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state-federal cooperative program for red drum research in the gulf of mexico

a three-year plan

GULF STATES
MARINE FISHERIES COMMISSION
1986

STATE-FEDERAL COOPERATIVE PROGRAM FOR RED DRUM RESEARCH IN THE GULF OF MEXICO

A THREE-YEAR PLAN

JUNE 1986

ALABAMA DEPARTMENT OF CONSERVATION AND NATURAL RESOURCES
FLORIDA DEPARTMENT OF NATURAL RESOURCES
GULF STATES MARINE FISHERIES COMMISSION
LOUISIANA DEPARTMENT OF WILDLIFE AND FISHERIES
MISSISSIPPI DEPARTMENT OF WILDLIFE CONSERVATION
NATIONAL MARINE FISHERIES SERVICE
TEXAS PARKS AND WILDLIFE DEPARTMENT

PREPARED BY
THE GULF STATES MARINE FISHERIES COMMISSION
OCEAN SPRINGS, MISSISSIPPI

OMISSION

The preparers wish to express regret for omitting Mr. Ronald E. Becker, Louisiana Sea Grant Program, from the list of contributors to the development of red drum research needs for this plan.

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This cooperative State-Federal research program was prepared under the direction of the Red Drum Work Group, Southeast Area Monitoring and Assessment Program (SEAMAP) of the Gulf States Marine Fisheries Commission.

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MARFIN PROJECT SUMMARY

A. Project Title: State-Federal Cooperative Research Program for Red Drum in the Gulf of Mexico

B. Project Status: New

C. Project Duration: July 1, 1986 to August 31, 1989 (three years)

D. Applicants (listed alphabetically):

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F. Project Objective: To provide scientific information necessary for sound management of red drum resources in the Gulf of Mexico.

G. Summary of Work to be Performed:

This is a cooperative, coordinated State-Federal program to develop information critically needed to manage red drum resources in the Gulf. Developed by the Red Drum Work Group of the Gulf States Marine Fisheries Commission's SEAMAP Program, the plan incorporates a wide range of surveys and studies in both coastal and FCZ waters across the entire Gulf. The three-year plan addresses four major research areas: (1) stock assessment, including catch/effort data; (2) stock identification; (3) age and growth validation; and (4) fishery-independent stock assessment. Program planning, review and communication of results will be through the SEAMAP Program.

Major features of the cooperative program are: (1) integrated State-Federal direction and coordination; (2) cost-effectiveness through a wide pool of existing facilities, personnel and information systems; and (3) immediate implementation of research.

H. Total MARFIN funds requested:

FY1986	$ 520,000	(Percent of total = 65.0 %)
Total (three years)	$1,254,600	(Percent of total = 65.4 %)

I. Project Costs to be Provided from Non-MARFIN Sources:

FY1986	$ 280,594	(Percent of total = 35.0 %)
Total (three years)	$ 663,581	(Percent of total = 34.6 %)

J. Total Project Costs:

FY1986	$ 800,594
Total (three years)	$1,918,181

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Cooperative State-Federal Research Plan for
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A. IDENTIFICATION OF PROBLEMS

1. BACKGROUND

There is little available information on the relative abundance and present condition of adult red drum (Sciaenops ocellatus) in the Gulf of Mexico. The species is currently being subjected to increasing fishing pressure from both commercial and recreational sectors throughout much of its range in the Gulf and South Atlantic regions of the United States. Levels of harvest fluctuate widely because of its designation in some states as a gamefish and present regulations in many states on allowable size and gear. Red drum is an increasingly targeted component of the catch of anglers in every Gulf state, and has become the focus of efforts for restricted allocation. Until recently, both the commercial and recreational fisheries were largely concentrated in estuarine areas, resulting in direct competition for the same resource. As the number of participants in the fishery increased, this competition has sparked a direct political confrontation between recreational and commercial fishermen over allocation of the common resource. In Texas and Alabama, this confrontation resulted in the prohibition of sale of red drum caught from state waters. In other states, other restrictions were placed on commercial fishing activities, especially the northern Gulf commercial purse seine fishery for red drum which began in 1977 (Swingle et al. 1984).

Analysis of data available for stock assessment indicates that growth overfishing of red drum, which occurs when fish enter the fishery at a size smaller than that supporting the maximum yield, has occurred in the estuarine fisheries of west central Florida, Texas and Louisiana because of the intense fishing effort (Swingle et al. 1984; Condrey 1986), although other data from tagging studies do not support this conclusion. The analyses also suggest that yield per recruit (YPR) and total yield of juveniles in the estuaries of west central Florida and Texas could be increased by decreasing fishing mortality or increasing the size at entry into the fishery through minimum size limits.

For the Gulf as a whole, it was concluded by Swingle et al. (1984 Fishery Profile of Red Drum) that virgin adult stock(s) could be rapidly reduced by increased fishing mortality on adults, based on assumed estimates of natural mortality implied from maximum age. A reduced level of abundance of offshore spawners would decimate the standing stock of adults. This is true of all populations with a fishing mortality (F) less than the F required to take the maximum sustainable yield (MSY). Recruitment overfishing, which

occurs when the spawning stock is reduced to a level too low to assure adequate production of young fish, was seen as a real possibility in this fishery.

There is a common consensus among managers, fishermen and scientists that, in view of the continuously expanding efforts by both commercial and recreational sectors, an urgent need exists to manage both the nearshore and offshore segments of the fishery if conservation and maintenance of the resource are to be effected. Sound management will require, in turn, reliable, current and timely scientific information on the fishery and the species itself, specifically a significant improvement in harvest information.

The current knowledge of red drum life history, fishery and management has been summarized by a series of profiles and papers (Williams et al. 1980; Perret et al. 1980; Overstreet 1983; Swingle et al. 1984; Mercer 1984). Matlock (1980) documented the history of the fisheries for this species, noting that most of the information prior to 1980 was from the Atlantic coast, especially old surveys and a very few recent, small studies. At present, however, the red drum fishery is concentrated in the Gulf of Mexico for both recreational and commercial harvests (Matlock 1980; Mercer 1984). Mercer (1984) reported that the recreational catch of red drum exceeds that of the commercial catch along both the Atlantic and Gulf coasts; recent commercial Gulf harvests have likely reversed that trend.

Stimulating the extreme interest in the resource by organized recreational groups is the unprecedented usage of red drum (or redfish, as it is known to the consumer and angler) as a staple in the current Cajun cuisine craze. Demand by processors, restaurants and supermarket consumers remains intense in response to interest in "blackened redfish" and other Cajun dishes. Following this very recent phenomenon, several events in Spring 1986 indicated a need for this proposed cooperative research plan for red drum:

a. The action by the Gulf States Marine Fisheries Commission (GSMFC) in March 1986 to immediately begin development of a GSMFC-sponsored Red Drum Fishery Management Plan (FMP) for both offshore and nearshore red drum resources in the Gulf.

b. Introduction of a bill (H.R. 4690) by Rep. John Breaux (LA) into the U.S. House of Representatives, mandating a moratorium on all fishing for red drum in the Gulf of Mexico FCZ until the Secretary of Commerce promulgates emergency regulations, and calling for research on stock assessment and identification, and other critically needed biological information required to properly manage the resource.

c. Introduction into the state legislatures of Louisiana, Mississippi and Alabama of regulations and/or enactments pertaining to restrictions on allowable size and gear, bag and catch limits, and other emergency management measures intended to protect the resource pending a red drum FMP.

d. Announcement by the National Marine Fisheries Service (NMFS), Southeast Regional Office (SERO) on June 1, 1986, of a 90- to 100-day commercial fishery allocation for red drum in the FCZ, to be based on historical catch data and implemented on July 1, 1986; as well, to develop a NMFS-prepared FMP for the resource, to be implemented in December 1986.

Subsequent to the GSMFC's decision to develop a FMP for red drum, including identification of information needs required for its preparation, Gulf State and Federal fishery management agencies realized that the most critical information needs had already been broadly defined, and research to address them should be implemented immediately if the resource was to be conserved. An information meeting of Gulf fishery management leaders was convened in mid-May 1986 to address the most appropriate and expeditious mechanism for securing funding and developing a research plan. This ad hoc discussion resulted in the decision to utilize an existing cooperative State-Federal program of the GSMFC SEAMAP (Southeast Area Monitoring and Assessment Program), to coordinate planning efforts.

SEAMAP is composed of fishery managers from all five Gulf states, the NMFS-Southeast Fisheries Center (SEFC), GSMFC, and Gulf of Mexico Fishery Management Council, with links to universities, the industry and management organizations throughout the southeast. One of its six advisory forces, the Red Drum Work Group, is composed of the leading university and management specialists on red drum. Under the group's guidance and in cooperation with Louisiana State University (LSU) and other institutions, SEAMAP has conducted an extensive study to determine whether genetic differences occur among young red drum from estuaries throughout the species' range. Preliminary results of biochemical studies utilizing electrophoresis of red drum tissues at Louisiana Technical University and Rice University suggest a nearshore genetic homogeneity of these fish in the Gulf; that is, no detectable genetic differences exist among estuarine systems (Ramsey 1986). However, since genetic homogeneity may be maintained by extremely low exchange rates between red drum populations, mixing rates need to be determined; extensive tagging studies are needed to further address the stock identification question.

Additionally, studies of red drum tissues from eight estuarine sites in the U.S. Gulf and three on the Southeast Atlantic were conducted at LSU, using high pressure liquid chromatography (HPLC). Preliminary results suggest anomalous differences among states in the Atlantic and Gulf, with similarities between Texas and Alabama (Bane and Nieland, 1986). The HPLC technique needs still further refinement and testing before becoming a useful stock identification tool, but the Red Drum Work Group concurred that examination of offshore specimens by both HPLC and electrophoresis is warranted, as well as implementation of a third technique, mitochondrial DNA (mt DNA) on both nearshore and offshore red drum.

The Red Drum Work Group was convened at the concurrence of all Gulf States and NMFS in late May 1986, and charged by SEAMAP to develop a cooperative, coordinated research plan specifying objectives, tasks, and sampling designs needed to provide the necessary information. This document is the result of that meeting, submitted for funding consideration to the Marine Fisheries Initiative (MARFIN) Program. Implementation of research tasks will begin immediately following awards to the individual organizations.

2. EXISTING INFORMATION

a. Biological Assessments

Where and how red drum are harvested is determined by the overall life history and population dynamics of the species. At present, there are numerous gaps critical to understanding the life cycle of the species (Swingle et al. 1984). Much of the information on red drum was gathered from nearshore estuarine studies that concentrated on the pre-reproductive (0-4 years) stage of the life cycle. Most studies (summarized in Swingle et al. 1984 and Mercer 1984) have documented quiet muddy backwaters in west central Florida and grass areas as nursery grounds of young red drum. These juveniles generally remain in estuaries until maturity, but details of emigration patterns have not been documented.

Red drum move from the estuaries into the Gulf of Mexico as they near maturity, presumably to spawn. Spawning locations are generally not well documented, although areas in west central Florida are well known. The age and size of red drum at maturity are also not well known, but it is generally accepted that mature females are 4 or 5 years old and at sizes usually longer than 700 mm (Mercer 1984). Mature adults spend little time in estuaries, with only a small portion of the population occasionally returning to the estuary (Pearson 1929; Simmons and Hoese 1959).

Very little is known about the early life stages of red drum from natural populations (Swingle et al. 1984). For most larval fishes, these early life stages are the most critical to survival in that they experience the highest total percentage of mortality. It is suggested that the size of the spawning population and the degree of spawning success, coupled with growth and survival, are determinants of recruitment and year-class strength. It is also suggested that a major spawning and recruitment source of red drum in the Gulf of Mexico is the large schools of mature red drum which are known to occur in offshore waters.

Overstreet (1983) documented large schools of adult red drum reported by menhaden spotter pilots seaward of the Mississippi barrier islands. The Swingle et al. (1984)

profile cited a large school of red drum (18,000-20,000 lb) captured in a purse seine in 1982 seaward of the Chandeleur Islands in the north central Gulf. That report and others noted that schools of red drum were associated with schools of blue runner (Caranx crysos) and/or little tunny (Euthynnus alletteratus). Red drum are often taken incidentally to the purse seine catch of blue runner or little tunny, and these incidental catches have been reported to be as large as 34,000 kg (74,956 lb).

As Overstreet (1983) and Swingle et al. (1984) noted, biological information on the composition and dynamics of offshore schools is inadequate. At present, there is a substantial purse seine fishery which targets the large schools of adult red drum in the FCZ, south of the Mississippi River delta region. From an entire school, estimated by spotter pilots to be as large as 150,000-250,000, up to 20,000 red drum can be harvested in a single set (Overstreet 1983). There is a growing concern that these offshore adult concentrations might be overharvested, further reducing a resource that is already affected by estuarine habitat loss and intensive fishing pressures on the immature fishes.

The offshore portion of the red drum life history has not been studied, but growing evidence suggests that large numbers of very large adult red drum (up to 25 kg, or 55 lb) found offshore may be critical to maintenance of the fishery (Florida Conference on Red Drum and Spotted Seatrout, November 1984). A recent Florida stock assessment workshop on red drum concluded that red drum were overfished in Florida. The critical, unanswered question was whether the large schools of red drum in the northern Gulf may be partially responsible for the continued existence of the Florida fishery. Recent preliminary analyses of intercept survey data from Louisiana suggest that recruitment into the spawning biomass of red drum from Louisiana's estuaries may be dangerously low (Condrey, pers. comm.).

Of critical importance in developing a FMP for red drum are age structure and growth patterns of the offshore stock(s). Estimates of the number of fish by age are needed for the offshore fishery to determine if recruitment from coastal areas into the offshore pool of mature fish is being impaired. Because this fish lives for up to 34 years (suggested but not verified by Murphy 1984), relative numbers by age of fish entering the offshore fishery are needed for fishery managers to understand the effects of inshore fishery on recruitment to offshore adult resources.

Seasonal movements of red drum have been documented along the Atlantic coast (Yokel 1966) and under certain environmental conditions, summer movements along the eastern seaboard have resulted in red drum landings as far north as New Jersey (Welsh and Breder 1923, cited in Mercer 1984).

This could have resulted, however, from a larger population of older fish at the northern edge of the range prior to heavy exploitation. However, adult movements are poorly documented for the Gulf of Mexico, although adult schooling red drum appear more extensively in the Gulf (Overstreet 1983; Mercer 1984). This further complicates determining school distributions and the relative importance of localized spawning areas of the Louisiana and Mississippi coasts.

In general, subadult populations of red drum exhibit little interbay movement and are restricted to estuarine areas within the Gulf of Mexico (Mercer 1984). Knowledge of movements by adult red drum in the FCZ has been based on limited tagging studies and observations by spotter pilots (Overstreet 1983; Simmons and Breuer 1976, cited in Mercer 1984). Large schools of either red or black drum are detected in coastal waters of the Gulf in April and recent large landings in Alabama (January-March 1986) suggest these schools are present much earlier. A general westward migration of fish from the eastern Gulf towards the Louisiana coast has been hypothesized by Overstreet (1983), who also reported that schools of red drum appear to spread out along the north central Gulf during September-October, presumably to spawn near estuarine passes. Movements from October to April are not understood but may coincide with the Loop Current during this fall-winter period (Overstreet 1983). Alongshore surface currents display yearly variations due to the Loop Current entering the central Gulf (Sturges and Evans 1983), but in winter, alongshore surface currents in the northern Gulf are generally westward.

Large red drum appear to make onshore movements as well as seasonal alongshore movements. Migration of large red drum to nearshore areas in spring has been documented (Pearson 1929; Gunter 1945; Miles 1950; Simmons and Breuer 1962, cited in Overstreet 1983). Overstreet (1983) and Overstreet and Heard (1978) suggest that feeding behavior may be a factor in these movements and that the residence time of large red drum in a given area may be related to food availability. Recent sampling by LSU suggests size distributions of red drum landed by commercial haul seiners working in nearshore waters of Breton Sound were larger than those from purse seiners operating outside of state waters (Wilson, pers. comm.). This preliminary information is consistent with previous reports of large individuals inshore. Numbers of large red drum observed in Texas bays reportedly to decrease during the summer months, presumably due to offshore movements (Pearson 1929). Seasonality and extent of onshore-offshore movements are generally poorly documented for red drum.

b. Stock Assessments

Existing information on stock assessment (i.e., relative abundance and distribution of red drum) is extremely sparse, especially in the FCZ. There is universal agreement in the region that the research area of paramount importance in this cooperative plan is stock assessment for this offshore resource.

Until very recently, very little information was available on YPR for Gulf of Mexico red drum. Preliminary YPR estimates have been made for red drum in Texas (Matlock 1984) and Florida (Murphy 1984) and for Gulf red drum by Condrey (1986). Published estimates of MSY have not been made.

YPR analyses indicate that the juvenile populations are growth overfished in west central Florida and Texas; available data are insufficient to determine the condition of juvenile populations in other Gulf areas because acceptable mortality estimates are unavailable (Swingle et al. 1984). Some information on relative abundance and present condition of the adult red drum population has been inferred from past (pre-1984) data on juvenile growth and mortality rates, but the current increasing offshore fishery effort in the FCZ requires a re-examination of data used to calculate adult abundance. The previous conclusion (Swingle et al. 1984) that:

> ". . . it is reasonable to conclude that adult abundance is affected primarily by changes in recruitment from the juvenile population and not so much by fishing directly on the adults."

must be reconsidered.

Calculations of numerical estimates of recruitment into the adult population Gulfwide and estuarine fishing mortality require knowledge of growth, mortality and total catch in each area (Swingle et al. 1984). Swingle et al. (1984) also noted that the historic lack of good recreational catch data from each state so severely limits the precision of any such estimate as to eliminate attempts to calculate abundance.

3. PROBLEMS

The major problem facing conservation and maintenance of red drum resources in the Gulf of Mexico is the lack of relevant, current scientific information upon which a sound management plan can be developed. This cooperative research proposal addresses priority information needs, establishes a coordinated, region-wide plan to provide the required information, and details how this information will be used in the development of a red drum management plan.

While there are many important information needs which should be addressed in order to understand fully the resource and fishery, four research areas are considered in this plan to be paramount. The four priority needs are: (1) migration studies to assess stock identification; (2) validation of age and growth patterns; (3) use of catch/effort statistics to estimate stock abundance and rates of mortality; and (4) fishery-independent surveys to assess stock abundance in nearshore areas. Of these four categories, the collection of reliable and compatible catch and effort statistics is especially challenging as the fishery includes a large and important recreational hook-and-line harvest, an important charter- and headboat component, a traditional (in some states) inshore and nearshore commercial fishery, and a controversial purse seine harvest in Federal waters. To be useful in assessing stock abundance and rates of mortality, the statistics program must provide estimates of catch, effort and number at age from the inshore recreational, inshore gill and trammel net fisheries and the offshore purse seine fishery. Other factors, such as length frequency, age and sex distribution of the catch are important for assessing the status of the stock(s). Factors such as search time and patterns of fishing will be helpful in evaluating temporal and spatial patterns in effort.

The fact that this proposal does not address all information needs does not indicate their unimportance. Indeed, several important information needs are addressed in other MARFIN proposals. However, the information which will be collected under this project is that which is essential to estimate MSY, surplus production models (YPR, with R known), estimate standing biomass, develop a yield model for evaluating management alternatives, and establish any necessary quotas on the take of red drum in the FCZ.

B. PROJECT GOALS AND OBJECTIVES

The overall goal of this project is to provide scientific information necessary for sound management of red drum resources in the Gulf of Mexiço. A three-year project is planned with modifications after the first or second year as necessary to optimize collection, management and use of data resulting from project activities. Implemention of first year activities will begin immediately following funding. Initial planning efforts by agencies participating in the development of this coordinated research program has resulted in expansion of ongoing research or new projects initiated in anticipation of funding. Four major categories of scientific information are needed, grouped loosely within two areas, biological assessments and stock assessments.

Biological assessment information priorities are: (1) stock identification, through determination of migratory patterns of red drum emigration (offshore-nearshore) and coastwide (alongshore) movements; and (2) age and size structure of both nearshore and offshore red drum. Stock assessment information needs include (1) reliable catch and effort

statistics for red drum from both commercial and recreational fisheries; and (4) relative abundance and distribution of juvenile and adult red drum in offshore and nearshore areas, through fishery-independent surveys.

Most urgently needed are evaluation of the fishery (stock assessment), escapement from the estuaries to the offshore stock(s) (stock identification, and age structure of the offshore red drum).

For the most part, survey methodology to achieve these objectives is presently available through both fishery-dependent and fishery-independent data collection techniques. Fishery-dependent information relies directly on the collection of catch and landings data provided by commercial and recreational fisheries. Fisheries-independent information (information collected without direct reliance on statistics reported by commercial or recreational fishermen) is critical to fishery management and development since statistics reported by fishermen can be significantly influenced by economic conditions, gear and vessel design, catch discard patterns and other fishing practices. Such information supplements and verifies fishery-dependent analyses.

Existing methodology can be modified in a very short time frame, but a limited amount of new methodology may be developed within the project to conduct fishery-independent sampling. Numerous methods will be employed, including some which will provide information on more than one objective (e.g., mark/recapture studies to validate annulus formation and determine migratory patterns), and alternative technologies needed to validate and corroborate such information as age and growth. Surveys and studies will be performed by many State, university and Federal agencies from a variety of platforms, data collection sites and laboratories. Data management and dissemination will be performed through existing information systems, in a coordinated, centralized program requiring minimal expansion or modification.

Specific objectives which will be addressed are:

1. BIOLOGICAL ASSESSMENTS

   a. Provide length-at-age estimates (age validation) for all size categories of red drum in offshore waters (FCZ).

   b. Provide length-at-age estimates (age validation) for all size categories of red drum in northern Gulf inshore (estuarine) waters.

   c. Provide age estimates for red drum larger than 800 mm (about 4 years) throughout the Gulf of Mexico.

   d. Validate procedures currently being used to estimate age of all sizes of red drum.

e. Determine growth parameters and length-weight relationships for both offshore and estuarine red drum.

f. Provide information on the extent and direction of red drum emigration (nearshore to offshore) in the northern Gulf.

g. Determine sex ratios of red drum occurring in the FCZ.

h. Provide information on the extent and direction of red drum coastwide movements (intra-estuarine) in the northern Gulf.

i. Develop information on schooling and behavior patterns of offshore red drum which may affect commercial harvesting strategies and practices.

j. Provide information on relative abundance and distribution of nearshore (estuarine) juvenile and adult red drum through fishery-independent sampling surveys in order to establish an abundance index for these areas.

k. Provide tissue samples of red drum and associated species to researchers investigating genetic structures, age/growth, reproduction, health and other biological information on these species in the offshore area.

2. STOCK ASSESSMENTS

a. Expand existing State and Federal Gulf of Mexico programs to collect fishery statistics, to provide both commercial and recreational catch and effort information and needed biological data on red drum.

b. Implement or expand recreational fishing (creel) censuses in the northern Gulf to provide catch and effort data on red drum, and information that could be used to evaluate recreational fishing mortality and size at capture.

c. Monitor commercial fishing operations for red drum in the FCZ through on-board observer programs, to obtain catch and effort, age/length-frequency and by-catch information.

d. Estimate number at age of red drum taken in the purse seine fishery to determine if the age structure shows impairment of recruitment in recent years to the offshore portion of the population.

e. Provide initial assessment of the size of the offshore red drum resource in the Gulf of Mexico, through analysis of catch and effort data, commercial fishing logs, fishery-independent survey data and other available data sources.

f. Provide information on the distribution of offshore red drum concentrations through aerial documentation and estimation (i.e., "spotter" airplanes).

g. Conduct a preliminary mark/recapture study to estimate the size and composition of the offshore red drum resource.

h. Provide an evaluation of aerial surveys for estimating population levels of inshore and offshore adult red drum.

3. INFORMATION MANAGEMENT AND TRANSFER

a. Provide centralized data management systems, accessible to all participants and researchers throughout the region, for entering, managing and retrieving information on mark/recapture studies, landings and catch/effort data, on-board observer monitoring data, and fishery-independent survey data.

b. Provide a region-wide forum for scientific review and evaluation of ongoing, planned and needed red drum research, through the cooperative State-Federal SEAMAP Red Drum Work Group of the GSMFC.

c. Provide a coordinated, systematic reporting of overall progress resulting from the proposed cooperative project to participants, the industry, legislative bodies and others concerned with the resource.

d. Provide a coordinated, centralized program to prepare and distribute reward posters and other information on tagged red drum.

C. NEED FOR GOVERNMENT FINANCIAL ASSISTANCE

As documented in the Marine Fisheries Initiative (GSMFC 1985), acceptable assessment/prediction information for estuarine fish, including red drum, is not available, especially for offshore areas, and quantitative data required for determining yield potentials are lacking and are urgently needed. The Initiative specifically notes the need for information about the "relationship between the exploitable offshore red drum stock and maintenance of the inshore population", and cites the inadequacy of landings and effort data for estuarine species. In the 17 months since the document's distribution, however, the explosive development of the offshore red drum fishery has created an entirely different scenario of the resource's importance:

> "With the exception of mullet it is unlikely that there will be any substantial increase of the commercial harvest of estuarine fish because of regulatory restrictions" (page 3-63)

merits reconsideration and redefinition of research priorities.

Intensifying the urgency of obtaining reliable information on this new, valuable commercial fishery are the recent actions by organized recreational fishermen in the southeast for designation of the red drum resource as a gamefish, thus eliminating all commercial harvest. As these groups have rapidly strengthened their membership and increasingly expressed to State and Federal legislators their desire for the species' management, a conflict between the two fishery components has arisen that has already attained extreme emotional levels in the Gulf.

As also noted in the MARFIN document, the information needed to determine the status of (estuarine) fishery resources, and to assess the nature and impact of recreational fishing on these resources does not exist on a Gulfwide basis. The belief by scientists that recruitment to the nearshore, heavily exploited recreational red drum fishery is dependent upon the large, mature, predominately commercial offshore fish mandates the immediate resolution of objectives entailed in this proposed cooperative plan: (a) stock identification; (b) catch and effort information on both fishery segments; (c) age and growth structure; and (4) relative abundance and distribution of nearshore and offshore red drum. Obtaining such information requires immediate action, especially on the offshore portion of the resource; recent actions of both State and Federal governments (page 2 of this document) indicate a strong possibility for closure of the offshore fishery once a quota is reached, thus precluding securing this vital information. It is imperative to implement immediately collection of the needed information while this fishery is still operating.

Past investment of public monies, especially Federal funds, for red drum research has not been significant and certainly inadequate in light of the fishery's explosive growth and importance. Funds available from presently existing fishery research programs (i.e., Sea Grant, NMFS, state and university efforts) are already fully committed and not available for the proposed red drum studies at this critical time. Additionally, recent heavy loss of funding to State fishery management agencies in the Gulf occurring because of reduction of oil and gas revenues has further stressed these agencies' research capabilities; state-generated funding for the needed red drum research is, in all likelihood, not possible.

Thus, Federal financial assistance is urgently needed to conduct cooperative studies to obtain information needed by both State and Federal fishery managers to conserve, protect, and best manage the resource. It should be noted that an extremely high level of logistic support (use of existing personnel, vessels, shoreside facilities, fishing gear, etc.) will be committed by the State agencies, universities and commercial industry. Federal funding requested to implement the project should be viewed as the enabling, coordinating mechanism for the cooperative research effort--the only effort likely to produce needed results.

D. PARTICIPATION BY PERSONS OTHER THAN THE APPLICANTS

It is anticipated that a number of outside research organizations and the fishing industry will actively participate in this cooperative research plan. The northern Gulf commercial red drum purse seine fishery will cooperate heavily through provision of captain's logs and spotter pilot's logs on catch data, the onboard observer program to collect data and tag fish, and collection of biological information (length-frequencies and other information) through the intercept surveys. Intercept survey data will also be taken for the inshore trammel net and gill net components of the commercial fishery. The cooperation of all commercial segments will be sought in returning fish tagged in this project.

The recreational fishing industry will also be requested to participate through cooperation on intercept (creel) survey data collection, and through returns of fish tagged in this project. It is hoped that widespread promulgation of the tagging components can be effected through the many publications targeted to both sectors of the fishery (e.g., angling and commercial fisheries magazines).

Indirect participation by other university researchers is expected through cooperative agreements between them and project participants for the purpose of securing red drum specimens and tissues. Through such compacts, previous and/or ongoing red drum biochemical studies (electrophoresis and HPLC) can be continued on a cost-effective basis, as it will not be necessary for other funding agencies to supply the heavy vessel (collecting) costs usually associated with these studies. It is likely that other fishes taken in association with the commercial red drum fishery (e.g., blue runners and black drum) will be similarly provided to requesting researchers to enable their studies. Probable participation is thus to be expected with the NMFS Charleston Laboratory and other regional seafood quality and latent resource development agencies (e.g., at universities). It will be the policy of the project and all its participants to assist where feasible in collecting the desired specimens at no cost to requesting researchers.

E. FEDERAL; STATE AND LOCAL GOVERNMENT ACTIVITIES

State-Federal activities that will be directly affected by this project include SEAMAP and the State-Federal Cooperative Fishery Statistics Program. The SEAMAP program will coordinate project planning and review, fishery-independent survey data management and programmatic reporting. The existing SEAMAP Information System, a cooperative fishery-independent data bank managed in conjunction with the SEFC's NSTL facility at Bay St. Louis, Mississippi will be expanded as necessary to accommodate fishery-independent and aerial survey data.

Catch/effort data from intercept surveys of both commercial and recreational fisheries will be incorporated into the existing Cooperative State-Federal Fisheries Statistics data management system of

the SEFC's Economics and Statistics office. Data from all sources will be submitted in one of two formats: (1) CSBSP (TIP) for commercial trips; and (2) MRFSS or a State recreational fishery format for recreational trips. Data retrieval from both these information systems will be available to participants through existing computer links between State management agencies and the SEFC.

Data on fish marked and recaptured under this project will be managed primarily through an existing centralized information system; notification of returns and rewards will be handled through the State management agency/university responsible for tagging the fish. State agencies and/or universities conducting analytical studies under this project (e.g., age/growth, stock assessment, biochemical analyses, etc.) will assume the responsibility for managing data collected in those studies, except for environmental data collected during surveys and special field studies, which may be managed by the SEAMAP Information System.

Programmatic administration and coordination relating to project activities (e.g., Red Drum Work Group meetings, workshops, summary reports, etc.) will be performed by the SEAMAP Coordinator and staff of the GSMFC. Additional information on the SEAMAP program and Information System may be obtained from the SEAMAP Coordinator, GSMFC, Ocean Springs, Mississippi. Information on the Cooperative Fisheries Statistics Program may be obtained from the Economics and Statistics Office, SEFC, Miami, Florida.

A large number of related red drum research activities is ongoing by the States, NMFS and universities. Mark-recapture studies of red drum in Texas estuarine systems have been conducted for 11 years, with 3-4,000 fish tagged annually by Texas Parks and Wildlife Department to determine migration and growth patterns. The Louisiana Department of Wildlife and Fisheries and Mississippi Department of Wildlife Conservation/Gulf Coast Research Laboratory have previously conducted nearshore mark/recapture efforts, with additional limited tagging conducted in the offshore area by Mississippi and the Gulf Coast Research Laboratory.

Other studies focusing on stock identification of nearshore red drum have been conducted and are ongoing, largely in conjunction with the previously mentioned LSU-SEAMAP Stock Identification Study. Electrophoretic work has been conducted by Louisiana Technical University, Rice University, and NMFS-Panama City Laboratory. It is anticipated that specimens and tissues obtained through the on-board observer and shoreside intercept survey components of this project will be supplied to researchers wishing to continue these studies on offshore red drum at little or no cost to them. Efforts are currently being coordinated to provide project personnel with protocols and procedures for obtaining, preparing, preserving and shipping specimens for electrophoresis, HPLC and mitochondrial DNA analyses. Researchers at these institutions have agreed to continue in their role as advisors to the Red Drum Work Group and SEAMAP Program.

Age and growth studies are also ongoing in the region. Researchers at LSU's Coastal Fisheries Institute are completing preliminary investigations for a Sea Grant-funded project on red drum captured in offshore waters east of the Mississippi River. Data analyses include validation of annulus formation in sagittal otoliths, age structure, length/weight/sex relationships, description of gonadal development and determination of intra-ovary fecundity differences. Data resulting from the proposed SEAMAP-coordinated research project may be compared and combined with these and other studies (e.g., Florida Department of Natural Resources) to permit more precise age structure definitions.

Egg and larval studies crucial to understanding the species' reproductive biology and its association with schooling are also ongoing at LSU and GCRL. Researchers are conducting ichthyoplankton surveys targeted specifically to red drum, in order to: (a) estimate spawning effort; (b) determine spawning times, and patch size and dispersion; (c) determine percentage of fertilization success; (d) determine age distribution and growth rate of post-yolk sac larvae to back-calculate spawning dates; (e) evaluate species interaction that may affect survival of larval and post-larval red drum; (f) compare growth rates of competitors; (g) determine the relationship of growth to temperature; (h) determine the incidence of parasites on larval red drum; and (i) assess the abundance of red drum prey organisms and potential larval competitors. Additionally, ichthyoplankton surveys in association with the SEAMAP program are routinely conducted throughout the U.S. Gulf, and in 1986, will be extended to cover September, when red drum larvae are expected to be encountered. SEAMAP plankton collections are sorted to family level at the Sorting Center in Szezcin, Poland, and subsequently maintained at the SEAMAP Archiving Center managed in conjunction with the Florida Department of Natural Resources, for loan to researchers throughout the country. Environmental data routinely collected concomitantly with each plankton station are also available through SEAMAP; these services will be provided to researchers of red drum at no cost to this proposed project.

A limited amount of catch statistics data on red drum is being collected and maintained by NMFS-Mississippi Laboratories through utilization of captain's logs of purse seine vessels. These data are for two years only, but are anticipated to be useful in evaluating catch/effort during that time period. Other data are available from landings and trip interview data collected in Alabama and Louisiana in conjunction with the State-Federal Cooperative Fisheries Statistics Program, including landings by area, state, month, length-weight data, size, effort and other information. Some additional information may be available on state gill net landings.

Finally, in conjunction with the preparation and expected implementation of this cooperative project, the SEFC-Mississippi Laboratories have placed NMFS observers on purse seine vessels to obtain needed information (e.g., location, depth, total catch by species, number of schools sighted, number of sets pursed and not pursed on schools, estimated percentage of school captured per set, by-catch, etc.). It is expected that in the future this activity will be conducted through industry-supported personnel.

F. PROJECT OUTLINE

1. RESEARCH CATEGORIES

The proposed project is divided into four information categories: (a) stock identification; (b) age and growth structure; (c) catch/effort statistics; and (d) fishery-independent stock assessment surveys. The proposed project will be coordinated through the SEAMAP program of the GSMFC. This coordination will assure maximum compatibility of the generated data base, and will minimize duplication of effort. Review of scientific findings within the Commission's hierarchy of committees will provide additional refinement of the project summary reports to MARFIN and will facilitate management's use of the information generated in this project. The time schedule of events and deliverables is structured to provide maximum input into the red drum management plan(s) being undertaken by NMFS and GSMFC and may be restructured, if necessary, to provide similar input into a plan developed by the Gulf of Mexico Fishery Management Council.

a. Stock Identification

Because preliminary findings of the SEAMAP Red Drum Stock Identification Study indicated a homogeneous inshore population structure, the stock identification portion of this proposal will mainly focus on gathering information about estuarine escapement, offshore migration patterns in the open Gulf through mark/recapture studies. Initial tagging efforts will concentrate in the northern Gulf, from the Florida panhandle to the Louisiana-Texas border. To the extent possible, fish from various areas will be tagged simultaneously to permit measurement of the degree of interchange or separation between these fishing grounds. Estimates of fishing mortality obtained in the catch/effort statistics portion of this study will be used to assess apparent migration patterns. Data on marked and recaptured fish will also be used by researchers in the age validation portion of this project.

During the first year period from June 1, 1986 to June 30, 1987, 20,000 to 40,000 hatchery-raised juvenile red drum will be tagged and released in discrete lots from several areas in Alabama, Mississippi and Louisiana. All juveniles will be tagged with a dart tag prior to release. Recapture of these known-age fish will be useful in (1) assessing movement of sexually immature fish; (2) determining time of recruitment to the FCZ; (3) verifying age techniques; and (4) providing estimates of fishing mortality and inshore/offshore harvest by user groups.

In addition to these estuarine releases, tagged larger red drum will be released off Alabama, Mississippi and Louisiana. This activity will be conducted in cooperation with the commercial purse seine fishery. At no direct cost to the project, the purse seiners will encircle a school of red drum. As a fish from this encircled school are brought aboard the vessel, they will be sampled for total length, scales removed for age verification studies, marked with an internal anchor or dart tag, and either returned to the encircled school or released directly into the wild. Some fish may be injected with tetracycline dye to permit age validation.

To maximize the rate of return for tagged fish, a coastwide publicity campaign will be conducted to inform fishermen of the goals and objectives of the study, importance of their participation, and the information and samples needed from the returned fish (tag number, area and method of capture, total length of fish, and if possible, scales and otoliths). This campaign will capitalize on existing mechanisms for information exchange; the Sea Grant Extension Service, local state port agents, and coastal news media. As an incentive, the project may also conduct several lotteries spread through the year following completion of tagging. Each lottery will offer cash prizes to optimize return of marked fish.

Winning numbers will be computer selected from a randomized listing of all tagged fish. Prizes will be awarded to persons who return fish with numbers appearing first on the randomized list.

Additional research will focus on developing a mt DNA technique that can be used to indicate whether genetic differences occur among the nearshore groups of red drum. This method may be useful in defining such differences where the previously used techniques (electrophoresis and HPLC) appear to lack the "fine tuning" discernment of extremely small variations in the structures of genetically dissimilar groups.

b. Age and Growth Studies

Considerable progress has been made recently in aging red drum. Age validation studies are reported for juvenile fishes in Texas by Wakefield and Colura (1983), for Florida, and by Beckman and others (unpublished) in Louisiana. In addition, age validation studies are currently underway in Louisiana for inshore and offshore red drum. Unvalidated age estimates of purse seine-caught fish from along the Louisiana coast are reported by Murphy and Taylor (1984). These estimates extend the known life of Gulf fish to 34 years. A growth curve for purse seine-caught fish is currently being developed by Wilson et al. at LSU.

The age/growth component of this project is designed to complete patterns developed by these researchers. Specific tasks include:

(1) Validation of age and growth patterns of juvenile red drum from the Florida panhandle to Texas.

(2) Validation of the age of adult red drum in the open waters of the Gulf.

(3) Collection of age information from red drum which are not currently exploited by the purse seine fishery operating in the north central Gulf.

Questions concerning the age validation of juvenile fish relate to the age of first annulus formation, although considerable validation by Florida (otolith sections) and Texas (scales) exists. Questions concerning the age validation of older fish relate to the number of growth rings which are deposited annually. Information is needed on the age of fish not currently exploited by the purse seine fishery in the north central Gulf, in order to assess the possibility of sample-induced bias, since the purse seine fishery is reportedly selecting for smaller (average = 15 lb) red drum. Age structure data for the fishery are also required to determine if the offshore, older fish have suffered reduced recruitment in recent years due to high fishing pressure on younger fish in inshore waters.

A large portion of the aging and age validation studies is totally integrated into the proposed migration studies. During the first year of the project, a large number of young red drum will be tagged and released from areas in Alabama, Mississippi, and Louisiana. These hatchery-raised juveniles will be of a known age, raised at one site. Fishermen returning tags from recaptured fish will be encouraged to provide information on total length of the fish and area of capture, providing scales and otoliths for aging. An incentive program, outlined in the section on stock identification, will be conducted to enhance the quality and quantity of returns.

In addition to these estuarine releases, essentially simultaneous offshore releases of larger fish are planned off Alabama, Mississippi, and Louisiana. As previously noted, the purse seine fishery operating in the Gulf has agreed to assist the project in the capture of these fish, at no cost to the project. The purse seiners will encircle a school of fish, place them onboard the vessel, researchers will take total length and weight, will remove scales for age verification studies, possibly catheterize the fish to determine sex, mark it with an internal or dart tag, and either return it to the encircled school or release it. An incentive system will be used to enhance returns of tagged fish.

Size and age information on very large red drum will be obtained from two sources. Major sportfishing rodeos will be utilized to obtain length, weight, sex, scales and otoliths of red drum landed. Additionally, age estimates of fish larger than those normally harvested by the purse seine fleet will be obtained by having the purse seines encircle schools of very large fish (more than 44 in, or 1300 mm, TL). Fish from such schools will be sampled, with a preselected target number per length class.

Scales and otoliths will be analyzed at cooperative institutions, with distribution of samples among the laboratories coordinated by the SEAMAP Red Drum Work Group.

c. Stock Assessment

The stock assessment program component will provide estimates for several analytical functions: (1) total and fishing mortality for use in YPR analyses; (2) catch and effort parameters needed for surplus production models; (3) assessment of stock abundance of fish which are fully recruited to the fishery; and (4) an index of stock abundance in the newly developing purse-seine fishery. This portion of the project is divided into three activities: (1) intercept surveys of recreational and commercial fisheries; (2) onboard observers on purse seine vessels, and (3) surveys using spotter pilots in the purse seine fishery.

Onboard Observers

The catch/effort records of the purse seine fleet will be kept by onboard observers. These records will be essentially identical to those used by the Gulf menhaden industry and will include:

(1) Dates and times the vessel left and returned to port.

(2) Name of the port.

(3) Location, depth, time and coordinates of each set.

(4) Identity of the species sighted (i.e., Were red drum set on directly or was the set made expecting to find red drum underneath other species? Was this expectation verified with sonar before the set was made?).

(5) The identity of the spotter plane, if spotter assisted.

(6) The captain's estimate of the total poundage of the set, as well as the portion of the school not encircled.

(7) If the captured fish are not landed, an indication of why (i.e., too large an individual fish, too abundant a catch, human error, etc.)

(8) An indication of whether the fish were landed or released.

(9) Standard SEAMAP environmental data: temperature, salinity, sea state, wind speed and direction, cloud cover.

(10) Length-frequency and measurements on otoliths, scales, and sex of randomly-selected fish, whether or not the captain elected to place onboard the pursed fish.

(11) Numerical estimates of any mortalities on fish released intentionally or accidentally, as well as footnotes on any likely cause of these mortalities. In the event the vessel does not fish, an indication of the reason it remained in port (i.e., poor weather, fish not showing, boat repairs).

The onboard observer will also record the basic characteristics of the vessel which are indicative of its fishing capability: length of vessel, horsepower, length and depth of purse seine net, tonnage, and any significant modifications which were made to improve its fishing efficiency. The information collected will be used to assess the seasonality of harvest, environmental parameters affecting fish vulnerability, size composition of the targeted fish (as well as that of the released fish) and to establish a sensitive index of stock abundance.

Intercept Surveys

Intercept surveys of the traditional recreational and commercial fishermen will be conducted to determine:

(1) The magnitude of effort, as well as spatial and temporal distributions.

(2) Size and species composition of the catch.

(3) Effective effort, such as catch per angler hour.

(4) Methods of exploitation.

To enumerate these patterns the following information will be obtained: classification of fishermen (recreational, commercial, and charter/headboat), number of fish caught and species targeted, length frequency of red drum caught, otoliths and scales, sex, area of catch, area of search, time trip began and ended, number of angler hours per area fished and number of fish caught per area (or number of hours a net

is fished), type of fishing gear, and (if used) vessel characteristics (length, horsepower, number of fishermen in party). Standard interview procedures and data collection forms (e.g., the CSBSP forms) already in use by current statistics programs will be used so that data can be easily incorporated into existing regional data bases.

Spotter Pilot Surveys

Aerial surveys are proposed to document the normal flight patterns used by spotter pilots in locating schools of red drum. Advantages of this method include:

(1) Cost effectiveness.

(2) Documentation of actual "fishing" strategy of the pilots involved on the fishery.

(3) Provision of a historic, quantitative record of changes in hunting strategy.

(4) Easy modification to assess the vulnerable portion of the population which lies outside the normal fishing grounds.

To document these flight patterns, each spotter pilot's plane may be equipped with appropriate documentary equipment (e.g., remote-controlled video systems interactive with the plane's on-board coordinates archival system).

Such a system may provide a complete record of the pilot's flight pattern by combining the LORAN-C coordinates of the flight with a visual record of any schools of red drum encountered or schools of red drum-associated fishes. In addition, the pilot may carry a small portable tape recorder and for each flight record the location, time of encounter, and size of any red drum school encountered. If any of these fish are harvested, the pilot's estimate of school size will be compared to the captain's estimate and the actual tonnage harvested.

These data can then be analyzed to assess the area of the existing fishery, weather and time conditions under which red drum are vulnerable to the fishery, and the searching strategy of the pilots. From this information, a suitable model for assessing apparent stock abundance in the area of exploitation can be developed.

d. Fishery-Independent Stock Assessment Surveys

Fishery-independent surveys of stock abundance on both pre-recruits and recruits to the fishery are necessary to forecast abundance, assess the effects of environmental forces on year-class strength, and verify the stock abundance

analyses conducted with catch/effort data collected on the fishery. Currently most of the Gulf States are conducting fishery-independent programs to obtain such information. At this time, however, only Texas wishes to use its catch rate of fish as an index of stock abundance.

Given the necessity for immediate, hard answers on red drum stock abundance, stock identification, and age/growth validation and the anticipated success in obtaining these parameters from the activities outlined above, the role of fishery-independent surveys is not expected to be large in the first two years of the proposed project. Central to the efforts will be the coordination of a workshop on fishery-independent estimates of red drum stock abundance. That workshop, to be held early in the second year of the project, will focus on the development of a coordinated, Gulf-wide approach to fishery-independent surveys of red drum. The research plan which results from that workshop will be incorporated into our third year proposal.

Additional fishery-independent stock assessment and identification activities that may be incorporated into the project include:

(1) Development of an inshore sampling program, using trawls, seines or other appropriate sampling gear, to determine the abundance of juveniles and subadults in coastal waters.

(2) Aerial linear transects conducted by chartered, experienced spotter pilots to assess concentrations of surfacing red drum in conjunction with ground truthing studies to verify school densities and size of fish. Spotter pilots may also be requested to record other information which may serve as indicators of red drum schools; e.g., mud plumes, other fish species, water color, etc.

2. INFORMATION MANAGEMENT

As indicated in Section E (Federal, State and Local Government Activities), comprehensive information systems presently exist that can be expanded or modified to accommodate immediately data generated by research activities of this project. These include cooperative State-Federal, NMFS and individual state agency data management programs.

Stock identification data obtained through coordinated mark/recapture studies will be managed through a centralized, cooperative data system. Data will include date and site of initial capture; length and weight at capture; tag number, tagger and tagging organization; method of capture and other pertinent information. A record of scales and/or otoliths taken for comparative growth studies will also be noted. Information on

recapture will be processed by the system and notification provided to the tagging organization for subsequent reward and analyses. These data will also be available to researchers investigating age validation.

Similarly, information obtained during project fishery-independent activities will be maintained in the SEAMAP Information System, a fishery-independent system operated in conjunction with SEFC-Mississippi Laboratories, with verified data generally accessible to all requestors (except for confidential data). Catch/effort information obtained through the expanded SEFC State-Federal Cooperative Fisheries Statistics Program will be managed by that system, in accordance with protocols and procedures agreed upon between the cooperating partners (i.e., the states--or their designees--and NMFS).

Catch/effort recreational fisheries data collected through expansion or implementation of State or Federal programs (e.g., creel censuses) will be managed by the collecting agency and processed according to that organization's policies and procedures. Similarly, data and information resulting from state-conducted analyses and studies [i.e., stock assessment, age/growth studies, aerial (spotter plane) surveys, etc.] will be managed through the facilities of the investigating agency.

Data resulting from on-board observer programs will be managed through the existing SEFC-Mississippi Laboratories system for such data, in accordance with NOAA protocols and policies, and in compliance with regulations pertaining to confidential information management.

It is the specific goal of the information management component of this project to manage, whenever possible, data and information in a cost-effective and timely manner to expedite its use in the production of the information needed to manage the resource.

G. PROJECT MANAGEMENT

Although this project should be viewed as a coherent, interactive research program, project management, overall, will be effected most efficiently by the respective participating organizations. Each participant will thus administer the individual segments in accordance with his agency's policies and procedures, utilizing available personnel and facilities.

Data and specimens collected by participants will be managed in several ways:

(1) Mark/recapture information will be managed internally by the respective participating agency, with these data also submitted to

a centralized regional tagging data base. Posters and other public relations information, and any reward systems used, will be managed by the respective organization.

(2) Catch/effort and biological information obtained through the expanded existing State-Federal Cooperative Fisheries Statistics Program will be submitted to and managed by that program.

(3) Information from vessel and spotter pilot observers and logs will be managed by the existing NMFS-Mississippi Laboratories observer data system.

(4) Whole specimens and tissues for use directly by participants, or through cooperative agreements between participants, will be collected, appropriately preserved, and provided to the requesting organization through compacts between those participants. Resulting analytical data will be managed by the respective participant.

Critical to the project's success are those tasks related to coordination and information dissemination. The GSMFC, through the SEAMAP Program, will provide these services, which include the facilitation of project planning and evaluation, and regular reporting of the status and progress of individual project participants. The overall coordination will be by the GSMFC SEAMAP Coordinator. Information dissemination will be in accordance with all applicable SEFC, NMFS, NOAA and Department of Commerce directives, policies and regulations, as well as those of the respective participant.

H. MONITORING OF PROJECT PERFORMANCE

Overall performance of each project incorporated into this cooperative plan will be monitored through the SERO by SEFC, through existing procedures. Because the program consists of many individual projects of a highly specialized nature, review of progress, research methods and accomplishments of all cooperative participants will be performed on a semiannual basis by the SEAMAP Red Drum Work Group. The group's findings and recommendations will be summarized in the semiannual program status report (distributed in December and June) as an advisory service to the SEFC and MARFIN Program Management Board. Each project also will be reviewed and monitored through existing mechanisms used by each participanting organization.

I. PROJECT IMPACTS

There is no question that the offshore red drum resource will be placed under emergency Federal Management regulations within the very near future. Expressly mandated as an integral component of that management is research on size of stocks, age structure, and recruitment

to the fishery (including stock identification), all urgently needed to develop a Gulf red drum management plan. The information produced by this cooperative program will be used specifically to address these information needs.

Stock assessment activities (e.g., catch/effort data collection; onboard observers reports; intercept surveys; spotter pilot and aerial linear transect surveys; and analysis of existing captain's logs and spotter pilot's logs) will produce preliminary assessments of red drum within the first year. Age validation studies will yield workable findings during this period, leading to subsequent definitions of stock age structure. These studies, coupled with inshore and offshore mark/recapture activities, will lead to further refinements in analyses related to age structure, plus good information on recruitment both to the inshore and offshore groups of fish.

An important impact of the project, especially during the first year, will be its effect on future research activities on red drum. For example, three of the proposed projects are highly experimental, involving mark/recapture studies for estimating size of the offshore stock of fish, aerial surveys to address this same issue, and genetic research to consider the question of stock identity. If these projects are successful, not only will they provide needed information, but they will also help define future research approaches to answer management questions on red drum, as well as other species.

Besides having specific application for estimating a refined MSY for red drum in the Gulf of Mexico, the project will provide considerable information for evaluating numerous management options. For example, information provided by the project on stock age and size structure, together with estimates of inshore and offshore recruitment to the fisheries, will be important in evaluating possible size restrictions. This same information taken in conjunction with seasonal variations in the red drum resource will also prove useful in evaluating gear, catch, and size restrictions by area and season. And finally, this project, through effective coordination and quick reporting, should help minimize unnecessary conflicts between user groups, and, in turn, between these groups and management agencies.

J. EVALUATION OF PROJECT IMPACTS

Project impact will be evaluated largely through development of a fishery management plan for the Gulf of Mexico red drum resource, utilizing information produced by participants in this project. Impact may also be measured through adoption of interim State and Federal regulations resulting from project analyses and recommendations. Evaluation of impacts will likewise specifically be considered by the Red Drum Work Group in its semiannual program and project reviews, for presentation as future recommendations on red drum research to the MARFIN Program Management Board.

K. PROJECT COSTS

Project costs for FY1986 are given in Table 1. A total of $520,000 is requested from MARFIN for the seven participating organizations. Matching funds from other sources are expected to be $280,700, for a total project cost of $800,700. Approximately 64.9 percent of total project costs will be provided by MARFIN funds.

Project MARFIN costs by research category for the three-year project period are summarized in Table 2. Total project costs for this period are estimated at $, with $1,314,000 provided by MARFIN and $ provided by other sources. Cost estimates for the second and third years, however, are very preliminary and will be modified and adjusted following evaluation of first-year activities.

Funding needs among participants, which include all five Gulf States, NMFS, and the GSMFC, vary rather widely according to desired level of participation and perceived need. Duplication of effort has been eliminated entirely from this project through the cooperative planning meetings held in May-June 1986; this proposed project is both cost-effective and immediately ready for implementation because of available program coordination through the SEAMAP Program of the GSMFC.

TABLE 1
FY1986 MARFIN BUDGET SUMMARY

Research category	Cost ($1,000) MARFIN	Other sources	Total
Stock Assessment			
Data analysis	80.0	67.5	147.5
Data collection	10.0	2.7	12.7
Offshore mark/recapture	50.0	16.7	66.7
Observers/vessel and spotter logs	60.0	50.0	110.0
Category total:	200.0	136.9	336.9
Stock Identification			
Inshore tagging	110.0	52.8	162.8
Biochemical analysis	80.0	30.0	110.0
Category total:	190.0	82.8	272.8
Age and Growth			
Age validation	33.0	8.0	41.0
Age structure/verification	30.0	10.0	40.0
Category total:	63.0	18.0	81.0
Fishery-Independent Stock Assessment			
Aircraft sampling survey	40.0	14.1	54.1
Nearshore sampling survey	20.0	20.0	40.0
Category total:	60.0	34.1	94.1
Project Coordination Category total:	7.0	8.9	15.9
TOTALS ALL CATEGORIES:	520.0	280.7	800.7

TABLE 2
SUMMARY OF ANNUAL BUDGET REQUIREMENTS FROM MARFIN
($1,000)

Research category	FY1986	FY1987	FY1988	Total
Stock Assessment				
Data analysis	80.0	80.0	80.0	240.0
Data collection	10.0	10.0	10.0	30.0
Offshore mark/recapture	50.0	50.0	50.0	150.0
Observers/vessel and spotter logs	60.0	-	-	60.0
Category total:	200.0	140.0	140.0	480.0
Stock Identification				
Inshore tagging	110.0	110.0	110.0	330.0
Biochemical analysis	80.0	60.0	60.0	200.0
Category total:	190.0	170.0	170.0	530.0
Age and Growth				
Age validation	33.0	30.2	20.3	93.4
Age struture and verification	30.0	30.0	30.0	90.0
Category total:	63.0	60.2	60.2	183.4
Fishery-Independent Stock Assessment				
Aircraft sampling survey	40.0	-	-	40.0
Nearshore sampling survey	20.0	20.0	20.0	60.0
Category total:	60.0	20.0	20.0	100.0
Project Coordination				
Category total:	7.0	7.0	7.0	21.0
TOTALS ALL CATEGORIES	520.0	397.2	397.2	1,314.4

J. PROJECT TASKS

STOCK ASSESSMENT TASKS

MARFIN PROJECT PROPOSAL: SA - 1

A. Project Title: Collection of Length, Weight, and Biological Information on Red Drum

B. Project Status: New

C. Project Duration: July 1, 1986 to June 30, 1989 (three years)

D. Applicant:

Alabama Department of Conservation
and Natural Resources
Marine Resources Division
P.O. Drawer 458
Gulf Shores, AL 36542

E. Principal Investigator:

Mr. Walter M. Tatum
Chief Marine Biologist
Marine Resources Division, ADCNR
P.O. Drawer 458
Gulf Shores, AL 36542

F. Project Objective: To provide information on the length, weight, fecundity, and age of red drum.

G. Summary of Work to be Performed: The Marine Resources Division, Alabama Dept. Conservation and Natural Resources, will conduct a data collection program of recreationally and commercially landed red drum. Emphasis will be placed on purse seine-landed fish. Data to be collected will consist of length, weight, sex, otoliths, and scales. In addition, location of catch and gear type will be obtained by interview and selected tissue samples will be collected.

H. Total MARFIN Funds Requested:

FY 1986	$ 5,000	(Percent of Total =75%)
Total (3 yrs.)	$ 15,000	(Percent of Total =75%)

I. Project Costs to be Provided from non-MARFIN Sources:

FY 1986	$ 1,667	(Percent of Total =25%)
Total (3 yrs.)	$ 5,001	(Percent of Total =25%)

J. Total Project Costs:

FY 1986	$ 6,667
Total (3 yrs.)	$ 20,001

MARFIN PROJECT PROPOSAL: SA - 2

A. Project Title: Collection of Length, Weight, and Biological Information on Red Drum

B. Project Status: New

C. Project Duration: July 1, 1986 to June 30, 1989 (three years)

D. Applicant:

Seafood Division
Louisiana Department of Wildlife and Fisheries
P.O. Box 15570
Baton Rouge, LA 70895

E. Principal Investigator:

Mr. Joseph Shepard
Seafood Division
Louisiana Dept. Wildlife and Fisheries
P.O. Box 15570
Baton Rouge, LA 70895

F. Project Objective: To provide information on the length, weight, fecundity, and age of red drum.

G. Summary of Work to be Performed: The Louisiana Department of Wildlife and Fisheries will conduct a data collection program of recreationally and commercially landed red drum. Emphasis will be placed on purse seine-landed fish. Data to be collected will consist of length, weight, sex, otoliths, and scales. In addition, location of catch and gear type will be obtained by interview and selected tissue samples will be collected.

H. Total MARFIN Funds Requested:

FY 1986	$ 5,000	(Percent of Total =83%)
Total (3 yrs.)	$15,000	(Percent of Total =83%)

I. Project Costs to be Provided from non-MARFIN Sources:

FY 1986	$ 1,000	(Percent of Total =17%)
Total (3 yrs.)	$ 3,000	(Percent of Total =17%)

J. Total Project Costs:

FY 1986	$ 6,000
Total (3 yrs.)	$18,000

MARFIN PROJECT PROPOSAL : SA - 3

A. Project Title: Mark/Recapture Program for Red Drum in the Gulf of Mexico

B. Project Status: New

C. Project Duration: July 1, 1986 to June 30, 1989 (three years)

D. Applicant: Richard L. Leard, Ph.D.
Bureau Director
Mississippi Department of Wildlife Conservation
Bureau of Marine Resources
P. O. Drawer 959
Long Beach, MS 39560

E. Principal Investigator: Frederick Deegen, Ph.D.
Chief, Division of Saltwater Fisheries
Bureau of Marine Resources
P. O. Drawer 959
Long Beach, MS 39560

F. Project Objective: To provide information on the stock size, growth, and migration patterns of red drum.

G. Summary of Work to be Performed: The Mississippi Department of Wildlife Conservation, Bureau of Marine Resources, in cooperation with the Gulf Coast Research Laboratory will conduct an offshore tagging program of red drum in order to determine stock size estimates, growth, and migration patterns of this species. Commercial purse-seine vessels will be contracted to capture red drum, and the fish will subsequently be tagged with sequentially-numbered internal anchor tags, measured to the nearest mm, and released. For each individual, the tag number, length, and capture and release site will be recorded.

Posters publicizing the mark/recapture effort will be developed and distributed solicting the return of tagged fish.

H. Total MARFIN Funds Requested:

FY 1986	$50,000	(Percent of Total = 75%)
Total (3 yrs.)	$150,000	(Percent of Total = 25%)

I. Project Costs to be Provided from non-MARFIN Sources:

FY 1986	$16,667	(Percent of Total = 25%)
Total (3 yrs.)	$50,000	(Percent of Total = 25%)

J. Total Project Costs:

FY 1986	$66,667
Total (3 yrs.)	$200,000

MARFIN PROJECT PROPOSAL : SA- 4

A. Project Title: Red Drum Stock Assessment

B. Project Status: New

C. Applicant: Dr. Richard J. Berry
Director
Southeast Fisheries Center
National Marine Fisheries Service
75 Virginia Beach Drive
Miami, FL 33149

D. Project Duration: July 1, 1986 to June 30, 1989 (3 years)

E. Principal Investigator: Dr. Walter R. Nelson
Director
Miami Laboratory, SEFC
75 Virginia Beach Drive
Miami, FL 33149

F. Project Objective: To utilize all available data, conduct analysis of the data, and interpret results of analyses on the catch, effort, abundance, and dynamics of the red drum to assess the likely effects of various levels of fishery take on the future of the resource and to provide scientific advice to the appropriate decision bodies tasked with the management of this resource.

G. Summary of Work to be Performed: The recent increase in catch of large, mature red drum from nearshore and offshore Gulf coast waters has resulted in much concern over the ability of the resource to sustain this level of harvest given the estimated heavy rates of harvest of the estuarine, juvenile component of the stock. The likely impact of harvest of both the offshore and estuarine components needs to be assessed to provide scientific advice on management of this stock of fish. Present assessment responsibilities for the SEFC fully utilize the present staff. Red drum assessment work will require hiring additional technical support staff to free time for senior analysts to complete the task.

Standard assessment tools will be applied and new tools developed, as appropriate, to provide the needed advice on risks to the stock(s) under various levels of harvest relative to estimated long-term sustainable levels. Personnel from the Miami Laboratory, principally Drs. J. Powers and G. Scott will be involved. Dr. Walter Nelson, Miami Laboratory Director and the SEFC Red Drum Program Manager, will be principal investigator for this

project. All work will be closely coordinated with Louisiana State University.

H. Total MARFIN funds requested:

FY 1986	$ 25,000	(Percent of total = 40.0%)
Total (3 years)	$ 75,000	(Percent of total = 40.0%)

I. Project costs to be provided from non-MARFIN sources:

FY 1986	$ 37,500	(Percent of total = 60.0%)
Total (3 years)	$112,500	(Percent of total = 60.0%)

J. Total Project Costs:

FY 1986	$ 62,500
Total (3 years)	$187,500

MARFIN PROJECT PROPOSAL: SA - 5

A. Project Title: Stock assessment information needed to manage red drum resources in Louisiana and in the fishery operating in the FCZ (a three-year plan).

B. Project Status: New

C. Project Duration: July 1, 1986 to June 30, 1989 (three years)

D. Applicant: Seafood Division
Louisiana Department of Wildlife and Fisheries
P. O. Box 15570
Baton Rouge, LA 70895

E. Principal Investigator: Richard Condrey, Ph.D. (504) 388-6456
Coastal Fisheries Institute
Center for Wetland Resources
Louisiana State University
Baton Rouge, LA 70803

F. Project Objectives:

1. To determine total mortality; fishing mortality; size at recruitment to and of escapement from the traditional Louisiana fishery; and seasonal and areal patterns in catch, effort, and mortality for the red drum fishery in Louisiana's waters.

2. Develop a sensitive index of apparent stock abundance of red drum in the FCZ from analyses of the searching and harvesting patterns of the purse-seine boats and their associated spotter planes. Employ this index in estimating the apparent stock abundance of red drum in areas either immediately outside the traditional fishing grounds or in new fishing grounds as they undergo exploitation. Partition this index of apparent stock abundance into weight-age intervals and discuss the impact of the fishery on the apparent age structure of the fish in terms of spawning biomass. Apply these catch/effort analyses to the management regime implemented in the FCZ and document how they can used to assess when a quota or MSY has been reached.

G. Summary of Work to be Performed:

1. (Objective 1). The Louisiana Department of Wildlife and Fisheries proposes to cooperate with the Coastal Fisheries Institute, Louisiana State University, in conducting statistical analyses of existing and planned fishery-intercept surveys, in order to determine the impact of the traditional Louisiana fishery on its red drum resource. Analytical techniques to be used include the following items. Total mortality will be assessed by constructing a catch curve and regressing the log of the number of fish caught per hour against their age (e.g., Gulland 1983). Analysis of Covariance

(Neter et al. 1985) will be used to test for the apparent effects of seasons and areas on total morality. Fishing mortality will be estimated as the difference between the estimate(s) of total mortality derived above and the best available estimate of natural mortality (currently being 0.17 on an instantaneous annual basis). The initial number of fish fully recruited to the fishery will be determined as in Chien and Condrey (1985). Analysis of Covariance will be used to determine apparent areal differences in recruitment to the fishery. Recruitment into the spawning pool and from the traditional fishery will be estimated by two procedures. The first will involve the procedure of Chien and Condrey (1985). The second will involve a simple simulation using our estimate of total mortality and number of fish recruited to the fishery. Though the estimates derived will not be independent, they should provide a suggestion of the variation due to analytical technique. This additional step is justified given the spawner/recruit concerns which have been expressed in the states of Texas and Florida. If appropriate, Analysis of Covariance will be used to assess apparent areal differences in recruitment to the spawning population stock and escapement from the traditional Louisiana fishery.

Data to be analyzed in the first year of the project (July 1, 1986 to June 30, 1987) were obtained by intercept surveys of recreational and commercial fisheries conducted by the LDWF across the Louisiana coast in 1984 and in the Barataria Bay system in 1984 and 1985. Similar catch, effort and length-frequency data will be collected by the LDWF from intercept surveys of commercial fishermen currently being conducted coast-wide in 1986-1987, and by an LDWF enhancement of the intercept portion of the Marine Recreational Fisheries Survey to be implemented in 1987.

Results from the 1984 and 1985 surveys will be compared with those from the 1987 survey.

2. (Objective 2). The Louisiana Department of Wildlife and Fisheries proposes to cooperate with the Coastal Fisheries Institute, Louisiana State University, in conducting statistical analysis of survey and catch data as well as the results of length- and weight-at age analyses proposed by Louisiana and Alabama, in order to determine the abundance of the red drum in the FCZ which are vulnerable to the purse seine fishery and the impact of that fishery on the vulnerable population.

Techniques to be used include analyses of the searching and set records of the offshore purse-seine boats and spotter pilots which are to be collected by the proposed onboard observer and the intercept-survey programs. Though the patterns evident in the data will dictate the final model, the index of stock abundance will be developed as in Condrey (1984) and Condrey and Fuller (1986) where fishing effort (f) is considered to consist of

$$f = f' \cdot t_s$$

where f is a physical measure of the total fishing gear is use and t_s is searching time measured as the proportion of the total fishing time (t) which is available for and used in searching. We will test the initial assumption that a Holling (1959) type II curve describes the interaction between fisherman and fish,

$$t_s = t - t_h\ (C/f')$$

where t_h is the time of each set and C is the catch per set. More complex models which describe non-random search or multispecies fisheries will be developed as appropriate using classical predator-prey models as reviewed in Hassel (1978). We will document how a surplus-production model developed along these lines can be used to assess the status of the fishery.

The aerial search of the spotter pilots will be used to assess both apparent stock abundance as well as environmental parameters affecting spotter efficiency. Landing records collected by the intercept surveys will be used to verify the pilot's estimates of abundance of fish within a school as well as to partition the catch by area into an age-structured model, using results of aging analyses proposed elsewhere herein by Alabama and Louisiana.

H. Total MARFIN funds requested:

FY 1986	$ 55,000	(Percent of total = 64.7%)
Total (3 years)	$165,000	(Percent of total = 64.7%)

I. Project costs to be provided from non-MARFIN sources:

FY 1986	$ 30,000	(Percent of total = 35.3%)
Total (3 years)	$ 90,000	(Percent of total = 35.3%)

J. Total Project Costs:

FY 1986	$ 85,000
Total (3 years)	$255,000

References

Chien, Y. H. and R. E. Condrey. 1985. A modification of the Delury method for use when natural mortality is not negligible. Fisheries Research 3: 23-28.

Condrey, R. E. 1984. Density-dependent searching time: Implications in surplus-production models. Fishery Bulletin 82:449-453.

Condrey, R. E. and D. A. Fuller. 1986. A new tool for forecasting maximum sustainable yield in developing fisheries. Proceedings of the Gulf and Caribbean Fisheries Institute 38.

Gulland, J. A. 1983. Fish stock assessment: A manual of basic methods. John Wiley & Sons, New York. 223 pp.

Hassel, M. P. 1978. The dynamics of arthropod predator-prey systems. Princeton University Press. Princeton, New Jersey. 237 pp.

Holling. 1959. Some characteristics of simple types of predation and parasitism. Canadian Entomology. 91:385-398.

Neter, J., W. Wasserman, and M. H. Kutner. 1985. Applied linear statistical models. Richard D. Irwin, Inc. Homewood, Illinois. 1127 pp.

MARFIN PROJECT PROPOSAL : SA - 6

A. Project Title: Vessel and spotter pilot observers and logs

B. Project Status: New

C. Project Duration: July 1, 1986 to June 30, 1987 (one year)

D. Applicant: Dr. Richard J. Berry
Center Director
Southeast Fisheries Center
National Marine Fisheries Service
NOAA, U.S. Department of Commerce
75 Virginia Beach Drive
Miami, FL 33149

E. Principal Investigator: Mr. Wilber R. Seidel
Mississippi Laboratories
Southeast Fisheries Center
National Marine Fisheries Service
NOAA, U.S. Department of Commerce
P.O. Drawer 1207
Pascagoula, MS 39568-1207

F. Project Objective: Provide information on red drum catches and fishing tactics for the Gulf of Mexico purse-seine fleet. Additionally, provide biological catch, effort, and environmental data needed by other program participants through at-sea sampling of red drum catches and monitoring of spotter aircraft.

G. Summary of Work to be Performed:

The work is divided into three parts: vessel observers, vessel logs, and spotter pilot logs. Observers will accompany a selected portion of the purse-seine fishing trips in the Gulf of Mexico FCZ. Costs will be shared with industry. The observers will record catch, effort, location, environment and related data, as well as obtain biological information and tag fish. Logs will be placed on purse-seine vessels for the captains to record data on catch, effort, and location. Flight logs placed on spotter aircraft will be used to determine searching effort and provide an index of the distribution and abundance of red drum in state and Federal waters. Information also will be collected from commercial fishing vessels incidentally catching red drum as a non-target species. (The level of effort and final cost of this project are impossible to judge at this time. They will depend on monitoring requirements and cost sharing arrangements specified in NMFS emergency regulations and the proposed Secretary of Commerce's Fishery Management Plan for Gulf of Mexico red drum.)

H. Total MARFIN Funds Requested:

FY 1986	$60,000	(Percent of total = 54.5%)
Total (3 years)	unknown	(Percent of total = unknown)

I. Project Costs to be Provided from Non-MARFIN Sources:

FY 1986	$50,000	(Percent of total = 45.5%)
Total (3 years)	unknown	(Percent of total = unknown)

J. Total Project Costs:

FY 1986	$110,000
Total (3 years)	unknown

STOCK IDENTIFICATION TASKS

MARFIN PROJECT PROPOSAL: SI - 1

A. Project Title: Red drum tagging in Louisiana

B. Project Status: New

C. Project Duration: July 1, 1986 to October 31, 1989 (three years)

D. Applicant: Seafood Division
Louisiana Department of Wildlife and Fisheries
P. O. Box 15570
Baton Rouge, LA 70895

E. Principal Investigator: Joseph A. Shepard (504-342-9252)
Finfish Section
Louisiana Department of Wildlife and Fisheries
P. O. Box 15570
Baton Rouge, LA 70895

F. Project Objective:

To mark and release red drum in Louisiana's estuaries and provide information needed to assess estuarine escapement and offshore migration patterns.

G. Summary of Work to be Performed:

Juvenile red drum captured in inshore waters will be marked with internal anchor tags and released. Tag numbers, location released and total length of individual fish will be recorded. All tagging information will be forwarded to the SEAMAP Subcommittee for inclusion in the SEAMAP data repository. The tagging effort will take place from June 1 to October 31 when red drum are most available for capture. Fourteen personnel of the Finfish Section of the Department of Wildlife and Fisheries stationed throughout the coast of Louisiana will spend five days a month for the five months of the project tagging red drum. In all, 350 man days will be allocated to tagging. Posters depicting a tagged red drum will be distributed in locations where the fish are taken. The Department will participate in the SEAMAP public awareness program and in collecting information on recaptured fish.

H. Total MARFIN funds requested:

FY 1986	$ 25,000	(Percent of total = 71.4%)
Total (3 years)	$ 75,000	(Percent of total = 71.4%)

I. Project costs to be provided from non-MARFIN sources:

FY 1986	$ 10,000	(Percent of total = 28.6%)
Total (3 years)	$ 30,000	(Percent of total = 28.6%)

J. Total Project Costs:

FY 1986	$ 35,000
Total (3 years)	$105,000

A. PROJECT TITLE: Restriction Endonuclease Analysis of Mitochondrial DNA (mt DNA) in Red Drum, Sciaenops ocellatus, from the Gulf of Mexico: Determination of Major Breeding Stock(s)

B. PROJECT STATUS: New

C. DURATION: July 1, 1986 to August 31, 1989

D. APPLICANT:

Gary M. Matlock, Ph.D.
Chief, Coastal Fisheries
Texas Parks and Wildlife Department
4200 Smith School Road
Austin, TX 78744

E. PRINCIPAL INVESTIGATORS:

Frank M. Fisher, Ph. D. and
William R. Wilder
Wetland Studies Program
Weiss School of Natural Science
Department of Biology
P.O. Box 1892
Rice University
Houston, TX 77251

F. PROJECT OBJECTIVES: (1) Determination of genetic stock(s) or reproductively isolated subpopulations of red drum in the Gulf of Mexico and associated coastal waters. (2) Compilation of the stock parameter data to facilitate incorporation into a concise, scientifically appropriate management plan. (3) Development of red drum-specific radiolabeled DNA-hybridization probes; to simplify future studies and make them available to non-biochemical genetics laboratories.

G. SUMMARY OF WORK TO BE PERFORMED:

The project will be designed in two parts: (1) determination of optimal experimental conditions and methods; and (2) the processing of numerous samples for the establishment of a usable data base. The restriction endonucleases used in this study will be selected from the commercially available choices, with the desirability being based on fragment production as well as relative expense.

The data generated in the initial phases of this work will provide a detailed protocol for future mt Dna studies of red drum. The data will also be included in the total data base where possible. In order to conserve those specimens which represent geographical locations that are difficult to sample, initial experimentation will focus on approximately 20 to 30 fish from Texas' bays, which are most easily obtained by this lab. These fish also represent the same locations sampled in the electrophoresis study recently

completed by Wilder (1986, in preparation), and as such, provide direct comparisons of the mt DNA data with extant data for purposes of verification and interpretation.

Following compilation of data and interpretation of results from the initial study, recommendations for future experimentation and stock management will be made.

The experimental conditions and methods phase is expected to be completed approximately six months after implementation. During the subsequent phase, a large number of specimens of red drum from other coastal areas in the Gulf, and from the FCZ, will be requested of other participants in the cooperative State-Federal red drum research program, to build the data base.

H. TOTAL MARFIN FUNDS REQUESTED:

FY1986	$ 80,000	(Percent of total= %)
Total (three years)	$200,000	(Percent of total= %)

I. PROJECT COSTS TO BE PROVIDED FROM NON-MARFIN SOURCES:

FY1986	$ 30,000	(Percent of total= %)
Total (three years)	$ 90,000	(Percent of total= %)

I. TOTAL PROJECT COSTS:

FY1986	$110,000
Total (three years)	$290,000

MARFIN PROJECT PROPOSAL: SI - 3

A. PROJECT TITLE: Studies to Assess Migrations of Inshore Red Drum in the Mississippi Sound

B. PROJECT STATUS: New

C. PROJECT DURATION: July 1, 1986 to August 31, 1989

D. APPLICANT:

Dr. Richard Leard
Director, Bureau of Marine Resources
Mississippi Department of Wildlife Conservation
P.O. Drawer 959
Long Beach, MS 39560

E. PRINCIPAL INVESTIGATORS:

Frederick Deegen, Ph.D.
Chief, Division of Saltwater Fisheries
Bureau of Marine Resources
Mississippi Department of Wildlife Conservation
P.O. Drawer 959
Long Beach, MS 39560

Thomas McIlwain, Ph.D.
Director, Fisheries Research
Gulf Coast Research Laboratory
East Beach Drive
Ocean Springs, MS 39564

F. PROJECT OBJECTIVE: To determine the migration patterns of large inshore red drum and contribute information on their recruitment to the offshore fishery

G. SUMMARY OF WORK TO BE PERFORMED:

Adult red drum will be tagged monthly in the Mississippi Sound during tagging trips, beginning in August 1986. Fish will be tagged with internal anchor tags each operating day, utilizing a special tagging knife developed by the NMFS Panama City Laboratory, for a target of 4,000 to 5,000 fish per year. Tagging will continue until August 31, 1989. Tagging will take place aboard commercial purse seine vessels, with the following information recorded: location of catch, total length, release point, and tag number. Posters publicizing the tagging program and soliciting the return of tags will be developed and distributed. Tag returns will be recorded, along with catch location and size of fish. This information will be utilized to determine migration patterns and growth rates. In concert with catch data of non-tagged red drum, the information will also yield estimates of total stock size.

H. TOTAL MARFIN FUNDS REQUESTED:

FY1986	$ 25,000	(Percent of total= 50%)
Total (three years)	$ 75,000	(Percent of total= 50%)

I. PROJECT COSTS TO BE PROVIDED FROM NON-MARFIN SOURCES:

FY1986	$ 25,000	(Percent of total= 50%)
Total (three years)	$ 75,000	(percent of total= 50%)

J. TOTAL PROJECT COSTS:

FY1986	$ 50,000
Total (three years)	$150,000

MARFIN PROJECT PROPOSAL: SI- 4

A. PROJECT TITLE: Tag/Recapture of Known-Age Young Red Drum Released into the Northern Gulf of Mexico

B. PROJECT STATUS: New

C. PROJECT DURATION: July 1, 1986 to August 31, 1989 (three years)

D. APPLICANT:

Alabama Department of Conservation
and Natural Resources
Marine Resources Division
P.O. Drawer 458
Gulf Shores, AL 36542

E. PRINCIPAL INVESTIGATOR:

Walter M. Tatum
Chief Marine Biologist
Alabama Department of Conservation
and Natural Resources
P. O. Drawer 458
Gulf Shores, AL 36542

F. PROJECT OBJECTIVES:

To provide informatuon on the movements of juvenile red drum within the nearshore and inshore areas of the northern Gulf of Mexico which may be used to assess the extent of interestuarine mixing, recruitment to the offshore commercial fishery, and validation and verification of age and growth rates through the release of known-age, hatchery-raised juvenile red drum. Information expected to result includes movement of sexually immature red drum; time of recruitment into the FCZ; movements of the offshore stock(s); crude estimates of fishing mortality; and crude estimates of inshore and offshore harvest by user group.

G. SUMMARY OF WORK TO BE PERFORMED:

Twenty to forty thousand 4-6" juvenile red drum will be produced each year at the Marine Resource Division's Claude Peteet Mariculture Center in Gulf Shores, AL, tagged with appropriate tags and released into selected estuaries in the northern Gulf of Mexico (Alabama, Mississippi and Louisiana). Personnel will spawn adult red drum, grow them out to the appropriate size ensuring maximum survival, and, assisted by personnel of the Mississippi-Alabama Sea Grant Marine Advisory Service, will tag all fish prior to release. Information recorded will include tag number, size of fish, date and location of release and other pertinent information.

The following hatchery techniques will be used:
Larval red drum obtained from induced spawning of offshore

stocks will be retained in the hatchery at the Peteet Mariculture Center until functional gut and feeding are observed. Post-larvae will then be transferred to 10-0.11 hectare grow-out ponds at a stocking density of 110,000 red drum/ha. Prior to stocking ponds with red drum, the ponds will be fertilized with both inorganic and organic fertilizers to insure adequate zooplankton forage for the stocked post-larvae. A 40% protein commercial feed will be fed to the red drum at a rate of 20% body weight/day initially, then lowered to 10% body weight/day as the fish grow and biomass increases. Feeding rates will be adjusted weekly, based on seine samples and growth determinatio. After approximately 110-120 days of culture, the ponds will be harvested and the fish brought into vats at the Center for tagging and transportation to release sites along the northern Gulf.

H. TOTAL MARFIN FUNDS REQUESTED:

FY1986	$ 35,000	(Percent of total = 75%)
Total (three years)	$105,000	(Percent of total = 75%)

I. PROJECT COSTS TO BE PROVIDED FROM NON-MARFIN SOURCES:

FY1986	$ 11,500	(Percent of total = 25 %)
Total (three years)	$ 34,500	(Percent of total = 25 %)

J. TOTAL PROJECT COSTS:

FY1986	$ 46,500
Total (three years)	$139,500

MARFIN PROJECT PROPOSAL : SI - 5

A. Project Title: Tag/Recapture Program in Inshore Waters of Pensacola Bay and Apalachicola Bay in Northwest Florida

B: Project Status: New

C. Project Duration: July 1, 1986 to June 30, 1989 (three years)

D. Applicant: Florida Department of Natural Resources
Bureau of Marine Research
100 Eighth Avenue S.E.
St. Petersburg, FL 33701-5095

E. Principal Investigators: Michael D. Murphy
Ronald G. Taylor
Florida Department of Natural Resources
Bureau of Marine Research
100 Eighth Avenue S.E.
St. Petersburg, FL 33701-5095

F: Project Objective: To determine offshore emigration rates of subadult red drum in northwest Florida to the offshore stocks in the northern Gulf of Mexico. Information on exploitation rates, growth, and inshore movement patterns will also be collected.

G: Summary of Work to be Performed:

The Florida Department of Natural Resources will tag up to 300 fish in each bay (Pensacola Bay and Apalachicola Bay) with internal anchor tags. Fish will be captured, measured for fork length, tagged, their condition assessed, and released. The date and location of release will be recorded. Rewards of $5.00 will be given for each tag returned. Recapture data will give estimates of exploitation rates within the bays and the contribution of inshore subadult stocks to offshore adult stocks of red drum in the northern Gulf of Mexico. Annual reports summarizing exploitation, movements, and growth will be provided within six (6) months of each annual phase of this project.

H. Total MARFIN funds requested:

FY 1986	$25,000	(percent of total = 80)
Total (3 years)	$75,000	(percent of total = 80)

I. Project costs to be provided from non-MARFIN sources:

FY 1986	$ 6,250	(percent of total = 20)
Total (3 years)	$18,750	(percent of total = 20)

J. Total Project Costs:

FY 1986	$31,250
Total (3 years)	$93,750

AGE AND GROWTH TASKS

MARFIN PROJECT PROPOSAL: AG - 1

A. PROJECT TITLE: Age Structure and Growth Rates of Red Drum Landed in Alabama

B. PROJECT STATUS: New

C. PROJECT DURATION: July 1, 1986 to August 31, 1989 (three years)

D. APPLICANT:

Alabama Department of Conservation
and Natural Resources
Marine Resources Division
P.O. Drawer 458
Gulf Shores, AL 36542

E. PRINCIPAL INVESTIGATOR:

Walter M. Tatum
Chief Marine Biologist
Marine Resources Division
Alabama Department of Conservation
and Natural Resources
P.O. Drawer 458
Gulf Shores, AL 36542

F. PROJECT OBJECTIVES:

To improve on the life history and related information for red drum, including age verification, age and length information, age and size of recruitment into the offshore fishery, age and size at sexual maturity, and the dynamics of age classes in the FCZ in association with offshore exploitation

G. SUMMARY OF WORK TO BE PERFORMED:

Scale and otolith samples will be taken both from the offshore purse seine fishery and the near and inshore recreational fishery. Comparison will be made of the two age-determination techniques and the most reliable method selected for intensive study. Additionally, a statistically valid number of red drum from both the near and inshore recreational fishery and the offshore purse seine fishery will be aged to determine any changes taking place in the age composition of the catch from the two fisheries. Information to be collected in conjunction with these activities includes length, sex, and weight; the work will be performed in cooperation with personnel at Auburn University and Mississippi-Alabama Sea Grant Advisory Service.

H. TOTAL MARFIN FUNDS REQUESTED:

FY1986	$ 30,000	(Percent of total = 75%)
Total (three years)	$ 90,000	(Percent of total = 75%)

I. PROJECT COSTS TO BE PROVIDED FROM NON-MARFIN SOURCES:

FY1986	$ 10,000	(Percent of total = 25%)
Total (three years)	$ 30,000	(Percent of total = 25%)

J. TOTAL PROJECT COSTS:

FY1986	$ 40,000
Total (three years)	$120,000

MARFIN PROJECT PROPOSAL: AG - 2

A. Project Title: Age structure and growth rates of Red Drum landed in Louisiana

B. Project Status: New

C. Project Duration: July 1, 1986 to June 30, 1989 (three years)

D. Applicant: Seafood Division
Louisiana Department of Wildlife and Fisheries
P. O. Box 15570
Baton Rouge, LA 70895

E. Principal Investigator: Charles A. Wilson, Ph.D. (504) 388-6283
Coastal Fisheries Institute
Center for Wetland Resources
Louisiana State University
Baton Rouge, LA 70803

F. Project Objectives:

To validate annulus formation in the saggittal otoliths of red drum landed in Louisiana; to estimate age structure and growth rates of the various sample groups.

G. Summary of Work to be Performed:

Samples of inshore red drum will be provided by Louisiana Department of Wildlife and Fisheries during their tagging program under MARFIN. Samples (heads or otoliths) of offshore red drum (with accompanying information on length, weight, and sex) will be provided by the MARFIN dockside sampling program and the state-federal sampling program at the Coastal Fisheries Institute to the Principal Investigator. The Principal Investigator will see that the otoliths are removed, weighed, and sectioned for microscopic examination. Annulus formation will be validated using marginal increment analysis. (Validation of annulus formation using tetracycline injection has been in progress for one year at Coastal Fisheries Institute's Age and Growth Laboratory).

The resultant age estimates will be used to determine age structure of inshore and offshore fish population and to derive a growth curve of these groups of fishes.

H. Total MARFIN funds requested:

FY 1986	$ 30,000	(Percent of total = 79.0%)
Total (3 years)	$ 90,000	(Percent of total = 79.0%)

I. Project costs to be provided from non-MARFIN sources:

FY 1886	$ 8,000	(Percent of total = 21.0%)
Total (3 years)	$ 24,000	(Percent of total = 21.0%)

J. Total Project Costs:

FY 1986	$ 38,000
Total (3 years)	$114,000

MARFIN PROJECT PROPOSAL : AG - 3

A. PROJECT TITLE: Age Validation of Subadult and Adult Red Drum in Florida

B. PROJECT STATUS: New

C. PROJECT DURATION: July 1, 1986 to August 31, 1989 (three years)

D. APPLICANT:

Florida Department of Natural Resources
Bureau of Marine Research
100 Eighth Avenue, S.E.
St. Petersburg, FL 33701-5095

E. PRINCIPAL INVESTIGATOR:

Michael D. Murphy
Florida Department of Natural Resources
Bureau of Marine Research
100 Eighth Avenue, S.E.
St. Petersburg, FL 33701-5095

F. PROJECT OBJECTIVES: To determine and validate age of red drum older than four years in Florida, and validate the use of tetracycline injection for this purpose

G. SUMMARY OF WORK TO BE PERFORMED:

Fish will be obtained from Indian River Lagoon, Florida, which, although this area is on the Atlantic rather than the Gulf Coast, is suitable for collection because of the existing group of large fish. From 10 to 50 fish weighing more than 10 lb each will be tagged with internal anchor tags and injected with tetracycline dye and subsequently held in outdoor ponds for the duration of the study. The fish will be sacrificed incrementally during the study, with otolith sections examined for fluorescing bands resulting from the dye.

H. TOTAL MARFIN FUNDS REQUESTED:

FY1986	$ 3,000	(Percent of total= 100%)
Total (three years)	$ 3,600	(Percent of total =100%)

I. PROJECT COSTS TO BE PROVIDED FROM MARFIN SOURCES:

FY1986	$ Unknown
Total (three years)	$ Unknown

J. TOTAL PROJECT COSTS:

FY1986	$ 3,000
Total (three years)	$ Unknown

FISHERY-INDEPENDENT STOCK ASSESSMENT TASKS

A. Project Title: Aircraft Sampling Survey Pilot Study.

B. Project Status: New

C. Project Duration: 1 July 1986 to 30 June 1987

D. Applicant: Dr. Richard J. Berry
Director
Southeast Fisheries Center
National Marine Fisheries Service
75 Virginia Beach Drive
Miami, FL 33149

E. Principal Investigator: Dr. Walter R. Nelson
Director
Miami Laboratory, SEFC
75 Virginia Beach Drive
Miami, FL 33149

F. Project Objective: To determine the feasibility of applying aircraft sampling survey techniques for estimating the spawning stock size of red drum in nearshore and FCZ waters. There are multiple objectives for applying the technique including development of absolute abundance estimates and development of an index of abundance potentially useful as a time-series, fishery-independent tool for monitoring the trend of this component and tuning fishery-dependent analyses under varying fishing regimes. The specific objective of the pilot study is to determine the design parameters for absolute abundance estimation, provide a conservative estimate of red drum spawning stock abundance, and to evaluate the statistical power of determining trends in abundance of the red drum spawning stock biomass using aerial, photogrammetric, and sea-truth sampling.

G. Summary of Work to be Completed:Pilot study sampling would begin in July, the month of peak commercial landings in 1985, and continue monthly through December. The appropriate model for this type of sampling has been described by Scott et al (1985) where the abundance of silver mullet in the Florida Bay was estimated using a sampling regime that included aerial line transect, aerial photogrammetric, and shipboard sea-truth sampling. In the Pilot Study, however, controlled effort sampling will be limited to aerial line transect and photogrammetric efforts. Data obtained from spotter-plane observer data and concordant purse-seine catch data will be evaluated for their utility in estimating unbiased average biomass per unit school. As per Scott et al. (1985) an appropriate index of abundance may be

the estimated area of surface schools. However, this needs investigation.

The data requirements for absolute abundance estimation are more intensive than that for indexing. At a minimum, estimates of the number (and/or area) of schools, the biomass per unit school (i.e. per unit area of school), and of the absolute efficacy of the sampling technique (i.e. the joint probability of a school being sampled and being at or near the surface to be sampled) are required for absolute abundance estimates. Estimates of the variables for absolute abundance might be obtained from examination of data obtained from spotter pilot logs and purse-seine catch. During the pilot study we shall evaluate the utility of the commercial data for use in estimation. For the pilot study we shall require utilization of spotter pilots for observations, use of a representative effort design (e.g. systematic with random start), records of right angle distance to sightings, photogrammetric records of the target schools, the number and size of schools sighted by species (or lowest taxonomic level), the estimated biomass of red drum per school, and a minimum of 30 target school observations per survey flight. The expected result from this study will be a statistical power analysis of the technique for trend detection, design parameters for sampling surveys for future efforts, and conservative estimates of spawning stock biomass.

Personnel from the Miami (G Scott) and Pascagoula Laboratories will be involved in the design, analysis and evaluation of the pilot survey results. The project is a pilot study and, as such, shall require only 1 year to complete. Follow-on work and implementation of an intensified sampling program will be based on the results of the pilot study.

H. Total MARFIN funds requested:

FY 1986	$ 40,000	(Percent of total = 73.9%)
Total (1 year)	$ 40,000	(Percent of total = 73.9%)

I. Project costs to be provided from non-MARFIN sources:

FY 1986	$ 14,100	(Percent of total = 26.1%)
Total (1 year)	$ 14,100	(Percent of total = 26.1%)

J. Total Project Costs:

FY 1986	$ 54,100
Total (1 year)	$ 54,100

MARFIN PROJECT PROPOSAL: FI - 2

A. PROJECT TITLE: Assessing the Stock Abundance of Nearshore Red Drum

B. PROJECT STATUS: New

C. PROJECT DURATION: July 1, 1986 to June 31, 1989 (three years)

D. APPLICANT:

Dr. Richard L. Leard
Director, Bureau of Marine Resources
Mississippi Department of Wildlife Conservation
P.O. Box 959
Long Beach, MS 39560

E. PRINCIPAL INVESTIGATOR:

Thomas McIlwain, Ph.D.
Director, Fisheries Research
Gulf Coast Research Lab
East Beach Drive
Ocean Springs, MS 39564

F. PROJECT OBJECTIVE: To determine the abundance and distribution of various life stages of red drum in Mississippi nearshore waters and contribute information on stock assessment of red drum in the Gulf of Mexico.

G. SUMMARY OF WORK TO BE PERFORMED:

An intense inshore sampling program will be carried out in Mississippi coastal waters directed specifically at red drum. Stations will be located from east to west across the Mississippi Coast, from the north shore of the barrier islands northward across the Mississippi Sound into the bays and bayous and freshwater streams feeding into these areas. A variety of gear types will be employed to sample for various life history stages: small-mesh beam trawls and seines will be employed to sample for alte larval stages and juveniles; variable mesh gill nets will be employed to capture subadults. Subadults will be tagged on an opportunistic bases with internal anchor tags, with the following information recorded: location of catch, total length, release point and tag number. Publicity and rewards will be managed for tagged fish in conjunction with other MARFIN-funded tagging in Mississippi. This intensive sampling and tagging program will complement an ongoing routine fishery monitoring and assessment program.

H. TOTAL MARFIN FUNDS REQUESTED:

FY1986	$ 20,000	(Percent of total = 50 %)
Total (three years)	$ 60,000	(Percent of total = 50 %)

I. PROJECT COSTS TO BE PROVIDED FROM NON-MARFIN SOURCES:

FY1986	$ 20,000	(Percent of total = 50 %)
Total (three years)	$ 60,000	(Percent of total = 50 %)

J. TOTAL PROJECT COSTS:

FY1986	$ 40,000
Total (three years)	$120,000

PROJECT COORDINATION TASKS

MARFIN PROJECT PROPOSAL: PC - 1

A. PROJECT TITLE: Coordinating, Planning and Progress-Reporting Activities of the Cooperative State-Federal Research Plan for Red Drum in the Gulf of Mexico

B. PROJECT STATUS: New

C. PROJECT DURATION: July 1, 1986 to August 31, 1989

D. APPLICANT:
Mr. Larry B. Simpson
Executive Director,
Gulf States Marine Fisheries Commission
P.O. Box 726
Ocean Springs, MS 39564

E. PRINCIPAL INVESTIGATOR:
Ms. Nikki Bane
SEAMAP-Gulf Coordinator
Gulf States Marine Fisheries Commission
P.O. Box 726
Ocean Springs, MS 39564

F. PROJECT OBJECTIVES: (1) To coordinate and facilitate planning of cooperative program activities concerning red drum research and enable evaluation of the program's status and progress through the Gulf States Marine Fisheries Commission's SEAMAP Red Drum Work Group; and (2) To prepare and distribute information on the program's progress and findings to all interested persons and organizations.

G. SUMMARY OF WORK TO BE PERFORMED:

(1) Program planning. The SEAMAP Red Drum Work Group will meet in the fall and spring of each year to review progress and activities of all cooperative program participants, evaluate techniques and preliminary findings, and recommend any program or project modifications needed to satisfy project objectives. Meetings coordination will be through the GSMFC staff.

(2) Progress reporting. The GSMFC, through the SEAMAP Program, will publish monthly updates of program/project activities and events, beginning one month after program implementation, for distribution to participants and others interested in red drum research and management. The major reporting of program/project findings will be through semiannual program progress reports, detailing individual project objectives, techniques and geographic areas; summarizing results; recommending project modifications and improvements; and reviewing planning and evaluation activities of the Red Drum Work Group. These semiannual reports will be distributed in December and June each year to participants and others interested in the program.

H. TOTAL MARFIN FUNDS REQUESTED:

FY1986	$ 7,000	(Percent of total= 44.0 %)
Total (three years)	$21,000	(Percent of total= 44.0 %)

I. PROJECT COSTS TO BE PROVIDED FROM NON-MARFIN SOURCES:

FY1986	$ 8,910	(Percent of total= 56.0%)
Total (three years)	$26,730	(Percent of total= 56.0%)

I. TOTAL PROJECT COSTS:

FY1986	$15,910
Total (three years)	$47,730

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