

METHODS

Study area definition

First, we defined boundaries for the data search area encompassing the proposed oil exploration sites or blocks and relevant biological and physical characteristics in the region known as “The Point”. We selected a study area surrounding the proposed Mobil oil exploratory well site in block 467 (35° 29' 23.6" N; 74° 46' 12.7" W) which was roughly a rectangle bordered east and west by the 20 m and 2000 m depth contours, respectively. The north and south borders extended 40 kilometers (21.6 nautical miles) in either direction from the proposed drill site (Figure 2). For many purposes any area delineated in the open ocean is a compromise between being too small or too large; however, we feel the area selected for this data inventory includes adequate information that can be related to impact and environmental assessment for “The Point” region.

Data acquisition

Information and research (published, unpublished, and ongoing) within, overlapping, or directly related to the defined study area were identified using our in-house library resources, electronic literature searches, library literature searches, and interviews with researchers. All potential candidates for inclusion in the bibliography were reviewed for relevance to the study area, often by comparing reference location data to the study area base map. Unpublished and/or unanalyzed (e.g., R/V Dan Moore, National Marine Fisheries Service, etc.) data were the most difficult to locate and define. Most of these were included based on previous research and experience of the senior author (S.W. Ross). We attempted to acquire copies of all references included in the data base. We grouped the references or studies into major categories (see below) which became the individual bibliographic chapters for this report.

Development of a computer-based relational database

A keyword-searchable electronic database was constructed using bibliographic software (ProCite version 4.03). The ProCite database allowed for an electronic archive that could be searched in a variety of ways (e.g., by keywords, authors, dates). Metadata (descriptive components of the bibliographic entry) were entered into the ProCite database for each citation (Table 1). The abstract of each published

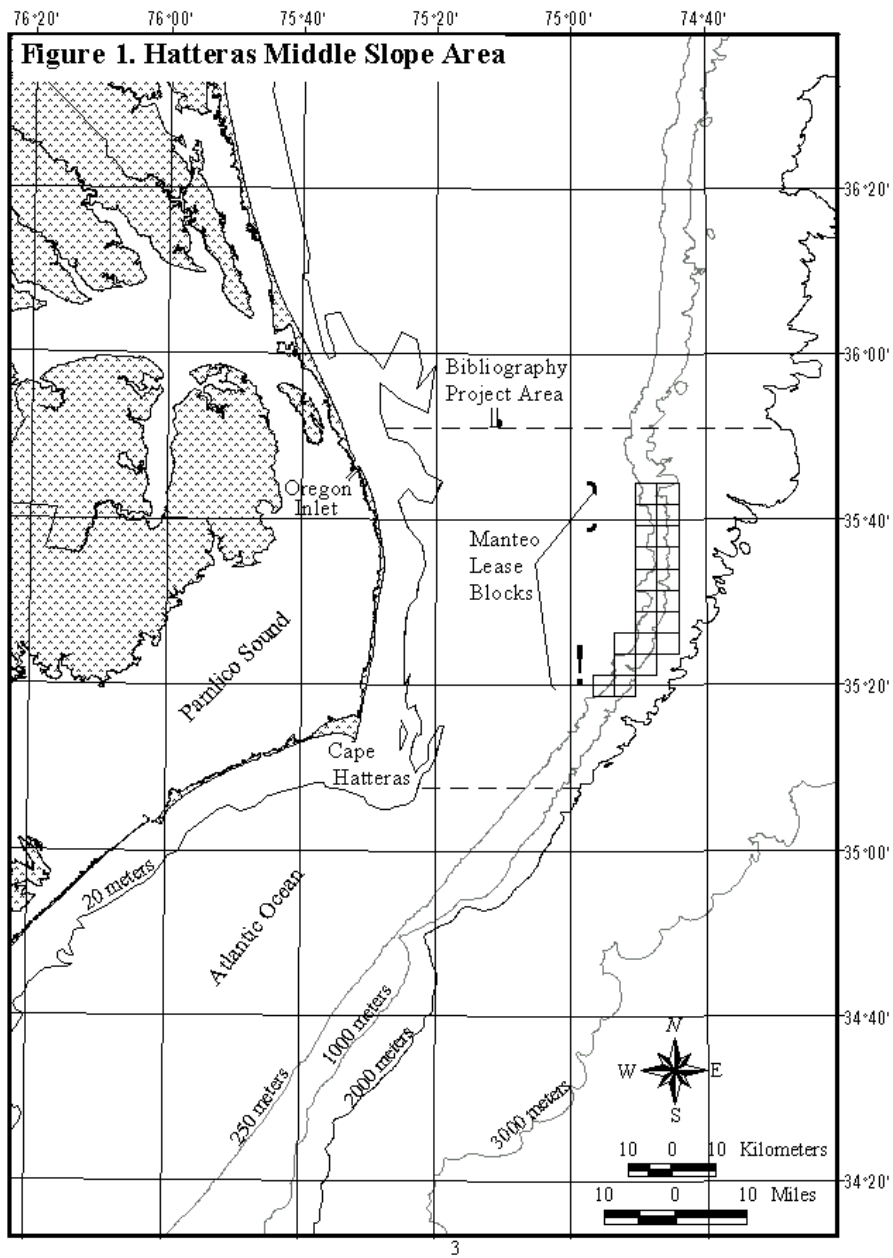


Figure 1

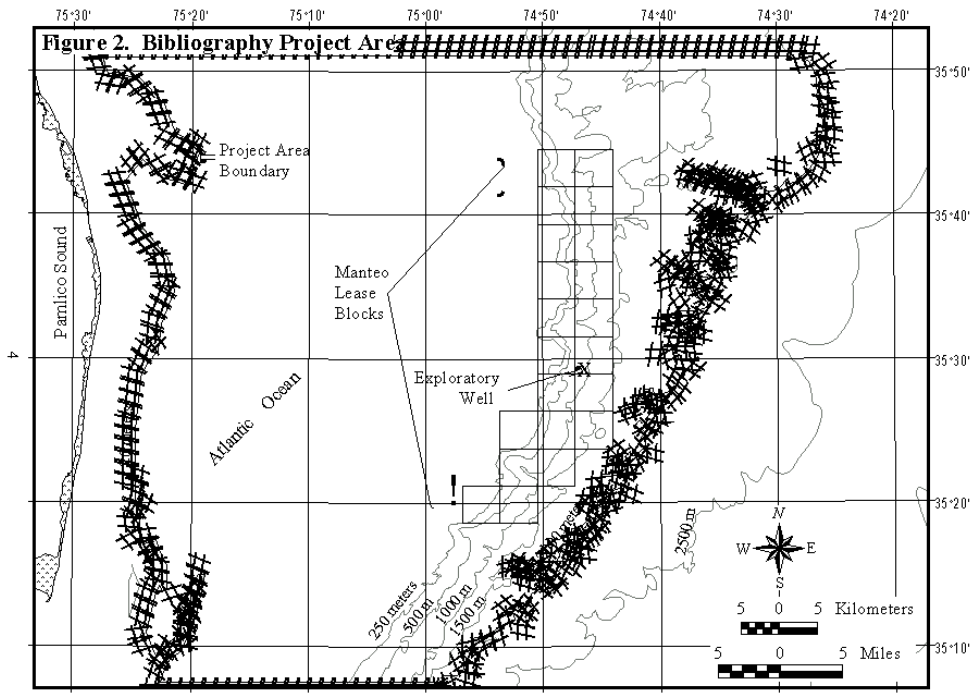


Figure 2

or otherwise written report was duplicated in the database. For citations lacking an abstract (e.g., some reports, unpublished data or programs), we generated a descriptive abstract for the entry, noted by an asterisk (*) within the bibliography.

Two levels of keywords were developed and applied to each citation in the ProCite database. First, we classified each citation into one or more general groupings (Table 2) that became the report chapters. These general keywords defined the broad scientific disciplines represented by the studies and allowed the references to be sorted into chapters. While many of the keywords below can be considered biological oceanography, this particular keyword usually referred to biological topics not represented by the other keywords (e.g., plankton, productivity). A multidisciplinary citation was assigned multiple general keywords and thus may be cited in multiple report chapters (see Appendix I). Second (and in addition to the above general keywords), if keywords were provided by the publication, these were entered. If descriptive keywords were not provided, we assigned several descriptive words or phrases that characterized the work. Keywords were not printed in the following bibliography chapters.

Geographic Locations for Study Sites and Database used for GIS

Georeferencing each citation (the general study area or all the stations in a citation) was the most time consuming task of the project. As the bibliography was developed, we created a spreadsheet database (using Microsoft Excel, Office 97 version) that summarized the major information for each citation. Initially this database included the author or principal investigator, reference title, date, and general keywords (Table 2). To this was added a variety of information needed to manipulate the data (e.g., information about the type of data, reference to figures, sorting information, and location data). The main purpose of this database was to create a computer framework for entry of the location data and subsequent GIS applications. Since it was a working tool and was also quite large, it was not reproduced in this report.

Station or study area location data provided within citations varied in geographic resolution, from specific geographic coordinates to broad area coverages. Consequently, our first step was to determine a general location class for each citation, based on the available information. The location classes include: 1) Mappable, 2) Focused on the Manteo Lease Blocks, 3) Covering the Hatteras Middle Slope Area, 4) Broad Regional Study, and 5) Based on a Fisheries Survey Database.

For the citations assigned to location class 1, "Mappable", three different methods were used to develop the location information required for GIS analysis.

First, when explicit geographic coordinates (including depths) were presented for stations or study areas in a citation, these coordinates were entered into the Excel spreadsheet. These were the simplest data to process.

Second, some citations described a study area as a range of geographic locations (e.g., from 35° to 35.5° N and 74.8° to 75° W). Polygons for these study areas were constructed using ArcView GIS by assigning latitudes and longitudes to the four corners surrounding the locations. The study area was delineated by digitizing a polygon connecting the four corners.

Table 1. Metadata entered into ProCite for each citation.

ProCite template information

Author(s)
Editor ¹
Title of work
Date of meeting ¹
Publication date
Publisher ¹
Journal or Book Title
Volume ¹
Edition ¹
Extent of work (number of pages)
Note (Study site location, reference to a research cruise/s or another study)
Abstract
Keywords

¹ if applicable

Table 2. General keywords used to group citations into report chapters.
One or more of these was associated with each citation.

Fishery
Invertebrate
Marine birdbird
Marine mammal
Marine reptilereptile
Biological Oceanography
Chemical Oceanography
Geological Oceanography
Physical Oceanography
Sargassum
Socioeconomic

Third, some citations provided a hardcopy map of the study area, but not specific geographic coordinates. For these studies, a best approximation was created by digitally reproducing (drawing) the study area boundary on a detailed computer display of the bibliography base map. If only part of the citation's study area entered our target area, we digitized just this portion.

Location classes two through four include citations that are general in nature or provide verbal descriptions of the study area coverage, but no explicit geographic coordinates. Studies that are "Focused on the Manteo Lease Blocks" (class 2) present information directly related to the exploratory well site and surrounding lease blocks. Those in location class 3 are studies of the conditions specific to the Hatteras Middle Slope, but have a wider areal converge than those in class 2. Finally, citations that are broad in nature (e.g., related to the entire Atlantic Ocean) or present general discussions are included in location class 4 (Broad Regional Studies).

Some citations used information from large fisheries survey databases and were assigned to location class 5. The data were collected during one or a series of research cruises conducted by agencies (e.g., National Marine Fisheries Service) often as long-term surveys and often for purposes different than those of the citation. These studies did not report the original station numbers nor the exact station locations and at best only presented a large scale map of stations sampled (e.g., Berrien and Sibunka 1999). From these citations we could only determine that sampling did or did not occur within the study area. In order to relate some geospatial framework to these citations, the original digitized cruise data were obtained from the parent agencies (when possible) and put in dBase files separate from the file derived from the bibliography (described above). Since it was impossible to determine from such references which stations were used, the locations of all sample stations within the study area for all time periods from these agency databases were plotted using their geographic coordinates (converted by us to decimal degrees). For example, many citations used the National Marine Fisheries Survey, Northeast Fisheries Center Woods Hole Laboratory survey database. We documented this database as a separate citation entry and plotted all the stations from this survey (up to a certain cut off date) within the study area. All other references that used all or a portion of this database were then referred to the whole group of potential stations plotted. While this has inherent inaccuracies for individual citations, it was the only practical way to tie such references to geographic locations.

The Geographic Information System

The NC National Estuarine Research Reserve Geographic Information System (GIS) was used to facilitate screening of references and to generate maps of the georeferenced citations. We used the ArcView (version 3.1) GIS software. The initial step was to develop a digital base map of the area covered (see above) in this bibliography. Digital files were obtained for the shoreline, basic bathymetry (20 meter plus 250 meter depth contours), oil lease blocks, and the proposed exploratory well site related to the study area defined above (Figure 2).

Geographic coordinates as available for each citation were entered into the Excel spreadsheet and converted to latitude and longitude in decimal degrees. The Excel file was then converted to dBase format (required by ArcView) and imported into ArcView as a table. Because a variety of information was furnished for each citation record, the citations could be sorted and displayed within ArcView in many different ways. For example, sample stations for the different projects may be plotted using unique map symbols or colors for each investigator or author.

The GIS maps that resulted from the citations may have explicit point samples, general survey stations used by many citations, and polygons of various types. Many maps, especially those in the Fisheries section, could have multiple levels of complexity depending on how the data are sorted or displayed. Agency data, for example, could be plotted by cruise type, gear, individual project, individual cruise, and many other characteristics (e.g., Figures 5 and 6). Maps that depict the study areas and sites for the relevant citations are provided at the end of each bibliography chapter. The map keys include the symbols for the mapped studies, as well as a listing of the unmappable citations by general location class (i.e., "Focused on the Manteo Lease Blocks").