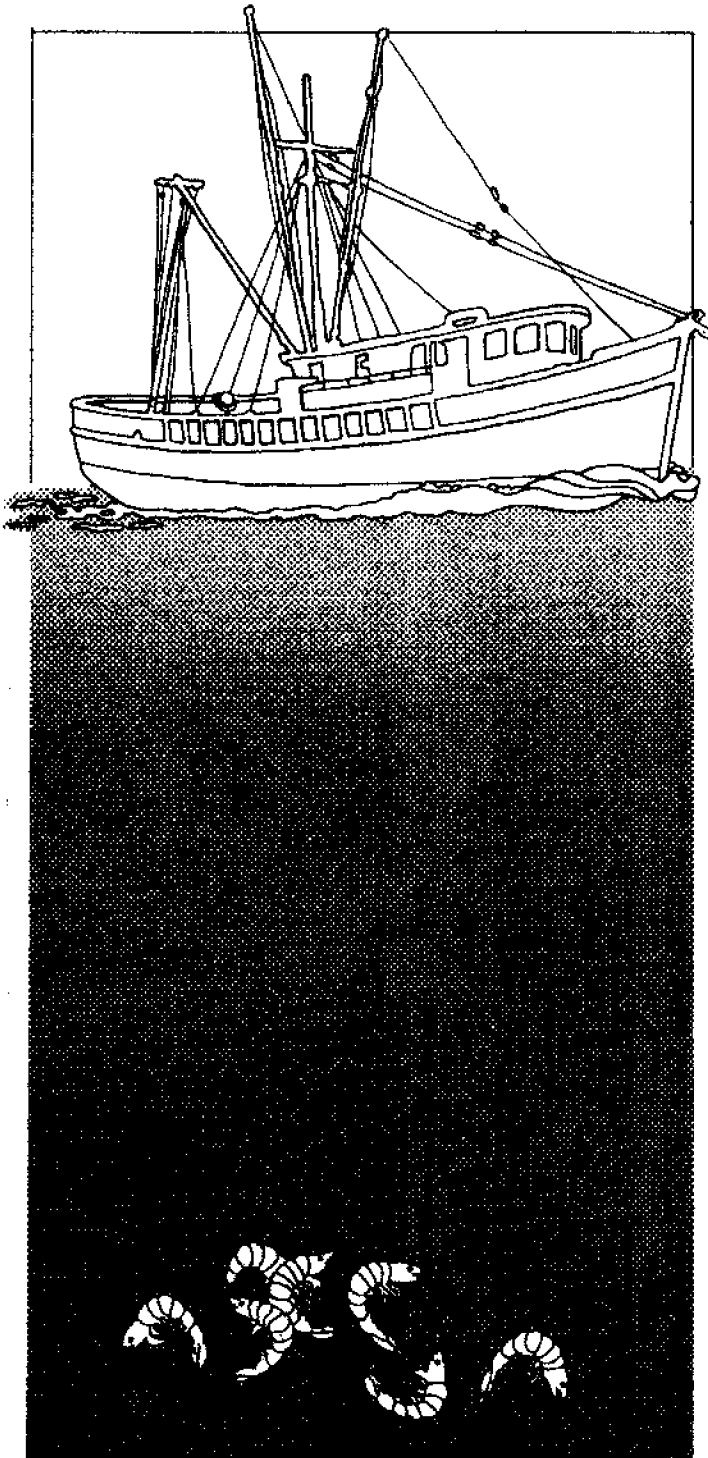


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The Mississippi Shrimp Industry: A Management Perspective

Proceedings of a
Mississippi Sea Grant
Advisory Service Workshop
April 12, 1989

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Compiled by
Dave Burrage
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Introduction

Dave Burrage
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Mississippi Sea Grant Advisory Service
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I guess the first question we need to ask is why have this program? Those of you in the industry are certainly aware of the problems we are experiencing in the shrimp industry, not only here in Mississippi, but Gulf-wide and nation-wide. Shrimpers are facing increased competition from imports, higher operating costs, lower prices for their catch, and impending TED regulations. Packers and processors are facing more stringent environmental and FDA regulations and labor laws and increasing costs.

State and federal regulatory agencies must try to equitably allocate a finite resource among various and often competing user groups, such as commercial producers, recreational fishermen, and the live bait industry. Therefore, it was only natural that we teamed up with our regulatory agency, the Bureau of Marine Resources, to put this program together.

Management often means regulation and regulation often occurs in conjunction with, or because of,

legislation. For that reason I'm glad to see several members of both our coast delegation and our Washington D.C. delegation in the audience today. From Congressman Larkin Smith's office, we have Billy Thornton and Royce Luke; from the Mississippi House of Representatives, we have Ed Ryan. We also have another special guest this morning who will be our keynote speaker.

So again, why have this program? First, to present information on the current status of the shrimp industry both nationwide and here in Mississippi. Second, to look closely at some management techniques which might be employed to relieve some of the current economic hardships prevalent throughout the industry, and third (and I think most importantly) to provide a forum for those members of the industry directly impacted by management decisions to have some input into the decision-making process. I'm pleased to see such a fine industry turnout here today.

The Mississippi Shrimp Industry: A Management Perspective

Keynote Address

The Honorable Bob Short
Mississippi House of Representatives
District 118 – Harrison County
Gulfport, Mississippi

Good morning to all of you. It is a pleasure for me to address this conference as we start discussing ideas that are as close to your heart as they are to mine. Like you, many of my friends are still making their living in the seafood industry. Some of them are commercial buyers, some deck hands, some are owners of processing plants or of seafood markets, and others are drivers or general workers around the seafood docks. They, or I should say we, have struggled at times between the good years and the bad. We have seen unparalleled growth in the shrimping industry. We've seen shrimp landings going up more and more. We've seen the consumption going up. But at the same time we've seen our profits going down more and more every year. That is one problem that I am very interested in, not only as a member of the legislature, but as someone who knows what it is like to put on a pair of white shrimp boots and unload boats from 6:30 in the morning until 10:00 at night.

Those were the good days. Today, we'd just love to have a boat pull up. Most of the problems that we had in the past were caused by weather. We'd have hurricanes, we'd have storms, or we'd have no rain – those were the serious problems in our shrimping industry. But the last few years, our problems seem to be of a different kind. As I said, we've watched production and consumption grow and our profits are still going down.

Ten years ago, we were producing half the shrimp consumed in this country and most of this was coming from the Gulf Coast. Now we're producing about a third. That's one of the problems. The main problem that we have as fishermen is the amount of money that we get per vessel for our shrimp. The bottom line is that we can't make a living if we can't pay our bank notes. I used to love to see the bankers come around. Now, I try to hide in the back closet when I see their car come up, and I think most of you may do the same sort of thing.

In this meeting we are going to have today, we're

going to discuss with experts several different things. Among our concerns are ways to limit the number of people who can get into the shrimping business. It's not a good idea to some, but we're going to have to look at it because the more shrimpers we put out there, the less income we're going to see per vessel unless there are drastic changes. Many people feel that tariffs are something we are going to have to impose on imported shrimp, yet we see realistically through the Congress and through other areas that this is not going to be a workable solution. For us here on the coast, this solution sounds good. But if you live in Little Rock, New York, or Kansas City, you don't look to see where the shrimp came from, you look at the price. Consumers don't think about how many times you go out and drag all night long and come up with only 50 pounds of shrimp; they think about price, whether shrimp is \$3.00 a pound or \$7.00 a pound. This is something we are going to have to look at.

We have a group of people here today who are experts in different areas. We're going to have to listen to them, we're going to have to try to incorporate what they know best with what we know best as shrimpers, not just for more money, but to survive. We're going to have to look at several different areas of shrimping.

Do we allow shrimpers to go out the first days of shrimp season and catch the small shrimp when we've been all winter long with no money at all? If we do this, are we cutting down on the size and the value of the shrimp in the next month or so? On the other hand, if we wait to open the season and have to go out into the deeper waters where the shrimp get larger, we're going to cut out a lot of the shrimpers who have small boats. We're going to cut out the individual's right to go out and shrimp if he can't go out into the deep waters. I don't know the answer, but this is a problem that we're going to have to work on together to try to come up with an answer. I don't feel like we can say that because your boat is only 35 feet

long we're going to stop you from shrimping. But if we delay the season from opening until later, that is basically what we are going to do.

It's time that we sit down as a group: managers, experts, shrimpers, processors, taxpayers, and other individuals to decide where we are going with the shrimping industry on the Mississippi Gulf Coast. Are we going to just keep plugging at one another until one day, all we will see is shrimp with a label we cannot even read? That's why it is so important that we meet together like this. We're going to have to work together.

If someone calls the Mississippi Gulf Coast from New York, they can call "Joe Blow" in Biloxi and say, "I'll pay you \$3.00 a pound," then call Bob Short in Gulfport and say, "Look, I can get the shrimp over there for \$2.70 a pound." The only people who get hurt in that, ladies and gentlemen, are us. We're going to have to quit cutting each others' throats and work together as a team. Competition is good, but when you use competition to eliminate each other, the only person who wins is some broker in New York City—a broker who could care less whether our boats tie up down here for 11 days, 20 days, or 30 days as long as he can get his 50,000 pounds of shrimp and makes his 10 or 15 percent profit. He could care less what we make. That's where I believe we are today; in a situation where we're going to have to work together. If we don't, when we have this meeting a year from now it will probably be half this size. If we don't stick together, I think it will be over with for us. Only working together as a team will we be able to come back and have the type of businesses that we've had before on the Mississippi Gulf Coast.

I can tell you that we've had problems before. I can tell you that I would love for us to go back to those problems where we argued and cussed each other because our boats didn't get unloaded first; because of who was going to get in line to get ice next before we ran out of ice; or because we were dying to get back

out and come back in with 50 or 100 baskets of shrimp on our boats. These are the kinds of problems I want to try to help you solve; not just the kinds of problems that we have to worry about if we're going to survive, if we're going to pay the bank notes.

I can promise you the support of Ed Ryan and the Mississippi Gulf Coast delegation, we'll do everything possible to see that money is put into the state's shrimping industry. We had a group of people in the Delta who worked together to start catfish farming, together, as a team, they built an industry and today are producing most of the catfish for the nation's consumers. They work closely with their delegation and with us to help in every way possible to pass state legislation favorable to their industry and to make sure that we get any monies available from the Federal Government or from any other areas to help them survive.

At this moment, Senator Tommy Gollott and some of our other delegation are meeting with the Governor. We're going to be asking for some legislation to help the shrimping industry. We will try to help lower insurance rates on our boats. If there is any money available (and we have Congressman Larkin Smith's people to help in Washington), we want to make sure we get a fair share for the Mississippi Gulf Coast. That's what it's going to take. We're down now, but I can promise you that working as a team we'll come back. We have to work together with our local people, our Delta people, and our people in Washington. But mostly, we, in this room, have to work together as one big family, because that is the only way we can survive.

You have a lot of good people talking here today, so I'm not going to keep you any longer. I can promise you the support of your Mississippi delegation and your legislature and together we will come back. If I can help you any time in Jackson, or if Ed Ryan or any other legislator can help you, please call on us, and together we can rebuild our industry.

An Economic Analysis of the U.S. Shrimp Industry

Kenneth Roberts

Professor and Marine Economics Specialist
Louisiana State University
Baton Rouge, Louisiana

Good morning and thank you for the warm welcome. It is a pleasure to be here this morning. We have a big task to cover—the economics of the shrimp industry in the United States and I'm going to move through a number of things; I'm going to talk a little bit about boats, a little bit about imports, a little bit about consumption, and quite a bit about processing. I want to clarify something. I'm not going to give you an analysis. What I'm going to give you is a collage of personal experiences, thoughts, and information.

I want to start and end on the same theme. From my experience, one of the things that you have to do is think dollars and not just pounds. We're guilty of this in my own home state of Louisiana and we are the biggest shrimp producers. I prefer to think in terms of dollars. It is a much broader understanding and I think that it helps bridge the gap between different sizes of shrimp, it bridges a gap between sizes of boats and it bridges a gap between part-timers and full-timers in the industry. One of the things that I encourage you to do in these deliberations is not to forget poundage, but to think in much broader terms and then get down to specifics.

The second thing is to think "beyond the dock," and personally this is one of the things that I am most interested in right now. The last few years in the shrimp industry, I think the thing that is the hidden problem in the industry is at the processing level and I hope to convince you of that. Even though there are managers who really perhaps only have legislative responsibility through their regulatory bodies to do something about the harvest, I still think a person who is a legislator or a day-to-day manager in the fisheries industry has to be aware of what is happening in the processing industry and how decisions at both the state and national level might affect it.

Since 1982, what has been happening to overall shrimp consumption in the United States is very impressive. As a matter of fact, it can lull you to sleep. You look at consumption statistics and you think everything has to be great, because 1982 marks approximately the beginning of the rebirth of consumers' interest in seafood, for whatever reasons. It may be

health aspects or it may be that rising per capita income since that time has been dramatic. Whatever the reason, that sort of thing can lull you to sleep because overall seafood consumption has been increasing at about half the rate as the shrimp component. Let's say the shrimp component of overall seafood consumption has been going up twice as fast. Everything must be fine, right? Well, I don't think we would have heard the previous comments or be looking at some of the issues that are later on the program if it was that way.

Domestic shrimp landings in the United States, fluctuating over the last 19 years right around the 200-million-pound-mark in terms of heads-off landings, are not an upward prospect. Back around 1975 or 1976, there was a very large peak in U.S. supply. Those happened to be some good years in about 1976-77, particularly in Louisiana and I'm sure in Mississippi. But, about that period, in the mid-1970's, the West Coast fisheries, primarily Alaska, were up around 190 million pounds heads-on. Since then, their landings have basically crashed and are closer to 20 to 40 million pounds. Their industry has really gone down a great deal. The Gulf's proportion of the U.S. share has gone up, basically by default in the Pacific Northwest.

Let's take a look at what has been happening in the Gulf. In 1988, we experienced about 66 million pounds of tails landed in Louisiana, down from 75 million pounds in 1987. That is a 9-million-pound decrease, and at landed value adds up to about \$18 to \$20 million. The point I'm getting at, particularly for people in the legislature and in management, is the kind of impact that occurred in seven coastal counties in the state of Louisiana. I think you have the same sort of situation in Mississippi with a fewer number of counties involved. If you put a multiplier of 2 to 2 1/2 on that, you are looking at a \$50 to \$60-million impact in a shrimp season that runs about 6 months in seven counties. That is a very large impact and you can't just "wash it away" because production was down a little bit. Our state representatives and legislators and management people have to factor that kind of thing into decisions. I'll wager this — if our legislature

in Louisiana was confronted with that kind of an economic impact in a seven-parish rural area with mostly farmers, we would see all sorts of things happening. The point I'm getting to is that I think we've got to be a little bit more responsive in terms of taking some risk and changing management measures and legislative approaches to our fisheries. Louisiana is just reflective of the Gulf and I think the same thing has been happening in Mississippi. There is something more involved here than just a short-term phenomenon. We are into something that is relatively long-term. Everybody dreams. We dream in Louisiana about getting into the fishing business, particularly since the oil industry went down in 1983.

The 1987 survey in Louisiana of shrimpers who were commercially licensed indicated that 41 percent of them were full-time. Fifty-nine percent of them were part-time and that is not because of the economic factors. They were part-time because they were using the shrimp industry as a supplemental income to other wages. We, like you in Mississippi, have a full range of boats. These kinds of things are absolutely critical to consider when you are doing economic analyses to change the way things are going in your shrimp industry.

Fifty-two percent of our full-time people had boats in the 20- to 30-foot range. Fifty-two percent! They didn't get their income full-time from shrimping, they may have oystered, they may have crabbed, they may have trapped, and a little bit of everything, but at least they were full-time devoted to the commercial fishing industry. Thirty-two percent had boats 30 to 50 feet. Only 11 percent had boats longer than 50 feet. You have a small number of the people representing a lot of fishing power working offshore and a large number of people representing small boats and, collectively, a lot of fishing power fishing inside. I think again you have to go back and look at the trends dockside and say "maybe it is time to take some risk in the way we approach things instead of perpetuating the same." That's what I like about talking dollars and impact by number of counties and in a short period of time.

If you examine 1988 northern Gulf of Mexico ex-vessel prices, you can see after about May, the 26/30 price for the rest of the year was above what it had been in the previous year. For the 41/50 count, it took a little bit longer for 1988 prices to exceed what they were in 1987, not until late October. Next, we'll discuss 61/70 prices. This is the beginning of our bread and butter in Louisiana. The vast majority of our shrimp (and I am talking about 70 percent plus) are this small or smaller.

What is happening in particular segments of the shrimp industry is important. One of the things I'm getting at by using a Louisiana example is to tell you to look within the industry you are trying to manage

and look for that particular segment in which you are strongest or in which you happen to be weakest and try to work with that particular area. We in Louisiana have a very different shrimp industry than the state of Texas and we should not in our state adopt the same types of things with just a snap of the finger just because they're doing them in Texas. We have an entirely different fishery. In most of 1988, prices for 61/70 count and smaller shrimp never got to 1987 levels. So you can take a mid-price for the Gulf of Mexico and it may not reflect what happened within Louisiana. Remember that 50 percent of our people worked 20- to 30-foot boats. You've really got to get in and work hard to identify the segment that is experiencing some problems and go after whatever can help them.

Overseas fishermen and imports cause all sorts of problems so let's leave the domestic fishery very briefly. Imports went up to a little over 500 million pounds in 1988. It is important to work with shell-on headless weight. If you take imports and break them out and try to find out what is happening, you'll find 1988 was entirely different from 1987. If you are trying to do something to improve your industry, you've got to know the subject and the subject is very complex. I simply want you to know that you have to dissect the import issue. If you look at shell-on imports for 1984 through 1988, in 1984 and 1985 they didn't change much and the overall figures reflected that. In 1986-87, they went up. In 1987-88, they went up dramatically. Peeled imports went down between 1987 and 1988, although between 1986 and 1987, they went up dramatically. What did we have in late 1987 and most of 1988? We had a weak peeled shrimp market didn't we? Things changed. What has happened? The peeled market has been coming back (particularly on smaller shrimp) a little bit since late in 1988. We have had fewer shrimp on the market. You get in and work on imports by breaking it up. Now, if you take 1987 and convert those peeled shrimp to shell-on tail weight we actually had more product enter in 1987 than we had in 1988. The composition was different in 1988. There was a lot more shell-on during the year compared to 1987, when a lot of it was peeled weight. So get in and work with your numbers instead of just condemning imports—take a look and see what your particular problem is.

If you took a look at the 1984 to 1988 import increase, what was responsible? Eighty-five percent of the increase between 1984 and 1988 of the pounds of shrimp imports was due to shell-on. We used to have a lot of problem with canned shrimp, right? That was what we felt a great deal in Louisiana, because of the product that was coming in from Thailand. That has leveled off.

Back when the Norwegians were going strong 3 or

4 years ago, we had a great deal of difficulty with peeled shrimp imports. The Norwegian fishery has basically deteriorated to the point where it is not a major fishery anymore. Eighty-five percent of the increase was in shell-on shrimp. Fourteen percent was in peeled, and all of the rest (breaded, canned, peeled, cooked, etc.) was 1.3 percent. Why? Primarily because of the development of aquaculture. If you want to try to do something about imports you have to know where they are coming from. You have to know the sizes and the product form. Otherwise, the trade laws in the United States are going to defeat you from the very start because they are very, very complex and you are going to need something specific to address shrimp.

In 1987, we imported roughly 40 million pounds of China whites. In 1988, we imported a little more than 104 million pounds and we could have gotten a lot more. Half the shrimp out of China go to Japan, and Japan is holding record quantities of imports and inventory right now. And you probably know that this week there is supposed to be another major shipment of Chinese shrimp into the United States.

Ecuador, another aquaculture country, was basically down from 1987. Maybe they have peaked and maybe they are simply in a holding pattern until they can get their hatcheries and some other things straightened out to go to a little bit more intensive-type shrimp farming.

Mexico has gone down significantly, and in Louisiana that doesn't affect us too much because we all know the Mexican shrimp are mostly whites and they are mostly big shrimp. They are probably going to be 40-count and larger shrimp and most of them probably 26-count and under. So with Louisiana producing small shrimp, that kind of a thing hasn't hurt us very much. We know this past year, big shrimp prices were strong throughout most of the year and I think that is part of the reason that the pond-raised shrimp were coming in at 41/50 or 51/60 count. Mexican shrimp production, which is basically big shrimp, was down a great deal so we had a lot of middle-size shrimp and very few large shrimp. We had a fracture in the marketplace. Small shrimp went down and stayed down, big shrimp went up a little and stayed up. So again, the import situation is very complex.

You've got to look at where the imports are coming from, because if you are going to take action then you've got three big countries right here, two of them Latin American and one Asian, and you might have to have different trade policies. I don't know what the State Department or the International Trade Administration would make you do. In 1988, smaller size shrimp were a larger element of imports than in 1987. These are shell-on shrimp, and in the space of one year, it changed that much from 31/60 to greater than

60's comprising 75 percent of the imports.

Peeled imports showed the same trend. Roughly 90 percent of the peeled shrimp came in smaller than 31-count tails. For the previous year it was about 80 percent. So 10 more percentage points entered as smaller shrimp. 1988 was a small count size shrimp year in terms of imports. We had a lot of imports in 1988, running ahead of 1987 through May, while the middle of the year through September was below 1987. At the end of the year, we had two dynamite months. In December, China sent us around 25 million pounds of tails in one month. So the point here is that if you're trying to approach some sort of remedy, get in and understand what it is the market is doing and the supply situation under which it is doing it.

Let's discuss what the beginning inventory situation has been. The beginning year inventory in public cold storage hasn't really gone up in proportion to import supply. There are two conclusions maybe. The market has been a lot more current. That means people are not storing and holding for some sort of price appreciation, which used to be the case during the first quarter of the year. The second thing is the people who are importing from Ecuador and China may be using their own cold storage and not going to public warehouses. What is actually happening I don't know. I tell you it is a consideration if you are trying to correct something. You've got to know exactly what is happening to that product when it comes in.

If you examine the processed weight in the Gulf of Mexico on shrimp from 1977 to 1986, you see from about 1977 through 1983, there was not much change. In 1986, processed shrimp from the Gulf of Mexico went up in terms of number of pounds, perhaps due to some people processing imports, but 1986 was a good year of domestic supply. We had a lot of shrimp available in 1986, so it might have been due to that. If we examine how much we're actually processing in proportion to how much is being landed, it has been somewhere around 85 to 88 percent in the last few years since 1983. So you could say we are not really in any upward trend there in terms of how much more we're processing. We're processing about all of it. The rest of it is going direct to market, let's say in fresh or roadside or something like that. So we're getting out of the Gulf fishery, proportion-wise, what it appears we're always going to get. We don't have any slack in terms of shrimp that are not being processed that we could use and make our people financially better off. Shrimp is the big thing in the Gulf of Mexico in terms of processing. It always has been and probably will remain that way. If you look at the processed value of shrimp and non-shrimp over time, shrimp has been about 88 percent of the processed value. In other words, if you are in the Legislature or the Con-

gress and you're concerned about the shrimp industry, you are really concerned about the seafood processing business in the Gulf of Mexico. That is one of the perspectives you have to have.

The shrimp plant from 1981 to 1985, averaged around \$6.5 million in sales. Other seafood companies that don't have shrimp in their product line, were around \$2.2 million in average sales. Again, the shrimp business was about three times the size of the typical processing business in that 1981 to 1985 period. In 1970, the top five shrimp firms in the Gulf of Mexico accounted for 36 percent of the sales. The top 10 had 58 percent. By 1985, the top five hit 34 percent and they went down in terms of power. The top 10 hit 53 percent, so we're not getting more concentration of economic power in the processing business, at least through 1985, in the shrimp business. It has basically been about stable. We don't have any big kingpins that have emerged over the last 15 years that are dominating someone else.

If we look at the volume of processed shrimp products in the Gulf in terms of shell-on, peeled, and breaded, peeled has been increasing some, breaded has been just about level since about 1983, and the shell-on is up a little bit. Processed shrimp products that are canned from the Gulf are way down. You know what has happened to the canning industry, I don't have to spend a lot of time with this. It has happened to us in Louisiana and I'm certain that it has happened in Mississippi also. What does this shrimp from the Gulf get in terms of share of the processed shrimp value in the United States? We've been trending along since 1983 at a little bit better than 50 percent. How stable is the industry you're trying to manage or do something about? I am trying to get you to think beyond the dock because I think it is really important.

From 1971-75, there were 60 shrimp establishments that went into business. Sixty-two established firms exited the industry. From 1981-85, there were 65 shrimp establishments that came into the business. Seventy-three went out of business. We have a very unstable industry. It isn't generating increasing concentration, (more power in fewer hands) and certainly one that doesn't have just entrants. We have people coming in and going out and some net outward movement. Gulf processing establishments for shellfish also indicate some trends. During 1970-75, 1980, and 1985, blue crab establishments were up in number. Oyster processing establishments were up a little bit. Shrimp processing establishments are down a little bit, and again, with no increase in terms of concentration of power in the top five or 10. You would think that when some people go out of business, the top five or top 10 are going to benefit and run somebody else out of business. This hasn't happened.

The value of processed shrimp during 1981-85 was a little over \$800 million. But, if you look at the trend over time in terms of deflated dollars, the value has actually gone down. In other words, the processing industry has not been able to keep up in terms of overcoming the effects of inflation. So their particular situation has worsened in terms of the inflation rate and the value of their product between the 1976-80 average and the 1981-85 average.

Processing also takes place in shrimp exporting countries. Processed shrimp imports is the other aspect of the import situation. Why isn't some of the shrimp being brought in processed? It is! Peeled, breaded, cooked, and canned poundage has gone up dramatically since 1983. In other words, all the value added, all the employment, all the tax base and everything else is done overseas. I think this is a concern some people have for the future. As aquaculture develops in third world countries, we should anticipate some of their resources will be put into value-added processing capacity.

The processed share of imports has been around 35 to 37 percent in peeled, breaded, and canned. The rest of it happens to be a shell-on shrimp basis. The Gulf of Mexico has had more processed shrimp in terms of millions of pounds than imports did, but since about 1983, the import product has been running us head-to-head. There is just about as much shrimp processed outside of the United States as is processed in the Gulf of Mexico.

Another aspect of the import issue is not just the total poundage but the size. In one year, we had a dramatic change in terms of size of shrimp coming from the leading aquaculture countries and I would guess that if they had tried to maintain a lot of 26/30 and 31/40-count shrimp they wouldn't have produced as many pounds. I think the way they produced pounds in 1988 in Ecuador, for example, was they went to a smaller shrimp.

Can aquaculture expand forever? There are so many shrimp farms in Taiwan they are having trouble finding places to put their pipes to draw water. If you know much about the import situation, Taiwan basically went down about 50 percent in their production of farm-raised shrimp this past year and we didn't even see it in the marketplace. If they had been up to par, you probably would have seen another 25 to 30 million pounds of shrimp in the United States market. So can it go on indefinitely? Probably not. It will have to be intensified a great deal in places like Taiwan where land constraints are evident. They have to go to a little bit more intensive system even though they are highly intensified already.

In 1981, about 2 percent of the world shrimp supply was aquaculture. Now it is about 23 to 24 percent of the total world shrimp supplies. Some of our pro-

fessors who have been over to China are amazed at what is going on over there. They are building levees as if they were pyramids and they are going to be there forever. I think the thing that will come to pass in places like Ecuador and China, is at some point in time, they will realize the value of converting some of their investment dollars to processing. Maybe that will change the approach we're having in the Gulf of Mexico of handling some imported shrimp in terms of our processing lines and make it a little bit more difficult for us to get supply.

For there to be a better prices, I think it has really got to come from supply decreases in the marketplace. I don't have any analysis to prove that but here is my basis: it seems to me since 1982-83 we had about as good economic conditions as one could hope for in the United States. I think unemployment, even last week, as announced from the Bureau of Labor Statistics, is only 5 percent nationwide. We have had declining or low unemployment for a lot of the period since 1982-83, declining interest rates from those very high rates in the early 1980's, and generally stable fuel costs, which are a big consideration in terms of people's disposable income. So it's about as good a situation as you can hope for, I believe, in terms of overall economic conditions to drive the market up from the demand side.

I'm just raising the question, "Can it be any better in the next 5 years than it was in the last 5 years on the demand side of the market?" I have a lot of trouble convincing myself that it can be better. It can be as good, but I'm not so sure it can be better. Therefore, if there is going to be a prolonged upside in terms of prices it would have to come from the supply side, such as interruptions in supply, or shortened supply in the marketplace. I have a bit of a problem with that in terms of sustaining long run price increases because we'll have the thing cropping up like we did in Ecuador with post-larval problems, or Taiwan with virus problems in hatcheries. We'll have short-run breaks and supply interruptions, but I don't believe we're going to have long-run increases from that. So for the next 5 years, I really question whether the economic conditions in the United States could be any better from the demand side. The down side of the market, I think, can come from either of two places: demand decreases (and I think that may be a realistic possibility if economic conditions aren't the same in the next 5 years as they were the last 8 or so) and supply increases. So I think on the up side, you've only got one thing that is realistically going to impact the market. On the potential down side I think you have both - the demand decreases and supply increases that are realistic.

Does the rest of the world represent enough consumers to take all of this extra shrimp off the market

if it keeps coming from aquaculture? Sure it does. The problem is they don't have any money to pay for anything. So who are going to be the big consumers? Japan and the United States and a little bit out of Western Europe. They have the ability in other countries outside traditional shrimp-consuming countries to take a lot of shrimp. They just have no purchasing power. Are we about to sail off the cliffs and be gobbled up by dragons? Most of the time economists will tell you that. I don't think we are. I think we've got a lot of problems--imports are one of them, "and we have met the enemy and he is ourselves," as Pogo would say.

But we have some short-term problems, too, that are very realistic. I'm serious about the effects of the TED regulations if, in fact, an 8 percent loss of shrimp prevails on a typical boat in the short-run. I'm talking about the short-run because I know the economic condition we have in the state of Louisiana on our boats and we can't worry about 5 years down the road on **this** issue. I think we're concerned about it starting May 1. Is the industry in a financial situation to sustain an 8 percent loss in shrimp if that's what in fact happens with these devices? I'm not sure that it does, but then again I don't think the economic condition is strong enough to sustain anything close to that, at least in my own state. So we have a short-term problem. We have longer-run problems, too. We have a lot of people who want shrimp and some of the fish want shrimp. You're going to hear something about stock augmentation later on today, maybe a good way to feed some shrimp and not just feed shrimpers. Well, we've got fish that want shrimp and we've got a lot of boats. Remember that little cartoon about the guy who is dreaming? He is dreaming about a Lafitte skiff, but I guarantee you that most of those people are dreaming about the next step beyond the Lafitte skiff.

Some of the economic research that is going on at LSU right now showed that in 1987 our big boats offshore, on a per day basis, net revenue about the same as our inshore boats. Think about that if you have \$300,000 worth of steel floating around. Lots of people want it. The fish want it, other shrimpers want it, there is no controlled access. Have we gone too far to do anything about it? I think you'll hear something about that later this afternoon.

Processing overseas, I have said before, I think will be something that will come along. Dr. Chuck Adams here is working cooperatively with me and Dr. Keithly at LSU concerning a survey in the Gulf of Mexico and the South Atlantic processing companies to find out what is happening in terms of utilizing imported shrimp in our processing lines. We saw that as an increasing trend and quite frankly a logical defensive, and in some cases an aggressive step, to preserve

yourself as a processor. If trade legislation gets imposed or discussed to stop or slow down imports via tariff or quota, what kind of reaction might there be in the processing industry in some of the exporting countries? They say, "Well if we're going to be charged a tariff or a duty let's add more value to it here." On a dollar basis, we might be better off. That may drive people into more processing overseas.

Are we about to be gobbled up by the competition? We'll always have a shrimp industry. The question is, how do we want it to look and how do we want the people to strive to make a living in it? How do we want

them to exist on a day-to-day basis? I said earlier and I will conclude with this final thing. Think dollars. Think beyond the dock. Think about taking some risks, because maybe the time has come that we've got to take some risks in terms of management. I think that people who are dealing with this on a day-to-day basis know we've been talking about big boats versus small boats, inshore versus offshore, and imports for the last 15 years. Maybe the things we've tried to do haven't been enough and there might be some imaginative things we all need to try to focus on in the future.

Profile of the Mississippi Shrimp Industry

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I was in Washington yesterday and one of the topics that we were talking about was what we are going to do about imported shrimp. There is not much intent to put any kind of tariff or restricting imports, etc., in Washington. You have five states in the Gulf involved in harvesting. Fifty states around the nation are importing and eating shrimp, so legislators are not real happy about the idea of doing anything that would increase the cost of those shrimp to those folks in other parts of the country. Traditionally, the Gulf has gotten the "short end of the stick" out of Washington anyway.

I would like to do several things today and Dave has asked me to provide a profile of the shrimp industry here in Mississippi. To be able to do that, I'd like to talk about several other things before we actually look at some of the numbers relative to Mississippi. I want to talk a little bit about the life history of the shrimp and some of the impacts that we are having and I want to talk a little bit about aquaculture. Then I want to try to place Mississippi's landings and the value of our product in perspective with the world, the United States, and the Gulf of Mexico.

I would like to begin with a review of the life history of the shrimp. Shrimp are an estuarine-dependent species. Approximately 98 percent of all of the commercial species of fish and shellfish that we harvest in the Gulf of Mexico are estuarine dependent. Now what does this mean? It simply means that most of

these species spawn their eggs somewhere out in the Gulf of Mexico, near shore or offshore some distance. As they develop over time, they go through various life history stages. The shrimp goes through some nine different stages before it becomes the post larva shrimp, which is about a quarter-inch shrimp and looks like an adult shrimp. By the time it reaches post-larval stage it has migrated to the island passes and is beginning to move into the marshes across our coast. This holds true for all of the Gulf and South Atlantic where our penaeid shrimp are found. They move into the marshes, go through a juvenile stage, and move on into what we call a sub-adult stage.

When the shrimp start getting up to somewhere in the neighborhood of a 68-count size, or so, we open our fishing season here in Mississippi. They don't all reach this stage at one day in time. It is a graduated thing. For brown shrimp in Mississippi, we start seeing the post-larvae coming into the Sound in late February to early March. This year, the numbers really look good. Only time will tell what kind of crop we will have this year. We'll be able to give you some better information on that a little bit later on as we get closer to the June time frame. As these shrimp come in and grow in the marshes, and as they reach the sub-adult stage of about 68-count in Mississippi, they start their migration back to the offshore spawning grounds. This is basically when we open the season on the shrimp, declare war on them, and go out and try to catch as

many of them as we can. Hopefully, a few of them are going to escape and make it back offshore to provide the broodstock for the next year's crop of brown shrimp.

We fish for three different groups of penaeid shrimp here in Mississippi— brown, white, and then pink in the winter and early spring. These all come in at different times. I've also made the statement that 98 percent of all of the commercially harvested species are estuarine-dependent. Seventy-five percent of the fish that are harvested recreationally in Mississippi are also estuarine-dependent. They depend on the marshes. I keep harping on this. Why? One of the things we have to continue to be aware of is the increased pressure on our wetlands across the coast. In Mississippi alone over the last 50 to 60 years, we've lost somewhere in the neighborhood of 66,000 acres of marsh. Louisiana is currently losing somewhere in the neighborhood of 50 square miles of surface area each year to a combination of factors. Look at it this way: if you've got a hundred acres of corn, and you are a real good farmer, you can produce "x" number of bushels of corn in that hundred acres of land. If you take 50 acres of that and don't plant it anymore, then you can't produce as much corn as you could before. In general terms, this holds for the marshes. We keep destroying our marshes and we are potentially reducing our ability to produce more shrimp.

In the last few years, with the crash of the oil industry, there have been more people who have gotten into the fishery and there is more pressure. We've looked at imports, we've talked about aquaculture, and you will hear later on about ways that may be proposed to control some of these things that are ongoing. These are all factors that influence what you ultimately get paid for the shrimp that you harvest.

Let's switch gears a little bit and talk a bit about aquaculture. There is a very large ongoing program currently supported by the U.S. Department of Agriculture to look at ways to reduce the cost of getting into aquaculture in the United States, including Hawaii. As Ken Roberts pointed out, 22 to 24 percent of the world's supply of shrimp currently is produced by aquaculture, primarily in Ecuador and China. Taiwan has crashed this year. They had a viral infection over there and one of the interesting things about that particular situation is that they were looking at some figures relative to the size shrimp that were being exported. From what I am told, collectively there was a decision made to hold their shrimp in ponds a little bit longer to get them up into larger size classes, which would make them worth more money. These shrimp normally harbor a virus. It is not infectious to humans, but it is a problem for the shrimp only if they are put under stress conditions, such as holding them in ponds at high densities. When you are pro-

ducing 31- to 50-count shrimp, you're not stressing them to a point where that it is a problem, but once you start crowding them a little bit more in those ponds, trying to get them on up to that 21/25 or larger size, then you start stressing the shrimp. Maybe the food is inadequate, maybe the water quality is inadequate. There are a whole host of factors, but they were beginning to see deformities in the shrimp, they were beginning to see stunted growth, and then they began to see mass mortalities. I've heard mortality is up around 75 percent of their production for this past year, so there are still a lot of problems in the world of aquaculture.

The bottom line is that, throughout the world, there are some 82 different countries producing shrimp and exporting them to the United States. Most of them are Third World countries. They have a lot of land area, they have very few environmental restrictions for the most part, and they have cheap labor. They can look at basically inefficient, low production systems for shrimp that produce less than 500 pounds per acre per year and still make a profit out of it because it doesn't cost them a whole lot to do that.

The shrimp research that is going on in this country is taking a different track. We have high labor and high energy costs, and some rather severe environmental restrictions for using our coastal areas. So what is happening here is that we're looking at more intensive systems to produce more shrimp per unit of land area and these require more control of the environment in which you are producing the shrimp. Some of the experimental systems that we are working with at this point in time are capable of producing upwards of 40,000 pounds of shrimp per acre per year as opposed to some of the extensive farms in China or down in Ecuador or over in India, Indonesia and other places in the world where they are producing only 500 to 900 pounds per acre per year. Obviously, it takes a lot of management to be able to do this and to do it economically. We haven't reached that point yet. Hopefully we will. There have been some new feeds that have been developed that promote good growth. Some of the systems that are being operated in Hawaii are getting two grams of weight increase per week in their shrimp. Here in Mississippi, we are actually getting upwards of 1.6 grams per week. Two years ago, we came nowhere near being able to do that type of culture. So it is possible that sometime in the future intensive aquacultural shrimp may have a place in our economy.

Let me switch gears now and let's talk about the Mississippi industry. Unfortunately, I wasn't able to get any numbers on boats and participants. We've been working with the Mississippi Bureau of Marine Resources to try to get all of the Mississippi data computerized. Total world landings of all seafood products

were 92.2 million metric tons in 1987. U.S. landings in 1987 were 3.1 million metric tons or about 6.9 billion pounds so U.S. total landings are only a small portion of the total world landings. U.S. landings had a dockside value, that was paid to the fishermen, of \$3.1 billion. U.S. shrimp landings in 1987 were about 363 million pounds worth about \$578 million. That represented a decrease in pounds of about 9 percent over 1985 and about a 13 percent, or 37-million-pound, decrease from 1986. There was a decrease of \$84.7 million, or 13 percent, in the total value of all our shrimp landings. Landings of New England shrimp were up approximately 70 percent and the North Pacific landings were up approximately 15 percent during that same timeframe.

Let's look specifically at Mississippi and the Gulf. There were approximately 2.5 billion pounds of fishery products landed in the Gulf of Mexico in 1987, with a total dockside value of about \$765 million. That is what is paid to the fishermen. Mississippi has the second largest **volume** of landings in the Gulf. We are only surpassed by Louisiana. If you look at the **value** of our fishery products, we fall down to number four and the reason for this is most of our landings in Mississippi are menhaden, which has fairly low dockside value.

The **value** of our landings comes primarily from shrimp. Our total shrimp landings accounted for

\$7,815,000 in 1987. We are number five as far as the total Gulf in shrimp landings. The shrimp landings have consistently increased over the last 18 years, but they have had some rather wild fluctuations.

We see that in finfish, menhaden account for 98-plus percent of volume of Mississippi finfish products. They count for 86 percent of all of the finfish value. If you look at the **total** (finfish and shellfish) of Mississippi, you find that menhaden make up 94.4 percent of all of the landings in Mississippi. They make up 41.8 percent of the total value of all fishery products landed in the state of Mississippi.

We find that shrimp make up 72 or almost 73 percent of the total **value** of all of the shellfish harvested and they make up 88.5 percent of **volume** of all of the shellfish landings. By shellfish we're talking about shrimp, oysters, and crabs. Shrimp only count for 2.8 percent of the total volume of all of the fishery products landed in Mississippi, yet they account for 45 or almost 46 percent of the total **value** of the seafood industry in the state of Mississippi. So it is a very, very important segment of our industry and it deserves all of the attention that we can focus on it to try to maintain that industry over time. Again, we're only talking about dockside value. There's another whole side of this and this is the processing industry. I would like to encourage our industry to look at further processing.

Overview of State and Federal Management Schemes in the Gulf of Mexico

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I'd like to thank the Mississippi/Alabama Sea Grant Consortium for their continued funding that allows me to speak at conferences like this. Rather than putting everyone to sleep with a detailed recitation of the shrimp management laws and regulations in the five Gulf States, I think I will discuss, in more general terms, the various state and federal management policies and philosophies. Toward the end of my presentation, I will give you a few of my impressions as to the future trends in shrimp management in the Gulf region.

Shrimp management policy in the Gulf region is determined on both the state and federal level. On the federal level, not much is currently taking place. Other than implementing a 45-day area closure out to the 200-mile limit off of Texas and a permanent area closure of the Tortugas Banks off of Southwest Florida, there is little federal regulation of shrimping in the Gulf. In contrast, the states intensively manage their shrimp resources. Instead of going through and reciting the various laws and regulations, I am going to discuss generally what shrimp policy is in the various states and what kind of philosophies they adhere to.

Generally, shrimp policy reflects a broad range of political, biological, economic, and social objectives. These objectives may be formalized, as when they are contained in statutes or ordinances, or they may be informal in the form of customs or traditions that just seem to evolve over the years. A couple of years ago at the Gulf and South Atlantic Fisheries Conference in New Orleans, Walter Keithly and Mike Wascom from LSU presented a paper that summarized and categorized the different fisheries management objectives of the five Gulf states. Their conclusion, basically, was that the management objectives were primarily biological in content and that the concept of economics didn't play a very large role in the management objectives. If economic concepts were involved, they were generally economic equity concepts in the form of full employment measures rather than

economic efficiency measures such as limited entry or industry quotas that would limit fishery effort.

As a result, their thesis was that it is going to be very difficult in the Gulf region to institute fishery reduction effort programs like limited entry until the Gulf states change their regulatory and management policies from almost total reliance on biological criteria to policies that more heavily encourage economic efficiency. Although I believe their thesis to be generally correct, I don't have the expertise or desire to get involved in that debate. I leave it to the economists and marine biologists out there to determine the validity of the theory. For my purposes, I do think it is a good jumping off point for me in my own survey of the laws and policies of the five Gulf states. First, I will describe the management objectives of each state and then I will summarize how they implement those objectives through the traditional management techniques of count restrictions, area and season closures, gear restrictions, and quotas of some kind.

Moving from east to west, I will start with Florida. Florida's statutory management objectives are to "preserve, manage and protect the marine, crustacean, shell, and anadromous fishery resources of the state and the waters thereof; to regulate the operations of all fisherman and vessels of the state engaged of taking such fishery resources and conduct scientific, economic, and other studies and research, all of which duties and operation shall be directed to the broad objectives of managing such fisheries in the interest of all people of the state, to the end that they shall produce the maximum sustained yield, consistent with the preservation and protection of the breeding stock ... among other measures, management regulations must be consistent with the following standards: the paramount concern of conservation and management measures shall be the continuing health and abundance of the marine fisheries resources of the state. Conservation and management measures shall be based on the best information available, including

biological, sociological, economic, and other information deemed relevant by the Commission. Conservation and management decisions shall be fair and equitable to all the people of the state."

Therefore, in Florida, fisheries are to be managed for the maximum sustainable yield (which is basically a biological term) for all the people of the state. Florida, like other Gulf states, seems to give a fair amount of guidance regarding the biological criteria they are interested in but very little guidance regarding the economic objectives. Other than placing paramount concern on the continuing health and abundance of marine fisheries, you really don't know what is in the best interest of the state. Is it in the best interest of the state to maximize employment or is it the best interest to maximize revenue or is it in the best interest to increase prices? What really are the economic objectives? Unlike other states like Louisiana and Texas that I will discuss a little later, that have more clearly defined management objectives, Florida is hard to categorize because these objectives are very vague. In addition, it is the only state among the five Gulf states that still relies on local laws to manage much of the state's fisheries resources.

When the Florida Marine Fisheries Commission was established 6 years ago, it incorporated more than 200 local regulations, some dating back to the late 1800's into state law. In order for the commission to repeal these local laws, it has to go through a protracted and costly procedure including public hearings in the affected counties. As a result, in Florida only about 15 or 20 of these local laws have been repealed over the last 6 years. There are still over 180 on the books and as a result, the management scheme is fragmented into a checkerboard pattern of local ordinances and state law.

It is therefore, very difficult to generalize or categorize what the philosophy is in Florida. A few statewide shrimp management techniques are in place including a shrimp count restriction of 47-count with heads, 70-count without heads. There is also a statewide prohibition against tickler chains in place. There are also a few gear restrictions contained in the code having to do with counties that border the St. Johns River, but generally all the other gear restrictions are contained in the local ordinances located in the administrative code. Large area closures like the Tortugas Bank, the Florida east coast shrimp bed, and Cedar Key are contained in the state regulations, but almost all of the small closures are determined on a local basis.

Many of the older local ordinances were passed without the benefit of modern management techniques that we take for granted today. Until there is some centralization in Florida and until these 180 laws and regulations are repealed and there is in-

creased centralization in Florida, it is difficult to know what the management philosophy is there. If I was fishing in those waters, I would just be sure to find out county-by-county what kinds of ordinances are in effect.

Alabama and Mississippi management policies, in contrast, are centralized and a lot easier to explain as a result. Alabama places full jurisdiction over seafood in state waters in the Department of Conservation and Natural Resources. The statutory policy of that agency is to "ordain, promulgate, and enforce all rules, regulations, and orders deemed by it to be necessary for the protection, propagation, or conservation of all seafood. It may, by order duly made and published, prescribe the manner of taking or catching, the time when, and designate the places from which the seafood may or may not be taken or caught as deemed to be in the best interest of the seafood industry." The language is, therefore, heavily weighted toward biological measures. However, again it must "be in the best interest of the seafood industry," which is a very vague concept. Once again, I question how much guidance that gives managers. Is it in the best interest of the seafood industry to put in place some kind of limited entry system? Are they interested in full employment or a stable supply of seafood for their processors? What exactly they are interested in doing?

Alabama uses an assortment of management techniques including a count restriction of 68 per pound with heads. They also use extensive area closures, I think more than most other states. The nursery area closures have increased in recent years and seem to be the predominant management technique. All the streams, bayous, and creeks within the state except Bayou St. John and Old River are permanently closed, along with the smaller bays and a sizable portion of the Mississippi Sound. I think one of the reasons for this is that Alabama doesn't have a seasonal closure. They instead rely entirely and exclusively on their area closures and, therefore, may close an excessive amount of waters because they don't have the ability to limit fishing during certain times of the year unless they close those bays off. As far as gear restrictions are concerned, they are not particularly harsh compared to other states. They have a two main trawl limit not to exceed 50 feet at the cork line and one test trawl not to exceed 10 feet in inside waters. In outside waters, there are no trawl restrictions. There are no restrictions on mesh size and generally the ordinances and regulations are not particularly detailed in Alabama. They leave, instead, quite a bit of discretion to their agency to develop and implement their policies.

Mississippi's management objectives are similar to Alabama's. In fact, the two states have coordinated their policies fairly well. The Bureau of Marine

Resources of the Mississippi Department of Wildlife, Fisheries, and Parks is vested with authority over saltwater aquatic life. "The public policy of this state shall be to recognize the need for a concerted effort to work toward the protection, propagation, and conservation of its seafood and aquatic life in connection with the revitalization of the seafood industry of the state of Mississippi. It is the intent of the legislature to provide a modern, sound, comprehensive, and workable law to be administered as may be necessary to protect, conserve and revitalize seafood life in the state of Mississippi." Therefore, you can see the language is almost identical to that of Alabama's. They use the language "protect, propagate, and conserve" the species. Their economic criteria are a little clearer than Alabama's but still not of much help compared to Louisiana or Texas.

Just as their management objectives are similar, so are their management techniques. They both have a 68-count rule in effect. Mississippi recently amended its law to allow two trawls of up to 50 feet and one test trawl to 12 feet. Mississippi does have closures, though they are not as extensive as Alabama's, and Mississippi, unlike Alabama, has a seasonal closure. The season opening begins the first Wednesday in June and closes on January 1, except south of the intercoastal waterway, where it only closes from May 1 until the first Wednesday in June. The shrimp management objectives in Mississippi and Alabama tend to be heavily biological in content. The two states give their management agencies quite a bit of discretion to develop and implement their policies.

This is not the case in Louisiana. As in many other things, Louisiana is, of course, different than everyone else. It gives little discretion to its management agencies. Instead, the legislature has traditionally exercised a tremendous amount of control over Louisiana's seafood laws and regulations. Most of the laws and regulations are legislatively enacted rather than administratively enacted by way of agency regulations. In Louisiana the statutory policy is to "protect, conserve, and replenish the natural resources of the state including all aquatic life." That, however, has been supplemented recently with a statutory provision that encourages employment as one of its primary policy objectives. This is contained in section 571 of Title 56 of the Louisiana Revised Code. It states: "recognizing the value of the seafood industry in the economy of the state of Louisiana and recognizing that the seafood industry employs hundreds of Louisiana citizens thereby decreasing unemployment and the burden employment places on the state fiscally, it is therefore the policy and purpose of this section to provide every method of encouragement and assistance to the commercial fishermen of the state of Louisiana to prevent

unemployment of Louisiana citizens and to provide economic stability in those areas of Louisiana so dependent on the seafood industry."

This emphasis on employment is unique to Louisiana and is reflected in their management techniques and policies. They have a very liberal 100-shrimp count rule in effect that only is applicable to white shrimp and there is no count restriction at all during the spring open season. There are no area closures in Louisiana, at least technically. They will, on an emergency basis, close areas, but there are no permanent area closures. Gear restrictions are similar to Alabama's and Mississippi's except in some cases they allow larger nets in certain waters. There is also a minimum mesh size in Louisiana unlike Mississippi and Alabama. Until last year, there was a statutory requirement in Louisiana to make sure that there are at least two open shrimp seasons per year of a specific duration. That was established by code, regardless of biological criteria.

This has recently been changed. In 1988, they passed an act that allows the Wildlife and Fisheries Commission to develop its own seasons based on biological data rather than being legislatively mandated as it was in the past. This, I think, may signify an important shift in Louisiana. It may be an indication that the legislature is beginning to relinquish some control over the fisheries management laws in the state. I could be reading more into it than I should, but this may be a portent of things to come.

Of the five states that I surveyed, Louisiana is the only state that expressly prohibits the use of all nets that are not specified in their ordinances. The exact language is that "saltwater shrimp may be taken by means of trawls, butterfly nets, or cast nets and by no other means except as provided in RS56." This seems at first glance to be a restrictive measure in contrast to the liberal policies normally employed in Louisiana. However, while they have prohibited the use of nets that are not specifically contained in the code, they have also developed a permitting system that allows fisherman who want to use new nets or innovative techniques to go to the agency and get a one-year permit to test them out. In one sense, they have taken something away from the fisherman and in the other they have given it back.

Clearly, Louisiana's management scheme is intended to assist its shrimp fisherman, especially the small shrimp fisherman, to make some kind of a living. It is not there to increase revenues. It is not there to make the industry more efficient. It is there to create employment, to make sure that everyone who wants to get into the fishery can get into the fishery. As a result of this heavy emphasis on employment, it will be very difficult for Louisiana to enact any kind of fishery effort reduction. My opinion is that of the five

states that I have surveyed, that kind of program will have the most difficult time in Louisiana.

Texas is much different. There, shrimp management is handled by the Parks and Wildlife Department, which is authorized to regulate the taking and conservation of fish, oysters, crabs, and all other forms of marine life. They have provided regulatory guidelines for shrimp that are very similar to the federal management guidelines contained in the Magnuson Act. These guidelines encourage "management measures to prevent over-fishing while achieving on a continuing basis the optimum yield for the fishery; measures based on best scientific information available; measures to manage shrimp throughout their range; and (this is the important one) measures where practicable that will promote efficiency in utilizing shrimp resources except that economic allocation may not be the sole purpose of the measures; measures where practical that will minimize cost and avoid unnecessary duplication in their administration and measures that will enhance enforcement."

Texas is the only Gulf state that expressly has placed in its management objectives economic efficiency as one of the criteria that it should use or should at least consider. This is reflected in its management techniques, which I think are more restrictive, than many of the other states. Also, as far as I know, Texas is the only state that actually tried to enact a limited entry program. About 5 years ago, there was a moratorium on commercial shrimp licenses that has since been phased out. I don't know whether any other Gulf states have tried this. If someone else knows more about the Texas limited entry program, I would like to know about it. I assume it did not work very well or it would not have been phased out.

The Texas management philosophy clearly reflects a greater priority on economic efficiency. As a result, its regulations are more restrictive. The restrictive regulations include the 200-mile closure that takes place between June 1 and July 15 out to the 200-mile limit. They also have a very restrictive shrimp count of 50 per pound with heads during the fall open season. They only allow the use of one main trawl and one test trawl rather than two trawls in inside waters like the other states, and they are the only state that has a catch limit on inside waters of no more than 300 pounds per vessel per day during the spring open season.

To summarize the general management philosophies in the Gulf states, Texas is really the only state that expressly encourages its management agencies to examine economic efficiency measures rather than biological measures or economic equity measures in order to develop its management programs. Louisiana, in contrast, places full employment

as its primary management objective and as a result has more lenient regulations and allows just about anyone who wants to, to get into the fishery. Mississippi and Alabama are somewhere in the middle. They are heavily influenced by biological criteria. Their management objectives don't really discuss economic measures. In addition, the management agencies in those two states are a little more powerful than in any other states because the legislatures have allowed them to develop and implement policies to a greater extent than any of the other states. Florida is "out in left field" because of its strange decentralized system in which there are local and state administrative combinations that determine what the management techniques will be.

I have left the subject of federal management to the end because I don't think there is any federal management. I don't know what they are doing other than the two major programs of closing waters off Florida and Texas. They have chosen to defer management to the states. They realize that the shrimp industry in the Gulf states is very diverse and politically volatile, and instead of wading in and developing some kind of policy, they are instead just waiting to determine what the states want them to do. As far as I know, the only new management initiative that they are considering right now is to impose a count restriction in certain portions of federal waters off of Louisiana and Texas depending on recruitment counts. There is some kind of automatic triggering device that would put this count restriction into place, but this proposal has not been formalized and I really don't think that much will come of it or I just don't know enough about it to say any more now. I think generally, the management philosophy of the federal government is to allow the states to come up with the innovative techniques and to request assistance from the federal government to help implement them. As far as the shrimp fishery is concerned, they won't come up with any innovative programs on their own. They are doing some things with other fisheries, such as spiny lobster, but I think they are scared of shrimp and will likely to hold off on any new initiatives for now.

I would like to conclude by just briefly mentioning what I think are some of the future trends in shrimp management in the Gulf region. As more imports flood into the United States, and as the over-capacity of the fleet continues to grow, I think it is inevitable that there is going to be more and more pressure put on the states individually and as a group to come up with some kind of limited entry program. I am also not particularly optimistic that we can institute a limited entry program in any of the states unless there are significant changes in the legal and regulatory regime currently in place. It is going to

take broad and express legislative support in order to push through a limited entry scheme in any of the states. It will be easier in Texas than in the other states. It will be more difficult in Louisiana, but I think it will be very difficult everywhere unless current laws and regulations are changed so that they reflect in their management objectives more interest in economic efficiency and less interest in some of the other criteria.

It is also likely that other states will adopt gear limitation provisions similar to Louisiana's – the limitation that I mentioned about expressly prohibiting nets that aren't specifically included in the code or ordinance. I recently spoke to a couple of fisheries management people who said that their states are also looking into this option. I have also talked to some fisherman who said that they are very confused about this whole area – whether they should or should not use nets that are not included in the code; whether they are in violation of the law simply because the net or other device they are using is not included in the code. I think in this regard that Louisiana has a good model that should be looked at closely by the other states. They do prohibit some nets,

which allows the management agency to control fishing practices in state waters, but at the same time they have this program that encourages fisherman to use new and innovative techniques and allows them, under the guidance of the agency, to go ahead and test them out for a year. This is a good compromise because I think it allows the agencies to monitor how the new gear works and at the same time it gives the fishermen a chance to use them rather than possibly being afraid to do anything new or innovative because they would be afraid that they would be in violation of the code.

Finally, I can't help but believe that there is going to be a continuing trend toward more area closures. I think that as we see more and more development on the coast and the possibility of reduced funding for management agencies, it is going to be harder to have ongoing monitoring programs to measure the size of the shrimp in particular areas. As a result, there will be more pressure to simply close certain areas that may be marginal. Again, I am not positive about the inevitability of larger area closures, that but I do think that without some kind of limited entry scheme larger area closures are likely.

Mississippi Shrimp Strategic Management Plan

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Basically, I just want to talk to everyone here about our strategic plan, how it came into being and what we are planning to do with it in the future. The strategic planning process was undertaken in the Department of Wildlife Conservation several directors ago and apparently it had been put on the shelf after we received another director. Following the arrival of Vernon Bevill as our current Executive Director, one of his first questions was, "What type of comprehensive plan do we have for the entire agency?"

We decided at that time they were going to include

the Bureau of Marine Resources in the planning process. So, about a year ago Tommy Shropshire, who is with the Planning Division of the Department in Jackson, undertook a major project to develop these strategic plans for many of the species that we have throughout the state. The important ones that we have here on the coast would be the shrimp, blue crab, saltwater finfish, and oysters. We also have a coastal access project, an endangered species project, and a few others. These plans will be available to the general public.

Basically, we got together in some small groups. For the shrimp strategic plan, we had law enforcement personnel from the Bureau, personnel from the Gulf Coast Research Lab, live bait dealers, commercial shrimpers (both with the smaller bay boats and the larger offshore boats), personnel from the Gulf States Marine Fisheries Commission, and our own biologists. They identified some problems that were associated with the shrimp industry and developed and prioritized strategies of how to deal with those problems. That's our strategic plan. What we expect to derive from the strategic plan is a clear rationale for professional decisions, a smoother budgeting process, team building, agency accountability, stability, better understanding of the public expectations, improved credibility, improved uses of the resource, and a clearer understanding among all employees and constituents about where the agency is heading.

We have a definite goal for 1992, although the strategic planning process is a continuing process and we will continue to revise the process as we go on with the help of the public. We are currently involved in some workshops that allow the public to have input into the agency. Director Beville made it very clear that he wants involvement from the public so that what we end up with is an agency that is responsive to the public and gives the public exactly what it wants or what it needs. Sometimes, what the public needs is not exactly what they think they want, but this still gives the public and the industry better input than we've had in the past.

In developing the strategic plan, we had to keep in mind the mission statement of the Department of Wildlife Conservation: "It is the mission of the Department of Wildlife Conservation to manage, conserve, develop, and protect Mississippi's wildlife and marine resources and their habitats to provide continuing recreational, economic, educational, ecological, aesthetic, social, and scientific benefits for present and future generations." That was a big mission for everyone to keep in mind as we were developing our planning process. I would also like to note that we have many of the people that were on the shrimp strategic planning team in attendance at the meeting today, and I'm sure they might be available to answer any questions you have. Now I would like to get into what the strategic plan is for shrimp.

We went over a brief program history and then we described the supply and demand for the shrimp fishery. The goal is to manage the annual shrimp resource in Mississippi to provide for optimum sustained benefits. The objective is to optimize, by 1992, the yield from shrimp recruited annually to the fishery on the basis of the maximum sustainable yield as modified by relevant economic, social, or ecological factors. That is estimated at 8.486 million pounds

headless annual Mississippi commercial shrimp landings. We want to optimize the resource for the benefit of the entire state of Mississippi.

I have a list here of the problems and strategies that make up the strategic plan. The Bureau of Marine Resources will be working to address these problems by using these certain strategies. The first problem is user conflicts and allocation of the resource and that has been a severe problem in the past. Just about the entire group was unanimous that this was the number one problem. What we looked at to solve the problem was to provide the adequate and accurate database necessary. We are currently collecting data, but in some instances we will have to expand on that.

The number two solution, surprisingly, was to enact limited entry into the fishery. Now I don't want everyone to think that it would necessarily be the traditional type of limited entry. What we might also want to do is discourage people from entering the fishery. That could also be construed as a type of limited entry.

We might develop season and area closures. We do that now to some extent. We should provide more and better trained law enforcement staff and create better means of communicating between the Department of Wildlife, Fisheries, and Parks staff and the user groups. We need to better educate the legislators and other politicians as well as the public and develop regional management strategies. We could try to increase the supply of shrimp and develop individual transferable quotas. These were prioritized possibilities and the first ones I mentioned are those that the group thought were most feasible for answering the problems.

Problem number two is lack of compliance with laws, unenforceable laws, and lack of law enforcement manpower. The strategies to address this are to review and revise current laws, ordinances, and regulations; provide and train more field staff; educate the public and those involved in the state's legal system about fishery laws; create better means of communicating with the Department of Wildlife Conservation staff and user groups; and provide a clear definition of the role of law enforcement officers.

The third problem is loss of habitat. The strategies for that are to provide and enforce stricter laws concerning practices that harm habitat, create permanent habitat (for example nursery areas), determine the role of habitat in shrimp reproduction, document the loss of habitat, and provide means to establish more habitat.

The fourth problem is lack of accurate data on catch per unit of effort. The strategies for solving that problem are to review existing data and identify gaps, utilize existing data and provide cooperation among other data source agencies. We're currently working

towards that with the Gulf Coast Research Lab in an ongoing data management project. We should also verify sampling techniques to represent commercial catch and track commercial sales, and determine quotas per user groups per time element.

The fifth problem is lack of a method for determining seasons for specified areas. To address this, we decided we should identify size and availability of shrimp based on a sampling program, determine ways to shorten the decision-making process, revise and update laws, regulations, and procedures; and inform the public of our techniques and the results. Some of these things we're working on right now.

The sixth problem is the lack of cooperation among Gulf states. There are a lot of laws that are different. We do have a fishery management plan in place for the shrimp fishery in the Gulf of Mexico and I would like to see the state of Mississippi work more towards falling in line with that program. The strategies to address this lack of cooperation are to formalize existing sampling or management schemes between the Gulf states, provide uniform laws and encourage agency contacts. Right now, we're in the process of developing projects that address those concerns and we have to have a budget for 1991 that would address these projects for each of our strategic plans.

Some of the projects that we currently have would include data collection and analysis and that would include both fishery independent data and fishery dependent data. The fishery independent data include our shrimp sampling, which is done in-house. The Gulf Coast Research Lab does some post-larvae monitoring as well as transect monitoring in Biloxi Bay.

The Southeast Monitoring Assessment Program has participated and are currently participating in that and we would like to increase our participation as well. Fishery dependent data are gathered by actually surveying the industry itself, which would be our commercial landings data. We have an ongoing state/federal cooperative statistics program that enables us to do that. We have live bait dealer reports that we have each dealer file monthly. License sales records give us some information. Ex-vessel prices, help give us some economic data.

Some of the other projects that we're working on are revision of fishery laws. Mr. Beville is very serious about this and he wants the laws to be current, useful and efficient for what needs to be done for the resource.

Enforcement of laws is very important and will be brought up in virtually every management plan that we have. If we can't have the laws enforced then the regulations are useless. Habitat protection and enhancement is going to be the goal of not just the state of Mississippi but the entire country to favor the protection of existing habitat over mitigation. The goal is no net loss of wetlands. Our entire system and resources are very heavily based on that.

The Bureau of Marine Resources also helps fund access projects for the different harbors and marinas and things like that. Our public relations people have to be very involved in informing the public about what we do and why we do it. They've been very helpful through this entire strategic planning process in getting these different user groups together. We will have some more workshops in the future.

Biological Implications of Area and Seasonal Closures

Richard Condrey
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This past summer, I was invited to give a talk at the National Press Club in Washington, D.C. The talk was part of a workshop entitled "Frontiers in Shrimp Research." The workshop covered all aspects of shrimp research associated with both wild-caught and pond-raised shrimp—from habitat requirements to the question of how many shrimp sperm are required to fertilize one shrimp egg. An afternoon was devoted to that last issue. Mine was the only talk on the use of models to evaluate management alternatives in the fishery.

There are those who would not have invited such a talk. They are those who think that the shrimp fishery is too large, too unmanageable. They are not uninformed, just less optimistic than myself.

My talk, though, was not positive. It reviewed the use of models in the management of U.S. Gulf of Mexico shrimp from my perspective as the primary author of the initial draft of the Gulf Council's Shrimp Plan. I stressed throughout the talk, as did Dr. McLaughlin this morning, that the historic use has been primarily limited to what appears to be a perpetual re-evaluation of two narrowly constructed management measures: The Texas Closure and the Tortugas Sanctuary.

Areas of major ecological or social concern where yield can be dramatically impacted have received little attention. These areas include, but are not limited to, excessive growth overfishing in state waters, wetland loss, and bycatch.

I recall that Washington talk this afternoon for two reasons. First, I will be drawing from it when I talk about the biological consequences of area and seasonal closures. Second, I want you to know you are challenging those who feel the wild caught shrimp fishery is going to die of its own weight—that it can only go from bad to worse, from one conflict into another, with fewer and fewer friends. I am far more optimistic about the future of this industry than I was in Washington because I see the states moving. Texas has developed a shrimp plan. Louisiana has established a Shrimp Task Force and is gearing up to

develop a plan. And you in Mississippi are developing a plan.

There are at least five good reasons for you to look at area and season closures in your fishery. If applied correctly area and season closures offer the potential to:

- (1) increase the pounds of shrimp you catch;
- (2) increase the number of female shrimp producing young;
- (3) decrease the waste of other national resources;
- (4) decrease conflicts; and
- (5) may, in some cases, offer a mechanism for buying effort out of the fishery.

I will touch on each of these areas with some specific examples.

(1) Area and season closures if properly applied can increase yield.

With the possible exception of the Tortugas pink shrimp fishery, we are growth-overfishing shrimp throughout the Gulf. What is growth-overfishing? It is taking the shrimp at too small a size so that man does not realize the full growth potential of the resources. It is the picking of your garden too soon.

To assess how much growth-overfishing is occurring, we first take into account two rates. The first is the rate at which an individual shrimp grows. The second is the rate at which the shrimp would die of natural causes in the theoretical absence of the fishery. The result is a theoretical curve relating the total weight of unfished shrimp in a population to their age. With shrimp, that poundage curve increases from young ages where you have a lot of small shrimp to an intermediate age of generally 4 to 6 months age and count sizes range around 40-60 tails to the pound. Here, the numbers have decreased but individual weight has greatly increased. From the peak, the curve declines, reflecting the normal slow-down in the growth of the individual shrimp.

In Louisiana, we apply a heavy fishing pressure at the beginning of that curve, harvesting lots of small shrimp, and obtaining little of the potential yield. In Texas and Florida, they fish farther up that curve.

Let me give you some examples from Louisiana. We have tremendous opportunities to increase yield of Louisiana's brown and white shrimp fisheries. Only one season may be marginal. That one is on our overwintering white shrimp.

With white shrimp, there is considerable interest among some Louisiana shrimpers for a closure of the Gulf waters from January to May or June to protect overwintering white shrimp. Recently-completed analyses at LSU suggest that such a measure might result in an increase in yield. In our work, we used Scott Nichols' growth rate equation, which described the daily growth of white shrimp off Louisiana as a function of temperature and size. Scott's equation predicts that the fastest daily growth of small shrimp will occur near the maximum temperatures encountered in the northern Gulf. That is, the little shrimp grow fastest in the hottest water. As the shrimp become larger, however, they exhibit their maximum growth rates at lower temperatures. Perhaps this is the result of an adaptation to the more moderate temperatures larger white shrimp encounter as they leave the estuaries and enter the Gulf in the summer and fall.

At LSU, we took the Gulf Coast shrimp data over the years where it more closely reflected the insight and attention to reality of its creator, Charlie Lyles. We followed the decline in the catch of shrimp per unit of fishing time (trawling time corrected for vessel efficiency) over the November to May period. From the analysis, we got annual estimates of mortality, or death rate, of shrimp during the winter months. Then, looking at rates of mortality as a function of the fishing effort, we were able to estimate the rate of natural mortality in the theoretical absence of the fishing.

Our range of rates, which I sincerely feel reflect reality, are much lower than some previous rates used for white shrimp. They are, however, entirely consistent with NMFS's estimates for pink and brown shrimp.

Our catch-curve analyses at LSU indicate that natural mortality (M) during the November-to-May period should be in the range of 0.15 to 0.28 on a monthly basis or lower. This means that between 14 percent to 24 percent of the shrimp in an area at the beginning of a month would be dead at the end of the month if there were no fishing or no migration. Given the historic mix of sizes of white shrimp caught in 0 to 10 fathoms, if M is in the range of 0.15, a closure from January 1 to June 1, would have a dramatic, positive impact on yield. Conversely, if M is in the range of 0.28, the closure will have a negative impact on yield.

If our mortality estimates for white shrimp are applicable to other areas and seasons, the modeling done

by Nichols (1984) suggests drastic changes in white shrimp management are warranted from a yield enhancement point of view. Specifically, Nichols points out that if M is less than 0.3 to 0.6 on a monthly basis, then yield during the major summer-fall period is dramatically increased if harvest is delayed. Our work suggests that M is below 0.3.

Regarding brown shrimp, Louisiana closes its inshore waters to shrimping on December 22, and reopens them at a variable time in May or June. The variable opening date is set in late April and normally coincides with the date at which 50 percent of the zero-year-class shrimp are expected to be at least 161 tails to the pound.

Given our currently accepted rates of natural mortality ($M = 0.2$ to 0.3 on a monthly basis) and fishing pressure, there is excessive growth overfishing occurring in Louisiana. We estimate that each weekly delay around the traditional opening date results in a 20 percent increase in yield. Such an increase should have a major, immediate impact on yield since Louisiana accounts for nearly 50 percent (by number) of the brown shrimp harvested in the Gulf.

Therefore, for Louisiana, there are tremendous areas for increasing yield through properly applied season and area closures.

(2) Area and season closures if properly applied can increase the shrimp spawn.

Years ago, when I was working on the Council's shrimp plan, Captain Joe Ross tried to educate me. I wish he had been successful. Captain Ross, like many other knowledgeable shrimpers, recognized that you can, at least theoretically, take too many shrimp before they reproduce and thus reduce the resulting number of young produced. Captain Ross wanted us to protect reproducing white shrimp. We didn't.

Two years ago, Dr. Ed Khima of the NMFS's Galveston Lab drew together conceptually three different scientific findings. The first was that the number of juvenile shrimp and menhaden entering our fisheries were increasing from 1960 to present. The second was that shrimp and menhaden use the marsh surface during flood stage as a nursery ground. The third was that in many areas our marshes are being lost and while they are being lost are often flooded for longer periods. Ed pointed out that marsh loss could be artificially providing for a short term increase yield in these fisheries. At some point this rate of increase must decline. At that point, given that there is such heavy fishing pressure on shrimp, the fishery could go into a state of collapse.

Area and season closures can be applied to increase yield and to increase spawn. That increase in spawn will decrease the likelihood that the resource cannot sustain itself.

(3) Area and season closures can decrease the waste of other national resources.

This afternoon, Dr. Scott Nichols will speak to you about the status of estuarine-dependent finfish which are caught in shrimp trawls because they are bottom-feeders. What he will tell you, correct me if I'm wrong, Scott, is that they are all in a state of decline.

Some of these finfish are important fish in other directed fisheries, such as that for red drum. All are national resources and important components of the ecosystem. All have an inherent, God-given right to thrive.

In the pattern emerging on the reasons for these declines, the high level of shrimp trawling is becoming increasingly visible.

For example, red snapper is either in a state of collapse or near one. Currently, it is estimated that no more than 5 percent of the natural spawn is occurring because of heavy direct and indirect fishing mortality. Twenty to forty percent is considered to be the minimal safe range. By some estimates, there is a heavy bycatch of 0-year class red snapper in shrimp trawls. By itself that catch and discard of the young red snappers reduces the spawning potential to 35 percent of the natural level. Then, with that reduced spawning potential, the fish enter the directed fishery.

Area and season closures if properly applied can decrease the waste of other national resources, increase yield of shrimp, and increase the shrimp spawn.

(4) Area and season closures if properly applied can reduce conflicts.

There is such an intensity of shrimp trawling that the sheer amount of effort generates conflicts. There are conflicts with oystermen when you drag over their leases; conflicts with crabbers when you catch their traps; conflicts with vacationers when dead fish wash ashore; conflicts with other shrimpers over a place to trawl and over the size of shrimp to be caught.

The individual shrimper rarely catches an endangered turtle. But when the environmentalists concerned with the preservation of those turtles multiplied that low rate of individual capture of a turtle in a trawl by the high rate of trawling, the resulting catch frightened them and resulted in the impending mandatory use of TEDs.

Area and season closures, if properly applied, can reduce conflicts, reduce waste of other national resources, increase shrimp spawn, and increase shrimp yield.

(5) Area and season closures, if properly applied may, in some cases, offer a mechanism for buying effort out of the fishery.

Two years ago, we were trying to get Louisiana shrimpers to cooperate in TED testing. None of the shrimpers who worked with us had insurance. One had previously lost his boat and house because of a suit over a freak shrimping accident. He didn't have insurance when the accident occurred. He didn't have it when he worked with us, but his wife shrimped with him—not a hired hand.

I am not an economist. And the title of the talk is being stretched. But it appears to me that there are too many shrimpers trying to slice that pie and many are going broke.

When I sit at my computer at LSU and I look at the tremendous yield potential that shrimp could provide, I sometimes wonder if that potential could be used to soften the financial blow of people dropping out of the fishery.

So as you develop your shrimp plan, I urge you to look at area and season closures. Area and season closures, if properly applied, can increase shrimp yield, increase shrimp spawn, decrease waste of other national resources, decrease conflicts, and may—just may—provide a mechanism for reducing effort and increasing the quality of life for those remaining in the fishery.

Techniques for Fishing Effort Reduction

Michael Orbach
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It is always a pleasure to be anywhere with folks like Richard Condrey. One of the things that is not on that introduction is that when I was in Washington, D.C., I was asked to be a member of the team that developed the original Gulf of Mexico Fishery Management Plan for the Gulf Council. That is where I first met Richard, Ted Ford, Charlie Lyles, and a lot of other people in the room. So I have some knowledge about the shrimp industry, although that was several years ago. I get down to the Gulf fairly often these days and try to keep up with what I can.

Now as you heard from the introduction, I am a cultural anthropologist. People hear that and they say, "Those people study bones; what is he doing with fisheries?" There are anthropologists who study bones, but I am different. I'm kind of like a sociologist, I study live people and the reason that I am involved in fisheries at all is that when the government makes a regulation or a law or a policy or a plan, they don't change the behavior of any shrimp, as all of you have noticed. The shrimp don't do anything different because there is a management plan. What plans and laws and regulations do is to change **fishermen's** behavior and **managers'** behavior often as well. So it is logical to a lot of people that if you're going to make a law or a regulation or a policy you ought to find out what the effect would be on the **people**, not just the fish, because that is where the main effect of the management plan is going to be. That is what I do. I go out and work with fishermen and fishing industries to try to document what the effect of these laws and policies will be, and to try and find better ways to feed fishermen's opinions and thoughts into the fishery management process. That is why a social scientist is involved in all of this. To me it is a **people** problem, it is not a shrimp problem that we are dealing with here.

I've been asked to talk a little bit about limited entry or limited access alternatives. Limited entry is a management approach that does something very particular. It assigns **specific** fishing rights or privileges to **specific** people. A quota allows any individual or collection of individuals to go out and fish until that quota is filled; an area closure says **everybody** is in or **everybody** is out. A limited entry or limited access program says **specific** people have **specific**

privileges in this fishery. Those privileges can be assigned to individuals; they can be in terms of gear; they can be in terms of catch; there are a lot of different ways to do these limited access systems. The point is that limited entry is a management system that is specific to individuals and how they participate in the fishery. That is the difference between a limited entry access system and all other kinds of management.

This means that almost by definition limited access is a social and economic management measure. It is not, by itself, very effective at addressing biological problems. It is a social and economic issue. Are there too many people in the fishery so nobody is making enough money? Are there too many traps in the water so everybody is bumping into each other all the time and there is conflict on the fishing grounds? It's that kind of issue that you have to be worried about if you're talking about limited entry. If it is just a biological question of how many shrimp come out of the ocean — put a quota on it and don't worry about limited access. Limited entry is largely addressing social and economic aspects of the fishery.

So the formal definition I like to use is "*any system that assigns specific fishing privileges to specific individuals or vessels such that the number and/or extent of those privileges cannot be changed unless you formally change the system somehow.*" That is, specific things assigned to specific people. That is what limited entry is. Limited entry is kind of a lousy term. At the request of Bill Gordon, who at the time was the director of the National Marine Fisheries Service, I wrote an article with some other people on limited entry that appeared in *National Fisherman*. The symbol on the head of that article that the editor of *National Fisherman* put on was a fishing boat with a big red circle with a line through it like you see on highway signs. We all cringed.

The reason limited entry is a lousy term is there are lots of ways to limit effort without necessarily excluding any particular people at all. In fact, one of the things you notice if you look at limited entry systems that have been put in place in other fisheries in other places is that everybody gets in at the beginning of the system. There aren't any that cut any major people out. Even in the limited entry systems that are

in place now everybody got in under a type of "grandfather clause." So effort limitation or access limitation is probably a somewhat better term to use although limited entry is the one that gets used all the time.

Marine fisheries is really one of the few exceptions to where systems like this are used in natural resource management. Public rangeland grazing years ago went to systems like this. Coal and petroleum extraction, minerals, mining, (offshore and onshore) are under this type of system. The National Park Service and U.S. Forest Service have managed forestry harvest under these systems for years. In fact, there are many marine fisheries, both state systems in the United States and foreign countries that use this kind of management approach. The most famous ones are salmon in Alaska, some of the prawn or lobster fisheries in Australia, bluefin tuna in Australia, and the New Zealand fisheries. In fact, now there are two approved limited entry systems under the U.S. Federal Fisheries Act. They are both in Hawaii and they are both for small fisheries, which are pretty different from Gulf shrimp. The point here is that this kind of management system is used in virtually all other natural resource management areas and it is used a lot in other countries and in state systems mostly on the West Coast, although it has been tried in some places on the East Coast (for example, Massachusetts, and the lobster fishery). If you have any questions about how those other systems work I'd be happy to talk a little bit about them. Alaska is the one people tend to have heard about the most.

Now I want to say a couple of words about what you have to do if you're going to consider this kind of management alternative. It is primarily aimed at social and economic issues, i.e., are people making enough money? Is the industry in trouble? It is clearly a people question, it tends to be by its very nature political, and there tend to be a lot of legal questions involved. For example, the fact is that not all the legislative or administrative rules in states or the federal government will allow you to even use these kinds of management systems. Florida and North Carolina are two good examples of states where you couldn't put a limited entry system in fisheries unless the legislatures made new laws or changed existing laws. For that reason I'm going to talk briefly about all the things you have to consider if you're thinking about this kind of system in any way.

First of all, what you have to do is decide who is going to get the original privileges in the fishery. Who gets to use these privileges, and how do you decide that. That's the first thing that you have to do. The second thing, because of some constitutional issues, in any system of any major size you would have to ensure that the privileges were transferable. You can't create what are called closed classes of individuals or

a privileged group that you can't get in or out of. That probably would not survive a constitutional challenge. The limited entry systems that are set up now have provisions to transfer the privileges. Sometimes you buy and sell them. That is the most common way to do it and that is the way it is done in Alaska. Third, you have to have some means to adjust the number or level of privileges that are out there. This is an important point. If you think that there are too many fishermen or boats or whatever it is out there, and you have to shrink the number, you had better plan to shrink the number up front because it is a lot of trouble to do in a system like this.

Limited entry has been a lot of trouble in all the places they've put it in so far, and unless you're going to reduce the effort or the participation or whatever you think the so called over-capitalization problem is, don't bother to use it because it is a lot of trouble and nobody will be any better off.

You have to decide how you're going to adjust in the downward direction, the effort or the number of people fishing out there. When you evaluate the best kind of system, you look at a lot of different factors. You have to look at the objectives of the management system. If it is going to be a federal plan like the Gulf shrimp, and if it is going to be Gulf-wide you have to look at the objective as well as the national standards of federal law. The federal law has a specific section that talks about limited entry. It says if you're going to use limited access you have to pay attention to certain things, and you also have to look at whether you have a biological, economic, or social problem and what is it you're going address with limited access. Finally you have to really consider your ability to enforce any of this. I'm a fishery commissioner in North Carolina and when people come up to us with new management proposals sometimes we just slap our foreheads and say, "You guys, we don't have a clue what you all are doing out there right now! You want us to put another restriction in? Give us a break. We can't even tell if you are following the ones that we have!" Unless you can enforce and properly implement a system, it is probably not going to be worth your while to try and fool around with figuring out how to do it.

With respect to one of the points that you heard earlier, federal law says that you're supposed to promote efficiency in the fishery, but you're supposed to avoid economic allocation as the only reason that you're doing whatever the management is that you want to do. Now in practical terms, all that usually means is you have to specify some kind of biological objective as well, so that is what happens. The point is that there is a justification in the federal law for considering these economic efficiency type objectives in your management scheme. As people point out to

us in North Carolina all the time our shrimp opening and closings there are done virtually solely on the basis of two economic variables, the size of the shrimp at harvest for yield (economic variable) and who gets it. We have inshore and offshore shrimpers as well. Those aren't biological questions for goodness sake, those are economic allocation and economic yield questions.

Even though you may not formally have the legal justification in your law we do it all the time. We take into account those factors all the time but we call it biology. The federal law says if you are going to admit that you're going to address the economic and social questions here's what you have to show that you've thought about: You have to have thought about who is in that fishery right now, you have to show what their historical fishing practice is and what their level of dependence is. You have to have a good handle on the economics of the fishery, you have to know which other fisheries those vessels could fish in as well and you have to know the social and cultural framework of the fishery. That is what the federal law requires if you're going to think about any of these kinds of limited entry systems. It is a social and economic question.

From my point of view any manager ought to know those things about **anything** he does with respect to fisheries because even if your objective is solely biological you're having an effect on the people when you enact a law. We had a discussion this morning about the objectives of the Gulf of Mexico Shrimp Fishery Management Plan, so I called Wayne Swingle, the council director over in Tampa and asked him to FAX me a copy of the objectives. The objectives of the Gulf Management Plan are: optimize yield, encourage habitat protection, coordinate the management measures with the states, endangered species, marine mammal protection, minimize bycatch, minimize conflicts, minimize the adverse impacts of underwater structures, and provide for a statistical reporting system through which one would like to think he'd have something like a handle on the number of fishermen out there. These are the objectives of the Gulf Shrimp Plan. The federal system would probably have to adopt a couple more objectives in their plan before they could have something like limited entry because they need to say specifically this is one of our objectives.

Remember what you're doing with the limited entry system is assigning specific privileges (I like to call them privileges instead of rights) to specific people and if you look at the way the people have done this in other fisheries around the country or around the world there are several things you can do. First, you can simply limit the number of licenses to fish in the fishery and you can do that one or two ways.

You can either assign them to vessels or you can assign them to individual fishermen. It is done in different ways in different systems right now. You do it this way if what you are concerned about is the total number of vessels out there because you've got too much effort. If you are concerned about too many people actually splitting the economic revenue from the catch what you would probably want to do is assign privileges to individual fishermen instead of vessels because what you are interested in is how much money fishermen are making, not necessarily how many vessels are out there. The sense here is that you license whatever the most direct thing is that you are concerned about. If you are concerned about too many boats, license boats; if you are concerned about too many fishermen, license the fishermen; or you can do both and there are systems that do that as well.

Now the second thing that you can do if you are concerned more directly about the amount of fish coming out of the ocean as well as who gets it is you can use the ITQ approach, Individual Fishermen Quota or Individual Transferable Quota. There are some limited entry systems that assign catches by issuing certificates. They'll say a certificate is to catch a hundred pounds of shrimp and you get 10 certificates, which means you can catch 1,000 pounds of shrimp a year. If you want to catch 2,000 pounds you have to buy some certificates from somebody else.

Some systems like that are based on the percentage of the catch. These tend to be cases where the total catch is fairly small in the fishery and the total number of participants is fairly small so that you are going to have a pretty good idea part way through the season what the total catch is going to be and you can assign the percentage and translate it in terms of pounds. The advantage of this is it gives you some direct control over catches as well as participation. The problem for shrimp is that you never really have managed on the basis of pounds caught in the first place and my impression is you don't have a real-time reporting system that would enable you to even know how many fish you had landed at any point in time during the season. So this is probably not one that you could do very easily. That is the catch certificate type system.

Number three is where you license effort directly and there are really three general ways to do that. One of them is to license directly on the basis of the length of the boat. This has been tried in Canada, in salmon, and in some of the Australian fisheries. The problem is that this really hasn't worked out to be very effective because what happened, in the Canadian case, is that they limited boat size and the guys started pulling two nets instead of one, or got a thousand-foot seine instead of a 500-foot seine. The point is that may not be a very good effort control. They have bigger

engines. The boat size turns out not to correlate with anything. Again, I am not quite sure how you would apply that to shrimp.

There are systems that are based on hold capacity. These tend to be systems where the ability to hold the fish and to transfer them back and forth is really a limiting factor in the fishery. That is, you've got to preserve the fish and you have to take them somewhere over a fair distance. That again may not be very applicable to the shrimp fishery. There are some systems that specify gear amount or size. The best example of this are things like the lobster fisheries or the prawn fishery, or the rock lobster fishery, where you use traps. Now a trap fishery gives you a big advantage in this area because you have a specific, identifiable unit of effort that you can license if you know how many of them are out there. The system that we are working on with the Organized Fishermen of Florida for spiny lobster has to do with trap certificates, so under that system you would get to fish a certain number of traps. That gives you some sort of an effort control measure and because you can buy and sell the certificates you can adjust how much effort you want but you have a total cap on the number of traps that can be in the fishery. If you are over-capitalized you are going to want to reduce those over time.

Now what happens when you try to put all of this together is that you end up with a diagram. This is the way we did the analysis for one portion of this project that we are doing with spiny lobster. What happened with the spiny lobster is that both the Gulf and South Atlantic Fishery Management Councils, the National Marine Fisheries Service, and the state of Florida approached us at East Carolina about designing some limited entry alternatives for the spiny lobster fishermen. We told them that we weren't going to do that until we did some research with the fishermen to know about the economics, what they do, who they are, and all of that sort of stuff.

We got that information and then we started to design some alternatives for them. We said that if you do a license limitation system you have to figure out who you are going to assign the privileges to (individuals or vessels), how many of them, whether everybody gets in or whether you reduce it initially, how you are going to transfer them (marketable or reverting to the state), how you are going to adjust it on biological, economic, or social grounds, how are you going to reduce effort, i.e., by a buy-back or just retire the licenses. We went through all the alternatives for doing this under the license limitation and then judged how those would fit each of these criteria. The objectives you had in management, the standards of the federal law, the impacts, biological, economic, social and how enforceable any of that system would

be were all considered. Then we did the same thing for the individual fishermen quota.

If you were to consider any kind of limited entry system I would encourage you to do this same thing. Look at what all the options are and then compare them and see how they work out to all your criteria. It is our impression that this is the best approach to doing this sort of thing and the people who ought to comment here are not only the fishery managers but the fishermen. We're going to do that for a year in Florida before we go back to the management agencies and say "here is what folks think about this and here is the way you may want to do it or not."

If you want to think about a limited entry or limited access system, there are some things that you ought to do. First of all, you ought to ask yourself "what's the problem?" Is the problem that there are too many shrimp being taken? If that is the problem then you probably don't need limited entry. Is the problem that they are being taken too small? That is an economic kind of problem. If that is the kind of problem you have, you probably don't need limited entry either. You simply do some of the seasonal closure and other things that Richard talked about. On the other hand, is it an economic problem such that there are just not enough shrimp being taken, given import competition and prices and all the other things that you heard about this morning? Are there too many fishermen out there to split the pie into big enough chunks to allow anybody to make a living? If that's part of your problem, you may want to consider a limited entry system. Is it a social problem? Is it a matter of which particular group of fishermen get to participate and in which amounts and in which times of the year? If that's part of the problem, you may also be able to control it through limited access or limited effort systems, but you'd have to do it in conjunction with these other conservation measures such as seasonal and area closures as well.

So you have to figure out what exactly is your problem, and achieve consensus that the problem is too many fishermen or too much effort in the fishery. We do have good data in spiny lobster about participation and effort and one of the things that is really clear in that fishery is that 10 years ago they got 6 million pounds of lobster with 200,000 traps. Today they catch 6 million pounds of lobster, with 600,000 traps. There are three times the number of traps in the fishery that are catching the exact same amount of lobster. So there is a fairly compelling argument in there that if you had fewer traps everybody would be making more money. Is that true for shrimp? I don't know.

The second set of things you have to ask yourself is realistically what are the resources you have to deal with? And I'm using the term resources real broadly here. The first one is authority. You heard this morn-

ing from your legal expert that not all the states have the authority to do this kind of management. That means that you're going to have to be able to argue strongly enough for it to convince your legislators that they should amend your state laws to allow it to happen. That is a fair amount of trouble to do sometimes as you probably know. You have to figure out what the authority situation is.

You need to consider funding. It costs money to issue the licenses and it especially costs money to get any of the effort out of the fishery. That is a big problem that you have with a license limitation system as opposed to one of these other ones like a trap certificate system. That one is easy because you can reduce the number of traps by simply reducing everybody a little bit and nobody has to get out of the fishery. With a license limitation system, if you are going to reduce the effort, you've got to reduce the number of licenses. That means somebody getting out of the fishery. Now one way to do that they have tried (it hasn't worked, but they've tried) is what is called a buy-back system. You give everybody a license and then the state creates a fund from a lot of different sources to try and buy people out of the fishery. There are two problems with that. One is that it is incredibly expensive to do. They tried this in salmon in the state of Washington. What happened is that their fund went broke right away because the licenses were very expensive. The other thing that happened was that the people who sold out of the fishery were people who weren't really very good at it in the first place, and so they didn't remove very much effort from the fishery. You have to figure out where you are going to get the resources to set up the system, monitor it, issue the licenses, transfer them and it may cost money to reduce the effort.

Where is that money going to come from? One notion is that you can put a fee or a tax on the landings or on the license transfers of the people in the fishery, and thereby build up a fund which buys people out of the fishery in theory benefiting those who are left in, which is why they should contribute through this landings tax. We did a calculation for spiny lobster and basically the answer was that if you put even a 5 percent tariff or tax on landings you weren't going to get enough effort out of the fishery to realize any advantages. That is a very difficult problem to address.

You have to consider management and enforcement resources. It would be difficult to imagine any limited entry system that did not have a good data system attached to it to do very simple things like keep track of who had licenses and who didn't. You would have to have that or the whole thing wouldn't make any sense either. You would have to take a hard look at what your management entities and industry would

be willing to support to make something like this work because it would probably be a lot more than you've got in place right now.

You also have to engender political support and there are two aspects to that. One is that you are going to need new laws to get any of this done at all. I would venture to say that there is no state in the Gulf (except maybe Texas) that could presently put in a limited entry system under their existing legal authorities. Even if they could squeak it by it is usually better to get it addressed up front to make sure that it is going to fly in the first place. That is the first aspect of the political support question.

The second aspect is whether the fishermen support it. In my opinion, no management system is really going to work unless the fishermen think it is a good idea. This is why we have always insisted in our work with things like the spiny lobster, that we go out and spend a lot of time with the fishermen, basically developing the system. One of the problems that has happened in a lot of the other limited entry cases that have been tried is that some managers, and usually economists, say this would all be more efficient. They develop a system and they go out and present it to the fishermen. The fishermen say, "well we didn't have any role in developing that." Even if they do implement it and people don't cooperate with it, it is not effective. So that is the other aspect of political support and why meetings like this are a good idea.

If limited access is something you want to consider, make sure that everybody understands it. I was talking to somebody today who said that there had been a survey done of the shrimpers, I guess a couple of years ago, and fully half of the shrimpers out on the ocean professed not even to know what season and area closures were being done. You couldn't allow that. If that were the situation with limited entry you would never get it in place because the people who it is going to affect will have to think at least that it is an acceptable idea, if not a good idea, before it is very likely to work.

Limited access is something that addresses social and economic questions. If it is only biology that you are concerned about, you probably don't need a limited entry system. You've got to think that you have economic problems and social problems, however you want to define them. There are some very particular things you have to consider right up front in terms of legal authority, which inputs into the process that you think you can license and would be best to license. You had better plan on reducing effort if you are going to have any significant effect.

There is essentially no limited entry system that I am aware of in the United States that has effectively reduced the effort in the fishery. They have all just capped it. In fact, in Alaska, they have more salmon

licenses issued now than they did when they started the program in 1974, and the reason is they have monitored it and they have decided economically that everybody is making so much money that they can put out more licenses. They did it as a conscious decision, having a good handle on how the whole system was working.

Finally, you have to decide where the resources are going to come from to do this. It is going to be both

money and political support that you are going to need. You have to figure out where that is going to come from and how you are going to develop it. In the end what you have to decide is whether the cost of doing something like this is worth the benefits to you; either to the fishermen in terms of increased net incomes or to the managers in terms of manageability, the fishery, or increased yields overall. Are the costs worth the benefits? That is the question.

Shrimp Industry Perspective of Limited Entry

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I have more or less altered my speech a little to take into consideration the things that Mike Orbach talked about. And the reason is that he covered it much better than I could. But I would have to say that a large part of what I originally thought I would have to say was covered by him, and since he's done such an excellent job, I'll just pass over that and get on.

What I would like to say is what I think—and mind you it's what I think—the Louisiana Shrimp Association might say with regard to limited entry. We have had two annual meetings at which the subject was thoroughly discussed by various authorities. While I could give you no consensus of opinion about what the Shrimp Association is thinking, I will do the best I can to tell you the way I interpret it. Incidentally, when you work with the shrimpers as I work with them, you can find that opinion changes from day-to-day. You have to be very flexible, if you can describe it that way.

I'm not an authority on limited entry, although I've been acquainted with the subject for about 50 years. I was introduced to it by a man named Bob Nesbitt, who was a biologist with the Fish and Wildlife Service, while we were working on shad in the Hudson River in 1938. He, too, said he didn't favor it but it might have to be used. The Fish and Wildlife Service and the Atlantic States Marine Fisheries Commission teamed up to put on one of the first debates, if not the

first debate, on limited entry. And it will give you a good deal of information into the historical background of the idea of limiting the number of harvesters in a particular fishery. That debate is published in one of the special scientific reports on fisheries of the Fish and Wildlife Service, a copy of which is in the Gulf Coast Research Laboratory's library. The reason I know is because I donated it to them.

We in the shrimping industry look at limited entry as a management tool, one of many that are available to the managing agency to control the fishery. It depends on what conditions you have within the fishery as to which management tool you use. As I said, we had a couple of general sessions in which we discussed limited entry. But afterwards, in talking with many of the fishermen who are experienced and operators of more than one large vessel, they look at the situation this way: there are a number of factors that contribute to the present decline. For example, if you go back 200 years on this coast, the coast was rather thinly populated, if at all, for some period of time. The area was covered with large live oaks and yellow pine. And there was a mat of decaying vegetation along this coast anywhere from 12 to 18 inches deep. When the rainfall came, it hit this decaying matter, picked up some of the nutrient salts there, reached about the same temperature as the water in

the bayou, and finally reached the bayou rather slowly, not in one big slush. There were no gasoline-powered vehicles here at the time. There were no large, paved shopping centers. There were no streets, just roads and trails.

With the passage of time, we built large shopping centers. There was a vast influx of people into the area. What happens when it rains now is that the rainfall hits the rooftop at about 180 °F. It finds its way down the drainpipe and onto the lawn where there are vast quantities of herbicides and other poisonous matters, including a substantial amount of nitrogenous fertilizer. The result was that by the time it reached the bayou—which was rather quickly through the various storm sewer systems—there is an enormous change in the temperature and structure of the water in the bayou. Many of the animals that live there and serve the food chain are destroyed. They are no longer available for food. The very marshland itself has begun to erode away.

Now what you've got today, then, is a situation that is less than pristine in which the productivity of the area is not nearly as good as it once was. There are many fishermen who remember when it was better and how the catch went down over the years. You've got a collapsed oil industry with thousands of people looking for work and there is no work. And you've got a resource that is not yielding as much as it once did. This creates a problem. In the last 5 years, I have heard a constant and increasing clamor to limit the number of boats. Some of the fishermen recognize that gradually they are going broke. What they are doing today is consuming their own vessel.

What has happened to the management of these resources that have been reduced in number? First, the management areas, agencies—and, mind you, I've been in the saddle there so I know what it's all about. The management agency ends up with most inefficient gear that they can find. This limits the catch so this is the one they should use and you end up with that as a gear. It becomes a management tool.

The clamor, as I said, began with the fact that we must limit the number of harvesters in this important fishery. We will use one or more tools as the

carpenter might select from his tool chest to solve this situation. But the question arises: "Why are we so sure that it's limited entry?" I also receive a number of complaints that it is not limited entry that we need, it's to protect the small shrimp outside and blah, blah, blah. Each one has his own idea of what we should do in the way of management.

The trouble with making decisions about limited entry is, first of all, you need to know how this is affecting the income of the fishermen. And, as far as I can tell, there are no data available today that will give us these facts. We should have been collecting data for years back so that we would be in a position to make a sound judgment in the best interest to both the fishery and the state. You must remember that the state has a vital interest in the use of that resource. They will direct the kind of regulations that they think correct the situation. It may not be the right decision, but, generally speaking, the best information that you have.

The first step we consider in the shrimping industry is to freeze the present number of fishermen in the business. That was tried in Louisiana a couple of years ago and it didn't fly. And, frankly, gentlemen, I don't think it's going to fly today. I might be for it and I might do the best I can trying to sell the idea, but I've got some misgivings about the average shrimper in Louisiana accepting the idea of limited entry. But the first step that should be, we think, is to freeze the number of fishermen, and from that point, you can proceed with your management of the program. It would be my considered opinion that we'd do well to get this thing through one step at a time and not swallow the whole management scheme. And the reason is that I think that freezing the number of fishermen that are there now would probably be our best shot.

Fishermen ask me: "Why don't you advocate a quota system?" Why don't you advocate managing the fishery so that the small shrimp are saved? The reason is that none of these—quota, gear size, or other measurements—will generally help the economic condition of the fishermen, and that's what you're really trying to do.

Stock Enhancement Techniques

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Abstract

An examination of a number of shrimp propagation and restocking programs in Kuwait, Italy, the United States and two in Japan, suggests that a number of factors must be in place before such a program can be successful. The target shrimp population must be relatively small and the hatchery output high to allow the stocked shrimp to make a significant contribution to the population. Hatcheries must be technically and economically efficient, producing large numbers of post larvae at reasonable costs at the appropriate times. The life history and ecology of the target species, particularly habitat requirements and migratory patterns, must be well known. A thorough knowledge of the stock dynamics of the exploited population is also essential. To avoid legal complications and allow for defraying of stocking costs, the ownership of the stock must be fixed.

The two successful restocking programs reviewed both had the following characteristics: enclosed waters, low predator abundance, small resident shrimp populations, established hatchery procedures and facilities, abundant fishery and ecological data, cooperative ownership of stocks, and favorable economics. The latter is a product of high market price for the shrimp, low fishing costs, and subsidized hatchery production of seed. These conditions do not exist for the Mississippi Sound or northern Gulf of Mexico shrimp fishery. Shrimp propagation and release programs do not appear to be economically feasible management options for this fishery. Emphasis and resources would be better directed instead towards preservation and creation of critical wetland nursery habitat.

Introduction

More than 35 species of penaeid shrimp are fished commercially worldwide (Holthius, 1980). All share a distinctive life history, which includes a significant portion of the life cycle spent in brackish or estuarine environments. Lassuy (1983), Muncy (1984), and Gitschlag (1986) describe the life cycles of the three commercially important penaeid shrimp in the Gulf of Mexico. Adults spawn offshore in deep water. The

buoyant eggs hatch immediately and the newly hatched larval shrimp go through a number of planktonic development stages. These include the nauplius, the zoea, and the mysis stage before the shrimp develops into a benthic post larva. Developing shrimp move shoreward as they progress through metamorphosis. For most Gulf species, the larval development period takes about 3 to 5 weeks. Post-larvae enter coastal or estuarine waters and grow for 2 to 6 months through juvenile and subadult stages. Subadults then migrate to offshore waters to spawn and repeat the cycle.

Whether in the Gulf of Mexico, the Philippine Sea, or in the Japanese Inland Sea, the cycle for penaeid shrimp is the same (Kutkuhn, 1966). The differences are in how far into brackish water the subadult form of a species ventures and how marine the adult population is.

Most shrimp populations are exploited at or near maximum capacity. Because there are no new populations to exploit, current management objectives focus on methods by which declining fisheries stocks can be conserved or restored (U.S. Department of Commerce, 1988). There are two approaches to this objective. The first is a technological approach of propagation for release, modeled on trout and salmon hatchery programs. This approach has been more recently attempted in the marine environment with scallops and abalone, for example, in Japan (Tong et al., 1987) with redfish in the U.S. (Gulf of Mexico Fishery Management Council, 1984), and in various areas of the world with shrimp. The second approach is much more basic. This involves the preservation and expansion of critical inshore nursery habitats. These habitats are critical to the development and growth of shrimp during their complex life cycle. Without such habitats, the exploited populations cannot be sustained (Kutkuhn, 1966; Turner, 1977; Lassuy, 1983; Muncy, 1984).

Both approaches depend on recent advances in technology. Because of recent technological breakthroughs in maturation, spawning, and hatchery techniques, it is possible to consider and implement release programs for shrimp. Hatcheries can now economically and consistently produce large numbers of post-larval shrimp. Production rates can

theoretically be sustained in the tens to hundreds of millions of shrimp post-larvae per year (Lawrence and Huner, 1987) at costs of \$10.00 per thousand produced, or less in the U.S. (Johns et al., 1981), Latin America (Griffin et al., 1985), Japan (Kurata, 1981) and Asia (Hirasawa, 1985). Knowledge of the structure and function of estuarine and coastal wetland communities has also advanced rapidly in recent years. New techniques for the creation and restoration of both wetlands (e.g. Zedler, 1984) and submerged aquatic vegetated habitats (e.g. Fredette et al., 1985), have also been developed. Combined, these promote better management of these critical areas to the benefit of shrimp and other fisheries. Both approaches have the same objective, to maintain or increase the stock of subadult shrimp and, therefore, the catch of adult shrimp in a commercial fishery.

There have been several efforts to implement propagation for release programs for shrimp in various areas. However, information on the success of these programs has not been readily available. Because of recurring interest in developing a shrimp propagation program for the Mississippi Sound or the northern Gulf of Mexico, this paper will discuss how such a propagation program would work and how it may apply as a management option in Mississippi Sound.

Artificial Propagation Technology

Any program designed to produce shrimp for restocking to augment a fishery depends on a number of important considerations (Doi, 1981; Kurata, 1981; Sander, 1981). The technology for hatchery production of post larval shrimp must be well established. The knowledge of the life cycle of the shrimp in relation to the fishery for the animal must be complete. To be successful, artificial propagation programs must have access to usable estimates of length, weight, and growth relationships. Further, estimates of population parameters including mortality, reproduction, dispersion of the stocks, and others must be available. More specifically, estimates of the population size and mortality factors for each part of the life cycle must be established. The relation of mortality to physical, chemical, and biological conditions must also be known. Finally, the habitat requirements or ecology of each life stage must also be fairly well understood. This demand for information is not excessive. Indeed, any meaningful fisheries management effort requires this information (Doi, 1981; Sander, 1981).

Any stock enhancement program must have a measure by which the success of such a program can be determined. A propagation and release program can be considered successful if the number released forms a significant proportion of the adult fishery (Doi, 1981). As a result, release programs work best

with small populations, where a contribution of several percent to the existing stock from a propagation and release program can be both economical and biologically effective. Because of their effectiveness with small populations, propagation and release programs are particularly useful in lagoon or enclosed sea fisheries.

The Japanese Experience

Doi (1981) and Kurata (1981) describe the Japanese propagation and release programs. The Japanese have had five release areas for shrimp since the early 1960's, located along the shores of the semi-enclosed Seto Inland Sea. Circumstances for the implementation of a shrimp propagation program for the Seto Sea were good. Fisheries managers had good information on *Penaeus japonicus* stocks supporting the commercial fishery. Information on life cycle, population size, movement, ecological requirements of all life stages and other factors was relatively well known. In addition, technology for the production of post-larval *P. japonicus* was developed in Japan to support aquaculture of this species. Studies of the mortality factors important in the various life cycles of this shrimp revealed that most mortality occurred in the period between the egg hatching and the twentieth day of post-larval life.

Based on this information, fisheries managers initiated a propagation and release program that would duplicate the natural life cycle and attempt to limit the mortality of the larval shrimp traveling between the spawning grounds and their estuarine habitat. Before such a program could be started, however, the optimal habitat requirements for the released juvenile shrimp and the minimal size for release had to be determined. Habitat for this species is best defined by tidal elevation and sediment particle size. Researchers found that survival was good on the upper parts of coarse-grained beaches. There were no correlations of survival with other physical or chemical factors. Researchers further determined that the minimum size for release was about three centimeters. At this point, the juvenile shrimp take on adult characteristics such as burrowing and nocturnal movement, which makes them less vulnerable to predators.

These results suggested that to be successful a release program should avoid direct release of smaller, younger post-larvae. Rather a nursery should be used to grow out the shrimp to appropriate size for release. Equally important for success was the identification and use of suitable release sites. Such sites would have the appropriate natural characteristics that would enhance the survival and success of the released shrimp.

Field surveys determined that natural sites were not generally available. First, natural sites around the Seto Inland Sea were patchy and scattered in distribution. Because of coastal development and other factors, most of these sites were already fully utilized by natural shrimp recruits. As a consequence, these could not be used for release programs as well because the added shrimp would cause crowding, increasing losses to predation and decreasing growth rates of all shrimp at the site.

The solution was to use artificial habitats. There are two main types of artificial habitats used for stocking of released shrimp in Japan. The first uses nets in lagoons or coastal shallow waters to eliminate predator fish from release areas and to contain the juvenile shrimp. Problems with weather, damage to nets, and fouling limits their use. In addition, because of the need to release entire batches of shrimp by lifting the net, the growth of the stocked shrimp is stunted by crowding and the population is very vulnerable to predators upon release.

A second approach was to construct artificial tidelands for release areas. These are now used widely in the Seto Inland Sea fishery management program. This approach mimics the different natural micro-habitats required by the shrimp as they grow from post larvae through their juvenile stages. In addition, these artificial habitats utilize differences in habitat requirements between shrimp size classes to allow increased stocking densities and between the shrimp and their predators to control predation. Artificial tidelands are designed to closely control elevation, water depths, waves, currents, sediment types, and other physical factors. When correctly designed, post-larval shrimp stocked at 10 millimeters into the tidelands grow to 3 centimeters in about 2 to 3 weeks and successfully migrate to open sea. Approximately 150 million hatchery-produced post-larval shrimp are stocked into these tidelands annually.

It is difficult to determine the effectiveness of this program. Tagging of shrimp of that size is ineffective. The only available method is tracing the effect of a released cohort of the existing wild population. This is, at best, indirect evidence and open to dispute. Proponents of the program say it is effective, pointing to a turnaround in the declining shrimp fishery in the Seto Sea (Kurata, 1981). The relation of increased annual shrimp landings to the number of shrimp released is cited as evidence that the release program is effective. Based on these observations, Kurata (1981) claims a benefit over cost of 2.75 yen per shrimp caught in the Seto Inland Sea fishery.

Critics of the program counter that there are no conclusive data on the effect of this program on the fishery (Doi, 1981). Even if successful, the fishery is only profitable because it sells live shrimp at greatly

inflated prices. The cost-benefit estimates of the program proponents are also questioned. Critics contend that the program must operate at 100 percent efficiency to meet the suggested cost benefit ratios. Finally, there is the legal question of ownership. Because of the public funding involved in the propagation and release of these shrimp, do the fishermen have exclusive rights to these animals?

Kuwait

In the 1970's, Kuwait experienced a declining catch of shrimp in the Persian Gulf (see summaries in Farmer, 1981). A shrimp propagation and release program, based on the Japanese model, was put into place in an attempt to reverse the trend. Despite a significant investment in resources and funds, the program was discontinued after more than 120 million post-larval shrimp were released. There were several reasons for this decision (Farmer, 1981, pages 413-415). The release program did not address the causes of the decline in the shrimp fishery. The causes remain unknown and the decline continues. The program was hampered by the lack of basic fishery statistics and population biology of the target species. Evidence also suggests that the program was ineffective because of the relatively large population size and mobility of the shrimp stocks. The program appeared to be too small and produced too few shrimp in relation to stock size to be effective.

Marifarms

Marifarms of Florida provides an example of commercial stocking and management of shrimp in natural waters. It also provides a case study of an inadvertent release program. Kittaka (1981) describes Marifarms' operations in detail. Briefly, hatchery-produced post larvae of all three commercial Gulf shrimp species were released at various times into enclosures. The enclosures were netted off portions of a coastal bay in northwestern Florida. Enclosures ranged in size from small pens, used to hold the smallest, newly stocked post-larvae, to larger nursery areas, to final growout enclosures. The pens were located within the nurseries, and the nurseries within the growout areas. Rotenone treatments were used to control predatory fish within the netted area.

Post-larval brown and white shrimp were stocked in spring and early summer for fall harvest. Pink shrimp post-larvae were released in late summer to overwinter for a spring crop. While survival in the initial stocking pens and in the nursery areas was good, recovery of harvestable shrimp was very poor, 2-13% for whites and 0-10% for browns; few pink shrimp were harvested. Problems with fouling of the nets,

escape of shrimp, weather damage, and an inability to control predator populations contributed to the failure of the operation, even after 3 full years of effort.

Incidentally, the catch of white shrimp in the vicinity of Marifarms' operations was reported to increase during the life of the project. This prompted some to suggest that the escaping shrimp were augmenting the natural stocks. Up to 100,000 pounds of white shrimp were landed in the bay after Marifarms started operations, up from negligible harvests in prior years (Kittaka, 1981). While interesting, the relationship between these increased harvests and released shrimp has not been substantiated.

Italy

In contrast with the unsuccessful restocking efforts attempted in Kuwait or the questionable results obtained at Marifarms, Italy is more of a success story. The local Mediterranean shrimp species (*P. kerathurus*) caught off the coast of Italy had been in decline for many years. Changes in water quality and over-fishing had put extreme pressures on the stocks. Since the opening of the Suez Canal, an alternative shrimp species from the Indian Ocean had become available. Following initial trials in the north in 1982 (see Lumare, 1984, 1986; Lumare et al., 1986), researchers in southern Italy stocked a 12,000-acre lagoon in 1983 with this exotic species. Three years of releases in this lagoon have resulted in a recovery of between 24 and 33 percent of the stocked numbers. Stocked shrimp exhibited excellent growth in all years. Researchers calculated benefits exceeding costs by over six to one. Because of this success, the effort was expanded to other lagoons along the Italian coast. Wide variations in lagoon configuration, salinity and temperature regimes, and especially in fish biomass in the lagoons have resulted in variable success for different restocking programs. Recovery rates of 20-46 percent are reported. The most successful programs are in lagoons that have restricted access to the sea and are fished by fishermen's cooperatives, which cooperatively and exclusively own the shrimp. The most important factor however, appears to be the presence of low fish biomass in the stocked lagoons. Because the cost to benefit ratios are good (from 1:2.2 to 1:9) and the returns of stocked shrimp are high (up to 46%), the program continues to expand to new areas.

The keys to the success of the Italian program are as follows. The areas stocked were lagoons with limited access to the sea and low fish densities. The resident shrimp populations in these lagoons was small or nonexistent so the release contributed significant numbers of recruits. Because this was a newly introduced species, the shrimp populations were

relatively well studied and growth, mortality, and other data necessary for effective stock management were well known. Based on previous work in both Japan and Italy, the ecological requirements of the shrimp were well known and suitable stocking areas had been clearly identified. A critical component of the program was an efficient hatchery system for producing inexpensive post-larval shrimp for the program.

Controlled production, synchronized with stocking needs, good larval survival, and low unit costs for the hatchery contribute significantly to the success of the restocking program. The cooperative approach used by the fishermen to fish the stocked shrimp resolved a potentially thorny problem of ownership. Clear ownership of the stock is required in order to have returns defray the cost of stocking and to direct the benefits to the target social group. Finally, the costs to benefits ratio is good because of the very high price received for the shrimp in the local markets.

Japan Revisited

In contrast with the high cost and controversial Seto Inland Sea management program, the successful program managed in a small coastal lagoon in eastern Japan deserves examination (see Uno, 1985). This is the first successful release program in Japan. The conditions for a successful shrimp restocking program appear to be in place. The lagoon is small and is cooperatively fished by the resident villagers. The shrimp fishery was small, landing about 40 tons per year. The biology and ecology of the shrimp species (*P. japonicus*) are very well known. The lagoon population is particularly amenable to management by a restocking program because the population does not migrate away from the lagoon. Releases of post-larval shrimp have been carried out by the Prefectural government since 1978. More than 17 million were released between 1978 and 1983. Prior to the release program, five natural shrimp populations were found in the lagoon. Analysis of trial release and fishery data indicate that most released shrimp stay within the lagoon to overwinter and contribute to the next year's fishery. Yields from the shrimp fishery after the start of the stocking program improved by a factor of over 2.4. Landings rose from about 40 tons per year to over 100 tons per year after the implementation of the program in 1978. As with the Italian experience, the limited area to be fished and managed, and a well-studied population contributed significantly to the success of the program. With effective state-run hatcheries producing inexpensive post-larvae, clear ownership of the stock by the villagers and good market prices for the product, the success of the program was assured.

Application to the Mississippi Sound Fishery

Based on the experiences and results of a variety of propagation and restocking programs worldwide, the success of such a program in Mississippi Sound does not appear to be feasible. For fisheries operating in wide areas, such as Mississippi Sound or the northern Gulf of Mexico and with larger and more mobile populations (Lassuy, 1983; Muncy, 1984; Gitschlag, 1986), the key is habitat preservation. At the scale of the fishery operating in Mississippi Sound and offshore in the northern Gulf, this is a less costly and more effective approach than the propagation and release program.

The roles of marshes and submerged aquatic vegetation to the shrimp fishery is well established (e.g. Turner, 1977; Weinstein, 1979; Laussey, 1983; Muncy, 1984). These areas serve as a nursery, providing shelter for juvenile shrimp from predators and providing important sources of food. There is a distinct negative correlation between landfill of wetlands and declining shrimp yields. Total shrimp yields in Louisiana were found to be proportional to the marsh acreage in the state. On a larger scale, shrimp yields in the northern Gulf of Mexico were found to be proportional to the combined area of submerged aquatic vegetation and marshlands. Finally, the decreased intertidal habitat that was flooded in spring tides correlated closely with declines in the size of captured shrimp as well as in the abundance of shrimp caught (Turner, 1977).

Both the critics of the Seto Inland Sea program in Japan and most other shrimp fishery management experts have concluded that it is more effective, more rapid, and less costly to preserve wetlands and submerged aquatic vegetation nursery habitats from further loss than to implement a hatchery and stocking enhancement program (Uno 1985). Avoiding indiscriminant development to protect nursery areas is overall of greater benefit to enhancing shrimp populations than any hatchery and release program. Experience has shown that stocking programs are expensive to start up, are prone to technical problems, are costly to operate, and require extensive databases and monitoring efforts to ensure success. Protecting, restoring, or even creating needed submerged aquatic vegetation and marsh habitat is the most promising approach to stock augmentation of shrimp in Mississippi Sound.

Bibliography

- Doi, T. 1981. Population dynamics and management of the shrimp fishery in the Seto Inland Sea. Pages 289-306 in A.S.D. Farmer, editor. Proceedings of the international shrimp releasing, marking and recruitment workshop, Nov. 25-29, 1978. Salmiya, Kuwait. Kuwait Bulletin of Marine Science No. 2. Kuwait Institute for Scientific Research, Salmiya, Kuwait.
- Farmer, A.S.D. 1981. Proceedings of the international shrimp releasing, marking and recruitment workshop, Nov. 25-29, 1978. Salmiya, Kuwait. Kuwait Bulletin of Marine Science No. 2. Kuwait Institute for Scientific Research, Salmiya, Kuwait. 415 pp.
- Fredette, T.J., M.S. Fonseca, W.J. Kenworthy, and G.W. Thayer. 1985. Seagrass transplanting: 10 years of Army Corps of Engineers research. Pages 121-134 in F.J. Webb, editor. Proceedings of the 12th annual conference on wetlands restoration and creation. Hillsborough Community College, Tampa, FL.
- Gitschlag, R. 1986. Movement of pink shrimp in relation to the Tortugas Sanctuary. North American Journal of Fisheries Management 6: 328-338.
- Griffin, W., A. Lawrence, and M. Johns. 1985. Economics of penaeid culture in the Americas. Pages 151-160 in Y. Taki, J.H. Primavera and J.A. Llobrera, editors. Proceedings of the first international conference on the culture of penaeid prawns/shrimps, Iloilo City, Philippines, Dec. 4-7, 1984. Southeast Asian Fisheries Development Center, Iloilo City, Philippines.
- Gulf of Mexico Fisheries Management Council. 1984. Artificial propagation and stocking. Page 5.29 in Fishery profile of the red drum. Gulf States Marine Fisheries Commission, Ocean Springs, MS.
- Hirasawa, Y. 1985. Economics of shrimp culture in Asia. Pages 131-150 in Y. Taki, J.H. Primavera and J.A. Llobrera, editors. Proceedings of the first international conference on the culture of penaeid prawns/shrimps, Iloilo City, Dec. 4-7, 1984. Philippines, Southeast Asian Fisheries Development Center, Iloilo, Philippines.
- Holthius, L.B. 1980. FAO species catalogue. Vol. 1. Shrimps and prawns of the world. FAO Fisheries Synopsis (125) Vol. 1: 271 pp.
- Johns, M., W. Griffin, and A. Lawrence. 1981. Budget analysis of penaeid shrimp hatchery facilities. Journal of the World Mariculture Society 12(2): 305-321.
- Kittaka, J. 1981. Large-scale production of shrimp for releasing in Japan and the United States and the results of the releasing program at Panama City, Florida. Pages 149-166 in A.S.D. Farmer, editor. Proceedings of the international shrimp releasing, marking and recruitment workshop, Nov. 25-29, 1978. Salmiya, Kuwait. Kuwait Bulletin of Marine Science No. 2. Kuwait Institute for Scientific Research, Salmiya, Kuwait.
- Kurata, H. 1981. Shrimp fry releasing techniques in Japan, with special reference to artificial tidelands. Pages 117-148 in A.S.D. Farmer, editor. Proceedings of the international shrimp releasing, marking and recruitment workshop, Nov. 25-29, 1978. Salmiya, Kuwait. Kuwait Bulletin of Marine Science No. 2. Kuwait Institute for Scientific Research, Salmiya, Kuwait.
- Kutkuhn, J.H. 1966. The role of estuaries in the development and perpetuation of commercial shrimp resources. Pages 16-38 in R.F. Smith, A.H. Swartz and W.H. Massman, editors. A symposium on estuarine fisheries. American Fisheries Society Special Publication No. 3. Bethesda, MD.
- Lassuy, D.R. 1983. Species profiles: life histories and environmental requirements of coastal fishes and invertebrates (Gulf of Mexico) - brown shrimp. U.S. Fish and Wildlife Service Publication FWS/OBS-82/11.1. 15 pp.
- Lawrence, A.L., and J.V. Huner. 1987. Penaeid shrimp culture in the United States: a brief overview stressing species, seed production and growout. Pages 31-41 in C.J. Sindermann, editor.

- Reproduction, maturation and seed production of cultured species. Proceedings of the twelfth U.S. Japan meeting on aquaculture, Baton Rouge, LA, Oct. 25-29, 1983. NOAA Technical Report NMFS 47, Washington, DC.
- Lumare, F. 1984. Stocking trials of *Penaeus japonicus* Bate (Decapoda, Natantia) post-larvae in Lesina Lagoon (southeast coast of Italy). Pages 593-608 in *Management of Coastal Fisheries, Studies and Reviews, Volume 2, No. 61*. General Fisheries Counsel of the Mediterranean, FAO, Rome, Italy.
- Lumare, F. 1986. Marine Shrimp culture in the world and present state and trends of Kuruma prawn culture in Italy. *Informes Tecnicos del Instituto de Investigaciones Pesqueras No. 136*. Consejo Superior de Investigaciones Cientificas, Barcelona, Spain. 23 pp.
- Lumare, F., C. Andreoli, G. Belmonte, G. Casolino, M. Cottiglia, L. Da Ros, G. Piscitelli, and L. Tancioni. 1986. Growing studies on *Penaeus japonicus* (Decapoda, Natantia) in management and environmental diversified conditions. *Estratto dalla Rivista Italiana di Piscicoltura e Ittiopatologia* 21(2): 42-58.
- Muncy, R.J. 1984. Species profiles: life histories and environmental requirements of coastal fishes and invertebrates (Gulf of Mexico) - white shrimp. U.S. Fish and Wildlife Service Publication FWS/OBS-82/11.20. Washington, DC. 19 pp.
- Sander, F. 1981. Factors affecting shrimp recruitment. Pages 311-351 in A.S.D. Farmer, editor. *Proceedings of the international shrimp releasing, marking and recruitment workshop*. 25-29 November 1978, Salmiya, Kuwait. Kuwait Bulletin of Marine Science No. 2. Kuwait Institute for Scientific Research, Salmiya, Kuwait.
- Tong, L.J., G.A. Moss and J. Illingworth. 1987. Enhancement of a natural population of the abalone, *Haliotis iris*, using cultured larvae. *Aquaculture* 62: 67-72.
- Turner, R.E. 1977. Intertidal vegetation and commercial yields of penaeid shrimp. *Transactions of the American Fisheries Society* 106: 411-416.
- Uno, Y. 1985. An ecological approach to mariculture of shrimp: shrimp ranching fisheries. Pages 37-46 in Y. Taki, J.H. Primavera and J.A. Llobrera, editors. *Proceedings of the first international conference on the culture of penaeid prawns/shrimps*, Iloilo City, Philippines, Dec. 4-7, 1984. Southeast Asian Fisheries Development Center, Iloilo City, Philippines.
- U.S. Department of Commerce. 1988. *Aquaculture and capture fisheries: impacts on U.S. seafood markets*. U.S. Department of Commerce, National Marine Fisheries Service Special Report pursuant to the National Aquaculture Improvement Act of 1985 (P.L. 99 - 198).
- Weinstein, M.P. 1979. Shallow marsh habitats as primary nurseries for fishes and shellfish, Cape Fear River, North Carolina. *Fishery Bulletin* 77: 339-357.
- Zedler, J.B. 1984. *Salt marsh restoration: a guidebook for southern California*. California Sea Grant College Program Report T-CSGCP-009. La Jolla, CA. 46 pp.

Import Restrictions and Related Economic Impacts on the U.S. Shrimp Industry

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I feel quite honored to be here. I understand that Dave did deviate from the policy of not allowing any "Aggies" to participate in the conference, but I appreciate the opportunity.

We are going to talk about the possibility of restricting imports. Within this framework, there are a couple of policy options that can be entertained. I want to talk about some previous research that was funded by the Florida Sea Grant Program at the University of Florida, in the Food and Resource Economics Department.

To my knowledge, there have not been very many studies completed where this topic was thoroughly wrung out. There have been a few investigations done by the International Trade Commission, and I'm going to mention these to give an historical perspective on what led up to the study that was done back in 1985 in Florida. But, there have not been any real in-depth analyses to look at this fairly popular notion of controlling or restricting shrimp imports. It's an idea that had its vogue. I think there are some political problems in terms of implementing such a

program. The 1985 study is the only study that I'm aware of that has really gone through and tried to assess some of the impacts of such policy.

I'm not standing up here as a proponent or an opponent of trade restrictions. I think, as Tom McIlwain mentioned, the political current is running against it right now. Our Republican Administration over the past 8 years has been in staunch support of the free market. That's obvious to most of us. The Caribbean Basin Initiative is an example of the Administration's position on trying to encourage export from developing countries into the United States. So I think that's a real tangible issue that would have to be addressed in trying to implement such a policy—what is the current political standing on these kind of trade restrictions that would limit imports coming into the United States?

I'm not going to give you too many trend numbers. You've already had two or three people give you a very comprehensive overview of the trends that describe the industry. Ken Roberts did a very good job of setting the stage and looking at the trends in import levels, prices, and landings. I'm not going to try to get into that. If you will, keep those numbers in mind, though, and in perspective. What I would like to do is provide a historical perspective on investigations that have taken place regarding tariffs, quotas, or other types of import restrictions.

If you look at landings, landings have historically been increasing up through about 1977. That was the record year, the year we boast about in terms of Gulf-wide production. Of course, there were some fluctuations. Yet, an upward trend existed through those years up to 1977. Landings have since been relatively stable, although there have been significant fluctuations from year to year.

Imports have been steadily increasing over the years. In fact since 1960, there have only been 3 years when landings exceeded the import on a heads-off basis. Starting in 1981, import volumes went "out the roof" for a variety of reasons.

The first formal trade investigation I'll talk about was in 1960. Domestic landings were the dominant source of supply. However, imports were increasing steadily up through 1960, and between 1960 and 1961 was the first year that imports exceeded domestic landings. In 1960, there was a mild recession in the economy. And there have been several recessions since 1960—in 1974, 1977, 1979-81, and in the mid-1980's. Each time one of those recessions occurred, we had a decline in prices. In other words, there was a price break in a nominal sense and also in a real sense, as Ken was talking about this morning, when you account for inflation. So even in a real dollar sense, we had breaks in terms of the prices being received for the product. Producers were seeing this growing im-

portance of imports, and perceived themselves as being crowded out. Persistent increases in imports existed and there was concern about that. So an investigation was launched by the U.S. Tariff Commission under the provisions of the Tariff Act of 1930 to assess this situation of growing levels of imports in the market—what's it doing to the domestic shrimp industry?

The USITC found there was considerable concern regarding import levels in the market. However, they felt that imposing tariffs or quotas would severely hamper the future growth of the industry. The shrimp industry was considered a growth industry in the early 60's, and putting restrictive measures in place would cut back on that growth and dampen it. Such policies were felt to be politically unpopular. The study concluded there were significant impacts of imports on the industry, but there was nothing to be done about it.

Again, in 1974 and 1976, the industry experienced some economic downturns (i.e., mild recessions). Disposable income actually declined in 1974 and 1976. Fuel costs began to increase rapidly during that period. The operating costs of the vessels were going up. Revenues and profits per vessel were going down. The cost-price squeeze was becoming a critical issue during the early and mid-1970's.

In 1975, the second formal investigation on shrimp imports was launched by the U.S. International Trade Commission. Again, during 1975, what motivated this study, what led up to it? The economy was in a recession. Disposable income was falling so the purchasing power of the dollar was falling. Demand for seafood products was dampening a little bit. Nominal and real prices for shrimp at the dockside were beginning to fall. Fuel costs were going up. Import volumes were persistently increasing. Between 1961 and 1977, imports and landings were pretty much neck and neck, one certainly not out-pacing the other. Like I mentioned earlier, domestic landings exceeded imports in 1971, 1977, and 1978, I believe. These were the motivations behind the industry to get this kind of a study done. What they found, again, was that there was considerable concern regarding imported shrimp products arriving into the country, at least at the production sector level.

The President actually commissioned relief funds to be released for those firms that felt they needed relief from import competition. Records indicate, though, that no one actually received the funds. Only one or two firms on record actually applied for them! So the Commission in its study found there to be concern or actual damage, reparations were warranted, the President authorized funds to be released to the industry for them to collect in an attempt to mitigate their damages due to the import volumes that were

coming in and exerting undue competition, yet nobody applied for the money.

Between 1979 and 1981, we again had a recession. Landings began declining in the late 1970's and 1980's. Real prices fell off again in 1982 and 1983, as did nominal prices. In fact, they began to take a slide and even through 1986 and 1987, the real prices had not recovered fully to the pre-1979 levels. Vessel costs remained fairly high, even though fuel costs were beginning to mitigate a little bit. Insurance became a crucial issue. Insurance costs skyrocketed and the vessel operator had a lot of concern about this issue during that period of time.

Imports began to really increase in 1981 as the U.S. dollar on the world market strengthened. When that happens, theory tells you that foreign countries want more of our more valuable dollars. In addition, foreign product is cheaper on the world market. So whenever the dollar strengthens, we tend to see imports increasing, exports decreasing. There are those, however, who will argue the theory on that. We were also beginning to see record per capita seafood consumption, and as Ken Roberts mentioned, increases in per capita shrimp consumption were even out-pacing those for total seafood consumption. So imports were climbing and domestic landings were relatively stable, although there was considerable fluctuation from year to year.

The final study was done back in 1985, again, by the USITC. The study was again motivated by all these economic conditions that were really being exerted at the production sector level and they did a very good job of documenting the loss in competitiveness of the domestic shrimp trawler. They did a very good job of showing that, in fact, imports had become an important source of product and U.S. processors were becoming very dependent on imported supplies of shrimp. But the study was fairly noncommittal. It didn't lead to any sort of recommendations regarding tariffs, quotas, or any other types of trade restrictions. In particular, there was no specific analysis done on the importance of various trade policies.

This lacking led to the study completed by the University of Florida. The authors were the late Fred Prochaska, who was in the Food Resources and Economics Department at the time, and Walter Keithly, now at LSU. They felt the issues regarding the impacts of tariffs and quotas needed to be looked at very closely and very comprehensively. Thus, a study was initiated through the department and funded through Sea Grant and departmental funds. Keep in mind the conditions that were currently existing in the economy: stable production, declining prices, and increasing import levels.

The attempt first constructed a model for the demand and supply of imported shrimp products. Then

they assessed the effects at the ex-vessel price levels of changes in import volumes. Then they wanted to look at the changes in investment in the shrimp fleet resulting from changes in ex-vessel price. So the attempt was to measure or to estimate some demand and supply models. Quantity supplied was hypothesized to be a function of imported shrimp price expressed as some weighted average of foreign currency. Another variable used was some proxy of the price that Japan was paying for imported product on the world market. Then they used a market clearing constraint saying that the quantity supplied has to be equal to the quantity demanded. So we've got a complete model here that will allow us to estimate these functions for quantities supplied and demanded. The model used data from 1960 through 1981.

What they found was that a 10 percent increase in import price will reduce the quantity demanded by roughly 3 percent. Quantity demanded of shrimp is not very price responsive. In other words, as price changes, the quantity of shrimp demanded doesn't respond very much. We've got a demand curve that we refer to as fairly price-inelastic.

If we look at quantity supplied, on the other hand, as related to import price, a one percent change in import price results in about a 0.955 percent change in quantity supplied, almost a one-to-one shift. As price increases by one percent, quantity supplied is going to increase by one percent. Again, our demand curve is fairly unresponsive to changes in price. Price can change quite a bit, but quantity demanded is not going to shift very much. In addition, there is about a one-to-one shift in terms of the price of product and the quantity supplied.

The two policy options we want to look at are tariffs and quotas. The first option we'll look at is a 30 percent tariff—in other words, a 30 percent ad valorem tax assessed on imported product being brought into the country. When you do that, you're not initially altering the demand curve. As we impose a 30 percent tariff on the market, the import price is going to increase by 23 percent. The reason we don't have a full 30 percent increase in import price is because we have a trade-off between price and quantity demanded. What that's going to do is reduce the import quantity demanded by 6 percent. So a 30 percent ad valorem tax or a tariff is going to increase import price by 23 percent and shift import volumes back by 6 percent—not much of an effect. I might add that this 30 percent tariff was what was considered politically popular at the time. The notion of a tariff or a quota has not been politically popular, but the 30 percent tariff was within the realm of possibility when considering these options. So that's the reason 30 percent was chosen.

A key question is what is the effect of this taxation?

It's essentially a tax. Who's going to pay it? Roughly, 80 percent is going to be paid by the U.S. importer—the 23 percent shift is going to be paid by him. The foreign exporter will be receiving a lower price per pound, so he's going to be paying essentially 20 percent. Will the U.S. importer simply pass the full amount on to the consumer? If not, how much would he absorb? How resistant will this particular market sector be to such a policy? Remember, this is a tax and will generate tax revenues, and in this particular scenario, that 30 percent tariff would create about \$130 million in tax revenues. That's a plus. That's assuming that the industry could get its hands on those revenues to be used in either enforcement, management, or research of some form. This issue of incidence of the taxation is important. Again, how much of that is going to be passed on to consumers? The exact amount is unknown, but it's a possibility that all of it could be.

The next option is the 90 percent quota. What this means is you're reducing the available volumes by 10 percent, not by 90 percent. You've got 90 percent of the volume now available after the quota has been put in place. With this 90 percent quota, you're going to have about a 50 percent increase in import price, and by definition, a 10 percent decrease in import volumes. The question is, who gets these profits? This is not a tax. The 30 percent tariff was a tax. The quota is simply an artificial volume restriction. How is this product going to come into the marketplace? Where is this profit going to go?

There are three options, maybe other options, but three of them I will discuss briefly. First, the domestic importer could simply go out and buy on the world market at a lower price per pound and then sell at a higher price, which is the likely scenario. The domestic importer would then gain those profits. Second, it could very well be that the foreign exporter, realizing that this policy is now in place, refuses to sell at the lower price. They know that the domestic importer can receive more, so they hold out for a much higher price, and, therefore, make the windfall profits that the policy was intended to generate for the domestic industry. Finally, another possibility is that the federal government could sell off import permits and use those sales to then fund industry management or research projects. So the question with the tariffs is who essentially pays for that taxation? With the quota you're talking about who is going to end up with the profit. Those are important issues to consider when you're trying to assess the potential impacts at the various market levels of these types of policies.

The whole idea behind these potential policies is to have an effect on the production sector. At least that's one of the major motivations for the four studies that

have been done to date. In addition to the demand and supply models, there was an ex-vessel price model estimated that was expressed as ex-vessel price being a function of real disposable income, Gulf and South Atlantic landings, beginning U.S. inventories, and volume of imports. Recall, now, that both the tariff and the quota impacted the volume of imports. So that's how we are able to generate this effect on ex-vessel price.

What are the impacts in terms of ex-vessel price of these two policies? The 30 percent tariff, again, would result in a 6 percent decline in import volumes, which would then result in an 8.4 percent increase in ex-vessel price. That's holding everything else constant. When you interpret these parameters in these models, you're saying let's change one thing and hold everything else constant. There are drawbacks in terms of doing that, but that's how you interpret these parameter estimates. So, the 30 percent tariff would result in only an 8.4 percent increase in ex-vessel price—not much. The 90 percent quota, on the other hand, by definition, reduces the volume by 10 percent. It would result in a slightly larger impact at the dockside of a 14 percent increase in ex-vessel prices.

Those are the first-round effects. That's holding everything constant. That's saying that the first initial impact on the marketplace would be this immediate increase in ex-vessel price. What would be the second-round effects as the market begins to shift to this change in dockside price? One of the second-round effects would be the possible price effects through inventories. If we decrease the import volumes, we might have a negative impact on inventory levels. That's been found to play a fairly substantial role in setting dockside prices. Ken Roberts, this morning, showed us a graph that indicated inventory levels have been fairly constant over the past 5 or 6 years. But if we were to institute a trade restriction policy and have a significant cutback in import volumes, we might see some decreases in inventories. Based on this model, a 10 percent reduction in inventories would increase ex-vessel price another 5 percent. Therefore, to look at the full effect we would have to look at not only the effect of the decrease in volumes of imports but also the inventory effect. We would have an additive effect that might be greater than the 8.4 percent or the 14 percent increase in ex-vessel price I mentioned before. So effects through inventories are another possible source of price increases.

Now, let's look at how the concept can turn around and bite you if you're not careful. The final model that was estimated was a determination of fleet size. Fleet size, in terms of number of craft (boats and vessels), is a function of lagged ex-vessel price. In other words, investment this year in shrimp boats and

shrimp vessels is a result of what happened last year in the industry. That might not be too unrealistic. The final model expressed total number of craft in the fishery as a function of ex-vessel price last year and landings last year. What are the potential impacts in terms of fleet size of such a policy?

With a 30 percent tariff, the 8.4 percent increase in ex-vessel price (and note that ex-vessel price enters into the function again here so that's how we're able to crank out some numbers for changes in fleet size) results in an increase of about 355 vessels or boats. The 90 percent quota, on the other hand, again, increasing ex-vessel price by 14 percent, would result in nearly 600 vessels and boats entering the fishery. If we want to buy into the notion that we've got an over-capitalized industry out there right now, and feel like there needs to be some kind of an effort-control mechanism, then we need to be cognizant of the fact that when we introduce these kinds of trade restrictions, there could be some effects in terms of investment. If we are increasing price, that could very well entice people to invest, entering more boats in the fishery, thereby having some effect, possibly in the long run, on catch-per-unit effort and profits. In other words, the entry of additional boats and vessels could dissipate any increases in per vessel profits gained through high prices. So we may very well be defeating the purpose of the entire program unless we've got some way to control this entry of new boats into the fishery as prices increase at the dockside through restricting volumes of imports arriving in the market.

In summary, the 30 percent tariff would decrease import volume by 6 percent, ex-vessel price would increase by 8.4 percent, and we would have an entry of 355 new vessels coming into the fishery. The 90 percent quota would, by definition, decrease volumes of imports by 10 percent, ex-vessel price would increase by 14 percent, and we would have roughly 600 boats coming into the fishery.

The model was estimated in 1985. What are some of the major changes that have taken place in the industry that would possibly alter the empirical relationships that were found? Obviously, we've seen some changes in price. We've also seen changes in quantity, particularly as Chinese shrimp have been arriving in record volumes, as well as the increase in Ecuadorian imports over the past 6 years. Those may likely not have much of an effect on the parameter estimates because all you're doing is changing quantity and price as you're sliding up along those curves. You're not changing the parameter estimates or the slopes of those curves. What you want to assess is what has happened in the marketplace that would change the slopes of those curves?

One possibility is that real disposable income has been increasing. Since the recession in the early

1980's, we've seen an increase in real disposable income. Per capita consumption has been going up. In essence, the demand for seafood products, particularly for shrimp, has been increasing. The market is becoming stronger and stronger. What that could possibly have done is made demand even more price-inelastic. In fact, if the model were re-estimated now we might even see more of a price impact from these two policies.

In addition, we've had a weakening of the U.S. dollar on the world market. During the early 1980's, when imports were really beginning to climb, as mentioned earlier, the U.S. dollar was very strong on the world market. In the past 3 years, it has begun to weaken substantially. Would that have had any effect on the nature of product supply entering into the U.S. market? In regard to the major countries exporting shrimp to us, our dollar is still very strong with them, so there may not be much of an effect even though in balance the dollar has been weakening. Also, world markets operate on flexible exchange rates, and our major trade partners are intrinsically related in terms of our trade patterns. So given flexible exchange rates, the old theory that as you weaken the dollar you decrease imports and increase exports may not have as much validity as it did in the past. Also, a major country that is now in the market that was not included in this particular analysis was China. So the relationships that would need to be included with that particular country in its major role in the marketplace were not included in this particular model. I'm not quite sure how that would affect it, but that is one major source of product that was not included.

I think Ken Roberts raised a few very important points this morning in that when we are looking at these import patterns and trends over time, we need to be very careful not to look at a "broad brush" of what's going on. This particular model did that. It didn't break out size categories. It didn't break out countries of origin or cold-water versus warm-water shrimp. Ken pointed out very clearly that even though imports have been increasing, we have seen particular increases in size classes and product forms. This model could be improved substantially by trying to focus on that. The tariff and quota might have more of an effect on particular size classes or more of an effect on certain regions in the Gulf as opposed to other regions because of potential dominance of size classes at certain times of the year in various regions. That would be an improvement to the model as it now stands.

Walter Keithly at LSU is currently in the process of revising the model and incorporating some of these more disaggregated concepts into the model. He has found, though, that incorporating the last few years up through 1987 into the model, actually the relationships have changed very little. I think if we can get

away from prices and quantities and just focus on those percentage shifts, they are still fairly valid.

You need to be cognizant of the fact (and this has been brought up several times this morning) that these kinds of policies have pros and cons. Import restrictions, theoretically, have positive benefits. They have a potential direct positive impact on domestic ex-vessel price. Also the inventory effect may apply upward pressure to ex-vessel prices due to reducing inventories. Import restrictions may provide some sort of short-run relief from the price/cost squeeze and, possibly, in essence, reduce our trade deficit on shrimp. So there are some positive benefits, not to mention the tax revenues that would be generated through the 30 percent tariff that could be used by the industry.

However, there are some negative attributes to the policies. Processors have become very dependent on imported shrimp. LSU and the University of Florida are currently involved in a Gulf and South Atlantic Fisheries Development Foundation-funded study to look at the growing dependence by shrimp processors in the Gulf region on imported shrimp. It's no surprise to anybody that, in fact, they have become very dependent. Everyone's saying "if you cut shrimp imports back we can't stay in business." I think that's no news flash! We're trying to not only look at the changes in dependence or the increase in dependence, but also where is this product going? What particular market channel is it better suited for? Are there particular product forms that imported products or aquacultured products are being directed to? Or are there specific market channels that aquaculture shrimp products are being directed to? If there are policies put in place that would restrict aquacultured shrimp or imported shrimp, then we need to look beyond the dockside and into the marketplace and see what impact it's going to have on consumers, on retail buyers and other market levels in the system. By reducing imports, we may jeopardize the economies of scale that the processors are enjoying right now with the large volumes of imports they can move through their plants. We could possibly increase the seasonal variation in the availability of shrimp products and thereby disrupt

the consistent local employment in communities where shrimp processing facilities are important to the local economy.

As ex-vessel prices increase, how much of that is going to be passed on to consumers? Disposable income has been rising. We've had recessions in the past. We could very well have recessions in the near future. If retailers push consumers too far with increases in price of shrimp products, that might have a detrimental effect on the growth we've been seeing in per capita consumption. How strong is that market out there for shrimp products? How strong is the market in general for seafood products? It could very well be that a recession could dampen the growth in the seafood market in general and in particular for shrimp. If we increase the price at the dock and it's passed on to consumers and then we encounter recessionary conditions in the economy, how will the market respond? Also, the administrative costs need to be considered. How would you go about administering such programs?

So, in essence, these kinds of import restriction policies could serve as double-edged swords. On one hand they may have positive attributes that need to be assessed and considered. But I think it is equally as important that we need to be aware of the potential negative attributes of these kinds of restrictive trade policies.

Are they politically acceptable? I think right now, given our current Administration, politicians probably would not entertain these kinds of policies. Who knows? I don't know what President Bush is going to do in terms of our trade agreements and in terms of trying to maintain the policies established over the past 8 years, whether they be good or bad.

The tariff and quota issue is certainly one that needs to be looked at. I think the initial attempt by Prochaska and Keithly to look at some of the basic relationships and basic impacts was an important contribution. I think if it's something that's going to be looked at more closely by the industry, then there needs to be much, much more research done on it and done on a much more disaggregated level in the future.

The Bycatch Issue

Scott Nichols

Chief, Resource Surveys Division
National Marine Fisheries Service
Pascagoula, Mississippi

I guess the finfish bycatch has come up in at least one talk, perhaps two, this morning. About 2 years ago, we were asked to make some updated estimates of the bycatch based on whatever data we had on hand for the Fisheries Management Councils. What I want to do is go through the information that has been passed to the Council based on the data on hand.

I want to talk to you about the data sources themselves. We don't maintain a data collection program on bycatch anything like we do the commercial shrimp statistic program and, therefore, we have to estimate bycatch in the shrimp fishery by fairly indirect means. I'll give you the results of some of those estimates, both in terms of the total quantity and the catches on some selected species. Of particular interest to commercial and recreational fisherman are some of the estimates of the catches of the less common species caught in shrimp trawls. We do have some estimates of the approximate levels for a good many of those species. I will talk a little bit about the cause and effect. The issue here is there have been some notable declines in standing stocks of a number of the finfish species, particularly the sciaenid family—the croakers, drums—in the Gulf of Mexico, and it's a knee-jerk reaction. "Well, it must be because of the shrimp fishery bycatch." I will show you that while there's certainly an important consideration there, the evidence is rather circumstantial. And I'll talk a bit about information needs, if indeed the Councils wish to have more detailed information on bycatch before making any decisions.

We do have, in our files, three sets of data that are direct observations by observers on shrimp boats engaged in commercial shrimping to estimate and measure bycatch on these vessels (Figure 1). These studies are fairly old. They were, in some cases, opportunistic, and in two cases, directed at other research. But they do provide at least some direct observations of about 15,000 hours of shrimping that did produce data relevant to the bycatch question.

The first of these was a directed bycatch study back in the mid-1970's. There were some observations that continued into 1981 as part of that study. We did place observers on vessels for the specific purpose of measuring the amount, species composition, and size com-

position, of bycatch. These were somewhat opportunistic. Of course, there was no requirement that anybody carry an observer, but we did arrange a fairly widespread program that collected a lot of data at that time. In the two other programs a little bit later in time, there were observers placed for direct observations of turtle catches, and for evaluating TEDs, that did provide some direct observations of shrimping activity and the amount of finfish caught.

We have a much longer time series available of our standard resource survey and SEAMAP cruises. These don't operate in any way like a commercial shrimping operation, and of course, we would not expect the catch rates of finfish on these cruises to be necessarily very close to what would occur on commercial shrimping vessels. They do give us a longtime series handle on the abundance of the finfish species in question that we can take into account to make our estimates. We basically have direct observations of what catch rates were during periods of known abundance, we have continuous estimates of shrimping effort from our commercial statistics program, and we have fairly continuous estimates of the abundance of these species from our resource surveys program. Therefore, we were able to generate a time series of estimates of the bycatch. Now keep in mind, we make no bones about it. These are not the same level of rigor, if you will, of our commercial statistics or even

DATA SOURCES

Projects	Year								
	72	74	76	78	80	82	84	86	88
Bycatch	██████████								
Turtle Catch					██████████				
TED Evaluations					██████████				
Resource Surveys	██								

Figure 1

BYCATCH STUDY AREAS

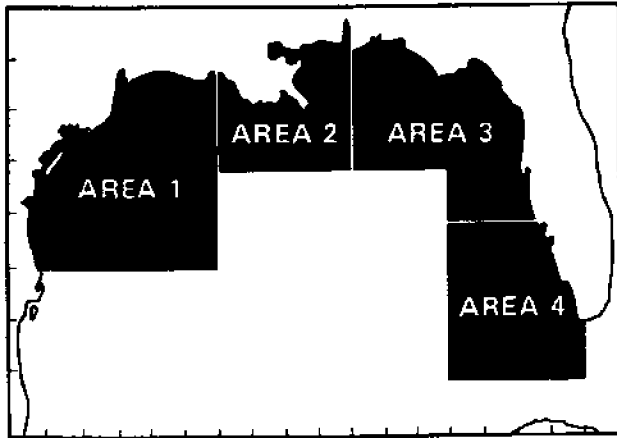


Figure 2

our recreational statistics. These are the data on hand and under the law of the Fisheries Conservation Management Act, they are the best available data and the ones that the Councils must use in their decision-making processes.

The studies were actually divided into separate areas. I'll focus primarily on the local area. When it actually came to making the time series estimates, we found that we did not have enough data down off the southwest Florida area to even make the estimates, so some of the estimates I'll give you a little later apply to the other areas (Figure 2). Also, a very serious limitation—they apply only offshore, essentially from the barrier islands outwards. We had only a scattering of observations inshore. There are virtually no direct observations of shrimping operations inshore and, therefore, we felt we could not make any estimates of the bycatch quantities. Based on sketchy observations there, we do have some indications of the rough amount of total bycatch, but nothing to estimate catches of individual species. That's probably the biggest unknown area still to be addressed.

We estimate that bycatch of finfish by the shrimp fishery is probably in excess of 1 billion pounds most years (Figure 3). It, of course, is so large not because any individual shrimper catches so much, but because there are so many shrimpers. As far as the local area is concerned, we have a breakdown of the species composition (Figure 4). This is primarily based on data that was taken in the 1970's. The species composition would be a little bit different today. There would be less croaker and, in a relative sense, the bycatch would be more dominated with long-spine porgy. The data suggests that for every pound of shrimp caught, something on the order of 10 pounds of fish are caught.

ANNUAL SHRIMP TRAWL FINFISH BYCATCH (Millions of Pounds)

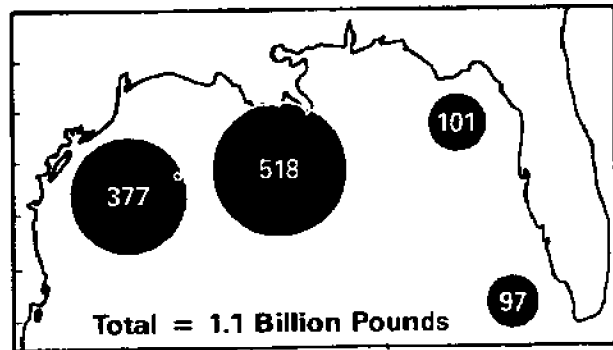


Figure 3

Again, the direct observations are rather old. The standing stocks out there for some species have changed considerably and, therefore, it seemed unwise to just take the bycatch estimates based on data from 1975 and say that's what's occurring today. We did make an attempt to extrapolate based on the ratio of the catch-per-effort of the shrimp fleet in direct comparison to catch-per-effort of research vessels working in the same area. We're not saying in any way that we catch the same thing. It would be different for every species. For species that are distributed, like

AVERAGE SHRIMP AND FINFISH CATCH NORTHCENTRAL GULF (AREA 2)

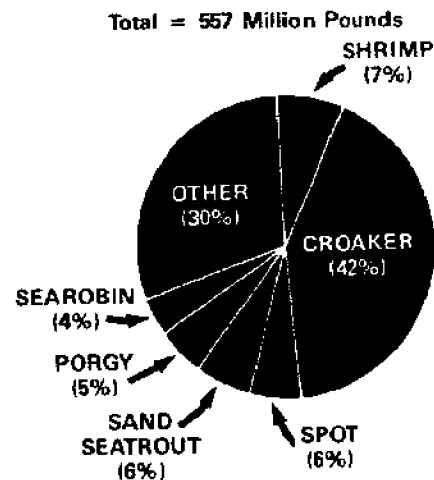


Figure 4.

SELECTED SPECIES

Problem: How to extrapolate discontinuous data to a more recent period—1985

Approach: Use research vessel data in a linear model where:

$$\frac{\text{CPUE Shrimp Fleet}}{\text{CPUE Research Vessel}} = \text{Constant}$$

Stratify by season and area

Limit to offshore waters and exclude Area 4

Figure 5

shrimp, shrimpers would probably have a higher catch-per-effort than the research vessels. For many species that are distributed much differently than shrimp, the research vessel catch-per-effort would probably be considerably higher. If you are willing to make the assumption that the ratio of catch-per-effort of the shrimp fleet and catch-per-effort of the research vessels is relatively constant, you can go ahead and make an estimate. That in itself is probably not a bad assumption (Figure 5).

We did so, and I have some estimates using a statistical technique. I won't go through any of the details of that. But we did come up with estimates (and these are averages over a 13-year period) of the numbers of target fish species caught in the shrimp fishery (Figure 6). Bycatches are dominated by croaker, the most abundant trawl-caught fish in the Gulf of Mexico by a considerable margin. If you look

LINEAR MODEL OFFSHORE BYCATCH ESTIMATES

Species	Millions of Fish
Croaker	1,500.0
Trouts	147.0
Catfish	43.0
King Mackerel	0.2
Spanish Mackerel	1.3
Red Snapper	12.0
Red Drum	0.13

Figure 6

at the catch in this area, and particularly just west of the Mississippi River Delta you find the catch is dominated by croaker much of the year. Species like king mackerel, Spanish mackerel, and even red snapper would be fairly inconspicuous in that catch. The potential problem arises because of standing stocks of king mackerel, Spanish mackerel, and red snapper are considerably lower than they are for croaker. So the possible impact that these much smaller catches may be having on those stocks is an area of some concern.

This concern was addressed by the NMFS Miami Stock Assessment Group, who took our bycatch estimates, did the same type of bookkeeping that we do for stock assessments of directed fisheries, adjusted for mortality, and estimated the survivorship rates. They looked back and estimated the amount of recruitment that went to support the shrimp fishery bycatch. They asked themselves, "if the shrimp fishery bycatch suddenly stopped, what potential would be there for increase in yield?" Red snapper (Figure 7) had the largest potential. I suspect it's because red snapper tend to be distributed out in the open Gulf, and along shore, very much the way brown shrimp are. Indications were that yields to the directed fishery for red snapper would increase 60 to 90 percent if the shrimp fishery bycatch did not exist. King mackerel yields would increase 20 to 30 percent and Spanish mackerel yields would increase 40 to 60 percent. The shrimp fishery is a user group that takes a fairly sizable share of the potential production of these species.

Let me switch topics slightly and talk about what we've seen in trends in abundance in the area that we've designated the primary area for our groundfish surveys (Figure 8). We've run surveys in this area, particularly in the fall of the year, and we have a con-

POTENTIAL YIELD INCREASE WITH NO BYCATCH

Species	Percent Increase
Red Snapper	60 to 90
King Mackerel	20 to 30
Spanish Mackerel	40 to 60

Figure 7

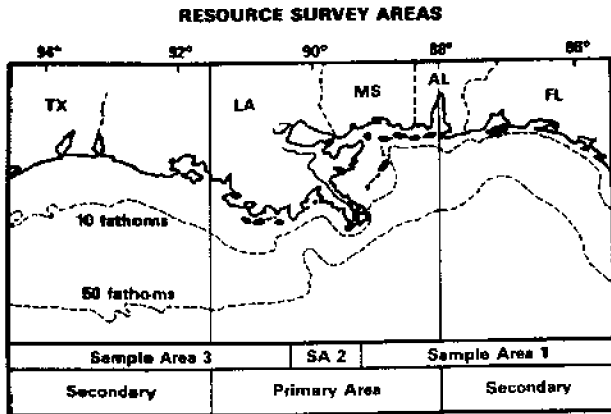


Figure 8

tinuous time series from 1972 through 1988. There have been some fairly major changes in abundance of croakers, trouts, and drums in this area. I'll step through what, I think, suggests that shrimp fishery bycatch, although definitely not the sole contributor to the situation, it is certainly associated with it. We had a fairly steady drop in our catch rates, expressed as a biomass estimate of kilogram per hectare in our fall trawl survey. Although things vary quite a lot from year to year, catch rates have dropped substantially and steadily over the 1972 - 1988 time period (Figure 9). If you plot that catch-per-effort, that biomass estimate, for just Atlantic croaker, which has made up the bulk of the catch, until most recently, (now it's down until it's approximately level with the quantity of longspine porgy in the catch), its catch rate had a substantial drop during that period (Figure 10).

The obvious question is, "are these declines due to environmental factors? Are they directly due to the bycatch, or is there something else?" Again, I can't answer this totally at this time. We had a strong upward trend in shrimping effort in the area surveyed over the same period of time (Figure 11). Again, considerable fluctuation year to year, but a fairly steady upward trend. If we then plot the catch-per-effort in the research surveys against shrimping effort, there is a pretty strong association (Figure 12). During time periods of low shrimping effort there was high biomass and during time periods of high effort there was pretty low biomass out there. Clearly, anything else that changed in a linear trend over time would also show a similar behavior.

One thing that does suggest that fishing is very much a part of this biomass reduction would be the **average weight** of the fish caught (Figure 13). That has dropped substantially over the time period. That sort of a drop in the average weight tends to be very

BOTTOM TRAWL FINFISH

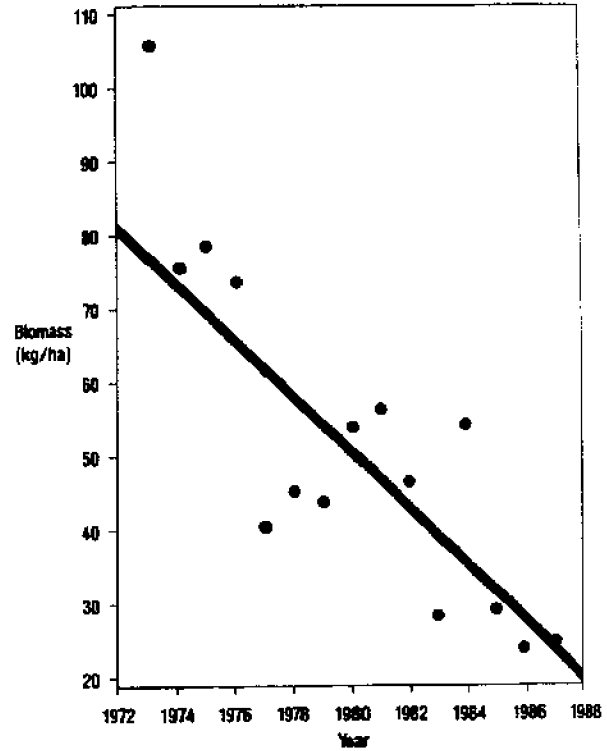


Figure 9

ATLANTIC CROAKER

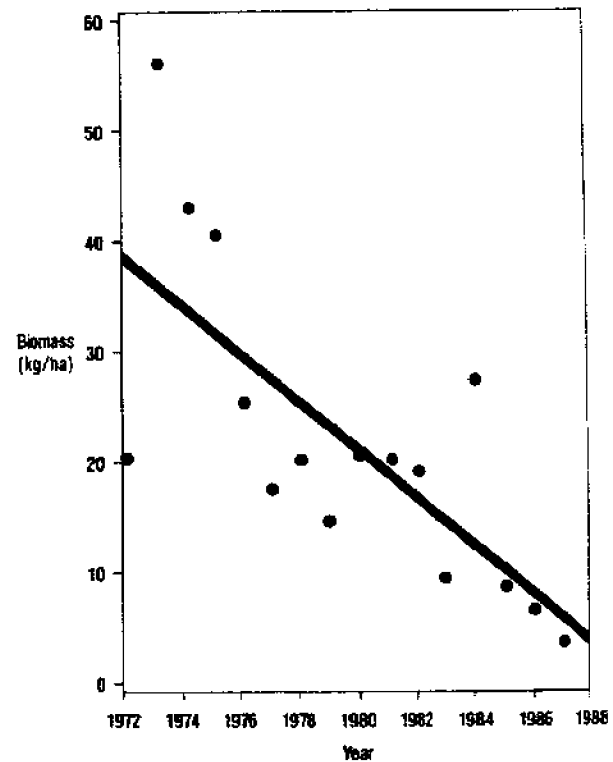


Figure 10

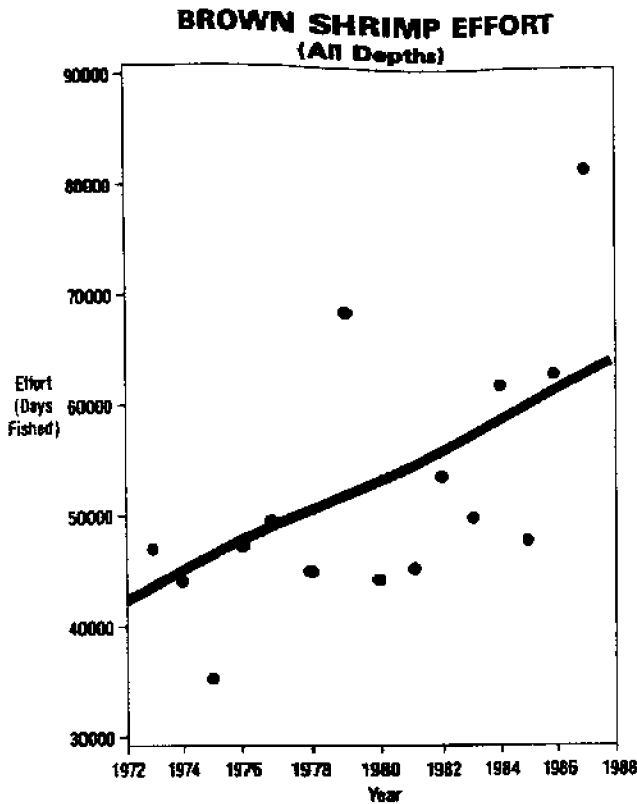


Figure 11

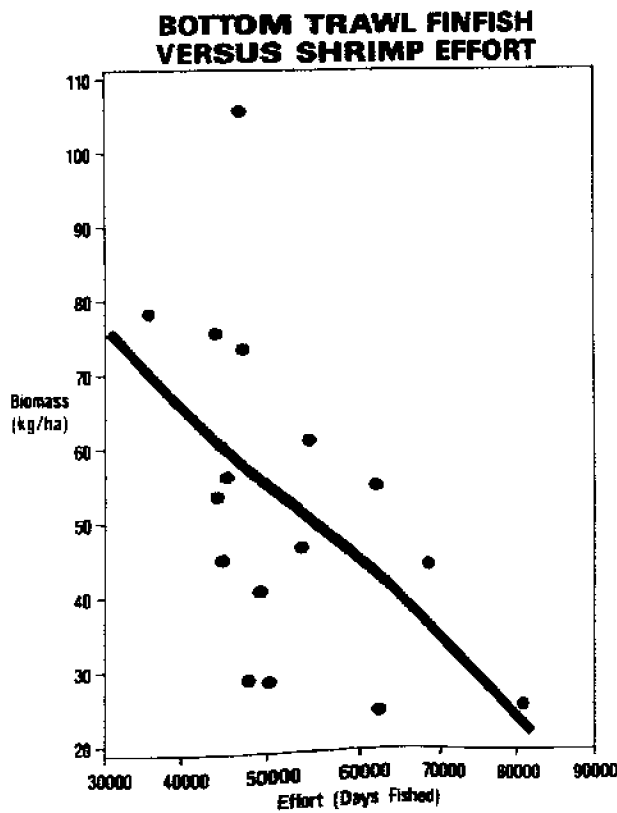


Figure 12

much associated with increased fishing pressure. Again, it's a circumstantial indication that the finfish catch in the shrimp fishery may be an important part of the reason for that decline in standing stock.

As far as there being an environmental cause, if it were purely an environmental cause, I think we would tend to suspect declines across the board in all species. That's not really the case. Most of the declines have been in the estuarine dependent species. We've seen declines in Atlantic croaker, catfish, spot, sand and silver sea trout, which are estuarine-dependent species. Much of their life cycle is like the life cycle of the penaeid shrimp. They go through a estuarine phase. Some of the more offshore species have also shown fairly significant declines.

A number of the other species that tend to be both a little more off-bottom and a little less estuarine-dependent have stayed fairly stable over the period, including the butterfish, longspine porgy, some of the sea robins, and sea basses. Blue crab has increased over the period (Figure 14). Is the shrimp fishery responsible for the decline in the finfish stocks? I think given the rates of shrimping and the catch rates, it's almost certain shrimping is contributing. But in terms of actually partitioning it out, if you viewed it as a problem of what is responsible, I cannot, at this

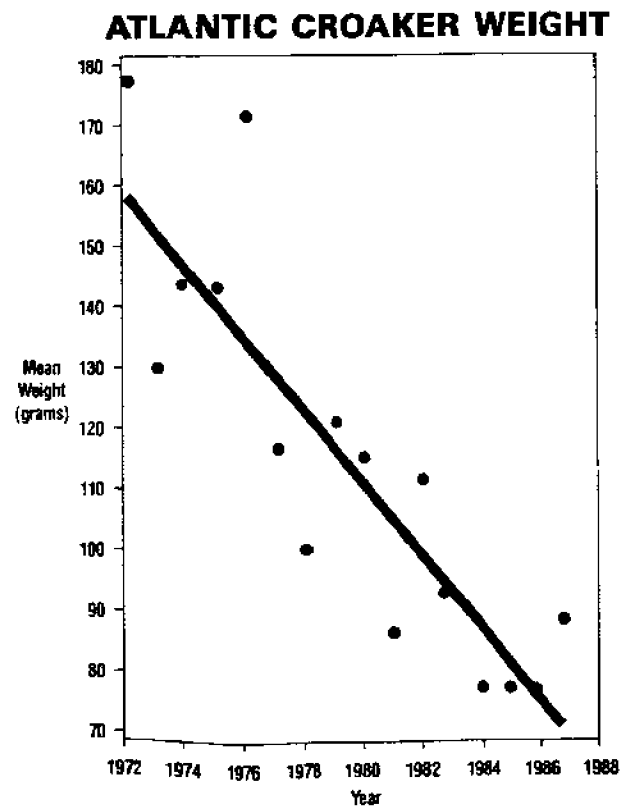


Figure 13

ENVIRONMENTAL CAUSE

Estuarine Dependent	Estuarine Independent
Atlantic Croaker —	Gulf Butterfish 0
Hardhead Catfish —	Longspine Porgy 0
Spot —	Blackfin Seerobin 0
Sand Seatrout —	Rock Sea Bass 0
Silver Seatrout —	Lesser Blue Crab +
Inshore Lizardfish —	
Atlantic Cudasesh 0	

Legend: — Significant decline 0 No change + Significant increase

Figure 14

time, assign how much is environmental and how much is fishing.

In terms of future needs, it certainly seems the Council is interested in making decisions in this area, and continuing to monitor the standing stocks of the

offshore species is a very vital part of that. The updated estimates of the bycatch are very important since the last directed observations of actual commercial shrimping activities that occurred in the offshore arena took place back in 1982. There is one small project underway now in Louisiana that is looking at the inshore and near-shore bycatch. There is a lot of work that is yet to be addressed in terms of assigning cause of the downward trends that we've observed in biomass (whether it's a fishing cause or an environmental cause). And, if bycatch is seen as a problem, there has been very little investigation to date of the technical options for reducing bycatch. The options do appear to be fairly promising. None of the TEDs that have been developed were developed to reduce bycatch, but The National Marine Fisheries Service TED, in fact, does reduce bycatch. I don't think any of the others have been tested for bycatch reduction, but the rigid TEDs seem to have some potential. If the hue and cry went up to come up with a technical means of reducing bycatch, there is probably good potential there.

Methods of Improving User-Group Input into Resource Management Decisions

Vernon Bevill

Executive Director

Mississippi Department of Wildlife, Fisheries, and Parks

Jackson, Mississippi

I appreciate the opportunity to be here with you today. As indicated, I am going to talk with you a little bit about the user group involvement that I see necessary to good decision making in governmental agencies. And to get to that point of discussion, I think I will share first with you a little bit of the things that drive the philosophy of management style of Vernon Bevill.

We are all products of our environment. I grew up in a family-owned grocery store in Mansfield, Louisiana. My daddy left me with a thought that I have not been able to shake and have found to be true time and time again. And the thought goes something like this: you can slap a man across the face with your left hand and pat him on the back with your right hand

and don't expect him to feel the pat. Treat folks like you would want to be treated, I think, is the essence of that statement.

When I went to college at Louisiana Tech, one of the cliches that has stuck with me revolves around the notion that 90 percent of wildlife and fisheries management is people management. If you can't bring the constituency along with you, you've got big-time problems. Being able to work with people to the betterment of resource management is the key to good resource management. In that same vein, I recall a biologist in Louisiana noting to me, "Son, I don't care how dumb, ignorant, and stupid the most basic sharecropper you ever cross paths with seems to be to you, if you will listen to him long enough, sooner

or later he's going to tell you something you didn't know." That ties into another cliché I heard—that knowledge is power. And I hope what we're here about today is the dissemination of knowledge for the betterment of all. The dissemination of good and proper information is what is going to lead us through the maze in which we find ourselves in the last of the 20th Century in the resource management arena.

The ability to work with one another in a constructive way is the ability to solve problems. If we cannot work with one another in constructive ways, we cannot find constructive solutions. I said at a public hearing in Wiggins, Mississippi, last year and I wasn't talking about shrimp, I was talking about deer hunting, but it applies, "If extremists could solve problems, there would have been peace in the Middle East in Jesus' time." I don't think that the resource management problems that we face in the late 20th Century will be solved by extremists and extremism approaches. They will be solved those who are willing to find and stand on the middle ground of good resource management.

Another comment I have had stick with me since the first day I went to work for the South Carolina Wildlife Department as a turkey biologist was made to me by a biologist named Robert Gooding. He observed to me as we drove from where I was stationed in Edgefield, South Carolina, to Columbia, South Carolina, that the piecemeal destruction of our fish and wildlife resource still results in the same end: it's destroyed.

So I will come to you very pointedly and tell you that my philosophy of management first and foremost puts the productive capabilities and care and stewardship of the resources above the uses of man. That might ring a little contrary to some of your thought processes, but think about this just a minute. If we don't put the resources that God gave us dominion over above our own greed, then our greed will destroy those resources. We have to become good stewards in the late 20th Century if we are going to have a 21st Century. It strikes me kind of poorly that in my lifetime the two most abundant resources on the face of the earth—air and water—have become the most unusable in this 44-year period of time that I've seen than they have been contaminated, destroyed, and disrupted in all those several billions of years that this old earth has spun around the sun. In the technology age that we are in—and some of us sometimes think that technology is the solution to all woes; I submit to you that technology has put us where we are—on the brink of destruction of a lot of things. While technology is a curse, it is also a blessing because technology and the wise application of it can help us solve some of the problems that we have talked about today.

But technology in all its capability is a useless tool

in the hands of people who have no knowledge of how to use it. And we have done a very, very poor job, and there are a lot of very learned people in this room who have done some tremendous work. But government, both state and federal, has done an extremely poor job of imparting that wealth of knowledge and information that could equate to great opportunity to the people who use the resource. Trying to dovetail what we know with the users' need has been a misfit ever since I've been in this business. In fact, when I came into this business, I know for a fact that government tried as hard as it could to keep the public, to keep the users, to keep its constituency at arms' length. We went through a tremendous growth opportunity and capability and knowledge to manage the resource, but we did a very poor job of trying to bring our constituency along with us. And now we find ourselves in the late 20th Century with a gap of sorts, several gaps as a matter of fact, and they all boil down to one big gap—it's called a credibility gap.

When I came to Mississippi, I didn't find any particular difference here than I found in the other two states that I have spent time in. We have done a poor job here of working with people, just as I felt like we did a poor job in the other two states of being good communicators and facilitators of opportunity in federal resource stewardship and management. I had a lot of opportunity to think about how to do a better job, and I am absolutely convinced that we have to find ways to merge the thought processes together in ways that are going to help facilitate good decisions about resource management.

They are not easy decisions. We have the privilege of working in this business at a time when all the easy decisions have been made, folks. It's the hard decisions that lie ahead. It's the tough decisions, and they are tough for several reasons. One, because the environmental stress that has taken place to this point has put a lot of these resources on the brink of collapse. The downward trends and trendlines of species that we see now, particularly in the Gulf of Mexico, concern me. And yet, 25 years ago, a fisheries biologist would have told you that you couldn't overfish a 10-acre farm pond. We have learned a lot in the last 25 years. But we've done a poor job of imparting what we've learned to the people in terms that will make things dovetail together and work for the betterment of all. That brings me to the point of my topic: how do we go from this point forward and build better working relationships through better communications that lead to better, stronger, more applicable decisions? Not easy decisions, but applicable decisions.

The Department of Wildlife, Fisheries, and Parks, like any public agency, gets information through a number of sources. We get information in forums just like we're here about today. We get information and

we dispense information through the telephone, through the public hearing, through correspondence. We get information through petitions and our response to petitions. We get information from facilitated workshops. I'm going to call Chris Snyder forward in a few minutes to talk to you about an upcoming facilitated workshop. And we get information through the survey, either mail surveys and/or telephone surveys. There are lots of ways to manage resources well, there is no one exact way to manage the shrimp resource exactly right. There are lots of methodologies that can be applied to manage shrimp or deer or whatever and do it well, if you set forth the right parameters within the goals and objectives of how you would go about doing it.

There's lots and lots of state and federal case law that says that in this country the fish and wildlife resources are held in trust for the people by the state. In other words, I own those shrimp out here just as much as anybody in this room owns those shrimp. So it is incumbent upon government to be good stewards of those resources for all the people, not just for a few of them. If we do our job of protecting the resources, then everybody benefits and, hopefully, everybody profits.

I have had the opportunity to sit here and listen to some discussion about imports and those kinds of things, and I submit to you that while the local economy and the local industry may have its woes and troubles, we in this country, through our knowledge base, are much more capable of bringing our resources back than are many of these Third World countries. These Third World countries are exporting their resource at the expense of and probable disaster of, in my opinion, many of these resources. It is going to be incumbent upon us to get our mess fixed to the greatest extent we can so that when that happens, the demand is still going to be there. Maybe we can then better fill that void if we do our job today and make good decisions today for tomorrow.

The facilitated workshop is one of the greatest tools I think we have available to us in the late 20th Century to build good interlocking communication between the professionals that manage the resource and those who use the resource. To me, the most important facet of what drives the facilitated workshop is, in one word, consensus. There are lots of different

thoughts that come out through the facilitated workshop methodology that are laid on the table for consideration by a manageable sized group. If we were going to have a facilitated workshop today, we would have to break up into about three or four groups to do that well because facilitated workshops work best when there are a maximum of a dozen to fifteen people around that table working together. I think we have a lot of opportunity to lay good information on the table for people to consider so that wise management decisions come out of the facilitated workshop approach to management. You use facilitated workshops to shape the issue, shape the management options, shape the regulatory options, and get them ready for public consideration. To me, in government, the facilitated workshop is not a means to an end, it's just a start in the process of reaching good decisions.

Lastly, I think a tool that has been underutilized in this state but I think represents an opportunity that is very much in front of us is the comprehensive mail questionnaire. You lay before your constituency, whether they are shrimpers or deer hunters or whichever group of constituents you are trying to deal with, good, sound management opportunities and let them "roll their own." You let them tell you what most suits them. I think that's part of what good governing is about. We are managing these resources for the people. Let the people be a part of telling us how best they would like to see those management options applied. That doesn't say you give the people in the survey ludicrous management options. You give them sound management options and let them tell you what types of options they would like to see you pursue.

These are the two things that I think we have a great opportunity to use as tools to improve better management of our resources because I think they create excellent lines of communication and improved understanding of what the resource circumstances are, resource needs are, and what the people needs are.

To sum up my management philosophy very clearly for you: I believe in participative management. I think that's the only way to go. We in government can't make decisions in a vacuum, and we can't be all things to all people. But I think we owe the people that we serve to become better listeners, and that's what we're going to try to be.

Methods of Improving User-Group Input into Resource Management Decisions

Chris Snyder

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As resource managers, we basically use regulations as the tool to accomplish the management goals that we set out. The law requires that we hold public hearings to get input from the public on these regulations. What we've found in the past is that these public hearings have been one of the worst enemies that we have as far as relating to the public that we're supposed to be getting input from. Primarily, it's because it's the only opportunity the public has had to speak. And when you only have one opportunity, you end up saying what's on your mind. So rather than public input, these usually turn into gripe sessions. No good input is received by us, the managers, and the public feels that no one has heard what they have said.

In looking at how to improve input, we looked for a different way to do it that provides good input to us. We've found that people don't want to go to public hearings. We don't because we end up being griped at all the time, and the public doesn't want to come because they feel that the decisions have already been made. The facilitated workshop process is one way to try to get people involved on the front end.

What we're doing right now is addressing what has been one of the most heated, controversial issues we've dealt with in recent times, and that's the live bait industry and the use of some of our estuarine waters by that group. Rather than us deciding what sort of changes we want to make, we've begun these facilitated workshop processes. As Mr. Beville stated, it's to be done with a small group of people. There are one or two ways you can do that. One is to invite everyone to come and break them into small groups. The other way is to try and have representatives of the larger groups come in, sit down, and make input for the entire segment.

That's what we're trying to do with live bait right now, to have the live bait dealers select a small group of 10 or 12 representatives to come, sit down with us, and make input into what they would like to see done across the board. There are no regulators or managers there. My role is not to answer questions, not to discuss the issues, but to help this group sit down and go through the process in an orderly manner and come to the conclusion. The way we do that is by a several-

step process where each person identifies their concerns and issues they want to talk to. Then once we've done that, the group discusses these issues, categorizes them, decides which ones are the highest priority, and then develops recommendations or solutions based on those priorities that have been established.

What you find is that you get out of that adversarial atmosphere. Our managers are not in the room. It's the bait dealers, in this case, who will come. So we write everything they say on wall charts so everyone knows that what they've said has been noted. It's based on a group consensus building process with the theory that a group will make a better decision than an individual. That's what we try to do. We've done it on a number of issues and we've had good results and we've had less-than-good results. But, in every case where we have used this process, the people who participate feel good about what they've done. Some of them are in the room today who have been to some of these workshops. Our people feel good about it because when they participate, they feel they have received genuine input. There's a little bit of complaining that goes on, and that's okay. We all need to say things sometimes.

What we're doing with the live bait issue is trying to get something more than emotionalism out of it—a real working consensus on solutions to the problem. After we meet with the live bait dealers, have gotten their input, and, essentially, helped them decide what they would like to see in a logical manner done in their industry, then we will take a smaller group of them and meet with our biologists and managers and go through the same process to try and see if we can make their input meld and work with good, sound, biological principles.

When we have done that and get something that we feel is a good consensus of this small a group, then we take it to a public hearing and the general public can come and comment.

We've found in the cases where we've done this that the response is extremely good from the public. The public hearings are not just gripe sessions, or they're not just us talking to no one (which is the other thing

that happens--no one shows up). We've done this with the blue crab and shrimp trawler issues. We've done it on some finfish issues. We find that we don't always get the perfect solution. In fact, on the blue crab workshop, we got a solution that everyone didn't like but everyone disliked equally. It was a consensus compromise that everyone felt was fair and something they wanted to try. It was a beginning of a working together process between groups that were conflicting. We're trying to do the same thing on a number of issues. I believe that as the public learns how this tool can be helpful to them, and we as managers learn how we can use it, it will accomplish the ultimate goal, which is to be able to sit down together and make some of the really tough decisions that we have to

make in the future if we're all going to survive with resources at the level that we have today.

I feel very positive about it, and I think that the Bureau staff members who have participated and the user groups share my feelings. It's going to take a while to get everyone involved and to get people comfortable with it. But as far as my experience with public hearings and people walking into my office and complaining versus my experience with this, this is a far better way to go about dealing with the public. We feel confident and comfortable about the idea and believe that those who have participated do too. That's basically what we're planning to do and how we're approaching getting better constructive input from users in the future for our programs.

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