

STUDY TITLE: MAFLA OCS Analysis of Hydrocarbons in Epifauna

REPORT TITLE: An Extension of Baseline Compositions of Hydrocarbons in Benthic Epifauna of the Outer Continental Shelf of the Eastern Gulf of Mexico, Final Report

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BACKGROUND: Offshore oil and gas development activities can result in the release of varying amounts of hydrocarbons to the environment through accidents and normal operating procedures. In order to assess the impacts prompted by such inputs and to mitigate deleterious effects, it is necessary to establish baseline concentrations of petroleum contaminants within the environment. This study was conducted as part of the baseline characterization effort conducted on the Mississippi-Alabama-Florida (MAFLA) Outer Continental Shelf, intending to measure baseline hydrocarbon concentrations in representative benthic macrofauna from the proposed lease area.

OBJECTIVES: (1) To establish indigenous levels of hydrocarbons in resident organisms, thereby establishing baseline values to which later analyses might be compared; and (2) to increase the current state of knowledge regarding ambient hydrocarbon concentrations in biota populating relatively unpolluted areas of the eastern Gulf of Mexico.

DESCRIPTION: A total of 44 samples (i.e., representing 24 benthic macrofaunal specimens) were collected in the MAFLA lease area during June and July, 1974. Twelve stations were sampled by diver (i.e., SCUBA) and boat-deployed dredge/rawl.

Collection sites represented 18 of the 65 sampling areas assessed during the MAFLA characterization. Six phyla (i.e., five invertebrate, one vertebrate) were represented in the samples. Individual specimens included two echinoderms (i.e., starfish, sand dollar), five arthropods (including rock shrimp, lobster, and crab species), seven cnidarians (i.e., hydrozoan and anthozoan corals), five poriferans (sponges), four molluscs (bivalves), and one tunicate. Following collection, specimens were stored in precleaned glass containers at -20°C until analyzed. Hydrocarbons were extracted from the tissues and separated into aliphatic and unsaturated fractions using methodology which was consistent with that being employed under similar studies (e.g., CT5-30). Each fraction was analyzed by gas chromatography using packed OV-101 and FFAP columns. A total of 96 gas chromatographic analyses were conducted by dividing the hydrocarbons from 24 samples into petroleum ether and benzene fractions, then analyzing each fraction on both non-polar and polar columns. Chromatograph results were punched onto computer cards and entered into an Amdahl 470V/6 computer at the University of Michigan, later to be used in the calculation of quantitative data and ratios required under contract.

SIGNIFICANT CONCLUSIONS: The ratio of odd to even alkanes was close to unity in all the samples and seemed to suggest that these results were a natural characteristic of marine fauna. A homologous series of n-alkanes peaking around C_{25} to C_{27} was also characteristic of many of the samples, with the most abundant n-alkanes occurring in the range of C_{20} to C_{30} . Unsaturated hydrocarbons were found in greater concentrations than aliphatic hydrocarbons. Results of hydrocarbon analyses seemed to indicate that the organisms were uncontaminated by petroleum or petroleum products.

STUDY RESULTS: Carbon preference indices from tested organisms were close to unity. Since test organisms represented six different phyla, low carbon preference indices may be typical of marine fauna. In the present study, the ratio of odd to even n-alkanes ranged from a low of 0.2 for a single shrimp specimen to a high of 5.26 for the bivalve mollusc *Spondylus americanus*. Ranges among the seven coral samples were 0.54-3.39, similar to ranges encountered by previous researchers.

Homologous series of n-alkanes occurred in the samples with the most abundant alkanes being in the C_{20} - C_{30} range. This trend included evidence of a homologous series of n-alkanes peaking around C_{25} to C_{27} which were characteristic of many of the samples. Pristane and phytane were commonly found but generally at low levels. Nineteen of 24 samples contained pristane while 22 of 24 samples registered the presence of phytane. The pristane to phytane ratio ranged from 1.01 to 3.38, indicating that for all organisms containing pristane, the former was more abundant.

Concentrations of hydrocarbons in the petroleum ether and benzene fractions typically were in the parts-per-million range. Three coral samples, however, exhibited concentrations (within the benzene fraction) at the parts-per-thousand level. Samples in which only tissue was analyzed generally exhibited higher concentrations when compared to those specimens in which the entire organism was dried and analyzed.

Squalene was an important constituent of the unsaturated hydrocarbon fraction of the marine lipids. Typically the concentration of total unsaturated hydrocarbons was considerably higher than that of the saturated hydrocarbons. This may serve as an indicator of non-polluted populations in the Gulf of Mexico area where crude oils tend to be high in paraffinic hydrocarbons. Overall, the data seemed to indicate that the tested organisms were uncontaminated by petroleum or petroleum products.

STUDY PRODUCTS: Meyers, P. A. 1976. An Extension of Baseline Compositions of Hydrocarbons in Benthic Epifauna of the Outer Continental Shelf of the Eastern Gulf of Mexico. Final Report. A final report by the Department of Atmospheric and Oceanic Science, University of Michigan for the U.S. Department of the Interior, Bureau of Land Management Gulf of Mexico OCS Office, New Orleans, LA. NTIS No. PB80-159106. Contract No. 08550-CT5-43. 40 pp. + app.

An additional study product prepared under this contract:

Meyers, P. A. 1976. Chromatograms and Computer Printouts to Augment Final Report of An Extension of Baseline Compositions of Hydrocarbons in Benthic Epifauna of the Outer Continental Shelf of the Eastern Gulf of Mexico. A final report by the Department of Atmospheric and Oceanic Science, University of Michigan for the U.S. Department of the Interior, Bureau of Land Management Gulf of Mexico OCS Office, New Orleans, LA. Contract No. 08550-CT5-43. 214 pp.