

The Role of Research and Monitoring in Management of Living Marine Resources off the Southeast U.S. Coast

Marine Resources Research Institute
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by

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Introduction

The South Carolina Department of Natural Resources (SCDNR) develops and implements policies for the conservation, management, and wise utilization of the state's natural resources. Within the SCDNR, the Marine Resources Division (MRD) is responsible for management of living marine resources, and conducts research in the marine waters of the state and the region to support management decisions. Management policies are based on fishery statistics collected by the MRD and on fishery-independent monitoring and assessment conducted by the MRD's research arm, the Marine Resources Research Institute (MRRI). Because of increasing demand for seafood, and development of technology to harvest more efficiently, there is concern for overfishing of marine stocks, and continued monitoring and assessment are needed to determine the status of stocks.

Through the MRRI, the SCDNR has conducted annual assessments and monitoring of offshore fishery stocks since 1973. These monitoring and assessment programs have resulted from, and provided stimulus for, several state-federal partnerships between the SCDNR and agencies of the National Oceanic and Atmospheric Administration (NOAA), particularly the National Marine Fisheries Service (NMFS, or NOAA Fisheries). These programs have enhanced science-based policy and management decisions, by providing data to management sections within the SCDNR, and to regional and federal agencies such as the South Atlantic Fishery Management Council (SAFMC), the Atlantic States Marine Fisheries Commission (ASMFC), the NOAA National Marine Sanctuary Program, the NMFS Highly Migratory Species Division and the Minerals Management Service (MMS). Research reports are submitted to those agencies, and MRD personnel serve on Advisory Panels of the SAFMC and ASMFC.

SCDNR research projects have included large-scale fishery monitoring and assessment programs such as the Marine Resources Monitoring, Assessment and Prediction (MARMAP) program, a partnership with NMFS. NMFS and its predecessor agencies have conducted exploratory fishing and hydrographic surveys on the continental shelf of the southeastern U.S. since the mid-20th century. Early surveys from 1950 through the subsequent two decades concentrated on describing hydrographic conditions, sampling planktonic early life history stages of fishes, and exploratory fishing. Extensive trawl surveys for bottom fish, such as those begun in the mid-1960s off the middle Atlantic States and New England, were expanded into the waters south of Cape Hatteras through the MARMAP program conducted by the MRRI. The MARMAP program in the southeast began as a trawl and plankton survey similar to those conducted in the northeast. Based on analysis of early results, MRRI determined that such survey methods were not useful for assessing reef fishes off the southeast coast, and the program was modified to assess the particular fishery species of southeastern waters. The results have

been of great benefit to South Carolina, the region and NMFS, and have resulted in a continuation of the MARMAP partnership, with expansion into other state-federal cooperative programs such as NMFS-MARFIN (Marine Fisheries Initiative). MARMAP results include description of fish assemblages and oceanography from over 800 trawl, 9000 fish trap and 1200 plankton and hydrography stations (see figures in Appendix). Fish community descriptions have been published, and seasonal circulation and hydrography in the South Atlantic Bight has also been described. Oceanographic features mapped during early cruises highlighted the importance of bottom topography in influencing oceanography, and led to more recently-funded cooperative programs with NOAA to study deep slope reefs (e.g. Islands in the Stream Expeditions) and the Charleston Bump.

Results and Relevance of State-Federal Partnerships

Early MARMAP sampling efforts indicated that the greatest biomass and diversity of fishes in the region were found in areas of rocky outcrops on the middle and outer continental shelf, which support populations of economically valuable species such as snapper and grouper. Fisheries for those species were expanding rapidly off the Carolinas and Georgia in the early 1970's. Today, many of these species are considered overfished, and have been monitored in the annual MARMAP reef fish survey since the 1970s. The program has conducted life history studies on reef fishes such as black sea bass, gag, scamp, snowy grouper, wreckfish, blackbelly rosefish, vermilion snapper, red snapper, tilefish, blueline tilefish, red porgy, knobbed porgy, white grunt, gray triggerfish, greater amberjack, king mackerel and Spanish mackerel. Monitoring of life history of these species over time has indicated general declines in fish abundance and signs of overfishing such as smaller size, skewed sex ratios, and decreasing size and age at maturity. Data from 2000-2001 show that population parameters for some species may be reversing this trend, and that strict management regulations that have had to be imposed could be having positive effects (see Appendix figures). Additional future monitoring is important for confirming these early recovery trends.

The MARMAP program has addressed some specific management problems, such as survival rates of reef fishes released as a result of minimum size regulations and bag limits. MARMAP tagging studies have documented movements of gag, greater amberjack, vermilion snapper, gray triggerfish, white grunt, red porgy, and black sea bass. Because of the long-term nature of the program, we have data from tagged fish that have been at large for several years, which has allowed us to validate growth rates. MARMAP scientists have provided the SAFMC and ASMFC with data on the age, growth and reproductive biology of reef species, and have documented the development and status of the fisheries in over 140 journal publications. Continued monitoring of growth rates and reproductive biology is needed to determine the effects of fishing and fishery management plans, in order to allow sustained productivity and to prevent overfishing.

The cooperative state-federal MARMAP program has developed a long-term database for reef fish that has proven valuable in interpreting fisheries landings data and developing regulations for protecting reef fish resources. Minimum sizes and bag limits imposed on most economically important species makes it difficult to monitor life history parameters and abundance data from port samples collected from the fishery. MARMAP has the only existing program that monitors reef fish length frequency, abundance, and life history parameters based on fishery-independent data. These data will become increasingly important as restrictions increase on commercial and recreational effort.

In addition to monitoring abundance and life history of reef fishes of the continental shelf and upper slope, the MRD monitors near-shore shrimps, crabs and fishes through another cooperative program with NMFS, the Southeast Area Monitoring and Assessment Program-South Atlantic (SEAMAP-SA). Since 1990, this program has conducted an annual trawl survey of shallow coastal waters from Cape Hatteras to Cape Canaveral, and submits data and reports to NMFS, the ASMFC, and other states in the region. The program has provided annual assessments of distribution and abundance of coastal shrimps, sciaenids (drums, croakers, spot), mackerels, and other species, and has provided materials to support life history and population genetic studies supported by the NMFS MARFIN and Fishtec programs. In addition, the SEAMAP-SA program has used long-term monitoring data from MARMAP to map reef habitats throughout the region.

Long term monitoring of life history attributes of fishes conducted by the SCDNR MARMAP and SEAMAP programs continues to be used for management purposes. Attributes such as size at age and changes in these parameters in response to fishing pressure are used by the SAFMC and ASMFC for setting biological benchmarks through YPR, SPR, and VPA analyses. It is necessary to annually monitor life history parameters and use updated values to determine status and population trends that result from fishing and from fishery management.

Fisheries off the southeastern U.S. have expanded enormously since implementation of the Magnuson Fishery Conservation and Management Act. Reef fishes such as those of the warm-temperate hard-bottom reefs off the southeastern U.S. appear to be particularly at risk as fisheries expand, and many species are severely overfished or in danger of being so. Goliath grouper and Nassau grouper have been so heavily overfished in the southeastern U.S. that they are candidates for the Endangered Species List. Warsaw grouper and speckled hind, formerly common groupers of the region, may soon follow. The fishery for red porgy in the U.S. Atlantic was closed in 1999 because of extremely low spawning potential. The economic value of this reef species complex makes protecting the sustainability of the fishery a critical consideration for this region.

In addition to reduced populations of top-level predators, community structure changes have been observed in reef fish communities, as predator-prey relationships are disrupted by overfishing. There is evidence from MARMAP monitoring surveys that this is occurring in the southeast, as relative abundance of fishery species declines while less economically-desired species increase in abundance (see Appendix figures). Because fishery and non-fishery species may feed very differently, such fishing-induced changes probably affect benthic prey communities. It is imperative the fish populations and associated benthic and pelagic communities be monitored to assess the effects of fishing and fishery management.

For those reef fish stocks on which we have data, most have been declared overfished. Through re-authorizations of Magnuson-Stevens Fishery Conservation and Management Act, the SAFMC has attempted to reverse and prevent additional overfishing of reef fish stocks in the southeast. It has become clear that the single-species approach does not work for some species, and the SAFMC is now considering Marine Protected Areas (MPAs). Long-term fishery monitoring databases such as MARMAP and SEAMAP-SA have been used by the SAFMC to support decisions, including siting of potential MPAs. MARMAP data have been examined to locate areas of reef habitat, concentrations of high biomass, abundance and diversity, or areas where fishery species spawn (see Appendix figures). Such areas are prime candidates for MPA consideration, and the long-term MARMAP database has been used to evaluate proposed MPA locations in relation to abundance of important life history stages of fishes. MPAs are

considered to be a drastic measure, and data must be provided to justify their need. In addition, monitoring to determine their effectiveness will continue to be needed as further consideration is given to their implementation throughout the region.

Although the programs like MARMAP have done an excellent job in assessments of individual fishery species, community studies have been limited as the programs became focused on specific fisheries. Additional effort should be expended on description and monitoring of fish assemblages from fished and unfished habitats. The MARMAP program has an extensive multi-year groundfish survey database from fished and unfished habitats that can be used to determine the effects of decadal climate changes on marine ecosystems. The MARMAP program preceded the rapid expansion in the reef fish fishery, and it has sampled habitats that are not fished. Comparing these baselines with future surveys will be useful in study of the effects of fishing and climate change on marine species assemblages. In addition to providing assessments of valuable or large-volume fishery species, assessment of biodiversity and fish assemblages need to be performed. It is often difficult to obtain funding to study those species that are a significant part of the ecosystem, but which are not fished, but studies of these species are needed. Additional study of predator-prey relationships, by-catch in fisheries, and life history of forage and ecologically dominant species is needed.

Summary and Conclusions

The SCDNR urges the Commission to recommend continued state-federal partnerships such as those described above, as a mechanism for meeting the objectives of the Commission and of the Oceans Act of 2000, in a cost-effective manner that involves local and regional scientific expertise of state and federal partners. Particularly relevant objectives include “responsible stewardship, including use, of fishery resources and other ocean and coastal resources.” Through efforts such as the SCDNR-NMFS MARMAP and SEAMAP-SA programs, long-term monitoring and annual assessments are documenting changes in fish populations that have resulted from fishing and management (see Appendix figures). The Oceans Act also addresses concerns for user conflicts and climate change. Databases on distribution of fishes and habitats, such as those collected through partnership programs like MARMAP and SEAMAP-SA, provide information needed for management to avoid conflict between fishing groups and other users of the marine environment. Historical data available from programs like MARMAP provide a baseline for evaluation and monitoring of climate and environmental change in a diverse fish community, including assemblages from habitats not subject to exploitation.

The Commission should also recommend continued development and improvement of technologies for use in ocean and coastal research and monitoring activities. SCDNR programs have been at the forefront of using expanding marine technologies such as hydroacoustics, submersibles, ROV and molecular biology to assess stocks of marine fishery species. These new technologies vastly increase the speed, quality and efficiency of data collection.

The Commission should recommend close cooperation among all government agencies to ensure consistent management, appropriate funding and facilities support, cost-effective operations and enhancement of state-federal partnerships. The SCDNR MARMAP program is an outstanding example of state-federal cooperation that provides data to state and federal management agencies that have resulted in fishery management plans, and monitoring of the results of those plans. Federal funding of the MARMAP and SEAMAP-SA programs are contingent upon annual reviews that assure that the programs meet state, regional and federal

research needs. The goals of these partnerships are consistent across government levels. Federal funding to SCDNR supports state and private facilities and persons, including the fishing community. State-federal partnerships such as MARMAP, SEAMAP-SA, Fishtec, and MARFIN are cost-effective partnerships of federal, state and local governments in science-based management and policymaking, and can serve as templates for national programs.

State-federal partnerships like MARMAP and SEAMAP have served the scientific and natural resource management agencies of the southeast very well for nearly 30 years. The SCDNR MARMAP program should be used as a model for other regions. These and other partnership programs (e.g. MARFIN) have a proven track record for providing science needed to make management policy and decisions. Funding and support should continue to be provided to states to conduct these studies. States recognize the need for research to address local management issues, but cannot afford offshore research programs on fisheries that are regional in scope. Local university and natural resource agencies are in the best position to determine assessment needs, and have facilities that make sampling logistics simpler. State institutions can conduct these assessments in the most cost-effective manner, and are better suited to involve local user groups, researchers and interested parties, thus resulting in more “community-based” research, planning and management and less of a “top-down” imposition of management from federal institutions far removed from the systems being managed. Funding of local entities to conduct research, monitoring and assessments allows for shared responsibility in developing management plans. This is particularly important in light of many of the very restrictive plans that are being considered by fishery management councils.

In addition to national state-federal monitoring programs, there is a need for exploration of unique regional habitats such as spawning banks and shelf-edge upwellings. Additional work is needed on evaluating biodiversity and documenting non-fishery species’ distributions in the region. Current survey efforts should be expanded to include assemblages that may not be directly exploited, but which are important components of systems that support exploited species. Such evaluations are particularly needed at this time, in light of evidence of climate change, introduction of exotic species, increased coastal development and demand for natural resources, and the implementation of highly restrictive management measures. Additional mapping of habitats is critically needed, especially habitats beyond the edge of the continental shelf. The coupling of pelagic primary productivity and production of bottom fishes is poorly understood in the region, and additional study is needed for design of effective MPAs that conserve and restore fish stocks with minimal impact on user groups. Additional oceanographic work and study of reproductive biology is needed to determine sources and fates of larvae from spawning aggregations of fishery species. Instrument arrays should be deployed to monitor upwellings other phenomena that might be important in fishery recruitment. For example, a DEOS (Deep Earth Observatories on the Seafloor) array could be established off the southeastern coast to more fully understand Gulf Stream dynamics in the vicinity of the Charleston Bump, an important fishing ground. Such arrays would help in developing models that can predict recruitment success in spawning marine fishes. Data and analyses should be made available on the web to scientists and to education networks such as those envisioned through the NSF-COSEE program. These recommendations should be incorporated into a national effort.

Appendix Figures



