

**STUDY TITLE:** Georges Bank Monitoring Program: Benthic Infauna - Year I.

**REPORT TITLE:** Georges Bank Benthic Infauna Monitoring Program.

**CONTRACT NUMBER(S):** BLM: CT2-07; MMS: 14-12-0001-29192.

**SPONSORING OCS REGION:** Atlantic.

**APPLICABLE PLANNING AREA(S):** North Atlantic.

**FISCAL YEAR(S) OF PROJECT FUNDING:** 1982; 1983.

**COMPLETION DATE OF REPORT:** April 1983.

**COST(S):** FY 1982: \$2,158,359; FY 1983: \$1,007,127; CUMULATIVE PROJECT COST: \$3,165,486.

**PROJECT MANAGER(S):** J. Neff.

**AFFILIATION:** Battelle New England Marine Research Laboratory.

**ADDRESS:** 397 Washington Street, Duxbury, Massachusetts 02332.

**PRINCIPAL INVESTIGATOR(S)\*:** J. Blake, J. Grassle, N. Maciolek-Blake, J. Neff, H. Sanders.

**KEY WORDS:** North Atlantic; Georges Bank; Oceanographer Canyon; Lydonia Canyon; faeces and effects; infauna; epifauna; benthos; sediment; grain size; benthic photographs; seasonality; community; exploratory drilling; monitoring.

**BACKGROUND:** The Georges Bank is one of the most productive commercial fishery areas in the world. As interest increased in exploring for oil and gas reserves in the Georges Bank area, substantial concern was expressed by several groups including environmentalists and the commercial fishing industry. These groups felt that petroleum exploration and possible subsequent development activities might seriously damage the bank's complex and highly productive ecosystem. Because of these concerns, a Biological Task Force (BTF) for Lease Sale 42 was established. One purpose of the BTF was to design environmental studies and monitoring programs to detect the possible early warning signs of environmental deterioration on Georges Bank. The Georges Bank Benthic Infauna Monitoring Program was one portion of a multidisciplinary monitoring program recommended by the BTF. The benthic infauna monitoring program addressed whether animal populations in the sediments changed during various stages of oil and gas exploration activity arising from Lease Sale 42.

**OBJECTIVES:** (1) To determine both the near-field, short-term and regional, long-term environmental impacts of oil exploration on the benthic infaunal community.

**DESCRIPTION:** Forty-six collecting stations were established on or adjacent to Georges Bank. These consisted of regional long-term assessment stations located: (1) at opposite sides of the bank; (2) in transects of three stations per transect; (3) along isobaths; and (4) at sites where drilling muds and cuttings might accumulate. Near-field impacts were assessed with three stations located from 200 to 2,000 m up and down current from the drilling rig in Block 410. A larger 29-station array in a radial pattern was placed around an exploratory drilling rig in Block 312. All stations were sampled in July and November 1981 and February and May 1982. At each station, six replicate biological samples and three replicate chemical samples of undisturbed bottom sediments were collected with 0.04 and 0.1 m<sup>2</sup> VanVeen grab samplers, respectively. Biological samples were sieved through a 0.3-mm sieve. Chemical samples were frozen. Samples for sediment grain size analysis and bottom photographs were taken at each station. In the laboratory, each benthic sample was transferred to 70% alcohol, stained with rose bengal, and identified to the lowest possible taxon. Wet biomass was determined separately for each species. Statistical techniques included agglomerative clustering, similarity analysis by the Normalized Expected Species Shared (NESS) and Bray-Curtis techniques, and Shannon-Wiener diversity calculations. Hurlburt's modification of the rarefaction method was used to predict the number

of species in a random sample without replacement. If available, six frames from each station per cruise were analyzed for microtopographic features and densities of visible epifauna.

**SIGNIFICANT CONCLUSIONS:** Results are presented from the sampling and subsequent analyses conducted during the first year of the multi-year Georges Bank Monitoring Program. Based on the analysis of biological specimens collected from the seafloor, researchers concluded that there were no significant changes in community structure attributed to oil and gas drilling activities on Georges Bank. Chemical analysis of sediment failed to identify, with any significant level of confidence, previous drilling activities as the source of noted increases in the concentration of select sediment-bound trace metals. Differences in the biological communities identified during the first year were attributed to the variable water depths and sediment textures encountered during sampling. No evidence of biological impact could be attributed to an estimated 1,600 to 1,800 MT of drilling muds and cuttings discharged in Block 410. No accumulation of muds and cuttings was noted in any of the benthic photographs.

**STUDY RESULTS:** In general, no significant changes in benthic community structure could be related to drilling activities. The variations in community structure identified during this study were attributed to differences in depth and substrate type. A total of 783 species were identified from infaunal grab samples taken during four seasonal cruises. Polychaetes represented 306 of the species collected and accounted for 39.1% of all taxa identified. Arthropods were represented by 159 species and accounted for 20.3% of the identified taxa. Molluscs accounted for 132 species, 16.6% of the fauna. Stations located along the same depth interval were similar in terms of dominant species. Stations at the 60-m contour were dominated by an archiannelid *Polygordius* sp. A, a bivalve *Tellina agilis*, and the amphipods *Pseudunciola obliqua* and *Protohaustorius wigleyi*. Along the 80-m depth range, syllid polychaetes and the oligochaete *Phalldrilus coeloprostratus* dominated. *Ampelisca agassizi*, *Polygordius* sp. A, and *Protodorvillea gaspeensis* dominated the 100-m contour. In the deeper stations on the southern slope of the bank and in Oceanographer Canyon, *Ampelisca agassizi* was dominant, but this species was less abundant in Lydonia Canyon and the stations in the 140 to 145 m depth range.

The average number of individuals per station varied substantially from station to station. The maximum density at any station was 12,000 individuals per 0.04 m<sup>2</sup>. Population densities were generally lowest during winter. However, several stations were characterized by marked population reductions during late spring while others were characterized by reductions in late summer and fall. Molluscs and echinoids dominated the biomass measurements because their shells and endoskeletons were included in the weights.

Statistical analyses indicated lower diversities in shallower water and higher diversities in deeper water. This pattern did not appear to shift significantly with the seasonality of sampling. Clustering analysis showed that each replicate within a station clustered first with the other replicates from the same station before joining those of other stations. This comparability within stations allowed detection of small changes in benthic community characteristics. No changes in the benthic community at any station on the bank were detected in relation to drilling activities. Stations clustered together primarily on the basis of depth and secondarily on sediment type.

Barium (Ba) concentrations increased in the bulk sediments at several of the site-specific stations. Using these Ba levels as the basis for a gradient, the total numbers of individuals and densities of 24 species abundant at these stations were plotted. Certain patterns of decrease and recovery in the densities of these species were noted in stations near and down current from the drilling in Block 312 by the semisubmersible ROWAN MIDLAND. Because of the large standard deviation associated with each mean, it was not possible to attach a high level of statistical significance to these observed patterns. Population differences observed in Block 410 were attributed to differences in substrate type. No evidence of biological impact could be attributed to an estimated 1,600 to 1,800 MT of drilling muds and cuttings discharged in Block 410.

Sediment on Georges Bank was 95% sand. To the south of the bank, the percentages of silts and clays increased, indicating that these areas received increased deposition. No accumulation of drilling muds and cuttings was noted in any of the photographs.

**STUDY PRODUCT(S):** Blake, J. A., J. F. Grassle, N. Maciolek-Blake, J. M. Neff, and H. L. Sanders. 1983. Georges Bank Benthic Infauna Monitoring Program. A final report by Battelle New England Marine Research Laboratory and Woods Hole Oceanographic Institution for the U.S. Department of the Interior, Minerals Management Service Atlantic OCS Office, Vienna, VA. Vol. I - NTIS No. PB83-204511; Vol. II - NTIS No. PB83-204529. Contract No. 14-12-0001-29192. 256 pp.

A reference biological specimen collection and benthic photographs are maintained by Battelle New England Marine Research Laboratory, Duxbury, Massachusetts.

\*P.I.'s affiliation may be different than that listed for Project Manager(s).