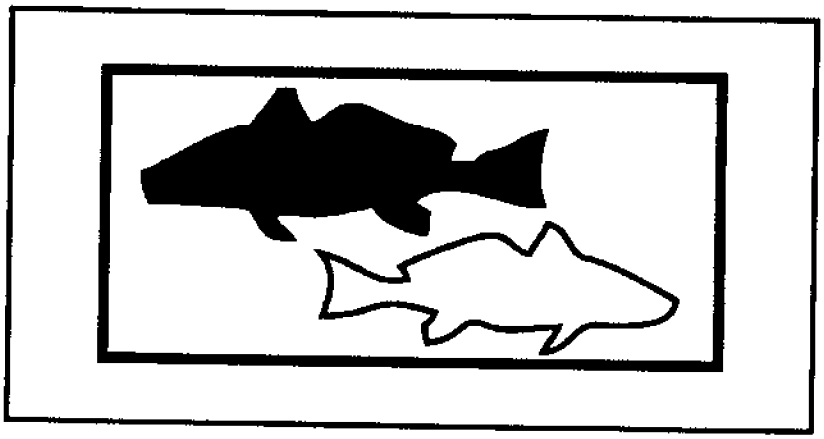
Proceedings
from the
North Carolina Marine Recreational Fishing Forum



An Overview of the Fishery
Status of estuarine, reef and pelagic species
Status of the environment
Economic issues
Fisheries management in the Southeast
Resource conservation programs

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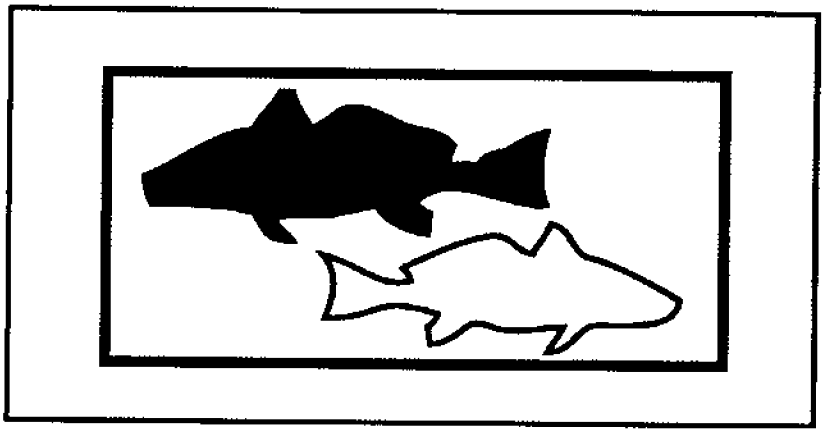
Proceedings of the First Annual

North Carolina Marine Recreational Fishing Forum



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This forum was convened to discuss the latest in fisheries management and research issues and to update the status and health of the fishery and the environment.

Moderated by Jim Murray, director of Marine Advisory Service for the UNC Sea Grant College Program.
Edited by Jim Murray and Jeannie Faris.

Feb. 1, 1992

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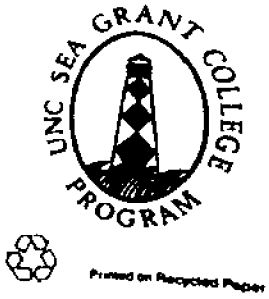


Table of Contents

Status of the Fishery

Estuarine Species

Bill Hogarth has been director of the N.C. Division of Marine Fisheries for six years. Hogarth earned his Ph.D. from N.C. State University in 1976.

Probably most of you know that over 90 percent of North Carolina's economically important species, both sport and commercial, are estuarine dependent. That means that they spend part of their life in the estuary, and they depend on the estuary for part of their growth and reproduction.

These species include red drum, spotted sea trout, weakfish, striped bass, croaker, spot, flounder, black sea bass and even Spanish mackerel. Such species use the estuarine areas for spawning, feeding or migration, and they could not complete their life cycle without the estuary.

North Carolina is very fortunate to have such a vast estuarine system. I think we all would agree that is one of the reasons we have such a good fishery in this state.

When we discuss the estuarine species, we will talk about the fish stocks and their status and how the actions of man affect their biological conditions. The fishery is the system that is built around the stocks, particularly the harvesting activities and the activities that take place before and after harvest.

The status of the estuarine recreational fishery in North Carolina is surveyed by recreational port samplers and a telephone survey. The telephone interviews are used to collect data on the number of trips made, the fishery location and when these trips took place. Then, from the intercept data, we get the catches and actual species, number, length, weight and sex.

We in the Division of Marine Fisheries (DMF) have increased the accuracy of the recreational fishery data by quadrupling the number of intercepts from 1987 to 1989. In total, they are eight to nine times higher than pre-1987.

When I discuss the recreational fishery, I will talk about it from 1987 on, because that is the only period for which we feel comfortable with the North Carolina data.

Today, we use a lot of the commercial data to look at status because that is a longer-term base. And though we feel it is underreported, it at least gives us some idea of the fluctuations in harvest. The estuarine species have fluctuated tremendously over the years, with most species reaching a high point in the 1980s. And if you look since then, they have fallen off quite a bit.

We are all aware that there used to be a great deal of outboard fishing in the Pamlico Sound for croaker and weakfish. There are very few doing that now. We keep hearing this type of information. There used to be a large sportfishery in the Albemarle Sound for striped bass and white perch. This has also declined.

For all areas, estuarine and ocean, an average of 1.2 million saltwater anglers take about 4.1 million trips annually in North Carolina. The number of fishermen and trips have fluctuated since 1987.

About half the anglers fishing in North Carolina are from other states. About 27 percent are from non-coastal counties, while 23 percent are from coastal counties. North Carolina ranks second on the Atlantic coast after Florida in the number of non-resident recreational fishermen.

North Carolina's total recreational coastal catch, estuarine and ocean, averages about 19.9 million fish annually. Catches peaked in 1988, fell off some in

1989, and then grew slightly.

Although for many species, catches have declined since the peaks in the early 1980s. Some of these species are weakfish, spot, croaker, white perch and striped bass. The recent trends are somewhat stable.

The commercial landings of spot, croaker, weakfish and summer flounder increased in North Carolina from 1972 to about 1980. Then they declined. But even looking at that decline, except for weakfish, they are still at a level that approaches the pre-1980 level.

Figures for recreational catches of weakfish, spot, croaker and summer flounder show that 1988 was a high point for the croaker. Croaker are on somewhat of a decline overall. The summer flounder showed an increase in 1990 and 1991. Spot showed a decrease. Weakfish are in some trouble right now. The weakfish is the next species we will have to manage.

Southern flounder appears to be very stable. Flounder, I believe, are benefiting from the 13-inch size limit put in place about four years ago. It was in the middle of an election year and quite controversial, but we made it. There was a lot of support for the limit, and everyone believes that it's helped.

Spanish mackerel is showing an increase. And of course, the spotted sea trout has been very important in recreational fishing this year. The catch of spotted sea trout was up somewhat in 1990.

The problem in tracking catch data is that catch alone does not indicate the status of the stock. We have to look at other things. But we thought that if we look at the commercial landings in North Carolina since 1955, we would see the fluctuations mentioned earlier.

Menhaden is the one species that data show is greatly improved in the 1991 catch. The catch is up about 24 million pounds over 1990.

There is not much directed effort on menhaden in the state. We have one company with two boats and two other vessels that may sell at times. But we know a lot of the recreational people feel this is an important issue.

Menhaden is one population that has shown some recovery due to the management activities and reduced effort. There were a lot of fluctuations in the late 1960s and early 1970s, and again in the 1980s. Then in 1991, menhaden landings increased from 72 million pounds in 1990 to 110 million pounds.

Of the 15 estuarine-dependent species, or species groups in North Carolina important to anglers, four are considered healthy by the DMF. There are, however, some differences of opinion, particularly concerning bluefish. Six species are so far down from historical highs that they could be considered overfished.

The Atlantic croaker is showing signs of decline, both in the commercial and recreational catch, but it is also showing declines in the catch per unit effort (CPUE) that we have from the fishery.

I think that is something to be looked at very carefully — the size of the population, fish size, age groups within the population — and not just the catch alone. The CPUE shows the age-class structure is declining, which bothers us quite a bit.

The black sea bass is considered stressed in the southern part of the state and overfished in the northern area. The Mid-Atlantic Fishery Management Council is preparing to develop a plan for sea bass.

Bluefish is one species that may be considered healthy in North Carolina, but some other states would want to call it stressed to overfished. We believe that population is probably fully exploited.

But what disturbs us is a decline in the number of large bluefish. That may be a reflection of the population or some movement of the bluefish. There is some

evidence that they may be farther offshore due to environmental conditions and consequently are not being counted in the fishery.

Southern flounder is definitely a healthy species. The catch, CPUE, size distribution and number of age-classes all look good for southern flounder. The restrictions have really helped. The southern flounder is primarily an inside species caught by the pound nets and gill nets. And the improvement reflects in the recreational catch.

Summer flounder no doubt is overfished. The spawning stock biomass is extremely reduced. The age-class structure is down to probably two or three principal year-classes, where we used to have several age-classes in the population.

The DMF has 13-inch size restrictions on summer flounder, which is primarily an ocean trawl-caught species. It is a winter trawl fishery here, and North Carolina has a 5-1/2 inch tailbag requirement in the ocean.

The federal government this year put in an emergency rule that made the 5-1/2 inch tailbag mandatory in all areas where summer flounder are fished. North Carolina has had it in place for two years, and we are seeing some signs of improvement. The catch of summer flounder was up last year. It was nearly double what it was in 1990, but also some of the other data are showing improvement, such as CPUE and juveniles.

Spanish mackerel is definitely a healthy species. It is one that has been very strictly managed. Southern flounder and Spanish mackerel show about as much success through management activities as you would want to see. I think we need to get across the message that with management we can improve the populations.

Red drum is overfished. No doubt it is overfished throughout its range. In North Carolina, it is in somewhat better shape than many other states. We do not have much of a directed commercial fishery in this state. It is a tremendous recreational species.

This year, we went to an 18-inch limit on red drum because we had a good year-class. We are trying to get them dispersed. Much of the data from tagging shows that they return to North Carolina, and we think we can get them more into the spawning population.

The DMF is working with the N.C. Wildlife Commission right now on future red drum regulations because there needs to be compatibility. We have had a hard time in court with red drum because the commission has a 14-inch size limit and we have the 18-inch limit. The judges say it is difficult to tell where the fish are caught. We have to resolve our differences.

American shad and hickory shad are definitely stressed. Spot is considered stressed.

Striped bass is definitely overfished. This is the next area of contention. North Carolina had a striped bass board that looked at the management of striped bass as a result of the Lake Gaston case. Even though we have been operating under the Atlantic States Marine Fisheries Commission (ASMFC) regulations, there has been some concern that we should not. Rather, we should manage striped bass as a North Carolina species. In fact, we want to have a management plan for striped bass in North Carolina.

Congress has given the ASMFC authority over managing striped bass. The DMF has been trying to operate with an 80 percent reduction in the commercial catch as required by the ASMFC. There is currently some concern that the ASMFC technical committee is saying we are still fishing at three times the mortality rate we should be. The mortality is extremely high. They have even recommended a 20-inch size limit in the sound and a 28-inch limit

in the river for the population that spawns in the Roanoke River.

I do not know what the future holds. The DMF and the fishermen are seeing a lot of striped bass. The sound seems to be full of them, but they are 21 inches and less. And the striped bass doesn't spawn until the males reach about 18 inches and the females reach about 22 inches.

On the red drum again, I plan to propose to the Marine Fisheries Commission no sale of red drum over 27 to 32 inches in length. It depends on the minimum size. We believe that would help sustain the population of the large fish. Red drum, again, don't spawn until they are 24 to 28 inches.

Turning to weakfish, commercial fishermen in North Carolina catch about 90 percent of the numbers and 70 percent of the weight on the entire East Coast. This species is now down to probably zero- to two-year-classes or one- to two-year-classes. We are fishing on that small a group.

The DMF is under pressure from the ASMFC to reduce mortality by 25 percent the first year. That goal was recently reduced to 15 percent the first year, 25 percent the second year and eventually 50 percent. To begin, this will require a minimum 10-inch size limit on weakfish in North Carolina. But this is going to be a difficult regulation to put in place because we had a large number of small weakfish in our estuaries.

So that is the status of the estuarine fishery. We are trying to do a better job of managing. We have rules that we can implement in late 1992 or early 1993 on bycatch reduction. The commission has given the director broad authority for managing summer flounder and weakfish. We will continue working to maintain healthy stocks and to restore the others.

Reef Species

Gene Huntsman is leader of the reef resources and coastal pelagics team with the Beaufort Laboratory, Southeast Fisheries Science Center of the National Marine Fisheries Service. He has been in Beaufort since 1967.

Though North Carolina is not in the zone of the true tropical high coral reefs typical of south Florida and the Caribbean, we are in the zone of reef fisheries, which extends from Hatteras to southern Brazil.

We share in that vastly distributed reef fishery for two reasons.

First, we have warm water, which reef fish want, because the Gulf Stream is impinging on the outer shelf of the southeastern United States. It keeps the water in the 60-degree range even in February and March off Cape Hatteras. This is a time of the coldest temperatures in Raleigh Bay and Onslow Bay.

The second need reef fish have is for hard substrate around which to aggregate. There are many kinds of hard substrate on the outer shelf of the southeastern United States for the fish to get around — wrecks, coral, and most importantly, steep cliffs and ledges on the outer continental shelf. The shelf breaks off into the continental slope at zones of 35 and 55 fathoms.

But the live bottom reefs are the major producers of reef fish throughout the U.S. continental shelf in the South Atlantic and the Gulf of Mexico. They are ledges of sedimentary rock or exposed, flat shelves of sedimentary rock, with many kinds of invertebrates growing on them that are extremely attractive to reef fish.

So with the substrate in place and the warm water available, we can share in this basically tropical resource even though we are at 35 degrees north latitude, which is a long way north for animals that are very tropical. Depending on where you

are off North or South Carolina, the shelf is between 15 to 30 percent reef area. I will talk today about South Carolina as well as North Carolina because for a Charlotte dweller, Murrells Inlet is closer, if not better, for reef fishing than Morehead City.

The fishery is fairly complex in that it has several components. One is the headboat industry that charges by the head for a day's fishing offshore. But this is not the only recreational fishery.

Increasingly, since I began research with the reef fishery in 1972, private vessels have entered the fishery because people have boats that will travel to the outer shelf. And more importantly, they have the electronics that will allow them to enter the fishery.

The commercial fishery operates in several different ways — mostly with medium-sized vessels using powered reels or some other device. But there are longliners in the fishery who are fishing in the deeper waters. Traps are important, especially for black sea bass in the early spring off the Carolinas.

And we can't omit divers. They are important both recreationally and commercially in taking fish for harvest. But most importantly, they are a unique component of this fishery because they are mostly non-consumptive users of the resource. So any management plan ought to take into account the people who just like to look at fish. And probably only for reef fisheries is this an important consideration.

The snapper population is the target of nearly everyone who goes reef fishing, particularly the red snapper. But another red snapper, the vermilion, is even more important. People are also interested in groupers such as the speckled hind.

But the real workhorses of the fishery are porgies, especially the red porgy, and a host of its cousins, which are tropical fish with the first name calamus. The white grunt is extremely important to the North Carolina fishermen.

On the inshore side of the fishery, where the water is cooler in the near-shore reefs, the black sea bass is the predominant species. And in deeper water, not necessarily reef areas, there is another community of species typified by various tilefish and some of the deeper water groupers. These are all included in the aggregate of snapper-groupers for management purposes.

The connection to the true reef fishery is in the way the fishery operates more than habitat. For discussion purposes, we are including all these animals in our discussion of reef fisheries.

When we began our research in 1972, the headboat fishery was the only important fishery and the only data source for reef fish in the region. So we began our research with a twofold approach to collecting information. We asked crew members from headboats in North and South Carolina to voluntarily record daily what they caught.

For 20 years we have been keeping fairly good data on reef fishermen. In January, we went to an entirely new system. Keeping records has become mandatory for headboats in the South Atlantic.

Simultaneous to data on catches, our own people work on the docks from Hatteras to Mexico, weighing and measuring fish and collecting samples to get the information we need.

What do we get out of all this? We see what they are catching. These are the animals that support the reef fishery: vermilion snapper, black sea bass, white grunt, red porgy, gag, scamp, greater amberjack, gray triggerfish, tomtates, yellow sea bass and spottail porgies. Those last three, by the way, are small animals that wouldn't have been considered important 20 years ago, but they now make up a fairly important fraction of the catch.

A good index of a stock's status is how well anglers are doing. If you are an angler, that is the only measure that really

counts. And we call that measured catch per unit of effort (CPUE), or catch per angler day for our purposes today. In 1972, if you had sailed on a Morehead City headboat, you would have expected to catch an average of 35 pounds per angler day, which was very respectable.

Looking at the history of catch per angler day in terms of number of fish per angler, it is interesting that there has not been a dramatic change. We are down to about two-thirds of what people caught in the early 1970s. Most of the decline occurred from 1972 to 1974, when the fishery was in its exploratory phase and still finding new ground. But once they fully occupied all fishing grounds, the average has remained at six fish per angler day.

But if you look at weight taken per angler, the picture is not so rosy. (See Huntsman Figure 1.) The period of decline was longer, from 1972 to about 1980. It has dropped to the point that anglers are taking about one-third of the weight per angler of what they took in the early 1970s. And it seems to have stabilized at that level over the last 10 years.

By taking into account that the numbers of fish have not fallen off much, but the weight of fish taken has, it becomes apparent that the weight per fish has decreased markedly. And that is probably the most dramatic bit of information I can give you about the reef fish stocks.

Looking at 10 of the species that were most important — but not necessarily important to producing catch now — we see declines in the average weight per fish taken on the order of 50 to 75 percent. This decline is especially true for some bigger species, the target trophies.

The scamp once averaged 11 pounds. It is down to 2 pounds. Speckled hind is down to about 2 pounds from 9 pounds 20 years ago. Snowy grouper is down from nearly 18 pounds to just over 4 pounds. Red snapper is down from 18 pounds to almost 3 pounds. These are dramatic changes in mean weight per fish.

Now, there is nothing unusual about the size of fish decreasing as a result of fishing. It is expected. The minute you begin trimming the population by harvesting, you are removing a fair number of the older fish and the mean weight is going down. And that is not necessarily bad. You have to make a qualitative decision about how much is enough or how much is too much. That is tough to do. But most people would probably agree that if we are running a fishery on fish that are now 25 percent of the size they were 20 years ago, we have probably gone too far.

There are also other ways of looking at the fishery. Perhaps you are interested in the availability of trophy fish and the percentage of catch by weight that is grouper. The percentage has changed relatively little.

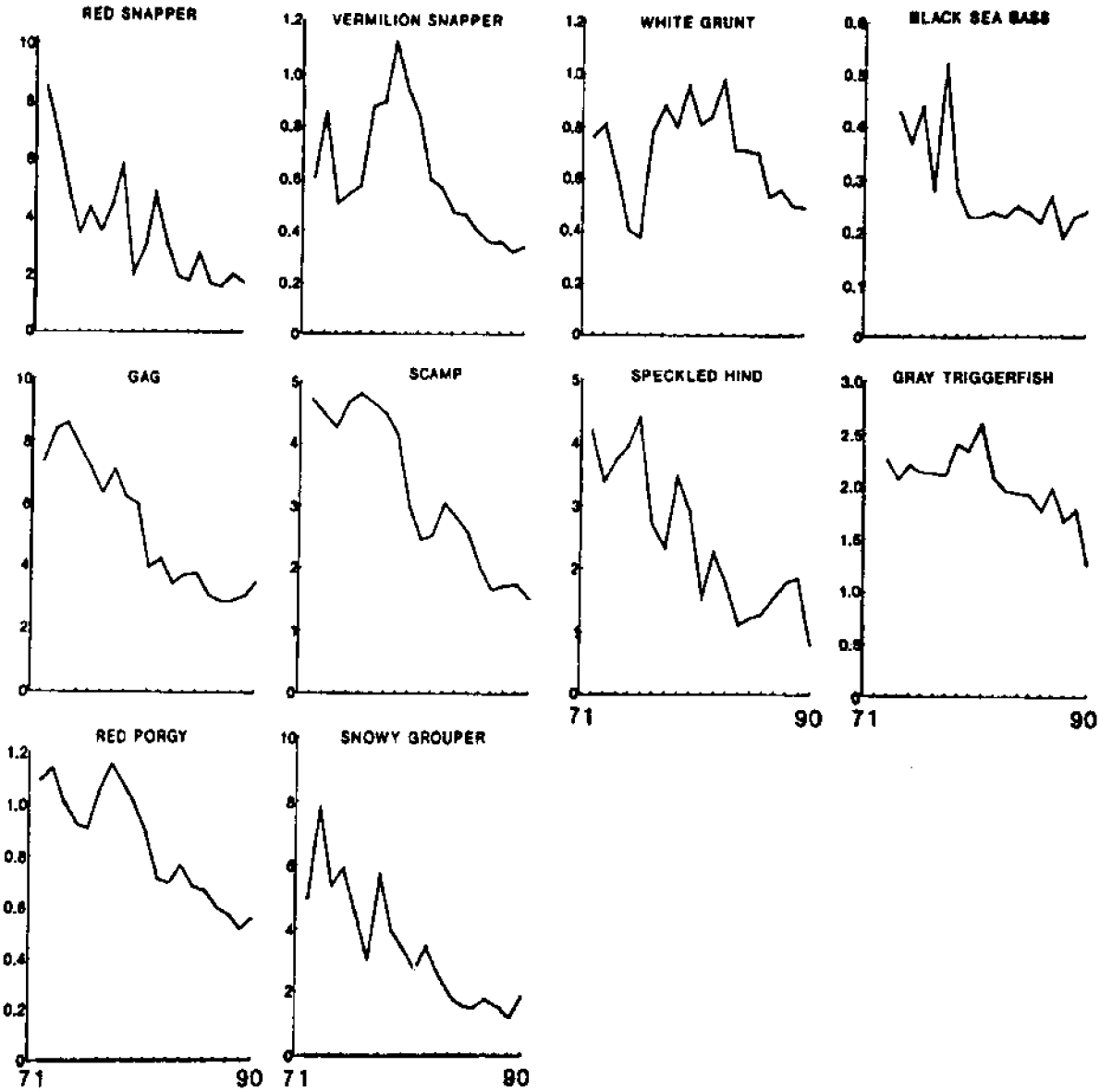
In the early days — 1972 to 1974 — when we were in the exploratory phase and had a population of snowy grouper that was being intensively fished, the catch was 22 to 23 percent grouper. By 1975, it had dropped to 18 percent. And if you look at 1989 and 1990, the percentages are not much different.

What has changed is the total catch of grouper. The percentage has not changed, but the amount of grouper is half what it was 20 years ago. And that change basically took place by 1975 to 1976. In 1989 and 1990, there were about 132,000 pounds of grouper.

Since the percentage change hasn't been great and the absolute change has been substantial, that means the total headboat catch has decreased a lot. We are now operating at about half the peak catch. The headboat fishery in the Carolinas is at about 900,000 pounds a year, compared to a peak at about 1.8 million pounds a year.

The commercial catch has done about the same thing. In 1990, it was more than 4 million pounds, compared to 2

Figure 1 **Mean Weight of Reef Fish off N.C. and S.C. 1972 to 1990**



Mean weight of 10 species of reef fish taken from headboats operating in the offshore waters of North Carolina and South Carolina.

million pounds today. This is somewhere on the order of half the peak catch. The fishery peaked 10 years ago. And both recreational and commercial data are showing us running at half-speed, which is not good.

Up to this point, you've heard information about the recreational catch. But a commercial fisherman with multi-day trips and bigger vessels would see a fishery that is in better condition than you might suspect just looking at recreational data.

So I will provide data taken from all fisheries: recreational, commercial, headboat and private recreational boats for the entire region, Cape Hatteras to Key West. I will also look at an index of stock status used by the South Atlantic Fishery Management Council to determine how the important species are faring.

First, let me explain spawning stock ratio. Simplistically and for practical purposes, it is a ratio of the pounds of spawning-age fish in the ocean today compared to those that would be in the ocean were there no fishing at all.

If we have only 30 percent of that spawning stock left, the species is probably in trouble. That 30 percent is the criteria the South Atlantic Fishery Management Council has established based on the experience of fisheries in other parts of the world. Any stock that has a spawning stock ratio of less than 30 percent is legally overfished. (See Huntsman Figure 2.)

Over the entire South Atlantic, about half the species that are considered important by the South Atlantic Council are overfished: scamp, speckled hind, vermilion snapper, white grunt, snowy grouper, gray snapper, red porgy, red snapper and warsaw grouper.

And the important thing to consider is all these species that are below 30 percent — greater amberjack, red grouper, lane snapper, yellowtail snapper, mutton snapper, black grouper, black sea bass, gag and gray triggerfish — are not legally overfished. But some are close to that point.

The philosophical question is, do you want to manage a fishery so it is sitting right on the 30 percent line and ready to fall over?

Two species, the gag and the black sea bass, are at about 32 percent. Basically, all those species under the 30 percent line are the Carolina species. Those above the line, for some unknown reason, are tropical Florida species such as the mutton snapper and yellowtail snapper. So in some ways it appears that the Carolinas have the worst condition.

Supposedly, there are ways of remedying this, and we have had some regulations in place to try to protect some of the reef fish populations since 1983. But those regulations were few and not very stringent because the data available in 1983 didn't indicate the need for more restrictions on fishing.

In more recent analyses, however, we see there are some problems. As of January 1992, there are new regulations on about 20 reef species in the South Atlantic.

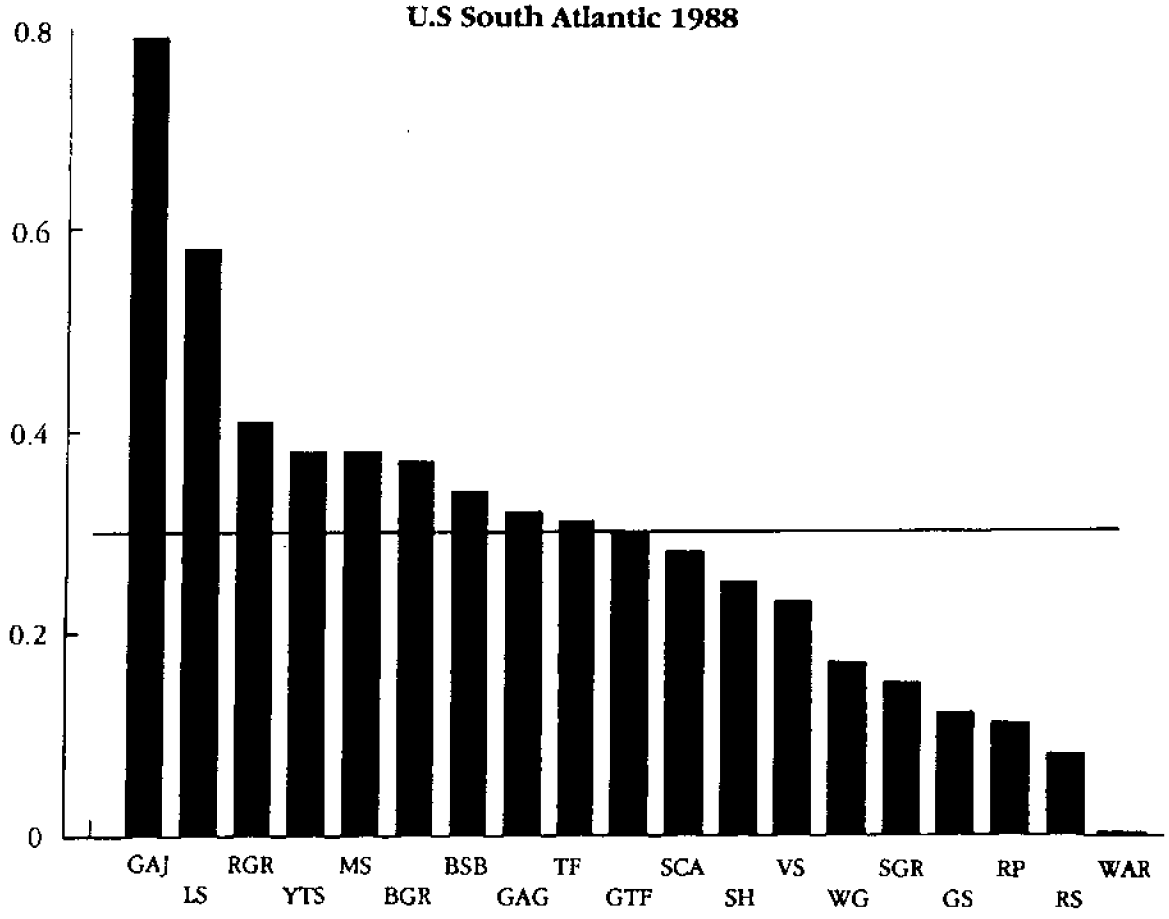
What's disturbing is that even the new regulations will not move us to where we need to be for many species, especially the Carolina species.

Why do we have regulations that are insufficient to return some populations to a healthy level? The regulatory process got ahead of the analytical process. My first analysis did not show the situation looking quite as bleak as it turned out to be, or else we probably would have had more restrictive regulations. Some adjustment will be made in the next year or two. But there is basically no real good news to be expected from even the newest regulations.

Regulations are still being developed for some species. The speckled hind, for instance, hasn't been regulated yet. And there will be special regulations for

Figure 2

Spawning Stock Ratios
U.S South Atlantic 1988



GAJ = Greater Amberjack
RGR = Red Grouper
MS = Mutton Snapper
BSB = Black Sea Bass
TF = Tilefish
SCA = Scamp
VS = Vermilion Snapper
SGR = Snowy Grouper
RP = Red Porgy
WAR = Warsaw Grouper

LS = Lane Snapper
YTS = Yellowtail Snapper
BGR = Black Grouper
GAG = Gag
GTF = Gray Triggerfish
SH = Speckled Hind
WG = White Grunt
GS = Gray Snapper
RS = Red Snapper

Spawning stock per recruit ratios for 19 species of reef fish based on catches and samples taken from the region between Cape Hatteras, N.C., and the Dry Tortugas, Fla.

warsaw grouper.

We try with basic regulations to protect reef fish, but many reef scientists are skeptical that we know enough to protect their populations by using ordinary means. Reef fish don't exist as individuals. The species do not live isolated from others. They live in complex communities. On a North Carolina reef, you will find over 300 species of fish and hundreds of thousands of species of invertebrates. They are all connected in very complex ways, and we don't know how a push on one side of this complex system by fishing will affect the other side.

We are already seeing events like the growth in abundance of a weed species, the spottail porgy. It seems to correlate with the removal of big gag from the reef system. So we are concerned that regulating by species may not be enough to return the populations to something approaching those of the 1970s.

And we are well aware of our ignorance as scientists. We have only fragmentary data on some species and our models are very simplistic. We know that the life histories of many animals are very complex and poorly understood.

We know, for instance, that groupers change sex. They are born girls and become boys late in life. So an intense fishery that takes the old fish would remove the males from the population, perhaps to the detriment of the overall spawning success of the species.

And there are many other things we don't know about reef fish. And it concerns many of us that the standard approach to reef fishery management might be considered insufficient to get the job done.

For that reason, we have proposed reef fishery reserves.

It has been proposed that some 20 percent of the reef area be set aside as a reef fishery reserve — a no-fishing area — to preserve some part of the population in case all other management efforts go awry. We would have something left to rebuild the populations and maintain some of the original stability of the communities these species live in. Then we would not have removed the genes necessary for the fish to grow old, which groupers do.

I want to make an analogy between fishery management and financial management. Most wise financial advisors would recommend putting at least a small portion of an investor's capital into a very conservative investment, perhaps with low interest. So someplace there will be a little left to fall back on if those pork bellies and general motors stocks go to pieces.

That is the argument that reef scientists are making here. Take some of this resource and put it where you won't hurt it. You will not get any harvest there, but at least it is there. And in five or 20 years, if you decide you don't need reef reserves, do away with them. But at this point, while we are learning to manage reef fisheries, we ought to do something very conservative.

I will conclude by pointing out that the resources of island nations throughout the Caribbean have been devastated by fishery technology that could be described as primitive at best.

And even though our reef resources are much greater and our shelf area is much larger than that associated with the Caribbean islands, our technology is thousands of times more effective. Many of us are concerned that we need a conservative strategy for reef fish if we are ever going to achieve this holy grail of big catches and big fish that most anglers are looking for.

Pelagic Species

Steve Berkeley is a fishery scientist with the South Atlantic Fishery Management Council in Charleston, S.C. He is responsible for pelagics and shrimp.

The pelagics are managed under a host of different management plans with objectives that are quite different among species.

First, the Atlantic group king mackerel. There are two stocks of king mackerel we recognize right now — one in the Gulf of Mexico and one in the Atlantic.

The 30 percent spawning stock ratio — the ratio of the spawning population with fishing to the spawning population without fishing — is the minimum level beyond which we don't want to drop.

By this measurement, the Atlantic group king mackerel is in relatively good shape. (See Berkeley Figures 1 and 2.) In fact, the ratio has been consistently above 30 percent since 1979 and is currently increasing through conservative management measures.

It is managed now by the South Atlantic Council with bag limits and quotas.

This fishing year, the bag limit is five per person per day and the quota is 10.5 million pounds, recreational and commercial combined.

And the spawning stock has continued to grow because the council since 1985 has selected a rather low target level within this allowable biological catch (ABC) range and has set quotas at the low end of the range.

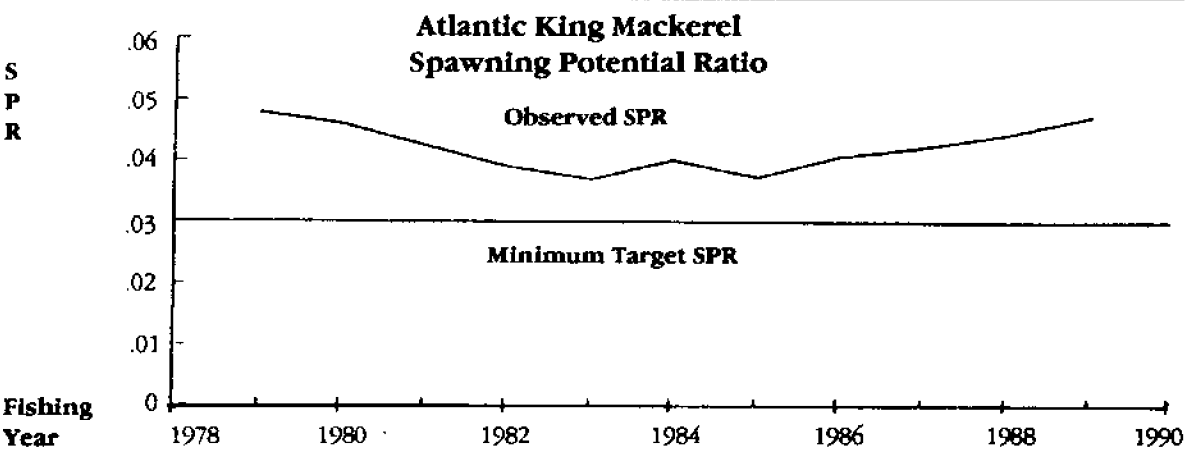
The quotas in many cases have not been taken, so the population continues to grow. There is certainly nothing wrong with allowing the spawning stock and the population to increase beyond the minimum target. In fact, 30 percent should be viewed as a minimum rather than a target.

But there is no guarantee that level is an absolutely safe level. Anything above that is certainly money in the bank.

Next, the Atlantic Spanish mackerel. It is not in as good shape. Bill Hogarth mentioned it is considered healthy. But the stock assessment panel that annually reviews the status of king and Spanish mackerel still considers the stock overfished, even though the current spawning stock is above the minimum 30 percent. (See Berkeley Figure 3.)

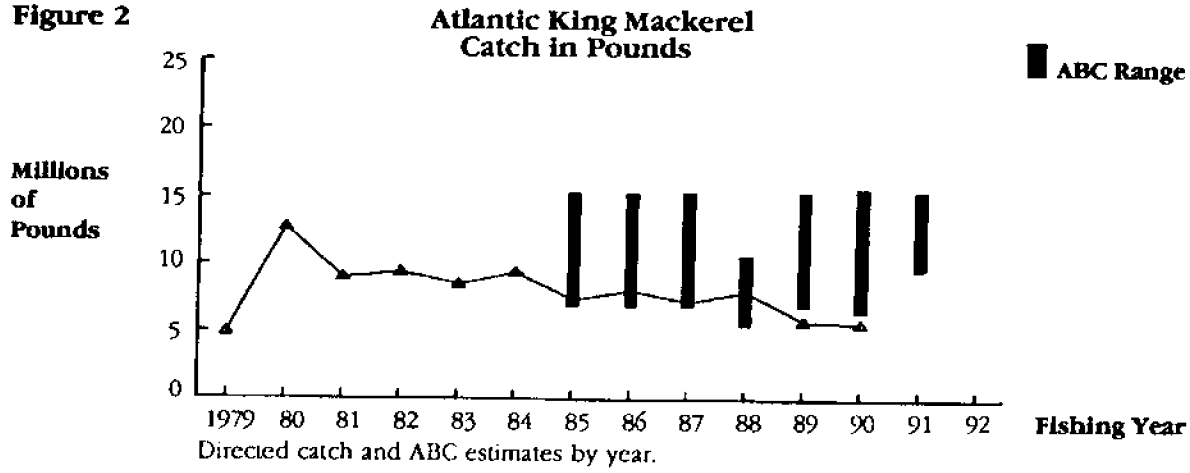
The panel considers this species overfished because the jump between 1988 and 1989 is driven almost entirely by a single age-class that is now coming into

Berkeley Figure 1



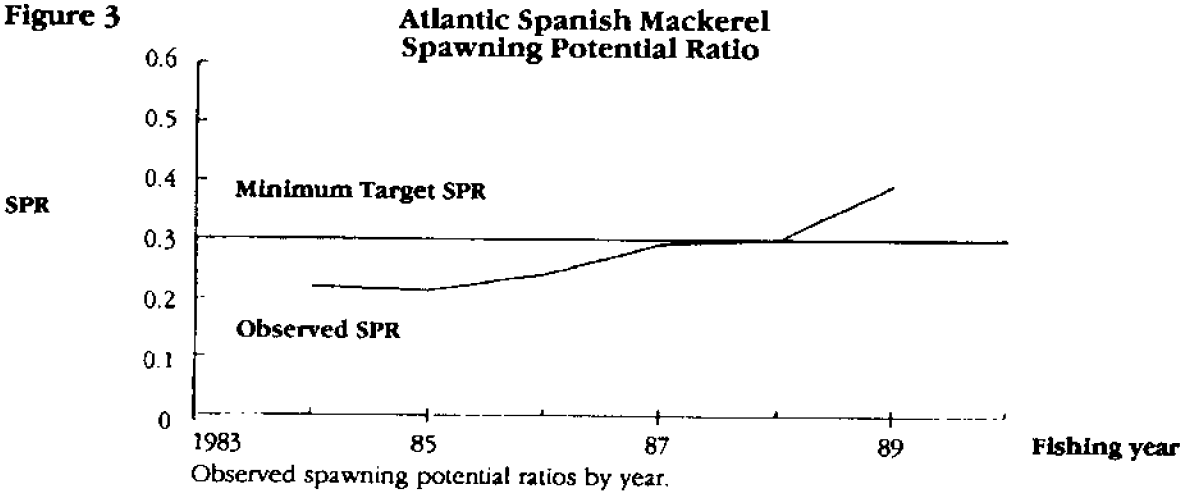
Observed spawning potential ratios by year.

Figure 2



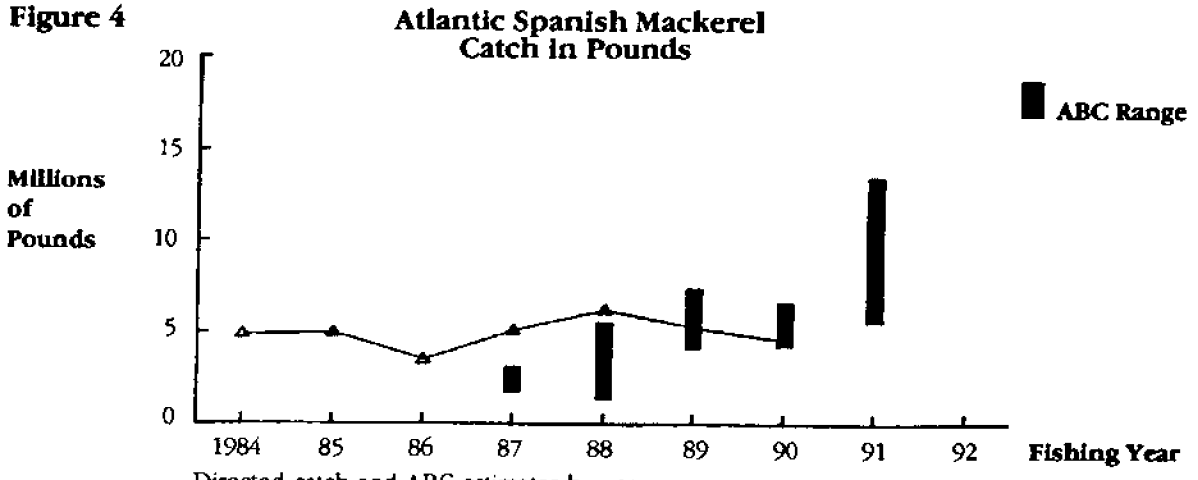
Directed catch and ABC estimates by year.

Figure 3



Observed spawning potential ratios by year.

Figure 4



Directed catch and ABC estimates by year.

Figure 5

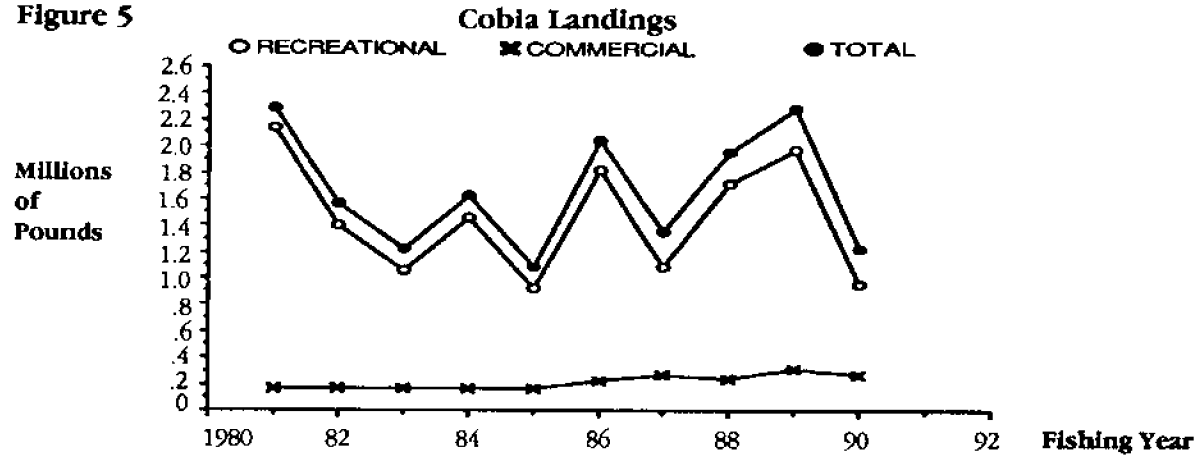


Figure 6

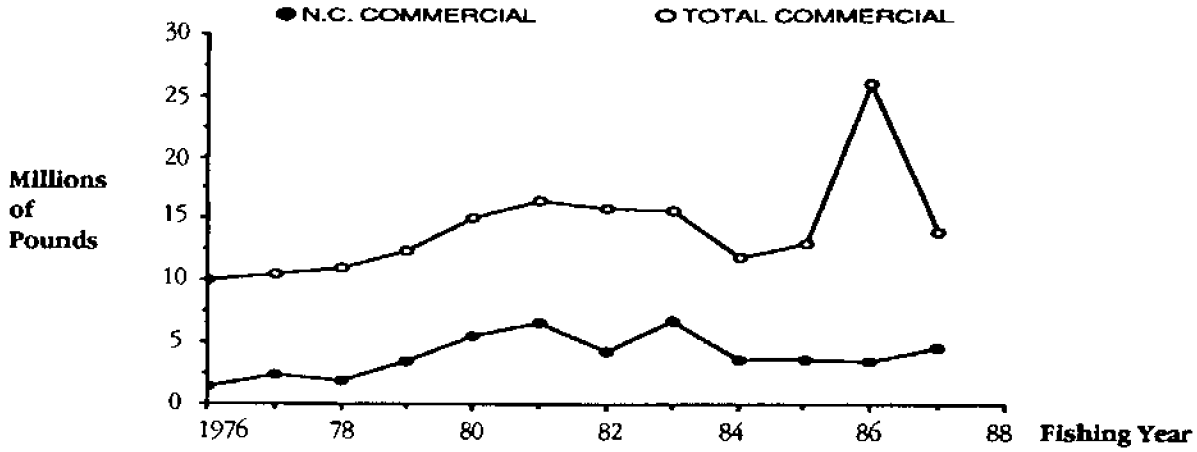
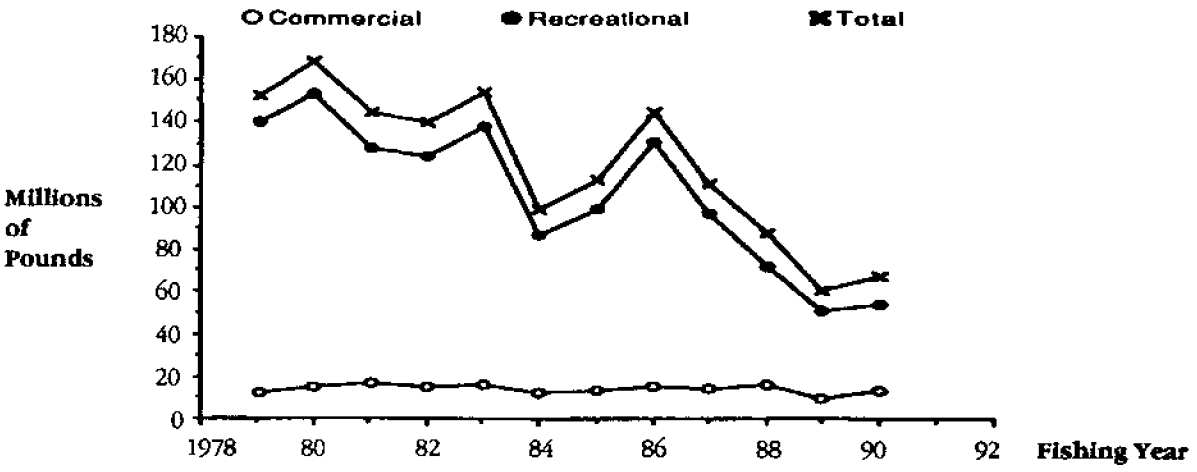


Figure 7



the fishery. And until that population starts to stabilize, the review panel decided there wasn't enough confidence in the numbers to consider this species out of the woods yet.

But again, conservative management has helped the stock on its way to recovery. It is also managed by quotas and bag limits. The current bag limit is 10 fish per person per day for recreational fishermen. The quota was increased recently to 7 million pounds for this fishing unit.

History explains why the spawning stock was driven down for a number of years. Landings in the late 1980s — 1987 and 1988 — were above the ABC. (See Berkeley Figure 4.)

Since then, more conservative quotas have been put into place and the stock has rebounded.

Also, the 1991 quota was taken by the commercial fishery, but the recreational quota probably will not be. There will be some excess biomass, which will contribute to the spawning stock and the recovery of the species. We expect the species to be taken off the overfished list soon, barring anything unforeseen.

The next species is cobia, which is managed by the same South Atlantic Council plan. Overfishing for this species is also defined in terms of the spawning stock ratio. But unfortunately, we don't have enough information for this species to know what the current spawning stock ratio is.

Cobia is a fairly important species recreationally — much more so than commercially. Commercial landings have been relatively small and stable, increasing some in the mid-1980s. (See Berkeley Figure 5.) Recreational landings have jumped around without any apparent trend.

The status of the resource is unknown, but the stability of the landings suggests cobia is not severely overfished. Cobia is believed, however, to be exploited up to maximum potential.

Currently, the maximum sustainable yield is very crudely estimated at about 1 million pounds, but landings have exceeded that amount through the entire time series (1981 to 1990), so probably the estimate of maximum sustainable yield is too low.

The next species, bluefish, is managed by the Mid-Atlantic Fishery Management Council rather than the South Atlantic Council, and it has defined overfishing somewhat differently. Every fishery management plan implemented at the federal level now must contain a measurable definition of overfishing.

The Mid-Atlantic Council has defined overfishing by rate of fishing mortality, which is the rate at which fish are removed from the population by fishing.

The target level for this fishing mortality rate for bluefish is estimated between .3 and .4. The current level is estimated at .35, right in the middle of the range.

So bluefish are considered fully exploited, as Bill Hogarth mentioned. And interestingly, there has been a fairly consistent decline in total landings. (See Berkeley Figure 6.) Again, this is primarily a recreational species. Bluefish is also managed with a bag limit, which is 10 per person. And the cap on commercial landings is 20 percent of the combined recreational and commercial landings. At least to date, the commercial landings have run close to that, but have not exceeded 20 percent.

The landings are rather high. Bluefish is caught all up and down the East Coast. The maximum sustainable yield (MSY) is estimated to be between 140 and 150 million pounds, a rather large stock. (See Berkeley Figure 7.) But the combined landings have been declining. It's not clear why, but it is believed to be due to a decline in the population

In North Carolina — the most

important state in terms of commercial landings of bluefish — the bluefish has averaged 31 percent of the total commercial harvest over the time series (1976 to 1987).

Again, commercial landings increased in the late 1970s and early 1980s but have remained fairly stable since then. The general decline in the population is thought to be due to poor spawning success in the 1980s. But it is not clear now why this is taking place.

Even less is known about the status of the next species, dolphin fish, although it is almost certainly not overfished. Overfishing hasn't even been defined for dolphin. It has worldwide distribution.

There is virtually nothing known about the stock structure on this fish, whether it is a single unit stock worldwide or oceanwide, or whether it is comprised of several different stocks. So there is really no basis to determine what the status of the resource is. It is included in the coastal migratory pelagics fishery management plan, although there are no federal regulations in place for dolphin fish.

The landings — even before 1984 — were fairly steady at a relatively low level. (See Berkeley Figure 8.) Then in the late 1980s, the level shot up and continued to increase in the last year or two. I suspect landings will increase again, mostly as a recreational fishery.

Dolphin fish is a very abundant species at sea, throughout the tropics and mid-ocean, so those caught recreationally are in the fringe of their range generally associated with the Gulf Stream.

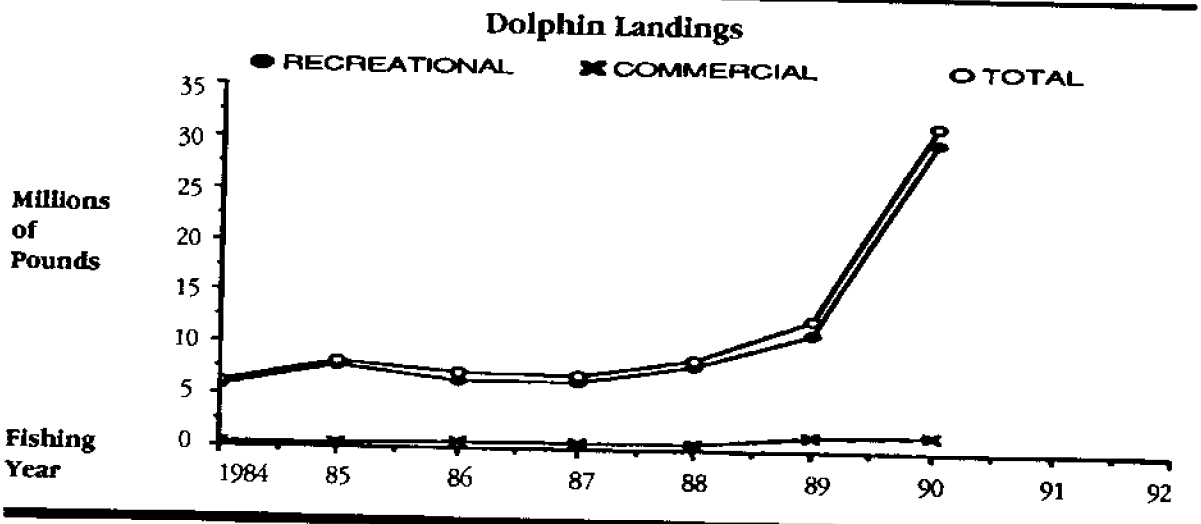
The next group, sharks, are managed by the National Marine Fisheries Service. Sharks constitute their own management problem because there are multiple species, many of which the average person and even the average scientist can't tell apart. Many are similar in appearance.

Most sharks bear live young — and very few young. The gestational period for sharks is long. They don't have the reproductive potential that most bony fish have, so they are particularly vulnerable to overfishing.

And once overfished, sharks take a long time to recover. Some species were overfished many years ago and still have not recovered, even though there were essentially no fisheries for them until recently.

But recently, commercial fisheries have developed for the meat and the fins, which are sold in the Orient for soup. This

Berkeley Figure 8



has created a big market for sharks, and fisheries have increased dramatically in recent years, putting a lot of stress on some species.

But because data is collected generically as shark, we were not able to come up with a management plan on a species-by-species basis, so they have fallen into large groupings.

Sharks in the Management Unit By Species Groups

Large Coastal Sharks

Sandbar	Blacktip
Dusky	Spinner
Silky	Bull
Bignose	Narrowtooth
Galapagos	Night
Caribbean reef	Tiger
Lemon	Sand tiger
Bigeye sand tiger	Nurse
Scalloped hammerhead	Whale
Great hammerhead	Basking
Smooth hammerhead	White

Small Coastal Sharks

Atlantic sharpnose	Blacknose
Caribbean sharpnose	Smalltail
Finetooth	Bonnethead
Atlantic angel	

Pelagic Sharks

Shortfin mako	Blue
Longfin mako	Ocean whitetip
Porbeagle	Sevengill
Thresher	Sixgill
Bigeye thresher	Bigeye sixgill

The first group are large coastal sharks, including species that are of recreational interest as well. They are the sandbar, blacktip, dusky, spinner, silky, bull, bignose, narrowtooth, galapagos, night shark, Caribbean reef shark, tiger, lemon, sand tiger, bigeye sand tiger, nurse shark, the three species of hammerhead, whale shark, basking shark and white shark.

The large coastal sharks are considered overfished as a group.

The small coastal sharks — Atlantic sharpnose, bonnethead, Atlantic angel, blacknose, finetooth, Caribbean sharpnose — are of less importance. The exception is the sharpnose, a fairly important recreational species that is not considered overfished at this point. Shrimp trawlers are responsible for most of the fishing mortality among the small coastal sharks.

The pelagic sharks are important recreationally. They include the shortfin and longfin mako, the porbeagle — which has been overfished for some years — the thresher and bigeye thresher, blue shark, ocean whitetip, sevengill, sixgill and bigeye sixgill. The last three are quite uncommon species, and their status is unknown at this point.

Regulations for sharks are not yet in effect, but the plan is available for public comment. It is expected to be implemented by summer 1992. The management of these species will include quotas and bag limits for large coastal, small coastal and pelagics.

The regulations for recreational fishermen combine large coastal and pelagics because of the difficulty in telling them apart, especially when landing them without their heads on. The limit for this combined category is two per boat per trip. For the small coastal species, which are not considered overfished, the limit is five per person per day. There is also a 66-inch fork length limit on mako sharks.

In the last few years, surplus production has exceeded the catch, which is why small sharks are not defined as overfished. (See Berkeley Figure 9.) Surplus production can best be explained using a banking metaphor. It is the amount of production that can be taken without affecting what is in the bank. That would be the equivalent of interest on capital.

The opposite is true for large coastal sharks. (See Berkeley Figure 10.)

Figure 9 **Production and Catch of Small Coastal Sharks**

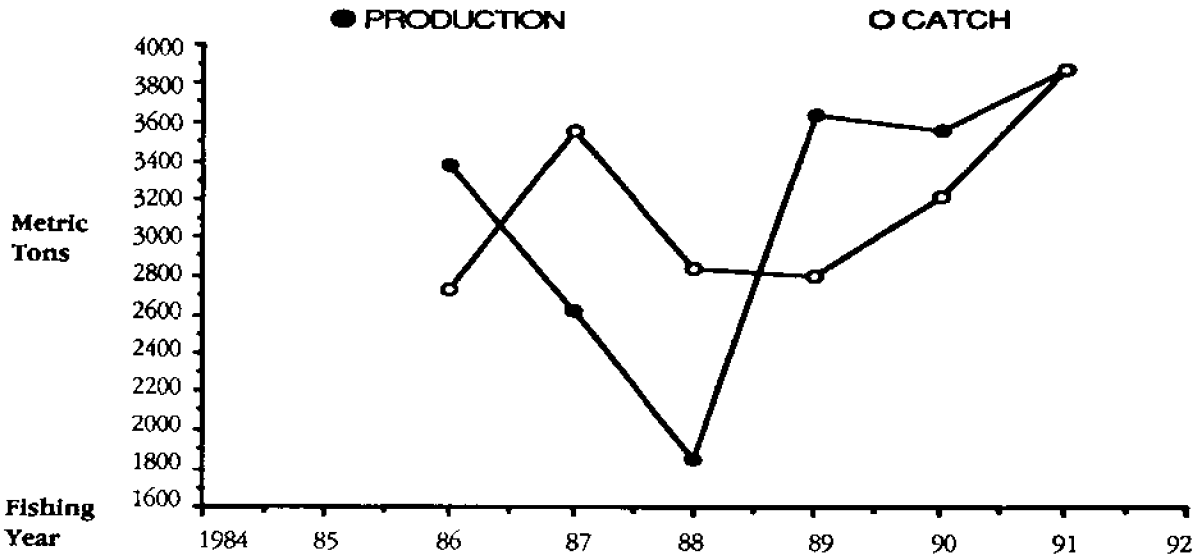


Figure 10 **Overfishing of Large Coastal Sharks**

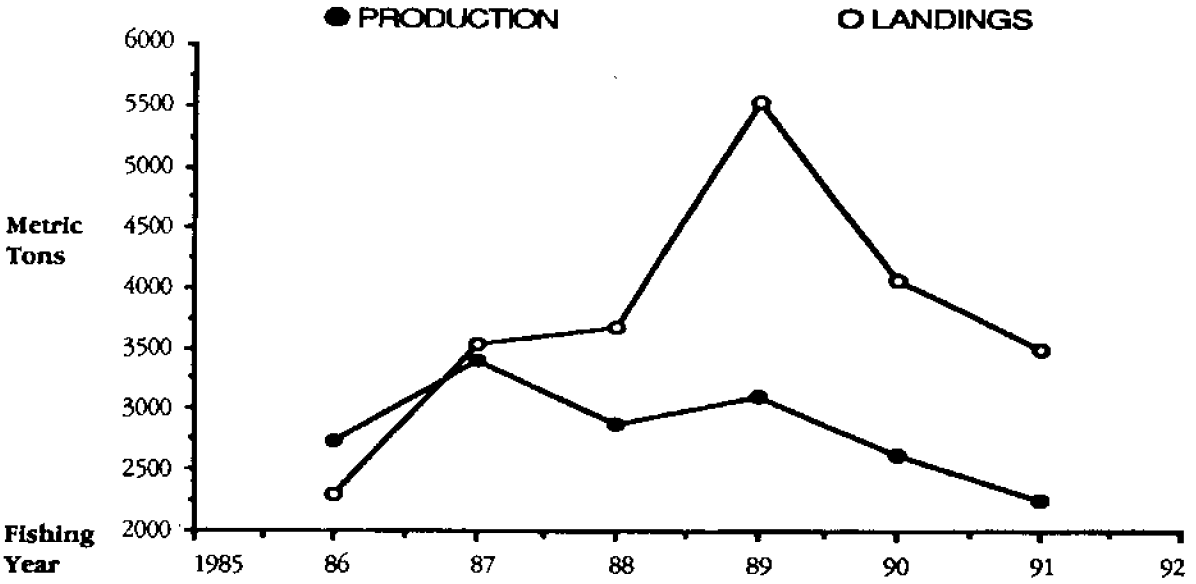


Figure 11 U.S. Commercial Shark Landings

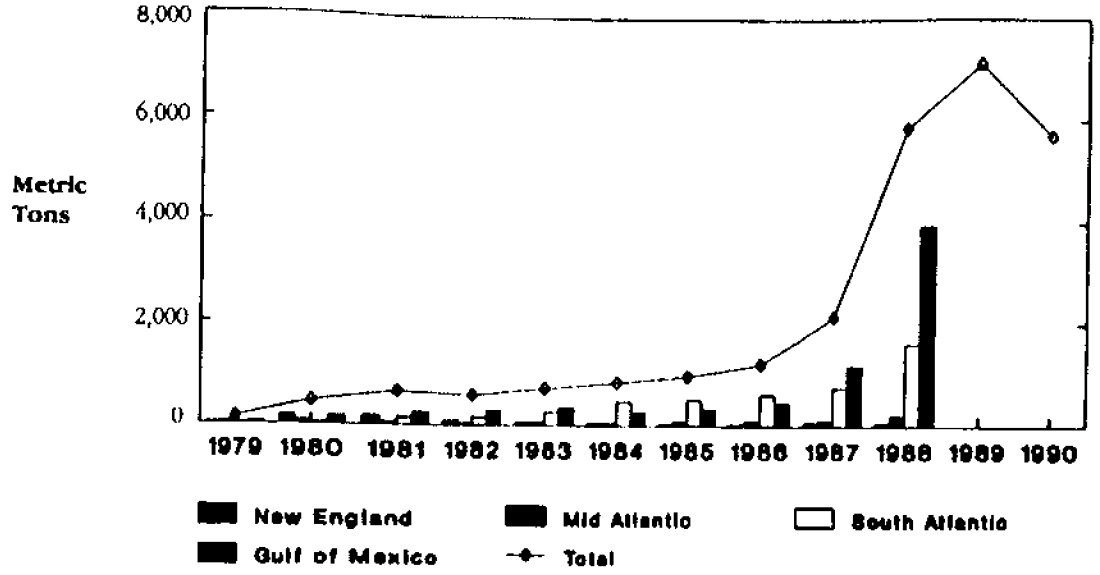


Figure 12 U.S. Recreational Shark Landings

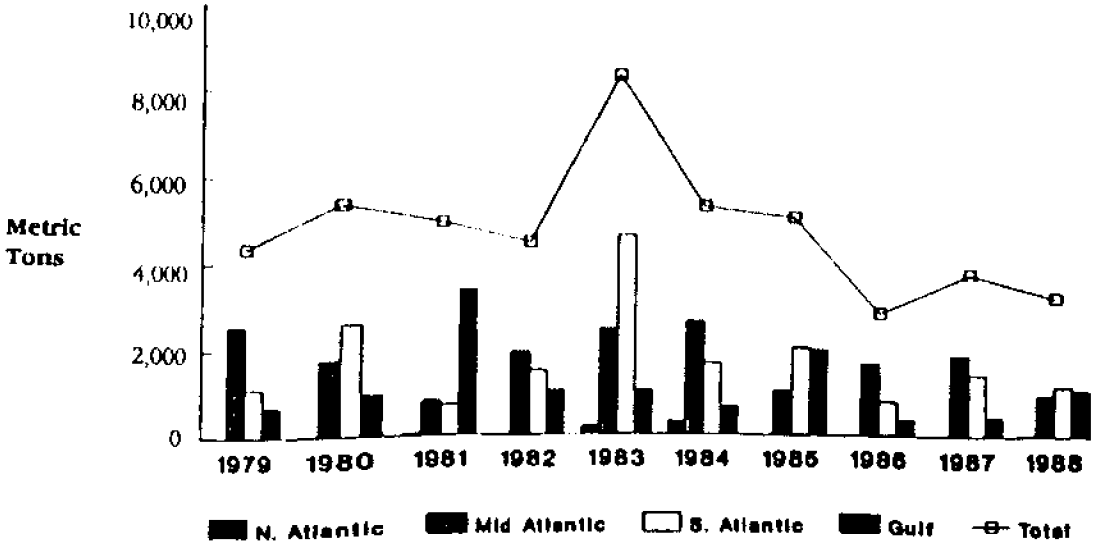
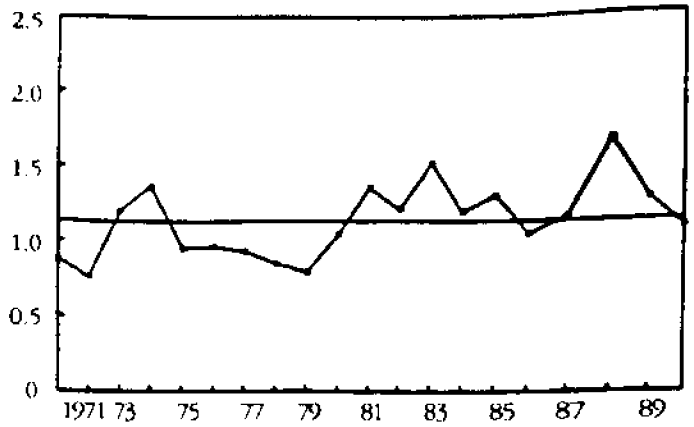


Figure 13

Catch Per 100 Hours of Fishing

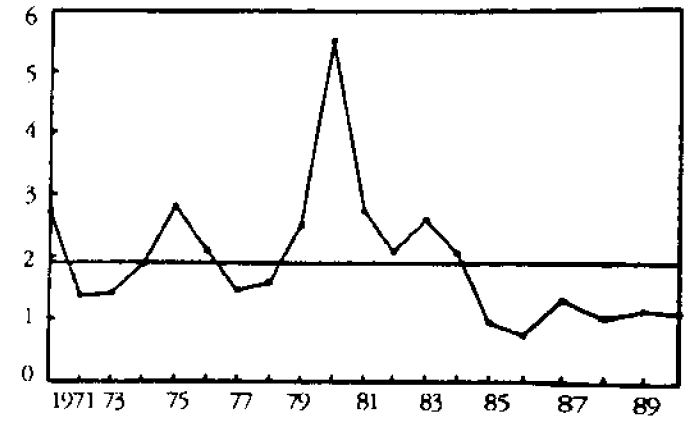
Blue Marlin



Mean Catch/ 100 Hours

Fishing Year

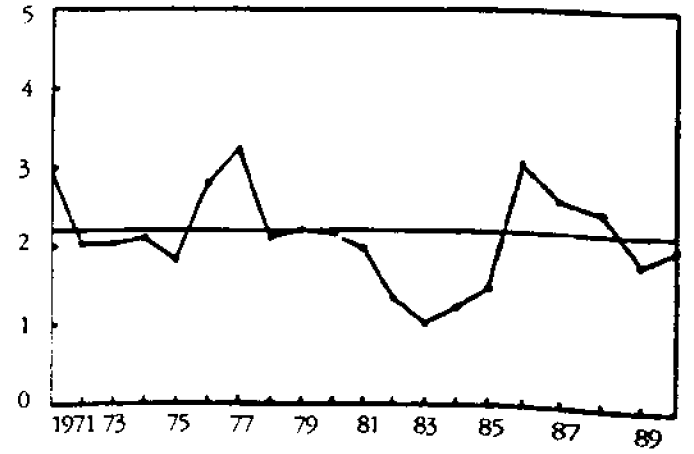
White Marlin



Mean Catch/ 100 Hours

Fishing Year

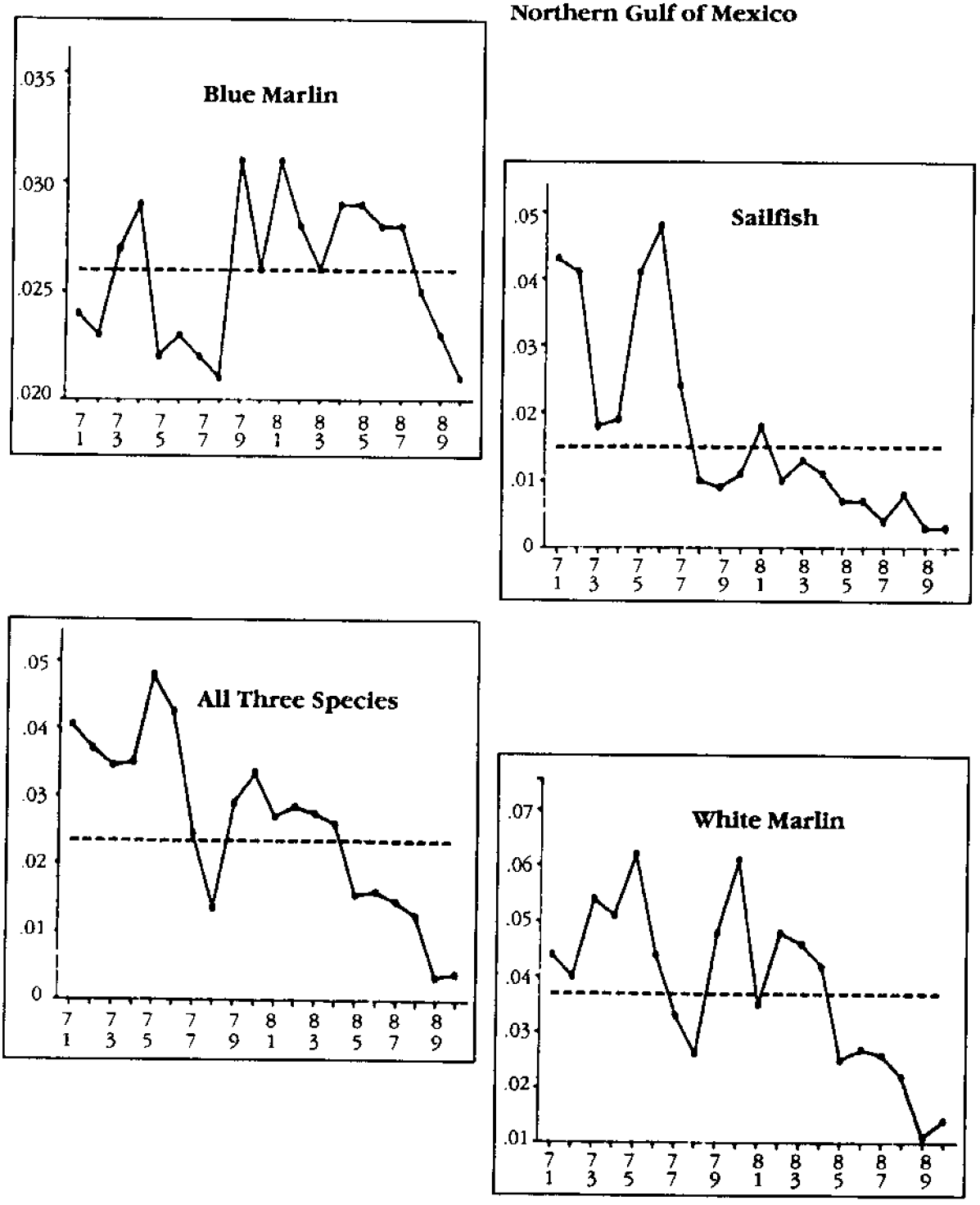
Sailfish



Mean Catch/ 100 Hours

Fishing Year

Figure 14 **Number of Billfish Hooked Per Hour Trolling**
Northern Gulf of Mexico



Dashed line indicates 20-year average for each category.

They are considered overfished. Landings have exceeded the surplus since 1987, and they are in fairly bad shape. (See Berkeley Figure 10.)

The reason can be seen in commercial landings. They were low for years because there was very little market for them. And suddenly in the late 1980s, landings doubled, redoubled and doubled again. The sharks as a group simply could not take that kind of fishing pressure. (See Berkeley Figure 11.)

At the same time, sharks are a fairly important recreational species in certain areas, including the Gulf of Mexico and the Mid-Atlantic. The recreational landings have generally been on the decline, probably due to the overall decrease in population. There was one blip in 1983. (See Berkeley Figure 12.)

The next group are billfish. The South Atlantic Council developed a management plan, but that responsibility has now been taken over by the Secretary of Commerce and the National Marine Fisheries Service.

These fish are managed by a minimum size. The minimum size is 86 inches fork length for blue marlin, approximately 200 pounds; 62 inches lower bill fork length for white marlin, approximately 50 pounds; and 57 inches for sailfish, approximately 30 pounds.

Data have been collected on catch per 100 hours of fishing for blue marlin, white marlin and sailfish off the Atlantic coast, the Gulf of Mexico, the Caribbean and the range of U.S. fishery. (See Berkeley Figure 13.) But these stocks are widely dispersed and poorly understood, so it's not clear if we are looking at a single stock or multiple stocks.

The long-term average catch rate for blue marlin is just over one fish per 100 hours of fishing. In the last few years, the level has been slightly higher. In 1990, it was right at the long-term average.

The white marlin in the last five or six years has been well below — at about half — the long-term average.

And blue marlin is considered fully exploited, perhaps overexploited. The status of white marlin is unknown.

The sailfish is considered not fully exploited. It has jumped around somewhat and is currently at about the long-term average catch per unit effort. This is from the recreational fishery.

By contrast, in the Gulf of Mexico there was a big decline in the 1970s that was thought to have been caused by the influx of the Japanese long-line fleet. (See Berkeley Figure 14.) Japanese long-liners left the Gulf of Mexico in 1982 and have not returned. But in 1984, a big fishery for yellowfin tuna developed in the Gulf of Mexico. And by the late 1980s, every one of the billfish species had declined dramatically in the recreational catch per unit effort. All the species are at about the lowest point in the history of the fishery.

Status of the Environment

B.J. Copeland has been director of the UNC Sea Grant College Program since 1972. He is an estuarine ecologist and recently created a synthesis document for the Albemarle-Pamlico Estuarine Study, a five-year undertaking to assess and improve the health of the environment.

A nighttime photograph of the United States, filtered to show incandescent lighting, tells you where all the people are. This is the way the population structure of the United States looks, and most of them live in the coastal fringe.

Therein lies part of our problem.

In North Carolina, our population is in what we call the golden crescent, which runs from Raleigh down to Charlotte.

Most of what I will talk about has to do with the little piece of territory between the high tide and the edge of the continental shelf. We have a lot of aquatic re-

sources in North Carolina. We are blessed and also cursed by the amount and complexity of the systems that we deal with here.

Now, one of the problems. Much of our ecosystem or habitat that supports the fishery happens to be inshore, surrounded by land or partial land where the people meet the water. It is also up in the little cracks, crevices and indentations in our estuaries and nursery areas.

Every once in a while, things go wrong. And one big problem is anoxia — the absence of oxygen in the water. Organic material consumes the oxygen as it decays. And in these shallow protected areas in the summertime, when the water warms up and the wind doesn't blow, the water does not mix and the oxygen is depleted. But most of the organisms we're interested in cannot live in the absence of oxygen. You wind up with fish kills.

Fish kills seem to be happening more now. That may be a reflection of the quality of the data, or it may be that people are simply coming into contact with them more. The problem is we don't know today how much worse the anoxia problem is going to get.

And there are other problems with anoxia. On the way down to zero-oxygen, all kinds of physical and chemical changes take place. The toxics and organics that we thought were inextricably bound into the sediments are re-released into the water. So some killers are being re-injected into the ecosystem.

Anoxia is a very serious problem. The despair is that there isn't much we can do about it. Mother nature still has calm days and warm temperatures, and unless we set up big wind machines out there and stir up the water, we aren't going to do much about anoxia.

All this corresponds to the distribution of population — just too many people. As more and more people live closer to the shore, there will be more problems stressing the system there. Anoxia will become more prevalent.

The second problem I want to discuss is the algae bloom. The blue-green algae bloom in the lower Neuse River system is caused by excess nutrients — again, calm conditions where the algae have a chance to build up and exclude others. Soon, there is an almost pure culture of one species of algae.

Now, blue-green algae trigger several other problems.

One, it is just aesthetically unpleasant. And the toxic metabolic by-products kill fish. It is not much good in the food chain. And when it decays, it takes up oxygen. So nearly everything you can think of about this algae is bad.

There are other algae blooms. We recently discovered a dinoflagellate that seems to jump out of the sediment, kill fish and hide again. It is triggered by some unknown protein exuded by fish schools. What are we going to do about it? It is not something that is going to be easily dealt with.

Another kind of algae bloom is the red tide. We had that back in 1987, and we all suffered from that. The red tide taught us several things. One is that we are not isolated from the rest of the world. The red tide originated off the west coast of Florida, traveled around the bottom of the state and caught in the Gulf Stream. It was spawned off by eddies, brought inshore by currents and stayed here. So we are not exempt from algae blooms even if we clean up our own waters. The whole world is involved.

This brings us a very important point ecologically and policy-wise. Everything we do is interconnected to what everybody else does. Oceanography is related to all the things that go on in the estuaries. What happens on the hill is related to what goes on in the estuaries. It all comes together there. So we are going to have to look at it in a total picture.

A third area that deserves mention are pathogens, which usually come from people who live in close proximity to the environment we are trying to deal with. And it comes from activities that may change the way land is used, change the way water is moved and affect animals. It involves toxics, heavy metals and pesticides.

All of these go into the water. Some are natural, sloughing off the land. The net result is the water is contaminated and signs are set out prohibiting the taking of certain animals from these waters.

Septic tanks create another kind of contamination. We have a lot of the tanks in coastal North Carolina. But a large proportion of the soils will not support conventional septic tanks and you have failures. The problem is that the waste runs downhill and gets into the water.

Now we have a whole bevy of things in the water that we'd never heard of five years ago — Vibrio, Listeria, Salmonella. And the despair is we don't even know what most of them are, much less where they came from and what they do. So it has become a very serious problem.

The fourth problem that deserves mention is the habitat. We go out and destroy habitat. Underwater eel grass is one of many valuable habitats on our coast. That is the good news. North Carolina has a variety of resources.

But we go out and change the water, create turbidity, dredge, do clam kicking. We do all these things, stretch that environment and decrease the potential for the production of resources we're interested in. And as we continue to stress that habitat, we will continue to lose that potential for resources.

Now, there is some good news, we can create plants. For instance, the micropropagation of eel grass. Biotechnology can create little plants where there had been no plants. Man has a lot of capability. The problem is applying it in a positive manner. Most of our capacity is applied in a negative manner. But we can use our biotechnology here to create new plants, new habitat.

That is not the answer, but it certainly will help to restore some areas that have been stressed to an unacceptable level.

We are also able to transplant marsh grasses and create new marshes. The question is how good is it and how long does it take? Some studies indicate that transplanted marsh takes five to 20 years under the best conditions to duplicate a natural marsh. Can we wait that long? I don't know.

Now, the fifth problem is a decline in fisheries. Fishing isn't what it used to be. And Gene Huntsman gave several illustrations of that.

The price has gone up. In the marketplace, we are compensating for the drop in supply by increasing the price. And what does that do? It brings out more and bigger and better technology to chase fewer fish. It is a big problem. I don't know whether that is despair or excitement.

Bycatch is part of that problem. We overfish in some cases. Sometimes we catch too many, more that we need.

Bycatch is catching those things that we don't want along with the targeted species. We must address this problem. We are impacting the total fishery by taking those organisms we don't particularly want. It will create a problem for the fishermen, so let's deal with it on that level.

Finally, we have fish diseases. All kinds of mycosis. It just isn't pleasant to catch a fish with a hole in it. It doesn't impress your neighbors. It don't look good in the newspaper. You are afraid to eat it. Yet we have fish out there with ulcerated mycosis, fish with red sore disease, blue crabs with holes in their shells.

We are beginning to learn about

this problem. But we are still a long way from understanding what the triggering mechanisms are, what the causes are, when and where it occurs. Many things work in combination and that is very difficult to unravel.

But I will close and leave you with more pleasant look at our coast. It is a wonderful place. We have many good things, but we also have many problems.

Economic Issues

The Economics of Fisheries Management

Jim Murray: The sportfishery has great economic value to our coastal communities. The message should be sent to tourism agencies and local governments to support recreational fishing and the fishing industry in general.

Jim Easley is a professor of agriculture and resource economics at N.C. State University. He has worked primarily as a fisheries economist since 1973. He is a member of the scientific and statistical committee of the South Atlantic Fishery Management Council.

I am going to introduce the approach that economists take in looking at fishery management issues. I want to discuss how we value the net benefits to fishing and provide a framework for thinking about some of the numbers that are used in fisheries management.

Since the mid-1980s, there has been a significant decline in recreational catch of species on the Atlantic and Gulf coasts. The number of angler trips has also declined. (See Easley Figure 1.) No one has looked carefully at why the number of trips is declining. It could be due to the recession or a response to the reduced stocks.

I am not optimistic about what is happening in many of our fisheries, and I will try to explain why.

The Mid-Atlantic Fishery Management Council has produced a document that covers 25 years and several major species targeted by East Coast anglers. Across all these species (summer flounder, bluefish, weakfish, sea trout, striped bass, scup and sea bass), the average catch was 828.7 million pounds from 1960 to 1970. But from 1980 to 1989, that average dropped to 449.3 million pounds.

Probably during this period, the number of anglers and trips increased. So the catch per angler or catch per trip has seen an even greater drop. The punch line is that things are not in great shape.

The Magnuson Act specifies that we try to manage our fishery resources in order to maximize the well-being to society. A commonly used phrase in the act specifies that we achieve optimum yields.

Optimum, as I interpret it, means you maximize something subject to some constraints. In this case, we are trying to maximize in a sense what we can get from our fishery resources. To an economist, that means the value of the services rendered from the resource.

The constraint is the biology, the reproduction and growth taking place. That constrains the size of a stock, how fast a stock can grow and what you can harvest from it.

So the economist thinks of a fishery resource as an asset producing a yield of services to a number of people — commercial and recreational fishermen. The focus here will be the recreational fishery.

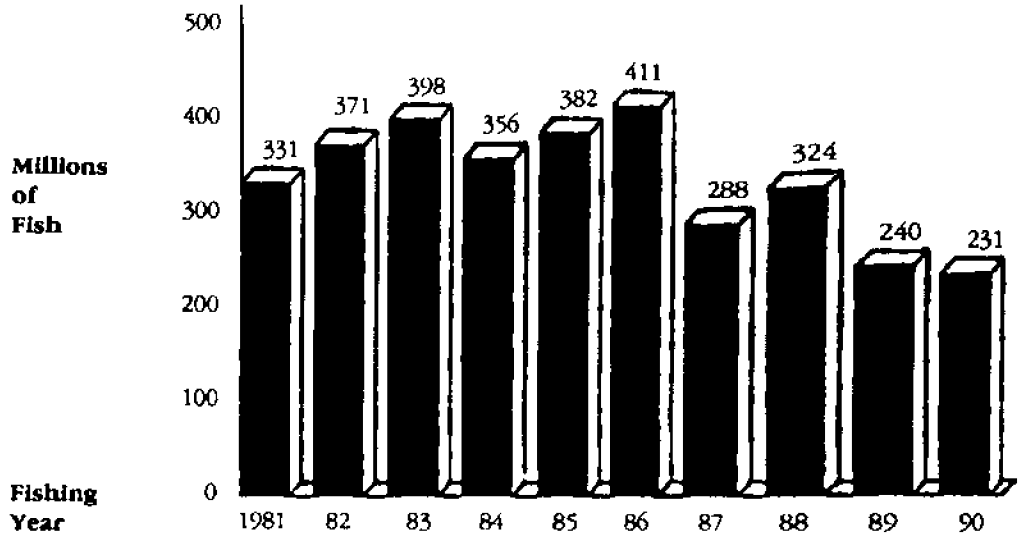
Basically, the economist wants to maximize the present value of the future flow of services. That is, we want to maximize the net value of the future stream of returns to this resource. That is a way of saying we want to get the most from the resource that we can.

The question is how do we measure that net benefit?

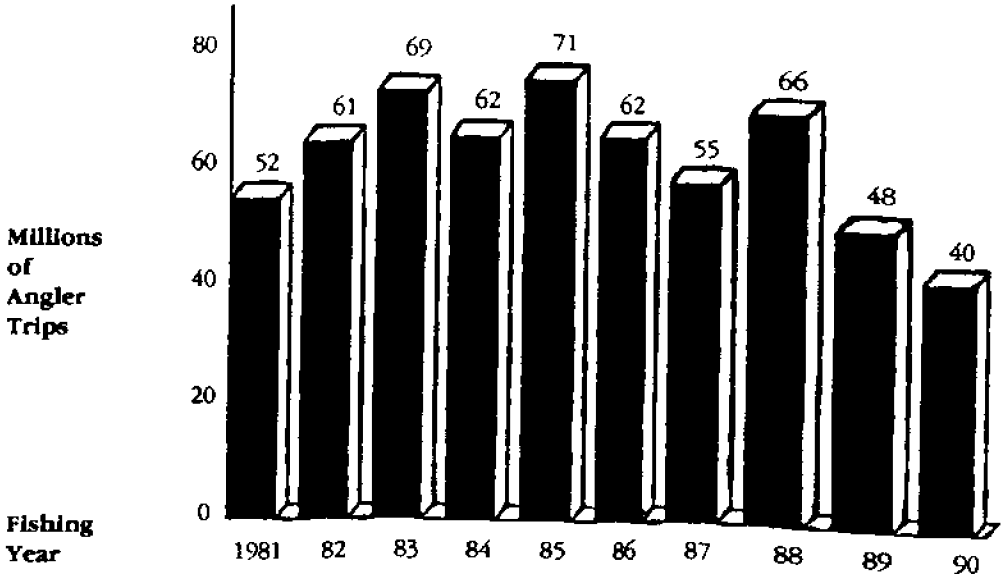
I think in a lot of our fisheries, we

Figure 1

Marine Recreational Fisheries Catch
Atlantic and Gulf Coasts



Marine Recreational Fishing Trips
Atlantic and Gulf Coasts



Source: National Marine Fisheries Service, *Fisheries of the U.S.*, 1991.

don't face an attractive future. We are coming down to a crunch time when we have to make some real tough decisions about reducing effort to help rebuild stocks. That effort may be primarily commercial in some fisheries; it may be primarily recreational in others.

I am a recreational fisherman. I have heard recreational fishermen say you can't overfish a fishery recreationally. The East Coast bluefish numbers have been discussed. So the problem is that people have to give up fishing and incur costs in the short-term to rebuild the stock. Economists also worry about weighing these current costs against the higher future benefits that the policies will bring about.

It won't surprise any of you that the greater the effort, the lower the equilibrium population of a species.

In an underexploited stock, demand increases for the fish and harvest increases. But because of the dynamics of a fish stock, if that demand continues growing, you are eventually going to run into a backward-bending supply of fish as the stock declines and harvest declines.

Figure 2 illustrates this relationship. At initial demand D1, harvests are at H1. Then as demand grows to D2, harvests increase to H2 — a rate of harvest approximating maximum yield.

As demand continues to grow to D3, the harvest begins decreasing as the stock declines. This may represent the situation in several of our fisheries. Note also that demand may represent recreational fishermen, fish consumers (from whom commercial harvesting demand is derived), or both.

Now, in much of our management we have emphasized the biology of the species. Certainly this is important in terms of keeping the stock from reaching the point of collapse, as the Chesapeake and East Coast striped bass fishery almost did in the early 1980s.

But an important point is that even if we just maintain some stocks, we are giving up a lot of economic benefits, both to recreational and commercial fishermen. So we need to look harder at these returns. Basically, I am representing a demand for recreational fishing and what causes people to go fishing. Obviously it's an activity they want to do.

You can diagram how many trips fishermen take per unit time, which is related to the cost of those trips — for gas, towing or boat rental, lodging, food — and what they expect to catch. The demand is affected by the stock of fish, in particular, the catch per unit effort.

On the other hand, people get more out of a fishing trip than what it costs them. Otherwise, many of us wouldn't go fishing. So there are net benefits accruing to fishermen from fishing.

This discussion is relevant to the payoff from rebuilding a stock in the future. Or if we are talking about an allocation issue between commercial and recreational fishermen, it is the vehicle by which we value some reallocation.

If we alter the stock, the catch rates are likely to increase and the demand will shift. It is the change in that area that's crucial to any management policy.

Figure 3 illustrates these points. The demand function shown as D(S0) simply represents the relationship between the number of trips a fisherman will take, and the price (or cost) of each trip (holding constant the stock, catch rate per trip, income, etc.).

The cost of each trip is represented as marginal cost, or MC. If stock increases such that the catch rate increases, the demand function shifts out. The net benefit, then, to the recreational fisherman is measured as the area between D(S0) and our hypothetical D(S1), but above the MC function. That is, we net out costs of the trip.

Now, just a couple of points. On

Figure 2 Long-Run, Backward-Bending Supply

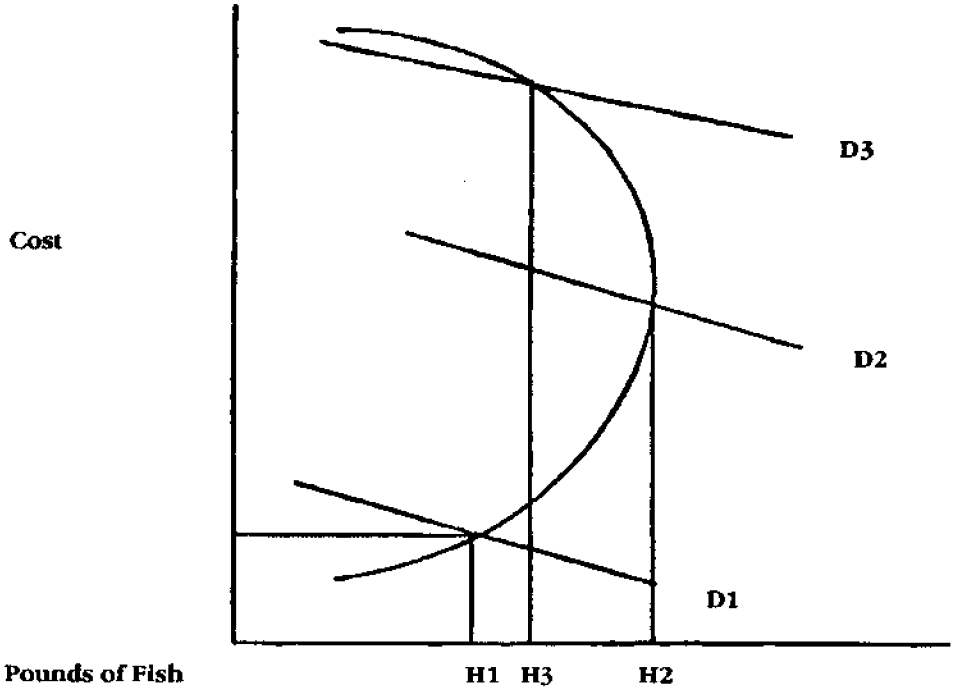
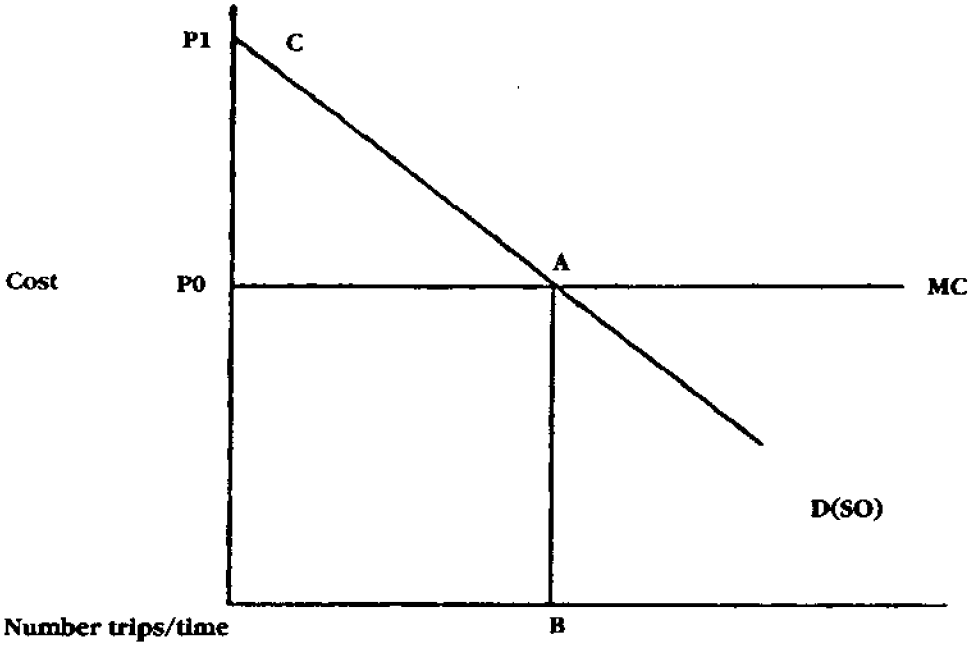


Figure 3 Demand for Trips in Recreational Sector



the cost of a trip, you frequently hear comparisons drawn between expenditures of recreational and commercial fishermen. In both sectors, those are largely costs. To the commercial fisherman, that is the cost of getting fish to the dock.

We really ought to be talking about changes in consumer welfare in the commercial sector for seafood as part of our measure of net benefits.

I learned in Rhode Island recently that 12 percent of every retail dollar spent for domestically harvested seafood goes to the vessel. So a lot of funds are tied up in processing and shipping seafood. And any changes in profits — not changes in expenditures or costs — would have to be measured in those sectors for these kinds of decisions.

Some people will interpret economists to say those expenditures aren't important. That is not the case at all. In a state policy sense, it is not a net benefit. It is a cost to one group, and revenue to another group, so it is a wash.

On the other hand, if I take two more trips to the coast and spend more money fishing, I am likely to spend less on other recreation. So in that sense, it is a wash and a transfer within the state.

But to the local community, these are important issues. I will just mention one measure. A lodge operator in Currituck said in a recent Sea Grant publication that when he bought his place in 1985, his October sales for restaurant and lodging were about $40,000.

Five years later, they are $8,500, and he is beginning to worry about whether he can hold onto the place. And it is all due to reductions in the demand for hunting and fishing in that area — reductions in activities brought about by reduction in waterfowl and largemouth bass populations.

That says something about the local impact of these activities.

This leads me to my final discussion. There are several pressing fisheries issues, but three stand out prominently: rebuilding our declining stocks; allocation between commercial and recreational fishermen, of which the bycatch or discard problem might be considered a subset of this larger allocation problem; and water quality.

If we are talking about regulating a recreational fishery, the total catch would be the number of fishermen times the number of trips times the catch per trip. That catch per trip is our catch per unit effort.

You can regulate any one of those three factors to modify catch and affect stock. The economic effects are quite different in terms of which factor you regulate. This is what we ought to be looking at more in management. Rebuilding stocks is one of the first things the state and nation should look at, and the different economic effects of different regulations are important to this rebuilding effort.

The discard problem has already been mentioned. Allocation disputes between commercial and recreational fishermen are important.

In many fisheries there will be both commercial and recreational fishermen. I hope we can get to the point of talking about decent decision rules and time frames for reasonable adjustments, rather than fighting it out in the halls of the General Assembly over who gets the harvest.

Water quality is a big issue. Baseline values associated with services currently produced from these resources are also important for damage assessment in the event of oil spills or hazardous waste spills.

Value of Water Quality Improvements to Recreational Fishermen

Kerry Smith has been a distinguished professor of economics at N.C. State University since 1987. His interests are resource economics in general and recreational fisheries in particular. He is a national leader in non-market economics, a field he's worked in for 20 years.

I want to describe the work of the Resource and Environmental Economics Program (REEP) at NCSU.

We have heard a lot about the physical measures of the quality and character of the fisheries in North Carolina. We've also heard about how those physical measures are changing as a barometer of the status of the fishery, how effort has been changing over time.

We are faced with two kinds of trade-offs when we examine these changes. One, we can fish now or fish later. If we defer fishing, we allow the stocks to recover naturally and we have a different character fishery and perhaps more and better fish. That is one kind of decision we make in response to the data on the North Carolina fisheries.

Another is we can change the activities that take place near the coast. Water runs downhill and the pollutants that are in that water can affect the fishery.

Either of the changes that would accompany these decisions imply costs to someone. And because they imply real costs, it is often useful to ask what are the results they yield worth? What are the dollar values that we can gain because we enhance the fishery?

It doesn't take much to realize it's worth a lot. You are interested in improving the fishery resources that support recreational fishing, maintaining and enhancing them.

Now, what is REEP? It is a group of nine faculty and eight graduate students at NCSU, started in 1987. We are trying to improve the information available about managing fish stocks and to determine how improvements would affect the quality of recreational and commercial fishing.

If it is a desirable thing, people would be willing to pay more per unit of that activity. That makes good sense and is reasonably simple to understand. But if there isn't a cash register telling us how a change in fish stocks will translate into dollars, we have to do some detective work.

We know, for instance, that water quality affects marine and estuarine resources: fish, sea grass and the life that supports the fish. And people use those resources in different ways. Economists call those uses and the dollar values people place on them use values.

There are also non-use values. I am not an active fisherman, but I like to think about it and to know it's there because my son loves to fish. So for me, the value I place on my son's fishing is a non-use value. But it is just as important to me as your fishing values are. This is an area that is increasingly important in economics and policy-making.

Up to this point, we in REEP have focused our research activities on valuing estuarine resources and their impact on fisheries. There are a variety of ways we can observe the connections between water quality and fisheries. On one hand, we have the physical resources others have described today. On the other, we have the methods economists use to value improvements in any one of those resources.

And the trick, of course, is to do research that connects them. Connect water quality to travel cost-demand models. How far would you travel to get better fishing? Can improvements in the fisheries be connected to a greater demand for that fish? Can we connect improvements in the beaches to a higher rate of rentals at the

beach? Can we ask people how much they would be willing to pay for those improvements?

An estimate of the value of improvements to the Albemarle-Pamlico estuary could be anywhere between 79 cents and $56.74. This range is simply too large because it says we are not able to be more informative in describing how much improving the fisheries is worth. It is either worth a little bit or a whole lot.

Why did we get these answers?

First, the data wasn't very good. And there is not much we can do about that in the short-term. We have to try to improve the information available. Second, we didn't understand the process very well, and we weren't representing it in the models especially well.

What are the elements in that understanding? One is something that is very apparent to you as people who fish, but not always apparent to people who sit in front of computer screens and try to figure out what's going on. If the fishing is bad but you enjoy fishing, the amount of effort that you are going to spend will increase if your objective is to catch a certain amount of fish.

If you go out there and say, "I am just going to work harder to catch fish," in economists' lingo that says the fishing effort per trip is endogenous. It is determined by how well you are doing.

If one thing you are interested in is catching a number of fish, you will stay out longer when you haven't met your quota. If you catch it right away, you might ride off in your boat and look at some of the inlets.

Another element in improving our understanding involves recognizing that the quality of fish stock is related to other influences. And we have to do a better job of making that connection. Natural scientists are moving along very well in making the connection, but too slowly for our purposes. So one question we will try to answer is could we improve the link between pollution and what's happening to the fish?

A third question is can we use the variations in numbers that came out of the models in a constructive way? Can we say that the models are different, but let's pick the strongest set and work with those?

And finally, we need to do a better job in representing what fishermen are interested in doing when they go out to fish. It may be more than quality of fish. You may be after a trophy species. It may be that you are interested in making sure you don't come back with an empty boat.

You want a mixture of things. We are working on all of those. And the latest effort at improving our valuation estimates deals with some information collected in 1988. We broke the process down into two components.

The first part involves the yield a fishing party gets when it goes out on a trip, and what influences that yield, such as the number of hours fished and the size of the party.

Some things decrease the yield. Fish stock would be decreased by a concentration of pollution from nitrogen loadings or pesticides that run downhill into the areas where fish spawn. And if these effects reduce the fish stock, they will decrease the yield. So we have a relationship that links pollution to yield.

Now, if we have a reasonable description of yield — what people would get when they go fishing — and connect it to their choice of location, perhaps we can predict how much it's worth to them. That is the second point.

Your willingness to travel is negatively related to the costs involved and positively related to the number of fish you expect to catch.

With the modeling equipment associated with these two relations — yield, effort and pollution; catch, cost and trip decisions — we can illustrate the

model with a policy issue.

Suppose you are interested in red tide, which forced the closure of some fishing sites in 1987. What would our models indicate fishermen have been willing to pay to avoid that episode? We estimated about $31.

How about the Pamlico-Tar River plan that is intended to reduce nitrogen loadings into the Albemarle-Pamlico area? What would fishermen be willing to pay for the improvements that will result from that program under the best of circumstances? How about $36?

While we feel this latest generation of models improves our abilities, we are not so satisfied that we are willing to stop.

What do we need to know?

First, we have to do a better job representing the fish. One fish is not the same as the next.

Second, my connections between pollutants and fish yields are largely guesswork. Scientists are working hard to improve them. To be convinced, we have to find ways to connect my work with what scientists are doing and validate that connection.

The effects on stocks are not there because we don't have good long-term measures of a stock. Allocation implies we are going to move some fish from commercial activities to recreational activities. What does that mean in terms of how many more will be caught?

Freshwater and marine fishing decisions are connected. We don't want to forget that. And certainly there are episodic disruptions to fisheries that prevent fishing for a short period of time, but not permanently.

What is the importance of this? These are issues on the slate for future work and we would certainly like to hear from you if there are others we should be working on.

Jim Murray: This is the kind of information that is used to influence and affect policy at the local and national levels.

Measures of the Size of the Fishing Industry

Tony Fedler is corporate secretary for the Sport Fishing Institute in Washington, D.C., where he is also in charge of research. Fedler is an economist and a social science researcher formerly with the University of Maryland.

The Sport Fishing Institute is a national fisheries conservation organization that represents the interests, views and policies of the recreational fishing industry and anglers. It focuses on how industry and anglers want the fisheries to be managed and how they want their interests represented in the decision-making process.

The institute has existed for 40 years and has worked with the National Marine Fisheries Service, the state fisheries agencies and many of the nation's sportfishing organizations.

I want to focus on the implications of expenditures, output and jobs in the state and how these may be changing over time. I also want to look at how changes — economic, social and political — will affect your enjoyment of the sport in the future.

The catch in the marine recreational fisheries in North Carolina has been up and down. Recently, it has been on the decline. (See Fedler Figure 1.)

And though there may have been slight improvements in 1988 and 1989, a consistent look across time shows that the abundance of individual species is going down and there is a lot of substitution in the recreational catch.

Participation in recreational fishing is important in looking at economics because the number of people and the number of trips they make influence how

Figure 1 **N.C. Marine Recreational Fishing Catch**

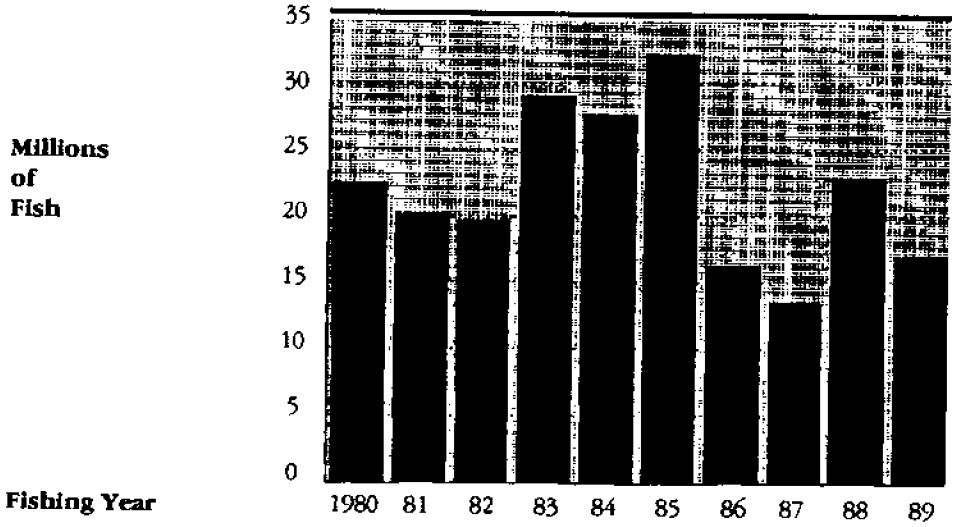
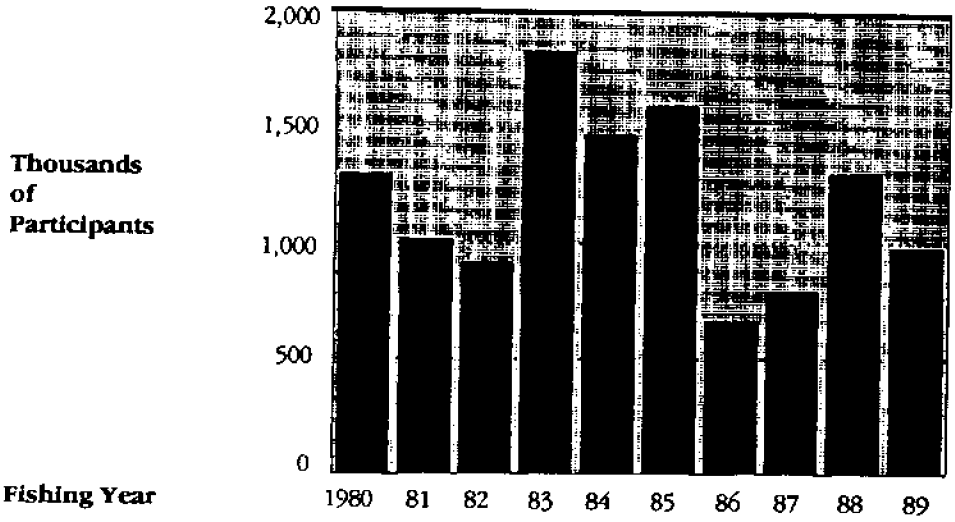


Figure 2 **N.C. Marine Recreational Fishing Participants**



Source: National Marine Fisheries Service, *Marine Recreational Fishery Statistics Survey*, 1980-1989.

Figure 3 **N.C. Marine Recreational Fishing Trips**

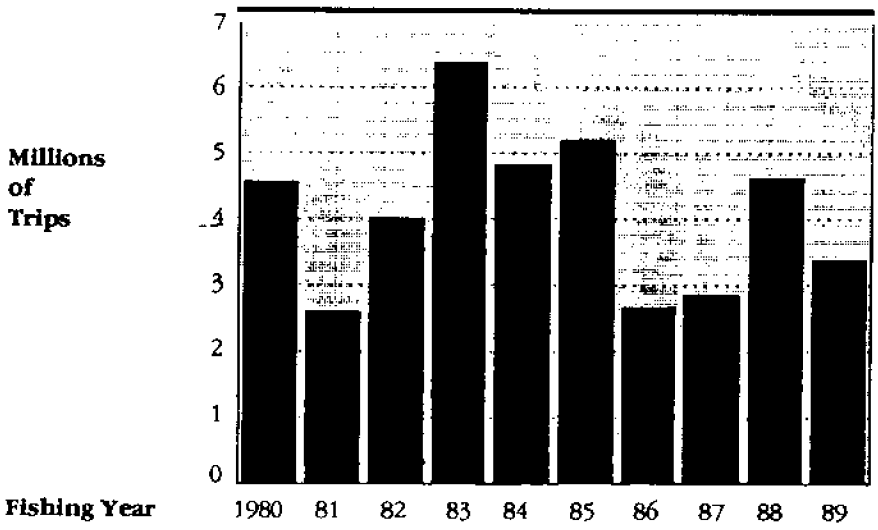
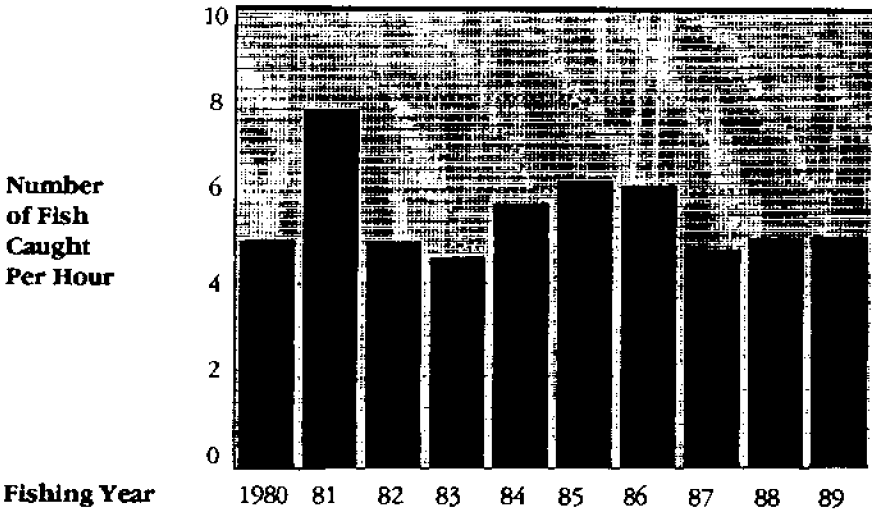


Figure 4 **N.C. Marine Recreational Fishing Catch Rate**



Source: National Marine Fisheries Service, *Marine Recreational Fishery Statistics Survey*, 1980-1989.

much they spend and how much of the total value is represented in dollars.

So in North Carolina, fishing participation has not been very stable. (See Fedler Figure 2.)

In the meantime, commercial finfish landings have been going downhill steadily. Statistical reports from the National Marine Fisheries Service show a strong decline, especially in the mid-1980s.

Recreational fishing trips, again, are sporadic and related to the number of participants. (See Fedler Figure 3.) Interestingly, North Carolina, unlike many other states, draws a majority of its anglers from out of state.

And again, that has a very important implication for what happens along the coastline in terms of businesses that support recreational fishing activities.

The catch rate indicates a couple of things. One, a declining catch rate on a fish stock would show it is not as abundant as it was. It takes more effort to catch the same number or fewer fish.

The catch rate has been relatively constant in the past few years after a drop in 1985 and 1986. (See Fedler Figure 4.) Again, the substitution of other species for predominant species can keep that catch rate up. You may target snapper or grouper. But you may end up with grunts and porgies and selectively keep other fish because you are not catching the number of snapper or grouper you normally would like.

And so, aggregate catch rates are not a good indicator of much because they don't reflect on the individual species — especially a species that's very important to you, such as red drum, Spanish mackerel or white marlin.

So you have to think about the statistics as they relate to individual species and not in the aggregate, because they can be very misleading.

In terms of the size of North Carolina's sportfishing industry, we have estimated the expenditures made by anglers.

Anglers in North Carolina spent around $226 million in 1985. Calculations for 1989 show spending dropped off to $184 million because fewer fishermen were making fewer trips.

N.C. Marine Recreational Fishing Economic Impact

	1985	1989
Expenditures	$226.0 million	184.0 million
Value Added	127.3 million	88.1 million
Wages/Salaries	54.3 million	37.5 million
Capital Expenditures	15.2 million	37.5 million
State Income Tax	7.4 million	6.1 million
State Sales Tax	11.2 million	7.7 million
Employment	6,000 jobs	4,250 jobs

Trips increased in 1990 and 1991, so the expenditures should have grown some.

The secondary impacts of spending also add value. If you spent $1 in a restaurant, it is re-spent for supplies and services. Wages and salaries generated from money spent on the goods and services that support fishing — $54 million in 1985 — dropped to $37 million in 1989. Employment fell from 6,000 to 4,000 jobs. Capital expenditures should be $7.5 million. Income and sales taxes generated are significant.

Now, that is not the basis for making decisions on allocating fish stocks. But again, this information is important when a congressman, senator or delegate asks about recreational fishing. The figures are not something that you can just ignore.

First, one of the biggest problems for recreational anglers is defining the industry and letting people know what it is. The industry is made up of bait and tackle shops, boat dealers, restaurants, lodging facilities and gas dealers. There are a whole host of places where anglers

spend money. And that has some meaning to a delegate from the coast who knows about commercial fishing and knows there are 1 million pounds landed in his district that create 150 or 200 jobs.

That moves you into the political arena for making decisions. And there are a number of factors that influence fishing participation.

N.C. Marine Recreational Fishing Causes of Change

Economy
Discretionary Time
Perceived Lower Fishing Quality
Reduced Fish Populations
Habitat Destruction
Development
Pollution
Overharvest
Restrictive Management Regulations
Bycatch
Wasteful Fishing Practices

The economy is one reason for the change in recreational fishing. If we have fewer discretionary dollars to spend, we have to decide whether to spend them on necessities such as food, clothing or an additional car payment; leisure activities such as a movie or a show; or fishing.

The number of fishing trips we make may also depend on how much money we have in our pockets. Discretionary time is also important. If you are working two jobs, you don't have much time for fishing. But if you work only one job, and it's 8 a.m. to 5 p.m., you may have more time.

Perceived lower fishing quality — whether it's the quantity, size or quality of fish — can affect the number of people who go fishing and the trips they take. As fish populations decline, and they become more difficult to catch, people may be less apt to try to fish for them.

Habitat destruction is inextricably related to declines in fish population. Development on the water, and not necessarily along the North Carolina coast, is a big problem because you can't get to the water. There is sometimes no boat landing, no shore facilities, no way to get to the water to cast a line. And along the waterfront there are miles of hotels. So getting to the beach to fish is often very difficult.

Pollution can also have a significant impact on fish populations.

Commercial fishermen and recreational anglers are overharvesting some fish stocks, and they are responsible for declines in population. Commercial overharvesting is focused on often, but recreational anglers play a role as well.

Restrictive management regulations also play a role in the changes in participation. For instance, new regulations in the bluefin tuna fishery in 1993 will lower the limit from four fish to two fish per angler. Well, who would take a trip 20 or 30 miles offshore to fish for bluefin tuna only to catch one fish, especially as the probability of catching that fish is being reduced all the time?

Bycatch also reflects on the overall population of fish and the wasteful practices of commercial fishermen and recreational anglers who keep more than they need.

There was mention earlier of catching two or three coolers of bluefish. But when people get them home, probably half end up in the garbage because they turned rancid, spoiled in the freezer or were dumped. I have seen that happen. I have watched people catch a lot of Spanish mackerel or king mackerel that end up in a dumpster at the back of a parking lot.

Why is that occurring? Well, people like to catch fish and keep them. They think they can use them, but they find out they can't. So a responsible ethic among anglers is important.

Changes in the fisheries and the economics do have implications for recre-

ational anglers. And there are a number of things that need to be done that will improve economics.

If fisheries were improved — or even the perception of fisheries — there would be a boost to the livelihood of the people who own restaurants, hotels, bait and tackle shops on the Outer Banks or the Albemarle-Pamlico Sound.

There are a number of things that anglers should do to make fishing better.

N.C. Marine Recreational Fishing Implications for Anglers and Management

Actively support management.
Actively seek fisheries agency budget increase.
Work with managers on regulation development.
Advocate elimination of wasteful bycatch.
Call for improved data collection.
Consider sources of mortality in management.
Improve regulation of commercial industry.
Work with other groups to increase influence.

Sportsmen need to actively support management. That doesn't mean agreeing with everything. But you need to work within the system, with the people responsible for making decisions. Get your influence in there and try to represent the recreational anglers' point of view.

It is important to actively seek budget increases for the fisheries agency. For Bill Hogarth to do the job he needs to at the Division of Marine Fisheries, he needs more money.

North Carolina doesn't have a recreational fishing license, and as a result, there is no license sales money to support the division. Licensing is a way to increase the budget and benefit anglers.

Of course there are some negatives. But again, actively supporting the budget increases, working with legislators and trying to convince them to give more money to the fisheries management programs is very important.

Work with managers on regulation developments. Don't wait until something is proposed to jump all over them and say, "This is the worst thing since the striped bass moratorium," or whatever. Work with them beforehand so that everyone can understand and agree on the regulations.

Also, advocate the elimination of wasteful bycatch. Call for improved data collection. If we don't have any data on how many fish are out there, then we can't make any decisions other than by the seat of our pants. Sometimes the decisions for protecting fish stocks are pretty good. Other times regulations don't reach the level needed to protect the stocks.

Consider all sources of mortality in management. In many fisheries, bycatch is not even considered a part of fishing mortality. It's just something that happens in commercial fishing.

Bycatch is also not considered in recreational landings. That could be significant. We are seeing that in North Carolina and the rest of the South Atlantic and Gulf.

Improved regulation of the commercial industry, improved reporting of catch and improved reporting of bycatch all should be figured into mortality to understand what is going on with the fish stocks.

We need to get a handle on the recreational fisherman's catch. In some places, very poor data causes the recreational catch to be underestimated from 30 to 400 percent.

Work with other constituencies to increase influence — organizations such as the Atlantic Coast Conservation Association and statewide associations such as the Maryland Saltwater Sportsmen's Association. These groups that pull anglers together into umbrella organizations are very important if the recreational fishing community is going to influence decisions made by the fisheries commission, state legislators and national policy-makers.

Now again, these suggestions will

enhance the recreational fishing industry. They will increase the value an angler places on the fish stock because there will be more fish and the angler will want to go more often. So anglers will be spending more in the coastal areas.

Boosts to the economy and the importance of sportfishing will create additional benefits for recreational anglers in terms of better access, more fishing piers, more boat ramps and a variety of other facilities and services.

So improved fisheries resources, of course, are the best thing for shoreside communities and the anglers.

The Sport Fishing Institute deals daily with some final points that I believe the management agencies and organizations have lost sight of.

First, the management objective for recreational fishing and commercial fishing is not the same in many cases. It is not important to recreational anglers to have a lot of fish. They many not need or want to catch 30 Spanish mackerel or 30 red drum. Catching two red drum or one red drum that is 30 pounds or 25 pounds may be more important.

Certainly there is diversity among anglers. Some like to catch a lot of fish regardless of size and some like trophy fish.

So there are different objectives. In commercial fishing, a large quantity of small fish may be just what they need. Those are the size fish that can go into the market and get an optimum price.

There is another trend that the bluefish fishery reflects on — the commercial catch for bluefish can be 20 percent of the total. If it was not 20 percent or the total, but at some fixed level or not even tied to the recreational catch, several things would occur.

For instance, recreational anglers may say, "We don't need 30 bluefish. We only need four or five because they don't keep well. They don't stay in the freezer well. So we are going to cut back on our harvest."

Then there is a surplus that won't be harvested. The commercial anglers can say, "We need to harvest that surplus," and their catch goes up. As a result, the balance that was being saved by anglers' conservation measures — not taking all the fish — is going to be cropped off. And the surplus that would have been there to recruit new fish in the fishery, to increase the overall size of the fishery, would not occur.

And it is not occurring in the bluefish fishery. But the way the proportion is set up, it could. Because if the commercial fishermen are taking 20 percent of 50, and recreational anglers drop their harvest to 20, then they are not going to get as many fish from only 20 percent of 20. And they may cry for some other regulations.

That ties into a third point. Anglers should not be content to hear that fish stocks will be managed at a particular level when the historic level of that stock is many magnitudes of order greater.

Many fish stocks are at 30 percent, 20 percent or even 15 to 10 percent of their historic highs in terms of harvest or population levels. In many cases, the management targets and recovery levels are being set much lower than the optimal yield or the historic high average for that fishery.

Many times this is overlooked in the decision-making process and the development of plans. Again, it is very disturbing because no one wants to bite the bullet. No one wants to have severe restrictions on recreational harvest or reductions in commercial harvest. It is going to hurt. It is going to hurt the shoreside recreational fishing industry and the commercial fishing industry.

But we need to be concerned about that. We need not, however, lose sight of the objective that there can be a more productive fishery than what we have or

what may be targeted in the future with management.

We should also be concerned that we do not allow the fishery to become a model in terms of the size structure of fish. Fish sizes have declined. And the size of many fish being harvested now in the commercial or recreational catch have decreased dramatically in the past 10 to 15 years.

Are we as anglers going to stand for catching 13- to 16-inch flounder when we could, with initially more restrictive management, get the population size up to 16- to 20-inch or 18- to 24-inch flounder?

Again, those are decisions that recreational anglers need to make. It reflects on the quality of the angling experience. And that reflects back on the angler participation, the number of people, the number of trips, the impact on shoreside communities and the value that anglers place on the fisheries.

If you are looking at that change in terms of consumer surplus or net benefits to anglers, the more fish, the more anglers, the bigger those benefits are going to be. And if you are looking at an allocation decision that compares recreational to commercial benefits, the greater the recreational benefits, the stronger the economic argument for allocating surplus fish resources to the recreational sector.

The Importance of Sportfishing to the N.C. Coastal Economy

Tom Fetzer is assistant secretary for natural resources in the Department of Environment, Health and Natural Resources. He oversees five divisions: the Division of Marine Fisheries, the Division of Parks and Recreation, the Division of Forest Resources, the Division of Soil and Water Conservation and the N.C. Zoological Park.

There have been times recently at the Division of Marine Fisheries (DMF) when we felt it was time to fix bayonets and dig trenches. The division has been under siege it seems from all sides at times. The commercial fishermen think there are too many regulations, and they don't want any. And the recreational fishermen think there should be more.

The Marine Fisheries Commission, which sets policy for the DMF in this state, is supported by the governor. And the very makeup of that commission — with representation by commercial, recreational and scientific interests — creates inherent tension and conflict.

But the goal of the commission is to seek balance. I think the current commission is one of the most balanced we've had.

Part of my department, as the name implies, is the environment. And the Division of Environmental Management has a water quality section in charge of permitting municipal and industrial wastewater treatment. Other states and federal agencies such as the EPA say we have one of the finest, if not the finest, water quality sections in the country.

Along with that, I also oversee the Division of Soil and Water Conservation and the Division of Forest Resources. Both spend a considerable amount of their time trying to institute the best management practices in agriculture and agribusiness.

Agriculture by most accounts is the leading source of pollution in our streams, estuaries and waterways. Most of it is the agricultural non-point source runoff. The agricultural community, I think, has an all-time heightened awareness about the needs to keep soil on their land and not in the streams. So I believe if water quality is not improving now — and many people think it is — it will be very shortly.

But that is really beyond the control of this group and the DMF. The part of the problem we have to tackle is overharvesting. And I believe that in terms of problems in the fishery, overharvesting is a greater problem than water quality.

There are three words I want to look at: controversy, conflict and cooperation.

This has not been a year without controversy in marine fisheries. In some public hearings, commercial fishermen sent a funeral wreath with Bill Hogarth's name on it. And a commercial fisherman recently made some dire implications in the newspaper about the future health and safety of observers we had placed on commercial fishing boats to check for turtles caught in the flounder trough.

Now, in my experience, most commercial fishermen are responsible, reasonable people who are truly interested in protecting the resource. It is also by extension a protection of their livelihood. And I do not judge the entire commercial fishing industry by a few loud, discordant, disproportionately unreasonable voices. I really believe most of the time they are trying to work with us rather than against us.

But there is inherent conflict in the fishery industry. Anytime the livelihood of people is involved — their ability to feed their families and put a roof over their heads — and it comes into juxtaposition with resource management, there is conflict. And I am not sure that conflict will ever be removed from this industry. It is sort of like the Middle East. It is just a problem that will always be with us.

But I believe firmly that cooperation can assure the interests and the survival of both the commercial fishing industry and the fishery resource. And the time to begin that cooperation is now.

I don't think it is overstating the case to say that, particularly in the case of summer flounder and weakfish, there are species teetering on the verge of collapse.

In the DMF, we need more and complete data to better manage. A lot of fish are caught and sold that are not accounted for. And I am not talking about just lost revenue to the state. Things are happening out there that we do not have the ability to use for measure.

I am convinced, and I believe the DMF and the DEHNR are convinced, that we need a new licensing system to better measure effort and catch. I hope to see some license-to-sell proposal winding through the General Assembly, if not in this session then next year.

I think it's important to leave a group with some sort of action, so I want to urge you to get more involved. The public hearings held around the state by the Marine Fisheries Commission are dominated by commercial fishermen. Recreational fishermen have to start showing up and being heard. You have to start working with local elected officials, congressmen, senators and the governor. Speak up more often and louder. Your interests are being underrepresented in the marketplace of public debate right now.

Saltwater commercial and recreational fishing means roughly $1 billion to this state every year. And two-thirds, or $2 out of every $3, is directly related to recreational fishing. The Big Rock Marlin Tournament alone, held one week every year, brings about $3 million to Carteret County.

So this industry, this fishery is extremely important to the state from an economic point of view. And you need to

make sure that economic point of view is represented in the halls of the General Assembly and in Washington.

But this is more than a billion dollars a year. It is a vocation for people who work in it for a living. It is an avocation for people like you. And it is even more than that. It is a way of life. Fishing is indelibly etched into the cultural fabric of this state. It is part of the North Carolina experience.

And we must all work together — commercial and recreational fishermen, scientists, at-large members of the Marine Fisheries Commission — to preserve this way of life for future generations of North Carolinians.

I can assure you that if your local elected officials are made aware of the clout that recreational fishermen have in the state, they will be interested in your input. Use it. Take advantage of it.

Fisheries Management in the Southeast

Managers Panel

Bob Mahood was director of the N.C. Division of Marine Fisheries before Bill Hogarth. Six years ago, he became executive director of the South Atlantic Fishery Management Council. He has also served as director of the Georgia Coastal Resources Division.

I want to talk today about the South Atlantic Fishery Management Council's perspectives on recreational fisheries management. It's not easy for managers to tell you whether we think recreational fisheries management has been successful or not successful.

However, I am more likely to lean toward the successful in many cases.

The council is responsible for managing the resources beyond the states' territorial seas — from three to 200 miles offshore. But because many of the managed species cross the three-mile boundary and come inshore, the council does count on cooperative management with the states.

Consequently, in the council makeup, the person responsible for marine fisheries in a particular state (or a designee) serves as a voting member on each of the councils. There are eight regional councils. North Carolina is part of the South Atlantic Council with South Carolina, Georgia and Florida through the Florida Keys.

Individuals who are qualified with recreational, commercial or other fisheries expertise are nominated by the governor of each state to the U.S. secretary of commerce. The secretary of commerce decides who will be appointed to the council. The South Atlantic Council has 13 voting members — three from each of the states and the regional director of the National Marine Fisheries Service (NMFS).

What are some of the criteria we might use to judge the success of recreational fisheries management? Obviously, we have to manage both the recreational and commercial groups and look out for the well-being of the resource. When we have taken care of the fisheries resource, we then allocate the resource accordingly.

First, we look for the health of the fish stocks involved. We have had some successes, and we are running with some failures that we are trying to correct.

Second, and especially relative to recreational fishing, is the control of harvest through quotas, size limits and bag limits.

The first year I was a North Carolina council member as the executive director, we were enforcing our first bag limits on king mackerel. At the time, we were looking at a three-fish bag limit.

We heard from fishermen, charter boat captains, the whole gamut, saying they would be put out of business or it

wouldn't be worth fishing anymore. And we asked people to bite the bullet to bring this resource back, hold it steady and increase its numbers.

I think that has happened.

Last year, an assessment of the king mackerel resource by the NMFS indicated the fishery has rebounded considerably. As a result, for the first time during my involvement in fisheries management, we were able to give something back to the fishermen after asking them to bite the bullet for a number of years.

What surprised me were the number of fishermen who said, "No, don't raise the bag limit. We are doing fine with the three-fish bag limit. We have seen the benefits. Please don't do something that is going to cause it to go the other way."

That surprised everybody, but we now have a five-fish bag limit. And from the landings we've seen this year, that might put us on target for the recreational allocation of the king mackerel resource.

On the harvest control side, we are encountering some problems similar to those with the Spanish mackerel, where states may leave the fishery open once the federal quota has been reached. This is a problem we are addressing now and will continue to face in the future because much of the pressure to leave that fishery open comes from the recreational fishermen.

The third criteria for judging the success of recreational fisheries management is the compatibility of state and federal regulations. This often affects enforceability of those regulations.

Initially, when we started with management by bag limits, few states had a limit in place. And those with a bag limit didn't match the limit in the federal zone. So consequently, we had a lot a problems with enforcement.

We have come a long way since then. North Carolina is compatible, South Carolina is compatible, Georgia is compatible right now. And Florida is compatible to the degree that it has a lower bag limit than allowable in the federal zone, which does cause some enforcement problems.

So we will still have to work to maintain that compatibility.

As we get into the management of the snapper-grouper fishery, many regulations became effective Jan. 1, 1992. We really have some incompatibility problems to deal with. There is now a Sea Grant document that explains the state and federal regulations, and you can see some of the incompatibilities in the snapper-grouper fishery.

Recreational catch statistics are the next category for discussion. Many of our plans and methods are driven by quota — harvest quotas are set on fisheries and closures occur when the quota is reached.

The problem has been that the data collected through the marine recreational fishing survey doesn't really meet the needs of the quota management on a timely basis. Consequently, we have faulted the marine recreational survey, but actually that survey was not created to manage under a quota system. It was created for something entirely different — to record catches on a very general basis over a longer time frame.

The good news is there's money in the budget this year to adapt that program for better and more up-to-date data collection relative to quota management.

Also, the states have put more effort into getting better data. North Carolina probably leads our four South Atlantic states in collecting data, especially relative to the life history of the various species, land uses, landings and other statistics.

There are a number of fisheries under management that affect recreational fishermen through regulations. Among them are coastal pelagics, which are mackerels and cobia; the red drum; the snapper-grouper complex, which encompass many species under regulations; bluefish;

flounder; marlins; and sailfish.

We are now creating a brochure of recreational and commercial regulations for the federal zone and the fisheries under management there. That should be available within the month. That's something you can carry with you. I can tell you I am perplexed with the size limits when I go out. And in my position, I have to make sure one of our officers doesn't grab me coming in with an undersized red snapper or anything else. I have found out, too, that a 19-inch red snapper is hard to turn loose.

And there are other changes to improve the system. We need to continue working with the states on compatible regulations. Also state closures — when the federal fisheries quotas have been reached and the fishery is closed. That's when you as recreational fishermen can help, because if there's a lot of pressure to keep state waters open, it's hard for state management to close them.

Enforcement will always be a problem. Enforcement officers will always be in short supply. But some states address this by entering into cooperate agreements with federal law enforcement to deputize officers who will enforce regulations under the Magnuson Act.

We need better catch statistics. Again, we are seeing improvements, but this is probably the weakest link in the entire management system. We must continually push our state legislatures and Congress to provide funds to ensure that we have good and accurate data for management.

Also, we need to regulate the red drum. We have closed all red drum fishing in the federal zone, beyond three miles. And we are encouraging the states, since they control the destiny of that fishery, to implement regulations that will allow escapement to that spawning stock beyond three miles.

And finally, there are questions about the sale of recreationally caught fish.

This is a question that arises all the time. And it is going to become more important as we start getting into commercial limited-entry programs and individual quota programs. It will impact the recreational sale of fish. This is one particular area that we would like to hear from you on.

Mike Orbach has been a professor of anthropology at East Carolina University since 1982. He joined the Marine Fisheries Commission in 1985. He is currently chairman of the commission's scrap fish committee and chairman of the Ocean Affairs Council, which advises the governor on marine policy issues.

I am in this management business because a new regulation or policy doesn't affect any fish directly. It doesn't affect any sea grass or water. It affects people. And if we don't understand how the commercial and recreational users work in a system, we can't manage it properly for any reason.

The Marine Fisheries Commission (MFC) in North Carolina has the policy-making authority for fisheries three miles out in the ocean, in the sounds and up to the point that the water gets fresh. There, the Wildlife Resources Commission takes over.

The MFC works with a number of groups on fisheries issues: the Wildlife Commission on striped bass; the South Atlantic Fishery Management Council on mackerel, which involve other states; and the Atlantic States Marine Fisheries Commission on trout and flounder, which again involves fisheries outside our jurisdiction.

Not only that, we control only fisheries regulations. We have no control over water quality, coastal management or many other things that affect our fisheries. So we are planted in the middle, but we are the policy-making group for the coastal

marine fisheries of North Carolina.

In general, the commission tries to operate on three principles.

First, conservation is good for all users, not only commercial and recreational. As a matter of course, we should conserve with all resources, not just fisheries. It is unclear to me that there is something called recreational conservation as opposed to commercial conservation. There is conservation as opposed to allocation, which is who gets to use the resources being conserved. It is important to distinguish those two things. So we use the principle that good conservation is good conservation.

Second, we operate on the principle that there is room for everyone as long as everyone acts responsibly, contributes, participates and abides by the rules, commercial and recreational. It is the infrequent case that we have to make black-or-white decisions that every user in one group is in or every user in one group is out. We do not see as much necessity as some others to make those kinds of decisions. Everyone can participate if everyone participates fully.

Finally, we operate as much as possible on what we can demonstrate and back up with data and information. We oftentimes make decisions because we think it is the right thing or the wrong thing to do. But we always try to operate as much as possible on the basis of something we can document.

Now, how effective is our fisheries management system for managing recreational fisheries? And what changes, if any, should be made to improve it?

First, I think it's fair to say the fisheries management system for marine fisheries in North Carolina has not always paid as much attention to the aims of the recreational users as it should or could have. But we have made some progress in that area.

The commission that I joined in 1985 tried to achieve some balance in users for the first time ever. Sen. Marc Basnight's legislation in 1987 made it law that we must have a balance on the commission, a certain number of recreational and commercial fishermen, processors, scientists and so forth.

I think that's a very good thing in North Carolina. Many other states do not have that requirement and don't have as rational a management system as we could have here. I think the balance has been in general good for recreational interests in the fishery.

Having said that, what can we do to more effectively manage the fisheries? There are some things we should keep in mind.

When we talk about what the commission should do, we are talking about more than achieving a distribution of benefits from these resources. We are talking about perhaps creating some new responsibilities and joint participation in management between the commission and other users. We are not only talking about benefits, but responsibilities. Not only our responsibility to make decisions, but users' responsibilities to participate in the system.

We will have to consider some major restructuring of our licensing system. And I think that should include a saltwater sportfishing license, among other things. We need more resources to manage with. We need more participation in the system. I think it will be necessary to look at other systems. Florida, for instance, has a saltwater products license, essentially a license to sell, and a license for all users. So commercial and recreational users will be counted and will participate in the system.

We in North Carolina may want to consider a reproductive size limit for many, it not all, of our major species. And we may have to move toward more quota management than we have in the past. Most other coastal states have already gone in this direction.

I think we will have to get more oriented to what I call ocean and water zoning. We have already gone to that with primary nursery areas and some of our artificial reef areas. We will have to dedicate certain areas to specific uses. As we use the water more, it is going to become more like land. We have land-use planning, and we will need water-use planning.

Finally, we will have to consider some new innovative systems of management, such as effort management systems, so-called limited entry ITQs. Again, many other states, our national government and other nations are going toward this system. We will at least have to look at some of those things.

This will all have to be done in a coordinated way. We need a plan, some kind of vision for our fisheries management. The division is already putting together such a concept, a framework that deserves as much discussion as individual management measures — the big picture. How does it all fit together?

Finally, the commission tries to operate with a principle of balance — without getting too Zen-like about all of this. We can have a balance of uses and interests with our marine fishery resources. The economists have said how important the dollars are. But as a social scientist, I get concerned if we use dollars as a measurement, just as I was concerned about pounds of fish caught as an index.

We have to talk about benefits and uses. A dollar for a hotel chain in Nags Head is not the same as a dollar to a bed and breakfast in Engelhard. A dollar for fishing tackle is not the same as a dollar for new bottom paint on a fishing boat. A dollar spent in one part of the state may have different uses and benefits than a dollar spent in another part of the state.

Unfortunately, if we are going to get past pure biology, we have to take all those things into account. Rather than focus on any single factor, we should look at how all factors balance together. Some people view that as politics, and I am afraid that is what fisheries management is.

Our goal is to make it as rational, as specific and as clear as possible with conservation measures identified as conservation measures, allocation measures identified as allocation measures, and all of it based on good biological, social and economic information.

Bill Hogarth, director of the N.C. Division of Marine Fisheries.

Our current fisheries management system is capable of being effective, but I am not sure that it has been.

North Carolina has made some strides in the last two or three years. We were the first state to put in a shark management plan and snapper-grouper regulations. So we haven't stepped back, but we haven't gone as far as we need to go.

I think, however, we have the ability to make the necessary regulations with the commission system, public input and the proclamation authority with which we can respond to existing conditions.

One thing that has been tough — the Division of Marine Fisheries (DMF) is an extremely political division. It has been more so in the past than in this administration. We are free to do our jobs and we get a lot of support. But in the fact that it is so political, it has not had consistency in leadership. I have been director for six years, but before me there were about six directors in 12 years. That's an average of two-year terms.

Sometimes it's tough to make some of the decisions we need to make. That bothers me about the system. People won't make the necessary decisions because they have to look at their future. I am the only person who has to worry about that now. This administration has taken a lot of personnel out, and I think that will make a

difference in the future.

DMF has to manage for the recreational and commercial industries. These are two different types of fishermen.

The commercial fisherman wants as many fish as he can catch that will bring him a good price. He doesn't care if it's a 6-inch weakfish selling for 80 cents a pound or a 14-inch weakfish selling for 40 to 80 cents a pound. Basically, he wants the most fish he can catch to get paid the most money.

But the recreational fisherman would rather have larger fish and fewer of them. He would rather have 14-, 16- or 18-inch weakfish to enjoy catching. Perhaps he wants to catch a few more than he is now without going as long between bites. But there is a real difference in philosophy that we have to deal with.

The system is there. Maybe it takes a little bit more intestinal fortitude from people like me who have the authority to do what we think is right without worrying about the future. And maybe we haven't done that as much as we should. But hopefully, we have, and we will continue to do more in the future.

We have to make changes. Among the things we must protect is spawning. We don't do that now. We have to protect the fish and let them spawn at least once. In my opinion, no edible finfish should be landed as scrap. There should be a size limit or some way to keep the edible finfish from being used as scrap.

We have to look at better gear. I think that is happening, fishermen are using gear that can better target fish. I know some people don't like gill nets, for example, but they can be a very selective gear if you set and fish them properly.

We need a license system. Ours is archaic — we don't know who does what. We have no idea how many people do anything. Anybody can sell. Anybody can buy a commercial license. It is very difficult to put out a proclamation that says the commercial industry can do this and the recreational industry can do that. We don't know which is which.

I don't know how many true recreational fishermen there are in this state, but there are a lot of commercial fishermen. Everybody basically sells.

I think everybody should have the right to harvest the resource and put it in his freezer to feed his family. But we have to come up with a licensing system that separates the commercial fisherman and yields better data.

We don't have money in the DMF to do many things we need to do. I don't think we should license people to get that money, but we don't have good enough data on the catch. We don't have the money for research. Wallop-Breaux funds allow us to do research for recreational fishing, but there is no research on a commercial basis.

We want to develop new gear. There is no money in the division to look at new gear from a commercial standpoint

Enforcement is very inadequate. We make new rules. But we have the same number of law enforcement officers we have had for 20 years — 47 for 2.2 million acres.

So we need to look at the licensing structure that gives us the data we need. We need to put in regulations that will protect the fish until they spawn. We need to do something about the bycatch and landing fish as scrap, particularly the edible finfish.

And we need involvement from everyone in management. If this were a commercial fishery meeting, I can guarantee there would be 10 or 15 legislators here. I don't see any lawmakers.

Every time we put in a regulation, I get calls from a congressman or senator who has been contacted by the commercial fishermen complaining that it will put them out of business.

The commercial fishing industry is

very concerned about the future, as it should be. But we are not managing. We need to balance better. And everyone needs to be involved in management and work toward common goals.

I met recently with a group of about 60 commercial fishermen. Their position was, "Let's put in the regulations that will protect the fish. Let's put in a size limit that will assure a future. But let us help decide the future."

They don't want to be put out of business, but they want to help.

I think that is what we are saying. We need to work together. The recreational industry needs to come forward with specific regulations or changes to help the resource. The commission makes those rules, and we will do our best to carry them out.

Fishermen Panel

Dick Brame is the first executive director of the N.C. Atlantic Coast Conservation Association. He also worked for the North Carolina and Pennsylvania Wildlife Federations after earning a master's degree from N.C. State University in wildlife management.

I want to share with you what I get out of talking to recreational anglers from Winston-Salem to Charlotte to Elizabeth City to Wilmington and all points in between. I want regulators to listen and understand what I am trying to say.

I am not necessarily speaking for the Atlantic Coast Conservation Association (ACCA). I am speaking for what I have felt and seen from the hundreds, if not thousands, of anglers I have talked to. In their opinion, the fisheries have been managed by and for the commercial industry. It used to be the Bureau of Commercial Fisheries, and in many cases that was its job — divvying up the resource within the commercial industry.

And that has been slow to change. Many still view their primary job as protecting the commercial fishery. The recreational fishery has become more vocal of late. These fishermen want the stock protected to allow at least a reasonable chance of catching the fish. The ACCA stands largely for the conservation and regulation of this fishery, making its first priority protecting the fish. The Marine Fisheries Commission (MFC) should do the same.

Unfortunately, however, our experience has shown otherwise. The recreational angler is frustrated. By its own report card, the MFC has been less than perfect. We have all seen the grass and fish stocks decline.

Overharvest, and bycatch in particular, is the anglers' biggest problem. There is simply too much gear in the water. In comparison to Virginia, South Carolina, Georgia and Florida, North Carolina allows virtually any harvest, anywhere, anytime. That is not true, but it is the perception. The state does allow a lot of harvest. The anglers have fished these other southeastern states and seen the effects of reducing pressure on these fish stocks. And they want to know why North Carolina can't do that.

The MFC estimates that scrap, which is the little fish not necessarily used for food, amounts to 53 million pounds annually. That's over 220 million fish. These are small fish tossed over the side dead or sold for pennies as crab bait. Eighty percent is from the shrimp trawl fishery.

The National Marine Fisheries Service has determined that shrimp trawl bycatch is a significant portion of the overharvest of weakfish in North Carolina. Yet we listen as the MFC and others say there is no scientific evidence that shrimp trawl bycatch harms anything — the bottom, the water, oysters, the shrimp or the fish. We listen as the industry says bycatch

is a perception problem, not a real problem.

We listen as shrimpers tell us in all seriousness that shrimp trawls help the fish because they till the bottom like a farmer tills his fields, all with equal incredulity. The answer to the shrimp trawl problem is finding a less destructive way to catch shrimp and moving shrimp trawlers out of bays, rivers and sounds.

Meanwhile, the catch has declined. The economic impact of the fisheries is large in this state. It is a large part of our tourism dollar. And that should be considered.

There are examples to show we are frustrated. In the past, we were frustrated as the MFC argued over limiting the commercial fishery to 2 1/2 tons of scrap fish daily. They wanted to limit themselves to 5,000 pounds of scrap. The agency asked for a 2,500-pound limit, but it got up to 5,000 pounds. That was passed.

The commercial fishery is now limited to 5,000 pounds of scrap per day. Yet we discovered after the regulation was published that it had been changed to 5,000 pounds per fishing vessel, rather than per fishing operation. This is frustrating.

And there is a regulation against directed inshore fish trawls, trawling for fish. Yet we see the crab trawl fishery, which is admittedly a flounder fishing operation, in the Pamlico River and Bay River in the winter. The MFC has not taken action yet to address that problem. It has put size and bag limits on fish with little or no restrictions on other types of harvest.

It is sheer frustration that I see.

Yet experience tell us regulations can work when they are properly applied and stringently enforced. King mackerel and Spanish mackerel stocks are rebounding due to the elimination of some commercial fishing practices and reasonable bag limits.

Florida and Texas have protected red drum and speckled trout, and they have recovered magnificently. The number of guides for these fish and the number of people fishing for them have skyrocketed since the protection was established.

I am pleased to say there appears to be movement for change on the commission. It agreed to the gray trout management plan and the summer flounder plan. For the first time in my experience, there are commissioners asking for more stringent regulations, asking to protect the fishery first. These are welcome developments.

The ACCA will continue to work with the MFC to produce positive change. But we need to get recreational anglers to these hearings. They are not hearing from you. Neither are your legislators. We need to get people out who will propose regulations affecting recreational anglers, and we will need your support in public hearings.

How can we better manage this fishery? First, we must support the Division of Marine Fisheries.

We want to see the recreational industry considered. I hardly ever see that. They talk about putting a netter or a crabber out of business, but they don't talk about the marinas around Pamlico Sound that have been put out of business. The recreational anglers don't go there because there are not any fish. They don't talk about the boat manufacturers that have been put out of business. At one time there were 200 primary boat manufacturers in North Carolina. I hate to think what there are now.

We also need to have better information and data collection, from both a license to sell fish and a saltwater license for recreational anglers. We have to get scientific, sociological and economic data to make those decisions. If we work together we can accomplish those ideals, but we are going to have to consider the recreational industry.

Bill Foster is a member of the Marine Fisheries Commission and former member of the commission's scrap fish committee. He is also former president of the Outer Banks Merchant Fishermen's Association. Foster has worked 22 years in the commercial business in Hatteras.

We can look at a couple of examples that address the effectiveness of regulations and management practices. One is the red drum, managed under the South Atlantic Fishery Management Council.

I was asked to serve on the advisory panel when the council was drawing up the management plan. We met, and that was the first time in anybody's recollection that every member of the advisory panel was there. We had some people who knew about red drum and we had a good discussion. The next time we met was after the plan had been formulated. The advisory panel had no input.

Consequently, the taking of red drum was prohibited in federal waters. It would have made more sense to have a one-fish possession limit with a landing compatible to the state where the fish was landed. But the emphasis was on writing a plan to address the recruitment of spawning stock biomass, which the states were required to carry out anyway.

So as a practical matter, you don't have much input through advisory panels and public hearings. The most effective way to be heard is through Dick Brame and the Atlantic Coast Conservation Association.

The king mackerel is another fishery that is being managed. It was the first fish I was aware of that came under the Magnuson Act through the South Atlantic Council. The goal of that plan, despite everything published, was to get rid of the large gill net boats in Florida.

To do that, you have to go through a complicated process of holding public hearings and gathering scientific data. The data did not indicate that the gill net boats had to be eliminated, but they started with a plan that set a quota for the commercial fishery and a three-fish limit for the recreational fishery.

The net result was a sharp decline in the commercial and recreational catch. In the Hatteras area, the king mackerel fleet dropped from about 75 commercial boats to 25 to 30 boats. The charter boats are no longer carrying recreational fishing parties and catching 1,000 to 1,200 pounds of fish. So the regulations themselves caused a decline in the landings.

The next year, the council looked at the results and decided that because the catch was down, the quotas were too high. And they were lowered. The council kept fiddling with them until the drift net boats were eliminated in Florida. I think now the fishery will be managed on a reasonable basis.

What I am saying here is we are in the real world, and the real world isn't always what you hear it is. We need to get back to the basics. When we speak about the effectiveness of management practices, we think regulations. We have plenty of regulations. And that was the easy part. The hard part is defining management goals and terms.

The Magnuson Act set up everything as maximum sustained yield. But only the biologist is interested in maximum sustained yield.

The commercial fisherman is interested in maximum economic return. The recreational fisherman is interested in the maximum standing crop so that he has the best chance of catching fish when he goes out. He doesn't care how many are harvested in a year. He cares about how many are left in the water.

Biologists work with maximum sustained yield and other measurements. The administrators and the politicians are looking for what I call political tranquility.

But what we have written down says everybody is looking for maximum sustained yield. So there is a basic failure to communicate.

Another reason we have a failure to communicate is a failure to define terms. The Magnuson Act set up a division of the resource between commercial and recreational fishermen. But nowhere in the act is commercial or recreational defined. Rarely are they defined anywhere.

If you want better data, and you send some graduate students out to sample and collect it, where do you tell them to put it? Is it commercial or recreational?

When the mackerel plan was first proposed, Bob Mahood told me the data is whatever the individual perceives it to be. And that is as good as any answer we have, but it doesn't do much for statistical analysis. We have to come up with something better if we are going to manage better.

The best definition I've heard is this: The sportfisherman is different from the commercial fisherman in that he takes a picture of his catch before he sells it. To that, you have to add the outdoors writer, and he sells the picture.

So if we are going to better manage our fish, we need to define goals in terms that everyone understands. If you as a fisherman have a goal of eliminating all commercial fishing, go ahead and say that. I can live with it. I can talk with you. But define it in simple terms.

The goal of the red drum management plan was to achieve a spawning stock per unit biomass ratio of .2 or .3. I wanted to put this in terms that people could understand. But that didn't have any result. And as it came out, it is meaningless to the average citizen. It is meaningless to me.

My tag says I am a commercial fisherman. But I am also a recreational fisherman and a biologist. Yours says you are recreational fishermen. And I challenge you to define what that is and to tell the fisheries management people who you are and what percentage of you do what things. Give us some information we can work with.

Audience Discussion

Jim Easley: Since 1976, with the passage of the Magnuson Act, the country has put more resources into the management of the fisheries. I suspect we would be hard-pressed to find many fisheries that have improved since then in profitability or recreational satisfaction. But I want to ask the panelists how they would react to the suggestion that we ought to go with: one, more rules and less discretion by managers; and two, alternative funding for management to measure improvement in the fisheries, biological or economic.

Mike Orbach: I think an attempt to construct such a system would result in a fairly hopeless quagmire, although we should certainly strive for accountability. Keep in mind two things.

First, in saying we have not had some successes that we have wished for since 1976, think of what might have happened had we not had the Magnuson Act at all. And we would not have any of the management structures we now have.

Also keep in mind how it might be if we didn't have the 1987 act in North Carolina that created a balanced commission. The question is not where we are between here and heaven, but where we are compared to where we might have been.

Bob Mahood: Another thing, there was a little misdirection in the question. The initial thrust of the Magnuson Act was to get foreigners out of the 200-mile zone and to turn those fisheries resources over to our domestic fishermen. That has been

very successful. Successful even to a fault. The fault was we did not stop that increased growth of the domestic fishery at levels the resources could sustain. We are now paying the price and trying to turn that around.

Jim Easley: Let me be clear that I am talking about the institution of management and not the fisheries involved. I used the Magnuson Act as an illustration of how we have put more resources into fisheries management. Where do these comments come from? Because of competing interest groups, many of our management agencies are forced into a position of postponing decisions, or not even making them in some cases. This may be true more in state waters than in the 200-mile area. And I think this is why we are seeing some declines in our fisheries. So I want to know whether there are institutional changes we could make in the management setting to improve it.

Tom Quay: This is for Mike Orbach. You have been chairman of the N.C. Marine Science Council from the previous Democratic administration to the current Republican administration. You are never on the firing line. I never see your name in the paper. Are you the most secretive group in the state? What do you do as the chairman of the Marine Science Council?

Mike Orbach: I think of it as subtlety in policy. The Marine Science Council, which is the precursor group to the new Ocean Affairs Council, has done a number of things over the years. The first was to initiate some planning measures for ocean space off the North Carolina shore. Among the artifacts was the Outer Continental Shelf Office, which was in a position to deal with the Mobil issue and ocean planning for the zero- to 200-mile zone. Another example was the state aquaculture plan, which has removed some of the impediments to aquaculture development. We have initiated something close to a one-stop permitting process in the Department of Agriculture — not in the Department of Environment, Health and Natural Resources — because it is a commercial agricultural item. Those aquaculture planning items were initiated with the Marine Science Council.

But we are aware that we have no regulatory authority. We take some long-range issues that line agencies, such as the Division of Marine Fisheries and the South Atlantic Fishery Management Council, don't have the wherewithal to look at. We try to look at the issues and hand them over to the regulatory agencies.

Mike Holleman: I heard Bill Hogarth, Mike Orbach and Dick Brame make references to a license for sale. Are you familiar with the bill in the Legislature?

Bill Foster: No. I know the bill is there, but I have not actually seen it.

Mike Holleman: What are your feelings, from a commercial standpoint, about a new licensing system?

Bill Foster: I can answer from a personal standpoint. It doesn't matter whether we do away with the distinction between commercial and recreational and let everybody fish, or we make a definite distinction between the two. What bothers me from a personal standpoint is the hypocrisy of downing the commercial fishermen for selling the catch while the recreational fishermen are also selling the catch.

From a management standpoint, we need a statistical estimate of the recreational sale of the catch, and if it amounts to a certain percentage of the overall, then we need a handle on that. Earlier, I was thinking that the dolphin fishery showed a fairly stable sale in commercial catch, but a big increase in the recreational catch. My

feeling is that a high percentage of the increase in recreational catch is being sold, but more directly to the restaurants since that is where it would not show up. We have no handle on that whatsoever.

Bob Simpson: As an outdoor writer, I would like to bring up something about commercial fishing. Some people don't know that state law allows an angler to sell $500 worth of fish without a commercial license. I don't know whether it says you can do that every day.

Jim Murray: Per year.

Bob Simpson: There is absolutely no way of checking on that. The law essentially says it allows you to sell $500 a day because there is no way of enforcing it. And that brings me to the next question. I was billed $30 for a boat radio because I am considered a commercial fishermen. Now, the federal government is also charging a recreational fee on boats. And I was wondering if the recreational fishermen could take that money being dumped into the federal government and buy a commercial fishing license. There would be enough money to run the Division of Marine Fisheries in a real royal fashion. I know that would go over like a lead balloon, but if you want to bring in some money, do it. And again, I've been on the waterfront long enough to know that for many years, a sportfishing trip wasn't considered successful unless you could sell enough fish to pay for it.

Dick Brame: This license to sell is extremely important. It is in a legislative study commission. Basically, the license is $100 and anyone can buy it. There is no exclusion for the $500, and if you sell one blowtoad, you must have the license. The license would require a system like a credit card where the Division of Marine Fisheries (DMF) gets a copy, the seller gets a copy, the buyer gets a copy and, if the state is smart, the Department of Revenue gets a copy. That way, we will have a better check on who is selling what.

The problem is that $500 exclusion. As a test, I surveyed six recreational anglers in the Wilmington area who are selling fish, largely king mackerel. In 1991, the six of them sold between $6,500 and $7,000 worth of fish. I have one receipt, the corner of a brown paper bag, that says "65 pounds of king mackerel, $50." It is a cash business and I dare say virtually none of that is reported to the Department of Revenue. A lot if it isn't reported to DMF. So a license to sell fish — which will accrue the catch and dollar amount to an individual and not a boat — is essential.

There are some commission members who might need prodding. One is from Greensboro, one from Dare County, one from Brunswick, one from Craven and one from Beaufort County. They need to hear that you support a license to sell fish. The ACCA supports it, as it supports a marine recreational license. Florida has one, and South Carolina has a license with plans for a stamp. We need the same.

Tony Fedler: A couple of comments to issues left unanswered. The National Marine Fisheries Service (NMFS) has a big problem defining who is a recreational fisherman — anybody who catches a fish for pleasure, to sell or anything else. A recreational fisherman can be a commercial fisherman by definition. For many years, the Sport Fishing Institute has been behind the definition of a recreational fisherman as someone who doesn't sell his catch. He goes recreational fishing for pleasure and uses the catch for personal consumption. We will continue to push that. We have pushed the NMFS to adopt that particular definition, but it has been very reluctant to do so. And this is an issue that must be resolved to better manage the resources. I hope those of you who sup-

port this definition will continue to work at the state and national levels.

Also, all the user fees that go to the national treasuries come back and benefit no one. A number of groups in Washington, D.C., were against that tax — boat groups, fishing organizations with boater constituency groups. But the fishing community did not respond loud enough to turn heads on Capitol Hill and make the fee come back as a user fee for the benefit of boaters and anglers. It could be used for access, habitat improvement or better management. The commercial and recreational fishermen have a stake together in these fees. They can have some payback from a direct tax that they pay but now offers no benefit.

So again, it is incumbent on the sportfishing industry to work with these folks and to organize better. If you don't, you are going to get a lot of these taxes. On Capitol Hill, they are looking for places to nickel and dime you to help reduce the federal budget deficit. And it is not going to come back to you. So when anything is proposed, you have to fight it very strongly or it will be like the boat user fee. It is going to come back with no benefit.

Mac Currin: Several speakers have mentioned the need for more information. I personally think the license to sell and the saltwater recreational fishing license are good ideas. But I don't think the important link between those two has been made clear. The real benefit from the recreational fishing license, besides revenue, is the information, the access to the angler. The Division of Marine Fisheries would then have a list of who is recreational fishing in North Carolina. These people can be surveyed to provide much more accurate and useful information on catches. You could then define the resource better.

We don't know much about the fish that are offshore because we don't have the means for knowing that. We have commercial landings. In some cases we have estimates of recreational landings. But we don't know how many people are out there doing this. Yet, the landings go up and down. How many people caught those fish? We don't know. And until we know that, we can't make good judgments about how the stocks are actually fluctuating.

The other point is a personal one on the license to sell. I would like to see the recreational fishermen get out of the commercial fishing business. I don't think we should be allowed to sell fish. I disagree with anyone being able to buy a $100 license to sell fish. A $100 license is not much for people who are running around on $50,000 or $150,000 boats. And a lot of them will buy those licenses. That catch is put on the commercial fishermen's quotas. And I don't agree with that.

Bob Mahood: There is even more to it than that. We are getting more pressure in the bureaucratic process to come up with good cost-benefit analyses for fisheries allocations. We also look at the social impacts on the constituents involved in the allocations. We have good data from commercial landings, and commercial fishermen are licensed. We know how many there are and what the impacts on them will be. But when you try to argue for an allocation that goes to recreational fishermen, we don't have much of this information. And to come up with these cost-benefit analyses is impossible. To come up with the social impacts on the marinas in Pamlico Sound is impossible.

So, because of the system we work in, we are limited to what can make it through that system. And without the proper data, those who are represented in the data tend to suffer. I will see a recreational fishing license in South Carolina, where I live, this year. It goes into effect July 1, 1992. This is something that has

both good and bad points, but as constituents of the resource, we all need to stand up and be counted when it comes to these type of allocation designs.

Bill Hogarth: It is true that the data we have is probably underestimated quite a bit. An oysterman told Greg Hunter recently that he was not the biggest or the smallest, but his catch data was more than the entire state's report. And I was talking to a summer flounder fisherman about a $5 million industry, and he said it's probably a $15 million to $20 million industry. So we are not getting the data I want. It is hurting from several standpoints — money that comes back to the state and quotas management.

Another problem I hear in talking to legislators about a license to sell is the percentage of income and who gets it. In the king mackerel fishery, it's probably not a big thing. But if you get into an area like the Albemarle Sound, you have small farmers who probably make $10,000 or $15,000 a year farming. They supplement that income with another $5,000 or $6,000, so their livelihood is dependent on the money they get as farmers plus the money they get from the fishery. The legislators are concerned about taking that segment out. And so if you put too high a percentage of income on that, you cut them out.

We do have a large percentage of part-time fishermen. From a survey we're taking now, I'm amazed at the number of part-timers who say they are fishing a lot of gill nets. So I don't know what the answer is, but we definitely are not getting the data. And we need the data.

Barry Ottman: One issue I haven't heard much about is law enforcement. Bill Hogarth said there were 47 marine patrol officers. If we make all these rules and regulations, are the civil penalties large enough to act as a deterrent? And if not, are the criminal penalties a deterrent? Do the courts actually believe these are real crimes? And it seems to be self enforcement or peer pressure more than actual inducements not to break the law. Would you comment on that?

Bill Hogarth: The penalty system is not very good. There is no doubt about it. But we have seen much stiffer fines recently than in the past, especially from the polluting standpoint. We just got a pretty tough bill for that. And the conviction rate, at 91 or 92 percent, is excellent. But a small fine doesn't do too well. We recently had a case on a tow time violation in the summer flounder fishery. The fines for that violation were $250 per individual, but the judge confiscated the catch and gave back half its value.

Our penalty system is very slack. And in fact, our commercial industry says it wishes the system was as tough as South Carolina's. The industry feels there would be better enforcement and compliance. We get a good conviction rate, but fines last year probably amounted to no more than $36,000, which went to schools.

Ron Schmied: I cover the southeastern United States in my job, and I want to pass on some thoughts from sportsmen in other states. You hear arguments for and against saltwater licensing. But generally speaking, licensing to create a data base is a poor justification. It doesn't buy much support with sportsmen because by the time it gets to the legislature, it has so many exemptions in it that you get only a small picture of the actual user population. Exemptions might include people under 16, over 65 or the handicapped.

What has carried more weight in Florida and other states has been the ability to raise revenue through licenses to survey and gather information. Also, and it may be a subtlety, the Florida license got support because it defined the recreational fishing community. It made these anglers a

legitimate constituency, from whom a revenue source was flowing into the state.

The fee for commercial products licenses in Florida and some other states is only $25. They've thought about raising the ante considerably, but that is not enough to keep anyone from getting a license, obviously. They have, however, included another license requirement for the snapper, grouper and other fisheries for which there is too much effort and not enough fish. These restricted species licenses require that anglers who fish for and sell them must prove they are receiving a certain percentage of their total income from commercial fishing. At that point, the cut gets a lot tighter.

And under some federal plans for vessel permits to participate in some fisheries, fishermen must prove 10 percent of their income comes from commercial fishing. In some cases for reef fish, it's 50 percent. That's pretty stiff. So there are other ways to establish a line between the general commercial operators and recreational anglers.

And finally, I agree that funding for surveys is extremely important. For years, we have been screaming as an agency and hearing all of you scream. We have made a number of attempts to get more funding, and finally this year we got another $2 1/2 million for our sportfishing survey. It has been level-funded since the beginning of the survey in 1979. This is pretty ridiculous because inflation alone causes you to buy less and less data.

Starting this month, we are collecting about 2 1/2 times the base sample level that we have collected historically. This will help. And the nice part is we will now be spending in the Southeast close to $2 million, which is about what we had to run the survey nationwide for the last 10 years. So we are finally seeing some improvements in that funding. And I have to say it's because the sportfishing community and others used their contacts and influence to get to the people who can pull the purse strings. It does work.

Walter Simpkins: What are the chances of funds from a sportfishing license coming back to enhance the fishery or going to the general fund? If they went to the general fund, what percent could we expect to go to the fishery?

Bill Hogarth: The argument we keep hearing is that one General Assembly cannot tie down a future General Assembly. If funds were to come back to us this year, next year they may revert back into the general fund. That seems to be a big hang-up.

So that is one argument, that one General Assembly cannot compel another one. It can be done, but I don't know how. I know legislators have talked about doing that and then cutting our appropriations by a comparable amount. From a very small saltwater fishing license, we would probably get more money than we get from appropriations. We don't get a lot of appropriated money now.

There is a lot of opposition to a saltwater fishing license, primarily from two sources. One is the Beach Buggy Association, which has written every legislator I know of. Most association members, it seems to me, are out-of-staters. They are from Virginia, but they are opposed to it. The other group is the Chamber of Commerce. The tourism boards are totally opposed to it because they say it will hurt tourism.

Mike Orbach: I just had an experience in Florida helping fishermen design a licensing system that is revenue-positive. It generates more than it costs, and the revenues go into dedicated funds. But Florida made a mistake with something else that is important. The state put revenues from the saltwater sportfishing license into a designated fund and then

failed to include a provision that it be appropriated every year. So for a while, the money was not used for anything. We just designed a bill to help Florida put the money into special funds and to require that it be appropriated each year for those uses. One of those designated funds, though, is the general revenue fund. So essentially, a deal was struck to set aside part of the money to run the government, but most would be marked for dedicated uses.

It is really important that you contact your legislators and tell them how you want it to work. That is how laws get passed and there is nothing that says this money has to go to the general treasury. You can decide what laws are passed.

Ron Koenig: There seems to be general agreement that a number of important species are overharvested. If the Division of Marine Fisheries has legislative authority, what difficulties are there to simply stopping it?

Bill Hogarth: First, the commission delegates a lot of that authority to me. Some of it comes with strings attached. We have responded to several. We are getting ready to respond to the weakfish now. I hope we responded to the red drum. We responded to speckled trout. Croaker, we have not. To be honest, we have not had the money to spend on croaker to decide what we need to do.

The bycatch issue is a bigger issue that affects many issues the commission is addressing separately. I have authority to require some reductions. But we have been reluctant to do that until we've addressed the entire issue, rather than piecemeal.

We have seen some improvement. It is not all gloom and doom. The king mackerel, Spanish mackerel, speckled trout, southern flounder and summer flounder are coming back. When we put the 13-inch limit in place, we said it would take three to four years to see improvement. But we have seen some in North Carolina already. The 5 1/2-inch tailbag requirement was a key to the ocean improvement. The federal government did not get that into place and still does not have it in place except for our emergency rule. This year we finally got an emergency rule, but that is all. Oftentimes, it takes cooperation among a number of states, and that is where it falls apart.

The two species in the most trouble are summer flounder and weakfish. We will take the appropriate action on that immediately.

Resource Conservation Programs

In this session, the speakers discuss ways for gathering information through research. The discussion also touches on how recreational anglers can help themselves and contribute to the scientists' research efforts.

Gear Research to Reduce Bycatch in the Shrimp Fishery

Jim Murray is director of the Marine Advisory Service for the UNC Sea Grant College Program.

There is a great deal of interest among sportfishermen in the bycatch issue, and I believe it is important to at least introduce it.

Though there are a number of bycatch issues nationally, I will focus on bycatch in the shrimp fishery in the Southeast region. When commercial shrimpers trawl, ideally they would like to have their nets contain nothing but shrimp. Unfortunately, that isn't always the case.

Past studies of bycatch have estimated that the number of fish caught incidental to shrimp and trawling operations can be quite substantial. The ratio

ranges upward from 2 to 18 pounds of bycatch to 1 pound of shrimp caught. The numbers depend on what study you read, what area it comes from and what time of year the study is done.

Commercial fishermen do not like that bycatch either. It requires more culling time, and they don't get the same fuel efficiency. So unlike the turtle problem, one positive with the bycatch issue is that we may come up with gear to minimize the take of bycatch while improving the ability of these fishermen to make a living catching shrimp.

It was difficult to convince fishermen that there was really a problem with turtles since the average shrimper did not catch many turtles. But collectively, multiplied by the number of boats in the fleet, it amounted to a problem. In the case of bycatch, shrimpers I have talked to understand there is a problem and they want to do something about it.

The emergence of the bycatch issue — and the perception that commercial fishermen caused the reduced catch per unit of effort — has increased with the sophistication among sportfishermen groups. The Atlantic Coast Conservation Association and a number of clubs have taken on bycatch as an issue. It has been discovered by the national environmental groups. Greenpeace and the Center for Marine Conservation have launched an active campaign to get government agencies to help minimize bycatch.

I would argue this came about in part from the turtle excluder device (TED) situation. A lot of groups — the Audubon Society, Sierra Club, Greenpeace — were involved in the certification trials for TEDs in Cape Canaveral, Fla., and I think they discovered the bycatch issue during these observations.

I should mention also that bycatch has been associated with other destructive fishing practices. The public hears about Japanese walls of death, these large pelagic drift nets, and then they hear about bycatch. And it all gets tangled up in the public view. Nevertheless, the public is increasingly calling for action. Fishery management plans are emerging and some are singling out bycatch as a problem.

There are a number of questions that may never be answered. But we are probably going to see some action without having definitive answers.

I have some questions here, and there are many more.

First, what are the interspecies relationships? If you reduce core populations, are you creating a niche for another species? Are you improving blue crab populations by dumping that bycatch overboard? What are the relationships between spot and croaker kills and other more highly valued sportfish that we like? And how do we know what relative contribution bycatch is making to the overall decline of the fishery if we throw in habitat loss, overfishing and water quality?

There are a number of real problems in identifying the contribution of bycatch. But intuitively, most fishermen realize that when you shovel that amount of fish over, there must be a problem. And the old political adage says even if there is not a problem, the public might not be right, but it is correct. And I think we will be dealing with public perception in the bycatch issue.

Three alternatives are usually discussed for dealing with bycatch.

Seasonal closures may be necessary if our goal is to reduce weakfish bycatch by 25 percent. It might be that proper surveys show juvenile weakfish live in a certain area of Pamlico Sound in May and June. We might want to close that area for those months.

It might also be that weakfish concentrate only in a certain geographic area. Again, we could close that area, perhaps permanently. Or we could put gear requirements into place.

But there are a few other ways to come at this. As Mike Orbach mentioned earlier, effort and fishing might be reduced through limited entry, also called individual transfer quotas.

And there are some things happening in the bycatch management arena in the Southeast region.

The National Marine Fisheries Service recently awarded a contract to the Gulf and South Atlantic Fisheries Development Foundation to set up a regional steering committee to develop a plan for dealing with the bycatch issue. The plan will be delivered back to Congress by Jan. 1, 1994.

The steering committee has already produced a draft plan due for release any day now. The representatives on the steering committee from North Carolina are Jerry Shields and Bill Hogarth. Mike Orbach and I sit on a technical committee that advises the steering committee.

At the state level, the Marine Fisheries Commission appointed a scrap fish committee that met for the first time in November 1991. It is expected to suggest regulations to the commission by November 1992 on how to proceed next spring.

So these two committees are actively looking at bycatch, and there should be some action at the state level by next year. Action at the federal level is expected by early 1994.

Let me also mention some gear programs we have at Sea Grant.

One mechanism for reducing bycatch while maintaining shrimp catch is called the accelerated funnel, which is a tapered funnel. There is a 20 percent increase in velocity right behind the funnel and a 20 percent decrease at the sides.

Videos in actual trawling conditions show the fish will avoid this high velocity water, and since they get pushed through there, will orient in the slack water at the sides. The shrimp, being poor swimmers, get blown to the back of the tailbag. We have been experimenting with escape holes at the sides where the fish will congregate.

Another design is a diamond mesh. This is similar to the square mesh but has a different configuration for the escape holes. I won't go into the reasons why one works for some species better than others. But suffice it to say this works well. On a preliminary basis, bycatch is being reduced by 50 percent under ideal conditions without affecting shrimp catch. And like turtle excluder devices, I believe these will work well under ideal conditions. But unfortunately, you don't always get ideal conditions.

Another project involves skimmer trawls. This was an idea that originated in the bayous of New Orleans after the concept was introduced, in part, by Vietnamese fishermen. They had what they called chopstick rigs. This design combines the Vietnamese chopstick rig and the beam trawl so that you lower the beams inside and push the trawl rather than pulling it as you would with a normal otter trawl.

We did some work on this off Carteret County last summer and had some encouraging results. The advantages of the skimmer trawl from a bycatch standpoint were surprising to us. We really didn't expect this, but we had a 41 percent reduction in bycatch, probably because the effective spread is reduced for finfish, without affecting shrimp catch overall. In fact, we had greatly increased shrimp catches during the white shrimp season.

The bycatch mortality is reduced because these fishermen are not losing haulback time. They are pulling back the net every 30 minutes because the mouth of the net is still fishing. They can retrieve the tailbag while still under push, and the average fisherman is using 30- and 40-minute tows instead of 90-minute tows. Theoretically, bycatch mortality should be reduced. The data show that bycatch mortality is reduced.

The bycatch is also released behind the net. Often, with a typical otter trawl, the fisherman is dumping the bycatch over and re-catching it because the net is fishing behind the stern of the boat. In the case of the skimmer trawl, the mouth of the net is fishing toward the bow and the catch is dumped back off the stern, so the bycatch can swim away without being re-caught.

As a result, the culling time is reduced. And if the fisherman is hauling back every 30 or 40 minutes, the fish are remaining on the culling table one-third the length of time.

From the fisherman's standpoint, these trawls can be pushed about 5 to 8 percent faster than a normal trawl because they don't have the drag of the doors. The gear fishes higher in the water column, which is an advantage for white shrimp that can actually jump over an otter trawl. Lost fishing time due to the haulbacks is eliminated. It consumes less fuel per hour of fishing. It doesn't have quite the drag. And culling time is reduced.

But there are some disadvantages.

Fishermen are limited to depths of 12 feet or less, so the trawl is applicable only in the Pamlico Sound or near-shore areas. It probably has some use just off the beach. It is difficult to fish on an uneven bottom. The net — and the way it sits in the rigging — is more difficult to clean and repair. And it collects more grass, which is more difficult to shake out.

To conclude, we worked this past summer on the project. And for a while, due to bugs with the gear and so on, it looked as though it wasn't going to work. We were being ridiculed by a number of fishermen in Carteret County. But as the white shrimp season was getting along, we were out-fishing the other boats by a ratio as high as 7-to-1. For example, on one night we netted 700 pounds of shrimp to the average 100 pounds reported on other boats. And at the end of another week or two, those folks who had ridiculed us on the radio were out building skimmer trawls.

There is more data to be analyzed for this project, but what we have is encouraging. Bob Hines, the Sea Grant agent for our Atlantic Beach office at the N.C. Aquarium, has taken the lead on this project.

Jess Hawkins is district supervisor for the Division of Marine Fisheries in Washington, N.C. The division has offices in Elizabeth City, Morehead City and Wilmington, and a field station in Manteo.

The Division of Marine Fisheries (DMF) has researched gear for bycatch reduction and believes bycatch is a problem that can be regarded from social, economic and biological standpoints.

North Carolina is blessed with numerous resources. We have one of the largest estuarine complexes in North America: the Pamlico and Albemarle sounds. And North Carolina is uniquely located in the sense that it has relatively warm water from the south that supports warm species coming into the sounds. The state also has cold water from the north that, in the winter, allows the fisheries to operate for cooler temperate water species.

The primary shrimp fishery in North Carolina is a trawl fishery. And about 90 percent of the shrimp landings in North Carolina come from trawls in the primary shrimping areas, the Pamlico Sound complex.

There are a variety of boats involved in the shrimp trawl fishery. For example, North Carolina has 1,500 to 1,800 full-time commercial shrimpers. And then there are about 2,000 who regard themselves as part-time shrimp trawlers. There are also 3,500 to 3,800 who consider themselves recreational shrimpers.

So shrimp trawl fishing involves more than a person trying to raise his

family on shrimping. It's also for people like us, who like to shrimp recreationally and even sell the catch, because state laws allow that now.

The trawl is very simple gear. It's been used in North Carolina to catch shrimp and crabs since the 1920s. Doors spread the net, which has a tickler chain across it that makes the fish or shrimp jump up and into the net.

North Carolina, again, is blessed with a vast estuarine complex. And management is complicated by the fact that North Carolina has three species of shrimp.

There is the white shrimp or greentail fishery in the southern area and, in some years, in the salty areas of the Pamlico Sound. The brown shrimp is the major fishery in the Pamlico Sound. The pink shrimp, called spotted shrimp by fishermen, overwinters in the sound and is harvested primarily in the spring and fall.

A bad aspect of the trawl fishery is that it catches quite a few juvenile fish, particularly spot and croaker.

The number of fish caught in shrimp trawls varies. A 4-to-1 fish-to-shrimp ratio is the general estimate used in the internal waters of North Carolina, but it can get as high as 300 pounds in the Gulf of Mexico. In some years and some months in the Pamlico Sound area, it has been 2-to-1 or even 1-to-1.

The DMF program on gear research to reduce bycatch in the shrimp trawl fishery is two-phased.

We started out sampling gear, using a lot of small boats in bays where small spot and croaker are most abundant. We did a lot of developmental work using small tow times and small 20-foot shrimp trawls to see how the reduction devices might work.

We also used our research vessel in the Pamlico Sound area using 30-foot nets and pulling for longer tow times.

One of the devices tested was a Florida fish excluder, a very simple design. (See Hawkins Figure 1.) A frame is sewn close to the tailbag of the net. It works by creating a dead area of water back in the tailbag and maintaining an opening that fish will seek out. The questions at issue were how big should this device be, and where should the excluder be placed?

Based on some films at Sea Grant, fish swim better than shrimp, and the shrimp are generally swept farther back into the tailbag. So the fish are actually swimming in the net and can leave through openings placed at the right locations and at the right size.

Another device that we tested was a tunnel — a modification of the Florida fish excluder using a tunnel design. We placed the tunnels in various areas of the net, testing different sizes and combinations.

There were also tests with finfish accelerators, which speed up water flow and provide escapement hatches for fish.

We tested skylights — traditionally used by some shrimpers — that are larger mesh cutouts in the trawl. Shrimp trawls are traditionally 1 1/2-inch stretched mesh or 3/4-inch bar mesh. Different sizes of skylights can be used in the tailbag, placed at different locations, to test their effectiveness.

Again, we had a variety of testing. We would test nets side-by-side on our research vessels to see how these devices worked. We found that, with manipulation and testing, we could get a 48 to 62 percent reduction in the amount of finfish caught in the trawls using the Florida fish excluder and accelerators. (See Hawkins Figure 2.)

The devices that tested best were the tunnel design on the Florida fish excluder and a modification of the simple Florida fish excluder. We decided to forego extensive testing on the finfish accelerator because federal agencies and Sea Grant were working on that phase.

In addition to testing the excluding devices, we tested tailbag sizes and found

Figure 1 **Size and Placement of Florida Fish Excluder, Tested June 1991**

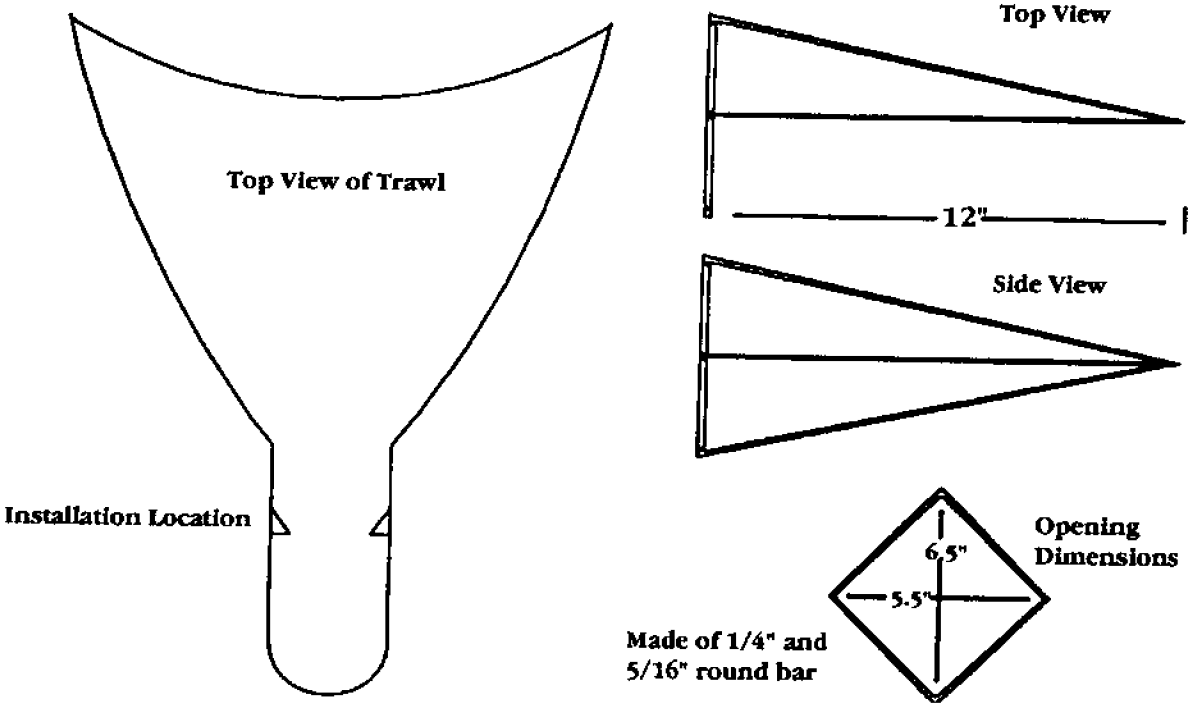


Figure 2 **Example mean catch weights (kg) and reduction rates for three placements of Florida fish excluder devices tested in Pamlico Sound October 1991**

FFE 19: A tunnel design with 6 1/2-by-7 1/2-inch escapements placed 45 meshes above the tailbag tie-off. Tested in five tows.

	Sum control	**Percent difference**
Total fish	38.33	-48.60
Total shrimp	10.83	- 1.04

FFE 21: A modified standard design with 9-by-9-inch escapements placed 55 meshes above the tailbag tie-off. Tested in five tows.

	Sum control	**Percent difference**
Total fish	47.34	-61.88
Total shrimp	11.88	-3.89

FFE 23: A tunnel design with 6 1/2-by-7 1/2-inch escapements placed 30 meshes above the tailbag tie-off. Tested in four tows.

	Sum control	**Percent difference**
Total fish	18.14	-45.64
Total shrimp	7.70	- 0.65

that the 2-inch stretched mesh tailbag will also reduce the finfish bycatch by about 30 percent.

In some cooperative sampling with Jim Murray of Sea Grant, we also tested turtle excluding devices (TEDs). TEDs are mandatory in Pamlico Sound unless you pull at a certain tow time. We found that the TED, modified with a finfish accelerator, was able to reduce finfish bycatch by about 50 percent.

The last part of the project involved getting this information to the fishermen who use shrimp trawls. Again, North Carolina has a large segment of recreational shrimp trawlers and a large commercial fishery.

We have devices that appear to work in the fall and spring pink shrimp fishery, the fall brown shrimp fishery and for recreational shrimpers. We are very happy so far with the preliminary results.

The division thinks bycatch is an important issue, and we have started to develop programs on bycatch reduction in other fisheries. A lot of our fisheries in North Carolina are multi-species fisheries. Our Morehead City staff is working on bycatch reduction in the fly net fishery. We are also looking at alternative shrimping techniques, such as pots and cast nets. We are looking at bycatch reduction in the crab trawl fishery — a small fishery that primarily exists to catch crabs in the spring, summer and fall.

David Hattman: Do these devices work at night?

Jess Hawkins: Yes. We found that they work at night in the spring in our pink shrimp fishery. And when I say work, that is a 48 to 60-some percent reduction in finfish, with little to no loss of shrimp. We would like to get an even higher reduction if possible. The project is two-phased. This summer, we are planning to work with commercial fishermen to test these nets and devices on the actual fishery.

Fishing Ethics Including Catch and Release Initiatives

Ron Schmied is special assistant for recreational fisheries in the Southeast regional office of the National Marine Fisheries Service. He has pioneered and encouraged catch and release programs in salt water. The Southeast region stretches from North Carolina to Florida, across the Gulf of Mexico to Texas. It also includes Puerto Rico and the U.S. Virgin Islands.

The title of my talk is "Who is in Charge of Fisheries Management?" I think most everyone will agree that effective management requires teamwork and that key management team members in North Carolina include the Marine Fisheries Commission, the South Atlantic Fishery Management Council, the N.C. Department of Environment, Health and Natural Resources and the National Marine Fisheries Service.

There is, however, considerable disagreement on the role of fishermen. Anglers seldom see themselves as fisheries managers. In fact, anglers most often see themselves as merely affected parties. In their minds, state and federal agencies make and enforce rules and regulations and are therefore the managers. However, when anglers don't like management decisions, anglers and management agencies begin developing adversarial relationships.

Unfortunately, anglers seldom see themselves as fisheries managers. Perhaps even worse, management agencies don't often look at anglers as managers either.

So, you might ask, how can anglers be fisheries managers? Well, if you accept Random House's definition that a manager is one who handles, directs, governs or controls by action or use, it's clear that anglers should indeed be viewed as man-

agers. Anglers very directly affect marine fishery resources by their actions and use — by virtue of what they do and don't do every time they go fishing.

Let's look at three specific ways anglers manage fish.

First, compliance. Anglers contribute positively to fisheries conservation and management when they comply with regulations. On the other hand, they thwart these efforts when they don't comply with regulations.

Second, conservation ethic. If the term "trash fish" is an active word in an angler's vocabulary and a visit to the local dumpster is a normal part of an angler's trip home, you can bet he won't get high marks on personal conservation or stewardship. These actions stymie fisheries management. Anglers who keep within the limits and minimize waste advance fisheries conservation.

Third, advocacy. Angler apathy or advocacy makes a huge difference in fisheries management. Being an advocate for sportfisheries in fisheries management and related environmental and economic development decisions is critically important, but it is often overlooked.

Hopefully, by now you agree that anglers are fisheries managers. Unfortunately, there are a number of constraints that keep anglers from fulfilling this role.

Perhaps the biggest is angler attitudes and perceptions. As I already mentioned, a clouded self-image often prevents anglers from being effective partners in fisheries conservation and management.

Second, a short-term perspective that says, "I better get it while I can or before someone else does" also inhibits effective management involvement by anglers.

The third constraint is the "we versus they" mindset. Many anglers, present company excluded, fail to see that they are part of the problem. They view commercial fishermen, developers and water polluters as the real culprits.

Few anglers really appreciate the impact they have on fishery resources. After all, they say, "I only catch a few fish here and there." Maybe individually they don't catch many fish, but there are 1.7 million saltwater anglers in the South Atlantic area. Collectively in 1989, they caught about 45 million fish. That is a lot of fish. So the "we versus they" attitude needs to be overcome.

And finally is the issue of equity. In my 12 years in the Southeast, equity issues keep coming up. On many occasions, I've heard anglers say, "Don't regulate us. Regulate them," or "Why regulate us this way when you're treating those guys that way?" This is an important issue that requires knowledge and trust to resolve.

In addition to attitudes and perceptions, basic fisheries management knowledge is another major stumbling block. Fisheries management is a very technical process and at times, a very political one. Oftentimes, anglers lack the basic knowledge to be effective in their management roles.

Many anglers don't understand the differences between state and federal jurisdiction or how these management institutions work. Fisheries management terminology sounds like alphabet soup to the untrained ear. And anglers frequently don't know why there are size and bag limits, how they are developed or what they are intended to do.

Another major constraint fishermen face is regulatory confusion. Many species traditionally targeted by anglers are stressed, and in some cases overfished. In response, there has been an explosion of state and federal regulations implemented to stop overfishing and to restore these populations. These regulations are increasing in scope and complexity; and worse, inconsistent state and federal rules have been implemented. Sometimes, anglers have a difficult time getting copies of

current regulations.

Many anglers, myself included at times, may know what the regulations are but are unable to accurately identify the fish they catch. There are a lot of misidentification problems that make it difficult for an angler to comply with the law. Training is clearly needed.

Depending on who you talk to and when, there's either too much or not enough law enforcement. Many people will take a chance if the fines aren't sufficient or they haven't seen an officer in a long time.

Current trends make angler involvement critical. Let me share some facts that make it important for fishermen to see themselves as managers.

Perhaps not so much in coastal North Carolina, but in many coastal areas of the region and the nation, considerable population growth has occurred and is expected to continue. Between 1960 and 2010, coastal populations are expected to swell 60 percent with another 15 percent growth projected between 2010 and 2030.

Already about 50 percent of the nation's population lives within 50 miles of the shore. This translates into tremendous pressure for the use of marine resources. As a result, habitat and water quality are experiencing a downward trend in many places. In the Tampa Bay area where I live, 80 percent of the sea grasses and 55 percent of the mangroves have been lost, primarily due to development.

Also, the demand for seafood consumption grew about 20 percent between 1980 and 1990 as people became more aware of the health benefits arising from seafood consumption.

And there was a threefold increase in saltwater sportfishing between 1955 and 1985. Further, the demand for saltwater sportfishing is expected to increase nationally by 36 percent between 1985 and 2025. In the Southeast, the projected increase is closer to 45 percent. Whether that demand materializes will depend on many factors, including general economic conditions and the status of the fishery resources.

As I mentioned before, because many species have been overfished, regulations have been brought on line to boost their numbers. Unfortunately, many agencies don't have sufficient resources to deal with these problems in a timely fashion.

What are the options for the future? What will happen tomorrow or in the next 25 years? How can we maintain or promote viable recreational fisheries in light of these trends?

There appear to be several options.

One, we can have more stringent regulations. I don't think anglers would vote for this option. And management agencies aren't too keen about this option either because regulations are expensive to develop, implement and enforce.

The second option involves convincing anglers to practice more self-restraint and to be more conservation-minded. In this way, we can help expedite the recovery of overfished stocks and perhaps reduce the need for more regulations.

The third option is a combination of the first two.

Promoting responsible fishing practices is an answer. Frankly, I strongly endorse and believe in option two. If we can work together to develop a stronger conservation ethic, we can avoid a lot of problems and bring about recovery of the fish stocks much sooner. I have tried to develop an angler education program in the region to eliminate some of the constraints anglers face in attempting to be effective fisheries managers. This effort has three major thrusts: simplify regulations, improve angler knowledge of and involvement in fisheries management and related issues, and promote responsible fishing practices.

For the balance of my talk, I want to tell you about my efforts to develop an

"angler code of ethics." Fishing ethics or responsible fishing practices can do a lot to restore our resource base, and it puts the responsibility where it ought to be, with the users of the resources. Anglers ought to be out there conserving, not wasting the resource.

To develop a code, I visited fishing clubs and groups and asked them what practices they thought should be included. We settled with 10 practices that are promoted using a series of materials, including a poster entitled, "Uncle Sam Needs You." I have produced a sticker for tackle boxes and boats that holds up well in water. Also, I have published a pamphlet that explains in some depth why each of the practices is important. Here are the 10 practices with a brief explanation of each.

1. Help fish stocks increase through catch and release.

In 1989, there were 1.7 million anglers who took 15 million fishing trips in the South Atlantic area and caught 45 million fish. Only about 48 percent of these fish were actually brought to shore. Another 18 or 19 percent were discarded dead or used for bait, while 33 percent were reported as being released alive. The point here is we don't know how many of those fish survived. However, if fishermen sharpened their catch and release skills, up to 51 percent of the fish caught by anglers that year could have been successfully released with a good chance of surviving. That would be a tremendous contribution to the conservation of the resource.

We have an excellent video on catch and release techniques and a summary of the major points you can put in the tackle box. I encourage you all to get copies of this.

2. Limit your take, don't always take your limit.

This item recognizes there may be times when it doesn't make sense to take your legal limit. You may already have a freezer full at home, or you're far from home and can't get your fish back in good shape. In these cases, it might make more sense to just enjoy the trip, save the memory and let the fish go.

3. Observe regulations and report violations.

If you're out fishing and see a lot of blatant violations, you can contact law enforcement personnel anonymously. Sometimes this helps enforcement agencies to better use their limited personnel.

4. Only keep fish for trophy or dish.

This one is easy — don't waste. Release the fish if you aren't going to eat it or you don't want it for a trophy. Fact is, you really don't need to kill the fish for a trophy anymore. Release it and use your skills to make sure that it has a fighting chance of surviving.

5. Escape tradition, try a new catch in the kitchen.

As I said, only about 48 percent of the fish caught are actually taken to shore and landed. Many times, that's because anglers have been told that a fish is no good to eat — it has worms, it is poisonous, etc. Consequently, a lot of fish that are excellent to eat and fun to catch get thrown overboard. They are called trash fish and often end up being tossed on the bank, dead or dying. We are asking anglers to try some of these fish and to learn to use a greater share of the fish available to them. As a result, anglers will have more opportunities to fish and to have a successful trip. Jim Murray has a host of educational materials he helped generate that get fishermen over some of this misinformation.

6. Get hooked on fishing's thrill, not alcohol or drugs that kill.

There are about 1,000 boating fatalities a year. Of those, about 50 percent involve alcohol. Of the alcohol-related deaths, about 90 percent are drownings. What a terrible way to end a fishing trip. Enough said I hope.

7. Bring all garbage in, don't teach

it to swim.

Places loaded with trash are disgusting. It is also against the law now to dispose of any plastic in navigable waters of the United States. Under federal law, there are serious penalties if you are caught. But more than that, throwing trash about is just a bad, nasty practice.

8. Captain your boat practicing safety afloat.

When you're at the helm, you are responsible for the safety of those on your boat as well as for other boaters and users. Be safe, be careful, be courteous. Don't be a statistic.

9. Show courtesy and respect, others' rights don't neglect.

This one's easy — as users of a public resource, we have a responsibility to treat other users and private property owners with courtesy and respect.

10. Share what you know to help your sport grow.

As anglers become more informed and step up to their personal stewardship roles, we hope they will feel an obligation to help others recognize their role. Responsible anglers can help generate more responsible anglers. Pass it on.

One last thought is worth considering. If we are fisheries managers, how good a job have we been doing? Think about it. Over your last three trips, how good a job have you been doing? If this "code of ethics" is a yardstick, how do you measure up?

As angler managers, some self-evaluation is in order since the future of our sport rests largely in our hands. Anglers can't continue to put that responsibility onto other people. I submit that as anglers, we have to play an effective and active part in managing marine fishery resources. If we work together, we can pass our sport on to our children and grandchildren and give them the opportunity to talk about the big one that really did get away.

Encouraging Voluntary Size Restrictions

Bo Nowell is a recreational fisherman who makes efforts to release all of his catch alive. He is the author of an article about voluntary ethical limits for non-regulated fish, published in the Raleigh Salt Water Sportfishing Club newsletter.

I wrote the article about ethical limits after seeing a man at Oregon Inlet cleaning some spots that were barely over 4 inches long. There couldn't have been much meat on them. I don't know why he kept those fish and felt he had to clean and prepare them, they were so small. But maybe he had kids, and they caught them. While I may have preferred that he taught his kids a lesson about releasing them, I am not in his situation. And ethics can be situational.

I am reminded of a fishing story of a guy named Old Joe, who always came back to the dock with a cooler full of fish. He never took anybody fishing with him. He could go north, south, east and west. And wherever he went in the sound, he came back with a cooler full of fish.

Finally somebody in a poker game won a fishing trip with him. The next day the guy got on the boat with Old Joe and they went out to the farthest part of the sound. All Old Joe had when he got on the boat was his net and a tackle box. And the guy with him asked how they were going to catch fish.

Well, Joe reached over, opened up his tackle box and pulled out a stick of dynamite. He lit it, threw it in the ocean, it blew up, the fish floated to the top and he started scooping them up. The guy with him said, "That is not ethical." Meanwhile, Old Joe had lit another stick of dynamite, handed it to the guy and said, "Are you going to talk or are you going to fish?" So ethics can be situational. That man is still alive.

I want to intertwine three themes about perspective, progression and the catch and release ethic. Perspective is how we form opinions or judgements about the resource. Progression is how we mature from being the fisherman who takes everything he catches to the sportsfisherman, who essentially releases the catch or limits his catch.

As an example, a friend of mine took his neighbor on a fishing trip to the Outer Banks. That was his neighbor's first trip, and there was beautiful weather, bait in the water, fish in the water. And from that day forward, his impression of Outer Banks fishing was it's like that all the time. I have been there, and it is not. But he has been going back ever since and wondering what he's doing wrong, or what's wrong with his fishing.

That is how his perspective was affected. We are fortunate to have marine scientists who objectively study and evaluate the catch by looking at year-classes, tagging information, samples and other studies. They have the tough job of trying to convince commercial and recreational fishermen there is a problem.

A fishery problem is tough to accept when somebody earns his living from fishing. Likewise, a recreational fishermen sometimes has a tough time believing there is a problem when he has been lucky enough to catch a lot of fish, and that is how his perspective sometimes gets shaped. Perspective works against scientific data sometimes.

And when you are fishing and catching fish, it is difficult to accept that the fish you catch may be overfished or stressed. That is why you frequently hear the argument from some people that fishing is better than ever, so why worry? On the other hand, when fishing is poor, it is easy to feel that the fishery is in worse shape than it really is. So perspective plays a part in what the average fisherman chooses to accept.

I believe recreational fishermen go through an ethical progression. When fishermen are young, less experienced or they don't fish very often, the tendency is to keep every fish caught, big or small. They want to fill the cooler. That's why people think a great day equals a cooler full of fish.

At some point, anglers start to throw back the fish that are too small. And I think that's when the first conservation voice begins to say, "Throw the fish back, it's too small."

With maturity and experience, fishermen respect the resource. Keeping the fish or a large number of them is no longer critical. Enjoyment comes from the act of fishing and being there. So perspective and progression have a lot to do with the growth of a natural code of fishing ethics. And I suggest we all do more to speed up that process.

On almost every fishing trip this year, fellow members of my fishing club witnessed recreational anglers taking and keeping undersized fish. Other times they saw fishermen taking more fish than legally allowable. When they spoke up to these anglers, they got shrugs or they got ignored.

It is ironic that I am encouraging a voluntary ethic when people have not yet begun to respect the legal limits, and yet it is in that irony that we are all challenged.

Undersized fish I believe should be released regardless of a legal mandate to do so. Fish need a chance to spawn. That can be compared to farming or an investment. Yet while it is good to release undersized fish to spawn, a few years down the road it is more important to understand that releasing a bigger fish today allows it to spawn this year. Releasing a big fish is an investment for the fastest return to the sport of fishing.

There are currently 22 species of fish with recreational size or creel limits within our state and federal waters. Seven

fish are classified as stressed and eight are classified as overfished within these waters. A combination of causes, rather than just one, can be blamed: People take too many fish, and they take too many of the breeding fish that support the population.

But don't misunderstand my push for voluntary size limits and catch and release. I encourage fishing as recreation and for the dinner plate.

We have reached the time that we have to start asking which direction we are going to go. And what about tomorrow? One solution is to do whatever possible to promote a voluntary catch and release ethic by improving the anglers' perspective of the status of the sportfisherman. And I encourage you to continue to help make catch and release a cornerstone in the art of fishing.

The Importance of Tagging Programs

Randy Gregory is a technician for the Division of Marine Fisheries.

There are many challenges in fisheries management today — depleted stocks, the need to allocate them. And there is also the problem of mobile stocks that go from one management group to another. It is difficult for North Carolina to manage a fish that goes to Florida. And there is also a problem in the fishery's enhancement. If we are going to put all this time and money into stocking, is it really worth it?

This is where tagging comes in. Tagging is a management tool like surveys or landings data. And it gives us five important facts: stock use, or who is catching the fish; age and growth; migration; mortality; and whether the stocked fish are being recruited into the fishery.

First, the stock use. Tagging tells us which user group caught the fish and how it was caught. It tells the recaptured size, or what size the fish was when it was caught.

Second, it tells age and growth, and we use this for stock assessments. It validates our aging techniques using scales to age fish. It tells us exact growth between the time the fish was tagged and when it was recaptured.

We are also able to chemically mark and tag fish and get the fisherman to return it to us so we can examine the structure we marked, such as the otolith.

Here's an example of how tagging will help us determine the age of some fish. It was previously thought that the life span of sailfish was only seven years. Yet there was a sailfish out there for 11 years — the time between tagging and recapturing.

Third, tagging tells us about migration. This is pretty simple. It tells where the fish was when tagged and where it was when recaptured. This helps with allocation between states — what areas will be involved in the management of species like king mackerel. We know they go from North Carolina to Florida and vice versa. We learned that by tagging.

Fourth, tagging tells us about mortality. That helps with stock assessment. The rate of return compared with the number of tags out helps determine life span, and we can learn which fish are making it into the fishery, at what time they are getting caught and whether they have a chance to spawn.

Fifth, and finally, do these stocked fish make it into the fishery?

There are currently four major programs in North Carolina that tag fish. One is the striped bass plan. It is a joint effort between the Division of Marine Fisheries and the U.S. Fish and Wildlife Service.

They tag fish for stocking. They come to the Edenton hatchery and tag the fish. Later, when the fish are caught, they learn whether the fish made it into the fishery. They tag adults by electrofishing

on the spawning ground. They also use the ocean trawl survey and the gill net survey in conjunction with some other research.

And by this tagging they have discovered that the fish that aren't spawning yet winter over at Alligator River, and perhaps the adults in our state — the Albemarle Sound striped bass primarily — may not contribute to the Atlantic migratory group.

Another program in North Carolina is flounder. We tag three species — summer flounder, southern flounder and gulf flounder. About 15,000 fish have been tagged since 1986 with a 9.5 percent return rate.

The fish were tagged by trawls, pound nets and hook and line. And we've learned that fish tagged north of Hatteras usually stayed north of Hatteras or went even farther north. And the fish tagged south of Hatteras usually moved south of Hatteras. That will help to manage our flounder stocks by dividing them up.

Another fish is red drum. There are over 8,000 tags out. They tag out of commercial pound nets and gill nets and they use recreational volunteers. Currently, they have about 60 volunteers who last year tagged over 1,000 fish. And they have learned that red drum, the large drum, migrate on and offshore. Puppy drum disperse throughout the sound.

The last project I worked on was king mackerel. About 6,000 tags have been put out since 1986 with a 2 percent return rate. That is a little on the low side, but it's about par for pelagic fish.

We know that about 15 percent of the fish off our state swim to Florida, so there is about a 15 percent migration. We are trying to pinpoint why these fish are going back and forth to Florida. And we have also initiated a new volunteer tagging program.

So recreational anglers can help. First of all, return the tags that the scientific community has put out. Promptly report length, weight and location. Keep the fish if the tag says to save it or if perhaps it is an old tag on a large fish. We can get valuable age and growth information off these fish.

Encourage others to return their tags. The information won't hurt you.

We use tag returns to look at allocations. So if you don't return your fish thinking that the commercial fishermen will get information about where to catch the fish, actually you are hurting yourself because you won't get your slice of the pie when the time comes to divvy it up. Anyway, the commercial fishermen already know where the fish are. That's their job.

Plus you get information on the fish. If you return the tag to us, you will get information on where the fish was initially tagged, where it went, how long it was out and the size it was when first tagged.

And last, you will get a reward. We have initiated monetary rewards, and occasionally in some programs there are hat and T-shirt rewards that are more satisfying to a recreational angler than a $5 check.

Recreational anglers can get involved with volunteer programs. The state has a king mackerel and red drum volunteer program. And there are other organizations in the state — the billfish foundation, the cooperative game fish tagging program, the cooperative shark tagging program. It is easy to participate, and tagging will not hurt the fish much more if you plan to release it. Tagging is estimated to increase mortality from 2 to 10 percent, and that is very little.

Last, recreational anglers need to be aware of conservation. Help the fish for the future and get involved. Tagging programs are a way to get involved.