Nuclear Operating Company

South Texas Project Electric Generating Station 4000 Avenue F – Suite A Bay City, Texas 77414

August 27, 2008
ABR-AE-08000068

U. S. Nuclear Regulatory Commission
Attention: Document Control Desk
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11555 Rockville Pike
Rockville MD 20852-2738

South Texas Project
Units 3 and 4
Docket Nos. 52-012 and 52-013
Response to Requests for Additional Information

Reference: Letter, Paul Kallan to Greg Gibson, "Request for Additional Information, Letter Number One Related to the Environmental Report for the South Texas Combined License Application", dated May 19, 2008 (AE-ABR-08000097)

Attached are the final two responses to NRC questions (02.04.02-01 and 02.04.02-03) that were included in the Reference letter. With this letter, STP Nuclear Operating Company (STPNOC) has now responded to all 177 questions issued by the NRC regarding the Environmental Report.

When a change to the COLA is indicated by a question response, the change will be incorporated into the next routine revision of the COLA following NRC acceptance of the question response.

There are no commitments in this letter.

If you have any questions, please feel free to contact me at (361) 972-4626, or Russell W. Kiesling at (361)-972-4716

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NRO

I declare under penalty of perjury that the foregoing is true and correct.

Executed on August 27, 2008

Gregory T. Gibson
Manager, Regulatory Affairs
South Texas Project, Units 3 & 4

rwk

Attachments:

1. Question 02.04.02-01
2. Question 02.04.02-03

cc: w/o attachment except*
(paper copy)

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Question Number 2.4.2-1

QUESTION:

Provide the results of the 12 months of aquatic resource sampling in the Colorado River.

Full Text (Supporting Information):

1. Describe the aquatic resources in the Colorado River within the vicinity of the site based on the sampling efforts in 2007–08. Include vertebrate and invertebrate species.

2. Describe how the species have changed in the Colorado River since the diversion channel was constructed into East Matagorda Bay in 1993. Include the changes in resources that are needed for evaluation of impingement and entrainment at the Reservoir Makeup Pumping Facility (RMPF).

3. Describe the sampling protocols and sampling locations used to characterize the aquatic resources in the river during efforts in the 1970's, 1980's and the most recent activities.

4. What is the relationship of the aquatic resources over 12 months compared to water quality parameters (e.g., salinity, dissolved oxygen, temperature)?

5. Describe any anomalies in the data and how anomalies may contribute to uncertainties in the data. For example, in 1983 one sample from the river included more than 99% of all the recorded catch efforts for bay anchovy.

RESPONSE:

1. DESCRIBE THE AQUATIC RESOURCES IN THE COLORADO RIVER WITHIN THE VICINITY OF THE SITE BASED ON THE SAMPLING EFFORTS IN 2007–08. INCLUDE VERTEBRATE AND INVERTEBRATE SPECIES.

STPNOC recently concluded a one-year sampling program of a 9-mile stretch of the lower Colorado River extending from the Intracoastal Waterway north to the FM 521 bridge, which is approximately 1.5 miles east of the STP facility. Fish and invertebrates were sampled monthly from June 2007 to May 2008 (ENSR 2008, page ES-1). The 9-mile stretch was divided into three 3-mile segments for sampling and analysis (details of the sampling protocol are described in #3 below). Biological and environmental data were used to characterize spatial and temporal patterns of species richness and diversity, relative abundance, and fish and macroinvertebrate size relationships. Species richness, diversity, and relative abundance were estimated by gear type for the entire study area as well as within each river segment (ENSR 2008, page ES-1).

In the 9-mile stretch of river, a total of 59 fish species, nine crustacean species, one cephalopod (squid) species, and one turtle species were collected during the 12-month sampling event. In the segment that includes the STP site (Segment C), 35 fish and 6 crustacean species were

collected, as well as 1 squid. All but three of the 35 fish species collected near the STP site were also present in Segment A, farthest downstream. The 5 most abundant fish species in Segment C (menhaden, striped mullet, blue catfish, Atlantic croaker, and black drum) were also collected in Segments A and B. Two freshwater fish species, longnose gar and flathead catfish, were caught only in Segment C, and were represented by one and two individuals, respectively. One species (silver jenny) was collected in Segment A but not in Segment B, again represented by a single individual (ENSR 2008, Table 3).

In most instances, percent species composition was dominated (>60%) by three to four species for each of the sampling gears. Dominant species included Gulf menhaden, white shrimp, grass shrimp, striped mullet, black drum, and Atlantic croaker, and were dependent on gear type. Drum, smallmouth buffalo, gar, and catfish species tended to dominate the gill net and hoop net catches, whereas Gulf menhaden, shrimp, and mullet species were prevalent in the trawl and seine catches. Despite the fact that most catches were dominated by a few species, a large number of species contributed (> 1%) to the overall faunal composition for each of the gears, an indication that the gears were not overly selective for particular species. Interestingly, despite demonstrating overall lower species richness, more species contributed at the 1% level to the composition of hoop net and gill net catches compared to trawl and seine samples (ENSR 2008, page 4-1).

2. DESCRIBE HOW THE SPECIES HAVE CHANGED IN THE COLORADO RIVER SINCE THE DIVERSION CHANNEL WAS CONSTRUCTED INTO EAST MATAGORDA BAY IN 1993. INCLUDE THE CHANGES IN RESOURCES THAT ARE NEEDED FOR EVALUATION OF IMPINGEMENT AND ENTRAINMENT AT THE RESERVOIR MAKEUP PUMPING FACILITY (RMPF).

Overall species richness, diversity and evenness were higher throughout the 9-mile reach in the 2007-08 study than in the 1974 or the 1983-84 studies (ENSR 2008, page ES-2). However, the upriver segment, which includes the site, had generally lower measures of species richness than the downstream segments (ENSR 2008; Tables 3 and 4). There was a moderate level of similarity between the current (2007-2008) aquatic community and that of the 1974 and 1983-84 communities (ENSR 2008, page ES-2). Results of the 1974 and 1984 surveys are summarized below, with emphasis on the occurrence of aquatic resources near the STP intake.

1973-74 Environmental Report

The Environmental Report prepared in 1974 for STP 1& 2 describes the aquatic communities of the lower Colorado River during 1973–1974, a period of high flows and freshwater influence at the STP intake. Salinity over the June - December (1973) sampling period ranged from 0.1 part per thousand (ppt) in December to 0.4 ppt in October (HL&P 1974; Table 2.5-10; page 2.5-40). Results of the 1973 studies are summarized below, with particular focus on Station 2, located at the intake site, and Station 3, located at the discharge site. No important aquatic species were abundant, or even common, at these stations.

During the summer of 1973, four divisions of phytoplankton made up more than 99% of the samples near the STP site. By far the most common group of phytoplankton were the diatoms (Chrysophyta), which comprised from 59 to 94 % of all samples collected from bottom waters at

the intake station (Station 2) during the three month sampling period. In surface water samples at the intake station, diatoms made up more than half of the samples in June and August, but less than 10 % of the July sample. The second most numerically dominant group at the intake station was green algae (Chlorophyta), which ranged from 10 to 41 % in surface waters and 0 to 32% in bottom water samples. Dinoflagellates (Pyrrhophyta) were common in July and August in surface waters of Station 3 (discharge), but uncommon in bottom water samples. Cyanobacteria (blue-green algae) made up more than 10% of the samples at Stations 2 and 3 only in surface waters in July.

In general, the phytoplankton community was typical of Gulf coast estuaries, which are dominated by diatoms and dinoflagellates (HL&P 1974; page 2.7-11). The Lower Colorado River appeared to provide a relatively stable environment that allowed development of a moderately diverse plankton flora (HL&P 1974; page 2.7-12).

Zooplankton were sampled from June through November, 1973 (HL&P 1974; page 2.7-12). The zooplankton community within the entire study area was characterized as diverse and stable (HL&P 1974; page 2.7-13); however, diversity was closely tied to salinity (HL&P 1974; page 2.7-12). Low salinity stations, such as those nearest the STP plant, had the lowest diversity of zooplankton (HL&P 1974; page 2.7-12). No station-specific species list was provided in the 1974 report.

Benthic macroinvertebrates were sampled in June and August, 1973 (HL&P 1974; page 2.7-14). Species richness (number of species) of benthic macroinvertebrates at the 14 sampling stations ranged from 0 to 17 (HL&P 1974; page 2.7-14). Station 2 had 16 species in June (HL&P 1974; page 2.7-78) and 11 species in August (HL&P 1974; page 2.7-85); Station 3 had 15 species in June (HL&P 1974; page 2.7-78) and 9 species, including one eel, in August (HL&P 1974; page 2.7-85).

The benthic community at Station 2 was dominated by aquatic insects (Ephemeroptera, Odonata, and Coleoptera) and oligochaetes. Station 3 had more oligochaetes and fewer aquatic insects, as well as several polychaetes and one decapod crustacean (HL&P 1974; Table 2.7-11). These differences may reflect the slightly increased salinity at Station 3, which is closer to Matagorda Bay. No mollusks were collected at Station 2; only one was collected at Station 3 (HL&P 1974; page 2.7-84).

Ichthyoplankton surveys conducted in summer 1973, yielded 14 taxa of postlarval and juvenile fishes (HL&P 1974; page 2.7-17). Sampling stations nearest to Matagorda Bay had the greatest abundance and diversity of species. (HL&P 1974; page 2.7-17) No ichthyoplankton were collected at Station 2. At Station 3, only 2 individuals were collected (one *Gobiosoma* sp. and one *Anchoa mitchilli*). In general, stations near the STP intake and discharge were devoid of ichthyoplankton (HL&P 1974; Table 2.7-15; page 2.7-89).

In 1973, fish were collected using gill nets (July to December), seines (October), and trawls (June, August, and October) (HL&P 1974; page 2.7-23). Commercially-, recreationally-, and ecologically-important fishes were collected at all stations; however, diversity and abundance decreased with distance from Matagorda Bay (HL&P 1974; Table 2.7-18; several pages). High

river flow, which characterized the majority of the collecting season, was generally associated with low species diversity (NRC 1975, page 2-16, paragraph 2).

At Station 2, a total of 58 individuals from 12 species were collected by trawl (HL&P 1974; Table 2.7-18). At Station 3, a total of 79 individuals from 7 species were collected by trawl (HL&P 1974; Table 2.7-18). Gill nets set between Stations 2 and 3 (called Station 2.5) caught 82 individuals from 13 species (HL&P 1974; Table 2.7-19). At Stations 2, 2.5, and 3 combined, a total of 21 fish species were collected. (HL&P 1974; Table 2.7-18 and 2.7-19, several pages). No seining was done near Station 2 or 3.

The blue catfish was the only species collected at all three stations. None of the fishes were caught in great numbers. Again, the blue catfish was among the most frequently caught, with a total of 33 individuals caught in gill nets. A total of 59 bay anchovies were taken in trawls and seines at Stations 2 and 3; this species likely occurred in the water between those two stations, but was not vulnerable to capture by gill net. Gill nets captured 31 sea catfish at Station 2.5, and 27 menhaden were caught by trawl at Station 3. All other fishes were caught in very low numbers (HL&P 1974; Table 2.7-18 and 2.7-19). By comparison, in 2007-2008, 35 fish species were collected in the 3-mile segment near the STP site (ENSR 2008, Table 3).

During the fish sampling, macroinvertebrates were incidentally collected. Although white and brown shrimp, and blue crabs, were collected in the general area downriver of the STP site (HL&P 1974; Table 2.7-23; page 2.7-137), none of these commercially important species was common near STP. At Station 2, only one white shrimp was taken (HL&P 1974; Table 2.7-23; page 2.7-137). In addition, 172 river shrimp were collected (HL&P 1974; Table 2.7-23; page 2.7-138). No other macroinvertebrates were collected there. By comparison, in 2007-2008, 6 species of macroinvertebrate were collected from Segment C, including blue crab, white shrimp, and brown shrimp (ENSR 2008, Table 3).

1975-76 Phase 1 Entrainment Monitoring Study

During the 1975–1976 sampling event ("Phase 1"), 26 sampling trips were conducted in the Colorado River at locations upriver and downriver from the STP plant, at approximately biweekly intervals for 12 months (NUS 1976, Abstract page 1 [microfiche page #665]). Rainfall during the 12-month sampling period was less than half the 61-year average for Matagorda, Texas, (NUS 1976, Abstract page 2 [microfiche page #666]) and saline conditions prevailed at the bottom of the river on all but two sampling days (NUS 1976, page 75, Table 3). This report focuses on sample results at the intake and discharge locations (Stations 2 and 3).

Species composition at Stations 2 and 3 was directly influenced by salinity, and was dominated by estuarine forms (NUS 1976, page 37, paragraph 2). However, during warmer months, dissolved oxygen at the bottom dropped below the 5.0 mg/L considered suitable to support aquatic life (NUS 1976, page 8, paragraph 3), greatly reducing the diversity of taxa at these stations. In the ichthyoplankton samples, estuarine fish species with commercial value, such as red drum and southern flounder, were taken most often further downriver, at Station 5 near the Gulf Intracoastal Waterway (GIWW) (NUS 1976, Abstract [microfiche page #667]). Neither of these fishes was collected in ichthyoplankton tows at Station 2 at any time during the 12-month

sampling (NUS 1976, p.94 and 95). Stations 2 and 3 yielded only 15.7 and 15.3 percent of the total catch, respectively, whereas Station 5 (near the GIWW) yielded 58.1 percent (NUS 1976, p. 21). During the majority of the sampling period, estuarine species dominated the ichthyoplankton; of these, bay anchovy, naked goby, Atlantic croaker, and Gulf menhaden were most common (NUS 1976, p. 22).

During the May and August sampling events that occurred when freshwater conditions prevailed, freshwater drum, cyprinids, and shad were abundant near Station 2, (NUS 1976, p.19, paragraph 1) especially in bank tows near the surface (NUS 1976, p. 19, paragraph 3.) No estuarine taxa were collected at Station 2 in August (NUS 1976, p. 19-20). Although these data indicate that such conditions are possible, historical rainfall and river flow data suggest that the co-occurrence of abundant freshwater drum and high river flows in August is a rare event (p.58; also in Abstract microfiche page 671, paragraph 2).

Important invertebrates such as brown shrimp and white shrimp occurred only rarely in plankton samples at the intake (Station 2). Brown shrimp postlarvae were taken at Station 2 on only 4 dates; mean abundance was 0.1 per 100 cubic meters of water. Less than 1 percent of the brown shrimp caught in the vicinity were from Station 2; 97.5 percent were taken at Station 5 (at the GIWW). White shrimp showed a similar pattern, with only 0.1 percent of the catch coming from Station 2, and 98.8 percent from Station 5.

In contrast, first-stage and juvenile blue crab were most abundant at Stations 1 (upriver from the intake) and 2 (at the intake), although absolute densities were considered low (0.3 per 100 cubic meters). Station 2 yielded 38.5 percent of the blue crab catch in the 5-station study area.

Seine and trawl collections targeted larger individuals (juveniles and adults) of fish and macroinvertebrates. Gulf menhaden were most common at Stations 2 (intake) and 3 (discharge), and also upriver. Other important species were uncommon at the intake but more common at the discharge and downriver; these include juvenile white shrimp and bay anchovy. During the winter, Atlantic croaker were also in the intake vicinity. All four of these species are widely distributed throughout Texas estuaries and beyond; abundances tend to track salinity and dissolved oxygen gradients across the region.

1983-84 Phase 2 Entrainment and Impingement Monitoring Study

During the 1983–1984 monitoring ("Phase 2"), ichthyoplankton samples were collected at Station 2 (intake) from July through September while the main cooling reservoir was being filled (McAden 1984, page 1). These data provided an estimate on entrainment (McAden 1984, p. 3). Impingement was evaluated by sampling the revolving screens during pumping (McAden 1984, p. 2). Nekton in the area of the intake was sampled using seines and bottom trawls (McAden 1984, p. 6, paragraph 1).

Plankton samples at Station 2 included 49 taxa of invertebrates (McAden 1984, p. 9) and 7 species of fishes. Invertebrates included freshwater and estuarine forms. Freshwater cladocerans were the most abundant group. Estuarine and freshwater copepods and malacostracans (shrimp and crabs) were also common. The larval stage of the xanthid mud crab was the most abundant

species in most samples. The commercially important crustaceans (brown shrimp, white shrimp, blue crab) were caught infrequently and in small numbers. Fish made up only a small portion of any sample, with the exception of bay anchovy, which was occasionally common (McAden 1984, p. 9; paragraph 2).

Macroinvertebrates and fish were sampled by bottom trawl and seine (McAden 1984, p. 13). Three freshwater and four estuarine crustaceans were collected. Freshwater species included the grass shrimp river shrimp, and crayfish. Estuarine species included the white shrimp, brown shrimp, blue crab, and mud crab (McAden 1984, p. 39). The most commonly caught invertebrates were the river shrimp, most of were collected during a single sampling trip (July 27-28), and the white shrimp.(p. 13) For comparison, in 2007-2008, 6 species of macroinvertebrate were collected from Segment C, including blue crab, white shrimp, and brown shrimp. The white shrimp was most abundant in Segment C (ENSR 2008; Table 3).

Twenty-nine species of fish were collected by seine and trawl at Station 2. The vast majority of these were estuarine species (McAden 1984, p. 13). One individual of an additional species, the green sunfish (*Lepomis cyanellus*) was collected from the revolving screen but not by trawl or seine (McAden 1984, p. 14). By comparison, in 2007-2008, 35 fish species were collected in the 3-mile segment near the STP site (ENSR 2008, Table 3).

2007-2008 Aquatic Ecology Monitoring Study

The recent 12-month sampling conducted by STPNOC is the most comprehensive study of the aquatic resources of the lower Colorado River since the diversion was built. The study shows that species diversity and abundance in the lower Colorado River overall are higher today than in the 1970s or 1980s (ENSR 2008, page 3-3), which compels the conclusion that operations at STP have not caused any substantive declines in important species due to either impingement or entrainment. In fact, life history traits of the key species near the site make entrainment extremely unlikely – most larvae and post-larvae of red drum and white shrimp occur well downstream of the site. Entrainment studies will not shed any additional light on this subject, as the basic life history and ecology of these commercially valuable species are very well understood. The existing data leave very little question about the SMALL impact that the intake has had, and can be expected to continue to have, on important aquatic resources in the lower Colorado River.

3. DESCRIBE THE SAMPLING PROTOCOLS AND SAMPLING LOCATIONS USED TO CHARACTERIZE THE AQUATIC RESOURCES IN THE RIVER DURING EFFORTS IN THE 1970'S, 1980'S AND THE MOST RECENT ACTIVITIES.

The historical and current surveys covered an area of the lower Colorado River from above the STP site to the intersection with the Gulf Intracoastal Waterway, about 9 miles below the STP site. The selection of sampling stations, the type of gear, and the sampling protocols differed slightly among surveys.

In 1973, gill nets, seines, and trawls were used to sample fish and invertebrates at 15 stations from the gulf of Mexico to above the FM 521 bridge (HL&P 1974, figure 2.7-5) Station 2 was the nearest to the proposed STP intake.

In 1975, STPNOC implemented a two-phase monitoring program to identify species that may be entrained by or impinged on the intake system. Phase 1 (April 75-April 76) included 26 sampling dates and several locations upstream and downstream of the intake, spaced at roughly 14-day intervals (ER page 5.3-8).

The Phase 2 monitoring (July 1983–December 1984) collected both impingement and entrainment samples. Impingement samples were taken at the traveling screens during filling of the MCR from July to September 1983, and again the following September (ER page 5.3-10), as well as by trawl and seine (McAden 1976, page 13).

In the 2007-08 study, seines, trawls, gill nets, and hoop nets were used, but no ichthyoplankton samples were collected. Within each segment of the river, sampling locations were chosen randomly. The stratified-random sampling design ensured that the distribution of samples collected provided sufficient spatial coverage to document species richness and catch rates of fauna inhabiting the waters in the vicinity of the STPEGS facilities. The broad spatial coverage also allowed for a general characterization of the dynamics of fish and macroinvertebrate assemblages related to flow rates and the mixing of fresh and saltwater in the lower part of the river (ENSR 2008, page 2-1). Sampling was conducted monthly for a period of one year (June 2007–May 2008). Monthly sampling ensured that seasonal variation in species richness and catch rates could be detected. Within each month, samples were collected during a two day period randomly selected each month. To reduce variability in sampling conditions among months and to ensure that river conditions were conducive to sampling, a maximum flow level of 5,000 cubic feet per second (cfs) was established. If river conditions exceeded this flow rate samples were not collected until the flow rate returned to a level below this value.

4. WHAT IS THE RELATIONSHIP OF THE AQUATIC RESOURCES OVER 12 MONTHS COMPARED TO WATER QUALITY PARAMETERS (E.G., SALINITY, DISSOLVED OXYGEN, TEMPERATURE)?

The lower Colorado River experiences extreme perturbations in temperature, salinity, dissolved oxygen, and flow on a seasonal and annual basis. Species composition at the STP intake varies tremendously in response to these environmental parameters, as shown in the overall dataset encompassing the past 30 years. Each study provided detailed measures of water quality parameters such as salinity, dissolved oxygen and temperature.

Although estuarine conditions often prevail at the RMPF, salinities at the intake have at times been essentially zero. In 1973, it was reported that the water was fresh at the bottom as well as at the surface, ranging from 0.2 parts per thousand (ppt) in July to 0.4 ppt in October (HL&P 1974, from page 5.3-7 in ER). The 1974 report identified white shrimp, river shrimp, menhaden, anchovy, and croaker as dominant species at the STP site.

The 1975 Phase 1 monitoring study was conducted during an unusually dry year when Colorado River flows were low and estuarine conditions extended up to the STP site. All but two of the

samples (May 6 and August 5) were collected when salinities at the intake represented estuarine conditions. Throughout the year-long monitoring period, bottom salinity remained high at the RMPF, ranging from 20.9 ppt in November 1975 to 31.0 ppt in August 1975. Surface salinity at the RMPF reached a maximum of 6.3 ppt on October 1, 1975, and by October 24, surface salinity reached an annual low of 0.8 ppt (NUS 1976, page 5.3-8 of the ER).

During the 1983 sampling period near the STP intake area, salinity at the mid-depth (about 10 feet) sampling location in the Colorado River ranged from 0.3 ppt in late July to 20.7 ppt in early August. Average Colorado River flow ranged from 492 cfs on July 13, 1983 to 2076 cfs on August 10, 1983 (McAden et al. 1984 and 1985; from page 5.3-11 of the ER). This sampling event produced six shrimp species, two crab species, and a crayfish species in seine and trawl samples in the vicinity of the STP RMPF. During the single sampling event in September 1984, two additional shrimp (grass shrimp and pink shrimp were collected).

During the 1983-1984 sampling, 30 species of fish were collected near the RMPF by trawl or seine; the large majority was estuarine or marine. Only four of the 30 fish were freshwater species. During the single sampling event in September, 1984, no fish or crustaceans were collected by trawl because dissolved oxygen concentrations at the bottom were thought to be too low to support these species. Seine collections yielded 20 species of fish, but only one (*Lepisosteus occulatus*, the spotted gar) lives in freshwater. Seine collections included eight estuarine/marine fish not collected in the previous year. (McAden et al. 1984 and 1985; from page 5.3-11 of the ER).

The 2007-2008 monitoring study reported surface water temperatures ranging from 11.6°C in January to 31.0°C in August. Surface temperatures were an average of 0.4°C warmer than bottom temperatures throughout the study period, reflecting the general shallow depths in the system. Salinity was generally low during winter and high during spring. Salinity readings at the surface were fairly stable, ranging from 0.0 parts per thousand to about 7 parts per thousand, with the highest salinities occurring downstream, below NMM 2, and the lowest occurring above NMM 8. Bottom salinities, which ranged up to 25 parts per thousand, declined toward upstream stations in nearly all months. An analysis of catch rate using various gears showed that catch rate declined as flow increased. The relationships between catch rate and DO or salinity did not show any strong trends overall; however, bag seine catch rates did appear to show a slight positive trend with salinity (ENSR 2008, page ES-2).

The 2007-2008 study clearly documented the stability of the dominant species of important fish and macroinvertebrates near the STP site. White shrimp, menhaden, and croaker, which were among the dominant fish and invertebrate species identified in 1974, were still abundant at the site in 2007-2008. Menhaden was the most common fish species collected in Segment C in 2007-2008, and white shrimp was the most common invertebrate. River shrimp and bay anchovy were less common in the 2007-2008 study than in the mid-1970s, but were still present. Given the large interannual variability in salinity and species assemblages documented in all of the studies, some shifting of the relative abundances among the top species is expected. As stated in the 2007-2008 report:

"There was a moderate level of similarity between the current 2007-08 faunal communities and the historic communities (1974 and 1983-84). Generally, when samples collected in the same river segments were compared, the data indicated greater similarity between the current and historic communities. Overall, the current faunal communities demonstrate greater species richness and diversity relative to the historic communities. There are several possible reasons for the observed differences in species richness and diversity between current and historic faunal communities. First, sampling gears and protocols may not be identical, resulting in potential biases in catch rates and gear efficiency. Second, the sampling completed for this study was completed over a more extensive spatial area and with greater temporal frequency than historical data collections. Sampling across three river segments each month using four different sampling gears may have allowed us to more fully characterize the faunal community in the current time period. Reduced sampling effort and spatial extent may have contributed to the lower richness and diversity during the historical sampling period. Lastly, the faunal community may simply have changed during the past two decades, particularly given changes in the bottom topography and channelization that have occurred in that time. The fact that the faunal community has become richer and more diverse in the past twenty-five years supports the contention that STPNOC facilities are having minimal negative impact, at least on the population dynamic of aquatic organisms" (ENSR 2008, page 4-2).

5. DESCRIBE ANY ANOMALIES IN THE DATA AND HOW ANOMALIES MAY CONTRIBUTE TO UNCERTAINTIES IN THE DATA. FOR EXAMPLE, IN 1983 ONE SAMPLE FROM THE RIVER INCLUDED MORE THAN 99% OF ALL THE RECORDED CATCH EFFORTS FOR BAY ANCHOVY.

No anomalies in the 2007-08 data were noted in the report (ENSR 2008).

REFERENCES:

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HL&P (Houston Lighting & Power Company). Environmental Report – Construction Phase, STP 1 & 2, 1974.

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McAden, D.C., G. N. Greene, and W. B. Baker, 1985. Colorado River Entrainment and Impingement Monitoring Program, Phase Two Studies, July – December, 1984 (Report #2), Prepared for South Texas Project by Ecology Division, Environmental Protection Department, Houston Lighting & Power Company, April 1985

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NUS Corporation. 1976. Colorado River Entrainment Monitoring Program. Phase One Studies April, 1975 – March, 1976. South Texas Project. December 1976

CANDIDATE COLA REVISION:

No COLA revision is required as a result of this response.

Question Number 2.4.2-3:

QUESTION

Characterize the aquatic resources in the MCR.

Full Text (Supporting Information):

- Describe the aquatic resources in the MCR. Include vertebrate and invertebrate species.
- Describe the sampling protocols and sampling locations used to characterize the aquatic resources in the MCR.
- What is the relationship of the aquatic resources over 12 months compared to water quality parameters (e.g., salinity, dissolved oxygen, temperature)?
- Describe the impingement/entrainment results at the CWIS. Include a description of the sampling protocol (e.g., sampling locations, sampling frequencies).
- Relate the aquatic species in the MCR compared to those found in the Colorado River.

RESPONSE:

In 2007, STPNOC commissioned ENSR to conduct surveys of the Main Cooling Reservoir's (MCR's) aquatic communities. The 2007-2008 surveys were intended to establish a baseline in the reservoir for the purposes of evaluating the impact of on-going plant operations and the potential impact of building and operation new Units 3 and 4.

A total of 11,605 finfish and invertebrates representing 25 species were collected during the 12-month study. Seines captured the highest number of organisms (10,091), the largest proportion of organisms (87 percent), and produced the highest species richness (17 species) of the three gear types used to collect adult/juvenile fish. Trawl samples resulted in 999 organisms collected comprising 9 percent of the total, and representing 12 species, while gill net samples yielded 515 organisms comprising 4 percent of the total and representing 13 species.

Abundance of organisms in samples varied seasonally and by gear type. In seine samples, the lowest abundance was in May (962 organisms); the highest was in October (5,477 organisms). Dominant species collected in the seine samples included threadfin shad (64%), inland silverside (20%), rough silverside (13%), and other species (3%). In May, samples were dominated by inland silverside; in August and October, by threadfin shad, and in February, by rough silverside.

The 999 organisms collected by trawl during the year were not uniformly distributed across seasons. October samples yielded the lowest number of organisms (56) and February the highest number of organisms (432), but the smallest number of species (3). Species richness was highest in August, with 10 species present. Dominant species collected in the trawl samples included

threadfin shad (77%), followed by Atlantic croaker (9%), blue catfish (5%), freshwater drum (4%), gizzard shad (3%), and other species (2%). May samples were dominated by Atlantic croaker, while August, October, and February samples were dominated by threadfin shad.

Gill nets collected the fewest organisms (105) in May samples and the most (164) in February. Dominant species collected in gill net samples included blue catfish (60%), common carp (19%), ladyfish (7%), black drum (5%), Atlantic croaker (3%), blue crab (2%), and other species (4%). May samples were dominated by common carp and blue catfish, August samples by blue catfish, October samples by blue catfish and ladyfish, and February samples by blue catfish.

A total of 5,362 macroinvertebrate organisms were collected in plankton samples in the MCR. Species were comprised almost entirely (84 percent) of mud crab larvae, specifically the species *Rhithropanopeus harrisii*. Finfish were represented by two taxa, shad and gobies. Mud crab larvae occur primarily during the early summer months (May through July), with a few small influxes occurring in the late summer.

Sampling Protocols and Sampling Locations

The MCR study was conducted over four quarterly sampling periods and employed four types of sampling gear: gill nets, trawls, beach seines, and plankton nets. A mix of gear types was employed to sample the different aquatic zones (habitats) and to document and establish a baseline characterization of the life stages of fauna in the reservoir. Samples were collected at fixed stations located in various regions within the MCR. These regions included Region 1 (cooling water discharge area), Region 2 (southwest part of reservoir), Region 3 (central levee/Y-dike), Region 4 (spillway area), and Region 5 (makeup water area and CWIS). Regions 1, 3, and 5 were sampled using all four gear types; Regions 2 and 4 were sampled only with trawls and beach seines.

The CWIS study involved twice-monthly sampling during the warmer months (May through September) and once-monthly sampling during cooler months (October through April). All samples were collected over a 24-hour period using small-mesh nets for impingement and plankton nets for entrainment. The CWIS was designed to document diel and seasonal patterns in impingement and entrainment at the circulating water intake for Units 1 and 2.

Water Quality and Aquatic Biota

Temperatures were, as expected, highest in summer (August) and lowest in winter (February). Dissolved oxygen (DO) concentrations were always high at surface, and were relatively high at bottom at most stations, even in August. With one exception (Station 2, August 27, 2007), DO concentrations were high enough to support a wide variety of indigenous fish and shellfish. Salinity showed no variation among stations, and almost no variation among seasons. Salinity measurement over the 12-month period ranged from 1.5 to 1.7 parts per thousand (ppt) and averaged 1.6 ppt. Data are indicative of a shallow, wind-blown reservoir that is well mixed year round and presumably never becomes stratified.

The aquatic communities of the MCR have become established over 20-plus years and are presumed to have reached some kind of steady state or equilibrium. Fish/shellfish eggs and larvae are pumped into the MCR with makeup water. Some of these eggs and larvae develop into adults. Some freshwater species (e.g., threadfin shad, catfish) are apparently able to reproduce in the MCR; estuarine and marine species (e.g., red drum, Gulf menhaden) are not able to reproduce, but their numbers are periodically replenished when more eggs and larvae are pumped into the basin.

Aside from hot side (discharge)/cold side (intake) temperature differences, water quality in the reservoir shows no "regional" differences. Dissolved oxygen levels, which are probably the most important factor in determining distribution of fish in a reservoir, are relatively high in all regions of the reservoir in all seasons. There were no indications that fish preferred (or avoided) a particular region or zone of the reservoir or that there were fish/shellfish kills associated with high water temperatures in late summer.

Impingement/Entrainment Results

Impingement sampling resulted in a total of 3,982 organisms representing 25 finfish and 7 invertebrate species (ENSR 2008). Impingement rates during the study were highly variable, with no seasonal trends emerging. Species most often impinged were threadfin shad (42 percent), blue crab (24 percent), mud crab (24 percent), and Atlantic croaker (5 percent).

Entrainment sampling resulted in a total of 207,696 organisms representing 9 families of fish and 12 classes of invertebrates (ENSR 2008). Ichthyoplankton comprised less than one percent of all entrained organisms. The majority of organisms entrained were crustaceans, represented by the estuarine mud crab (67 percent) and other decapods (21 percent). Rates of entrainment were highly variable over the 12-month study, with the highest rate recorded in April and lowest rate recorded in August.

Comparison of MCR with Colorado River

Species of fish and invertebrates in the MCR represent a highly skewed subset of aquatic resources in the Colorado River near the STP site. For example, the dominant fish in Segment C of the Colorado River, which encompasses the Reservoir Makeup Pumping Facility, include Atlantic menhaden, striped mullet, blue catfish, and Atlantic croaker. Conversely, dominant fishes in the MCR were threadfin shad, silversides, blue catfish, common carp, ladyfish, and Atlantic croaker. The blue catfish and Atlantic croaker are consistently found in both the MCR and the river. Other species show a substantial divergence. Twelve months of sampling in the river yielded (1) only 10 threadfin shad; (2) only 23 silversides (3) no common carp; and (4) only 3 ladyfish, but none in Segment C (ENSR 2008 River Report, Table 2)

The dominant invertebrates collected in Segment C, the Colorado River segment adjoining the STP site, were penaeid shrimp (white, brown, grass). The dominant invertebrate in the MCR was the mud crab, which was collected only in Segment A, the river segment nearest the bay (ENSR 2008 Final River Report).

REFERENCE:

ENSR (ENSR Corporation). 2008. Aquatic Ecology – Main Cooling Reservoir and Circulating Water Intake Structure Study, Unit 3 and 4 Licensing Project. August.

CANDIDATE COLA REVISION:

No COLA revision is required as a result of this response.