MARINE FISHERIES INITIATIVE[1]

Gulf of Mexico Phase

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Dedicated in Memory of

Dr. Theodore B. Ford

whose continued efforts to promote State-Federal cooperation and work helped make this document possible and its implementation more of a reality.

PREFACE

In the summer of 1983 a discussion paper entitled "Research Needs for Information Leading to Full and Wise Use of Fishery Resources in the Gulf of Mexico" was distributed. The paper proposed an additional investment in fisheries research in the Gulf of Mexico to increase the economic contribution of underutilized and unutilized species, developing more valuable products from existing fisheries, developing export markets, forecasting variation in yields and conserving and maintaining presently exploited resources.

The Gulf States Marine Fisheries Commission submitted and was awarded a contract with the Gulf and South Atlantic Fisheries Development Foundation, Inc. to develop a plan for implementation and funding of the research required to achieve optimum contribution from marine fishery resources.

In order to obtain the broadest base of input an industry-federal-state-academic Task Force was organized. Their resultant efforts are contained within this document. Credit for writing the contents of this document has not been assigned to individuals. Each member of the Task Force contributed in the area of his expertise and in discussions that resulted in changes of draft materials.

This document would not have been possible without their input.

We thank Mr. Ken Varden, Art Director, Louisiana Sea Grant, for designing our cover layout and wish to extend a special thank you to Lucia B. O'Toole for her able help with the Task Force meetings, minutes, typing, corrections to the document, and distribution of correspondence.

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LIST OF ACRONYMS/ABBREVIATIONS

CPUE	Catch Per Unit of Effort
EIS	Environmental Impact Statement
FCZ	Fisheries Conservation Zone
fm	Fathoms
FMP	Fishery Management Plan
GASAFDFI	Gulf and South Atlantic Fisheries Development Foundation, Inc.
GMFMC	Gulf of Mexico Fishery Management Council
GS/FFMB	Gulf State/Federal Fisheries Management Board
GSMFC	Gulf States Marine Fisheries Commission
ICCAT	International Commission for the Conservation of Atlantic Tunas
K	Thousands
KK	Millions
m	Meters
MARFIN	Marine Fisheries Initiative
MFCMA	Magnuson Fisheries Conservation and Management Act
MSY	Maximum Sustainable Yield
mt	Metric Tons
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
OSY	Optimum Sustainable Yield
OY	Optimum Yield
PL	Public Law
PMP	Preliminary Fisheries Management Plan
RFP	Request for Proposals
SEAMAP	Southeastern Area Monitoring and Assessment Program
SEFC	Southeast Fisheries Center
SERO	Southeast Regional Office
SPERT	Simplified Program Evaluation and Review Technique
sp/spp	Species
VTW	Vessel-ton-week

SECTION 1. EXECUTIVE SUMMARY

1.1 Purpose

The purpose of this document is to identify fisheries research needs and budget requirements to support research that will provide information for full and wise use and enhancement of fishery resources in the Gulf of Mexico.

The demand for fishery products is strong nationwide and will, in all likelihood, continue to increase. In 1983 the value of imported fishery products less exports exceeded total domestic production, contributing $4 billion (8%) to the national trade deficit. The U.S. demand for fishery products has increased about 2½ percent per year since 1960. Without increased domestic production, increased demand will be satisfied only by additional imports and increased trade deficits. Conservatively, if demand continues at this rate, by 1990 the annual supply of fishery products will have to increase by over 2.2 billion pounds. For U.S. producers to displace most of the imports and meet the increased level of demand, the domestic catch must at least double by 1990.

A principal factor preventing increased use of fishery resources in the Gulf of Mexico is lack of information on available fishery stocks, harvest methods, processing, and marketing methodologies. The Gulf of Mexico in 1983 accounted for 37 percent of the volume and 26 percent of the value of all U.S. commercial landings. In 1980 37 percent of all marine recreational fish landings and 33 percent of the value of the U.S. recreational fishery came from the Gulf of Mexico. In 1982, only about 14 percent of the total Federal budget for fisheries research and development was allocated to the Gulf of Mexico. It is apparent that this allocation is not proportional to landings, value, potential, or information needs for the region.

Historically, commercial Gulf fisheries have concentrated on the harvest of shrimp, menhaden, groundfish, crabs, oysters, and other traditionally exploited species. The focus on the two major species, shrimp and menhaden, resulted in little emphasis in the past to develop additional fisheries. Therefore, there are a number of potential fishery resources in the Gulf which, if fully developed in a wise manner, can contribute substantially to increased landings and value. For example, it is estimated that the coastal herring resources of the Gulf could contribute an additional 2.2 billion pounds to U.S. landings annually. Menhaden, which is currently processed into fish meal and oil, could be used for the production of surimi for direct human consumption, thus greatly increasing the value of that fishery to the nation. There are other resources such as squid and sharks which, if fully developed in a wise manner, could also help to meet future needs. In addition to the need to develop new fisheries, there is also a need to investigate ways to sustain our existing fisheries at current production levels and to meet the increased competition from imports. For example, mariculture of shrimp in Central and South America and in India will have a tremendous impact on the price structure of the Gulf shrimp fishery if their projection of 250 million pounds of production is realized by 1990. Increased fishery production could provide an estimated 103,000 new jobs in U.S. fishery industries.

The common property nature of open-access fisheries does not permit small, owner-operated firms to accumulate sufficient capital to invest substantially in research. It is in the best interest of the nation to maintain and increase employment, and to prevent increases in and to reduce the national trade deficit. Investment of public funds in the acquisition of additional fishery information needed to maintain and expand

existing fisheries and to establish new fisheries could meet increasing demands for fishery products, reduce existing needs for imported fishery products, and increase export of fishery products. Increased production would provide substantial increases in employment opportunities.

Underutilized resources and expanded fisheries could provide a basis for continued growth and stability of Gulf commercial and recreational fisheries, and at the same time provide fishing alternatives to vessels and personnel in marginal and economically stressed fisheries. The growth potential of Gulf commercial fisheries is estimated to be in excess of 2.5 billion pounds (Table 1.1) with an exvessel value of over $831 million. This growth could add roughly $7.7 billion to the national economy bringing the total commercial production of Gulf fisheries to over $13.4 billion annually (direct and indirect economic impacts). The impact of this growth on employment would be to increase man years of employment from over 142,000 to over 230,000. The effect of better information on recreational fisheries is more difficult to estimate, but assuming a growth roughly proportional to catch (17 percent); the total economic impact increase would be about $374 million including about 15,000 new jobs (man years). The current economic value of commercial and recreational fisheries both direct and indirect of $7.9 billion will thus increase to $16.0 billion and the employment level increase from the current 200,000 jobs to approximately 300,000 (this assumes the number of current jobs related to recreational fisheries, direct and indirect, is about 63,000 man years and these would increase to 78,000).

Table 1.1 Summary of landings, direct and indirect economic value, and direct and indirect employment from Gulf of Mexico fisheries, current and potential

	Current*			Potential*		
Fishery	Landings (million lbs)	Value (billion $)	Jobs (thousand man years)	Landings (million lbs)	Value (billion $)	Jobs (thousand man years)
Commercial	2443	5.7	143	4983	13.4	231
Recreational	134	2.2	62	154	2.6	73
Total	2577	7.9	205	5137	16.0	304

*Does not include contributions from mariculture

1.2 Program Development

The Marine Fisheries Initiative (MARFIN) was developed by a task force which included existing Gulf of Mexico fishery research and management organizations. The Lott/McIlwain discussion paper, "Research Needs for Information Leading to Full and Wise Use of Fisheries Resources in the Gulf of Mexico" served as the basic document for program development.

The following list of research units, with over 200 species included, was developed to be compatible with Gulf of Mexico Fishery Management Council's (GMFMC) management units. The list served as a basis for determining current status of information and the needed additional information to accomplish program objectives.

- Shrimp
- Menhaden
- Coastal Pelagics
- Reef Fish
- Coastal Herrings
- Ocean Pelagics
- Marine Mollusks
- Crabs and Lobsters
- Bottomfish
- Estuarine Fish
- Anadromous and Catadromous Fish
- Mariculture
- Marine Mammals/Endangered Species
- Corals and Sponges

After extensive review of the literature, Task Force working groups were charged with examining the current state of knowledge, identifying data gaps, and developing new or expanded research projects required to accomplish optimum yield for each research unit. Detailed reports have been maintained by the GSMFC as a working document for future use, and include detailed information on:

- Status
- Assessment/Prediction
- Harvesting Technology
- Handling and Processing Technology
- Market Research and Development
- Business and Economic Evaluation
- Recreational Fisheries Research and Development Needs

Brief discussions of each report were included in the document and a matrix showing estimated percentage of additional information needs in each unit and species or species group was prepared.

Based on information needs identified in the foregoing reports, problem and opportunity identification and discussion forms were used to develop a Program Summary. Elements of the summary table were combined to show totals for each unit in Table 1.2. This summary shows that for an added Federal investment of roughly $7 million per year for five years, Gulf of Mexico fisheries could approach their full potential of adding $8.1 billion annually to the national economy.

1.3 Program Management

A management organization has been recommended to manage the five-year research program, as depicted in Figure 1.1 (Marine Fisheries Initiative Organization). As with any program, coordination and communications may become a limiting factor in successfully carrying out stated objectives. The recommended organization structure minimizes this potential problem by utilizing existing Gulf of Mexico fishery research and management

Table 1.2 Unit Summary of Research Program Summary

Research Unit	Costs x 1000 First Year Amount	Second Year Amount	Third Year Amount	Fourth Year Amount	Fifth Year Amount	Total
Shrimp	690	1019	699	562	372	3342
Menhaden	185	246	303	640	573	1947
Coastal Pelagics	1518	1030	776	535	490	4349
Reef Fish	100	75	50	360	350	935
Coastal Herrings	831	736	930	1277	1119	4893
Ocean Pelagics	688	596	509	328	327	2448
Marine Mollusks	430	535	510	325	285	2085
Crabs and Lobsters	235	150	150	350	400	1285
Bottomfish	1073	985	957	766	761	4542
Estuarine Fish	543	498	380	334	325	2080
Anadromous and Catadromous	321	229	189	-	-	739
Mariculture	630	1380	2380	570	570	5530
Marine Mammals/ Endangered Species	-	-	-	-	-	-
Corals and Sponges	67	67	37	37	37	245
General	1050	1050	1050	1390	1390	5930
Totals	8361	8596	8920	7474	6999	40350

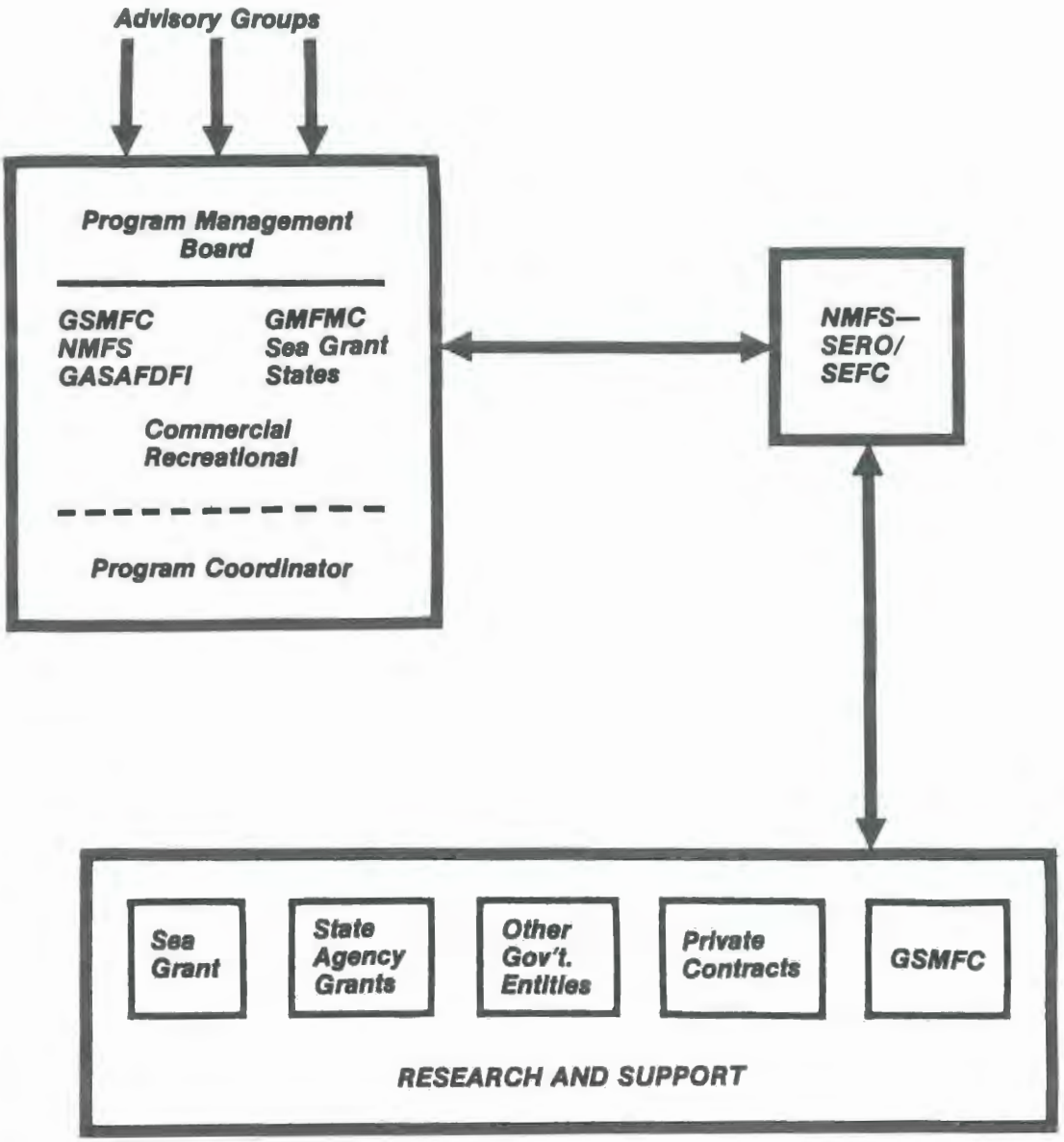

Figure 1.1 Marine Fisheries Initiative Organization

organizations already accustomed to coordination of fishery issues and programs. Thus, a built-in coordination and communications network is assured.

The National Marine Fisheries Service (NMFS), through the Southeast Regional Office (SERO), will be responsible for administering the program, with reliance primarily upon a Program Management Board for guidance on program development and on the selection of appropriate grant and contract recipients. The Program Management Board will be comprised of 8 members, one representative from each of (1) the Gulf States Marine Fisheries Commission, (2) the Gulf and South Atlantic Fisheries Development Foundation, (3) the Gulf of Mexico Fishery Management Council, and (4) the National Marine Fisheries Service. Additionally, each of the four groups of (1) five Gulf states, (2) four Sea Grant programs, (3) the recreational fishery organizations, and (4) the commercial fishery organizations will select a representative to serve on the Board. The Board will utilize ad-hoc advisory groups to provide broader representation to their deliberations. A program coordinator will be retained, together with appropriate clerical support, to assist the Board in the conduct of its business. Individual members will serve staggered 3-year terms, to provide program continuity. The Board will elect a chairman to serve for a period of two years.

The location of the Program Management Board Program Coordinator's office will be determined after the Board begins functioning. It is assumed, however, this office will be located either in the office of the GSMFC or SERO to capitalize on available facility and administrative support capabilities. The flow of funds for initiation and continuation of this program will be from the U.S. Congress through the Department of Commerce, NOAA, NMFS, SERO, and then to program participants.

1.4 Program Implementation and Operation

Plan implementation will begin after the appropriate organizations have approved the document and funds have been made available. The plan will be implemented and administered by the Marine Fisheries Initiative Organization, as shown in Figure 1.1 per authority by NMFS. The initial organizational meeting will project and establish a detailed schedule for full operational continuity and establish working groups to enhance timely goal accomplishments.

In essence, the program process flow will consist of the following sequences of steps:

1. The Program Management Board will recommend to NMFS priorities for research projects (in consort with the several commercial and recreational marine fisheries advisory groups).
2. NMFS will develop Requests for Proposals (RFP's) based on these priorities and submit them to potential research recipients.
3. Proposal response will be reviewed by NMFS-SERO/SEFC and technical review panels or working groups recommended by the Program Management Board.
4. Reviewed proposals will be forwarded to the Program Management Board for final recommendations.
5. The Program Management Board will submit the final recommended proposals to NMFS for action. NMFS will award the selected research contracts/grants to the designated recipients.

The Gulf States Marine Fisheries Commission, under contract to SERO, will perform general coordination functions, including setting up meetings, preparing program reports, maintaining communications networks, etc.

NMFS and the Program Management Board will monitor and evaluate the research projects. They will evaluate the effectiveness of the entire regional fisheries research systems, particularly concerning the solutions of identified problems. Funding for the MARFIN program is expected to be in addition to existing fishery funding programs now in existence.

1.5 Funding

To achieve the mission of the Gulf of Mexico MARFIN program will require an investment of an estimated $8 million per year for five years, as depicted in Table 1.2. These are new funds for the acquisition of information directly applicable to maintenance or expansion of existing fisheries and orderly development of new fisheries.

Based on current capabilities and historic roles, project funding may result in a 20-25% share going to each of the four major participating groups (the states, Sea Grant, NMFS, industry) with 5-10% going to various administrative costs, including contracts for administration. The actual distribution of funds will, of course, depend upon year-to-year research and development objectives and the merit of specific project proposals in relationship to those objectives. The participants, as members of the Board, will be primary determinants of the Board's decisions and recommendation to NMFS. While the SERO will administer the funds, its project proposals will be subject to the same review and selection process as all others. The SEFC will be the primary NMFS participant in terms of its research and development role.

SECTION 2. INTRODUCTION

2.1 Purpose

The purpose of this document is to identify fisheries research needs and budget requirements to support the research that will provide information for full and wise use and enhancement of fishery resources in the Gulf of Mexico.

There is a recognized shift in the U.S. population to the Southeast region, the so called "Sun Belt", which includes the five Gulf States. The increase in population in the region will contribute to increased demands on the traditional fishery stocks sought by both recreational and commercial fishermen. Additionally, the demand for fishery products is strong nationwide and will, in all likelihood continue to increase. The U.S. demand for fishery products has increased about 2½ percent per year since 1960. Conservatively, if demand continues at this rate, by 1990 the annual supply of fishery products will have to increase by over 2.2 billion pounds. For U.S. producers to displace most of the additional imports, which contributed $4.0 billion to the national trade deficit in 1983, and meet the increased level of demand, the domestic catch must at least double by 1990.

A principal factor preventing increased use of fishery resources in the Gulf of Mexico is lack of information on available fishery stocks, harvest methods, processing, and marketing methodologies. While there are a number of factors which contribute to this lack of information, probably the primary one is that historically the Gulf was considered by many "experts" as a virtual "fishery desert." This belief no longer exists, but its effects are still apparent especially in the allocation of Federal funds for fisheries research and development. For example, in 1982, only about 14 percent of the total Federal budget for fisheries research and development was allocated to the Gulf of Mexico although the Gulf of Mexico in 1983 accounted for 37 percent of the volume and 26 percent of the value of all U.S. commercial landings and, in 1980, 37 percent of all marine recreational fish landings and 33 percent of the value of the U.S. recreational fishery. It is apparent that the Federal allocation of research funds is not proportional to landings, value, potential, or information needs for the region.

Historically, commercial Gulf fisheries have concentrated on the harvest of shrimp and menhaden and, to a lesser degree, groundfish, crabs, oysters, and other species. The focus on the two major species, shrimp and menhaden, is fortunate in that there has been little emphasis in the past to develop additional fisheries. Therefore, there are a number of potential fishery resources in the Gulf which, if fully developed in a wise manner, can contribute substantially to increased landings and value (Table 2.1). For example, it is estimated that the coastal herring resources of the Gulf could contribute an additional 2.2 billion pounds to U.S. landings annually. Menhaden, which is currently processed into fish meal and oil, could be used for the production of surimi for direct human consumption, thus greatly increasing the value of that fishery to the nation. There are other resources to be investigated, such as squid and sharks which could also help to meet future needs if fully developed in a wise manner. In addition to the need to develop new fisheries, there is also a need to investigate ways to sustain our existing fisheries at current production levels and to meet the increased competition from imports. For example, mariculture of shrimp in Central and South America and in India will have a tremendous impact on the price structure of the Gulf shrimp fishery if their projection of 250 million pounds of production is realized by 1990.

Table 2.1

Research Units - Volume/Value/Potential Yield

Research Unit	Commercial Landings[1] Volume (million lbs)	Commercial Landings[1] Value (million $)	Recreational Landings[2] Volume (million lbs)	Total Landings[3] Volume (million lbs)	Total Landings[3] Value (million $)	Potential Yield Volume (million lbs)	Potential Yield Value (million $)	Employment[5] Current (No.)	Employment[5] Potential (No.)	Capital Investment[6] Current (No.)	Capital Investment[6] Potential (No.)
Shrimp	198	417	16[4]	214	451	225	474	11,000	11,000	19	20
Menhaden[9]	2,036	82	-	2,036	82	1,211	74	1,300	1,300	8	5
Coastal Pelagics	10	6	28	38	23	35	21	300	300	1	1
Reef Fish	19	26	12	31	42	80	108	2,000	2,000	2	5
Coastal Herrings	7	1	1	8	1	2,200	314	50	8,000[7]	0	15
Ocean Pelagics	2	3	2.2	5.2	6	10	15	150	450	.4	1
Marine Mollusks	28	33	-	28	33	50	59	4,000	6,000	2	3
Crabs and Lobsters	45	29	-	45	29	72	46	1,000	1,500	1	2
Bottomfish/Estuarine Fish	97	19	75	272	36	1,100	336	900	3,000[8]	1.6	17
Mariculture	-	-	-	-	-	-	-	-			
Marine Mammals/Endangered Species	-	-	-	-	-	-	-	-			
Corals and Sponges	-	-	-	-	-	-	-	-			
Anadromous and Catadromous	-	-	-	-	-	-	-	-			
Total	2,442	616	134.2	2,677.2	703	4,983	1,447	20,700	33,550	35	69

1/ Commercial landings are for 1983.

2/ Recreational landings are for 1980.

3/ Total value estimates are calculated by multiplying total landings by commercial value. This should be considered an underestimate of true total value.

4/ Estimate from Fishery Management Plan for the Shrimp Fishery of the Gulf of Mexico, United States waters, November 1981.

5/ Man years of employment. (Total impact, direct and indirect, estimated as 142,854 man years.)

6/ Estimated annual expenditures on capital equipment (commercial) millions.

7/ Based on projections on use of coastal pelagics and bottomfish.

8/ Based on projections on use of bottomfish for surimi and canning bottomfish and estuarine fish combined.

9/ Menhaden have been an expanding fishery and the estimate of the potential yield may be low as a result. Furthermore, yearly catch can fluctuate considerably around a long-term average value.

Underutilized resources and expanded fisheries could provide a basis for continued growth and stability of Gulf commercial and recreational fisheries, and at the same time provide fishing alternatives to vessels and personnel in marginal and economically stressed fisheries. The growth potential of Gulf commercial fisheries is estimated to be in excess of 2.5 billion pounds (Table 1.1) with an exvessel value of over $831 million. This growth could add roughly $7.7 billion to the national economy bringing the total commercial production of Gulf fisheries to over $13.4 billion annually (direct and indirect economic impacts). The impact of this growth on employment would be to increase man years of employment from over 142,000 to over 230,000. The effect of better information on recreational fisheries is more difficult to estimate, but assuming a growth roughly proportional to catch (17 percent); the total economic impact increase would be about $374 million including about 15,000 new jobs (man years). The current economic value of commercial and recreational fisheries both direct and indirect of $7.9 billion will thus increase to $16.0 billion and the employment level increase from the current 200,000 jobs to approximately 300,000 (this assumes the number of current jobs related to recreational fisheries, direct and indirect, is about 63,000 man years and these would increase to 78,000).

The common property nature of open-access fisheries does not permit small, owner-operated firms to accumulate sufficient capital to invest substantially in research. Research in this context includes a broad range of activities and is not limited to the strictest sense of research. It includes but is not limited to marketing, development activities, data collection, improved gear and design, etc. It is in the best interest of the nation to expend public funds to maintain and expand existing fisheries and to develop new fisheries to meet the increased demand for fishery products and to lower our national trade deficit. An expanded and improved data base will provide the necessary information so that solutions can be obtained for other problems such as: the protection and enhancement of fishery habitat; the need to improve access to coastal waters and fishery resources; the need to improve communication and user information.

2.2 Commercial and Recreational Considerations

The total United States commercial harvest of fishery resources in 1982 was 6.4 billion pounds with an ex-vessel value (price paid to the fishermen) of $2.4 billion. The five Gulf States produced 37 percent (2.4 billion pounds) of this volume and accounted for 26 percent ($616,000,000) of the value of these landings. Included in these landings are shrimp, the most valuable fishery in the nation and menhaden, the largest volume fishery in the nation. In 1980, the last year for which data are available, Gulf marine recreational fishermen participated in 24 million fishing trips and landed approximately 154 million fish. Twenty-eight percent of all recreational angling trips in the nation occurred in the Gulf and these anglers landed 37 percent of all fish reported by recreational anglers in 1980. Twenty-eight percent of the 24 million fishing trips were made by non-resident anglers. The value of the recreational fishery in the Gulf is estimated to be $2.2 billion. The Gulf region accounted for approximately 33 percent of the value of the recreational fishery nationwide.

The fishery resources in the Gulf of Mexico support an extensive commercial and recreational fishery. Due to increased demands for fishery products in the marketplace and an increase in individual leisure time and discretionary income, more pressure is being brought to bear on the fishery resources of the Gulf. It is important that we understand the status of the fishery resources of the Gulf of Mexico and the demands being placed on them. Following is a discussion of both the commercial and recreational fisheries in the Gulf.

2.2.1 Commercial

The traditional seafood industry in the Gulf of Mexico produces a variety of species with many of them being unique to the region. In 1983, Gulf fishermen landed 2.4 billion pounds of all fish and shellfish valued dockside at $616 million. These landings had a total impact on the national economy of roughly $5.7 billion and provided over 142,000 person years of direct and indirect employment. In 1982 the Gulf states had 862 seafood processing and wholesale plants and there were over 17,000 boats and vessels in the fishery. These harvesting platforms range from large shrimp and menhaden vessels to small inshore gill-net boats. The processing plants range from some of the world's largest shrimp processing plants to a variety of fish processors and specialized plants for oysters, blue crabs and scallops. All estimates are considered to be conservative.

A large portion of the region's fishery products satisfy markets outside the Gulf states. For example, in Florida over 80 percent of the shrimp products are sold outside the state, oyster and blue crab shipments exceed 70 percent, and at least 60 percent of all other food fish end up in non-Florida markets. Likewise, recent developments in the utilization of non-traditional species have resulted in Gulf fishery products being exported to markets in Nigeria, Egypt, West Germany, Japan, France, the Netherlands, Venezuela, Columbia, and Kuwait.

Some of the Gulf of Mexico's traditional fisheries have or will soon reach their maximum yield potentials. Furthermore, competition between commercial and recreational fisheries is increasing in some fisheries and management measures have been proposed or in some instances implemented to control or limit catches. Management measures also are being implemented and evaluated as methods to increase the economic viability of selected fisheries. For example, a cooperative closure of state and Federal waters off Texas to shrimping is being evaluated as a method to increase the value of landed shrimp by allowing them time to grow to more desirable sizes.

Some Gulf fisheries are in poor economic condition. For example, the Gulf shrimp fishery, which is the most valuable fishery in the United States, is also probably the most economically stressed fishery. In the last decade, the shrimp industry has faced the brunt of two periods of major economic recession, sharp rises in costs of operation, especially in fuel and credit, and wide fluctuations in resource availability. Despite recovery of many domestic industries from the recent recessions, business failures in the shrimp fishery are widespread and many shrimp fishing enterprises continue to face the prospect of failure. Conditions are not expected to improve; rather, they are expected to worsen due to increasing competition from imports and the projected impact of analog shrimp products.

Fortunately, the warm and productive waters of the Gulf of Mexico provide access to a large variety of non-traditional fishery resources. These underutilized resources could provide a basis for continued expansion of the Gulf seafood industries and at the same time provide fishing alternatives to vessels and personnel in marginal and economically stressed fisheries. Potential yields from these resources could exceed 2 billion pounds annually. Considerable research in a broad range of disciplines ranging from harvesting and processing technologies through fisheries science and marketing, however, will have to be done to achieve these yield potentials economically and efficiently.

Besides the use of non-traditional fishery resources to improve the economic situation of many of the Gulf fisheries, enhancement of existing fisheries through new product development could have profound economic implications. For example, the Gulf menhaden fishery, representing the largest volume fishery in the United States, produces

relatively low valued products. The use of menhaden in higher value products such as in surimi could easily double or triple the value of this fishery to regional and national economies. Additionally, if an economic means could be developed to utilize the estimated one billion pounds of bottomfish discards from the Gulf shrimp fishery, this currently unused resource could contribute substantially to the economic stability and well being of the region.

2.2.2 Recreational

Marine recreational fishing in the Gulf of Mexico has become an outdoor recreation activity of considerable significance in terms of participation, catch and expenditures. In 1980, over 24 million saltwater sportfishing trips were made in waters of the Gulf of Mexico. Of these trips, nearly 20 million were made by approximately 4 million anglers who reside in coastal states bordering the Gulf.

Marine recreational fishing in the Gulf is an activity of economic significance to the region. Not only are saltwater anglers visiting the productive waters of the region in growing numbers, but they are also spending increasing amounts of money. In 1980, fishermen averaged $17.50 per trip with 60 percent of all trip expenditures being made within 5 miles of the fishing site. According to a study conducted by the Sport Fishing Institute (1983), marine recreational fishermen spent nearly $1.3 billion in the Gulf area in 1980 on fishing tackle, boats, motors, trailers, marine services, charter and headboat trips, boat fuel, boat insurance, bait, food, lodging, transportation, and other miscellaneous items. These direct sales resulted in nearly $600 million in indirect economic impacts as money was respent throughout the region. Furthermore, direct sales stimulated nearly $53 million worth of capital investment and directly supported over 21,000 person-years of employment representing $260.6 million in wages and salaries. From a national perspective, the Gulf accounted for over 33 percent of all retail sales associated with marine recreational fishing in the United States in 1980.

Based on the available data, it is evident that saltwater sport fishing in the Gulf continues to be pursued by growing coastal populations to fulfill partially their desire for water-based recreation. Major advances in the design and manufacture of recreational boats, outboard motors, navigational equipment and sport fishing gear are certainly contributing to increased participation in saltwater sport fishing. However, to ensure the future stability and growth of marine recreational fisheries in the Gulf, a number of problems must be addressed and/or resolved.

It is imperative to improve the marine recreational fisheries data base. Much of the information needed to determine the status of fishery resources in terms of their biological productivity and sustainable yields and to assess the nature and impact of recreational fishing on these resources does not exist. This situation is hindering and, in some cases, preventing the optimum use of the Gulf's fishery resources. Data needs fall into two major categories.

The first major category is data concerning the nature and extent of saltwater sport fishing. Data on participation, catch, effort, and expenditures are essential for understanding recreational fishing. A better understanding of the motivations, preferences and fishing patterns of saltwater anglers is also needed along with geographical and seasonal fishing effort data. Further, the present understanding of the economic aspects of marine recreational fishing needs to be improved. Such data will make it possible to deal more effectively with the effects of increased sport fishing pressures on fishery resources as well as the effects of proposed regulations on stocks, fishermen, and supply/demand situations for sport fishing opportunities.

The second major category of data requirements involves biological and environmental data relative to recreationally significant fish stocks. Data on habitat requirements and the influences of environmental variables versus man-induced mortalities are essential to understanding the dynamics of marine fish populations. Further, basic biological data such as age/growth relationships and stock abundance information, as well as data on relationships between species (e.g., predation and competition), are needed.

2.3 Contractual Requirements

The contract for producing this document is between the Gulf and South Atlantic Fisheries Development Foundation, Inc. (GASAFDFI) and the Gulf States Marine Fisheries Commission (GSMFC).

The seafood industry of the Gulf and South Atlantic has been beset by changing problems over the past several years. Not only has the industry been faced with increased competition from imported product, but concurrently, there has been a dramatic escalation in operating costs. Uncertain market conditions, combined with fluctuating energy and interest costs, have squeezed profitability.

To respond to this spiraling pressure, GASAFDFI has sought to focus attention on new fisheries development, particularly the harvesting, processing and marketing of underutilized species. Additionally, GASAFDFI has endeavored to strengthen the region's traditional seafood activities through research, education and advisory efforts in the areas of quality control, waste utilization, energy efficiency, etc.

To expedite both stability and growth, GASAFDFI, with assistance from the National Marine Fisheries Service, National Oceanic and Atmospheric Administration, has, therefore, continued its program to develop both the underutilized and traditional seafood resources of the region.

The goal of the contract resulting in MARFIN was to develop a five-year plan to implement the Lott/McIlwain discussion paper: "Research Needs for Information Leading to Full and Wise Use of Fishery Resources in the Gulf of Mexico". The objectives of MARFIN are stated as follows: (a) Identify and describe needed research projects, including: (1) type of action, (2) function of project, (3) priority, (4) estimated benefits/costs, and (5) recommended funding sources. (b) Develop a management organizational structure for a 5 year Gulf of Mexico fishery research program. (c) Develop implementation and operational plans. (d) Develop monitoring and evaluation procedures. (e) Develop task force workshop process cohesiveness. (Contractual information in Appendix A.)

2.4 Documentation Reviewed

Pertinent documents, including the Lott/McIlwain fisheries initiative paper were reviewed subsequent to the development of this project. Council fishery management plans and other applicable published (and preliminary) documents were reviewed for stated research necessary to solve known problems in the several fisheries. Appendix B includes a listing of selected pertinent documents.

2.5 Working Task Force Members

Working Task Force members were chosen to participate in the preparation of this document on the basis of their expertise in Gulf fisheries and affiliation (State fishery

agency, Federal fishery agency, industry representatives - commercial and recreational, etc.). This procedure was followed to insure that the people with broadest base of knowledge of Gulf fisheries would participate in the development of this document. Listed below is the name, or the designee, and the affiliation of each Task Force member.

Task Force Member	Representing	Designees
Mr. Robert J. Kemp Texas Parks and Wildlife Department	State agency	Mr. C. E. Bryan/ Dr. Gary C. Matlock
Mr. J. Burton Angelle Louisiana Dept. of Wildlife and Fisheries	State agency	Mr. William S. Perret/ Mr. Claude J. Boudreaux
Dr. Richard L. Leard Mississippi Bureau of Marine Resources	State agency	
Dr. Elton J. Gissendanner Florida Department Natural Resources	State agency	Mr. Edwin A. Joyce, Jr./ Mr. J. Alan Huff
Mr. Hugh A. Swingle Alabama Marine Resources Division	State agency	Mr. Walter M. Tatum
Dr. Frederick Deegen Mississippi Bureau of Marine Resources	Rec. fishing industry	
Dr. Kenneth J. Roberts LSU Center for Wetland Resources	Specialist	
Dr. Wade Griffin Texas A&M University	Specialist	
Dr. Theodore B. Ford LSU Center for Wetland Resources	GSMFC Technical Coordinating Committee	Dr. Richard E. Condrey
Dr. James I. Jones MS-AL Sea Grant Consortium	MS-AL Sea Grant	Dr. William Hosking
Dr. James C. Cato University of Florida	FL Sea Grant	Dr. Fred Prochaska
Dr. Jack R. Van Lopik LSU Center for Wetland Resources	LA Sea Grant	Mr. Ron E. Becker
Mr. Feenan D. Jennings Texas A&M University	TX Sea Grant	Mr. Willis H. Clark
Dr. Richard J. Berry NMFS Southeast Fisheries Center	NMFS SEFC	Dr. Bradford E. Brown
Mr. Jack T. Brawner NMFS Southeast Regional Office	NMFS SERO	Dr. Jack E. Greenfield/ Mr. Ronald L. Schmied
Mr. Wayne E. Swingle Gulf of Mexico Fishery Management Council	GMFMC	
Mr. Ralph Rayburn Texas Shrimp Association	Comm. fishing industry	

Task Force Member	Representing	Designees
Mr. Charles H. Lyles Louisiana Shrimp Association	Comm. fishing industry	
Mr. Nick A. Mavar, Jr. Mavar Shrimp & Oyster Co.	Comm. fishing industry	
Mr. Dalton R. Berry Petrou Fisheries, Inc.	Comm. fishing industry	
Mr. Dick Ingram Gulf Coast Conservation Association	Rec. fishing industry	
Mr. Robert P. Jones Southeastern Fisheries Association	Comm. fishing industry	
Mr. Tom Sebring	Rec. fishing industry	
Ex-officio/Administrative Members		
Mr. J. Y. Christmas Gulf Coast Research Laboratory	GSMFC Consultant	
Dr. David J. Etzold Univ. of Southern Mississippi	GSMFC Consultant	
Dr. Thomas D. McIlwain Gulf Coast Research Laboratory	GSMFC Consultant	
Dr. Andrew J. Kemmerer National Marine Fisheries Service	NMFS	
Dr. Roger D. Anderson Gulf & South Atlantic Fisheries Development Foundation, Inc.	GASAFDFI	
Mr. Larry B. Simpson Gulf States Marine Fisheries Commission	GSMFC	
Ms. Lucia B. O'Toole Gulf States Marine Fisheries Commission	GSMFC	

2.6 Advisory Groups

In order to solicit the widest inputs from the several Gulf of Mexico marine fisheries interests, existing advisory groups were utilized. The existing GSMFC committee chairmen -- Industry Advisory, Menhaden Advisory, Recreational Fisheries, Technical Coordinating, Law Enforcement, Southeast Marine Advisory Service Network (Sea Grant) -- were utilized for advice and preliminary review.

SECTION 3. STATUS OF RESEARCH NEEDS

3.1 Current Status

The fishery resources of the Gulf of Mexico comprise an extremely diverse complex of species. The Gulf of Mexico Fishery Management Council (GMFMC), the Gulf States Marine Fisheries Commission (GSMFC), and the states identified management units from that complex and listed information needed for effective optimum yield strategy when fishery management plans were developed. The Task Force has retained traditional management units as research units, developed additional research units, and assigned additional species to existing management units. As an example, certain species not previously listed but targeted by recreational fishermen were included with existing management units because they are associated with other species in those units.

Task Force members were assigned to working groups charged with examining the current state of knowledge, identifying data gaps, and developing new or expanded research projects required to accomplish optimum yield from each research unit. In preparing their reports working groups used a detailed outline (Appendix B).

The resultant voluminous draft reports will be retained by GSMFC for future reference. Many species occur only incidentally in the harvest and are not known to occur in concentrations that will support a directed fishery. Relatively little is known about some of those and many species may occur in more than one fishery. We have, however, listed each species in only one research unit. Additionally, general problems may involve more than one research unit, especially in the processing and marketing sectors. Consequently, brief discussions presented in the following pages provide essential information on research units *per se*. Species may be treated in groups. Where there is no indication that a species may substantially contribute to increased returns from the resource, that species may not be included.

The resultant research units are as follows:

SHRIMP

Brown shrimp - *Penaeus aztecus*
White shrimp - *Penaeus setiferus*
Pink shrimp - *Penaeus duorarum*
Rock shrimp - *Sicyonia brevirostris*
Royal red shrimp - *Hymenopenaeus robustus*
Sea bob - *Xiphopenaeus kroyeri*
Broken neck - *Trachypenaeus* spp.

MENHADEN

Gulf menhaden - *Brevoortia patronus*
Finescale menhaden - *Brevoortia gunteri*
Yellowfin menhaden - *Brevoortia smithi*

COASTAL PELAGICS

- King mackerel - Scomberomorus cavalla
- Spanish mackerel - Scomberomorus maculatus
- Blue runner - Caranx crysos
- Crevalle jack - Caranx hippos
- Bluefish - Pomatomus saltatrix
- Dolphin - Coryphaena hippurus
- Cero - Scomberomorus regalis
- Cobia - Rachycentron canadum
- Permit - Trachinotus falcatus
- Florida pompano - Trachinotus carolinus

REEF FISH

- Snappers - Lutjanidae family
  - Queen snapper - Etelis oculatus
  - Mutton snapper - Lutjanus analis
  - Schoolmaster - Lutjanus apodus
  - Blackfin snapper - Lutjanus buccanella
  - Gulf red snapper - Lutjanus campechanus
  - Cubera snapper - Lutjanus cyanopterus
  - Gray [mangrove] snapper - Lutjanus griseus
  - Dog snapper - Lutjanus jocu
  - Mahogany snapper - Lutjanus mahogoni
  - Lane snapper - Lutjanus synagris
  - Silk snapper - Lutjanus vivanus
  - Yellowtail snapper - Ocyurus chrysurus
  - Wenchman - Pristipomoides aquilonaris
  - Voraz - Pristipomoides macrophthalmus
  - Vermillion snapper - Rhomboplites aurorubens
- Groupers - Serranidae family
  - Rock hind - Epinephelus adscensionis
  - Speckled hind Epinephelus drummondhayi
  - Yellowedge grouper - Epinephelus flavolimbatus
  - Red hind - Epinephelus guttatus
  - Jewfish - Epinephelus itajara
  - Red grouper - Epinephelus morio
  - Misty grouper - Epinephelus mystacinus
  - Warsaw grouper - Epinephelus nigritus
  - Snowy grouper - Epinephelus niveatus
  - Nassau grouper - Epinephelus striatus
  - Black grouper - Mycteroperca bonaci
  - Yellowmouth grouper - Mycteroperca interstitialis
  - Gag grouper - Mycteroperca microlepis
  - Scamp - Mycteroperca phenax
  - Yellowfin grouper - Mycteroperca venenosa
- Sea Basses - Serranidae family
  - Southern sea bass - Centropristis melana
  - Bank sea bass - Centropristis ocyurus
  - Rock sea bass - Centropristis philadelphica
- Tilefishes - Malacanthidae family
  - Great northern tilefish - Lopholatilus chamaeleonticeps
  - Tilefish - Caulolatilus spp.

REEF FISH Continued

Jacks - Carangidae family
- Amberjacks - Seriola spp.

Triggerfishes - Balistidae family
- Gray triggerfish - Balistes capriscus

Wrasses - Labridae family
- Hogfish - Lachnolaimus maximus

Grunts - Pomadasyidae family
- Tomtate - Haemulon aurolineatum
- White grunt - Haemulon plumieri
- Pigfish - Orthopristis chrysoptera

Porgies - Sparidae family
- Red porgy - Pagrus sedecim
- Knobbed porgy - Calamus nodosus
- Jolthead porgy - Calamus bajonado
- Littlehead porgy - Calamus proridens
- Pinfish - Lagodon rhomboides
- Grass porgy - Calamus arctifrons

Sand Perches - Serranidae family
- Dwarf sand perch - Diplectrum bivittatum
- Sand perch - Diplectrum formosum

COASTAL HERRINGS

- Atlantic thread herring - Opisthonema oglinum
- Spanish sardine - Sardinella aurita
- Round herring - Etrumeus teres
- Scaled sardine - Harengula jaguana
- Round scad - Decapterus punctatus
- Rough scad - Trachurus lathami
- Atlantic bumper - Chloroscombrus chrysurus
- Striped anchovy - Anchoa hepsetus
- Bay anchovy - Anchoa mitchilli
- Silver anchovy - Engraulis eurystole

Associated Species
- Ballyhoo - Hemiramphus brasiliensis
- Halfbeak - Hyporhamphus unifasciatus
- Bigeye scad - Selar crumenophthalmus
- Chub mackerel - Scomber japonicus

OCEAN PELAGICS

- Bluefin tuna - Thunnus thynnus
- Blue marlin - Makaira indica
- White marlin - Tetrapturus albidus
- Swordfish - Xiphias gladius
- Sailfish - Istiophorus platypterus
- Blackfin tuna - Thunnus atlanticus
- Yellowfin tuna - Thunnus albacares
- Little tunny - Euthynnus alletteratus
- Nurse shark - Ginglymostoma cirratum
- Bull shark - Carcharhinus leucas

OCEAN PELAGICS Continued

Sandbar shark - Carcharhinus plumbeus
Dusky shark - Carcharhinus obscurus
Tiger shark - Galeocerdo cuvieri
Lemon shark - Negaprion brevirostris
Scalloped hammerhead - Sphyrna lewini
Great hammerhead - Sphyrna mokarran
Finetooth shark - Carcharhinus isodon
Blacknose shark - Carcharhinus acronotus
Blacktip shark - Carcharhinus limbatus
Atlantic sharpnose shark - Rhizoprionodon terranovae
Bonnethead shark - Sphyrna tiburo
Shortfin mako shark - Isurus oxyrinchus
Longfin mako shark - Isurus paucus
Silky shark - Carcharhinus falciformis
Ocean whitetip shark - Carcharhinus maou
Night shark - Carcharhinus signatus
Slope gulper - Centrophorus uyato
Cuban dogfish - Squalus cubensis
Smalltooth sawfish - Pristis pectinata
Atlantic guitarfish - Rhinobatis lentiginosus
Lesser electric ray - Narcine brasiliensis
Clearnose skate - Raja eglanteria
Roundel skate - Raja texana
Southern stingray - Dasyatis americana
Atlantic stingray - Dasyatis sabina
Spotted eagle ray - Aetobatus narinari
Cownose ray - Rhinoptera bonasus
Atlantic manta - Manta birostris
Atlantic bonito - Sarda sarda
Wahoo - Acanthocybium solanderi

MARINE MOLLUSKS

American oyster - Crassostrea virginica
Atlantic bay scallop - Aequipecten irradians
Southern quahog - Mercenaria campechiensis
Calico scallop - Argopecten gibbus
Queen conch - Strombus gigas
Brief squid - Lolliguncula brevis
Common squid - Loligo pealei
Tropical arrow squid - Doryteuthis plei
Short-finned squid - Illex illecebrosus
Octopus - Octopus vulgaris

CRABS AND LOBSTERS

Blue crab - Callinectes sapidus
Gulf crab - Callinectes similis
Stone crab - Menippe mercenaria
Deep water golden crab - Geryon sp.
Spiny lobster - Panulirus argus
Slipper lobster - Scyllarides nodifer

BOTTOMFISH

Atlantic croaker - Micropogonias undulatus
Spot - Leiostomus xanthurus
Sand sea trout - Cynoscion arenarius
Silver sea trout - Cynoscion nothus
Atlantic cutlassfish - Trichiurus lepturus
Sea catfish - Arius felis
Longspine porgy - Stenotomus caprinus
Silver perch - Bairdiella chrysoura
Southern kingfish - Menticirrhus americanus
Banded drum - Larimus fasciatus
Star drum - Stellifer lanceolatus
Southern hake - Urophycis floridanus
Spotted hake - Urophycis regia
Gulf hake - Urophycis cirrata
Offshore hake - Merluccius albidus
Gulf butterfish - Peprilus burti
Harvestfish - Peprilus alepidotus
Inshore lizardfish - Synodus foetens
Shoal flounder - Syacium gunteri
Blackfin searobin - Prionotus rubio
Atlantic threadfin - Polydactylus octonemus
Sand perch - Diplectrum formosum
Leopard searobin - Prionotus scitulus
Dwarf sand perch - Diplectrum bivittatum
Gafftopsail catfish - Bagre marinus
Mexican flounder - Cyclopsetta chittendeni
Broad flounder - Paralichthyes squamilentus
- Cyclopsetta spp.
- Bothus spp.
Fringed flounder - Etropus crossotus
Orange filefish - Aluterus schoepfi
Dusky flounder - Syacium papillosum
Blackedge cusk-eel - Lepophidium graellsi
Blackcheek tonguefish - Symphurus plagiusa
Blackear bass - Serranus atrobranchus
Atlantic midshipman - Porichthys plectrodon
Gulf kingfish - Menticirrhus littoralis
Polka-dot batfish - Ogcocephalus radiatus
Harvestfish - Peprilus alepidotus
Silver jenny - Eucinostomus gula
Bay whiff - Citharichthys spilopterus
Bighead searobin - Prionotus tribulus
Southern flounder - Paralichthys lethostigma
Gulf flounder - Paralichthys albigutta

ESTUARINE FISH

Red drum - Sciaenops ocellatus
Black drum - Pogonias cromis
Sheepshead - Archosargus probatocephalus
White mullet - Mugil curema
Striped mullet - Mugil cephalus

ESTUARINE FISH Continued

Spotted seatrout - Cynoscion nebulosus
Snook - Centropomus undecimalis
Tripletail - Lobotes surinamensis
Rainbow runner - Elagatis bipinnulata
Ladyfish - Elops saurus
Bonefish - Albula vulpes
Tarpon - Megalops atlanticus

ANADROMOUS AND CATADROMOUS FISH

Striped bass - Morone saxatilis
Alabama shad - Alosa alabamae
Gulf sturgeon - Acipenser oxyrhynchus desotoi
American eel - Anguilla rostrata

MARICULTURE

MARINE MAMMALS/ENDANGERED SPECIES

Caribbean manatee - Trichechus manatus
Atlantic right whale - Eubalaena glacialis
Finback whale - Balaenoptera physalus
Sei whale - Balaenoptera borealis
Humpback whale - Megaptera novaeangliae
Sperm whale - Physeter catodon
Bottlenose dolphin - Tursiops truncatus
Spotted dolphin - Stenella plagiodon
Spinner dolphin - Stenella longirostris
Striped dolphin - Stenella coeruleoalba
Green sea turtle - Chelonia mydas
Hawksbill sea turtle - Eretmochelys imbricata
Kemp's Ridley turtle - Lepidochelys kempii
Leatherback sea turtle - Dermochelys coriacea
Loggerhead sea turtle - Caretta caretta

CORALS* AND SPONGES

bamboo coral - Keratosis flexibilis
Acanella eburnea
Stylaster filogranus
Black coral - Leiopathes glaberimma
Black searod - Plexaura homomallum
Black coral - Cirripathes lutkeni
Rose coral - Manicina ureolata
Wool sponge - Hippiospongia lachne
Yellow sponge - Spongia barbara
Grass sponge - Spongia grassia
Vase sponge - Ircinia campana

*Species include only those with potential commercial value.

Study areas (Figures 3.1.1-3.1.15) were taken from the study outline (Appendix B) to provide information needed by managers, harvesters, processors, marketers, financers, consumers and recreational fishermen. Those needs may and probably will change over time. In most cases required research needs impact both commercial and recreational fisheries. There are, however, specific information needs for each of them, and identified needs applying specifically to recreational fishing are shown in the last two columns. These figures provide the basis for development of the Research Program Summary for each research unit (Tables 3.1.1-3.1.15).

3.1.1 Shrimp

Shrimp are the most valuable fishery crops in the United States. Average reported commercial landings (1978-1982) were 374.4 million pounds (heads on). In 1983 U.S. commercial fishermen were paid $503.4 million at the dock for landing 249.7 million pounds. Almost 80% of the volume and 83% of the value of 1983 landings were produced in the Gulf. It is estimated that an additional 16% (40 million pounds) of the volume was either caught by Gulf recreational and bait fishermen or discarded by commercial fishermen.

Domestic landings provide less than half of the demand for shrimp in the U.S. Imports of shrimp cost $1198 million for 328 million pounds of shrimp (statistics on imports are the weight of individual products as exported) in 1983. Shrimp imports alone exceed the total value of all fishery exports. Although relatively small increases in domestic shrimp production from wild stocks can be expected, it is reasonable to expect their quality and the efficiency with which they are harvested to be significantly improved through better research information. This would make domestically produced wild shrimp much more competitive in the world markets. Additionally, there is a potential to increase the availability of shrimp through increased domestic cultured shrimp production.

The research unit includes seven species. Brown, pink and white shrimp provide about 98% of Gulf landings. There are relatively small directed fisheries for royal red, seabob and rock shrimp. Broken neck or sugar shrimp (Trachypenaeus spp.) are harvested for bait in some areas, and notable numbers occasionally occur in commercial catches.

Brown shrimp range from Martha's Vineyard, Massachusetts to Campeche in Mexico with some discontinuity. In the Gulf they are absent north of the Sanibel, Florida grounds to the vicinity of Apalachicola Bay in Florida. Their maximum offshore density occurs along the coast of Texas and they are relatively abundant eastward along the coast to the Florida panhandle. They are commercially abundant out to depths of 60 fm.

White shrimp range along the Atlantic coast from Fire Island, New York to St. Lucie Inlet in Florida. In the Gulf they occur at the mouth of the Ochlockonee River in Florida and continue uninterrupted around the Gulf of Mexico to the Golfo de Campeche. Centers of abundance occur off Louisiana and in northeast Tabasco including the adjacent waters of Campeche. The fishery for white shrimp extends to depths of about 20 fm.

The range of pink shrimp extends from the lower Chesapeake Bay to the Florida Keys and the Gulf of Mexico. In the Gulf it ranges from Tortugas along the coast, through the coastal waters of Mexico to Cago Catouche and south to the Isla Mujeres. The most dense populations are off southwestern Florida and in the southern portion of the Golfo de Campeche. The greatest concentrations are in depths between 6 and 20 fm, but in some localities they are abundant at depths of as much as 35 fm.

Brown, white, and pink shrimp all range through adjacent estuarine areas as postlarvae, juveniles, and young adults and move offshore to spawn. Historical development of the fishery from inshore areas to the offshore limits of the range has resulted in development of distinct inshore and offshore fisheries that target the same stocks.

Landings and effort in the offshore commercial fishery are generally well known. Additional information on inshore (estuarine) recreational catches, discards, and unreported landings sold direct to consumers is needed.

Stock trends are well known. Large annual fluctuations occur. No apparent or significant trends in annual catches of brown, white, or pink shrimp have yet been determined despite large increases in effort. Commercial users are well identified but recreational users are only marginally identified. Jurisdiction is well established.

Current research is directed at monitoring population status, landing trends, and evaluating management measures. Descriptive environmental relationships have been studied extensively. More cause and effect information on food requirements, habitat modification, freshwater inflow, pesticide, and pollutants is needed. Recruitment processes and life history are relatively well known. However, there is little information on the possible existence of genetically or environmentally separated stocks within the various species. Migratory patterns have been generally identified but there is a critical need for quantitative information on transboundary migration between U.S. and Mexican waters.

An area where information is critically needed is for yield predictions which will require a significant research effort to be able to predict recruitment in any detail. Periods of spawning are fairly well known but the mechanisms which stimulate spawning are not well understood nor are the factors which affect survival of shrimp eggs and larvae well defined.

Information needs related to harvesting technology generally pertain to improvements in fishing efficiencies. The Gulf shrimp fishery is the second most energy inefficient fishery of the U.S. and as such is heavily impacted by fluctuating fuel prices. While it is unlikely that dramatic improvements in fishing efficiencies can be achieved through more research it is reasonable to expect improvements ranging from 15 to 25 percent, which would be very significant to domestic fishermen competing with imports.

The increased world supply of shrimp projected by recent studies in conjunction with the need to maintain a competitive domestic industry indicates a need to expand the market. In consideration of this need, development of adequate handling methodologies and techniques is required to ensure the consumer will be delivered a quality product.

Considerable areas of bottom where shrimp occur are not trawlable. Fishing gear developed to fish some of those areas would result in additional production. While excluder trawls can greatly reduce the fish by-catch which is discarded, more information is needed to demonstrate their applicability and develop appropriate excluder devices for the inshore fishery.

Market research and development information needs include studies of domestic retail and/or institutional preferences for packaging and size preference, promotion technique effectiveness, demand stimulation techniques, and demand for fast food outlets. Export potentials should be explored and the impact of quality standards should be evaluated.

Business and economic evaluation needs include knowledge of the world supply vs. world demand, the future of traditional fisheries, and the increasing reliance of domestic upper level marketing-processing on foreign sources of raw product.

For the recreational fishery there are data gaps in catch and effort statistics, user profiles, and assessment of regulatory impact. There is a need for better information dissemination.

Some information needs apply to only one species. For example, before the present-day intensive effort developed, white shrimp were known to occur in extensive dense schools. The current status of schooling characteristics is unknown and may affect abundance or offer a potential for overfishing.

There is little assessment/prediction information for rock shrimp and limited information is available for the other minor species. Some areas of royal red concentrations have been identified but others probably exist and have not been discovered. Additional information needs for users of the minor species occur in all areas.

Figure 3.1.1 illustrates the best estimate of current information. Table 3.1.1 summarizes identified problem/opportunity projects. Following are annotations of shrimp research problems which have been identified in the preparation of this document.

S1 Inshore Yield -- There is inadequate information on commercial and recreational catches in the highly productive inshore fisheries. The definition of CPUE for inshore fisheries is poor. Landings data are available for large areas only. Fine scale effort and landings data are essential for making management decisions. Also, size composition data are inadequate. Better data on small size shrimp distribution are needed, especially during the May-July season as shrimp are recruited to the offshore fishery. Potential benefits: detailed knowledge of inshore fishery will provide better information for prediction, as well as size data for evaluating timing of egress; also relative productivity for individual bays and their eventual contribution to the offshore fishery.

S2 Transboundary Migration -- Texas shrimp. Since Mexican waters are closed to U.S. fishermen and the Texas Closure occurs when transboundary shrimp migration is known to occur, U.S. fishermen do not have access to an unknown quantity of the harvestable resource occurring in U.S. waters. Potential benefits: an unknown increase in shrimp harvest that could be substantial; resolution of a social and political problem involving management and shrimp fishermen.

S3 Shrimp Yield -- The limited success of predicting shrimp yield each year affects cost-effective planning in the shrimp industry. Early predictions of harvestable shrimp yield each year have not been very accurate. Because of this, all sectors of the shrimping industry including harvesters, processors, and marketers are deprived of information that could assist them in reducing costs and improving profits. Especially with white shrimp and pink shrimp, important habitat parameters that control recruitment are virtually unknown. In order to predict yields, these controlling effects must be accurately factored into prediction models. Each shrimp species has particular environmental needs and these must be delineated separately and clearly understood for good prediction. Potential benefits: cost-effective preparation each year by the fleet for harvesting of brown, white, and pink shrimp; crucial improvement in stock inventory handling and financial planning by processors; reliable advance notice to marketers on size of forthcoming domestic crop in order to effectively displace imports; more effective determination of Gulf states shrimp closure events.

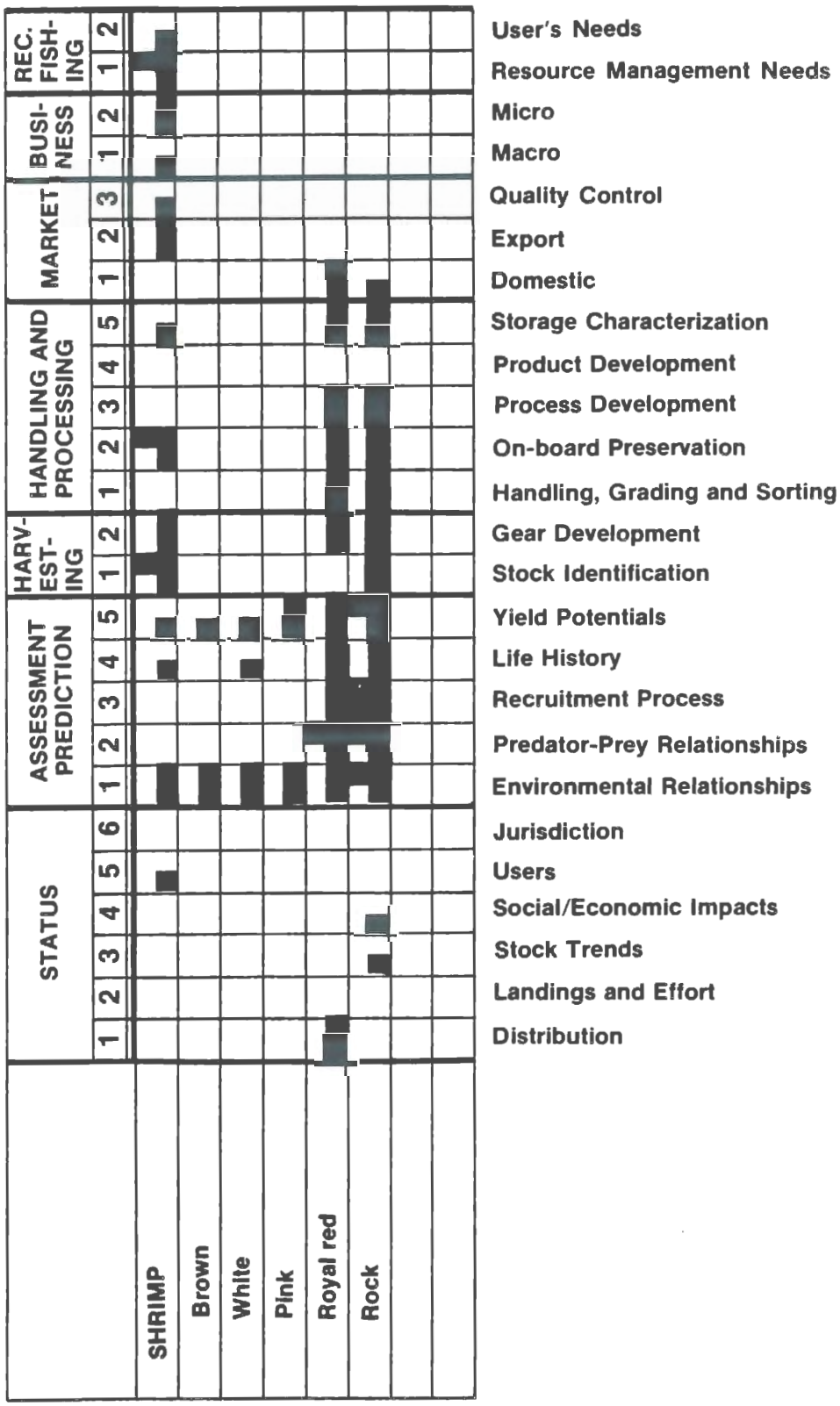

Figure 3.1.1 Summary of information needs. The estimated degree of need is shown in each matrix block as follows: ☐ available information adequate for current needs; ▞ 1-25% more information needed; ■ 26-50% more information needed; ▞ 51-75% more information needed; ■ 76-100% more information needed.

S4 Increase Fishing Grounds -- The quantity of shrimp harvested in the Gulf of Mexico cannot be substantially increased from the traditional fishing grounds. The area off south Florida from Tampa down to Key West probably contains a large population of unexploited shrimp. However, the area is covered with loggerhead sponges and rough bottom and is a major area of congregation for loggerhead turtles which makes it unsuitable for trawling. This shrimp stock could be utilized providing adequate shrimp trawling gear that could economically work this area is developed. Potential benefits: a major shrimp fishery could eventually harvest between 10 and 20 million additional pounds; provide additional trawling bottom and expansion of the shrimp fishery.

S5 Inshore Assessment -- The highly productive inshore (< 5 fathom) shrimp fisheries of the northern Gulf of Mexico are not described, due to lack of synoptic surveys, and thus cannot be managed effectively. Resource surveys during spring, summer, and fall are currently designed to assess stocks from western Florida through Texas in 5-50 fm waters only, in part due to vessel restrictions. This leads to inadequate assessment of shallow-water white shrimp stocks throughout the year and of brown shrimp stocks during summer as they migrate out of estuaries into deeper waters. Potential benefits: more accurate assessment of shrimp stocks; better information for state and federal management strategies.

S6 Gear Development -- Shrimp fishing methods, particularly gear, are inefficient and relatively underdeveloped compared to gear in other fisheries and in other countries. Shrimp fishing gear has evolved over the years on a trial and error basis. This has resulted in gear that works adequately but there has been little or no effort to apply engineering principles or scientific testing to existing gear or in the development of new gear. Potential benefits: a more efficient harvest which would help to keep domestic shrimp prices competitive with the rapidly growing import market.

Table 3.1.1 Research Program Summary for Shrimp.
Each project has been categorized as recovery, maintenance, expansion, or new fishery.

Ident. Number	Function of Task	Costs x 1000 First Year Amount	Second Year Amount	Third Year Amount	Fourth Year Amount	Fifth Year Amount	Total	Program Category	Priority
S1	Inshore Yield	150	150	150	150	150	750	Maintenance	L
S2	Transboundary Migration	330*	330	17	-	-	677	Expansion	H
S3	Shrimp Yield	800	800	600	450	150	2800	Maintenance	L
S4	Increase Fishing Grounds	275	325	295	195	-	1090	Expansion	L
S5	Inshore Assessment	195	195	195	195	195	975	Maintenance	L
S6	Gear Development	285	364	387	367	372	1775	Maintenance	M

*Funded for '85 ($200K) needs $130K

3.1.2 Menhaden

The menhaden fishery is one of the oldest and most valuable fisheries in the United States and is the largest in volume of landings. Menhaden landings were first reported in 1880. The first substantial catch (14 million pounds) was reported in 1902. With considerable annual fluctuations, Gulf landings increased to the 1983 record of over 2 billion pounds with a dockside value of $82.4 million. This amounted to about 69% of the volume and value of U.S. menhaden landings and over 46% of the total reported U.S. commercial landings of fish and shellfish. Annual landings of menhaden at Gulf of Mexico ports averaged 1.7 billion pounds over the last six years (1978-1983). Current catch statistics indicate that 1984 landings will set a new high record.

In 1983 Gulf menhaden were processed to produce fish meal, solubles and oil valued at over $165 million. Substantial quantities of menhaden fish meal and oil were exported.

The menhaden research unit includes three species. Gulf menhaden range from Tampa Bay in Florida to the Yucatan Peninsula in Mexico with greatest concentrations in the north central Gulf. Yellowfin and finescale menhaden, along with a small percentage of other species occur incidentally in the harvest. While the range of menhaden is well documented, there is little information about the density of populations outside the traditional fishing grounds.

Menhaden landings are well documented. The vessel-ton-week (VTW) provides a useful but limited measure of effort. An extensive data bank collected since 1978 in "Captain's Daily Fishing Report" has seen limited use.

Gulf menhaden are apparently harvested at or near MSY. Catches under this condition may change annually. There is no evidence of overfishing. The existence of more than one stock has not been demonstrated, and the one stock hypothesis is accepted at this time. However, there is evidence that distinct stocks may exist east and west of the Mississippi River delta. If this is the case, management strategies may need to be adjusted. More information is needed to determine the annual available level for harvesting such that the fishery may be fully utilized.

No social or cultural research effort has been performed in the Gulf menhaden industry. Existing economic studies treat and summarize data from the combined Atlantic and Gulf of Mexico menhaden fisheries. More information is needed in those areas. The identity of users of menhaden resources is well known.

Menhaden are estuarine dependent species which spawn in Gulf waters and move to near-shore Gulf and inshore areas in the spring. The fishery has been conducted predominantly in waters under state jurisdiction; consequently, management has been conducted by individual state regulations coordinated through the Gulf State/Federal Fisheries Management Board. If a menhaden fishery developed on spawning stocks in the FCZ, federal regulation to prevent overfishing of the spawning population may be required.

It is generally believed that environmental conditions have a large impact on Gulf menhaden year class strength. Quantification of those relationships in restricted areas has been studied in recent years, but additional information is needed throughout the range of research unit species.

Gulf menhaden play dual roles as predators and prey. The effects of predation on estuarine and marine larval communities in the Gulf of Mexico have not been quantified. The full ecological value of the menhaden resource in addition to its important use in the

production of fish meal, oil, and solubles may be realized only when predator/prey relationships are quantified. Additional information must be accumulated before that value can be quantified.

Life history of menhaden are relatively well documented in the fishery area.

Annual harvest predictions based on the historical relationship between catch and effort have been made by NMFS since 1973. Local predictions, based on the abundance of young fish and environmental conditions, have been made. More information is needed to improve estimates of potential yield and predicted harvest.

In the menhaden industry, improvement in harvesting techniques will increase the efficiency of operations, reducing costs and thus enhance continuing economic gains heavily impacted by increasing fuel costs and relatively low product prices. Industry anticipates efforts to improve efficiency in several areas and will require more technical information than is currently available.

Handling and processing menhaden to produce traditional products is well developed. The most critical area of information needs is in product use. Menhaden, as a member of the herring family, appear suitable for food use. Potential food uses include smoked, canned, minced, dried and salted fish, and use of oils in foods such as margarine. Conversion of menhaden to food use would significantly increase the value of the resource by about $82 million. The research to realize this potential, however, is extensive, ranging from improvements in handling and storage facilities aboard fishing vessels, to preparing, packaging, and storage of the product. Significant marketing research also would be needed to identify and promote stable markets for the product.

Figure 3.1.2 illustrates the best estimate of current information. Table 3.1.2 summarizes identified problem/opportunity projects. Following are annotations of menhaden research problems which have been identified in the preparation of this document.

M1 Economic Enhancement -- Menhaden comprise the largest U.S. fishery in terms of landings, but value is low because there are no existing food uses for menhaden in this country. Potential benefits: increased economic value for the menhaden resource through development of food products (canned, cured, or minced); increased value and market stability for menhaden oils if FDA approval for domestic food use is obtained; reduction of the national trade deficit through the export of significant quantities of frozen and/or processed menhaden products.

M2 Seasonal Age and Size Distribution -- Lack of samples of age and size information from the purse seine fishery during early and late season undermines the analyses and guidelines for effective management. Staff and fund limitations restrict sampling of April, May (spring) and September, October (fall) landings. Samples are obtained, however, during June-August period when most of the catch is made. Potential benefits: more accurate samples of landings and within season changes; more accurate analyses of the fishery and forecasts; more accurate management guidelines and industry advice.

M3 Fecundity Studies -- Determine age and size specific maturation rates, potential egg production, and sex ratios for Gulf menhaden on a within and between season basis. Fecundity studies conducted to date have not adequately addressed the potential of fractional spawning, differential survival rates by sex, or variation between years in fecundity parameters. Analyses to date indicate an analytically useful relationship between spawners and recruits, hence more refinement of parameter estimates is sought.

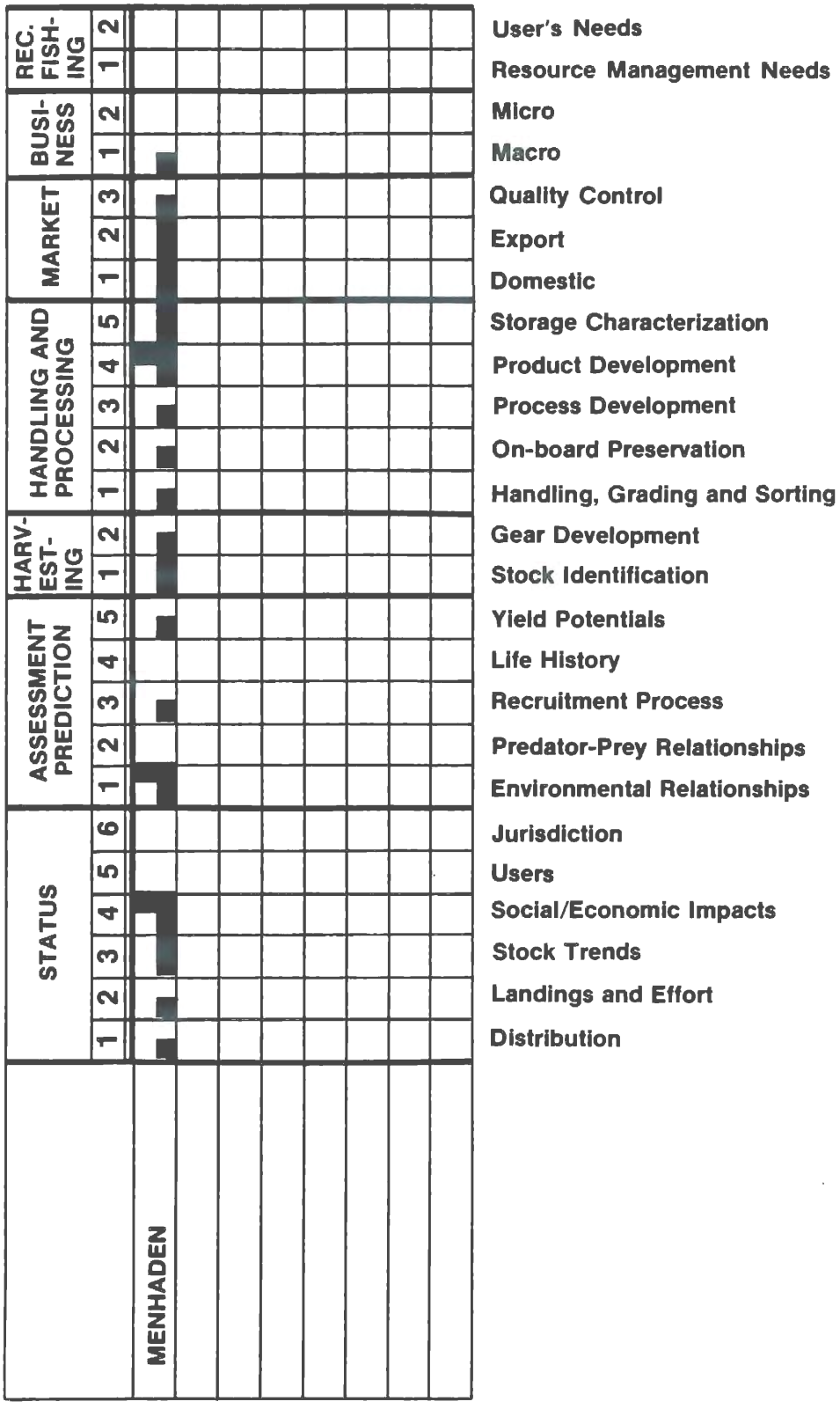

Figure 3.1.2 Summary of information needs. The estimated degree of need is shown in each matrix block as follows: ☐ available information adequate for current needs; ▪ 1-25% more information needed; ▪ 26-50% more information needed; ▪ 51-75% more information needed; ■ 76-100% more information needed.

Potential benefits: increased accuracy and precision for parameters used in the spawner/recruitment relationship will increase the reliability of results from simulation models used to evaluate management options and develop management strategies.

M4 Larvae Survival Studies -- Long-range forecasts of year class abundance are limited by inadequate understanding of the factors which influence survivability of the early life stages. A large part of the natural variation in abundance by age class appears to be due to variations in egg, larval, and juvenile survival. However, there has been no systematic examination of the early life stages to describe survival and growth on the transport mechanisms which lead to estuarine recruitment. Potential benefits: increased understanding of factors affecting survival of early life stages of menhaden will lead to better forecasting of population fluctuations and more effective resource utilization.

M5 Seasonal Adult Abundance -- Determine abundance and distribution of adult Gulf menhaden via experimental fishing gear and aerial surveillance throughout the year outside of the currently exploited fishing grounds. Gulf menhaden are known to occur east, west, and offshore of the current fishing grounds. Their abundance and distribution in these outside areas are not known but do affect the fishery and management guidelines. Potential benefits: complete information on the distribution and abundance would permit improved analyses of the total resource and the effects of the catch by the purse-seine fishery; management and industry guidelines would be improved by better forecasts and resource status and well-being analyses.

M6 Effective Unit of Fishing Effort -- In order to manage fishing harvest on the basis of fishing mortality, one approach requires an effective unit of fishing effort which can then be regulated. Because of natural variability in recruitment, it is better to manage on the basis of fishing mortality than on the basis of harvest quotas. Potential benefits: an effective unit of fishing effort would allow the menhaden fishery to be managed on the basis of fishing effort; surplus production models could be used with more confidence to determine MSY and/or OY.

M7 Mortality Rates -- Age specific natural mortality rates are unknown for menhaden. Knowledge of age-specific natural mortality may provide different management advice as compared to advice assuming natural mortality is constant throughout juvenile and adult stages. Potential benefits: better estimates of the risk of overfishing menhaden populations will be available, this will be important in cases where a significant portion of the catch of these species may consist of young age groups.

M8 Market Development and Economic Analysis -- Development of food uses for menhaden will require market development and economic analyses to achieve the benefits anticipated in M1.

Table 3.1.2 Research Program Summary for Menhaden.
Each project has been categorized as recovery, maintenance, expansion, or new fishery.

Ident. Number	Function of Task	Costs x 1000 First Year Amount	Second Year Amount	Third Year Amount	Fourth Year Amount	Fifth Year Amount	Total	Program Category	Priority
M1	Economic Enhancement	185	185	227	260	183	1040	Expansion	H
M2	Seasonal Age and Size Distribution	37	37	37	37	37	185	Maintenance	M
M3	Fecundity Studies	134	134	134	134	77	613	Maintenance	M
M4	Larvae Survival Studies	380	390	380	380	145	1675	Maintenance	H
M5	Seasonal Adult Abundance	485	485	485	485	485	2425	Maintenance	L
M6	Effective Unit of Fishing Effort	180	180	180	180	180	900	Maintenance	M
M7	Mortality Rates	165	165	165	165	165	825	Maintenance	M
M8	Market Development and Economic Analysis	0	61	76	0	0	137	Expansion	H

3.1.3 Coastal Pelagics

The coastal pelagic research unit includes ten species. All species are harvested by both commercial and recreational fishermen though some species are largely incidental in the catch. Each species should be considered a separate research subunit, except when research is more effectively conducted by studying two or more species simultaneously.

With the exception of cero mackerel, which is not abundant in U.S. Gulf waters, all the species range throughout the Gulf region. All of the species are migratory at least during part of their life cycle. Some of the larger specimens of amberjack and crevalle jack are occasionally associated with reef complexes and reef fish harvest. King and Spanish mackerel often comingle in their migratory routes, but usually king mackerel are taken further offshore in less defined schools. Cobia do not appear to travel in discreet schools, are frequently found very close to shore and migrate over a more extended period than do the mackerel. Bluefish school by size in smaller groups which are loosely associated into larger aggregations. The groups of bluefish are often found along the shore or in passes. They are frequently associated with offshore oil structures. Dolphin are most frequently associated with blue water, and therefore, are usually further offshore in the Gulf. They also associate with stationary or floating objects on the ocean surface. Young dolphin school, but older individuals are more solitary.

Blue runner frequently travel in immense schools which are sometimes associated with schools of little tunny and redfish. Juvenile amberjack and crevalle jack also school, but the older fish are more solitary.

Many of the coastal pelagic species are attracted to or associated with underwater reefs or structures, but appear to occupy the water column above these structures. Their association is seasonal.

More is known about distribution patterns of king mackerel than is known about the distribution patterns for other coastal pelagics. Several apparently distinct migratory groups have been identified but not delineated. There is little scientific information available on the distribution patterns of Spanish mackerel. The fish are migratory and are found geographically in patterns similar to king mackerel. Migration routes and the occurrence of separate stocks have not been delineated. Migratory patterns of cobia are not well understood. Cobia in the South Atlantic and Gulf are currently assumed to be one stock which may not be true. They are frequently taken very close to shore and also occur further offshore, often associated with floating objects. Dolphin tend to be more oceanic in their distribution, ranging from Nova Scotia to South Africa in the Atlantic Ocean. Gulf migratory patterns are unknown.

Little scientific information is available on the distribution pattern of the blue runner. The fish do form rather immense schools in part of their range and often are associated with schooling little tunny, Spanish mackerel and king mackerel. Large red and black drum are sometimes taken in association with blue runner in the central Gulf area, apparently schooling below the blue runner. Virtually no scientific information about distribution or migratory patterns of crevalle jack is available. Gulf bluefish appear to be a separate stock from Atlantic coast bluefish. Bluefish tend to migrate north in spring and summer and south in fall and winter.

Although migration and stock studies of coastal pelagic species have produced limited information on some species there is little or no knowledge available for others. More information is needed for all species. Extensive tagging and/or genetic programs are indicated.

Landings and effort data for the coastal pelagics resource are generally inadequate or not available. Landings data for commercially caught Spanish and king mackerel are relatively reliable. Recreational landings data are improving. Both recreational and commercial landings data are available for blue runner and blue fish, jack crevalle, and dolphin. The commercial fishery for blue runner has been traditionally in Florida. More recently, schooling blue runner have been harvested by purse seine in the north central Gulf for human food export markets. Commercial landings of dolphin are probably less than 2% of total landings. Commercial landings for cobia are probably reasonably reliable although it is likely that a higher percentage than for other species is marketed through channels that are not monitored. Effort data are not adequate for any species.

Current analyses indicate that the Gulf migratory group of king mackerel is overfished and stock level is below MSY. Successful remedial measures to restore the Gulf group to an MSY level require precise stock analysis data on an annual basis. In the absence of more precise information, the assumption that Spanish mackerel are currently underutilized has been used. More precise information is needed for stock assessment and estimates of yield potentials.

Stocks of blue runner, jack crevalle and bluefish appear to be underutilized. Dolphin recreational catches declined slightly between 1980 and 1981, but no information on stock size or yield of dolphin or cobia is available.

Information on the economic impact of commercial Gulf mackerel fisheries seems to be adequate for current needs. Such information on the recreational fishery is not available for species in the research unit. Species specific economic information is needed for recreational mackerel fisheries.

Sociological information for coastal pelagics users is generally lacking. Some sociological studies of the mackerel fisheries are available and additional species specific information is needed. Information on the socioeconomic importance of blue runner in the commercial export market, the bait fishery and in charter boat fisheries is needed.

Data delineating the users of coastal pelagic resources are generally not available except as indicated in reported landings for commercial and recreational fisheries.

Jurisdiction for some species is not clear because information showing catch location is not always available.

Environmental parameters affecting distribution, migration, spawning behavior, larval survival and transport, etc. are not well understood for any coastal pelagic species. Information concerning environmental relationships should be developed in accordance with priority needs.

Except for a fair amount of data on the food of mackerel, there is relatively little or no information on predator/prey relationships for coastal pelagic species. The relationship between migration of prey species and migration of mackerel should be determined. The impact of predation on Spanish mackerel should be determined. In general there is very little information on predator/prey relationships for other species in the Gulf.

Recruitment processes are not well understood for any species. Information is needed.

Considerable information on mackerel life history characteristics is available but is negligible in the Gulf for other species. Accurate estimates of these parameters are needed for stock assessment.

Estimates of yield potential are available only for the mackerels. Improved accuracy for annual or other periodic updating is needed. Information for prediction based on fishery independent data should be developed. The accumulation of data required for reliable yield estimates of other species should be started.

User groups need more information on seasonality and areal distribution of densely aggregated schooling patterns to achieve better fishing efficiency in fishing mackerels, blue runner, jack crevalle, and bluefish. More information on selectivity of gill nets, efficiency of gear and potential alternate resources is needed. Studies of purse seine depth as it relates to species composition of catches and effectiveness in harvesting blue runner should be made.

Information on handling, grading, sorting, and onboard preservation of commercial catches seem to be adequate. More information is needed to develop improved products with better storage characteristics and domestic market acceptability. Market research and development should determine public acceptability of fishery products with improved storage characteristics. Acceptability of current products in new domestic institutional markets should be explored to reduce dependency on export markets for mackerel. Marketing programs to develop expanded export markets for blue runner should be undertaken.

An analysis of business opportunities based on existing analyses of business structure and stock yields should be completed. Based on current analyses of business structure and stock yields an analysis of business opportunities should be completed. A complete economic evaluation of the purse seine fishery harvesting blue runner and other species for the export market should be undertaken. Economic evaluation of the commercial and charter boat fisheries for jack crevalle, dolphin and cobia, as appropriate, is needed.

Recreational fishery catch, effort, and distribution statistics should be improved for most species. Other management needs should be satisfied when information needs in the areas already discussed have been satisfied. Assessment of regulatory impacts on both recreational fishermen and industries should be compiled and distributed. Social economic and demographic information should be compiled for charter vessel and private boat users.

Recreational users need more information on catch utilization enhancement. Public access and aggregation structures should be improved. Informational brochures, news sheets, etc. should be used to provide information useful to recreational anglers on all aspects of research and development.

Figure 3.1.3 illustrates the best estimate of current information. Table 3.1.3 summarizes identified problem/opportunity projects. Following are annotations of coastal pelagic research problems which have been identified in the preparation of this document.

CP1 Cero Mackerel MSY/OY Unknown -- There is no available information upon which to obtain yield estimates. Specific information on Cero is sketchy or non-existent. Potential benefits: little at this time.

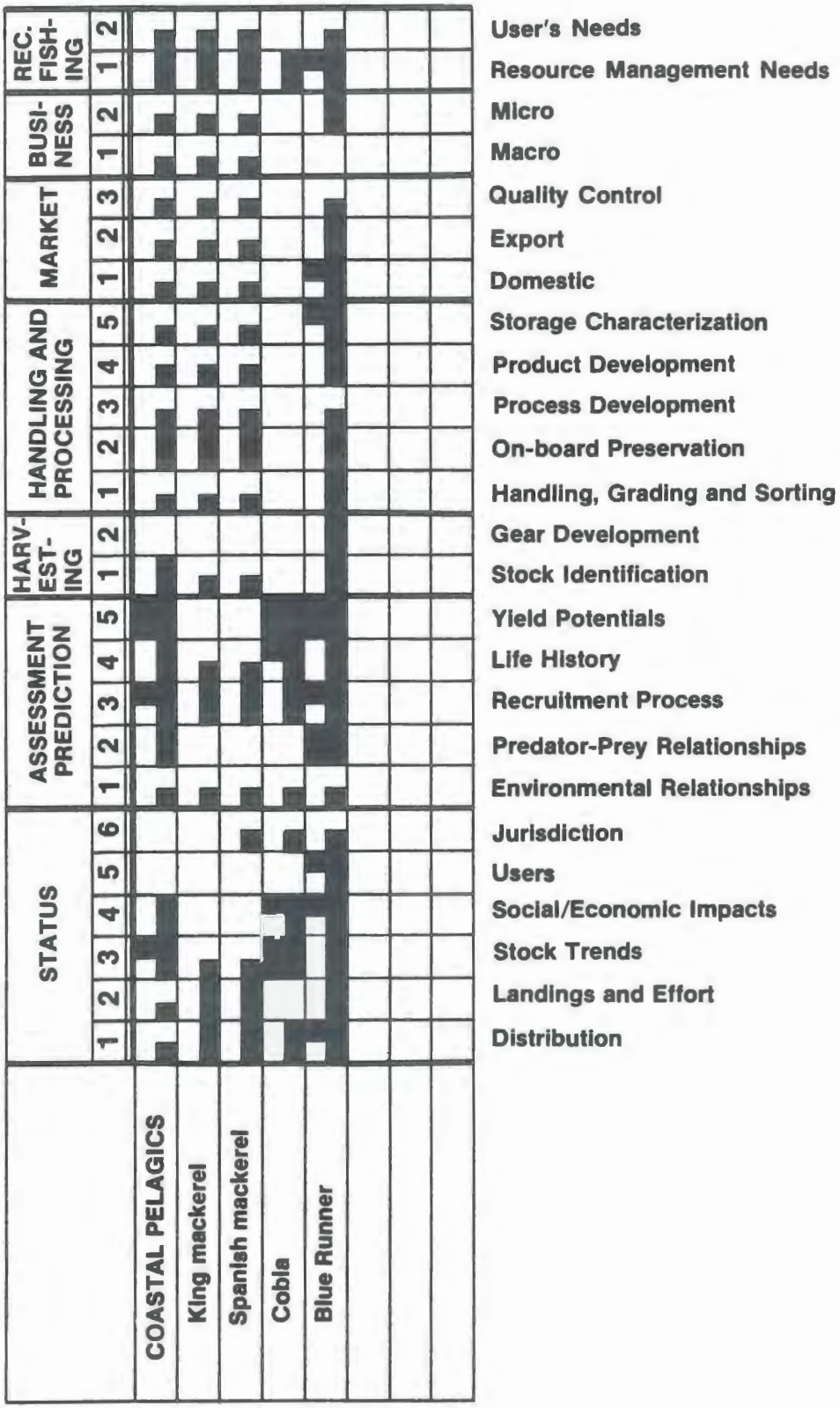

Figure 3.1.3 Summary of information needs. The estimated degree of need is shown in each matrix block as follows: ☐ available information adequate for current needs; ▪ 1-25% more information needed; ▬ 26-50% more information needed; ■ 51-75% more information needed; ■ 76-100% more information needed.

CP2 Jack Crevalle Life History -- Little is known about the life history of jack crevalle or its relative importance to the fishing industry. Basic information of the importance of jack crevalle to the charter boat industry is not well documented and before a management program could be implemented for jack crevalle research on its life history (distribution of early life stages, movement patterns, length and weight as related to age, and fecundity) should be done. Potential benefits: better understanding of the importance of jack crevalle in the charter boat fishing industry.

CP3 Pompano Migration and Spawning Activities -- More information is needed in the pompano's migration patterns and spawning activities in order to develop a northern Gulf fishery for pompano. No one has determined for sure where the pompano spawn (whether deepwater or estuary or beach zone), and no one knows whether or not pompano in the North Gulf die off during the colder winter months or migrate to the warmer waters off Florida. Potential benefits: provide information necessary to determine OY for this species.

CP4 King/Spanish Mackerel Growth and Mortality -- Growth and mortality values used to estimate MSY are poorly known. Growth-overfishing, particularly for king mackerel, may occur. Since size and age gradients may exist on a north-south basis in the Gulf and inshore-offshore, current modeling parameters may not apply or be of limited value in looking at the entire stock. Potential benefits: Information would more clearly define MSY from which OY could be determined.

CP5 Unknown Blue Runner Yield Estimates -- There is little information available on yield or demand in the recreational and commercial fisheries; sketchy data on population dynamics. Fishing pressure has not been adequately defined. There does not appear to be a fishery directed at blue runners; catches appear incidental. Potential benefits: maintenance of a recreational fishery and development of a commercial fishery.

CP6 King Mackerel Gulf and Atlantic Seasonal/Spatial Separation -- Determination of seasonal/spatial separation between Gulf and Atlantic migratory groups of king mackerel. Such determination involves tagging of king mackerel off southeast Florida during April. Potential benefits: would result in more equitable allocation of available stock and possibly prevent overfishing the Gulf group of king mackerel.

CP7 King Mackerel Migratory Separation -- Determination of whether separate migratory groups (or stocks) of king mackerel exist in the western Gulf of Mexico. Such determination involves tagging of king mackerel in Louisiana and Mexico and offering rewards for return of tags. Potential benefits: if separate stocks do exist, this would allow much higher allocations of king mackerel for Louisiana and Texas fishermen.

CP8 King Mackerel Electrophoretic Patterns of Tissue Samples -- Examination of electrophoretic patterns of tissue samples of king mackerel from the Gulf for genetic differences. Such examination should include at least five replicate samples of tissue from fish for each of the differing sizes from the Florida west coast, Louisiana, and Mexico. Potential benefits: substantiate tagging results of CP7 and have the same benefit.

CP9 Spanish Mackerel Migratory Group Differentiation -- Determine whether different stocks of migratory groups of Spanish mackerel exist in the Gulf of Mexico and South Atlantic areas. Such determination involves tagging of Spanish mackerel off North Carolina, southeast Florida, Mississippi/Louisiana coast, and Mexico. Potential benefits: would indicate whether separate stocks exist which may require separate management strategies.

CP10 Coastal Pelagic Distribution -- Determination of distribution and migration patterns for cobia, dolphin, crevalle jack, and amberjack. Such determination involves tagging of these species by volunteer charter boat operators. Potential benefits: would enhance user group utilization of these less exploited stocks through description of migration and abundance patterns.

CP11 Blue Runner Migratory Patterns -- Determination of migratory patterns for blue runner. Such determination includes tagging of purse seine caught fish. Potential benefits: would provide for more efficient recreational and commercial utilization through descriptions of migratory patterns.

CP12 Charter Boat CPUE of Coastal Pelagics -- Determination of CPUE data for charter boat catch of coastal pelagic fishes. Such determination involves a survey of charter and head boats, in which operators will be compensated for providing catch data. Potential benefits: would provide more precise information for calculating MSY and other population analysis parameters, and may result in increases in user group allocations.

CP13 Recreational CPUE of Coastal Pelagics -- Determination of CPUE for recreational angler catch of coastal pelagic fishes. Such determination involves computer analysis of data files for National Recreational Surveys. Potential benefits: would have same potential benefit as CP12.

CP14 Commercial CPUE of Coastal Pelagics -- Determination of commercial CPUE for coastal pelagic species. Such determination includes increased effort by NMFS and state port agents to interview commercial vessels to collect CPUE and other catch parameter information. Potential benefits: same as CP12.

CP15 Standing Stock of Gulf Coastal Pelagics -- Determination of estimates of MSY or standing stock level for coastal pelagic species. Such determination involves compiling and analyzing available data, using stock production or other population models or larval abundance/spawner relationship techniques, or other techniques to provide standing stock estimates for each species. Potential benefits: would provide an indication to users as to the potential for increased harvest of these stocks.

CP16 Export Market Potential of Coastal Pelagics -- Determination of the utilization of coastal pelagic species in export markets and market potential. Such determination involves examination of catch by species for these markets, marketing cooperatives and industry structure, marketing channels, export markets, and potential for expansion in these markets. Potential benefits: should result in increased export markets for underutilized coastal pelagics.

CP17 Bait Market Potential of Coastal Pelagics -- Determination of the utilization of coastal pelagic species in the bait market and market potential. Such determination involves examination of catch by species for this market, industry structure, market channels, market location, and potential for expansion of market. Potential benefits: should result in increased domestic market for underutilized coastal pelagics.

CP18 Economic Dependence of Charter Boats on Coastal Pelagics -- Determination of the utilization and economic dependence of charter boats on coastal pelagic fish. Such determination involves survey of the Gulf charter boat fleet to determine number of days of operation, gross receipts/day, percentage of year spent pursuing coastal pelagic species, principal species targeted and captured, other species targeted. Potential benefits: should determine the importance of each coastal pelagic species to the recreational charterboat industry.

CP19 Recreational Angler Participation in Coastal Pelagics Fishery -- Determination of number recreational participants harvesting coastal pelagic fish. Such determination involves computer analysis of individual intercept data for the 1979-1983 national recreational surveys for each species. Potential benefits: should determine percentage recreational anglers catching each species of coastal pelagics.

CP20 Water Temperature Effects on Coastal Pelagic Migration -- Determination of the relationship of water temperature to migration of coastal pelagic fishes. Such determination involves providing reliable temperature measuring instruments to cooperative charter boat operators to measure surface water temperature at times of capture of coastal pelagic fish. Potential benefits: should provide a basis for predicting availability of coastal pelagic species by temperature patterns.

CP21 Water Temperature Effects on Coastal Pelagic Larval Abundance -- Determination of relationship of temperature to larval abundance of coastal pelagics. Such determination involves compiling and analyzing SEAMAP ichthyoplankton and temperature data related to coastal pelagic species. Potential benefits: provides basic information on temperature relationships to larval abundance and survival.

CP22 King and Spanish Mackerel Prey Species Determination -- Determination of prey species of king and Spanish mackerel related to migration. Such determination involves examining stomach contents of mackerel as they first appear in each geographical location along migration routes to ascertain if migrations are related to movement of certain prey species. Potential benefits: would provide information on whether mackerel migrations are related to migrations or abundance of certain prey species.

CP23 King Mackerel Effort Trends -- Determination of effort trends in the king mackerel fishery. Such determination involves polling operators in the Gulf charter boat fleet to obtain logs of catches over a ten-year period and compiling these data. Potential benefits: would provide very important information to assess fishing mortality levels utilized in procedures for setting total allowable catch (TAC) for king mackerel.

CP24 Areal and Seasonal Distribution -- Determination of areal and seasonal distribution of stock aggregations (schools) of coastal pelagic fishes. Such determination involves surveys of spotter aircraft operators and review of historical sighting records of fish schools by NMFS and state research vessels for ground truth and satellite observations to delineate geographically, and by time, the aggregations of coastal pelagic fishes. Potential benefits: would provide information on stock aggregations which should increase harvests and efficiency of harvest.

CP25 Gear Economics -- Determination of cost and return of vessels using the three major gear types in the mackerel fisheries and their dependence on mackerel. Such determination requires an economic evaluation of a sample of vessels utilizing hook and line, gill nets, and purse seines. Potential benefits: provides economic information upon which user groups can base investment and operation decisions.

CP26 Optimum Size -- Determination of the mesh sizes of gill nets which harvest coastal pelagic fishes of a size that is in greatest demand by the market. Such determination involves initially determining market demand for various sizes of coastal pelagics and subsequently determining optimum mesh size to capture these fish. Potential benefits: provides information that may allow management or provide greater economic returns to net fishermen.

CP27 Process Development -- Development of processes which improve the storage characteristics and the acceptability of underutilized coastal pelagic fishes in the domestic market. Such development involves biochemical and palatibility tests of storage characteristics of raw and processed products, as well as development of processes to improve these characteristics, such as bleaching, mincing, smoking, canning, vacuum oil extraction, etc. Potential benefits: should provide for increased domestic and foreign utilization of coastal pelagic species and, thus, higher revenue to the industry.

CP28 Handling - Gill Net -- Development of mechanical methods of removing gill net caught fish. Such development may involve gill net modification to allow mechanical shucking. Potential benefits: should improve product quality, and thereby provide increased revenue to industry.

CP29 Gear Efficiency -- Determination of the effectiveness of pair trawls and midwater trawls in harvesting schooling, underutilized coastal pelagic fishes. Potential benefits: may result in improved and more efficient harvest methods.

CP30 Export Market Potential -- Determination of domestic and export market potential of products developed with improved palatibility and storage characteristics. Such determination includes promotion of retail and institutional markets, with emphasis on domestic markets. Potential benefits: should result in increased revenue to industry through new foreign and domestic markets for improved and higher valued fishery products.

CP31 Institutional Marketing -- Promotion of institutional markets for underutilized coastal pelagic fishes. Such promotion involves marketing of existing available products in domestic institutional markets. Potential benefits: should result in increased revenue to the industry for currently available fishery products.

CP32 Recreational Fishery Information -- Development of brochure describing life history characteristics of each species as they relate to recreational fishing opportunity. Such brochures should include information on seasonal and temporal migratory characteristics by geographical area, schooling characteristics, associated species, preferred habitat associations, fishing methods, processing and handling techniques, cooking methods, etc. Potential benefits: should increase recreational harvest success and participation for less utilized coastal pelagic species.

CP33 Bluefish Yield Estimate -- No reasonable estimate of yield available. Data on bluefish is insufficient for Gulf. There is little directed commercial or recreational fishery in the Gulf. Potential benefits: should provide information resulting in a higher level of services and products for recreational fishermen.

Table 3.1.3 Research Program Summary for Coastal Pelagics.
Each project has been categorized as recovery, maintenance, expansion, or new fishery.

Ident. Number	Function of Task	Costs x 1000 First Year Amount	Second Year Amount	Third Year Amount	Fourth Year Amount	Fifth Year Amount	Total	Program Category	Priority
CP1	Cero Mackerel MSY/OY Unknown	5	5	4	-	-	14	Maintenance	L
CP2	Jack Crevalle Charter Boat Catch	180	-	-	-	-	180	Maintenance	L
CP3	Pompano Migration and Spawning Activities	340	340	302	-	-	982	Expansion	M
CP4	King/Spanish Mackerel Growth and Mortality	330	330	520	-	-	1180	Maintenance	H
CP5	Unknown Blue Runner Yield Estimates	5	5	5	-	-	15	Expansion	L
CP6	King Mackerel Gulf and Atlantic Seasonal/Spatial Separation	48	48	9	9	-	114	Maintenance	H
CP7	King Mackerel Migratory Separation	71	71	99	99	40	380	Maintenance	H
CP8	King Mackerel Electrophoretic Patterns of Tissue Samples	34	34	-	-	-	68	Maintenance	M
CP9	Spanish Mackerel Migratory Group Differentiation	110	110	19	12	-	251	Maintenance	M
CP10	Coastal Pelagic Distribution	33	11	10	6	6	66	Expansion	L
CP11	Blue Runner Migratory Patterns	111	15	11	5	-	142	Expansion	M
CP12	Charter Boat CPUE of Coastal Pelagics	105	102	70	70	-	347	Maintenance	M
CP13	Recreational CPUE of Coastal Pelagics	-	-	70	38	-	108	Maintenance	M
CP14	Commercial CPUE of Coastal Pelagics	60	60	60	60	60	300	Maintenance	L
CP15	Standing Stock of Gulf Coastal Pelagics	150	37	-	-	-	187	Expansion	M

Table 3.1.3 Research Program Summary for Coastal Pelagics. (Continued)

Ident. Number	Function of Task	Costs x 1000 First Year Amount	Second Year Amount	Third Year Amount	Fourth Year Amount	Fifth Year Amount	Total	Program Category	Priority
CP16	Export Market Potential of Coastal Pelagics	155	85	-	-	-	240	Expansion	H
CP17	Bait Market Potential of Coastal Pelagics	57	-	-	-	-	57	Expansion	M
CP18	Economic Dependence of Charter Boats on Coastal Pelagics	180	83	-	-	-	263	Maintenance	M
CP19	Recreational Angler Participation in Coastal Pelagic Fishery	21	-	-	-	-	21	Maintenance	L
CP20	Water Temperature Effects on Coastal Pelagic Migration	16	9	9	9	9	52	Maintenance	M
CP21	Water Temperature Effects on Coastal Pelagic Larval Abundance	190	105	-	-	-	295	Maintenance	L
CP22	King and Spanish Mackerel Prey Species Determination	49	33	-	-	-	82	Maintenance	L
CP23	King Mackerel Effort Trends	39	-	-	-	-	39	Maintenance	H
CP24	Areal and Seasonal Distribution	150	58	-	-	-	208	Expansion	M
CP25	Gear Economics	78	18	-	-	-	96	Maintenance	L
CP26	Optimum Size	108	35	-	-	-	143	Maintenance	M
CP27	Process Development	230	155	140	-	-	525	Expansion	H
CP28	Handling - Gill Net	390	165	-	-	-	555	Maintenance	L

Table 3.1.3 Research Program Summary for Coastal Pelagics. (Continued)

Ident. Number	Function of Task	Costs x 1000 First Year Amount	Second Year Amount	Third Year Amount	Fourth Year Amount	Fifth Year Amount	Total	Program Category	Priority
CP29	Gear Efficiency	282	-	-	-	-	282	Expansion	L
CP30	Market Potential of New Products	190	245	245	-	-	680	Expansion	H
CP31	Institutional Marketing	125	85	69	-	-	279	Expansion	M
CP32	Recreational Fishery Information	130	53	30	30	30	273	Maintenance	M
CP33	Bluefish Yield Estimate	5	5	4	-	-	14	Expansion	M

3.1.4 Reef Fish

The reef fish fishery is among the most complex of the major fishery units in the Gulf of Mexico. Records indicate that early settlers in the eastern Gulf depended heavily on reef fish, particularly red snapper, and that this need prompted the development of offshore fishing craft and the search for the most desirable fishing grounds. Now, more than one hundred years after those early ventures, the knowledge of reef fish has grown but so has the demand in both the commercial and recreational sectors. In the 1980 time frame some fifty plus species are included in the reef fish fishery even though the dominant stocks and preferred catches are in the snapper-grouper and sea bass families comprised of 33 species. Tilefishes, which are not reef associated, and other reef associated jacks and triggerfishes are targeted fishermen equipped for reef fishing.

Historically, reef fishes and the reef fishery are associated with waters of less than 100 fm. In the Gulf of Mexico, this depth approximates the outer edge of the continental shelf. On the other hand, reef fish do not reach commercially exploitable sizes in shallow water. Consequently, it is estimated that the area for reef fisheries comprises about one-half the total area of the FCZ. Within general areas associated with reef fish only about 15,000 square miles contain reefs or reef-like hard bottom areas which are habitable by reef fish, mostly within the 55 fm contour. Consequently, only some 12.4 percent of the shelf or 5.7 percent of the FCZ is habitat for this fishery. This does not take into account recent observations that significant stocks may be overlooked because of their association with extensive smooth bottom areas.

The total economic value of the private and commercial charter recreational reef fisheries in terms of sales, value added, wages, employment and annual capital expenditures in the Gulf of Mexico in 1975 was estimated to be $146 million. However, the total value of the fishery is unclear inasmuch as there is a close interlock between reef fishing and activities carried out under other fisheries, such as for shrimp, groundfish, spiny lobster, and stone crab. While specified stressed areas are subject to special management regulations designed to assure recovery and/or maintenance of reef fish resources, estimated potential yield indicates that full and wise use of all reef fish resources will result in substantial increases in economic return.

Distribution patterns of reef fish associated with irregular bottoms is reasonably well known, but information about their distribution and density over other bottom habitats is sparse. Landings and effort data are inadequate.

It is believed that reef fishes were the first target of any consequence among demersal fish in the Gulf of Mexico. These efforts being concentrated near the Florida panhandle in the 1850 period, using small craft which did not venture beyond the 40 fathom line. Earlier fishing ventures were to meet the need for food, a need which preceded the recreational aspect of the fisheries by several decades. But even with this history, no studies have been published on separate reef fish stocks. Essentially, each species is treated as a stock throughout its range and regardless of its general identification with other reef species in a physical sense.

The trends for the existing fishery as described by available references suggest that the reef fishery associated with irregular bottom is well understood biologically and that, with but a few exceptions, future investigative efforts should be addressed primarily to the mechanics of maintaining a viable industry and improving habitats, catch procedures, and gear. In this context, it should be re-emphasized that reef fish are a resource common to both commercial and recreational fishermen. Except in those cases where artificial reefs are constructed and recruitment to these reefs is realized to the

point that they will support fishing, the most important task is to assure that historically productive natural reefs are used in a manner which will enhance their productivity. This includes continued efforts to maintain and enhance their recruitment to reef sites, to maintain and improve fishing gear and fishing technique, and to encourage and support the construction of artificial reefs as habitats for new populations. There is little or no information on stock trends of other groups.

Social/economic impacts of the reef fishery are not well understood. For example, significant data are available on some members of the snapper or grouper fisheries while others have not received adequate consideration. User groups are generally known but poorly defined. Jurisdiction is divided by boundaries of the FCZ and adjacent states.

Reef fish of the Gulf of Mexico are comprised of warm water species, are normally associated with specific bottoms, and undergo minimum migrations. Movement or relocation does take place, however, as is evidenced by the buildup of reef fish stocks in the vicinity of petroleum platforms or artificial reefs. In addition, there is evidence that in some areas of the Gulf there are significant stocks associated with generally smooth bottoms although the extent and stability of these events is not clear. These factors suggest the need not only for information on food habits, age, growth, sex reversal and recruitment but, also, for a knowledge of chemicals and toxic substances which might affect the stocks or human consumers. Thus it can be suggested that the health of reef areas and what brings about the degradation or stresses on the stocks at particular locations is of particular concern.

Unlike the major fishery of the Gulf of Mexico, shrimp, the reef fish population is not represented by a single year class. Frequently, therefore, it is difficult to assess the recruitment process with any degree of accuracy even at a single site. Also, even though migrations are believed to be minimal as compared to other species, movements do occur for unknown reasons. And, as noted, significant quantities are sometimes found on flat bottoms far removed from bottom structures with which the several species are normally associated.

The technology for fishing reef fish varies from the conventional hook and line common among recreational fishermen to the use of traps and bottom longlining in the commercial sector. Each is effective for its intended purpose, however, since each technique involves only the process of catching, there can be no discrimination as to year class, and therefore, on the impact fishing technology may have on the overall status of the stocks. Therefore, a fishery in which the catch is already believed to approach the estimated MSY, recruitment, size and catch limits become a critical concern. To date, however, much of what can be done through regulatory measures is hindsight. The results, though not acceptable to all parties, have not created a crisis as yet.

In summary reef fish constitute a fishery in which much is known about the biology of the several species involved; for which there is inadequate knowledge of habitat preference, movement, recruitment, or stock composition by species and year class; which are prime species for recreational fishermen; and much in demand by commercial fishermen and which are subject to a variety of fishing technologies as well as the regulatory process of state and federal agencies.

Figure 3.1.4 illustrates the best estimate of current information. Table 3.1.4 summarizes identified problem/opportunity projects. Following are annotations of reef fish research problems which have been identified in the preparation of this document.

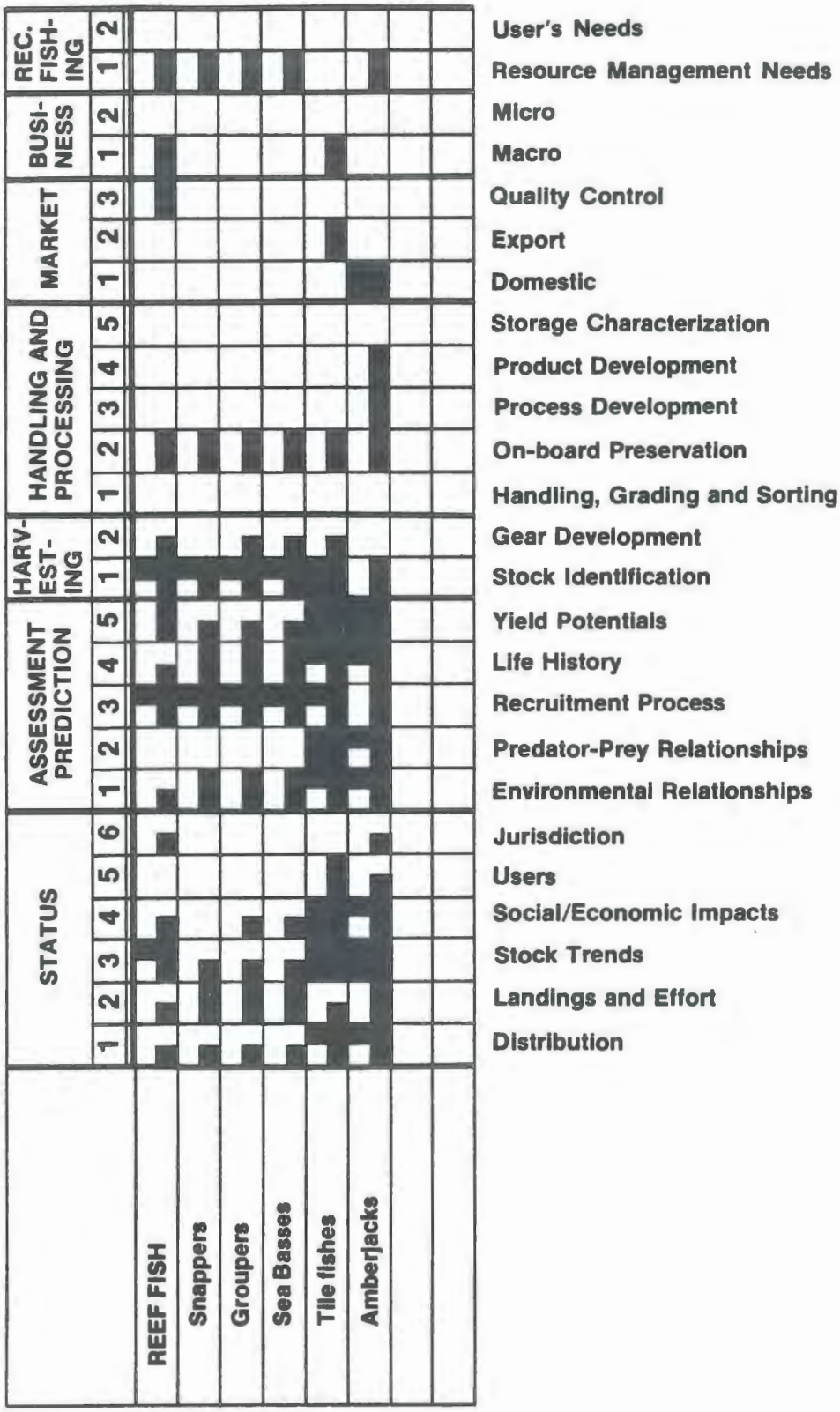

Figure 3.1.4 Summary of information needs. The estimated degree of need is shown in each matrix block as follows: ☐ available information adequate for current needs; ▖ 1-25% more information needed; ▒ 26-50% more information needed; ▀ 51-75% more information needed; ■ 76-100% more information needed.

RF1 Life History/ Management on Grouper -- Incomplete life history/management information on scamp, gag, and yellowedge grouper. Exact spawning times are unknown, as are predator/prey relationships, rate of influx to estuaries, survival, growth, and ecology - lack of stock assessment information. Potential benefits: better management and OY.

RF2 Extent of Reef Fishing Activities by Recreational Fishing in the FCZ -- In order to fully understand fishing pressures in the FCZ, better data is needed on the participation of recreational private boat fishermen. Potential benefits: will provide information necessary for allocation if necessary.

RF3 Need for Comprehensive Management Information on Recreational Charter and Party Boats in the Gulf Region -- Accurate information on the wide variety of boating services for recreational fishing does not exist or is not readily available even though such information would be a valuable tool for management purposes. Potential benefits: needed to determine fishing pressure from charter and party boats on reef fish stocks so that proper management measures can be instituted where necessary.

RF4 Red Snapper Fishing Using Long Lining Technique -- Potential overfishing of snapper stocks on flat or soft surfaces using long lining technique could lead to early depletion of breeding stocks. Potential benefits: provide necessary information with which to regulate longline gear.

RF5 Stocks Associated With Smooth Bottoms in the Gulf -- Inadequate information. Long lining operations suggest the existence of commercial quantities of red snapper in areas of extensive smooth bottom. Potential benefits: provide to industry necessary information on which to develop a potential new fishing methodology.

RF6 Alternative Methods for Commercial Harvesting -- Reef fishing technology varies, often as a function of habitats and bottom topography. Potential benefits: allow commercial fishing units to become more efficient, thus reducing cost.

RF7 Reef Fish Marketing -- A marketing structure for reef fish exists but criteria for the process itself is not well established or understood. Potential benefits: available fishing technology suggests that reef fish would be made available in varying sizes and this might enhance the demand.

RF8 Grouper Marketing Study -- Conduct a study to determine market demands for various sizes of grouper. Potential benefits: available fishing technology suggests that grouper could be made available in varying sizes and this might enhance the economic return.

RF9 Identification and Verification of Reef Fish Stocks -- Some evidence suggests that reef fish throughout the Gulf represent three separate stocks and should be studied and managed in that context. Potential benefits: each stock could possibly be managed for higher production if each stock is subject to difficult fishing pressures.

RF10 Improving Quality of Reef Fish -- Some evidence suggests that environmental matters and factors such as the depth at time of catch influences the quality of reef fish. Potential benefits: increased consumer acceptance and production.

RF11 Identification of Stressed Areas -- Evidence suggests that reef fish habitats may become less capable of supporting stocks at levels assumed to have existed in past decades. This needs to be understood. Potential benefits: will provide necessary information for maintenance of existing stocks.

RF12 Competition Between Commercial and Recreational Fishermen -- To a considerable extent commercial and recreational fishermen operate in a competitive posture in the same fishing grounds for the same resource. Potential benefits: increased efforts to establish artificial reefs and to dedicate these to recreational demands could reduce the conflict, particularly if the new reefs were sited so as to make them accessible to recreational fishermen.

RF13 Reef Habitat Management -- Inadequate knowledge of ecosystem, or habitat, to include the composition and processes through which a system functions. There is a tendency to address or be concerned with the species which inhabit an area, on land or in marine waters, rather than the habitat or ecosystem which supports their existence. Potential benefits: habitat information would allow for more efficient management of reef areas.

R14 Environmental Tolerances and Preferences -- Inadequate knowledge. Past studies have frequently concentrated on field studies whereas more could be learned through direct studies of the species in laboratories or controlled environments. Potential benefits: improved understanding of how and why they seek and survive at particular locations.

RF15 Life Histories of Reef Species -- Only in a general way are the life histories of reef species understood. There is a need for more thorough life history studies to include documentation of movement, spawning stocks, migrations, non-reef habitats. Potential benefits: will provide more detailed information with which to make management decisions.

RF16 Information is not Available to Manage Gulf Reef Fish Resources Using a Multispecies Approach -- The Gulf reef fish resource consists of approximately 50 separate species. Fishery management policies need to be cognizant of interspecies relationships, especially as full exploitation of regional resources is approached. Without this information, it will be impossible to attain optimal use of the total reef fish resource. Potential benefits: improved scientific understanding of the Gulf fishery resource ecosystem will allow management approaches on a multispecies basis to be considered; maximizing total returns for Gulf reef fish resources and preventing deteriorating fisheries due to adverse changes in the carrying capacity of the Gulf ecosystem require such approaches.

Table 3.1.4 Research Program Summary for Reef Fish.
Each project has been categorized as recovery, maintenance, expansion, or new fishery.

Ident. Number	Function of Task	Costs x 1000 First Year Amount	Second Year Amount	Third Year Amount	Fourth Year Amount	Fifth Year Amount	Total	Program Category	Priority
RF1	Life History/Management on Grouper	190	186	124	110	110	720	Maintenance	M
RF2	Extent of Reef Fishing Activities by Recreational Fishing in the FCZ	110	100	100	-	-	310	Maintenance	M
RF3	Need for Comprehensive Management Information on Recreational Charter and Party Boats in the Gulf Region	220	140	140	-	-	500	Maintenance	L
RF4	Red Snapper Fishing Using Long Lining Techniques	-	-	75	50	50	175	Maintenance	L
RF5	Stocks Associated With Smooth Bottoms in Gulf	100	75	50	-	-	225	Expansion	M
RF6	Alternative Methods for Commercial Harvesting	-	-	-	50	50	100	Maintenance	L
RF7	Reef Fish Marketing	40	40	40	-	-	120	Maintenance	L
RF8	Grouper Marketing Study	40	40	40	-	-	120	Maintenance	L
RF9	Identification and Verification of Reef Fish Stocks	190	110	110	-	-	410	Maintenance	M
RF10	Improving Quality of Reef Fish	25	25	-	-	-	50	Maintenance	L
RF11	Identification of Stressed Areas	35	35	35	-	-	105	Maintenance	L
RF12	Competition Between Commercial and Recreational Fishermen	30	30	30	-	-	90	Maintenance	M
RF13	Reef Habitat Management	150	150	150	150	150	750	Maintenance	L

3.1.5 Coastal Herrings and Associated Species

Collectively, the coastal herrings probably are one of the least understood group of fishes in the United States. None of the species is exploited significantly, although the potential of this group of fish has been recognized for 25 or more years. Estimates of yield potential range from 2.2 to 11 billion pounds. The total present day harvest is only a small fraction, probably less than 1 percent, of the combined sustainable yield of these species. Most of the current landings of coastal herrings are from directed purse and beach seine fisheries. The landings generally are used for bait, although considerable interest recently has evolved to use these fish as export products for human consumption.

Coastal herrings are an extremely diverse group of fishes. They characteristically school and inhabit the surface and mid-waters. Schools are often mixed, and they rarely are caught in any number in bottom trawls. Exploratory fishing trials by NMFS in the 1960's with small mid-water trawls failed to produce significant catches apparently because the fish were able to avoid the nets. More recent commercial fishing trials with drum and purse seines have been more successful, although the relatively small schools that many of these fish form make this type of fishing marginal from an economic viewpoint.

Good catch and effort data are conspicuously lacking for the coastal herring complex. Lack of knowledge about the availability and capture technology for these fish are major problems which inhibit development. There is an overall lack of stock assessment information with the most critical needs being to determine population size, age structure, and growth and natural mortality rates.

Stock assessment information would be most valuable if obtained before significant fishing mortality occurs. There are also important questions to be answered about stock identity and the role of these fish in food chain dynamics and in sustaining predator populations of currently exploited fish. Additionally, questions relating to on-board handling, processing, product development, and market need to be addressed before the harvest can achieve its full potential.

Fourteen species are included in the coastal herrings and associated species. Since there is so little information on most of those species the following brief summaries of available information are included here. More information is needed in all appropriate areas, unless otherwise indicated, if the full potential of these resources is to be achieved.

The thread herring is relatively abundant in coastal waters and over the inner continental shelf of the Gulf of Mexico. A substantial purse seine fishery once existed for these fish off Florida, but local laws preventing the landings of those fish resulted in a closure of the fishery. They are, however, still periodically taken in the north central Gulf by the menhaden fishery, but inadequate catch statistics make estimates of those landings questionable. Attempts by the menhaden fishery to develop thread herring into an off-season fishery for their vessels have not been successful primarily because of inadequate locationing and capture technology. The bulk of the stock seems concentrated off Florida although seasonal movements are thought to occur with the fish moving south in the fall and north in the spring. The fish tend to stay offshore where salinities are relatively high, but will move inshore when estuarine salinities approach oceanic conditions. There is probably more known about the dynamics and life histories of thread herring than most of the other fish in the coastal herring complex. This knowledge,

Table 3.1.4 Research Program Summary for Reef Fish. (Continued)

Ident. Number	Function of Task	Costs x 1000 First Year Amount	Second Year Amount	Third Year Amount	Fourth Year Amount	Fifth Year Amount	Total	Program Category	Priority
RF14	Environmental Tolerances and Preferences	110	90	90	-	-	290	Maintenance	L
RF15	Life Histories of Reef Species	190	186	124	110	110	720	Maintenance	M
RF16	Information is not Available to Manage Gulf Reef Fish Resources Using a Multispecies Approach	250	250	250	250	250	1250	Maintenance	H

however, is still inadequate for effective management or development of the resource. Yield potential estimates range from 331 million to 1.4 billion pounds.

The distribution of Spanish sardines is only sketchily known in the Gulf of Mexico even though they are probably the most heavily fished species in the coastal herring complex. Yield estimates suggest an annual potential of about 882 million pounds should be available for harvest. The current harvest is about 6.6 million pounds. Spanish sardines appear to prefer waters with salinities above 35 ppt which may be why they tend to be found further offshore than most of the other coastal herrings. At least one company has tried to commercially can these fish, but lack of knowledge on availability and capture technology has prevented a substantial fishery from developing. As with the rest of the coastal herring complex, information is needed in almost all areas from distribution and availability to effective handling and processing systems to produce high quality products from these perishable fish.

Round herring is believed to be the most abundant clupeid in the Gulf of Mexico with yield potential estimates ranging as high as 3.3 billion pounds. They appear to occur throughout the Gulf mainly in the deeper waters along the slope and edge of the continental shelf. Catch data are not reported for this species although some are likely taken for bait when they occasionally enter coastal waters. Even though round herring are believed to be very abundant, there is virtually no information on their population dynamics, life history, environmental relationships, or their role as prey for predatory fish. Additionally, there is very little data available on their chemical composition and required processing and handling technology to ensure a high quality product.

Scaled sardine are a small fish with the majority of the stock appearing to occur within state waters. They are believed to be fairly numerous with yield potential estimates ranging between 308 and 606 million pounds. They are caught primarily for use as bait with the annual harvest being less than 4.4 million pounds. Good catch statistics are lacking along with information on population dynamics, life history, and environmental relationships.

Four species of anchovy are included in the coastal herring complex. The most abundant species, the bay anchovy, is a small and extremely abundant fish considered important because of its role as a major forage species for many commercial and recreational fishes. The striped anchovy is somewhat larger and faster growing than the bay anchovy, but apparently less abundant. They are generally found further offshore than the bay anchovy apparently due to their preference for waters with salinities above 20 ppt. The silver anchovy occurs farther offshore than either the striped or bay anchovies and apparently is less abundant. The least abundant anchovy, however, is probably the dusty anchovy which is normally found offshore in waters with salinities above 35 ppt. Overall, there is little information available on stock size, life history, population dynamics, or environmental relationships for any of the anchovies. Additionally, for this species group to constitute an important commercial fishery, information would have to be developed on economically efficient harvest, handling, and processing technology.

The rough scad may be an abundant species in the Gulf of Mexico with yield potential estimates ranging as high as 37 million pounds. From egg and larvae data their greatest abundance appears to be in the eastern portion of the Gulf. Some rough scad are periodically taken for bait with the landings probably being less than 1.1 million pounds annually. Very little information exists on life history, population dynamics, or environmental relationships for these fish.

Bigeye scad is known to occur world-wide in tropical waters. The distribution of these fish in the Gulf, however, is poorly known although they have been collected off

Texas, Louisiana, and Florida. They are not fished and their role as prey species for commercial and recreational predatory fish is unknown. There are no estimates available on yield potentials.

The Atlantic bumper is sometimes classified as a bottomfish because they are periodically taken in bottom trawls. They probably, however, have a more pelagic existence. They are taken most frequently by bottom trawls in nearshore waters, but reports of captures at depths to 900 fathoms have been made. There is no directed fishery for Atlantic bumpers in the Gulf although they are taken incidentally in the shrimp trawl fishery. No reliable estimates of yield potential are available nor is there much information available on the biology, distribution, or population dynamics of these fish.

The distribution of ballyhoo in the Gulf of Mexico is reasonably well understood. They are abundant mainly off Florida near the Florida Keys where they occur in shallow waters. They are fished for bait with landings averaging between 100 and 180 metric tons annually. In general, information on life history, population dynamics, and environmental relationships is fairly good. Yield potential has been estimated between 595 thousand and 1.5 million pounds.

The halfbeak is widely distributed in the Gulf of Mexico being most common in bays, estuaries, and shallow coastal waters. There is no information available on migrations, although seasonal movements in response to changing temperatures have been suggested. No directed fishery exists for halfbeaks although they are probably taken incidentally in the shrimp trawl fishery and periodically for bait. There are no estimates available on yield potential, but it is generally assumed that this potential is relatively small.

Chub mackerels are not fished commercially in the Gulf of Mexico, and little information exists on distribution and movement patterns. They appear to occur primarily along the edge of the continental shelf in relatively deep water. Significant catches of these fish have been made during NMFS exploratory fishing cruises although normally the catches were mixed with other species. There are no reliable estimates available on yield potential although the potential is not believed to be very large.

Figure 3.1.5 illustrates the best estimate of current information. Table 3.1.5 summarizes identified problem/opportunity projects. Following are annotations of coastal herring research problems which have been identified in the preparation of this document.

CH1 Coastal Herrings are Abundant but do not Have the Desired Edibility Characteristics for Domestic Fresh or Frozen Products -- More knowledge of handling, processing, and marketing requirements is needed. Potential benefits: increased employment and economic activity with the establishment of a significant canning industry for coastal herrings; reduction of the national trade deficit through the export of quantities of frozen and/or canned herrings; greater consumer options for nutritious but inexpensive food products.

CH2 Gear Development -- Historical efforts to capture coastal herrings aggregated offshore during the colder month periods were unsuccessful because the fish could avoid traditional small midwater trawls. New trawling technology consisting of large mesh midwater and high opening bottom trawls appears to have significant potential for efficient harvest of these fish, but needs to be evaluated. When the fish are inshore during the warmer months, they often form small schools which are not economical to harvest. Past research to concentrate these fish with passive structures and lights were successful, but commercial-scale demonstrations are needed to determine if concentrating methods will indeed enhance efficiencies of operation. Potential benefits: economical methods to commercially harvest coastal herrings.

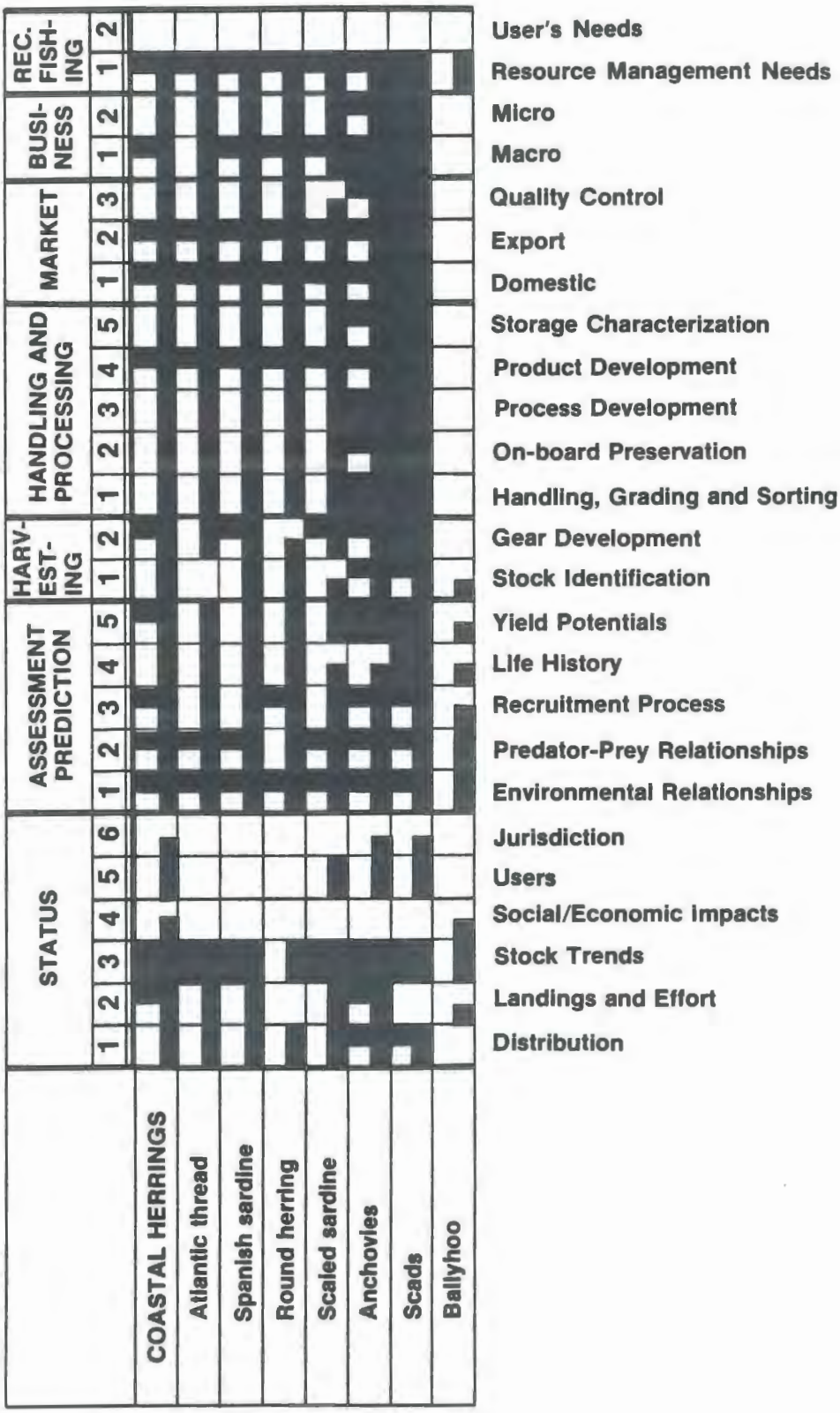

Figure 3.1.5 Summary of information needs. The estimated degree of need is shown in each matrix block as follows: ☐ available information adequate for current needs; ▙ 1-25% more information needed; ▟ 26-50% more information needed; ▙ 51-75% more information needed; ■ 76-100% more information needed.

CH3 Stock Assessment -- Estimates of yield potentials for coastal herrings are based on egg and larvae data. These estimates need to be verified through carefully designed surveys of the adult stocks before being accepted as truely valid. Additionally, there is a critical need to determine annual variabilities in the stocks as many herrings exhibit boom and bust population levels. If these widely ranging conditions exist, both industry and management should be advised so the fishery can be developed accordingly. Potential benefits: reliable estimates of yield potentials and annual variabilities to guide investment and management decisions.

CH4 Handling and Processing Technology -- Coastal herring are characteristically small and easily damaged if not handled properly. Additionally, their warm water environment will result in the quality of the fish degrading rapidly if not properly handled aboard the fishing vessel. There is also a need to investigate product forms which would make coastal herrings more valuable in foreign and domestic markets. Seasonal differences in the chemical composition, storage characteristics, and shelf life of these fish need to be determined. Potential benefits: information leading to quality products and forms with the greatest potential for widespread market acceptance.

CH5 Economics -- As with any developing fishery and especially because of the many avenues open to research and development interests in the coastal herrings complex, economic research is essential to guide developmental efforts. This research needs to be done on a continual basis and be designed in such a way to maximize potential benefits from all investigations relating to coastal herrings. Potential benefits: coastal herring research and development efforts will be focused into those areas with the best economic payoff potential.

CH6 Marketing -- It is anticipated that most coastal herrings will be used for export into markets which traditionally like and accept herring-like fishes. Most of these markets will be in the foreign sector. Market research is required to identify quality standards and the best product form to insure maximum economic value. This research also should consider ways to handle competition and alternative markets if and when there are excessive quantities of herrings in traditional world markets. Potential benefits: up-to-date information on markets and market potentials for alternative product forms.

CH7 Predator-Prey Relationships -- A major concern of recreational fishing groups is the impact harvesting coastal herrings will have on target predatory species. A number of the coastal herrings appear to be important forage species for such fish as marlins, mackerels, sailfish, and others. Research is needed to ensure that sufficient numbers of the coastal herrings are available for predatory species so that recreational and commercial fishing is not adversely impacted when fisheries develop for the coastal herrings. Potential benefits: information on which to base management allocations of coastal herrings to prevent adverse impacts on predatory species.

Table 3.1.5 Research Program Summary for Coastal Herrings.
Each project has been categorized as recovery, maintenance, expansion, or new fishery.

Ident. Number	Function of Task	Costs x 1000 First Year Amount	Second Year Amount	Third Year Amount	Fourth Year Amount	Fifth Year Amount	Total	Program Category	Priority
CH1	Product Development	151	151	290	452	469	1513	New Fishery	H
CH2	Gear Development	450	300	150	100	100	1100	New Fishery	H
CH3	Stock Assessment	50	50	200	300	300	900	New Fishery	H
CH4	Handling and Processing	50	50	150	150	100	500	New Fishery	H
CH5	Economics	25	25	25	25	-	100	New Fishery	H
CH6	Marketing	50	80	150	150	100	530	New Fishery	H
CH7	Predator-Prey Relationships	55	80	100	100	50	385	New Fishery	H

3.1.6 Ocean Pelagics

The ocean pelagics research unit includes 40 species of billfish, tuna, sharks, skates, rays, and others. Gulf commercial landings of ocean pelagics in 1983 amounted to 2 million pounds valued at $4 million and recreational fishermen took 2 million pounds in 1980. Total value of the 4 million pounds was estimated at $6 million and should be considered as an underestimate. Potential yield was estimated at 10 million pounds (Table 2.1).

The NMFS has a responsibility of collecting and analyzing data on ocean pelagic fishes. This is part of a commitment by the United States to participate in cooperative international investigations through the International Commission for the Conservation of Atlantic Tunas (ICCAT). The ICCAT is responsible for coordinating and guiding scientific investigations on stocks of tunas and tuna-like fishes, including billfishes, in the Atlantic Ocean and adjacent seas. Data collected through NMFS programs are used in population modeling and in annual assessments of the status of stocks of Atlantic billfishes and tunas, and these results are presented to the international scientific community at ICCAT each year. In addition, the information collected on these species are also used to formulate domestic regional fishery management plans.

Distribution patterns of white marlin in the western Atlantic are fairly well known, but not well understood for blue marlins and without a discernible pattern for sailfish. Atlantic bluefin tuna are distributed throughout the Atlantic, Mediterranean, and Gulf of Mexico. Their migration pattern is well understood. There is less information on other species of tuna. Little tunny are found in coastal areas in northern and eastern Gulf of Mexico. Sharks are distributed worldwide, but information on specific distribution is generally lacking.

Landings and effort are well documented for only bluefin tuna. Recreational billfish surveys have been conducted in the Gulf since 1971. Landings and effort data for other ocean pelagic species are generally incomplete or lacking. Shark catch data that are available are lumped under "sharks." Additional information is needed.

Available information on stocks and trends indicates that bluefin tuna stocks are overexploited, and possibly some other species, including swordfish, are approaching full utilization. Recent year catches indicate a decline in swordfish. There is no trend information on sailfish, sharks, little tunny, and blackfin tuna.

Social and economic features of bluefin tuna fisheries are well understood. Some information has been developed for swordfish. There is practically a void for all other species.

Prior to 1982, Japanese longline vessels were very active in the Gulf of Mexico catching as many as 10,000 giant (greater than 297 pounds) bluefin tuna per year. Catches of some sharks, blackfin tuna and little tunny have been reported from the Gulf. Recreational fishermen fish for and catch all species. Many billfish are released.

Tuna and billfish are currently under the auspices of the ICCAT. U.S. regulations further restrict the U.S. catch. A U.S. Preliminary Fisheries Management Plan (PMP) requires that all sharks and billfishes caught by foreign fishermen within the FCZ be released (dead or alive).

The bluefin tuna in the Gulf are large adults that migrate to the Gulf in winter to spawn. It is the only known spawning area for bluefin in the western Atlantic population. With the exception of information on the association of bluefin tuna with thermal fronts, there is almost no information on environmental relationships of ocean pelagics in the Gulf.

Predator/prey relationship information is sparse. Some information on food habits of tunas, sharks, and swordfish is available. Blackfin tuna and little tunny, subject to predation by the adults of larger species which are so large that the number of potential predators is very limited.

Recruitment processes of bluefin are fairly well understood but information for all other species is generally limited to spawning seasons and location. Extensive studies on planktonic larvae in the Gulf are in progress and should be continued. Almost no data are available for sharks. Recruitment information will be required when fisheries expand or are developed.

The best information available on the life history of ocean pelagics is for bluefin and yellowfin tuna and swordfish. Data gaps occur in life history information on all species. There is almost no data available for sharks.

Due to current regulations giant bluefin tuna are harvested only as a bycatch in the Gulf. Assuming the existence of a single Atlantic stock, yellowfin tuna are fully exploited and, as suggested by available information, so are blue and white marlin. Preliminary yield per recruit of swordfish has been calculated but not validated. Yield estimates for all species will be required if optimum yield is to be achieved.

Information for commercial users of bluefin tuna and swordfish is adequate. Additional harvesting technology for yellowfin tuna is needed. Business and economic information on recreational fisheries for ocean pelagics is very sparse. User group information on blackfin tuna, little tunny and sharks must be acquired if optimum yield from those species is to be achieved.

Information needed for the management of recreational fisheries for ocean pelagics is relatively sparse. There are substantial gaps in recreational catch and effort data. The Cooperative Game Fish Tagging Program and tournament sampling provide essential information. Success of the NMFS Ocean Pelagics Program is highly dependent on cooperation from fishermen.

All three activities of the Ocean Pelagics Program (i.e., Recreational Billfish Surveys, Cooperative Gamefish Tagging, and Research on Age and Growth) are closely associated and are being conducted simultaneously in the same geographical region to provide comprehensive data for stock assessment. For example, many of the billfish tagged for cooperative gamefish tagging are tagged during the same tournaments that are monitored by the billfish surveys. Conversely, tagged billfish that are recaptured after being at-large for extended periods are sampled for skeletal structures to aid validation of the accuracy of our ageing studies. In addition, many of the fish sampled for age and growth studies are obtained at tournaments or from docks monitored by the billfish surveys.

There is little information on user profiles, and regulatory impact is not understood except for bluefin tuna and swordfish.

Recreational user needs include catch utilization, aggregation structure and motivation-satisfaction enhancements for several species. There is considerable room for progress in information dissemination.

In general, there is relatively little information available on ocean pelagics except for bluefin tuna and swordfish. In the Gulf there are considerable resources of blackfin tuna, little tunny, and sharks that can be considered as under or unexploited by either commercial or recreational fishermen. Extensive additional information is needed before optimum yield under ICCAT and domestic FMP jurisdiction can be realized. In addition it is possible to increase the U.S. harvest of yellowfin tuna in the Gulf of Mexico.

Figure 3.1.6 illustrates the best estimate of current information. Table 3.1.6 summarizes identified problem/opportunity projects. Following are annotations of ocean pelagics research problems which have been identified in the preparation of this document.

OP1 Insufficient Knowledge of the Chemical Composition, Handling, Processing and Product Characteristics of Available Ocean Pelagics -- e.g. blackfin tuna or little tunny. Potential benefits: reduction of the national trade deficit through the export of quantities of pelagic species and/or substitution for imports by domestic tuna processors; new product options for consumers.

OP2 Shark Resources of the Gulf -- Not fully exploited. The shark resources of the Gulf are not fully utilized as a food product and a source of recreational activity. Shark resources offer potential for increased economic return to Gulf fisheries. Potential benefits: an increase in shark harvest that could be of substantial value.

OP3 Tunas in the Gulf are Underutilized -- Small tunas (blackfin tuna, little tunny, frigate mackerels) offer the potential to develop a major fresh fish market for these species in the Gulf area. Potential benefits: the addition of a high-quality, valuable food product to the list of commercially produced fish items.

OP4 Gear Selectivity -- Gear developed to take selected sizes and/or species is needed. Potential benefits: increased value of catch.

OP5 Stock Assessment -- Stock assessment is not available for most ocean pelagic species. Potential benefits: increased harvest with sustained yield.

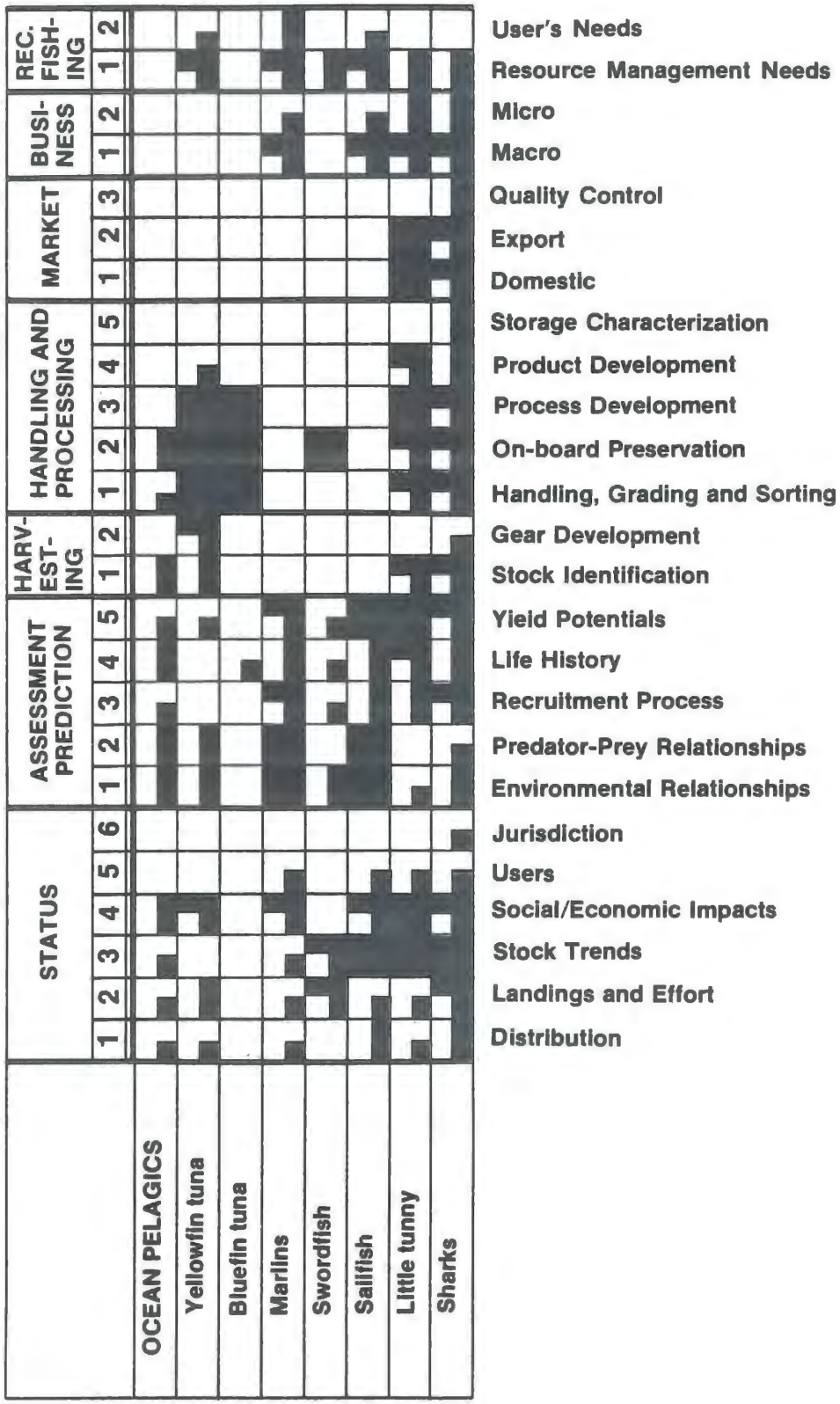

Figure 3.1.6 Summary of information needs. The estimated degree of need is shown in each matrix block as follows: ☐ available information adequate for current needs; ▖ 1-25% more information needed; ▞ 26-50% more information needed; ▙ 51-75% more information needed; ■ 76-100% more information needed.

Table 3.1.6 Research Program Summary for Ocean Pelagics.
Each project has been categorized as recovery, maintenance, expansion, or new fishery.

Ident. Number	Function of Task	Costs x 1000 First Year Amount	Second Year Amount	Third Year Amount	Fourth Year Amount	Fifth Year Amount	Total	Program Category	Priority
OP1	Handling, Processing, and Marketing of Ocean Pelagics	125	118	140	191	190	764	Expansion	H
OP2	Shark Resource Exploitation	78	78	44	37	37	274	Expansion	M
OP3	Tuna Underutilization	135	100	125	-	-	360	Expansion	H
OP4	Gear Selectivity	150	100	50	-	-	300	Maintenance	M
OP5	Stock Assessment	200	200	150	100	100	750	Expansion	H

3.1.7 Marine Mollusks

This group is composed of a variety of species, several of which are being harvested near MSY (oysters) and several which potentially could provide a tremendous new industry in the Gulf (squids).

The oyster industry in the northern Gulf has approached MSY. Oyster production, although relatively stable, continues a slow decline. Common biological, environmental, and management problems exist throughout the Gulf oyster industry. Periodic flooding causes mass mortalities of oysters. Predation from the southern oyster drills, blue and stone crabs, and black drum continues to be a significant source of mortality. The oyster pathogen, "dermo", continues to be a problem on offshore, high-salinity reefs, or on those nearshore reefs affected by saltwater intrusion. Alteration of salinity regimes and current patterns by various estuarine modifications as well as domestic and industrial pollution continue to reduce suitable oyster habitat or production for human consumption. There appears to be little prospect for increased natural oyster production under traditional cultivation systems, but it is necessary that we maintain the current level of production.

The Atlantic bay scallop occurs from New England down the east coast, across the Gulf into Mexico. They are generally found in high salinity, clear water nearshore bays that support large expanses of seagrasses. These areas are characterized by very low wave energy. Scallops attach to the seagrasses as juveniles and hide in the seagrass as adults. They are generally harvested commercially using roller nets. They support a small recreational fishery. They generally live from one to two years and generally spawn in the fall of their first year. No expansion of production in the industry is foreseen. Pollution appears to be destroying available habitat.

The southern quahog is found from New Jersey down into the Gulf. It is replaced around the Mississippi River by Mercenaria texana, a hybrid between Mercenaria mercenaria and Mercenaria campechiensis. These clams are long-lived and fast growing, generally reaching market size in two years. The current market is for the smaller steamer and raw clams which are harvested leaving the larger clams for brood stock. Currently there is a small fishery at Port St. Joe, Florida. Historically a fishery has existed in southwest Florida from around the turn of the century. This fishery diminished because of habitat degradation and an adverse, extremely low temperature event. In the early 1970's a fishery existed in southeastern Louisiana. This fishery was lost due to adverse environmental conditions (low oxygen conditions). Most of the available harvestable population is now found in closed shellfish harvesting areas. In some areas a small recreational fishery exists.

The calico scallop ranges from the northern side of the Greater Antilles, throughout the Gulf of Mexico, to Bermuda and slightly north of Cape Hatteras. Exploitable calico scallop beds are generally distributed on the continental shelf parallel to the coastline in depths of 27 to 90 m, mostly in depths less than 50 m.

Spawning in calico scallops is related to age. They can spawn as early as 4 to 7 months. They are short-lived (18 to 24 months).

Relative abundance of the calico scallop varies with scallop size both within and between areas, seasonally and annually. It is generally most abundant off the Florida east coast near Cape Canaveral, with lesser concentrations near Cape San Blas, Florida and from the eastern Gulf of Mexico between Sanibel Island and Dry Tortugas.

Because of the large fluctuations in abundance, it is difficult to assess the present condition of the stocks. Stocks fluctuate widely each year, but there is no reason to believe that the stock is undergoing greater fluctuations now than in previous years.

The calico scallop fishery is unpredictable because of the naturally occurring fluctuations in stock abundance. Several fishery-related factors preclude the possibility of overfishing. Many scallop beds are not harvested each year because of the vastness of the scallop grounds and the relatively small size and wide dispersion of scallop beds on the grounds. Spawning stock is provided by scattered individual scallops and scallops which occur in beds at densities too low to harvest economically. Scallops less than about 40 mm shell height usually are not harvested by the fishery because they are below market size, but scallops as small as 20 mm are capable of spawning. When catch rates drop below a profitable level harvesting ceases, leaving the remaining scallops to contribute to stock replenishment. Considering these factors the calico scallop stocks are expected to remain viable indefinitely unless environmental factors change to a degree which severely affects production and survival.

The queen conch ranges from Bermuda throughout southeastern Florida into the Bahamas, into the Caribbean Sea to the West Indies. They are generally found in or near turtle grass beds in the vicinity of coral reefs at depths down to 40 feet. Spawning appears to occur year-round with brief interruptions during the colder months. Growth is slow, and it seems to take about 2½ years for queen conchs to reach maturity.

These conchs are fished widely for food in the Bahamas and parts of the Caribbean. Much of the conch meat sold in Florida comes from Honduras. The shells are sold in the curio trade.

It is generally agreed that populations are declining throughout its range because of overfishing. Therefore, no increase in landings is anticipated. There is some potential for harvesting other species.

Within the southeast region there are five species of commercially important squid. Because of the slight differences between some of the species they are not easily recognized. The longfin and arrow squid are generally lumped together under the name longfin squid, while the northern and southern shortfin squid are lumped as shortfin squid. The brief squid stands alone.

Both the longfin and shortfin squid have, for many years, been fished commercially in the northeast and in Canada, mainly for bait. Only in the last 10 years or so has the fishery extended down from New England into the middle Atlantic region and the catches taken for human consumption.

Very little exploratory fishing has occurred south of Cape Hatteras, North Carolina. Our only source of information on commercial squid distribution and numbers in the Gulf of Mexico are from research vessels, resource studies on groundfish and the records of by-catch from shrimp trawlers. On the basis of those data it is believed that the potential for commercial concentrations exists at certain times in the Gulf of Mexico which could support a fishery.

A full squid fishing exercise being conducted by NMFS and Japan in a cooperative effort should provide better information. Further studies on seasonal and areal distribution are necessary so that the full potential of this resource may be realized. It is thought that the squid resource may be one of the first new fisheries developed in the Gulf.

The octopus represents an unknown resource in the Gulf of Mexico. It is generally thought to occur across the Gulf. It is generally harvested as a curiosity. With the increasing sophistication of seafood lovers in the Gulf and increased population it appears that there is a place for a limited directed octopus fishery.

Currently, research is underway to test the efficiency of longline gear for capturing local species of octopus, to determine areas with commercial potential, to assess stock size and species diversity and to demonstrate the use of octopus fishing gear.

Figure 3.1.7 illustrates the best estimate of current information. Table 3.1.7 summarizes identified problem/opportunity projects. Following are annotations of marine mollusks research problems which have been identified in the preparation of this document.

MM1 Assessment of Stocks of Squid -- Little is known about the Gulf of Mexico squid stocks, their size, distribution - seasonally or geographically, or spawning grounds. Potential benefits: with the knowledge in hand it would be possible to encourage private industry to expand into the squid which would provide an alternate fishery for our shrimp fishermen.

MM2 Squid Fishing Methodology -- The best type of gear to catch squid in the Gulf needs to be determined. Potential benefits: this information would help to bring on the development of the squid in the Gulf.

MM3 Squid Product Preparation -- There is a need to train our fishermen in the proper handling and storage of squid so that the product when delivered to the dock can be in a condition to compete with other squid on the world market. Potential benefits: this effort would allow our fishermen to compete successfully in the world squid market place.

MM4 Squid Market Development -- There is a need to develop the market structure necessary to accommodate the squid fishing fleet as it develops. Potential benefits: there is a need to develop this expertise so that as the fishing effort grows, the processing and marketing industry may grow along with it.

MM5 Calico Stock Assessment -- Fluctuations in calico clam abundance have prevented formation of a stable directed fishery. Potential benefits: stabilization of existing fishery.

MM6 Quahog Distribution -- Distribution of the quahog in Gulf waters has not been adequately mapped, particularly the distribution of the cherrystone size clams. Potential benefits: development of an underutilized resource.

MM7 Quahog Marketing -- There is no market for the chowder size hard clam; there is no supply of the cherrystone hard clam. Demand for hard clams depends on the available supply along the Atlantic coasts. Potential benefits: development of an underutilized resource.

MM8 Polluted Oyster Sales -- Some outbreaks of Vibrio cholera and hepatitus have been traced to the sale of polluted oysters. Potential benefits: increased consumer confidence.

MM9 Mechanical Oyster Shucking -- The number of people willing to work in the oyster industry, particularly shucking oysters, is decreasing. Potential benefits: mechanical device to supplement structural employment shifts.

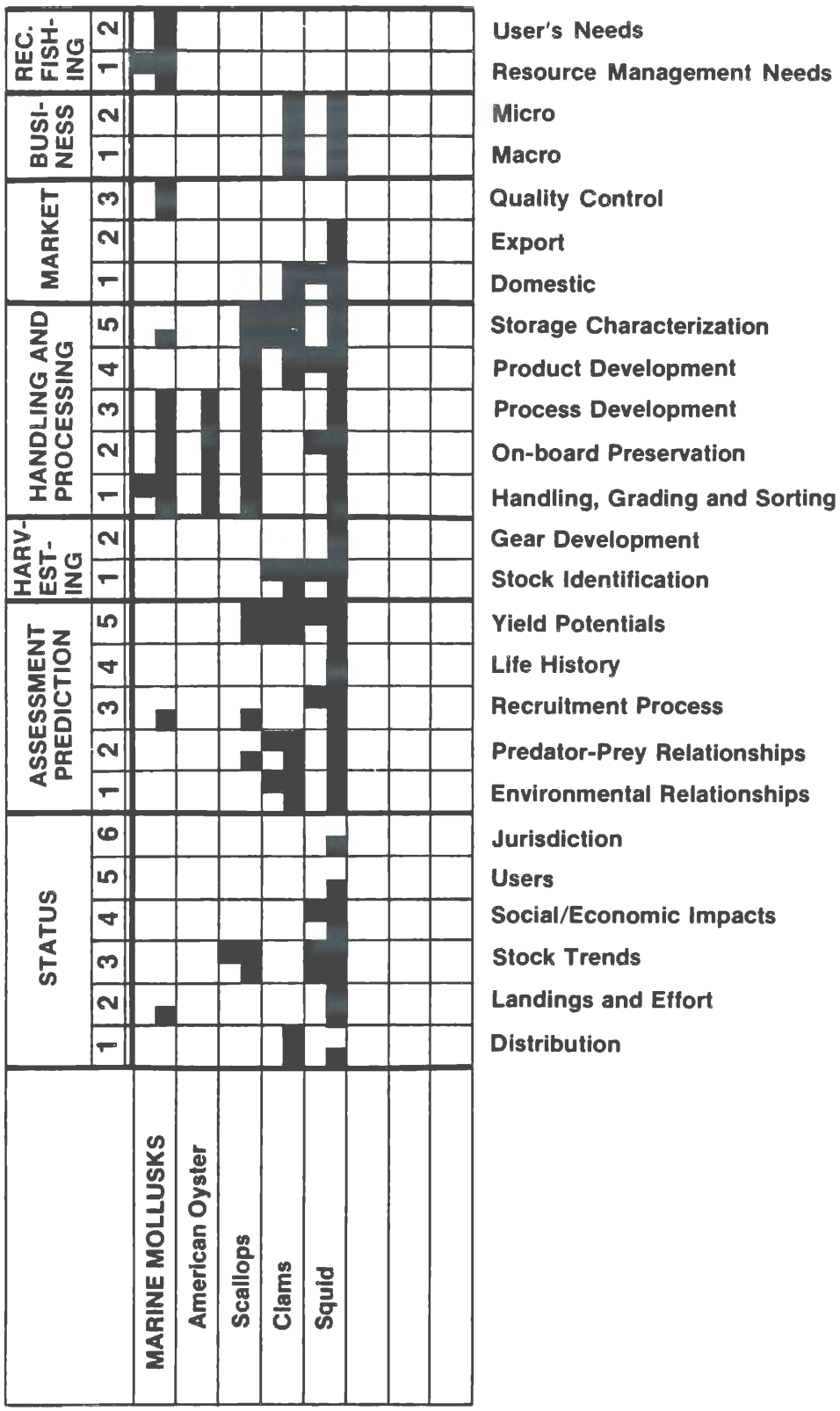

Figure 3.1.7 Summary of information needs. The estimated degree of need is shown in each matrix block as follows: ☐ available information adequate for current needs; ◧ 1-25% more information needed; ▣ 26-50% more information needed; ◨ 51-75% more information needed; ■ 76-100% more information needed.

MM10 Oyster Seed -- The natural availability of oyster seed is unstable and not of a quantity to satisfy the needs of the oyster industry. Potential benefits: increase in availability of seed, leading to an increase in production of oysters.

MM11 Shellfish Depuration -- The expansion of urban and industrial development adjacent to productive grounds has resulted in closing of areas to the harvest of oysters because of high fecal coliform concentrations. Potential benefits: large areas of productive shellfish grounds now closed to harvest would be reutilized.

MM12 Expand Oyster Grounds -- Habitat loss. Activities associated with the discovery and production of petroleum have caused saltwater intrusion and pollution on the oyster grounds. Potential benefits: stability and increase in area in which oyster harvest activities can occur.

MM13 Oyster Management -- Incomplete information needed for management of resource and determining OY. Management of oyster populations and harvest is uniquely tied to estuarine water quality - creating difficult and sometimes unefficient management action. Potential benefits: more efficient management and greater yield (biological and economical) from oyster resources.

MM14 Conch Management -- Incomplete information for management of stocks and determining OY. Conchs are the basis for a popular recreational fishery both for food and shell. Conchs are particularly vulnerable to harvest and conch populations have declined in recent years. Potential benefits: better understanding of economic impact of the fishery; food and shell production.

Table 3.1.7 Research Program Summary for Marine Mollusks.
Each project has been categorized as recovery, maintenance, expansion, or new fishery.

Ident. Number	Function of Task	Costs x 1000 First Year Amount	Second Year Amount	Third Year Amount	Fourth Year Amount	Fifth Year Amount	Total	Program Category	Priority
MM1	Squid Stock Assessment	100	150	150	50	50	500	New Fishery	M
MM2	Squid Fishing Methodology	75	75	50	25	25	250	New Fishery	M
MM3	Squid Product Development	-	30	30	-	-	60	New Fishery	M
MM4	Squid Market Development	-	25	50	50	10	135	New Fishery	H
MM5	Calico Stock Assessment	100	100	100	-	-	300	Maintenance	M
MM6	Quahog Distribution	100	100	100	-	-	300	Expansion	M
MM7	Quahog Marketing	30	30	30	-	-	90	Expansion	M
MM8	Polluted Oyster Sales	80	80	80	-	-	240	Maintenance	M
MM9	Mechanical Oyster Shucking	150	150	250	200	200	950	Maintenance	L
MM10	Oyster Seed	-	50	50	50	-	150	Expansion	L
MM11	Shellfish Depuration	50	50	25	-	-	125	Expansion	H
MM12	Expand Oyster Grounds	75	75	75	50	50	325	Expansion	H
MM13	Oyster Management	175	175	145	145	115	755	Maintenance	L
MM14	Conch Management	72	72	42	42	42	270	Maintenance	L

3.1.8 Crabs and Lobsters

Landings of crabs and other crustaceans in the Gulf in 1983 amounted to 45 million pounds with a dockside value of $29 million. There are no data available on the recreational landings or value for this group although there is a large recreational and subsistence fishery for blue crabs, stone crabs and spiny lobster.

3.1.8.1 Crabs

The blue crab is generally distributed from northern Massachusetts to northern Argentina. This fishery is becoming more important to the Gulf states. Variation in the abundance of crabs due to environmental factors and disease, use of more efficient gear, increased fishing effort and the economic condition of the market are reflected in historical blue crab catches. The fishery in Mississippi and Alabama has been relatively stable. Louisiana continues to be the largest producer in the Gulf. Landings for Louisiana have fluctuated widely although reported landings from 1975 to 1980 have not approached the 1973 landings of 23 million pounds. Florida Gulf coast landings have remained relatively stable at 13 million pounds after declining from 21 million pounds in 1965 to 9 million pounds in 1978.

The season for harvesting blue crabs occurs generally in the summer months and into the early fall. There is a tremendous interest in the production of soft crabs in the Gulf because of their value.

The Gulf crab is a higher salinity species of crab occurring along the Gulf coast. It is generally smaller in size than the blue crab. There is a recognized potential for development of a fishery for this crab.

The stone crab occurs throughout the Gulf of Mexico and in the Atlantic as far north as Cape Lookout, North Carolina. The U.S. fishery for this species is largely restricted to south Florida where abundance is greatest due to more favorable habitat conditions. Ninety-nine and eight/tenths percent of the landings are from the Florida Gulf coast. Gulf landings for recent years have averaged 3.7 million pounds of claws with an ex-vessel value in excess of $4 million.

Work is currently underway in Mississippi and Texas to evaluate the commercial potential for stone crab fisheries in those two states. Preliminary results indicate there is the potential for development of a limited fishery in Mississippi.

The stone crab, like the blue and Gulf crabs, is also estuarine dependent with the juveniles inhabiting the bays and estuaries and adults moving offshore. Inshore grass beds are utilized for spawning, and the pelagic larvae drift into the bays where they become benthic and grow rapidly. Shelter in the form of rock, shell, sponge, or other protective cover is sought by the stone crab throughout its life span. Adults move offshore, and the fishery now occurs in waters in excess of 10 fm depths. The fishing season extends from October 15 through May 15 each year.

Degradation of estuarine habitat through dredge and fill operations and pollution by excessive nutrient loading of the bays through sewage discharge has been a serious threat to estuarine dependent species such as the stone crab. There is concern about overfishing of the stocks and any new development in this fishery is predicted to come about by the opening of new fishing areas.

The golden Gulf crab fishery is a new fishery which is developing off the west coast of Florida. This fishery occurs offshore in depths of from 240 to 800 fm. The current literature suggests that this species is concentrated in the eastern Gulf region.

There is little known about the biology of this crab. Biologists are concerned about the potential for possible overfishing of these crabs because of their larger size and assumed long life.

The current commercial harvest is being carried out with only four vessels. They are producing a very competitive product which has gained immediate acceptance.

There is a need for more life history, population estimates and distribution studies of these crabs.

3.1.8.2 Lobsters

There are two or more species of lobsters harvested in the Gulf. The two primary lobsters fished for in the Gulf are the spiny lobster and the slipper lobster. The spiny lobster is the more important of the two, both in value and volume. The spiny lobster is under management by both Florida and the Gulf of Mexico Fishery Management Council. This fishery is near MSY. There is concern about mortality of undersize lobsters used as attractants in traps and overfishing of stocks and recent regulations have been implemented to conserve these stocks and to perpetuate this fishery. Spawning areas and larval migration have not been delineated.

There has been a tremendous growth in the landings of slipper lobster taken in the Gulf since 1979. Landings have increased from 1,200 pounds in 1979 to 102,000 pounds in 1983. Virtually all of this increase has come from the Florida west coast and 43 percent of these landings occur during the reproductive season of May through August. Interest in this fishery continues to grow because of the favorable market price for this lobster.

There is a concern that the growing fishery may impair the productivity of the stock particularly because such a large proportion of the landings occur during the spawning season. This is further reinforced by the fact that other slipper lobster fisheries have not been capable of sustaining commercial fishing pressure.

Figure 3.1.8 illustrates the best estimate of current information. Table 3.1.8 summarizes identified problem/opportunity projects. Following are annotations of crab and lobster research problems which have been identified in the preparation of this document.

CL1 Fishery Practices Increase Mortality and Reduce Yield -- Stone crab mortality associated with claw removal and exposure of crab to air prior to claw removal is significant. Theoretically, no crab need die from claw removal. Potential benefits: increased yield.

CL2 Incomplete Life History/Management Information -- Reported blue crab landings reflect only commercial catches (typical of most fishery landing statistics). However, the recreational and live market harvest are unknown and there is virtually no information on sustainable yield. Potential benefits: improved management information.

CL3 Lobster Recruitment -- Spiny lobster spawning areas and larval migration are not delineated. Potential benefits: maintenance of larval recruitment to lobster fishing areas.

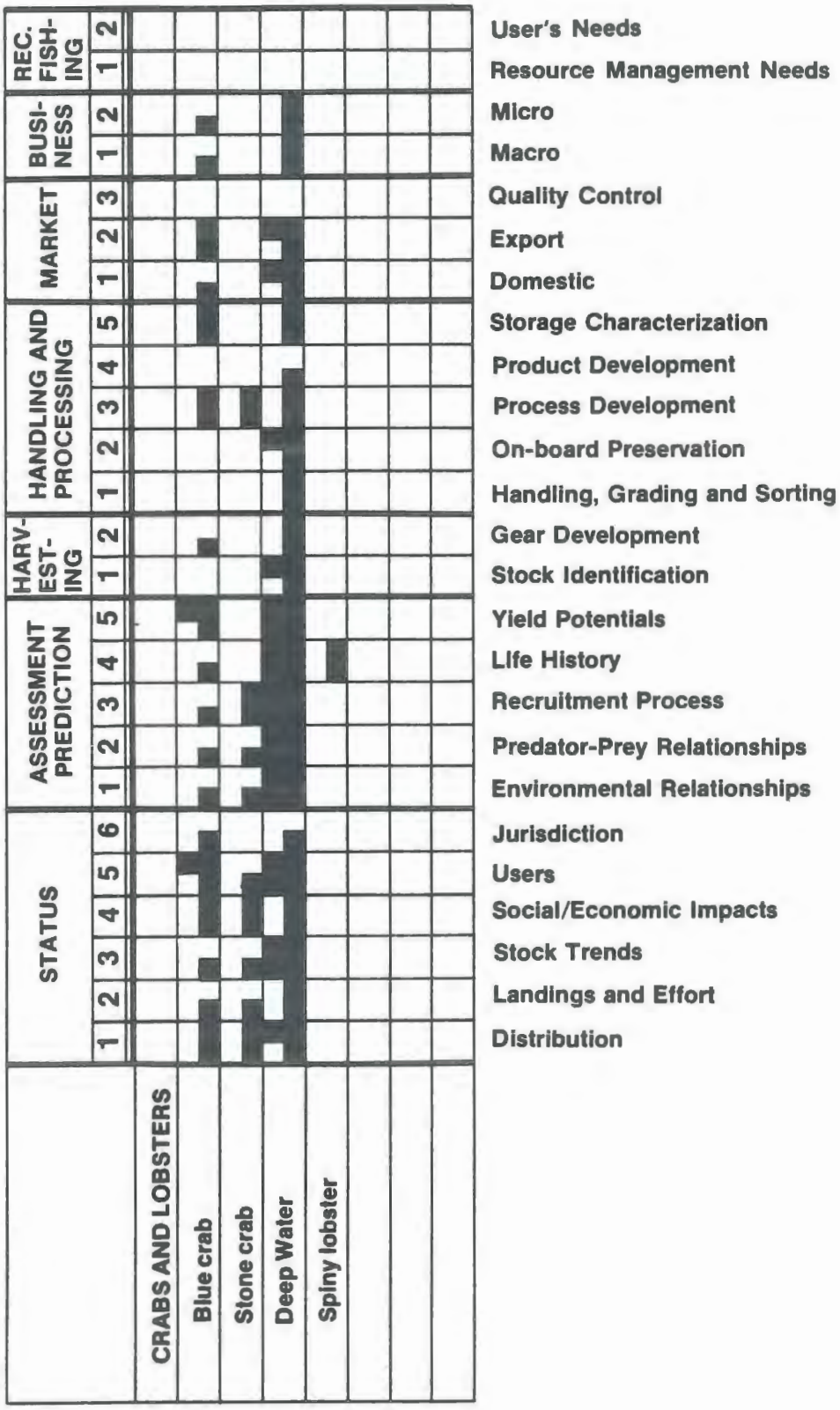

Figure 3.1.8 Summary of information needs. The estimated degree of need is shown in each matrix block as follows: ☐ available information adequate for current needs; ◪ 1-25% more information needed; ◨ 26-50% more information needed; ■ 51-75% more information needed; ■ 76-100% more information needed.

CL4 Deepwater Crabs -- Deepwater crabs and other crustaceans appear to represent potentially valuable new fishery resources. Virtually no information exists, however, on the safe harvest potential of these animals, especially at depths greater than 200 fm. Information also is needed on effective onboard handling and processing techniques. Potential benefits: Reliable estimates of yield potentials and improved handling and processing techniques.

Table 3.1.8 Research Program Summary for Crabs and Lobsters.
Each project has been categorized as recovery, maintenance, expansion, or new fishery.

Ident. Number	Function of Task	Costs x 1000 First Year Amount	Second Year Amount	Third Year Amount	Fourth Year Amount	Fifth Year Amount	Total	Program Category	Priority
CL1	Stone Crab Fishing Mortality	74	74	44	44	44	280	Maintenance	M
CL2	Blue Crab Life History	145	115	75	75	75	485	Maintenance	L
CL3	Lobster Recruitment	300	350	300	200	-	1150	Maintenance	M
CL4	Deepwater Crabs	235	150	150	50	50	635	New Fishery	H

3.1.9 Bottomfish

The term bottomfish is used to encompass fish commonly taken in bottom trawls without regard to their preferred pattern of existence. Over 200 species of fish included in this research unit have widely varying life histories, distribution and abundance patterns, and fishery potentials. Those that are most common include Atlantic croaker, spot, sand and silver seatrouts, Atlantic cutlassfish, sea catfish, longspine porgy, silver perch, southern kingfish, banded drum, gulf butterfish, harvestfish, southern and offshore hakes, and southern and gulf flounders. Of the species listed, information is relatively good only for Atlantic croaker, spot, sand and silver seatrouts, and flounders.

In the western and central portions of the Gulf of Mexico, Atlantic croaker dominate the bottomfish stocks inside of 50 fm while in the more tropical eastern Gulf, spot and other species dominate. Overall, however, Atlantic croaker appear to comprise the largest portion of the resource. Commercially, bottomfish are harvested by directed fisheries or as the bycatch of shrimp vessels. Those that are landed are marketed as fresh food fish, pet food, minced fish, and surimi.

The commercial bottomfish fisheries are concentrated in the north central Gulf. Landings for canned pet food reached a high of over 103.6 million pounds in 1974, but have averaged less than about 75 million pounds since 1974. Food fish landings for Atlantic croaker have undergone significant fluctuations, but have averaged about 11 million pounds. Flounder landings have averaged about 1.5 million pounds. The total discarded catch of bottomfish from the shrimp fishery exceeds 1.1 billion pounds annually.

Altantic croaker and flounder are important recreational bottomfish both inshore and offshore. They are caught from bridges, piers, jetties, boats, and from along the shore. Spot and the two seatrouts also are important recreationally, with the seatrouts being favorite target species for many sport fishermen. There are no known significant conflicts between commercial and recreational Atlantic croaker fishermen as the larger fish preferred in the recreational fishery generally are not available to the trawls used by commercial shrimp and pet food vessels.

Commercial directed landings and effort are reasonably well monitored for Atlantic croaker and flounder but annual variabilities in offshore shrimp fleet discards are not available except as estimates from NMFS survey data. There are no reliable estimates of the inshore commercial or recreational shrimp discards of croaker and other bottomfish. The recreational catch of all species is poorly understood, except for the Texas coastal area and some localized areas.

There has been a declining trend in many of the bottomfish species and especially with Atlantic croaker over the last 10 or 12 years. Average size of many of the species also has declined. The reason or reasons for these declines is unknown although the cause has been attributed by some to discards from commercial and recreational shrimp trawlers. Changes in environmental conditions, however, are also likely causes although no research has been done to establish concomitance. The decline in the average size of Atlantic croaker has had a significant economic impact as it has prevented establishment of a fishery for these fish for production of surimi. The smaller size classes are not economically feasible to process into this product form with current technology.

Except for the flounders and Atlantic croaker, there is very little life history, population dynamics, environmental relationships, and predator-prey information available. Most of the information is from the inshore waters, and much of this would have to be categorized as limited. Many of the bottomfish species have a life history where they

spawn offshore and depend on currents to transport their eggs and larvae into estuarine nursery grounds. Many also appear to have broad tolerances to salinity and temperature conditions being found in waters only slightly brackish to supersaline. Most begin their existence feeding on small invertebrates and in turn serving as prey for a large number of predatory species such as sharks, spotted seatrout, red drum, and others. As they increase in size, their food habits change; and they become more dependent on small fish. Unidentifiable organic matter is common in most Atlantic croaker and spot stomachs and probably represents a significant source of energy and nutrition for these fish.

The hakes appear to have significant potential for development in the Gulf of Mexico even though currently there are no significant landings of any hake species. The offshore hake has the best food quality potential although it is only infrequently taken commercially for sale primarily in the northeastern markets. The deepwater hakes require special handling and processing aboard fishing vessels because if they are not headed, gutted, and quick-frozen their flesh will become soft and mushy.

Another species which appears to have significant potential for development is the Gulf butterfish. Recent cooperative surveys with Japan indicated an average weight of these fish in waters deeper than 40 fm of slightly more than 100 grams which in the Japanese market is considered medium size. These fish appear to be more pelagic than bottom dwelling which means either midwater or high opening bottom trawls would have to be used for effective harvest. Specialized handling, processing, and packaging also would be demanded for the fish to be accepted in Japanese markets. The yield potential of butterfish is unknown and would have to be established before many fishing companies would begin to invest in the gear and processing systems required to economically harvest these fish.

The Atlantic cutlassfish too could have developmental potential for sale in oriental markets. The principal problem with these fish, however, is their relatively small size. In the deeper and more pelagic regions of the Gulf, larger cutlassfish may occur although there is no evidence to support this hypothesis.

Of all the bottomfish species and especially of those in coastal waters, Atlantic croaker has the greatest potential for development if an economic means could be found for using them. Croaker taken by the shrimp fleet are too small to have enough of a market value for extensive use. Thus, most are discarded. A high quality surimi can be developed from croaker, but the small size of most of the fish caught makes this economically unattractive. Either technology needs to be developed to improve the economics of producing surimi from small croaker or the fish need to be allowed to grow larger on the fishing grounds.

If the decline in biomass of Atlantic croaker in the northern Gulf of Mexico is due to fishing mortality by shrimp trawlers, one method to reduce this mortality and allow the fish to grow to a larger size is through gear modifications designed to reduce the incidental catch of bottomfish by shrimp trawls. A recent such modification, the Trawl Efficiency Device (TED), appears to offer potentials for significantly reducing the incidental catch of bottomfish without adversely affecting shrimping efficiency. A number of these systems are already in use in the Gulf and are finding greater and greater acceptance because of the ability of the TED to eliminate bottom trash from trawl catches.

In general, handling and processing of most bottomfish processed for current users is generally well understood. Improvements to process small fish for human food, however, would result in increased values. Product forms such as fillets, minced blocks, and

smoked, canned, salted, and dried products have not been tested and evaluated for many of the bottomfish species. Marketing research would be required for all of these new product forms. A comprehensive examination of the economic viability of existing and potential fisheries also is needed to aid in focusing developmental efforts into those channels most likely to succeed.

Figure 3.1.9 illustrates the best estimate of current information. Table 3.1.9 summarizes identified problem/opportunity projects. Following are annotations of bottomfish research problems which have been identified in the preparation of this document.

B1 Shrimp Fishery Discards -- Generally assumed to be the primary reasons for a 12-year decline in the average size and biomass of bottomfish stocks in the northern Gulf. This decline has prevented development of a directed fishery for bottomfish. Development of a technological option to reduce or essentially eliminate the discard has the potential of allowing the bottomfish stocks to return to more near optimum levels and sizes. Shrimp trawls are non-selective fishing gear. In the offshore shrimp fishery, the annual discard of non-targeted finfish approaches 1.1 billion pounds. Data on the inshore incidental catch and discard are limited, but suggest a major source of mortality occurs especially in terms of numbers. Commercial and recreational shrimpers would prefer to eliminate the catch of unwanted finfish in their trawls and indeed generally avoid areas where the catch of fish is expected to be high. Potential benefits: development of a technological option which would economically benefit the shrimp fishery plus potentially allow bottomfish stocks to return to more optimum levels - these bottomfish stocks could support an economically valuable fishery in the Gulf; elimination of bad bottom areas where decaying bottomfish adversely impact commercial and recreational shrimping activities.

B2 Decreased Biomass and Average Size of Gulf Bottomfish -- 40 to 50 percent decrease over the last 12 years. This decrease has at least in part prevented development of a viable surimi fishery for croaker and other bottomfish species. Relatively large croaker are required for production of surimi based on existing technology. The average size and biomass of northern Gulf croaker stocks, however, has declined since about 1972 to a point where the resource is no longer considered adequate for production of surimi. The reasons for this decline is not understood although the most likely cause is the incidental mortality caused by inshore and offshore commercial and recreational shrimp trawlers. The need is to identify the cause or causes such that through management or technological advancements the decline in the bottomfish stocks can be averted. Potential benefits: information which would be used through management to allow stocks of key bottomfish to return to optimum levels; resolution of social and political problems evolving from assumed impacts of shrimp discards.

B3 Bottomfish From the Gulf are not Fully Utilized -- The major volume is discarded at sea by shrimpers. Potential benefits: a major increase in the amount of bottomfish available for food use by consumers; increased employment and economic activity associated with the processing of bottomfish for food products from the Gulf; new products for consumers based on the application of minced fish processing technology to available Gulf bottomfish.

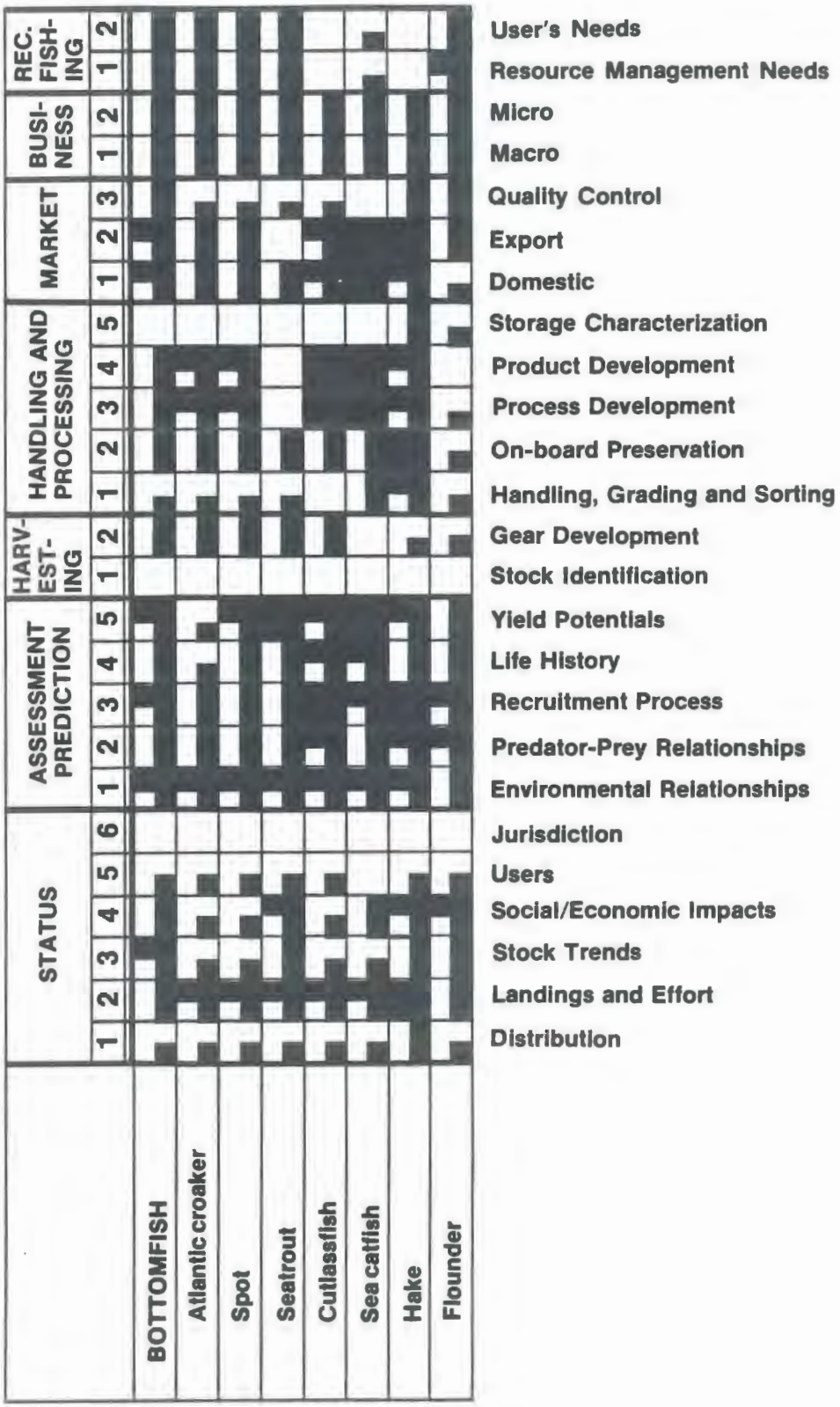

Figure 3.1.9 Summary of information needs. The estimated degree of need is shown in each matrix block as follows: ☐ available information adequate for current needs; ▫ 1-25% more information needed; ▪ 26-50% more information needed; ▪ 51-75% more information needed; ■ 76-100% more information needed.

Table 3.1.9 Research Program Summary for Bottomfish.
Each project has been categorized as recovery, maintenance, expansion, or new fishery.

Ident. Number	Function of Task	Costs x 1000 First Year Amount	Second Year Amount	Third Year Amount	Fourth Year Amount	Fifth Year Amount	Total	Program Category	Priority
B1	Shrimp Fishery Discards	212	212	212	115	55	806	Expansion	H
B2	Bottomfish Decline	653	565	344	157	157	1876	Recovery	H
B3	Better Bottomfish Utilization	208	208	401	494	549	1860	Maintenance	M

3.1.10 Estuarine Fish

Fourteen species have been assigned to the estuarine fish research unit. Management units of the GMFMC do not include a comparable management unit because all species in this group are primarily harvested in territorial and internal waters. Recreational fishermen take all species; and all except snook, rainbow runner, bonefish and tarpon are included in reported commercial landings. Red drum and spotted seatrout are choice target species sought by both recreational and commercial fishermen. Commercial (96 million pounds, 1983) and recreational (40 million pounds, 1980) landings (Table 2.1) of 136 million pounds were valued (dockside) at $25 million. Striped (black) mullet is considered to have worldwide circumtropical range. With some exceptions, the range of species in this unit includes the U.S. Gulf Coast. The range of all species includes relatively low salinity estuarine waters to high salinity offshore waters. Mullet enter fresh water.

Landings and effort data for the species in the estuarine fish research unit are inadequate. There are little to no effort data for commercial landings. There is very little information on stock size, age, composition, size composition, natural and fishing mortality rates and other parameters required for quantitative stock estimates. Estimates (and opinions) of estuarine fish stock trends around the Gulf vary from one area to another and, in many cases, from one estimator to another within areas. Quantitative information for all important species is urgently needed. The need for social/economic and user impact information is magnified by the continuing competition among user groups. The fishery primarily occurs within the states jurisdiction; but the range of many species extends into the FCZ and there is an increasing harvest of some species in the FCZ. Cooperative efforts of state and federal authorities are essential if optimum yield is to be achieved.

Acceptable assessment/prediction information is not available. Descriptive information for inshore areas is generally adequate but relatively little information has been accumulated from offshore areas. Comparable Gulf-wide quantitative data including all parameters required for modeling yield potential are urgently needed.

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. More information is needed in all mullet user group study areas.

Recreational resource management needs include better catch and effort statistics, fishing mode and pattern statistics, user profiles, and regulatory impact assessment. Users' needs include access improvement and aggregation structure enhancements. Information dissemination should include the occurrence and potential impact of recurring parasites along with accelerated dissemination of harvesting and resource status information.

In general, problem areas identified in the GSMFC red drum -- spotted seatrout profile should be solved for all species.

Figure 3.1.10 illustrates the best estimate of current information. Table 3.1.10 summarizes identified problem/opportunity projects. Following are annotations of estuarine fish research problems which have been identified in the preparation of this document.

EF1 Identify Tarpon Habitat -- The range of tarpon, particularly along the northern Gulf, appears to be diminishing. Fewer tarpon are caught by sportsfishermen now than in past years. Habitat degradation is likely the principal cause. Potential benefits: improved sportsfishing opportunities for this highly sought-after species.

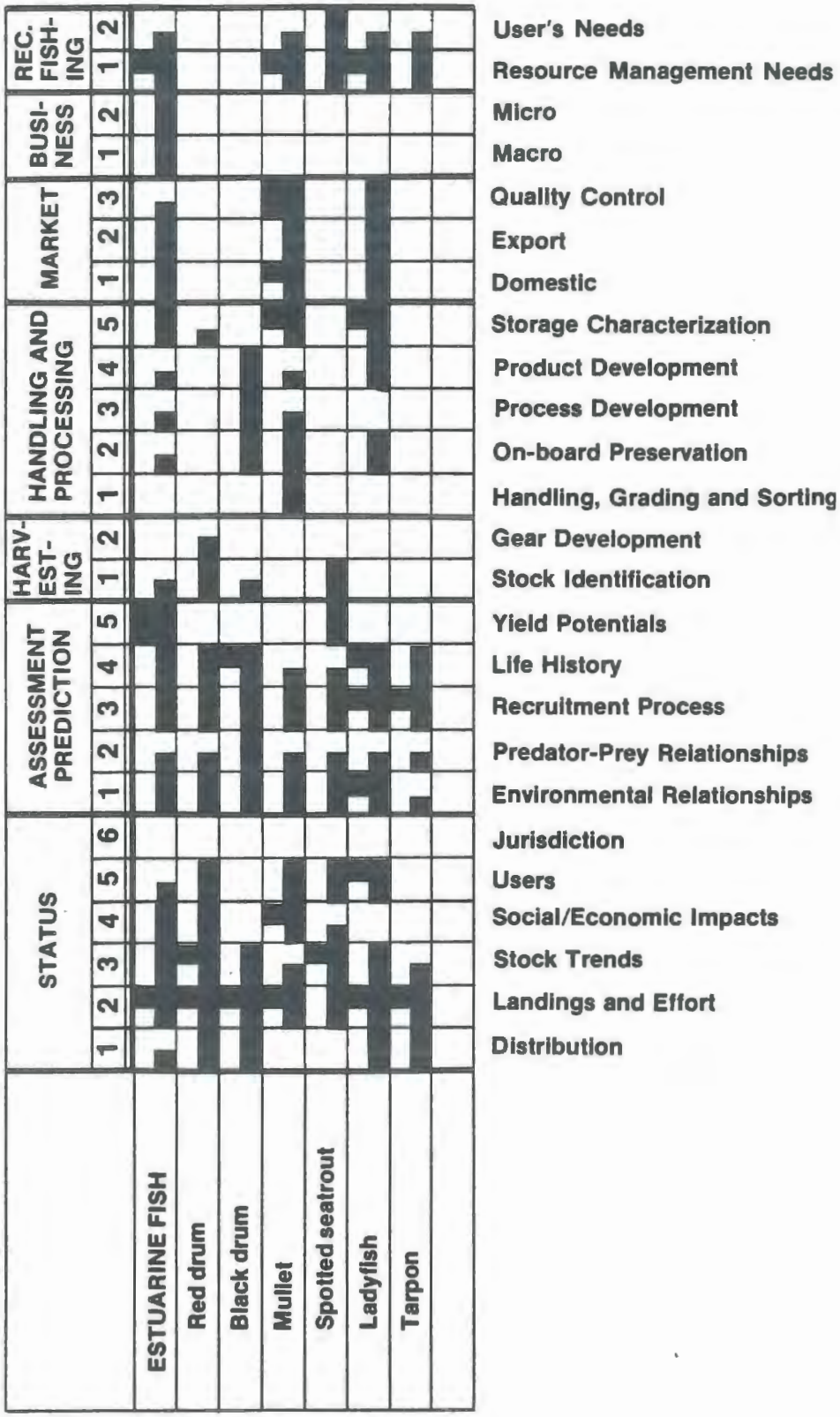

Figure 3.1.10 Summary of information needs. The estimated degree of need is shown in each matrix block as follows: ☐ available information adequate for current needs; ▖ 1-25% more information needed; ▞ 26-50% more information needed; ▟ 51-75% more information needed; ■ 76-100% more information needed.

EF2 Red Drum Migration -- Adult, offshore. Exploitable populations of large red drum can be found offshore. The relationship between this stock and maintenance of the inshore population is unknown. Potential benefits: improved population knowledge.

EF3 Product Quality and Stability -- Several estuarine species, in particular striped mullet, are underutilized due to problems of product quality and stability. Potential benefits: reduction of the National trade deficit through the export of quantities of frozen mullet, black drum, etc.; increased value of the resource and increased employment and economic activity associated with the production of appropriate processed products.

EF4 Tarpon Life History -- Incomplete life history management information. Tarpon are a prized recreational target species throughout the region; however little information is available to develop management strategies. Potential benefits: increased economic benefits from recreational fishing.

EF5 Assessment of Mullet Landings by Species -- Current landings are listed as "mullet" with no species breakdown. Problems which may develop in the mullet fishery may therefore be masked by a shift in the fishery to another species. Potential benefits: better population estimates.

EF6 Identification of Exploitable Populations of Mullet in the FCZ and the Development of Safe Harvest Limits -- Discussions with individuals in the offshore purse seine fishery indicate tremendous potential for mullet harvest in the FCZ if product stability and market areas open up. The effects of potential fishery development in the FCZ on the traditional inshore fishery and the development of safe harvest limits from the FCZ which will not adversely impact the traditional fishery must preceed any encouragement towards the development of the offshore fishery. Potential benefits: increased yield.

EF7 Determine Safe Harvest Limits for Red Drum and Black Drum in the FCZ -- Exploitation of these populations is currently taking place in the FCZ with a general assumption that future and current harvest will have no effect on the inshore recruitment into the FCZ. The effects of potential fishery development in the FCZ on the traditional inshore fishery and the development of safe harvest limits from the FCZ which will not adversely impact the traditional fishery must preceed any encouragement towards the development of the offshore fishery. Potential benefits: provide the information with which to establish a reliable OY.

EF8 Identify Problems Surrounding the Survival of Snook -- Snook provide an important recreational fishery, especially in south Florida. Factors affecting survival and recruitment of snook are not well known. Additional information is needed to maintain and possibly increase snook populations. Potential benefits: Maintenance and enhancement of the fishery for snook.

EF9 Develop Techniques for Assessing Annual Stocks of Spotted Seatrout in Estuarine Systems -- To obtain OY for seatrout the status of stocks must be known in order to apply appropriate management strategies. Potential benefits: maintenance and enhancement of the fishery.

EF10 Develop Capability of Predicting Safe Harvest Limits of Spotted Seatrout From Estuarine Systems -- Creel limits, size limits, catch quotas, etc. established for spotted seatrout by management agencies along the Gulf coast may be needed to achieve OY. Records for predicting scientific data on which to base harvest criteria must be developed and put in place in order for the current fisheries to survive. Potential benefits: maintenance and enhancement of the fishery.

Table 3.1.10 Research Program Summary for Estuarine Fish.
Each project has been categorized as recovery, maintenance, expansion, or new fishery.

Ident. Number	Function of Task	Costs x 1000 First Year Amount	Second Year Amount	Third Year Amount	Fourth Year Amount	Fifth Year Amount	Total	Program Category	Priority
EF1	Identify Tarpon Habitat	15	66	66	-	-	147	Maintenance	L
EF2	Red Drum Migration	155	155	36	36	36	418	Expansion	H
EF3	Product Quality and Stability	188	143	144	148	139	762	Expansion	M
EF4	Tarpon Life History	47	47	47	42	42	225	Maintenance	L
EF5	Identification of Mullet Landings by Species	50	25	-	-	-	75	Maintenance	M
EF6	Assessment of Exploitable Populations of Mullet in the FCZ and Development of Safe Harvest Limits	30	30	30	-	-	90	Expansion	M
EF7	Determine Safe Harvest Limits of Red Drum and Black Drum in the FCZ	20	20	20	-	-	60	Maintenance	H
EF8	Identify Problems Surrounding the Survival of Snook	50	50	50	-	-	150	Maintenance	L
EF9	Develop Techniques for Assessing Stock Identification of Spotted Seatrout	75	75	75	75	75	375	Maintenance	H
EF10	Develop Capability of Predicting Safe Harvest Limits of Spotted Seatrout	75	75	75	75	75	375	Maintenance	H

3.1.11 Anadromous and Catadromous Fish

There are several species of anadromous and catadromous fishes which occur in the northern Gulf of Mexico that have potential for recreational or commercial exploitation. These include the striped bass, Alabama shad, Gulf sturgeon, and the American eel.

The striped bass which naturally occurred from the panhandle region of northwest Florida to eastern Louisiana was subject to both commercial and recreational fishing pressure prior to the 1960's. Beyond that time populations had declined to such a low level that there was not an identified fishery for striped bass. Since the early 1970's, after techniques had been developed to spawn the striped bass in captivity, efforts have been underway to restock the northern Gulf region. To date limited recreational fisheries have been reestablished along the northern Gulf. Intensive rearing and stocking programs being carried out west of the Mississippi River have resulted in the establishment of fishable populations in that region.

Research in recent years has centered around determining whether or not these rebuilt populations will be self-perpetuating. Additionally, with the drastic decline of the striped bass on the east coast of the U.S., new areas of research into the potential of rearing striped bass for commercial market have been initiated. The refinement of hatchery and rearing techniques continue to be areas of research which should be continued to support the restoration program and the potential for rearing striped bass for market. The economic value of the recreational fishery generated by the introduction of this species should be evaluated.

The Alabama shad is reported from all major drainages of the Gulf of Mexico from eastern Florida to Louisiana, inclusively, and is undoubtedly the most abundant anadromous fish in the Gulf. It supports a small sport fishery, and several thousand pounds are taken by commercial gear incidental to the catch of menhaden and other species. The catch is mainly used for bait and reduction or pet food. Recent studies have focused on its life history, abundance and migratory behavior to determine its potential value as a commercial or sports species. These studies have shown that the populations are not large enough to support a fishery.

Historically a sturgeon fishery existed along the northern and eastern Gulf coast. Due to overfishing, construction of dams, and pollution the populations have been reduced to a level that will not support a fishery. The species that occurs in the Gulf is considered to be severely depleted and fishing for them is now banned in Florida. No directed fishery exists and there does not appear to be any potential for a wild population. Recent investigation into sturgeon culture may hold promise for future production.

Eels constitute a major fishery worldwide. The U.S. fishery for eels is best developed along the Atlantic coast in the region of the Chesapeake Bay and North Carolina. There is little known about the potential for an eel fishery along the Gulf. There are several studies that indicate the potential for a limited fishery, but most investigators are in agreement at this time that the eel population in the Gulf is smaller than on the Atlantic coast. A small eel fishery has been established in Louisiana. This fishery has been limited because of a poor marketing channel. Studies are currently underway to assess the eel resources in several areas along the Gulf. There is a need for marketing studies so that this fishery can continue to develop.

Figure 3.1.11 illustrates the best estimate of current information. Table 3.1.11 summarizes identified problem/opportunity projects. Following are annotations of anadromous and catadromous fish research problems which have been identified in the preparation of this document.

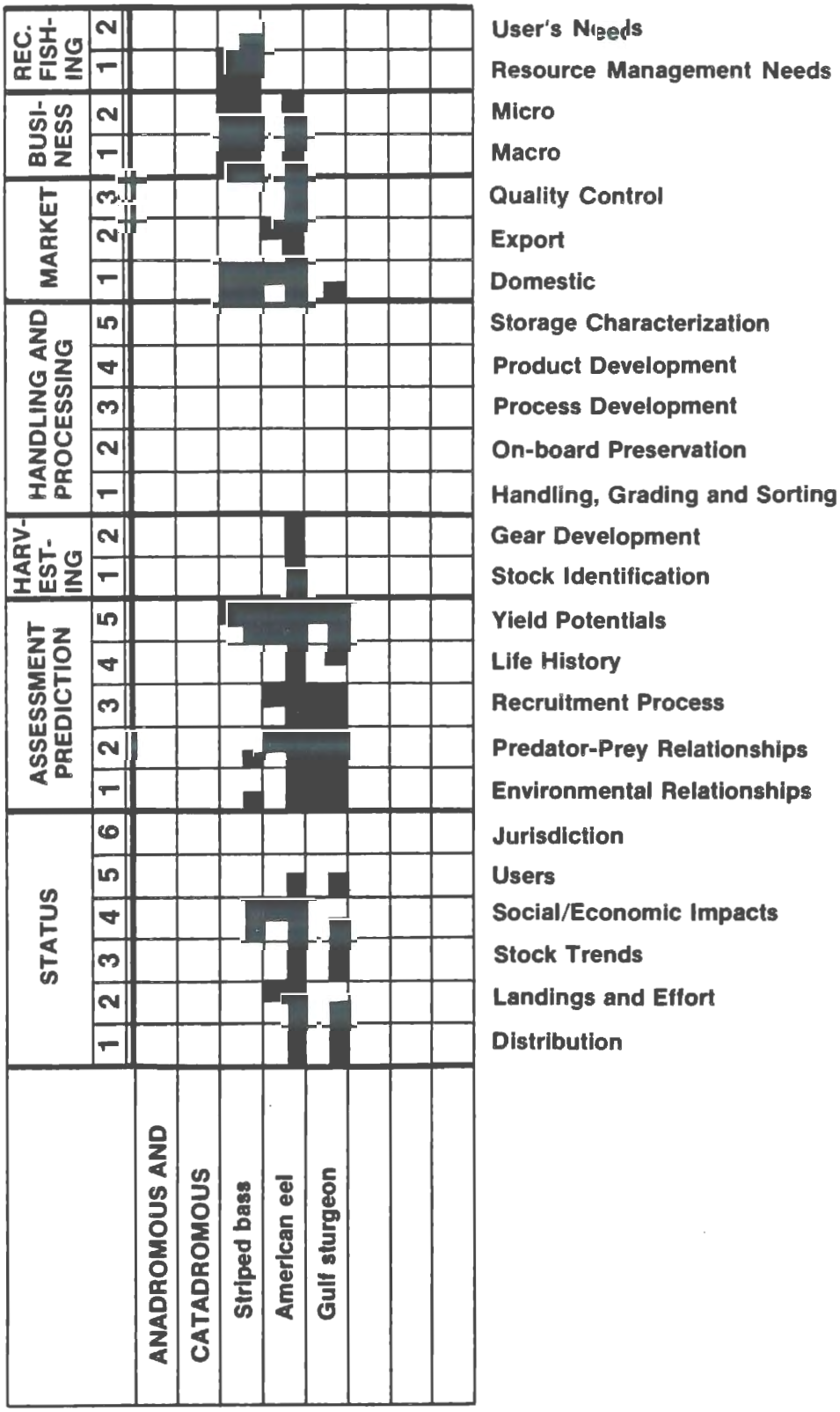

Figure 3.1.11 Summary of information needs. The estimated degree of need is shown in each matrix block as follows: ☐ available information adequate for current needs; ▙ 1-25% more information needed; ▙ 26-50% more information needed; ▙ 51-75% more information needed; ■ 76-100% more information needed.

AC1 Striped Bass Culture -- Evaluate striped bass culture to determine the feasibility of rearing striped bass for a market fish. Striped bass are currently being reared to support stocking efforts. These production facilities should be reviewed to determine the feasibility of expanding the rearing of striped bass in ponds, etc. for the commercial market. There is a good market for striped bass because of the declining wild stocks on the east coast. Potential benefits: because of the declining east coast stocks the market needs are not being met. Therefore, if these fish can be reared to a market size in ponds then a whole new culture industry can be developed.

AC2 Striped Bass Reproduction -- Investigate the reproductive potential of stocked populations of striped bass in the northern Gulf region. Many populations of striped bass have been established by stocking along the Gulf coast. They are currently being augmented each year by additional stocking. There is a need to determine whether or not these fish are capable of sustaining and increasing the populations. Potential benefits: if it could be established that the stocked population are capable of successful spawning and survival then monies currently spent on hatchery production could be used to investigate other Gulf anadromous resources.

AC3 Develop Artificial Diet -- Develop adequate artificial diets for all life history stages of striped bass. Currently all striped bass culture work relies on brine shrimp for larval food. There is a need to develop an artificial diet to replace brine shrimp to reduce costs and to maintain consistency in the diet of larval striped bass. Potential benefits: development of a suitable diet would improve the survival rate of striped bass under culture condition and make the culture of striped bass more efficient.

AC4 Economic Evaluation Gulf Striped Bass -- Economic evaluation of the value of the introduced populations to the recreational fishery along the northern Gulf. Many populations of striped bass have been established across the Gulf coast. These populations are supporting a growing directed fishery. The economic impact of these fisheries needs to be determined. Potential benefits: this effort would provide some direction for future striped bass research in the Gulf.

AC5 Eel Population Assessment -- Assessment of the commercial harvest potential of eels along the northern Gulf. Currently there is scant information on the distribution and population size of commercial eel population in the Gulf of Mexico. Potential benefits: this information could be turned over to the private sector for immediate development.

AC6 Eel Market Studies -- Marketing studies of eels landed in the northern Gulf. One of the major problems of developing an eel fishery in the Gulf is the lack of a consistent market for the raw product. Potential benefits: a ready market for the raw product would hasten the development of the eel fishery.

Table 3.1.11 Research Program Summary for Anadromous and Catadromous Fish.
Each project has been categorized as recovery, maintenance, expansion, or new fishery.

Ident. Number	Function of Task	Costs x 1000 First Year Amount	Second Year Amount	Third Year Amount	Fourth Year Amount	Fifth Year Amount	Total	Program Category	Priority
AC1	Striped Bass Culture	190	110	110	-	-	410	New Fishery	M
AC2	Striped Bass Reproduction	80	80	-	-	-	160	Maintenance	M
AC3	Develop Artificial Diet	85	81	81	-	-	247	Maintenance	M
AC4	Economic Evaluation Gulf Striped Bass	40	40	-	-	-	80	Maintenance	L
AC5	Eel Population Assessment	91	79	79	-	-	249	Expansion	M
AC6	Eel Market Studies	40	40	-	-	-	80	Expansion	M

3.1.12 Mariculture

It is estimated that world-wide aquaculture production is as much as 21 billion pounds. Global production has increased significantly over the past 15 years. Aquaculture production in the U.S. has increased over 300 percent since 1975, but mariculture (culture of marine species) has accounted for a small portion of that increase. There are major increases in mariculture, particularly in shrimp, in other parts of the world. The increase in mariculture of shrimp is having a major impact on the stability of the Gulf shrimp fishery. Cultured shrimp imports has been a major factor contributing to lower U.S. shrimp prices during the 1984 shrimp season.

Interest in mariculture in the Gulf areas has increased in recent years. There are several factors which have contributed to this increased interest; the three most important appear to be: 1) increasing per capita consumption of seafood; 2) a general consensus that a limit to commercial fishing of traditional species has been or shortly will be reached; and 3) the increased activity outside the U.S. particularly in marine shrimp and its impact on the U.S. shrimp fishery.

There have been many impediments to the development of a mariculture industry in this country. The Joint Subcommittee on Aquaculture listed in the National Aquaculture Development Plan the major constraints for continued use of wild animals that have not been genetically improved for culture; understanding of nutrition and diets of culturable species, continuing problems in preventing and controlling diseases, and knowledge of water quality in culture systems. Coupled with these impediments is a need for education, information, and technology assistance, and a need to understand markets and marketing barriers for and about mariculture products. All of these impediments are still obstacles to rapid and orderly expansion of mariculture today.

If funds were directed to providing answers to eliminate or negate the above listed impediments to mariculture then that segment could have a more profound effect in meeting U.S. demands for fishery products and could contribute to a reduction in our fishery trade deficit. There are a number of finfish and shellfish which could be cultured in the Gulf region.

Shrimp mariculture has potential in the near future. In response to the increasing demand for this popular product, shrimp farming has evolved in many parts of the world during recent years. World production of shrimp through mariculture has grown from just over 33 million pounds in 1975, to 165.4 million pounds in 1983. Because much of foreign production is exported to the U.S., the expansion of the U.S. shrimp farming industry can have a positive impact on our seafood trade deficit, as well as in areas of employment, development of marginally-productive lands, and growth of the mariculture industry.

Currently, there are obstacles to the development of a U.S. Marine shrimp farming which are both technical and economic in nature. Although there is a general understanding of the life cycles of a number of shrimp species, technical questions relating to stock management, maturation, spawning, larvae rearing, nutrition, pathology, production methodology and economics, and so on, remain to be answered before significant investment capital from the private sector will be generated to support land-based marine shrimp production facilities. It is recognized that the United States has the technical capability to solve problems which are constraints to the development of the marine shrimp industry in this country.

There are currently many efforts on-going to culture various species of finfish. The sample technical problems generally faced by the shrimp culturist apply equally to the finfish culturist. Efforts should be directed to solving these problems so that the culture of finfish can accelerate in the near future.

The culture of such species as red drum, striped bass, and others to re-establish or augment fish populations for the fishing industry should be accelerated. There has been limited success in this area, but an increase in funding would allow many of the technical problems to be overcome.

Currently, there is a $100 million per year finfish culture industry in existence that supports the aquarium industry. Additional effort is needed to further that industry.

Advances are being made in the culture of certain finfish (dolphin and mullets) for direct human consumption. This industry is in its infancy, and considerable effort could be directed to that segment of the industry.

There are a number of shellfish, clams, scallops, etc. which have a potential as mariculture candidates. These should be investigated and research plans developed to investigate these resources. With increasing pressure on the traditional growing waters for many shellfish, now is the time to place some emphasis on these species.

Mariculture is a dynamic and growing segment of the American economy. Tremendous increases in yields have been seen in the past 15 years. Mariculture can and will become a significant source of aquatic products in this decade.

Figure 3.1.12 illustrates the best estimate of current information. Table 3.1.12 summarizes identified problem/opportunity projects. Following are annotations of mariculture research problems which have been identified in the preparation of this document.

MA1 Mariculture -- A marine species aquaculture facility and program are needed to provide early life stages for ecological and physiological studies of recruitment processes related to commercial and recreational fisheries of the Southeast region. Such are needed to provide seed stock for commercial production farms and for stocking of recreational species in selected natural habitats. Potential benefits: a marine species aquaculture facility would be constructed and operated to supply shrimp, redfish, striped bass, and other species for ecological/physiological research related to recruitment processes, stocking of commercial production ponds, and stocking of recreational species in selected natural habitats.

MA2 Develop Bait Shrimp Production Techniques -- Different strategies will have to be used for this production purpose than for food shrimp. A different size product is needed at a different time of year. Pond loading at maximum production is very important. Also, the need for native shrimp (P. aztecus or P. setiferus) will be imperative. Hatchery techniques for spawning and for maturation studies will be necessary during the early stages. Potential benefits: establishment of a new fishing-related industry.

MA3 Develop Bait Fish Production Techniques -- Fundulus grandis is only one of several finfish used for live bait in the coastal area. Pinfish, croaker, and spot are used extensively. We should explore the pond production potential of these species as well as looking into salt tolerant species of Tilapia - like the gold or mossambica, etc. Potential benefits: establishment of a new fishing-related industry.

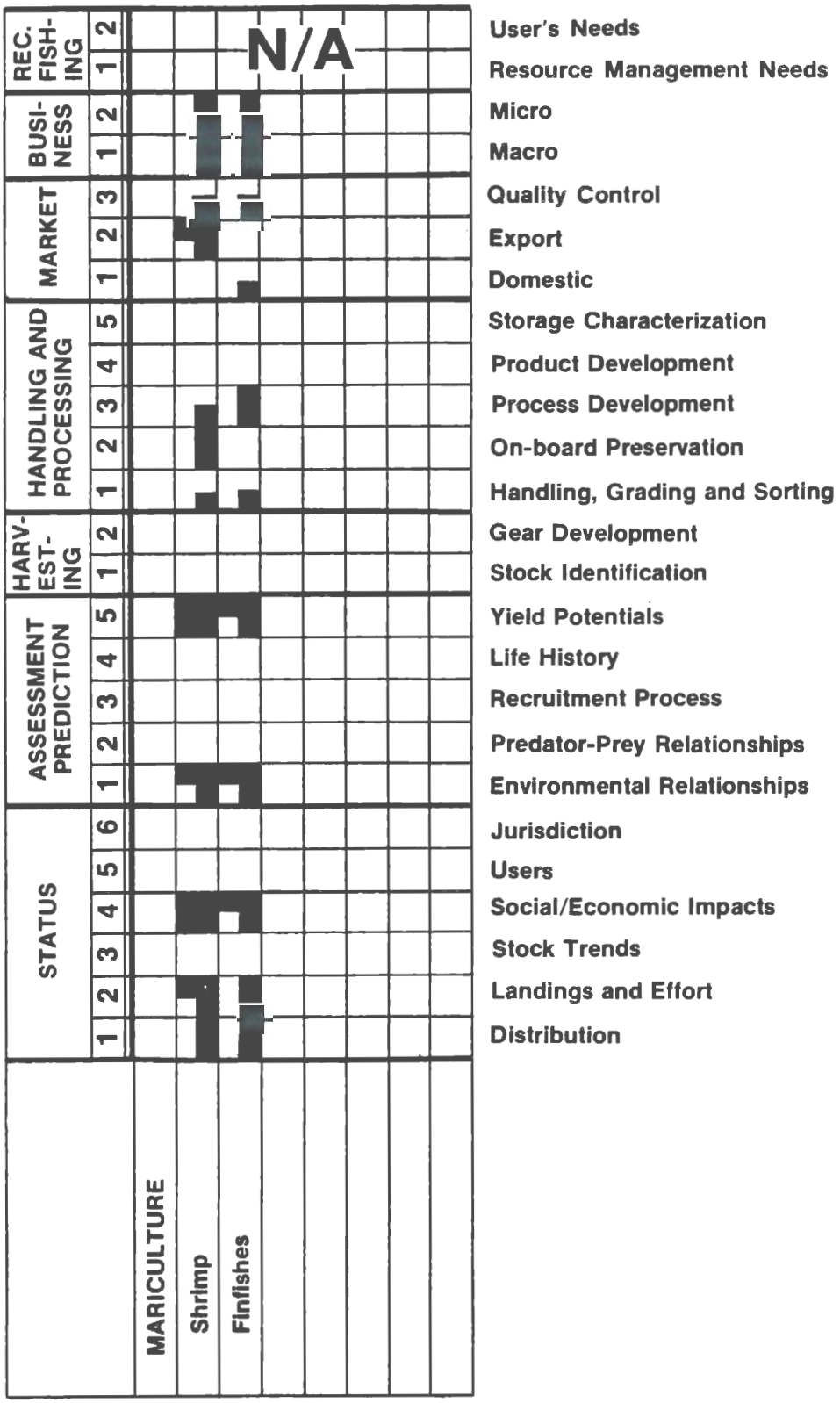

Figure 3.1.12 Summary of information needs. The estimated degree of need is shown in each matrix block as follows: ☐ available information adequate for current needs; ▖ 1-25% more information needed; ▞ 26-50% more information needed; ▟ 51-75% more information needed; ■ 76-100% more information needed. Several categories in this table do not apply to mariculture.

MA4 Develop Market Research for Bait Fish and Bait Shrimp by 150 Linear Mile Coastal Units -- What are the current and future needs for bait fish and bait shrimp in this region? Answers to these questions must preceed any substantial capitalization by potential commercial producers. 150 mile coastal units were used to derive areas from which bait shrimp and fish could be economically transported to jobbers from strategically located production stations. Potential benefits: establishment of a new fishery.

MA5 Improve Spawning, Rearing, and Marketing Strategies for Spotted Seatrout, Red Drum, and Red Tilapia -- Red drum and spotted seatrout may soon be unavailable commercially. Techniques to produce these species in ponds must be developed if these species are to remain on the market. Techniques for producing red tilapia in brackish or freshwater ponds is already a reality. Mortality strategies offering the red tilapia as a snapper substitute could reduce the fishing pressure which currently exists on Gulf of Mexico snapper populations. Potential benefits: would provide tool necessary for maintenance and enhancement of Gulf population.

Table 3.1.12 Research Program Summary for Mariculture.
Each project has been categorized as recovery, maintenance, expansion, or new fishery.

Ident. Number	Function of Task	Costs x 1000 First Year Amount	Second Year Amount	Third Year Amount	Fourth Year Amount	Fifth Year Amount	Total	Program Category	Priority
MA1	Mariculture	500	1250	2250	500	500	5000	Expansion	H
MA2	Develop Bait Shrimp Production Techniques	30	30	30	30	30	150	Expansion	M
MA3	Develop Bait Fish Production Techniques	25	25	25	25	25	125	Expansion	M
MA4	Develop Market Research for Bait Fish and Bait Shrimp by 150 Linear Mile Coastal Units	25	25	25	5	5	85	Expansion	M
MA5	Improve Spawning, Rearing, and Marketing Strategies for Spotted Seatrout, Red Drum, and Red Tilapia	50	50	50	10	10	170	Expansion	H

3.1.13 Marine Mammals and Endangered Species

The marine mammals and endangered species research unit was included because certain marine mammals are harvested for aquaria and because of the potential negative impact of endangered species preservation on fisheries. In the Gulf the principal concern is for porpoises and sea turtles at the present time.

Available marine mammal information seems to be adequate for current needs. Harvesting is limited to an effective permitting system for large display facilities.

There is a need for additional information on excluder trawls (See 3.1.1).

Figure 3.1.13 illustrates the best estimate of current information.

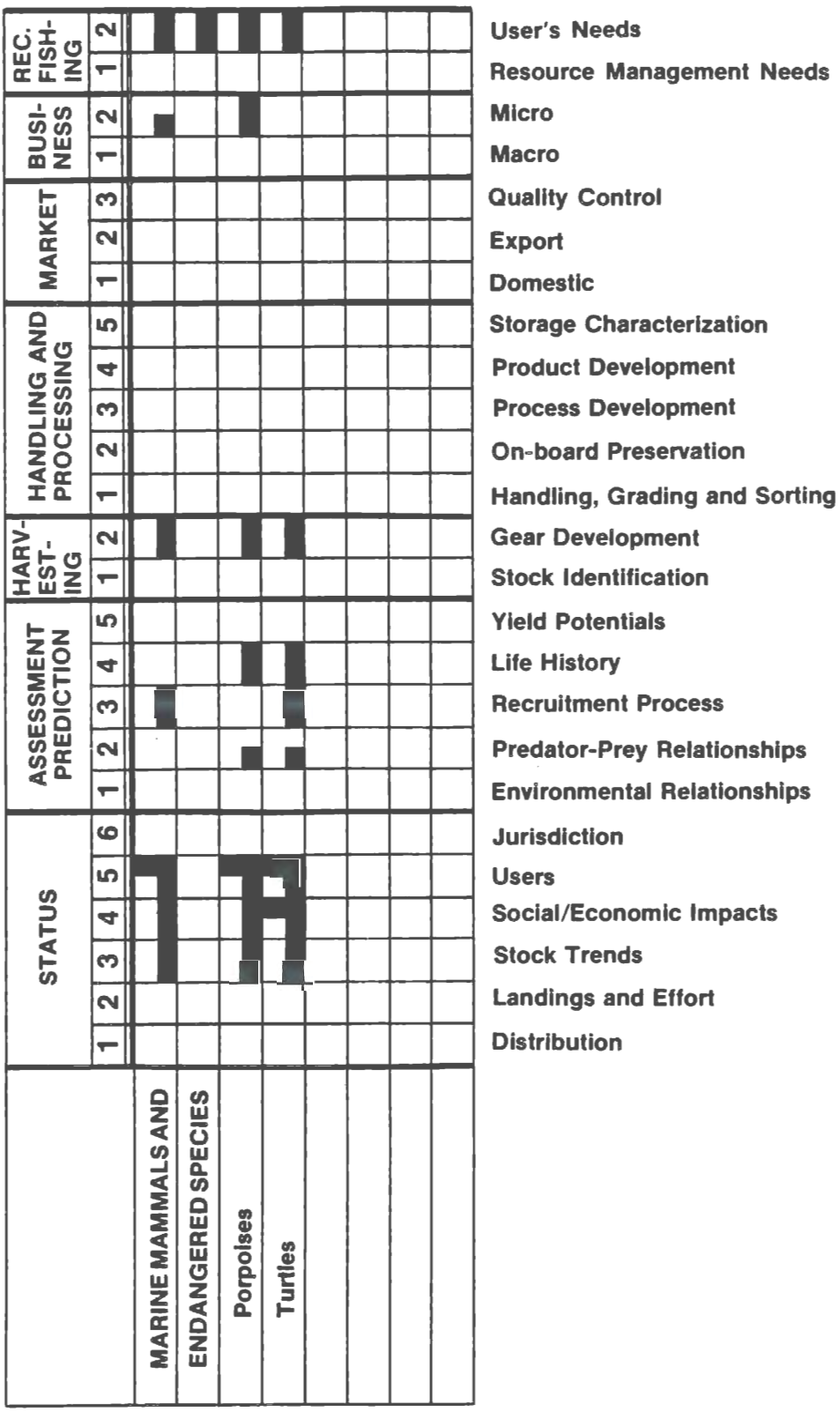

Figure 3.1.13 Summary of information needs. The estimated degree of need is shown in each matrix block as follows: ☐ available information adequate for current needs; ◪ 1-25% more information needed; ▩ 26-50% more information needed; ◧ 51-75% more information needed; ■ 76-100% more information needed.

3.1.14 Corals and Sponges

3.1.14.1 Corals

The corals are widely distributed throughout the Gulf of Mexico, occurring in both state and federal waters. With the exception of reefs at Bermuda and the northern Bahamas, the Florida Keys represent the northernmost limits of viable and growing shallow water tropical coral reefs in the western Atlantic.

In the northeastern Gulf of Mexico region (Everglades north to Cape San Blas) the best known and most important area is the 1536 km^2 hard bottom northwest of Tampa known as the Florida Middle Ground (FMG). The FMG is characterized by steep-profile limestone escarpments and knolls rising 30-40 ft above the sand and shell substrate varying from 48-88 fm in depth. At present, live corals contribute little to the configuration of the area. There are several very diverse communities of coral species in this area.

There is a limited fauna of non-reef building shallow water corals in the Northern Gulf Region (St. Josephs, Florida to the Mississippi River delta). Discontinuous mounds, hills and pinnacles at depths of 146-307 fm with an average relief of 27 ft occur in this region. Although there is no evidence of recent reef construction, several species of living coral have been collected from those structures.

In the Northwestern Gulf (MS River delta west) the principal coral communities are localized on the hard banks occurring in deep water. These banks usually originate in waters 73-183 fm deep. Only the east and west Flower Garden Banks peak at depths less than 46 fm and the other banks peak at 106-128 fm. At least some of the relief has been contributed by currently active reef-forming corals.

Information concerning the Gulf deep-water corals (occurring at depths greater than 366 fm) is exceedingly sparse. In most instances the information is too incomplete to make assessments as to the abundance of the stocks. Several species have been reported as having some potential commercial value.

Historically the collection and sale of coral from domestic waters has been centered around the coral reefs and patch reefs of the Florida Keys. Corals were collected primarily as by-catch with fish and assorted shellfish. Even during the peak in Florida coral marketing no more than three or four people earned the bulk of their income from corals. In the 1970's some 18 to 20 divers supplied shells and corals to curio retailers. Apparently there are no satisfactory catch and effort data.

Beginning in 1976 legal restrictions in Florida on the harvesting of corals eliminated this industry. The Gulf Council FMP was implemented in 1984. Consequently, consumptive use of domestic coral is limited to collection for scientific purposes under permit. The curio and jewelery industry depends on imports.

By far the greatest value of coral resources is found in nonconsumptive uses. Recreational use (nonconsumptive) supports a considerable fleet of charter boats, diver shops and other associated tourist enterprises. Coral habitat is essential to the continued harvest of many fish and shellfish species.

Corals in the Gulf of Mexico have been studied in disjunct areas for numerous research projects. The net result has been an accumulation of sporadic data that leaves many geographic areas, species, and topics unstudied. MSY and OY estimates are not

reliable. A thorough survey of the physiology, biology, and ecology of corals in the Gulf is needed.

Although suspected existing information does not provide conclusive evidence of harvesting impact on coral resources, limited experimental fisheries carefully designed to generate data of all man-induced impacts on coral resources is needed. Socio-economic studies of user groups, their cultural characteristics and needs have not been accomplished.

The extent and potential harvest of deep-water corals are unknown. Dependence of the processing industry on imports has been clearly demonstrated. Reduction of imports could conceivably be accomplished if a domestic harvest could be taken without damage to the much greater ecological value of coral resources.

3.1.14.2 Sponges

Until the 1940's the sponge fishery was one of the most valuable fisheries in Florida. In 1934 landings of five species totaled 655.3 thousand pounds. In 1940, after the 1939 epidemic sponge blight, landings dropped to 242.9 thousand pounds. Florida landings in 1946 amounted to 266.6 thousand pounds worth over $3 million. In 1950, after the 1946 sponge blight, landings had dropped to 22 thousand pounds worth $130.5 thousand. The combination of blight damage and the introduction of synthetic sponges has resulted in reduction of the commercial fishery to a very small fraction of its former importance.

Although the demand for natural sponges is partially satisfied by the production of synthetics, there is not enough domestic production to supply current demand. The United States imports over $2 million worth of sponges each year. In addition to the value of the landed product, the sponge fishery supports a large tourist industry in Tarpon Springs, Florida. Little economic information about either the tourist related or the independent commercial fishing industry is available.

Harvesting technology in Florida waters has changed from divers using heavy deep sea apparatus to hooking methods using small boats. In hooking sponges the bottom is scanned, often using a glass bottom bucket, until a commercial sponge is spotted. A long pole and hook is then used to tear the sponge loose and bring it to the surface. Since the bottom must be visible, hooking is restricted to shallow waters and calm weather conditions. Small skiffs, not meant for use far from land, are the primary boats used.

Tarpon Springs divers, on the other hand, can continue to work in rougher and deeper water when the bottom is not visible from the surface. These divers work from large, 40-50 foot vessels with air supplied from a deck-mounted compressor. The diver is weighted to allow him to walk along the bottom, 200-300 feet of rubber air hose provide enough slack for the vessel's captain to maneuver the boat behind or alongside the diver. Since these dive operations are conducted from much larger vessels, there is no need to go into shore on a daily basis. The deep draft of these boats (4-7 feet), however, precludes dive operations in the shallower waters worked by sponge hookers. Another type of diving operation is sometimes used in the Florida Keys. Small boats are used to tow divers over productive grounds, the diver dropping off of the towline when a sponge is spotted.

Recent efforts to revive the Florida sponge industry indicate that the resource will support increased production and that diving for sponges could augment the present hooker-based production from some areas. In addition to production of planktonic larvae, sponges are able to grow back if some of the sponge is left attached to the substrate. When

hooking for sponges, often very little of the sponge is left behind. This sponge material may grow back to produce another commercially valuable sponge; however, cutting the sponge would insure that sufficient sponge for fast regrowth was left behind. The potential for this method needs further study. Although we know that sponges can grow back, it is not known how quickly or at what optimum level the sponge should be cut to insure the fastest possible regrowth of a commercial sponge.

Current Florida law, enacted to prevent damage to young sponges caused by heavily weighted divers stepping on them, prohibits the use of heavily weighted apparatus used by deep sea divers in the taking of commercial sponges. Scuba or hooking gear did not become a viable method of extended underwater diving until many years after enactment of the law.

Information needed to revive the sponge fishery includes economic and social data, data on the survival and growth rate of remnants left attached to the substrate after harvesting, and the feasibility of artificial culture.

Figure 3.1.14 illustrates the best estimate of current information. Table 3.1.14 summarizes identified problem/opportunity projects. Following is an annotation of a sponge research problem which has been identified in the preparation of this document.

CS1 Improved Harvest Methods -- Current harvesting techniques (hooking) causes unnecessary mortality and reduced yield. Florida statutes prohibit the use of diving suits, helmets, and scuba. However, harvest by scuba would allow severing of sponge above its attachment base - relatively rapid regrowth of sponge would result. Potential benefits: increased yield.

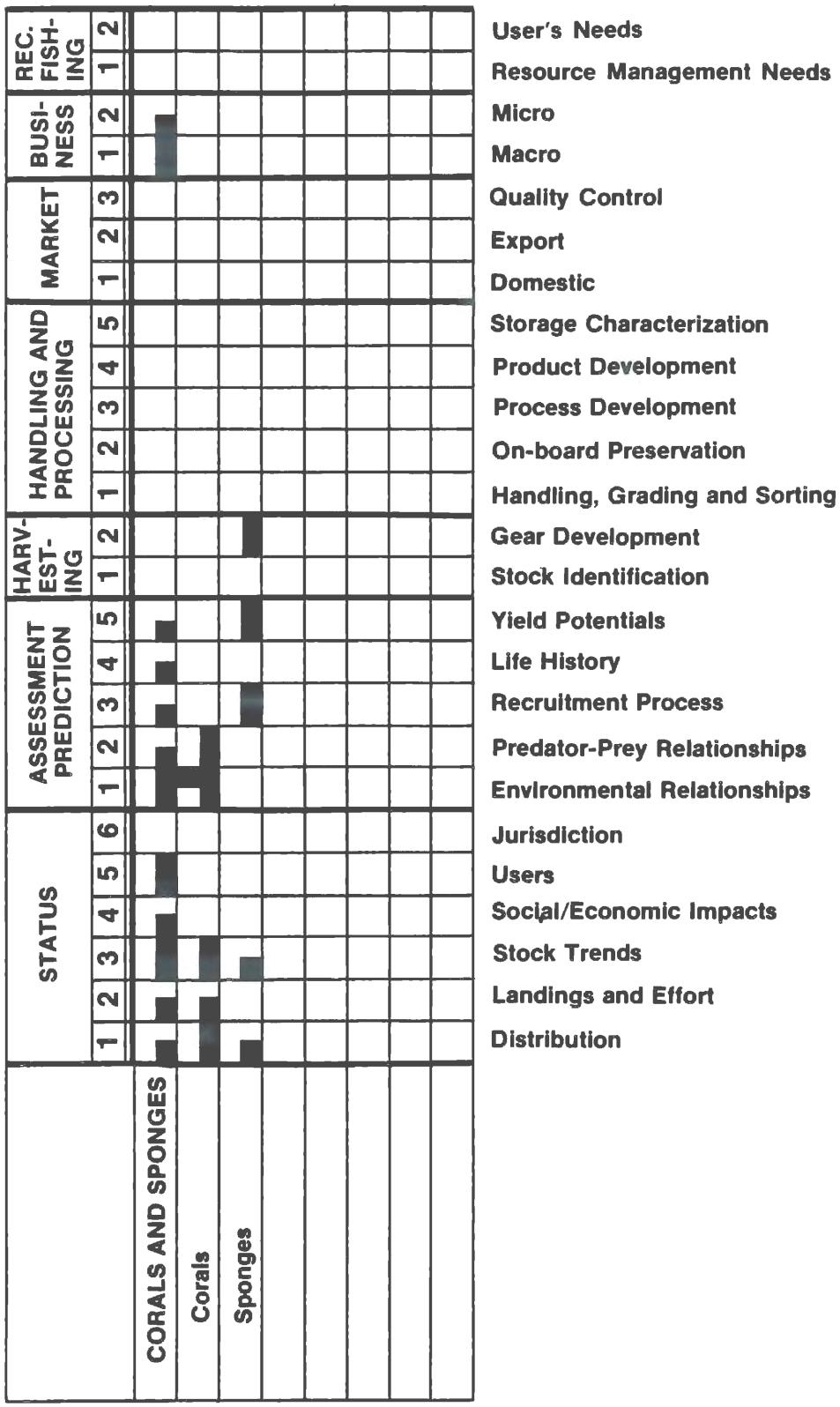

Figure 3.1.14 Summary of information needs. The estimated degree of need is shown in each matrix block as follows: ☐ available information adequate for current needs; ▖ 1-25% more information needed; ▞ 26-50% more information needed; ▚ 51-75% more information needed; ■ 76-100% more information needed.

Table 3.1.14 Research Program Summary for Corals and Sponges.
Each project has been categorized as recovery, maintenance, expansion, or new fishery.

Ident. Number	Function of Task	Costs x 1000 First Year Amount	Second Year Amount	Third Year Amount	Fourth Year Amount	Fifth Year Amount	Total	Program Category	Priority
CS1	Improved Harvest Methods	67	67	37	37	37	245	Expansion	M

3.1.15 General

A number of research problems which were identified in the preparation of this document are applicable to all fisheries. These include such activities as more accurate fishery statistics for both commercial and recreational fisheries, population dynamics models, larval survival and recruitment studies, stock identification, and causes of variability within populations. Rather than separating each of these problems in each unit they have been lumped into this section.

Table 3.1.15 summarizes identified problem/opportunity projects. Following are annotations of general research problems which have been identified in the preparation of this document.

G1 Population Dynamics Model -- Existing population dynamics models do not adequately reflect the outputs of interest to recreational fishermen. Optimal yield fishing strategies do not take into consideration the sportsfisherman's desire to catch trophy-sized fish. In fact, such strategies would require some restriction in total effort in order that sportsfishing interests are satisfied. Potential benefits: greater sociological benefits to both recreational and commercial fishing interests and increased support for management plans.

G2 Larval Survival and Recruitment -- The relationship/dependency of larval survival and recruitment on offshore current features is unknown for most species. Potential benefits: more accurate modeling of yields and better prediction of yields.

G3 Fishery Statistics -- Incomplete for Gulf fisheries. Fishery statistics provide basic data for fishery population analysis and economic evaluations. Trip-specific information collected for a representative sample of trips is the appropriate data base for these analyses and evaluations. The present data base is inadequate. Potential benefits: improved management policies based on adequate knowledge of fisheries performance.

G4 Stock Identification -- Biological stock units are not identified for Gulf fishery resources. Managers do not have the scientific information on biological stock units for Gulf fishery resources that would enable them to develop appropriate fishery regulations on a subregional basis. Potential benefits: fishery populations could be managed on a subregional basis if separate stocks within the region are found to exist, thus providing the opportunity of adjusting regulations to the unique needs of both the subregional populations and the users of the resource in these subregions.

G5 Cause of Variability -- Information on recruitment variability is not available for Gulf fishery resources. The major source of variation in Gulf fishery stocks is probably due to year-to-year variability in recruitment stocks. The causes of the variability are not understood and thus fluctuations in fishery stocks and fishing success cannot be predicted. Potential benefits: understanding of causes of variations in stock levels will allow prediction of changes in population levels and allow adoption of management policies which will encourage optimum utilization of Gulf fishery resources.

G6 Recreational Technical Bulletin -- Development of technical bulletins providing guidance on construction, operation, maintenance, licensing and permitting requirements, and potential profitability of marine recreational based commercial operations. Such brochures should be prepared for businesses such as fishing camp launching facilities, bait shops, marinas, dry boat storage facilities, camping grounds, charter and guide boat operations, etc. Potential benefits: increased recreational catch per effort.

Table 3.1.15 Research Program Summary - General.
Each project has been categorized as recovery, maintenance, expansion, or new fishery.

Ident. Number	Function of Task	Costs x 1000 First Year Amount	Second Year Amount	Third Year Amount	Fourth Year Amount	Fifth Year Amount	Total	Program Category	Priority
G1	Population Dynamics Model	35	35	65	-	-	135	Maintenance	L
G2	Larval Survival and Recruitment	340	340	120	40	40	880	Maintenance	H
G3	Fishery Statistics	1050	1050	1050	1050	1050	5250	Maintenance	H
G4	Stock Identification	220	180	180	180	180	940	Maintenance	H
G5	Cause of Variability	310	310	310	310	310	1550	Maintenance	H
G6	Recreational Technical Bulletin	120	46	10	-	-	176	Maintenance	M

3.2 Action Program

Priority in program emphasis will be placed upon funding projects which have the greatest probability of maintenance and improvement of existing fisheries, generating increased revenue for the domestic industry, generating increased yields from fisheries, and generating increased recreational opportunity and harvest potential. Projects will be evaluated as to the likelihood of achieving these benefits through both short-term and long-term research projects with consideration of the magnitude of the eventual benefit that may be realized. Both short-term projects that may yield more immediate benefits and long-term projects yielding greater benefits will receive high priority emphasis. Planning emphasis will be placed upon attaining each discrete target benefit either through a single project or series of projects necessary to attain that goal.

Projects attaining a benefit of increased revenue for the domestic industry include those which provide for improved efficiency of operation, as well as those generating increased gross income. Such projects include those resulting in new fisheries, new markets, new products, improved technology and processes, improved gear, etc.

Projects attaining a benefit of increased yield from fisheries include those which directly increase production through mariculture and stocking programs, etc., as well as those supporting management actions which may yield increased poundage or dollars from exploited populations.

Projects attaining a benefit in increased recreational opportunity and harvest potential include those providing information on stock characteristics, fishing techniques, and other facets supporting recreational fisheries as well as projects facilitating access and availability.

Projects categorized as recovery, expansion and new fisheries (Tables 3.1.1-3.1.15) have been included in the following tabulation (Table 3.2) of projects recommended for action. In addition selected maintenance projects have been added. Recommended research for the 5-year MARFIN program includes some $40,350,000, which was selected from identified research projects (Tables 3.1.1-3.1.15) totaling some $68 million. Since practically all projects were submitted showing implementation in the first year of the program, it has been necessary to change the timing of some projects to conform with anticipated funding requests.

Estimated costs to this program have been reduced from original estimates wherever it is known that funding for some of the needed work is already appropriated.

There were a number of research proposals submitted which were not considered for funding because they were of a lower priority for this program, but the data to be generated by these proposed projects are necessary to supply management and conservation related information. Review information on those proposals will be supplied to those agencies and funding organizations with responsibility for various fisheries (e.g. states, Sea Grant, NMFS, universities, etc.).

Funding for the MARFIN program is expected to be in addition to existing fishery funding programs now in existence.

Table 3.2 Recommended Research

Research Unit	Ident. Number	Costs x 1000 First Year Amount	Second Year Amount	Third Year Amount	Fourth Year Amount	Fifth Year Amount	Total
Shrimp	S2	130	330	17	-	-	477
	S4	275	325	295	195	-	1090
	S6	285	364	387	367	372	1775
Menhaden	M1	185	185	227	260	183	1040
	M4	-	-	-	380	390	770
	M8	-	61	76	-	-	137
Coastal Pelagics	CP3	340	340	302	-	-	982
	CP5	5	5	5	-	-	15
	CP7	-	-	-	120	120	240
	CP11	111	15	11	5	-	142
	CP12	-	-	-	250	210	460
	CP13	-	-	-	160	160	320
	CP15	150	37	-	-	-	187
	CP16	155	85	-	-	-	240
	CP17	57	-	-	-	-	57
	CP24	150	58	-	-	-	208
	CP27	230	155	140	-	-	525
	CP30	190	245	245	-	-	680
	CP31	125	85	69	-	-	279
	CP33	5	5	4	-	-	14
Reef Fish	RF2	-	-	-	110	100	210
	RF5	100	75	50	-	-	225
	RF16	-	-	-	250	250	500
Coastal Herrings	CH1	151	151	290	452	469	1513
	CH2	450	300	150	100	100	1100
	CH3	50	50	200	300	300	900
	CH4	50	50	150	150	100	500
	CH5	25	25	25	25	-	100
	CH6	50	80	15	150	100	395
	CH7	55	80	100	100	50	385
Ocean Pelagics	OP1	125	118	140	191	190	764
	OP2	78	78	44	37	37	274
	OP3	135	100	125	-	-	360
	OP4	150	100	50	-	-	300
	OP5	200	200	150	100	100	750
Marine Mollusks	MM1	100	150	150	50	50	500
	MM2	75	75	50	25	25	250
	MM3	-	30	30	-	-	60
	MM4	-	25	50	50	10	135

Table 3.2 Recommended Research (Continued)

Research Unit	Ident. Number	Costs x 1000 First Year Amount	Second Year Amount	Third Year Amount	Fourth Year Amount	Fifth Year Amount	Total
Marine Mollusks (Cont'd.)	MM5	-	-	-	150	150	300
	MM6	100	100	100	-	-	300
	MM7	30	30	30	-	-	90
	MM11	50	50	25	-	-	125
	MM12	75	75	75	50	50	325
Crabs and Lobsters	CL3	-	-	-	300	350	650
	CL4	235	150	150	50	50	635
Bottomfish	B1	212	212	212	115	55	806
	B2	653	565	344	157	157	1876
	B3	208	208	401	494	549	1860
Estuarine Fish	EF2	155	155	36	36	36	418
	EF3	188	143	144	148	139	762
	EF6	30	30	30	-	-	90
	EF7	20	20	20	-	-	60
	EF9	75	75	75	75	75	375
	EF10	75	75	75	75	75	375
Anadromous and Catadromous	AC1	190	110	110	-	-	410
	AC5	91	79	79	-	-	249
	AC6	40	40	-	-	-	80
Mariculture	MA1	500	1250	2250	500	500	5000
	MA2	30	30	30	30	30	150
	MA3	25	25	25	25	25	125
	MA4	25	25	25	5	5	85
	MA5	50	50	50	10	10	170
Corals and Sponges	CS1	67	67	37	37	37	245
General	G2	-	-	-	340	340	680
	G3	1050	1050	1050	1050	1050	5250
Totals		8361	8596	8920	7474	6999	40350

SECTION 4. PROGRAM MANAGEMENT ORGANIZATIONAL STRUCTURE

4.1 Purpose

A Management Organization has been recommended to manage the 5-year research program depicted in Section 3. The recommended organization is described in 4.3. Implementation and operational plans are described in Section 5, with monitoring and evaluation developed in Section 6.

In recommending the Management Organization, the Working Task Force considered what the organization should be able to do and developed a list of criteria for judging the applicability and capability of structures considered. The management organization should be able to: ensure competition; ensure consistency; ensure continuity; coordinate, implement, review and evaluate; disseminate programs to user groups; assign priorities; legally accept and disburse monies; be aware of current research; be cognizant of jurisdiction boundaries and regional concepts; have a regional perspective; be sensitive of user group involvement; be a structure supported by broadest political base; evaluate and recommend research proposals periodically; define the five-year research plan; have proposal peer review; have audit/fiscal responsibility; have data base coordination; and be flexible.

4.2 Gulf of Mexico Fishery Research and Management Organizations

Existing Gulf of Mexico marine fishery organizations, in alphabetic order, are as follows:

Gulf and South Atlantic Fisheries Development Foundation, Inc. (GASAFDFI)
Gulf of Mexico Fishery Management Council (GMFMC)
Gulf State/Federal Fisheries Management Board (GSFFMB)
Gulf States Marine Fisheries Commission (GSMFC)
National Marine Fisheries Service - Southeast Fisheries Center (NMFS - SEFC)
National Marine Fisheries Service - Southeast Regional Office (NMFS - SERO)
Recreational Fishery Organizations
Sea Grant Programs
State Resource Agencies
Trade Associations

These existing organizations were represented on the Task Force in the development of this document and also constitute the Program Management Board membership.

4.3 Marine Fisheries Initiative Organization

Several management organization structures were considered by the Task Force during the development of this document. As with any program, coordination and communications may become a limiting factor in successfully carrying out stated objectives. The recommended organization structure minimizes this potential problem by utilizing existing Gulf of Mexico fishery research and management organizations already accustomed to coordination of fishery issues and programs. Thus, a built-in coordination and communications network is assured.

The National Marine Fisheries Service, through the Southeast Regional Office, will be responsible for administering the program, with reliance primarily upon a Program Management Board for guidance on program development and on the selection of appropriate grant and contract recipients. The Program Management Board will be comprised of 8 members, one representative from each of (1) the Gulf States Marine Fisheries Commission, (2) the Gulf and South Atlantic Fisheries Development Foundation, (3) the Gulf of Mexico Fishery Management Council, and (4) the National Marine Fisheries Service. Additionally, each of the four groups of (1) five Gulf states, (2) four Sea Grant programs, (3) the recreational fishery organizations, and (4) the commercial fishery organizations will select a representative to serve on the Board. The Board will utilize ad-hoc advisory groups to provide broader representation to their deliberations. A program coordinator will be retained, together with appropriate clerical support, to assist the Board in the conduct of its business. Individual members will serve staggered 3-year terms, to provide program continuity. The Board will elect a chairman to serve for a period of two years.

The Board will consider recreational and commercial fishing research and development needs and recommend research and development priorities for project solicitation and evaluation to the Southeast Regional Office. An annual solicitation based on these priorities will be made by the Southeast Regional Office to the broadest possible range of institutions with relevant expertise and resources. The solicitation will be coordinated by the Gulf States Marine Fisheries Commission under contract or through a cooperative agreement with the SERO. Proposals submitted in response to the solicitation will be evaluated for technical merit by the Southeast Fisheries Center and ad hoc technical review groups. These proposals with technical reviews and ratings will be submitted to the Program Management Board, who in turn, will make final funding recommendations to the Southeast Regional Office Director.

Each participating organization represents certain strengths and areas of special expertise vital to the overall objective of this initiative and the extensive research and development effort implicit in it. Based on current capabilities and historic roles, project funding may result in a 20-25% share going to each of the four major participating groups (the states, Sea Grant, NMFS, industry) with 5-10% going to various administrative costs, including contracts for administration. The actual distribution of funds will, of course, depend upon year-to-year research and development objectives and the merit of specific project proposals in relationship to those objectives. The participants, as members of the Board, will be primary determinants of the Board's decisions and recommendation to NMFS. While the SERO will administer the funds, its project proposals will be subject to the same review and selection process as all others. The SEFC will be the primary NMFS participant in terms of its research and development role.

The location of the Program Management Board Program Coordinator's office will be determined after the Board begins functioning. It is assumed, however, that the office will be located either as part of the Gulf States Marine Fisheries Commission or with the Southeast Regional Office. In either location, the receiving organization will provide facility and other required support on a no cost or charged cost basis. The flow of funds for initiation and continuation of this program will be from the U.S. Congress through the Department of Commerce, NOAA, NMFS, SERO, and then to the grant and contract recipients.

A significant portion of the work performed annually is to develop an annual budget request which would be submitted to the Administration with the annual NMFS budget. In preparing this annual budget request, the Program Management Board will rely heavily on existing NMFS, GSMFC, GASAFDFI, and Sea Grant advisory groups. Based on the advice from these organizations and advisory groups, and guidance from the Program Management Board,

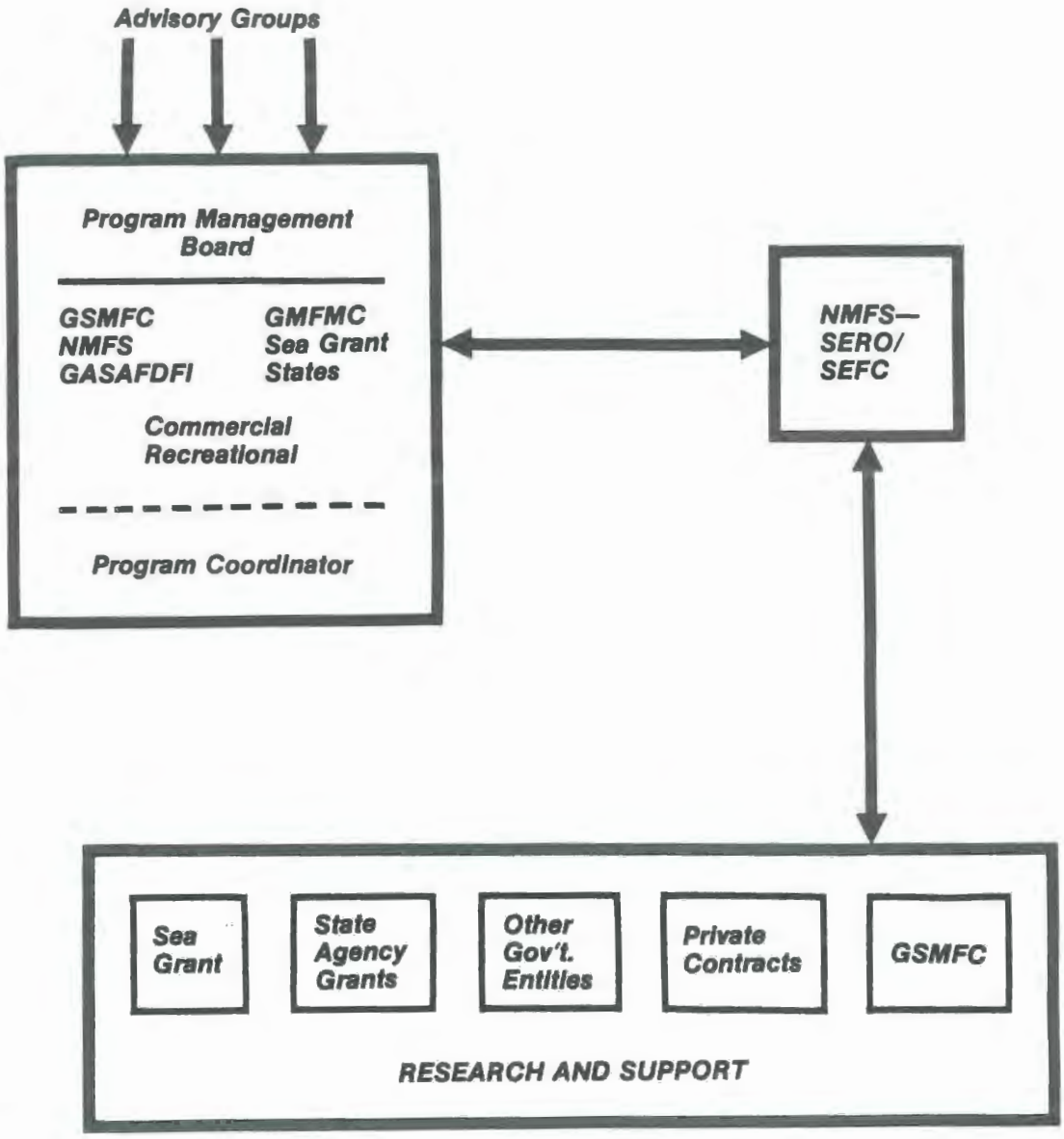

Figure 4.1 Marine Fisheries Initiative organization

the Program Coordinator will prepare the annual budget request for review by the SERO and modification and/or endorsement by the Board.

Funding for the MARFIN program is expected to be in addition to fishery funding programs now in existence.

SECTION 5. IMPLEMENTATION AND OPERATION

5.1 Plan Implementation

Plan implementation will begin after the appropriate organizations have approved the document and funds have been made available. The Plan will be implemented and administered by the Marine Fisheries Initiative Organization, as shown in Figure 4.1. The first action of the Program Management Board will be to develop an Operational Plan to assure that:

- Members of the group will be aware of the current status of fishery research
- Ongoing programs will be recognized as well as how they integrate in order to minimize duplication, and to make maximum use of existing mechanisms
- Research grants and contract awards will utilize a peer review process
- A regional perspective will be maintained
- Jurisdictional boundaries will be recognized
- Planning and research efforts will be coordinated throughout the program
- The program will be reviewed and evaluated at appropriate intervals
- Priorities will be assigned in accordance with constituency needs
- Emergency needs and changing conditions will be considered
- All program funds will be legally accepted and dispensed by a fiscally responsible entity
- Implementation of the action program will accomplish applied economic research objectives
- Proposal review and evaluation will be thorough
- There will be adequate dissemination of information to user groups

Working groups will be established to enhance implementation in a timely manner. The initial organizational meeting will project and establish a detailed schedule for full operational continuity.

5.2 Five Year Strategic Plan Summary

The five year Research Action Program Summary in Section 3 will govern implementation and operational decisions. Using this strategic plan as a basis, the first year operational plan will be developed to address those research projects with the highest

priorities. Any changes to the strategic plan must not only be justified, but the five year plan must be duly updated to reflect all changes.

5.3 First Year Operational Plan

Subsequent to full plan implementation, the Program Management Board will reconfirm and/or identify research needs. Any research changes will be linked to established goals. Request for Proposal (RFP) packages for the research projects will establish the degree of visibility and control to be exercised on each proposal project to accomplish the objectives of this program. There will be a description of the research to be accomplished, the resources required (manpower, material, equipment), the schedule, and the budget. An example of information to be included:

- o Project title
- o Project objectives
- o Background (e.g. literature review)
- o Project procedures
- o Responsible (key) personnel
- o Interface events and dates
- o Beginning and completion dates
- o Project costs and budgets
- o Project schedules and control points.

Appropriate organizational facets will coordinate the projects, judge their success in relation to their contribution toward satisfying plan objectives as well as their relevance to problem solutions confronting the several fisheries.

Meetings should be conducted at least twice each year, and more often as necessary to ensure satisfactory program progress.

5.4 Program Process Flow

Figure 5.1 depicts the overall program process flow. Flow of funds for initiation and continuation of this program will be from U.S. Congress through the Department of Commerce, NOAA, NMFS, and then to the grants, contracts, and research support recipients.

Upon authorization and funding of the Marine Fisheries Initiative, NMFS-SERO will initiate authority for implementation of the Program Management Board, and establish appropriate funding and control mechanisms. One of the initial activities of the Board will be to review the five year strategic plan in light of existing knowledge of the several Gulf of Mexico fisheries, in consort with the various fishery advisory groups.

The process flow will follow the sequence of steps depicted in Figure 5.1, as follows:

1. The Program Management Board will recommend research priorities to NMFS.
2. NMFS will prepare requests for proposals (RFP's) based on these recommended priorities and distribute them publically. (The solicitation will be coordinated by the Program Coordinator through the GSMFC.)
3. Proposal responses will be reviewed for technical merit by NMFS/SERO-SEFC and their normal peer review groups, and any Program Management Board recommended technical review panels.

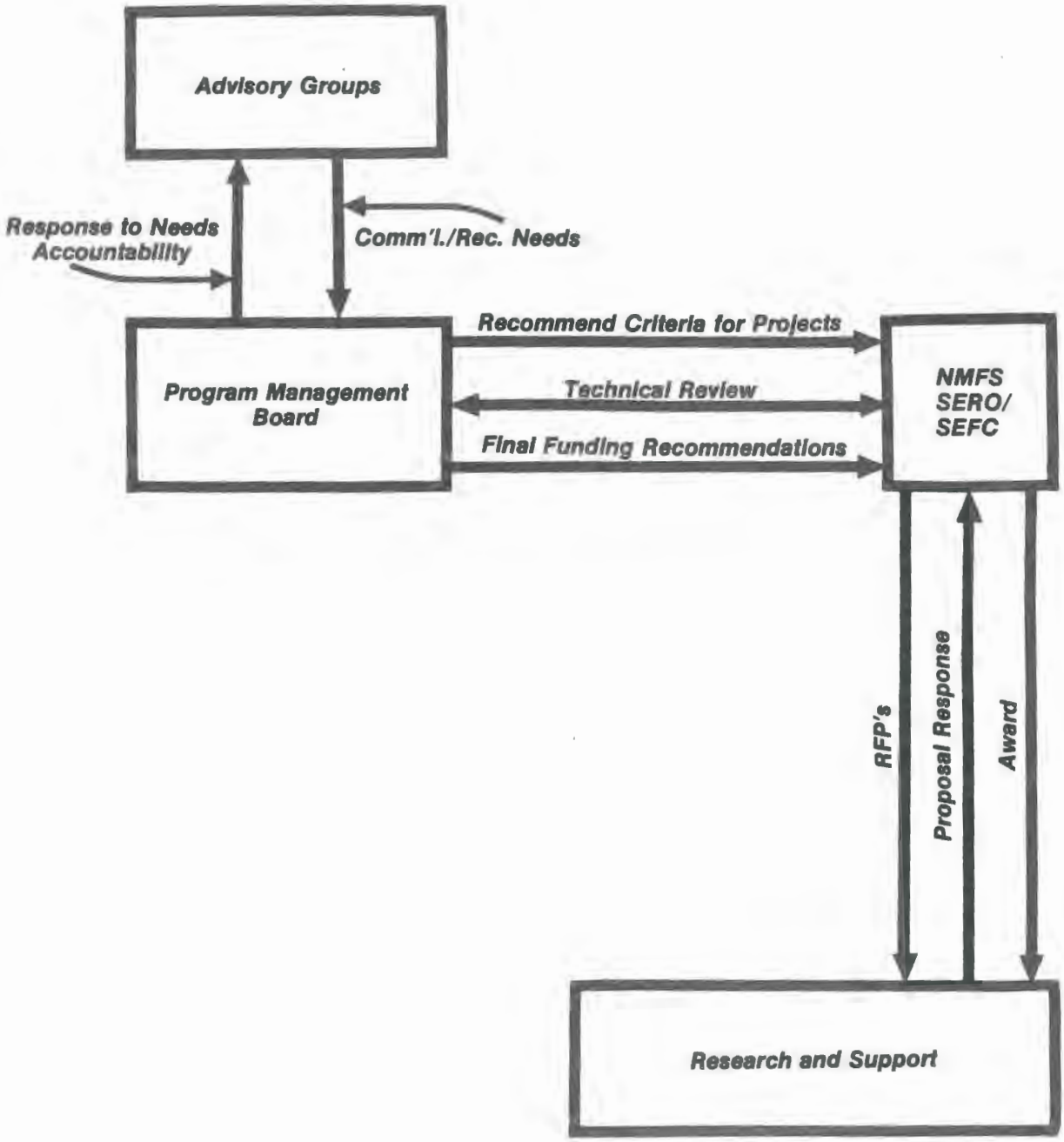

Figure 5.1 Program Process Flow

4. Technical review comments and recommendations will be consolidated by the Program Coordinator in cooperation with NMFS and forwarded to the Program Management Board with the proposals for final recommendations.
5. The Program Management Board will submit the final recommended proposals to NMFS for action.
6. NMFS will award the selected research contracts/grants to the designated recipients.

The Gulf States Marine Fisheries Commission, under contract to or through cooperative agreement with SERO, will perform general coordination functions, including setting up meetings, preparing program reports, maintaining communications networks, providing travel reimbursements for approved participants, etc.

SECTION 6. MONITORING AND EVALUATION

In accordance with the Operational Plan, NMFS and the Program Management Board will monitor and evaluate the research projects. The project evaluation process will allow judging the impact of individual projects on a regional basis, and to readjust priorities as required. The Board will evaluate the effectiveness of the entire regional fisheries research systems, particularly concerning the solutions of identified problems. Development of an Operational Plan (Section 5) enhances the establishment of the proper control mechanisms to monitor and evaluate results.

6.1 Monitoring

It is important to monitor not only projects funded through MARFIN, but also other fishery research and development activities which directly or indirectly impact the Gulf of Mexico. A matrix form of modeling/tracking will be developed which identifies known research and development activities affecting Gulf fisheries. The Program Coordinator, in behalf of the Program Management Board, will request periodic progress reports from the individuals and organizations which are involved in fisheries development and research. Examples of information requested include name of funding institution, research entity, title and brief description of project [including person(s) to contact], project dates, etc. will enhance information flow to the Board. In addition, in a lesser detailed and general manner, United States and World fisheries research monitoring can be established.

Examples of the organizations which will be requested to provide periodic progress reports are listed in Section 4.2. Others will be identified, compiled and included in the monitoring request for information flow. Monitoring of the research responsibilities of the research and support groups will follow the same type format.

This monitoring program will greatly enhance timely updating and the minimizing of research duplication. It will also initiate thoughts relative to new, as well as improved research areas. Monitoring will be performed primarily by the Program Coordinator in cooperation with NMFS and the GSMFC.

6.2 Evaluation

The Program Management Board, in consort with associated fisheries groups and NMFS, will periodically review the research and development projects performed under the auspices of MARFIN. Each research project, upon completion, shall be reviewed for performance, budget and timeliness. The project research team (recipients of awards) will be measured and evaluated on their overall effectiveness and duly recorded for future reference.

There will be an annual review and update of the five-year Plan, including budget review, to support the program. As a result of the annual overall evaluation, an updated one-year operational plan depicting specific research to be performed will be developed and issued for incorporation and implementation.

6.3 Process Flow

The Program Process Flow model depicted in Figure 5.1 and described in Section 5.4 will be utilized to monitor and evaluate program and fiscal accountability of research and support. Completed research will flow to NMFS for acceptance, with copies to the Program Management Board, and others, as may be deemed appropriate.

APPENDIX A

STATEMENT OF WORK

PROJECT SUMMARY

Planning research needs for information leading to full and wise use of fishery resources in the Southeast Region.

A comprehensive state-Federal fishery research program for the Southeast Region of the United States does not exist. Such a program is needed to ensure that information needs of Federal and state fishery management agencies, commercial and recreational fisheries, and fishery developers are adequately met for the least possible cost and for the ultimate benefit of the Nation. Elements of a comprehensive program are beginning to fall in place through such programs as the regional cooperative statistics program, SEAMAP in the Gulf of Mexico, South Atlantic, and Caribbean, and development activities of the Gulf and South Atlantic Fisheries Development Foundation. However only for the Gulf of Mexico has a fully comprehensive research program been proposed (Research Needs for Information Leading to Full and Wise Use of Fishery Resources in the Gulf of Mexico, Dr. Thomas D. McIlwain, May 1983). The program outlines needed research to develop fisheries for underutilized and unutilized species, develop more valuable fishery products primarily for export markets, forecast variations in yields, and conserve and maintain presently exploited species.

While the need is for a regional fishery research program, this proposal addresses only development of a program plan for the Gulf of Mexico as the first phase of a regional planning effort. It is anticipated and recommended that similar program planning efforts be undertaken for the South Atlantic and Caribbean as separate planning phases. The program plan for the Gulf could then serve as a model or outline for these latter two regions.

As a means to accomplish the above the Gulf States Marine Fisheries Commission is submitting this proposal to develop a plan for funding and implementation of the research required for achievement of total economic and social benefits from Gulf fishery resources, including commercial, recreational and aesthetic values, as the first phase effort.

Objectives: Outputs of this proposal will be the results of efforts as outlined below:

1. Identify and describe needed research projects, including: (a) type of action, (b) function of project, (c) priority, (d) estimated cost/benefits, (e) recommended funding sources.

2. Develop a management organizational structure for a 5 year Gulf of Mexico fishery research program.

3. Develop implementation and operational plans.

4. Develop monitoring and evaluation procedures.

5. Develop task force workshop process cohesiveness.

Proposed Beneficiaries: U.S. Southeast Region and Gulf of Mexico Commercial and Recreational Fishery Industries and Consumers.

PROJECT DESCRIPTION FOR GULF OF MEXICO (PHASE I) EFFORT

1. Identification of Problem(s)

The need for additional research information leading to achievement of the total economic and social benefits from Gulf of Mexico fishery resources has been recognized and described. A coordinated plan for funding and implementation of this required research is required and does not exist.

2. Project Goals and Objectives

Goal

To develop a 5 year plan to implement the Lott/McIlwain Discussion Paper: "Research Needs for Information Leading to Full and Wise Use of Fishery Resources in the Gulf of Mexico." The paper proposes a fishery research program for increasing the economic contribution of fishery resources in the Gulf of Mexico. The program outlines needed research to develop fisheries for underutilized and unutilized species, develop more valuable fishery products primarily for export markets, forecast variations in yields, and conserve and maintain presently exploited species.

Objectives

(a) Identify and describe needed research projects, including: (1) type of action, (2) function of project, (3) priority, (4) estimated costs/benefits, (5) recommended funding sources.

(b) Develop a management organizational structure for a 5 year Gulf of Mexico fishery research program.

(c) Develop implementation and operational plans.

(d) Develop monitoring and evaluation procedures.

(e) Develop task force workshop process cohesiveness.

3. Appropriateness and Need for Government Financial Assistance

The Gulf of Mexico is the largest producer of domestic fishery landings in the United States. These commercial and recreational landings help to stabilize economic conditions in the coastal region by adding over 5.6 billion dollars annually to the economy and providing employment for well over 30 thousand people. The renewable nature of the fishery resources, if wisely managed and efficiently used, will insure continued economic profitability and well-being to those who depend on fisheries for commercial production and recreational enjoyment.

An additional investment in fisheries research of approximately 7 million dollars annually for five years is needed to provide the necessary information to take full advantage of Gulf fishery resources.

The full economic benefit of these resources will not be realized unless the necessary investments in research are made from public funds. The common property nature of open-access fisheries neither provides incentive for large, nor permits small, owner-operated firms to accumulate sufficient capital to invest substantially in research.

4. Participation by Persons or Groups Other than the Applicant

As with other programs, a great share of the work and support for the development of this proposal will be supplied by both public and private sector entities. The workshop task force will consist of representatives of the State marine fisheries agencies and state Sea Grant Programs, the Gulf of Mexico Fishery Management Council, National Marine Fisheries Service, Gulf and South Atlantic Fisheries Development Foundation, industry, university and other specialists. All will contribute their time and efforts to this program, and some will also provide their own travel expenses.

5. Federal, State, and Local Government Activities

Since the Gulf States Marine Fisheries Commission is not a federal, state, or local form of government, there are no formal linkages between its programs and those proposed by government. The Gulf States Marine Fisheries Commission is an interstate instrumentality established by P.L. 81-66. The Commission's participation with the several Gulf states marine fishery agencies, National Marine Fisheries Service, and other programs, provides a constant dialogue between government and industry.

6. Project Outline

Assuming the contract will be awarded on or before May 1, 1984, the project will be scheduled for completion on January 15, 1985. A tentative schedule of some key events are as shown below:

	M	J	J	A	S	O	N	D	J
Events									
Workshops	X		X	X			X		
GSMFC Meeting						X			
Progress Reports			X			X			
Final Report									X

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An organizational and workshop meeting will be held in May, 1984. Prior to this meeting preplanning events will be developed, the workshop task force will be determined and participants notified. The participants will consist of the following (not to exceed 25):

(a) Gulf states marine fisheries agencies

(b) Sea Grant

(c) National Marine Fisheries Service

(d) Gulf and South Atlantic Fisheries Development Foundation

(e) Gulf of Mexico Fishery Management Council

(f) Gulf States Marine Fisheries Commission

(g) University specialists (etc.)

(h) Others, as may be designated

The workshop task force will be charged with reviewing the Lott/McIlwain paper. In particular the task force will be asked to review and assign priorities to research needs, and to define and describe the required research efforts, costs, coordination requirements, and schedules. Working procedures and forms will be discussed and distributed. Subcommittees will be appointed to enhance homework assignments. A working schedule will be established to enhance task completions in a timely manner. The program approval process will be discussed, which will include the Technical Coordinating Committee of the Gulf States Marine Fisheries Commission, Gulf States Marine Fisheries Commission, and the Contracting Officer's Technical Representative (representing the Gulf and South Atlantic Fisheries Development Foundation).

Workshops are tentatively scheduled for May, July, August, and November, and will be located in areas not prohibited by the World's Fair crowds. A management organizational structure will be developed and recommended to manage the 5 year research program. Advantages and disadvantages of several alternative structures will be addressed.

Implementation and operational plans will be developed, including a work package format. Procedures for monitoring and evaluating the research projects will be established.

During the task force workshop efforts, emphasis will be on developing a smooth and compatible cohesive process, which should enhance future plan acceptance and effective implementation.

7. Project Management

The Gulf States Marine Fisheries Commission will manage the proposal described herein. Work, however, will be shared with planning consultants and a task force comprised of representatives of impacted entities. The executive director, acting as Principal Investigator, will coordinate activities of all participants, distribute draft material, and submit reports as required. This procedure has proven to be effective in the development, acceptance and implementation of management plans produced by the Commission.

8. Project Monitoring and Evaluation

(a) Workshops -- will include agendas, minutes of meetings, schedule of events, work assignments and efforts completed.

(b) Monthly in-house (Gulf States Marine Fisheries Commission) planning and review meetings will be conducted.

(c) Quarterly progress reports will be written and filed with the COTR and with workshop task force members.

(d) Gantt type scheduling will be performed, with development of a simplified non-computerized PERT completion network.

(e) Problems will be discussed for resolution with workshop task force members and the COTR.

9. Project Benefits

Outstanding opportunities exist to greatly expand commercial and recreational values of the Gulf fisheries. The proposed project will define a mechanism to achieve these opportunities through the availability of comprehensive fishery information. These opportunities translate into an increase in fisheries from their current 0.6 billion dollar annual ex-vessel value to 1.3 billion dollars. If one assumes a research investment of an additional 7 million dollars as estimated in the Lott/McIlwain paper the investment could result in cost-benefits of 48 to 1 for the first 5 years and 144 to 1 for 10 years, based on ex-vessel values. The total economic benefits based on a conservative multiplier of four range from 191 to 1 for the first 5 years to 575 to 1 for 10 years. Much of the projected growth would be due to increases in exports of fishery products. The stability of the national economic condition would be improved by offsetting a significant portion of the current 3 billion dollar trade deficit in fishery products.

10. Dissemination of Project Results

Upon completion, copies of the project results will be printed. The results will be distributed by the Gulf States Marine Fisheries Commission to the Gulf and South Atlantic Fisheries Development Foundation, Inc. (five copies), the Congressional delegation for the Gulf of Mexico, Congressional committees dealing with fishery resources, state marine fisheries agencies, state Sea Grant Programs, Gulf of Mexico Fishery Management Council, National Marine Fisheries Service and other federal agencies, industry, universities, and other interested persons.

11. Project Costs

Included within this proposal are anticipated project costs, broken-down to reflect the proposed funding, both requested and shared. The proposed shared funding will be by the Gulf States Marine Fisheries Commission, state Sea Grant programs, National Marine Fisheries Service, Gulf of Mexico Fishery Management Council, and representatives from industry and universities.

12. Cost Sharing for the Project

Gulf States Marine Fisheries Commission accepts responsibility for generating significant cost sharing. For this project it is expected that Sea Grant and National Marine Fisheries Service will participate in funding with additional in-kind contributions from state fishery agencies, National Marine Fisheries Service, the Gulf of Mexico Fishery Management Council, industry and universities.

APPENDIX B

INFORMATION NEEDS: ASSIGNMENTS, OUTLINE, AND REFERENCES

INFORMATION NEEDS: ASSIGNMENTS, OUTLINE, AND REFERENCES

In forming the Task Force to carry out this contract representation was drawn from various aspects of the Gulf fisheries community as well as from State, Federal, and university researchers and State and Federal management agencies. These individuals were assigned the responsibility of providing summary information on various fisheries. The assignments and the outline used to develop the information on each fishery unit follows.

Information needs were emphasized in short accounts of the summary for each unit. Those accounts are included in the document and summaries have been archived for future reference. The very large volume of references used in developing the summaries cannot be included in the following limited list of references. Management plans and profiles can, in most cases, be consulted for detailed lists of references. As an example, the management plan for menhaden completed in 1983, includes all information needed for this document.

LIST OF ASSIGNMENTS

Shrimp - Robert Kemp/C. E. Bryan, Ralph Rayburn, Edwin Joyce
Menhaden - Dalton Berry
Coastal Pelagics - Wayne Swingle, Frederick Deegen
Reef Fish - James Cato/Fred Prochaska, Feenan Jennings/Willis Clark, Wade Griffin
Coastal Herrings - Andrew Kemmerer, Jack Greenfield
Ocean Pelagics - Bradford Brown
Marine Mollusks - William Perret/Claude Boudreaux
Crabs and Lobsters - Jack Van Lopik/Ronald Becker, James Jones/William Hosking
Bottomfish - Nick Mavar, Jr./Andrew Kemmerer
Estuarine Fish - Walter Tatum, Theodore Ford/Richard Condrey
Anadromous and Catadromous Fish - Thomas McIlwain
Mariculture - Thomas McIlwain
Marine Mammals/Endangered Species - J. Alan Huff
Corals and Sponges - J. Y. Christmas

OUTLINE FOR SUMMARY OF EACH FISHERY UNIT

3.0 Research
Identify research units and species.

3.1 Current Status*
a. Priority - identify priority species and/or research units.

3.1.0 Research Unit (name)
Range of resource and fishery or fisheries. Fishery or species interaction with other fisheries or species.

3.1.0.0 Species (name)

(Identify data gaps for each of the following)

a. Status
   1. Distribution patterns
   2. Landings and effort
   3. Stock trends
   4. Social/economic impacts
   5. Users
   6. Jurisdiction

b. Assessment/Prediction
   1. Environmental relationships
   2. Predator-prey relationships
   3. Recruitment processes
   4. Life history
   5. Yield potentials

c. User group information requirements
   1. Harvesting technology
      (a) Stock identification (in addition to management needs)
         (1) Seasonality
         (2) Schooling characteristics
         (3) Behavioral characteristics
      (b) Gear development
         (1) Selectivity
         (2) Efficiency
         (3) Technology transfer
   2. Handling and processing technology
      (a) Handling, grading, sorting
      (b) On-board preservation
      (c) Process development
      (d) Product development
      (e) Storage characteristics
   3. Market research and development
      (a) Domestic
         (1) Retail
         (2) Institutional
      (b) Export
      (c) Quality Control
   4. Business and economic evaluation
      (a) Macro
      (b) Micro

d. Recreational fisheries research and development needs
   1. Resource management needs
      (a) Catch statistics
      (b) Effort statistics
      (c) Fishing mode and pattern statistics
         (1) Temporal
         (2) Spatial
      (d) User profiles
         (1) Social
         (2) Economic
         (3) Demographic
      (e) Regulatory impact assessment

2. Users' needs
   (a) Catch utilization enhancement
   (b) Access improvement
   (c) Aggregation structure enhancements
   (d) Support for supply industries
   (e) Motivation-satisfaction enhancement
   (f) Development of recreationally-based commercial businesses
   (g) Information dissemination

3.1.0.1--2 etc. for each species
(includes a, b, c, etc.)

3.1.1--- for each research unit
(include 3.1.1.0 etc. for each unit)

3.2 New or Expanded Projects Required to Accomplish Objectives

3.2.0 Research Unit (name)
- a. Assessment
- b. Prediction
- c. Catching technology
- d. Uses of products

3.2.1--- for each research unit
(includes a, b, c, etc. for each unit)

3.3 Research Action Program Summary
- a. Time frame
- b. Cost
- c. Priority
- d. Benefit
- e. Cross reference

*Consider these factors when completing items 3.1 etc. - completed and documented, ongoing, planned and needed.

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