Excerpt from *Data Analysis of the LOOP Marine and Estuarine Monitoring Program, 1978-1995 - Volume 1: Executive Summary* (LSU Long Term Data Analysis)

the predicted largest anticipated oil spill), which indicates sensitivity of the present monitoring design to detection of oil spills, and ability to determine the impacts of a much larger spill. The monitoring program should take into account the information needs of this larger, yet unrealized oil spill.

The variability of the Mississippi River is a significant complication in the analysis because of the size and proximity of the river to the monitoring stations. For example, an increase in the measured parameter values between a before-and-after impact analysis might not be due to the potential impact factor (e.g., brine), but actually to the results of long-term trends in the environmental forcing function. The water masses are moving through the sampling area too quickly to measure impacts on the water chemistry variables, making the fixed present location of the monitoring station network and sampling frequency often too sparse to detect impacts even if they exist to a significant degree. In other words, if an impact had occurred, it would be likely that the affected water mass had moved out of the area before the monthly sampling occurred. This does not mean that no monitoring is necessary. An intensive, adaptive sampling program that is implemented when a major spill occurs should be designed with adequate sampling in space and time to document such a spill.

The analysis of the water chemistry data should be integrated with the biological data sets, on an ongoing basis. For example, the benthic community is the logical analytical subject for competent investigation of impacts near the brine diffuser, and for oil spills (past and present). The benthic community is subject to a probable enhancement around the diffuser, if results from other studies are appropriate for this site. The immediate area of the brine plume (about 4 km^2 for a 1+ ppt plume) sweeps over an area of 16 km^2. The plume orientation is very responsive to currents, and the plume may move between the stations without detection by the present sampling grid. The LOOP benthic data should be analyzed by benthic ecologists to check on the implications of the results of this report, including: the possibility of a brine plume 'halo' or disturbance area around the diffuser; the impacts of the April 1990 oil spills, the presence of brine or oil spill

Excerpt from *Data Analysis of the LOOP Marine and Estuarine Monitoring Program, 1978-1995 - Volume 5: Demersal Nekton* (LSU Long Term Data Analysis)

Females migrate offshore into higher salinity waters after mating because of the relatively high salinity requirements of their eggs (Hill *et al.* 1989).

Three species of penaeid shrimp were collected in numbers sufficient for analysis. White, pink, and brown shrimp avoid intense competition through spatial and temporal habitat partitioning (Bielsa *et al.* 1983). Habitat segregation among penaeid shrimp was evident from the factor analysis plot (Fig. 2c and Table 8). Most individuals of the three species of penaeid shrimp collected were juveniles, which use low salinity estuaries as nursery habitat (Pattillo *et al.* 1997). Brown shrimp are more abundant in the summer, and move offshore as adults, whereas white shrimp remain in estuaries longer, and are more abundant in the fall (Pattillo *et al.* 1997). Pink shrimp are nocturnal, but may be negatively influenced by brown shrimp (Pattillo *et al.* 1997).

The brine discharge also had significant influences on size classes of two species. Both Gulf menhaden (between 30 and 100 mm) and southern flounder ($\geq$ 100 mm) decreased significantly at the brine diffuser station (Station 36_I) during the period of high discharge, but neither was abundant at the control stations. The results of the analyses including turbidity as a covariable for these species suggest that these responses were probably related to the observed changes in turbidity.

Nekton species and size classes within species respond to environmental gradients. For estuarine species the most important variables are salinity and temperature, followed, generally, by other abiotic variables and then by biotic variables (Moyle and Cech 1996). Environmental gradients along the pipeline corridor generally followed expected patterns based on the overall salinity gradient (Baltz et al. 1993). Freshwater input influences many other gradients, including turbidity and chlorophyll *a* concentrations. The primary sources of fresh water in the inshore and middle portions of the study area are precipitation (160 cm/y) and exchange with the Gulf of Mexico through tidal forcing and storm surges associated with meteorological events (Baumann 1987; Madden and DeLaune 1987). The inverse relationships of salinity with turbidity and chlorophyll *a* levels (Table 1) probably results from nutrient depletion with increasing distance and time as coastal waters move away from the nutrient source. Most of the nutrients are used

CONCLUSIONS

The construction and operation of the LOOP pipeline did significantly influence some nekton species abundances, but the analyses were not as robust as possible because of factors related to the monitoring program design. The most notable impacts included a significantly negative influence on southern flounder resulting from brine discharge and a positive short-term influence of construction on spotted seatrout at Station 33_I. Some of the apparently positive influences, however, may translate to negative or neutral impacts away from the particular impact station. This is because the locally increased relative abundance of a size class or species may influence densities elsewhere. Individuals responding to locally favorable conditions may be drawn from nearby locations where densities diminish and the overall density of the population remains unchanged. Therefore, we cannot conclude that apparent positive LOOP-related effects are enhancements to the nekton populations or to the whole nekton community.

From of a total of over 2,200 comparisons, only 14 significant interactions were detected. There are several possibilities why we did not detect more significant differences. It is, of course, possible that LOOP did not impact any more demersal nekton. Nevertheless, the variability of the CPUE estimates was high, due to the natural variability inherent in nekton populations, low trawl replication, and discontinuous monthly sampling. Significant temporal effects for size classes and species without significant interaction terms may still be related to the LOOP pipeline if the sphere of influence of the LOOP construction and operation extended to the chosen control stations. If control stations were even slightly influenced by LOOP activities, then the sensitivity of the BACI comparisons would be reduced. Another possibility is that short term impact events, such as oil spills, may not have occurred at a sensitive stage in the life cycle of the observed species. The absence of an impact from an oil spill does not necessarily indicate that the system is insensitive to the spill, but may only be less sensitive to the spill at certain times of the year, when sensitive life history stages of nekton species are not present. Additionally, the tested oil spills were relatively small. Larger spills would probably have a greater influence on demersal nekton.