44
500	0.40	0.83	1.27
250	0.41	0.85	2.12
125	2.01	4.2	6.32
74	29.93	62.1	68.42
62	4.61	9.6	78.02
Pan (Dry	5.30	11.0	89.02
(Wet	5.29	11.0	100.02
TOTAL	48.16		

SAMPLE NO. 1a

Sieve Size Microns	Weight Retained (gram)	% Weight	Cumulative %
1000	5.80	8.19	8.19
500	2.17	3.07	11.26
250	3.09	4.37	15.63
125	6.55	9.25	24.88
74	28.54	40.32	65.20
62	2.37	3.35	68.55
Pan (Dry	2.79	3.94	72.49
(Wet	19.48	27.52	100.01
TOTAL	70.79		

SAMPLE NO. 2a

Sieve Size Microns	Weight Retained (gram)	% Weight	Cumulative %
1000	0.12	0.71	0.71
500	0.10	0.60	0.31
250	0.14	0.83	2.14
125	0.67	3.99	6.13
74	1.56	9.2?	15.42
62	0.33	1.96	17.38
Pan (Wet	0.84	5.00	22.38
Pan (Dry	13.04	77.62	100.00
TOTAL	16.80		

SAMPLE NO. 3a

Sieve Size Microns	Weight Retained (gram)	% Weight	Cumulative %
1000	0.39	1.77	1.77
500	0.35	1.59	3.36
250	0.47	2.13	5.49
125	1.08	4.90	10.39
74	2.58	11.70	22.09
62	0.60	2.72	24.81
Pan (Dry	1.04	4.72	29.53
(Wet	15.54	70.48	100.01
TOTAL	22.05		

SAMPLE NO. 4a

Sieve Size Microns	Weight Retained (gram)	% Weight	Cumulative %
1000	4.80	72.62	72.62
500	0.57	8.62	81.24
250	0.42	6.35	87.59
125	0.35	5.30	92.39
74	0.22	3.33	96.22
62	0.02	0.30	96.52
Pan (Dry	0.03	0.45	96.97
(Wet	0.20	3.03	100.00
TOT"I	6.61		

SAMPLE NO. 5

Sieve Size Microns	Weight Retained (gram)	% Weight	Cumulative %
1000	9.36	24.0	24.0
500	4.22	10.8	34.8
250	17.59	45.0	79.8
125	5.36	13.7	93.5
74	0.88	2.3	95.3
62	0.79	2.0	97.3
Pan (Dry	0.17	0.4	97.7
(Wet	0.69	1.8	99.5
TOTAL	39.06		

SAMPLE NO. 5a

Sieve Size Microns	Weight Retained (gram)	% Weight	Cumulative %
1000	8.94	10.2	10.2
500	4.63	5.3	15.5
250	22.57	25.6	41.1
125	10.67	12.2	53.3
74	28.88	33.0	86.3
62	2.70	3.1	89.4
Pan (Dry	2.48	2.8	92.2
(Wet	6.73	7.7	99.9
TOTAL	87.60		

SAMPLE NO. 6

Sieve Size Microns	Weight Retained (gram)	% Weight	Cumulative %
1000	8.94	10.2	10.2
500	4.63	5.3	15.5
250	22.57	25.6	41.1
125	10.67	12.2	53.3
74	28.88	33.0	86.3
62	2.70	3.1	89.4
Pan (Dry	2.48	2.8	92.2
(Wet	6.73	7.7	99.9
TOTAL	87.60		

SAMPLE NO. 6a

Sieve Size Microns	Weight Retained (gram)	% Weight	Cumulative %
1000	3.83	9.33	9.33
500	0.53	1.29	10.62
250	0.74	1.80	12.42
125	2.88	7.01	19.43
74	21.61	52.62	72.05
62	2.39	5.82	77.87
Pan (Dry	2.79	6.79	84.66
(Wet	6.3	15.34	100.00
TOTAL	41.07		

SAMPLE NO. 7

Sieve Size Microns	Weight Retained (gram)	% Weight	Cumulative %
1000	0.44	1.9	1.9
500	0.93	4.1	6.0
250	1.89	8.3	14.3
125	3.18	13.9	28.2
74	6.13	26.9	55.1
62	0.78	3.4	58.5
Pan (Dry	1.35	5.9	64.4
(Wet	8.11	35.6	100.0
TOTAL	22.81		

SAMPLE NO. 7a

Sieve Size Microns	Weight Retained (gram)	% Weight	Cumulative %
1000	21.29	54.62	54.62
500	1.83	4.69	59.31
250	2.46	6.31	65.62
125	2.64	6.77	72.39
74	4.97	12.75	85.14
62	0.55	1.41	86.55
Pan (Dry	1.21	3.10	89.65
(Wet	4.03	10.34	99.99
TOTAL	38.98		

SAMPLE NO. 8a

Sieve Size Microns	Weight Retained (gram)	% Weight	Cumulative %
Pan (Dry	0.21	58.33	58.33
(Wet	0.15	41.67	100.00
TOTAL	0.36		

SAMPLE NO. 8a

Sieve Size Microns	Weight Retained (gram)	% Weight	Cumulative %
1000	3.84	51.00	51.00
500	0.67	8.90	59.90
250	0.71	9.43	69.33
125	0.52	6.91	76.24
74	0.23	3.05	79.29
62	0.01	0.13	79.42
Pan (Dry	0.03	0.40	79.82
(Wet	1.52	20.19	100.01
TOTAL	1.53		

ANECDOTAL INFORMATION

The following people were interviewed during visits to the Stuart area.

Name: Mr. Hart and son
Location: Salerno
occupation: Operators of wholesale fish house at Manatee Pocket.
Statement: There was over a 90% drop in pompano catches in 1952 over 1951 due to the of the locks during the fall when they usually get their pompano run. Other species such as mackerel did not show up in abundance either. When the locks are open, fishing is worse than at any other time.

Name: Mr. Reditt and son-in-law
Location: Salerno
Occupation: Commercial fisherman or 25 years at Salerno.
Statement: He finds it necessary to fish up the Indian River when the locks are open. All saltwater species driven from the flow of the river water. He claims that the natural food of the fishes is also destroyed due to the fresh water and also that the bottom is covered with mud from the lake. This mud makes it hard for the natural marine organisms to reestablish themselves and also fouls up the nets. The nets will also rot out quicker if they come in contact with such mud.

Name James Sheldon and Harvey Sheldon
Location: Salerno
Occupation: Operate a fish wholesale house at Salerno
Statement: They affirm all Redditt said plus the fact that their business suffered to a great extent and also that the tourist business was affected.

Name: J. H. Whitfield
Location: Salerno
Occupation: Semiretired
Statement Besides all the other things, he thinks the water table is being lowered thru the present canal system. He states that several people had to drill deeper wells in quest of water. Mae Anderson had to deepen her well from 60 to 85 feet. It went dry in May, 1953.

Name: Mr. Smith and Mr. McPhearson
Location: Salerno
Occupation: Salerno fishermen
Statement: Essentially the same as Redditt. It hurts fishing,

Name: Mr. George Carrigan
Location: Salerno
Occupation: Operates a fishing, camp and rents boats and cabins.
Statement: He was outspoken in his resentment concerning the opening of the St. Lucie locks, complaining that it ruined everything.

Name: Popy Forest
Location: Salerno
Occupation: Fisherman
Statement: He thinks it hurts fishing but doesn't know to what extent.

Name: Chink Stiller, and Francis Stiller
Location: Salerno
Occupation: Fisherman and operators of a fish wholesale business.
Statement: They agree with other statements as to the harm being done. They realize that other interests, such as farming and cattle, are concerned but they do not want the breeding grounds and bottom covered over to cause irreparable damage to the estuary. They would like to see something done about it. They attribute good catches at the inlet immediately after the water is released to the fact that the fish, snook in particular, are chased down by the flow.

Name: Wm. R. Glennon.
Location: Salerno
Occupation: Operates S & S Grab Co.
Statement: He has just taken over this business. However, he did hear reports that crabbing was not good when the locks were open. At present (end of August, 1953) his crabbers are getting crabs up the almost to the Stuart bridge. Most of his crabs are being brought from the West Coast.

Name: H. W. Schwab
Location: Stuart
Occupation: Operates Gulf Oil Station by the Stuart bridge.
Statement: The opening of the locks hurts the fishing in the North Fork and the South Fork. Before they opened the locks you could catch fish all the way up the North Fork. That ends as soon as the locks open. He referred to other fishermen as better sources of information.

Name: Louis Soter
Location: Stuart
Occupation: Retired
Statement: All kinds of fish could be caught in the river until they opened the locks and then fishing is ruined.

Name: Capt. Ronnie Hill
Location: Stuart
Occupation: Fishing guide and charter boat certain out of Stuart and Jensen Beach.
Statement: Capt. Hill says he had been fishing the north and south forks of the St. Lucie during July, 1953, and had been catching trout, snook, snappers, and channel bass, 1 - 3 lbs. jacks, and 1 - 2.5 lbs. ladyfish; he caught croakers and drums under the bridge by bottom fishing. Fishing was abruptly terminated by the opening of the locks. On August 5, 1953, he could only catch a few sailcats by the Roosevelt Bridge. He has given up river fishing since past experience has shown that you cannot anything in the river when the locks are open.
In relation to his offshore charter boat fishing, he finds it necessary to go from 1 - 3 miles offshore before he even begins to fish when the locks are open. At other times, you can fish any place offshore. He pursues bonita, kingfish, spanish mackerel and sailfish, plus many others. He says fishing offshore begins to pick up about 2 weeks after the locks close.

Name: Earl Ricon
Location: Stuart
Occupation: Conservation 0fficer
Statement: He has seen thousands of people who all say, as he does himself, that the fishing is ruined all the way up, the north and south forks and down to the inlet when

the locks are opened. It takes 2 to 3 months before it clears up and fishing is near normal.

Name: Raymond Smith
Location: Stuart
Occupation: Contractor - Sport fisherman.
Statement: He agrees with others in that the opening of the locks ruins the fishing.

Name: Ernest Lyons
Location: Stuart
Occupation: Stuart News
Statement: In the early '30s there was a steady flow for about a year from the lake. The tourist business was ruined and the river all silted up. Ten feet of water were in places here, now there are only 3 5 feet. Oysters in the river and north fork are killed. The cattle and farming interests are gradually closing in on the marsh areas so that now an emergency is created by a much less extreme condition than formerly.

The Stuart population is only 2800 Martin County, 7,800, but they have 10,000 fishing visitors every year which is over a million dollars worth of tourist business.

Big tarpon (40 lbs. and over) used to come in the St. Lucie Inlet and now pass it by. There are 10 20 lbs. tarpon in upper river but no big ones like they used to have in Broad Bay. There is usually a run of snook in July and August following the dogfaced eels. There were none this year.

Siltation and the marring of a beautiful river are undesirable happenings. He would like to see a water conservation program which would not dump all the water from the lake into the river in such large amounts.

The C-23 Canal into Bessie Creek also damages the fishing and is ruining Bessie Creek.

Name: Captain Ray Young
Location: Stuart
Occupation: Charter Boat Captain.
Statement: He finds the river full of hyacinths and debris which are dangerous to the navigation of his boat to and from the inlet. He also has to go out much further to get beyond the discolored water flowing from the inlet in order to fish.

Name: Ernest Brasgaila
Location: Stuart
Occupation: Sport fisherman
Statement: He finds there is no good sport fishing in the river when the locks are open.

Name: Ezra Woods - President Palm City Civic Org.
Location: Palm City
Occupation: Operates a fishing camp and guide service. He has cottages and boats for rent. He also has a boat repair and boat building business equipped with marine ways.
Statement: There was good fishing until the first week of August, 1953, about the 4th or 5th. There were a lot of 3 - 5 lbs. snook and a large run was expected but it is hopeless since they opened the locks. He has only been here about 3 years but with the opening of the locks it gets worse every year. His hauling out business has also been hurt due to the filling and silting of the channel. He used to be able to haul boats of 6 ft. draft but now is lucky to be able to get over 3 or 4 feet of water into his place. Bars and shallows are being built up of sand and silt every tine they open the locks.

The fishing is better when you have calm weather even when the lock are not open since the water is clearer and the bottom is not roiled up. Oysters, claims, etc, are all killed by the fresh water. Lines deteriorate rapidly in this water.

Name: Mr. Boyd Fox
Location: Palm City
Occupation: Operates a guide and fishing boat rental service.
Statement: He says fishing is good up the south fork of the St. Lucie when the locks are open. There are plenty of snook and tarpon in the swift water when the locks are open but you cant catch them because the water is too swift.

Name: Mr. Otto Matousek
Location: Palm City
Occupation: Retired
Statement: Agrees with Mr. Wood's statement.

Name: Earl Daniel
Location: Palm City
Occupation: Dredge worker
Statement: He has worked on the dredging of the canals and knows it is a big project. He wonders about the effects.

Name: Arthur Brannon.
Location: Stuart
Occupation: Western Auto Store, sport fisherman
Statement: Fish was no good August 2, 1953, up Bessie Greek. Fishing was no good August 9, 1953 up the north fork by the airplane anchorage.

Name: Richard Latham
Location: Stuart
Occupation: Sport fisherman
Statement: Same as Brannon

Name: Wilfred Beebe
Location: Rio
Occupation: Workman at Anchorage Boat Basin and Yachtel at Rio below the Stuart Bridge.
Statement: The water gets pretty dirty but our business is not hurt too much if the locks are open in the summer because we don't have any business then anyway.

Name: Harry Swinglehurst
Location: Rio
Occupation: Tackle shop
Statement: He complains of the odor from the dead shellfish which cluttered the shore in front of his place when they opened the locks. The oysters are killed and the sheepshead caught in the inlet

Name: Captain Jones Langford
Location: Rio
Occupation: Charter boat Dolphin
Statement: He voices the general protest and adds that he has to go 6 miles out at times to get out of the river water and do sailfishing.

Name: Captain James Lovvorn

Location: Jensen
Occupation: Charter boat business
Statement: Fish is no good when the locks are open. He says you have to go 5 miles to get good fishing.

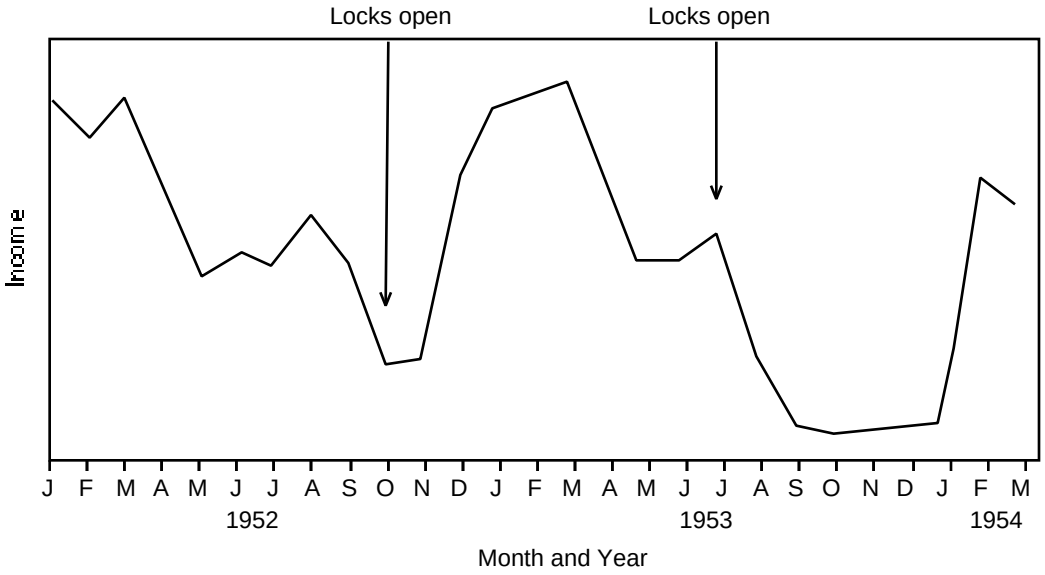
Name: Peter Koust
Location: Jensen
Occupation: Charter boat
Statement: Same is Captain Lovvorn.

Name: THE STUART NEWS
Statement: Numerous articles written pointing out their views on this subject.

The information gathered concerning the fishing, especially the sport fishing, is in agreement with the fact that the water releases from the lake hurt fishing in this area. There is a general resentment concerning these releases. This resentment increases with every additional day that the locks are kept open. It is also greater during the late fall and winter than it is during the summer.

At no time during these interviews did it appear that there were any deliberate misstatements offered.

GRAPH SHOWING THE TREND OF TIHE FLUCTUATIONS IN INCOME FROM BOAT RENTALS TO SPORT FISHERMEN



DISCUSSION

TEMPERATURES

The temperatures recorded are those that might be expected at the time of year that sampling was conducted. They are not extreme and probably do not have an adverse effect on the fish population. Changes temperature caused by the release of lake water are not, believed to be harmful to the fish.

HYDROGEN ION CONCENTRATION (pH)

The pH of water released from Lake Okeechobee is not greatly different from the pH of ocean or estuarine waters. During August when the locks were open there were greater differences in the pH of waters containing from the original south fork of the St. Lucie River, and from the waters coming from Bessie Creek and the north fork of the St. Lucie River, than from the Canal. Ecological effects caused by a lowering of the pH would more likely be found in these waters than in the waters being released from the lake. This might also be said of any harmful effects depending upon the synergistic action of a lowered pH with other changes occurring in the waters of the original river, or of Bessie Creek, or of the north fork of the St. Lucie River.

DISSOLVED OXYGEN

The lowest dissolved oxygen value obtained (20.1%), while the locks were open, was in the waters of the original branch of the south fork of the St. Lucie River, above where it leads into the St. Lucie Canal. Values of from 46.9% to 65.2% saturation were recorded from, this location during March when the locks were closed. Factors other than lake water releases contribute to these differences.

Dissolved oxygen values from 38.4% to 54.1% saturation were recorded from the waters of the north fork of the St. Lucie River during August while the locks were open. These waters had a high dissolved oxygen content of from 95.1% to 122.6% saturation during March when the locks were closed. Factors other than lake water releases contribute to these differences.

One factor, which is partially responsible for the low dissolved oxygen content of the upper reaches of the south and north forks of the St. Lucie River, is the introduction of large amounts of water of low dissolved oxygen content during the rainy season. These waters and their tributaries, such as Bessie Creek, would experience such seasonal changes independent from lake water releases.

The dissolved oxygen content of the canal water, during lake releases, was higher than that found in the original branch of the south fork of the St. Lucie River, above where it leads into the St. Lucie Canal or the north fork of the St. Lucie River.

The lowest dissolved oxygen value obtained (29% saturation), when the locks were closed, was in the St. Lucie Canal by Marker #42. This value is lower than any recorded from the Canal when the locks were open.

The dissolved oxygen content in general was lower while the locks were open. The release of lake water is mainly responsible for these decreases in the dissolved oxygen content at locations other than those discussed. Waters from the South and North forks and their tributaries are contributing factors to the overall general decrease in the dissolved oxygen content when the locks are open.

SALINITIES AND TIDAL EFFECTS

It is evident from the measurements that the release of lake water effects major changes in the salinity of this estuary.

At or near conditions of maximum, release the waters above the bridge at Stuart might be considered "fresh" at all stages of the tide. There is a change in the velocity of flow due to the tidal influences, but no appreciable change in the salinity.

In March when the locks were closed, salinities as high as 22.5°/oo were recorded in the north fork of the St. Lucie and 15.0°/oo was recorded from the Canal at Marker #42.

In the river at Marker #23x salinity measurements from 27.0°/oo to 30.1°/oo were recorded when the locks were closed. This differs greatly from the values recorded when the locks were open and the salinity did not measure above 2.8°/oo.

Above Sewall's Point, there was not much change in salinity measurements clue to tidal action.

Below Sewall's Point the salinities recorded during March did not vary greatly from high to low water. The low water salinities being about 2°/oo less than those measured during high water, the lowest was measured at 34°/oo.

During the period of water releases the tide was able to penetrate the inlet during high water when salinities approaching 30°/oo were recorded. On the ebb tide there was a rapid and severe lowering of the salinity to as low as 4°/oo on the surface and 10°/oo at the bottom.

These salinity changes are severe enough to cause a temporary exodus from this area of species of fish preferring a more saline habitat. Such conditions could also cause the death of forms unable to migrate from this environment.

SEDIMENTS

The deposition of sediments in the Stuart area has been investigated during and after the release of water from Lake Okeechobee. Sediment samples were collected at nine stations in the St. Lucie River and estuary during August while water was being released and again during March when there was no lake water discharge. The analysis of the samples is enclosed.

The U. S. Army Engineers conducted sampling during November, December and January. Laboratory analyses of these samples were forwarded to this office.

Two main types of sediments are being deposited in this area. Classified as to grain size there are heavier quartz particles greater than 62 microns (U. S. Standard Sieve Size 230) and, highly organic silt or clay size particles less than 62 microns. Shell fragments, detritus and plant fibers are also found in varying amounts.

All sources in to the St. Lucie River contribute to the sediments being deposited in the river and in the estuary.

When water is released through the St. Lucie Canal a large amount of the heavier quartz material is carried into the lower reaches of the south fork of the St. Lucie River and deposited in the vicinity of the Palm City Bridge. Laminations of black organic material found in Sample #1, taken from the station at Marker #34 during August indicated that the type of sediment

being deposited was not uniform. Similar laminations were found in Sample #1a, taken from the sane station during March. The following table offers a comparison of the two samples:

	Dry Wt.	% By Wt. > 62 µ	% By Wt. < 62 µ	
#1	430.89 grams	78.00	22.00	Locks Open
#1a	70.79	68.54	31.46	Locks Closed

Samples taken by the U. S. Army Engineers at this station between November 20, 1953 and January 5, 1954, contained 0.06 foot of sand during a 3 day period and again during a 17 day period. In one instance this amount of sediment was removed from the bottle between morning and afternoon inspections. A gradation curve of one of these samples does not differ greatly from gradation curves plotted for sample #1 and #1a.

The net dry weight of Sample #1 was greater than any other sample collected from the area and in fact was greater than the combined weight of all the other samples. The fraction of this sample less than 62 microns was 94.8 grams which amount was equal to 60% of the total sediment collected at the other stations during August.

The fraction of sample #l (94.8 grams) less than 62 microns was also 36% greater than the total amount of sediment less than 62 microns collected from all nine stations during March when the locks were closed.

The large amount of sediment collected in Sample #1 in relation to other samples taken during the same time might be attributed to the location. With respect to other samples taken at the same point the larger amount might be attributed to the time of sampling in that greater amounts of sediment were deposited within a few weeks after the locks were opened than were deposited after flow had continued for some time.

The spoil bank along the southern side of the channel by Marker #34 is an effective barrier, preventing the flow of more than a small amount of water into the cove to the south of this channel. Sample #2 from this area indicated that only a slight amount of the total sediment is carried over this bank. Bottom samples taken from this area indicated that deposition of black organic material has been considerable in previous years.

Sample #22 from this area taken during March contained a greater amount of sediment than #2 and most of Sample #2a was composed of material finer than 62 microns:

	Dry Wt.	% By Wt. > 62 µ	% By Wt. < 62 µ	
#2	1.35 grams	--	--	Locks Open
#2a	16.80	17.38	82.62	Locks Closed

These results indicate that most of the sediment finer than 62 microns is being deposited in this area while the locks are closed. A comparison with the total amount of sediment finer than 62 microns which was collected in Sample #1a would indicate that it is possible for this amount of sediment to be deposited in this area independent of lake water releases.

Another possibility is suggested by the fact the largest amount of sediment less than 62 microns was collected in Sample #1. The introduction of the sediment less than 62 microns may take place while the locks are open and be redistributed after they are closed.

Samples #3 and #4 which were taken at channel markers #27 and #24, at or near the axis of stream flow, contained small amounts of sediment. Here, too, samples #3a and #4a taken after the locks were closed contained greater amounts of sediment:

	Dry Wt.	% By Wt. > 62 µ	% By Wt. < 62 µ	
#3	0.80 grams	--	--	Locks Open
#3a	22.05	24.80	75.20	Locks Closed
#4	0.23	--	--	Locks Open
#4a	6.61	96.52	3.48	Locks Closed

Samples #5 and #6 which were taken at channel Marker 23x and at the range Marker in Indian River north of the St. Lucie River contained more sediment than samples #5a and #6a taken at these stations when the locks were closed:

	Dry Wt.	% By Wt. > 62 µ	% By Wt. < 62 µ	
#5	39 64 grams	97.80	2.20	Locks Open
#5a	12:03	92.52	7.48	Locks Closed
#6	87.93	89.50	10.50	Locks Open
#6a	41.07	77.87	22.13	Locks Closed

Sample #7 which was taken at the entrance to the Intercoastal waterway south of the St. Lucie River contained less sediment than Sample #7a taken from this location when the locks were closed:

	Dry Wt.	% By Wt. > 62 µ	% By Wt. < 62 µ	
# 7	0.24 grams	58.50	41.50	Locks Open
#7a	0.36	76.56	13.44	Locks Closed

Sample #8 and #8a taken at Marker #22 contained little sediment:

	Dry Wt.	% By Wt. > 62 µ	% By Wt. < 62 µ	
#8	0.24 grams	--	-- Locks	Open
#8a	0.36	--	-- Locks	Closed

Sample #9 which was taken in the north fork 1000 yards above the confluence with the St. Lucie contained less sediment than sample #9a taken from this location after the locks were closed:

	Dry Wt.	% By Wt. > 62 µ	% By Wt. < 62 µ	
#9	3.26 grams	45.70	34.30	Locks Open
#9a	7.53	79.41	20.59	Locks Closed

EFFECTS UPON FISHING

This report embodies statistics for the total amount of fish landed in Martin County by month for the last few years.

Monthly fish production lan6ings have been collected only since September, 1950, and such data are unavailable prior to that date. The landings are compiled from reports collected from

the commercial wholesale fish dealers. These reports give the number of pounds of the individual species landed during each month. The smallest unit of area into which these reports are subdivided is the county.

Statistics of the yearly totals prior to 1950 were based upon yearly estimates of the commercial catch given by the wholesale fish dealers to the Florida State Board of Conservation.

The statistics have certain limitations for the present purpose. For example, not all fish reported as landed in a certain county are actually caught in waters of that county. Secondly, some landings are unreported. This error is thought to be small and is compensated in the landing curve by the error being relatively equal in all areas, so that a direct comparison between landings of various counties is usually valid. Since these and other errors in the landings are common to all counties it is believed that the trends shown by the landing curves may be depended, upon in their general form.

In order to assess the effect on commercial fish production of the of fresh water from, Lake Okeechobee the landings are examined. There are always marked, fluctuations of fish catches in an area due to seasonal abundance of the fish and to short-term changes in temperature, and winds. Markets for fish also affect fishing effort and therefore, landings. Thus, declines in landings, per se cannot be taken as evidence of bad effects of water outflow. A valid method of judging effects of the openings of the locks would be to compare the landings in the county effected by the lake outflow, with adjacent counties, whose fishing is unaffected by this factor, and with the whole east coast of Florida. After the release of water from Lake Okeechobee, if landings consistently declined in Martin County (including St. Lucie inlet) while they increase in the rest of the east coast counties, or in the adjacent counties, it right be justified to say that the fresh water has a bad effect on commercial fishing. The graphs, included in report 54-9 (Fish Catch, Statistics in Relation to Water Release from the St. Lucie Canal) do not support this idea. In practically every case (whether dealing with total fish landings, or landings by species or whether yearly or monthly) Martin County landings rose or fell when those in other counties did likewise.

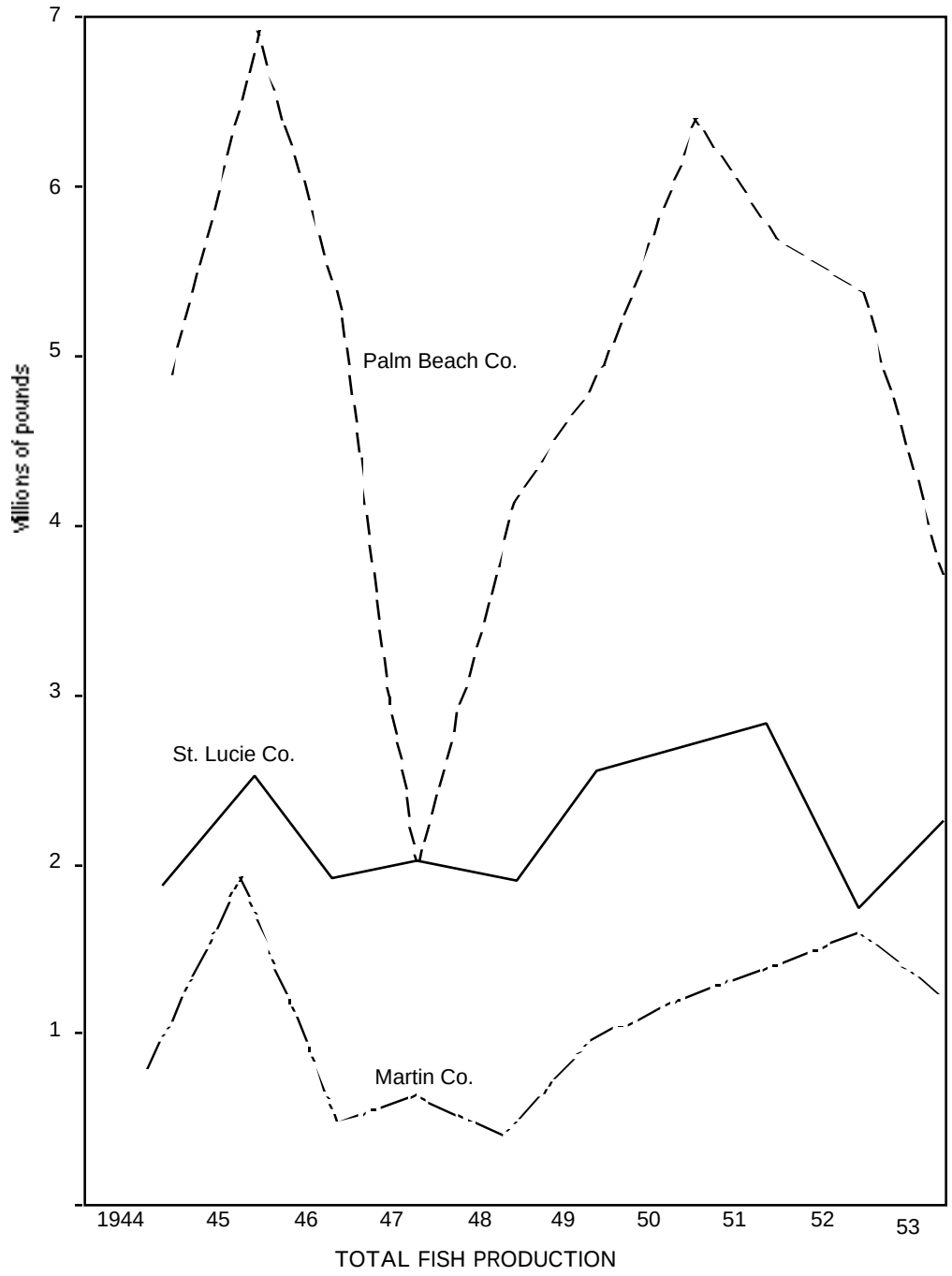
It should be pointed out, however, that the effect of the fresh water should be most noticeable in 1953 when the locks were open for the longest period (August thru December). No significant, difference is evidenced in the Trend of the Martin County Fishery as shown in the accompanying graph. (Shown on next page.)

From this evidence it may be said that the fresh water outflow from Lake Okeechobee has not significantly affected commercial fish landings in Martin County. However, commercial fish, such as the pompano, Bluefish, mackerel and trout would avoid the fresh water outflow, and during periods of release commercial fishermen may find it necessary to travel further to make their catch.

Evidence concerning the effects of the fresh water on sport fishing is contrary to this, however. Features on the amount of fish caught by sportsmen are not available. Information obtained through interviews and direct observation points strongly in one direction: namely, that sport fishing has undoubtedly been harried.

Two types of consideration are involved in this problem and they should be carefully distinguished in order to avoid confused thinking. The first approach involves a definition of "harm" to the fishing in terms of reduction of fish stocks the destruction of fish. Under this concept the lake outflow has not "harmed" sport fishing, since the fish are probably not killed but are merely pushed out of the areas where they have lived. The other concept - and a more

valid one here - is that "harm" to the sport fishery occurs if fish are harder to catch. This is unquestionably the case in the St. Lucie Inlet. When the fresh water from the lake invades the inlet, fish which live in salt or brackish water leave the area. They are not killed but neither can they be caught, and to the angler they are gone. It is of no interest to him that there is an abundance of fish ten miles away, which he can, perhaps, catch next month. He needs the fish here and now. It has been stated previously that the effect on sport fishing of the outflow from the lake was "temporary". In the sense explained here this is undoubtedly true, but the statement is not meant to under estimate the seriousness of the effect.



Permanent effects upon angling may be caused by the accumulation of sediment. Unfortunately, no statistics of the sportsman's catch are available and a fair appraisal of the long term effects cannot be made without detailed investigation.

CONCLUSIONS AND RECOMMENDATIONS

As long as it remains necessary to release water from Lake Okeechobee, through the St. Lucie Canal, in order to control the level of the lake, there will be a difficult problem in connection with the boating, fishing and recreation of the Stuart area.

Temperature, dissolved oxygen and pH do not appear to be of great importance.

Evidence is presented that severe and rapid changes in salinity occurred as a result of the release of water from the lake. The lowering of the salinity is severe enough to cause a temporary exodus from this area of species of fish preferring a more saline habitat, and could also cause the death of forms unable to integrate from this environment.

The seriousness of this effect is felt more severely in Stuart than in Fort Myers because of the differences in the economics of these cities. In the Stuart area protests against the water releases are greatest during the tourist season.

A study of the commercial fish landings does not indicate any serious reduction in commercial activity due to the discharge of water through the St. Lucie Canal. It is believed, however, that the sports fishing business, insofar as inshore and estuarine species are concerned is quite seriously harmed, although no damage may be done to the fish stocks themselves by the fresh water influx.

In relation to both sport and commercial fishing activities the effects of the sediments being deposited now are of a more permanent nature and will remain long after water releases cease. More detailed studies on the effects of the sediment on marine life are needed.

Sediments are being deposited throughout the estuary during water release. Sediments are also being deposited or transported in the estuary after water releases cease. More detailed research would be necessary to establish the proportion of the sediments which are directly deposited by the water releases and their ultimate disposition.

The control of the sediments is considered the most important problem involved in the water releases.

Topographic changes due to the deposition and/or the retransportation of sediments is another problem. This concerns the silt and clay size particles.

The preliminary nature of the work done to date does not offer sufficient data for one to state (1) the portion of the silt or clay size particles coming into the estuary from the various sources, (2) the amount of this material being carried into this area independent of lake water releases, (3) the pattern of distribution of this material under the various conditions of water release, weather and tidal effects, (4) the ultimate ecological effects of this material, (5) effective methods of control.

The salinity changes and the sediment deposition are sufficient to cause substantial damage to the ecology and fisheries of this area.

Since it is absolutely necessary to release certain columns of water through the St. Lucie inlet the only possible means of alleviating the ill effects is to reduce the rate of flow and to increase its duration. This might be expected to limit the range of sediment transport and to bring about some improvement in the salinity characteristics of the area. It is, therefore, recommended that a careful study be made of these possibilities as well as the general nature of the ecological effects of the silt and the permanent effects of the salinity changes. Since the release of water may be continued for a considerable number of years, and since many of the effects are relatively permanent it appears to us of great importance that there effects be determined as fully as possible. In this way, the continuing effects of sediment may be estimated and an attempt made to forecast their long range effects on the ecology and fisheries of the St. Lucie.