

SARGASSUM CHAPTER

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Ashjian, C.J., S.L. Smith, C.N. Flagg, A.J. Mariano, W.J. Behrens, and P.V.Z. Lane. 1994. The influence of a Gulf Stream meander on the distribution of zooplankton biomass in the Slope Water, and the Gulf Stream, and the Sargasso Sea, described using a shipboard acoustic Doppler current profiler. *Deep-Sea Research I* 41(1): 23-50.

The influence of a Gulf Stream meander on the distribution of zooplankton biomass in the Slope Water, the Gulf Stream, and the Sargasso Sea, described using a shipboard acoustic Doppler current profiler. Patterns in zooplankton biomass distribution in a Gulf Stream meander were documented using a ship-mounted acoustic Doppler current profiler (ADCP) in fall 1988 as part of the BIOSYNOP program. The dominant signal in biomass was the regional variation between water masses, with greatest biomass recorded in the Slope Water, intermediate biomass at the Slope Water-Gulf Stream front, and lowest biomass in the Gulf Stream/Sargasso Sea. Biomass was more variable in the Slope Water than in the Sargasso Sea. Diel variation, a consequence of diel vertical migration, was also observed. Comprehensive maps of the surveyed region documented meander associated enhancement of zooplankton biomass. Elevated biomass was documented in the region downstream of the meander crest, where entrainment of Slope Water and convergence of flow are hypothesized to occur. The ADCP was demonstrated to be an effective means of documenting patterns in zooplankton biomass, including estimates of the variability (patchiness).

Butler, J.N., B.F. Morris, J. Cadwallader, and A.W. Stoner. 1983. Studies of Sargassum and the Sargassum Community. Special Publication No. 22. Bermuda Biological Station for Research.

*Chapter 1 The Quantity of Sargassum in the Sargasso Sea, and Chapter 2 The Sargassum Community include the defined study area for The Point.

The quantity and distribution of *Sargassum* in the Sargasso Sea, as estimated by various investigators, is reviewed. There has apparently been no significant change in the biomass of *Sargassum* from 1933 to 1981, except for an area northeast of the Antilles (20-25° N, 62-68° W) where measurements made in November 1977 and November 1980 were about 0.1% of values measured in February and March 1933. Because of the lack of change in the Bermuda region, the Bahamas region, or the Gulf Stream region, this effect does not appear to be due to pollution or broad climatic changes; it is most likely due to a seasonal or long-term shift of the currents defining the southwestern boundary of the Sargasso Sea.

Motile macrofauna on *Sargassum* were identified and counted for 244 samples taken at Station 'S' near Bermuda, and for 155 samples taken from other parts of the western North Atlantic and Caribbean. The nature of this community and its seasonal variations are discussed. Preliminary studies of the food web, as well as of the microfauna (copepods) and sessile fauna are reported. Although petroleum hydrocarbon residues are found in all samples of *Sargassum* and its larger associated fauna, the variability of individual samples is so extreme that no correlation of community structure with hydrocarbon pollution could be demonstrated.

Chen, Chin, and N.S. Hillman. 1970. Shell-bearing Pteropods as Indicators of Water Masses off Cape Hatteras, North Carolina. *Bulletin of Marine Science* 20(2): 350-367.

Three water masses occur within a radius of 120 nautical miles off Cape Hatteras, North Carolina. Several species of shell-bearing pteropods characterize these water masses: subarctic *Limacina retroversa* in the slope water, subtropical *Limacina inflata* in the Sargasso Sea, and tropical *Limacina trochiformis* and *Creseis virgula* in the Gulf Stream.

The pattern of vertical distribution of pteropod species is compatible with the seasonal structure of the water. In summer, a thin, warm surface layer bearing tropical species of pteropods overlies thick, cold, slope water carrying subarctic species in the region of 35°30'N to 37°10'N. In winter, the slope water surfaces at about 36N. The sharp gradient exhibited by the vertical slope of isotherms acts as a temperature barrier separating subarctic from tropical species of pteropods.

Pteropod shells are found in sediments beneath the Gulf Stream at depth of about 400-2150 m. *Creseis virgula conica* is the dominant species in the sediments.

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.

Fedoryako, B.I. 1989. A Comparative Characteristic of Oceanic Fish Assemblages Associated with Floating Debris. *Journal of Ichthyology* 29: 128-137.

A comparative characteristic of fish assemblages associated with oceanic debris (drifting macrophytes, terrestrial material and epipelagic invertebrates) of tropical ocean zones was made. In the floating debris of the oceanic pelagial 110 species of 35 families were found. About 30% of all fish species were found only in some assemblages. The highest species diversity was associated with macrophytes (75% of all species), and terrestrial material (78% of all species). Representatives of the majority of common species, up to a certain size, occurred in the macrophytes. Fishes associated with drifting macrophytes formed more abundant assemblages than those associated with terrestrial material. Over 50% of species associated with oceanic flotsam occurred commonly in the neritic zone. With the increasing distance of the flotsam from the coast the species diversity decreases and the dominant species change.

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.

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.

*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.

Lee, D.S. 1991. 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. 1992. Pelagic Seabirds Off the North Carolina Coast: An Overview of 16 Years of Surveys. pp. 78-86. 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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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.

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*This section provides a brief overview of pelagic seabirds off the North Carolina coast with an overview of 16 years of surveys. Figure 14 An Example of Seabird Sightings Compiled by the North Carolina State Museum, is on page 78. The role of sargassum patches as bird habitat is described.

Lee, D.S., and M.L. Moser. 1998. Importance des *Sargasses* pelagiques pour la recherche alimentaire des oiseaux marins. *El Pitirre* 11(3): 111-112.

Based on gut contents of 16 genera and 38 seabird species (n = 1033) and 240 days of at sea observations we document importance and species specific variation in use of *Sargassum* 'reefs'. Over half the seabird species studied forage in this tropical pelagic community. We classify these birds as *Sargassum* specialists (> 25% occurrence of associated prey), users (up to 25% of prey), and incidentals (evidence of use but no associated prey identified).

Sargassum association was documented in most Procellariiforms (9 of 10 species) and less frequently in Charadriiforms (12 of 25). Five seabirds had > 25 % documented use (Audubon's Shearwaters, 59%; Masked Boobies, 100%; Red-necked Phalaropes, 62%; Royal Terns, 40%; and Bridled Terns, 58%). These birds target *Sargassum* for feeding, and the presence or absence of this alga drives local occurrence and abundance. Selected prey tends to be small (15-40 mm) fishes, but each avian species used the resource in specific ways.

It is assumed that birds use this community throughout the tropical and sub-tropical North Atlantic. In view of the low productivity of nutrient poor surface waters in the tropics, the importance of *Sargassum* to seabird abundance and seasonal distribution is assumed to be high. Estimates in the Sargasso Sea (an area larger than the United States) suggest a standing crop of 2.0 - 5.5 metric tons/sq. nautical mile. In the Gulf Stream off the Carolina coast an additional standing crop of 57,290 tons occurs, where *Sargassum* productivity is estimated at 27,074 tons/year. The number of fishes/ton is about 2,400 individuals and the total fish biomass is usually > 1% of the *Sargassum*

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 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, 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.

Moser, M.L., P.J. Auster, and J.B. Bichy. 1997. Effects of mat morphology on large *Sargassum*-associated fishes: observations from a remotely operated vehicle (ROV) and free-floating video camcorders. Attachment 10. 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.

Attachment 10: Vagile larger juvenile and adult fishes are often under-represented in traditional sampling of *Sargassum*-associated fishes in the open ocean. We used underwater video recordings from free-floating camcorders and a remotely operated vehicle (ROV) to assess the relative abundance of large mobile fishes under large *Sargassum* mats (> 10 m diameter), under dispersed clumps of *Sargassum* (< 1 m diameter), and in open water without *Sargassum* as a reference. In addition, we conducted dipnet sampling in each *Sargassum* treatment for a comparison to traditional methods. All samples were obtained in September 1992 along the western wall of the Gulf Stream off Cape Hatteras, North Carolina. A total of 31 fish taxa were identified from both video and dipnet collections. Only 8 taxa were identified in both video and dipnet collections, while 11 taxa were seen only in video and 10 were only found in dipnet collections. Dipnet collections were dominated by juvenile balistids and other small, cryptic fishes, while the video observations were mainly of larger, rapidly-moving carangids. Fish diversity increased with the amount of continuous *Sargassum* habitat: four taxa were observed when no *Sargassum* was present, 12 under clumps, and 19 under mats. Our results indicated that mat morphology significantly affects the *Sargassum*-associated fishes, and that both video and traditional capture methods are complementary and should be used together to accurately census this community.

*This is the same abstract from Moser et al. (1998)

———. 1998. Effects of mat morphology on large *Sargassum*-associated fishes: observations from a remotely operated vehicle (ROV) and free-floating video camcorders. *Environmental Biology of Fishes* 51: 391-398.

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Myers, T.D. 1968. Horizontal and Vertical Distribution of Thecosomatous Pteropods off Cape Hatteras. Ph.D. Dissertation. Department of Zoology, Duke University. 223 p.

Cape Hatteras, North Carolina lies at the confluence of the warm northerly flowing Gulf Stream and a cool, southerly flowing Virginian Coastal Current. Previous workers have demonstrated marked north-south changes in the species composition of benthic marine invertebrates at Cape Hatteras and have noted that this change is associated with the different types of water present in the area.

This investigation attempts to determine whether a similar change in faunal composition can be found in a holoplanktonic group of animals in the waters off Cape Hatteras. The Thecosomata, or shelled pteropods were chosen for study.

A total of 26 species of Thecosomata within 9 genera have been found in six water types sampled in the Cape Hatteras area. The greatest number of thecosomes was found in the upper 60 meters of the water column with a concentration maximum of 10,000-20,000 animals/1,000 m³ water filtered being present as a persistent feature of the 15-30 meter depth range in the Gulf Stream and Sargasso Sea. The number of species present in the water column is 5-8 in Carolinian Coastal Water, 12-17 in Gulf Stream and Sargasso Sea, one in winter Virginian Coastal Water and Slope Water, and 1-5 in semiar Virginian Coastal Water and Slope Water.

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).

Ross, J. 1989. Commercial and Recreational Marine Fisheries off North Carolina's Outer Banks. pp. 40-44. 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.

*This section provides an overview of year round, recreational fishing, commercial fishing, and fisheries harvests in the study area. The potential project-related-impacts to fisheries-based socioeconomics, and the impact of project-related pollution are discussed. Sargassum is mentioned.

Ross, S.W. 1998. Habitat and Living Resource Review: Scientific Data for Fisheries and *Sargassum* at the Hatteras Middle Slope (Including "The Point" and Manteo Exploration Unit). pp. 37-42. 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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The purpose of this review is to provide a brief summary of the state of fisheries and *Sargassum* knowledge in and near to the geographic region proposed for oil exploration activities off of North Carolina (referred to here as the Hatters Middle Slope, HMS). This will result in a basic listing of what we know about the subjects and what we still need to know. This treatment is restricted to the HMS area and thus is not to be a complete description of the North Carolina ichthyofauna. Time and space constraints imposed by the North Carolina/Minerals Management Service Technical Workshop do not allow a full treatment of this subject nor a detailed presentation of the data that support various conclusions. Prioritized and expanding the list of data needs will require additional discussions, some completed at this meeting, with input from a variety of scientist, managers, and the public. Since the last such summaries (1989 and 1991), considerable data have been collected (much of it published) related to the HMS. Ironically, the major impetus (upper water column fishery concerns around "The Point") for research here resulted in most studies being conducted on or near the bottom close to the proposed drill site rather than studies about the processes driving fisheries at "The Point". This section discusses Benthic Slope, Mid-Water Mesopelagic, Surface-Upper Water Column, Sargassum Community, Commercial/Recreational Fisheries, Oil Exploration/Development Concerns, and a Summary of Data/Study Needs including: Trophodynamic/Energetic Pathways (Plus Other Life History Data); Fisheries at "The Point"; Data Inventory Around HMS and "The Point"; Larval Fish Data; Lighting Effects; Mechanisms Structuring Benthic and Mid-water Fish Communities of the HMS; and Physical Oceanography.

Ross, S.W., K.J. Sulak, J. Gartner, and D.S. Lee. Unpublished data. Ongoing project: Definition of Ecological/Trophic Linkages Among Fishes and Other Nekton in the Area Known as The Point -- North Carolina Continental Shelf Slope.

*This is an on-going study of fishes, invertebrates, sargassum and marine birds at the area known as The Point. The emphasis is on trophic linkages throughout the water column. The summer 1999 and 2000 stations were mapped.

Settle, L.R. 1993. Spatial and Temporal Variability in the Distribution and Abundance of Larval and Juvenile Fishes Associated with Pelagic *Sargassum*. M.S. Thesis. University of North Carolina at Wilmington. 65 p.

A survey of the larval and juvenile fishes associated with the pelagic Sargassum habitat in the South Atlantic Bight and adjacent western Atlantic Ocean was conducted from July 1991 through March 1993. Fishes representing 104 taxonomic categories were identified, including reef fishes, coastal demersal, coastal pelagic, epipelagic and mesopelagic species. The most important families were Balistidae and Carangidae, each represented by 15 species. Species composition, species diversity and abundance varied both seasonally and regionally. Diversity was highest during spring through fall over the outer continental shelf and in the Gulf Stream. Abundance decreased from spring through winter and from the continental shelf into offshore waters. The numbers of fishes and fish biomass were found to be positively correlated with the wet weight of algae in most cases examined. The results of this study will be useful to fisheries managers assessing the potential impacts of commercial *Sargassum* harvesting in the region.

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.

Attachment 11: 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 (OUR), 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.

Shepard, A., and A.H. Hulbert (eds.). 1994. Workshop Report: Present and Future Research Initiatives on the Upper Hatteras Slope off North Carolina. National Undersea Research Center at the University of North Carolina at Wilmington. Wilmington, NC. 30p.

*This report is the result of the May 1993 workshop held in Raleigh, NC. The topics of discussion were research (present and planned) at the Upper Hatteras Slope (UHS) and potential funding sources. The workshop was sponsored by National Undersea Research Center at the University of North Carolina at Wilmington. The report provides a brief description of the UHS invertebrates, biological oceanography, chemical oceanography, geological oceanography (bathymetry, oil and gas exploration), physical oceanography, fisheries, and *Sargassum*. Appendix A is a workshop agenda and list of speakers. No abstracts for speakers are provided. Appendix B is a list of potential funding sources. Appendix C contains a list of publications pertaining to the UHS.

South Atlantic Fishery Management Council. 1998. FINAL Habitat Plan for the South Atlantic Region: Essential Fish Habitat Requirements for Fishery Management Plans of the South Atlantic Fishery Management Council: The Shrimp Fishery Management Plan; The Red Drum Fishery Management Plan; The Snapper Group Fishery Plan; The Coastal Migratory Pelagics Fishery Management Plan; The Golden Crab Fishery Management Plan; The Spiny Lobster Fishery Management Plan; The Coral, Coral Reefs, and Live/Hard Bottom Fishery Management Plan; The Sargassum Habitat Fishery Management Plan; and The Calico Scallop Fishery Management Plan. South Atlantic Fishery Management Council. Charleston, SC. 457 p.

*This report emphasizes South Atlantic Coast, nearshore habitat (from shore to 200m isobath). On pages 125-133 Sargassum habitat is described. Page 134-135 mentions "The Point" within Section 3.2.3.2.1 Description of Water Column Habitats. Figure A Water Masses off Cape Hatteras, is located on p. 135 and shows a schematic diagram of "The Point", relative to the Gulf Stream, Virginia (longshore) Current and Sargasso Sea. Table 18b taxonomic list of larval and early-juvenile fishes from offshore of Cape Lookout to Cape Hatteras including the region known as "The Point" is located on pp. 139-145. Oil and gas exploration, development and transposition are mentioned in section 4.1.2.4 on page 323 (Offshore Cape Hatteras, NC is mentioned, but no specific reference to "The Point" is made).

Stoner, A.W. 1983. Pelagic Sargassum: Evidence for a major decrease in biomass. Deep-Sea Research 30(4) A: 469-474.

A survey of pelagic *Sargassum* spp. in the North Atlantic Ocean, Caribbean Sea, and the Gulf of Mexico between 1977 and 1981 showed that the biomass of the plants in the Sargasso Sea was <6% of the values in 1933 to 1935. There were also major decreases in the Gulf of Mexico, in the slope water mass of North America, and near the Bahama Islands. The drastic reduction over the past half century may be related to an increase in anthropogenic materials in the ocean.

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 (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 and the National Marine Fisheries Service laboratory in Beaufort.

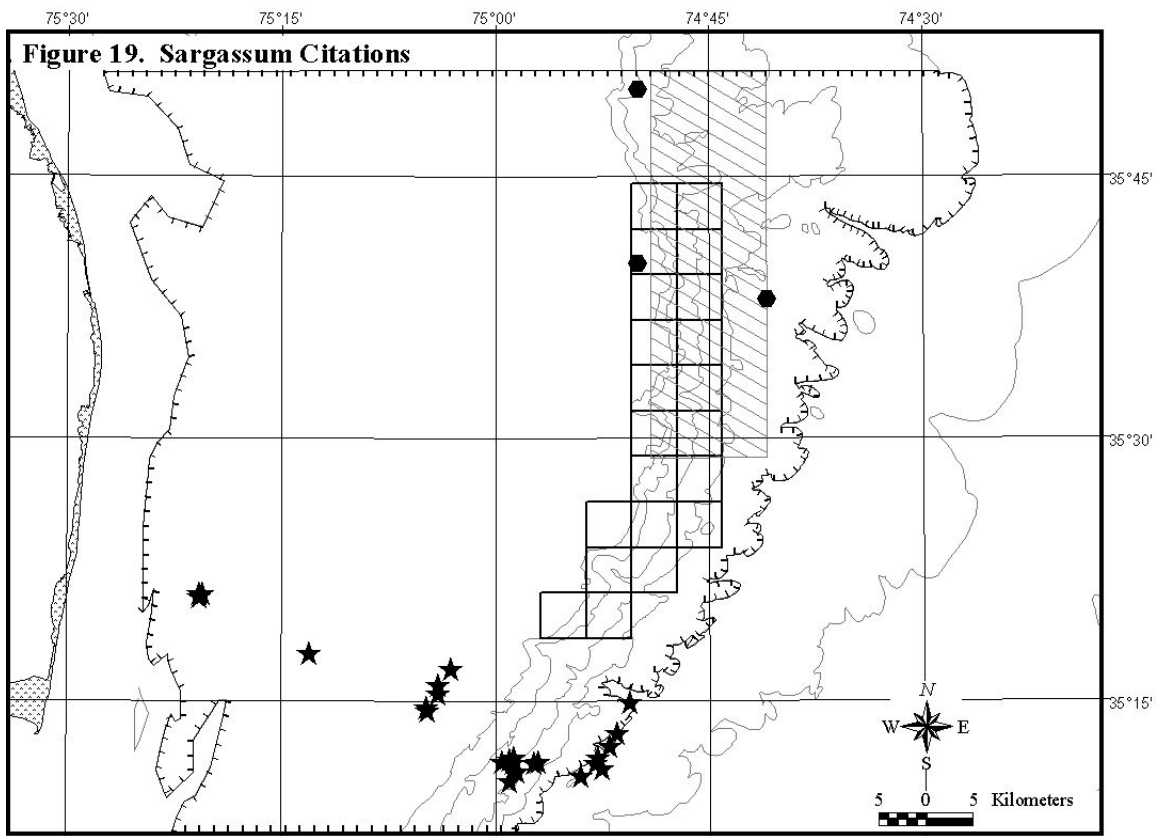
Developments in oil spill cleanup technology and capabilities are described by both the Coast Guard and the industry. A socioeconomic report describes the effects of the oil and gas activities on the tourist industry. Lastly, research on the restoration of salt marshes indicates that rehabilitation of 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.

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 through 1995. Sargassum is mentioned.





Key to Sargassum Citations (Figure 19).


 Study Area Boundary

 Lease Blocks

Mapped Citations

 Chen & Hillman (1970)

 Moser et al. (1997, 1998)

 Myers (1968)

Studies that Focus on the Manteo Lease Blocks

Crawford (1989)

Lee & Lang (1998)

Shepard & Hulbert (1994)

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

Vigil (1998)

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

Lee (1991, 1992)

Orbach (1989)

Ross, S. (1989, 1998)

Shepard (1991)

Broad Regional Studies

Ashjian et al. (1994)

Butler et al. (1983)

Coston-Clements et al. (1991)

Fedoryako (1989)

Keinath (1992)

Lee & Moser (1998)

Settle (1993, 1997)

S. Atlantic Fishery Mgmt. Council (1998)

Stoner (1983)

Witzell (1999)

Studies Based on Large

Digitized Databases

Ross et al. (unpub.)