

MARINE REPTILE CHAPTER

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Abernathy, S.A., M.T. Baer, C.S. Benner, M.S. Brody, D.K. Francois, J.K. Gilliam, L.K. Good, C.J. Ohara, and J.V. Martin. 1989. Atlantic Outer Continental Shelf: Description of the Mid-Atlantic Environment. Abernathy, S.A. (ed.). U.S. Department of the Interior, Minerals Management Service, Atlantic OCS Region, Environmental Assessment Section. Herndon, VA. 167 p.

*This document discusses the major issues and areas of concern for the mid-Atlantic environment that are considered in the planning process for oil and gas leasing and operations on the Outer Continental Shelf. The issues are addressed with respect to the potential environmental consequences of mid Atlantic oil and gas exploration, development and production. A section discussing The Physical Environment (e.g., geology, non-petroleum minerals, physical oceanography, chemical oceanography and water quality, ocean dumping, meteorology, air quality), Biological resources (e.g., plankton, benthos, fishery resources, marine reptiles, marine mammals, marine and coastal birds, estuaries, wetlands, sensitive coastal habitats, canyon areas), Socioeconomic Environment, and other issues (e.g., archaeological resources, marine vessel traffic, National Aeronautics and Space Administration/ Department of Defense activities, oil and gas infrastructure, marine sanctuaries, and estuarine research reserves) is included. Most of the figures showing fisheries resources are taken from bottom-trawl and shellfish surveys of the National Marine Fisheries Service, Northeast Fisheries Center, Woods Hole, MA.

CETAP: Cetacean and Turtle Assessment Program. 1979. A Characterization of Marine Mammals and Turtles in the Mid- and North- Atlantic Areas of the U.S. Outer Continental Shelf: Annual Report for 1979, Cetacean and Turtle Assessment Program, University of Rhode Island. 68 p.

Published reports of sea turtles in the region from Cape Hatteras to Nova Scotia are limited primarily to records of strandings of dead or dying individuals (Bleakney, 1965, Brongersma, 1972). Schwartz (1967) reported the occurrence of sea turtles in near-shore and bay waters of Maryland and Lazell (1976) reported records around Cape Cod, Massachusetts, with added comments and questions about sea turtle in the area. Babcock (1919) summarized information on sea turtles in the Northeast, including locality data, but his work did not include Kemp's ridley turtle, which may have been mistakenly identified at the time as the hawks- bill. While sea turtles have long been known from the region, no comprehensive studies of the temporal distributions and relative numbers were made prior to this study. This chapter addresses data generated in the first year of a study on marine turtles in United States waters up to 200 n.mi. offshore from Cape Hatteras, North Carolina to Nova Scotia as part of the CETAP (Cetacean and Turtle Assessment Program) funded by the Bureau of Land Management. This chapter includes all 1978 and 1979 data collected on Turtle Watch Group (TWG) field efforts, all other CETAP field efforts, and analyses of the data generated by these groups. Additional information contributed by other observers is included as well. All sea turtles in the area are classified as endangered or threatened. The purpose of this ongoing project is to provide basic information on sea turtles for resource management. Completion of the entire project may change certain data interpretations, ideas, or suppositions presented herein.

Coles, W.C., and J.A. Musick. 2000. Satellite sea surface temperature analysis and correlation with sea turtle distribution off North Carolina. *Copeia* 2000(2): 551-554.

We used satellite sea surface temperature data and aerial survey data to identify an upper (28 C) and lower (13.3 C) thermal limit to preferred loggerhead sea turtle temperatures. The available

temperature range for the turtles to occupy, during this study (May 1991 to Sept. 1992), was 4.9 C to 32.2 C. These thermal limits fall within the ranges previously identified in the laboratory. This study suggests that sea turtles are not geographically randomly distributed but stay within preferred temperature ranges which are seasonally variable.

Coston-Clements, L., L.R. Settle, D.E. Hoss, and F.A. Cross. 1991. Utilization of the Sargassum Habitat by Marine Invertebrates and Vertebrates - A Review. National Marine Fisheries Service. NOAA. Southeast Fisheries Science Center, Beaufort Laboratory. Beaufort, NC. 32 p.

Numerous species of brown algae (Class Cyclosporeae: Order Fucales: Family Fucaceae) of the genus *Sargassum* occur throughout the world's tropical and temperate oceans. The pelagic complex in the western North Atlantic is comprised primarily of *Sargassum natans* and *S. fluitans*. Both species are hyponeustonic and fully adapted to a pelagic existence (Parr, 1939). Known commonly as gulf-weed, sea holly, or sargassum, they are characterized by a brushy, highly branched thallus (stem) with numerous leaf-like blades and berry-like pneumatocysts (floats). These floating plants may be up to several meters in length-but are typically much smaller. There is a well known assemblage of small fishes associated with sargassum rafts, many of which serve as forage for commercially or recreationally exploited species (Table 2). Dooley (1972) described 54 species from 23 families in the sargassum community of the Florida Current. Only 14 species from 11 families are known from the Sargasso Sea (Fedoryako, 1980; 1989). During the pelagic stage, hatchling loggerhead, *Caretta caretta*, green, *Chelonia mydas*, Kemp's ridley, *Lepidochelys kempi*, and hawksbill, *Eretmochelys imbricata*, sea turtles have been observed in sargassum off Florida, Georgia, North Carolina, and Texas (Smith, 1968; Fletemeyer, 1978; Carr and Meylan, 1980; Carr, 1986; 1987a; Schwartz, 1988; 1989; Manzella and Williams, 1991; Schwartz, pers. comm.). Schwartz (1988) reported numerous loggerhead hatchlings captured during commercial trawling for sargassum. This observation constitutes the largest known aggregation of loggerhead hatchlings encountered off the North Carolina coast.

Crawford, K. (ed.). 1989. Proceedings: 1989 Marine Expo: The Natural Resources Associated with Mobil's Proposed Drill Site. NC Outer Continental Shelf Office, NC Department of Administration. Raleigh, NC. 64 p.

*This report contains abstracts from each presenter. Chapter topics include: Mobil's Proposal, Geologic Overview -- Introduction and Potential for Oil and Gas Discovery, Oceanographic Conditions, Comments on Last MMS Modeling, Biological Production Near the Bottom (invertebrates), Fisheries Resources, Commercial and Recreational Marine Fisheries, Winter Storm Effects on Spawning and Larval Drift of Pelagic Fish, Marine Birds, Sea Turtles in North Carolina, Marine Mammals, Plenary Session, Summary. Each chapter also cited individually when appropriate.

Epperly, S.P., J. Braun, A.J. Chester, F.A. Cross, J.V. Merriner, and P.A. Tester. 1995. Winter distribution of sea turtles in the vicinity of Cape Hatteras and their interactions with the summer flounder trawl fishery. *Bulletin of Marine Science* 56(2): 547-568.

Aerial surveys of North Carolina offshore waters between Cape Lookout and the North Carolina/Virginia state line were conducted November 1991-March 1992 to determine the abundance of sea turtles in the area where a trawl fishery for summer flounder was active, and to relate the distribution of turtles to physical oceanographic processes. Turtles were sighted throughout the winter as far north as Oregon Inlet. Individual surveys yielded surface density estimates greater than 12 turtles

/ 100 km², depending on the method of analysis. The distribution of turtles appeared to be related to water temperature, with turtles being mostly in waters >11° C. Favorable temperature and depth regimes for sea turtles occur throughout the winter along the western edge of the Gulf Stream from the vicinity of Cape Hatteras southward. The nearshore waters of Raleigh Bay, more than any other nearshore area of the South Atlantic Bight, are affected in the winter by the warm, fast-moving Gulf Stream and its frontal eddies that impinge upon and override the narrow continental shelf. Characteristically the waters in the vicinity of Cape Hatteras are warmer in the winter than nearshore areas to the south. The narrowness of the continental shelf and the influence of the Gulf Stream on these nearshore regions serve to concentrate sea turtles emigrating from nearshore waters in the Middle Atlantic Bight and Pamlico and Core Sounds in the late fall and early winter. Thus, sea turtles can be at greater risk for interaction with fishing activity on the continental shelf near Cape Hatteras, during the winter, than in any other area in the South Atlantic Bight. The summer flounder fishery, operating between Cape May, New Jersey and Cape Lookout, North Carolina during November 1991-February 1992, was monitored for interactions with sea turtles. Observers were aboard nearly 6% of the reported trips landed in Virginia and North Carolina. The sea turtle catch comprised loggerheads (60%), Kemp's ridleys (36%), greens (2%), and a hawksbill (1%). The catch of Kemp's ridleys during November-December 1991 south of Cape Hatteras was high (N = 26). Overall turtle catch rates were similar to those reported for the Atlantic shrimp fishery, but catch rates south of Cape Hatteras were 6-8 times higher than catch rates north of the Cape. A total of 1,063 turtles was estimated to have been caught November 1991-February 1992, and 89-181 were estimated to have died as a result of the trawl fishery. None of the turtles tagged during this study was recaptured during the study period, but three were recaptured subsequently; one had been resuscitated. Trawl activity was aggregated, and a number of turtles required resuscitation after 60 min tows. Sea turtle conservation regulations are needed for this fishery because the turtle/fishery interaction is great (> 1,000 turtles estimated caught), the proportion caught that is Kemp's ridleys is high (35%), and the physical processes that concentrate the sea turtles on the fishing grounds are operable every winter.

Epperly, S.P., N.B. Thompson, J.A. Keinath, J.A. Musick, and D.T. Crouse. 1989. Sea Turtles in North Carolina. pp. 49-61. In: Crawford, K. (ed.). Proceedings: 1989 Marine Expo: The Natural Resources Associated with Mobil's Proposed Drill Site. NC Outer Continental Shelf Office. NC Department of Administration. Raleigh, NC.

In 1973 Congress enacted the Endangered Species Act (PL93-205) immediately listing the leatherback (*Dermochelys coriacea*), hawksbill (*Eretmochelys imbricata*), and Kemp's ridley (*Lepidochelys kempfi*) as endangered sea turtles. In 1978 the loggerhead (*Caretta caretta*), green (*Chelonia mydas*), and olive ridley (*L. olivacea*) were listed as threatened species except that the Florida and Mexican Pacific coast breeding populations of green sea turtles, and the Mexican Pacific coast breeding population of olive ridleys were listed as endangered (U.S. Dept. Commerce 1978). Only the flatback sea turtle of Australia (*C. depressa*) has not been listed. Of the six species of sea turtles in the Atlantic Ocean, all but one of them, the olive ridley, has been reported off the coast of North America.

In summary, the offshore waters of North Carolina regularly harbor all North American species of sea turtles except the hawksbill, which is infrequently reported. Inshore waters of the Pamlico-Albemarle Estuarine Complex and of the Chesapeake Bay seasonally contain numbers of loggerhead and Kemp's ridley sea turtles, and in Pamlico and Core Sounds, the green sea turtle is also present. The turtles' seasonal abundance in the area is probably a function of water temperature -- as the waters warm they immigrate or migrate through, and as the waters cool, they emigrate. Sea turtles are capable of

hibernating and sometimes overwinter in cool waters by burying in the substrate (Ogren and McVea 1982). Although there have been a couple of reports of turtles overwintering in North Carolina (T. Henson, N.C. Wildlife Resources Commission, pers. commun.), there are no data to indicate the extent to which turtles hibernate in the state's waters.

George, R.Y., and A.W. Hulbert (eds.). 1989. North Carolina Coastal Symposium. National Undersea Research Program, NOAA. Rockville, MD. 582 p.

*This is a multidisciplinary Marine Scientific Proceedings, with frequent reference to the North Carolina Coastal Oceanography. Two studies (also cited individually) include maps with study plots (p. 283; reef site) or migratory movements (p. 309; sea turtles) in the project study area. Zoogeography and ecology of fishes inhabiting North Carolina's Marine Waters to depths of 600 meters are included. The transcript from speaker representing Outer Continental Shelf (p. 549) mentions offshore oil drilling off North Carolina Coast and mid-Atlantic region. The speaker does not refer to a specific site.

Hoss, D.E. 1992. Research at the Beaufort Laboratory. pp. 51-54. In: Department of the Interior, Minerals Management Service. Proceedings of the Fourth Atlantic OCS Region Information Transfer Meeting, September 1991. U.S. Department of the Interior, Minerals Management Service. Herndon, VA.

The Fourth Atlantic Outer Continental Shelf (OCS) Regional Information Transfer Meeting (ITM) was held on 24-25 September, 1991, in Wilmington, NC. The focus of the meeting was on the OCS off North Carolina, specifically on activities related to a proposed exploratory well for oil and gas by Mobil on Block 467 a site 40 miles off the coast of North Carolina. The area of industry interest is known as the Manteo Prospect, while the activities surrounding the proposed drilling are referred to collectively as the Manteo Project. The wildcat wellsite is in 2,690 ft. (857 m) of water near the edge of the Gulf Stream. It is also near a fishing ground known locally as "The Point". The area is believed to be gas prone rather than oil prone. The estimated size of the resource could be as high as 5 trillion cubic feet of gas.

The purpose of the meeting was to exchange information on the leasing background, legislative activities, scientific results, and socioeconomic studies. Legislative-related reports include descriptions of the Oil Pollution Act of 1990, the Outer Banks Protection Act, the Environmental Studies Review Panel, and the North Carolina Physical Oceanography Panel. Reports of studies on marine life include benthic diatoms, benthic fauna, pelagic seabirds, sea turtles, and right whales. One report describes the use of airships (blimps) for ocean research a capability relevant to North Carolina because of the east coast airship facility is located in the state. Local marine science facilities described include NOAA's National Undersea Research Center at the University of North Carolina at Wilmington (NURC/UNCW) and the National Marine Fisheries Service laboratory in Beaufort.

Developments in oil spill cleanup technology and capabilities are described by both the Coast Guard and the industry. A socioeconomic report describes the effects of the oil and gas activities on the tourist industry. Lastly, research on the restoration of salt marshes indicates that rehabilitation of an area is possible when development or an accident has occurred. While the emphasis of the meeting was on oil and gas, two reports described the results of projects related to offshore sand mining. The appendix lists the names and addresses of speakers. Individual chapters are cited individually when appropriate.

*Ongoing research at the National Marine Fisheries Laboratory in Beaufort, NC is described. A description of North Carolina marine reptile, marine mammal, coastal, and fishery research is included.

Keinath, J.A. 1992. Sea Turtles Off the North Carolina Coast. pp. 111-117. In: Department of the Interior, Minerals Management Service. Proceedings of the Fourth Atlantic OCS Region Information Transfer Meeting, September 1991. U.S. Department of the Interior, Minerals Management Service. Herndon, VA.

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*This section describes sea turtle data (e.g., from strandings, tagging programs, trawl fisheries, aerial surveys, and telemetry) from coastal North Carolina. These data suggest coastal North Carolina is used as a migratory corridor by sea turtles. The role of sargassum mats as habitat is described.

Lazzell, J.D., Jr. 1980. New England Waters: Critical Habitat for Marine Turtles. *Copeia* 1980(2): 290-295.

New England waters, herein defined as all marine habitats north of the Nantucket Lightship, out to the "200 mile" limit, and north to Canadian territory, contain the largest known late summer and autumn (August to November) concentrations of the leatherback in the Atlantic. Inshore habitats in the

southern sector (primarily Massachusetts) formerly supported thousands of Kemp's ridleys seasonally; despite overall decline of *Lepidochelys kempii*, they are still common in Massachusetts today. A significant population of subadult greens summers in Nantucket Sound. The hawksbill is rare and probably accidental.

*Figure 1 Mercator projection of the North Atlantic region showing major migration routes of the leatherback, with key locations marked, (p. 292) includes the defined study area for The Point.

Lee, D.S. 1985b. Marine Turtles in North Carolina Waters. Appendix F. In: U.S. Department of the Navy. EMPRESS II: Supplemental Draft Environmental Impact Statement for the Proposed Operation of the Navy Electromagnetic Pulse Radiation Environment Simulator for Ships (Empress II) in the Chesapeake Bay and Atlantic Ocean. United States Navy. Environmental/ Intergovernmental Section. Atlantic Division. Naval Facilities Engineering and Command. Norfolk, VA.

*This report describes seasonal distributions of marine turtles in North Carolina's offshore waters. Lee and Palmer (1981) previously summarized this material. The southern portion of the VACAPES EMPRESS II Area of North Carolina overlaps with the northern portion of the defined study area for the Data Inventory Related to the Hatteras Middle Slope (The Point) Area.

———. 1991a. Offshore Research of NC State Museum in Area of the Point. pp. 2-3. In: Shepard, A. (ed.). NURC--UNCW 1991 Undersea Research: Informational Meeting. National Undersea Research Center, University of North Carolina at Wilmington. Wilmington, NC.

Although the current information on the biology, distribution, and season of occurrence of seabirds, marine mammals, and marine turtles in North Carolina is still incomplete, it is better than what is available for most other areas of the world. A 15- year extensive study conducted by the NC State Museum (NCSM) is perhaps the longest and most intensive ocean study of seabirds and marine mammals conducted anywhere. The Hatteras area has long been regarded as a biological "Mason-Dixon Line" between boreal and tropical maritime elements. North Carolina is at a latitude usually associated with temperate seas; however, boreal, temperate, and tropical species are transported, or follow prey items transported by converging oceanic currents to the outer continental shelf area at Hatteras. This, in part, explains the diversity. North Carolina has the largest documented marine bird (over 50 species) and marine mammal (28 species) fauna of any geographic unit in the North Atlantic. Much of what has been added to fauna of the state is the result of studies in the area known as "The Point." It is primarily the location of the state in general, and "The Point" in particular, in relation to tropical and subtropical areas, migration routes and oceanic currents that account for the diversity of species. The relatively rich diversity is offset by comparatively low densities, but many of the species found here are tropical ones with small populations, so densities are naturally low. For a tropical - subtropical environment the densities are really quite high. The *Sargassum* community is also discussed.

Lee, D.S., and W.H. Lang. 1998. Biological Environment: Surface Biota. pp. 84-86. In: Vigil, D.L. (ed.). North Carolina/Minerals Management Service Technical Workshop on Manteo Unit Exploration: February 4-5, 1998. U.S. Dept. of the Interior, Minerals Management Service, Gulf of Mexico OCS Region. New Orleans, LA .

*These are the proceedings from a workshop/meeting (February 4-5, 1998) between the North Carolina Department of Environment and Natural Resources and the U.S. Department of the Interior's Minerals Management Service (MMS). The geographic area discussed is approximately 45 miles east-northeast of Cape Hatteras, NC, referred to as the Manteo Unit. This workshop reviewed environmental and socioeconomic information known and needed on the Manteo Unit. The MMS's Gulf of Mexico OCS Regional Director gave an MMS perspective on history and status of the area. Chevron gave a presentation on how the exploratory well would be drilled. The scientific characterization was presented in greater detail by a number of scientific experts who spoke on the following disciplines physical environment, habitat and living resources, seabirds, marine mammals, sea turtles, and social and economic issues. Specific chapters are cited individually, when appropriate.

Surface biota during this session was defined as a catch-word phrase to refer to a combination of seabirds, cetaceans, (whales and dolphins), and sea turtles. The group was tasked to discuss immediate concerns that could result from one exploratory drillship's activities on the surface biota in the Manteo Unit. Once potential effects of the exploration well were discussed, remaining time was spent on additional concerns, assuming further development and production were to occur.

Lee, D.S., W.A. McLellan, R. Boettcher, and W.H. Lang. 1998. Habitat and Living Resources Review: Recent Information on Pelagic Seabirds, Marine Mammals, and Sea Turtles of the North Carolina Outer Continental Shelf and an Evaluation of Effects of Proposed Offshore Oil and Gas Exploration. pp. 53-63. In: Vigil, D.L. (ed.). North Carolina/Minerals Management Service Technical Workshop on Manteo Unit Exploration: February 4-5, 1998. U.S. Dept. of the Interior, Minerals Management Service, Gulf of Mexico OCS Region. New Orleans, LA.

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During the late 1980's, the state of North Carolina responded to a proposal by the Mobil Oil Corporation to undertake exploratory gas/oil operations in Federal lease blocks on the Outer Continental Shelf (OCS) known as the Manteo Unit. One of the products resulting from the permit request was a report that addressed potential biological effects from offshore drilling activities as related to sea birds and other fauna of the region (Lee and Socci 1989). Chevron USA now proposes an exploratory well on one of the same Manteo blocks originally leased to various oil companies by the Minerals Management Service (MMS). Since 1989, additional information concerning the seabirds, marine mammals, and sea turtles on the North Carolina OCS has been obtained, and new research is planned or underway. This paper is intended to highlight recent development and briefly mention some concerns associated with offshore oil and gas activities that may affect these animals (e.g., Pelagic Seabirds: Globally Endangered Species, Seabirds of Concern; Marine Mammals; Sea Turtles; Potential Effects From Drillship Operations).

Lee, D.S., and W.M. Palmer. 1981. Records of Leatherback Turtles, *Dermochelys coriacea* (Linnaeus), and Other Marine Turtles in North Carolina Waters. *Brimleyana* 5: 95-106.

New information is presented on the occurrence of five species of marine turtles in North Carolina waters *Dermochelys coriacea* and *Caretta caretta*, the two most commonly occurring species, are emphasized. Thirty-three unpublished records of *Dermochelys*, for North Carolina, and information from other sources, indicate that in North Carolina at least, this turtle typically occurs throughout the warmer months in relatively shallow shelf waters. It may not be an open-ocean wanderer.

Musick, J.A. 1985. Final Report on the Distribution and Abundance of Sea Turtles in the Proposed EMPRESS II Operating Sites. Appendix I: In: U.S. Department of the Navy. EMPRESS II: Supplemental Draft Environmental Impact Statement for the Proposed Operation of the Navy Electromagnetic Pulse Radiation Environment Simulator for Ships (Empress II) in the Chesapeake Bay and Atlantic Ocean. United States Navy. Environmental/ Intergovernmental Section. Atlantic Division. Naval Facilities Engineering and Command. Norfolk, VA.

*This report describes distribution and abundance of marine turtles from the Chesapeake Bay, Virginia to North Carolina's coastal waters. The southern portion of the VACAPES EMPRESS II Area of North Carolina overlaps with the northern portion of the defined study area for the Data Inventory Related to the Hatteras Middle Slope (The Point) Area.

Orbach, M. 1989. Plenary Session: How Could These Resources be Affected By the Proposed Drilling and What Mitigation Measures Might be Used to Prevent Irreversible Damage. pp. 63-64. In: Crawford, K. (ed.). Proceedings: 1989 Marine Expo: The Natural Resources Associated with Mobil's Proposed Drill Site. NC Outer Continental Shelf Office, NC Department of Administration. Raleigh, NC.

*The following is a summary of the plenary session.

There appears to be a good deal of baseline information available about Mobil's proposed drill site area. However, there was a general consensus that there are serious gaps in our understanding of the relationships and functions of the many communities found in and around the exploration area known as the "Manteo Prospect." Some major areas of concern include protection of area benthos, impacts on community ecology, and effects of drilling discharges .

There was almost unanimous support for a monitoring program of the drilling operations and their impacts. Programs should be devised to examine: 1) The fate of drilling discharges, including dispersion (range and extent) and accumulation along fronts and the ocean bottom; and 2) The effects (both chemical and mechanical) of drilling discharges on the benthos, the indigenous fisheries (including eggs/larvae), prey species, forage strategies, and the sargassum communities.

Concerns were also raised regarding the effects the ship and anchor system might have on the biota as a result of displacement, noise, or collisions, and the impacts of exploration activities on the commercial and recreational fisheries found at "The Point ".

Because of previous scientific work done at or near the proposed drill site, this area may be well suited to such monitoring programs. Not only would information from these programs be vital for developing

mitigation measures, but it could also serve as a critical database on which to build a management framework for future development. In addition, data already collected on local fish resources, marine birds, the benthos and bottom conditions, and physical oceanography could provide an excellent base for further research.

*This text also mentions marine mammals and Threatened and Endangered species (marine reptiles).

Renaud, M., G. Gitschlag, E. Klima, A. Shah, D. Koi, and J. Nance. 1993. Loss of shrimp by turtle excluder devices (TEDS) in coastal waters of the United States, North Carolina to Texas: March 1988-August 1990. *Fishery Bulletin* 91: 129-137.

Observers from the National Marine Fisheries Service collected information on catch rates of shrimp aboard commercial shrimp vessels during March 1988-August 1990. Comparisons were made between nets equipped with Turtle Excluder Devices (TEDS) and standard shrimp nets. Three types of TEDs were tested: Georgia TEDs with and without accelerator funnels, and Super Shooter TEDs with funnels.

Fishing areas, time of day, and duration of tows were controlled by the captain of each vessel to simulate commercial conditions. A statistically-significant ($P < 0.05$) mean loss in shrimp catch-per-unit-effort (CPUE) of 0.24 lb/h (3.6%) and 0.93 lb/h (13.6%) was exhibited by nets equipped with Georgia TEDs (with and without funnels, respectively) compared with standard nets. There was no significant difference in shrimp CPUE between standard nets and nets equipped with Super Shooter TEDs with a funnel.

Ross, S.W. 1985a. A Summary of Biological Processes in the Proposed VACAPES EMPRESS II Area Off North Carolina Relating to Plankton Communities, Pelagic Macroinvertebrates, Ichthyofauna, Sea turtles, Marine Mammals, and Sea Birds. Appendix B. In: U.S. Department of the Navy. EMPRESS II: Supplemental Draft Environmental Impact Statement for the Proposed Operation of the Navy Electromagnetic Pulse Radiation Environment Simulator for Ships (Empress II) in the Chesapeake Bay and Atlantic Ocean. United States Navy. Environmental/ Intergovernmental Section. Atlantic Division. Naval Facilities Engineering and Command. Norfolk, VA.

*This technical report is Appendix B within the "EMPRESS II: Supplemental Draft Environmental Impact Statement for the Proposed Operation of the Navy Electromagnetic Pulse Radiation Environment Simulator for Ships (Empress II) in the Chesapeake Bay and Atlantic Ocean" report. The report is a Summary of Biological Processes in the Proposed VACAPES EMPRESS II area off North Carolina Relating to Planktonic Communities, Pelagic Macroinvertebrates, Ichthyofauna, Sea turtles, Marine Mammals, and Sea Birds. Technical reports supporting this summary were written by authorities in each discipline and are included in Appendices. These supporting technical reports are cited individually. The southern portion of VACAPES EMPRESS II Area of North Carolina overlaps with the northern portion of the defined study area for the Data Inventory Related to the Hatteras Middle Slope (The Point) Area.

Schwartz, F.J. 1989. Outer Continental Shelf. pp. 309-332. In: George, R.Y. and A.W. Hulbert (eds.). North Carolina Coastal Symposium. National Undersea Research Program. NOAA. Rockville, MD.

Five species of rare and endangered sea turtles frequent North Carolina's coast. Their abundance and seasonality is influenced by water mass and Gulf Stream currents, seasonal water temperatures, and

effects of natural and man's alteration of the available habitat. Annually, 200 - 500 loggerhead nests are found on state beaches. Green turtles have nested in recent years on only six occasions. The pattern of nesting varies depending on position of the Gulf Stream and seasonal water temperatures. Natural causes (cold stunning or attacks by sharks) account for some turtle deaths. A limited number of deaths result from ingestion of artificial substances. Most deaths are man induced. Recent, often meager, conservation efforts have attempted to protect incubating nests by screening or removal to hatcheries. A sanctuary was established off one of the most productive beaches in the state (Onslow Beach) to lessen fishing fleet influence on adult turtles. Accommodation must be made by man to further protect sea turtles, otherwise a valuable heritage will be lost forever.

*A map showing sea turtle migratory routes (Fig. 1) through the defined project area for The Point is included.

Settle, L.R. 1997. Commercial harvest of pelagic Sargassum: A summary of landings since June 1995. In: South Atlantic Fishery Management Council. Essential Fish Habitat Workshop # 9: October 7 - 8, 1997 Pelagic Habitat Sargassum and Water Column. South Atlantic Fishery Management Council. Charleston, SC. May 1997. 66 p.

The commercial harvest of pelagic *Sargassum* resumed in June 1995. To date the fishery is prosecuted by a single firm, Aqua-10 Corporation of Beaufort, North Carolina. Aqua-10 processes the raw algae into a variety of agricultural fertilizers and dietary supplements used in the swine and poultry industries. The firm purchases algae harvested by local fishing vessels. Two vessels, the FV Outer Banks (16.5 m snapper boat) and the FV Rising Sun (15 m long-liner) have been equipped with Sargassum nets by Aqua- 10. The gear consists of a 1.2 in x 0.9 n frame trawl rigged with 7.6 am mesh trawl webbing. The vessels harvest algae ancillary to their normal fishing activities. When algae are landed, Aqua-10 notifies the NMFS, Beaufort Laboratory. The algae are examined for by-catch at dockside and at the processing plant. Vessel captains are interviewed to obtain data on the date and location of harvests, effort, and by-catch.

All algae have been harvested from off the North Carolina coast from northern Onslow Bay to northeast of Cape Hatteras (Fig. 2). Although Sargassum has been harvested on the continental shelf, most was obtained in the Gulf Stream (Fig. 3). The observed by-catch has been minimal in terms of numbers of individuals. No sea turtles and few fishes have been noted. Most fish have been young juveniles and are generally in advanced stages of decomposition. Identifiable taxa include filefish (*Monacanthus hispidus*), amberjacks (*Seriola* spp.), blue runner (*Caranx crysos*), jacks (*Caranx* spp.), flyingfish (Exocoetidae), sergeant major (*Abudefduf saxatilis*), gray triggerfish (*Balistes capriscus*), sargassum fish (*Histrion histrio*), and pipefish (*Syngnathus* spp.). The most commonly observed macrofaunal by-catch have been crustaceans including several shrimp (genera *Hippolyte*, *Latreutes*, and *Leander*) and crabs (genera *Planes* and *Portunus*).

Shepard, A. (ed.). 1991. Undersea Research at The Point. NURC/UNCW 1991 Undersea Research: Informational Meeting. National Undersea Research Center, University of North Carolina at Wilmington. Wilmington, NC. 9 p.

*This handout is a summary of research being conducted at "The Point" area (Manteo Lease Block 467).

The National Undersea Research Center at the University of North Carolina at Wilmington, funded by a grant from the National Oceanic and Atmospheric Administration's (NOAA) Office of Undersea Research, was established in 1980 to promote, facilitate, and conduct research in the Southeastern United States utilizing undersea techniques, including advanced wet diving and manned and unmanned submersibles. A main Center goal is to provide information to NOAA that will assist the agency in fulfilling its charter to explore, understand, conserve and manage the U.S. marine environment and associated resources. To help meet this goal, the Center supports and conducts interdisciplinary oceanographic research projects studying continental margin processes, particularly the interactions and linkages between estuarine, continental shelf, and slope (including submarine canyon) environments.

Shoop, C.R., and R.D. Kenny. 1992. Seasonal distributions and abundances of loggerhead and leatherback sea turtles in waters of the northeastern United States. *Herpetological Monographs* 6: 43-67.

Seasonal distributions and abundances of loggerhead (*Caretta caretta*) and leatherback (*Dermochelys coriacea*) sea turtles in continental shelf waters off the coast of the northeastern United States were derived from more than three years of aerial and shipboard surveys. There were 3460 sea turtle sightings, including 2841 loggerheads, 128 leatherbacks, and 491 unidentified. Relative abundance patterns, corrected for uneven distribution of survey effort, demonstrated an extensive area of loggerhead distribution from near Long Island, New York, along the mid-shelf to near Cape Hatteras, North Carolina. Areas of high relative abundance of leatherbacks were more scattered, with clusters south of Long Island and in the central and eastern Gulf of Maine. Loggerheads occurred significantly farther south ($x = 38^{\circ} 20' N$) than leatherbacks ($x = 40^{\circ} 05' N$), and in significantly warmer waters (mean surface temperatures of $22.9^{\circ} C$ and $20.4^{\circ} C$, respectively). The two species did not differ significantly in water depth or bottom slope at sighting; the modal depth interval for both was 21-40 m. Patterns of distribution and concentration of sea turtles differed greatly from nearly all species of marine mammals, suggesting little overlap in resource utilization. Both relative and absolute density estimates were much higher for loggerheads. Overall mean relative densities were 21.6 loggerheads per 1000 km of survey track, and 6.85 leatherbacks per 1000 km. Absolute density estimates, derived from 454 special aerial surveys, ranged from 1.64×10^{-3} to 5.10×10^{-1} loggerheads km^{-2} and 2.09×10^{-3} to 2.16×10^{-2} leatherbacks km^{-2} . The maximum densities for both species were higher than values reported for the Gulf of Mexico and off the eastern Florida shore. Total study area populations during the summer were estimated at 2200-11,000 loggerheads and 100-900 leatherbacks. These estimates are minimal because they are based on observations of turtles at the surface, and may represent much greater abundances. The patterns of relative abundance derived from this analysis could be used as a basis for the designation of critical sea turtle habitat off the northeastern U.S.

U.S. Department of the Interior, Minerals Management Service. 1989. Environmental Report Visual II: Study Area for Coastal North Carolina. U.S. Department of the Interior, MMS Minerals Management Service, Atlantic OCS Region.

*This map was developed using base mapping from Espey, Houston and Associates, Inc. This map (Environmental Report Visual II: Study Area for Coastal North Carolina) includes the project area and specifically shows lease blocks, including Manteo Lease Block 467. Features include: Habitat types, Bird Nesting Habitat (described by species), National Wildlife Refuge Boundaries, National Seashore Boundaries, Endangered/Threatened Species (e.g., birds, plants, sea turtles).

U.S. Department of the Interior, Minerals Management Service. 1992. Proceedings of the Fourth Atlantic OCS Region Information Transfer Meeting, September 1991. U.S. Department of the Interior, Minerals Management Service. Herndon, VA. 198 p.

The Fourth Atlantic Outer Continental Shelf (OCS) Regional Information Transfer Meeting was held on 24-25 September 1991 in Wilmington, NC. The focus of the meeting was on the OCS off North Carolina, specifically on activities related to a proposed exploratory well for oil and gas by Mobil on Block 467 a site 40 miles off the coast of North Carolina. The area of industry interest is known as the Manteo Prospect, while the activities surrounding the proposed drilling are referred to collectively as the Manteo Project. The wildcat wellsite is in 2,690 ft. (857 m) of water near the edge of the Gulf Stream. It is also near a fishing ground known locally as "The Point". The area is believed to be gas prone rather than oil prone. The estimated size of the resource could be as high as 5 trillion cubic feet of gas.

The purpose of the meeting was to exchange information on the leasing background, legislative activities, scientific results, and socioeconomic studies. Legislative-related reports include descriptions of the Oil Pollution Act of 1990, the Outer Banks Protection Act, the Environmental Studies Review Panel, and the North Carolina Physical Oceanography Panel. Reports of studies on marine life include benthic diatoms, benthic fauna, pelagic seabirds, sea turtles, and right whales. One report describes the use of airships (blimps) for ocean research a capability relevant to North Carolina because of the east coast airship facility is located in the state. Local marine science facilities described include NOAA's National Undersea Research Center at the University of North Carolina at Wilmington and the National Marine Fisheries Service laboratory in Beaufort. Developments in oil spill cleanup technology and capabilities are described by both the Coast Guard and the industry. A socioeconomic report describes the effects of the oil and gas activities on the tourist industry. Lastly, research on the restoration of salt marshes indicates that rehabilitation of an area is possible when development or an accident has occurred. While the emphasis of the meeting was on oil and gas, two reports described the results of projects related to offshore sand mining. The appendix lists the names and addresses of speakers. Individual chapters are cited individually when appropriate.

U.S. Department of the Navy. 1985. EMPRESS II: Supplemental Draft Environmental Impact Statement for the Proposed Operation of the Navy Electromagnetic Pulse Radiation Environment Simulator for Ships (Empress II) in the Chesapeake Bay and Atlantic Ocean. United States Navy. Environmental/Intergovernmental Section. Atlantic Division. Naval Facilities Engineering and Command. Norfolk, VA.

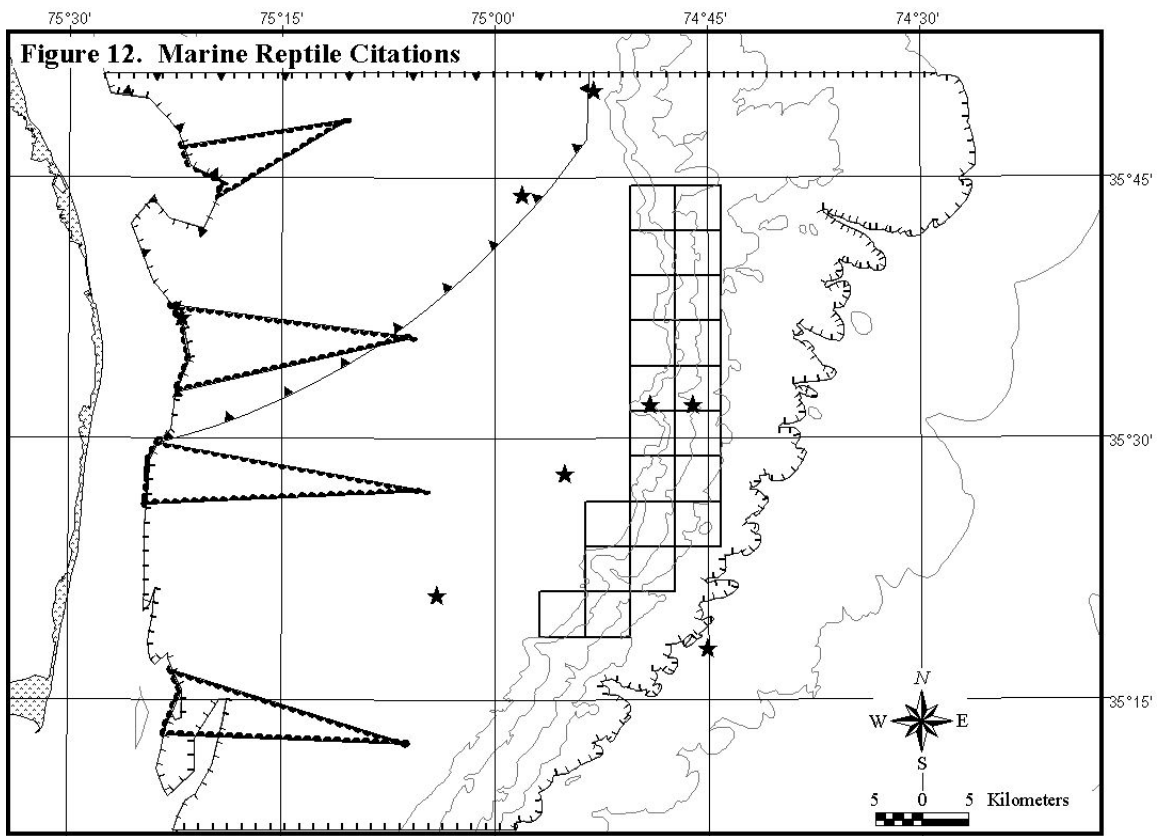
*This is a National Environmental Policy Act document characterizing the proposed EMPRESS II project. Appendix B is a Summary of Biological Processes in the Proposed VACAPES EMPRESS II area off North Carolina Relating to Planktonic Communities, Pelagic Macroinvertebrates, Ichthyofauna, Sea turtles, Marine Mammals, and Sea Birds. Technical reports (cited individually) supporting this summary were written by authorities in each discipline and are included in Appendices. The southern portion of VACAPES EMPRESS II Area of North Carolina overlaps with the northern portion of the defined study area for the Data Inventory Related to the Hatteras Middle Slope (The Point) Area.

Vigil, D.L. (ed.). 1998. North Carolina/Minerals Management Service Technical Workshop on Manteo Unit Exploration: February 4-5, 1998. U.S. Dept. of the Interior, Minerals Management Service. Gulf of Mexico OCS Region. New Orleans, LA. 168 p.


*These are the proceedings from a workshop/meeting (February 4-5, 1998) between the North Carolina Department of Environment and Natural Resources and the U.S. Department of the Interior's Minerals Management Service (MMS). The geographic area being discussed is approximately 45 miles east-northeast of Cape Hatteras, NC, referred to as the Manteo Unit. This workshop reviewed environmental and socioeconomic information known and needed on the Manteo Unit. The MMS's Gulf of Mexico OCS Regional Director gave an MMS perspective on history and status of the area. Chevron gave a presentation on how the exploratory well would be drilled. The scientific characterization was presented in greater detail by a number of scientific experts who spoke on the following disciplines physical environment, habitat and living resources (invertebrates and fish), seabirds, marine mammals, sea turtles, and social and economic issues. Specific chapters are cited individually, when appropriate.


Witzell, W.N. 1999. Distribution and relative abundance of sea turtles caught incidentally by the U.S. pelagic longline fleet in the western North Atlantic Ocean, 1992-1995. Fishery Bulletin 97: 200-211.

*This paper examines the seasonal distribution and relative abundance of threatened and endangered sea turtles (e.g., loggerhead sea turtle, *Caretta caretta*; and leatherback sea turtle, *Dermochelys coriacea*) caught incidentally by the U.S. Atlantic pelagic longline fishery for tuna, *Thunnus* spp., and swordfish, *Xiphias gladius* from 1992-1995.




Key to Marine Reptile Citations (Figure 12).


 Study Area Boundary

 Lease Blocks

Mapped Citations

 Coles & Musick (2000)

 Lee & Palmer (1981)

 Ross, S. (1985a); U.S. Dept. Navy (1985)

Studies that Focus on the Manteo Lease Blocks

Crawford (1989)

Lee & Lang (1998)

U.S.D.O.I.-Minerals Mgmt. Service (1992)

Vigil (1998)

Studies that Cover the Hatteras Middle Slope Area ("The Point")

Lee (1991)

Lee et al. (1998)

Orbach (1989)

Shepard (1991)

U.S.D.O.I.-Minerals Mgmt. Service (1989)

Broad Regional Studies

Abernathy et al. (1989)

CETAP (1979)

Coston-Clements et al. (1991)

Epperly et al. (1989, 1995)

George & Hulbert (1989)

Hoss (1992)

Keinath (1992)

Lazzel (1980)

Lee (1985b)

Musick (1985)

Renaud et al. (1993)

Schwartz (1989)

Settle (1997)

Shoop & Kenny (1992)

Witzell (1999)