

Marine Fisheries Initiative

(MARFIN)

Gulf of Mexico Phase



Proceedings:

Fourth Annual MARFIN Conference



September 10-11, 1991

San Antonio, Texas

PREFACE

The MARFIN Board consists of members representing the National Marine Fisheries Service, Sea Grant, the Gulf of Mexico Fishery Management Council, the Gulf States Marine Fisheries Commission, the Gulf and South Atlantic Fisheries Development Foundation, Gulf States' marine agencies, the recreational industry, and the commercial industry. These members assist the Regional Director of the Southeast Region NOAA Fisheries in developing gulf fishery priorities, evaluating proposals for financial assistance, and monitoring existing projects. The NOAA Fisheries (NMFS) provides a program manager to coordinate all of the MARFIN activities, and individual program officers for each of the projects. A grants officer in the NOAA Grants Management Division in Washington, DC, administers the awarded projects with the assistance of the designated program officer.

The MARFIN Conference is held annually and is designed to allow a free interchange of ideas among all the MARFIN cooperators, to disseminate information to fishery managers, researchers, and other interested gulf fishery parties, and to assist the MARFIN Program Management Board and the NOAA Fisheries in identifying priorities for future MARFIN projects.

The MARFIN research units include:

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

The conference sessions are organized to address most of the research units with MARFIN PMB members acting as chairpersons for each of the sessions.

The MARFIN Program was developed around the concept that fishery data concerning the Gulf of Mexico required coordination. Many state, university, federal, and private groups were not working in concert. Enhancing cooperation among these groups was a key aspect in the initiation of MARFIN. If those of you who read this document are considering submitting a proposal to MARFIN, think in terms of cooperation. We would like to see proposals that bring together talent from a number of areas. We would also like to receive proposals that could help develop a fishery resource, maintain an existing resource, or aid in the recovery of a resource that had been diminished. The economic aspects of fishery development, maintenance, and recovery are also key areas of interest.

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Tuesday, September 10, 1991

WELCOMING REMARKS - Robert L. Shipp, MARFIN Board Chairman

I would like to welcome you to the Fourth Annual MARFIN Conference. We are beginning to establish a little history. We met first in St. Petersburg and then New Orleans and then Orlando and now San Antonio. I think the precedents are starting to settle in and people will begin to relate this time of the year with the MARFIN conference. As you know we have chosen to meet with American Fisheries Society for good reason. We hope that we can lure some of those folks away from some of the basic research presentations to the cutting edge of applied research. In fact, some of it may still be in progress. Since we are meeting in conjunction with AFS, we will have to conduct our agenda over the next day and a half a little bit more rigidly than we have in the past, because we have concurrent sessions. I was over at the AFS meetings this morning, and I know a lot of those folks are planning to come over to some of our presentations and some of you may want to go over to some of theirs, so I've asked the Chairpersons to stick pretty closely to the schedule. The presenters are prepared to leave four or five minutes for questions at the end, so please feel free to participate. Now Don Ekberg is scheduled to give a little bit more about the background of MARFIN, but I know Dr. Kemmerer wants to say a few words of welcome, too.

CONFERENCE OBJECTIVES - Andrew J. Kemmerer, Regional Director, NMFS Southeast Region and Don Ekberg, MARFIN Program Manager

ANDY KEMMERER: Thank you, Mr. Chairman. First, I want to congratulate a new member of the Gulf of Mexico Fisheries Management Council. Dr. Bob Shipp is, if you don't already know, the new member so please feel free to jump all over him if something is going wrong in fisheries management.

I am pleased to be here. I have missed just about every MARFIN meeting since becoming Regional Director due to a heavy travel schedule. Therefore, I did not want to miss the opportunity to attend this meeting. MARFIN has become a critical element of fisheries research and management programs in the southeast region and by the National Marine Fisheries Service. We have seen a significant shift of MARFIN priorities over the last few years from ones dealing with fisheries development to ones dealing almost exclusively with fisheries management. MARFIN is now providing critical information on management measures to recover fisheries, and on how to maintain important resources. I believe it is doing an excellent job.

MARFIN can be viewed as an experiment. No where else in the country do they have anything like it. They have tried, but so far no one has been successful. People are watching how the program functions because of its successes, not its failures. It has changed over the years, as any good program should. And, it is getting better.

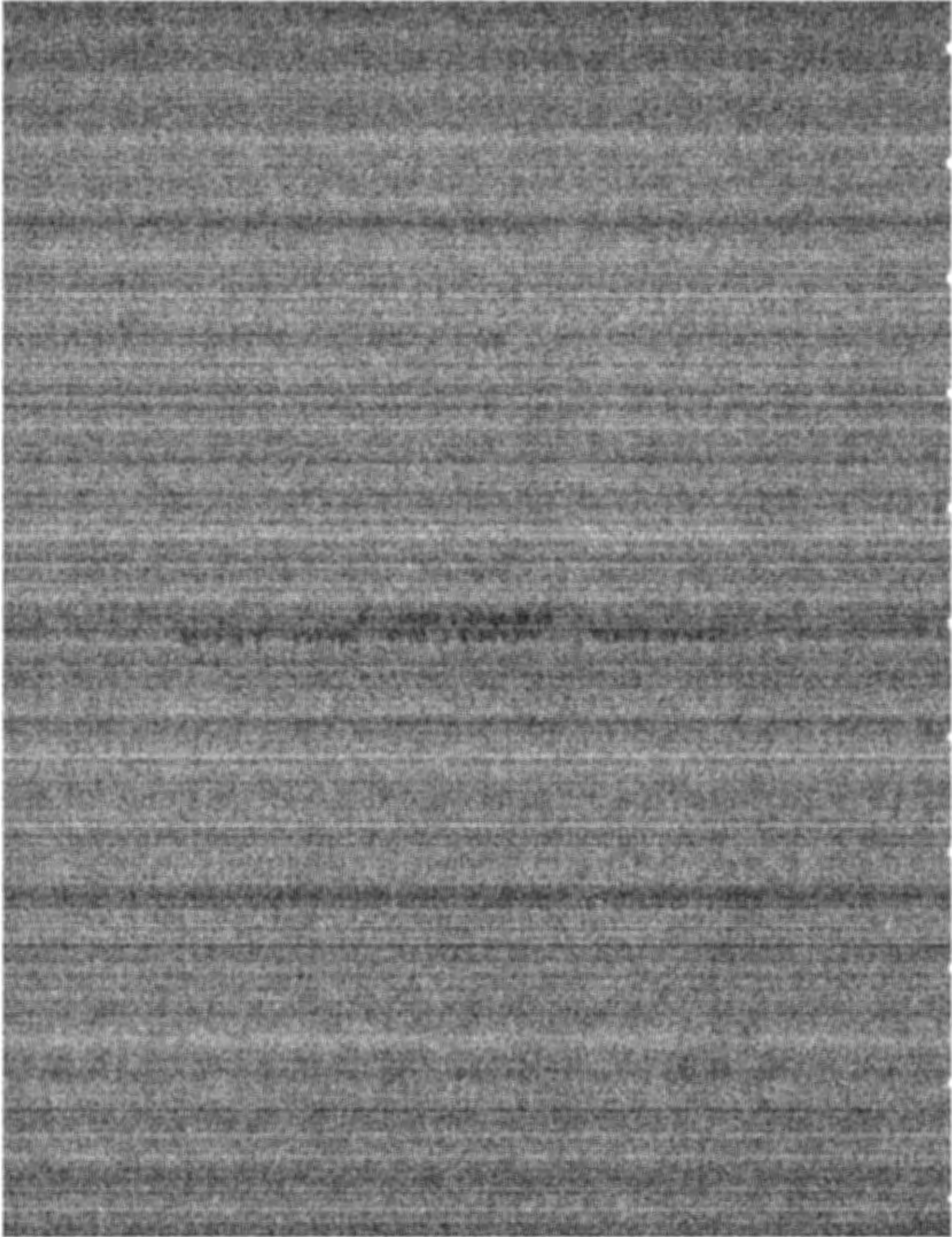
The MARFIN Conference is part of the experiment. Its goal is to provide a forum for reviewing salient results from MARFIN supported work. Besides this, its intent is to share MARFIN related information to stimulate other investigators to get involved in the MARFIN process. We want other scientists to submit proposals in areas which are of critical importance to the region. We

have some exciting times ahead. Shrimp trawler bycatch is one of the areas of work which MARFIN can really deal with.

I would like to welcome you here. I appreciate the chance to say something to the MARFIN Board. I used to be able to sit here and provide advice; now I have to listen to the advice of others. By the way, I did want to mention that if you want to take the opportunity to talk to someone who is very close to the power in the National Marine Fisheries Service, Dr. Mike Sissenwine is here. He is the Chief Scientist for the agency. He is here to find out how a successful program operates. Thank you very much.

DONALD R. EKBERG: A few days ago I noticed we didn't have any conference chairmen listed for our five sessions, so we've gone ahead and named a few of these. Scott Nichols is going to take the first session on Shrimp, Turtles and TEDs; Bob Shipp the second one on Coastal Herrings; Corky Perret the third one, Estuarine Fish, Menhaden and Oysters; Larry Simpson for Coastal Pelagics; and Wayne Swingle for Reef Fish and Coastal Pelagics. I'd also like to mention that I'm the Program Officer for all the MARFIN cooperative agreements. We handle the technical side, using technical monitors from the Regional Office and throughout various NMFS laboratories of the Gulf of Mexico. Jean West is here from our Washington office of NOAA Grants. If you have any questions about grants we will try to answer them for you.

SESSION I
SHRIMP, TURTLES AND TEDS



SESSION I - SHRIMP, TURTLES AND TEDS - Scott Nichols, Chairman

I understand, Session Chair means official timekeeper. Let's synchronize our watches. We are starting about 20 minutes early. We'll give everyone 25 minutes, I'll make a signal after 20 minutes so you can see how much time you have left for questions. Leading off is Jerry Clark, Louisiana Department of Wildlife and Fisheries with "Enhancing the Benefits Derived from Shrimp in the Gulf of Mexico through Optimizing Shrimp Management in Louisiana."

**Enhancing the Benefits Derived from Shrimp
Management in the Gulf of Mexico by Optimizing
Shrimp Management in Louisiana**

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Abstract

The goal of this project is to provide a sound program, based on the best scientific data, for the management of shrimp in Louisiana waters. This is the second year of a two year project. The Louisiana Department of Wildlife and Fisheries, and Louisiana State University's Coastal Fisheries Institute, are cooperating to: assess and model the shrimp stocks in Louisiana and adjacent waters; describe the fishery and related fishing industry; assess and predict future conditions of shrimp habitat and socio-economic circumstances; and develop conservation and management options for the future conduct of the fishery. The options will be consistent with the seven National Standards of the MFCMA and will not conflict with applicable Federal laws.

To date, most analyses needed for the plan have been completed. Economic evaluations of price structure and flexibilities, imports, and processing, have given us some indications of the statutes, regulations, and court decisions which have affected the fishery and industry has brought interesting insights to our deliberations. Yield per recruit studies and a re-evaluation of previously published biological literature have provided a basis for evaluation of new management options for the fishery. Work with Dr. Wade Griffin's "General Bioeconomic Fisheries Simulation Model" has brought its own insights into the shrimp fishery. Possible options which may "maximize the economic benefit" derived from the resource are now under review.

There are three major conclusions which are affecting all of the options under consideration. One, no major improvement in the fishery is likely unless the amount of fishing effort within the fishery is significantly reduced. Two, imports and the future business decisions of foreign aquaculturists hold the key to the manner in which the fishery should be managed in the future. Three, degradation of habitat will adversely affect the future fishery no matter what other management measures are put into effect.

Scott Nichols - Thank you, Jerry. We've got time for several questions.

Wayne Swingle - Jerry. In your plan does it propose that certain estuarine areas become sanctuaries for small shrimp?

Jerry Clark - As a matter of fact, and one of the reasons that we are about 30 to 60 days away from a draft, is because we have decided to have a chapter in the plan on that specific question, of sanctuaries. It is my impression that that's likely to be a recommendation of the plan.

Wayne Swingle - The reason I raised it is because of this issue you raised about Louisiana politics. I know that was tried or suggested years ago by Dr. St. Amant and I guess politically it just couldn't be implemented at that time.

Jerry Clark - That's exactly right. My understanding is, and we have a publication in our publications series on the use of sanctuaries in shrimp fisheries and the staff of Louisiana Department of Wildlife and Fisheries put together a series of recommendations for sanctuaries statewide. It was finished, a published document, they took it to public hearings throughout the state, and at the end of those public hearings it was decided not to proceed forward with that issue at all. If there is a difference now than then, it would be that there are perhaps more people interested in the marsh now than there were before, and there are more and more complex questions and at that time it may have only been a shrimp issue and now I think it is much more than just a shrimp issue and maybe more people are interested in it. Whether or not it is do-able, or whether or not it will even generate the results that some people think, is still a debatable issue, but yes, there will be specific chapter in the plan on the use of sanctuaries in Louisiana.

Robert Shipp - Jerry, in regard to the insidious privatization of the marshes, would you be willing to give a little background on how that initiative got so far in the first place, who is behind it and how that came to be, knowing full well how difficult it is for things to progress through any State Legislature.

Jerry Clark - Well, it is actually several years old, and I can't give you exact dates, but five to six years ago, I believe is about the time frame, a bill went through the Legislature that essentially created, or privatized a part of the marsh, and as I understand it, since I wasn't here at the time, it just slipped through. It wasn't a thoughtful bill. And it was sold as an experiment, but never really was an experiment, it was just privatization in a mild way. As soon as it got public everybody was upset and another bill was passed almost immediately and the previous bill was repealed. The second bill was in fact a bill to attempt to allow people to do aquaculture in the marsh and I think it's a good bill. However, before the first bill was repealed, at least one of the permits was given out. Those individuals have carried this bill ever since. They and Representatives and Senators from Coastal Louisiana rammed it through our Legislature this year. The so-called Friends of Commercial Fishermen rammed it through the Legislature and without the efforts we took, it would have passed.

Peng Chai - In a recent issue of Fisheries there is actually a comparison about the concept of open access and limited entry. They felt open entry is better for the fishery, but I think, you know, shrimp fisheries in the country are making that idea effective by devising more habitat.

Jerry Clark - I think those are two distinct issues and maybe someone with a better mind than I can figure out how to solve the open access problem with privatization of the marsh, but as of now I don't support that.

The privatization of the marsh to me is a much larger issue than shrimp. And it impacts nearly everything and everybody in this room. Everybody in this room I think is probably interested in marine fisheries and marine shrimp management. If you privatize the marsh and put a dike up around all of our estuaries in the Gulf of Mexico, then we can all go home. Maybe some people would like that.

James Cato - Jerry, regarding the first two general conclusions here, will your plan make a specific recommendation regarding the vessel size class and numbers of vessels that would maximize the revenue from the fishery and secondly, would it tell us what size classes we ought to produce in order to find our niche in the world market relative to competing optimally with some other countries? Will it be that specific?

Jerry Clark - Yes, I think we would be fooled if we thought we could give exact answers to those questions as if you were to say that the shrimp fishery in Louisiana could be run as any business. In essence that's what you get involved in when you start talking about limited entry and deciding on the answers to those questions that you're talking about. In essence then we have to become the entrepreneur to answer those questions, and entrepreneurs make bad decisions, just like councils and just like state directors, and just like legislators. But those are the important questions and so we will have specific recommendations about those but the question is will we say that we need 125 65-foot boats and 45 40-foot boats, no, we're not going to get into that. I think we'd be fools to attempt that. Will we discuss that issue and talk about relative numbers? Yes. Will we talk about size-classes of shrimp? Yes.

James Cato - So you should be able to tell us at least here what the model tells us and that's the point from which the political arguments commence.

Jerry Clark - Yes. Yes.

James Cato - I think that's critical.

Jerry Clark - That's why we're using Wade's model, because to my knowledge it is probably the most flexible and most complete model available. We're looking at this model for this fishery. It was developed to do that sort of thing. So the answer to your question is yes.

Ralph Rayburn - I understand that based on the work that's done, the shrimp industry in Louisiana if managed in a different format could contribute, ex-vessel or economic impact of \$36,000,000.00.

Jerry Clark - My understanding is that it would be net economic benefits and those could be either to individuals or associated industry would depend on the fishery. In economic jargon that would be economic rent.

Ralph Rayburn - That in essence is being left on the table until such time as you could limit the number of participants in the fishery. This would not only give them a windfall profit in that they now have exclusive access to the fishery but also you would be coming in and increasing the value of the fishery by

\$36,000,000.00. It seems to me that if it's a public resource, and one of the goals is to best utilize that public resource by putting money into the economy, that it's best to go ahead and take that step. To recognize at this point that you're leaving \$36,000,000.00 on the table until such time as you can establish a select group of people that will not only capture the value of the fishery now but also may give them \$36,000,000.00, to me just complicates the issue of ever getting to a limited entry program. I would certainly advise against that from the public standpoint.

Ed Klima - I don't know what study you are referring to. There is a National Marine Fisheries Service study that refers to just brown shrimp and that is gulf-wide. The economic rent to the fishery would be above \$30,000,000.00 for that one fishery. We're going to develop one for the white shrimp. Wade's main difference from ours was that his economic basis is gulf-wide which includes Louisiana, Mississippi and Alabama for that one species.

Jerry Clark - I'm sorry if I misstated something. All I was attempting to do was to talk about the importance of the research that we're undertaking. There isn't a fishery that I know of in the gulf that we can talk about numbers like \$35,000,000.00 just because it could be better managed. That's all I was trying to do.

James Cato - Well in theory what you're doing is you tax away with economic rents and return the taxes to the public coffers with gains.

Jerry Clark - That's the idea.

James Cato - That's what I'm doing with the limited entry.

Jerry Clark - Yes.

Scott Nichols - Okay. Very interesting work. Very important.

Jerry Clark - One final comment. I guess I may have been too negative on the politics which may have left you with well, if this is going to happen, why are we doing the research? And I guess my point is if you don't know where you want to be, you don't know how to move in that direction. To be honest with you I really don't think there's any chance that in a very short period of time Louisiana or any other state in the gulf can make the kinds of social and political changes necessary to try to develop \$35,000,000.00 in benefits, whoever those benefits accrue to. If you don't have an idea of what the rainbow looks like you are not going to head off in that direction. It's most important that we know what we could do and then try to head off in that direction and we take it one step at a time.

Scott Nichols - The next speaker is Lucy Gibbs, who is representing the Gulf Shrimp Research and Development Foundation, reporting on a "Feasibility Study: Finfish Excluding Gear in Shrimp Trawls in the Western Gulf of Mexico."

Feasibility Study: Finfish Excluding Gear in Shrimp Trawls in the Western Gulf of Mexico

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Abstract

Introduction

The objective of this project is to assess the feasibility of gear that will exclude a significant number of finfish from shrimp trawls in the Western Gulf of Mexico while retaining an acceptable level of shrimp. The project is designed to function in conjunction with the Regional Bycatch Steering Committee established through a grant to the Gulf & South Atlantic Fisheries Development Foundation and charged with presenting an overview of the bycatch issue and proposing solutions. The focus of this project is to provide a forum for testing of industry innovations and prototype excluder gear developed at the NMFS Pascagoula Lab under actual shrimping conditions. Co-administrators of this project are the principal investigator, industry cooperator (Jan Harper) and gear specialist (Gary Graham).

This project was funded for one year. Second year funding has been received and the project has been expanded to include cooperation with the NMFS Galveston Lab on an observer program utilizing shrimp vessels to collect data on bycatch and evaluate the effectiveness of TEDs and prototype excluder devices in reduction of bycatch in the Gulf of Mexico and South Atlantic.

Summary of Results

1. Project cooperators working with the NMFS Galveston and Pascagoula Labs established a standard method of data input and analysis that will be utilized by the Bycatch Steering Committee and the NMFS observer program.

2. The gear specialist conducted field trials and began gathering baseline data on shrimp trawl bycatch.

3. The industry cooperator and gear specialist visited with industry innovators, analyzed various gear modifications to be tested in later field trials, and conducted trials on two alternate methods for keeping finfish away from shrimp nets: various arrays of lights and noise makers to either scare or lure fish away from nets. Results of the field trials are still being analyzed and efforts are planned to expand this activity in the fall.

4. Project cooperators and NMFS personnel established a method for compensation of industry participants for shrimp loss associated with testing of prototype gear. This method will be utilized by the Bycatch Steering Committee and the NMFS observer program.

5. Since March of 1991 project cooperators have been involved in discussions with NMFS personnel on establishment of a sampling protocol for collection of data on shrimp trawl bycatch. To date no agreement has been reached. Vessel owners who volunteered to participate in the testing of prototype gear have been unable to proceed with the collection of data during the shrimping season. Until a sampling protocol is established, no further data collection or gear testing can be done either by this project or the Bycatch Steering Committee.

Wayne Swingle - What is the holdup in establishing the sampling protocol?

Lucy Gibbs - Okay, we do have a sampling protocol. The holdup is trying to figure out if there is or what is baseline data. The industry feels like baseline data needs to be collected at some point using a standard trawl (without TED). We need to know what the bycatch is. Now a secondary part of that is the industry feels that with the use of TEDs there has already been some bycatch reduction. They want to get credit for that. They want to find some way we can do some limited testing with a standard trawl on one side and one of the certified TEDs on the other and see if we can come up with a percentage reduction that the industry gets credit for, for each TED. Then we can start from there, we can go on with the prototype excluder devices and I think at that point the industry will accept that.

Wayne Swingle - Scott, do you know if there's a legal problem with this using a standard trawl, I mean rather than using one that's equipped with a TED?

Scott Nichols - There is a concern about allowing long towtimes without a TED equipped trawl, but not with allowing shorter towtimes. However, the question is are the short towtimes representative?

Larry Simpson - Lucy, try to help me and put this in perspective. I know you and I have talked about this. How many people are you talking about involving? This would give us an idea of the magnitude of the issue and understand why this wouldn't be treated like any research effort?

Lucy Gibbs - That's what we feel it is. I've got two fleets that are willing to work with the program. Five or ten vessels, I guess it kind of depends on NMFS.

Larry Simpson - So ten vessels and one standard trawl for ever how long they'll be used in capturing that data. I, too, fail to see the reason behind the problem with being concerned with too long a towtime to the destruction of turtles.

Lucy Gibbs - We're willing to operate within any parameters that NMFS wants to put up. We'll get a Section 9 permit. Yes, there will be a problem with validity of data if the trawls are too short, but we'd certainly be willing to work with NMFS on how short is too short, how long is too long.

Andy Kemmerer - Our position on the problem that we have with a standard trawl and essentially a trawl without a TED is currently our regulations do not provide for operating trawls without TEDs. That's a mandate, that's part of it. Unless we limit towtimes. Limiting towtimes, we're talking about right now 90 minutes and very shortly that's going to be down, probably after going out in public hearings. It will probably be in the neighborhood of 60 or 40 minutes, and that is because of the turtle situation. We feel that there is sufficient information and there will be additional information developed to use a standard TED in a standard net. Most of these TEDs, or at least the hard TEDs, the super-shooters, the Georgia-type TEDs, do not release much bycatch. We've got literally thousands of hours on those TEDs. We also have developed a protocol which we feel will work, and that protocol is currently being reviewed and will be probably improved and then it will go through an outside review and once that happens then we will be off and running. I think it will solve the problem. This will end up with most industry vessels, where they're actually operating independently, well, they're not independent, but where they're going for their

own evaluation, they will be operating probably with a standard trawl within which there is a standard TED.

Lucy Gibbs - Can we work on some kind of agreement, like for instance, the Andrews TED.

Andy Kemmerer - We've got to have inherent in the overall program some mechanism for getting back to a non-TED situation because we don't have specific information on the effectiveness of a given TED on the reduction of, say, red snapper. We've got to establish what that number is and the only way I know how to do that is through comparison drags with TED equipped nets.

Lucy Gibbs - It just seems like the lack of a protocol is delaying progress under the project.

Andy Kemmerer - No, I disagree. I think the project will go ahead with the standard TED. The problem that we've run into is, I think industry is saying hey, wait, we want to see the overall picture, the complete picture, before they move out and start doing something. That's their concern. We've defined goals with basically a supershooter or TED of that nature and want to use that TED because we feel comfortable that we can calibrate back to virtually anything with that TED.

Wilbur Seidel - We are doing some calibration and comparison towing with the supershooter on a charter boat. We have been and we will be again next month. The supershooter is the TED that we want to select as the standard TED because it's been pretty well documented. It's got a very small shrimp loss, if any, with a data base from the Galveston data collections, our work, and there's a move toward more fishermen using it, particularly on the East Coast. Also, as Andy said, it doesn't have a very large finfish reduction. So in effect, you're comparing to a standard net anyway, as far as finfish goes. We'll establish what that percentage is, whether it's five percent or eight percent, but it's not very large. Some of the other TEDs do have a larger finfish liberation and we will also eventually look at those and/or look at them on boats with the TEDs for a shorter towtime.

Lucy Gibbs - The industry is inherently extremely suspicious of NMFS. They don't understand what's going on. I'm a lot easier to deal with than they are. What I was trying to do is assure them we are all going in the same direction, if we're all using the same data, nothing is hidden. In some cases you're going to have to actually prove to the industry, "No, the TED does not reduce that much bycatch," and unless you can convince them, you know, and if I can convince them, this TED doesn't reduce bycatch you've still got a problem. You have still got to come up with some way to reduce red snapper bycatch 50% by 1994. If you finally absolutely convince them of that then they're going to be ready to go on and deal. We've got to get to a point where what I'm calling universally accepted data is used, and at that point the industry cannot say anymore well, we didn't have a part in this, we don't believe this is the case. They've got to have a part in this and understand this is really the situation, we can't say the data is crummy, we have to deal with what we've got. That's what I'm trying to get across.

Wilbur Seidel - Lucy, we all are involved in that, Galveston, you, I, all of us. How do we get at that point, then, because the data we collect is off commercial boats. We produce it, and they say they don't believe it.

Lucy Gibbs - I know. I've got my own computer now.

Wilbur Seidel - How do you overcome it?

Lucy Gibbs - If I can crunch the same numbers y'all are crunching and I can say to them, "Guys, they didn't do anything to this data. I've got the same results." That'll help. We're going in the right direction.

Wilbur Seidel - How do you get the same data, with two different observers on the same boat or what are you suggesting?

Lucy Gibbs - No, basically we'll all be getting the same data. Y'all will run it through your computer, I'll run it through mine.

Wilbur Seidel - You're saying they think that we modify the data.

Lucy Gibbs - Yes.

Wilbur Seidel - But it's signed by the captain of the boat. They don't believe him, either?

Lucy Gibbs - Well, he didn't know what he was looking for. I'm telling you what they're arguing.

Wilbur Seidel - Okay, it sounds like there's no solution to it then.

Lucy Gibbs - No, there is. Another thing that I was trying to do in a similar project to this is we're going to hold workshops. Before that captain goes out Gary Graham is going to sit down with that captain and say, "This is what a baby red snapper looks like. The guy is about this long and he's not red. You all are catching those. Look, this is it." Then when we're getting that data back, that captain is going to say, "Well, for Pete's sake. I am catching red snapper. Okay, I need to do something about that."

Ed Klima - I'd like to make a comment. I understand the problem, because when our observers go out we go over the data sheet with the captain. And then he signs it at the end of the day and I understand that they say they don't know what they're signing, they don't know what they're looking at and that may be so or may not be so. When our observers sort through that sub-sample they will take out all the baby red snapper and they will show it to the captain. Let him count it for the day. That may be a way of relieving some doubt, although he may not believe that is a red snapper identified by a fisheries biologist.

Lucy Gibbs - Right, that's my job, to make sure he knows that's a red snapper.

Ed Klima - But while doing this he's always gone through that process and as you well know we then give all the data sheets back to the captain, we also send you all the data. Now what have you done with the data sheets?

Lucy Gibbs - I haven't done anything to date. I just now got the computer.

Ed Klima - And that's what's just adding to the problem.

Lucy Gibbs - And that is my problem.

Ed Klima - Okay, I think these workshops will help. We need to be involved with those workshops trying to show those people that are actually going to take observer jobs.

Scott Nichols - A paper by Gregg Gitschlag, "Evaluation of the Impacts of Bycatch Excluder Devices (BEDs) on Finfish and Shrimp Catch Rates in the Gulf of Mexico."

Evaluation of the Impacts of Bycatch Reduction Devices (BRDs) on Finfish and Shrimp Catch Rates in the Gulf of Mexico

Gregg R. Gitschlag, Maurice L. Renaud and Edward F. Klima
National Marine Fisheries Service

Abstract

Concern by resource managers, commercial and recreational fishermen, conservationists and environmentalists with fish bycatch in the shrimp fishery has prompted research on Bycatch Reduction Devices (BRDs). BRDs are still in the initial phase of development. To evaluate their effectiveness will require the collection of data on finfish bycatch from shrimping vessels in both offshore and nearshore waters where shrimping is prominent.

The objective of this research is to compare catch rates of shrimp and fish for BRD-equipped trawls and trawls without BRDs in selected shrimp fishing areas of the Gulf of Mexico. All non-BRD nets will contain Turtle Excluder Devices (TEDs). NMFS, Pascagoula and Texas A&M Sea Grant will assist in the acquisition of vessels for the project and provide gear tuners for the vessels. Our work is part of a larger effort by state and federal agencies as well as private corporations to help collect data on bycatch exclusion. Data collected by NMFS, Galveston will be available to all parties participating in the project. NMFS will only analyze its own data.

Catch per unit effort (CPUE) of finfish and shrimp from each net will be determined during peak months of the shrimping season. Standard statistical procedures, including paired t-tests and ANOVAs, will be used to evaluate the fishing performance of nets with and without BRDs by region, season, BRD type, and bottom type. Aside from standard trip, vessel, tow and equipment identifiers, the following data will be collected: 1) group weights and number of shrimp by species per sample, 2) group weights and number of individual fish by species per sample, 3) lengths of all red snapper, king mackerel and spanish mackerel per net if possible; otherwise just those fish in the net sample. We anticipate being on vessels throughout Fiscal Year 92 along all regions of the gulf coast and if funding permits, from Florida to North Carolina in the Atlantic.

As yet, the project has not been fully implemented. Sampling procedures were refined during 2 trips in June and July 1991. Our major concern was the correct estimate of total fish catch per net. Entire net catches were worked up in 50 to 70 lb increments. The percent of catch sampled and estimate of fish catch per net using the sample was compared to the actual fish catch in each net. Utilizing 30-40 percent of a net's catch yielded a total estimate of fish that was within 10 percent of the actual amount of fish landed.

Observers are capable of processing approximately 140 lbs of catch per net (1 control and 1 experimental net). This would fall into the 30-40 percent range for catches from 350 to 460 lbs. Regardless, observers will weigh the entire catch in each net that they sample so we know exactly what percent of the catch was sampled.

To date, two baseline trips have been completed testing the TED-equipped control nets against standard nets. A single trip using the Golden TED, also classified as a BRD, was completed in July.

Various Speakers - Are we experiencing a subtle change in the acronyms here? We have "BRDs" in the book of abstracts and we have "BEDs" in the program. If we have an official acronym - Sometimes we subtly change things as we move somewhat. I don't believe we'll ever shake "Feds."

Wayne Swingle - Gregg, is this sampling going to be done in the federal waters or will any of it be done in the state waters at all?

Gregg Gitschlag - We will work in offshore waters, not inshore waters, but wherever the shrimp boat captain wants to go essentially is where we're going to sample. You don't tell them where to fish.

Wayne Swingle - Okay. What do you mean by bottom type as one of your separations, is that by depth or what?

Gregg Gitschlag - No. Well, during the TED study we had a wide variety of bottom types that we described by things like rough bottom, smooth bottom, shell hash and rocks. It's somewhat difficult to accurately place each tow within one of those types of categories, so we're pretty much just going to go with either depth or rough or smooth bottom, and we're going to see how the data come in. It depends upon how much work actually gets done in different areas and what we encounter but certainly we'll be recording depths on all the tows so we can always compartmentalize by depth.

Hal Osburn - Did you give any consideration in your 150 pound samples to identifying each of the organisms to species?

Gregg Gitschlag - There just is not sufficient time to do that on a commercial boat. You need to have a contract vessel or research vessel in order to do that. That work is being done as Wil Seidel is going to show us. They are doing a little bit more on species identification for every single fish. Some of that work has been done but we don't have time to do it on a commercial boat. You delay the operation too much.

Hal Osburn - You verified that it will delay the operation too much?

Gregg Gitschlag - Yes, we've been working on shrimp boats, well, personally I have, for about ten years or more, ten or twelve years, and there just is not sufficient time to do it.

Hal Osburn - Do you have the opportunity to set some of those samples aside and then during the time when you're not in the way of the deck operations finish the samples? It seems like a lot of good information that a few years from now they're going to be saying, I wish we had some baseline data on this species.

Gregg Gitschlag - Your point is very well taken, and we try to get as much sampling done as we can when we go offshore but the fact of the matter is usually our observers are kept busy from the time the first trawl is hauled back till the time ten to sixteen hours later when the last trawl is hauled back. The only option we would have to process every single fish would be to store them for later workup back on land at the laboratory. Then you run into some serious problems as far as how are you going to store them. A lot of the boats aren't freezer boats. Even if they were, you'd have just thousands and thousands of pounds of fish that you'd have to return to the laboratory, so it becomes a difficult logistical and storage problem, and then finally the processing time

as well back at the lab. We have tried to, as I say, collect as much as we can, but there comes a point where you just can't do everything because there isn't enough time. If we want to get that kind of information, we have to get a dedicated vessel to do it.

Bob Ditton - In light of the previous comments, what kind of steps are you taking or precautions are you taking to insure that people are going to believe the data that you are collecting? Are you taking any precautions or are you assuming that you're going to write a report that they are going to run out and think is the greatest thing since sliced bread?

Gregg Gitschlag - Well, Dr. Klima already addressed a few points in relation to that question. We pretty much go out and do the best job that we can, realizing that there are going to be certain factions in the industry that won't believe it unless the results are what they want to see. All that we feel we can do is give our personnel we send out on the boats the best possible training so that they know exactly what they are doing, they are doing the job right, we get the captains involved, at least taking a look at the data sheets. Some are more interested than others. Some will actually walk out on the back deck and see, well, here's a TED equipped trawl and here's the bycatch trawl, and here's the difference, just kind of eye-balling. Others just won't ever leave the wheelhouse, so your question is well taken, but unfortunately there's only so much that we can do. It's attitudes I think that we have to change as well, and that perhaps could be another MARFIN project that might be funded.

Jerry Clark - Are croaker and white trout specific groups that would be identified?

Wilbur Seidel - The croaker are separate. And white trout is separate all together. Snappers and some others. Twenty-one species I think it's up to now. We started with 13 or 14 and we've expanded it. And that's based on the most dominant species that's normally found as well as the one that isn't.

Scott Nichols - Wil Seidel, "Gear Development for Bycatch Reduction."

Shrimp Trawl Bycatch Reduction

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Abstract

Introduction

FY91 is the second year of a three year project to study methods of reducing shrimp trawl bycatch. Project objectives for FY91 included: 1) developing and testing modifications to certified commercial TED designs to increase finfish reduction rates, 2) developing and demonstrating new approaches to separating shrimp from finfish that utilize behavioral differences and can be used independent of TEDs if desired, 3) provide prototype designs to Southeast Regional Bycatch Program cooperators for testing on commercial vessels under different shrimping conditions, 4) provide diver evaluation support to industry, state, and Sea Grant cooperators in the development of alternate prototype modifications to reduce finfish bycatch. FY91 cooperators have included representatives from Sea Grant, Florida DNR, North Carolina DNR, Florida State University, and from the commercial shrimp fishing industry (Table 1).

Forty-three field days, 26 on a contracted commercial vessel, 2 on the research F/V GEORGIA BULLDOG, and 15 days with Florida and North Carolina State programs, have been completed to date. Studies conducted on the F/V SHELLY included diver evaluations, comparative trawling, and snapper behavior. The F/V GEORGIA BULLDOG was used to demonstrate the performance of two NMFS finfish excluder designs and to evaluate three industry designs. NMFS involvement in Florida and North Carolina has been to assist in rigging and evaluating finfish excluder equipped trawls under varied fishing conditions.

During diver evaluations, approximately 20 finfish excluder design combinations have been studied. Several designs, including funnel designs with large mesh escape sections and designs incorporating the Florida fish excluder, were carried over from tests conducted in FY90. New NMFS designs for FY91 included a low opening trawl, a top and bottom opening TED with side openings for fish exclusion, and a modified cod end with stiffening lines to hold it open. From industry, we evaluated a fish excluder grate designed by fishermen in Tampa Bay, a low opening trawl design and a funnel with large mesh escape section, and three soft TED designs with finfish reduction potential.

In comparative fishing tests, three finfish excluder design combinations--an extended funnel with a wire fish deflector, and a single Florida fish excluder attached to the bottom of the net directly behind a TED with a wire fish deflector have been tested. A mini super shooter was used in combination with the three finfish excluder designs and in the control net used for comparison. Catch results are shown on Table 2. The best fish exclusion rates were achieved with the extended funnel with a wire fish deflector with an average of 45% reduction. Red snapper reduction was best with the Florida fish excluder design with about a 50% reduction rate. There was no appreciative shrimp loss with any of the excluder designs tested.

In red snapper behavior studies, fish ranging in size from 75 to 150 mm fork length tended to stay in small schools and appeared to be strongly structure oriented. When released into trawls, they showed little escape response until they reached the narrow confines of the cod end. In finfish excluder equipped trawls there was as high as a 76% escape rate observed.

For the remainder of FY91, there are 23 days scheduled on the NOAA Ship OREGON II and 14 days on the F/V SHELLY. More diver evaluations, comparative trawling, and red snapper behavior studies will be conducted. Further cooperative work with Sea Grant, state programs, and the shrimping industry is also anticipated.

Table 1. FY91 shrimp trawl bycatch reduction project cooperators.

Sea Grant Programs

University of Georgia
University of North Carolina
Texas A&M University
Mississippi-Alabama Sea Grant

State Programs

Florida State University
Florida DNR
North Carolina DNR

Industry Representatives

Robert Richards
Richard Perez
Buford Golden
Ralph Andrews
Fulton Love
Hollis Forrester
Joe Nguyen
Peter Hoar

Table 2. Total finfish, red snapper, and shrimp reduction in three finfish excluder designs.

Finfish Excluder	% Reduction Rates		
	Fish	Red Snapper	Shrimp
Extended funnel w/ wire deflector	44.7	19.0	+8.4
Extended funnel w/ chain deflector	21.9	0.9	+5.9
Florida fish excluder with wire deflector	28.1	49.7	0.9

Robert Shipp - Wil, you talked about the two sizes, two age classes of snapper, and the one that's over 100-115 mm are the ones that have swimming behavior with which the gear people can deal. Are these numbers, then, just for the larger snappers?

Wilbur Seidel - Yes, released snapper those were larger than that size. They were about 130-140 mm.

Robert Shipp - So, with the Florida fish excluder the 49% that was only with big snapper?

Wilbur Seidel - No, that was on the control test. Overall the commercial test was with any size that came through, whatever we encountered, and I don't know the whole size range for that data set.

Robert Shipp - With respect to the two distinct year classes here, do you have a gut feeling for the proportion of snappers that are in that smaller size class?

Wilbur Seidel - No, I sure don't, and I think that some of that type of data ought to come out of the general observer program that'll establish baseline data. We can look at our data as we go along, but as you see we don't have a great deal of it yet. We measure every snapper that we catch, so, in our study we can answer that somewhat, but I can't say generally.

Unknown Audience Member - You said you had tested in Florida, the inshore, what was the depth, what do you mean by inshore?

Wilbur Seidel - Inside the bays. Tampa Bay, Apalachicola, I think, a little bit in Pensacola Bay, maybe some just outside the Pass, but I don't know specifically in each one what the depth was, it can be fairly shallow.

Lucy Gibbs - Is there any difference from the percentage of those snappers...?

Wilbur Seidel - I don't know, I can't answer that right now.

Larry Simpson - Wil, have you been able to determine if the hummer apparatus is something to do with change in water pressure, the hydrodynamics, or just the actual presence of something there and them sensing that?

Wilbur Seidel - I'm not sure, Larry. I don't think it is due to water pressure. In observing results, divers in the daytime can see it's the fish. The fish sense that particular little hummer wire grid before they get to it, fairly close, but before they get to it. Then if they touch it and I don't think they can see the small wires, they sure enough react to it. They don't do that with the chain type design and that free hanging wire type thing I showed you. They'll touch both of these and go through them. Those should have just as much pressure associated with them as the hummer wires. We were trying to look at it in a little more depth to see why one's more effective.

Jerry Clark - I understand you are concerned with snapper and know why you work up that data. Did you encounter any Spanish or king mackerel and what do you remember about them?

Wilbur Seidel - Pretty much in line with the summary results which include mackerel. And again it is size dependent. At some point the fish can't keep up

because there's a maximum number of tail beats per second. There's been some research done in England on that. I don't care whether it's a tuna or a small fish, there's a maximum number. In one tail beat there is a maximum distance of travel, something like $\frac{2}{3}$ body length, so the smaller the fish is, the slower its maximum speed is, so it just can't keep up with a moving trawl and that gets to then be a problem. Above some size they begin to swim fast enough to keep up. One of the things we are doing is trying to create dead water zones in the cod end so that smaller fish can seek out the dead water zones where they can swim fast enough to maintain their position and eventually escape.

Jerry Clark - What your point is, now that you've got those quiet areas is they've got to have a reason to leave and that's what you're looking for.

Wilbur Seidel - That's right, and that's what we're looking for. And there are ways of doing that. There have not been any studies done on the cod-end, it's just a stretched piece of whatever webbing, it tends to ball up in the end and choke down in front of it and close up the meshes. We are looking at some rib lines and strength lines that distribute the load and keep it open which would give us more control over the water flow into the back of the net. We've got some ideas in the works.

Scott Nichols - You're the next speaker on TED Technology Transfer.

TED Technology Transfer

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Abstract

Introduction

The TED technology transfer project is a multi-year project designed to assist the U.S. commercial shrimp fishing industry in adopting TED technology as required by federal and state regulations and assist foreign countries in introducing TED technology in order to protect endangered sea turtles species. Cooperative partners in the TED technology transfer project include the commercial shrimping industry, state Sea Grant agencies, and the U.S. State Department. Objectives for FY91 were to assist the commercial shrimp industry, Sea Grant, and state agencies with TED expertise through workshops, videos, training demonstrations, and vessel evaluations, and to conduct new-TED certification trials.

Summary of Results

TED technology transfer activities in FY91 have included: direct assistance to shrimp fishermen in choosing and installing TEDs, assistance to law enforcement, TED manufacturers, and Sea Grant agents, in determining legal requirements and definitions of TEDs, technical assistance to fishermen, net shops, and TED manufacturers in determining if various TED designs meet legal requirements, assistance in construction and installation techniques, assistance to TED designers in developing new TED designs, providing certification tests for new TED designs, and dissemination of TED informational literature and videos. Twelve TED workshops have been held to date, including three in North Carolina, three in Louisiana, two in Georgia, and one each in Florida, Alabama, Mississippi, and Texas. Technical assistance was provided to the North Carolina Division of Marine Fisheries in providing and testing modified TED designs for use in the winter flounder trawl fishery in North Carolina.

Two TED certification tests have been conducted in FY91, one in the Cape Canaveral Ship channel in July using the comparative trawl protocol in which one TED design was evaluated, and a second in Panama City, FL using captive reared juvenile sea turtles and scuba divers. Five candidate TEDs were tested using the protocol established in 1988, to determine their efficiency in excluding smaller sized sea turtles. Both tests were conducted aboard the University of Georgia research vessel the "Georgia Bulldog".

Turtle excluder device (TED) construction and operation workshops were held in Mexico, Panama, and Honduras in FY91. The objective of the workshops was to provide the necessary training in TED technology to countries affected by U.S. legislation which provides that shrimp harvested with gear that may adversely affect certain sea turtle species may not be imported into the United States after May 1, 1991. The workshops funded by AID consisted of extensive

instruction in the construction and installation of grid type and soft TED designs and at sea operation and problem solving demonstrations.

Ralph Rayburn - Do you see when the rules are extended into inshore waters that we are going to have any additional requirements for technology development for those smaller boats?

Wilbur Seidel - That's a good question. I don't know how much technology development but we certainly will have a lot of problems to address. There's a couple of TEDs, we've done a fair amount of testing with what's called a mini-supershooter. Fair amount in North Carolina in inshore waters, in Pamlico Sound, some in Florida, and some in, a little bit in Alabama. This TED can be adapted into most inshore nets. Also I think a couple of soft TEDs can be used pretty easily. But that's a whole new area we will be entering into and I think we can expect some problems that will have to be addressed.

Mike Sissenwine - Is flexibility there to adapt Michael Morrison's soft TED to a smaller size net?

Wilbur Seidel - I think so, although you get nets down to 30 feet in size. Probably not too much smaller than that, commercially. The Morrison TED as it's changing could be used in a smaller net. We have done some evaluation on that TED. Probably the Andrews TED can be adapted to the small nets, it's simply a net within a net. And again the mini-supershooter can be made to fit a cod end with a diameter of about 100 meshes, inch and a half meshes, so that's certainly installable on any 30 foot net and even maybe a 25 foot net.

Mike Sissenwine - I'm curious what the industry reaction has been in some of these Latin American countries to the use of TEDs.

Wilbur Seidel - The Panamanians only have four or five boats that fish in the Atlantic. Their fleet fishes the Pacific and it's not targeted, so they were quite positive and felt like if it's required in the future, they could respond to it. The Honduran fleet is an excellent fleet. It's the best fleet I've ever seen. It's well maintained, they're really nice boats and those people are progressive. They were ready to get on with it and they were the first country that put their program together and said bring it down here. The industry's position is if the government requires us to do it, we'll do it. If not, we probably won't. But they got into position real quick to start taking a look at it. I'm sure that a couple of the owners that we worked with are probably currently looking at the TEDs. They had started purchasing TEDs without knowing anything about them. Salvador's an exception. They're really looking down the road at finfish more than turtles. Those are the only ones I can relate to right now. Venezuela I think informed us they are in the process of developing their program for the State Department. Now, what happens in the actual application to industry I can't answer until probably down the road. But they send good gear people to the sessions that we've had.

Larry Simpson - Wil, characterize for me the domestic fisherman's interest, willingness to participate, attendance, anything along those lines because I know it's been a long-term program compared to this past year.

Wilbur Seidel - Oh, I think this last year we had awfully good compliance in a lot of areas. I don't know how willing they are to attend workshops, but I think that an awful lot of fishermen know a lot more about TEDs now and for whatever the incentive has been there was a high compliance rate. I think Andy probably has the numbers available that he can provide, but in the areas that we worked in there's certainly a good compliance. So I think the fishermen are getting

over the initial reaction in most areas and responding to it. Some of them are changing TEDs that they are using. We know of a number of them that are going to supershooters, this style TED; on the East Coast particularly, where they started out more with the Morrison soft TED, so there's probably a little evolution as they learn the TEDs and their conditions and they'll change back and forth depending on fishing conditions in an area. I think it's certainly been a big change in terms of the overall perception.

Ralph Rayburn - I seem to recall having seen something recently about the GATT indicating that the U.S. did not have the authority to ban tuna caught with gear that impacted dolphin and therefore was an infringement on GATT if the State Department carried out that embargo. Is the same thing applicable to the embargo, or potential embargo, on shrimp for countries that do not use TEDs if they are signatory to GATT that it would be a violation of GATT?

Wilbur Seidel - I think that's certainly true. I think that ruling is going to undergo a legal review sometime soon, but I would say yes.

Mike Sissenwine - I think technically that ruling only applies to the dolphin situation. If you interpret what the precedent is, it is to help protect the shrimpers. So it would have to go through another litigation to apply to turtles and to TEDs. I mean obviously it has very wide, very important parameters but there has been no legal action as to turtles.

Peter Hoar - How well attended were your domestic meetings over the past year?

Wilbur Seidel - Pretty well.

Peter Hoar - Was it mostly by associations or were there fishermen also?

Wilbur Seidel - No, this consisted of more fishermen, but their associations, too. It depends upon when you hold them. If you have them in the off-seasons then more fishermen attend. If you have them during the shrimping season in that local area, then the attendance is not so good unless you timed it during the week and when there may be more boats in.

SESSION II
COASTAL HERRINGS AND GENERAL

SECTION 11
CONSTANT WEIGHTS AND GREAT

SESSION II-COASTAL HERRINGS AND GENERAL - Robert L. Shipp, Chairman

Bob Shipp - This afternoon we have a rather short session, Coastal Herrings and General. Actually we've got one General and one Coastal Herring, so we'll start off with the General, "Educational Tools for Marine Recreational Fishermen to Promote Wise Use and Conservation of Gulf Fishery Resources," Ron Schmied with NMFS.

Educational Tools for Marine Recreational Fishermen to Promote Wise Use and Conservation of Gulf Fishery Resources

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Abstract

Introduction

The long term goal of this multi-year education program is to convince and assist saltwater anglers in the Gulf of Mexico area to assume their rightful role in the conservation of marine fishery resources. Significant progress has been made in developing needed educational materials through the combined efforts of NMFS, state, Sea Grant, sport fishing industry, university and private sector personnel.

Under previous MARFIN projects, the principal investigator has developed various angler ethics related educational materials including a brochure summarizing federal sportfishing regulations for the Gulf of Mexico, a 28-minute broadcast quality video and three public service announcements promoting effective catch and release fishing, a "NMFS Catch and Release Quick Reference Card", a poster/sticker series promoting an angler code of ethics, and a 10-page pamphlet summarizing the entire program.

Additional "angler ethics" educational materials have been developed in cooperation with other organizations using MARFIN and S-K program grants. These projects have resulted in production of a 5-part video training series for tournament directors, an expanded gamefish tagging program, and development of a multifaceted educational program encouraging reduced waste and increased use of less utilized sport-caught species.

This year's MARFIN project has addressed three objectives:

1. The reprinting and extended distribution of previously developed education materials;
2. The design of a computer-based information network on saltwater sportfishing regulations; and
3. Establishment of a Steering Committee to plan and organize a 2-3 day regional angler ethics conference.

Summary of Results

All project objectives have been successfully met although some redirection has occurred to enhance the program. Specific accomplishments are as follow.

Objective 1.

The "NMFS Catch and Release Quick Reference Card" and Angler Ethics pamphlet/sticker were reprinted and additional copies of educational videos were produced. These materials have been very well received by anglers and numerous program cooperators have voluntarily agreed to reproduce and distribute materials at their own expense. For example, all other NMFS regions have now refined and/or reprinted the catch and release card, angler ethics pamphlet and sticker, and poster for use in their areas. The Florida and Georgia State park systems have copied the catch and release and underutilized species videos and are using them along with printed program materials in educational presentations made at state parks. Similar cooperative printing and distribution arrangements have been made with aquaria, county extension offices, newspapers, fishing organizations and other state and federal agencies to maximize the supply and distribution of program materials.

Objective 2.

A computer-based sportfishing regulation information system was designed and each gulf state has agreed to implement and participate in this cooperative information network. This system uses a standardized format, Word Perfect 5.1 software, and IBM compatible hardware to provide a continually updated listing of state and federal sportfishing license and regulatory requirements. When fully implemented, key state and federal regulatory contacts will be networked through an electronic mail system. Others wishing to access this regulatory information will be able to do so by obtaining copies of the data base on floppy discs. Ultimately, it is anticipated that Sea Grant programs, fishery management councils, fishery commissions, sport fishing associations, magazines, newspapers, marinas and tackle shops will utilize this information system.

Objective 3.

A 15-person Steering Committee was established representing key sportfishing and conservation organizations to begin planning a regional angler ethics conference. Two meetings were held in St. Petersburg (6/13 and 7/19) and a third is scheduled for September 19-20. After considerable discussion, the Committee put conference planning on hold and decided to first draft an "Angler Education Plan". Using NMFS' angler ethics program as a foundation, this plan will articulate a more comprehensive education program and implementation plan that includes funding commitments from sportfishing industry and trade association sponsors. If successful, this effort will result in a more comprehensive education program that enjoys a much broader base of support (manpower and funding) than currently exists. Ultimately, a conference will be organized and held to launch this expanded program.

Unidentified Questioner - Yes, how have you done with personal consumption, publicly distributing these, I mean, do you have actually have a mailing list or do you give them to newspaper writers?

Ronald Schmied - Basically all the above, plus we work with some of the bait wholesalers and they've agreed to have their drivers take copies of regulations to deliver directly to tackle shops, bait shop store, and we do direct mail to fishing clubs and captains. We try to use whatever means we have at hand and with the resources we have to do it. We use Sea Grant to deliver information to all the five Gulf States. Second goal really is if we're going to regulate these species because they're stressed or overfished we have to do a better job of helping anglers understand how to release the fish in a way that gives them a better chance of survival. To do that we've developed some 28-minute videos which were commercially produced to educate anglers on catch and release techniques and distributed about 300 copies. We have a number of cooperative programs throughout the State of Florida and Georgia Park Systems is reproducing and using the videos in their coastal parks so we are trying to expand the distribution as best we can and we have a little card that goes along with the video. It summarizes the major points of catch and release. We've probably put out several hundred thousand of these so far. Very simple product but pretty effective so far.

Our third goal is to encourage responsible fishing practices. And the main way we've gotten to that is trying to develop an acceptable, if you will, Angler Code of Ethics. We went to the clubs and asked them, "What kind of behavior would you promote and encourage if you were to paint a picture of a responsible conservation based fisherman, and we came up with a list of ten and we stated them in a little bit more of a poetic way that hopefully makes them remember them a little bit easier. But we have this ten point code. These stickers go on tackle boxes, boats, we also have a poster that I have copies of that goes up in marinas. We directly mail to marinas to get those posters up in public places. We try to explain why we're promoting that kind of behavior and what the positive impact would be if we could have a greater compliance with that kind of behavior, and we also list sources of additional information in here. We've put out to date about 50,000 of those and again we're using some of the same distribution means. Some of the other supplementary information we've done is a series not necessarily funded by MARFIN trying to encourage people not to waste some of the less-utilized or nontarget species. If you're not going to use it, not going to eat it, at least release it, but in addition to that we're saying, "You may want to try some of these fish, because many of them are excellent to eat." They've caught on quite nicely. Triggerfish and some of the others have a more positive acceptance. We have an expanded cooperative tagging program called The Tag-Flag Tournament. In addition to getting more involvement and participation in tagging, we're trying to create some additional bragging rights around tag, catch and release. And we have a five-part video training program for tournament directors. Tournaments are very visible events. They can help shape public attitudes and values and we're trying to work with tournament directors.

Let me turn more specifically to what we have done this past year. We had three objectives. The first one was simply to reprint some of these materials that we had previously developed and we have done that. In fact, interestingly we have had most all the other NMFS regions participate in reprinting so they are reprinting and using these materials in their regions. The second objective was to design a computer-based sportsfishing regulation and information system, and quite frankly the problem there is even for those of us that deal in management

it's hard to keep up with all these regulations. I get phone calls constantly about, "Hey, I'm going fishing, is there a size limit or bag limit on king mackerel or Spanish?" Well, yes, there is. "Oh, by the way, I live in Alabama, does Alabama have one?" And you kind of scramble around and try to figure out the latest piece of paper that you got from Alabama, so one thing we thought we would do is put together and design a computer-based information system. What we came up with was a format that's going to be consistently used by the states and by my agency. We've kept it simple. We're using Wordperfect 5.1 and IBM compatible hardware. All the states have been contacted and they've agreed to participate in this program. They'll be responsible for keeping their sections of the database current and with a little bit of luck we hope to have all this information input in November, up and running. We also will be hooking the states into our electronic mail system so we can transfer this information on a real timely basis.

James Cato - Will groups like Sea Grant and NMFS, Pascagoula, be able to tap in to your electronic mail system?

Ronald Schmied - Jim, we can basically offload this data to a floppy and make it available to Sea Grant offices, to outdoor writers and others and once they have it up as you'll see it'll be very easy for them to upgrade and update it. In the database we include what are the sportfishing requirements. The main point here is we have an individual identified as the chief contact. He's the person to call to find out about licenses. It tells you, you know, the specific information on the license, what's required, the cost, where you buy it, if there are any exemptions and so on and so forth. It will have a comment down here to tell you when that was last changed. Just continuing, it will show you if there are any vessel or pier license requirements, any species stamp requirements and again where you get these items and when's the last update, and we have a column for any notes or comments that they may want to increase or add to the database. I don't know how many times I've looked in sportfishing magazines and they have a listing of regulations in it and there are lots of errors in it. And their readership might be 250,000 readers and they just sent bad information to that number of folks. The third objective and final one was really to plan and organize a two to three day angler ethics conference.

Wayne Swingle - Just one thing about the last one. On your computer bulletin board, is the public going to be able to tap that if they had a modem and could go into your computer system and pick that information up directly on their computers?

Ronald Schmied - We haven't designed that input at this point. I know there can be some substantial cost involved there, but right now we figure let's start at the primary level of state managers and National Marine Fisheries Service and Councils and perhaps as we explore further avenues we can expand it. The idea of this conference was to build upon the progress that we've made in the program recognizing that really there's not a whole lot more I can do with this program on my own within NMFS. So the idea of the conference is really to elevate the importance of ethics and to build a stronger team of supporters for this program. We pulled together a Steering Committee, and began to organize a conference to be held region-wide. I did set up a 15-member Steering Committee, it represents most of the major sportfishing organizations, Sea Grant, others. We've met three times. By the end of this month we will have met three times. We have a meeting scheduled the 19th and 20th of September. But the first decision we made was that maybe a conference wasn't the best thing to do, yet. The problem with a

conference is that people come, you have some interesting dialog and then they go home and oftentimes nothing's happened. So what we decided as a committee to do was to put the conference on hold, to retile the steering committee, restructure it into an Angler Education Task Force. We added some additional members and our new objective at this point is to develop an angler education plan. This plan would identify what are the issues that need to be addressed through education outreach, what are the messages that we need to send out, what are the audiences that we need to get to, how do we get to those audiences, and also how are we going to fund this program, that is, how are we going to implement the program on a broader scale on a cooperative basis. We've made progress in beginning to draft that plan. Our intent is that once it's complete that we will go out and seek comments, endorsement, and ultimately some funding commitments from the sportfishing industry, hopefully agreement by the states to participate and other conservation groups. At that point it will become a much broader program, far beyond just what we're doing in the Regional Office. That's the intent there. We've not given up on the idea of a conference. Probably when the plan is completed we would hope at that point to convene a conference maybe as a way to launch this program and make it more of a media event.

The last point I'd like to make and finish up here, pretty much on time, is that we are seeking some additional funding support to continue this planning effort and finish out our plans, a small amount of money for the coming year.

Wayne Swingle - Ron, do you ever consider an 800-number system for people to call in and look for regulations? It's been discussed in Louisiana, our fishermen have recommended it, not just recreational.

Ronald Schmied - Yes, in fact we put in a proposal to get some funds to do that. It hasn't been funded. We've not given up on it but the idea would be basically one of these computer based boards to activate the system where you could call in and have a decision tree that would take you down to get you the information you're seeking.

Chuck Wilson - You could do that on a regional level or do it each state have its own 800 program.

Ronald Schmied - That's a possibility.

Chuck Wilson - You could rely upon the data here, the states.

Ronald Schmied - Exactly. That way we could extend the service from eight-hour days to 24 hours a day, 7 days a week, where people could call in.

Chuck Wilson - The other point or comment I want to direct to the MARFIN Board as well as to Andy if he is still here, and that's it would certainly be nice to have the same system developed for commercial regulations because we have the same questions come up with both recreational and commercial fishermen. We'd like to have that integrated into this system so that we have access to it when they call us.

Ronald Schmied - That's definitely a possibility to expand beyond. I guess you have to start somewhere.

Larry Simpson - How do you feel about encouraging and how does this Board or this group feel about encouraging new entrants in recreational fishing when, as you mentioned, its fully exploited?

Ronald Schmied - Well, I don't think they're taking the position to encourage. I don't think we need to. That's going to happen of its own accord. The question is, can we socialize them in a way that they will have perhaps a new set of accepted behaviors that will guide them in their participation so that they hopefully won't contribute to more severe problems.

Larry Simpson - No, I'm asking should we be promoting new entrance into the recreational fishing community. I know that once you get them in, we should educate them, right. But do you think it's proper to promote new entrance into stressed recreational fishing. I asked that for a professional reason. Yesterday or day before I was at the International Association of Fish and Wildlife Agencies meeting in Hot Springs, Arkansas, and I said that I didn't think that was proper and they wanted to crucified me.

Ronald Schmied - The international took that position?

Larry Simpson - In funding grants by the Grants Aid Committee. Definitive projects to promote new entrance into sportfishing. They make no bones about it, it's to sell licenses. And I said, no, I didn't think that was the proper thing. You should educate and provide access and answer questions and manage habitat but I don't think you should be promoting new entrance into a stressed fishery. And they just thought I was somebody from the back side of the moon.

Robert Shipp - Our last paper, "Small Pelagics in the Gulf of Mexico Resource Surveys," will be presented by Chris Gledhill.

Small Pelagics Research in the Gulf of Mexico

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Abstract

Introduction

Small pelagics (coastal herrings, small jacks, and small scombrids) form a large and potentially valuable latent resource in the Gulf of Mexico. Biological and ecological data for most of the species are lacking so the consequences of a significant commercial fishery are unknown. Without precise estimates of their biomass, rate of replacement, and importance to other living marine resources in the Gulf of Mexico, efficient fisheries development is difficult and effective management is unlikely.

In response to the recognized potential of the small pelagic resource, NMFS initiated a Latent Resources Research Program in 1983. Emphasis was on developing management and development information ranging from refined biomass and seasonal availability estimates, through predator-prey relationships, to defining environmental relationships with remote sensing techniques, to product handling and processing protocols, to international and national market development, and to technology transfer to the industry. Activities conducted during the past year center on coastal herrings, and have been oriented at improving assessment methodology, standardizing assessment gears, determining the feasibility of applying advance hydroacoustic techniques to survey activities, and to implementation of the experimental seafood processing plant in Pascagoula.

Project Objectives

1. Conduct seasonal surveys for coastal herrings in the eastern gulf, and conduct the first gulf-wide survey on the coastal herring complex.
2. Continue evaluation of an advanced acoustic integrator system, and implement an acoustic-based survey strategy.
3. Continue gear research to standardize a midwater sampling trawl technology for sampling during acoustic surveys.
4. Conduct gear research to reduce the size of standardized high opening bottom trawls.
5. Sample the harvest of small pelagic resources through a limited vessel observer activity and by monitoring landings harvested for petfood production.
6. Continue studies of satellite applications for inferring distribution and abundance patterns of selected small pelagics and butterfish.

7. Expand the capabilities of an ROV for studies of underway trawling gear performance and fish-gear interactions.

8. Complete construction and implementation of the experimental seafood processing plant in Pascagoula.

9. Initiate research studies on selected species to develop these into value added products for human food use.

10. Continue technology transfer of research results.

Summary of Results

Research under the Small Pelagics program included development of new survey equipment. One fisheries acoustic survey in the northeastern Gulf of Mexico was completed. A total of 21 day/night transects were completed, with 46 bottom trawl and 30 midwater trawl tows conducted to collect biological samples and identify acoustic targets. All echoes were recorded on Digital Audio Tape for analysis. An upgrade to the fisheries acoustic system was ordered to allow procession of echoes with the echo integrator and dual-beam processor simultaneously in real time. The new equipment should be delivered in September, 1991, and will be tested during an October-November, 1991 cruise in the north-central gulf.

Gear research completed development of a standardized midwater trawl for sampling during surveys. A reduced size, 90-ft high opening bottom trawl was developed and tested. The new trawl is a scaled-down version of the 123-ft Shuman bottom trawl that has been used in the past. Gear comparison experiments were conducted during two cruises of the NOAA Ship CHAPMAN to determine the new trawl's ability to capture small pelagic species and to develop catch conversion factors between the new trawl and the 123-ft Shuman trawl.

Landings of the industrial trawl fishery were sampled for biological data on the small pelagics used in pet food. A stock assessment of gulf butterfish was completed and the bycatch data collected during observer trips on butterfish vessels from 1986-1989 was updated. Gulf butterfish catch is less than the estimated MSY of 26,500 metric tons, with the majority of the catch taken by the shrimp fleet as bycatch.

A satellite receiving station was acquired. The receiver will support MARFIN activities involving remote sensing data. Satellite imagery was collected and processed into sea surface temperature and water turbidity data to detect and delineate the Mississippi River Plume. Satellite imagery is periodically processed throughout the year for use in Panama City Laboratory MARFIN and other projects. An upgrade of the underwater Remote Operating Vehicle (ROV) was completed. This upgrade allows precise navigation of the vehicle for trawl evaluation work.

The Experimental Seafood Processing Laboratory (ESPL) in Pascagoula was completed and is fully functional. The seafood laboratory is a cooperative effort between the Agriculture and Forestry Experiment Station, the Cooperative Extension Service of Mississippi State University, and the National Marine Fisheries Service. Processing equipment has been installed and is fully operational. Laboratory personnel have initiated preliminary studies focusing on obtaining information on composition, uses, handling methods, processing

requirements, yields, and quality retention of Gulf of Mexico species. Several samples of butterfish, rough scad, round herring, Spanish sardines, and chub mackerel were collected for fatty acid and proximate composition studies. Preliminary evaluations on the sensory characteristics of chub mackerel held in ice or refrigerated seawater have also been completed.

Lucy Gibbs - I've got a question, just out of curiosity. One latent fishery is gulf butterfish and we're trying to come up with a market that sells gulf butterfish. Is there a market?

Chris Gledhill - Well, I don't think we're trying to direct a market. There are a couple of vessels fishing for butterfish in the gulf right now, targeting them, and they do have their market. And I can't tell you what they are, I don't know.

Lucy Gibbs - I was just wondering. With the amount of bycatch of butterfish, would it be feasible to try to get those butterfish off the shrimp vessels and sell it? If they are already catching them.

Chris Gledhill - I don't know the economics. I can't answer that question. They do get a lot of butterfish, though.

Wayne Swingle - Chris, you mentioned, I guess, for that tow on DeSoto Canyon, that you also picked up shrimp. Is there any data on what kind of shrimp is that?

Chris Gledhill - Usually megalops and parapenaeids. I think we had one tow of parapenaeus at a depth of about 80 meters below the surface, south of Pascagoula, of about 800 pounds, almost all shrimp.

Chuck Wilson - What was the target strength of those, do you know?

Chris Gledhill - No, I don't. I haven't processed that tape yet.

James Cato - This, one of the projects that we'll be reviewing for additional funding Thursday during our Board meeting, is the continuation of this latent resources project. One of the statements in the proposal is that back in 1988 they projected 11 vessels would be involved in the fishery and unfortunately only two are, and if they had done some economic projections and studies maybe they could have foreseen this problem that not as many people are involved as they thought would be, but yet we never have seen any economic proposals from NMFS that deal with the economics of those fisheries. It seems to me that they acknowledged, they being NMFS, back in 1988 that economics were a problem but yet we are still spending half a million dollars a year for developing butterfish but we're still not trying to figure out if we need the butterfish or not, the market's point of view. So I'm just bringing this up as a question I'm going to ask Thursday so that those that are here, I'm not against the project if there's a need for it, but we continue to say economics is a problem but we never see a proposal from NMFS on the economics of it and I think it's time.

Wayne Swingle - The Council's proposing to do a plan for butterfish or at least considering that is. 1988 was the largest harvest year for the vessels that typically have harvested butterfish; vessels out of the mid-Atlantic area moved down and accounted for most of the butterfish catch and apparently that tended to somewhat overload the Oriental market for butterfish. The gulf butterfish have other problems in that they have nematodes in them which don't make them as acceptable in the Japanese market and they are also smaller than the mid-Atlantic butterfish and tend to have less fat content. All of those three are, at least in the Japanese market, strikes. Currently as Chris indicated there are two vessels in the fishery, knowing some of the people that are in there, and basically what they do is get a market order for butterfish for a domestic market

before they go catch them. It's something you can just go out there and you can overload the market pretty easily.

James Cato - Wayne, therein lies my question. I mean, why do we need to continue spending half a million dollars a year developing butterfish if there's no market for them? I mean, I'm just, speaking as a taxpayer now.

Andrew Kemmerer - I have to respond to that. The intent of this program is not butterfish. That's what you're missing. Butterfish is only a very, very small part of that program. There's a whole host of other things. The fact is we know virtually nothing about our small pelagics in the Gulf of Mexico. At first we knew nothing. That's what this program's aimed at. Whether they have commercial, economic, social, ecological or whatever value, we're not sure at this point. But until we get some good handle on that, we're never going to know. That's what this program's aimed at, not butterfish. Butterfish has more than paid for itself many times over. But the question is, what else is out there in that small pelagic area? I don't have an answer for that. I don't think anybody does.

James Cato - Well, I think I still have a valid point in that your proposal for next time says that if you had done some economic work then this problem wouldn't have occurred of trying to develop the market for butterfish and I'm just saying give us some economic proposals to go along with this.

Andrew Kemmerer - I'm not sure what statement you're referring to, I'd have to go look at it.

James Cato - I have it underlined.

Andrew Kemmerer - It's never been the intent of the program to develop a market for butterfish.

SESSION III
ESTUARINE FISH, MENHADEN AND
OYSTERS

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Wednesday, September 11, 1991

SESSION III-ESTUARINE FISH, MENHADEN AND OYSTERS - William S. "Corky" Perret, Chairman

Bob Shipp - Good morning, our moderator this morning is Corky Perret. Corky, it's all yours.

Corky Perret - Thank you, Mr. Chairman. Welcome to the third session relative to Estuarine Fish, Menhaden, and Oysters. I understand that we are trying to keep things on time as much as possible because of some of the other activities going on. I have been advised that one of the speakers, Behzad Mahmoudi, will be unable to attend and there will be no one speaking in his place. Our first speaker is here, Kenneth Heck, Marine Environmental Sciences Consortium. He will speak to us on the "Evaluation of Quahog Abundance and Growth in Inshore Alabama and Northwest Florida."

**Evaluation of Quahog (*Mercenaria mercenaria*) Abundance and
Growth in Inshore Alabama and Northwest Florida:
Assessment of Clam Culture**

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Abstract

Introduction

The objectives of this two year project were to document hard clam (*Mercenaria mercenaria*) survival and growth rates in Alabama and northwest Florida. In addition, we are evaluating the suitability of nearshore vegetated habitats as sites for commercially harvestable hard clam populations. For the past year and a half we conducted field surveys and carried out experiments to examine the effects of seasonality and sublethal predation (siphon nipping) by animals such as flatfish on hard clam abundance and growth. This information can be used to provide a more general and complete understanding of the environmental factors influencing hard clam survival and growth rates in the northern Gulf of Mexico. Of special importance is our assessment of the relative value of seagrass meadows, which we believe to be "critical" habitats, for hard clam production in the Gulf of Mexico.

Summary of Results

Field surveys of hard clam populations in seagrass and adjacent sand habitats in Alabama and northwest Florida have documented existing population sizes and habitat specific growth rates. As anticipated from prior studies, field clam densities were too low to sustain commercial harvesting (0-0.35 inds. m⁻²). Using annual growth bands of field-collected clams, we found that clam growth rates in seagrass beds varied substantially, declining with distance from the leading edge of the grass bed.

We also assessed experimentally the relative survival rates of juvenile (2-3 cm length) clams in different seagrasses (*Thalassia* and *Halodule*), by documenting both lethal and sublethal predation rates. In addition, we experimentally simulated the effects of sublethal predation on clam growth by excising siphon tissue from anesthetized individuals. Two month experiments were initiated in May and October, 1990 and May, 1991 using replicated caged and uncaged treatments, each of which had nipped and unnipped clams (a final October, 1991 experiment is yet to be initiated). Initial experiments were conducted in Perdido Pass, Alabama *Halodule* beds, but later experiments were also done in *Thalassia* meadows at Big Lagoon, Florida.

Results of the experiments showed that growth ranged from 1.5-5.5 mm/month in sand, and from 2.5-4.35 mm/month in seagrass, with highest growth rates in both habitats during fall/winter. Growth was greater in sand than seagrass in fall/winter. In contrast, growth was greater in seagrass than sand in spring/summer. In addition, growth rates varied seasonally among locations in the seagrass bed (edge, quarter way, or half way into the bed). As anticipated,

growth rates were much higher in the Gulf of Mexico than those previously reported from cool temperate Atlantic coast locations. The effects of siphon nipping significantly decreased growth, while there were no noticeable artifacts detected from the use of cages.

We conclude that: (1) habitat (sand or seagrass) and season significantly influences growth rates, with clams in sand growing fastest in cooler months and clams in seagrass growing at relatively greater rates in summer months; (2) location within the grass bed significantly influences growth rate, with different locations in the bed changing ranks by season, but with overall annual growth rates higher near the edge and lower in the interior of the bed; and (3) simulated siphon nipping can significantly reduce growth rates of clams.

Mean growths of Mercenaria mercenaria (mm) per two month study period.

SPRING/SUMMER		FALL/WINTER	
<u>Habitat</u>	<u>Perdido Pass</u>	<u>Perdido Pass</u>	<u>Big Lagoon</u>
Sand	1.5	5.15	4.4
Seagrass			
Edge	2.5	4.05	3.3
Quarter	2.8	4.35	1.2
Center	3.5	3.85	N/A

Wayne Swingle - Ken, I guess what you're looking at in the long term is a culture situation. Would you be able to culture the clams in the grassbeds? Would it not have to be done on the sand?

Kenneth Heck - That's a good question. You certainly couldn't go out and mechanically harvest from the grassbed. You'd have to go out and actually harvest by hand and we have been doing this and we don't see any long term effects on the grassbeds from our small operation. That's something that would have to be looked at. One thing that you might want to look at is putting out artificial grass. If we find that the presence of these blades really does enhance growth you might go out to unvegetated bottoms and lay out some artificial grass that's going to serve the same kind of role as the real stuff, and that's another option that we're looking at.

Corky Perret - Just out of curiosity. Are those waters open to shellfish harvesting?

Kenneth Heck - Yes, they are.

James Cato - Just a comment. We just published a fairly extensive document on investing in hard clam culture that covers the states of Virginia through Florida for the Atlantic culture.

Kenneth Heck - I'd like to get a copy of that.

Chuck Wilson - I just had a comment. I find it fascinating that you're finding siphon nipping, I'm familiar with some of the work that's going on. What is happening is that clam siphons are a significant part of the biomass in estuarine systems that contribute to food chains and this siphoning process is pretty fascinating. I hope there's going to be a lot of work on it in the near future.

Kenneth Heck - Kind of a renewable resource.

Corky Perret - Okay, our next speaker is David Nadeau, Marine Environmental Sciences Consortium, who is going to talk to us about the "Relative Value of Vegetated and Unvegetated Habitats to Juvenile Spotted Seatrout and Red Drum: Comparisons of Nursery Habitats and Field Growth Rate Measurement Techniques."

Relative Value of Vegetated and Unvegetated Habitats to Juvenile Spotted Seatrout and Red Drum: Comparisons of Nursery Habitats and Field Growth Rate Measurement Techniques

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Abstract

Introduction

The objectives of our ongoing project are (1) to further understand the habitat requirements of early juvenile spotted seatrout and red drum by determining the relative importance of food availability and refuge from predation; and (2) to develop a simple, cost-effective method of comparing in situ individual growth rates of juvenile fishes among potential "nursery" habitats. We are in the second year of a two-year project.

We used field experiments to assess the relative value of seagrass (Halodule wrightii and/or Ruppia maritima) and nearby unvegetated habitats by comparing growth of juvenile spotted seatrout and red drum in each. We used large (1.4 m²) enclosures to restrict fishes to target habitats and measured growth of enclosed fish after approximately 60 days using two techniques. Fish were first graded to similar initial size, and otoliths were marked with calcein (250 mg/l for 12 hrs) to establish a fluorescent time-reference mark. This allowed us to (1) estimate growth in length and/or weight (final fish size minus mean initial size; and (2) track growth of individual fish by measuring otolith growth distal to the calcein mark.

Summary of Results

Field Growth Experiment #1 (February 15-April 18, 1990) - Juvenile Red Drum

Initial results indicate no significant difference in growth of red drum in vegetated and unvegetated habitats (ANOVA; SL: $F_{1,24}=2.20$, $p=0.151$; TL: $F_{1,24}=0.04$, $p=0.837$; otolith growth in μm : $F_{1,18}=0.01$, $p=0.943$), corroborating the results of four previous red drum growth comparisons which also indicated no significant difference in growth in seagrass and unvegetated habitats (Nadeau, MS thesis, 1991). Red drum growth in both habitats was roughly 30 mm SL, 35 mm TL, and 147 μm otolith growth and was comparable to growth of wild red drum in December (D. Nadeau, K. Heck, & R. Shipp, unpublished data). Therefore, the results of these experiments indicate that the role of food may be less important than other factors such as protection from predators or general habitat preference in explaining the association of juvenile red drum with seagrass habitats.

Red drum otolith growth and growth in SL and TL was never correlated with aboveground seagrass biomass, the number of fish recovered from enclosures (i.e., density), or sediment characteristics (percent sand, percent mud, percent organics) in enclosures. In addition, aperiodic measurements of water

temperature, salinity, and dissolved oxygen never differed significantly between habitats.

Field Growth Experiment #2 (August 26-October 26, 1990) - Juvenile Spotted Seatrout

In contrast to red drum, juvenile seatrout otolith growth and estimated growth in SL, TL, and weight was significantly higher in seagrass than over adjacent unvegetated substrate (otolith growth: $F_{1,10}=85.63$, $p<0.0001$; SL: $F_{1,13}=65.81$, $p<0.0001$; growth in TL: $F_{1,13}=51.76$, $p<0.0001$; growth in weight: $F_{1,13}=54.42$, $p<0.0001$). Therefore, the results of these experiments indicate that seagrass habitats provide juvenile seatrout both a rich foraging habitat and protection from predators.

In summary, because conclusions drawn from growth data are identical regardless of technique used to measure growth, it appears that measuring growth based on mean initial length and weight is the most cost-effective means of tracking growth. Because these experiments indicate that habitat-related growth was dependent on fish species, species-specific characteristics such as fish morphology may be important in evaluating habitat suitability. We propose that habitat-related growth may also vary with plant morphology and density, and conclude that the role of food in the seagrass nursery paradigm is often less important than the provision of shelter.

Lee Fuiman - Do you propose that habitat-related growths may vary with vegetation morphology and density?

David Nadeau - Yes. Although we never found any relationship between fish growth in the enclosures and seagrass biomass in enclosures. This may only have been true over the range of seagrass densities tested.

Wayne Swingle - David, I was just curious. Did you have much of a problem with fouling on your cages that you put out for the 60 days, or was that not a major factor?

David Nadeau - We periodically scrubbed the cages to make sure that fouling organisms didn't build up on the cages and impede water flow or prey movement through the cages.

Bruce Thompson - Just so you'll know that Louisiana does have grassbeds, data from the beds in Lake Pontchartrain back up your statement exactly with regards to trout. That's the main area where you find spotted seatrout about the same size that you're talking about, so yes, we do have grass, and yes, it operates the same way it does in Alabama.

Scott Holt - Also you know Bill Harkey looked at spotted seatrout. He looked for spotted seatrout larvae and juveniles in marshes and really didn't find any. He concluded that marshes weren't a good place for spotted seatrout in Louisiana, that they'd be somewhere else.

Corky Perret - Man, we could discuss that statement all week.

Scott Holt - Do you have evidence that red drum the size you tested, 50 to 80-90 mm really use seagrass beds?

David Nadeau - We don't have any estimates of density in the field though we have collected them. They are in both habitats in our study sites but we don't have any estimates of density.

Scott Holt - Our experience in South Texas is that real small ones, 6 to 20 mm, are almost exclusively in seagrass beds. Beyond that size, they move out more into little channels and places. They don't use seagrass as extensively at that size as they do earlier.

David Nadeau - If refuge was the primary benefit they were deriving from the seagrass beds you might predict that.

Corky Perret - Lee Fuiman with the University of Texas at Austin will speak to us next on "Dynamics of Estuarine and Offshore Red Drum Stocks, as Determined by Otolith Analysis."

**Dynamics of Estuarine and Offshore Red Drum Stocks,
as Determined by Otolith Elemental Analysis**

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Abstract

This research attempted to use otolith microgeochemistry to reconstruct the chronology of migrations between estuarine and offshore sites for red drum, *Sciaenops ocellatus*. Data so obtained would contribute toward an understanding of the age structure of estuarine and offshore stocks, the age when juveniles escape to the offshore stocks, and whether individuals in those stocks remain offshore. The proposed use of microgeochemistry recognizes the thermal and chemical differences that exist between inshore and offshore waters in Texas and that these differences could leave a chemical "signature" in the otolith that could be dated accurately, using otolith aging techniques. Therefore, laboratory experiments were designed to identify and calibrate a chemical assay for the different water masses.

Other investigators showed that the ratio of strontium to calcium ($[Sr/Ca]$) in otoliths was inversely correlated with water temperature for other species. We designed experiments to determine whether any of the major elements of otoliths (Ca, Sr, K, Na, Mg) is a good indicator of water temperature or salinity for red drum. The influence of diet on the composition of otoliths was examined by preparing artificial diets that contained enriched and depauperate levels of the elements studied.

Contrary to previous findings, $[Sr/Ca]$ did not correlate strongly with water temperature ($R^2=0.09$). Of the elements examined, $[Na/Ca]$ and $[K/Ca]$ were most closely associated with temperature ($R^2=0.33$ and 0.28 , respectively). $[Na/Ca]$ also showed the best correlation with salinity ($R^2=0.53$). Variations in the elemental composition of the diet had no detectable effect on the elemental composition of the otoliths.

Otoliths have been taken from subadult and adult red drum from most areas of the Texas coast, through the cooperation of the Texas Parks and Wildlife Department. After further analysis of the experimental data, this one year project will be completed by examining these otoliths in an effort to reconstruct their migratory history, providing more information about the dynamics of estuarine and offshore populations of red drum along the Texas coast.

Chuck Wilson - Lee, did you ever try and run the strontium and calcium ratios on fish in the wild at about the same size?

Lee Fuiman - No, I didn't. I haven't done anything with wild fish.

Chuck Wilson - It might be interesting to look at that in fish in the wild.

Lee Fuiman - Yes, even if there are other chemical indicators that might relate to life history, for instance isotopes. When we saw some of our unexciting data on elemental composition, we did in fact send some of our otoliths with known thermal histories to a lab in Michigan where they are actually scraping out sections of otoliths and determining isotope ratios, principally oxygen isotopes. We sent three distinct temperature histories without identifying them. The isotope analyses were not able to reconstruct our known temperature histories, so that technique may not be as reliable as thought, either.

Corky Perret - Charles A. Wilson, LSU, is going to speak to us on "Age Structure and Reproductive Potential of the North Gulf of Mexico Offshore Population of Red Drum not Vulnerable to Purse Seine Capture."

**Age Structure and Reproductive Potential of the Northern
Gulf of Mexico Offshore Population of Red Drum Not Vulnerable
to Purse Seine Capture: The Missing Fish?**

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Abstract

In our pursuit to monitor changes in the age structure and reproductive output of the red drum (Sciaenops ocellatus) population we found two anomalies that warranted further investigation. There is a potential bias in our sampling of the red drum population and a possible pathological condition in red drum ovaries. These were additions to our research under the Cooperative Red Drum Research Program.

Snapper fishermen have reported "large numbers" of red drum at depths of 30 to 50 meters off the Louisiana coast. Previous samples of these fish ranged from 2 to 5 kg (4.5 to 11 pounds); they were sizes which were under-represented in purse seine catches. Our intent was to document the size, age structure and reproductive biology of these intermediate-sized fish. Captain Ron Anderson (RV Ranger) was the cooperating fisherman on the project and our source of samples.

Last year we reported the presence of an apparent invasive bacterium in red drum ovaries. The infection is limited to reproductively active fish and the September incidence has increased annually from 0% in 1986 to 44% in 1990. Since we were not reaching our anticipated sample size of red drum from Captain Anderson, we requested a change in our work statement to expand our investigation of this pathological condition. Dr. Ron Thune of the LSU Veterinary School has assisted in the processing and analysis of samples.

Our objectives were to determine age structure and reproductive biology of the "missing" red drum population, make comparisons with red drum sampled from large surface schools by purse seine, and to intensify our analysis of the bacterial infestation observed in red drum ovaries collected during the past 4 years.

Captain Anderson provided 59 red drum specimens from water depths ranging from 60 to 150 feet. Ninety-three percent were 3 years old or less and not mature. The age frequency distribution of these fish was very similar to "young" schools of fish captured by purse seine and significantly different from the age structure of "old schools". The fish provided by Captain Anderson fill in an apparent gap of ages missing in the age frequency distribution of red drum when inshore and offshore fish are combined. However the true value of this "missing" component is unknown because there are no estimates of the magnitude of this population.

The pathological condition we have found in mature drum gonads is either a post-mortem infestation due to delayed fixation, or it is a real pathological condition that may interfere with individual red drum spawning potential. We have observed a large gram positive bacillus adjacent to the lumen of mature

ovaries. The incidence of infection has increased annually in September samples since 1986. Sampling and fixation techniques have not changed during the same period. Intensification of sampling with appropriate sterile technique this fall will help to determine the nature of this condition.

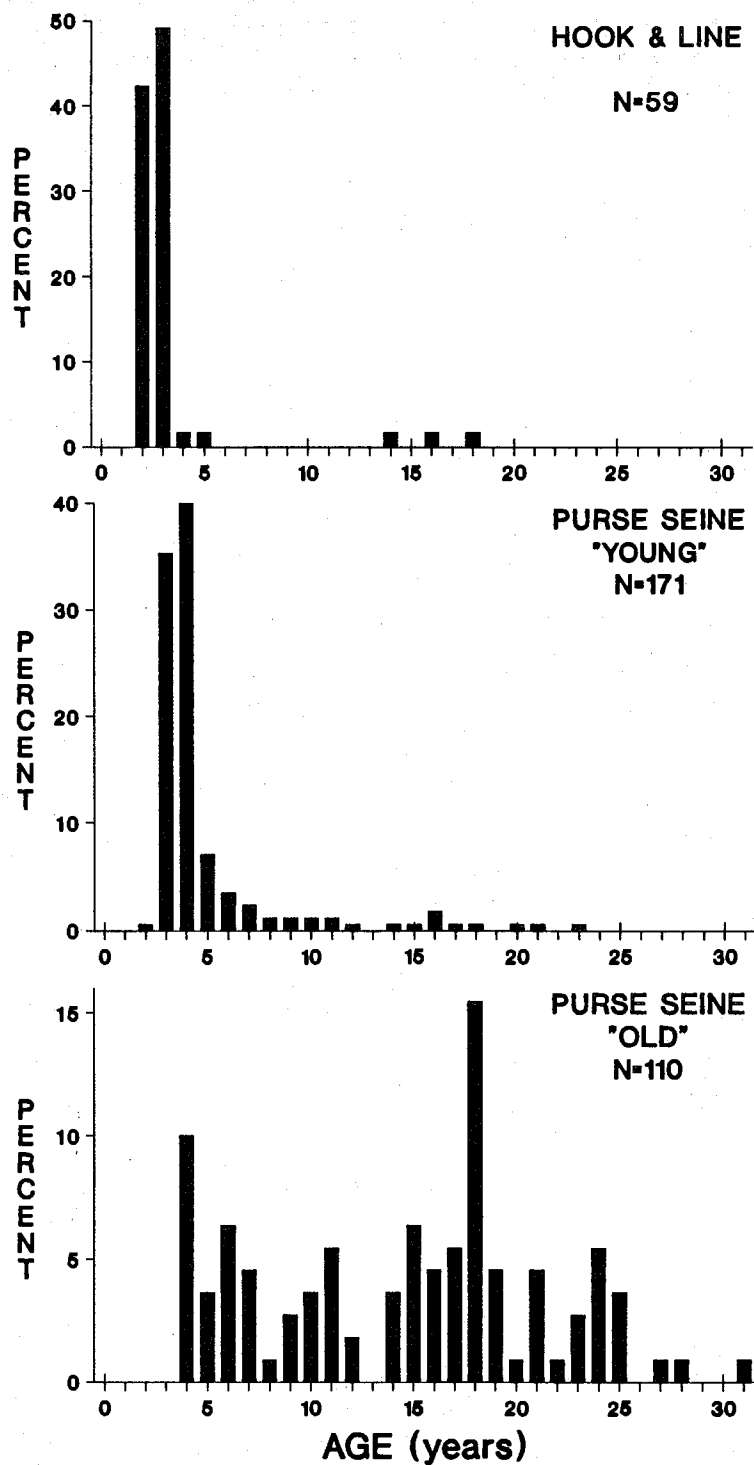


Figure 1. Percent frequency histogram of the ages of red drum collected 1990-1991. Hook and Line = fish sampled by Captain Ron Anderson in water depths ranging from 20 to 60 meters; Purse Seine "Young" = sets from schools where the mean age was less than 9 years; Purse Seine "old" = sets from schools where the mean age was greater than 9 years.

Table 1. The incidence of bacterial infestation observed in red drum ovaries by year (1986-1990) for August and September.

Year	August	September
1986	0.0% (100)	0.0% (68)
1987	4.4% (45)	4.1% (146)
1988	4.1% (171)	7.0% (71)
1989	0.0% (22)	23.4% (64)
1990	14.3% (35)	43.8% (64)

Number of specimens examined in parentheses.

Larry Simpson - Have you identified the bacteria?

Chuck Wilson - The vet school has tried to culture it and they haven't had any success yet. Dave Nieland just went out a few weeks ago and brought back some specimens and they have isolated two bacterium out of one fish, but they haven't identified them.

Larry Simpson - And the associated bacteria causes a breakdown in this...tissue that could possibly affect production of eggs? Do you see it as a chronic enough problem or is it just a short-term problem?

Chuck Wilson - I would say if it's real, the answer to that might be yes. In the sections it appears to prevent the cell from ovulating, but the other unique thing about this infection is it is located around the center of the ovary so any eggs outside of that are would pass through the infection on their way out.

Corky Perret - Have you seen that in black drum also?

Chuck Wilson - Yes, but the incidence is much lower.

Corky Perret - Lower? Any other species?

Chuck Wilson - I think we saw a similar bacteria in one or two specimens of red snapper. It is curious because you don't know it's there unless you're looking for it. Now that we've started looking for it we see odd bacterium in several species. It's most common in red drum, which is the other unusual thing, because all samples are treated the same way in our lab, all the fish are processed the same way.

Wayne Swingle - Chuck, in regard to the small fish offshore, I don't know whether you've ever looked at the Marine Rec Fishing Statistics Survey data but for some several years they indicate that the average size of red drum taken in the EEZ off of Louisiana are on the order of two to three pounds average, and when that first appeared in some of the work Goodyear did I was a doubting Thomas that they were actually that small in the EEZ but basically what you're saying is that is a very good likelihood.

Chuck Wilson - Yes, it seems to fit basically. We see a disappearance inshore of one to two year olds and now we're seeing an appearance offshore of one to two year olds. We really don't know whether this is sloshing back and forth as Lee was referring to. Maybe these things leave the marsh, go offshore, come back in. Maybe they're going out there and staying out there and then moving into the bigger schools. I don't know. I don't know if that's part of the graduation process or not.

Wayne Swingle - I'm not familiar enough really with their data in that to know how many fish are actually measured each year but it's been a consistent trend of smallest fish in the EEZ...

Chuck Wilson - That's a good point. I would like to look at that. It's a good point, I hadn't thought of it.

Corky Perret - The captain that was telling you the fish were in 150, 80 or whatever depth, was that off the entire coast or was that southeast Louisiana?

Chuck Wilson - Mostly southeast Louisiana but that's where he fishes. I don't know that he's been off the Cameron region. He may go as far as Ship Shoal or something. Some of them came from Ship Shoal which is central Louisiana.

Chuck Wilson - No, only in the nearly mature red drum, the ones that are right near spawning.

Gene Nakamura - Are these bacterial infections found in all the stages of the developmental...

Chuck Wilson - Dave, I think he found one fish that had a hydrated egg and the bacteria.

Dave Nieland - No, I can't remember ever seeing a hydrated fish and the bacteria.

Unknown Audience - Have you seen very many ovaries with hydrated eggs?

Dave Nieland - Last year we didn't find any. In years past we've gotten a fairly great many, over 180, from the purse seine fish.

Unknown Audience - That might be a clue as to whether or not this has an impact on...

Chuck Wilson - That was another one of our concerns. As a matter of fact we called Joanne and said that we're not finding any hydration. You're not going to find any eggs, and the first time they went out they didn't and everybody went, Oh, God, no eggs. But it turns out they did find some later in the year. But we never found any hydrated fish last year.

Scott Holt - I've got two basic questions. Couldn't it be that the reason that we're finding these small fish now is that fish regulations that were implemented in the last decade are now working and we're now seeing these fish escaping into the offshore areas? And secondly, was the increase in the bacteria infection in these fish two years, could it also be an indication that they may be having more red drum out there, they're having more interaction with these schools of fish that are infected and this could be a direct reflection of an increase in red drum?

Chuck Wilson - It has been proposed that it is a sign that a population is becoming too big. And I would not want to concede that but it's a possibility. To answer your first question I think what Wayne brought up is a good way of going back and evaluating that. Ron Anderson said that he has been catching red drum out there like this for as long as he's been fishing, and other fishermen have said the same thing. I don't have any data to support it or refute it, but I think what Wayne pointed out would certainly help answer that. Seems logical. The other question is that first we've got to convince ourselves this is real. We're not at all convinced it's real yet. And hopefully this next year we'll be able to hammer that down.

Scott Holt - Do you have data on the age structure of the inshore fish? Are those data available?

Chuck Wilson - Well, length frequency distribution. Wildlife and Fisheries has been doing that.

Scott Holt - But not otolith aging data like your offshore data?

Chuck Wilson - Yes, Scott, we did age some and it wasn't a full blown research project. We did age some with Wildlife and Fisheries and as you know your age estimates of inshore fish are fairly accurate based on length frequency distribution and that did show disappearance rates that were very high from the one to four year olds. The question was where they were going, were they being caught or were they getting out.

Corky Perret - John Gold from A&M is next to speak to us on "Population Genetic Studies of Red Drum in the Gulf of Mexico."

Population Genetic Studies of Red Drum in the Gulf of Mexico

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Abstract

Introduction

This project is a two-year study designed to determine if significant population substructuring (the existence of discrete stocks) occurs among red drum (Sciaenops ocellatus) in the northern Gulf of Mexico. Specific objectives of the study were to: (1) obtain tissue samples from 400-500 red drum individuals (including both sexually mature adults and juveniles) taken from throughout the northern Gulf of Mexico; (2) assay variation in red drum mitochondrial (mt)DNAs (using restriction enzyme digestion and Southern blotting) and nuclear genes (using gel electrophoresis of proteins) among these individuals; and (3) determine if spatial (geographic) and/or temporal genetic heterogeneity occurs within the fishery. Cooperators in the project include Texas A&M University and the Texas Parks and Wildlife Department.

Summary of Results

Appropriate tissues were obtained from ca 630 red drum sampled from the northern Gulf of Mexico and 31 red drum from the Atlantic coast of the southeastern United States. Individuals were obtained by a variety of methods. Ages of all but yearling individuals were determined by otolith analysis. Sequence variation in mtDNA was assayed using 13 different, polymorphic restriction enzymes, and nuclear gene variation was assayed at nine polymorphic loci. The data were combined with data obtained previously to give a total of 1,061 individuals assayed for mtDNA variation and 1,131 individuals assayed for nuclear gene variation. Between 700-750 individuals were from the 1986 and 1987 year classes, taken from eleven nearshore localities in the northern gulf. The eleven localities ranged from Sarasota, FL, to Port Isabel, TX. Nearly 200 individuals were sexually mature adults (belonging to the 1985 year class or earlier), taken from offshore localities in the northern gulf. Most of the adult individuals were sampled in waters off of Texas and Louisiana. Approximately 175 individuals were from five nearshore localities along the Atlantic coast. Most of the individuals taken from the Atlantic were from the 1986 year class.

Nuclear gene variation -- All nine loci in nearly all geographic and/or temporal samples were found to be in Hardy-Weinberg equilibrium. Exceptions were: (1) at the Got-1 locus in the 1986 year class sample from Galveston Bay, TX; (2) at the Gpi-B locus in the pooled 1987 year class from the gulf; and (3)

at the Acp-2 locus in the pooled gulf sample. The deviations from equilibrium in the latter two were not significant when corrected for multiple tests. The number of alleles at the nine polymorphic loci ranged from two (at Est-1) to 13 (at Ada-1); the mean number of alleles over the nine loci was 4.33. Average heterozygosities ranged from 0.190 in the 1987 year class sample from Pass Cavallo, TX, to 0.258 in the 1987 year class sample from Biloxi Bay, MS; the overall mean heterozygosity was 0.225. When corrected for 33 monomorphic loci screened previously, the average heterozygosity (H) in red drum is estimated to be ca 0.048. These data indicate that red drum have "normal" levels of nuclear gene variability both within and among geographic localities. Significant heterogeneity in allele frequencies (when corrected for multiple tests) was detected as follows: (1) at Pep-D among geographic samples from the 1987 year class in the gulf; (2) at Ada-1 between the 1986 and 1987 year class at Riviera Bay, FL; (3) at Ada-1 between the 1986 (pooled) and 1987 (pooled) year classes in the gulf; (4) at Ada-1 among the 1986 (pooled) and 1987 (pooled) year classes and the adults (pooled) in the gulf; and (5) at Adh-1, Ada-1, and Got-1 between the gulf (pooled) and Atlantic (pooled). With the exception of the comparison between gulf and Atlantic red drum, most of the heterogeneity appears to be due to frequency differences in a rare allele. This was especially true at Ada-1, at which 13 different alleles were found. The frequency differences between the Atlantic and gulf appear to involve two alleles at Adh-1 and four alleles at Ada-1. High levels of gene flow and the absence of spatial and/or temporal genetic subdivision among red drum in the gulf also were indicated by: (1) Wright's F_{ST} values which ranged from 0.003 to 0.023 in geographic and/or temporal comparisons; (2) Slatkin's qualitative analysis using conditional average allele frequencies; and (3) Nei's unbiased estimates of genetic distance between pairs of samples which ranged from 0.000 to 0.100 and averaged 0.001.

MtDNA variation -- One hundred twenty-nine (129) mtDNA haplotypes (genotypes) were found among all individuals surveyed: 11 haplotypes were found in >30 individuals, seven haplotypes were found in 11-30 individuals, 23 haplotypes were found in 4-10 individuals, and 67 haplotypes were found in only one individual each. A total of 98 mtDNA restrictive sites were surveyed among all individuals. MtDNA nucleon diversities ranged from 0.850 in the 1986 year class sample from Charleston Bay, SC, to 0.987 in the 1986 year class sample from Lower Laguna Madre, TX. The mean nucleon diversity averaged over all samples was 0.946. These nucleon diversity values are among the highest reported in vertebrates. The mean (\pm SE) nucleotide sequence divergence among the 129 haplotypes was $0.876 \pm 0.003\%$ (range = 0.002 - 1.912%). Heterogeneity tests of haplotype frequencies were carried out: (1) among geographic localities in the 1986 gulf year class (24 haplotypes); (2) among geographic localities in the 1987 gulf year class (20 haplotypes); (3) among the 1986 (pooled) and 1987 (pooled) year classes and adults (pooled) from the gulf (33 haplotypes); and (4) between the (pooled) gulf and (pooled) Atlantic (41 haplotypes). For comparisons involving samples from the gulf, significant heterogeneity ($P=0.03$) was detected only in the frequency of one haplotype among geographic samples from the 1986 year class. No geographic pattern in the distribution of this haplotype was evident, and the heterogeneity detected appeared to result from an elevated frequency of the haplotype in the 1986 year class sample from Apalachicola Bay, FL. Parsimony and phenetic analyses revealed no evidence of cohesion of haplotype or geographic/temporal groupings within the gulf. For comparisons between the gulf and Atlantic, significant heterogeneity was detected in the frequencies of 10 of the 41 haplotypes tested. The heterogeneity for four of the haplotypes remained significant ($P<0.001$) even when (conservative) corrections

were made for multiple tests. F_{ST} values over these four haplotypes ranged from 0.064 to 0.168 (mean $F_{ST}=0.097$).

Collectively, the nuclear gene and mtDNA data obtained to date indicate that red drum are genetically subdivided, with distinct subpopulations or stocks occurring in the northern Gulf of Mexico and along the southeastern Atlantic Coast. This suggests that a biological or geographical barrier separates, or perhaps historically separated red drum in the gulf from those in the Atlantic. The relative magnitude of genetic differentiation between gulf and Atlantic red drum, however, is not large, and there is evidence that considerable gene flow (migration) occurs between the two subpopulations. Red drum in the northern Gulf of Mexico do not appear to be genetically subdivided either spatially or temporally. This suggests that (1) gene flow among gulf red drum is extensive, and (2) the effective size of the red drum subpopulation in the northern gulf is very likely quite large. Levels of genetic variability in gulf red drum are comparatively high, suggesting that the perceived decline in gulf red drum abundance has not affected the genetic variability base of the gulf subpopulation.

Bob Shipp - Going back to one of your first slides, John, in your sampling sites you indicated off southeast Florida no sites at all to speak of. Is that because populations there are thin or nonexistent?

John Gold - You mean like Biscayne Bay?

Bob Shipp - Yes.

John Gold - There aren't any red drum in Biscayne Bay, I've been told.

Bob Shipp - Right, and how far up before you start seeing them?

John Gold - Actually, Bob, that was a question we had. We were not funded to work on Atlantic red drum, and the work we did was essentially gratis for the Sea Grant as well as the MARFIN projects. As it turned out, in terms of the help we received, we were never really able to make good connections in southeastern Florida. We now have about 80 individuals from the Indian River system. They were not included in this analysis.

Bob Shipp - That's as far south as you have them though?

John Gold - That's as far south as we have them, although we do have 13 individuals from Florida Bay that were provided to us by Florida DNR. The genetic break between the gulf and Atlantic, however, appears to be real; it's slight, but it's real.

Bob Shipp - So there is true disjunction.

John Gold - Well, that's an interesting question. Yes, red drum from the gulf and from the Atlantic are significantly heterogeneous in both nuclear gene and mitochondrial DNA haplotype frequencies. That suggests the two are different units or subpopulations. The estimates of gene flow would suggest that there should be sufficient gene flow to minimize spatial heterogeneity. There is a well known break somewhere around Cape Canaveral that has been reported for a lot of different species. That really is the rationale behind the Indian River samples.

Bob Shipp - Two other quick questions. Mitochondrial DNA, your comparison with other teleosts, are you using cytochrome B, is that the one...?

John Gold - It's the entire mitochondrial DNA molecule.

Bob Shipp - Would the cytochrome b mapping that is going on with other teleosts provide you with a better model?

John Gold - You mean direct sequencing?

Bob Shipp - Yes.

John Gold - We actually do direct sequencing, and we use the cyt b gene. Our work in this area is primarily for the inference of phylogenetic hypothesis (i.e., for systematics and taxonomy). Using genetic markers, particularly nucleic acid markers, for population genetics questions has proven an important approach. What is equally important is to identify an entire molecule, or part of a molecule, that has sufficient levels of variation to detect heterogeneity

at given hierarchical levels. That is a fancy way of saying that by direct sequencing of most genes, particularly coding genes, one is either going to find appropriate levels of variation or one is not. More often than not in a population genetics study, what one typically ends up with by using direct sequencing is that every single fish is different. This means that one has a very difficult time in terms of having enough cells up in a lot of the work on cod on the northeastern coast where direct sequencing of *cyt b* and other mitochondrial DNA genes has been carried out over the last couple of years. The technology is very powerful, but what's important is to know going in exactly at what level one is testing for heterogeneity and what's the appropriate genetic tool to use to test for heterogeneity at that level. So that, no, we don't use direct sequencing for population genetics work, in part because of the expense, but largely because we have found enough variation using restriction sites in the entire mitochondrial DNA molecule to test for among locality heterogeneity. One needs to have a certain level of variation, but you can't have every individual being different because then you would have nothing to test with and the entire analysis has to then rest on a phenetic or phylogenetic approach.

Larry Simpson - Is there any possible way to theorize or to get a comparative method to determine what kind of size the population is, to get that kind of genetic diversity?

John Gold - There is. The equations, however, rest on several assumptions. One crucial assumption is that the mitochondrial DNA molecule evolves at the same rate in all lineages or species. That assumption is under such incredibly heavy fire that we haven't touched it. We have done the estimates, and given that the estimates appear to underestimate the census size by one to three orders of magnitude, the effective breeding size of the red drum populations appears to be enormous. Certainly the effective population size in red drum, based on critical data, is sufficiently large so that there is no deficit of genetic variation either spatially or temporally. At most gulf localities, we've looked at 25 or more fish, and the estimates of genetic variability are extraordinarily high.

Larry Simpson - Have you done any work with snappers?

John Gold - Yes, I'll go into that this afternoon.

Joanne Shultz - How long would it take for a declining population to show up in a region, for you to see it in reduced variability?

John Gold - That's probably a good question. We don't see it.

Joanne Shultz - Is there a time lag there?

John Gold - We don't have enough individuals from given year classes prior to 1984 to ask if there's been any temporal change. In other words, in our adult samples, we have individuals all the way from 1953 to 1983. It sure doesn't look like there is any reduced variability. That was one of the questions we had going into the project and one of the reasons for looking at adult individuals. What most people who look at adults realize is that if you collect 200 or 300 individuals of an animal that lives to be 30 years, the probability of finding enough individuals of a given year class (relative to testing for differences among year classes) is relatively small. The answer is I don't know. Certainly, it would be interesting, if regulations relative to red drum change appreciably

over the next few years, to come back in some period of time to see if there are any detectable difference.

Estimates of Population Parameters and Exploitation Rates Striped Mullet in Tampa Bay

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Abstract

Introduction

The goal of this research was to provide measurements of striped mullet (*Mugil cephalus*) population parameters based on mark-recapture experiments. The specific objectives were: (1) to estimate seasonal and annual survival and escapement rates, (2) to investigate the effects of initial tagging-handling mortality, tag shedding, seasonal growth, gear selectivity, and reporting rate on the estimate of exploitation rates, and (3) to determine relationships between tag recaptures and production (catchability and availability effected by climatological variabilities).

Summary of Results

Mark-recapture data matrices were constructed based on weekly tag-release experiments conducted during the spawning season (November-January) in three strategic habitats in Tampa Bay. Gill nets were used to capture fish in the tag-release study. The recapture data matrix was mainly based on returns from the commercial fishery. In addition, we initiated a special sampling regime in which a portion of the commercial catch from a selected region was monitored by biologists for tagged fish.

To investigate the relationship between the recovery rate and fishing activities, seasonal recovery rates were compared to seasonal catch and effort statistics (Figure 1). Recovery rate significantly increased during the spawning season when the catch and effort were at a maximum. However, spawning-season recovery rates gradually increased during the past five years while catch and effort have remained fairly stable.

To estimate tagging-handling mortality, a series of in-situ experiments were conducted during spawning and post-spawning seasons. Mullet were held in either floating cages or a tank (10,000 gallon fiberglass tank). Fish collected for these experiments were divided into four categories: shucked and tagged, shucked and untagged, unshucked and tagged, and unshucked and untagged. Results are presented in Table 1.

The effect of seasonal growth (of the marked populations) and gear (gill net) selectivity on the catchability of the tagged mullet, were investigated using estimates of seasonal growth increments (based on mark-recapture data) and gill-net selection curves. Figure 2 shows expected number of marked animals vulnerable to the gill net as the result of the seasonal growth and gear selectivity.

Information gathered through special monitoring from a portion of the commercial catches for tag returns and landing statistics collected through the Marine Fisheries Information System provided a data base to examine reporting rate. During this experiment 26 observations were made. A total of 71,777 lbs of mullet (16% of total 3-day landings and 14% of the 4-day landings) were monitored and 96 tags were recovered. The expected number of tag returns were calculated in the range of 421 to 509. The non-reporting rate was estimated in the range of 64% to 70%.

Analysis of inter-bay movement of mullet (based on mark-recapture data) indicated that at least 9-17% of tagged mullet emigrated permanently from the region of release (Tampa Bay and Charlotte Harbor systems). However, the estimates of emigration rate into areas with little or no fishing activities are not included in these figures. Additionally, estimates of emigration rate is complicated by adjustments made for reporting rate.

Seasonal and annual mark-recapture matrices were used to provide estimates of survival (S) and mortality rates (Z, F, and X) for mullet populations in the Tampa Bay system. Methods used for the analyses were based on the time-constant and time-specific models. Table 2 presents summary results of the analyses performed based on recapture data collected during the past four years. Accurate estimation of natural mortality (M) rates was not possible in the absence of precise estimates of migration rate, long term tagging-handling mortality rates, and tag-shedding rates.

Table 1. Initial tagging handling mortality experiments, (cage-tank studies) for black mullet, 1989-90, Tampa Bay.

A.

(CAGE STUDIES)

STUDY	GROUP	N	START DATE	STOP DATE	NO. DAYS	PERCENT MORTALITY
C-I	-/-	31	09/11/89	10/18/89	38	0
	S/T	30	09/11/89	10/10/89	38	53
C-II	-/T	18	10/10/89	11/13/89	27	5
	-/-	13	10/10/89	11/13/89	27	0
C-III	S/T	47	12/18/89	05/18/90	157	72
	S/-	50	12/18/89	01/08/90	26	30
C-IV	S/T	28	01/09/90	01/16/90	7	100
	S/-	13	01/09/90	03/20/90	79	38
	-/T	9	01/09/90	01/22/90	14	100
	-/-	8	01/09/90	03/28/90	79	38

B.

(TANK STUDIES)

STUDY	GROUP	N	START DATE	STOP DATE	NO. DAYS	PERCENT MORTALITY
T-I	S/T	25	01/24/90	03/30/90	65	25
	S/-	25	01/24/90	03/30/90	65	20
	-/T	25	01/24/90	03/30/90	65	16
	-/-	25	01/24/90	03/30/90	65	4
T-II	S/T	37	04/10/90	06/12/90	64	84
	S/-	37	04/10/90	06/12/90	64	70
	-/T	25	04/10/90	06/12/90	64	56
	-/-	30	04/10/90	06/12/90	64	0
T-III	S/T	24	06/20/90	07/03/90	13	100
	-/-	21	06/20/90	07/03/90	13	30
T-IV	S/T	16	07/05/90	07/10/90	5	100
	S/T	4	07/09/90	07/12/90	2	100
	S/T	5	07/10/90	07/11/90	1	100
	-/T	8	07/10/90	07/11/90	1	100
	S/-	21	07/10/90	07/11/90	1	100
	-/-	6	06/20/90	08/10/90	51	-
	-/-	1	07/05/90	08/10/90	36	-
	-/-	6	07/09/90	08/10/90	32	-
	-/-	13	07/10/90	08/10/90	31	-

Table 2. Summary results of the annual survival and mortality estimates of the exploited mullet populations in Tampa Bay based on mark-recapture studies.

YEAR	S	Z	F		X	
			r=.36		r=.36	
			I=.3	I=.5	I=.3	I=.5
1987-1988						
TIME-CONSTANT						
Method-1	0.25	1.37	0.46	0.65	0.91	0.72
Method-2	0.22	1.50	0.49	0.68	1.01	0.82
TIME SPECIFIC						
Method-1	0.21	1.54	0.50	0.69	1.04	0.84
Method-2	0.20	1.60	0.51	0.71	1.09	0.89
1988-1989						
TIME-CONSTANT						
Method-1	0.15	1.91	0.76	1.07	1.14	0.83
Method-2	0.12	2.10	0.82	1.14	1.29	0.96
TIME-SPECIFIC						
Method-1	0.118	2.14	0.83	1.16	1.31	0.98
Method-2	0.146	1.92	0.77	1.08	1.16	0.85
1989-1990						
TIME CONSTANT						
Method-1	0.04	3.28	1.36	2.51	1.92	0.77
TIME SPECIFIC						
Method-1	0.23	1.47	0.76	1.06	0.71	0.40

S = annual survival rate

Z = annual instantaneous mortality rate

F = annual instantaneous fishing mortality rate

X = annual instantaneous non-fishing mortality rate

I = initial tagging handling mortality

r = reporting rate

Figure Not Available at Press Time

Figure 1.

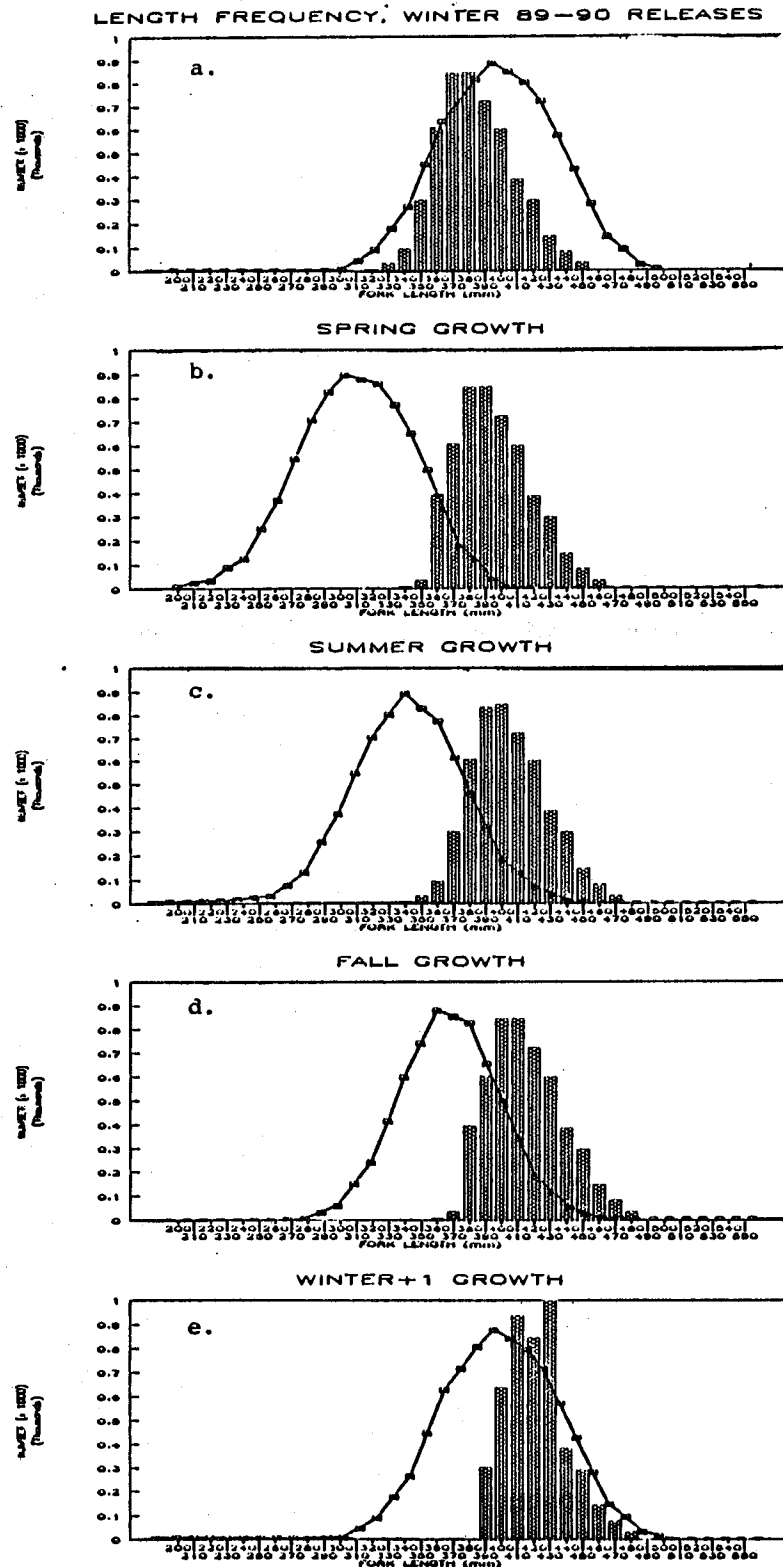


Figure 2. Growth increment of the spawning season 1989-1990 tag release cohort and seasonal gill net selectivity.

SESSION IV
COASTAL PELAGICS

SESSION IV-COASTAL PELAGICS - Larry B. Simpson, Chairman

Larry Simpson - Thank you, I'm going to have a very small session on the coastal pelagics. We are not interested in quantity, we are interested in quality. Jim Ditty from Louisiana will be talking about cobia and bluefish progress and Karen Burns from Mote Marine will talk about her mackerel work. Jim's project is "Utilization of Fisheries-Independent Data: Future Management Implications."

Utilization of Fisheries-Independent Data: Future Management Implications

R. F. Shaw and J. G. Ditty
Coastal Fisheries Institute
Center for Wetland Resources
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Baton Rouge, Louisiana 70803-7503

Abstract

Introduction

This research was undertaken to fill the information gap on early life stages of selected species of commercially and recreationally important fishes in the Gulf of Mexico. Final reports on the distribution, abundance, and ecology of clupeids and carangids were submitted during year 1 of this three year project. During year 2, we have thus far completed final reports on cobia (*Rachycentron canadum*) and bluefish (*Promatomus saltatrix*). We will subsequently be compiling data and preparing reports on dolphinfish, mullet, amberjack, Atlantic spadefish, and tripletail. Work on developing spawner biomass estimates and investigating the relationship between abundance of offshore red drum larvae and inshore postlarvae in cooperation with Joanne Lyczkowski-Shultz and others of the Gulf Coast Research Laboratory is ongoing.

Cobia eggs hatch in about 24 hours at 29°C. Eggs are usually collected in the upper meter of water and larvae in surface-towed nets. Larvae hatch at about 2.5 mm SL and are recognized by the large supraorbital ridge with a single spine, 'swollen' pterotics, heavy body pigmentation, minute epithelial prickles, and pair of moderate to large, simple spines at the angle of the posterior margin of the preopercle. Fewer than 50 larvae <20 mm SL have been collected in the Gulf of Mexico (GOMEX) and most occurred between June and September. Evidence suggests that cobia spawn in both estuarine and shelf waters during the day. Most larval cobia in the GOMEX have been collected at surface water temperatures of 25°C or greater and salinities >27 ppt.

Bluefish were collected at salinities of 26.7-36.3 ppt and water temperatures from 22.4-26.9° during April and October-November. Spawning may be associated with riverine/oceanic frontal areas and probably occurs over the middle and outer continental shelf. Bluefish eggs hatch in about 30-36 hours at ambient surface water temperatures (\bar{X} =25°C) during months of peak spawning and based on the size of early larvae, spawning occurred in the vicinity of our collections.

Gene Nakamura - Did you find any, or have you found any Coryphaena equisetis larvae?

Jim Ditty - Well, as a matter of fact, I only had distribution maps generated for one species, but and it was not the C. equisetis. The common dolphin in the SEAMAP samples are much more abundant than C. equisetis. Current sampling indicates that the C. hippurus is more abundant than C. equisetis.

Steve Szedlmayer - Did you see any Seriola larvae?

Jim Ditty - Not many. In the carangid paper that we have in review the Seriolas are lumped as just Seriola spp., because there is a taxonomy problem. About the first of the year I'm going to be investigating the Seriolas from the larval standpoint, at which time I will be able to give you a better indication.

Larry Simpson - Karen Burns will speak next about mackerel activities in the southern part of the Gulf of Mexico.

King and Spanish Mackerel Migration and Stock Assessment Study in the Southern Gulf of Mexico

Karen M. Burns
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Sarasota, Florida 34236

Abstract

Introduction

Objectives:

1. To determine the movement and migration of king and Spanish mackerel in the southern Gulf of Mexico.
2. To obtain length/frequency and CPUE data for king and Spanish mackerel captured in Mexican waters.
3. To acquire the Mexican Historical Landings Data for king and Spanish mackerel for the southern Gulf of Mexico.
4. To procure king and Spanish mackerel specimens for stock assessment studies.

Schedule:

This project is of one-year duration. However, 1991 is the sixth consecutive year Mote Marine Laboratory (MML) has conducted this research in cooperation with the National Marine Fisheries Service (NMFS-Panama City Laboratory) and the Mexican Instituto Nacional de la Pesca (INP) under the auspices of the MEXUS-Gulf Agreement. Since the winter tagging effort will take place in November and December, the number of mackerel tagged and the length/frequency and CPUE data for this project are not complete.

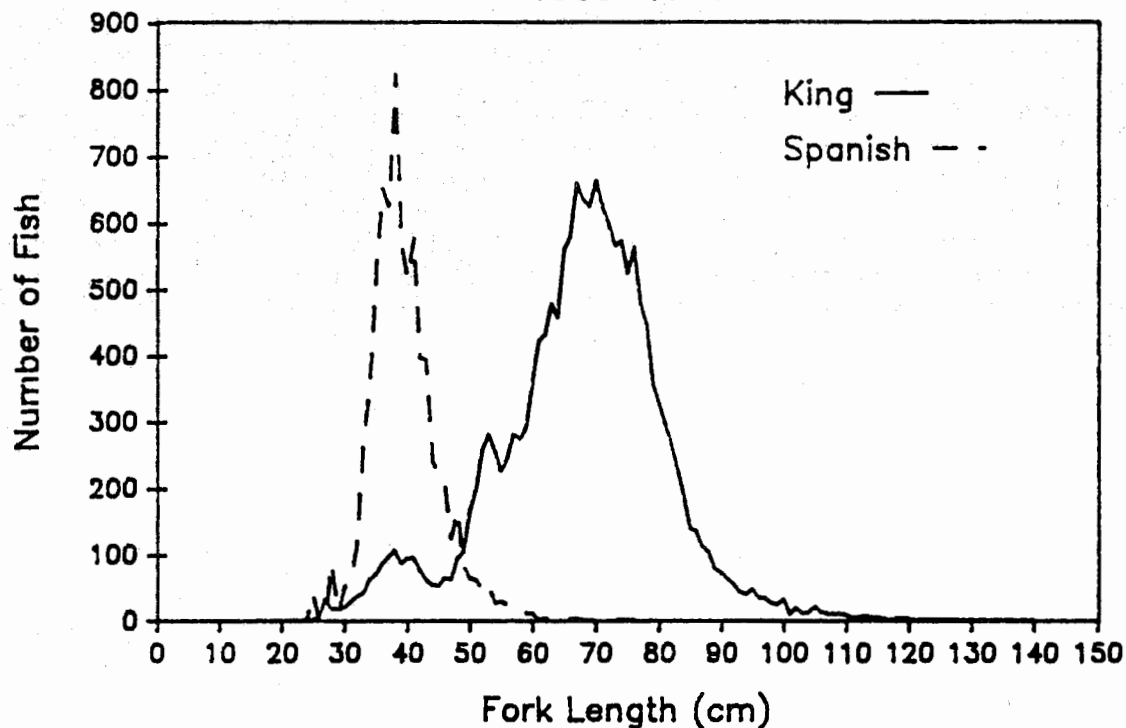
Summary of Results

To determine movement and migration patterns of Spanish mackerel (*Scomberomorus maculatus*) during 1991 in the southern gulf, 192 Spanish mackerel were tagged off Veracruz, Mexico, during the spring (March-May). More Spanish mackerel will be tagged off the Yucatan Peninsula during the winter tagging effort (November-December). The spring tagging effort increased the six-year tally to a total of 3,092 (1,855 KM and 1,237 SM) mackerel tagged. From January 1-August 1, 1991, 21 Spanish mackerel tags and one billfish tag have been recovered. During the past five and one-half years, 270 mackerel (181 KM, 89 SM) have been recovered under MML's Rapid Reward System. Length/frequency measurements for king (2,376), Spanish (2,019) and cero (6) mackerel were recorded during 1991, making a total of 18,964 king, 9,641 Spanish and 6 cero mackerel measurements during the past five and one-half years. In 1991, 74 measurements of CPUE were obtained, providing a five-and-one-half year total of 5,351 measurements. Historical Landings Data for 1989 and the preliminary 1990 totals for both species from all Mexican Gulf Coast States, have been obtained

and sent to NMFS-Panama City. Data are reported by year, month, state, port and weight (in metric tons). In 1991, 418 adult mackerel samples have been sent to NMFS-Panama City for electrophoretic studies. Adult mackerel samples included 197 king mackerel (Scomberomorus calvalla) and 221 Spanish mackerel (S. maculatus). A six-year total of 2,695 mackerel samples (1,243 king, 871 Spanish, 155 cero, 23 Serra Spanish and 403 juvenile king) have been sent to NMFS-Panama City for electrophoresis. Otoliths from adult king (191), and Spanish (215) mackerel were collected during 1991. Combined with the collections from previous years, the total number of mackerel otoliths obtained is 1,454. Right otoliths were sent to NMFS-Panama City, the left to INP-Mexico City. The 1991 values and six-year totals are not final as work will continue in Mexico through December, 1991.

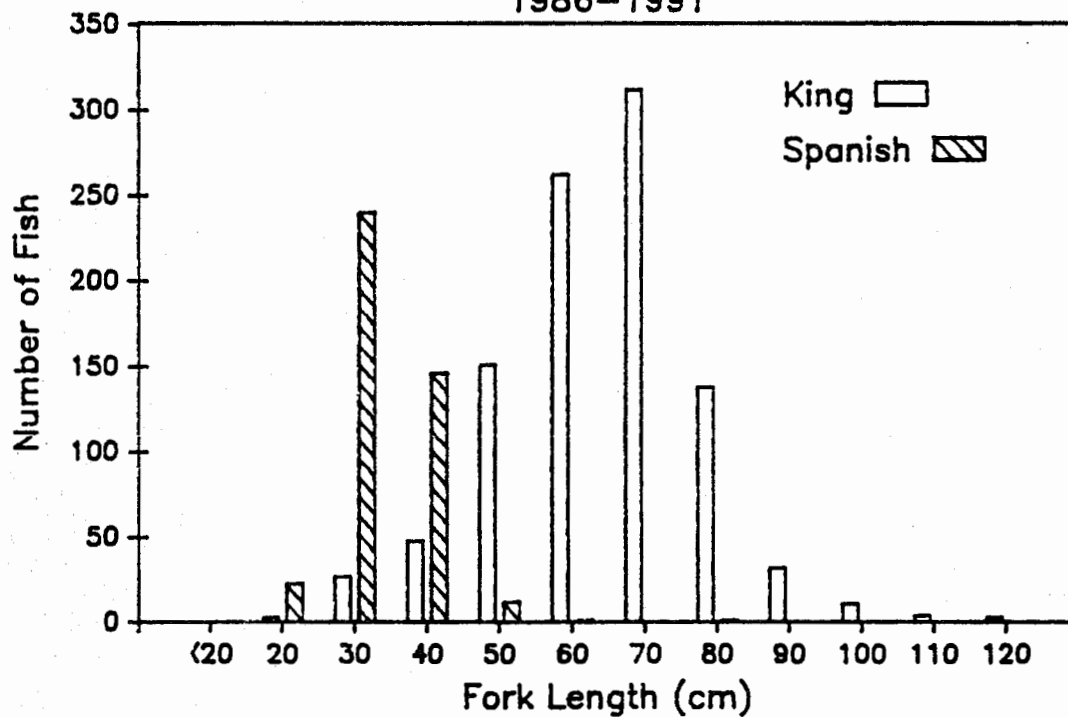
L/F Summary for King And Spanish Mackerel from Mexican Gulf States

1986-1991



Otolith Collection Size Range Summary for King and Spanish Mackerel from Mexican Gulf Coast States

1986-1991



- Figure 1. Number of mackerel tagged off Mexican Gulf Coast States (1986-1991).
 Figure 2. Significant long distance tag returns between the U.S. and Mexico (1986-1991).
 Figure 3. Significant tag returns within Mexico and from Veracruz, Mexico, to the U.S. (1986-1991).
 Figure 4. Important tag returns from Texas to Mexico (1986-1991).

Fig. 1

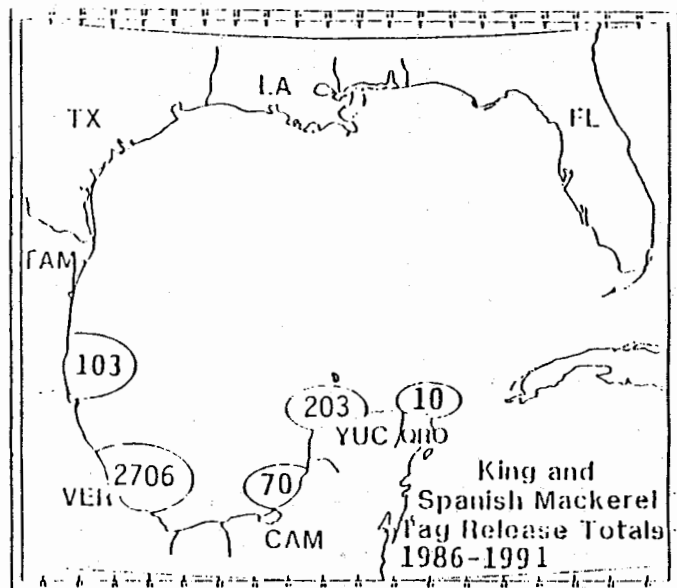


Fig. 2

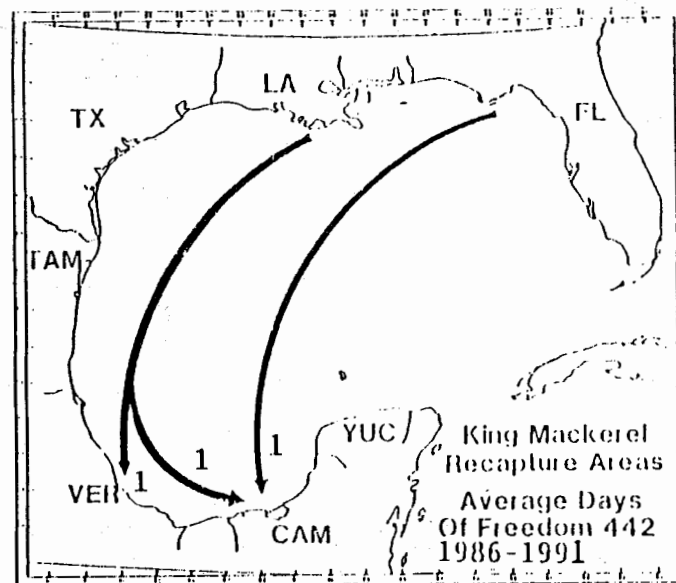


Fig. 3

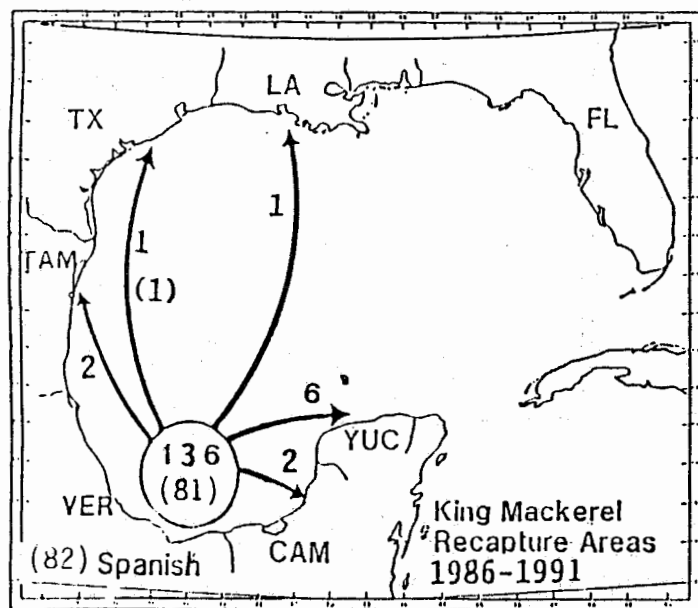


Fig. 4

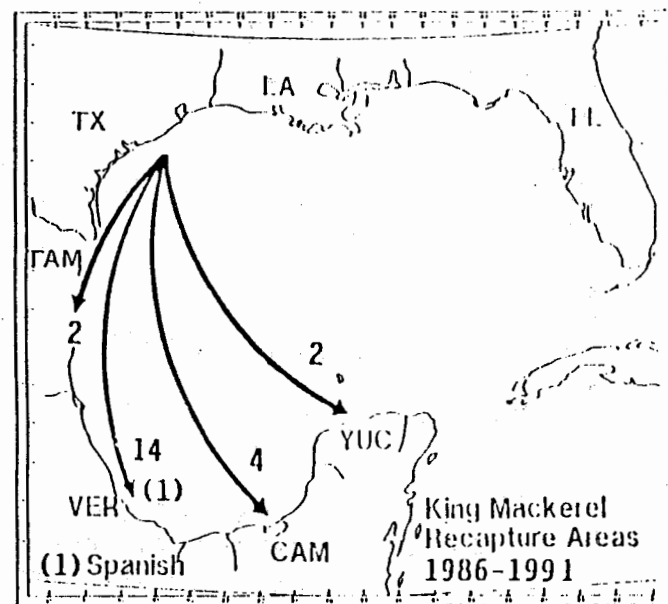


Figure 5. Significant tag returns from Tamaulipas to other Mexican states (1986-1991)
 Figure 6. Significant long distance tag returns from Campeche to other Mexican states (1986-1991).
 Figure 7. Important long distance tag returns from Yucatán to Veracruz (1986-1991).

Fig. 5

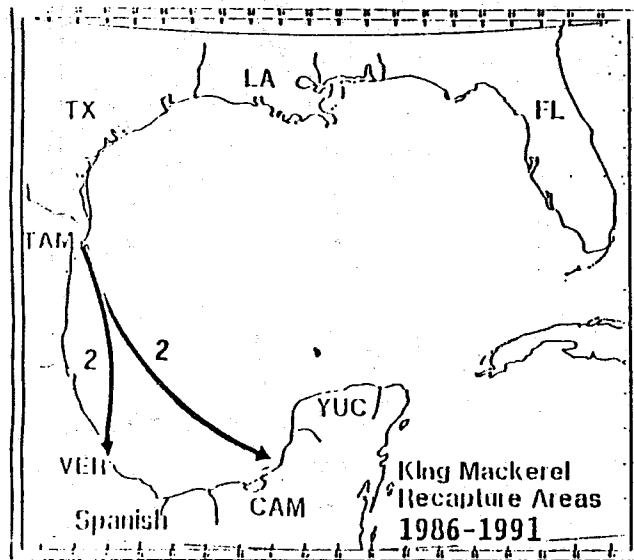


Fig. 6

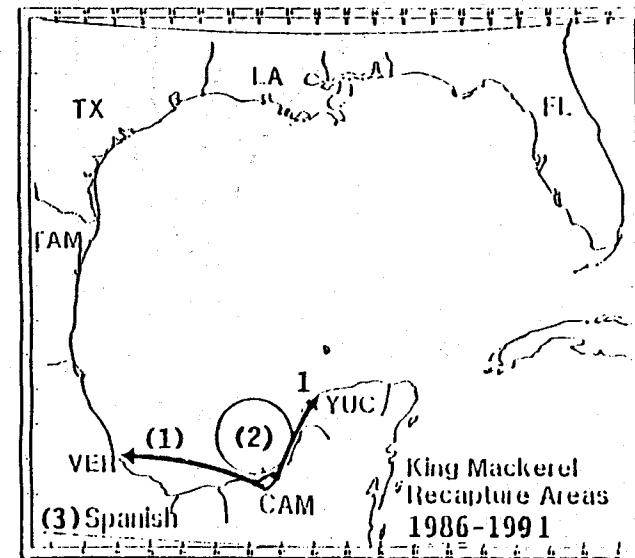
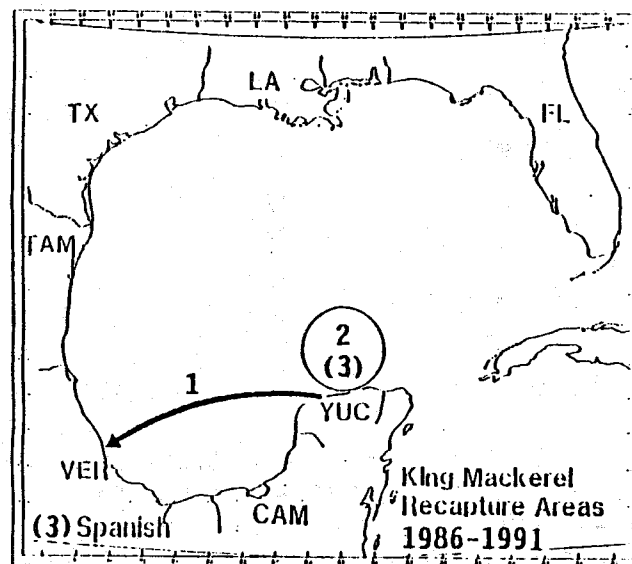


Fig. 7



Corky Perret - If the data show that it needed additional restrictions, are Mexican biologists going to use their influence and recommend additional restrictions on the fishery, and if they're even recommended do you think they would even be considered by the management level government?

Karen Burns - Well, I have seen more and more of interest in the Mexican biologists in looking at management for the king and Spanish mackerel fisheries. Whether at this time the government would actually entertain implementing any sort of recommendation put forth by the Mexican biologists, I don't know. It is a new administration that is coming to power just this last couple of months and I don't know what their feeling would be.

Bob Shipp - Karen, the lack of much catch in Quintana Roo and in Puerto Morelos, is that due to the fact that the mackerels are not there or there's not a fishery developed or is the reporting a problem.

Karen Burns - The lack of mackerel there is basically because lobster is king and the fishermen get so much more money for lobster than they do for finfish that they ignore finfish with the exception of setting out gillnets for red grouper and red snapper that they can collect at the same time they are collecting the lobster. The only time that they actually turn their attention to finfish is during the season when lobster is closed. So there are fish there because the Cubans fish them right off the island of Quintana Roo; so there is a Cuban fishery for king mackerel.

Bob Shipp - But if they got any tagged returns do you think there is any likelihood you might hear of them?

Karen Burns - I was in Cuba last year and I asked some people that were involved in the fishery over there and so far they haven't gotten any tags.

Bob Shipp - I hear anecdotally that the lobster fishery is on the decline there, do you think if that is true there may be a shift towards finfishing, or is that wrong and the lobster fishery is maintaining itself?

Karen Burns - I don't know about the lobster fishery, but I think that if it is, the fishermen will probably except one little island that's more into the gulf than into the Caribbean whose fishermen consistently go out for king and Spanish mackerel with gillnets. With that exception I think that most of the fishermen will go out and target red grouper, red snapper instead.

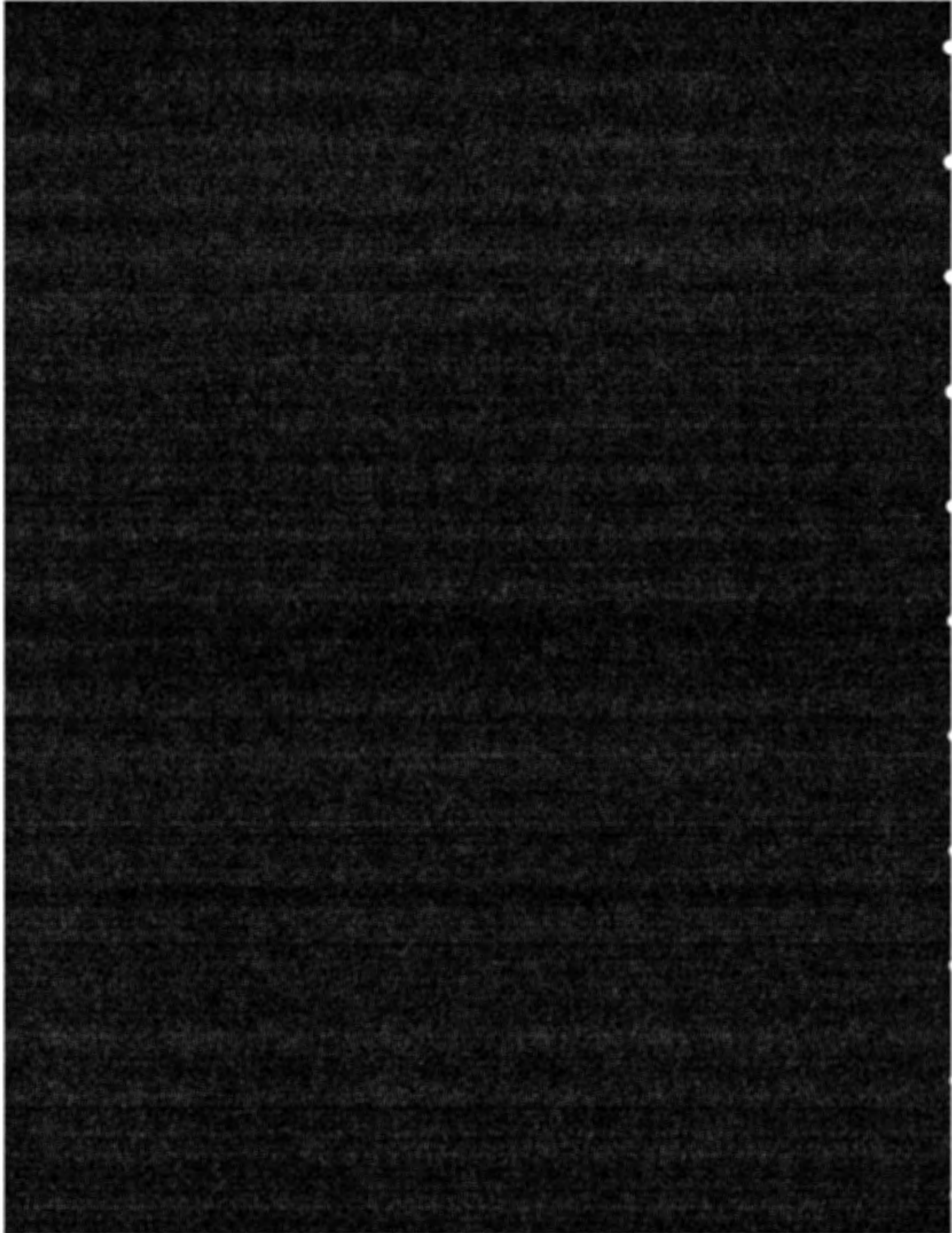
Hal Osburn - Karen, do you have a hypothesis on why the king mackerel are larger in general in May than in January of those different years?

Karen Burns - I think probably one of the reasons is that we don't have depth data. The fish that we catch in January are usually off Yucatan peninsula. The ones that we catch in May are off Veracruz. The majority of the fish that are caught off Yucatan are caught in gillnets and that would be in the winter months and the majority or a good portion of the fish that are caught in Veracruz are caught by hook and line and I don't know as far as depth is concerned whether it is just gear that's making that difference or whether it's also depth.

Wayne Swingle - Karen, what are the typical exvessel prices for king and Spanish mackerel in terms of the U. S. dollars to date?

Karen Burns - Well, it changes very rapidly, and it also depends on whether you want to buy Mexican fish or you want to buy export quality fish. There's two different prices in Mexico. You go into a fishhouse, you can get internal fish that are going to be used in Mexico which are poor quality, or fish that are for export which are a lot more expensive and they are a higher quality. Those are the fish that are kept on ice, you look at them their gills are nice and red, their eyes are clear. The fish that are used internally, well..

SESSION V
REEF FISH AND OCEAN PELAGICS



SESSION V-REEF FISH AND OCEAN PELAGICS - Wayne Swingle, Chairman

Wayne Swingle - We'll begin with Joanne Shultz's presentation on the "Early Life History of Snappers in the Coastal and Shelf Waters of the Northeast Gulf of Mexico."

**Early Life History of Snappers in Coastal and Shelf Waters
of the Northcentral Gulf of Mexico Late Summer/Fall Months, 1983-1989**

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Ocean Springs, MS 39564

Abstract

Within recent years it has become apparent that both commercial and recreational segments of the reef fish fishery in the Gulf of Mexico are in trouble. Numerous taxa of fishes contribute to the gulf reef fish resource but the majority of species belong to the family Lutjanidae, the snappers. Primary objectives of this project (completion date, 30 September 1991) were to: document and describe the distribution and relative abundance of snapper larvae, especially red and vermilion snapper, in northcentral gulf coastal and shelf waters from extensive collections primarily in the month of September; provide new data on snapper spawning locations in relation to both natural and artificial reef sites; describe the developmental morphology of small, < 4 mm, preflexion red and vermilion snapper larvae; and assess the feasibility of aging snapper larvae using daily otolith growth increments.

Identification of snapper larvae from northcentral gulf collections was believed to be a more tractable undertaking than in southern waters because there are fewer species in northern waters. Yet initially, specific identification was difficult because most snapper larvae in these collections were < 4.0 mm in length, i.e., in stages prior to dorsal and pelvic spine formation and smaller than the larvae described in published accounts of three common northern gulf species. Three different morphological types were found among our small, unidentified larvae based primarily on the presence or absence of pigment on the anterior surface of the gut, isthmus or throat musculature, and dorsal midline. These three larval morphs have now been identified as the larvae of vermilion and red snapper, and the wenchman (Pristopomoides aquilonaris) by linkage to progressively larger larvae that could be identified using published accounts or adult fin ray counts. Illustrations depicting the key characters used to distinguish small red and vermilion larvae are shown.

Collections at 19 to 60 locations from Chandeleur and Breton Sounds, Louisiana to northwest Florida during Mississippi/SEAMAP Fall Ichthyoplankton surveys in September 1986 to 1989 indicated that snapper larvae are more abundant in the eastern end of the survey area than in the western end nearer the Mississippi River delta. Discrete depth collections taken in 1983 & 1984 and 1986 & 1987 indicated that snapper tended to be more abundant at or below 5 m than in the upper 5 m of the water column. Now that all of our material has been examined it is evident that the most abundant larval snapper in the 1986-89 September collections were vermilion snapper. Red snapper larvae accounted for only 0.3 to 23% (mean = 6%) of the total number of identified snapper larvae in these same collections.

Distinct growth rings were found on whole-mounted otoliths of both red and vermilion snapper larvae suggesting that otolith increment counts could be useful

in estimating the age of field-caught larvae. Counts of otolith rings in 2 to 5 mm vermilion snapper larvae are presented. Analysis of larval snapper age and growth relations remains contingent on verification of the daily periodicity of these growth marks. Workers at the University of Miami have already confirmed the daily deposition of growth rings on the otoliths of land and yellowtail snapper larvae (Dr. Liz Clark, pers. commun.).

The major contributions of our study have been to more completely describe red and vermilion snapper larvae, and to ascertain the feasibility of aging red and vermilion snapper larvae using otolith growth increments. These results will allow larval abundance data to be used to more completely describe seasonal spawning curves and habitats, and to assess adult stocks.

**Investigation of Life History Parameters of Species of
Secondarily Targeted Reef Fish and Dolphin in the
Northern Gulf of Mexico**

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Coastal Research and Development Institute
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Abstract

This project has focused on life history parameters of secondarily targeted reef fishes (e.g. lane and gray snapper, gray triggerfish, and gag grouper) in the north central Gulf of Mexico with the inclusion of some data on the red snapper (Lutjanus campechanus). Emphasis has been placed on obtaining age-at-length data, growth rates and movement of reef fishes. We are currently completing the third year of a three year project.

Otoliths were collected from reef fishes caught from charter boats and trawlers in the north central Gulf of Mexico. Fork and total lengths were recorded to the nearest millimeter, and sex was recorded when available. Of the 1698 red snapper (Lutjanus campechanus) otoliths collected, 439 were sectioned; rings could be identified and counted on 92% of the sectioned otoliths. Each ring was considered to be an annulus. Observed age at length ranged from 184 mm for age 1 to 890 mm for age 30. Growth rate curves obtained from tag and release of red snapper tended to validate data obtained from sectioned otoliths.

Otoliths were sectioned from 107 lane snapper, Lutjanis synagris, and rings could be identified and counted on 96%. Observed age at length ranged from 156 mm for age 1 to 504 mm for age 7. Sixty-four otoliths donated by NMFS (Beaufort, NC) from Southwest Florida were sectioned with 100% legibility. Observed age at length ranged from 250 mm at age 1 to 377 mm at age 11. Observed age at length was higher for lane snapper in the north central gulf compared to Southwest Florida (present study) and Southeast Florida (Manooch and Mason 1984).

Twenty-three otoliths were sectioned from gray snapper, Lutjanus synagris, with 100% legibility. Observed age at length ranged from 276 mm at age 1 to 733 mm at age 27.

Four-hundred-twelve (412) out of 916 first dorsal spines from gray trigger fish, Balistis capriscus, were sectioned and rings could be identified and counted on 87%. Observed age at length ranged from 276 mm at age 1 to 500 mm at age 7 (Florida).

Observed growth rate for the north central Gulf of Mexico (present study) was similar to observed and back-calculated growth rates found in the Northeastern Gulf of Mexico (Johnson and Salomon, 1984).

Eighty otoliths from gag grouper, Mycteroperca microlepis, were sectioned and rings could be identified and counted on 97%. Observed age at length ranged from 392 mm at age 1 to 1185 mm at age 18.

Data on dolphin (Coryphaena hippurus) captured from the north central gulf indicated rapid growth, with rates averaging 3.88 mm SL/day. Maturity was complete at 50 cm SL for females and 52.8 cm SL for males. A maximum age of about four years is predicted for this species in the north central gulf (Bentivoglio, 1989).

Literature cited:

Bentivoglio, A. A. 1989. Fishes parameters of dolphin (Coryphaena hippurus) in the Gulf of Mexico. MS Thesis. United College of North Wales, Bangor, Gwynedd, North Wales, United Kingdom. 30 p.

Johnson, A. G., and C. H. Saloman. 1984. Age, growth, and mortality of gray trigger fish, Balistis capriscus, from the Northern Gulf of Mexico. Fish Bull. 82(3):485-492.

Manooch, C. S., and D. L. Mason. 1984. Age, growth, and mortality of lane snapper from Southern Florida. N. E. Gulf Science, 7(1):109-115.

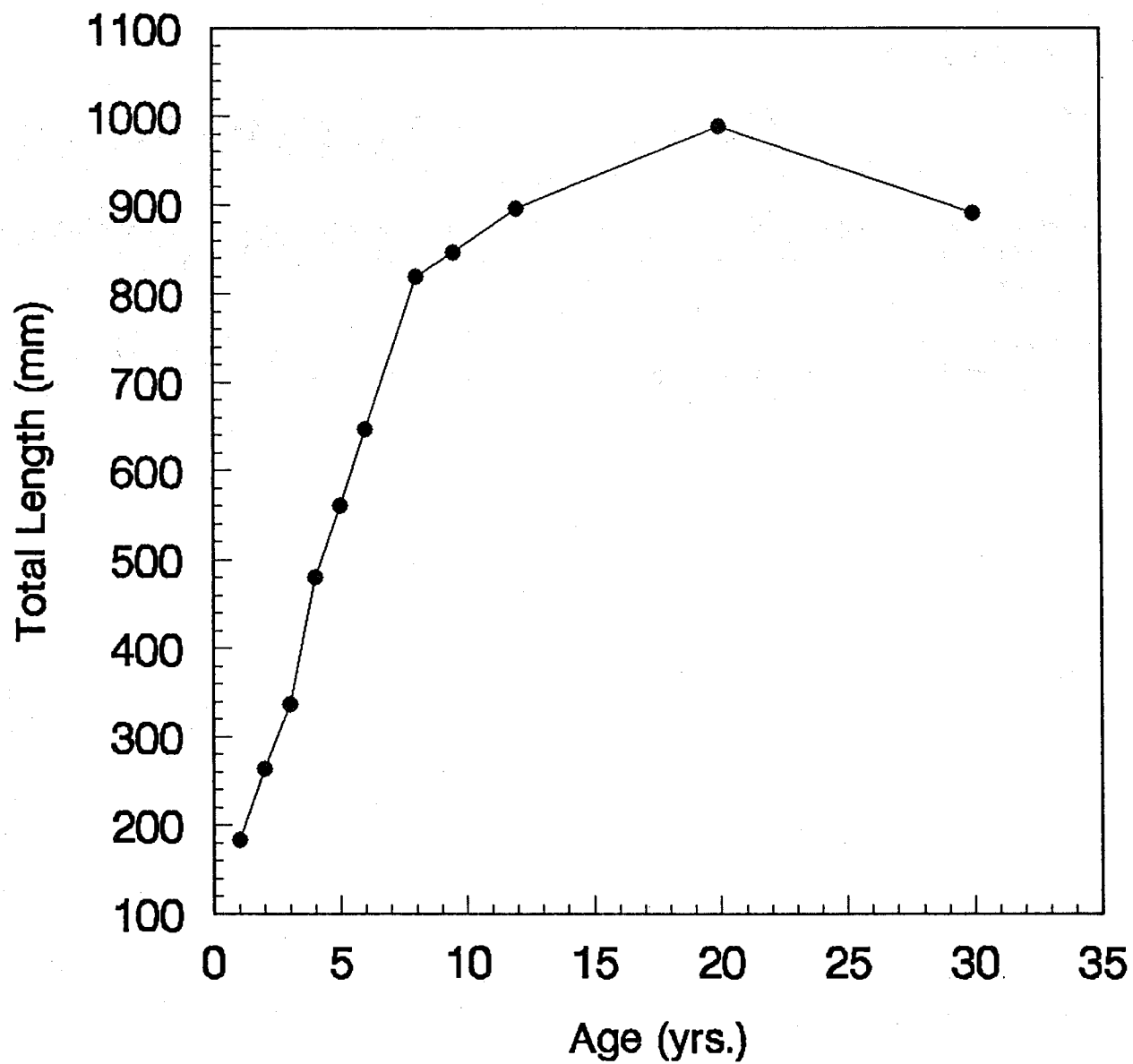


Figure 1. Age (years) versus total length (mm) for red snapper (Lutjanus campechanus) aged by cross sectioned otoliths collected in the North Central Gulf of Mexico.

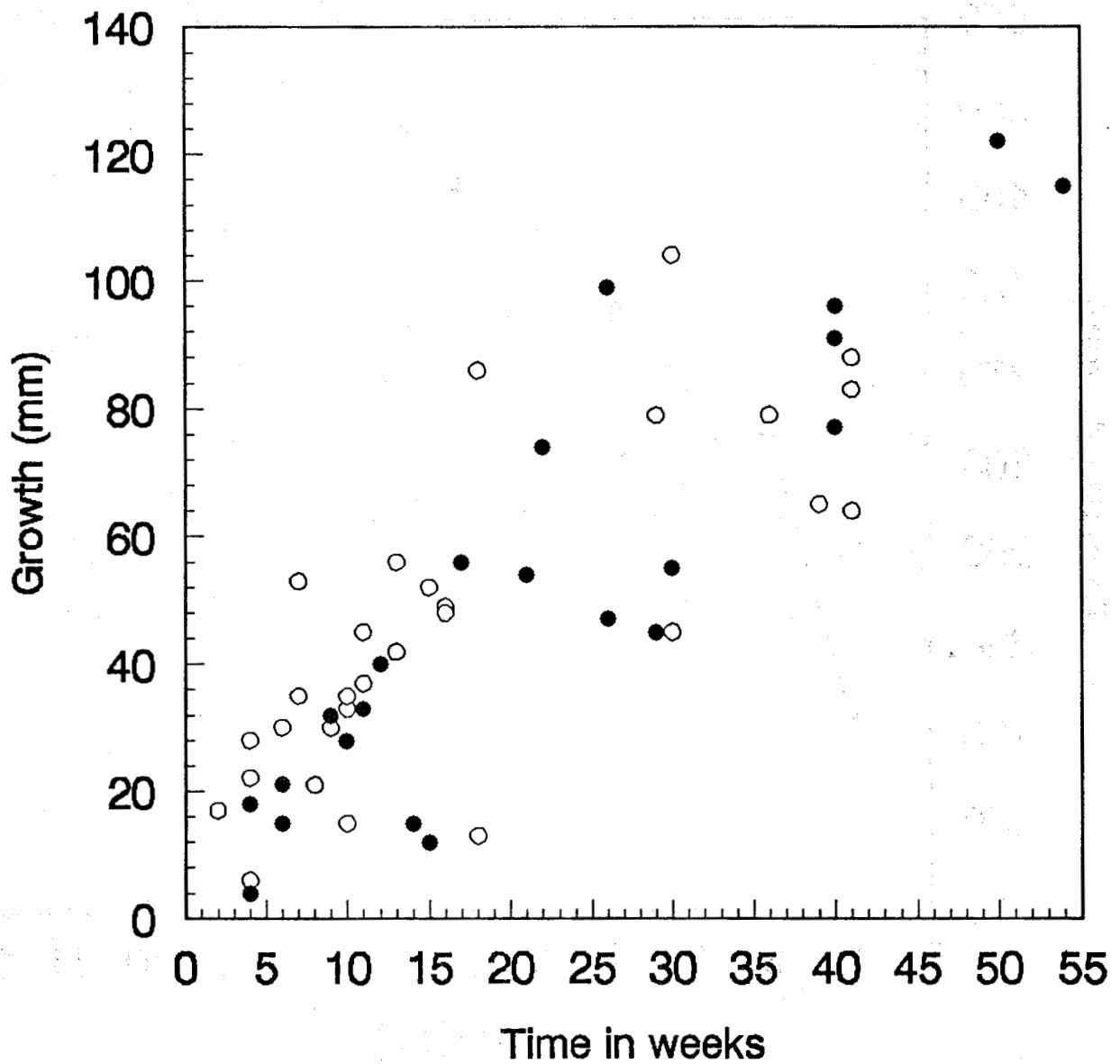


Figure 2. Growth (mm) versus time (weeks) of red snapper tagged and released from Dauphin Island and Orange Beach, Alabama. Open circles denote fish measured by the recoverer (converted from inches) and solid circles denote fish measured by lab personnel.

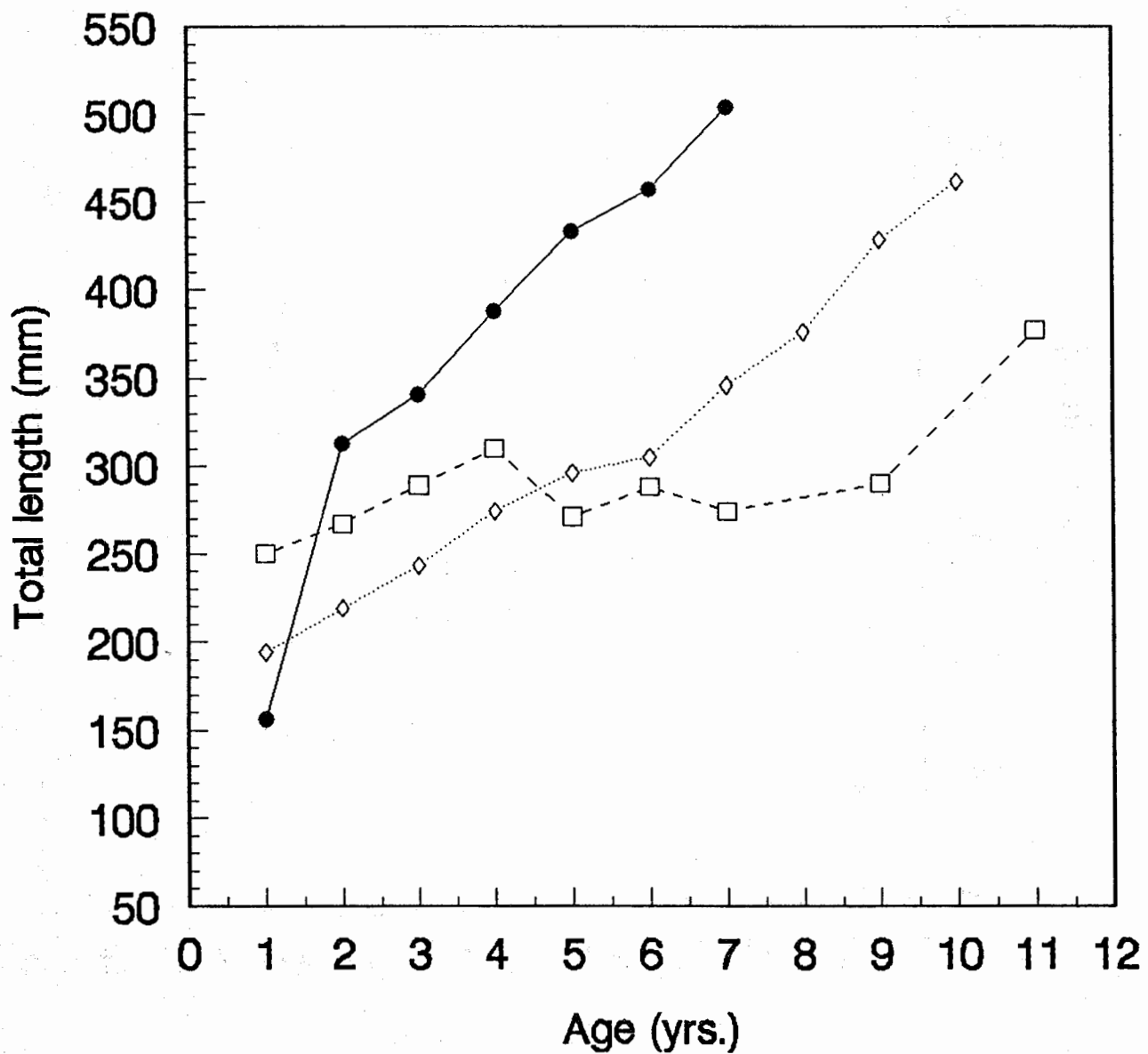


Figure 3. Age (years) versus total length (mm) for lane snapper (*Lutjanus synagris*) aged by cross sectioned otoliths. Solid circles denote observed growth rate from the North Central Gulf of Mexico, open squares denote observed growth rate from Southwest Florida (present study), and open diamonds denote observed growth rate from Southeast Florida (Manooch and Mason 1984).

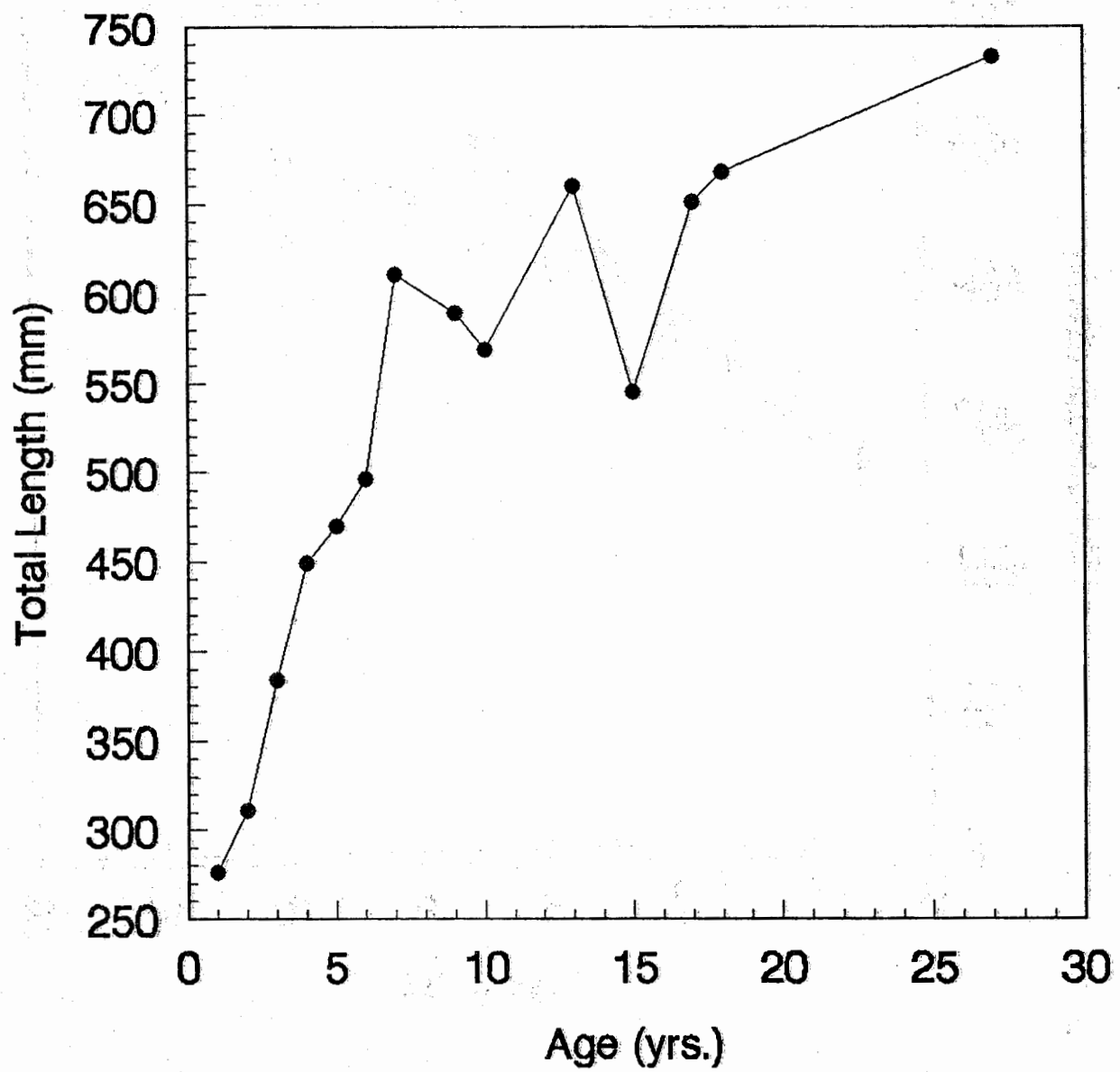


Figure 4. Age (years) versus total length (mm) for gray snapper (Lutjanus griseus) from the North Central Gulf of Mexico aged by cross sectioned otoliths.

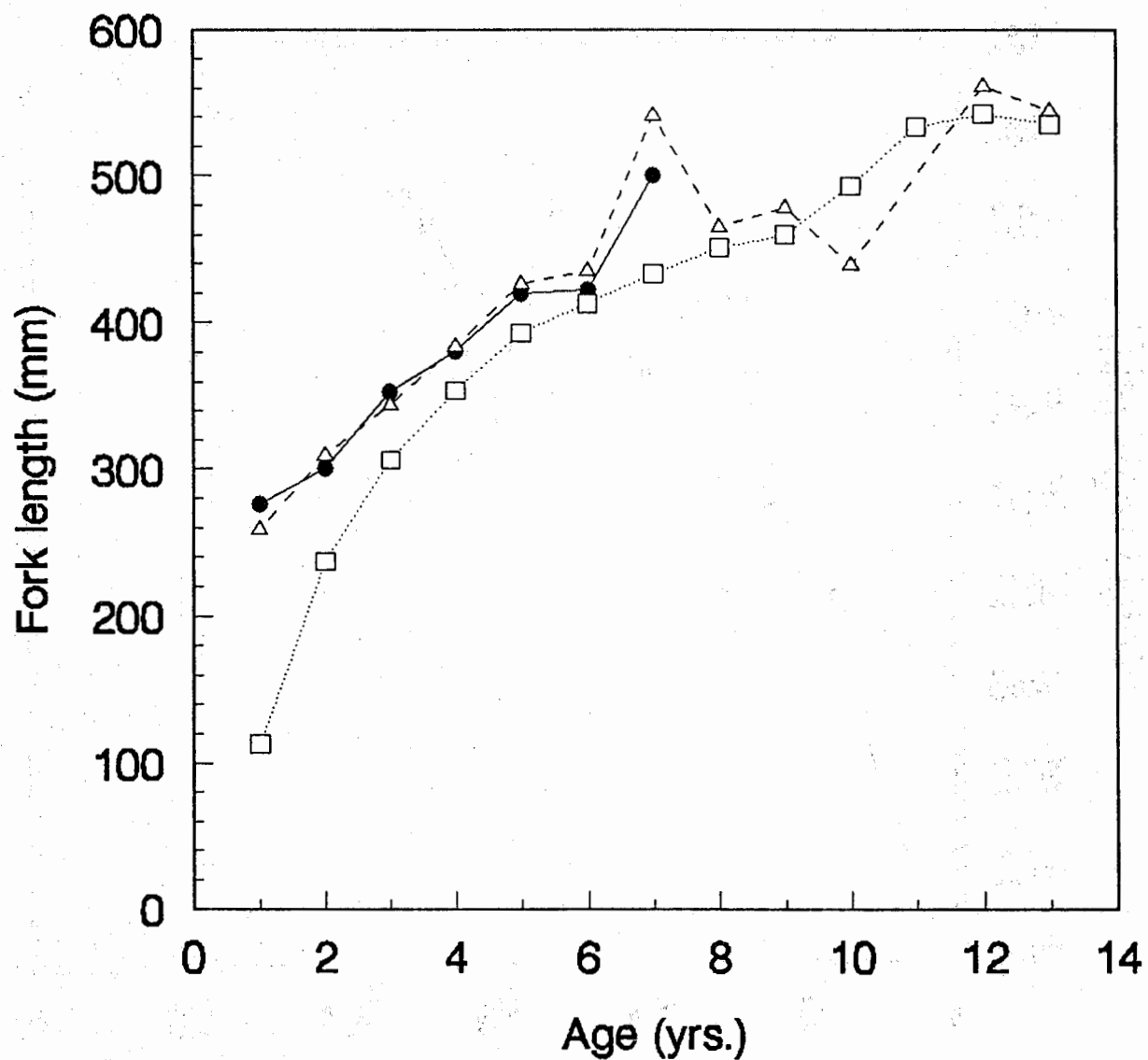


Figure 5. Age (years) versus fork length (mm) for gray triggerfish (*Balistis capriscus*) aged by cross sectioned first dorsal spines. Solid circles denote observed growth rate from the North Central Gulf of Mexico. Open triangles denote observed growth rate and open squares denote back-calculated growth rate from the Northeast Gulf of Mexico (Johnson and Saloman 1984).

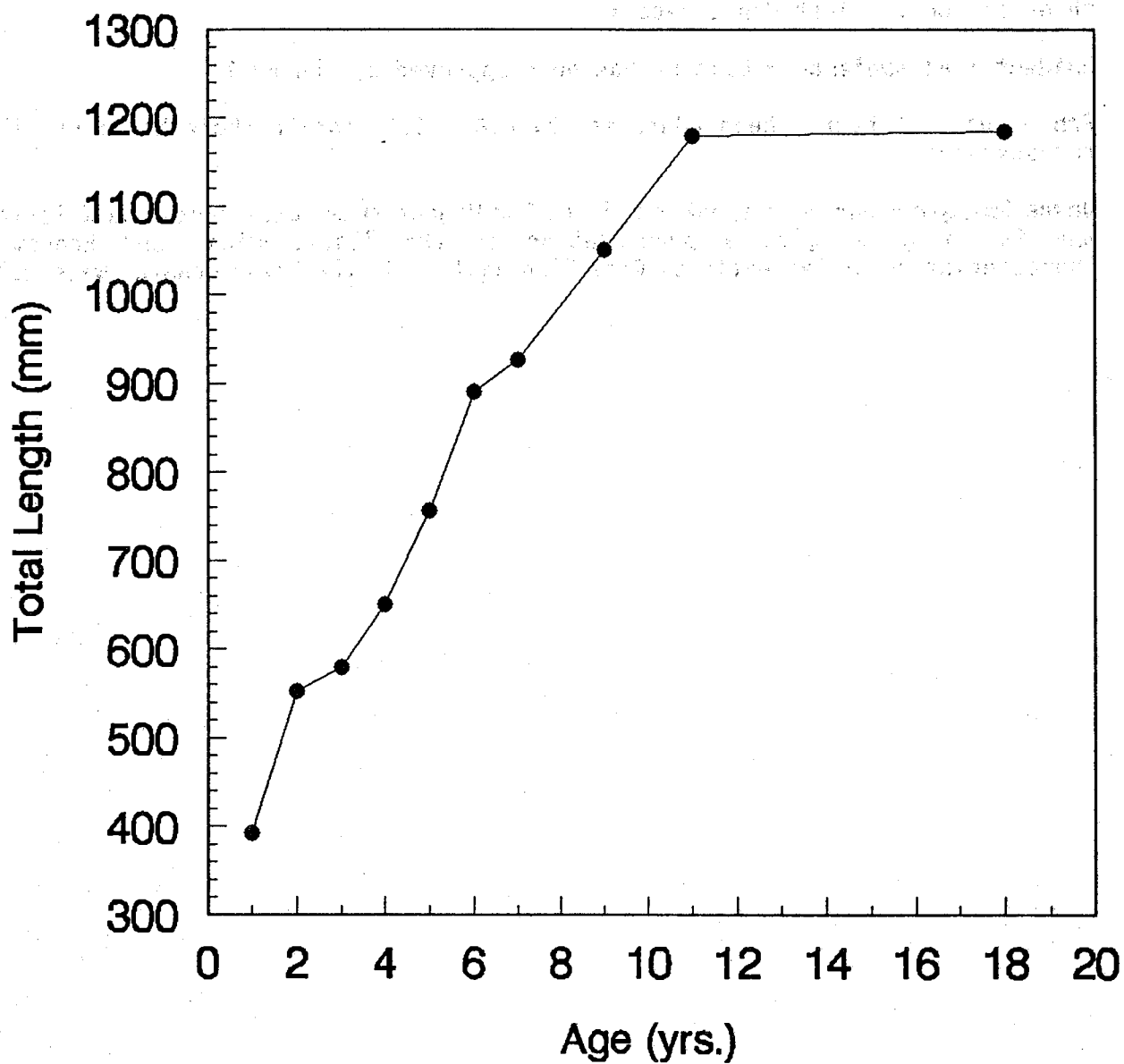


Figure 6. Age (years) versus total length (mm) for gag grouper (Mycteroperca microlepis) aged by cross sectioned otoliths.

Unidentified Audience - Do you have any information for yellow edge grouper or for amberjack?

Bob Shipp - Amberjack, I'll let Bruce Thompson address that I think a little later on today. The yellow edge groupers, gosh, I don't think we got more than three or four, I just don't recall.

Unidentified Audience - Calcine has been approved by the FDA?

Bob Shipp - It hasn't been addressed by FDA. It's not on their hit list like tetracycline.

Wayne Swingle - Our next speaker will be Tom Wagner from Texas Parks and Wildlife who is going to give a presentation on the "Sociological and Economic Characteristics of Recreational Reef Fish Anglers in the Texas Coastal Waters."

Sociological and Economic Characteristics of Recreational Reef Fish Anglers in Texas Coastal Waters

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Abstract

Introduction

This project summarizes data obtained from Texas Parks and Wildlife Department's on-site creel survey and statewide mail survey pertaining to sociological and economic characteristics of recreational reef fish anglers in Texas coastal waters. Intercept data from anglers landing reef fish and mail survey data from anglers preferring reef fish were compared to data from other user groups. The project year runs from 1 October 1990 through 30 September 1991, and utilizes on-site survey data collected during the interval 15 May 1987 through 21 February 1990, and mail survey responses from 1986 through 1989. Dr. Robert B. Ditton and Dr. John Stoll of Texas A&M University assisted with the design and implementation of the sociological and economic portions of both the on-site survey and the mail survey.

Summary of Results

The on-site survey compared successful gulf reef fish anglers (n=295) with successful gulf anglers landing fish other than reef fish (n=936) and successful bay and pass anglers (n=18,219). All three user groups rated nonconsumptive aspects of their fishing trips more important than either catching or keeping fish. Both groups of gulf anglers reported greater trip satisfaction and perceived themselves as catching and keeping more fish than did bay and pass anglers. Mail survey respondents who listed reef fish as their preferred species (n=482) supported management tools relating to area restrictions more than size and bag limits, gear, and bait restrictions.

Gulf anglers landing reef fish spent an average of \$102 per trip, while anglers landing other gulf species and successful bay and pass anglers spent \$165 and \$85, respectively. Based on a contingency valuation questionnaire format, both groups of gulf anglers would have been willing to spend more to continue fishing than bay and pass anglers. Gulf reef fish anglers reported an average of 22 saltwater trips in the previous year, while other gulf anglers and bay and pass anglers reported 19 and 24 trips, respectively. Gulf reef fish anglers caught nearly seven fish/person/trip, while other gulf anglers and bay and pass anglers caught an average of three and four fish/person/trip, respectively.

These Texas results provide a proxy of the sociological and economic characteristics of reef fish anglers throughout the gulf. Support of various management tools indicate that reef fish anglers may be amenable to different fishery management techniques than those currently used in Texas coastal waters.

Information reported here may be useful as baseline data for subsequent comparisons of sociological and economic impacts of recreational reef fish regulations.

Genetic Studies to Determine Stock Structure of Reef Fishes in the Gulf of Mexico

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Abstract

Introduction

This project is a one-year study designed to generate mitochondrial mtDNA probes for three target reef fish groups, viz., snappers, groupers, and jacks. Specific objectives were to: (1) generate mtDNA probes for each target group using recombinant DNA technologies; and (2) survey restriction enzyme variation among the mtDNAs of geographic samples of three target species, viz., red snapper (*Lutjanus campechanus*), red grouper (*Epinephelus morio*), and greater amberjack (*Seriola dumerili*), in order to identify informative or polymorphic enzymes. The overall goal of the project was to provide group specific mtDNA probes and background information on each target species in order to allow initiation of studies on the genetic stock structure among species in each target group.

Summary of Results

Appropriate tissues were obtained during the fall of 1990 from individuals of the three target species as follows: red snapper (25 individuals offshore from Port Aransas, TX; 36 individuals offshore from Grand Isle, LA; and 25 individuals offshore from Pensacola, FL); red grouper (46 individuals from the Middle Grounds off of the west coast of Florida and 5 individuals from the Dry Tortugas off of the Florida Keys); and greater amberjack (1 individual offshore from Port Aransas, TX; one individual offshore from Grand Isle, LA; 26 individuals offshore from Pensacola, FL; and 34 individuals offshore from Sarasota, FL). All individuals were obtained by angling.

Entire mtDNA molecules from red snapper and red grouper were cloned into lambda bacteriophage using the lambda DASH-II system and EMBL arms with BamHI compatible ends. The size of both mtDNA molecules is ca 16.8 \pm 0.2 kilobases (kb). Using the same approach, a BamHI-generated fragment (ca 13 kb) from the mtDNA of greater amberjack was also cloned into lambda. The size of the mtdna molecule of greater amberjack is ca 17.5 \pm 0.2 kb.

Red snapper mtdnas were screened with 33 different restriction enzymes. Thirteen (13) enzymes were found to be polymorphic. The polymorphic enzymes (number of restriction sites resolved) were as follows: ApaI (3); BclI (5); DraI (8); HindIII (4); HpaI (3); NcoI (4); NheI (9); PvuII (3); ScaI (4); SmaI (4); SstI (4); StuI (8); and XbaI. Invariant enzymes which were found to have only a single site (useful in constructing a mtDNA map) included: BglIII, MluI, NdeI, NsiI, and PstI. Twenty-seven (27) mtdna haplotypes (genotypes) were found among the 81 individuals surveyed. Nucleon diversities within samples ranged from 0.60 (TX sample) to 0.87 (FL sample). The overall nucleon diversity was 0.77. Mean nucleotide sequence divergence (\pm SE) among the 27 haplotypes was 0.56 \pm 0.3 per cent. Heterogeneity tests of haplotype frequencies by locality and both

Unidentified Audience - Is there any reason you don't calculate variance?

Tom Wagner - As of today we have not done any analysis on this data, it will need to be done in the future.

Wayne Swingle - Our next speaker will be John Gold from Texas A&M University, and John's going to give you a presentation on the "Genetic Studies to Determine Stock Structure of Reef Fishes in the Gulf of Mexico."

cladistic and phenetic analysis suggest that red snapper may not be genetically subdivided in the northern Gulf of Mexico.

Red grouper mtDNAs were screened with 35 different restriction enzymes. Ten (10) enzymes were found to be polymorphic. The polymorphic enzymes (number of restriction sites resolved) were as follows: ApaI (4); KpnI (3); NcoI (2); NdeI (3); NheI (3); NsiI (2); PvuII (4); SspI (7); XbaI (4); and XmnI (7). Invariant enzymes which were found to have only a single site included: Alw44I, BamHI, Csp45I, EcoRV, MluI, and SstI. Twelve (12) mtDNA haplotypes were found among the 51 individuals surveyed. The overall nucleon diversity was 0.42. Mean nucleotide sequence divergence (\pm SE) among the 12 haplotypes was 0.24 ± 0.01 percent, indicating that all 12 haplotypes were derived fairly recently from one another.

Work on mtDNA variation in greater amberjack is still in progress. Thus far, 59 individuals have been screened with 22 different restriction enzymes. Twelve (12) enzymes have been found to be polymorphic. The polymorphic enzymes (number of restriction sites resolved) are as follows: ApaI (4); DraI (6); EcoRI (2); EcoRV (3); HindIII (3); HpaI (3); NcoI (4); NsiI (2); ScaI (5); SstI (5); PstI (4); and PvuII (3). Invariant enzymes which have been found to have only a single site include: ClaI, NdeI, NruI, and XhoI. Thirteen (13) mtDNA haplotypes have been identified, although all polymorphic enzymes have not been screened for all individuals. Preliminary estimates of nucleon diversity within samples are 0.79 (Pensacola, FL) and 0.72 (Sarasota, FL); the preliminary "overall" estimate is 0.75. Preliminary heterogeneity tests of mtDNA haplotype frequencies suggest that the two samples of greater amberjack from Florida are not differentiated genetically.

Bob Shipp - John, nucleon diversity which you have mentioned twice today is intriguing, but it also has very, very serious implications and possible uses as a tool to get information that we don't really have an easy way to get anywhere else. My question is has anyone done that sort of analysis on species with known small population?

John Gold - Yes, we also work on minnows which often have very small population sizes. Nucleon diversity is, at present, the only easily applied estimator or variation, not differentiation, in mitochondrial DNA molecules. As such, it hasn't been broadly used and we don't have a lot of data from tested organisms relative to what you're asking.

Robert Shipp - Are you the only group doing this sort of thing? The one that came to mind was sturgeons where you've got a really limited population, you know its like 100 to 1,000. Even minnows who have a broadly distributed population can still be tens of thousands or millions.

John Gold - Well, there was a recent paper on sturgeons in Marine Biology.

Bob Shipp - Doing the same thing?

John Gold - Oh, exactly the same thing. The sample sizes were fairly small and intermediate nucleon diversities, somewhere around 0.6 as I recall, were found. The paper had the data, but I can't remember the exact values. Other species studied in the paper were black sea bass and menhaden.

Bruce Thompson - Are there any studies of animals like desert pupfish or something where we know we are only talking about a couple thousand, maybe 5,000, 6,000, where you would find out what is a value of a population that's really almost down to nothing.

John Gold - There's really not a whole lot of comparative data. In our laboratory we study a lot of cyprinids, but some cyprinids, certainly some of the groups (for example, the red shiners) that we study, have relatively large populations.

Bruce Thompson - You're still I think talking about real large populations.

John Gold - I know what you're asking. I'm not really sure. To my knowledge, there are no studies with sufficiently different known population sizes to ask whether these estimators of variation are worth it. I don't think they exist in the appropriate kinds of taxa.

Gene Nakamura - John, do your diversity indices of nucleon diversity in the mitochondrial DNA molecules, those indices that you showed particularly for the red drum and red snapper indicate that the introduction of cultured specimens in the gulf isn't in common genetic integrity of the gulf population?

John Gold - I can't touch that with a ten foot pole. Truthfully, I don't really know. That is the topic of our current Sea Grant Project, and we don't have all the data at this point. Our present data would not address that issue. Further difficulty would be in terms of knowing the kinds of genotypes that have been produced for enhancement purposes through the years. That's a bit historical. I'm not sure what the answer will be. Certainly, one could obtain data to

address the issue, although how robust one's conclusions might be would be another matter altogether.

Wayne Swingle - The next speaker will be Bob Ditton from Texas A&M. Bob's presentation will be on "A Social and Economic Characterization of the Gulf of Mexico Recreational Shark Fishery."

A Social and Economic Characterization of the Gulf of Mexico Recreational Shark Fishery

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Abstract

Introduction

The goal of this research is to gain a better understanding of the social and economic characteristics of the recreational shark fishery of the Gulf of Mexico. The Draft Secretarial Shark Fishery Management Plan identified the need for more social and economic information on the fishery, and it is thought that better social and economic data could expand constituency support for shark conservation. Study objectives are as follows: 1) To provide a social and economic profile of shark tournament anglers in the Gulf of Mexico, 2) To provide a social and economic profile of party boat shark anglers in Port Aransas, Texas, and 3) To determine possible impacts of the proposed federal shark management strategy and identify future directions based on the data collected. This is a one year project.

Summary of Results

Eighteen shark tournaments were identified during 1990 in the Gulf of Mexico; nine tournaments were sampled, and seven hundred shark anglers were selected for the mail survey. Most of the sample resided in Florida (84%) and Texas (8%). Three hundred and forty-two anglers responded for an effective response rate of 58% (excluding non-deliverables). Tournament shark anglers had an average of 20 years of saltwater fishing experience, but only 10 years of shark fishing. In total, these shark anglers reported spending an average of 57 days fishing in the previous twelve months. Shark was the species most preferred (first choice) by 26% of the respondents, followed by grouper (20%) and snook (15%). Respondents usually fish for shark in the gulf, 10 miles or less from the shore, with an average expenditure of \$199 per trip. Consumers surplus was \$120 per shark fishing trip. Acceptable substitutes for shark were king mackerel, snapper, grouper, tarpon, and bonefish for the majority (>50%) of the respondents. Flounder, amberjack, billfish, pompano, sea trout and red drum were not acceptable substitutes for the majority of respondents.

Corky Perret - Bob, did you say the anglers keep 1.3 sharks per day per person or per boat?

Bob Ditton - That was per person.

Corky Perret - Texas sells the saltwater stamp so you've got the universe. Do you have a percentage of having anglers are solely after shark, you say a small number, I didn't get it.

Bob Ditton - Like red snapper, in the last presentation. They had to pool across several years to get sufficient sample size. In this case, two percent of the statewide population of saltwater anglers target sharks.

Corky Perret - What percent is done only for tournaments?

Bob Ditton - I don't know.

Bob Shipp - When you're talking about substitute species were there any of them who indicated that if they couldn't fish for shark they would just quit altogether?

Bob Ditton - Yes, 30% of the people said there was no suitable substitute for shark. But 66% were willing to make a substitution. Again, you have to remember as with angler attitudes we're dealing with the hypothetical. But that's useful, that's better than not knowing where they are likely to go. We have an idea of where they're likely to go and where they're not likely to go.

Larry Simpson - You sampled only shark tournament types, right?

Bob Ditton - We sampled among shark tournaments in the Gulf of Mexico.

Larry Simpson - Well, there's a large growing component then that I'll characterize as just private shark fishermen, and I think that will affect a great deal of that species substitution as well as catch rates.

Bob Ditton - All of my results are within the bounds that I presented. We would like to move into some of these other areas but going through our saltwater stamp and going through the statewide sampling frame that we work with every day is not going to get you far to understand that group. So we have a major sampling frame problem. I could design a study to find the general population of shark anglers using telephone intercepts that no agency in the United States could afford. We will have to use what we have.

Gene Nakamura - Bob, perhaps it is a semantic question, but I am intrigued with your conclusions about whether or not there is a directed shark fishery in Port Aransas. There seems to be a lot of evidence to the contrary. One of those is major head boats there. All the shark hunters I recall, based on my interviews and my employees' interviews over the past six years, go out and catch one of two things. It's probably red snapper that they can do it with, if they aren't there they're popping to the Atlantic sharpnosed and aiming for them. Maybe the anglers aren't directing that fishery but the operators certainly are.

Bob Ditton - Our principal cooperator was Captain Paul Dirt with the party boat, SHARK HUNTER. It's really interesting when you go to Port Aransas and you see the big sign THE SHARK HUNTER. Maybe it comes down to what is a fishery and what

is a directed fishery. That's all I can tell. They are catching sharks, there are reports of sharks being caught, but in terms of why anglers are there and the product that the party boat operators are selling - the product is not shark fishing.

Wayne Swingle - Our next speaker will be Gene Nakamura from the National Marine Fisheries Service and he is going to give a presentation on the "Fecundity by Size of Reef Fishes for Spawning Potential Ratios."

Fecundity by Size of Reef Fishes for Spawning Potential Ratios

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Abstract

Introduction

The fishery management plan (FMP) for reef fishes in the gulf was implemented in November 1984. One of the objectives of the plan was to rebuild declining stocks of reef fish. Existing data bases to determine the status of stocks were sparse. Red snapper was the species for which available biological and fishery data were, and still are, the most plentiful. The FMP has since been amended and additional data have been accumulated. Also methods of determining the status of stocks have been refined and the state of overfishing has been quantitatively defined.

Overfishing is defined in terms of the spawning potential ratio (SPR). The most direct and practical method of estimating SPR is the calculation of the ratio of the spawn production of the species when being fished to the spawn production of the species when no fishing is occurring. In practice, the amount of eggs produced by all the females of a species when the stock is experiencing a fishing mortality is divided by the amount of eggs produced by all of the females of that stock if no fishing mortality were occurring. High risks of subsequent recruitment decline exists when a stock of fish falls below the level of 20 percent SPR.

Acceptable biological catches (ABCs) and total allowable catches (TACs) are determined by the Southeast Fisheries Center and the Gulf of Mexico Fishery Management Council to achieve desired levels of SPRs. Thus, for determining SPRs, ABCs, and TACs, information on fecundity by size or by age of females is needed.

Objective

The objective of this project is to determine fecundities by sizes (and ages) of reef fishes that are caught in the Gulf of Mexico.

Summary of Results to Date

This project was initiated in January 1991. Sampling has been done primarily in fish houses for the recreational fishery and at docksite for the commercial fishery. Recreational fishermen from charterboats and headboats bring their catches to the fish houses to have their fish cleaned. Fish house proprietors have allowed us to sample the catches. Commercial fishermen usually eviscerate their catches at sea, but four commercial fishermen have agreed to bring in their last day's catches intact, so that we may sample the fish.

As of the end of August, 1,533 gonad samples and 2,045 otolith samples have been collected from 13 species of reef fishes. Most of the samples (86% of otoliths and 93% of gonads) have been obtained from three species of grouper (gag, red grouper, and scamp) and two species of snapper (red snapper and vermillion snapper). Collection data are summarized as follows:

Number of Specimens Collected

SPECIES*	OTOLITHS		GONADS	
	FEMALE	MALE	FEMALE	MALE
GROUPERS				
Gag	240	30	380	37
Scamp	183	26	163	23
Red grouper	68	6	132	38
SNAPPERS				
Vermilion snapper	453	40	315	10
Red snapper	408	138	308	46
Lane snapper	124	86	29	0
Gray snapper	63	21	15	0
GREATER AMBERJACK	16	9	25	12

*Insignificant numbers of four other species have been collected.

Otoliths were examined for age marks by counting "annuli" on the surfaces and also in cross sections. Agreements between surface and cross-sectional readings and between readings of two cross sections of the same otolith were noted. Results were as follows:

PERCENTAGE AGREEMENT BETWEEN OTOLITH READINGS

READINGS	GAG	RED GROUPER	SCAMP	RED SNAPPER	VERMILLION SNAPPER
Surface vs. cross section	91	64	29	surface unreadable	19
Cross section 1 vs. 2	99	100	99	89	100
No. of fish	244	74	136	139	78

Ages of the groupers ranged from 1 to 27, and of the snappers, from 2 to 35. Age ranges are summarized below.

AGE RANGES

SPECIES	YOUNGEST AGE	OLDEST AGE	N
Gag	1	27	244
Red Grouper	3	25	74
Scamp	3	21	136
Red snapper	2	35	139
Vermilion snapper	2	11	78

Frequencies of ages of these three groupers and two snappers are shown below:

AGE FREQUENCIES

AGE	GAG	RED GROUPER	SCAMP	RED SNAPPER	VERMILION SNAPPER
1	1				
2	2			14	6
3	19	1	3	60	22
4	31	1	10	44	29
5	137	7	27	6	5
6	13	9	34	7	6
7	12	13	19	1	3
8	11	20	26		4
9	10	7	9	1	1
10	2	5	4	1	1
11	1	1	1	1	1
12		2	2		
13		1			
15	2				
16		1			
17		2			
18		2			
19				1	
21		1	1		
23				1	
25		1			
26	1				
27	1				
30				1	
35				1	
N	244	74	136	139	78

Age-length keys were developed with the available data. These will be updated as additional samples and new data are obtained.

Ovaries of 376 gag obtained during February to June, 1991, were used to determine gonadosomatic indices (GSIs). The vast majority (76%) of these fish were within the range of 70 to 90 cm total length. The GSIs and length frequencies are summarized in the following two tables.

GSIs OF GAG

MONTH (1991)	N	MINIMUM	MAXIMUM	MEAN	STD. DEV.	COEFF. VAR. (%)
FEB	21	0.21	5.19	1.93	1.54	80
MAR	118	0.07	6.17	2.60	1.67	64
APR	179	0.01	8.29	1.09	1.08	99
MAY	44	0.04	1.80	0.34	0.29	85
JUN	14	0.03	0.30	0.15	0.08	53
TOTAL	376					

LENGTH FREQUENCIES OF GAG USED FOR GSIs

TOTAL LENGTH (CM)	FEB	MAR	APR	MAY	JUN	TOTAL
55-59			5			5
60-64		1	6			7
65-69		3	9	2	3	17
70-74	3	15	32	8	1	59
75-79	3	33	42	12	3	93
80-84	2	29	36	8	2	77
85-89	4	24	19	4	4	55
90-94	4	6	9	2		21
95-99		3	9	2		14
100-104	3	2	9	2		16
105-109	1	2	1	1	1	6
110-114	1		1	2		4
115-119			1	1		2
TOTAL	21	118	179	44	14	376

The relation between age and length of mature gag (those fish whose ovaries were classified as either late maturing or ripe) is shown in the following table.

AGE-LENGTH RELATIONS OF MATURE GAG

AGE	RANGE OF TOTAL LENGTH (CM)	N
3	74	1
4	73-88	4
5	71-92	22
6	87-97	2
7	89	1
8	102-103	2
9	94-103	4
10	100-115	2
14	115	1
ALL	71-115	39

Since the gag was the most readily sampled species, it was selected as the first to be examined for fecundity. Ovaries were cleaned of non-ovarian tissues and then weighed. Sections of the ovaries were dissected and weighed. Only ovaries with hydrated eggs were used. Results are shown in the following table.

BATCH FECUNDITY OF RIPE GAG

AGE (yr)	TOTAL LENGTH (cm)	DATE OF CATCH	GONAD WEIGHT (g)	GSI	BATCH FECUNDITY (no. hydrated ova)
4	73	4/5/91	75.2	1.53	93,105
5	82	3/21/91	226.4	3.65	265,294
5	90	4/8/91	302.6	3.25	129,782
6	97	5/14/91	197.6	1.80	148,519
7	89	3/21/91	421.7	4.63	745,940

Joanne Shultz - Gene, are there any plans to try to determine the spawning frequencies on any of these species?

Gene Nakamura - Yes, we plan to do that. We want to see if we can identify or find post ovulatory follicles in the ovaries and see if we can estimate spawning frequencies. It's an interesting and important question, because one thing that we don't really know is how many times a fish spawns in the spawning season and that has a great deal to do with spawning potential.

Wayne Swingle - Our next speaker will be Bruce Thompson from LSU and Bruce is going to make a presentation on "Age, Growth and Reproductive Biology of Greater Amberjack and Cobia from Louisiana Waters."

**Age, Growth, and Reproductive Biology
of Greater Amberjack and Cobia
From Louisiana Waters**

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Abstract

Introduction

We are in the second year of a two-year study. The goal of this study is to collect biological data from cobia and greater amberjack in coastal Louisiana waters to determine selected aspects of their life history and population dynamics. Specific objectives are: 1) To validate aging periodicity of sagittal otolith increments via marginal increment analysis, 2) To determine age and growth patterns, 3) To obtain reproductive information, including age and size at maturity, sex ratios, timing and location of spawning, and fecundity, and 4) To compare data from our various fishery sources (e.g. hook and line vs. diver).

Summary of Results

Cobia (*Rachycentron canadum*)

Cobia otoliths were analyzed from almost every month of the year and marginal increment data are consistent with an interpretation of a single annulus formed each year. Most otoliths examined between August and January possessed a translucent margin. Cobia caught between March and August had otoliths with partially to completely formed opaque marks at the margin.

We have size information for 715 cobia caught between 1987 and 1991. Over this time period females averaged slightly longer and heavier than males, but the contrast in size is not as large as reported from Virginia (Richards 1967).

Our data set includes cobia between one and ten years old. During the four-year period, year class composition was dominated by two to four-year olds that comprised about 78% of our specimens.

Although length-weight relationships showed no difference between males and females, length-at-age and weight-at-age models differed significantly for each sex.

We found an unbalanced sex ratio for each year, 1987-1990, always skewed towards males. Ratios were: 1987 1.59M:1F, 1988 2.7M:1F, 1989 2.02M:1F, and 1990 2.67M:1F.

Our reproductive study remains incomplete due to the scarcity of hydrated females in our samples. Peak spawning appears to take place in May and June along Louisiana's coast, with maximum GSI values and highest percent frequency of vitellogenic oocytes occurring during this time.

Greater Amberjack (Seriola dumerili)

Eight hundred twenty two greater amberjack were collected between April 1989 and July 1991. Charterboats supplied 370 fish (45%), recreational fishermen supplied 90 fish (11%), and the remaining 362 fish (44%) were obtained from saltwater fishing and spearfishing tournaments along the Louisiana coast.

Greater amberjack collected ranged from 194mm to 1628mm total length and 0.1kg to 45.9kg total weight. The specimens were comprised of 189 males (23%), 329 females (40%), and 304 juveniles (37%) whose sex was not determined.

Preliminary age estimates (using sagittal otoliths) range from <1 to 15 years, with the majority (62%) being between 3 and 5 years of age. The age estimates have not yet been validated.

Eleven greater amberjack have been injected with tetracycline, tagged, and released. Two of these fish were recaptured. Sagittal otoliths of the recaptured fish showed that annulus formation occurs before March. More fish will be injected with tetracycline, tagged, and released in the future in an effort to better validate annulus formation.

Based on histological analysis of ovaries and comparative GSI values, peak spawning occurs in May and June in Louisiana waters. We are still examining materials from the 1990 spawning season to determine why many ovaries showed no sign of oocyte development and maturation. We suspect an unknown pathogen.

Comparisons are continuing to help solve the identification problems that Louisiana fishermen are having in distinguishing among the four species of Seriola.

Corky Perret - Are the lessers being brought in or are they still in the same situation?

Bruce Thompson - Okay, the lessers are currently being brought in for two reasons. One for us, several of the docks, Chicky Dardar or Chicky Seafood, who's just absolutely one of the finest commercial dock people that I've ever worked with, is doing that and the fact that they feel that they're getting off the large ones, they are getting a usable small filet. There probably would be a directed fishery developed into this by some.

Corky Perret - Out of curiosity, those fishermen indicate to you that if indeed they catch the lesser, that wouldn't make the size, are they releasing fish and if they are, are they surviving, just eyeball approach, I know nobody's done any work on that.

Bruce Thompson - I'm going to say I think so. I think fish are tough critters.

Gene Nakamura - We've been finding a lot of ascarid worms in the gag ovary both within the ovarian tissue and in the interstitial tissue. It doesn't seem to be affecting the formation of the hydrated eggs so that we can assume it's not affecting spawning.

Bruce Thompson - In most cases if you take a section immediately including the worm itself so that you get the cross section of the worm with all the ovarian tissue around it you can find no effect whatsoever.

Wayne Swingle - Our next speaker will be Steve Szedlmayer from University of South Alabama. His presentation will be the "Species Identification of Amberjacks: Impact from Reef Fishery Management Plan Implementation and Management of Stocks in the Gulf of Mexico."

**Species Identification of Amberjacks: Impact on
Reef Fish Management Plan Implementation and
Management of Stocks in the Gulf of Mexico**

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Abstract

Introduction

The objective of this one year project was to define morphological characters that can easily be used by fishermen to discriminate the greater amberjack, Seriola dumerili, and the lesser amberjack, S. fasciata. These characters must be clear and consistent in fresh caught specimens, as well as determinable without causing harm to the fish.

Summary of Results

The species status of greater amberjack, Seriola dumerili, and lesser amberjack, S. fasciata were confirmed. We examined a total of 18 S. dumerili and 71 S. fasciata, both fresh specimens from the northern Gulf of Mexico, and preserved museum specimens. From each fish, we measured ten morphometric and five meristic characters. Significant differences (T-test, 0.05 level) between the two species were detected in gill raker counts, eye diameter to snout length ratio, dorsal fin spine count, and dorsal fin ray count. In S. dumerili (n=18; size range = 33 to 671 mm TL) gill raker count averaged 14.4 (± 0.38 SE) and ranged from 13 to 17. For this species, eye diameter to snout length ratio averaged 0.56 (± 0.12 SE). In S. fasciata, (n=71: size range = 25 to 613 mm TL) gill raker count averaged 23.9 (± 0.12 SE) and ranged from 22 to 27. For this species, eye diameter to snout length ratio averaged 0.77 (± 0.016 SE). The preserved specimens from Philadelphia Academy of Natural Sciences, American Museum of Natural History in New York, and the Smithsonian in Washington, DC, had most of their color bleached out, but different bar patterns were observed. Seriola fasciata had thin bars approximately half the width of the eye diameter that were patterned in double rows, and varied in width so as to appear blotched. Seriola dumerili had bars that were smooth, and the same size or larger than its eye diameter. The most important difference for fishermen, between these two species was detected in fresh specimens from the northern Gulf of Mexico: a yellow second dorsal fin in S. fasciata that differed from a gray colored second dorsal fin seen in S. dumerili. This color difference can easily be used by fishermen to distinguish these two species without harming the fish.

In General

Table 1 shows the characters that showed significant differences between these two species. Figure 1, shows the individual sizes of fish examined, and the eye diameter to snout length ratios.

Table 1. Characters that showed a significant difference (T-test, 0.05 level) between Seriola fasciata and S. dumerili. GR=gill rakers, EDSNL=eye diameter to snout length ration, DS=dorsal fin spin count, DR=dorsal fin ray count.

N	Variable	N	Minimum	Maximum	Mean	SE
<u>Seriola fasciata</u>						
71	GR	67	22	27	23.9	0.12
	EDSNL	71	0.50	1.24	0.76	0.01
	DS	55	7	8	7.9	0.03
	DR	55	28	33	30.6	0.13
<u>Seriola dumerili</u>						
18	GR	16	13	17	14.37	0.37
	EDSNL	16	0.38	1.11	0.56	0.05
	DS	8	7	7	7	0
	DR	8	30	34	32.1	0.51

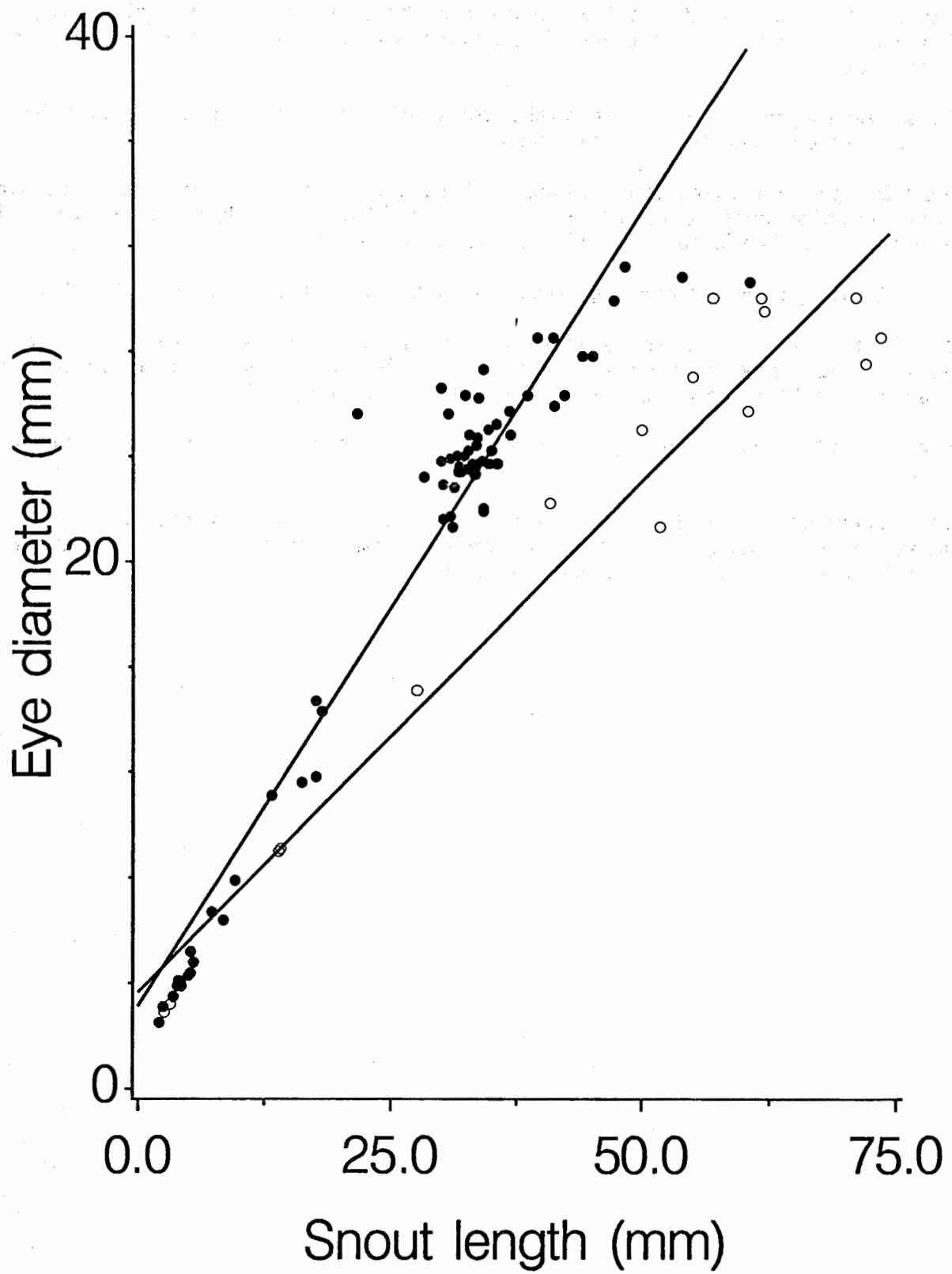


Figure 1. Eye diameter versus snout length regressions. Solid dots = *Seriola fasciata*, circles = *S. dumerili*.

Brad Brown - Yes, on the yellow dorsal fin, how long does that last, I mean is it something that would be there if the fishermen catches it, it would still show up at dockside?

Steve Szedlmayer - Yes, these fish, those pictures were frozen, and then we thawed them out and took the pictures.

Wayne Swingle - I think Brad raises an interesting point because at shore side where the enforcement takes place. Hopefully all of those characteristics would be retained at least for iced fish would they not or?

Steve Szedlmayer - You can't go wrong with the gill raker, that's the thing.

Bob Shipp - Yes, what we're looking for is something you can quick make a decision and throw him over before he's dead, but if you want to go through the trouble of gill rakers there's just no way to be confused.

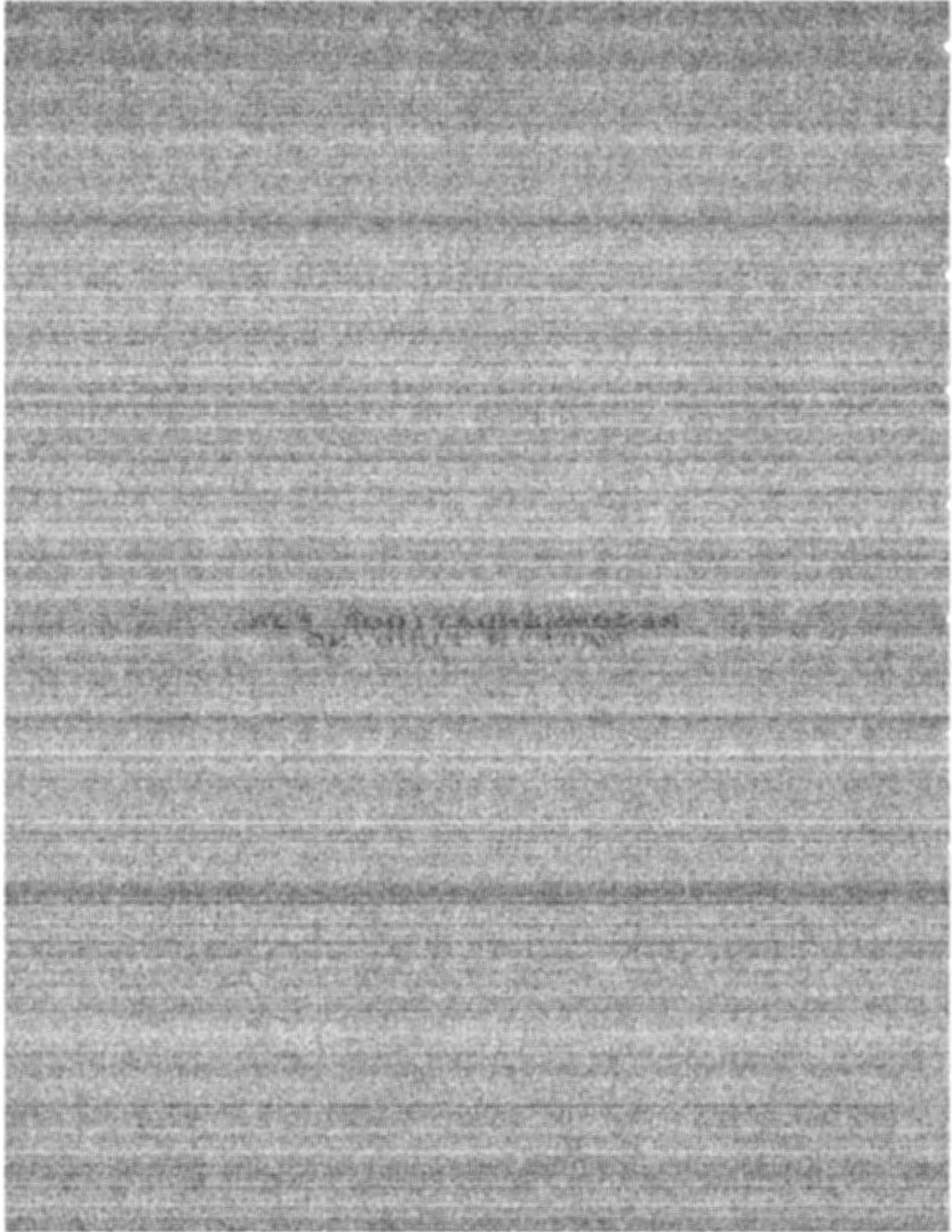
Corky Perret - Well, we may have some law enforcement people that may have trouble.

Steve Szedlmayer - Well, what we plan to do is publish these pictures and characteristics and get it out to the law enforcement people and to the fishermen so that it will just clear up this problem.

SUMMARY AND CONCLUSION - Robert L. Shipp, MARFIN PMB Chairman

I want to express our appreciation to everyone for coming, especially those of you who were attending some of the AFS sessions and took the trouble to come over here. We enjoyed having you and because of the interaction we're seriously considering continuing this on a regional basis, but again thank you all.

RECOMMENDATIONS FOR
MARE IN FUNDING



MARFIN Research Recommendations

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Cobia - Our work on cobia has established a reasonable data base for understanding the basic life history of this species. With both minimum size and creel limits imposed additional work should provide information on the effectiveness of these regulations.

Amberjack - Work should continue on the reproductive biology of this species for comparison with the unusual results found during 1990. Similar to cobia, additional age and growth work should provide information on the effectiveness of the current size and creel limit regulations.

Shark - Considerable monitoring has been done on commercial shark harvest in the north-central Gulf of Mexico, but little information is available concerning the recreational catch. Due to confusing past species identifications, several species probably have much greater sport harvest levels (i.e., spinner shark) than previously recorded. Both catch information and life history data should be obtained.

Reef fish - The reef plan contains 55 species, a bewildering number to effectively work with. Regionally along the Louisiana coast, this list can easily be reduced to 20-25 species with priority on 8 to 10 species. In Louisiana, the family Serranidae (Seabass/Groupers) are receiving more attention by both sport and commercial fishermen. They are probably very susceptible to overfishing, but our data base on life history and population dynamics from the north-central Gulf of Mexico is very poor. Eight to ten of the most sought after species should be investigated for age and growth and reproductive information. Age and size at maturity information is probably very important since several of these species are probably long-lived and reach several hundred pounds in weight.

Tilefish - This species, although fairly well-studied elsewhere has not been investigated in the north-central Gulf of Mexico. It has become more popular with commercial fisherman fishing the deeper coastal waters of Louisiana.

MARFIN Research Recommendations

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Sampling coverage is poor during late fall to early spring, particularly shelf coverage during March-May when many fishes spawn. These data gaps are readily apparent for all the species which primarily occur during late fall-early spring (i.e., round herring, rough scad, bluefish, mullet). Recommendations: (1) need better cross-shelf sampling during these months; and, (2) SEAMAP neuston samples should be sorted because many species (e.g., bluefish and mullet) are primarily neustonic and, therefore, bongo sampling does not adequately sample the population.

MARFIN Research Recommendations

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Red Drum - MARFIN has invested a great deal of money into red drum and we now know more about this species than most in the gulf region. We continue to have the opportunity to monitor effects of the current Federal moratorium and reduced state harvest regulations on red drum. Although it should not be as high a priority of other research needs, the Board may consider another tag-recapture effort during the next few funding cycles. This would provide a snap shot of age composition and standing stock of the previously sampled population.

Reef Fish - This should be a very high priority area. However it is confounded by the some 55 species in the management unit. Therefore research effort should be focused on those projects that have realistic goals (e.g. sample acquisition is likely).

Red Snapper life history studies should remain important (early life history, age structure and reproductive biology of the commercial harvest, mortality, etc.).

Vermillion Snapper is one of the more common species in commercial and recreational harvest and warrants complete life history research.

Several species are beginning to appear in the commercial harvest that were not encountered previously. Triggerfish, spadefish, and sheepshead are a very abundant reef dwelling species and might be susceptible to over harvest. Life history data for these species should be a high priority. Here is our opportunity to work on a species (spadefish) which has not been subjected to intense fishing; and another species (triggerfish) that has been subjected to some harvesting.

The groupers have life history characteristics that should make them more susceptible to overharvest than others. Most are long lived, reproduce late in life and are sexually dimorphic. The MARFIN Board should not only focus on those species under the most intense pressure, but also invest in those species that the fishery appears to be moving into. There are regional differences in catch composition that may affect funding priorities.

The fidelity of most reef species is not understood; what is the affinity of these species for a particular habitat and do they migrate? Our work with Amberjack indicates they are very rig specific and may remain in the area year-round. Previous red snapper research provides evidence that they make periodic excursions away from a reef, but remain in the area. The MARFIN Board should set a high priority to the habitat selection of important reef species, particularly Amberjack, red snapper, vermillion snapper, and grouper(s). This information should be in the management equations, as habitat affinity affects the potential for harvest impact.

Pelagics - The potential for development of coastal pelagics remains an important research area. As samples are collected by NMFS, the MARFIN Board should encourage life history studies of these species.

Yellowfin tuna longline monitoring is not only important, but also it provides biologists with otherwise difficult-to-acquire specimens of sharks, swordfish, and billfish. So the Board should continue to support observers on a cross section of longliners to collect these data. The Board should fund the analysis of these samples; targeting life history data, particularly age composition and reproductive biology.

MARFIN Research Recommendations

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General Comments

The general recommendation I submitted last year concerning the appropriateness of MARFIN funding for research into the processes causing annual variations in recruitment is still, I feel, valid. Factors affecting the survival of all life stages prior to actual recruitment to the fishery, eggs through juveniles, need to be exhaustively studied in relation to the entire Gulf of Mexico ecosystem, and subsets thereof. Excellent examples of how detailed knowledge of system-level physical and biological processes and interactions has led to more rational and defensible management policies can be found in the California Current and George Banks ecosystems.

Early life stages are, in general, more easily captured than adults, and egg and larva surveys have the advantage over adult surveys in that the young of most species can be collected with the same (relatively inexpensive) sampling gear. Well-integrated, fisheries/oceanography-ichthyoplankton surveys (including both broadscale and finescale, process-oriented efforts) are cost-effective and can yield critical information to stock assessments and recruitment/ecosystem research.

MARFIN has a good "track-record" thus far in supporting early life history related research, but it must be stressed that in most cases single year funding for studies of early life ecology is not an adequate timeframe in which to complete these endeavors and provide all potential and necessary information.

Specific Recommendations for Research Support:

1. Efforts to examine the response of red drum to current fishery management regulations.
2. Continue work on larval snapper taxonomy, including both rearing efforts and examination of field collections, and expand this endeavor to include all important species in Gulf of Mexico reef/hardbottom fish communities. This area of research is (or will be) fundamental to the use of early life stages in stock assessments and recruitment research as are efforts to use daily growth increments to estimate larval snapper growth rates and, ultimately, mortality rates.
3. Develop growth models for larval snapper using data on otolith growth increments.
4. Define species-specific, seasonal spawning curves (spawning intensity) for all the important snappers. This information will be critical in stock assessments based on larval abundance.

5. For the snappers (as was done for red drum) describe critical adult reproductive parameters such as spawning frequency and batch fecundity using presence of post-ovulatory follicles and enumeration of hydrated oocytes.