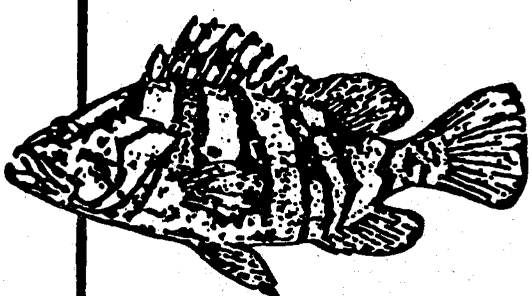
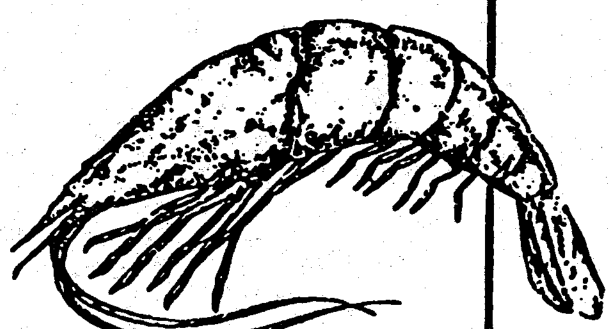
Marine Fisheries Initiative

(MARFIN)
Gulf of Mexico Phase



Proceedings:

Third Annual MARFIN Conference



October 31-November 1, 1990
Orlando, Florida

PREFACE

The MARFIN Board consists of members representing NMFS, 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 (National Marine Fisheries Service - 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 mangers, researchers, and other interested Gulf fishery parties, and to assist the MARFIN 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 Board 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.

For further information call or write the MARFIN Program Office:

Donald R. Ekberg
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Wilber Seidel, National Marine Fisheries Service
Allen M. Foley, Florida Dept. of Natural Resources
Bruce Thompson, Louisiana State University
Donald Baltz, Louisiana State University
Joanne Lyczkowski-Shultz, Gulf Coast Research Laboratory
T.M. Miller, Marine Chemurgics
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Walter Keithly, Louisiana State University
Karen Burns, Mote Marine Laboratory
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Walter Nelson, National Marine Fisheries Service
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Eddie McCulla, Gulf & South Atlantic Fisheries Development Foundation
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Jan Harper, B&H Seafood
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Wednesday, October 31, 1990

WELCOMING REMARKS - Robert L. Shipp, MARFIN Board Chairman

I would like to welcome you to the Third Annual MARFIN Conference. From the looks of the audience, we may start off a little bit informally, but we are going to do a few formal things. The MARFIN Conference has evolved into, I think, a rather important aspect of fishery management and research in the Gulf of Mexico, and with each conference we have been able to produce a little bit more meaningful information. This year we are going to take a number of steps to make it even better, and I will cover the procedures here so that it will make it easier for the people who are transcribing it. First of all, other than my introductory remarks and those of Don, we are going to keep everything pretty close to schedule. My introductory remarks are going to be quite short and Don's also, so we are going to start off with a few extra minutes, but as we get rolling, I'm going to try to keep this very close to on schedule. A number of people are keying in on certain talks so it's, in some ways, just as bad to get too far ahead as it is behind. If we get a little bit ahead, we'll just take a short break. At the end of each presentation, assuming we have a few minutes, I'd like to have a question and answer session done at that time rather than wait until the end of the session. That way, again, so that we can accommodate those people who want to come and go for a particular presentation. And anyone who has some questions, we'd appreciate it if you come up to the microphone and identify yourself so that the transcribers can enter that into the record. I'll turn it over then to the Program Manager, Don Ekberg.

CONFERENCE OBJECTIVES - Don Ekberg, MARFIN Program Manager

I think one of the reasons that we're probably smaller this year is that the first couple of years we've had everybody that had a MARFIN Project present. So at least we had an audience made up of presenters, and this year we decided to cut it back some to about 20 to 25. I think we're in about that neighborhood and that may be one of the reasons we don't have as many people as we'd like. Obviously, the major objective is to discuss and disseminate information and point out fisheries problems.

Our major management problems in the near future are going to be not only single fisheries such as king mackerel, red drum or snappers, but bycatch is probably our biggest overall problem along with user conflicts. Recently, I understand that Congress has put an amendment to the Magnuson Act that says there won't be any management actions taken until calendar year 1994 with regard to bycatch, which gives us about three years to solve the bycatch problem. We may need a lot longer than that to do it. One other thing I'd like to point out is that as the Program Officer on all these projects, I'll be here answering questions you may have. Jean West is also here, she's our MARFIN Grant's Officer.

If you have any questions about the financial aspects of your projects, I'm sure she'll be glad to answer those. So, without further ado, let's proceed from there.

Bob Shipp - Larry Simpson is going to chair this first session.

SESSION I
SHRIMP, TURTLES AND TEDS

SESSION I-SHRIMP, TURTLES & TEDS - Larry B. Simpson, Chairman

Thank you Mr. Chairman. This session is titled "Shrimp, Turtles and TEDS." Two of the most important, or at least let me say controversial, topics in marine work these days are the turtles and bycatch effort. Turtle work has been going on for many years, being funded by MARFIN for several years now. As Don mentioned earlier, the number of presentations has been shortened, and one of the reasons they were shortened was to limit it to those individuals who had completed work or were nearing completion of their work. This is one of the reasons we had fewer presenters. These projects are in everyone's mind, everyone at least in government, industry, and management is looking for this information. Don alluded to Congress indicating a need for more information recently because of the public hearings concerning red snapper. The people in the gulf community indicate the need for additional information. This work is important. It's going to be an important thrust of MARFIN funding for FY91. Of course, it remains to be determined just how much through the program funding status for next year. These are some of the best individuals in their fields that are here presenting this information.

If I might run through for those of you who are here, you have a pointer, we'll work the lights, we have a wireless on your 35 mm carousel, you have an overhead, we also have an easel for those of you who might need that equipment. If I might Mr. Chairman and Ed, before you get started, we have a couple of individuals in the audience who might need introduction to the group. The economist from Florida Marine Fisheries Commission, Bob Palmer; and the Chairman of the Gulf of Mexico Fisheries Management Council, Eddie McCulla from Louisiana. There is one change, Dr. Richard Condrey will be speaking on the Optimization of Shrimp Management in Louisiana instead of Jerry Clark, who is the last presenter. Dr. Condrey is not here at this time, but the other panel members are, and the first speaker that we have is Dr. Ed Klima, who'll be speaking on the "Evaluation of the Impacts of Turtle Excluder Devices (TEDs) on Shrimp Catch Rates in the Gulf of Mexico."

Evaluation of the Impacts of Turtle Excluder Devices (TEDs) on Shrimp Catch Rates in the Gulf of Mexico

Edward Klima
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4700 Avenue U
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Abstract

Introduction

Trained National Marine Fisheries Service observers collected information from March 1988-September 1990 on catch rates of shrimp and finfish from commercial shrimp vessels voluntarily participating in this study. Data were compared between TED-equipped nets (Georgia TED with and without an accelerator funnel) and standard shrimp nets. [This represents partial fulfillment of OMB and House Appropriations Committee requirements with respect to TEDs and their economic impact on the shrimp fishery.]

This report summarizes preliminary results through July 1989, including 4159 hours of fishing time. The field portion of the study was completed in September 1990, a comprehensive economic analysis is being completed with these data by Texas A&M University.

Summary of Results

Standard and TED-equipped nets appeared to operate similarly with respect to types and frequency of problem tows. When problems with the fishing gear occurred, the TED-equipped nets lost more shrimp and finfish than standard nets.

Differences in the CPUEs between standard and TED-equipped nets were compared using multivariate paired t-tests. Overall, a 10% loss of shrimp was experienced for quad-rigged vessels, whereas, the overall loss for twin-rigged vessels was about 2%. In general, for quad-rigged vessels, there were significant mean differences in the paired catch rates between the standard and TED nets for both shrimp and finfish. In all cases, the overall mean differences between CPUEs of standard and TED nets were positive, indicating the standard nets caught more shrimp and finfish than TED-equipped nets. The mean differences in the seasonal shrimp catch rates were less than 0.9 lbs/hr, without including trynet data and 1.4 lbs/hr with trynet catch added to the trailing net. Shrimp CPUEs ranged seasonally from a gain of 0.1 lbs/hr to a loss of 1.4 lbs/hr. CPUEs vary seasonally and only during the winter months were there no significant differences in the overall shrimp catch rates between standard and TED-equipped nets; during all other seasons, differences were significant. The overall finfish CPUEs were 74.0 and 64.5 lbs/hr for standard and TED nets, respectively, or a mean difference of 9.4 lbs/hr.

Significant differences were noted between the shrimp catch rates of the two TED types. When the Georgia TED without a funnel was compared with a standard net, the catch rate for the standard net was 7.2 lbs/hr and 5.9 lbs/hr for the TED-equipped net, or a difference of 1.3 lbs/hr. The Georgia TED with the funnel caught 5.9 lbs/hr compared to 6.7 lbs/hr for the standard net, or a difference of 0.7 lbs/hr.

For twin-rigged vessels, the overall shrimp CPUE with TED-equipped nets ranged from 2% better than the standard net to 18% worse than the standard nets with a trynet adjustment. No significant difference was observed in the overall catch rates between TED and standard nets for twin-rigged vessels.

Yield was modelled to determine what impact various levels of shrimp loss would have on the overall population. Overall decrease of 10% in fishing mortality rate resulted in no detectable change in the overall yield of both brown and white shrimp fisheries and a 2% decrease in the yield for the pink shrimp fishery.

A total of 40 turtles were caught in the observer program, of which 27 were caught along the Atlantic coast and 13 were caught in the Gulf of Mexico. Nine of the 40 turtles came aboard unconscious and 36 were released alive. The estimated total capture of turtles using 1988 fishing effort is 14,112 for the Gulf of Mexico and 14,986 for the Atlantic Ocean. The capture rate of sea turtles in the Gulf of Mexico was similar to earlier studies, but apparently declined in the Atlantic.

A total of 17 trips were completed in 1990, entailing 34 observer days (406 fishing hours) in the Gulf of Mexico and 77 observer days in the Atlantic (679 fishing hours). Shrimp loss by TED-equipped nets versus standard nets during 1990 has been approximately 6%.

Ten turtles were captured during 1990 in the Standard or Try nets, and two in TED-equipped nets. Eleven of the 12 turtles were caught along North Carolina and one in the Gulf of Mexico. One turtle could not be revived and was marked and returned to the sea. Data collected during the past 12 months are presently being analyzed.

L. Simpson - Thank you Dr. Klima. Ed will stand for questions from the Board members.

B. Shipp - Ed, you gave us some numbers on the Super Shooter shrimp loss. How about a feel for bycatch for the Super Shooter.

E. Klima - I can't comment, Bob, because we haven't looked at the data. We haven't gotten all the data into the computer.

B. Shipp - Can you give an impression?

E. Klima - I can't even give an impression.

B. Shipp - It's not really going to be different from the grid style here?

E. Klima - I can't, I apologize to you, but we just haven't had a chance to look at. Wil has a better feel than I do for that.

W. Seidel - It's just a standard grid except it's designed to drop all the grass and sponge out where the others aren't.

E. Klima - Basically, what I think is happening with the funnel in that you're loosing the same amount of fish as you are shrimp. And until Wil has developed these bycatch excluders that are specifically targeted for fish I don't think the TEDs are going to do much. It really surprised me that when we started looking at the data in detail that there wasn't more of a difference. But it just seems it's almost the same as the shrimp loss.

C. Perret - Of the fifty-four turtles you caught in the standard nets, I assume they were all in good shape?

E. Klima - No, they were not. As I recall during the first part of the study, nine of them came onboard unconscious. That's not out of the fifty-four, that's out of about thirty-four. Nine of them came aboard unconscious and six of them we were able to release alive.

C. Perret - What was the length of the tows?

E. Klima - Tows varied anywhere from two hours to ten hours. Depending on where we were fishing and what season. Let me add one other point. This was a commercial operation. The vessel captain decided where he wanted to tow, when he wanted to tow, and the length he wanted to tow. There was no direction by the NMFS observer, whatsoever. It was completely up to him, so it was purely what he thought he wanted to do under commercial conditions.

C. Perret - O.k., I have one other question. Ed, you had one of your figures, I think it showed fifty pounds of fish per hour with the TED and seventy pounds with the standard. Obviously approved TED use in the nets is already cutting down tremendously on bycatch. Are you guys going to come out and publicly say that?

E. Klima - Well, I think we have said that from our results that the TEDs significantly reduce the bycatch from the figures you have. We also looked at the snapper, the red snapper bycatch reduction and as I recall from that data we could not determine that there is a reduction in the red snapper between the standard and the TED.

E. McCulla - You were talking about bycatch and you said that you had no real effect on the bycatch of fish. The TEDs did not. Secondly, You showed that effort was increasing in the gulf. Was that inshore and offshore effort or was that offshore effort only?

E. Klima - I believe I showed only offshore effort.

E. McCulla - We had an Advisory Panel meeting last week and they just don't understand how you're getting, and they've been fishing the same way they've been fishing for the last twelve years, how you're getting an increase in effort.

E. Klima - Yes, this question seems to come up all the time and the data we have shows some areas there is a reduction in effort. I'm looking at the total gulf. Now in some areas there is a reduction; there's no question about that. When you break it down by areas there are some overall load differences. Also, I'd caution you that this effort is not adjusted to the quad-rigs. This is still the same effort, nominal effort. If you were going to adjust it over time from 1960 to the present time, then you'd have to make the adjustment back before the increase efficiency due to quad-rigs. This is not included in there.

E. McCulla - Can you break it down as where the effort is in concentrated effort, as traditional effort that is being done. Because when you say that effort is increasing, I think everybody just assumes that it's the entire gulf that has increased and it may not be. It may be...

E. Klima - It's not, you're absolutely correct. There are certain areas...

E. McCulla - Could you break that down for us?

E. Klima - Yes, if you'd like I'd be happy to.

E. McCulla - I'd appreciate that.

L. Simpson - O.K. There's a question I had. You indicated increased fishing effort with the reduction of some 40% to 50% licenses sold in Texas an elsewhere.

B. Palmer - In giving figures for losses of catch in pounds per hour, is that per net or per pair?

E. Klima - That is per individual net. In other words, if there were four nets on the boat you multiply that by four. Or if there were two.

There is some data that we have where there is just a twin-rigged vessel so we identified that in terms of catch per hour per individual net.

C. Perret - What's the top three species of fish?

E. Klima - Croaker, spot, and sandtrouts.

L. Simpson - Mr. Chairman, we'll move to our second presenter on the panel, Dr. Wade Griffin, from Texas A&M University. He'll be talking about the "Economic Impact of TEDs on the Shrimp Industry."

Economic Impact of TEDs on the Shrimp Industry

Wade Griffin
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Abstract

Turtle excluder devices (TEDs) used in the Gulf of Mexico to control the numbers of turtles caught in shrimp trawl nets are a major concern to the shrimp fishing economy, due to a potential loss of shrimp. The extent to which the economic gains and losses may impact the Gulf shrimp trawl fleet, however, has never been reported. In 1988, both the Office of Management and Budget (OMB) and the House Appropriations Committee required studies and reports relating to the effective exclusion of turtles and economic impacts to fishermen and the shrimp fishing industry. As a result, the NMFS was funded to collect information on shrimp catch rate from the use of the TEDs by commercial vessels in the Gulf of Mexico. Texas A&M University, advised by several agricultural economists on updating costs and returns for shrimp boats and vessels and selecting base parameters for the model, was funded to complete the analysis by using the catch rates determined by the NMFS to estimate the economic impact for the use of standard nets versus TED equipped nets to the Gulf of Mexico shrimp fleet. The objectives of this project were to: 1) update costs and returns for shrimping by region and by vessel class in the Gulf of Mexico, 2) determine catch and effort data by region and by vessel class in the Gulf of Mexico, and 3) estimate the economic impact for vessels equipped with TEDs by region, by vessel class, and by depth zone in the Gulf of Mexico. In analyzing the economic impact of the TEDs for the Gulf of Mexico, a base case was compared to four scenarios. The base case assumes no TED regulation in place and fixed and opportunity costs adjusted so that economic rents equal zero. While scenarios 1 and 2 analyzed the impact assuming a 10% shrimp loss from individual tows and a 100% compliance with the TED regulation, they differed in loss of tow time; scenario 1 assumed no loss and scenario 2 assumed a loss of 3.9%. Scenarios 2 and 4 analyzed the impact assuming the same reduced tow times, respectively, only with a 20% shrimp loss from an individual tow instead of a 10% loss. Comparing the base case to scenario 1, shows that percent decrease in landings was the greatest for region 2 which included AL., MS. and E.LA. Across all regions, the greatest decline in landings for each species occurred in depths 2 and 3 which are 1 to 5 fathoms and 5 to 10 fathoms offshore, respectively. The overall impact to the Gulf of Mexico in landings was 5.3%. When analyzing for the impact of TEDs on rents of vessel owners and crew in scenario 1, region 4 (TX) had the greatest negative impact. Again by rent analysis, the negative economic impact to the brown shrimp fishery was the greatest in region 4, however, owners and crew who harvest white shrimp suffer the greatest economic loss in region 3. Overall results indicate that the TED regulation with a 10% shrimp loss and no loss in individual tow time impacts the Gulf of Mexico by a 16 million dollar decrease in rent for vessel owners and crew. This impact increased with a greater percentage loss of shrimp and tow time.

Table 1. Economic impact of TEDs on total rents of vessel owners and crew by region and species in the Gulf of Mexico.

	Pink	Brown	White	All Species
	------------ (in 1000's) ------------			
Region 1 (FL)				
Base	498	0	0	498
Scenario 1*	-2077	0	0	-2077
Decrease in rent	2,575	0	0	2,575
Region 2 (AL,MS,E.LA)				
Base	0	743	76	819
Scenario 1*	0	-845	-1,000	-1,845
Decrease in rent	0	1,588	1,076	2,664
Region 3 (W.LA)				
Base	0	6,151	-9,302	-3,151
Scenario 1*	0	3,344	-11,036	-7,692
Decrease in rent	0	2,807	1,734	4,541
Region 4 (TX)				
Base	0	8,121	-7,574	547
Scenario 1*	0	3,481	-9,177	-5,696
Decrease in rent	0	4,640	1,603	6,243
Gulf Total				
Base	498	15,015	-16,800	-1,287
Scenario 1*	-2,077	5,980	-21,213	-17,310
Decrease in rent	2,575	9,035	4,413	16,023

*10% loss from individual tow; 100% compliance with TED regulations; and no loss in tow time.

Table 2. Economic impact of TEDs on on shrimp landings by vessel class and region species comparing the Base Case to Scenario 1.

	Pink	Brown	White	All Species
	------------- (in 1000's) ------------			
Region 1 (FL)				
Base	13,989	0	0	13,989
Scenario 1*	13,045	0	0	13,045
Total % decrease	6.7	0	0	6.7
Region 2 (AL,MS,E.LA)				
Base	0	6,120	3,525	9,645
Scenario 1*	0	5,581	3,220	8,801
Total % decrease	0	8.8	8.7	8.8
Region 3 (W.LA)				
Base	0	24,579	25,061	49,640
Scenario 1*	0	23,258	24,332	47,590
Total % decrease	0	5.4	2.9	4.1
Region 4 (TX)				
Base	0	26,690	5,706	32,396
Scenario 1*	0	25,383	5,286	30,669
Total % decrease	0	4.9	7.4	5.3
Gulf Total				
Base	13,989	57,389	34,292	105,670
Scenario 1*	13,045	54,222	32,838	100,105
Total % decrease	6.7	5.5	4.2	5.3

*10% loss from individual tow; 100% compliance with TED regulations; and no loss in tow time.

L. Simpson - Dr. Griffin will stand for any questions. We'll have questions from the Board first.

W. Nelson - I guess I'm confused with basically the biological and effort models. I guess I'm confused by the results. What differences, if any, (possibly I'll direct this question also to Ed Klima) are there in the biological models you used for catch-effort models and the models NMFS has been using?

W. Griffin - One of the differences is that their models, Ed, correct me if I'm wrong, includes inshore, also.

E. Klima - And also the different estimate for effort.

W. Griffin - I haven't been able to compare our "q." I'm going to be able to when he gives me some additional data on those, on the actual days fished. Then I can compare that, but until then I can't. The other thing is, their model treats the entire gulf as one cell. My treats it in smaller areas and depth zones. That can have an impact too, where the TED is actually applied.

E. Klima - We are going to break up models so that it will exclude the inshore. Our model presently includes the inshore. We have been developing a new model which is more appropriate, because inshore is not included for brown, whites and pinks. Our yield model includes the whole stock.

W. Griffin - Another difference is also they estimate out and they don't use nominal-based times "q." Their's is already in the estimate in the data. I break that down, and I plug in the "q," and I plug in the nominal base. My model calculates out for each type for each step. That's another difference in the model.

J. Greenfield - You mentioned that your model allowed some survivability of shrimp into the next depth and time period. Is it also making the same adjustment for predator finfish being saved?

W. Griffin - No, that has no finfish in it. Oh, one other difference between our models. Their's is on a monthly time step, and mine is on a quarter month time step.

J. Greenfield - Isn't the use of a TED increasing the survivability of prey finfish species more than the shrimp themselves.

W. Griffin - Yeah, but my model does not conclude that.

J. Greenfield - Does yours also, Ed?

E. Klima - No sir.

J. Greenfield - Is you natural mortality constant, your model?

E. Klima - Yes.

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E. Klima - No sir.

J. Greenfield - Is you natural mortality constant, your model?

E. Klima - Yes.

J. Greenfield - Is that realistic? Aren't you saving more predator species of finfish than you are shrimp?

W. Griffin - We were only looking at shrimp. When looking at shrimp natural mortality, that is basically held constant.

E. Klima - What we assume is that if you don't catch that shrimp today, it has a likely chance of being caught, but it has a natural mortality.

J. Greenfield - But that natural mortality, in fact, is likely to change if indeed you are saving a higher percentage of prey finfish?

B. Shipp - What your saying is natural mortality is going to increase.

E. Klima - I don't think there is going to be any change in that. I think natural mortality on those animals is going to remain the same. The big difference, I think between the two models, is that our natural mortality is higher than Wade's, two or three percent. And that has a shift. But when we reconcile our models, which we are in the process of doing, I think we're going to come out very, very close. I don't think there is going to be much difference in what our percentages are, and what he thinks. I think they are going to be very similar.

W. Seidel - As you pick out some shrimp and it has an opportunity to increase in size and get into the next size class, do you also account any at all for the increase value of shrimp as it gets larger?

W. Griffin - Yes, if he goes to another size class when he is landed he gets priced at that higher size class.

B. Brown - One of the difference that you mentioned, could you use your model to keep the cell, but let the effort float to where it would be optimal for the fishermen to fish if they were maximizing?

W. Griffin - Yes, I do want to do that. I have it in the model, but I haven't done that. Each one of these cells will run independently. What I wanted eventually was to put the whole thing together and yes, let effort move around. But I have not gotten to that point yet. Even within the individual cells, I'd like to see and let effort move out of the industry to see how much would move out because if you could let this model run across time which it is capable of doing, I just haven't done it. I haven't tested it to be confident enough, but it works like I want it to and like I think it is supposed to. I'm going to do that eventually, it is just I don't want to do a report on it at this point in time.

E. Klima - With the new data that we're going to be giving you, you may want to look at lowering the 10%.

W. Griffin - Why did you use 20%, I did it because...

E. Klima - Because that was the maximum that we ever saw. We just wanted to take the worst-case scenario.

L. Simpson - Thank you Wade. Our next presenter in the particular session is Wil Seidel of the Mississippi Laboratory. Wil will be talking about "TED Technology Transfer."

TED Technology Transfer

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Abstract

Introduction

The objective of the TED Technology Transfer project was to support adoption of TED technology in the southeastern United States by assisting the commercial shrimp industry, Sea Grant, and Federal and State agencies with TED expertise developed with the Mississippi Laboratories. The objective was to be accomplished through direct demonstrations, information dissemination and problem solving activities on commercial vessels and assistance in developing design improvements to solve specific problems. The project also provided gear expertise support to an impact study conducted by the Galveston Laboratory to determine the economic effect of TEDs on the commercial shrimping industry. The goal was to assist the commercial industry in adopting TED technology under the endangered species regulations and minimize the impact of the introduction of TEDs.

Project Objectives

1. Provide technical support to the U.S. shrimping industry in adopting TED technology.

2. Assist the industry in identifying and solving operational problems associated with the use of TEDs.

Summary of Results

TED technology transfer assistance was provided to individual fishermen, industry associations, Sea Grant, and state and Federal agencies. The project maintained three trained personnel to provide direct technical assistance to net shops, TED manufacturers, individual fishermen, and designers of new TEDs. Assistance provided included construction of TEDs, design of modifications to reduce fouling and to improve shrimp retention, instruction in the installation, tuning, and operational use of TEDs, and trouble shooting and problem solving on-board commercial vessels. Video productions demonstrating currently certified TEDs were produced and distributed and written material on commercially available TEDs was distributed upon request. New TED designs which are designed to operate in grassy conditions and which tend to have minimum shrimp loss were developed by independent gear manufacturers with the assistance of NMFS Mississippi Labs gear technicians. These TEDs including the "Super Shooter, mini Super Shooter and the Anthony Weedless design are designed to operate without clogging in "trashy" conditions and in these conditions maintain better shrimp retention than the original commercial grid type TED designs.

L. Simpson - Thank you Wil. Mr. Seidel will stand for questions.

J. Greenfield - It's really a question for both Ed and Wil. Because the industry will always question federally generated data, I'm wondering how you'd answer the concern that providing special technical assistance to your cooperators might reflect on the representativeness on these results as being commercial. Did your cooperators get a lot of tuning assistance from Wil's staff to the degree then that those results were significantly better than would be achieved in the commercial fleet?

E. Klima - O.k. Let me take a few seconds to answer that question. Without the assistance of Pascagoula and from Texas A&M, we could not have willingly gone on the vessel. We felt it mandatory to have a professional gear expert (which we are not) to go on the vessel and tune those nets up. As you know, one time I was the Division Chief for gear research as well so I had some familiarity with fishing gear and in almost every case, we felt comfortable with the data. We were with Wil or Gary Brown able to get those nets fishing properly before we let the observer record the data. To make it as crystal clear as I can, without that assistance, we would have not been able to generate the data.

J. Greenfield - I understand that Ed, and I know it is an instrument for getting cooperation when it's hard to come by, but doesn't that then to some extent limit your ability to sell the idea that the loss can be as low as 3% or 4% rather than 10%.

W. Seidel - I don't think so.

E. Klima - I don't think so. Jack, we were on boats in North Carolina, as an example, for two months. The gear tuners came on in the first two days - then they were gone. With the positive attitude of the captain, once he knows what to do, he can make it work. If he doesn't want to make it work, he won't make it work. That is quite obvious, but if he wants to make it work, he will make it work. Another example with John Ray Nelson's group. We were on I would think ten different boats for two trips a piece. What John Ray did was very smart, he had us rotate on the boats so that his fleet could learn how to use it by using Wil's expertise, John Watson, and the rest of the group and then with our guy recording the data. And that worked fine, because once they became familiar with what to do to get the nets fishing properly then they did it. Now, in some cases, we went on a vessel which had used other TEDs where we didn't need a gear tuner because the guy had used TEDs extensively for a year or a year and a half. Is that answering your question?

W. Seidel - The first thing some fisherman did was change the TED before he put it in the net. He said,"Hey, I know how to do this better." Then he messed it up.

E. Klima - That's right.

W. Seidel - There is another factor in this too, Jack. In the beginning, at least, there was some intent. Because the TEDs didn't work as well. Some of those nets were adjusted after our gear tuners left. Some were just left alone. All nets require tuning periodically to make them continue to fish well. Some of these were just left alone for two trips and just let what happens happen. So the guys that are using it now and there is one area of them, particularly in the Atlantic. They are not having a 10% shrimp loss. They've learned how to adjust the net, particularly the Super Shooter with the funnel.

L. Simpson - Our next presenter will be Dr. Klima again. Dr. Klima will be talking about "Continuation of the Improved Sea Turtle Stranding and Salvage Network (STSSN) in Shrimp Statistical Subareas 17-21, Southwest Louisiana and Texas."

Continuation of the Improved Sea Turtle Stranding and Salvage Network (STSSN) in Shrimp Statistical Subareas 17-21, Southwest Louisiana and Texas

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Abstract

During fiscal year 1990 (October 1, 1989 - September 30, 1990), sea turtle strandings were documented along the coasts of Texas, from the Rio Grande River to the Sabine River (excluding the Padre Island National Seashore surveyed for strandings by National Park Service - NPS, and the Wynn Ranch portion of Matagorda Island, surveyed for strandings by the U.S. Fish and Wildlife Service - FWS), and southwestern Louisiana, from the Sabine River to the Mermentau River. Total statute miles of coastline on the surveyed coast were 407.4. Because of inaccessible tidal marshes, islands or undriveable seawalls, the accessible coastline surveyed was limited to 303.6 statute miles. This accessible coastline was surveyed for strandings at least once per month. NMFS also responded to reports of strandings from other agencies and from the general public by visiting the stranding sites and documenting the strandings.

When a stranded sea turtle was found, observations were taken on species, size, sex, location, condition, external injuries, mutilations, fouling and abnormalities, and recorded on standardized Sea Turtle Stranding and Salvage Network (STSSN) data form. Data forms were sent to STSSN State Coordinators in Texas and Louisiana. A separate file of stranding data for the surveyed coastline was maintained by Galveston Laboratory personnel on microcomputer (hard disk with floppy disk back up) and semi-monthly or monthly preliminary summaries of strandings were made and distributed to selected agencies and organizations (FWS, Louisiana Department of Wildlife and Fisheries, Center for Marine Conservation, and HEART - Help Endangered Animals - Ridley Turtles).

Total effort expended (one-way distance and hours) in systematic stranding surveys was determined. If a particular survey required doubling back over a beach just surveyed then only the distance covered and hours spent on the initial trip (one-way) along the beach were recorded. A total of 914.3 hours were spent looking for stranded sea turtles and 8,845.3 miles of beach were driven in systematic surveys.

Only 90 (30%) stranded sea turtles were recorded from systematic surveys. An additional 212 (70%) animals were documented after being reported by the general public, for a total of 302 sea turtles reported stranded on the surveyed coastline. Most of the animals (77%) were found in shrimp statistical subareas 18, 19, and 20 (89, 71, and 74, respectively). The actual stranding location (and therefore the

statistical subarea) could not be determined for two carcasses. One was found in a trash dumpster on Galveston Island, Texas; the second was left on a doorstep of Pan American University's Coastal Studies Laboratory in Port Isabel, TX.

All five species of sea turtles known to inhabit the Gulf of Mexico were found on the surveyed coastline. Strandings were dominated by Kemp's ridley (133, 44%). Loggerhead (109, 36%) were the second most frequently found, followed by hawksbill (21, 7%), green (13, 4%) and leatherback (7, 2%). Nineteen carcasses (6%) could not be identified to species.

Strandings were exceptionally high in July and August (78 and 52, respectively) 1990. Overall, nearly 66% of all the strandings found (198 of 302) were documented as stranding in the spring and summer months (April through August).

Forty-seven of the 302 animals were still alive when found. Of these, three were released immediately. Four were released after rehabilitation and, as of 8 November 1990, 13 others were still in rehabilitation centers. Twenty-four animals died during rehabilitation and three are permanently disabled and cannot be released.

Seven sea turtles were found entangled in marine debris. Entangling materials included rope (4), fish hook (1), monofilament fishing line (1,) and trawl netting (1). Three of the entangled carcasses were found in shrimp statistical subarea 19, two in 21 and one each in subareas 18 and 20. None were found in shrimp statistical subarea 17.

As proposed, carcasses (150) were delivered to Texas A&M University for necropsy. Fourteen of the carcasses came from shrimp statistical subarea 17 with 84 and 52 respectively from subareas 18 and 19.

Fifty-nine stranded marine mammals were also documented by the surveyors. A stranded marine mammal report was completed for each carcass and submitted to the Marine Mammal Stranding Network.

The relationship between sea turtle strandings (number per 100 km of surveyed shoreline per month, $\underline{S}$) and nominal shrimping effort (days fished per 100 km^2 per month, $\underline{f}/\underline{a}$) in the northwestern Gulf of Mexico during 1986-1989 was examined. Data from shrimp statistical subareas 17-21 were grouped into two zones, the upper coast (subareas 17-18) and the lower coast (subareas 19-21) for the analysis. Strandings and effort were transformed to natural logarithms after the addition of 1 (because some values were zero), and the product-moment correlations between $\ln(\underline{S} + 1)$ and $\ln[(\underline{f}/\underline{a}) + 1]$ were determined, first with $\ln[(\underline{f}/\underline{a}) + 1]$ calculated for depth interval 0-5 fm, then for 5-10 fm and so on to 25-30 fm, for each zone.

Highly significant ($P < 0.01$) positive correlations between $\ln(\underline{S} + 1)$ and $\ln[(\underline{f}/\underline{a}) + 1]$ occurred for the 0-5, 5-10, and 10-15 fm intervals on the upper coast and for the 5-10 and 10-15 fm intervals on the lower coast, where intense shrimping took place. Loggerhead (_Caretta caretta_) and Kemp's ridley (Lepidochelys kempi) sea turtles were the dominant species in the strandings. Peak strandings occurred in April-May with a secondary peak in August. While the observed correlations are only circumstantial evidence, they are consistent with direct observations from other studies that sea turtles are caught, stressed and killed during shrimping. Therefore, it was concluded that the most likely explanation for the correlations was an effect of shrimping.

L. Simpson - Dr. Klima will stand for any questions.

E. Klima - I might mention that the tarpon are back up in the northern gulf. There are fishermen fishing for tarpon. I know there were a number of them that were actually hooked. Some of them could have been killed and washed ashore obviously from recreational fishermen, but it is a pleasure to know that tarpon, large ones - from six to eight feet - are off of Galveston.

C. Perret - Eight feet?

E. Klima - Eight feet. Hey, you're in Texas. Well anyway, that is the bright side to my presentation. If you have any questions, I'll be happy to answer them.

L. Simpson - Thank you Ed, and one of the largest tarpon that has been caught is in the Louisiana aquarium. It's not even eight feet. Our next presentor will be Dr. Allen Foley. Dr. Foley will be presenting "Systematic Survey for Stranded Marine Turtles in NMFS Statistical Zones 4 and 5.

Systematic Survey for Stranded Sea Turtles in Statistical Zones Four and Five

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Abstract

Initiated 1 November 1987, this project proposed to evaluate the effectiveness of turtle excluder devices (TEDs) in reducing sea turtle mortality in statistical zones four and five. This was to be done by comparing sea turtle mortality trends prior to and during the use of TEDs. Sea turtle strandings were used to establish mortality trends. Also, the validity of stranding trends was increased by conducting systematic aerial surveys and improving the efficacy of the local seaturtle stranding and salvage network (STSSN). To date (30 September 1990), three years of mortality trends have been documented. The lack of consistent TED regulations have, however, prevented a comparative analysis of mortality prior to and during TED use.

Through the combined effort of systematic aerial surveys (N = 143) and the STSSN, 439 sea turtle strandings were reported in zones four and five from 1 November 1987 - 30 September 1990. This total comprised 365 loggerheads (*Caretta caretta*), 37 Kemp's ridleys (*Lepidochelys kempi*), 28 green turtles (*Chelonia mydas*), 2 hawksbills (*Eretmochelys imbricata*), and 7 sea turtles not identified to species.

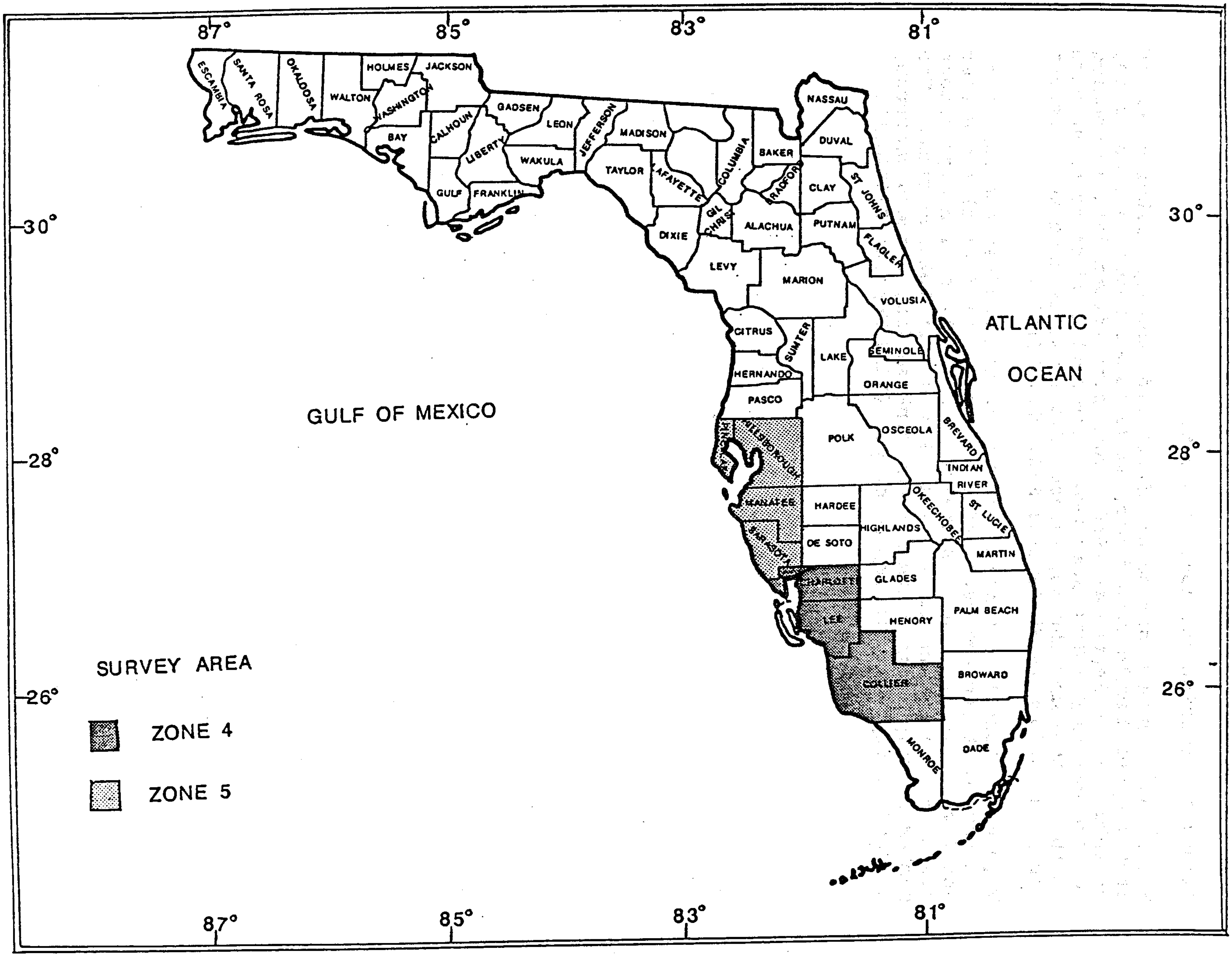
During the first 23 months of this study, sea turtle mortality trends and shrimping effort (represented as shrimping trips; NMFS shrimp landing data, Report: SHR040LA) in zones four and five were synchronous. When quantitied on a monthly basis, strandings rose and fell one month later than shrimping effort, but this may be attributed to the time it takes a carcass to wash ashore. Nevertheless, a linear regression analysis revealed a significant positive correlation ($r = 0.734$, $P < 0.001$) between monthly shrimping effort and the monthly number of reported strandings. Shrimping effort data is pending for the last 12 months of the project and will be used to see if this correlation is true for the latest project year as well.

Considering that 1) incidental capture of sea turtles in shrimp trawls is not the cause (or contributory cause) of death for all stranded turtles, and 2) not all dead turtles are discovered and reported; such a straightforward correlation between strandings and shrimping effort would appear unlikely. It is known, however, that shrimping is a major cause of sea turtle mortality. If the majority of turtles stranding in zones four and five are killed in shrimp trawls, and currents consistently strand at least a representative sample of the dead turtles; then this correlation is not unexpected. The potential for the latter situation does exist in zones four and five, as shrimping grounds and sea turtle habitat almost completely overlap and much of the shrimping occurs near shore. If this correlation is causal, the use of TEDs in this area will affect future stranding trends.

Figure 1. Statistical zones 4 and 5.

Figure 2. Monthly shrimping effort and monthly distribution of reported sea turtle strandings, statistical zones four and five, November 1987 - September 1990. Shrimping effort data is pending for October 1989 - September 1990. The number of trips taken each month for the pink shrimp, *Penaeus duorarum*, is used to represent shrimping effort (NMFS Report: SHRO4OLA, 12/89).

Figure 3. Monthly shrimping effort plotted against the number of sea turtle strandings reported each month, statistical zones four and five, November 1987 - September 1989. There is a significant positive correlation ($r = 0.734$, $P < 0.001$) between them. The number of trips each month for the pink shrimp, *Penaeus duorarum*, is used to represent shrimping effort (NMFS Report: SHRO4OLA).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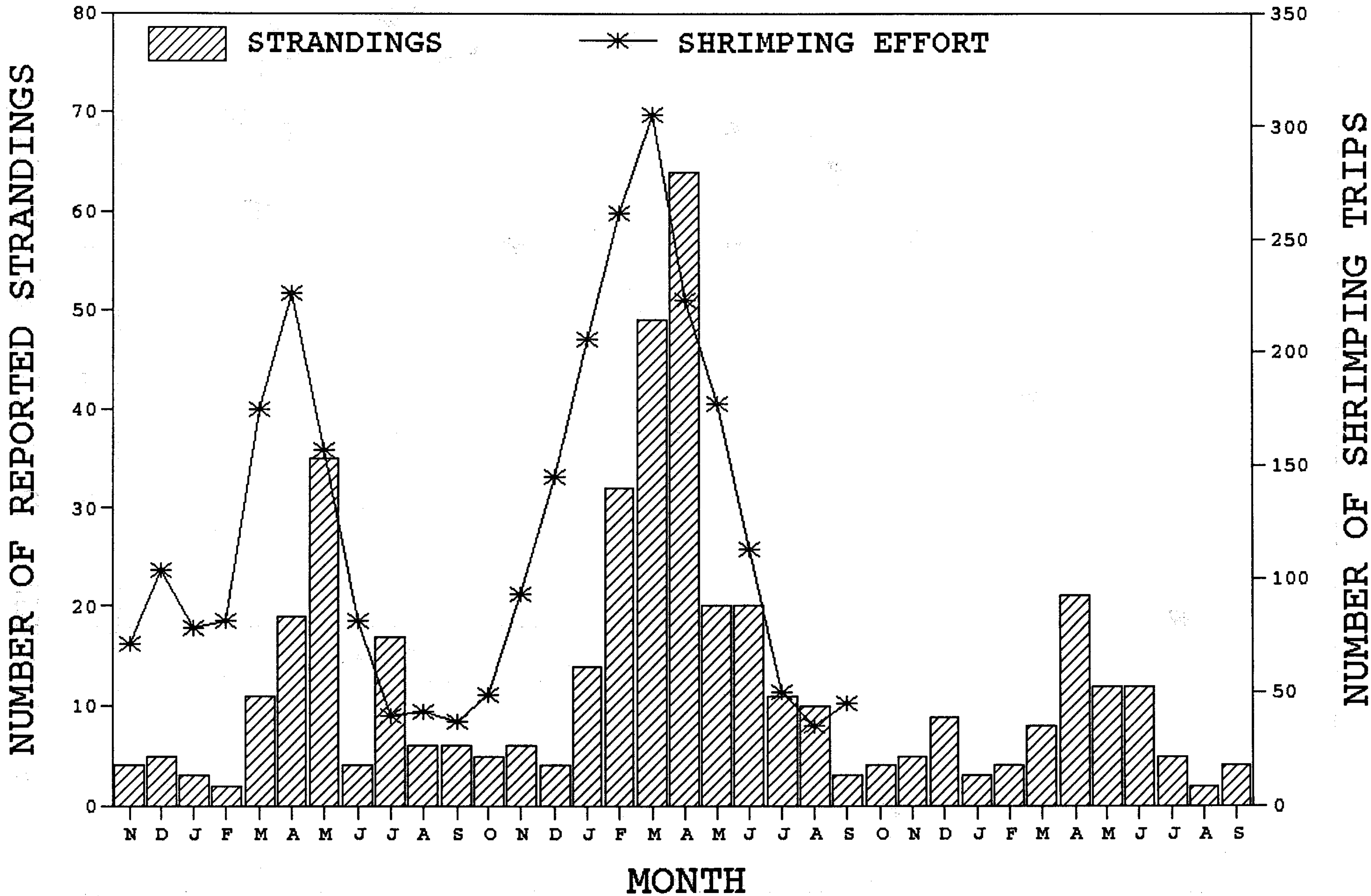
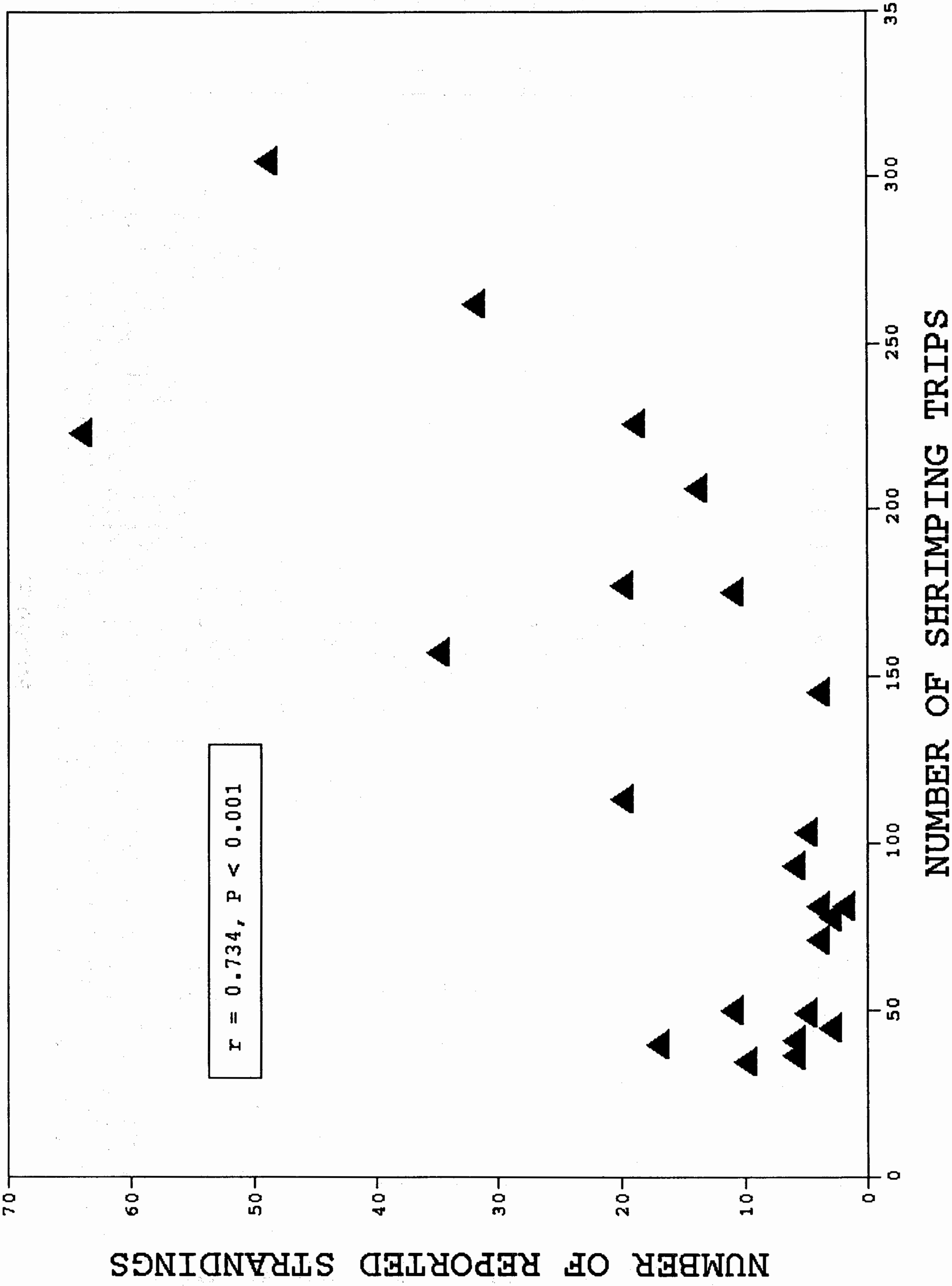
BAY
CALHOUN
GADSEN
LEON
LIBERTY
WAKULA
GULF
FRANKLIN
JEFFERSON
MADISON
TAYLOR
LAFAYETTE
COLUMBIA
BAKER
NASSAU
DUVAL
CLAY
ST JOHNS
DIXIE
ALACHUA
PUTNAM
FLAGLER
LEVY
MARION
VOLUSIA
CITRUS
SUMTER
LAKE
SEMINOLE
HERNANDO
ORANGE
PASCO
HILLSBOROUGH
POLK
OSCEOLA
BREVARD
INDIAN RIVER
MANATEE
HARDEE
OKEECHOBEE
ST LUCIE
HIGHLANDS
SARASOTA
DE SOTO
MARTIN
CHARLOTTE
GLADES
LEE
HENDRY
PALM BEACH
COLLIER
BROWARD
MONROE
DADE
ATLANTIC
OCEAN
GULF OF MEXICO
SURVEY AREA
ZONE 4
ZONE 5


STRANDINGS
SHRIMPING EFFORT
NUMBER OF REPORTED STRANDINGS
NUMBER OF SHRIMPING TRIPS
MONTH
0
10
20
30
40
50
60
70
80
0
50
100
150
200
250
300
350
N D J F M A M J J A S O N D J F M A M J J A S O N D J F M A M J J A S


NUMBER OF REPORTED STRANDINGS
NUMBER OF SHRIMPING TRIPS
r = 0.734, P < 0.001
0 10 20 30 40 50 60 70
0 50 100 150 200 250 300 350

L. Simpson - Thank you, Allen. Dr. Foley will stand for questions.

C. Perret - Allen, are you satisfied that flying a 172 Cesna at 80 miles per hour is a pretty good way to document turtle strandings?

A. Foley - Yes, I'm very satisfied. I took over this project after the first year was already completed. And when I first started the survey, I was very afraid that I wouldn't be able to see a dead turtle on the beach, and I was very anxious to see one so I could see what it looks like and feel reassured. When you see them on the beach, they are extremely noticeable. Three hundred feet isn't that high when we're flying along the beach, you can look at the people in the condominiums right on the same level as you are. The beaches are nice, white sandy beaches. They are clear of vegetation; at least there is a stretch of clear of vegetation say at least twenty feet. In some cases, much, much greater than that. A dead sea turtle on that sand from 70 knots, 70 knots is really slow at 300 feet, is very easy to see. In fact it's too slow.

C. Perret - Are you the observer?

A. Foley - Yes, I've been the observer on approximately 85% of the flights since June 1989.

C. Perret - After you spot one, do you ground-truth it. Do you get somebody to go down to verify?

A. Foley - Oh, Yes! All the time. We've also, aside from doing areal surveys, worked with the Sea Turtle Stranding Salvage Network in our area. The Florida Department of Natural Resources coordinates that network. The project people on this project have been working very, very closely in the stranding network in that area to make sure that all these turtles are documented. When we get back we call the appropriate person.

C. Perret - Were you ever wrong?

A. Foley - In that we've thought we saw a turtle and it wasn't? No.

C. Perret - One hundred percent accurate?

A. Foley - Yes. What we would do is, we wouldn't mark it down as a stranding until the network found it on the ground. I've only seen a few turtles since I've been flying. That black year on the graph where the mortality was the greatest was before I started, and that's when most of the turtles were seen from the area. None were marked down as a stranding until they were ground-truthed.

C. Perret - I see.

Walter Nelson - Just a comment. Initially, setting up the stranding network was to see if that would be the way to determine the impact of use of TEDs on the decrease in mortality of turtles. The reasons for selection of zones 4 and 5 was because there was not a great deal of shrimping effort going on. During the maximum month, I think you only had 300 trips.

A. Foley - Right.

W. Nelson - It's kind of surprising to see that because it was thought this would be more or less kind of a control area and we wouldn't see much of a change as compared to other areas where there are major amounts of shrimpers.

A. Foley - Maybe we don't have the large turtle population the east coast has and we don't have the large inshore shrimp effort or nearshore shrimping area the east coast has, so maybe our strandings are more reliable in that we tend to get a representative sample of the overall mortality on our shores more often than other places. We see a clearer relationship perhaps than other places even though we don't get the numbers of strandings and we don't get the high number of vessels, we have a clearer picture because of other environmental factors.

L. Simpson - Mr. Chairman, our next presenter would be Wil Seidel, again from the Mississippi Laboratories. He'll be talking about "Shrimp Trawl Bycatch Reduction."

Shrimp Trawl Bycatch Reduction

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Abstract

Introduction

Trawls of the shrimp fishery are the major harvesting device in the Gulf of Mexico. Unfortunately, trawls are non-selective and their bycatch has become a significant problem. During 1990, red snapper became the focus of this problem, but other species have as much commercial and recreational importance and will receive future attention. In many areas, resource surveys show a decrease in finfish levels and in size of fish caught. A method to allow unwanted fish to escape from shrimp trawls could eliminate much of the problem and provide flexibility in management and utilization of public resources. This project was implemented to initiate studies to design and test finfish separator modifications to certified Turtle Excluder Devices (TEDs). This approach was pursued because TEDs are already required in some areas and times of the year to protect sea turtles, and additional modifications to these devices were hoped to represent less of a burden on the shrimp industry if successful. Some of the incentive for the project was a documented reduction of over 50 percent of the finfish bycatch in the National Marine Fishery Service's TED during its development testing for protection of sea turtles.

Project Objectives

1. Conserve southeast fishery resources by development and demonstration of selective trawling gear for shrimp which also reduces the bycatch of finfish and other non-target components.

2. Study modifications to certified TEDs to determine the feasibility of an approach that could achieve a 50% reduction of finfish bycatch without significant shrimp loss.

3. Complete development of prototype bycatch separator designs for commercial comparison testing and catch evaluations under commercial conditions during 1991 shrimp seasons.

Summary of Results

Basic grid-type TEDs (Georgia, Matagorda, Cameron) and a Morrison soft TED were studied to determine if modifications could be made that would release finfish without increasing shrimp loss or impacting the ability of the TED to release sea turtles. Because of the constricted space of the simple grid-style TEDs in the cod end of a net, it was

apparent that any modification to release finfish would be more effective behind the turtle deflector grid. Modifications within the envelope of the grid had already been investigated during studies of the NMFS TED. Twelve separate ideas and approaches were developed for initial evaluation to determine their feasibility and practicality. First phase field testing during 1990 consisted of diver evaluations of separator design approaches, their integration into the cod end of a net, and the apparent fish behavior interaction to achieve control and release of the animal. Subsequent comparison dragging during 1990 second phase evaluations was designed to determine gross impacts of each prototype idea on the shrimp catching efficiency of the net, and to produce an initial evaluation of the finfish releasing potential of each idea. These preliminary results will be combined into full scale net prototypes for commercial testing in 1991.

Systematic testing has currently allowed consolidation of the initial 12 ideas into 4 full prototypes. Fish behavioral observations indicate that the design prototypes are feasible and the key to successful separation over a range of environmental conditions is the development of design modifications which induce a stimulus which encourages the fish to escape the net. Commercial comparison dragging will be conducted with these devices during October-November, 1990. Because of the high visibility of red snapper in the Gulf of Mexico, field testing is currently targeted on this species to insure that gear to reduce red snapper bycatch 50% is developed as soon as possible. Testing during October-November will continue to do this.

Sufficient progress has been made during this 1990 project to project that the development of a bycatch separator trawl is ahead of schedule looking toward 1993 as an implementation year. Preliminary data with the prototype designs indicate that each of the designs is capable of averaging 50% reduction in fish catch during both day and night but more testing is required to document the finfish separation rates under different conditions and to document shrimp retention rates. Extensive testing of the prototypes on commercial vessels will be conducted in 1991 to document performance on different fish species and sizes under different fishing and environmental conditions.

L. Simpson - Thank you Wil. Mr. Seidel will stand for any questions. Is that all the videos that you had to give?

W. Seidel - That's all on this one; I've got those other two on TEDs that we can show later if you want to.

L. Simpson - I have a question. Near the last comment, are you saying that your gear bycatch reduction data should not be used for management?

W. Seidel - I'm saying that it should be used as gear efficiency data on evaluating its impact on the biomass, but it's not data that can show you what the impact to shrimp trawlers are on red snapper in the Gulf of Mexico. That is not its role. Its role is to go out there and show what the gear will do on red snapper. Not where red snapper are and what the abundance level of red snapper is or what the impact of shrimp trawling is on the red snapper resource. That is not what we're doing.

L. Simpson - Well, I agree with your first part of your evaluation, but the second part of your evaluation I'm having problems with.

W. Seidel - I didn't say it couldn't be used for management purposes; I said it had to be used for the reasons it was developed for management purposes. That is deciding can you reduce red snapper catch by 50% by using this device. But if it reduces the catch rate by 50%, are you going to reduce the mortality of red snapper by 6 million fish or something? Some other data has to be used to do that. I can tell you that our device is 50% effective on snapper or mackerel or something.

L. Simpson - That will be how it will be used though.

W. Seidel - That's what I'm saying, yeah. That's the purpose...

L. Simpson - Whether you want it that way or not or think it should be, that's the way it will be.

W. Seidel - No, it can't be; there won't be enough of it.

C. Perret - But it's being used in reverse the other way by saying that shrimp trawls are killing whatever number of snappers or other finfish.

W. Seidel- And they are, but the data that went into those projections still won't come out of this and be statistically valid across the Gulf of Mexico. The data could go into a data set that is broader than this and be used for those projections, but it alone can't. We caught the devil with the TEDs; the TEDs data were evaluating the fishing with a TED in developing the gear. That data also became the basic data that was used to project the catch rate of turtles.

L. Simpson - I hear what you're saying, and you understand what people are going to be looking for. And this is going to be obviously a major thrust of next year in the bycatch gear work.

W. Seidel - What I was leading up to was that we're, in the southeast, trying to eventually evolve an overall red snapper or bycatch program that's managed by an overall steering committee or whatever. This is just a component of that whole program. As part of that program, there needs to be a data collection process program on a lot of these other species that more directly addresses what the overall resource status is and it's relationship with shrimping. This and some of the data can go into that, but this won't be nearly complete enough to make the projection like that.

L. Simpson - Are going to continue to collect data on the species.

W. Seidel - Oh, we obviously have to. We've got length-frequencies; we've got all kinds of stuff in that data that hasn't been analyzed. I'll say it again, this is preliminary data. This is summary information. It isn't statistically valid with all the variances and everything that have to go with it.

W. Nelson - Just a quick comment, all Wil's group has been doing for the past year on this particular MARFIN funded project is trying to develop a piece of gear that excludes finfish and try to determine what the efficiency of such a piece of gear is. It's going to require other information on location of red snapper, timing, seasonal aspects, that kind of thing. Some of which is already in place, but which is questionable. Under, hopefully, the plan and program activities for this next year, once the prototype gears are developed by Wil's group, they can then be taken to the field and tested with observer programs over extensive areas which the fishery operates under commercial conditions. When we're using this type of TED and a standard net for the comparison of the efficiency of the TED that will give us another opportunity to collect another data set. A more recent data set on bycatch.

W. Seidel - One of the detrimental things about focusing on red snapper all of a sudden is that we have to go looking for red snapper. Where you find red snapper in the spring you might find shrimp. Where you find red snapper in the fall, you may not find any shrimp so we don't get the full efficiency evaluation.

L. Simpson - You didn't really go looking for turtles though, did you?

W. Seidel - No, we approached that differently. We just put that on, Ed's project, and that's the way we tested TEDs. That's the way we need to test these devices through Sea Grant or whoever on a commercial boats. The TED devices we put on any commercial boat that wanted to try them and would take an observer on the boat and keep him on there for six months and that's where the boat went. It's not what we're doing with the MARFIN project. We're looking at gear efficiency. Now, the next step in the commercial evaluation process is to begin introducing it among commercial fishing boats wherever for as long as you want and collecting data on these devices to see how well they are working under those conditions and that area. If you want a piece of gear that I can tell you is 50% effective on bycatch, and if somebody starts saying, "I'm going out for cowfish." I've got to forget a lot of those species and go for cowfish and that dilutes and delays some of the accomplishment because we're not looking at everything we should be. We aren't necessarily where the most commercial shrimp are in November of 1990. We might be where cowfish are in November 1990. So, what I'm saying is if people put too much pressure on species of interest, one at a time, we're not gong to accomplish as much as quickly.

C. Perret - While we're on the snapper, you indicated that beyond five, six, seven inches, whatever, we don't have a problem or the net can be developed or the device for the net can be developed that fish over that number of inches should be able to get out. The NMFS data on red snapper bycatch, did it not include fish above six and seven inches also? It included all sizes?

W. Nelson - The Lab calculations were reduced, I think, only to age zero and one fish. They tried to throw out everything above that. Dr. Goodyear's numbers.

L. Simpson - Thank you Wil. Mr. Chairman, I would like to suggest at this time in the absence of Richard Condrey or another representative from Louisiana Department of Wildlife and Fisheries that we dismiss the session presenters.

[Note: Walter Keithly agreed to briefly present information on "Optimization of Shrimp Management in Louisiana" whose principle investigator is Jerry Clark. Richard Condrey was scheduled to present for the PI but was not able to attend. The presentation was made during the last session of the conference but is placed here for continuity.]

Optimization of Shrimp Management in Louisiana

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Abstract

The goal of this project is to develop a fishery management plan for saltwater shrimp from Louisiana waters which will maximize the economic benefit derived from the resource by Louisiana and the region. We are currently in the ninth month of our first year of this two-year project and are involved in the synthesis of existing bio-eco-socio-logical data, development of yield models, and description of the current state of the fishery.

We are taking full advantage of the existing federal and state plans, work done by the Galveston Lab, and are planning to take full advantage of Dr. Wade Griffin's model. Our work includes a reanalysis of the Department's biological samples back to at least 1960 from which we hope to obtain inshore recruitment, growth, and mortality of white and brown shrimp; an analysis of the aggregate Gulf Coast Shrimp Data for general regional trends; and an anticipated analysis of vessel mobility patterns and interstate movement of caught shrimp once we receive the disaggregate Gulf Coast Shrimp Data.

We are also attempting to reconstruct as much of the history of the fishery as possible not only to learn from the lessons of the past but to test the hindcasting ability of current yield models. This historical reconstruction includes a history of the Louisiana fishery laws back to 1807; a reconsideration of the historic landings; a study of the Louisiana Wildlife Commission reports back to 1912 and of the minutes of the Gulf States Marine Fisheries Commission meetings for at least its first four years of existence; a reconsideration of the size distribution of commercially-caught or catchable shrimp from at least Lindner and Anderson 1955; Hildebrand 1954; and the first Oregon cruise in 1950 (e.g., Springer 1951, 1952); an examination of a portion of the historic maps and surveyor logs back to at least 1699; and a study of the historic popular literature on the fishery back to at least 1883.

What we are finding is a highly unstable fishery and environment. The purpose of this talk is to share these emerging patterns and to receive input which will assist us in the completion of our data synthesis phase.

L. Simpson - Dr. Keithly will try to answer questions on Dr. Condrey's project.

C. Perret - I have one. You've got the ball so you're it. With the goal being to maximize economic values so forth and so on, how can this historical review help us maximize economic value?

W. Keithly - I tell you, if you could ever put back those conditions...

C. Perret - We know that can't happen there are too many people in the world, habitat's diminished in quantity and quality, so that's not going to happen.

W. Keithly - O.k. Then it can't. There's no doubt about. Basically, you have to look at marginal changes in the shrimp industry. You're never going to see the eight inch shrimp in the inshore waters. Now, I can't say whether the shrimp resource decline is due to fishing. According to some of these photographs there has been a decline, whether it is a decline due to environmental factors such as erosion or so forth or just more effort. I tend to agree with you. They'll never get back to that condition.

C. Perret - Well, now I saw eight count shrimp three weeks ago. It came out of Lake Pontchartrain. Not a lot of them, but again I don't know how many there were in 1920 or 1930 or 1940 or whatever it was either.

W. Keithly - Again, I couldn't debate that, you could. Even if you were to limit entry to two boats, my own guess is you couldn't get that size, that large shrimp due to environmental conditions.

C. Perret - Well, you did a good job as backup quarterback.

J. West - Walter, from what you said at the beginning of this project. Is this project still working on the original statement of work or have you changed your direction?

W. Keithly - The big problems I'm seeing is that of conflicting goals on the project. If you say to maximize economic benefits to Louisiana, you would not be able to maximize economic benefits to the gulf region. What would happen if you look at maximizing economic benefits to the gulf region, quite possibly you'd allow for the larger size shrimp that would get off into federal waters and be harvested by out of state boats. That's hardly maximizing the economic benefits to Louisiana. If you want to maximize those benefits, you don't want to sell eight inch size shrimp, now maybe a little bit larger, but I don't know. Basically, what we are attempting to do to the extent possible given the year data limitations and everything else is try to look at if we allow the shrimp to increase in size, what may happen to Louisiana or what may happen to the rest of the gulf region. So, I guess if anything else it's a combination of maximizing some function of benefits to Louisiana and the gulf region.

J. West - Just a reminder to be aware if you are deviating from the original scope of work be sure you work with your program officer to have that change incorporated into the grant award document.

W. Keithly - O.k.

J. West - It sounded to me like there could have been a change in the statement of work because of their initial findings that they found that it was not feasible to continue on the statement work that they had been awarded on. And if there is any change or if there is a substantial change or new direction in the statement of work, then he should come to the program officer and run that by him and ask for a change in direction and change in scope of work and have it incorporated into the award document. Otherwise, there could be problems.

SESSION II
ESTUARINE FISH, MENHADEN AND OSYTERS

SESSION II-ESTUARINE FISH, MENHADEN AND OYSTERS - William S. Perret, Chairman

B. Shipp - Corky Perret will be chairman this morning, so Corky it's yours.

C. Perret - Thank you, sir. Welcome to our second session on estuarine fish, menhaden, oysters. I think all of us in this room are probably familiar with trying to manage or attempting to manage estuarine fish, oysters, menhaden. I think a lot of the basic problems we have in all our fisheries certainly started in the estuarine areas, and while we over the years have accumulated a tremendous amount of biological and ecological information, especially on oysters, we know very little about the economics and social aspects of the fishery, so we'll hear a little about that aspect today. We're already 20 minutes late, but we will try and speed things up as we go. And for the record, everything is being recorded. If there are any questions by the Board as well as members of the audience, please identify yourself for the record. Please try and keep your comments to the designated time that you are given. Our first speaker is Bruce Thompson from LSU who will talk about "Fishery Independent Characterization of Population Dynamics and Life History of Striped Mullet in Louisiana - Year Three."

Fishery Independent Characterization of Population Dynamics and Life History of Striped Mullet in Louisiana -- Year Three

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Abstract

Introduction

We are completing the final year of a three-year study on all size classes of striped mullet in Louisiana. This study was primarily based on samples obtained from the Louisiana Department of Wildlife and Fisheries Finfish Section's coastal monitoring program via gill nets, trammel nets, and bag seines. Sampling protocol remains the same as previously described (Thompson, Render, Allen, and Nieland 1989).

Objectives of this study were: 1) to validate aging periodicity for striped mullet using sagittal otoliths via marginal increment analysis, 2) to determine age and growth of all size classes of striped mullet in Louisiana, 3) to determine sex ratios, fecundity, and timing and location of gonad development to understand the reproductive cycle of striped mullet in the northcentral Gulf of Mexico, 4) to determine population genetics of Louisiana striped mullet, and 5) to compare data from Louisiana's commercial mullet fishery with this project's information.

Summary of Results

1. Striped mullet were analyzed from every month of the year and marginal increment data are consistent with an interpretation of a single yearly annulus. Nearly all otoliths examined from mullet taken between August and March possessed a translucent margin. Mullet otoliths with opaque margins were found in fish captured from April through July.

2. Louisiana striped mullet have a linear mean size at age to about age three. Beyond this age, growth rates declined dramatically, nearly leveling off at about 350 mm FL. Continued growth is evident however, in the continued increase in mean sagittal otolith weight. Otolith weight appears to be the best estimator of size at age. Louisiana striped mullet are mature around 200 to 220 mm FL (males) and 220 to 230 mm FL (females). All striped mullet below 160 mm FL were immature (sex indistinguishable). All males above 280 mm FL and all females larger than 290 mm FL were mature.

3. We found that data on striped mullet sex ratios were very gear dependent, particularly gill net samples. We examined the changes in catch composition of varying mesh gill nets and the sex ratio switched from 100% male (smaller meshes) to 100% females (larger meshes). The location within the estuary also strongly influenced the sex ratio of the catch. Reproductive information on fecundity, gonad development, and maturation stages for Louisiana mullet was similar to most previous literature reports. No hydrated or spawning individuals were obtained during this study, agreeing with previous reports of mullet spawning in the open Gulf of Mexico waters offshore.

4. Electrophoretic analysis of eye, muscle, and liver tissue indicates that Louisiana striped mullet have minimal interpopulational allelic variation. Samples of striped mullet from the Atlantic Ocean (Charleston, SC) and the Pacific Ocean (Hawaii) were compared with Louisiana samples.

C. Perret - O.k. Bruce, thank you. Dr. Thompson will stand for any questions. You talked about fish from the seven different areas in Louisiana; did you detect any differences from east to west or vice versa so far as growth or any other patterns?

B. Thompson - Some. I didn't bring that kind of information, but yes. What it really appears to be is that there are two areas in Louisiana that mullet are extremely abundant. The areas one and two in southeast Louisiana. That in Louisiana is from approximately the east side of the mouth of the Mississippi to the Mississippi border. We've combined those two from a standpoint of all the mullet data because we can't detect any differences. The other place where they seem to be most abundant is the western side of the Atchafalaya area. This would be Louisiana's area six around Marsh Island. Lots of freshwater inflow and muddier. Those two areas appear to be where they are most abundant. They appear to be the same. Other areas it looks like the varying salinities and other factors actually have slightly slower growth. Statistically, it is not of greater magnitude.

[tape break]

B. Thompson - ...six to seven pounds in three to four years. Almost two pound roe. A few commercial fishermen that experimentally harvested these things just couldn't believe their eyes when we cut some of these open. You're looking at an awful lot of money if somebody could actually come up and work on that. If we're going to go in any direction in the state of Louisiana right now the best thing would be how to make a compatible harvesting program perhaps with some of that kind of aquaculture. We've gotten about 250 samples from over there. If you could work out the logistics on it, I know from seeing this stuff naturally grown that you could put roe on the market that would be worth a small fortune because their maximum price is for eight ounce roe. We're talking about 22 ounce roe, and some of the buyers just went crazy when we showed them some of this stuff. So, yes Corky, there is some stuff but it doesn't jump out at you that much. I was really a little bit surprised to discover that area one and two and six were so similar until I started to look at some of the Pearl River, Atchafalaya River, things like that and then I think it started to make more sense to me.

G. Nakamura - Bruce, at what age do they begin spawning?

B. Thompson - O.k., good question. In this particular situation, there is sexual dimorphism involved. We have some males that mature the first time, that would be their second winter not counting their birth. So at that particular point, the males are contributing to spawning at two. There are enough females that are also reaching that maturity at that size that you're getting some spawning for those early maturers before they enter the fishery at all, but I would have to say that 100% of everything is by the time they're three. But you are also by that time having some males that quite frankly at three or four are old men, at that particular situation. I don't see looking at the ages and sexual maturity of commercially caught stuff that there is a problem at all because I think enough of every year class reaches maturity before it recruits strongly into the fishery. I think an awful lot of them hadn't got the chance to make that first run offshore then come back and then it would be the next year that they would enter the fishery. I don't see that as a problem at all. Because of the large size mesh they're really bypassing those early maturers. I think they are passing right through the mesh of the gill netters in Louisiana.

G. Nakamura - I'm kind of surprised that you have such a broad variation in size at age when they're spawning. Essentially three months to spawn.

B. Thompson - Actually, in Louisiana I don't think it's even three months. Yeah, what it looks like to me is that they rapidly grow up to a size. At that particular point they're not getting any longer, but they're getting older. Fork length is an awful predictor of age. It's terrible particularly once you get beyond four. They're all basically about the same size except you've got four, five, sevens and some eights mixed in there. So fork length is the pits from the standpoint as an age predictor. Otolith weight is a superb predictor except that's a little bit tougher for picking out. You see a fish with a big otolith you know it's old whether its that big or that big. So there is your answer, if somehow you can figure out how to get the otoliths out. That's a superb predictor of age.

C. Perret - Our next speaker also from Louisiana State University, Don Baltz is going to give us two presentations, one on "Larval Food, Growth and Microhabitat Selection: Factors Affecting Recruitment of Estuarine-Dependent Fishes in the Northern Gulf of Mexico" and then he's going to follow-up with "Habitat Selection and Recruitment in Juvenile Blue Crabs Along Environmental Gradients in Louisiana."

Larval Food, Growth, and Microhabitat Selection: Factors Affecting Recruitment of Estuarine-Dependent Fishes in the Northern Gulf of Mexico

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Abstract

In this study we are addressing larval food habits, microhabitat selection, and daily growth as factors that affect the recruitment of spotted seatrout (Cynoscion nebulosus) and red drum (Sciaenops ocellatus) in estuarine nurseries in the northern Gulf of Mexico.

In the food habits aspect of the study, we have examined 79 red drum and 80 spotted seatrout with food items. The diets of postlarval spotted seatrout and red drum differed substantially. As early postlarvae, both species preyed heavily on calanoid copepods, but spotted seatrout quickly shifted to other prey species including mysid shrimp and fishes. Red drum postlarvae continued to feed almost exclusively on calanoids until they exceeded 12 mm in length.

Standard lengths of red drum ranged from 6-16 mm. Prey of the smallest fish was exclusively zooplanktonic copepods (Acartia). There is a suggestion of an ontogenetic feeding shift, as fish from 12-16.5 mm also have mysids (mysid species have been identified where possible) in stomachs. We have now obtained larger red drum, from 16 to about 70 mm, for diet analysis.

Standard lengths of spotted seatrout ranged from 5-75 mm. The smallest spotted seatrout are primarily zooplanktonic copepod feeders (Acartia); however, mysids are present in the diet for even the youngest specimens. An ontogenetic feeding shift occurs at about 20 mm after which zooplankton no longer serve as prey. Fishes become important prey of spotted seatrout at about 50 mm. Identifiable fish in the stomachs have always been gobies.

In the nursery microhabitat aspect of the study, 331 drop samples from the recruitment periods of 1988 and 1989 were examined for sciaenids. Thirty-five postlarval seatrout were contained in 21 samples from 1988 and 57 were present in 32 samples taken during the 1989 period. The range of densities sampled was between 0.84 and 10.0 m^{-2} (i.e., 1-7 per sample).

Distributions of frequencies of postlarval spotted seatrout occurrence (observed) were compared with distributions of all samples (expected) for several microhabitat variables. Postlarval seatrout

occurred more frequently than expected in mesohaline and polyhaline salinities between 16 and 31 ppt than in mesohaline and oligohaline salinities less than 16 ppt. Due to seasonal effects, postlarval seatrout occurred more often than expected at high water temperatures between 27 and 35°C, reflecting water temperatures during breeding for this species. The occurrence of postlarval seatrout was greatest between one and three meters from the marsh edge and typically less than expected both right at the marsh edge and more than 3 meters from the marsh edge. Finally, postlarval seatrout occurrence usually was greater than expected in samples among emergent stems (Spartina alterniflora) and less than expected in samples without emergent stems.

Microhabitat use by postlarval spotted seatrout was also analyzed by regressing $\log_n$ (density + 1) on microhabitat variables. Microhabitat variables included water temperature, salinity, dissolved oxygen, turbidity, depth, stem density, water velocity, distance from the marsh edge, and second order terms for all these variables. No models were significant for seatrout density when zero density values (N = 278) were included. However, both salinity and turbidity were significantly related to seatrout density when only non-zero density values were included (N = 49). Two multiple regression models were significant for seatrout density when regressed on salinity and turbidity, one linear and one non-linear. In both models, spotted seatrout density was positively related with salinity and inversely related with turbidity.

A total of 20 drop samples taken during autumn 1987 and 1988 contained between one and 78 postlarval red drum. Thirteen of 27 samples taken during October 1987 contained postlarval red drum, while only seven of 58 samples taken during September and October 1988 had postlarval red drum. Densities in samples ranged between 0.84 and 156 m^{-2}, indicating patchy distributions.

Several microhabitat variables appeared important to the occurrence of postlarval red drum. Water temperatures ranged between 20.8 and 34.2°C for red drum samples. Sample depths were relatively shallow, ranging between a minimum depth of 3 cm and a maximum depth of 52 cm. Only six of 20 red drum samples contained emergent stems. Finally, red drum samples were usually close to the marsh edge, since 13 of 20 were less than 0.5 meters from the edge and 15 of 20 were less than one meter from the edge.

In a preliminary attempt to bring our data on food, growth, and microhabitat together, we examined the influence of microhabitat and prey variables on recent daily growth increments of postlarval spotted seatrout. We first removed the influence of individual length by calculating the residuals from a regression of daily otolith growth on fish length. A General Linear Model that included nine microhabitat variables (and their squares to account for non-linearity) and three prey variables was used to predict growth residuals. This preliminary model explained 62% (R^2 = 0.616) of the variation in daily growth. Six variables made significant ($P < 0.05$) or marginally significant ($P < 0.10$) contributions to the model. In order of importance the variables were DIST (distance to the marsh edge), $DIST^2$, VEL (velocity), VEL^2, PREY DIVERSITY, and STEMS DENSITY. The inclusion of two variables for distance and velocity indicates non-linear relationships (i.e., growth is optimum at intermediate values, but diminishes at high and low values).

Habitat Selection and Recruitment of Juvenile Blue Crabs (*Callinectes sapidus*) Along Environmental Gradients in Louisiana

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Abstract

Juvenile blue crabs, *Callinectes sapidus*, using marsh-edge habitats, were collected by drop sampling beginning in December 1988. A total of 451 samples through January 1990 have been processed. The lesser blue crab, *C. similis*, was also common in the samples. *C. sapidus* accounted for 80% of the total number (3150) of *Callinectes* species. Sex ratios for both species were 1:1 for the year, but varied monthly. For *C. sapidus*, the modal size class was 3-5 mm carapace width (CW) with first appearance in the 1-3 mm class. Individuals larger than 20 mm CW were rare in marsh-edge microhabitats.

Densities (number per m^2) were calculated and log (x + 1) transformed to approach the assumption of normality. We used stepwise multiple regression to model the influence of environmental variables on blue crab densities. Variables, including date, temperature, water depth, dissolved oxygen (DO), and substrate type, were entered in the model if they exceeded a significance level of 0.10. High water temperature decreased crab density, while shallow water and high dissolved oxygen concentration had a positive influence on crab density. Organic detritus substrate significantly increased blue crab densities. Salinity and vegetation density were only included in the model at a significance level of 0.15. Interactions of temperature and date, temperature and depth, and temperature and DO were significant ($P < 0.10$). Turbidity, mean water column velocity, distance from the marsh edge, and other interactions did not significantly improve the fit of the model.

Mean densities were calculated and compared monthly and seasonally by Tukey's studentized-range test. August densities were significantly higher ($P < 0.05$) than all other months and corresponded to the reported spawning peak in June and July. Seasonally, densities were low in the spring (March-May), peaked in the summer (June-August), and remained relatively high in the fall (September-November) and winter (December-February). Spring densities were significantly ($P < 0.05$) lower than other seasons.

Suitability indices were calculated from relative frequency distributions by dividing the proportional use in an interval on a microhabitat variable axis by the proportional availability in that interval. Suitability is defined as:

S = P(E C)/P(E) = Proportional use/Proportional availability.

For minimum depth, we observed a range of 10 to 70 cm. For all seasons, suitability indices suggest that blue crabs were selecting shallow depths. Spring suitabilities indicate selection in the 10-20 cm interval (X^2 = 30.9, $P < 0.001$). Summer suitabilities indicate selection in the 10-20 cm interval (X^2 = 78.99, $P < 0.001$) and in the 20-30 cm interval (X^2 = 72.413, $P < 0.001$). Avoidance was suggested in the 40-50 interval (X^2 = 48.89, $P < 0.001$). Fall suitabilities indicate selection in the 20-30 cm interval (X^2 = 21.5, $P < 0.01$). In the winter, suitabilities were high in the 10-20 cm and 20-30 cm interval but the distribution pattern was not significant.

For distance to the marsh edge, sampling effort and catch for all seasons were skewed to the left. Most of our sampling was within 2 to 3 m of the marsh edge. However, sampling ranged from 0 to 6 m. Although distribution patterns were not statistically significant, suitability indices peaked in the 2-3 m interval in the spring, in the 0-1 m interval in the summer, and in the 3-4 m interval in the winter. In the fall, juvenile blue crabs selected the 0-1 m interval (X^2 = 53.41, $P < 0.001$).

For salinity, we observed values that ranged from 5 to 30 ppt. Modes for catch and effort were in the 15-20 ppt interval for all seasons. In the spring, juvenile blue crabs selected the 15-20 ppt interval (X^2 = 8.2, $P < 0.05$), and avoided the 10-15 ppt interval (X^2 = 10.5, $P < 0.01$). In the fall suitabilities indicate selection of the 15-20 ppt interval (X^2 = 15.5, $P < 0.01$), and avoidance of the 10-15 ppt interval (X^2 = 10.7, $P < 0.05$). In the summer, mode of catch effort was in the 15-20 ppt interval, but crabs selected the 10-15 ppt interval (X^2 = 52.5, $P < 0.001$), and avoided the 5-10 ppt interval (X^2 = 90.2, $P < 0.001$). Winter suitabilities indicate selection of the 10-15 ppt interval (X^2 = 16.06, $P < 0.01$).

For dissolved oxygen concentrations, we observed crabs using a range of 4 to 12 mg/l. We did not observe dissolved oxygen concentrations below 4 mg/l; however, all of our sampling was conducted during daylight hours. In the spring, mode of catch peaked at 7-8 mg/l, but suitability indices peaked at 8-9 mg/l and indicate selection (X^2 = 11.94, $P < 0.01$). Suitability of the 6-7 mg/l interval indicate avoidance (X^2 = 11.12, $P < 0.01$). Fall suitabilities peaked at the 6-7 mg/l interval but distribution patterns were not significant. In the summer, juvenile blue crabs selected the 7-8 mg/l interval (X^2 = 14.12, $P < 0.05$) and avoided the 5-6 mg/l interval (X^2 = 11.12, $P < 0.01$). In the winter, suitabilities indicate crabs preferred the 10-11 mg/l interval (X^2 = 7.87, $P < 0.05$).

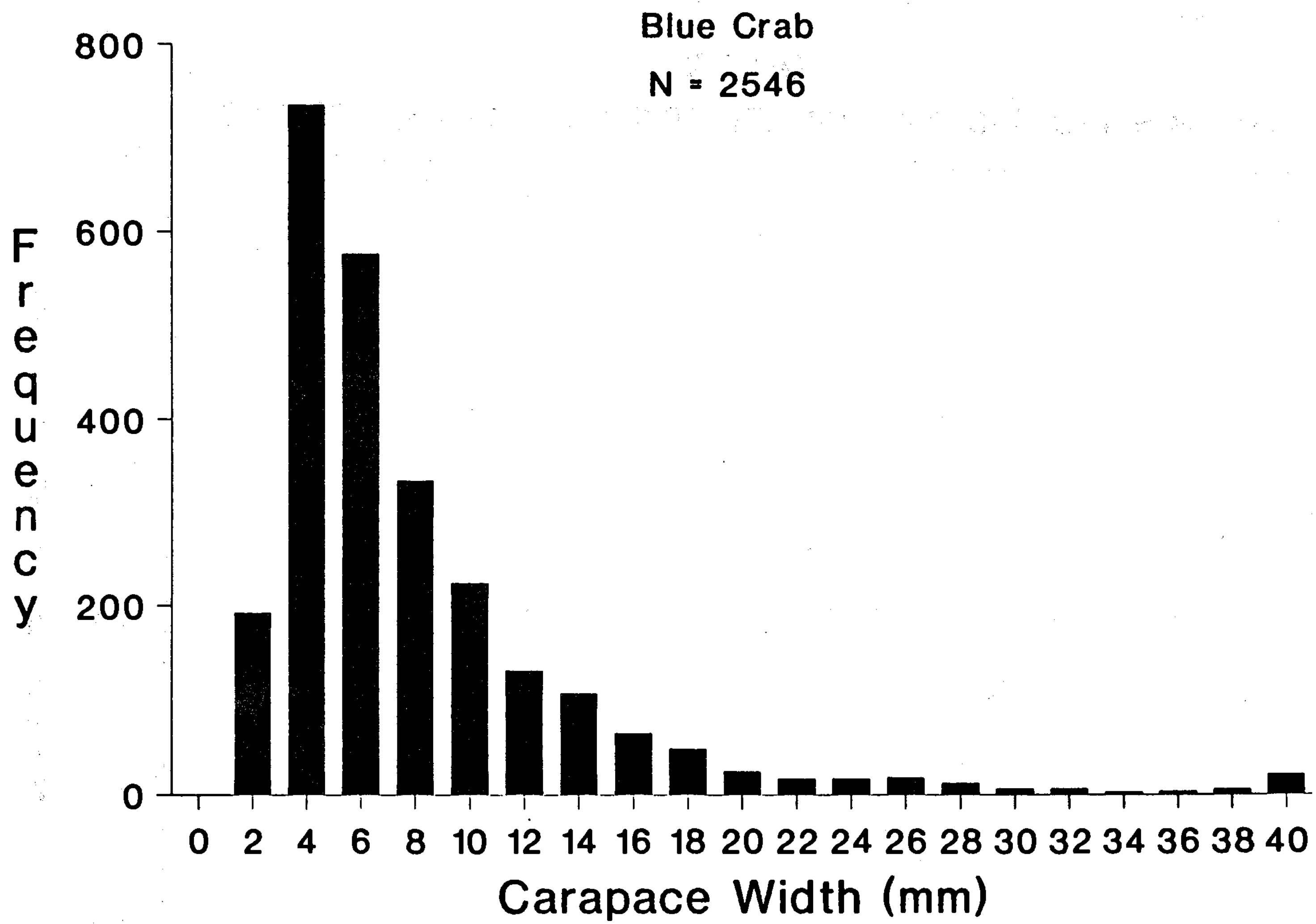

Figure 1.- Juvenile blue crab carapace widths collected by drop sampling in Barataria Bay, LA from 1988-90.

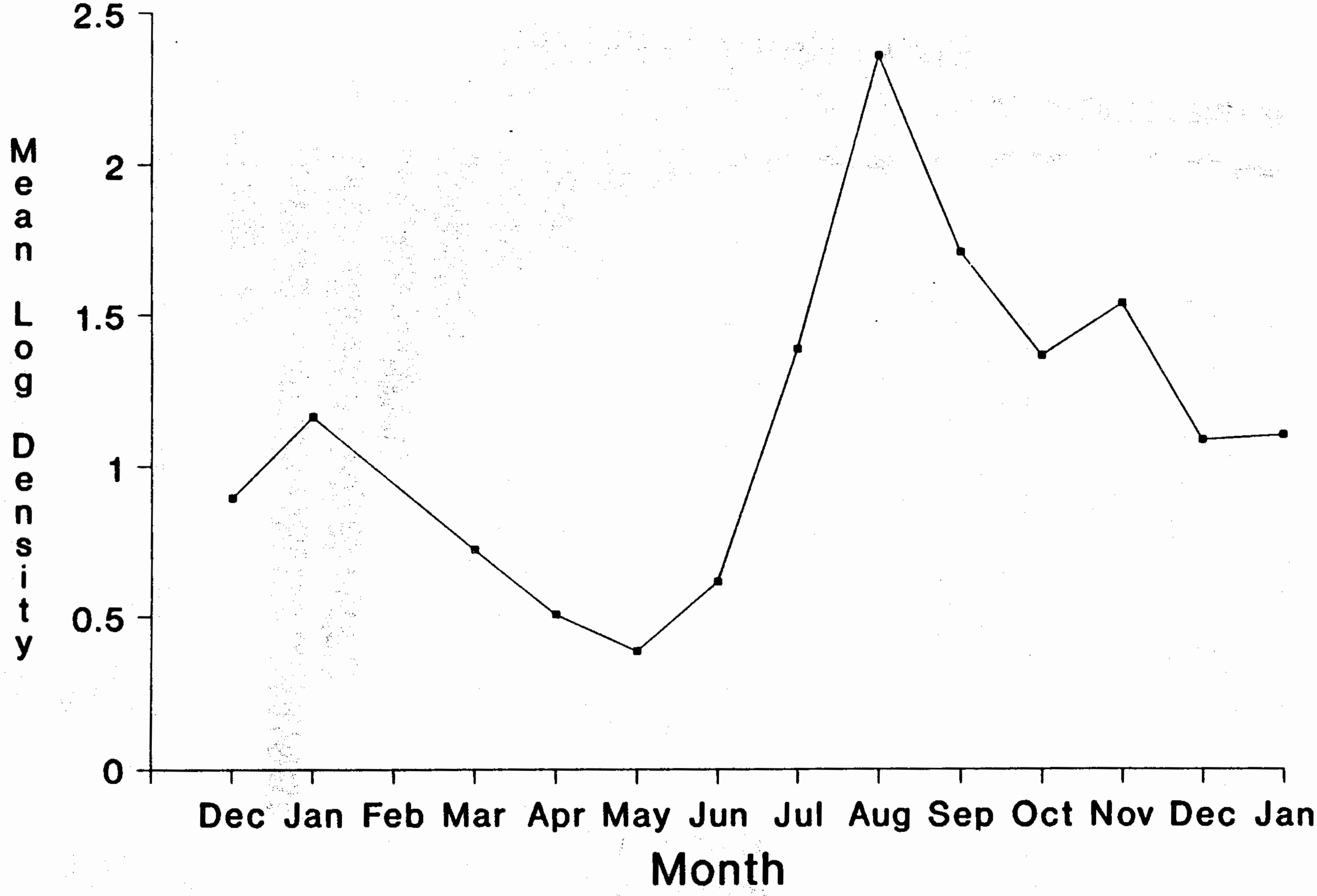

Figure 2.- Mean densities (number per m^2) of juvenile blue crabs collected by drop sampling in Barataria Bay, LA from 1988-90.

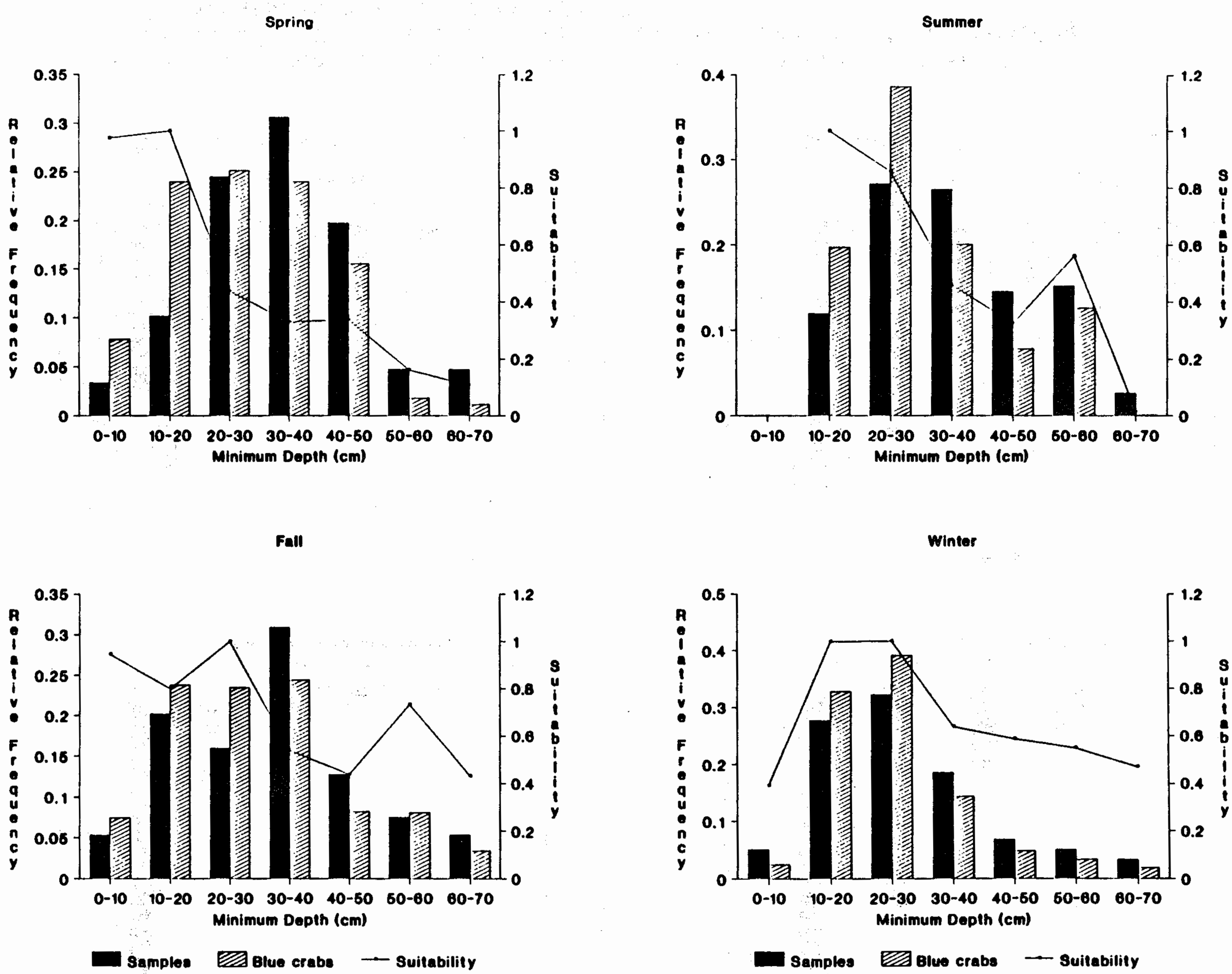

Figure 3.- Seasonal suitability indices of minimum depth for juvenile blue crabs collected by drop sampling in Barataria Bay, LA from 1988-90.

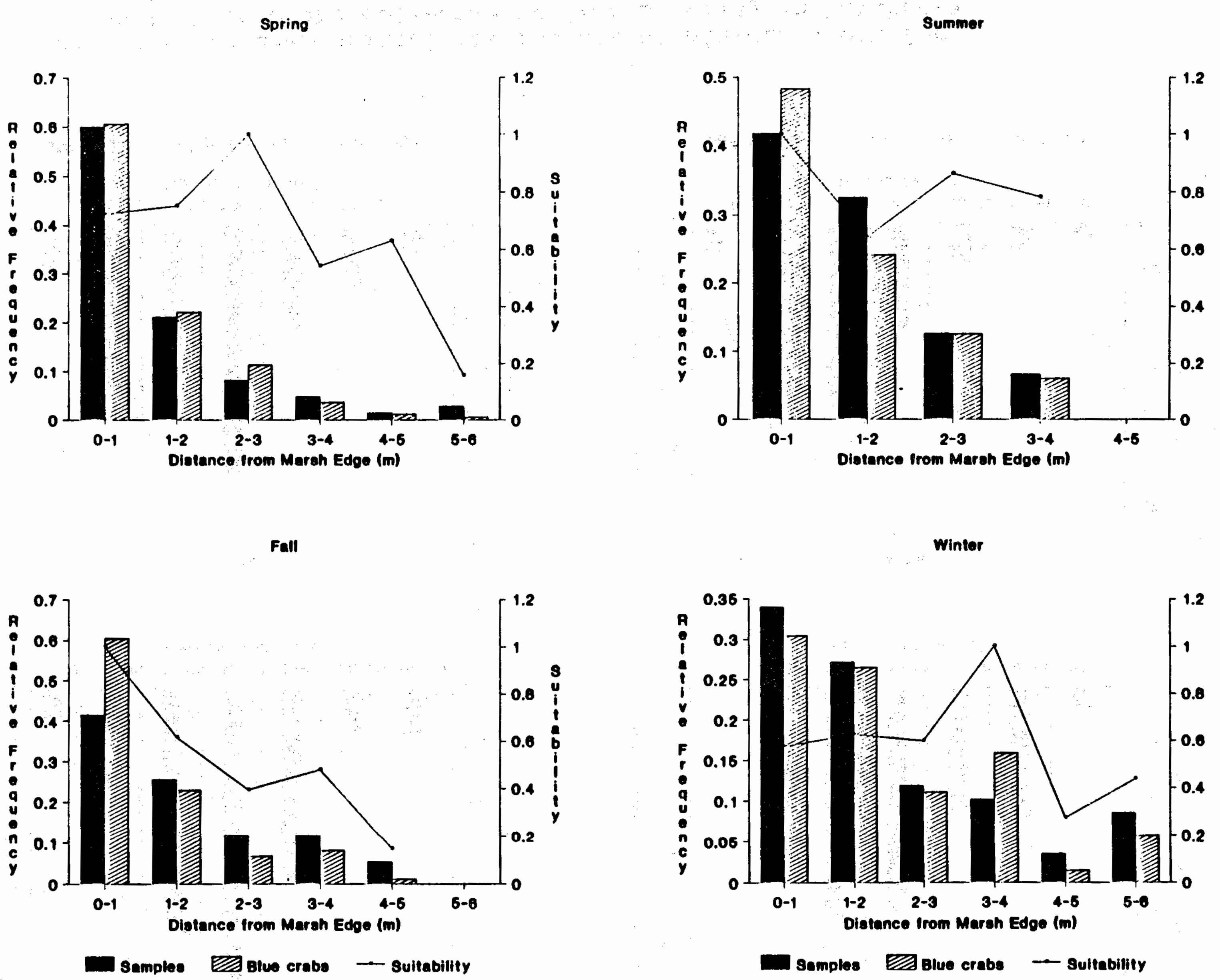

Figure 4.- Seasonal suitability indices of distance from the marsh edge for juvenile blue crabs collected by drop sampling in Barataria Bay, LA from 1988-90.

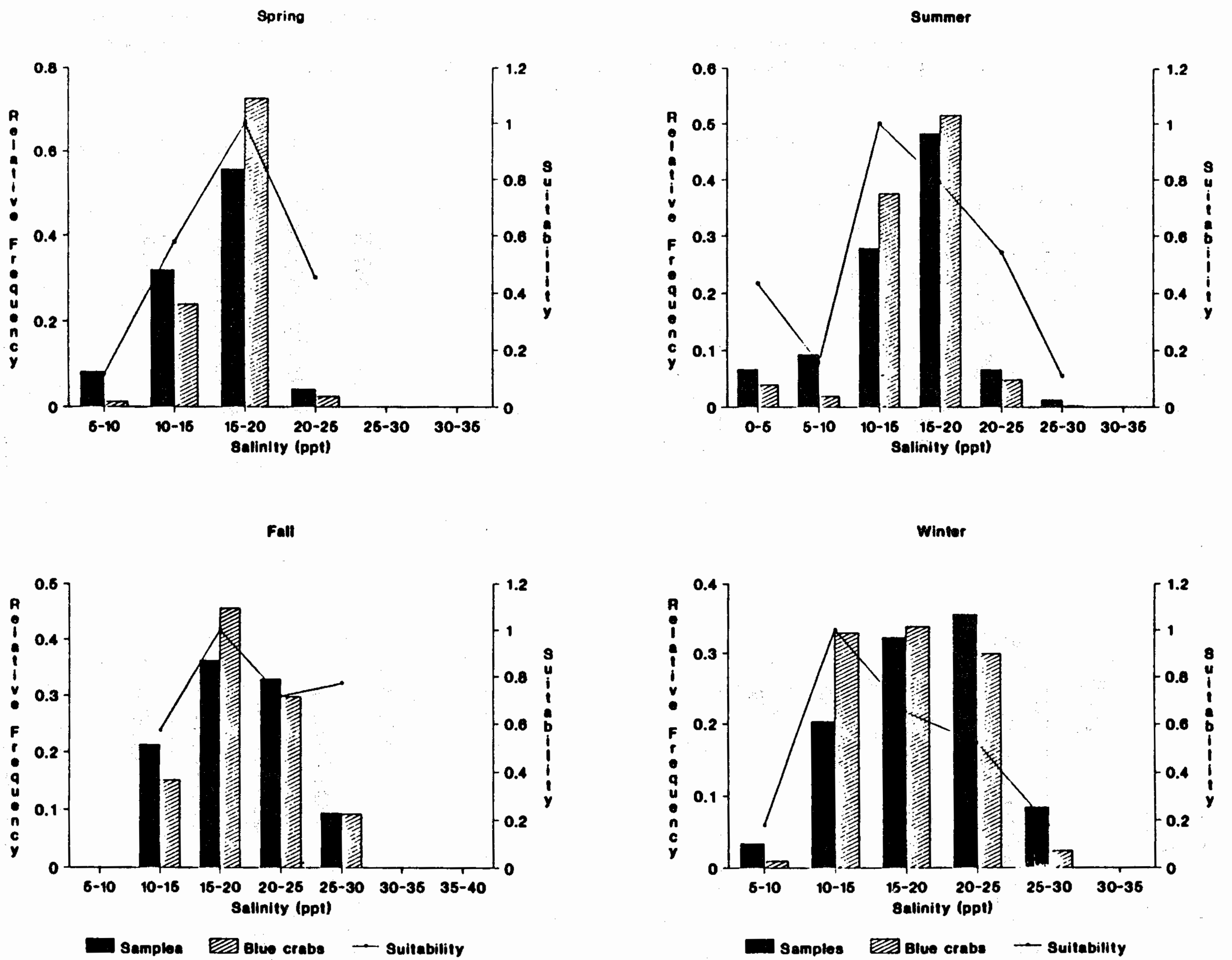

Figure 5.- Seasonal suitability indices of salinity for juvenile blue crabs collected by drop sampling in Barataria Bay, LA from 1988-90.

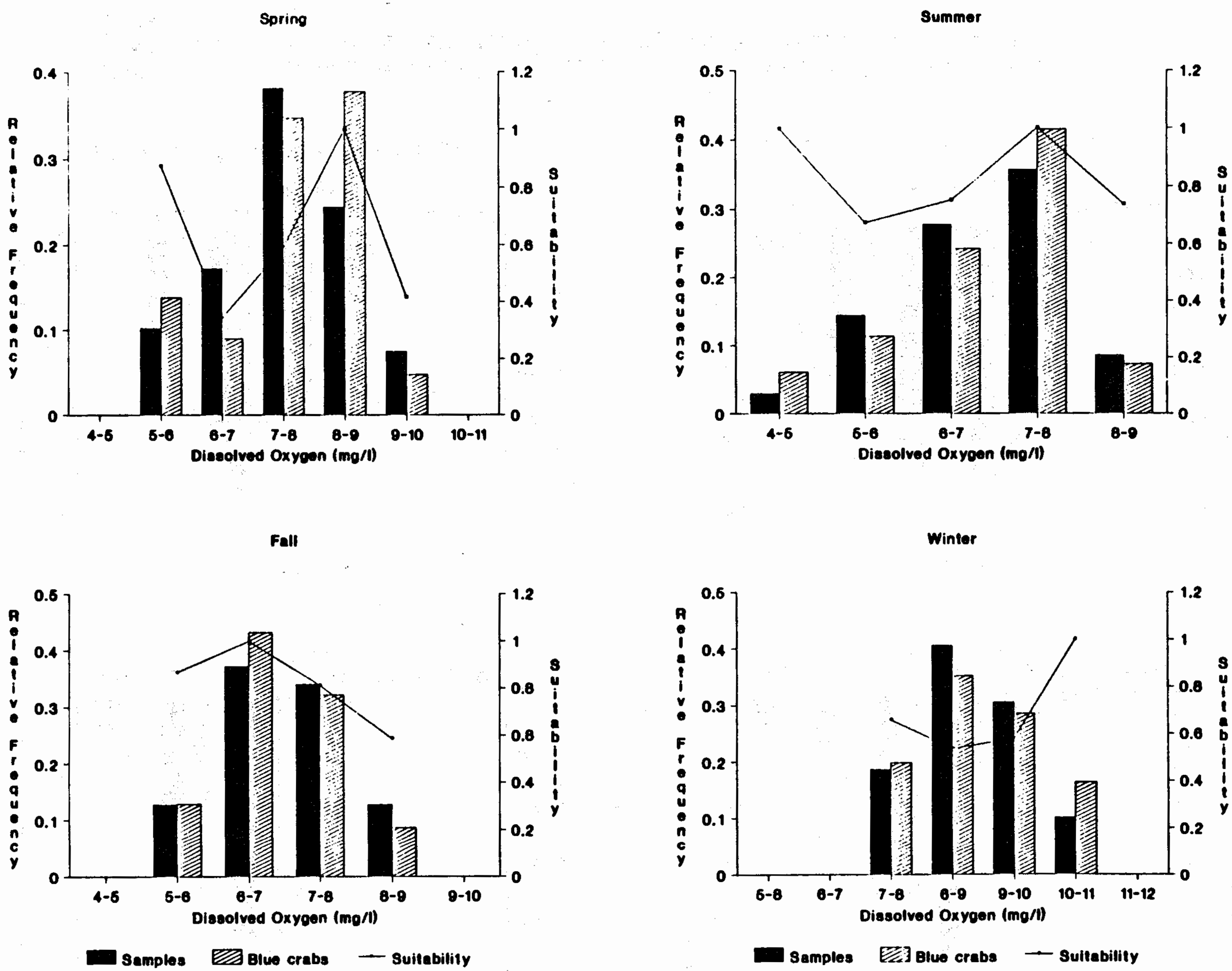

Figure 6.- Seasonal suitability indices of dissolved oxygen for juvenile blue crabs collected by drop sampling in Barataria Bay, LA from 1988-90.

C. Perret - Thank you, Dr. Baltz will stand for questions.

J. Van Lopik - Don, do you have any thoughts about population relative to land loss, break-up of the marsh?

D. Baltz - That's an interesting question, but kind of tough to address. We know that for many species that as the fisheries landings are related to the area of marsh habitat, but we also know that we're loosing marsh habitat. But the landings are increasing. We don't know why, maybe as the marshes are broken up into broken bits of grass the marsh edge increases. So before those broken bits of grass then are converted to open water, there is an effect of increasing marsh area that covers up the habitat loss. The microhabitat may temporarily increase in size, but then be gone altogether. That's something that Roger Zimmerman has talked about quite a bit. We don't know if it's the marsh edge that the fish are using or if it's the flooded marsh that the fish are using. The fish only have access to flooded marsh when the tide is high which may be only one third of the time. But it may be in spite of what the tide tables say, the tide may be low for days at a time because of passive recurrence or set. And during all that time, the fish seem to be concentrated along the marsh edge. We're not clear exactly what the truth about the marsh habitat is or what the effect of habitat losses are going to be.

B. Shipp - What are the months that the red drum are in there? Are they in November and December pretty much?

D. Baltz - We are seeing them beginning in late August. They're there through September, and we catch them in October. We're going to go out this next week, and hopefully they'll still be there in November. But that varies, you know, we catch them in that wide a range every year. We've been doing this for three years.

B. Shipp - They're only there until about 15 millimeters?

D. Baltz - That's what our data indicated at this point.

B. Shipp - And you think then they just move into deeper water as they get bigger?

D. Baltz - They move away from the marsh edge into the deeper water, I suspect.

W. Nelson - I have a comment. This is a difficult sampling area, and I would just like to commend both the sample design and the numbers of samples that you're able to take in. Very good results, I think.

C. Perret - Why do you select dissolved oxygen as one of your parameters for your crab model?

D. Baltz - We didn't select it; we measured it. The step-wise regression analysis selected it. It was useful in predicting the density of crab.

C. Perret - Did you ever have any levels you felt may have been problem areas. In other words, the oxygen was so low at certain times of summer, late summer?

D. Baltz - We've seen dissolved oxygen (D/O) levels on the order of two parts, and that sometimes occurs early in the morning in the summer when the air is still. Nothing causing any oxygenation along the banks. We haven't seen any die-offs as a result of that.

J. Lyczkowski-Shultz - Don, do you have any data or information on selections on your solicitation mechanism in comparison with more traditional methods.

D. Baltz - No we don't, but what we think we get is a fairly quantitative estimate of what is there and a very good recovery rate. Roger has done quite a bit of that kind of work where he's thrown in say so many marked shrimp and gotten real good recovery rates. It's over, I think, 90%. So our densities are, we think, quantitative. They're probably within 90% of the actual value for most of the species that we're looking at. And we're only looking at macroinvertebrates and fishes. We're not looking at anything you might call a microinvertebrate or anything that there is. Certainly, we also think that mullet are probably able to avoid the sample because they spend a lot of time at the surface, and they can see us coming even if the water is turbid. The gear also works well on turbid water as opposed to less turbid water because of avoidance. We always sneak up on the marsh. We point it about where we want it to go, cut the engine, raise the motor, and drift in.

C. Perret - Joanne Lyczkowski-Shultz, Gulf Coast Research Lab, will tell us about "Red Drum Spawning Biomass in the Northern Gulf of Mexico."

Utilization of Fisheries -Independent Data:
Future Management Implications
(Louisiana State University/Richard Shaw, Prime Contractor)

Red Drum Spawning Biomass in the Northern Gulf of Mexico
(Gulf Coast Research Laboratory/Joanne Lyczkowski-Shultz and Bruce Comyns, Subcontractor)

Abstract

Under current regulations a harvest quota of zero pounds for a directed commercial red drum fishery in federal waters is in effect. All harvest of red drum off Florida and Texas is unconditionally prohibited, but directed commercial harvest of red drum off Alabama, Mississippi, and Louisiana can be resumed once it has been determined that a surplus in spawning stock necessary for optimum production exists. In an earlier MARFIN project we found that it was feasible to use larvae to calculate total red drum egg production and, thereby, estimate spawner biomass given that critical adult reproductive parameters had been made available through the results of another MARFIN project (Wilson et al. 1988). The primary objective of the red drum portion of our current MARFIN project (year 1 of 3) is to continue and further refine estimates of spawning stock biomass in order to monitor future changes in the red drum population in east Louisiana, Mississippi, and Alabama coastal and shelf waters and to track the effects of both state and federal management regulations.

Our first estimates of red drum spawner biomass for the 1986, 1987, and 1988 seasons were 1.25, 0.13, and 0.55 million pounds, respectively, and were much lower than the 15 million pound estimate obtained from NMFS mark/recapture data for the same area in 1986. Variability in larval catches was thought to have caused the apparent underestimation. Sampling effort during the 1989 Mississippi/SEAMAP Fall Ichthyoplankton Survey, was tripled in an attempt to reduce sampling error and improve the accuracy of the spawner biomass estimate. The 1989 estimate, 2.3 million pounds, is also lower than the mark/recapture estimate but its consistency with our earlier estimates and the precision of the catch data on which it was based leads us to the conclusion that it may represent an accurate estimate of the offshore red drum population in our survey area. Potential sources and relative magnitudes of error associated with both population assessment methodologies will be presented and discussed.

The growing time series of red drum spawner biomass estimates extending from 1986, and by the end of this project to 1991, will provide the critical test dataset for judging whether egg production methodology can be used to index adult population size and, thereby, monitor annual changes in offshore adult biomass. Recommendations for future red drum larva surveys will be presented and discussed in light of comparisons of the results from multiple surveys conducted in September 1989 and 1990.

C. Perret - Thank you, Joanne. Ms. Shultz will stand for questions. I have the first question. The area that you're discussing is from the Mississippi River to west Florida, and these estimates are based generally on how much field data or how many cruises you've been able to make each year? 1, 10, 100...

J. Lyczkowski-Shultz - One to two.

C. Perret - One cruise. I've got some serious concerns with these numbers, very serious concerns. I even have more, well I don't have as many concerns with the numbers because I think data from one cruise is worth absolutely nothing. In 1986, NMFS mark-recapture for that area shows the population estimate of 15 million pounds. Is that right?

J. Lyczkowski-Shultz - Yes.

C. Perret - And you come up with 130,000 pounds for 1987. I'm sorry, I think its totally ludicrous. We all know the regulations that have been put in place. Personally, I know what kind of fish are out there because I'm out there a lot more than one time a year. I'm going to tell you one little story and then I'm going to shut-up. In the 1960's, we used to predict shrimp abundance based on daily post-larval samples. Not once a year, every day. It wasn't worth a darn, and using this eggs and larvae on one, two, four cruises a year, I think is about the same situation. And that's my personal opinion on that.

J. Lyczkowski-Shultz - Well, on the last thing you just said, we're not predicting. That is prediction and that's different from what we're doing. Some of the uncertainties in this data are possibly the survival, mortality rates during that period before they're collected, right after hatching. And if that's different, that will affect our estimate because we are assuming a continuous, single mortality estimate through there. If there are some differences there, then, it will change our biomass estimate, but it will not change enough to bring it up or put it over that 15 million pound value. With red drum, I will agree with you one cruise seems like too few in observatoins. The data come consistently low and the actual numbers are just so consistent that I was the first skeptic, but I've come to believe in the validity there. The other thing about red drum is they have concentrated spawning over a short period of time and that's the key I feel with this species. They spawn over such a short period of time. I conclude by saying yes, we need two cruises, perhaps three, but I would hazard a guess that that is all you'll ever need for that peak spawning occurrence. Two cruises for four weeks, a four week period. That is supported by a lot of data that I've collected over the years and Chuck Wilson's observations on reproduction. Gulf-wide that seems to be the case, except in south Florida waters.

C. Perret - How do you explain then the 1986 mark-recapture estimate of 15 million pounds. It was totally wrong?

J. Lyczkowski-Shultz - I called Phil Goodyear just the day before I got here and said, 'Phil, have you been reading?' I've been sending him my reports looking to some of the adult finfish people to perhaps point out if there are biases and problems. Things that can happen with that type of data - losing a lot of tags although I know that there has been variables factored into it, but that could affect that.

C. Perret - Are they not the same errors and inaccuracies that could happen with your data?

J. Lyczkowski-Shultz - Not with tags.

C. Perret - But not the same...

J. Lyczkowski-Shultz - No

C. Perret - My only point is this, you've got people taking a lot of heat when they make these managment decisions, and when you people give this kind of information it makes it worse. You just said it a few minutes ago; there are a lot of holes in it. Please put that in there.

J. Lyczkowski-Shultz - I always do.

L. Simpson - I'm reminded of the story about the young kid that wanted the pony so bad. He came down Christmas morning, and there was a lot of horse manure. He kept jumping up and down and running around saying great there has to be a horse around here somewhere. So you can be optimistic and pessimistic and while I too think that 130,000 pounds can't be right, the small amount of money spent trying to get a secondary comparison is appropriate, I think. I look at it from an optimistic point of view that given these regulations, and as stringent and difficult as they are, there is at least an increasing amount from your estimate. Certainly they're not precise and they may not even be accurate, but they do show a trend at least. If you want to be optimistic about it.

B. Shipp - I also share Larry's optimism in a sense. I think this is a totally different approach and while fine tuning may still be required, I think the mere fact that the numbers are so different also targets the other methods so that it examines very carefully what they're doing. I have a question, too, and that is (I wish Chuck were here), it seems to me that crucial to this are his data that he provides to you regarding fecundity. A small change in his estimate would have a major, major impact on your numbers, and that's the one factor that I worry about. We have these traditional ideas in fisheries that if you have a big stock, the fecundity is going to be way down, and if he can't provide you accurate numbers there or if you're not real secure with them...so how do you feel about what he's giving you?

J. Lyczkowski-Shultz - I feel good about them. I'm glad we have them; it makes less work. And we had thought about just if it shifted. If say in his batch fecundity and other places where there could be improvements. Batch fecundity estimates are based on hydrated oocytes so you need to get your samples as close to spawning time as possible. And he has said that his samples are probably a little too early in the day so he may be missing some of these oocytes. If that's the case then his batch fecundities are underestimates. That means that there are actually fewer. The other thing is the duration of the post-ovulatory follicles and I didn't point this out in this presentation. But there is some indication with this year's work that duration is I said 24 hours, that was the early estimates. They have now laboratory studies by holding drum that show perhaps the post-ovulatory follicles last for 36 hours. Going through this procedure, that would increase our spawning biomass by 20%.

B. Shipp - How does he arrive at his number, where does Chuck get his numbers from?

C. Perret - Can you answer that, Bruce?

B. Thompson - Our Sea Grant work provided to LSU provided all the baseline information on that, and batch fecundity has a little bit of black magic involved in it. But, the values that we developed at LSU are getting closer and closer to being more consistent. The cautions that you have to have on this is that it's size specific, and that's the one thing that we had been talking about is that this doesn't tell you anything about the fact that batch fecundity is smaller for small individuals and larger for large individuals. I think if you get some kind of information, that's the kind of thing you need to fine tune Joanne's model on this. Essentially, the values that you get, you want to know how they're derived. They're derived by actually going into an ovary and counting the hydrated individuals from wade samples and so forth. The duration of the hydrated oocyte and how long the post-ovulatory follicle which is more or less like a fingerprint left behind, the cellular structure, still needs to be a little bit fine-tuned. It isn't going to take Joanne's figures and make them, what 2.3, it isn't going to make them 15. It's never going to be that far off. It may be like she said 20% more. I would have maybe even said 10% more on something like that. This is done from the actual red drum that are brought in off the Gulf of Mexico.

B. Shipp - It's fishery-dependent though isn't it?

B. Thompson - Some it is, some of the stuff is. Some of it is fish that are being held at tanks at LSU.

J. Lyczkowski-Shultz - He's also gone in recent years and this year I know for sure, they had difficulty because of weather going out with fishermen and collecting.

B. Thompson - And some of the material are purse seined individuals.

B. Mahmoudi - I just wanted to comment. I think you mentioned in 1990 you had basically a different period of peak of the spawning. I think some of these numbers suffered from that, basically 1988 and 1989, the data showed that we had a warmer season during the summer. You may have a shift.

J. Lyczkowski-Shultz - Well, I feel that we were in the northern gulf waters. I think that off Tampa and farther south we see from the Peters and Michael paper that definitely the shift is more, the peak is in October. That's not true in our waters. I have similar data to date our peak period.

B. Brown - Just one quick comment. You've suggested that we might concentrate best on trying to make an estimate of the spawning structure biomass and developing a viable index to that biomass because that reduces the number which helps yield the variability built in the fecundity estimator. You will find that more valuable in terms of an index with a cohort analysis than in trying to estimate actual numbers.

J. Lyczkowski-Shultz - Could I just say one thing. I just defer to Bruce Thompson. When I talked about the batch fecundity figures and all, Bruce, did the work on that much earlier and started Chuck Wilson on the whole process. I'm sorry for not acknowledging that.

C. Perret - Thank you. Our next speaker is Mr. Miller who is going to talk about "Shelf Life of Food Grade Gulf Menhaden Oils, Fish Oil/Vegetable Oil (FO/VO) and FO/VO Used in Food Systems."

Shelf-Life of Food Grade Gulf Menhaden Oils, Fish Oil/Vegetable Oil (FO/VO), and FO/VO Used in Food Systems

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Abstract

Introduction

Atlantic and Gulf coast menhaden landings (1983-1988) averaged 0.7 and 2.0 billion pounds, respectively. The Gulf landings produced 281 million pounds of prime crude menhaden oil for which the plants received only $39.6 million. This low return for so much fishing provides economic justification for this project and its overall objective:

> To enhance the value of Gulf menhaden oil by demonstrating how to use refined prime crude menhaden oil, or menhaden oil prepared directly from the edible parts of food grade Gulf menhaden, (1) as part of the fat added to those prepared foods which frequently contain unhydrogenated vegetable oils as ingredients, and (b) to evaluate the stability of fish oil/vegetable oil combinations, before and after use in food products.

Food and Drug Administration (FDA), 09-15-89, affirmed the Generally Recognized as Safe (GRAS) status of hydrogenated and partially hydrogenated menhaden oil for use as edible fats and oils. Structurally unchanged refined menhaden oil (RMO), that could contribute omega-3 fatty acids to many foods, i.e., salad dressings, soft spreads, sausages, canned products, awaits final FDA action.

Presumptions that RMO can be safely consumed in moderation are based on extensive fish consumption throughout history, widespread use of cod liver supplements for over 100 years, and few reported adverse effects, i.e., bleeding, when relatively large amounts are fed.

It has been noted that the amount and effect of n-3, n-6, and n-9 fatty acids has never entered into the promulgation of national dietary guidelines. Concern has been expressed that the average intake of linoleic acid (n-6): α-lineolenic acid (n-3), 10:1 ratio, is much too high. Moderate amounts of food grade menhaden oils added to vegetable oils would decrease this 10:1 ratio by contributing n-3 fatty acids.

The reactivity of the highly unsaturated n-3 fatty acids makes them physiologically active, and susceptible to oxidation. Unhydrogenated canola and soybean oils contain about 10% and 7% α-linolenic acid, respectively, while menhaden oil contains over 30% omega-3 fatty acids. These relative n-3 fatty acid levels help reflect the extent of the stability problem.

Summary of Results

This summary includes preparation for the project, and accomplishments during its first six months, ending 09-30-90. Samples of food grade Gulf menhaden (FGGM) and prime crude menhaden oil (PCMO) were collected last summer. Peroxide values (PV) and anisidine values (AV) were determined on oils from menhaden backs, belly flaps, and entrails. AVs were 2.4, 5.3, 8.4, respectively, which partly explains the AV levels in PCMO. Collections of PCMO for refining required many precautions at the producing plant to enable delivery of a suitable feedstock to The Cambrian Engineering Group, Ltd. in Canada, where four samples of RMO were produced.

PV and AV were determined on the RMO samples, and a variety of (refined, and expeller produced) unhydrogenated vegetable oils. Improperly stored fish oils rapidly became rancid, and over longer intervals this occurred with vegetable oils.

The Schaal Oven Test and Active Oxygen Method (AOM) for measuring stability imposed too much stress for the required comparisons. The test conditions selected involved bubbling clean dry air through oil samples @ 25 deC. PV and AV data proved the reactivity of fish oil and showed suppressed oxidation in some of the VO/FO mixtures.

The AV of fish oils and vegetable oils were increased substantially by exposure to 1 hour frying temperature. An interpretation awaits further work, but this apparent sensitivity of the oils to secondary oxidation may influence food systems, cooking methods, and processing conditions.

VO/FO combinations were substituted for soybean oil and other vegetable oils in refrigerated salad dressings and sauces, and in canned fish and clam products. After 30 days, the oils did not show significant PV and AV changes.

I. TYPICAL OF VEGETABLE OILS & RMO USED IN THIS STUDY

CONTENT OF DIETARY FATS (PERCENT)

	Canola	Corn	Cotton	Olive	Peanut	Saf.	Soy	Sun.	RMO
Sat.	Ø6	13	27	14	18	9	15	11	29
Monounsat.	58	25	19	77	48	13	24	2Ø	27
Polyunsat:									
n-6	26	61	27	Ø8	34	78	54	69	3
n-3	1Ø	Ø1	--	Ø1	--	tr	Ø7	tr	32
Other	--	--	--	--	--	--	--	--	7

II. MODERATE INTAKE OF RMO CAN REDUCE n-6/n-3 RATIOS

FATTY ACIDS (FA) (Groups, % of FA)	COMPOSITION OF FATS FROM MENHADEN PARTS Upper Body	Belly Flaps	Entrails
Total Saturates	34.Ø	34.2	32.9
Total Monoenes	26.Ø	26.8	26.8
Total Dienes	3.9	3.9	3.9
Total Polyenes	37.7	36.8	38.3
Total n-3	27.4	26.5	27.9
Total n-6	2.7	2.6	2.8
n-3/n-6	1Ø.1	1Ø.3	9.9

III. RMO SAMPLES PRODUCED AND USED IN THE PROJECT

Sample	FFA	IV	PV	AV	Phos.	Color	Flavor
Prime Crude Menhaden Oil (PCMO)							
P 27	2.Ø	165.5	19.2	2Ø.6	5.5 ppm	sl.green	fish
P 32	2.1	161.2		14.4	7.7 ppm	yellow	fish
Refined Gulf Menhaden Oil (RMO)							
Camb. 1. (P 27+P 32 5:6 ratio)	Ø.6	161.Ø	nil	23.9	-------	2ØY+3.2R	sl. fish
Camb. 2. (P 27)	Ø.1	164.7	1.Ø	13.6	<Ø.Ø1 ppm	1ØY+1.ØR	sl. fish
Camb. 3. (P 27)	Ø.2	164.6	Ø.6	13.5	<Ø.Ø4 ppm	1ØY+1.ØR	sl. fish
Camb. 4. (P 32)	Ø.1	161.4	Ø.8	3.2	Ø.12 ppm	4Y+Ø.3R	sl. fish

IV. ESTIMATING STABILITY OF OIL SAMPLES

OIL SAMPLE	DRY AIR BUBBLED INTO SAMPLES @ 25 deC START OF TEST			END OF 10.2 DAY TEST		
	-PV-	-AV-	-FFA-	-PV-	-AV-	-FFA-
Cambrian 1. (RMO)	0.4	23.9	0.6	31.4	>100	1.0
Canola oil/RMO (2/1)	1.4	8.5	0.2	2.3	9.8	<0.1
Soybean oil/RMO (2/1)	1.4	8.4	0.2	2.4	8.8	0.1
SBO/RMO (2/1) + lemon	1.4	8.4	0.2	2.5	8.5	0.1
SBO/RMO (2/1) + orange	1.4	8.4	0.2	2.5	10.0	0.1
SBO/RMO (2/1) + Soya-fluff	1.4	8.4	0.2	1.0	8.5	0.1
SBO/RMO (2/1) + Soya-rich	1.4	8.4	0.2	0.8	8.3	0.2
SBO/RMO (2/1) & Wheat germ oil (9 to 1)	1.4	8.4	1.0	2.4	8.5	2.0
RMO & Wheat germ oil (9 to 1)	0.4	21.5	1.1	28.4	25.3	1.9
RMO & Sesame oil (9 to 1)	0.5	22.0	0.2	2.0	8.8	0.4

V. EFFECT OF HIGH TEMPERATURE ON OIL SAMPLES

SAMPLE	OILS HEATED IN TURBO CONVECTION OVEN At start		1 hr. @ 329 deF	
	--PV--	--AV--	--PV--	--AV--
Cambrian 4. (RMO)	3.2	5.0	8.2	70.5
Canola oil	4.0	6.0	7.6	53.0
Canola oil/RMO (70/30)	---	---	6.4	58.1
Corn oil	2.8	5.8	2.0	40.5
Corn oil/RMO (70/30)	---	---	7.6	55.6
Olive oil	13.0	7.0	2.0	27.0
Olive oil/RMO (70/30)	---	---	6.8	61.3
Peanut oil	0.8	3.5	10.4	30.0
Peanut oil/RMO (70/30)	---	---	8.0	55.6
Soybean oil	2.8	1.3	11.6	52.5
Soybean oil/RMO (70/30)	---	---	8.2	63.8
"Vegetable oil"	1.6	2.0	12.0	39.5
Veg. oil/RMO (70/30)	---	---	6.2	39.4

C. Perret - Mr. Miller will stand for any questions. Do we have any questions? I guess that shows there are not a lot of chemists here.

T. Miller - It's a change in pace.

C. Perret - Thank you very much. Behzad Mahmoudi from Florida Department of Natural Resources will speak on "Estimation of Spawning Stock Biomass and Exploitation/Escapement Rates for Population Assessment of Black Mullet."

Estimation of Spawning Stock Biomass and Exploitation Rates for Population Assessment of Striped Mullet

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Abstract

As part of an ongoing research program to study the population dynamics of striped mullet (commonly referred as black mullet) in Florida, three independent surveys (hydroacoustics, mark-recapture, and catch and effort) were conducted simultaneously during the 1988 spawning season. The purpose of this project was to provide time-specific direct estimates of the spawning stock biomass and exploitation rates of the fishery during the spawning (roe) season in the Tampa Bay region.

The hydroacoustic sampling was conducted from November 20 through December 30, 1988. Daily transect surveys were made over a major holding region in the upper Manatee River system, lower Tampa Bay. These surveys generated daily time series of schooling density and population biomass of mullet schools aggregated in the holding area. Repeated measurements were specifically made during days with peak aggregation prior to the passage of cold fronts when outmigration of mullet schools from the holding area were known to occur. The mullet abundance reached a peak during the week of December 4, prior to a major spawning run on December 11, when a strong cold front passed through the Tampa Bay system. Three other spawning runs were recorded during the acoustic survey. Direct measures of exploitation rates were made based on estimates of population biomass (adjusted for gear selectivity) and landings (commercial gill net fishery) associated with each spawning run from the Manatee River system.

During the hydroacoustic survey, portion of the aggregated schools in the holding region were marked and released prior to the spawning run. The tag returns from the commercial catches made during and after the cold frontal events provided time specific recapture matrices for each spawning run. The number of marked animals available to the fishing grounds was corrected for the initial tagging/handling mortality (based on experimental studies) and gear selectivity. The number of tag returns were adjusted for non-reporting rate. The adjusted number of marked and recaptured animals and landing records from the commercial fishery during each spawning run were used to provide additional estimates of the spawning stock size and exploitation rates.

A third method was based on daily catch and effort data collected from the fishery during the spawning season. Under the assumption that catch per unit of effort (CPUE) is proportional to the stock present, the rate of decline in CPUE over a short period of time (days between cold front events) was used to estimate the catchability coefficients and stock sizes.

The estimates of exploitation rates, catchability coefficients and spawning stock biomass during a major spawning run, generated based on three independent surveys, were compared. Problems with the variance measurements and sample size associated with estimates from each of the three surveys were discussed.

C. Perret - Thank you Bezhad. Dr. Mahmoudi will stand for questions.

W. Nelson - We're absolutely thrilled when we can identify individual targets. Can you tell males from females, acoustically?

B. Mahmoudi - No. As I said the only way is for us to sample at the same time simultaneously with the purse seine operation at the same area we're doing the acoustic survey.

C. Perret - Thank you. Walter Keithly is going to present a paper entitled, "An Economic Analysis of Leasing Activities in the Louisiana Oyster Industry."

An Economic Analysis of Leasing Activities in the Louisiana Oyster Industry

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Abstract

Introduction

Louisiana currently enjoys the distinction of highest annual oyster production among all states in the nation. Its landings generally fall in the 8-12 million pound range though landings in excess of 13 million pounds are not uncommon.

While Louisiana's vast wetland systems and conducive growing conditions help explain the states' large and relatively stable annual oyster harvests, the significance of the state's water bottom leasing system cannot be overlooked. This system has encouraged leasing activities and has fostered the state's production of oysters.

Total leased water bottom acres have increased by more than five fold during its past 40 years and currently approaches 330 thousand acres. Oyster production, however, has increased only marginally; indicating a sharp decline in productivity of leased grounds. Rehabilitation efforts are, as evidence clearly shows, warranted.

An analysis of the stability of lease-based oyster businesses, including economic and financial aspects of the leasing situation, is a precursor to reef rehabilitation efforts of private grounds. Such an analysis serves the overall goal of this two-year project which also includes several specific objectives. These objectives include:

1. To identify in a business sense the stability among lease holders and examine whether stability varies with changes in the economic environment.

2. To research the lease files of the Department of Wildlife and Fisheries (LDWF) in order to obtain information on sales agreements between oyster lease sellers and buyers and to use these values to examine the relative economic "health" of the leasing situation.

3. To tabulate sales values established via public auction of leases (resulting from non-renewal) and to relate these values to characteristics of the lease (e.g., location of lease, acreage of lease, etc.) and buyer's linkage to the industry.

4. To identify all leases serving as collateral for loans for the purpose of determining leverage capacity which might be available for future reef rehabilitation efforts by lessees, and

5. To survey financial institutes and Farmers Home Administration (FmHA) loan offices to gather information on the extent of debt in the oyster industry incurred for reef/lease maintenance and rehabilitation.

Completion of the stated objectives will provide economic and financial information which can be incorporated in the decision making process of investors in the oyster industry, public agencies, and lenders asked to finance rehabilitation projects.

Results

The following results are based on the first year's findings of a two year project. Therefore, the results should be viewed as preliminary and subject to revision as the analysis of the data is further refined.

Oyster production in Louisiana accounts for about 50% of the Gulf region's total and has contributed about two-thirds since 1986. Nationally, Louisiana typically supplies 15-20% of total landings and, since 1966, has increased its contribution to about a third. About 80% of Louisiana's annual oyster production is derived from private grounds.

Increases in private ground acreage have taken place over the last forty years. In 1951-52 less than 40 thousand acres of oyster grounds were leased. During 1960-61 about 65 thousand acres were leased. By 1970-71 total leased acreage had increased to more than 110 thousand acres and more than doubled to about 230 thousand acres by 1980-81. The acres of leased water bottoms then expanded to approximately 310 thousand acres by 1988.

Along with the increase in acres leased came increases in the lease transfers which took place. During the 1950s, 1960s, 1970s, and 1980s, there were 299, 380, 629, and 1,188 transfers registered, respectively, with the LDWF. The number of leases per transfer were relatively stable at about four from 1950-79. However, during the 1980s, the number fell sharply to less than three.

When transfers that were between family members, involved a corporate name change, created a partnership, or dissolved a partnership were excluded, the number of transfers during the 1950s, 1960s, 1970s, and 1980s fell by 37, 21, 24, and 25 percent, respectively.

Leases have been sold at public auction since 1987. In the first auction 164 leases went up for bid. These leases averaged about 66 acres in size. Sixty-seven leases were available for auction in 1988; they averaged 49 acres each. The 1989 auction had 78 leases averaging 112 acres each. The most recent auction, 1990, had 81 leases averaging 81 acres each.

Results of the auctions show that in 1987 only 99 of the 164 available leases received the minimum bid. The average bid per lease taken was $650.34. During the 1988 auction 54 leases were taken at an average price of $226.90 per lease. The number of leases taken in 1989 and 1990 were 33 and 58, respectively. Leases taken in 1989 averaged $226.90 and fell to $162.71 during the 1990 auction.

Oyster leases have been used as collateral in securing at least 48 FmHA loans in recent years. The average loan amount was $113,955 and about 570 acres of leased water bottom were used as collateral to secure each loan. Of the 48 FmHA loans analyzed, 30 are currently outstanding (as of 1990). Principal on these 30 loans totalled about $2.4 million, or about $80 thousand per loan. Sixteen thousand acres of water bottom were used as collateral in securing the $2.4 million. This 16 thousand acres represents about 5% of the total water bottoms leased from the state.

B. Shipp - Thank you very much Walter. Dr. Keithly will stand for any questions.

C. Perret - Walter, when you say $50 to $60 an acre for the term of a lease. Do you put it at $60 and divide it over 15 years to get $4 an acre? Is that what you're saying?

W. Keithly - If you want to use 15 years. Potentially, you can have the lease indefinitely.

C. Perret - Well, if you put it at 30, then we're right at two bucks an acre. You have to understand, and you do, there's not a whole lot of people that know a whole lot about oyster lease economics.

W. Keithly - Some of the acreage is probably worth thousands of dollars. Most of it is not worth $2. That's what I wanted to point out with the auction information. That which was only worth $2 an acre was mostly that which went up for auction overall. We had cases in there where it was $1,000 to $1,500 per acre, but again you are talking about a very small percentage there. The majority of it is going for $20 to $30 per acre.

D. Ekberg - Relative to that, do you have any feel at all for the amount and if the effort has changed over time?

W. Keithly - The only thing we really have is two sources. The NMFS data in terms of number of boats. Let's just go with dredges. The NMFS data shows very, very little increase in terms of number of boats and fishermen. I find that a little hard to believe unless it's just people that maybe have some leases that are getting worse and worse and they're just expanding to keep that same amount of cash inflow that they used to have so they'd be working more days and so forth. Like I say, the NMFS data shows very little increase in the amount of effort. Louisiana Department of Wildlife and Fisheries data does show some, I can't remember what it is off hand, but much more increase in effort from Wildlife and Fisheries license sales.

B. Shipp - I can't understand that if you look at Plaquemines Parish and the leases are going up and apparently though the habitat is going down. I just wonder why the relationship is not clear. How has pollution affected the industry.

W. Keithly - We're still working on that part. There is no doubt about it that pollution is playing a larger and larger part in seasonal or conditional closures even if it's not permanent. Louisiana does it a little bit differently than a lot of states. They will continue to rent it to you even if it does become a permanently polluted area. They will not lease a new area, I don't think, in polluted waters, but they will continue to lease something that is in conditionally polluted or whatever the long-term polluted areas are. There may be a lot of people holding onto those leases anyway. And still trying to get new leases. From the environmental part of it, in Plaquemines Parish it is quite obvious that some of the bigger oyster dealers are down there.

You step on the dock and they will tell you half goes to the estuaries. Once there was all marsh land out in front of them. Now there is no marsh land. Essentially, it is providing more areas that they can reseed.

B. Shipp - Thank you very much, Walter.

SESSION III
COASTAL PELAGICS

SESSION III-COASTAL PELAGICS - Walter Nelson, Chairman

W. Nelson - Our first presenter is Bruce Thompson from Louisiana State University. Bruce will be presenting "Age, Growth and Reproductive Biology of Greater Amberjack and Cobia from Coastal Louisiana Waters."

Age, Growth, and Reproductive Biology of Greater Amberjack and Cobia from Coastal Louisiana Waters

Bruce A. Thompson, Charles A. Wilson,
Jeffrey H. Render, Marty Beasley

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Abstract

Introduction

This is the first year of a two-year project. The target species for this research are greater amberjack (Seriola dumerili) and cobia (Rachycentron canadum). Project objectives for these two species are: 1) to validate aging periodicity using otoliths via marginal increment analysis, 2) to determine growth patterns, 3) to determine sex ratios, fecundity, timing, and location of gonad development to understand reproductive cycle, 4) to compare data from major sources of specimens, and 5) to compare project data with previous species information.

Summary of Results

Cobia

This project compares information on cobia from 1987 through 1990 (168=1987, 97=1988, 181=1989, 132=1990) taken from charter boat catch and saltwater fishing rodeos. Over the four-year period, females averaged slightly larger than males; the contrast in size not as large as reported by Richards (1967) from Virginia waters due to more large males from Louisiana. The sex ratio is strongly skewed towards males during all months over the four-year period (189F, 387M, 1F:2.1M).

	FL Range (mm)	$\bar{x}$ FL (mm)	TotWt Range (kg)	$\bar{x}$ TW (kg)	N
1987					
M	574-1225	914.8	1.8-23.7	9.0	103
F	358-1355	979.8	4.0-30.1	12.9	65
1988					
M	680-1175	942.1	3.0-20.3	9.9	68
F	681-1270	1049.8	3.2-29.3	15.3	25
1989					
M	675-1432	956.8	4.7-30.8	12.1	121
F	633-1352	1042.3	2.6-33.6	14.0	60
1990					
M	528-1250	1002.6	1.5-22.6	12.2	96
F	830-1445	1114.4	7.1-45.6	17.6	36

Marginal increment data from cobia sagitta are consistent with an interpretation of a single annulus formed each year between March and July. Virtually all otoliths examined between late July and January possessed a translucent margin. The first annulus appears when Louisiana cobia are between 11 and 14 months old. Year class composition was dominated by two to four-year olds, with 10 being maximum age found for both sexes. Year-of-birth (YOB) for our cobia catch was:

	YOB 90	89	88	87	86	85	84	83	82	81	80	79	78
1987	-	-	-	0	18	34	43	19	12	4	2	2	1
1988	-	-	0	4	18	14	18	9	5	1	1	0	0
1989	-	0	4	25	65	13	8	4	5	3	0	1	0
1990	0	2	2	25	39	9	3	0	1	0	1	0	0

Information on gonad maturation (GSI) points to a May-June spawning season with possibly some reproductive activity extending into July. Histological examination of ovaries shows most vitellogenic oocytes being found during this time period.

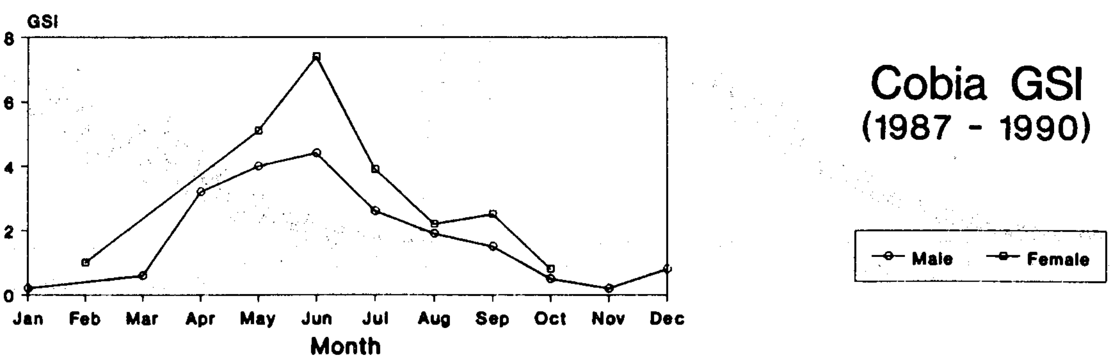
<u>Greater Amberjack</u>

The first concern addressed for amberjack has been correct species identification. In addition to <u>Seriola dumerili</u>, <u>S. rivoliana</u> is fairly common. Also, we have documented <u>S. fasciata</u> off Louisiana and have obtained specimens of what may be <u>S. zonata</u>.

Amberjack have been obtained from commercial catches, charterboat, and saltwater fishing rodeos, with a good representation of most size groups. Our analyses of amberjack are not as complete as for cobia, particularly with aging and reproductive stage determinations.

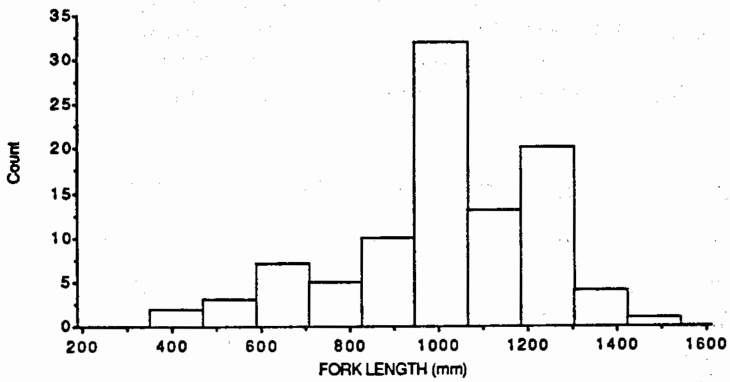
Like cobia, amberjack has sexual size dimorphism with larger females (M 1280 mm FL, 28.8 kg; F 1441 mm FL, 45.9 kg). Growth shows no evidence of reaching an asymptote. Sagitta weight appears the best predictor of growth with continued enlargement even after length and weight has slowed.

Preliminary reproductive data points to a May-June spawning season for amberjack off Louisiana.

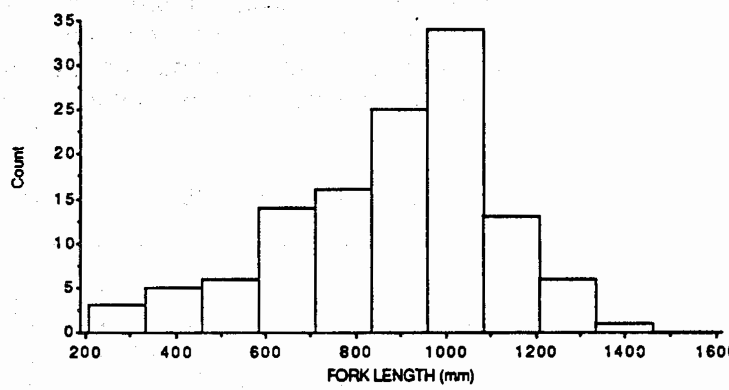


GREATER AMBERJACK

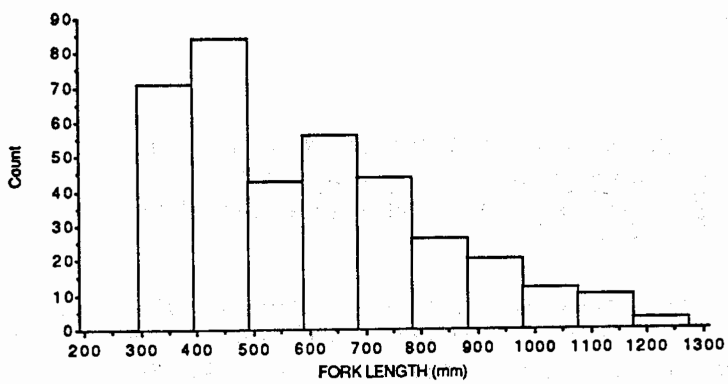
RODEO DIVE



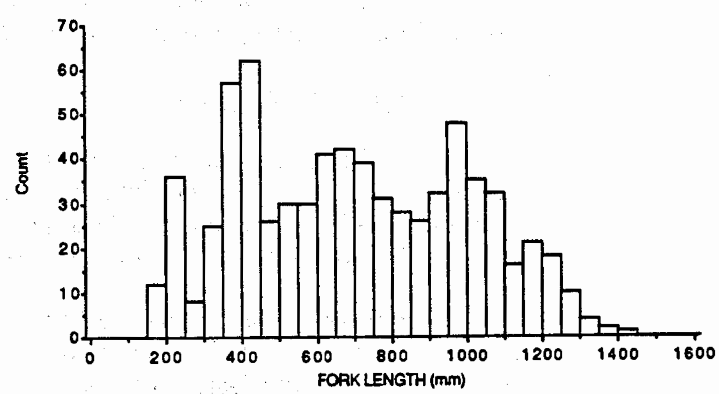
RODEO HOOK & LINE

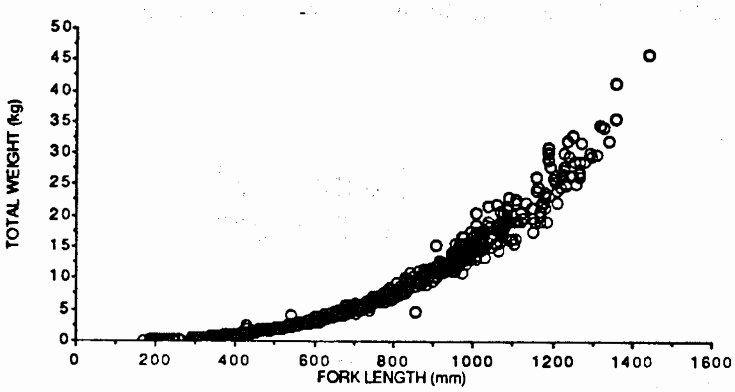


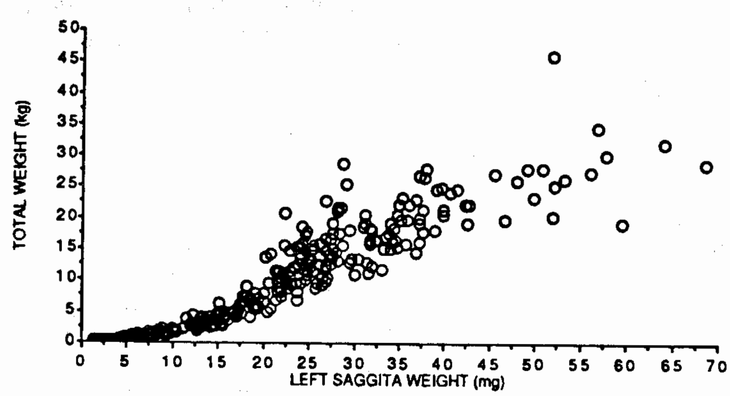
CHARTER BOAT



ALL SOURCES







W. Nelson - Dr. Thompson will stand for any questions.

B. Shipp - Bruce, the relative frequency with which you get these younger amberjack, I know that's kind of skewed because the fishermen are fearful that they're undersized, do you have a gut feeling for this? Are they 1%, 40%, 70%, of what's out there?

B. Thompson - Of what?

B. Shipp - Of lesser amberjack?

B. Thompson - That's relatively funny because, I kept telling the fishermen that they were making a mistake until one commercial guy said, 'I'll take you out there and I'll put you right on a great big population of them.' So I said, 'Show me.' So we went out to a relatively deep water rig in several hundred feet of water off of Grande Isle, and at that rig, Bob, it was the most common Seriola that we brought up. So I think some of these populations may be very, very pregnant or probably very, very isolated. The stuff that was coming up that whole evening was almost nothing but lesser's. We went to another rig, six or eight miles away, and we had almost no lesser ambers. So I think for an awful lot of the catches it makes up virtually no percent of it. What I'm concerned with is that you have these pockets that these things may be making up a high percentage.

B. Shipp - What about S. zonata, any feel on that one or what you think is S. zonata?

B. Thompson - Two to three percent, and so far the only thing that we've seen are in the charter catch.

R. Schmied - What do you see in the charter catch?

B. Thompson - We're talking about the different species of Seriola. And this particular case a form that we're now convinced is rudder fish, but they aren't banded. Either that or there is a second form of greater amberjack that matures at a much, much smaller size, whereas the other stuff that we've got looks like maturity may be as high in some individuals as 25 pounders or so.

C. Perret - Bruce, you've been doing the cobia work for a few years. Just off the top of your head, have you seen any trend in so far as what's coming in, more fish, less fish, smaller fish, bigger fish?

B. Thompson - Actually, it's been relatively uniform except I've seen what I'm very impressed with is terrific compliance from the recreational fishermen who once they learned about that 33" lower limit. They vanished out of our samples. And they're saying we're catching them, and we're throwing them back.

C. Perret - O.k. with that do they indicate if the fish that they're throwing back are surviving, just from visual observation. Have they volunteered anything to you or have you asked about that?

B. Thompson - Yes, because we've actually been looking at some of these things, and since an awful lot of the young or relatively small cobia are surface caught, I don't think they're undergoing much in the way of stress. I'm also totally convinced that any animal that can swallow hard-head cats whole and then totally digests them, isn't all that concerned about swallowing a hook. We have a collection at the lab of some amazing hooks that we pull out of the guts, we've been doing some gut analysis. They also eat crabs. So I think that there is very, little hook damage. I think the antidotal information tells us there is little mortality from these things being hooked and released.

G. Nakamura - Bruce, what is the basis for your estimating the time-lapse between the exclusion of the modal groups of eggs? The larvae modal group against the next spawning batch but then the second to the last modal group...

B. Thompson - Right at the present time, that's a little bit of data and a reasonable amount of imagination. We're just now getting the batch frequency involved. That's real preliminary information. If you're really going to hold it me, I'll say I never said that figure. It's real preliminary information. We're just getting that kind of stuff from doing all the sectioning of gonads and everything.

R. Schmied - Just a quick comment. One is that we've noticed the real problem of describing the different species of catch, particularly on the southwest coast of Florida charterboat captains. There is a lot of screaming and grunting of captains out there saying that they've had the greater, the banded. They are having a tremendous problem trying to identify. On head boats the fish that they're seeing are almost always less than 28 inches, particularly head boats because they are not in the deeper water. That's been a problem, the species identification. Council regulations do not look at all amberjack, just the lessers. I think Florida regulations do look at all amberjack, it differentiates between them. The other issue is that one project we started with expanded tagging through the cooperative game fish tagging program called tag/flag tournament. I think you're aware of it. It does specifically target the cobia and amberjack. You could get to them to see what data has come in from their tagging.

B. Thompson - We've been returning tags to fish trackers out of Texas. We see their tags in Louisiana tournaments, and I have returned several tags to the Wallop-Breaux Project in Mississippi, Jim Frank's group. We get GCRL tags not so frequently, but we do see those. Your comment on identification, I didn't infer that that was a Louisiana problem. We have, I think, all four species. I think its a matter of something. When I wrote up our project, I wasn't aware that it was going to be as much of a problem as it actually was. Of course, the lesser doesn't get anywhere near that size. I think a 16 to 18 inch lesser is a giant lesser. So if you were going to manage for the 28 inches, you would essentially be throwing all lesser amberjacks back.

W. Nelson - Our next paper was entitled "Mackerel and Reef Fish Bioprofile and Catch/Effort Data Collection from the Northern Gulf of Mexico." Sandy Russell could not be here to make that presentation due to illness. We'll hear from Karen Burns from Mote Marine Laboratory. The title of the paper is "King and Spanish Mackerel Migration and Stock Assessment Study in the Southern Gulf of Mexico."

Mackerel and Reef Fish Bioprofile and Catch/Effort Data Collection and Analysis Program in Louisiana

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Abstract

The goal of this project is to record catch/effort and bioprofile data from the mackerel and reef fish fisheries in the northern Gulf of Mexico. This was the first year of a proposed three-year study which will build upon the computerized data base of similar fishery and biological information established by LSU's MARFIN-funded sampling program during 1986-89 and by LSU's ongoing (since 1983) state/federal program in cooperation with the Louisiana Department of Wildlife and Fisheries. Specific objectives include obtaining interviews from commercial and recreational fishermen (goal of 150); obtaining fork lengths of mackerel and reef fish from random samples of commercial and recreational catches (goal of 2000 lengths); collecting otoliths, muscle tissue, and other organ samples for use by NMFS-Panama City Lab; and collecting red snapper gonads and otoliths for a reproductive study at LSU.

This was a very difficult year as cooperation from the commercial fishermen hit an all-time low and deteriorated even further following the Gulf Council's new reef fish management proposals in early 1990. Since the king mackerel quota for the western Gulf had also not been increased for 1990, the fishermen didn't see any good coming from their voluntary cooperation with LSU's port sampler. After putting up with much verbal abuse from the fishermen and dock managers over the last couple of years, plus getting too politically involved with fishermen's cause, the LSU port sampler was burned out and felt he could no longer do an effective job. He resigned at the end of July. A temporary port sampler was hired in mid-August in the Venice area to finish out the contract year collecting data from the Asian-American handliners.

Since that time, a new port sampler, hired under the state/federal program, has developed some excellent relationships with a few rapidly expanding reef fish/mackerel/tuna docks in the Leeville area. He will be picked up by this project during its second year.

From October 1, 1989 through August 30, 1990, LSU port samplers collected 23 interviews from bandit boats, 3 from longline vessels, 4 from mackerel handliners, 13 from mackerel trollers, and 1 interview from a vessel carrying both a longline and mackerel trolling gear. From these commercial catches, the port samplers obtained fork lengths from 452 red snapper, 118 yellowedge grouper, 13 vermilion snapper, 48 tilefish, 415 king mackerel, 5 Spanish mackerel, 7 snowy grouper, 32 scamp, 1 greater amberjack, 1 queen snapper, 6 longtail bass, and 18

Warsaw grouper. Muscle tissue samples were obtained from 35 king mackerel and sent to the NMFS-Panama City Lab.

The samplers attended 3 offshore fishing tournaments in 1990 and measured 12 Spanish mackerel, 20 red snapper, 1 red hind, 1 scamp, 3 common dolphin, 4 bluefish, and 5 gray snapper. Otoliths were taken from all of these fish except the groupers, and the gonads were collected from the red snapper.

Gonads and otoliths were collected from approximately 70 female red snapper this past year. Histological slides of the gonads have been prepared and the otoliths have been sectioned, but none have been read yet. Additional samples will be obtained during the coming year from a headboat in the Venice area and the prepared samples will be analyzed.

A trip was made by the PI and a port sampler to Texas in early July to assess the status of that state's mackerel and reef fish fleets as it appeared that boats traditionally fishing off Louisiana were moving farther and farther westward to find fish. Texas evidently has no mackerel fleet except for a few Asian-American handliners in the Galveston area, but many Louisiana mackerel boats land there during the summer and have their fish trucked back to Louisiana docks. Texas has a fairly resident reef fish fleet of approximately 45 boats, about 70% longliners, 25% bandit boats, and 5% handliners. Very little reef fish is sold locally, most is trucked to Alabama. Louisiana vessels also seasonally land their catches at various Texas ports, and these are trucked back to Louisiana. Enforcement was lax as longliners were seen fishing inside of 50 fathoms, and headboats openly displayed their catches of undersized red snapper.

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

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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, 1990 is the fifth 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. Due to the late start up time precipitated by the February 1990 federal award, the winter tagging effort which usually occurred in January and February will take place in November and December. Therefore, the number of mackerel tagged and the length/frequency and CPUE data for this project are not complete.

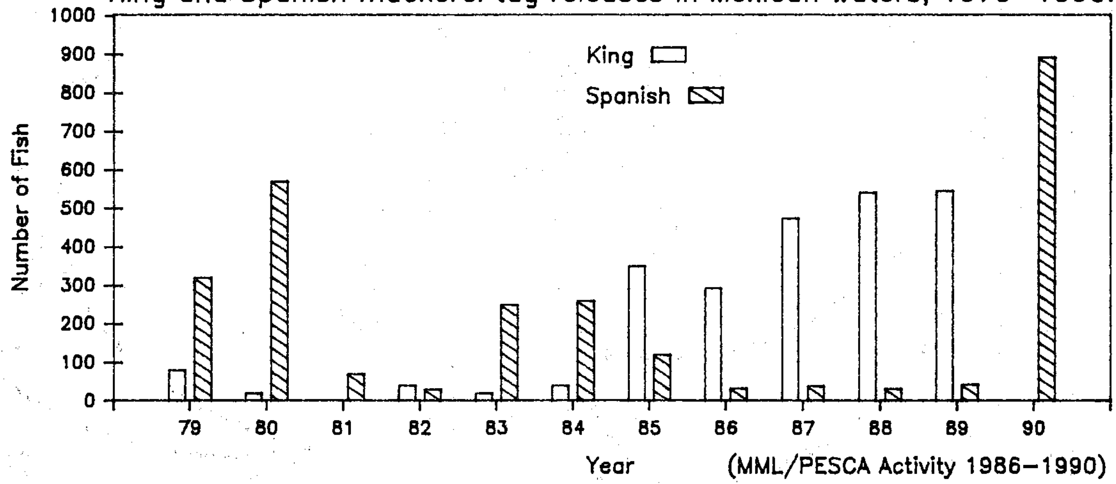
Summary of Results

To determine movement and migration patterns of Spanish (Scomberomorus maculatus) mackerel during 1990 in the southern Gulf of Mexico, 892 Spanish mackerel were tagged off Veracruz, Mexico, 892 Spanish mackerel were tagged off Veracruz, Mexico, during the spring (March-May). More mackerel will be tagged off the Yucatan Peninsula during the winter tagging effort (November-December). The spring tagging effort increased the five-year tally to 1,855 king and 1,039 Spanish mackerel tagged. From January 1-October 1, 1990, 83 tags (34 KM, 49 SM) have been recovered. In five years, 242 tags (175 KM, 67 SM) have been recovered under MML's Rapid Reward System. Length/frequency measurements for king (705) and Spanish (903) mackerel were recorded during 1990, making a total of 15,505 king and 5,037 Spanish mackerel measurements during the past five years. In 1990, CPUE data were obtained, providing a five-year total of 3,369 measurements. Historical Landings Data (1982-1988) for both species from all Mexican Gulf Coast

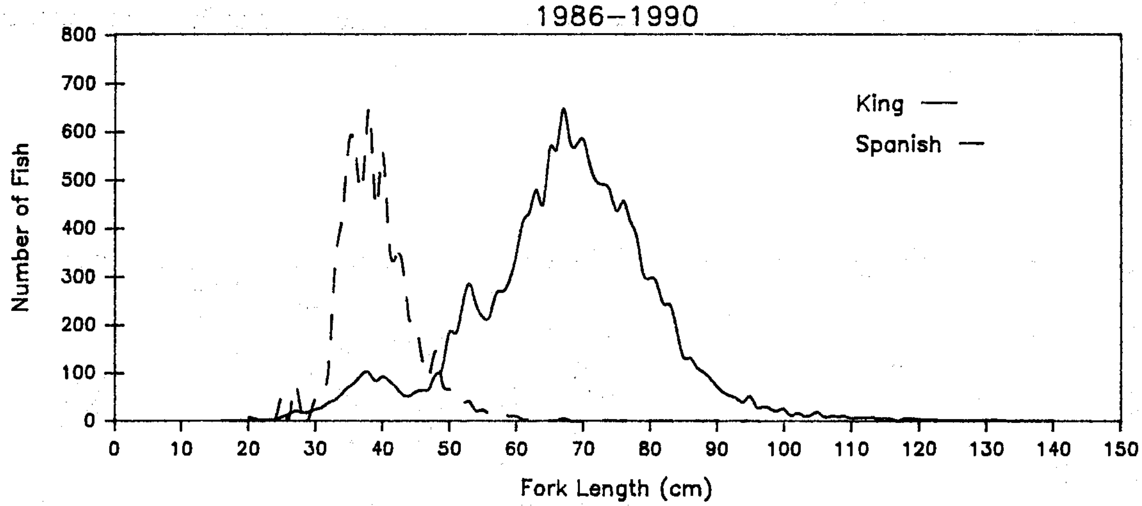
States, have been obtained and sent to NMFS-Panama City. Data are reported by year, month, state, port and weight (in thousands of pounds). The 1989 Landings Data have been requested. In 1990, 466 adult mackerel and 103 juvenile king mackerel samples have been sent to NMFS-Panama City for electrophoretic studies. Adult mackerel samples included 291 king mackerel *Scomberomorus cavalla*, 119 Spanish mackerel (*S. maculatus*), 55 cero mackerel (*S. regalis*) and 23 Serra Spanish mackerel (*S. brasiliensis*). This is the first report of *S. brasiliensis* from Mexico. Specimens of *S. brasiliensis* were sent by NMFS-Panama City personnel to Bruce Collette at the Smithsonian for verification. A five-year total of 2,355 mackerel samples (1,046 king, 525 Spanish, 255 cero, 23 Serra Spanish and 506 juvenile king) have bee sent to NMFS-Panama City for electrophoresis. Otoliths from adult king (291), Spanish (119), cero (55) and Serra Spanish (23) mackerel were collected during 1990. Combined with the collections from previous years, the total number of king mackerel otoliths obtained is 577. Right otoliths were sent to NMFS-Panama City, the left to INP-Mexico City. The 1990 values and five-year totals are not final as work will continue in Mexico through December, 1990.

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

King and Spanish mackerel tag releases in Mexican waters, 1979–1990.



L/F summary for king and Spanish mackerel from Mexican Gulf Coast States
1986–1990



Otolith collection size range summary for king and Spanish mackerel from
Mexican Gulf Coast States, 1988–1990.

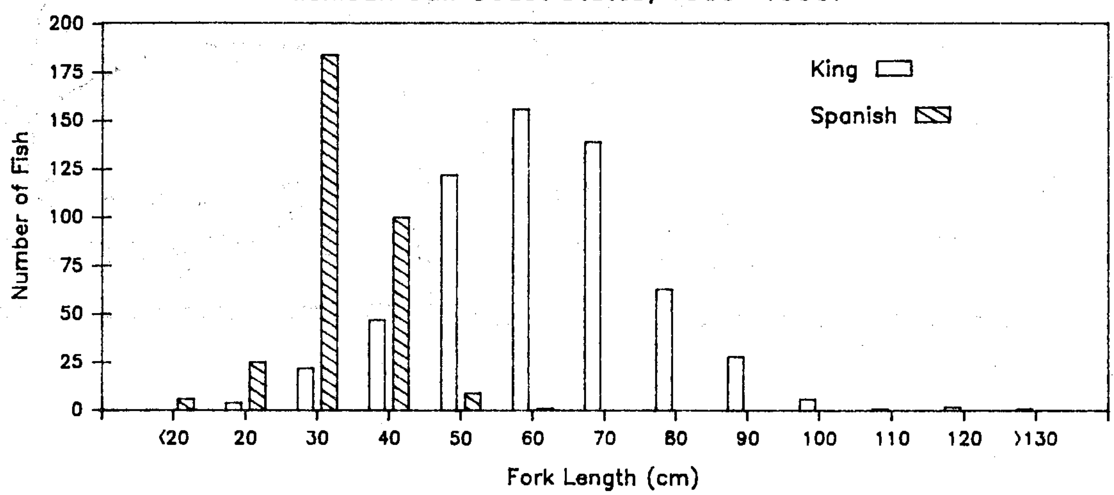


Fig. 1. Number of mackerel tagged off Mexican Gulf Coast States (1986-1990).
Fig. 2. Significant long distance tag returns between the U.S. and Mexico (1986-1990).
Fig. 3. Significant tag returns within Mexico and from Veracruz, Mexico to the U.S. (1986-1990).
Fig. 4. Important tag returns from Texas to Mexico (1986-1990.

Fig. 1

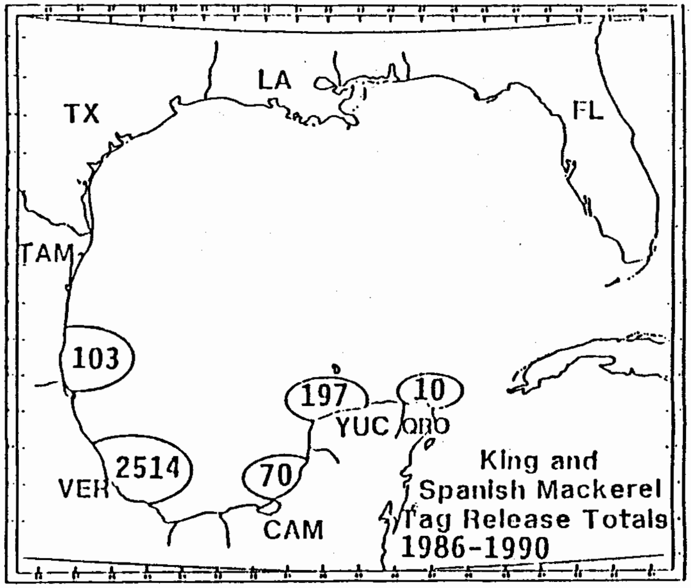


Fig. 3

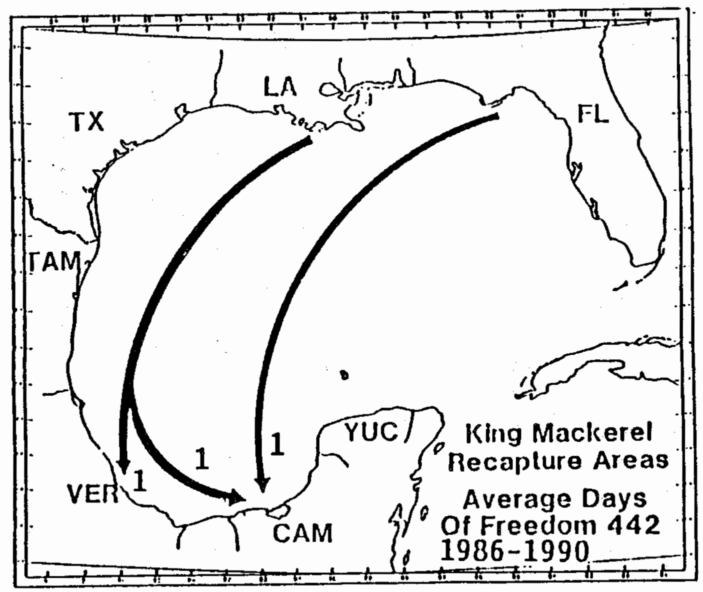


Fig. 2

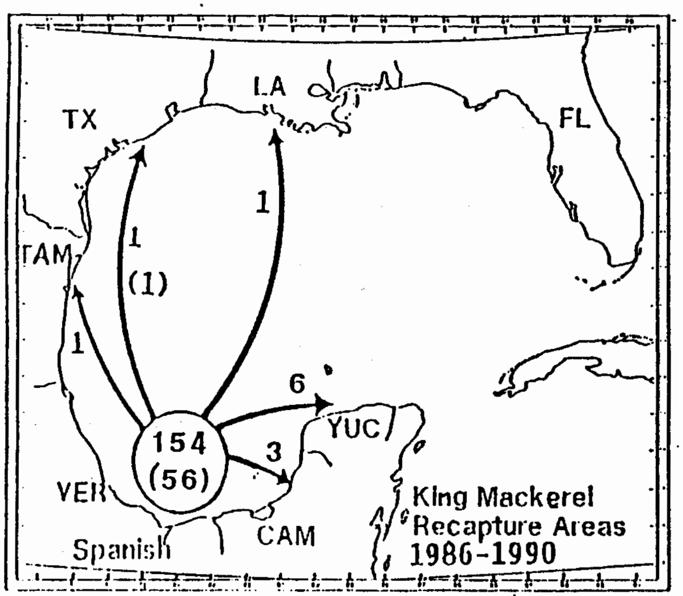
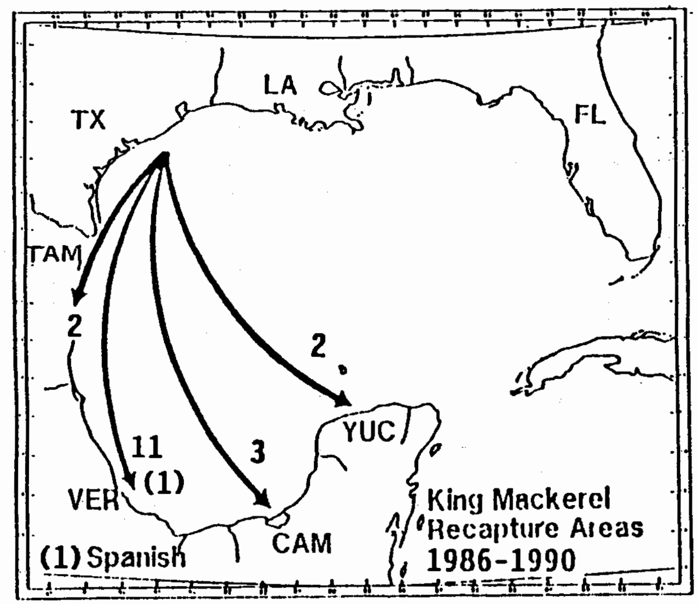


Fig. 4



W. Nelson - Ms. Burns will stand for any questions.

C. Perret - Karen, how good or how bad are the landings data that we get out of Mexico?

K. Burns - For the king mackerel, we know that they are all king mackerel, and the landings data are fairly accurate. For the Spanish mackerel, it is not very accurate at all because we know that in the past they have been combining both cero and Spanish mackerel together under the caption of Spanish mackerel, and now with this new determination we don't even know exactly how far this species, Scomberomorus brasiliensis, is actually entering into Mexico. Bruce Collette had put this species only going as far as Belize, but now we know that it is in Mexico, so this was news to the Mexicans this year about that species in their waters. So I would say that the Spanish mackerel landings data are not accurate.

G. Nakamura - The Mexicans have two common names for the mackerel, peto and they also call it carito for king mackerel. For Spanish mackerel they have Sierra, but when they sell Sierra they lump together the cero and the juvenile king mackerel. So when you buy Sierra as Karen has done and shipped to us, we may get four species.

W. Swingle - Karen, do you have any feel for the relative proportion of cero to Spanish mackerel.

K. Burns - Well, it seems to depend upon the location. There seem to be more Spanish mackerel off Veracruz even though cero are counted into the catch there. And there seem to be more cero off the Yucatan Peninsula, but they are mixing them in all those locations.

W. Swingle - But they would be dominant off the Yucatan?

K. Burns - I wouldn't say that they are dominant, but they make up a good percentage of the catch. Spanish mackerel still are dominant within the catches, but cero do make up a good portion of that catch. But we have not looked at the problem as far as what percentage of each of these different types of Spanish mackerels are in the landings data of what they're calling Scomberomorus maculatus.

W. Nelson - You mentioned the Spanish were a lot smaller this year. Did you get an impression that they are more abundant or just smaller?

K. Burns - We got an impression that in Veracruz (because we haven't gone down to Yucatan yet) that they were quite abundant. In previous years we have seen quite large Spanish mackerel, and this year they seemed like they were more abundant, but they were just really tiny. We never saw any really descent size Spanish mackerel at all.

W. Nelson - Our next speaker today is Gene Nakamura, National Marine Fisheries Service, Southeast Fisheries Center, Panama City Laboratory. His topic is "Coastal Resources Research in the Southeast."

Coastal Resources Research in Southeast

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Abstract

Introduction

The goals of this project were to continue obtaining data needed for stock assessments of mackerels and to initiate the development of similar data bases for other coastal species, both pelagic and demersal. Vital statistics, biological samples, and catch-effort data from charterboats were collected on species listed in the Coastal Migratory Pelagics FMP and the Reef Fish FMP. To avoid duplication and to maximize data collection, field sampling and laboratory analyses were coordinated with state agencies, Mote Marine Laboratory, Louisiana State University, Gulf Coast Research Laboratory, University of South Alabama, and the University of Miami. All landings data, vital statistics, and CPUE data were computerized for immediate use in stock assessment analyses.

Summary of Results

Vital Statistics. Collection of vital statistics was expanded to include all species of coastal pelagic and coastal demersal fishes. Species for which more than 100 fish have been measured this year are shown below (compared to last year):

	Number of Fish	
Species	1989	1990 Jan.-Aug.
Spanish mackerel	14,722	10,045
King mackerel	15,219	4,094
Dolphin	2,421	1,443
Cobia	230	139
Bluefish	51	437
Little tunny	0	424
Greater amberjack	204	208
Red snapper	0	1,800
Vermilion snapper	0	3,953
Gag	0	159
Scamp	0	212

Aging. Otoliths were collected from king and Spanish mackerel to develop age-length keys for stock assessment. Over 2,000 king mackerel and over 1,700 Spanish mackerel were processed. Numbers of specimens were as follows:

Species	Area	Female	Number of Fish Male	Undetermined	Total
King mackerel	Gulf	666	353	148	1,167
King mackerel	Atlantic	516	348	0	864
Spanish mackerel	Gulf	522	533	42	1,097
Spanish mackerel	Atlantic	157	92	0	637

Charterboat CPUE. Catch and effort data from charterboats in the southeast were categorized by area, method of fishing, and fishing year. Effort (fishing hours) was recorded as follows:

Area	Fishing method	Fishing year	Hours of fishing
Gulf	Trolling	Jul. 89-Jun. 90	3,479
Gulf	Non-trolling	Jul. 89-Jun. 90	3,595
Atlantic	Trolling	Apr. 89-Mar. 90	8,481
Atlantic	Non-trolling	Apr. 89-Mar. 90	2,800

The five most frequently caught species by trolling and non-trolling in the Gulf and Atlantic were as follows:

	Gulf of Mexico		Atlantic	
	Trolling	Non-trolling	Trolling	Non-trolling
1.	Spanish mackerel	Gray triggerfish	Spanish mackerel	Black sea bass
2.	King mackerel	Red snapper	Dolphin	Unident. grunts
3.	Dolphin	Vermilion snapper	King mackerel	Unident. porgies
4.	Little tunny	Unident. porgies	Bluefish	Vermilion snapper
5.	Atlantic bonito	Unident. grunts	Atlantic bonito	Yellowtail snapper

The data on vital statistics, aging, and catch per unit of effort were all collected for determining the status of stocks. For the mackerels, these data were used in the virtual population analyses conducted annually. For non-mackerels, the data bases required for the VPAs were initiated so that similar computations may be conducted in the future. The VPAs for the mackerels provided the information to determine the acceptable biological catches by stock assessment personnel. The ABCs were then presented to the fishery management councils, who established total allowable catches, as follows:

Stock	Fishing year	Million pounds ABC	Million pounds TAC
Gulf			
King mackerel	Jul. 1, 90-Jun. 30, 91	3.2-5.4	4.25
Span. mackerel	Apr. 1, 90-Mar. 31, 91	3.9-7.4	5.25
Atlantic			
King mackerel	Apr. 1, 90-Mar. 31, 91	6.5-15.7	8.30
Span. mackerel	Apr. 1, 90-Mar. 31, 91	4.2-6.6	5.00

W. Nelson - Thank you, Gene. Gene will stand for any questions.

W. Swingle - Gene, we had some verbal results from charterboat fishing in the Panhandle area and on through the central gulf on through Alabama indicating what you would classify as the 1990/1991 year has been one of the better ones they've had for king mackerel. Is that showing up in your data as far as comparison of catch per unit of effort?

G. Nakamura - Yes. It's showing up in the amount of data that we're collecting on bioprofile samples that we're getting and from the reports from the captains. The charterboat captains are telling us that the right thing was done by setting the bag limits and quotas for commercial fishermen on the resource and that they think that some of the other coastal pelagics are in need of the same kind of regulations. Dolphin, for example. So not all fishermen were bad guys.

W. Nelson - Are you hearing the same thing from commercial fishermen or was it just the charterboat fishermen?

G. Nakamura - This was just the charterboat fishermen. The commercial fishermen reach their quotas rather quickly. For example, fishing for king mackerel starts in July. For this fishing, the quota was obtained in October in the western area of the gulf, and the other side, the eastern side, was reached in January.

SESSION IV
COASTAL HERRINGS AND GENERAL

SESSION IV-COASTAL HERRINGS AND GENERAL - Wayne Swingle, Chairman

W. Swingle - I'm going to serve as chairman for Dr. Nelson for this session. I guess the first of our presentations will be by Walter Nelson on the "Latent Resources Research in the Gulf of Mexico." I think, as you all probably recall, original focus to a large extent of MARFIN was to try to develop these latent resources into harvestable resources for the commercial industry. That was one of the original focuses of the MARFIN Program.

LATENT RESOURCES 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. Because of their large biomass and trophic importance, the ecological 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 Gulf butterfish, and have been oriented primarily at improving assessment methodology, improving knowledge of environmental relationships, standardizing assessment gears, and determining the feasibility of applying advance bioacoustics to survey activities.

Project Objectives

1. Resource surveys - Develop an acoustics-based survey strategy, conduct fishery-independent surveys with high-opening bottom trawls, collect environmental data for ecological studies and for satellite ground truth, and continue cooperative latent resources studies through SEAMAP.

2. Sampling gear development - Develop an efficient mid-water trawling capability, upgrade trawl data evaluation software, and acquire an ROV for survey purposes.

3. Observers and port samplers - Continue sampling at-sea for CPUE, species composition and discards, and sample latent resource landings for data on catch, size frequency and use of latent resources for industrial purposes.

4. Survey technology - Continue studies of satellite applications and test predictive systems in cooperation with commercial and recreational fishermen, upgrade current satellite predictive systems and evaluate ROV capabilities.

5. Handling and processing technology - Complete construction of experimental seafood processing laboratory in Pascagoula, and initiate studies of fish composition, holding and processing, and surimi potential of latent resources.

6. Technology transfer - Conduct workshops on vessel rigging and harvesting techniques, work with industry to upgrade vessels and equipment, apply satellite-derived data to the industry and investigate applicability of satellite technology to recreational fisheries.

Summary of Results

Spring and fall surveys in the northcentral Gulf of Mexico with large high-opening bottom trawls were successful in locating sizeable concentrations of several species of small pelagics, in providing additional information on distribution and abundance of these latent resources, and in providing additional information concerning distribution by size and abundance in relation to temperature, depth, and area in the northern Gulf of Mexico. The cruises were also instrumental in standardizing the 123-ft Shuman trawl for assessing stocks of small pelagics. A fish-shooter device was added to the trawl, increasing its effectiveness and providing a successful modification for the use of smaller trawls in the commercial harvest of these fast-swimming, elusive species. Hydroacoustic surveys were also conducted in the early spring and late fall to determine the ability of a new hydroacoustic system to differentiate individual targets, and to estimate school sizes of the small pelagics. Research conducted on improving the configuration and effectiveness of large mid-water trawls and on the applicability of those trawls in sampling and assessing stocks of small pelagic fishes in the water column at night. A recently acquired Remotely Operated Vehicle (ROV) was tested for its ability to provide species identification and species composition for ground truth for hydroacoustic sampling. NMFS samples approximately 60 landings of small pelagics from a targeted fishery and as components of the petfood trawl fishery.

A butterfish expert remote sensing system, allowing rapid transmittal of satellite imagery to at-sea fishing vessels was developed and tested successfully. Daily satellite images identifying areas of potential fish concentration were carried by northern Gulf TV stations as a demonstration project.

Construction on the planned experimental seafood processing laboratory was not completed until October 1990. Equipment is currently being installed and work on handling and processing, composition analyses, and the potential for surimi for these underutilized species will begin in the immediate future.

W. Swingle - Walter is now going to show some video of their work.

B. Shipp - How fast are you trawling there, Walter?

W. Nelson - Two or two and a half knots, that's all you can do when you're pulling a house under water. And this is the ROV. That's all we need is a little system that tells us where it is and where it's headed and relays that information back to the vessel. Lastly, the major thing is the fish funnel. You're in the cod end of the net. This funnel is attached just as you go into the cod end of the net. The fish come through it by the increased water flow rate through that funnel. This is back into the cod end of the net itself. Here you can see the fish being blown out through the funnel to the back end of the net.

Unknown speaker - Butterfish?

W. Nelson - Yes, butterfish and a few catfish there.

L. Simpson - That catfish is inside that net?

W. Nelson - Yes, he's inside the cod end. The main thing with this is you can go to smaller nets.

J. Van Lopik - What is the market for the butterfish?

W. Nelson - Thanks for reminding me. One of the things that have been going on in the past year is a hard look at market conditions in Japan. It's not very good. Japan is trying a fishery of its own not too far from Japan. Between that and the stuff out of the northeast, the market has been extremely poor for gulf butterfish. Jim Harris, who is with the Regional Office, is stationed in Pascagoula. He's spent the better part of the past three or four months looking into markets in Taiwan and in Korea. Right now we have a very poor market.

L. Simpson - How many total vessels fished butterfish this past season?

W. Nelson - Total vessels not counting the pet food folks, three part of the year and two part of the year.

L. Simpson - All from the northeast?

W. Nelson - No, no.

L. Simpson - These are out of the gulf?

W. Nelson - The northeast guys came down initially, and then when the market went bad, they got out of it.

W. Swingle - Thank you Walter. Our next speaker will be Ron Schmied who is gong to discuss "Educational Tools for Marine Recreational Fishermen to Promote Wise Use and Conservation of Gulf Fishery Resources."

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

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Abstract

Never before have Gulf of Mexico fishery managers faced the serious challenges they now face in managing marine recreational fisheries. The demand for marine recreational fishing is continuing to grow despite the fact that most traditional target species are stressed or overfished. Indeed, saltwater sport fishing in the Gulf has evolved from a "relatively insignificant" and unregulated fishing activity to a heavily regulated and politically important one. More and more our ability to effectively manage saltwater sport fisheries depends on our ability to obtain widespread understanding, support and regulatory compliance from a large and diverse angling community. This paper provides an overview of a MARFIN-funded Angler Ethics program within NMFS' Southeast Regional Office that is designed to gain angler support of state and federal fishery conservation efforts. The paper discusses the circumstances leading up to the program and activities and accomplishments to date.

SESSION V
REEF FISH AND OCEAN PELAGICS

SESSION V-REEF FISH AND OCEAN PELAGICS - B. Shipp, Chairman

B. Shipp - Without a break, we'll go on to the last session on Reef Fish and Ocean Pelagics. The first presentation is by Curtis Kruer from the Florida Keys Artificial Reef Association on "An Evaluation of the Use of Large Fabricated Artificial Reefs to Enhance Reef Fish Populations at Different Depths in the Florida Keys."

An Evaluation of the Use of Large Fabricated Artificial Reefs to Enhance Reef Fish Populations at Different Depths in the Florida Keys

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Abstract

Introduction

In June, 1988, 7 fabricated concrete units (up to 8 tons and 16' high) were placed by the FKARA on sandy areas of the Florida Reef Tract off Big Pine Key. Two large units were placed 50 m apart and 50 m from adjacent natural bank reefs at depths of 14 m and 25 m. Three smaller, low profile units were placed 50 m apart at a depth of 8 m approximately 50 m from a shallow bank reef. The proposal for work included bimonthly total counts of the fish and macroinvertebrate populations associated with the units and an intensive assessment of the adjacent natural reefs using the stationary visual census technique developed by NOAA Fisheries in Miami. Specific objectives include:

1. Quantifying the species composition, biomass and seasonality of fishes attracted to and produced by the artificial reefs over a 24 month period.

2. Comparing the colonization and community structure of reef fishes on the fabricated habitats to nearby natural reefs.

3. Evaluating the effects of reef siting at different depths on species composition, recruitment and biomass.

4. Using photographic techniques, document plant and invertebrate fouling communities as a function of substrate, height from the bottom and water depth.

5. Separating fish communities into trophic levels to assess the location of the food source being used.

6. Determining if large fabricated habitats of this type can provide significant fishing opportunities.

7. Evaluating the economics of constructing, transporting and placement of this type of fabricated artificial habitat.

8. Censusing the fish populations of nearby older bridge rubble artificial reefs for comparison to those of the fabricated units and natural reefs.

Summary of Results

The scheduled field work was completed in June, 1990. A total of 24 months of postplacement census work on the fabricated units and the adjacent natural reefs was accomplished with MARFIN funding available for 21 months of that period. The following summarizes the census work conducted:

Location	Artificial	Natural
shallow (8 m)	42	106
mid depth (14 m)	38	88
deep (25 m)	30	70
American Shoal A.R. (12 m)	24	
Bahia Honda A.R. (9 m)	26	
Total	160	264

The creation of computer data bases utilizing software provided by the Southeast Fisheries Center of NMFS in Miami has been completed and analyses are being conducted consistent with that of recent research by the Center. Of particular interest to date is the regular occurrence of large numbers of yellowtail snapper (*Ocyurus chrysurus*) on the high profile of the mid and deep fabricated units, the difference in overall species composition and abundance as a function of depth and the high diversity and biomass on the Bahia Honda and American Shoal bridge rubble sites. Presented will be methodologies utilized in construction, transportation and monitoring as well as preliminary results.

B. Shipp - Thank you very much Curtis. Curtis will stand for any questions.

L. Simpson - Were you able to look at what the different species were?

C. Kruer - We intend to do that. Again, we didn't have a whole lot in the way of results to present here. We intend to do that for the final report to look at similarities between units, similarity in species between the units in the natural reefs and the same with the bridge rubble reef. We're going to do as much statistical analysis as we can. I'm hoping that NMFS and Miami are going to help us.

L. Simpson - You have it broken down by species...

C. Kruer - Oh yes, our monitoring is by species. Absolutely, yes, I probably should have gone into more detail on what the visual census method entails, but it looks at species composition, abundance, length/frequency information. We've good programs provided by NMFS to run analysis on the data. We'll have it broken out into a lot of displays. It can do a lot of comparisons that I think will be useful.

[tape break]

D. Ekberg - fishes off the bottoms of these areas did you notice any correlations of trends in general of geometry?

C. Kruer - That's something that we're going to try to do what we can with. We're going to look at volume because some other past research on artificial reefs have looked at volume of the unit or the material and try to look at the issue of diversity and abundance versus volume. We don't have a whole lot to compare these units to because we haven't been involved in fabricating units so as far as the specific geometry, there has been some research done elsewhere showing vertical, 90°, or 45° materials are more suitable than other type angles, but we will look at volume and try to compare to the work that NMFS has just done, some recent work that was done in Hawaii to quantify. We think we can also look at volume of these bridge rubble sites. The structural diversity is obviously the big issue, and small habitat is missing on these units. We'd like to go back in the future and add small structure to these units and see what the result is. Once the fish population stabilizes on the units as they are, go back and add small habitat and small structure and see what the result is. That would be good source information.

R. Schmied - I just have a comment. Some of the earlier studies I've seen, that was a major controlling factor that reflects the habitat diversity in having very little rock or rubble probably skews the diversity of species.

C. Kruer - That's why we think this is a very good opportunity to go back and add this to the small spaces and see what the result is. It would obviously increase the diversity. We felt we were limited initially in putting together what we did here.

R. Schmied - I just have one more question. Did you see much scouring? I know there is sand blasting, but did you see much scouring?

C. Kruer - There was scouring. In the period of two years, there were two near-misses with hurricanes in the Keys. There was scouring underneath the units, and there is hard bottom not too far underneath that sand, so there wasn't the potential for them to go very far. After some of those winter storms and tropical storms, you could see the bottoms underneath the units being rearranged. It provided some of the small habitat that is used in the tighter spaces and protected. We did look at the stability of the units; we put rebar in the bottom at set points around each unit to see if they moved in storms and detected no movement. We had very stable units the way we designed them so that they'll be there for a long, long time.

W. Swingle - I was just curious on the near misses by the hurricanes. Did that seem to change the species diversity or the abundance of species?

C. Kruer - I think that it did. I won't, you tend to go back and try to pull out those numbers to see what you find in that time frame. What we did notice in the wintertime after big winter storms that are pretty strong through the Keys, a lot of turbid water, a little drop in water temperature. A number of species eventually dropped. As far as the near misses with hurricanes, that's something we'll try to plug in, but I don't have much to offer.

B. Shipp - Thank you, Curtis. Our next scheduled speaker, Sandy Russell, will not be here to present her paper entitled "Biological and Catch/Effort Sampling from the Domestic Tuna and Shark Fisheries in the Northern Gulf of Mexico" for reasons stated earlier. The next presentation is by Chuck Wilson from Louisiana State University on "The Application of Pelagic Longline Data in Reducing Billfish Bycatch and Resource Monitoring."

Biological and Catch/Effort Sampling of the Domestic Tuna and Shark Fisheries in the Northern Gulf of Mexico

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Abstract

The goals of this project are to collect biological and catch/effort data from the domestic tuna and shark longline fisheries in the northern Gulf of Mexico, and to collect biological and catch/effort data from the nearshore shark gill-net fishery in Louisiana. The 1989-90 project year just completed was the first year of a three-year MARFIN project and was very successful. Two years of similar work had previously been completed by LSU through direct MARFIN awards.

Two veteran LSU observers sought trips aboard tuna and shark longline vessels to record detailed effort data, length frequencies, and species composition of the catch and discarded bycatch. Most of the trips originated in Venice, Louisiana, the hub of the tuna fishery in the northern Gulf, but several terminated in Texas and Florida. As of mid-August 1990, the observers had recorded data from 27 trips targeting tunas (on 13 different vessels), 2 trips targeting swordfish (aboard 1 vessel), and 3 trips targeting sharks (on 2 different vessels) for a total of 272 days at sea. Of the 13 vessels targeting tunas, 3 had Caucasian-American captains, 9 had Asian-American captains, and 1 had a Caucasian-American captain for 2 trips and an Asian-American captain for 5 trips. The swordfish vessel was captained by a Caucasian-American, while 1 of the 2 shark vessels also had a Caucasian-American captain.

Seven of the tuna trips made no sets at all due to either bad weather or mechanical difficulties, while the remaining 20 tuna trips made 68 sets with 34,600 hooks and 1,429.6 miles of line. The retained catch consisted of 855 yellowfin tuna, 47 miscellaneous tunas, 89 swordfish, 137 common dolphin, 70 wahoo, 15 miscellaneous sharks, 30 escolar, and 14 miscellaneous fish for a total of 1,257 fish. The discarded catch consisted of 103 blue marlin (45 discarded alive), 111 white marlin (53 alive), 108 sailfish (41 alive), 109 little tunny (17 alive), 193 yellowfin tuna (37 alive), 271 sharks (141 alive),70 blackfin tuna (13 alive), 27 longbill spearfish (2 alive), 27 swordfish (15 alive), 21 escolar (5 alive), 43 skipjack tuna (3 alive), 12 common dolphin (6 alive), and 138 miscellaneous fish (44 alive) for a total of 1,233 fish. The billfish bycatch has increased tremendously over the past year, and mortality rates were very high because most of the Asian-American crews shot or clubbed these fish to death to retrieve their $0.75 hooks.

Yellowfin tuna mean fork lengths were significantly larger in 1990 than they had been in either 1988 or 1989. This was surprising as the discarded catch of very small yellowfin (<50 lb) appeared to increase greatly this past year. The yellowfin tuna catch rate of 2.79 fish per 100 hooks was significantly greater than the 1988-89 catch rate of 1.85 fish per 100 hooks.

The Asian-American captains would not use frozen bait and would often fish 3-5 nights to catch enough live bait to make just one set. It appears from this year's data that live-baited sets catch more billfish and yellowfin tuna than do dead-baited sets, but this trend has not been consistent over the last three years.

Illegal activity in the trade of giant bluefin tuna with the Mexicans was reportedly rampant after the quota was reached in mid-February. U.S. vessels would trade as many as 8 bluefin each to the Mexicans for an equivalent amount of yellowfin tuna. Foreign buyers in the Venice and Dulac areas also continued buying bluefin tuna for at least 2 months past the close of the season.

The 3 shark trips put out 111.3 miles of bottom longline with 7,082 hooks in 14 sets, and captured 580 sharks (mostly blacktip and Atlantic sharpnose), 44 snake eels (for bait), and 7 miscellaneous fish for sale. The discarded by-catch consisted of 75 sharks (2 discarded alive), and 4 miscellaneous fish. Most of the sharks caught in the spring were pregnant females with near-term pups.

The two swordfish trips put out 3,437 hooks with chemical light sticks to capture 91 swordfish, 3 common dolphin, 9 escolar, and 17 sharks for sale. The discarded bycatch consisted of 17 sharks (5 alive), 5 live swordfish, 2 live leatherback turtles, 3 billfish (1 alive), and 12 miscellaneous fish. Many small swordfish (<20 lb) were retained by the crews of both the tuna and swordfish vessels for personal consumption.

Correction to MARFIN Abstract entitled "Biological and Catch/Effort Sampling of the Domestic Tuna and Shark Fisheries in the Northern Gulf of Mexico", page 1, paragraph 3.

The retained catch consisted of 795 yellowfin tuna, 46 miscellaneous tunas, 87 swordfish, 118 common dolphin, 51 wahoo, 15 miscellaneous sharks, 28 escolar, and 14 miscellaneous fish for a total of 1,154 fish. The discarded catch consisted of 48 blue marlin (15 discarded alive), 33 white marlin (7 alive), 21 sailfish (3 alive), 61 little tunny (4 alive), 107 yellowfin tuna (22 alive), 60 sharks (40 alive), 37 blackfin tuna (8 alive), 8 longbill spearfish (0 alive), 23 swordfish (12 alive), 9 escolar (0 alive), 39 skipjack tuna (1 alive), 11 common dolphin (4 alive), and 66 miscellaneous fish (13 alive) for a total of 523 fish.

The Application of Pelagic Longline Date in Reducing Billfish Bycatch and Resource Monitoring

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Abstract

Introduction

Pelagic longlining began in the 1960s when the Japanese fleet entered U.S. waters and longlined for tuna until they abandoned the fishery in 1981. During this period two data collection and reporting programs were implemented: 1) the Japanese Quarterly Statistical Report (1963-1981), and 2) the Foreign Fisheries Observer Program (1978-1981).

The Foreign Fisheries Observer Program was developed by National Marine Fisheries Service (NMFS) to address rising concern over billfish and shark bycatch by the Japanese. Data obtained during this program provided accurate records of Japanese activity and raised questions about the validity of the data available through the required Quarterly reporting program. When the Japanese abandoned the fishery in 1981, U.S. concerns over targeted and non-targeted pelagic resources eased. During the past several years, however, domestic landings of tuna have increased significantly and new concerns have been raised regarding tuna and billfish resources.

The goals of this project were to: 1) use existing NMFS longline data (Foreign and domestic) to determine relationships between billfish bycatch and longline fishing techniques that could be used to reduce billfish bycatch, and 2) use existing NMFS data to develop guidelines for a pelagic longline monitoring program.

Summary of Results

Analyses were conducted on data from 2,385 foreign longline sets of which 1,657 were from the Atlantic region and 728 were from the Gulf region. Data from the domestic fleet was more sporadic, and included sets from the swordfish fishery (114 sets) and the Gulf of Mexico yellowfin fishery (80 sets).

In the Atlantic region, McConnaugey's co-occurrence analyses showed high species associations between albacore and bigeye, yellowfin and bigeye, swordfish and bigeye, yellowfin and albacore, white marlin and yellowfin, swordfish and yellowfin, and swordfish and albacore. Moderate association occurred between blue marlin and yellowfin, white marlin and albacore, and white marlin and blue marlin. Highest negative associations were between blue marlin and bluefin, white marlin and bluefin, blue marlin and swordfish, and yellowfin and bluefin.

In the Gulf region, high association occurred between swordfish and bluefin, swordfish and yellowfin, bluefin and yellowfin, white marlin and yellowfin, and bigeye and bluefin. Moderate association occurred between blue marlin and yellowfin, and bigeye and swordfish. High negative associations occurred between blue marlin and bigeye, and white marlin and bigeye.

Analyses were conducted using multiple regression techniques to model temporal, spatial, physical, and meteorological regressor variables against ln(CPUE + 1) as a response. Although much of the total variation in catch rate by species was not accounted for by the model, surface water temperature explained most of the model variation in catch rate of 4 species (yellowfin, blue marlin, white marlin, swordfish) in the Atlantic region. Various temporal variables (month, year, quadratic date) explained most of the model variation in catch rate for bluefin and bigeye tuna. Other spatial, physical, and meteorological variables were important for explaining some of the model variation in catch rate by species.

In the Gulf region temperature was less important for explaining model variation in catch rates within species with the exception of bluefin. Effort, however, in the Gulf region was restricted in general from January through May, thus annual temperature effects on catch rates by species could not be fully evaluated. Temporal variables were important for explaining model variation in catch rate of yellowfin, white marlin, and bigeye.

In the Atlantic region, canonical correlation analyses showed a relationship between higher temperature and catch rate of yellowfin, blue marlin, and white marlin, and a relationship between lower temperature and catch rate of bluefin. Temporal variable analyses showed higher catch rates of yellowfin, blue marlin, and white marlin during summer through early fall while catch rate of bluefin declined towards early winter. Catch rates of yellowfin, white marlin, and blue marlin decreased with year for the period analyzed (1978-1981) while catch rate of bluefin increased. Other relationships included variation in catch rate of bluefin, albacore, bigeye, and yellowfin associated with number of floats and distance between floats.

In the Gulf region, canonical correlation analyses showed variation in catch rate of bluefin, yellowfin and white marlin related to longitudinal position (eastern versus western Gulf) and Quadratic month. Other associations were shown between bluefin, bigeye, yellowfin, and white marlin to longitudinal position, linear date, number of floats, and number of hooks.

Catch per unit effort (CPUE) and length frequency simulations were conducted to determine the level of sampling effort necessary to: 1) monitor relative abundance of pelagic species based on number of sets, and 2) estimate length frequency distribution to allow assessment of population size shifts. Results from the CPUE simulations indicated that sampling effort varied from 100 to 200 sets (longline length = 50 miles) to adequately estimate CPUE of yellowfin during 1978-1981 (Figure 3A). Additionally, effort was inversely related to CPUE requiring additional sampling effort when CPUE declines. Length frequency distribution was determined adequately at a level of n=2,000 measurements by Komolgorov-Smirnov's 2 sample test.

Table 1. Temporal, spatial, physical and meteorological variables used in multiple regression analysis and canonical correlation.

Class	Variable
Temporal --	month year linear date cubic date quadratic date set time (time at which line was set)
Spatial --	block (lat. or long. position)
Physical --	longline length distance between floats float line length number of hooks number of floats
Meteorological --	surface water temperature wind direction wind speed wave speed wave height

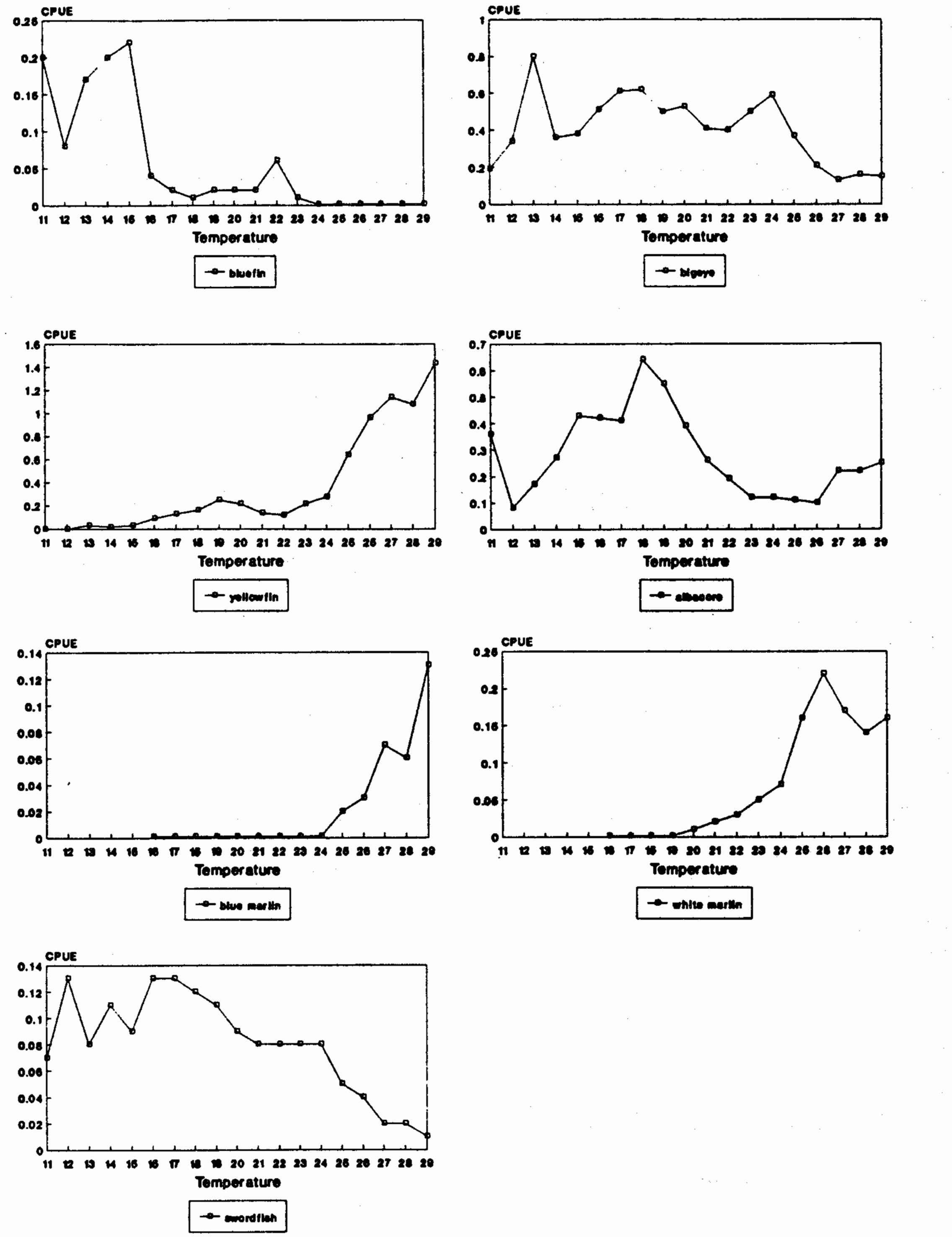

Figure 1. CPUE by temperature and species for the Atlantic region (1978 - 1981).

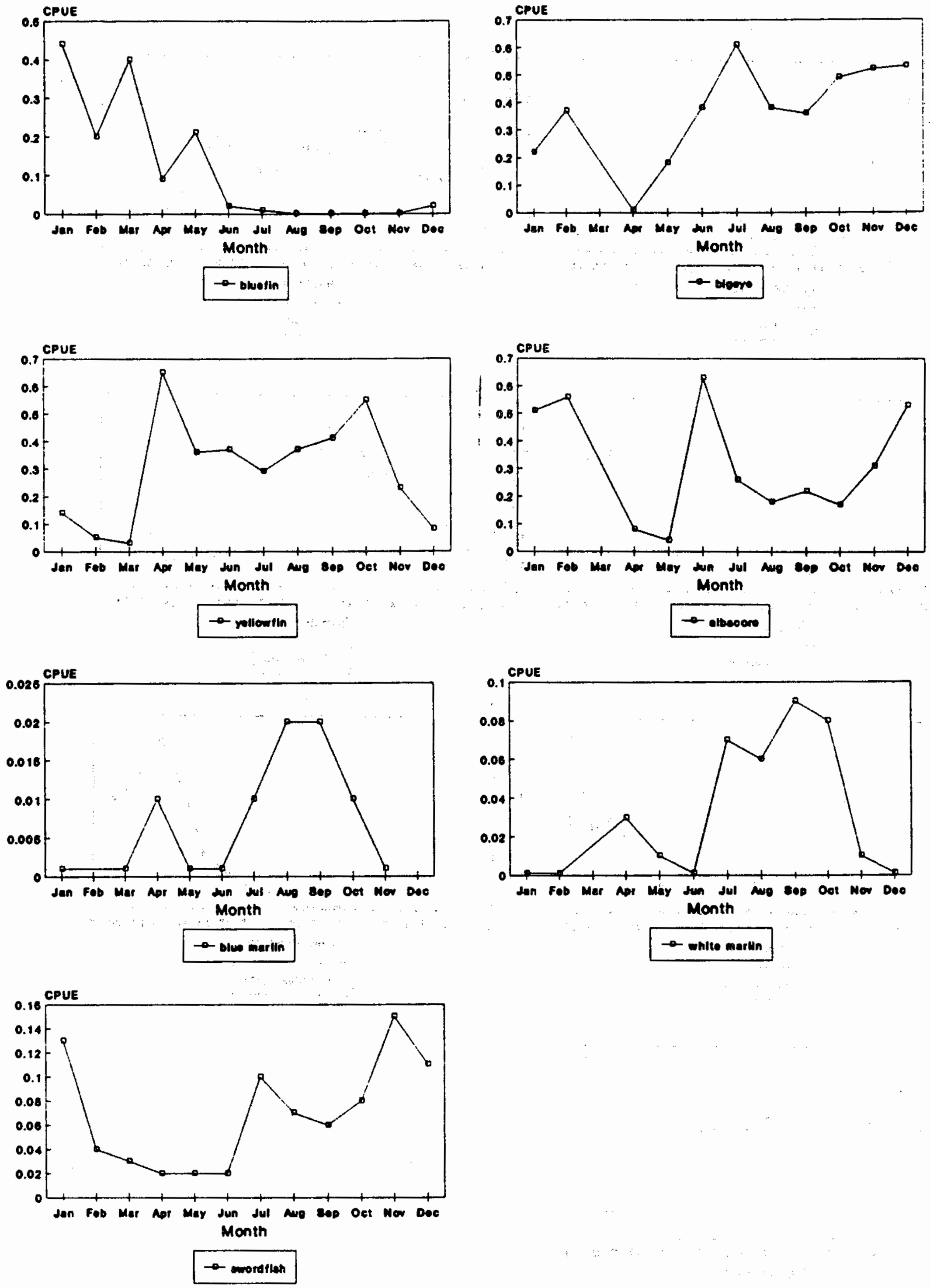

Figure 2. CPUE by month and species for the Atlantic region (1978 - 1981).

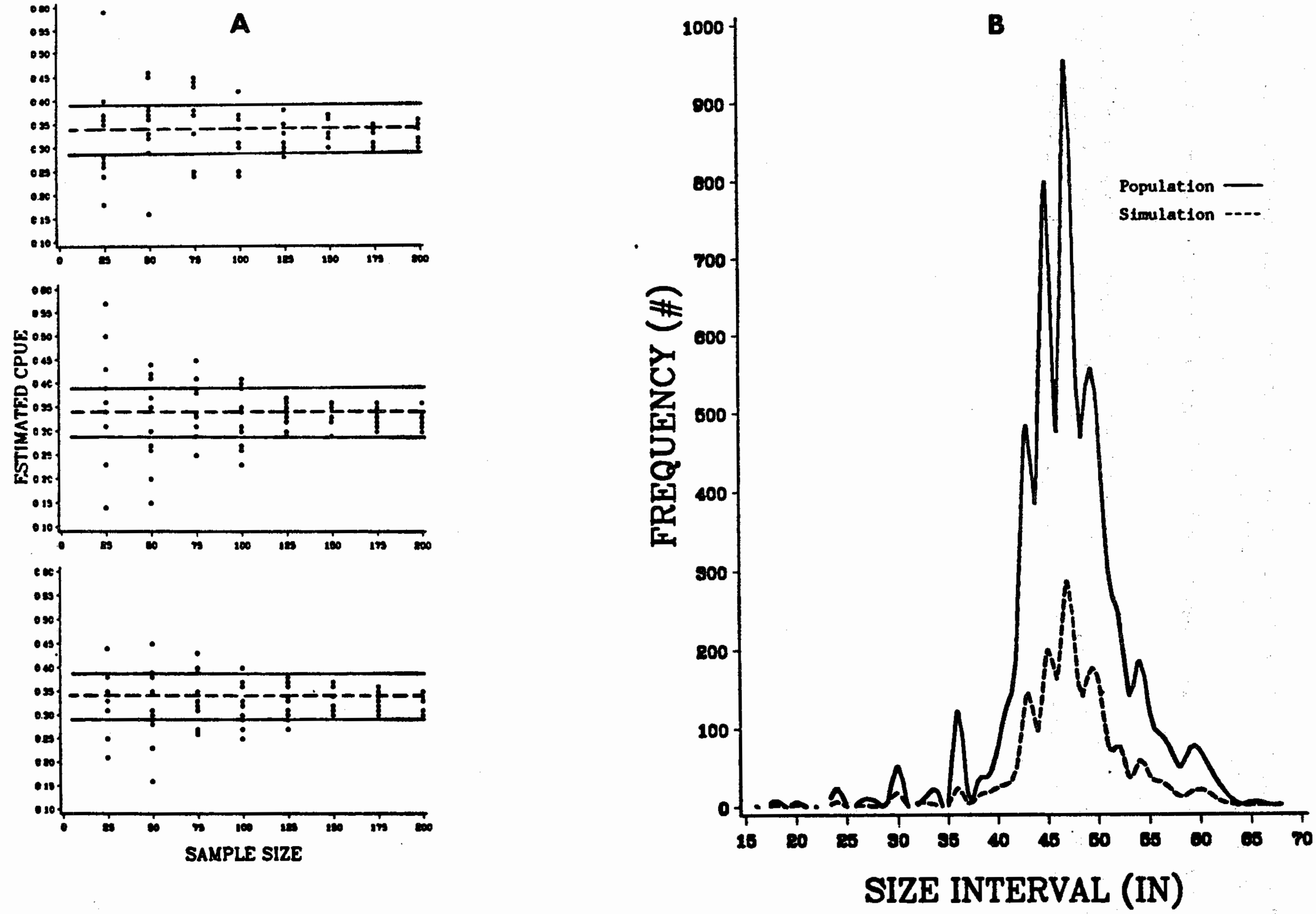

Figure 3. Simulation distributions showing: A) Monte Carlo simulation method to determine sample size, and B) simulated length frequency distribution of 2,000 randomly selected lengths.

B. Shipp - Thank you, Chuck. Dr. Wilson will stand for questions.

C. Perret - Observer coverage on domestic vessels, what percent coverage are we getting or have we been getting?

W. Nelson - In the gulf where Sandy's [Russell] got her team, probably about 5%.

B. Shipp - Thank you. Our last presenter is Joanne Lyczkowski-Shultz. She'll be speaking on "Early Life History of Snappers in Coastal and Shelf Waters of the Northcentral Gulf of Mexico, Late Summer/Fall Months, 1983-1989."

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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Abstract

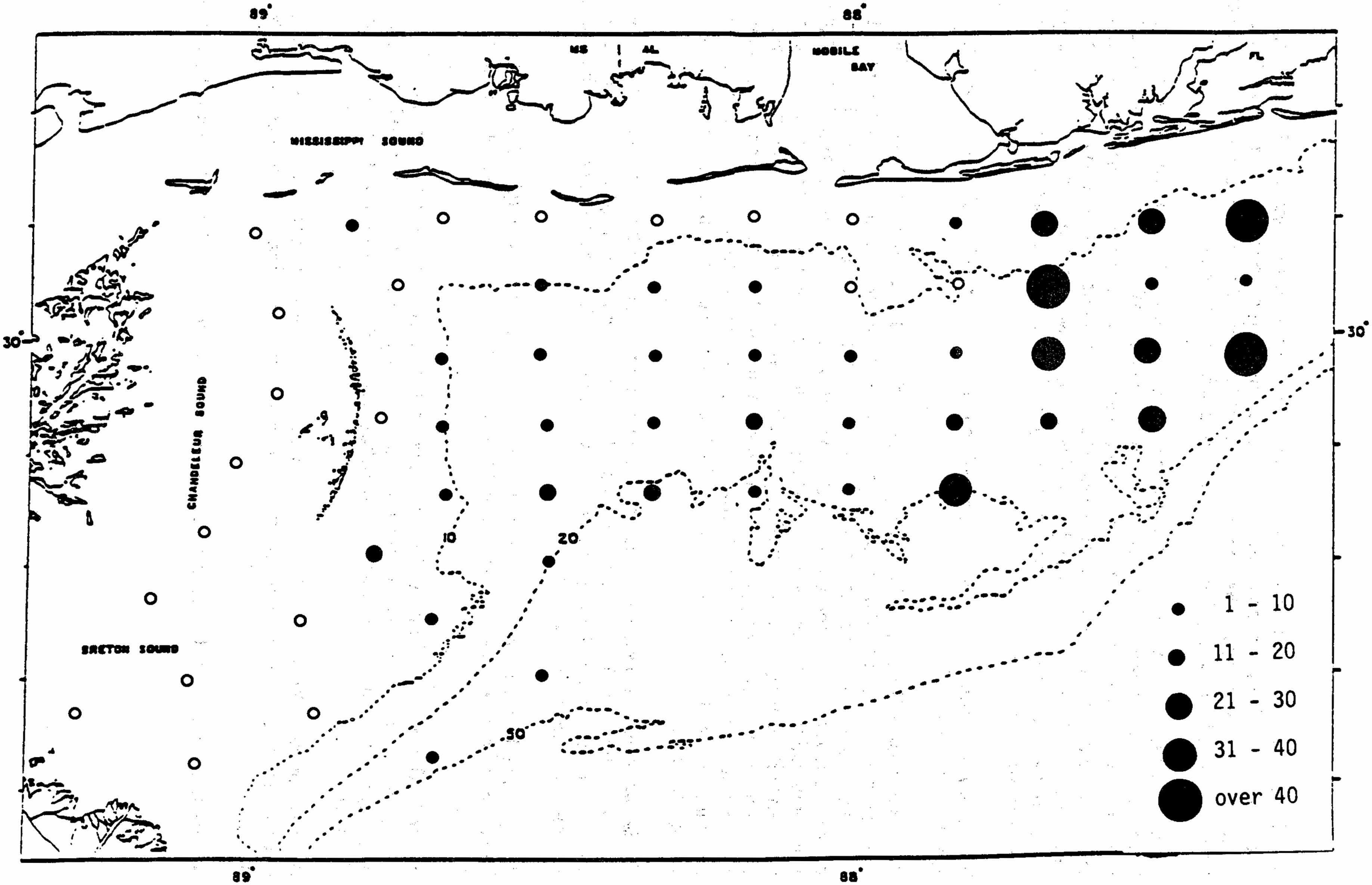
Within recent years it has become apparent that both commercial and recreational segments of the reef fish fishery in the Gulf of Mexico are in trouble. Numerous taxa of fishes contribute to the Gulf reef fish resource but the majority of species belong to the family Lutjanidae, the snappers. Primary objectives of this project (now in year 1 of 2) are to: document and describe the distribution and relative abundance of snapper larvae, especially red (_Lutjanus campechanus_) and vermilion (_Rhomboplites aurorubens_) snapper, using extensive collections from northcentral Gulf coastal and shelf waters; provide new data on snapper spawning locations in relation to both natural and artificial reef sites; and assess the feasibility of aging snapper larvae using daily otolith growth increments in order to estimate larval snapper growth and mortality rates.

Information is lacking on nearly every aspect of the early life history of the snappers. Of the 15 snapper species listed in the Reef Fish FMP the larval development of only the vermilion (Laroche 1977), red (Collins et al 1980), and grey or mangrove (_L. griseus_; Richards and Saksena 1980) snappers have been described. The vermilion and red snapper descriptions, however, do not include larvae < 4 mm in length and thus smaller larvae of these species remain unknown. Resolution of problems in larval lutjanid taxonomy is forthcoming as early snapper development is currently being studied by workers at the University of Miami, and Southeast Fisheries Center/Pascagoula and Miami laboratories.

Abundance and distribution of lutjanid larvae taken at 60 locations from Chandeleur and Breton Sounds to northwest Florida during the Mississippi/SEAMAP Fall Ichthyoplankton survey, 16-19 September are presented. Snapper larvae were most abundant in the eastern end of the survey area with 80% of all larvae being taken at the four easternmost transects. Only 19% or 174 of the 932 snapper larvae collected during this survey could be identified to the species level. Of those identified larvae, 166 were vermilion snapper, 7 were red snapper, and 1 was grey or mangrove snapper. Specific identification was difficult because most snapper larvae in these collections were less than 4.0 mm in length, and in stages prior to dorsal and pelvic spine formation. Four different morphological types were found among our 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. As more material is examined it is anticipated that the most abundant, unidentified morphological type will turn out to be small vermilion snapper. Identification of snapper larvae from northcentral Gulf collections is a more tractable undertaking than in southern waters

because there are fewer species in northern waters. Our collections will provide data for more complete descriptions of red and vermilion snapper larvae, thus allowing use of larval abundance data to more completely describe seasonal spawning curves, and as a tool in assessing adult stocks.

Abundance (number under 10 sq.m.) of snapper larvae collected at stations in the northcentral Gulf of Mexico during the Mississippi/SEAMAP Fall Ichthyoplankton Survey, September 16-19, 1989.



B. Shipp - Ms. Shultz will stand for questions. Do you think that the seasonality discreetness of different spawning periods may lead to helping you resolve the tropical problem or is it pretty much the occurrence of spawning activity by most of the snappers?

J. Lyczkowski-Shultz - In the major compilation of data that Churchill Grimes put together in a publication a number of years ago on tropical snappers spawning and such, he talked about the snappers kind of falling into two categories - one, species that are around islands and such that have kind of a continuous spawning, and two, others that are more continental in that they spawn really only in the summer months, early summer into the early fall.

B. Shipp - What about your SEAMAP data? Is it all strongly summer, spring and summer?

J. Lyczkowski-Shultz - For the SEAMAP data, I haven't looked at that. The Pascagoula Laboratory has that information and they are looking at it. People have just started looking at the larvae snapper data. But there should be something there; there's coverage from SEAMAP Ichthyoplankton collections, the piggy-back collections from the summer groundfish survey, the June and July period, not too much in May although some the piggy-back efforts during the butterfish resource surveys will be there. And again, this is data only up through 1986. We should have some 1987 and 1988 data coming up hopefully. That's going to help.

W. Swingle - Are red snapper not abundant off Texas that you could maybe look at the smaller sizes from that collection and maybe separate the Vermilion and red based on that analysis? Or would that be a bad assumption to start with?

J. Lyczkowski-Shultz - I don't know. I don't know enough about it. I know that there aren't many ichthyoplankton collections taken from off Texas.

W. Swingle - I'm just going by the catches by the recreational leads that, say it's almost entirely red snapper in this area of Texas. Although that doesn't mean that they were the predominant species of snapper.

J. Lyczkowski-Shultz - That is a way. If that is the case, then that would definitely help narrow the field of what we need to do comparisons on.

W. Swingle - I don't think that Vermilion are nearly that common there.

SUMMARY AND CONCLUSION - Bob Shipp, MARFIN PMB Chairman

That concludes our Third Annual MARFIN Conference. I would like to say a few things, especially thanking the presenters. Any of you, and I guess this includes almost all you who have sat in on council meetings or public hearings since 1985 or 1986, have heard the controversy regarding red drum and turtles and now reef fish and sharks. When you go to those things, it's especially interesting to listen to the politicians. I don't know if its unique to Alabama, but when I go to the Alabama hearings, the politicians always lead off, a process which I find very disturbing because it usually leads to a situation where there is very little dialogue between people wanting to make public statements and the representatives of the council. The mood is set by the politicians, and I think, in general, I'll just leave that statement at that. One thing that they always allude to is possible solutions to these problems. Some of the political solutions are astounding, but others, if they are to come to pass, are going to have to come from MARFIN or S-K or somebody else that's going to provide the solutions. So I think in terms of the presenters, the quality of presentations, the scientific objectivity, the care of the work is critically important to the future in resolving these problems, and I very much appreciate all of your work. I hope next time, we'll have an even larger turnout. I'm sure we will, we're talking about having the next MARFIN Conference in conjunction with perhaps a council meeting or the scientific societies or something like that. But again, my thanks to you all.

Recommendations for MARFIN Funding

GENERAL COMMENTS: No single method for stock size assessment is without potential biases and shortcomings, therefore, all available methods should be explored. One such fishery-independent method is based on the production of fish eggs and larvae, and has been successfully used to estimate spawner biomass (best case scenario when larval growth and mortality rates, and adult reproductive parameters are known, eg. red drum in northcentral gulf) or, at the least, provide a relative, annual index of stock abundance. This latter approach may be particularly relevant to snapper stock assessments because adult habitat is so difficult to sample effectively.

An even more fundamental research goal in fishery science utilizing early life history stages and worthy of MARFIN support is to understand the processes causing annual variations in recruitment. 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 the success of such research endeavors can be found in the California Current and Georges 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 yield critical information in stock assessments and recruitment/ecosystem research.

SPECIFIC RECOMMENDATIONS FOR RESEARCH SUPPORT:

1. Efforts to examine the response of red drum to current fishery management regulations.

2. Larval snapper taxonomy, including both rearing efforts and examination of field collections. This area of research is 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. 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.

4. 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.

ADDITIONAL MARFIN RESEARCH: In light of possible cutbacks in existing gulf fisheries, namely the shrimp fishery, support should be extended to research germaine to alternative fisheries (particularly those with established markets eg. squid) or alternative techniques in existing fisheries. Research directed towards identifying new or additional resources, establishing fishery potential, and describing critical aspects of biology to support effective management prior to exploitation should receive high priority for funding.