

STUDY TITLE: University Research Initiative on the Effects of Offshore Petroleum Development in the Gulf of Mexico

REPORT TITLE: Review and Reexamination of OCS Spatial-Temporal Variability as Determined by Previous MMS Studies in the Gulf of Mexico

CONTRACT NUMBER: 14-35-0001-30470

SPONSORING OCS REGION: Gulf of Mexico

APPLICABLE PLANNING AREA: Gulfwide

FISCAL YEARS OF PROJECT FUNDING: 1989 - 1992

COMPLETION DATE OF REPORT: August 7, 1992

COSTS: FY 89:\$ 0, FY 90: \$ 6,465, FY 91: \$12,175, FY 92:\$22,348

CUMULATIVE PROJECT COSTS: \$40,988

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KEY WORDS: Benthic Fauna, Data Analysis, Data Archives, Gulf of Mexico

BACKGROUND: The Gulf of Mexico has been the site of extensive faunal surveying. However, for the most part, these continental shelf surveys have not been used by the scientific community to improve survey designs or to increase our understanding of the functioning of the benthic community. The Gulf of Mexico continues to be an area of considerable oil and gas activity, and there is need for more and better information upon the possibility of environmental risk to the fauna.

Three studies afford an opportunity to develop a more useful synthesis. These are the South Texas Outer Continental Shelf Study, the Mississippi-Alabama-Florida Study, and the Southwest Florida Study. All three undertook cross-shelf infaunal surveying. While the Louisiana OC Robert S. Carney S is less well studied. A previous impact investigation, Central Gulf Platform Study, provides some data for this region.

Since these studies were conducted over 10 years ago, data analysis employing advanced computer workstations has become highly advanced. These systems allow direct visual examination of large data sets. Therefore, application of these

technologies affords new opportunities to examine and compare the large data set generated by benthic fauna surveying.

OBJECTIVES: The primary objectives of this study were to employ the National Oceanographic Data Center (NODC) data archives for the above mentioned studies to compare place to place and time to time variation in benthic fauna on the Gulf of Mexico continental shelf. Specific objectives are as follows.

1. Identification and conversion of suitable NODC archives into a vector and matrix form suitable for massive data handling in the workstation environment.
2. Examination and cross study comparison of the major trends for faunal abundance.
3. Examination and cross study comparison of the major trends for species diversity.
4. Examination and cross study comparison of the major trends for faunal composition and similarity.

SIGNIFICANT CONCLUSIONS:

1. Faunal abundance and taxa richness are sufficiently log-normal to be treated as such. They are, however, high variance attributes of the benthic system in which variation is multiplicative. Up to 5 to 1/5 times the mean for abundance and 2 to 1/2 times the mean for taxa richness.
2. Cross-shelf macroinfauna abundance decreases as a function of distance from shore most in the South Texas region and Least in the Central Gulf Platform area. Off Florida, there is an increase in abundance near the seaward edge of the shelf at the southern end. Only the South Texas study showed a distinct long-term trend in abundance. While sometimes pronounced, cross-shelf and temporal variation explain less than 20% of variance at best.
3. Faunal variation is predominantly cross shelf. Zoogeographic patterns in the macroinfauna are possibly obscured by taxonomic inconsistencies. Only 74 species were found to be in common to all four studies.
4. The utility of species diversity is greatly complicated by the fact that all four studies showed a very similar underlying pattern of relative abundance amongst species. This suggests an underlying mechanism which is either a reflection of random events or common ecological processes. Whatever the cause, the ubiquity of the relationship suggests that more informative species analyses could be developed which looked at departures from the common pattern, rather than contributions to it.

STUDY RESULTS: Of the studies considered, archive utility varied considerably. The Mafla NODC archive contains numerous confusing entries due to the changes in program management. However, a series of computer programs were written which could successfully convert NODC record format into a more useful form. From these converted files, taxa by sample arrays greater than 1000 taxa by 2000 samples were created and used in analysis. Analyses consisted of application of data visualization techniques of the program, Precision Visuals - Workstation Analysis and Visualization Environment, (PV-Wave).

The macroinfauna of the South Texas region had the lowest overall species richness, the lowest abundance, the most pronounced cross-shelf abundance decline and the most pronounced long-term increase in abundance. The much smaller Central Gulf Platform study found a similar species richness, higher abundance, less cross-shelf decline in abundance and too short a time span for long-term trends. The Mafla study was so confused as to make drawing conclusions worrisome. However, that region seemed to have higher species richness and higher abundance, with less variation. The southwest Florida region had high species richness, high abundance, and a cross shelf abundance pattern which included a mid and northern shelf minimum and increased abundance at the southern seaward edge of the shelf.

Prior to this reexamination, it was appreciated that species diversity is a complex concept which mixes the number of species with the relative abundance of species. It was not anticipated however, that when abundance is equalized through scaling and species numbers are equalized by scaling that all four studies would have such a pronounced similarity. This finding warrants additional study to determine the feasibility of developing a statistical model more appropriate for studying diversity than the commonly used indices.

STUDY PRODUCT: Carney, R., 1993. Review and Reexamination of OCS Spatial-Temporal Variability as Determined by MMS Studies in the Gulf of Mexico. A final report by Louisiana Universities Marine Consortium for the U. S. Department of the Interior, Minerals Management Service, Gulf of Mexico Region, OCS Office, New Orleans, LA Contract No. 14-35-0001-30470, OCS Study 93-0041, 215 pp.

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