SOUTH TEXAS PROJECT
ELECTRIC GENERATING
STATION

REPORT #2

COLORADO RIVER ENTRAINMENT AND IMPINGEMENT MONITORING PROGRAM

PHASE TWO STUDIES — JULY - DECEMBER, 1984

APRIL, 1985

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PREPARED FOR

SOUTH TEXAS PROJECT

SUBMITTED BY

ECOLOGY DIVISION, ENVIRONMENTAL PROTECTION DEPARTMENT

HOUSTON LIGHTING & POWER COMPANY

APRIL 1985

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TABLE OF CONTENTS

LIST OF TABLES

INTRODUCTION

Section 6.1.3.2 and Appendix E of the Final Environmental Statement require Phase Two of the aquatic ecology studies to begin within one week of the start of reservoir fill pumping. The initial report (McAden et al. 1984) covered the period July 1983 - June 1984. This report presents data from the sampling period July - December 1984. Due to limited pumping during this period, only one set of samples was collected.

METHODS

All stations, schedules and methods employed were the same as those described in the initial report (McAden et al. 1984). A malfunction of the pH meter precluded pH measurements during sampling.

RESULTS AND DISCUSSION

HYDROLOGY AND WATER QUALITY

Water temperature, turbidity and dissolved oxygen data from the Colorado River station are shown in Table 1. Conductivity values are given in Table 2, and salinity values are given in Table 3. Water temperature, salinity and dissolved oxygen data from the Reservoir Makeup Pumping Facility (RMPF) siltation basin are given in Table 4. Water temperature, salinity and dissolved oxygen data from the RMPF revolving screens are given in Table 5.

On 5-6 September a salt wedge was present in the Colorado River, extending to within 5-10 ft of the surface. The wedge was up to 3.0 C warmer than the low salinity surface water and contained low dissolved oxygen levels (maximum 0.8 ppm at the bottom).

Surface water quality in the RMPF siltation basin was similar to that of the surface water in the river. Bottom water quality measurements were not made in the siltation basin.

Surface water quality at the revolving screens was similar to the surface water quality in the river. However, bottom salinity at the screens was lower (as much as 6.3 ppt) than salinities at comparable river depths.

River flow during the sampling period is shown in Table 6 and the daily volume of water pumped into the reservoir during July-December 1984 is shown in Table 7.

MACROZOOPLANKTON AND ICHTHYOPLANKTON

Samples collected by 0.5-m plankton net yielded 29 taxa of invertebrates and 7 taxa of vertebrates (Table 8). The most abundant invertebrates were jellyfish (medusae), copepods (especially Acartia tonsa and Oithona spp.), barnacle nauplii, the zoeae of the brackish water shrimps Palaemonetes spp. and Callianassa spp. and the zoeae of the brackish water crab Rhithropanopeus harrisii. All of the vertebrate taxa consisted of larval and juvenile stages of both freshwater and estuarine fishes. A single sunfish larva (Family Centrarchidae) constituted the freshwater component of the ichthyoplankton samples, whereas the bay anchovy and at least two species of gobies dominated the estuarine taxa.

Table 9 shows the variations in macrozooplankton abundance over the 24-hr sample period on 5-6 September 1984 in the Colorado River. The largest total numbers of organisms were taken in samples collected at mid-depth and in the oblique tows. Considerably smaller numbers of taxa, as well as numbers within taxa, were collected at the surface and near the bottom. The reasons for these spatial differences in abundance can be seen in the hydrological and water quality measurements made at the times of sample collection (Tables 1-3). There was a layer of very low salinity water at the surface, which contained a paucity of both taxa and numbers of individuals within taxa. The reason for the relative scarcity of zooplankton near the bottom of the river is the critically low dissolved oxygen levels near the river bottom (Table 1).

By far the most commonly found and most abundant of the river zooplankton taxa was the xanthid mud crab, Rhithropanopeus harrisii. Other abundant forms were jellyfish medusae and the zoeal stages of the ghost shrimp, Callianassa spp. Relatively low numbers of the commercial white shrimp, Penaeus setiferus, and the megalops stage of the blue crab, Callinectes spp., were taken, although Callinectes spp. megalops did occur at a high density in the 0300-hr oblique sample. It is possible that this taxon consisted of both the commercial blue crab, C. sapidus, and the noncommercial pygmy blue crab, C. similis.

A list of the common and scientific names of the larval and juvenile stages of fish taxa collected from both the Colorado River and the siltation basin is found in Table 10.

Table 11 shows the temporal and spatial variations in ichthyoplankton abundance in the Colorado River. The data are too limited to draw any meaningful conclusions, except to note the total absence of ichthyoplankton near the bottom. This is understandable given the low dissolved oxygen levels noted in the earlier discussion of macrozooplankton abundance.

Table 12 depicts the changes in abundance of macrozooplankton and ichthyoplankton over the sampling period. As in the river samples, the zoeal stage of the xanthid mud crab, Rhithropanopeus harrisii, was the most abundant taxon, but unlike the river samples, highest densities occurred during the hours of daylight. The reasons for this are unclear, because siltation basin samples were collected at the surface and zooplankton abundance in surface samples is typically lowest in the daytime. Another commonly occurring, albeit in low densities, taxon was the parasitic fish louse, Argulus spp. No penaeid shrimp or blue crab larvae were taken from the siltation basin, and only one ichthyoplankter, an unidentified yolksac larva.

MACROINVERTEBRATES AND FISH

Representatives of 27 species were captured in seine and revolving screen samples during the study (Table 13), but no organisms were captured in the trawl samples. Critically low dissolved oxygen levels at the bottom of the river (Table 1) appear to be the limiting factor.

Six (6) species of macroinvertebrates, including 5 species of shrimp and 1 crab, were taken in seine samples (Table 14). Macrobrachium ohione, a small river shrimp, was the only freshwater representative, while the estuarine/ marine white shrimp, Penaeus setiferus, was the most abundant invertebrate (643 caught).

Twenty species of vertebrates, all of which were fish, were caught in the seine samples (Table 14). Of these, only the spotted gar, Lepisosteus occulatus, is freshwater, with the remainder being estuarine and marine. The fish most commonly caught was the bay anchovy, Anchoa mitchilli (170).

Impingement samples (Table 15) yielded 4 macroinvertebrate species, one of which was the pink shrimp, Penaeus duorarum, found only in the impingement samples. The total catch was 15 individuals. In general, the animals were small, 5-64 mm in length.

REFERENCES CITED

McAden, D.C., G.M. Greene and W.B. Baker, Jr. 1984. Report #1. Colorado River Entrainment and Impingement Monitoring Program, Phase Two Studies - July, 1983-June, 1984. Ecology Division, Environmental Protection Department, Houston Lighting & Power Company.

USNRC 1975. Final Environmental Statement. South Texas Project Units 1 and 2. Houston Lighting & Power Company, City Public Service Board of San Antonio, Central Power and Light Company, City of Austin. Docket Nos. 50-498 and 50-499. Prepared by Office of Nuclear Reactor Regulation, United States Nuclear Regulatory Commission.

TABLE 1

TEMPORAL VARIATIONS IN TEMPERATURE, TURBIDITY, AND DISSOLVED OXYGEN AT MID-CHANNEL OF THE COLORADO RIVER, SEPTEMBER 1984

Sampling Dates	Time (CST)	Temperature (°C) Surface	Temperature (°C) Bottom	pH Surface*	Secchi disk Turbidity (inches)	Dissolved O_2 (ppm) Surface	Dissolved O_2 (ppm) Bottom	Bottom Depth (ft)
5 September	2045	27.7	29.6	-	17.0	7.8	0.1	17.0
6 September	0300	26.5	29.5	-	20.5	7.4	0.1	20.0
6 September	0855	26.2	29.5	-	21.0	8.2	0.1	19.5
6 September	1450	29.2	29.6	-	20.0	9.1	0.8	18.0

*pH meter not working

TABLE 2

TEMPORAL AND SPATIAL VARIATIONS IN CONDUCTIVITY (MILLIMHOS/CM)
AT MID-CHANNEL OF THE COLORADO RIVER, SEPTEMBER 1984

Sampling Dates	Time (CST)	DEPTH (ft.) S	5	10	15	20	B (Depth)
5 September	2045	4.3	31.8	44.3	45.2	-	45.5 (17.0)
6 September	0300	4.3	22.1	42.6	44.0	45.5	45.5 (20.0)
6 September	0855	4.9	23.6	40.8	44.8	-	45.4 (19.5)
6 September	1450	4.5	25.0	42.3	44.6	-	44.9 (18.0)

TABLE 3

TEMPORAL AND SPATIAL VARIATIONS IN SALINITY (PPT)
AT MID-CHANNEL OF THE COLORADO RIVER, SEPTEMBER 1984

Sampling Dates	Time (CST)	DEPTH (ft.) S	5	10	15	20	B (Depth)
5 September	2045	2.4	20.0	28.8	29.5	-	29.8 (17.0)
6 September	0300	2.4	13.5	27.7	28.6	29.8	29.8 (20.0)
6 September	0855	2.8	14.5	26.3	29.2	-	29.7 (19.5)
6 September	1450	2.5	15.4	27.4	29.1	-	29.3 (18.0)

TABLE 4

TEMPORAL VARIATIONS IN SURFACE WATER QUALITY PARAMETERS
IN THE RMPF SILTATION BASIN (SEPTEMBER 1984)

Sampling Dates	Time (CST)	Temperature (°C)	Salinity (PPT)	Dissolved Oxygen (PPM)	pH*
6 Sept.	0020	26.8	2.8	8.6	-
6 Sept.	0500	25.9	2.5	6.9	-
6 Sept.	1030	27.1	3.5	8.1	-
6 Sept.	1615	29.2	3.5	9.1	-

* pH meter not working

TABLE 5

TEMPORAL VARIATIONS IN TEMPERATURE, CONDUCTIVITY, SALINITY, AND DISSOLVED OXYGEN AT THE STP REVOLVING SCREENS, SEPTEMBER 1984

Sampling Dates	Time (CST)	Temperature (°C)		Conductivity (millimhos/cm)		Salinity (ppt)		Dissolved Oxygen (ppm)		pH*	Bottom Depth (ft.)
		Surface	Bottom	Surface	Bottom	Surface	Bottom	Surface	Bottom	Surface	
5 September	1910	28.3	29.0	5.7	25.4	3.2	15.7	7.8	1.3	-	6
6 September	0300	26.4	27.2	5.2	12.4	3.0	7.2	7.8	7.4	-	5
6 September	1104	27.4	28.3	7.5	22.4	4.2	13.7	6.2	2.8	-	5

11

* pH meter not working

TABLE 6

AVERAGE* COLORADO RIVER FLOW (CFS) ON DATES OF SAMPLE COLLECTION, SEPTEMBER 1984

DATE	RIVER FLOW
5 September	663
6 September	721

*Derived by taking arithmetic mean of 3 daily flow values recorded at the beginning of each shift

TABLE 7

RESERVOIR MAKEUP PUMPING FACILITY (RMPF)
DAILY PUMPAGE (M^3), JULY-DECEMBER 1984

DATE	JULY	AUGUST	SEPTEMBER	OCTOBER	NOVEMBER	DECEMBER
1		687,444				
2		498,332				
3	618,317	330,252	39,757			
4	745,407	226,549	268,477			
5	300,178		376,127			
6	262,975	35,661	403,647			
7	122,316		401,340			
8			440,344			
9			7,697			
10			314,278			
11			494,298			
12			39,103			
13						
14						9,399
15				68,892		
16				119,825		
17		130,815				
18		636,709		49,563		
19	25,448	403,647				
20	81,524	158,582				
21		109,833				

TABLE 7 (Cont'd)

DATE	JULY	AUGUST	SEPTEMBER	OCTOBER	NOVEMBER	DECEMBER
22			65,414			
23				15,604		
24						
25						
26						
27						
28						
29					2,751	
30	79,439					
31	557,245					
Totals	2,792,849	3,217,824	2,850,482	253,884	2,751	9,399

TABLE 8

MACROZOOPLANKTON AND FISH TAXA COLLECTED IN THE COLORADO RIVER BY 0.5-M PLANKTON NET, 5-6 SEPTEMBER 1984

TAXA	Surface	Mid-Depth	Bottom	Oblique
CNIDARIA				
Jellyfish medusae	X	X	X	X
ANNELIDA (Polychaeta)				
Polychaete larvae	X	X	X	X
MOLLUSCA				
Pelecypoda juvenile		X	X	X
Gastropoda juvenile		X	X	
CHAETOGNATHA				
Sagitta sp.		X		X
CLADOCERA				
Daphnia sp.	X			X
Moina brachiata	X			X
Moinodaphnia macleayii		X		X
COPEPODA				
Copepoda nauplii		X		
A. tonsa		X	X	X
Diaptomus spp.			X	
Eucalanus sp.		X		
Cylopoida copepodida		X		
Halicyclops spp.		X		X
Oithona spp.		X	X	X
Unidentified Caligoida	X			

TABLE 8 (Cont'd)

TAXA	Surface	Mid-Depth	Bottom	Oblique
BRANCHIURA				
Argulus spp.				X
CIRRIPEDIA				
Barnacle nauplii		X	X	X
Barnacle cypris		X		
MALACOSTRACA				
Mysidopsis spp. juveniles		X	X	X
P. setiferus postlarvae	X			
Hippolyte sp. zoeae		X		
Palaemonetes spp. zoeae	X	X	X	X
Callianassa spp. zoeae		X	X	X
Callianassa spp. postlarvae		X	X	
Callinectes spp. megalopa	X	X		X
Rhithropanopeus harrisii zoeae	X	X	X	X
R. harrisii megalopa		X		X
Sesarma sp. zoeae				X
PISCES				
Unidentified fish larvae	X			
Anchoa mitchilli	X			
Unidentified Centrarchidae	X			
Cynoscion arenarius		X		
Gobionellus spp. larvae		X		
G. hastatus		X		X
Gobiosoma bosci		X		

TABLE 9

NUMBER (PER 100 M^3) OF MACROZOOPLANKTON COLLECTED IN THE COLORADO RIVER BY 0.5-M PLANKTON NET ON 5-6 SEPTEMBER 1984

	SURFACE				MID-DEPTH				BOTTOM				OBLIQUE			
TAXA TIME (CST):	2045	0300	0855	1450	2045	0300	0855	1450	2045	0300	0855	1450	2045	0300	0855	1450
Jellyfish medusae	2.7					178.8		192.6		7.3	10.9	9.0		64.7		452.1
Polychaete larvae		3.3				41.3		25.2	10.7	7.3	2.2		25.9	10.8	18.9	12.1
Gastropod juveniles						4.6			2.1							
Pelecypod juveniles						41.3				7.3	2.2		6.5	21.6		12.1
Sagitta spp.						2.3	3.2	9.0						21.6	4.7	
Daphnia spp.	11.0												64.8	10.8		
Moina brachiata	2.7	10.0											6.5			
Moinodaphnia macleayii							1.6							10.8		
Copepod nauplii						11.5		3.6								
Acartia tonsa						249.9	9.7	10.8			2.2			21.6	9.4	4.0
Eucalanus sp.							3.2	3.6							4.7	
Diaptomus spp.									2.1							
Halicyclops sp.					2.1	6.9								10.8		
Oithona spp.						39.0	1.6	9.0			4.4				9.4	
Cyclopoida copepodida						2.3										
Caligoida (unidentified)	5.5	3.3														
Argulus spp.														10.8		

TABLE 9 (Cont'd)

TAXA	SURFACE				MID-DEPTH				BOTTOM				OBLIQUE			
TIME (CST):	2045	0300	0855	1450	2045	0300	0855	1450	2045	0300	0855	1450	2045	0300	0855	1450
Barnacle nauplii						300.4		41.4			6.6			21.6		12.1
Barnacle cypris						9.2										
Mysidopsis spp. juveniles						4.6	6.5	1.8			2.2			10.8		12.1
Penaeus setiferus postlarvae		6.7														
Hippolyte sp. zoeae							1.6									
Palaemonetes spp. zoeae	5.5	10.0	13.5		2.1		4.9		2.1	3.7			45.3	64.7	4.7	4.0
Callianassa spp. zoeae					2.1	811.7	309.3	70.2		11.0	10.9	2.2	13.0	172.6	51.9	48.4
Callianassa spp. postlarvae							1.6				2.2					
Callinectes spp. megalops		6.7				22.9	3.2	1.8					13.0	151.0		
Rhithropanopeus harrisii zoeae	8.2	13.4	108.1	16.9	6.2	181.1	174.9	90.0	34.4	22.0	13.1	2.2	537.5	1661.3	4004.7	189.7
R. harrisii megalopa					2.1	4.6										
Sesarma sp. zoeae														10.8		

TABLE 10

LIST OF FISH TAXA COLLECTED IN 0.5-M PLANKTON NET SAMPLES FROM THE COLORADO RIVER (C.R.) AND THE SILTATION BASIN (S.B.), 5-6 SEPTEMBER 1984

COMMON NAME	SCIENTIFIC NAME	LOCATION OF COLLECTION
Bay anchovy	*Anchoa mitchilli*	C.R.
Unidentified sunfish	Fam. Centrarchidae	C.R.
Sand seatrout	*Cynoscion arenarius*	C.R.
Unidentified goby	*Gobionellus* spp.	C.R.
Sharptail goby	*G. hastatus*	C.R.
Naked goby	*Gobiosoma bosci*	C.R.
Unidentified larvae	---	C.R., S.B.

TABLE 11

NUMBER (PER 100 M^3) OF ICHTHYOPLANKTON COLLECTED IN THE COLORADO RIVER BY 0.5-M PLANKTON NET ON 5-6 SEPTEMBER 1984

TAXA		SURFACE				MID-DEPTH				BOTTOM				OBLIQUE			
	TIME (CST):	2045	0300	0855	1450	2045	0300	0855	1450	2045	0300	0855	1450	2045	0300	0855	1450
Anchoa mitchilli		8.2	3.3														
Centrarchidae larvae		2.7															
Cynoscion arenarius							2.3										
Gobionellus sp. larvae							2.3										
G. [illegible]nstatus							4.6							6.5			
Gobiosoma bosci						2.1	2.3										
Unidentified larvae			3.3		5.6												

TABLE 12

NUMBER (PER 100 M^3) OF MACROZOOPLANKTON AND ICHTHYOPLANKTON COLLECTED IN THE SILTATION BASIN BY 0.5-M PLANKTON NET ON 6 SEPTEMBER 1984

TAXA	TIME (CST)			
	0020	0500	1030	1615
Sagitta spp.				12.9
Daphnia spp.	25.7			
Acartia tonsa			38.6	
Harpactacoid copepodida		38.6		
Argulus spp.	12.9	12.9		12.9
Callianassa spp. zoeae		51.4		
Rhithropanopeus harrisii zoeae	51.4	77.1	552.7	115.7
Unidentified fish larvae	12.9			

TABLE 13

MACROINVERTEBRATE AND FISH TAXA COLLECTED IN THE COLORADO RIVER BY TRAWL, SEINE AND REVOLVING SCREENS, 5-6 SEPTEMBER 1984

TAXA	TRAWL	SEINE	REVOLVING SCREENS
Penaeus aztecus		X	
P. setiferus		X	X
Penaeus duorarum			X
Trachypeneus constrictus		X	
Palaemonetes pugio		X	
Macrobrachium ohione		X	X
Callinectes sapidus		X	X
Lepisosteus occulatus		X	
Elops saurus		X	
Alosa chrysochloris		X	
Brevoortia patronus		X	
Anchoa hepsetus		X	
A. mitchilli		X	
Fundulus grandis		X	
Poecilia latipinna		X	
Menidia beryllina		X	
Hemicaranx amblyrhynchus		X	
Oligoplites saurus		X	
Eucinostomus argenteus		X	
Lagodon rhomboides		X	
Cynoscion arenarius		X	

TABLE 13 (Cont'd)

TAXA	TRAWL	SEINE	REVOLVING SCREENS
Leiostomus xanthurus		X	
Mugil cephalus		X	
Evorthodus lyricus		X	
Gobionellus boleosoma		X	
Citharichthys spilopterus		X	
Paralichthys lethostigma		X	

TABLE 14

TOTAL NUMBER, TOTAL WEIGHT (g) AND MEAN LENGTH (mm) OF MACROINVERTEBRATES AND FISH COLLECTED IN THE COLORADO RIVER BY SEINE ON 5-6 SEPTEMBER 1984

TIME (CST):	2045			0300			0855			1450		
TAXA	No.	Wt.	L.	No.	Wt.	L.	No.	Wt.	L.	No.	Wt.	L.
Penaeus aztecus	3	0.5	29.0	2	1.5	42.5						
P. setiferus	189	61.9	30.1	68	54.3	44.7	259	579.5	61.3	127	218.0	59.4
Trachypeneus constrictus										1	0.8	46.0
Palaemonetes pugio	36	13.8	-	23	11.1	-	6	2.0	-			
Macrobrachium ohione				1	0.7	41.0						
Callinectes sapidus	3	0.3	10.3	3	0.9	13.7	1	1.1	27.0	2	79.9	65.5
Lepisosteus occulatus							1	595.0	465.0			
Elops saurus				1	230.3	254.0						
Alosa chrysochloris	1	0.9	37.0									
Brevoortia patronus	8	15.0	45.0	16	53.7	51.2						
Anchoa hepsetus							1	0.9	43.0			
A. mitchilli				6	2.5	32.2	161	74.2	34.4	3	1.1	32.3
Fundulus grandis	2	7.9	52.5									
Poecilia latipinna	1	2.9	44.0									
Menidia beryllina	1	0.6	39.0				2	1.7	43.5			
Hemicaranx amblyrhynchus										5	7.2	36.6

TABLE 14 (Cont'd)

TIME (CST):	2045			0300			0855			1450		
TAXA	No.	Wt.	L.	No.	Wt.	L.	No.	Wt.	L.	No.	Wt.	L.
Oligoplites saurus							1	0.2	24.0			
Eucinostomus argenteus	4	1.5	24.2	1	0.1	20.0	2	1.6	33.5	2	1.2	30.5
Lagodon rhomboides	7	69.9	67.7				1	4.1	55.0	1	15.5	80.0
Cynoscion arenarius	1	1.7	45.0				1	5.6	70.0	1	3.9	63.0
Leiostomus xanthurus	5	25.2	57.8	4	40.5	72.0						
Mugil cephalus	2	9.2	56.5	5	47.1	71.0	2	11.2	63.0	1	0.4	28.0
Evorthodus lyricus							1	4.1	60.0			
Gobionellus boleosoma	10	5.7	32.2									
Citharichthys spilopterus	1	1.4	48.0									
Paralichthys lethostigma	1	935.5	350.0									

TABLE 15

TOTAL NUMBER, TOTAL WEIGHT (g) AND MEAN LENGTH (mm) OF MACROINVERTEBRATES IMPINGED ON 2 INTAKE SCREENS IN 30 MINUTES ON 5-6 SEPTEMBER 1984

TIME (CST):	1910			0300			1104		
TAXA	No.	Wt.	L.	No.	Wt.	L.	No.	Wt.	L.
Penaeus setiferus				1	1.8	64.0	3	1.5	39.7
P. duorarum	1	2.2	63.0						
Macrobrachium ohione	1	2.4	58.0	3	1.4	28.0			
Callinectes sapidus	2	0.2	12.0	3	2.9	22.0	1	0.1	5.0