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**KEY WORDS:** South Atlantic; North Carolina; South Carolina; Georgia; Florida; biology; hard-bottom; shelf; epifauna; fish; hydrography; videotapes; photographs; seasonality.

**BACKGROUND:** Widespread areas of hard bottom on the continental shelf offshore the southeastern United States are important to commercial and recreational fisheries of the region, but the ecology of these areas is poorly known. The region has been opened to oil and gas exploration, and areas of prime industry interest often coincide with outcroppings of sedimentary rocks that support abundant sessile epibiota and bottom fishes. This study, which was a second-year continuation in a multi-year program, was funded to provide a better understanding of such "live-bottom" habitats so that potential impacts of oil- and gas-related activities could be assessed and minimized.

**OBJECTIVES:** (1) To characterize invertebrate and fish communities associated with representative live-bottom habitats on the continental shelf offshore the southeastern United States; (2) To characterize food habits of selected fish species of commercial or recreational importance; (3) To conduct a limited assessment of bottom topography and substrate type; and (4) To evaluate potential impacts of oil- and gas-related activities on live-bottom organisms.

**DESCRIPTION:** Three representative live-bottom stations were chosen in each of three depth ranges (inner shelf, 16 to 25 m; middle shelf, 26 to 45 m; and outer shelf, 46 to 100 m) on the continental shelf offshore North and South Carolina and Georgia. Five of the nine stations had been sampled during Year 1 (1980) of this study. All stations were sampled during winter (February-March), spring (April-May), summer (July-August), and fall (October-November) of 1981. Sampling at each station generally included: (1) profiles (10-m depth intervals) of water column temperature, salinity, transmissivity, and dissolved oxygen, and a light penetration (Secchi depth) measurement; (2) three 20-min transect surveys using a towed television system; (3) collection of 25 color still photographs, each encompassing an area of 3.0 m<sup>2</sup>; (4) trawl sampling of fishes and other nekton using a 40/54 fly net (3 day and 3 night tows of 1 km each); (5) deployment of baited fish gears (Antillean S-traps and electric reels on rods); (6) collection of juvenile fishes using an epibenthic sled (two 5-min night tows); (7) dredge sampling of epibiota and rocks using a heavy-duty Cerame-Vivas rock dredge (two 0.1-km tows); and (8) collection of five samples of small epibiota and infauna in sediments overlying hard bottom using 0.1-m<sup>2</sup> suction (inner and middle shelf stations) or Smith-McIntyre grab (outer shelf stations) samplers.

All samples and data were processed and analyzed to produce physical and biological descriptions of the stations and to elucidate spatial and seasonal trends. Physical descriptions were based on data from television surveys. Benthic epibiota were characterized by analysis of television and still photographs and data from dredge, trawl, and suction/grab sampling. Numerical classification techniques were applied to dredge, trawl, and suction/grab data; diversity (Shannon index) and evenness (Pielou's J') values were calculated and dominance-diversity curves plotted only for the suction/grab data. Fish populations were described (biomass and abundance) on the basis of data from trawls, baited fish gears, television surveys, and epibenthic sled sampling. Stomach contents of selected fish species were analyzed to determine the composition and inter-species overlap of fish diets.

**SIGNIFICANT CONCLUSIONS:** Live-bottom areas were typified by expanses of sand-covered hard bottom and scattered outcrops and ledges of low to moderate relief (generally <2 m). Outcrops were most common at inner and outer shelf stations offshore North Carolina. Bottom coverage by epibiota averaged 75 to 100% for all stations. Both tropical and warm-temperate forms of invertebrates and fishes were common. Species composition of live-bottom communities varied in relation to depth and, to a lesser extent, latitude and season. Sponges accounted for most of the attached biomass (wet weight) and for the largest number of species at all stations except on the inner and middle shelves offshore North Carolina. Enhanced abundance and diversity of fishes in comparison to results reported for soft-bottom habitats reflects in part availability of numerous food organisms and shelter associated with live-bottom habitats. Offshore oil- and gas-related activities could damage live-bottom communities by smothering or burial of epibiota, but the presence of offshore structures could have favorable effects by increasing the amount of available habitat.

**STUDY RESULTS:** Bottom temperatures ranged seasonally from about 12 to 28°C on the inner shelf and from about 16 to 24°C on the middle and outer shelves. Salinities were generally >35 ppt except at a few inner and middle shelf stations that were affected by river runoff during spring. Dissolved oxygen levels were high (generally >4 ml l<sup>-1</sup>) at all stations, depths, and seasons. Transmissivity (water clarity) values ranged from 44 to 97%, but there were no consistent spatial or seasonal patterns. Light penetration (Secchi depth) varied from 8 to 28 m, with the maximum noted in summer at most stations.

Substratum relief ranged from <0.5 to about 4 m but was generally <2 m at most stations. The incidence of rock outcrops ranged from 5 to 40% and was highest at inner and outer shelves stations offshore North Carolina; offshore South Carolina and Georgia, outcrops were more common on the middle and outer shelves than the inner shelf. All stations averaged between 75 and 100% coverage of live bottom; cover was highest at inner shelf stations offshore South Carolina and Georgia and inner and outer shelf stations offshore North Carolina. Live-bottom cover was not related to the incidence of outcrops because most epibiota was attached to sand-covered hard bottom.

A total of 1,307 invertebrate taxa were collected by all sampling methods. Overall species richness from dredge and trawl collections varied spatially (no consistent geographic pattern) but not seasonally. More algal species were collected during summer than during other seasons. Sponges contributed the largest number of species at inner shelf stations offshore South Carolina and Georgia and at the outer shelf North Carolina station. Biomass (wet weight) was generally higher at inner and/or middle shelf stations than on the outer shelf; sponges contributed most of the biomass at all South Carolina and Georgia stations and at the outer North Carolina station. Macroalgal abundance and biomass were highest during summer at inner shelf stations offshore South Carolina and Georgia and at the middle shelf North Carolina station. The most frequently collected organisms in dredges and trawls were species of bryozoans, cnidarians, barnacles, and echinoderms. Species composition varied in relation to depth, with inner and outer shelf biota being the most dissimilar. The epibenthic sled and suction/grab sampling collected a variety of benthic organisms that are not restricted to live bottom.

Fish abundance, biomass, and community composition varied in relation to depth, season, and time of collection (day vs. night). Overall abundance and biomass were highest and least seasonally variable at

middle shelf stations. Most species showed large seasonal differences in abundance and biomass, and overall abundance and biomass were highest during fall. Diversity was highest at outer shelf stations and lowest at inner shelf stations, except during winter when some inner shelf station catches were most diverse. Night trawls collected a different and more diverse group of fishes than did day trawls. Benthic and planktonic crustaceans were important food items for bottom fishes. Low dietary overlap of the fishes studied reflects diversity of available prey items.

**STUDY PRODUCT(S):** Marine Resources Research Institute, South Carolina Wildlife and Marine Resources Department. 1982. South Atlantic OCS Area Living Marine Resources Study--Year II. A final report for the U.S. Department of the Interior, Minerals Management Service Atlantic OCS Office, Vienna, VA. Executive Summary (An Investigation of Live-Bottom Habitats in the South Atlantic Bight) - NTIS No. PB84168285; Vol. I (An Investigation of Live-Bottom Habitats off South Carolina and Georgia) - NTIS No. PB84168251; Vol. II (An Investigation of Live-Bottom Habitats off North Carolina) - NTIS No. PB84168269. Vol. III (Appendices) - NTIS No. PB84168277. Contract No. AA551-CT1-18.

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