

STUDY TITLE: North Carolina Fisheries and Environmental Data Search and Synthesis Study.

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Executive Summary; Final Report.

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SPONSORING OCS REGION: Atlantic.

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KEY WORDS: Mid-Atlantic; South Atlantic; North Carolina; biology; geology; physical oceanography; benthos; community; commercial fishing; recreational fishing; endangered species; shelf; literature review; historical review; synthesis; data management; abstracts; bibliography.

BACKGROUND: Significant oil and/or gas reserves may be located under portions of the North Carolina Outer Continental Shelf (OCS). Several tracts have been leased off the North Carolina coast and additional areas have been nominated for further lease sales. The U.S. Department of Interior, Minerals Management Service (MMS) has responsibility for leasing Federal OCS lands and conducting studies in lease sale areas to ascertain and minimize environmental impacts on human, marine, and coastal environments that may be affected by oil and gas activities. This study updates all useful information on living marine resources and habitats of the North Carolina OCS for use by the MMS and others to support management decisions concerning oil and gas activities.

OBJECTIVES: (1) To collect, annotate, and synthesize all useful information on living marine resources and habitats of the North Carolina OCS.

DESCRIPTION: The North Carolina OCS is defined as from the shoreline to a depth of 200 m (656 ft), and from a northern boundary of 36.5°N Lat to a southern boundary of 33.0°N Lat. The study was divided into four separate but related phases: (1) identification and selective collection of published and unpublished information; (2) review and annotation of the information; (3) development of a computer program that accesses, cross-references, and stores the database; and (4) interpretation and synthesis of information in a technical report with separate visuals (maps) and an executive summary. Over 1,450 published and unpublished data sources were reviewed. The synthesis report contains summaries for the following topic areas: geology, oceanography, biological communities, commercial and sport fisheries, endangered and threatened species, and sensitive biological areas and unique habitats. Data gaps were identified, implications to OCS development were discussed, and suggestions for additional research were provided.

SIGNIFICANT CONCLUSIONS: The North Carolina OCS is a transition zone between the South and Middle Atlantic Bight. The climate, proximity, and behavior of the Gulf Stream, and presence of cusped projecting shoals and capes influence unique oceanographic and biological features. Extensive hard-bottom and live-bottom areas were present within Onslow Bay and along the North Carolina continental shelf edge. Upwelling along the shelf edge and intrusion of nutrient rich eddies into mid-shelf and inner-shelf waters occur frequently. The upwelling, eddy formation-intrusion phenomenon is not well studied and makes risk assessment for OCS development difficult.

STUDY RESULTS: The continental margin off North Carolina typifies Atlantic-type continental margins, in that it has had a relatively long period of tectonic stability. There are cusped projections and shoals off the capes, large sand ridges that generally align at right angles to the shoreline, and terrace-like features along the shelf edge. Extensive hard-bottom and live-bottom exist within Onslow Bay and in other areas along the North Carolina continental shelf edge. These hard-bottom areas are of several geologic origins and types. Relic and calcareous sediments dominate the Carolina Shelf indicating low terrigenous deposition. Shelf edge and slope sediment slumping is the primary geological hazard to OCS development. Incidence of faulting and sediment slumping on the shelf is low.

Study area coastal climate is described as temperate-rainy. Five processes control seasonal current patterns off North Carolina: (1) winter wind-driven, near-coast advection from north of Cape Hatteras; (2) persistent intrusions of near-surface Gulf Stream meanders and eddies; (3) late summer, wind-driven, subsurface intrusions of Gulf Stream waters; (4) cooling of shelf waters by atmospheric cold fronts and subsequent down slope cascading of water; and (5) river run-off. Cusped embayments, capes, and cape shoals affect coastal circulation patterns by forming barriers to alongshore currents and steering upwelled waters. Gulf Stream meanders, at times, form an upwelling ridge bringing nutrient rich waters to the Carolina Shelf. This event results in a short period phytoplankton bloom followed by increased abundance of zooplankton and eventually fishes.

Overall phytoplankton abundance and species diversity tend to decrease with distance from shore. Phytoplankton communities have a regional demarcation in the Cape Hatteras vicinity with neritic and pelagic species south of the cape exhibiting subtropical and tropical affinities, and species north of the cape exhibiting temperate or boreal affinities. Generally, total zooplankton concentrations tend to decrease with distance offshore. A total of 67 fish families have been identified from surface ichthyoplankton samples off North Carolina and another 60 fish families from midwater samples. Three distribution patterns occur, characterized by families spawning in the area, including the shelf, shelf/slope, and slope patterns. Benthic organisms also have three distribution patterns: along the inner shelf; the Carolinian Province south and the Virginian Province north of Cape Hatteras; and the Tropical or Caribbean Province on the outer and upper slope associated with the Gulf Stream. Seasonal fluctuations in province boundaries occur. Algal flora from coastal North Carolina are represented by 289 taxa. This diversity is due to the variety of available habitats and seasonally variable environment allowing growth of both temperate and subtropical species. Meiobenthic faunal distribution patterns are highly correlated with sediment composition and bottom water temperature. Density values are highest in the inner-shelf and mid-shelf depth ranges and lowest in depths beyond 100 m (328 ft). Live-bottom sessile invertebrate communities are of two types: (1) exposed eroded carbonate rock outcrops within and near Onslow Bay encrusted with coral and other associated epifauna; and (2) lithothamnion reef assemblages occurring along the shelf edge.

Fishes comprise the most abundant portion of the nektonic community off North Carolina with temperate to subtropical species found nearshore and subtropical to tropical species offshore. During 1981, a total of 388,552,891 lb of finfish were landed in North Carolina, valued at \$36,280,328. This catch was represented by 55 finfish species with Atlantic croaker, Atlantic menhaden, flounders, and grey seatrout leading in terms of value. In 1981, the total shellfish harvest was 43,452,992 lb, valued at \$21,239,682. Shrimps, oysters, calico scallop, and bay scallop comprised 99% of the catch. Five species of marine turtles, 8 species of fishes, and 27 species of marine mammals that are protected by the Endangered Species Act of 1973 exist in or migrate through North Carolina OCS waters.

Four types of sensitive biological areas and unique habitats are recognized on the Carolina Shelf: (1) inner-shelf, live-bottom areas; (2) mid-shelf, live-bottom areas; (3) shelf-edge, live-bottom areas; and (4) numerous shipwrecks. Six major areas have been identified where additional studies are needed: (1) mapping and description of hard-bottom and live-bottom areas; (2) coupling of shelf upwelling events with bioproductivity; (3) review of existing data for relationships of upwelling data and fishery data; (4) fates and effects of continental and OCS substances discharged into the marine environment; (5) re-evaluation of OCS risk analyses models; and (6) multidisciplinary monitoring programs to investigate potential effects of OCS activities on endangered species and unique habitats in the study area.

STUDY PRODUCT(S): Continental Shelf Associates, Inc. 1983. North Carolina Fisheries and Environmental Data Search and Synthesis Study. Executive Summary. A final report for the U.S. Department of the Interior, Minerals Management Service Atlantic OCS Office, Vienna, VA. NTIS No. PB84141357. Contract No. 14-12-0001-29189. 18 pp.

Continental Shelf Associates, Inc. 1983. North Carolina Fisheries and Environmental Data Search and Synthesis Study. Final Report. A final report for the U.S. Department of the Interior, Minerals Management Service Atlantic OCS Office, Vienna, VA. NTIS No. PB84141365. Contract No. 14-12-0001-29189. 363 pp.

Other study products include:

Abstracts of pertinent literature, typewritten and on magnetic tape. Map series consisting of five maps (scale 1:80,000) of biological and geological features. Data management computer program with documentation.

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