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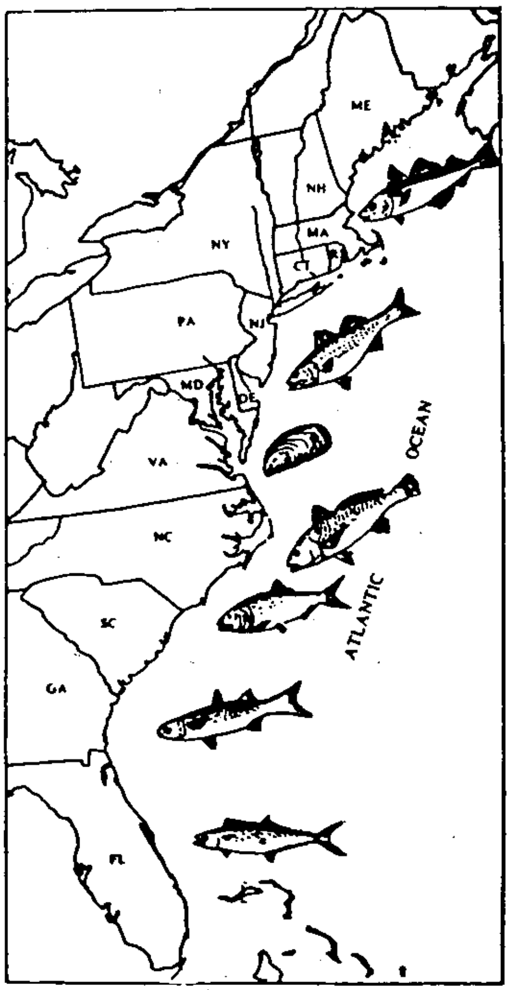

AN EVALUATION OF METHODS FOR MAPPING HARD BOTTOMS IN THE SOUTH ATLANTIC BIGHT

EXECUTIVE SUMMARY

SEAMAP

March 1987

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EXECUTIVE SUMMARY

by

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Completion Report for Project SM-11, Activity II of
North Carolina/National Marine Fisheries Service Cooperative
Southeast Area Monitoring and Assessment Program (SEAMAP)

March 1987

This project was conducted under contract to the
North Carolina Department of Natural Resources
and Community Development, Division of Marine Fisheries

INTRODUCTION

The Southeast Area Monitoring and Assessment Program-South Atlantic (SEAMAP-SA) provides a unifying framework for management and research agencies operating in the marine waters of the South Atlantic Bight (SAB). This program potentially inherits a huge volume of historical data from throughout the area which could yield a wealth of knowledge about animal and habitat distributions and abundances. SEAMAP initiated this project to evaluate data on the area's hard bottom resources, to determine who would be interested in these data, and to develop guidelines for data handling that will be compatible with future sampling.

To ecologists, who are routinely concerned with animal or plant relationships to abiotic factors, type of habitat is an important ecological characteristic. For biota like primary reef fishes that are tied to certain habitats, the amount of habitat is also very important and often can be equated with the biomass or numbers of the biota. Data on the placement, size, and type of reef (hard bottom) habitat can indirectly provide information about the inhabiting biota because data exist on species composition, distribution, and abundance for numerous types of reefs. In fact, if given the depth, season, latitude, and profile of a SAB or northern Gulf of Mexico hard bottom, a list of associated algae, invertebrates, and fishes, including relative abundances, could be provided.

South Atlantic Bight hard bottoms are an important offshore habitat, perhaps even the most productive offshore habitat. To manage, utilize, or study biological resources it is necessary to accurately describe and estimate areas of the benthic habitats of the SAB. Such information would be useful in developing habitat specific fishery management plans, determining fishery yields for habitat specific organisms, predicting impacts from energy or mining explorations, and planning future research. The ultimate product is a long-term goal. This project represents a first attempt to address problems related to quantifying a major continental shelf habitat (hard bottom) in a section of the SAB. Our evaluation of methods and problems may be widely applicable; but because our data were from a restricted area off North Carolina, attempts to use our analyses outside the test area, or especially outside North Carolina, may yield variable and inaccurate results.

The objectives of this project were 1) to conduct a survey of SAB agencies having management responsibilities in the area to determine their involvement with hard bottom habitats, the type and detail of data they need, and how they view management of such data, and 2) to evaluate representative data sources from a test area in Onslow Bay, NC for their adequacy to meet the needs identified by the survey and their ability to delineate hard bottom resources.

RESULTS AND DISCUSSION

User Survey

Survey respondents concluded that future habitat mapping efforts should include the whole South Atlantic Bight (Cape Hatteras to Cape Canaveral) from shore through the 200 mile (322 km) Exclusive Economic Zone, which extends considerably offshore of the continental shelf into water thousands of meters deep. This report recommends that the highest management and research priorities related to hard bottoms be concentrated shallower than 250-300 m on natural hard bottom features.

Survey respondents preferred methods of reef habitat data collection that were direct and/or non-destructive. These techniques, which include geophysical profiling (indirect, but non-destructive) and visual observation using SCUBA or submersible, were suggested for future reef habitat surveys and were given first priority in evaluations of historical data. Most management agencies expressed concern about the potentially destructive nature of some sampling methods such as bottom trawls, and there was only moderate interest in reef surveys using traditional methods (trawl, dredge, hook and line). However, a huge historical survey data base in the SAB was acquired by such methods, and many similar surveys, including a developing one by SEAMAP-SA, are ongoing. Data from these surveys can be valuable in comparison with preferred methods.

Management agencies were most interested in the biological resources, particularly fishes, of reef areas and preferred to have a biological data base developed. Simple lists of species seemed to be the most desirable biological product with some emphasis in decreasing order of importance on commercially and recreationally important biota, fishes in general, dominant invertebrates (especially molluscs and crustaceans), macro-invertebrates in general, and flora. Although abundance data were ignored by most respondents, numbers of individuals by species should be included as a minimum in any biological collection and species group weights and/or size data are highly recommended.

Relevant physical descriptions of hard bottom habitats are necessary to fully interpret biological data. Location to the nearest minute of latitude and longitude, depth to the nearest meter, area to the nearest square nautical mile, profile (relief) to the nearest meter, and general lithology (clastic or carbonate rock) were desired physical parameters for a hard bottom data base. Collection dates and data sources (either organization, vessel or both) should be included along with other biologically relevant parameters such as temperature, water clarity, and nutrients. Information on current live bottom user groups and names of those holding hard bottom data were of little interest.

Survey responses indicated that a data base developed from historical or future reef related collections should be created, managed, and stored by one agency, namely SEAMAP-SA. The data retrieval flexibility desired by most users requires a standardized, computerized system. Data should be available as summaries by any stored variable such as location, date, or depth. Regardless of what and how data are eventually stored, there was a desire by management agencies either to have variously scaled charts of reef locations produced for them or to have data available with which they could produce their own charts. Narratives documenting both the original data sources in the hard bottom data base as well as the new SEAMAP data base should be produced and should accompany any data sets supplied to users. The data base should be updated annually.

Standardization of field collection of data was considered impractical. The SEAMAP Bottom Mapping Work Group recommended that data supplied by cooperators for storage and handling by SEAMAP be submitted in a standard format, regardless of how it was collected or coded. Standardization of data coding, formats, and computer systems is feasible and efforts should be concentrated here. Along these lines, survey results suggested a preference for IBM compatible systems.

In conclusion, the user survey determined that management and research agencies in the SAB are interested in the resources of offshore hard bottom habitats. They have expressed a need for a data base relevant to specific habitats, especially hard bottoms, that is compiled by, managed by, and available from one organization. Centralization, organization, and standardization of the immense volume of historical SAB offshore data, incorporating compatibility with future data, are large but feasible projects. Somewhat more difficult is the task of defining habitat composition from various data in a way meaningful to research and management.

Test Area Data Evaluation

We examined portions of nine data bases (Table 1) occurring in a section of Onslow Bay, NC (Figure 1). These data were easily acquired and incorporated into a single data system. The data were quite diverse, representing most of the methods used for marine biological and geophysical surveys in the South Atlantic Bight (Tables 1 and 2). Analyses were concentrated on geophysical and fish trawl data.

Geophysical methods, especially seismic profiling (3.5 kHz) and side-scan sonar, were very effective for determining presence or absence of hard bottoms. These methods coupled with direct observations (i.e. divers, submersibles, or underwater television) are preferred for rapidly collecting hard bottom location data.

Not all biologically oriented methods are adequate for determining bottom type, and at best such techniques are indirect. We developed two methods for evaluating fish trawl catches in relation to bottom composition. Discriminant functions were developed for classifying reef or non-reef catches using pre-classified trawl catches. In addition, the percent of non-reef species in a catch also appeared to adequately classify stations. If a catch had ≥ 50% non-reef fishes it was designated non-reef,

Table 1. Test area data sources including basic descriptions of the types of data that were received and evaluated for the SEAMAP-SA project. NMFS refers to National Marine Fisheries Service, BLM to Bureau of Land Management, MARMAP to Marine Area Monitoring and Assessment Program, and DMF to Division of Marine Fisheries. Only the number of stations in the test area are given. Notebook means that data were in original field sheets or other non-computerized form.

Source	Gear Type[1]	No. Stations	Original Storage	Primary Target	2° Biological Data	Previous Reef Definition Analysis
S.W. Ross	2	10	Notebook	Fish	Rare	Yes
R.B. Searles (C.W. Schneider)	4	93	Notebook	Algae	No	Yes (Schneider 1975)
S.R. Riggs (D.L. Mearns)	4,7,8,9,10	2270 km seismic + other	Graphic	Geology		Yes (Mearns 1986)
NMFS-Beaufort (R.O. Parker)	3	4	Notebook	Fish	Rare	Partial (Parker & Ross 1986)
BLM-Duke Univ.	1,2,4,5,6	45	Computer	All biota		Partial (Duke Univ. Marine Lab 1982)
NMFS-Woods Hole	1	182	Computer	Fish	Yes[2]	No
NMFS-Pascagoula	1	168	Computer	Fish	Yes[2]	Partial (Miller & Richards 1980)
SC-MARMAP	1,5,6	68	Computer	Fish	Yes[2]	No
NC-DMF	1,4,6	100	Notebook	Fish Shrimp	Yes[2]	Yes (S.W. Ross)

[1] Gears: 1=trawl; 2=SCUBA, visual or hand collection; 3=submersible, visual; 4=dredge or grab; 5=hook & line; 6=trap; 7=side-scan sonar; 8=vibracore; 9=3.5 kHz profiles; 10=Uniboom & Sparker

[2] Mostly inconsistent lists of commercially important invertebrates.

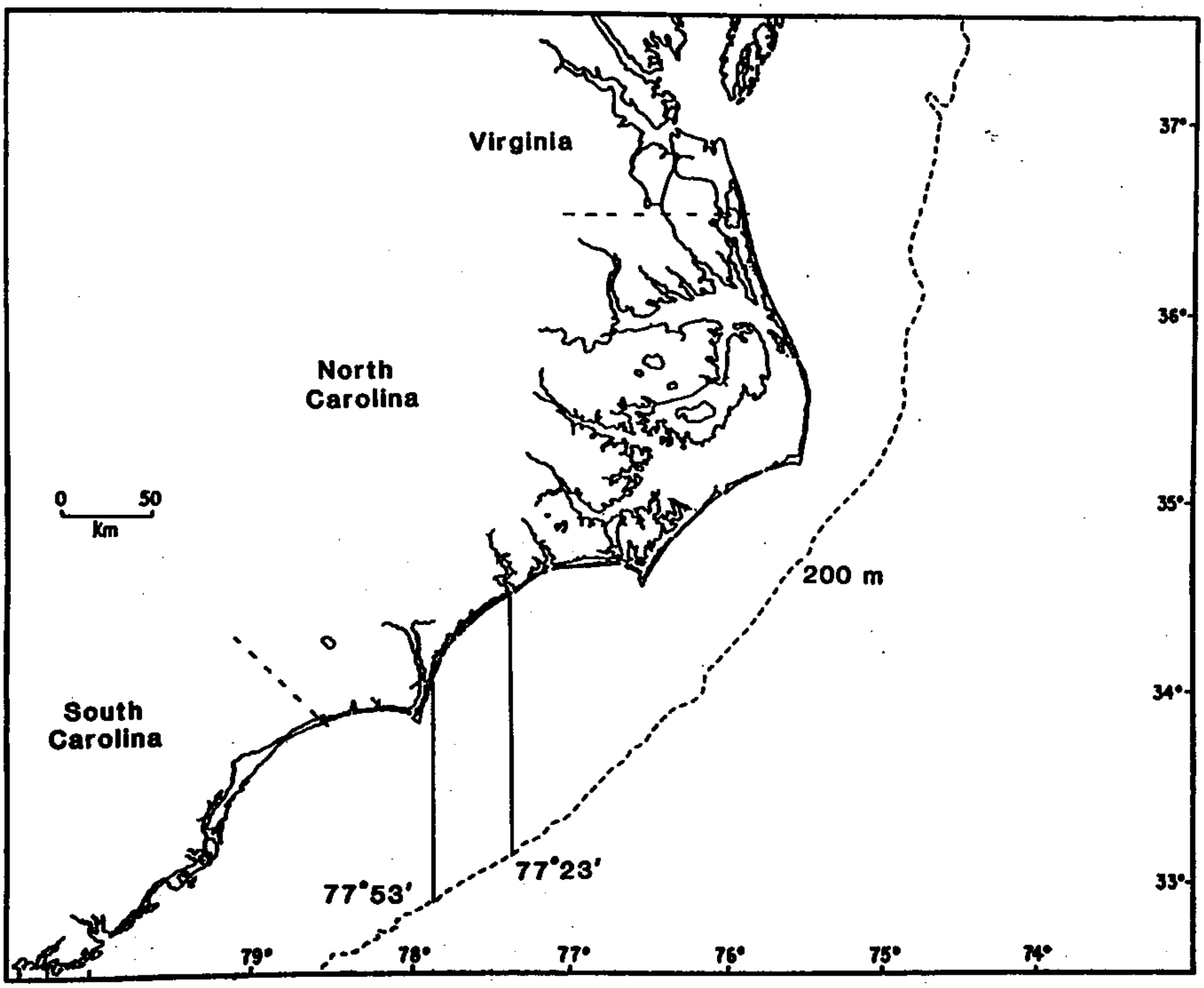

Figure 1. SEAMAP hard bottom project test area in Onslow Bay, NC.

Table 2. The quality and degree to which the test area data sources as originally received addressed the major parameters of interest as identified from the survey. Interest level was derived from the survey and our evaluation of the data. For location L-A or C=LORAN A or C; most latitude (Lat) and longitude (Long) data were derived from LORAN navigation.

Source	Location	Area	Depth[1]	Relief	Geology	Biology[2]	Major Method[3]	Interest
S.W. Ross	L-A,C		ft	yes		1,3	A	high
R.B. Searles	Lat,Long		ft			1,3	B	low
S.R. Riggs	L-C	yes	m	yes	yes		N	high
NMFS-Beaufort	L-C		ft	partial		3	A	high
BLM-Duke Univ.	Lat,Long		m			3,2	B	moderate
NMFS-Woods Hole	Lat,Long		m			3	B	low
NMFS-Pascagoula	Lat,Long		fm			3	B	low
SC-MARMAP	Lat,Long		m			3	B	low
NC-DMF	Lat,Long L-A,C		fm			3	B	low

[1] ft=feet, fm=fathoms, m=meters.

[2] Biological data: 1=partial species, qualitative; 2=inclusive species, quantitative; 3=partial species, quantitative.

[3] Method quality: A=direct observation or collection, non-destructive; B=indirect collection, destructive; N=indirect, non-destructive.

otherwise it was considered a reef catch. We imposed a further condition that at least 5 fish species must be caught for a catch to be classified as reef. An extensive list of reef fishes (R-M-R list) in the area was made for the above analyses as was a shorter list of the most common indicator species. Indicator lists were provided for invertebrates and algae, but invertebrate analyses could not be accomplished because of a lack of data. For algae, we determined that the presence of at least five species (excluding pelagic species) indicated a reef area.

Figure 2 summarizes the extent of the geophysical and biological data that indicated the presence of hard bottoms in one square nautical mile quadrats in the test area. This is an example of the type of mapping product available from these analyses.

We conclude that habitat definitions and related data can be obtained economically and with reasonable accuracy. Geophysical profiling coupled with direct observation, analyses of fish catches from trawls and algae analyses are useful techniques for determining bottom composition, and they are the methods best represented in the historical data bases. Although refinements of our methods for analyzing fish trawl data are desirable, we consider them adequate for preliminary estimations of bottom type. Habitat definition analyses using other biological data may be less useful and will require additional treatment to develop habitat relevant criteria, especially for invertebrates. Onslow Bay may exhibit different geological and biological characteristics than the rest of the SAB, and this must be considered before applying our analyses to the whole area. Our treatment of SAB data and analysis techniques represent an initial approach from which may evolve a SEAMAP habitat related data system.

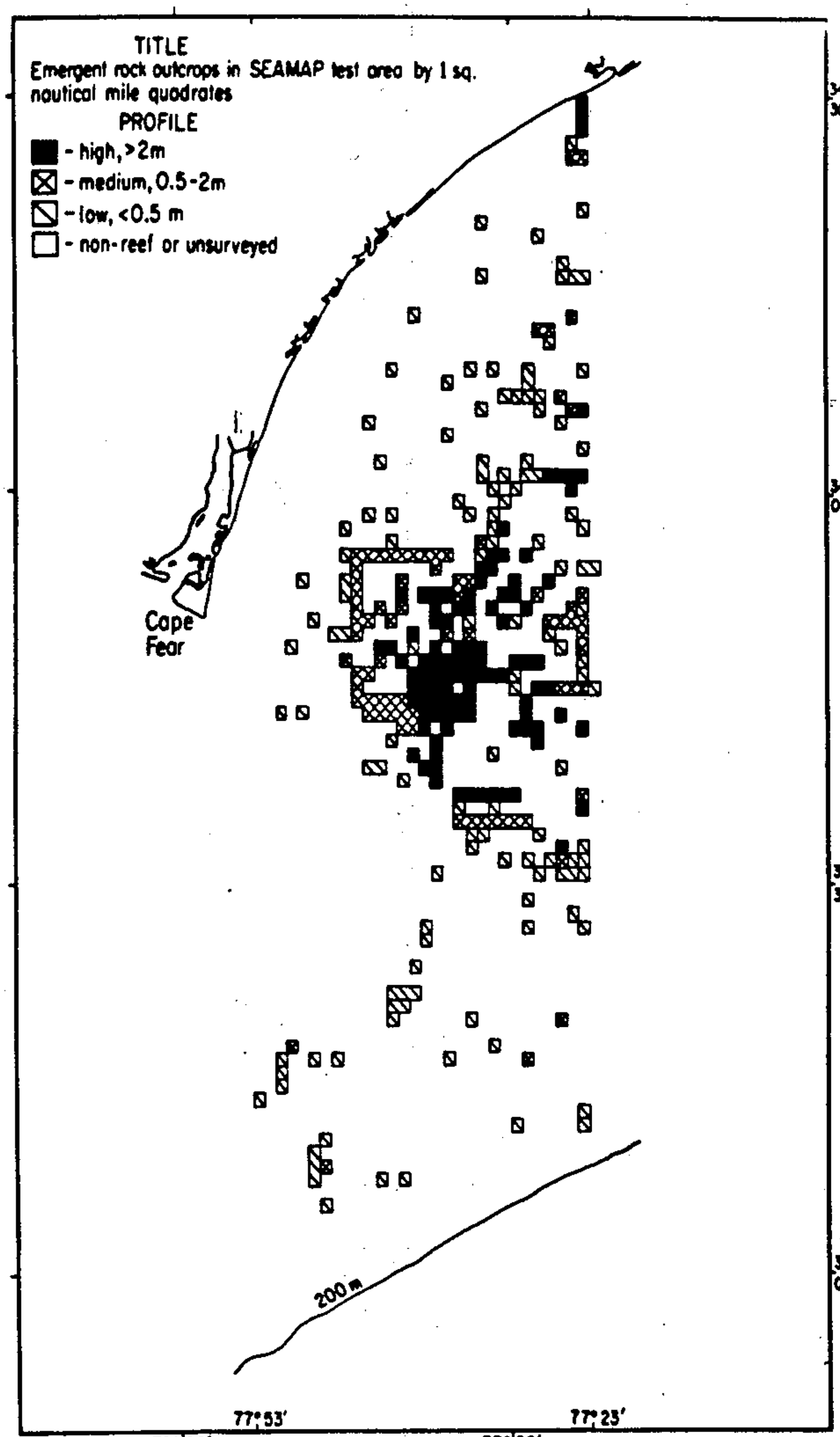

Figure 2. Emergent hard bottom outcrops in the North Carolina SEAMAP test area by 1 sq n mi quadrats based on data from SCUBA, submersible, trawl, and seismic profiles.

RECOMMENDATIONS

I. Adopt National Oceanographic Data Center species codes (NODC 1984) for all SEAMAP use and encourage other agencies in the area to do likewise. Establish SEAMAP criteria for standardization of other variables (depth, dates, etc.).

II. Appoint a SEAMAP technical subcommittee having area wide familiarity with trawl and other gear catches from hard and soft bottoms to develop a hard and a soft bottom set of stations valid for a larger area and greater depth, method, and season ranges than possible in the test case. Then more accurate discriminant functions can be developed for application to data from the whole area.

III. When a SEAMAP data system is operational it should attempt to incorporate all major SAB historical data, including data from all MARMAP, MMS, and NMFS programs, into a single consistent system which should be updated annually. Non-computerized data should not be accepted.

IV. If SEAMAP's objective is to initiate a new field oriented program to identify and quantify bottom habitat, we recommend using direct observations and high resolution geophysical techniques like side-scan sonar and 3.5 kHz subbottom profiling.

V. Historical data exist which, if analyzed for habitat composition, could help guide future management and research efforts. We recommend evaluating all the major data bases of the SAB as done here for a test area and storing and mapping the results as hard or soft bottom. Geophysical data are being collected by several researchers in the SAB and these data should be given high priority for bottom type evaluations. Since historical biological data seldom have been used to identify bottom type, these data should also receive high priority.

VI. Data from transects (e.g. trawls) should include, as a minimum, starting and ending locations to the nearest minute. Ideally, for transects longer than 30 min (time), location should be recorded every 15 min and at any change in course. In addition, a fathometer tracing should be recorded during the transect with the beginning, end, and other significant features marked on it. Each tracing should be stored with its corresponding station data sheet.

VII. Careful on-site examination of catches from indirect gears (trawls, dredges) should include notations of the amount and general type of non-biological material. Samples of rocks, sediments, and/or corals should be saved for expert evaluations if necessary. Damage to gear should be noted.

VIII. The importance of program narratives for providing details not apparent on digitized data was emphasized throughout this project. All agencies contributing data to SEAMAP should include detailed narratives of the field and computer components of the data. These should explain such specifics as computer codes for variables, limitations to biological data (e.g., when and if species lists are incomplete), measurement methods and precision for variables, indications where data conversions were made, and lists of publications based on the data. We suggest that SEAMAP also develop its own narratives relevant to the data it collects or stores to be supplied with any data requests.

IX. The area subcommittee suggested in Recommendation II should refine the R-M-R reef fish list, which would include adding other known reef species and resolving the habitat affinity of such fishes as *Stenotomus* spp.

X. Area wide algae and reef invertebrate lists should also be developed with pelagic invertebrates listed separately. Resolving invertebrate problems identified in this report may require a separate subcommittee of specialists.

XI. In future bottom classification efforts one square nautical mile blocks should be named. Blocks having multiple data sets and methods should be analyzed for consistency of habitat classification. Non-reef blocks should be included in analyses and mapping.

XII. Our final recommendation is that SEAMAP, perhaps through the Bottom Mapping Work Group, prioritize these and other recommendations in this report to make them compatible with constraints of budget and operational goals. A logical plan of execution can then be suggested.