Summary of Proceedings

COASTAL FISHING '95: FINFISH FACTS

March 25, 1995
LSU Agricultural Center

Sponsored by
Louisiana Sea Grant College Program
Louisiana Cooperative Extension Service

INTRODUCTORY REMARKS

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Approximately five years ago, really with the beginning of the Roemer administration, you may remember that one of the favorite means of involving the public in deliberating natural resources policy issues began with what was called task forces. Personnel from the Sea Grant Program and the Extension Service often get named to these task forces and, when we do, we embark on public policy education programs. We have been conducting these programs for about five years. Our programs include fact sheets, newsletters, appearances at sportsman and outdoor shows, public policy workshops like this one, and then publication of the proceedings. This is the second in a series. Last year, April 5 and 6, a two day meeting was conducted here on the campus called *Coastal Fishing: What is the Future?* It was a very broad program. Today's program is focused on finfish.

Since the speakers today have not met as a group for this year's program, you and I are going to be hearing these talks for the first time. Nothing has been controlled, contrived, or in any other fashion orchestrated for this meeting. We have not met as a group, we don't have a common goal other than one thing: To make sure we clearly speak about facts. Today's speakers are going to give you the benefit of their experience and knowledge. The comments of the speakers will be recorded and summarized for the information of a larger audience. Although we will receive questions after each presentation, the proceedings will not include them.

LOUISIANA SEA GRANT College Program
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BASIC FISH STOCK DYNAMICS

John Roussel
Louisiana Department of Wildlife and Fisheries

I was asked to talk about fish stock dynamics. Let's begin with the definition. **Fish stock dynamics** is a phrase used to describe all the processes and forces which influence or control the kinds and amounts of fish within a given waterbody. This includes hundreds of natural and man-induced processes. It encompasses physical, chemical, and biological processes. It also includes how those processes may interact with each other and change in response to each other.

Although many of us would like to believe otherwise, it is a fact that the numbers and kinds of fish within a given waterbody are always in a state of flux. We always want to make a trip like our last trip, but that's impossible because the numbers and the kinds of fish are always in a state of flux. That is a fact whether or not you even harvested because many processes are going on that affect the kinds and numbers of fish, even if you stayed home. The same processes would also happen if man never inhabited the earth. A look at historical records shows that species come and they go, and their position in the ecosystem changes with time because of all these processes that are going on. So just recognize the fact that there is a constant state of flux.

It would be impossible for me to even begin to cover all of these processes, so today I'm going to limit this topic to those processes that I think are relevant to fish and fish management. We will look at some of the basic biological processes. I'm also going to limit the topic to single species concepts. We are not going to talk about ecosystem concepts or multi-species processes that take place. In trying to explain some of these concepts and processes, I'm going to try to show you how all of these processes interact and how these processes can be studied and used to provide advice to the fishery management decision makers.

We are going to start with a model, an easy way to demonstrate concepts. I'm going to start with what I call the fundamental model of fish population dynamics.

When we make a model of fish population dynamics, we deal with **population biomass.** Biomass is simply the total weight of a given species, the total weight of all the fish of a given species combined. (We will use that term, biomass, throughout the presentation, so remember that definition.)

There are **four major forces** (from biological processes) that act on that biomass to cause it to change. Two tend to decrease the biomass — natural mortality and fishing mortality, and two tend to increase that biomass — recruitment and growth. Let's define them all. **Natural mortality** is simply all those removals from the population that are not attributed to fishing like disease, old age, predation, etc. **Fishing mortality** is the removal that results from fishing activities. **Growth** in this particular context is the growth of an individual fish, the amount of biomass that an individual fish adds as it gets older. **Recruitment** is the addition of new individuals to the population. If the two that reduce biomass and the two that increase biomass exactly balance each other, you have a stable population biomass. But that's very rarely the case for any animal population.

For example, if we were managing a herd of cattle, we could certainly count the

cows that died of natural causes, and by looking out in the pasture, determine which ones died of disease, predation or whatever. We could certainly count the cattle that we brought to the auction barn, which would be equivalent to those removed by fishing mortality. We could weigh or measure the growth of the individuals in the herd and we could also count the new calves, to figure out the number of cattle added to the herd. With all that information, we have actual estimates of all those forces, and, from a biological perspective, we would have a fairly easy job to manage that cattle herd. But with fish, we can't count the animals as easily. We've got to use indirect measures to be able to estimate these forces and model the fish population.

Individual fishermen actually have only two observations that each can make to assess the condition of the stock. He's got his individual catch per effort, which he can keep in his mind or in a log, noting how many fish he catches per trip. He can also note the sizes of fish he catches. This is his data. Those two data givevery little information about what is going on in the water.

Resource agencies like the Louisiaa Department of Wildlife and Fisheries (LDWF) use a little different approach. We collect as many different types of data and as much data as possible so that we can look at many individual components. To do this, we sample the fishery, and we also sample the population itself, using various approaches. Agencies such as LDWF are often criticized for our data collection because they don't mimic the fishery. We hear people say, "Well you take a sample outside the fishery." There is a purpose. We don't mimic the fishery because we're trying to measure certain things that give us clues to those four major forces . We don't have to catch fish necessarily to make the proper measurements that we need to put everything together into a model to try to understand what's going on. We accept that criticism, we just want you to recognize that we have specific purposes for the data that we collect.

The data must also be used properly. In the past, data that LDWF collected have been used by individuals with no idea how it was collected. The result was that they used it improperly. It's important that data be collected within an established program to measure certain things. Don't use it for something else.

Another term that is important to fish population dynamics is the concept of a cohort. A **cohort** is simply a group of fish that are born within a given time period, (usually it's within a year). Cohort is sometimes used interchangeably with the term "year-class." If I listed all the people that were born on my birthday, the year that I was born and the date I was born, and then counted the number of those people alive today, I will find less of us now than there was on the day I was born. Some of us in my cohort have died. This is what we can find by looking at cohorts. We will almost always see a decreasing number. Then we need to determine the proportion that was removed from the cohort due to natural mortality, and the proportion due to fishing mortality.

In many of the analytical techniques that are used in stock dynamics analysis each particular cohort is analyzed by itself or separately. But we know that there are multiple cohorts that exist in a population at any one period of time. We analyze them separately and in a lot of cases we combine them on an appropriate time scale to actually get an idea of what's going on at a particular point in time.

Someone might say, "But you can't

accurately count the number of fish in the cohort, and you certainly can't count the ones that die naturally." A lot of people would argue that you can't count the ones that are caught either. In a lot of cases you don't need an exact count, you simply need a reliable relative count which you can find by using a mortality rate. There are a number of widely accepted mathematical and statistical tools that allow you to calculate mortality rates. Sometimes rates are actually just as useful as actual numbers anyway. These mathematical and statistical calculations are not unique to fish population dynamics. They are used in many other areas where sample data is used, for example in the fields of medicine, finance, and insurance.

The next force is **growth** of individual fish, production of biomass of individual fish. Usually, the growth rate, in a relative sense, is relatively slow initially. Then it enters a period of more rapid growth, and then, at some point, it slows down again.

The final force in the model, **recruitment**, is the addition of new individuals to the population. There are two types of recruitment. In one, biomass increases as the number of recruits increases. But then, at some point, depending on species, recruitment actually decreases even though the spawning stock biomass increases. In the second type, recruitment hits some type of plateau and levels off. The decrease or plateau is because of competitive forces that may be taking place such as older fish eating their young. To explain what I mean, use my cattle herd example: If you had an excess number of cows on your pasture, the birth rate resulting from that population would be high as long as the pasture could accommodate the herd, as long as the carrying capacity of the pasture was large enough. But if the number of cows was right at carrying capacity, the birth rate will be reduced because those cows are going to be competing with each other for food, they are going to be in a more stressed condition so they won't bear as many live young. Those types of forces may cause the number of recruits to actually go down even though you have more spawning stock biomass. With most fish, recruitment is highly variable. There have been very few instances where you could develop real good quantitative models to represent the relationship between spawning stock and recruitment.

How, then, do we evaluate the health of the resource? The answer comes from a noted fish population dynamicist, the current director of the fisheries research lab at Lowestoft, England. He said,

> "As with most real life situations, the existence of more than one way of judging the success of a fishery means its relative health will seem different to different people. Consequently, there will be no one best situation for a fishery to be in."

Every individual has his own criteria that he measures the health of the resource by.

I mentioned earlier that the dynamics are influenced by many processes, natural and man-made, physical, chemical, and biological. But from our perspective, we focus on the fishing impacts and the ability of the population to replace itself. The generally accepted approach is to use some type of biological reference point or conservation standard to evaluate what levels of fishing mortality are acceptable. Historically, these reference points have been based on the concepts of maximum sustainable yield or maximizing yield per recruit. But in more recent years, the reference points are often based on maintaining some minimum level of spawning stock or some

minimum level relative to unfished conditions. These are expressed as spawning stock biomass ratios (SSBR) or spawning potential ratios.

The appropriate biological reference point or conservation standard for a given species or a stock is unique to that species. It should be developed by evaluating that species or that stock's biological viability relative to observations of past conditions and relative to that stock's potential. It's only in the absence of past observations that we should resort to some arbitrarily chosen reference point. Generally, in recent years, they are based on maintaining some minimum spawning stock either as a ratio or some absolute measure of spawning stock.

Out there in the water, all of these processes are occurring at the same time. Let's look at a pond situation to understand how two of these processes work simultaneously. Let's say we have a pond stocked with 100 fish of a particular species. No fishing is occurring in this pond, however we can sample to estimate the growth rate and the natural mortality rate. In this case, the natural mortality rate will be 0.3, which results in roughly a 75% survival rate. Let's use this information to figure out when is the best harvest time if we are interested in getting the maximum production of biomass out of that pond. As we observe our 100 fish that we put in the pond, we observed that even though some fish died along the way, they were all growing so the biomass continued to increase as the days went by. They increase up to a point but then the biomass begins to drop off. In other words, when you have two of those forces, growth and natural mortality, in that model working on the population, there is a point where growth dwarfs the mortality aspects, but then there is a point where just the reverse happens. If you wanted to get the maximum production in terms of biomass out of this pond, you would want to harvest when you get the maximum pounds. Most of the time, more forces than only these are working on the fishery, so let's look at some more.

There are a couple of things that we need to know about the fish and the fishery. I'm going to give our fish in our pond some life history parameters to make the demonstration more realistic. We are going to use the same natural mortality rate of 0.3 which I mentioned earlier, a survival rate of 75%, and the same growth rate that we've been using. The other life history parameters: We are going to say that these fish recruit to the fishery at one year old. (This happens with most fish.) You don't begin catching fish as soon as they are born, they have to grow to a certain size before they become vulnerable to whatever gear you are using. So I'm going to make these start recruiting to the fishery at 1 year old. We are going to say that the fish matures at 4 years old and, when they turn 4 years old, they escape from the fishery to an area where the fishery can't operate (a closed area, for example). We are using these parameters for the sake of demonstration. We are going to say the fish spawns and then it dies after spawning. We don't have a fish like this in Louisiana but this is close to some salmon type species. Lets look at a hypothetical situation, Figure 1. Given these life history parameters, we end up with a spawning stock of 80 pounds. When those fish just turn 4 years old they will be 80 pounds total biomass, (the number of fish X the weight of those fish at that age), and those 80 pounds of fish will spawn and die. That's with no fishing. Now if I subjected these fish to a fishery at a fishing mortality rate of 0.4, which is slightly higher than the natural mortality rate, the annual survival rate resulting from fishing would be about 64%, while the annual survival rate from natural mortality would be about 75%. But notice that the actual annual survival rate of both of those working together would be 50%, that is, when fish harvesting occurs simultaneously with natural

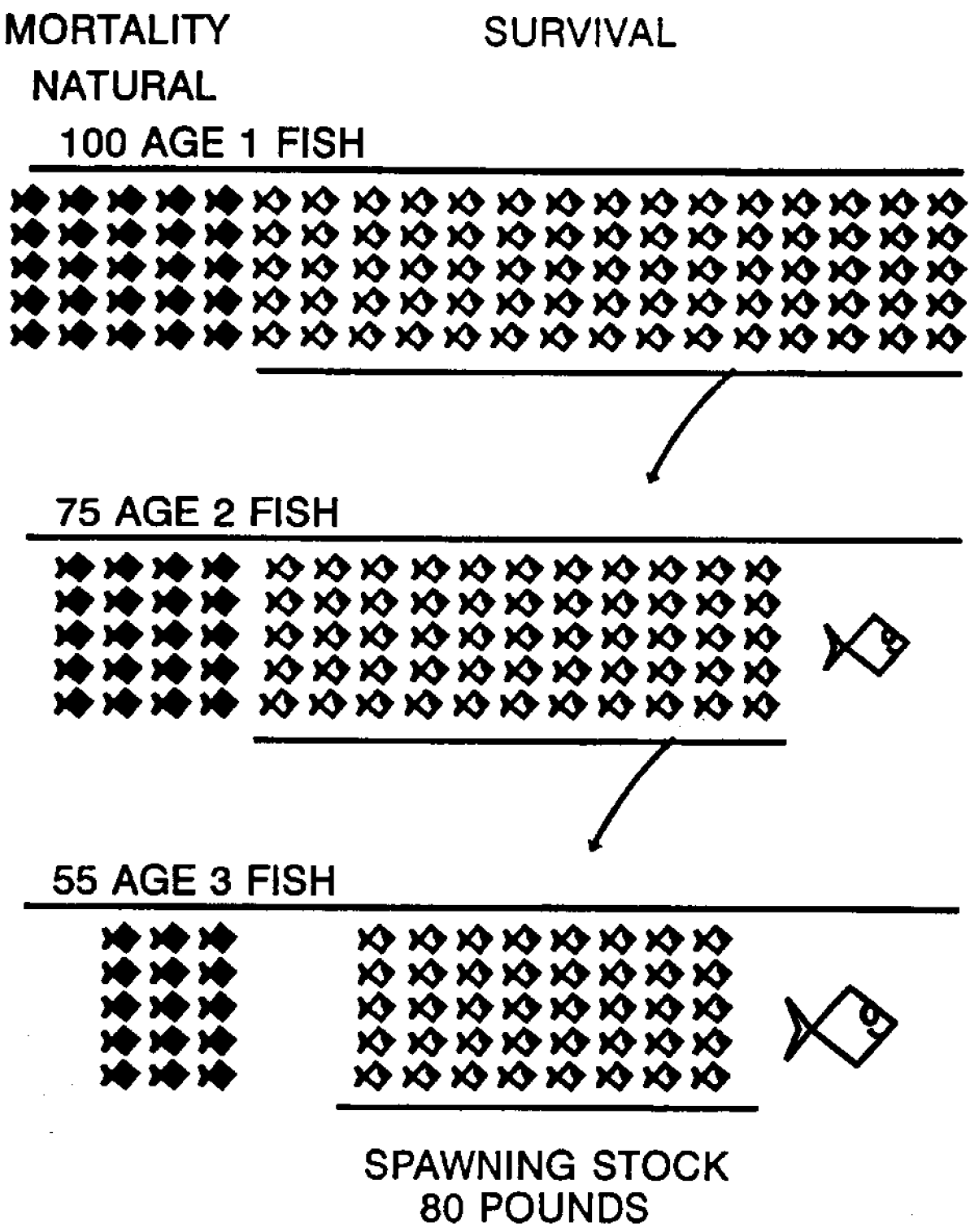

MORTALITY
NATURAL
SURVIVAL
100 AGE 1 FISH
75 AGE 2 FISH
55 AGE 3 FISH
SPAWNING STOCK
80 POUNDS

Figure 1.

mortality, less fish die naturally even though we are starting with the same number of fish, 100. This happens because fishing mortality competes with natural mortality for the same fish. A fish can only die once. If it dies naturally, it can't die from fishing later on. If it dies from fishing, it can't die naturally. There is competition for the same fish going on between these two rates of mortality. The total mortality is not a simple arithmetic increase. Actually in this particular case only 25 fish died naturally during the whole three-year period, whereas in the previous case, 60 individuals died naturally during the period. Note also that spawning stock is reduced. Only 24 pounds of spawning stock survived when fishing is permitted as opposed to 80 pounds when there was no fishery. Over the three-year period, 63 individuals were caught and their total weight would be 45 pounds. I've held the mortality rates constant across ages which is the case in some fisheries, but in others the fishing mortality and the natural mortality rates vary according to age.

Before we go farther, we need to look at a communication problem between fishermen and managers, and between people who provide biological advice and the management decision makers. Fishing regulations affect the fish population in one of two ways: either by changing the rate of removals resulting from fishing or by changing the size of fish removed by fishing. That's the way fishing regulations operate on a population. You can change the size of fish removed by setting minimum and maximum size limits or regulating mesh sizes to address the size of the fish that will be harvested, but you can't directly control the rate of removal by fishing. You can't simply have a regulation which says, "OK fishermen, next year create a fishing mortality rate of 0.4." You can only indirectly control the rate using things typically seen as regulations — seasons, quotas, bag limits, or closed areas. The manager has to have the art of selecting the right techniques to control that rate of fishing. You can see how difficult it must be for a biologist to set a bag limit when he has to estimate the population based on the rate of mortality, rate of growth, and rate of recruitment. The closest you can come to actually setting a mortality rate is to calculate an average mortality rate over a course of years.

Now let's evaluate a number of different alternatives or approaches to managing this particular cohort of fish. (Remember, normally multiple cohorts occur in the population at any one point in time, but this demonstration focuses on only one at a time.) We are going to still use our same hypothetical fish and all the same life history characteristics and parameters. We are going to set three alternatives: (1), we are going to fish it at a rate of 0.4, which, we saw earlier, along with natural mortality, results in an annual survival rate of about 50%; (2) we are going to fish them twice as heavy at double that fishing rate; and (3) we are going to fish them at the same rate as in alternative (1) but, rather than allowing the fish to recruit to the fishery at age one, we are going to impose a minimum size so that they can recruit to the fishery at age two. We are going to protect the age ones.

The results show on Figure 2: Using alternative (1), 63 fish will be harvested while the fish are in the fishery, and they would have weighed a total of 45 pounds. Under alternative (2), fishing them at double the effort, 80 fish would be caught, but the total biomass would only be 42 pounds. Fishing with the minimum size, alternative (3), we would have caught 32 individuals (actually about half of what we would have caught under fishing them), but the total biomass would have been almost the same as in alternative (1). Remember this rate in alternative (3) is the same as in alternative (1) but we are protecting the fish for an extra year with a minimum size. In this case, we would have had a big influence on the

MORTALITY

	FISHING		NATURAL
	NUMBER	WEIGHT	NUMBER
1)	63	45	25
2)	80	42	17
3)	32	43	50
NO FISHING	0	0	60

SPAWNING

	BIOMASS	SSBR
1)	24	30%
2)	6	8%
3)	36	45%
NO FISHING	80	100%

Figure 2

number of fish that die naturally by imposing that minimum size. We would have had a lot of fish die naturally relative to the other two options. In fact, under all the options, less fish die naturally than an unfished cohort.

Let's look at spawning biomass. Under the situation of no fishing, we had 80 pounds of spawning biomass; under alternative (1) we had 24 pounds of spawning biomass escaping the fishery, spawning and dying; under alternative (2) we had only 6 pounds escaping the fishery, spawning and dying; and under alternative (3) with the minimum size, we had 36 pounds of spawning biomass. If you calculate spawning stock biomass ratios using these numbers, you would end up with a spawning stock biomass ratio of 30% in alternative (1), 8% in alternative (2), and 45% in alternative (3), quite different numbers between alternatives. The weight of fish that we harvested is virtually identical if we look at it in terms of total harvest from that cohort over the course of three years. The natural mortality and the number of fish are significantly different from alternative to alternative, however.

You can see that if you just look at one force only, you could be easily misled into what's going on with all the other forces. If someone was simply looking at annual landings of fish, yet we had three successive cohorts that each were really subjected to three successive fishing regimes, we would see stable landings, but there would be three different things going on with that population. That's why it's important that you look at all the aspects of the dynamics. You need to try to understand all the aspects of the dynamics of a given species if you are going to truly evaluate the health of the resource, and then you must look at what will result from making various management choices.

Let me summarize and hit some of the high points of what I have tried to explain today. (1) The numbers and kinds of fish in a given body of water are always in a state of flux. (2) The numbers and the sizes of fish of a particular species or a particular stock of fish are also in a state of flux. This state of flux would exist whether or not the fishery is operating and regardless of the intensity of the fishing activity. (3)The main purpose for evaluating or studying the dynamics of fish populations is to look at how it relates to the effects of fishing and fishing success, and, to a certain extent, how it relates to any man-induced change to any of these processes. Keep in mind that man makes habitat and other alterations, but we primarily focus on how these relate to fishing and fishing success. (4) Evaluations are done with various conceptual and mathematical models which are developed to explain the dynamic aspects of the population and also to provide biological advice. These models and approaches are not unique to fish. Many of them are applied in a wide range of areas. Various types of scientific data are collected in quantitative fashion to make predictions about the reactions of fish populations to alternative management choices. (5) Knowledge about the dynamics of a given species or a stock allows you to evaluate the health of the resource relative to past conditions. It also allows you to evaluate various management alternatives. (6) Fishery regulations affect the fish population in one of two ways: by changing the size of fish removed or by changing the rate of the removals. But the rate of the removals can only be adjusted indirectly. (7) Finally, I think a basic understanding of the fundamentals of fish population dynamics is necessary if we are going to have intelligent and successful fish management. Otherwise, we are simply managing by throwing at a dart board. You have to have an understanding of some of these aspects before you choose a management alternative.

STATUS OF STOCKS AT ISSUE

Harry Blanchet
Louisiana Department of Wildlife and Fisheries

I will talk about the biological condition of some of the stocks of finfish found in Louisiana waters. These species provide both sport and commercial fishermen with harvest opportunities, and provide managers with a continuous source of controversy.

Many species of fish are harvested by each user group every year in Louisiana, but we'll concentrate today on four species: black drum, red drum, spotted sea trout, and striped mullet. These species have been selected because they are species that are conserved primarily with state management rather than federal management such as is found for the reef fish, pelagic species, and others. Federally-managed species are regulated by the Gulf of Mexico Fishery Management Council or the National Marine Fisheries Service (for species such as sharks and highly migratory pelagics) or by international treaty groups such as the International Commission for the Conservation of Atlantic Tunas. Even by only considering the species under primarily state jurisdiction, we could still address a wide variety of fish. The species that we will talk about today are the ones that we've done complete stock assessments on, and also the ones we receive many questions on from the public. For each species I'll briefly outline the life history and the fishery characteristics that are pertinent to the discussion, review the stock assessment information for the species, and describe the status of the species under its conservation standard.

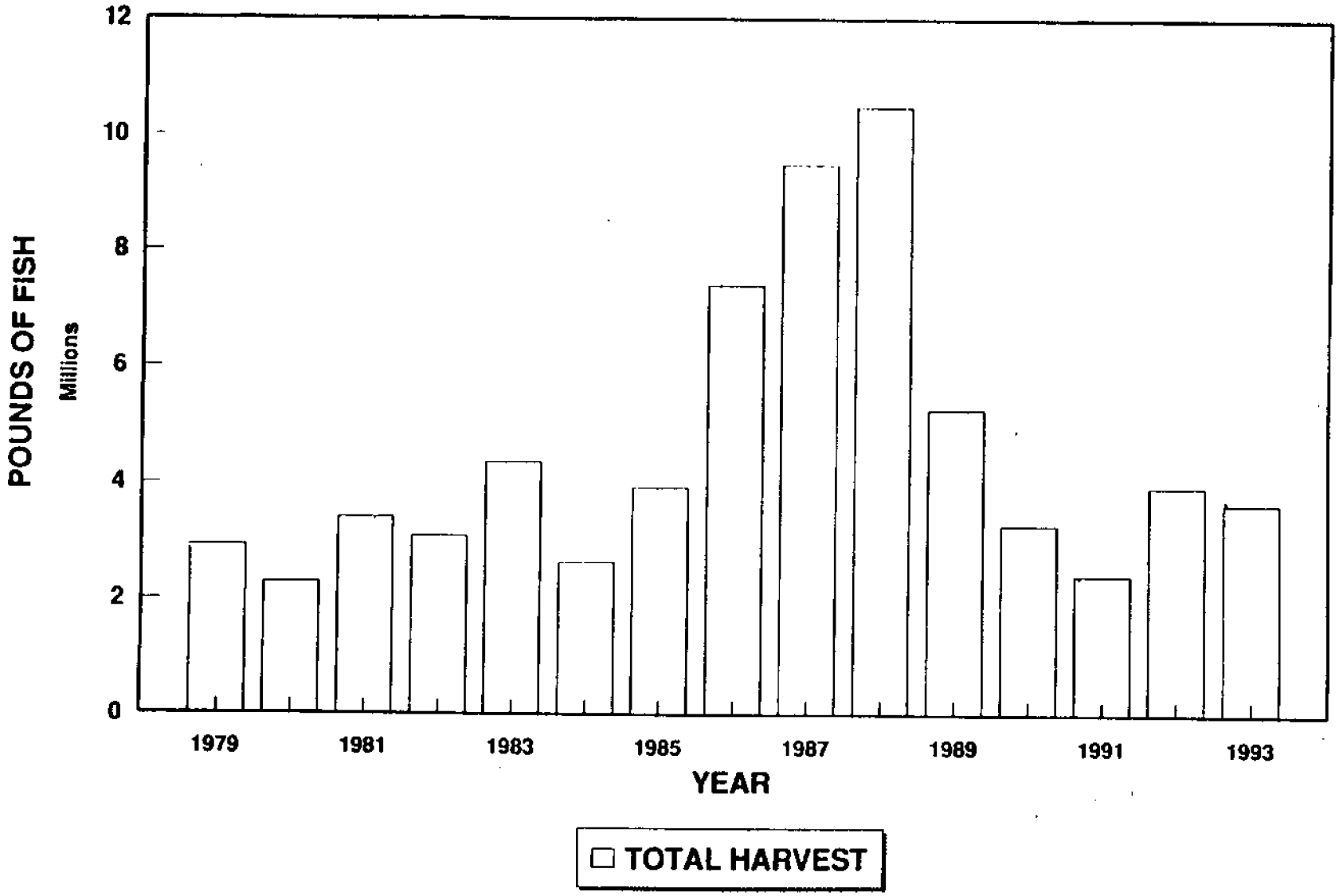
The first species is **black drum**. Like many *sciaenids*, black drum are spawned in the lower bays, passes, or the near offshore waters of the state. Juveniles grow in estuarine nursery areas at a relatively rapid rate, reaching maturity at about five years of age. Older fish continue to grow throughout their life, though at a much slower rate than juveniles.

The first commercial fishery for black drum was focused on juveniles as there was little market for the flesh of the adult. In the 1980s, a market developed for the adults, and both the juvenile and adult fisheries expanded. (This was during and after the increase in the harvest for red drum.) Interim regulations were established in October 1989 and permanent rules were established in 1990 regarding the harvest of black drum in Louisiana waters. No regulations exist to date for harvest of black drum from federal waters. Louisiana drafted a fishery management plan during 1989 and '90 which included a stock assessment. This assessment estimated that harvest at rates (F profiles) of 1987 or 1988 would exceed the conservation standard. However, it did not find that the stock was presently overfished, as there were more old fish in the population than were required under the stock assessment.

Since the establishment of regulations, the harvest of black drum has been substantially reduced due to reductions from both the recreational and commercial harvesters. Harvest has been relatively stable over the last couple of years, and, barring any unforeseen factors, should be expected to continue in this mode. The high degree of variance between year-classes of black drum will, of course, create some variability in harvest between years. However, since the occurrence of these strong year classes would be identified by the department's fishery-independent monitoring program, such increases would not be mistaken for increasing rates of harvest. If a change in the rate of harvest is identified, then another stock assessment could be raised in priority.

LOUISIANA LANDINGS

BLACK DRUM



Lacking a change in the harvest rate, it is still necessary to do a stock assessment on a regular basis to evaluate the postulates of the regular assessment, and to verify the status of the stock. For long lived species such as black drum, which lives about 40 years, if harvest rates remain stable, I would expect us to reexamine the assessment about every 5-10 years.

A recent stock assessment was conducted for black drum in the Gulf of Mexico by the Gulf States Marine Fisheries Commission. The results of this assessment were very similar to the results of the Louisiana assessment, in that fishing mortality rates had declined by 1989, from the peak levels of 1987, '88, and that it showed no evidence of recruitment overfishing. The Gulf States Marine Fisheries Commission management plan did not make specific recommendations regarding quotas, allowable biological catch, or total allowable catch.

Louisiana has established commercial quotas for both adult and sub-adult black drum. Each of these fisheries targets different fish, often using different gear or different techniques. Both the Louisiana and the Gulf States Marine Fisheries Commission management plans recognize these as distinct fisheries. Therefore, they are managed in Louisiana under separate quotas by the use of a special black drum permit which is required to commercially take black drum over 27 inches. Recreational harvest is constrained by 16-inch minimum size limit, a 27-inch maximum size limit with one fish allowed over the maximum, and a five-fish bag limit. The bag limit was not intended to provide conservation effect, since very few recreational harvesters keep more than five fish. Rather it's intended both as a method of separating recreational from commercial harvesters in the event of a closed commercial season, and as part of a suite of regulations which would be easy for anglers to remember. The minimum and maximum sizes mirror those for red drum, a more highly targeted species. By instituting the same limits on these similar species, we hope to increase the number of fishermen knowing and abiding by these limits.

Based on the assessments to date, the existing harvest rates, black drum stocks are very healthy in Louisiana. The Secretarial Finfish Advisory Panel has just reviewed the stock assessment information available, and has requested that the department review the possibility of reducing the recreational size limit on black drum to 14 inches total length. I hope to have this analysis complete by the next meeting of that panel. If the panel would decide to make such a recommendation, it would have to pass through a review by the Secretary and be passed as a rule by the Wildlife and Fisheries Commission to become effective.

The next species that I will talk about is **red drum.** The life history of red drum is very similar to that of black drum. They are spawned in the lower bays, passes or near offshore waters of the state. Juveniles grow in estuarine nursery areas at a relatively rapid rate, reaching maturity at about two to four years of age. Older fish continue to grow throughout their life, but at a much slower rate than as juveniles.

Historic commercial and recreational fisheries targeted the juvenile red drum. During the early 1980s, the growth of the directed purse seine fishery in the offshore waters attracted the attention of scientists and stock assessment experts. Age structure information from the purse seine commercial fleet was the first data that brought out the variation in the year-class strength over the offshore stock that was the basis for the development of conserva-

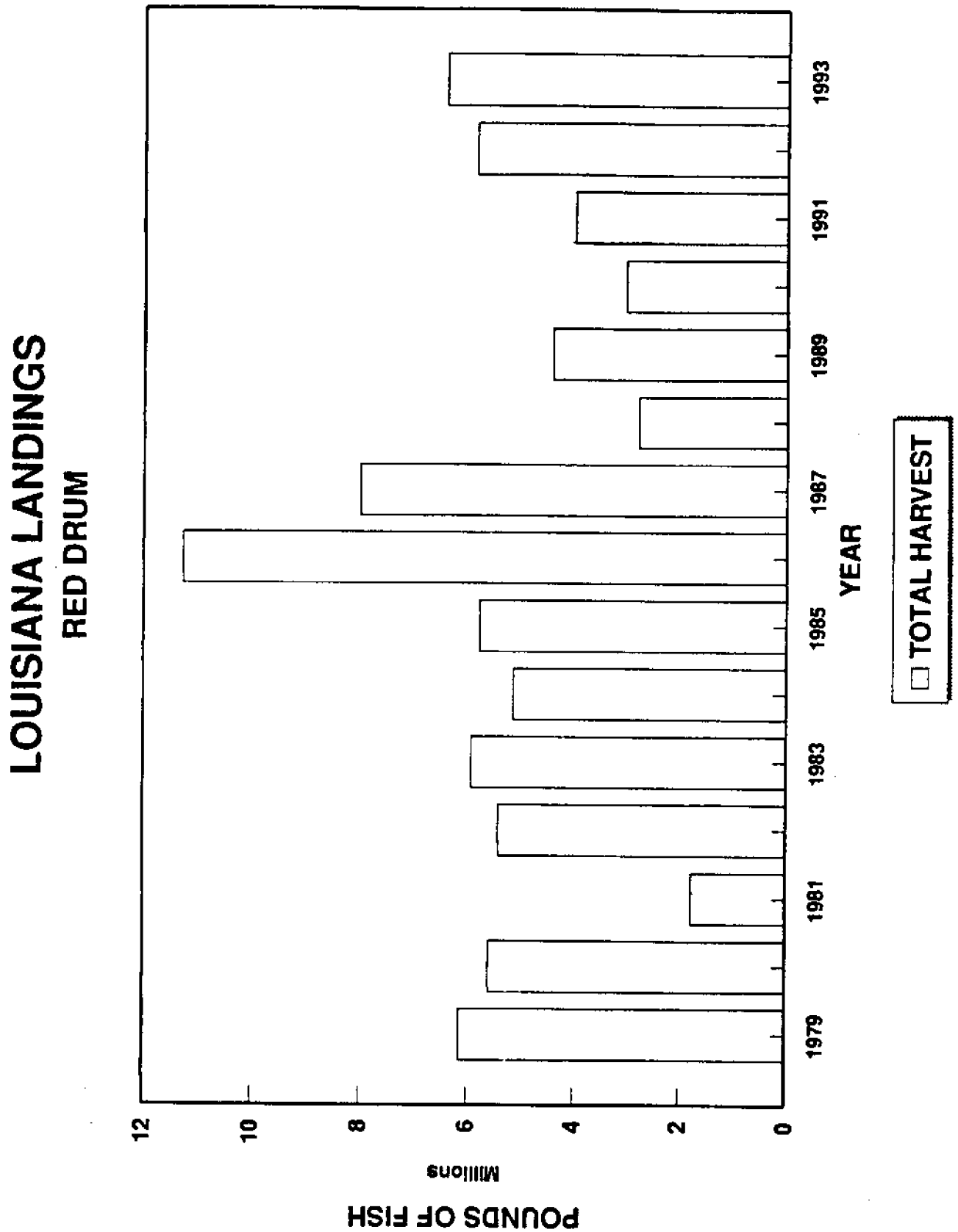
tion measures on the stock.

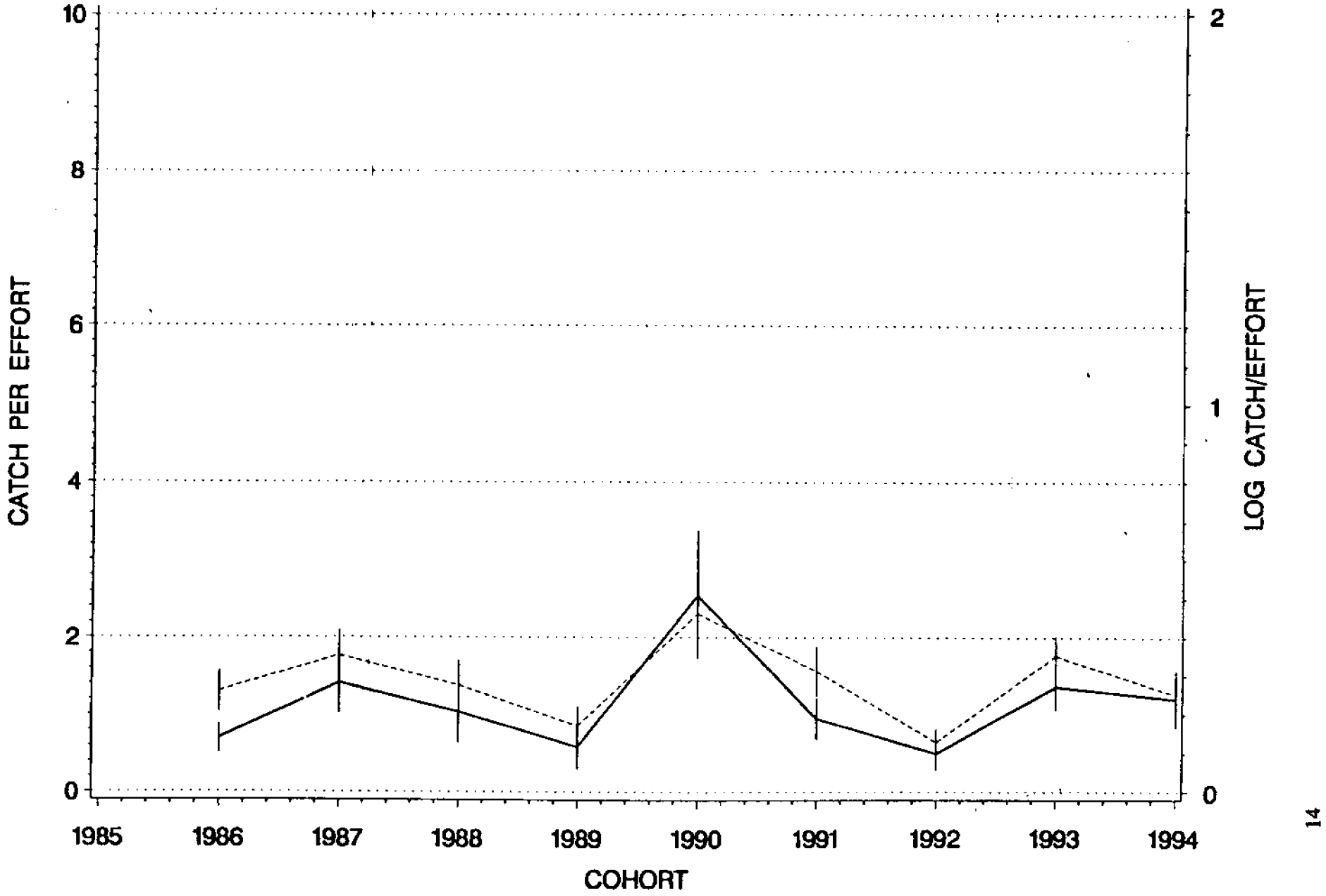
Several strong year-classes were noted in the offshore stock which was spawned in the early 1970s. These were followed by at least three very weak year-classes. The strong cohorts were in 1972-74, with 1973 being the most abundant in the samples. Weak cohorts were in 1975, '76, '77 with a stronger cohort seen in 1978. The hole in 1975-77 was obvious, but the relatively low level of recruitment to offshore waters after that period also generated concern among stock assessment specialists. Later investigations have determined that complete recruitment to the schools that the purse seines were targeting begins at about age 5 or so, and that the distribution of ages within these schools is not random. Therefore, it is necessary to have information from a lot of different schools, as well as a substantial number of fish, in order to characterize the age structure of the offshore stock. In the years after about 1988, relatively few samples were taken in the offshore waters since both the commercial and recreational fisheries were closed. During the most recent year of data available (which was 1991-92), a few more samples were taken, and these samples indicate that the age structure of the offshore stocks is becoming dominated by young year-classes. This is at least partly due to the conservation efforts of the states in inshore waters, allowing a larger fraction of the juvenile stock to escape these estuarine fishing grounds and enter the offshore stock.

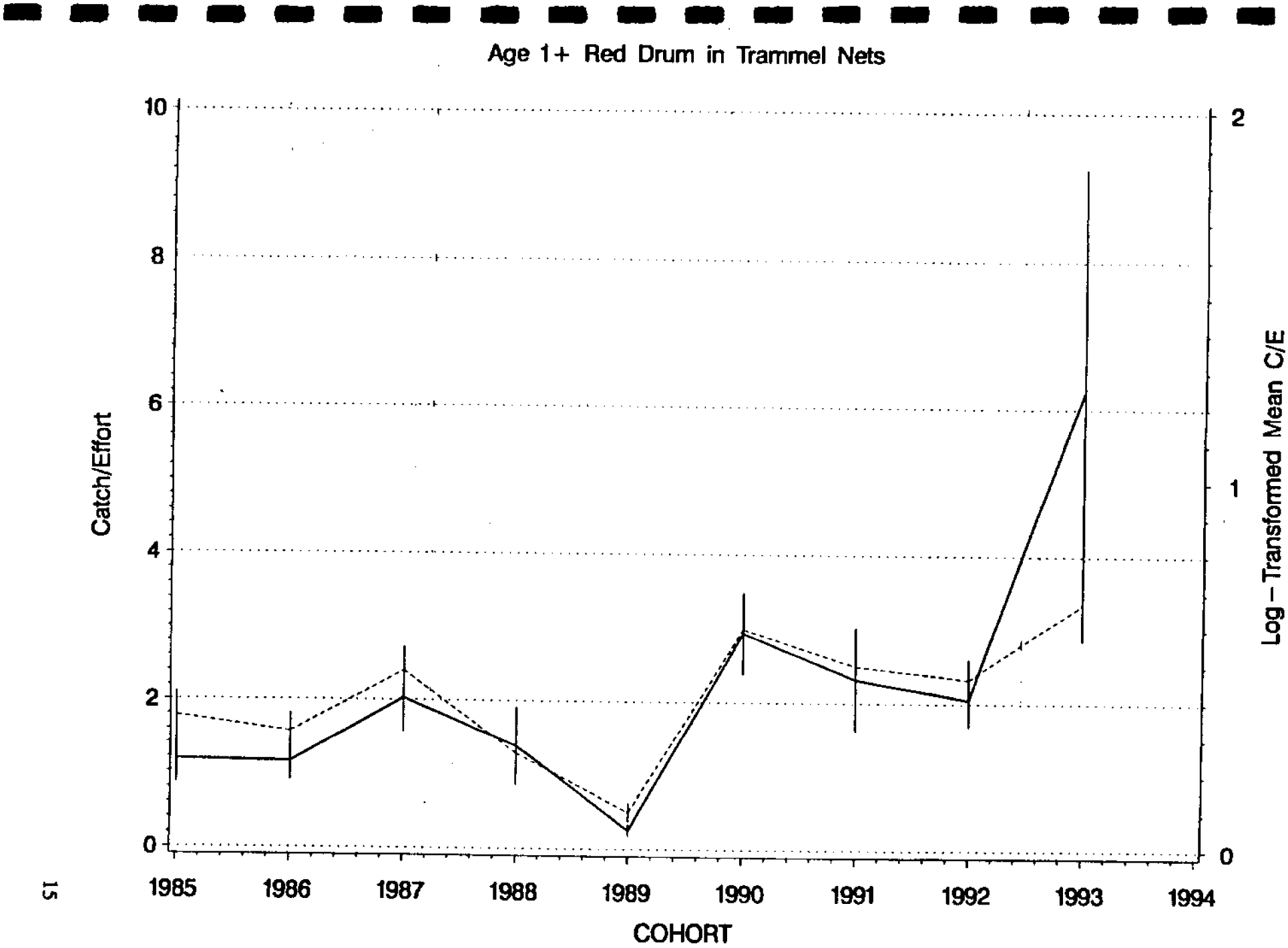
In recent years the department has seen relatively high recruitment indices in fishery-independent samples taken across Louisiana. The reason for the relatively high recruitment is not completely known, but environmental factors seem to be important. In recent years, trammel net samples of fish just after their first birthday have shown higher indices than would have been expected from the seine samples, which are taken on fish only a couple of inches long during the first fall of their life. These high trammel net indices have been good predictors of fishing success rates for anglers the following year, as the fish become available to them.

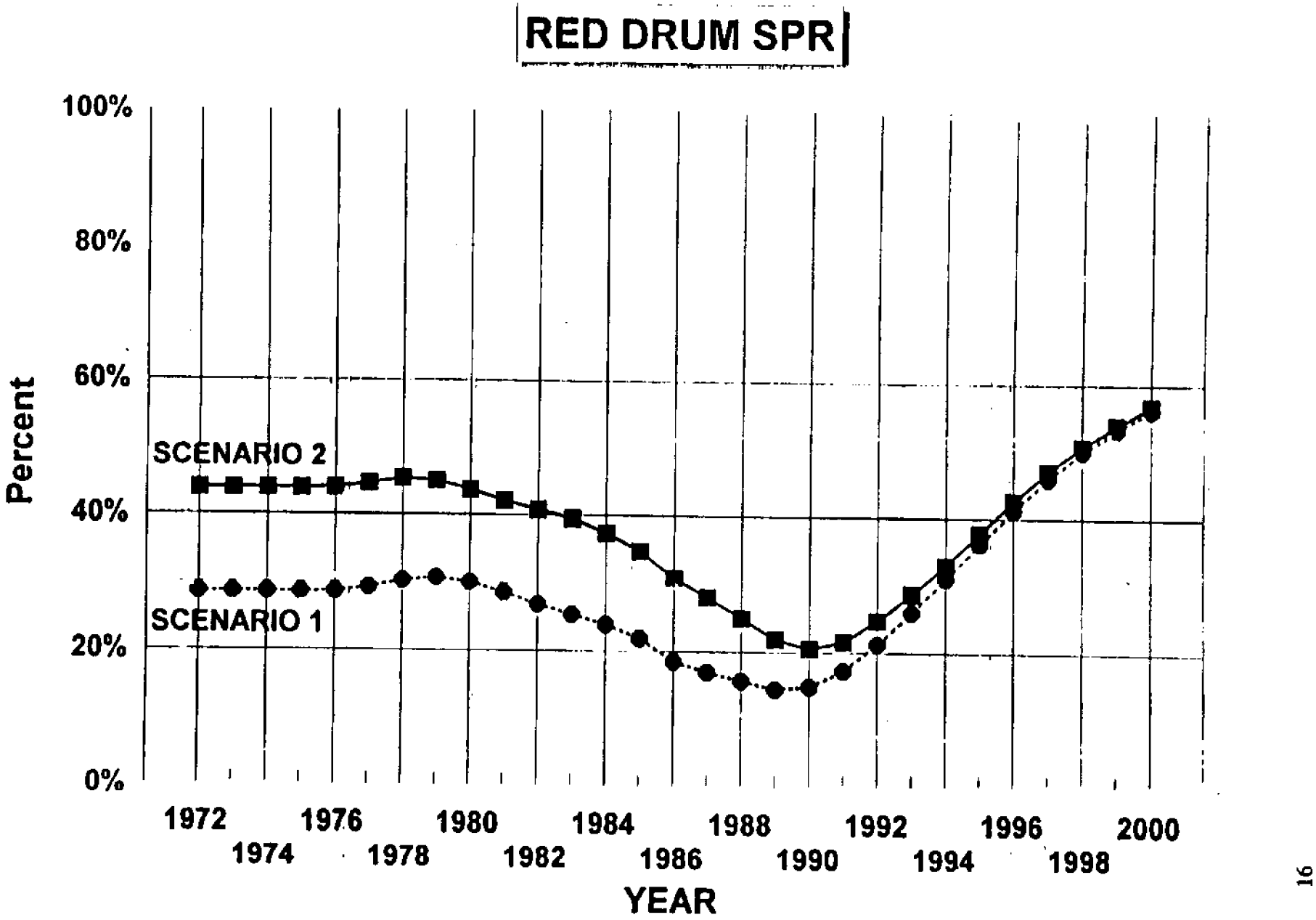
The point of this discussion is that even though harvest of red drum has been higher than earlier stock assessments indicated that would be occurring under the existing regulations, much, if not all of this increase in harvest has been due to the increased availability of fish in the estuarine and nearshore fishing grounds, and not to increasing rates of harvest. This is an important distinction since an increasing harvest due to increasing rates rather than due to increasing abundance would be significant to the escapement rates to the offshore stock.

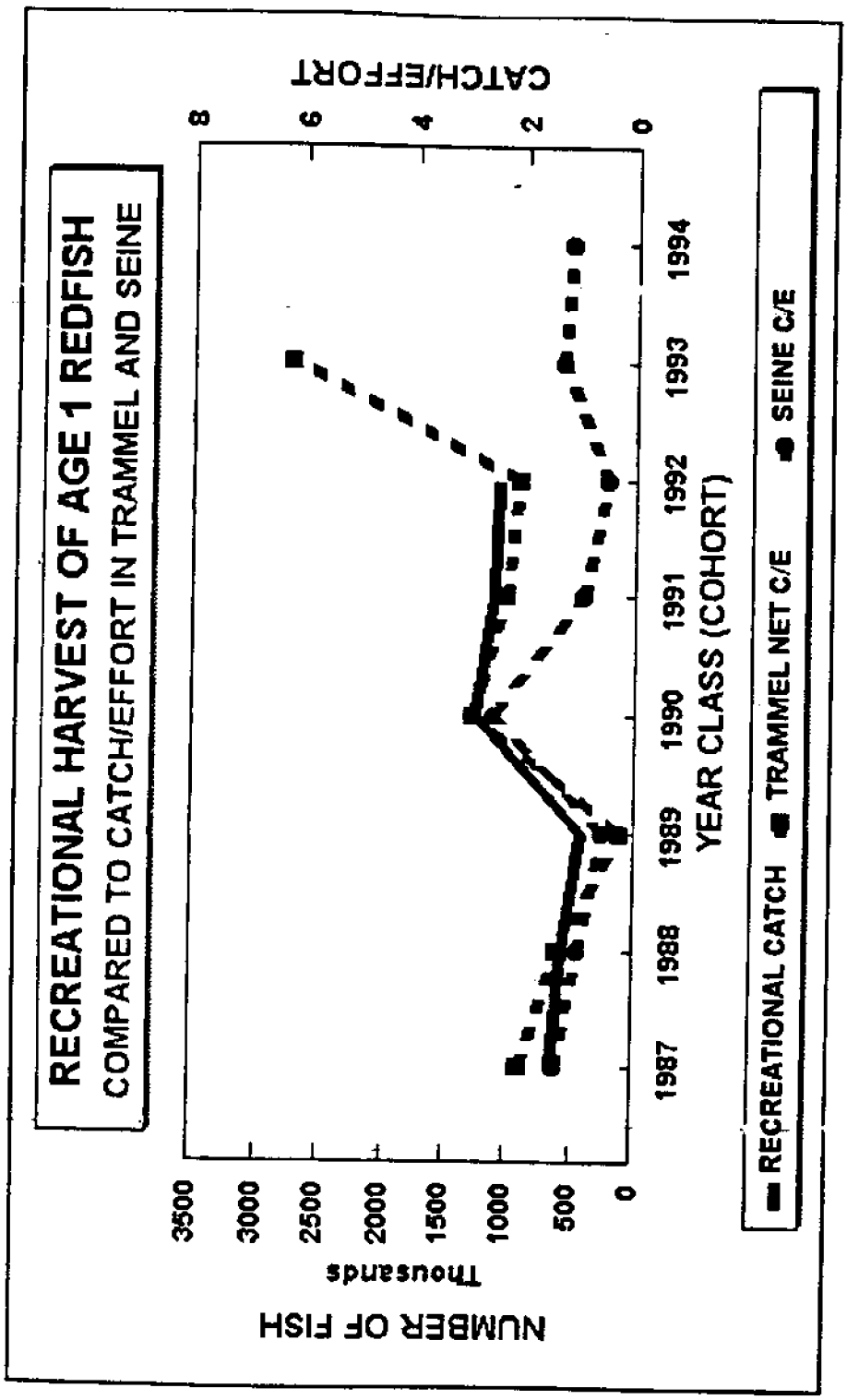
LDWF is required to annually assess the stock of red drum as part of a legislative charge to the commission, and to report to the legislature on the status of the species. This report has been widely distributed, and I will not go into great detail here. The important point to this discussion is that the offshore stock is capable of producing sufficient juveniles to maintain the inshore recruitment levels that the environment will accept, and that existing regulations insure that the stock size of the offshore stock will continue to increase at a fairly rapid rate. The 1990 year-class, the first of the very strong cohorts seen in recent years, is now 4 1/2 years old and most of this cohort has already grown beyond the 27-inch maximum size limit and has moved offshore, outside of the historic fishing grounds of our state. This cohort will be followed by others that are not as strong, but are still well above the strength of those seen in the recent historic past. Personally, I believe that the abundance of red drum seen now in the estuarine waters of the state may be unprecedented, at least

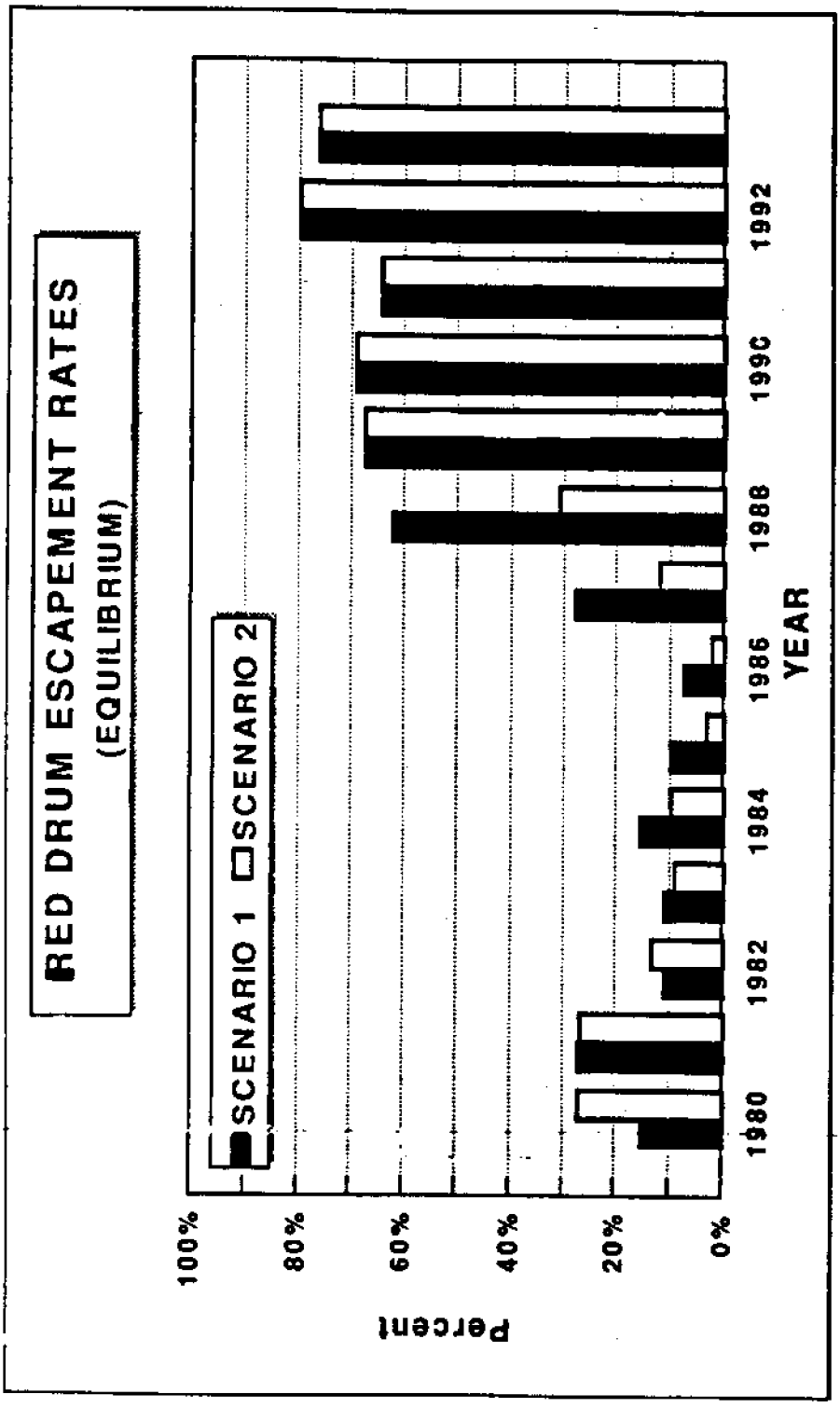

LOUISIANA LANDINGS
RED DRUM
POUNDS OF FISH
Millions
0
2
4
6
8
10
12
1979
1981
1983
1985
1987
1989
1991
1993
YEAR
TOTAL HARVEST


Age 0 Red Drum in Seines
CATCH PER EFFORT
LOG CATCH/EFFORT
10
8
6
4
2
0
2
1
0
1985
1986
1987
1988
1989
1990
1991
1992
1993
1994
COHORT


Age 1+ Red Drum in Trammel Nets
Catch/Effort
Log – Transformed Mean C/E
COHORT
0
2
4
6
8
10
0
1
2
1985
1986
1987
1988
1989
1990
1991
1992
1993
1994


RED DRUM SPR
100%
80%
60%
40%
20%
0%
Percent
SCENARIO 2
SCENARIO 1
1972
1974
1976
1978
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
YEAR


RECREATIONAL HARVEST OF AGE 1 REDFISH
COMPARED TO CATCH/EFFORT IN TRAMMEL AND SEINE
NUMBER OF FISH
Thousands
3500
3000
2500
2000
1500
1000
500
0
CATCH/EFFORT
8
6
4
2
0
1987
1988
1989
1990
1991
1992
1993
1994
YEAR CLASS (COHORT)
RECREATIONAL CATCH
TRAMMEL NET C/E
SEINE C/E


RED DRUM ESCAPEMENT RATES
(EQUILIBRIUM)
SCENARIO 1
SCENARIO 2
100%
80%
60%
40%
20%
0%
Percent
1980
1982
1984
1986
1988
1990
1992
YEAR

within the last 20 years.

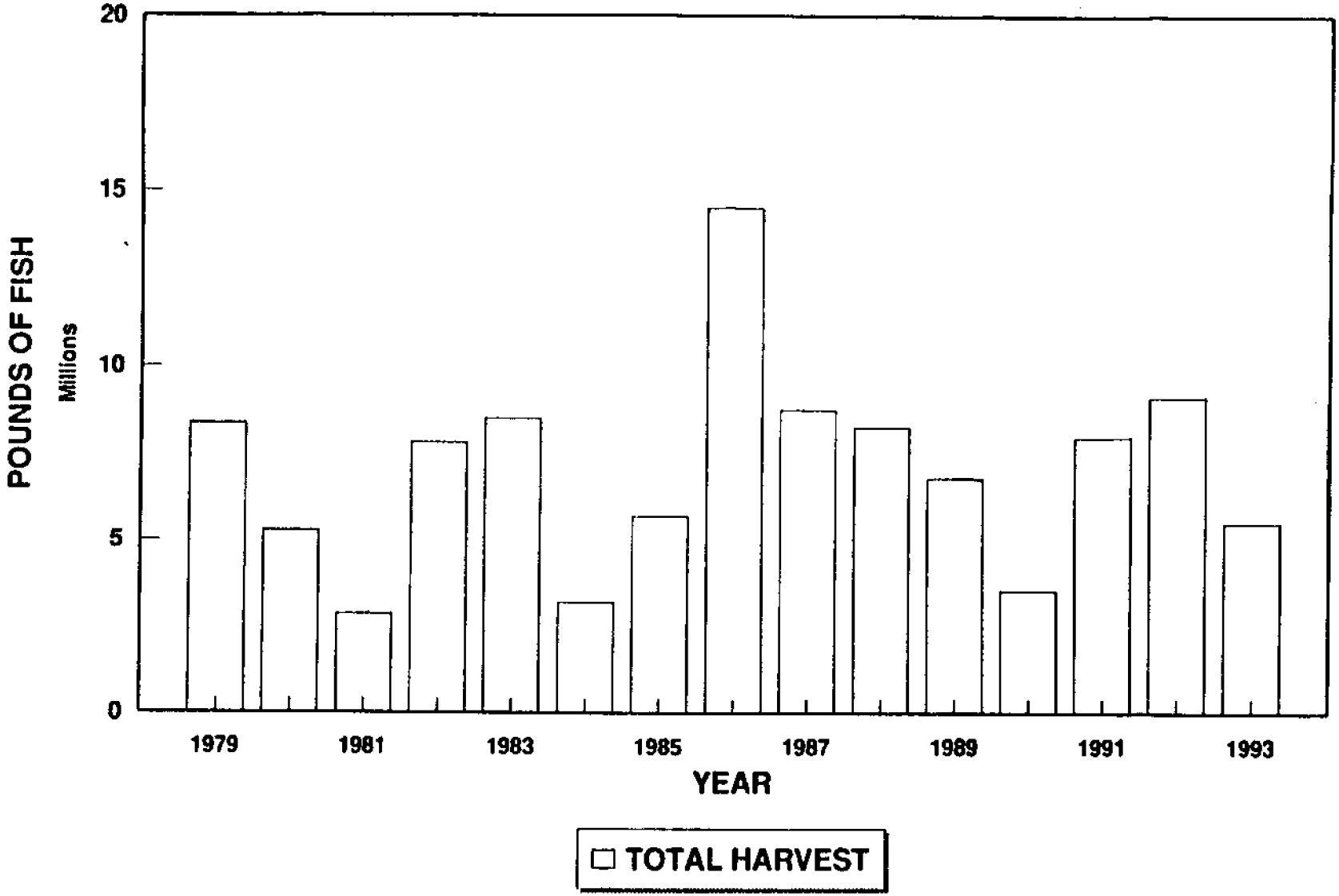
The Louisiana stock assessment indicates that the existing escapement rates from the state fishery are approximately 70 % over the last several years. No obvious trends are seen in the data indicating that fishing rates are changing. The existing conservation standard is 30 % escapement. The stock of red drum is presently being harvested at a rate well below the standard requested of the state by the Gulf of Mexico Fishery Management Council. The strong cohorts presently in Louisiana waters will (barring the event of another severe freeze or environmental catastrophe) provide for rapid increases in the size of the offshore spawning stock. The National Marine Fisheries Service stock assessment for this species has just been delayed so it will not be provided until February 1996. It will give a Gulf-wide estimate of the stock. Additional work toward a tag recapture project in the offshore waters will hopefully be initiated this year. But that project will not be complete until at least 1998 including all analyses. When these analyses are done, the age structure of the offshore stock will be confirmed by a larger sample of fish and the change in the overall size of the offshore stock will be verified. We feel that we have already good estimates of these parameters from our state assessment but issues such as the actual measures of natural mortality rates in offshore waters will help us to give more precision in our analyses.

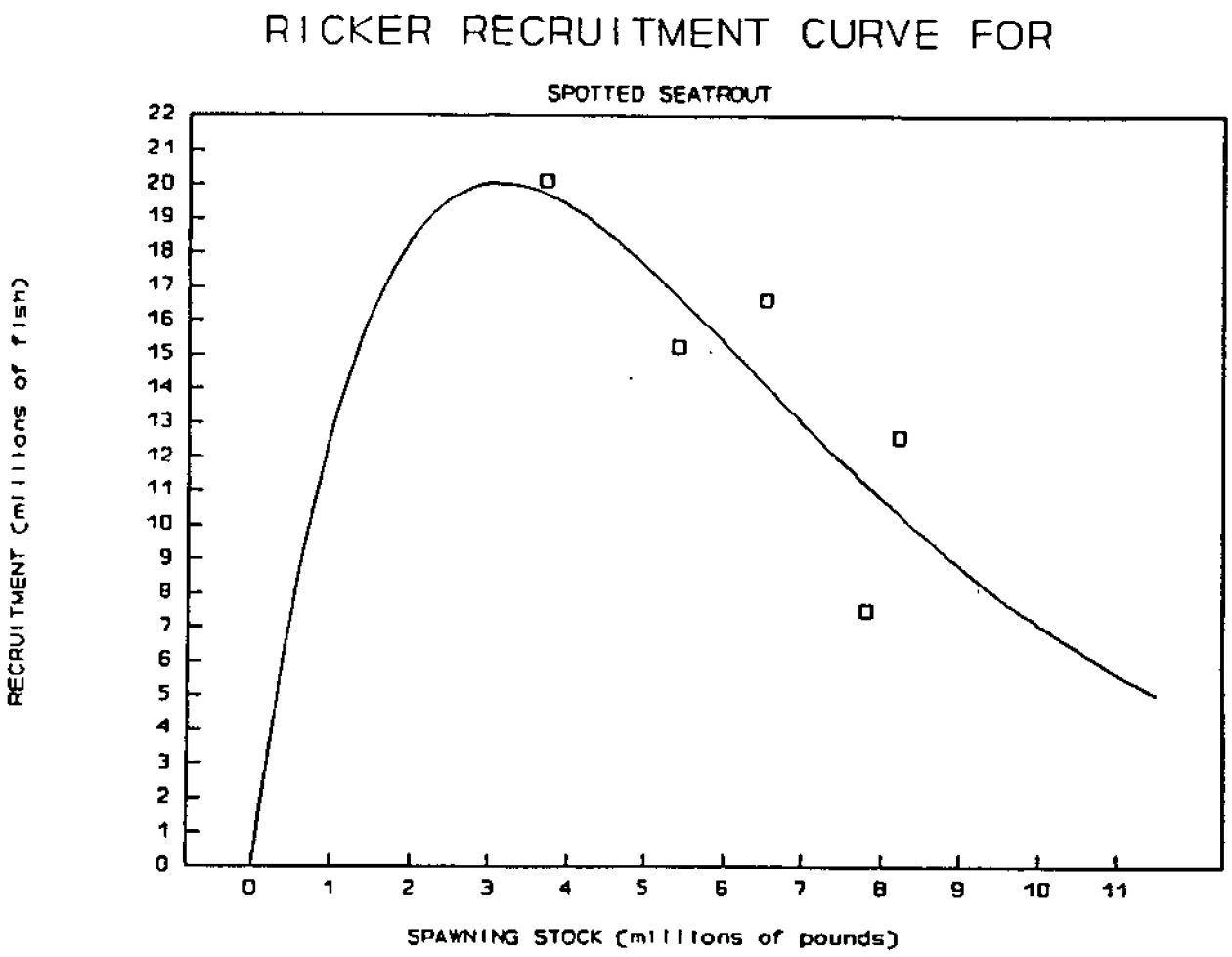
One point to leave you with regarding red drum. Eventually whatever factors that have produced the very strong cohorts that we now see in state waters will return to their more typical conditions. Recruitment will also return to more typical conditions. Recreational fishing success will decline in terms of total harvest and average harvest per angler. This will not mean that the fishery needs further regulations or that it is in a crisis. Louisiana natural fisheries exist in one of the most dynamic ecosystems in the world. As such they do not maintain a steady state of production or biomass but fluctuate with those ecological conditions. So long as regulations continue to allow sufficient numbers of juveniles to go offshore for spawning and so long as harvest on the spawning stock does not excessively deplete that stock, fluctuation in harvest rates is not a matter of great biological anxiety.

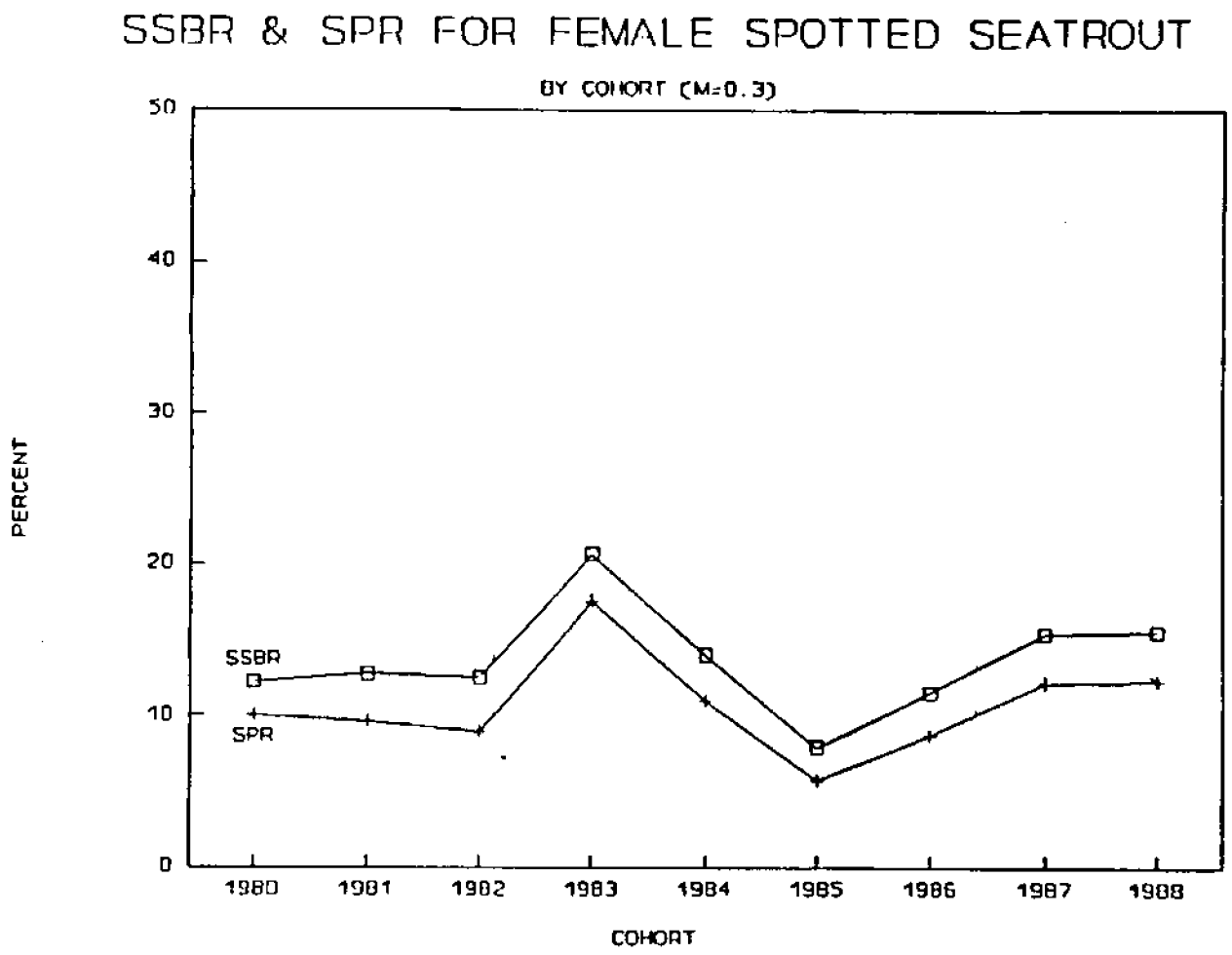
Spotted sea trout is the next species I'm going to talk about. This species differs from the two drums species in many respects. Spotted sea trout begin spawning at a young age, perhaps as early as one year old. It spawns in the summer in the lower bays, passes, and near offshore Gulf where conditions are suitable. A single female may spawn many times over the summer. Male fish tend to grow slower than females especially after they become mature. The reasons for this are not entirely clear, but probably are associated with the spawning habits of the males. The information to date indicates that the male trout tend to remain in the area of the spawning activity throughout the season while the females may move away from the spawning areas into other areas for feeding between batch spawns. At any rate male fish average about 12 inches total length at two years old and grow very slowly after that. Fourteen inch male trout are three to four years old. It is very unusual to find a male trout over a couple of pounds in weight. Females have attained 14 inches by their second birthday and continue to grow somewhat faster than males from then on. The fish has a relatively short life span, living up to five or six years in Louisiana waters. Most of the egg production comes from two and three year old fish, since these constitute a large fraction of the biomass of the spawning stock. Most of the recreational and commercial harvest is also composed of these

LOUISIANA LANDINGS

SPOTTED SEATROUT




RICKER RECRUITMENT CURVE FOR
SPOTTED SEATROUT
RECRUITMENT (millions of fish)
SPAWNING STOCK (millions of pounds)
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22


SSBR & SPR FOR FEMALE SPOTTED SEATROUT
BY COHORT (M=0.3)
PERCENT
50
40
30
20
10
0
SSBR
SPR
1980
1981
1982
1983
1984
1985
1986
1987
1988
COHORT

ages. Data from Louisiana indicate that female trout as small as 10 inches may be sexually mature. These small fish tend to produce fewer eggs per batch than larger fish, but the fish are also more abundant than the very large fish, so that the cumulative effect is still important for the population.

With this species as with the others that we have discussed, a substantial variation exists between years and survival of young that are produced. This produces good and bad years for spotted sea trout as it does for other species as well. There are not direct measures for stock size for times before about 1979 when the Marine Recreational Fishing Statistics Survey established a consistent recreational creel survey. However, commercial harvest data can be used to give some indication of inter-annual variation in standing stock sizes, with some qualifications.

Commercial harvests increased steadily in the early 1970s, and peaked at about 2.5 million pounds in 1973. (This peak may have been partly due to increased accuracy of landings associated with the reporting requirements imposed on commercial fishermen to secure the maximum fuel allotments during the Arab oil embargo, and to the introduction of monofilament gill nets into the fishery, and perhaps to increased effort.) Decreased landings following 1973 through 1982 were largely attributable to several successive years of adverse environmental conditions, i.e., freshwater flooding during 1973, '74, '75 and severe winters in 1975 and '76, as well as to later restrictions placed on the commercial fishery for net materials, length of nets, mesh size and so forth. These same trends are notable in commercial landings data from other states, indicating that the variations in the landings probably reflect Gulf-wide variation in stock size as well as these other factors.

Within more recent years where total harvest figures are available, the effects of the freezes in 1983 on the 1984 harvest and in 1989 on the 1990 harvest can be seen. After these minimum harvest years, harvests increased well beyond the average of adjacent years because the stock produced unusually strong cohorts which became available for harvest.

The stock of spotted sea trout in Louisiana waters has shown strong resiliency, rebounding from flood or freeze events with unusually strong cohorts. Some of this is due to the nature of the fish which is documented as being cannibalistic. When the abundance of large spotted sea trout is reduced in the nursery areas, the younger trout have a better chance to survive, increasing the size of the resulting cohort. This can be due to displacement of the adults by flood or freeze, as well as mortality directly or indirectly attributable to these events.

Relatively recent regulatory changes including the establishment of a 12-inch minimum size limit for trout harvested recreationally, a 14-minimum size for commercially harvested trout, and the establishment of a commercial quota to constrain harvest from that sector, have all acted to protect the stock of trout from harvest until they reach a size where they have had a chance to spawn at least once. Recent harvest rates have reflected the rebound in the stock following the 1989 freeze, and the effect of minimum size regulations allowing more growth in the fish before harvest. Since the freeze itself, the Department has predicted this increase in stock size, and that this increase will be followed by a gradual decline. I estimate that the overall harvest in 1995 will be a larger than average fish, and that harvest in terms of numbers will probably be below 1994 levels.

The Department stock assessment

shows there is a vigorous fishery for the species, and that harvest rates have been very high over the entire time that has been examined (that is since about 1980). Establishment of the existing minimum sizes have helped constrain the harvest on the youngest fish and thus provide a buffer for the stock that was not present earlier. Harvest rates on older fish has shown no consistent trend over the time period examined, neither consistently increasing nor decreasing.

The conservation standard for spotted sea trout in Louisiana is based on the observed capacity of the species to maintain a recruitment in Louisiana waters. The standard is designed to stabilize the spawning stock at or above the median level found in the 1980s, where existing evidence indicates that the spawning stock has not been reduced below a level that would adversely impact recruitment.

There has been some discussion at various times regarding the possibility of increasing the minimum size limit on spotted sea trout to 14 inches or so. This increase in size would increase spawning stock biomass ratio somewhat, but as I have already said, that increase would not result in any increase in recruitment. It would result in the harvest of larger trout, but many more trout would have to be released due to these limits. It would especially impact the harvest of male trout, which grow slower and reach smaller sizes. The net result would depend on factors such as the catch and mortality rates of released fish, and any responses, including negative ones, of recruitment to the increased biomass of adult fish. We estimate that any increase in harvest weight would be minimal, and that the numbers of fish harvested would be substantially reduced.

If fishing mortality rates on spotted sea trout were to increase to levels that would push the spawning stock biomass rate below the limits that we consider safe, I would strongly recommend that a wide range of options be considered before deciding on how to reduce any excess mortality. These would not be limited to raising the minimum size limit.

The next species I will talk about is **striped mullet.** Striped mullet is different from the other species I've talked about today. It has a relatively short spawning period in the fall. Each female will develop all the eggs it will spawn in a year at one time (isochronal spawner), and release these eggs over a relatively short period, probably within a week or so. The overall spawning period may take a couple of months, 2-3 months, but the individual females only spawn for a week or so. Spawning takes place well offshore of Louisiana, probably concentrated around the outer shelf in several hundred feet of water. Juveniles recruit to the marshes during the winter and early spring, and remain in the estuaries for the first year or so of life. They mature sexually when they are around two years old, and at the size of about 11 inches. The oldest fish in Louisiana waters are around six years of age. Four and five year old fish average about 14-16 inches, respectively.

The existing conservation standard for striped mullet in Louisiana is a spawning potential ratio of 20%. This standard was proposed because we did not have the data necessary to develop a standard which was specific for striped mullet.

The commercial harvest of striped mullet has only been developed within the last few years. There was a relatively small harvest for many years, initially for use for crab or catfish traps, later also for roe. Due to the relatively short time that the fishery has existed, the stock assessment for the species has examined potential yield of the fishery, and

how a variety of harvest rates would affect the spawning stock. I do not believe that it is possible at this time to give a good estimate of the possible yield of the mullet, other than to say it is probably well above present harvest levels.

One complicating factor in the analysis is that mullet seem to grow at different rates in different parts of the state. Mullet grow fastest in the part of the state east of the Mississippi River. The relatively slow growth rate in other parts of the state may inhibit development of a commercial industry in those areas, since the existing regulations on gill net sizes constrain the harvest of the smaller mullet.

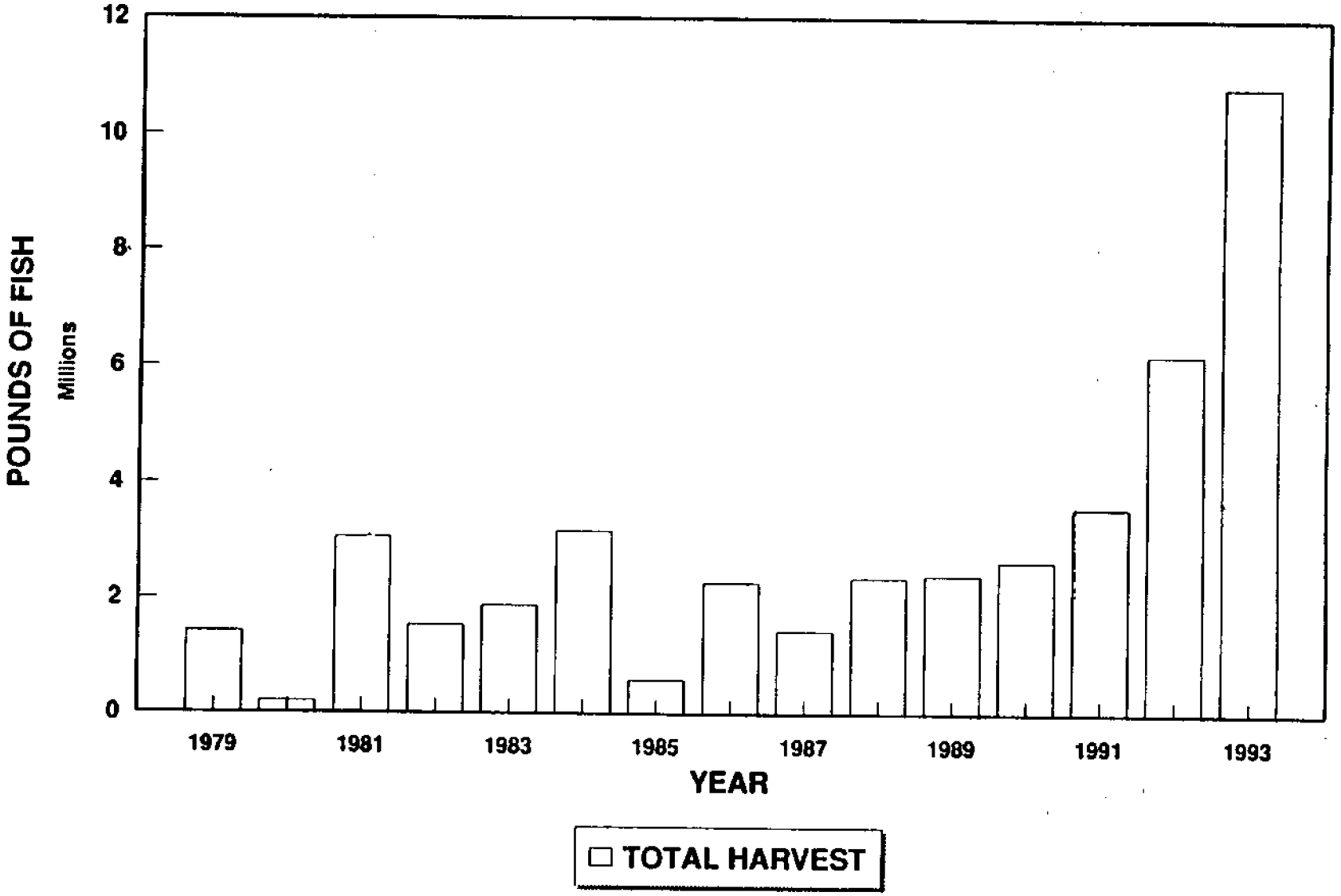
The age structure of harvest by gill nets is dominated by three and four year old fish. This is due to the existing mesh sizes (3.5-4 inch mesh) used by the fishery. Most age two fish, averaging around 29-30 cm., are not effectively harvested by those methods. The assessment for mullet demonstrates that continuation of the practice of harvesting fish at least three and four years old will not cause a decline in total harvest, even at high rates of fishing. However, there would be a decline in the catch per effort for individual fishermen long before reaching the maximum rates. This data is based on the existing fishery, which is centered east of the Mississippi River, on relatively rapidly growing fish. If the fishery were to expand to the west, so that more of the slowly growing fish were included in the fishery, the fish would be harvested at an older age than is estimated in this assessment.

A virtual population analysis can only examine that part of the stock that is being harvested. Information from Florida suggests that mullet return from spawning to the same estuary system from which they had previously migrated. This means that the lightly fished parts of the state stock would only be partially included in estimates of the stock size, leading to underestimates of the potential yield of the stock. These potential errors in the assessment indicate that the existing assessment would tend to overestimate existing harvest rates, underestimate stock size, and underestimate existing spawning potential ratios.

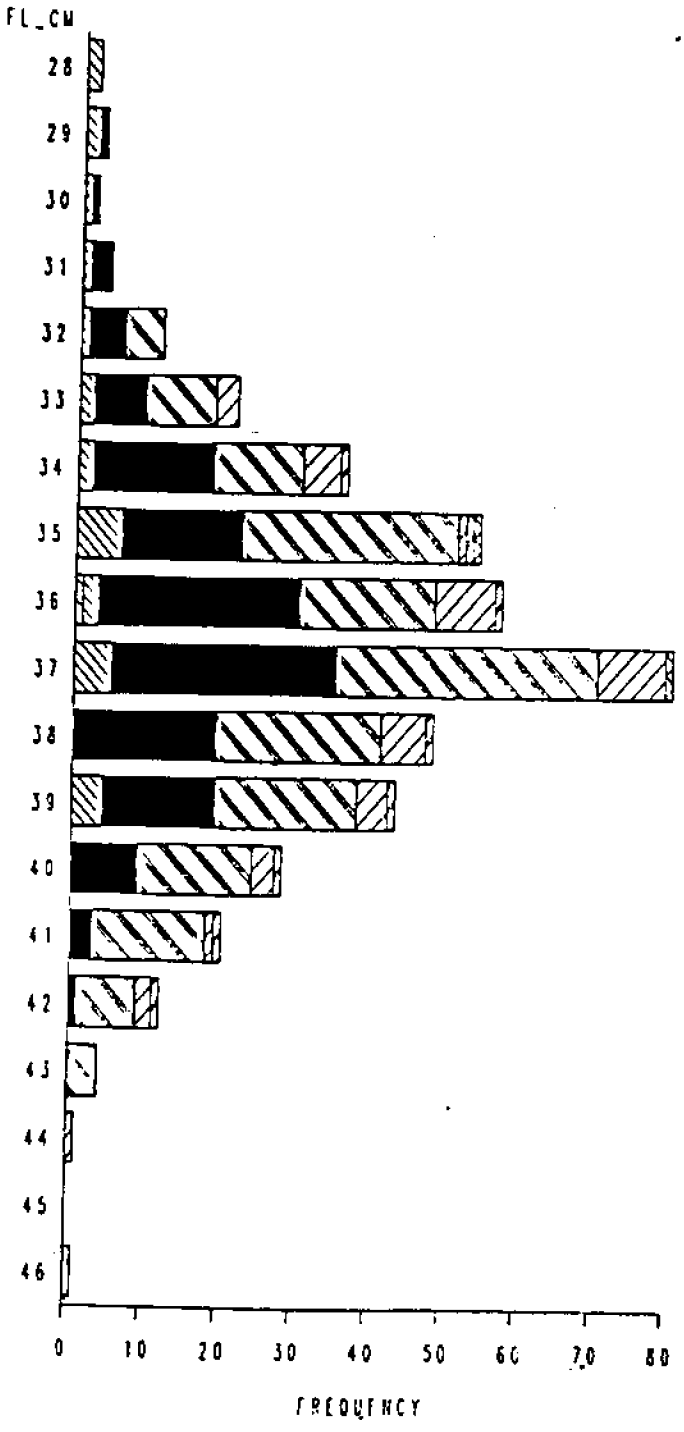
Review of the commercial harvest data from Florida shows a long term trend of declining harvest rates. I believe this is due to the gradual loss of coastal habitat in that state. Superimposed on this long term trend is a 7-8 year cycle of landings which I interpret as being a function of environmentally driven variation in recruitment. At present, Florida is at the bottom of one of these cycles. If recruitment to Louisiana mullet stocks are driven by the same factors as those causing the cycles in the Florida fishery, then some increasing biomass of mullet in Louisiana waters is possible over the next couple of years. However, this is pure speculation at this point, because we don't know what drives mullet recruitment, either in Florida or in Louisiana. At present we estimate the mullet stock in much of Louisiana is still under exploited. Harvest rates in some areas may be near the rate which would maximize yield in those areas, but other areas have very lightly exploited stocks.

LOUISIANA LANDINGS

MULLET



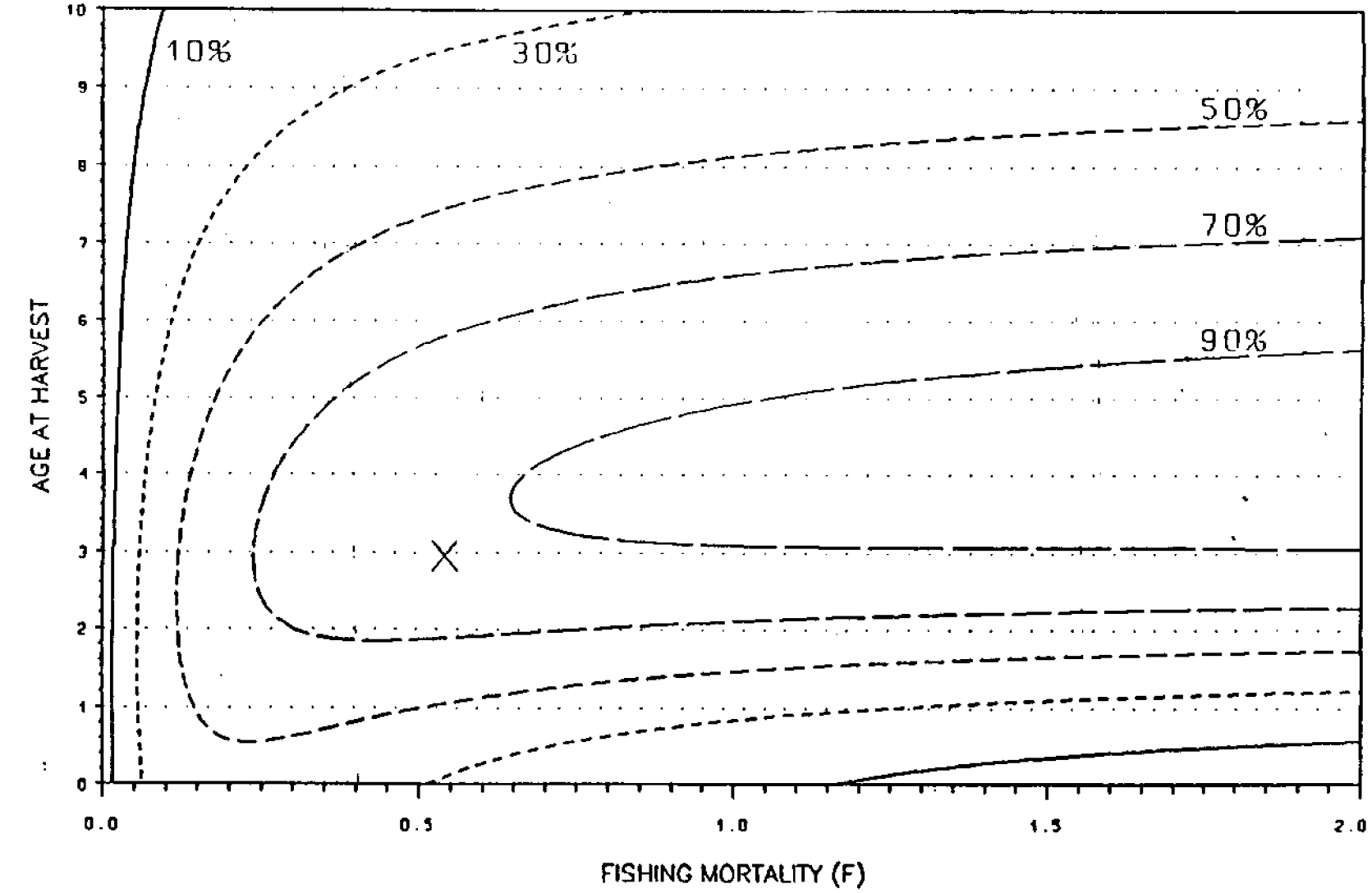
Commercial Gill Net Data Only



FL_CM	FREQ.	CUM. FREQ.	PCT.	CUM. PCT.
28	2	2	0.47	0.47
29	3	5	0.70	1.17
30	2	7	0.47	1.64
31	4	11	0.94	2.58
32	~~11~~	~~22~~	~~2.58~~	~~5.15~~
33	21	43	4.92	10.07
34	36	79	8.43	18.50
35	54	133	12.65	31.15
36	57	190	13.35	44.50
37	80	270	18.74	63.23
38	48	318	11.24	74.47
39	43	361	10.07	84.54
40	28	389	6.56	91.10
41	20	409	4.68	95.78
42	12	421	2.81	98.59
43	4	425	0.94	99.53
44	1	426	0.23	99.77
45	0	426	0.00	99.77
46	1	427	0.23	100.0

MULLET YIELD / RECRUIT

PARAM - M=0.3 LL=453.9 K=0.332 T0=-0.05

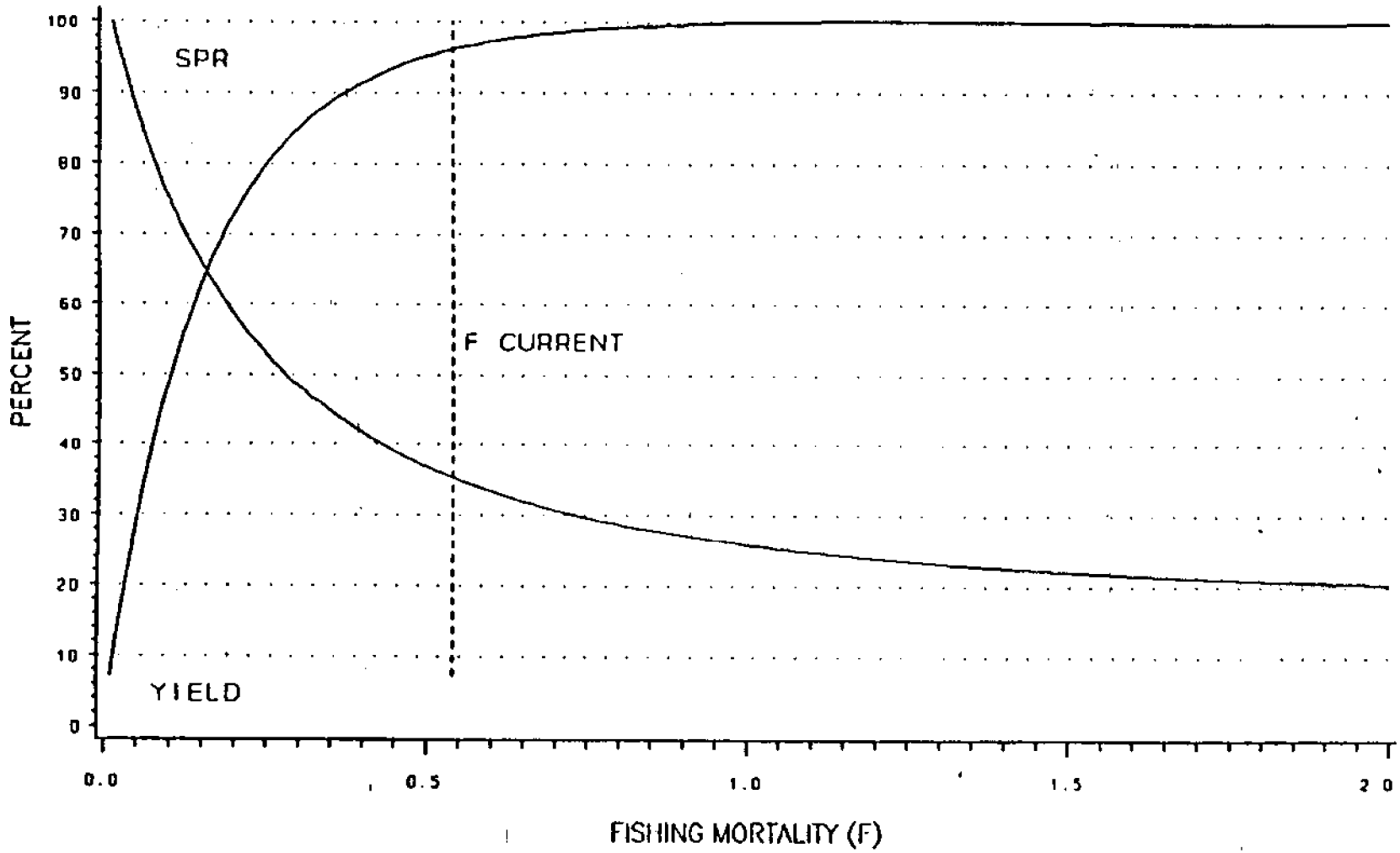


X - ESTIMATED MAXIMUM CURRENT FISHING MORTALITY RATE

PERCENT MAXIMUM YIELD AND SPAWNING POTENTIAL

AGE AT FIRST HARVEST = 3

PARAM - M =0.3 LL=453.9 K=0.332 TO=-0.05



F CURRENT - ESTEMATED MAXIMUM CURRENT FISHING MORTALITY RATE

PERSPECTIVES ON CATCHES BY USER GROUPS

Jerald Horst
Louisiana Cooperative Extension Service

It's a pleasure to be here. The topic, catch statistics, is controversial. Nobody ever agrees on catch statistics, what they signify, and what they mean. If statistics agree with someone's opinion, they are quoted often. There is another group of people who, like Mark Twain say statistics are lies, "damn lies," and then there are those who find flaws and errors in the statistics and attack them pretty vigorously.

Another point about statistics, can be demonstrated by two very dear fishing friends. One of them described the other fellow by saying, "You know, Jerald, John really knows what he knows." In other words, there is a big gap between perception and reality when it comes down to what is said by catch statistics and what people believe about them.

I want to discuss in the realm of perception compared to reality the latest regulatory action that caused some conflict among user groups in the Gulf of Mexico. That was the increase in regulations that pertain to recreational fishermen on red snapper. As some of you know, beginning January 1, 1995, the minimum size on recreationally caught red snapper went to 15 inches, and the limit for recreational fishermen was reduced from 7 fish to 5 fish. This generated some controversy and some letters. Here is one letter to the Gulf of Mexico Fishery Management Council (GMFMC). This is the perception.

Dear Sir:
I am a recreational fisherman responding to your new five fish bag limit imposed on red snapper fishing in the Gulf of Mexico. You are penalizing the recreational sector. We fish for sport and consumption. It's hard to imagine that the new restrictions imposed on sportfishermen will have a great impact in preventing over-fishing. Why not impose more restrictions on the commercial fishery? If you are trying to prevent over fishing, leave the sportsman alone and monitor the profiteers more closely.

Reality. Recreational fishermen caught almost double their allocation in 1994, while the commercial fishery was within their limits that year.

Same issue - another letter to the GMFMC.

To Whom It May Concern:
I am writing in concern about the new rules and regulations on the bag and size limit on red snapper. It is my opinion that the new bag and size limit on red snapper be re-evaluated by the Gulf of Mexico Fishery and Management Council. I am an avid angler of the Gulf of Mexico. I feel that the new bag and size limit are harmful to the fishing industry. The average recreational angler cannot justify the cost of snapper fishing with the new limit. This, in turn, hurts the party boat industry due to the fewer anglers partaking in this sport. Also, without the lure of offshore red snapper fishing, many seaside towns will lose revenue. I do understand the conservation aspect of it, but the commercial industry is the largest reaper of red snapper, and, allowing the commercial industry to remain at 1994 limits defeats the conservation aspect. Also, the commercial fisherman will clean out all the prime snapper at 14 inches and prevent the snapper from having a chance to reach the new limit of 15 inches. This means less fish for the anglers, less business for the party boats, and

a loss of revenue for towns.

Reality; For three consecutive years, recreational fishermen out-harvested commercials. For four consecutive years, they over-harvested the allocation by an increasing amount each year. Does this mean recreational fishermen are better fishermen? Of course not.

Similar perceptions in contrast with reality exist among commercial fishermen. For this talk, I picked the most recent letters from those written to the GMFMC. I am talking about a gap between perception and reality. Statistics don't always matter. I believe that people don't understand statistics and choose not to use those statistics wisely. I want to emphasize that this is true of both recreational and commercial fishermen; it doesn't really matter which is reporting or discussing. You find the same complaints, the same gripes. It kind of reminds me of a joke I heard which points out how different people see the same phenomenon from different view points.

Three fellows appeared at the Pearly Gates, and, when St. Peter went out to meet them, he asked, "How did you get here? Before you can pass the gates, tell me What happened? How did you die?" First guy says, "Well, St. Peter, my story is a little bit complicated, but I will explain it to you as best as I can." He said, "I was at work and I developed a splitting headache, so I went home early. When I walked into the house, there was my wife dressed up in some really fancy, nice clothes, and there were candles lit. Music was playing, and there were two wine glasses on the table. I immediately suspected something was going on, so I looked all over the apartment. I went frantic. I looked in the closet, under the bed, in all the rooms, even the bathroom, everywhere, and I couldn't find anyone. Then I heard a noise coming from the refrigerator. So, I grabbed the refrigerator and I wrestled it across the living room, and I dragged it out on my fifth floor balcony. Just as I was reaching up to push it over the top of the rail, I had a heart attack." St. Peter said, "Uhm, that's an interesting story." He turns to the second fellow, and asks, "How did you get here?" The second fellow said, "I was sitting on my fourth floor balcony reading my newspaper, drinking a cup of coffee. I look up, and saw a refrigerator coming at me. That's the last I remember." When St. Peter asked the third fellow, "Well, how did you get here?" The response was: "You'll never believe it. I was sitting in this refrigerator minding my own business, and ....." I'm trying to illustrate that those are different views of the same event. The way you interpret statistics, the way you see things, may be entirely different from the way another person sees them.

Let's look at some statistics in those fisheries that are a little more important to the State of Louisiana. Harry Blanchet covered some of these. For example, these statistics on **Gulf red snapper harvest** suggest that the catch differs from the allocation. (Table 1) The catch is allocated roughly so that 51% are commercial landings, and 49%, recreational. It's almost a 50-50 division. But a rapidly recovering fisheries population has made it easier for recreational fishermen to catch their limit each time they go out, resulting in a larger harvest. As a result, the recreational harvest has exceeded the expected harvest,but the recreational sector is constrained by having an actual shut down when they reach their physical limit.

In the **speckled trout harvest data** which we compiled by numbers instead of by pounds (Table 2): In the last 13 years, there has been a variation in the take from a low of 8% commercially to a high of 92% recrea-

GULF RED SNAPPER HARVEST
(Millions pounds)

	Recreational			Commercial		
YEAR	ALLOC	CATCH	PCT OVER	ALLOC.	CATCH	PCT OVER
1979	--	10.55	--	--	4.51	--
1980	--	10.45	--	--	4.57	--
1981	--	10.90	--	--	5.50	--
1982	--	7.57	--	--	6.25	--
1983	--	7.09	--	--	7.16	--
1984	--	4.04	--	--	5.67	--
1985	--	4.13	--	--	4.19	--
1986	--	1.98	--	--	3.75	--
1987	--	1.71	--	--	3.07	--
1988	--	2.23	--	--	3.98	--
1989	--	2.18	--	--	3.10	--
1990	2.94	1.43	-51%	3.06	2.66	-13%
1991	1.96	2.04	4%	2.04	2.23	18%
1992	1.96	3.42	75%	2.04	3.14	35%
1993	2.94	5.13	75%	3.06	3.02	-1%
1994	2.94	5.70	94%	3.06	3.05	0
AVE	2.55	3.54	39%	2.65	2.82	6%

Table 1.

LOUISIANA SPOTTED SEATROUT HARVEST

	Recreational		Commercial	
YEAR	NUMBER	PCT	NUMBER	PCT
1980	5,298,035	92%	440,899	8%
1981	2,415,382	85%	414,152	15%
1982	5,464,036	91%	519,807	9%
1983	5,945,308	86%	956,607	14%
1984	1,228,668	64%	702,446	36%
1985	4,666,244	85%	827,267	15%
1986	10,526,307	88%	1,392,327	12%
1987	6,919,827	84%	1,278,377	16%
1988	4,784,623	82%	1,055,122	18%
1989	4,159,415	79%	1,102,445	21%
1990	2,286,235	83%	477,399	17%
1991	6,853,866	90%	790,924	10%
1992	6,008,366	92%	550,653	8%
Average	5,119,716	86%	808,340	14%

Table 2.

tionally. These are probably some of the most manipulated and massaged statistics that you are ever going to find in the state of Louisiana. I have seen people who wanted to present a certain point of view change recreational catch statistics by as much as four fold, and I have seen commercial catch statistics increased by as much as ten fold. The most recent attempt by the Department of Wildlife and Fisheries to determine the accuracy of catch statistics was in 1991 when they conducted a massive sweep of seafood dealers throughout the State of Louisiana to compare commercial statistics. At that time they found there was a 5-6% error margin.

Redfish (red drum): Since 1988, redfish have been classified as a game fish, but it was allocated to commercial and recreational sectors before that year. (Table 3) The harvest from 1979 to 1987 was roughly on a 70%-30% split. In 1986 the commercial sector took its largest share of the harvest at 51% overall by numbers (not pounds) of redfish. The commercial landing numbers started to increase in 1983, and continued in '84, '85, and '86.

There is a widespread *perception* that the blackened redfish craze, which really started about 1983, stressed and encouraged over-harvest of this resource, creating the statistical hole in the spawning stock of redfish that you frequently hear about. Interestingly, and Harry mentioned this, it was in the year-classes of the fish that were spawned in 1975, '76, and '77 that exhibited the hole; and if over-fishing indeed caused that hole, the over-fishing occurred in 1979 to '81. So, the reality is that this craze probably didn't cause the statistical hole.

Statistics can be manipulated. (Tables 4 and 5) Here are some calculations to show you how statistics can actually be manipulated to hurt or help someone's cause. In 1993-94 the licensed population of recreational fishermen in the state of Louisiana was 265,759 people — that's 8.9% of the total population of the state. To come up with some figure on the total number of people that fish recreationally (licensed and unlicensed), I had to do some quick calculations. From population census statistics, I determined the number of people that were aged 11-15 in the state. Then I took 8.9% of that figure and assumed that the resulting 29,338 is the number of people in that age group that fish recreationally. I disregarded any people that were younger than age 11 for recreational fishing purposes. I did roughly the same thing with the age 60 and over unlicensed people, also exempt from buying licenses, to get 39,864. I also calculated the nonresident season licensed people for the 1993-94 season, because we felt that when these people bought a season license and made a reasonable investment in fishing in this state's waters, they indicated they would regularly fish during the year. I came up with 340,928 people in this category, although some people might argue that there are less than that. Sometimes people in the commercial sector argue that only the number of people licensed should count; and under the previous Department of Wildlife and Fisheries Administration, under Virginia VanSickle, figures well in excess of 400,000 people were used to define licensed and unlicensed recreational fishermen.

The reason I calculated these numbers was to determine how many fish are caught by recreational fishermen per year. I took the number of speckled trout that were harvested last year and divided by the number of fishermen to get the result of 12.8 speckled trout per recreational fisherman per year of harvest. I did the same thing with redfish and got 4.9 redfish per person per year.

What can people do with this data? I have seen people from the commercial sector

LOUISIANA RED DRUM HARVEST

	Recreational		Commercial	
YEAR	NUMBER	PCT	NUMBER	PCT
1979	2,455,057	90%	264,174	10%
1980	1,704,990	90%	181,194	10%
1981	412,927	65%	224,646	35%
1982	1,405,850	89%	363,626	21%
1983	2,551,357	84%	484,654	16%
1984	1,105,117	63%	652,096	37%
1985	1,359,552	65%	733,394	35%
1986	1,814,145	49%	1,954,424	51%
1987	1,478,423	56%	1,142,794	44%
1988	814,199	96%	61,341	4%
1989	1,052,081	100%	0	0%
1990	616,604	100%	0	0%
1991	872,713	100%	0	0%
1992	1,767,938	100%	0	0%
1993	1,653,479	100%	0	0%
Average 79-87	1,567,491	70%	668,778	30%

Table 3.

NUMBER OF SALTWATER RECREATIONAL FISHERMEN
(Excluding N. R. Saltwater Trip Licenses)

1993-94 licensed	265,759 (8.9 of population)
Aged 11-15 unlicensed	29,338*
Aged 60 and over unlicensed	39,863*
1993-94 non-resident season licensed	5,963**
TOTAL	340,924

* estimated
** does not include non-resident trip licenses

Table 4.

ANNUAL CATCH PER RECREATIONAL FISHERMAN
SPECKLED TROUT

1993

SPECKLED TROUT

4,278,228 Fish/334,961 fishermen = 12.8 trout per person per year

REDFISH

1,653,479 Fish/334,961 fishermen = 4.9 redfish per person per year.

Table 5.

that are involved in some of these squabbles look at these statistics and conclude, "If every recreational fisherman that goes out only catches two limits per year, he will have taken four times as many fish as was indicated in landing statistics. So, the landing statistics are way off." While people from the recreational sector say, "Those recreational landing statistics are no good at all. It's been shown that they have vastly over-estimated the amount of fish that recreational fishermen catch."

The question I have of each group is *Do you understand the other group?* Those in the commercial group who would accept these estimates or manipulations reason that no one would invest in a good boat and a fishing license for 12.8 trout per person per year. Actually, there are an awful lot of residents that buy a license and yet only fish once a year. Thus, while some may get the limit or even exceed it, many are not very skilled fishermen, and they get few if any. When you add it all together, the average will probably be a figure close to that. Likewise, the people in the recreational sector who say the calculation is too high may be basing their conclusion on their own experience. Some recreational fishermen are successful, extremely successful. So, even if the number does not reflect your own experience, it is probably close to the overall average when you consider all experiences.

The bottom line is that we manage by these statistics. And, I think the proof is in the pudding. At present, there is not one species of fish in Louisiana state waters that is officially classed as overfished. Everything has recovered or never was overfished. Everything is very well managed.

I will give you an illustration of why I believe these statistics are good. Look at the speckled trout management that Harry Blanchet just described. He mentioned that we're managing this species on a 15% SSBR, which some researchers would have you believe is a real delicate line and very low. In 1989, while we were managing the fish on the basis of 15% SSBR, we had a massive freeze which just devastated our fish population. If our fishery statistics were so far off that they were no good for management purposes,why, in just a few years, did our fishery population of speckled trout recover to today's level. In 1990, the year after the freeze, it was difficult to find a fish out in the marsh. Yet two or three years later, we have abundant trout. That's a very good illustration that the fishery statistics that we have in the state are very good and they serve us very well in management.

CONTROLLING FISHERMEN NUMBERS: EXPERIENCE OF OTHER STATES

Sandy Corkern
Louisiana Cooperative Extension Service

I'm going to talk about the experience of other states in controlling participation in their fisheries. But, before we start looking at how other fisheries have addressed this issue, let's look back at the history of how Louisiana has made efforts to do something in this regard.

Earlier this morning Ken Roberts mentioned that task forces were quite common in resolving some of these issues in the Roemer administration. In the 1989 regular session, House Concurrent Resolution #180 by Representative Siracusa created a task force to study the possibility of establishing a limited entry system for managing saltwater finfish in Louisiana by limiting the number of licenses for gill nets, trammel nets, and seines, and to report back to the joint Natural Resources Committee prior to the 1990 regular session. That task force, composed of representatives from all sectors of the fishing community, had voting members representing both recreational and commercial fishing organizations, seafood dealers, consumer education, and the Louisiana Restaurant Association. It met eight times over about a three-month period, including twice with a joint task force representing all segments of the seafood industry not just the finfish area, before it arrived at its recommendations. The task force looked broadly at the fishing management options, recognizing that no two areas are exactly alike, and different management measures may be needed to address differing or even similar situations in different areas. In fact, the task force didn't even limit itself in looking at options used in the United States, but looked at what had worked and what had not worked in various countries of the world. Specifically, the task force considered at length the following options: limiting the number of licenses that could be issued, a moratorium on license sales, delaying entry into the fishery (that is, requiring an apprenticeship period before allowing entry but putting no limit on the number of licenses that could be sold). They also considered progressively increasing the license fees to a point where the fishermen dropped out of the fishery, legislatively reducing the number of licenses, or looking at individual transferable quotas or ITQs.

In the March 15, 1990 report to the House and Senate Committees on Natural Resources, the Finfish Limited Entry Task Force made the following recommendations: 1) biologically sound measures directed at maintaining the long term viability of the commercial saltwater fishery needed to be established, and 2) eligibility for licenses should be as follows: (a) beginning January 1, 1991, you must have participated in that fishery in either '87, '88, '89, or '90 to obtain a saltwater vessel license or saltwater gill license; (b) beginning January 1992, you must show through either a 1990 or '91 income tax return that you earned a minimum of 25% of your earned income or at least $5,000 from commercial fishing, and you must have owned that vessel or gear license the previous year. Alternately, you would be eligible if 25% of your gross earned income or $5,000 resulted from commercial fishing, and that you obtained that gear or that vessel license from another fisherman who had it the previous year. In other words, no new licenses would be issued. The only way to secure one was through transfer; (c) beginning January 1993, the conditions would be exactly the same except that the income requirement would be at 50%.

House Bill #1648 by Representative Adley of the 1990 regular Louisiana Legislative Session essentially followed the recommendations of the task force, except that it made the income requirements a bit more stringent. It set forth the following requirements to obtain either a commercial vessel or gear license. As of January 1, 1991, you had to have a valid commercial license in either '87, '88, '89, or prior to September 7, 1990. After January 1, 1992, you had to have a valid copy of your federal income tax return for either of the two previous years to show that 25% of your gross income or a minimum gross income of $10,000 was derived from commercial fishing, and that you held that gear or vessel license the previous year or obtained it from another fisherman who had held it the previous year. After January 1, 1993, you had to show a federal income tax return for one of the previous two years indicating a 50% earned income or a minimum of $12,000 derived from commercial fishing, and held the commercial vessel or fishing license or obtained it from another fisherman who had. Unfortunately, from the standpoint of the committee members and many in the fishing industry, the legislature, in its wisdom, chose not to adopt these measures.

Now let's look at some of the long term experiences other states have had in controlling participation in their fisheries, recognizing that different management measures are needed to solve different problems. Therefore, it is first necessary to honestly and objectively figure out what the problem is. Problems may be related to biology (for example, when a user group has over-harvested or when species reproduction is affected by such things as pollution or loss of habitat), economics (when there are already too many participants in a fishery to make entry an economically viable employment alternative), or sociopolitical (when there's conflict between user groups for a resource, either due to inequities in allocations, or when there is a perceived, but not real, overuse by one or more of the user groups).

Over the last two decades, **California has** had over two dozen fisheries with restricted participation, and about four or five more are poised to be introduced before the California Generni Assembly this year. The California Department of Fish and Game has three types of limited access systems that they refer to as **qualified entry, an entry moratorium, and limited entry.**

The first type, **qualified entry**, is designed to assure that fishermen are knowledgeable and/or experienced in the fishery before they are permitted to operate a vessel in that fishery. For example, they require that new recipients of gill net permits meet specific qualifications like having either a year's experience as a crew member on a licensed vessel, a history of activity in the fishery, or a passing score on a proficiency exam that the California Department of Fish and Game administers. Qualified entry programs do not place a limit on the number of participants in the fishery, but they may slow down the pace of new entry.

A **moratorium** on new permits puts a stop on all new entry, and is usually a preliminary step in setting up a limited entry system. As the name implies, a moratorium freezes the number of permits issued as of a particular date. Although a moratorium temporarily permits no new entry, it also seeks no reduction in the numbers of fishermen. California implemented a temporary moratorium on the salmon fishery before going to a limited system. The temporary moratorium on the salmon fishery was replaced two years later by a limited entry system.

A full blown **limited entry program**

has specific procedures and conditions for licensing new fishermen, and, depending on the area, those procedures and conditions will vary. California has had several fisheries under a limited entry program including the roe-herring, the commercial abalone, and the salmon fisheries, the drift gill net fishery for shark and swordfish, the experimental drift gill net fishery for shark and swordfish off central California, and the near shore set gill net and treble net fishery off of central California.

The abalone fishery is a good example of a biological reason to limit participation in the fishery. In the mid 1970s the abalone stocks were down and California was under pressure from the federal government to try to reduce some of the human-sea otter conflict that was growing at the time because of a growing sea otter population. Abalone is one of the favorite foods of the sea otter. With industry support, California Fish and Game set up a limited entry program as one aspect of a comprehensive plan to restore stocks and to increase yields. A large percentage of the abalone divers were inexperienced with as many as 50% having less than two years of experience at the time. So, one of the goals was to remove the inexperienced divers from the fisheries as well as to reduce the contact between divers and otters. The initial permitting system allowed 397 participants. The annual renewal of these nontransferable permits requires a landing of at least 6,000 pounds of abalone. Permits may be revoked either due to failure to meet the landing requirements or for fishing violations into the burgeoning otter population. The number of allowed diving permits is now down to 100. Even so, they have a drawing among the qualified applicants because the number of applicants exceeds the number of available permits.

The California salmon fishery is an example of limiting participation because of economic factors. Over an 18-year period, the salmon fleet had increased from 1,365 to 4,919 vessels, but the value of the landings had fallen from about $8,200 per vessel to $3,400 per vessel during that same period. During a subsequent two-year moratorium, a comprehensive limited entry program was developed, establishing a salmon vessel permit limited to the owner of the vessel. This permit could not be transferred separate from the vessel. In other words, if you wanted to enter the salmon fishery, you had to find someone willing to sell you a permitted vessel.

The herring roe fishery that developed in the San Francisco and Tamalas Bay areas is an example of a sociopolitically motivated limited participation program. The fishery developed to satisfy the Japanese market during a period in which they couldn't supply their own needs. When salmon sportfishermen and local residents became disturbed by the sudden growth of the fishery, a platoon system was initiated so that even numbered permits fished on even numbered weeks, and odd numbered permits fished on odd numbered weeks. After a while, in addition to that, the number of permits for purse seines and round nets was limited, and these last groups were restricted to fishing only during the month of December before the opening of the traditional fishery in January. As you might expect, some of these conditions produced something of a goldrush attitude among fishermen to get the salmon before it was all gone. These regulations have increased in complexity since then, but not because of stock reductions. In fact, the herring population continues to expand. Rather, regulations resulted from social pressures. Primarily, the fishing boats were competing for a very limited space with each other, with commuter ferries, and with yachts.

One of the largest areas with limited participation is the state of **Alaska**. It has over

50 fisheries that are under some sort of **limited participation program**. By state law, these are licensed limitation programs. In other words, the permit is issued to an individual and he must be aboard the vessel while it is fishing. Pending legislation would tie the permit to gear capacity in the Dungeness crab fishery. In other words, the permit would be good for only 100 or 200 or 300 crab pots.

One of the other fishery management methods that has worked very well in some places, notably **New Zealand and some areas of the U.S., is an ITQ or an IFQ** - an individual fishery quota. The North Pacific Fishery Management Council has helped establish an IFQ system for halibut and sablefish in the EEZ and in the Gulf of Alaska. Both of these fisheries are primarily longline fisheries. An ITQ essentially gives a percentage of the quota to each of the qualified participants, based on his history of participation in the fishery. IQs in sablefish and halibut each produce about 40-50 metric tons per year, and probably bring $2-$3 per pound to the fishermen. Prior to the limited entry system, the halibut fishery typically was open for 24 hours, and the sablefish fishery was opened for only a few days, resulting in a rodeo or goldrush environment. They averaged losing about six vessels and eight people per season under those rodeo conditions. The IFQ system took seven years to design, and it was implemented on March 15, 1995, just a few days ago. The sablefish IFQ was much easier to devise because there are fewer participants, only about 1,100 vessels in the fishery. Generally, these are larger boats that fish further offshore in deeper water. There's a quota on both of these species. For halibut, the quota is set by the International Halibut Commission after tracking from the total allowable take for the subsistence fishery, calculating an amount for bycatch from other fisheries, and considering the recreational fishery. Primarily, though not exclusively, made up of charter boats, it is the fastest growing segment of the halibut fishery. There are 5,500 permits in the halibut fishery in Alaska; 3,000 of those boats are less than 35 feet in length — suggesting that these are generally inshore-type boats that are trying to reach as far out as possible. There is a long history of halibut fishing along the entire Alaska coast, primarily a few individuals from many, many small fishing villages . In addition, a lot of folks from urban areas get into the fishery to make a few dollars. Even one or two fish can amount to several hundred pounds, enough to make a significant income. In total, this 3,000 boats less than 35 feet, 2,000 between 36 and 60 feet, and only about 300 or so greater than 60 feet in length are permitted. If you have ever seen pictures of how crowded the Gulf of Alaska can get, you can understand the risk of working in one of those 3,000 boats under 35 feet.

The point is that these are not management systems that came about in the blink of an eye, overnight, even within a few weeks. They took years to devise with a lot of participation by everybody. However, both in California and Alaska, these systems have been a very positive experience from the standpoint of fish managers, commercial fishermen, recreational fishermen, and the public in general. They all view it as a very positive experience.

A state without long term experience in limiting access include Pennsylvania, which **banned gill nets in Lake Erie**. The ban, passed in 1994, goes into effect in '96. This affected 8 — not 80 or 800, but 8 license holders. Part of this legislation was a provision for transitional compensation for gill net licensees who had to switch to other types of gear. To pay for this buy out, sportfishermen of the state must buy a $3.50 permit to fish Lake Erie ($3.00 of this goes into the buy out fund and $.50 remains with the permit seller to

cover administrative cost). The buy out for these commercial fishermen is equal to the average value of their highest two years among the last five years.

North Carolina enacted a temporary moratorium on commercial fishing in 1994 to allow time to study what is happening with fish stocks and to revamp the licensing system. A 19-member steering committee is working on this and will report to the general assembly in June of 1996. They have been given $250,000 to accomplish this task, funded through the North Carolina Sea Grant program. Preliminary studies show that of about 20,000 commercial licenses sold; probably only about 600 are actually full-time commercial fishermen, with the remainder actually commercial sports or sportfishermen who sell their catch to pay for trip expenses.

You can see from looking at these other states that Louisiana has certainly been at the forefront since at least 1989 in proposing innovative and progressive fishery management solutions although our state may not have in place management plans to control the number of participants in the commercial harvest of saltwater fish.

ECONOMICS OF FISH HARVESTING

Ken Roberts
Louisiana Cooperative Extension Service

I've been out of college about 23 years, and nothing is harder to talk about than what I am about to talk to you about today. The conflict between the angler and commercial fisherman over marine finfishing is something I have worked on in three different states. It's not any different here in Louisiana than anywhere else. Sandy Corkern indicated that some other states have tried to resolve these conflicts by addressing the numbers of commercial fishermen and, I think, probably a lot of you were surprised that even Louisiana was pretty aggressive in these matters beginning in 1990. But in our state, there was no follow through. In my experience, splitting atoms is a lot easier than dividing fish!

There are **critical aspects** to this situation. First, before you go too far in trying to use economics, it is of absolutely no value to begin the long process of using economics if you don't **identify a target for management**. Many people try to use economics without doing this, and, as a result, they apply economics to different things. It is important to first make a clear statement of what you are trying to achieve. Most of the time, management is related to money in some way. In fishery management, we may use fish, but they are simply a proxy for money. In fishery management, we make general statements that guide us like "We want to manage on the basis of optimum yield." That gives you a lot of room to maneuver, but basically, optimum yield is maximum sustainable yield modified by relevant social and economic factors. Those statements sound good, but I think it's really important when using economics in natural resources issues to make sure you have a clear understanding of the management target the various groups of people are speaking about. And, I repeat, management involves money most of the time. That's the topic of my presentation. There are no noncommercial uses of fish. There is nothing more noble about killing a fish with a hook and line than with a net. Economics are involved in both issues.

The second critical aspect you have to **identify is the species**. It is very difficult to generalize across all species. Try to be species specific. The economics profession, at least the natural resource economics profession, is going to implore you to do the same thing. Why? The "lifestyles" of these fish are different, therefore, the economics are different. You have to begin with a species and build from there in terms of the economics.

Third, economists want people to **note user group differences**. Today, we are simply going to crudely divide people into anglers and commercial fishermen or a commercial/consumer group. The economics between these two user groups is different. Angling is important, but it is an economic system based on inefficiency. The more money we can get anglers to spend on fish without increasing the bag limit, the better off the economy will be. For example, we are spending more money to saltwater fish in 1994 and 1995 than we were in 1986 and 1987, even though the bag limit then on red fish in the state of Louisiana was 25 and combined catch was 50. Today the bag limit is five fish. Does that mean we ought to reduce the bag limit to two, maybe lose only $10 million in expenditures and be a lot better off? No, of course not. The point is, this system of angling is based on a different foundation than is commercial fishing. The commercial side is based on an efficiency

system. You can't go out and repeatedly catch fish unless you are making money. You can see that the economics of one user group is based on efficiency, the other, on inefficiency. I'm a veteran of over 500 recreational guide trips and I've seen every kind of custom. I know what it takes to please people on a boat. That angler system, though, remains based on inefficiency while commercial fishing is based on efficiency.

Look at the **implication of economic impact analysis** between those two systems. In angling, when you spend for bait, fuel, ice, travel to the site, gear, or equipment, you may want to equate these expenditures to the value of fish. A natural resource economist is going to tell you, "No, economic impact is not necessarily value." For example, the value of the ice you bought to go fishing can't reflect the value of fish. It must reflect the value of that bag of ice because ice has different uses. If you don't use it when fishing, you might take it home for a party. If someone asked you the value of the bag of ice, you would probably say, "Well, I paid a dollar for it. I gave up a dollar and got a bag of ice." Therefore, the ice has got to be worth a dollar. If you assign that dollar value to the fish as well, you are counting the value of the ice twice. It can't simultaneously be the value of fish and the value of the bag of ice. Economic impact analysis can be applied to the commercial sector, too. The same type of analogies can be made. Economic impact analysis fails to make the distinction between impact and value. It is the value of fish we want to know.

Economic impact analysis does not indicate economic value. Remember, we want to know what the value of fish is. Since I don't have time to further convince you that economic impact is not economic value, I'm going to do the simplest thing I can, appeal to authority. The Sports Fishing Institute in 1985 (it's now called the American Sports Fishing Association) has a document signed by 19 natural resource economists from the Gulf of Mexico and the South Atlantic states. It was a research agenda for economics in the red drum fishery, and it says:

> The 19 participants agree that if economics principles are to be used for allocation purposes, then allocation should not be based on economic activity measured in terms of sales. These measures are intuitively appealing, but are incorrect for purposes of allocation.

The second authority, the National Marine Fisheries Service in the National Oceanic and Atmospheric Administration technical report called "An Economics Guide to the Allocation of Fish Stocks between Commercial and Recreational Fisheries," November, 1990 says:

> Particularly worrisome is the misuse of purely financial information, such as expenditures and revenues, to assess the economic values of commercial and recreational fisheries. Instead, what is needed is an understanding of how data on expenditures and revenues can be correctly used with any contacts to benefit cost analysis to measure the economic value of fish in commercial and recreational uses.

A third quote by the Inspector General of the U.S. Department of Commerce in 1992 disallowed a North Pacific Fisheries Management Council regulation on allocating fish between groups. In his finding, he included the following:

Cost benefit analysis is the principle analytical methodology used by economists to evaluate public policy decisions. Input/output analysis (which is another way of saying economic impact analysis) is an inappropriate surrogate for cost benefit analysis.

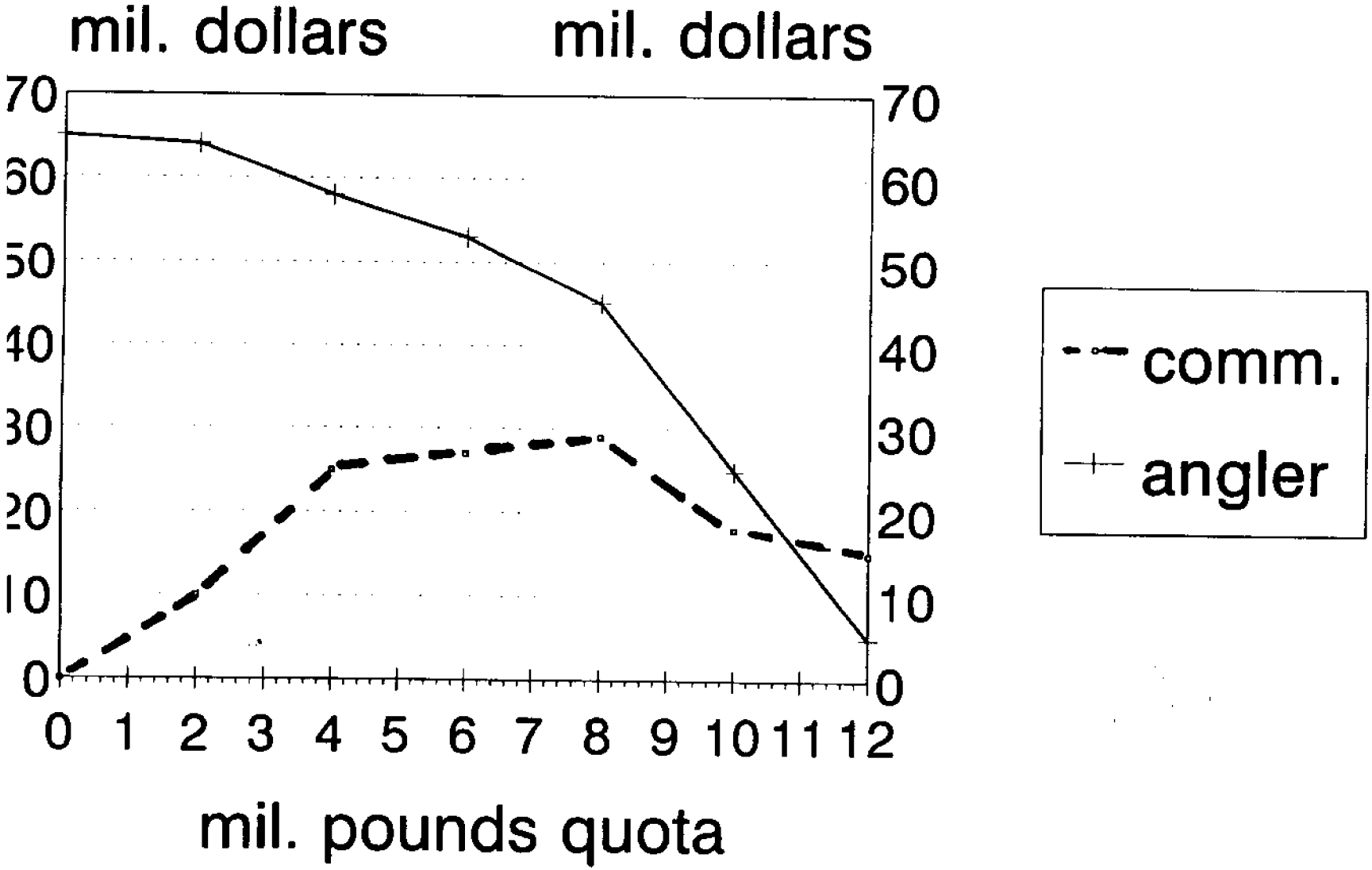
We want to **use cost benefit analysis or net benefit analysis to determine the value of fish.** What is net benefit analysis? The expenditures of the anglers, and the expenditures and revenue of the commercial sector are perfectly relevant. They just function in different systems so they can't be compared using economic impact analysis. Instead of throwing away the massive expenditures that are made by these groups, we are simply incorporating them in a different format. For example, the Corps of Engineers must complete a cost benefit analysis before it can dredge to determine the benefits received for the costs involved. Political influence does play some role but the Corps tries to pick the projects that have the best net benefits.

Cost is always well known; expenditures really are costs. Benefits are often more difficult to measure. The Corps of Engineers will make a cost benefit analysis to see how much money they really ought to put into a dredging project or a navigation project before the benefits start dropping off to the point where the benefits don't really justify the cost. That's what we really want to do if we want to use economics to make fishery management decisions. The natural resource economist can help management see the trade offs in terms of costs and benefits of different fishery management plans. He or she doesn't make the management decision.

Let's take a look at this benefit analysis. Let's assume we've already measured our cost and we've measured our benefits and there is a net gain of some kind. Let's look at the commercial fishery first. (See Graph 1) On the vertical axis is millions of dollars. The range goes from zero to $70 million. On the horizontal axis is millions of pounds of fish from a quota. Let's say we can safely take 12 million pounds of fish according to biological analysis. In the commercial fishery, net benefits, that is benefits after costs, normally increase as the allocation is increased. Yet, when you look at this graph, you might ask why the net benefits appear to decrease after the commercial allocations (broken or dashed line) passes 8 million pounds. There's a very good reason. Sometimes these net benefits generate excess effort in terms of numbers of boats, more nets per boat, more hooks per boat, etc., - more effort. What's that mean? Cost. That's the cost of fishing. With free entry into the fishery, anyone can get a boat, nets and hooks and impact the fishery. It tends to get crowded. As the costs of dealing with this crowded situation increase, the net benefits decrease. Even though you are catching more fish, the costs increase faster than the benefits. So it is very typical in a commercial fishery that your net benefits can be going down even though you are catching more fish.

Now let's take a look at the anglers (see Graph 1, solid line). We're still dealing with net benefits and the same numbers— 0 to 70 million dollars. But this graph looks different. You must read the horizontal axis from right to left, that is, the intersection of the right vertical axis and the horizontal axis is zero. Proceeding to the left, each unit is a million pounds. We can see about $5 million in net benefits and yet the recreational people don't get any fish. I can depict $5 million of net benefits in this particular example when anglers are catching but not retaining any fish out of the quota.

Net Benefits



Graph 1.

This suggests that as you give fish to the angling community (i.e. move left), their net benefits go up. But as John Roussel showed you, the increase does not continue indefinitely because growth slows down as the fish ages. For instance, if we made a 10-fish red snapper bag limit but the average trip only results in four fish, how much of the quota is going to the angler? Psychologically the higher bag limit may drive people to spend more money but the fact that all anglers can't get the bag limit continues to protect the resource. In this case, a higher bag limit will attract a few more people and they will spend more money, but the effect on the stock will not be proportional.

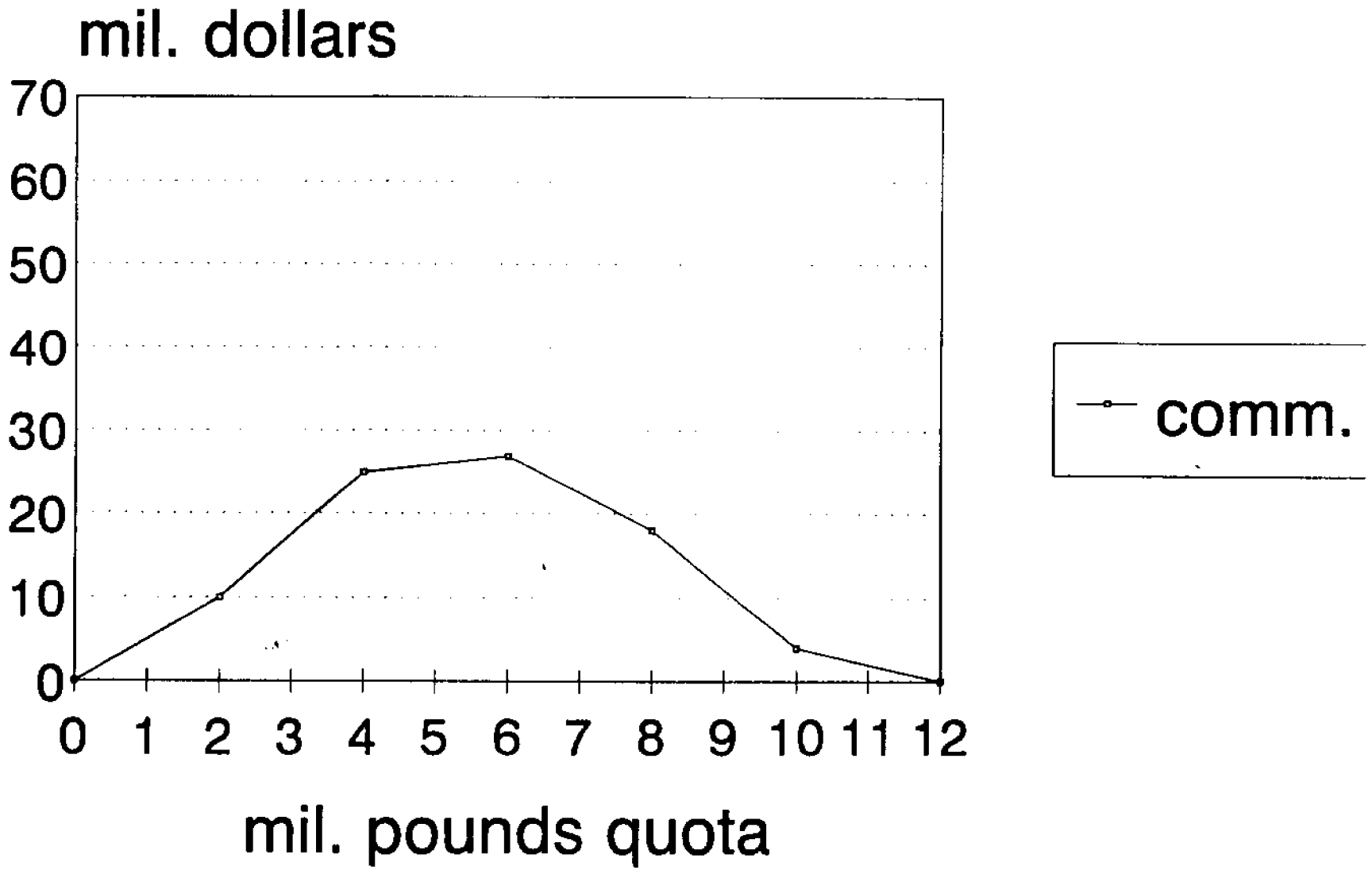
To further review this graph, let's look at six million pounds for both commercial and sport fishermen. The result would be $28 million net benefits for the commercial fishery if they take 6 million pounds of fish. Allocating the remaining six million pounds of quota to the recreational fishery, $55 million worth of net benefits results. That's the way you read the chart. Now, on this same graph, let's look at $65 million on the left axis, the net benefits if all of the fish — all 12 million pounds — are allotted to the angling community. And, if we allocated all of the fish — 12 million pounds— to the commercial community, the benefits would be about $18 million. What's the correct decision for the fishery managers? Too often, someone will say, "It's logical to give all the fish to the angling community. You'll get $65 million for it, whereas if you give all of the fish to the commercial industry, you'll only get $18 million." Where competition is heavy for the same species, if you use that reasoning, all fish would be allocated to the recreational fishery. I caution you, that's not what most natural resource economists recommend. Natural resource economists recommend that you maximize the net benefits. Strangely enough, 65 million, all 12 million pounds to the angling community, doesn't maximize net benefits. To maximize, we have to look at sums of the maximum allotment as recommended by the biologists. For instance, let's see what would happen if we divided the 12 million pounds so that two million pounds are allocated to the commercial fishery (that would result in about $10 million in benefits) and the remaining 10 million pounds were allocated to the anglers (on the graph, this would result in about $62 million in benefits). If we add $62 million plus $10 million, we get $72 million, which is larger than $65 million. This would result in maximum benefits — together the two groups would net more benefits if the anglers were allocated 10 million pounds of fish and the commercial fishermen were allocated 2 million pounds. On the graph, you take fish away from one group, add it to the other group, and then you pick the point where the maximum benefits occur. Try eight and four million pounds, which also add up to a total of 12 million. On this graph, that gives us a total benefit of $83 million compared to $65 million when all goes to the anglers or compared to $18 million when all goes to the commercial fishery. Is it a perfect world? Clearly not. Should economists always prevail? Surely not. But, if you want the best scientific approach to allocation, this method is a good one.

Let's flatten out the commercial curve a little bit, and reconsider. (See Graph 2) After about 6 million pounds of fish, so many people may decide to enter the commercial fishery that the benefits have to be divided among many. It becomes so crowded that costs increase and, perhaps, price decreases. Profits as reflective of net benefits would decrease. The net benefits start going down, and it's entirely possible in terms of net benefits that after 12 million pounds are given to the commercial fishery, there might be zero profits (benefits).

The angler benefit line was also changed to reflect higher benefits (Graph 3).

Graph 2.

Net Benefits



With anglers, there are economic benefits from 100% catch-and-release fishing. In Graph 3, this is depected as the intersection of the right axis, $15 million, from no retention of quota. As anglers are allocated more fish, people spend more money, and the net benefits increase. But at some particular point, the growth rate and/or catch rate of the fish tends to flatten out and the anglers net benefits respond. The result in summing the net benefits at each allocation shows benefits are mazimized at a 4 million commercial and 8 million recreational quota split (Graph 4).

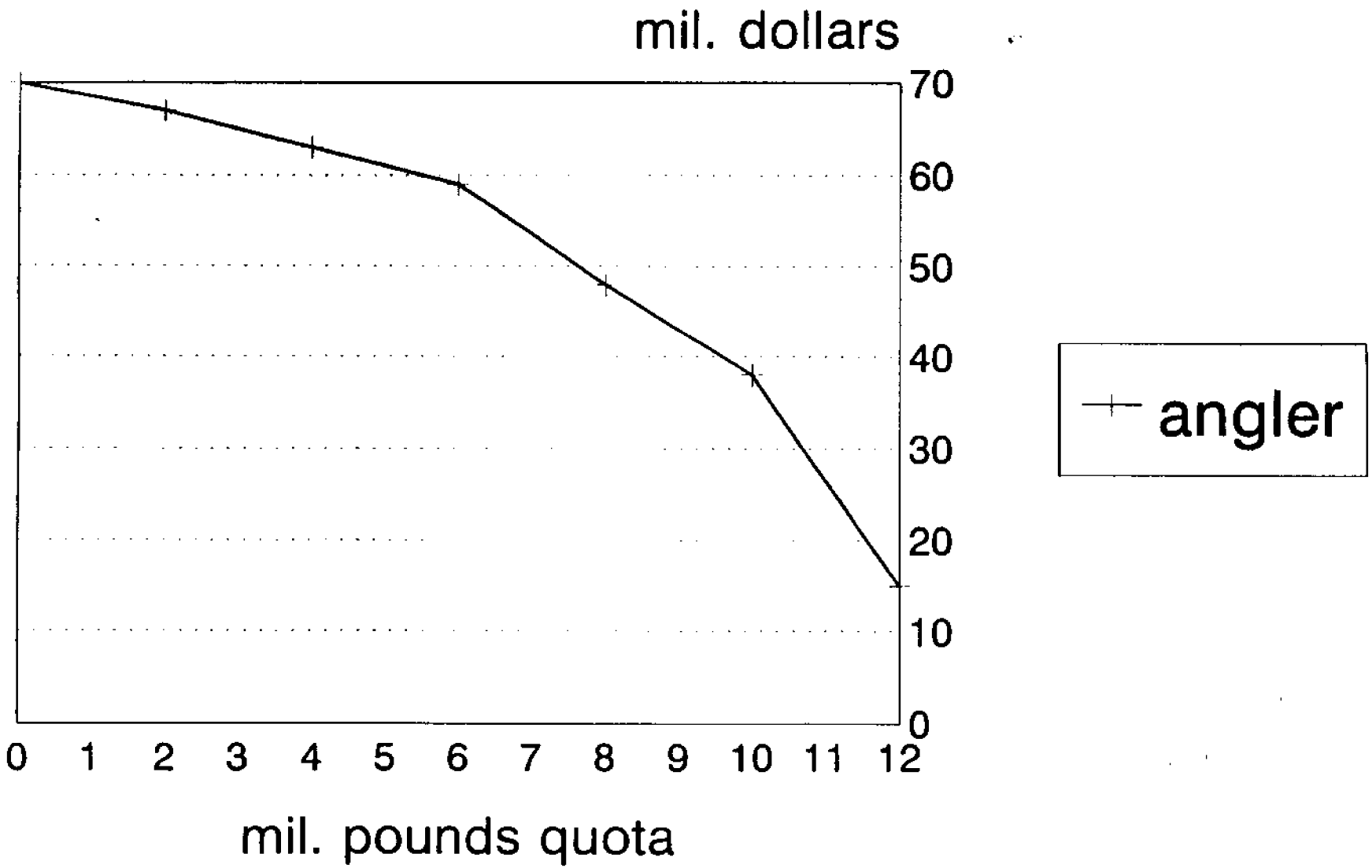
The point I want to make is this. Abuse, misuse, over-simplification of natural resource economics can lead you to the wrong public policy decision. If everything is based on economics, policy errors can occur. No natural resource economist who has been involved in allocation disputes would ever tell you that economics is the only consideration. There are many other considerations.

The general conclusion of natural resource economists is that strictly on the basis of economics, most fisheries that are heavily utilized by different user groups get maximum net benefits through some kind of allocation system rather than allocating all of the resource to one user group. Net benefits are always calculated after costs are deducted from revenues. If there is no restriction, net benefits on the commercial side generally drop off before all of the quota is filled. Keep in mind that without major restrictions on this fishery, the commercial industry would be using the most efficient gear. So when something changes the gear that the commercial fishermen are using, I can assure you that net benefits are going to shift down. They have to shift down because by law we are forcing people to use a less efficient technology. You will see the effect of mandating a change in gear economically, because the users will get less net benefit from the resource.

In conclusion: Economic considerations must be modified at all times by our relevant social and political factors. (1) Economics alone determines nothing. When invoking economics to justify your actions, I implore you to be correct, because one day you'll need economics. Use scientifically sound findings. Evaluate economics on the same basis that you do your biological science. And remember, economics gives you the "what is" or the "what would be" type of an answer. If you want to know "what *ought* to be," go to the political system. (2) There are all kinds of factors involved in the economics of harvesting. Bring all of the information together in sound, scientific principles. These examples that I showed you should jog your memory in the future, I hope. (3) Economics alone, when it's of concern, indicates shared allocation maximizes net benefits.

Keep in mind that fish use is no less static than the habitat in which these fish live. You have to recognize trends, and you've got to plan your economic analyses to incorporate, react, and anticipate those trends. Here is a specific example about trends: In 1983 Alvin Bertrand, an internationally known rural sociologist at LSU, did a study in which he surveyed saltwater recreational anglers in the state of Louisiana. He estimated trip expenditures for saltwater recreational fishing in 1983 at $181 million. I think we all have to admit, recreational fishing is growing. In fact, the numbers of licenses that the Louisiana Department of Wildlife and Fisheries sells to resident saltwater anglers has been increasing around 6% a year over the last 10 years, and nonresident licenses have been increasing around 8.5% per year. The benefits have been growing. This is undeniable. However, the National Marine Fisheries Service, Marine Recreational Fishing Statistics Survey, eight years

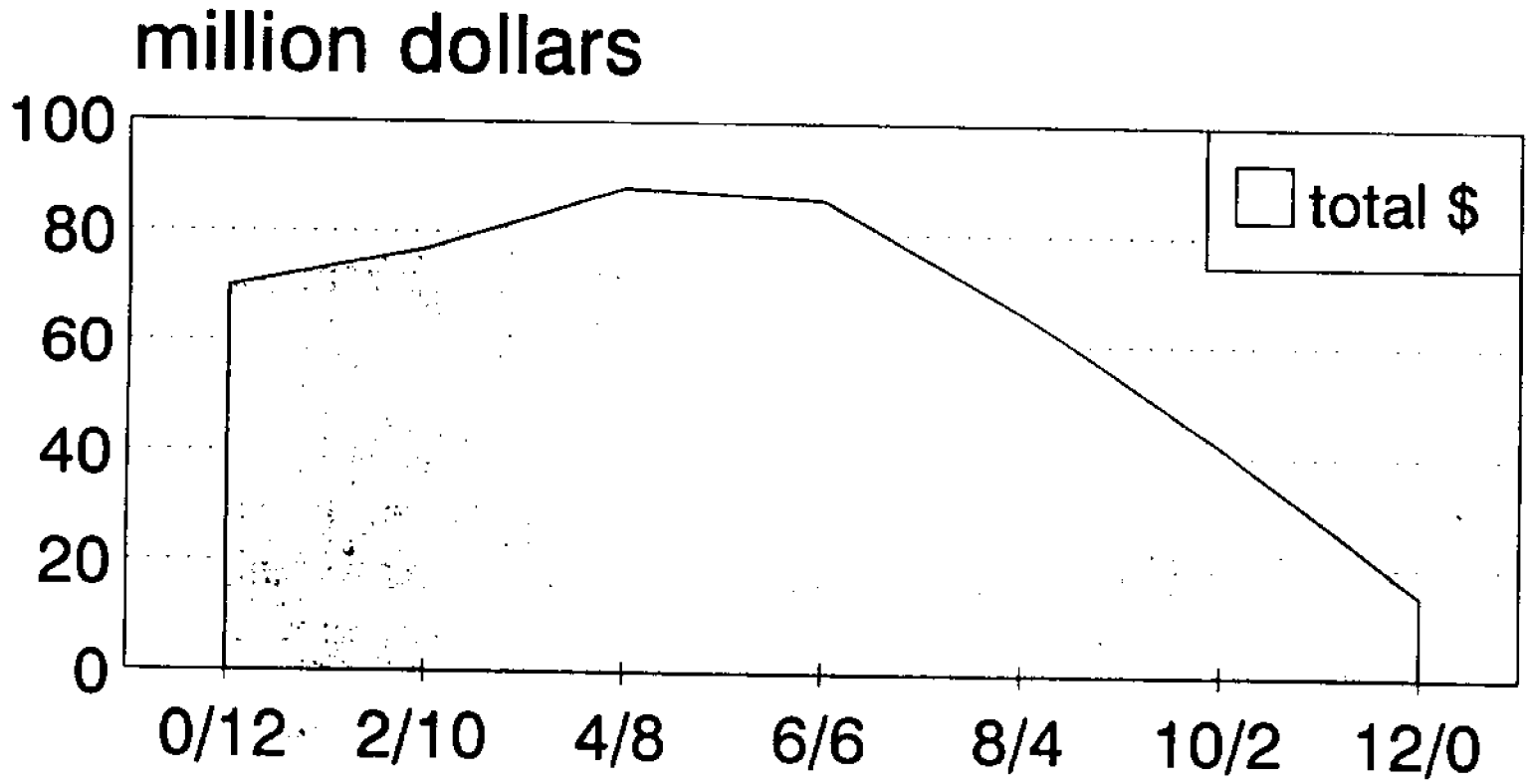
Net Benefits



Graph 3.

Net Benefits

Allocation



total $	70	77	88	86	66	42	15

comm. / angler quota share

Graph 4.

later, in 1991, indicated only $183 million dollars in expenditures for Louisiana saltwater recreational fishing. We have two numbers, basically 8 years apart — $181 million dollars in 1982-83; and $183 million in 1991 (only $2 million higher). How can that be? You know what? One of these is wrong. I implore people to try and find out what is wrong here. Let's look at this data more closely. The 1982-83 study says people took an average of 14.3 trips per year to go saltwater angling but the National Survey of Fishing, Hunting, and Wildlife Associated Recreation, which is done by the U.S. Fish and Wildlife Service, for 1991 says saltwater anglers took 9 trips per person per year. That distinction is important because the more trips anglers take, the more money they spend. My point is that the accuracy of economic information should be a policy that is adhered to as strictly as we adhere to accuracy in biological information.

With that I am going to end by reminding you that all uses of fish are commercial. If you don't believe it, there are numbers everywhere to document it. Be careful what numbers you use. You want to be correct. I know you do. You want to use the best information so that the political system can determine what *ought* to be, because scientists don't have the role of telling you what *ought* to be.

SUMMARY OF '95 PROPOSED NET BAN AND LIMITED ENTRY BILLS

Mike Wascom
Louisiana Sea Grant Legal Program

We know there are going to be passions on every possible side of several of these issues because they will result in legislative decisions, and we will have to live with those decisions. The legislature is charged with making the laws of the state, and I respect that. In reviewing the legislation with you today, I hope to give you a summary, and help you to find weaknesses or incorrect wording in the law, perhaps some areas that might need to be clarified. In Louisiana's wildlife and fishery statutes, there are over 100 definitions in the first part of Title 56, and that is for a reason. Sometimes laws are poorly written. In the heat of a legislative session, you know, lots of things get put in that maybe shouldn't be put in. Now since the competition for the resource is heavy and everyone is trying to do what's best for the people of the state, the laws are becoming more precise.

Allow me to give some background information. Under a constitutional amendment adopted a few years back, we have a regular legislative session every two years. This is a regular legislative session. The idea was to try to cut down on the number of bills. Of course, that will not happen. This is an election year and, when you meet every two years, a lot of stuff builds up. So, the bills that I will be talking about had been introduced through [the] Thursday [before this talk was presented]. Additional legislation will be introduced once the session began.

One final thing: I would like to point out some parts of our state constitution, and Title 56 which will be relevant to the various net ban and/or moratoria legislation. Title 56 contains the wildlife and fisheries laws. Article 9, Section 1, of our 1974 Louisiana Constitution establishes a public trust responsibility on state agencies managing state-owned resources. It basically says that the natural resources of the state shall be protected, conserved, and replenished insofar as possible, and the legislature shall enact laws to implement this policy. Under Article 9, Section 7, in 1974, the Wildlife and Fisheries Commission was given constitutional status. Prior to the adoption of that version of the Louisiana Constitution, the Wildlife and Fisheries Commission and the Department of Wildlife and Fisheries were one entity. The Commission was the Department and the Department was the Commission. In other words, the Commission did regulating and administering. The 1974 Constitution called for 20 departments to be developed, and in 1977 that was done by legislation, creating the Department of Wildlife and Fisheries. But, because the Wildlife and Fisheries Commission was a constitutionally protected body, it was put into the department. The Department would be the administering body and the research body; and generally, the regulatory authority would be with the Commission. But, of course, that was subject to the authority of the legislature.

In the RS (revised statues) Title 56 deals with the authority of the Commission, particularly with respect to legislation. In Section 58, which has a long list of defined terms that are used throughout Title 56, the Right to Fish legislation is found at section 640.1 and sections following it. I would also like to point out the Saltwater Fishery Conservation and Management Act and Standards that was adopted in 1991 based on the Marine Finfish Panel appointed by Gov. Roemer. It was composed of recreational and commercial fishermen, and every word was negotiated; and

this sets forth certain findings about the finfish resources of the state, a philosophy about how they should be managed, and this kind of thing.

On what we will generally call the net bans, the primary vehicle would be Senate Bill 126, which was dropped by Senator Bankston early. Senate Bill 412 is a similar bill with some changes. And, I will address Senate Bill 412 since I assume that will be the one they'll go with, but there are some changes from 126. Senate Bill 537 by Senator Hankle is identical to Senator Bankston's bill. In the House of Representatives, the big correspondent to Senator Bankston's bill is House Bill 919 by Representative Triche. It is almost identical to the Bankston bill, but there is one significant difference, and I will point that out. House Bill 657 by Representative Murray, House Bill, 658 by Representative Murray.

Under the general criteria of moratoria and limited entry, and I will get into specifics: House Bill 370 by Representative Siracusa, House Bill 789 by Representative Theriot, House Bill 998 by Representative Odinet, House Bill 1802 by Representative Triche, and House Concurrent Resolution #42 by Representative Odinet.

I am going to use Senator Bankston's bill as my vehicle for explaining what I believe will be the primary vehicle for the net ban legislation. And, as I mentioned, there is an earlier version, Senate Bill 126 by Senator Bankston. Basically, when I'm talking about 412, I'm roughly also talking about House Bill 919 by Representative Triche. Representative Triche's bill has 30 representatives as co-sponsors. Senator Bankston's bill has 12 senators as co-sponsors.

Unlike Senate Bill 126, Section 1 of Senate Bill 412 calls this act the Louisiana Marine Resources Conservation Act of 1995. That title is also used in the Triche bill. Section 2 of the bill basically lists the sections of Title 56 that the bill proposes to amend and it also announces what new sections will be enacted. It has a couple of definitions that were not in Senate Bill 126: (1) a definition of gill net to mean any net of one or more layers not customarily used for shrimp or menhaden fishing. (2) a definition of the federal Exclusive Economic Zone (EEZ) to parallel the federal regulations defining that zone, and (3) a definition of a strike net. Section 302.3 is amended to say no recreational fisherman shall use gill nets, trammel nets, strike nets, or seines. The strike nets is added.

Section 305, on commercial gear licenses would be amended to say that residents shall pay a commercial gear fee as follows: Gill nets - $25, to use any legal number of gill nets in the freshwater areas of the state as defined in section 322 (a) and (b). But they would add a subsection to (b) defining a gear fee of $250 per gill net used in the EEZ. This amendment basically takes out the fee for the use of gill nets in the saltwater areas of the state. As you know, a few years back the legislature divided the state legislatively into saltwater and freshwater areas, but as with everything else done in legislation, sometimes what you see is not all there; that is, there are some lakes that would technically be north of the freshwater/saltwater line that are specially defined in the act as saltwater lakes. So you have to look at the line, and you have to look at the designated lakes to determine whether you are fishing in saltwater or freshwater areas of the state. This amendment sets a $25 fee to use any legal number of trammel nets in the freshwater areas of the state, and then it adds a rod and reel fee of $250 to fish in the saltwater areas of the state.

In section 305, the amended portions say "no commercial gill net or purse seine

licenses shall be issued to any nonresident whose domiciliary state prohibits the use of similar commercial fishing gear." The previous language said, "prohibits the use of those nets in commercial fishing." Now, I will tell you just from a drafting standpoint that "similar commercial gear" is a wide open term. Some amendments to section 305.5 provide for permits to be issued in the EEZ.

The basic scope of the bill is that gill nets, strike nets, trammel nets, and seines will be prohibited to be used for commercial fishing in the saltwater fishery area of the state as defined by state statue. However, you will be able to possess one of these nets if you have a permit from the Louisiana Department of Wildlife and Fisheries (LDWF) to go from state waters to the EEZ. As you may know, the area from three miles out to 200 miles out is regulated primarily by the Magnuson Fishery Conservation and Management Act. To the extent that it's legal to use these nets in the EEZ (which would be beyond state territory three miles out), you would be able to traverse these nets through those waters with a permit from LDWF and use them in the EEZ. Under Title 16 of the United States Code, Section 1856 deals with state jurisdiction with respect to the Magnuson Act. It says that the states do have a fair amount of discretion, and they can regulate state waters. Now there is also a provision that says that if anything that a state does in regulating its fisheries in its state waters interferes with the implementation of a federal fishery management plan, then the Secretary of Commerce can supersede the state law. It is legal for the state to regulate the carrying of these nets in its state waters to the extent that it doesn't frustrate a federal fishery conservation management plan.

In establishing these permits under, section 305.5 (b), the Wildlife and Fisheries Commission is charged with the issuing regulations for the comprehensive control of birds, finfish, quadrupeds, all species basically. This means that the Secretary of LDWF shall promulgate the rules and regulations for the issuance of permits to persons authorized to possess these nets within the territorial boundaries of the state while traversing state waters to and from the EEZ. The Secretary shall charge a fee of $250 for each permit pursuant to the rules and regulations. And, it seems to me that this would shift enforcement of regulations from the Commission to the Department Secretary.

An amendment to Section 320 b-(1) (the section that talks about how commercial finfish can be caught, the kinds of gear that can be used) adds the language: "in the saltwater areas of the state, commercial finfish may be taken by means of rod and reel." Now, I would say that the term "may be" is permissive, "shall" is mandatory. That's the way it's done in our laws. So, I'll just point out that this amendment is a permissive statement. It doesn't mandate that they do, but it does say that they are permitted to do.

Section 320.1 in the Senate Bill 126 added, "no person shall use, possess, or have in possession, or have aboard any vessel any gill net, trammel net, strike net or seine in the saltwater areas of the state as defined, except as provided for in Section 318, which is the scientific permit that the Department can issue, or 320.2." Section 320.2 is also a new provision and it says, "the possession of gill nets, trammel nets, strike nets or seines on or aboard any vessel in the saltwater areas of the state is strictly prohibited unless the captain or owner of the vessel has in his immediate possession upon the vessel, a valid permit issued by the Department while traversing." I understand that it is common not to have the captain or the owner on the vessel. This section would apparently not cover that situation. So if you

are not a captain or owner, you could argue that you might not have the permit in your possession. The language is not precise.

In Section (b) it says: "While traversing state waters going to and from the waters of the federal EEZ, all gill nets, trammel nets, strike nets, or seines shall be rendered totally inoperable while in state waters." Now, this is the kind of term that caused the kind of litigation which results in all the definitions to be put in the front of the bill. I would just say that "totally inoperable" is a very loose, very attackable terminology, and at minimum, it should be defined. I base that only on my experience with other statues that commercial fishermen have been able to get around, you know, just like recreational fishermen or anyone else, because of unclear or broad language. Violation of this section is a Class 6, which means that violating this section can result in the suspension of the state permit. That is pretty stiff. (I think the highest is a Class 7 violation.) In addition, the law says that all state-issued permits and licenses, (which is, again, not great language because the only permit that you have is the one to carry the gear out to the EEZ) shall be immediately suspended upon any conviction. Then it says that no person who has had his permit suspended shall be allowed to reapply for a new permit until one year after completion of any sentence imposed and/or payment of any fine. And, then again, it says the Secretary shall promulgate rules and regulations to carry out this section.

The amendment to Section 322 deals with seines. And, I think this is a pretty interesting. The original Bankston bill said that in Section 322(c), the following provisions shall apply to saltwater areas. As you know, monofilament is prohibited, but this language will use the terms monofilament and multifilament. So that it reads: "The use and possession of trammel nets, gill nets, strike nets, and seines constructed of monofilament, multifilament, or other material (and again that's one of those terms) is prohibited."

One thing that the draftsman of this legislation did was to delete, as part of this, a reference to Section 406. Originally it said: "Nothing in this Section shall pertain to Section 406." Later in the statutes they actually delete the entire section 406. And, from my reading of this, Section 406 deals with the use of trammel nets, seine, gill nets, or webbing prohibited in the waters of Breton and Chandeleur sounds, exceptions, and a penalty. It specifies certain areas of Breton and Chandeleur sounds where you can't use certain of these nets. However, it adds two other things: It is specifically provided that "nothing contained in this Section shall prohibit the use of shrimp trawls or menhaden purse seines within the described area or the use of pompano nets having a mesh size of not less than five inches during the period from May 1 to October 31." Then, "no person using any pompano net in the described areas provided herein shall have in his possession, etc." It's very clear that this amendment would not only cut out the use of gill nets, seines, and trammel nets in Breton and Chandeleur sounds, it would cut out pompano fishing using those gears in that area. I do not think this is Larry Bankston's intention, but it raises some questions as to whether there could be a little argument made that shrimping and mendhaden fishing could be cut out in Breton and Chandeleur sounds. If it was not the intention, it needs to be tightened up. There are provisions that allow shrimping and menhaden fishing in those areas, but the way law works is the last legislative pronouncement controls. So, if you have those prior provisions and you now have a provision that somehow raises a question as to whether or not menhaden and shrimping can be done in those areas, then my

argument is that at least it raises some very legal issues that someone would want to address.

The bill also takes out all provisions for unattended nets (This is still under 322 (c)-7, unattended nets): "No nets or beam trawls used to take fish or shrimp from the saltwater areas of the state shall be left unattended except such legal nets or trawls which are attached to a wharf at a camp. Any net or beam trawl which is seized for a violation of this paragraph..." become violations of Section 322, raising them from class 3 to classes 4 and 5. It makes them a little more serious.

There is substantial rewording in the next section. In the original Senate Bill 126 there were several provisions like 409, 410, 410.1 that applied to Calcasieu Lake. They were able to get around local special law problems. The Bankston bill originally left them in. This time they specifically take them out. These deal with nets.

Section 640.3, which is part of the right-to-fish legislation is completely rewritten. And, basically, it talks about public trust. Section (a) says the legislature recognizes the public trust doctrine and marine fisheries are managed by the state trust for the benefit of all its citizens. The legislature also recognizes that all citizens of the state have a right to fish in and otherwise enjoy marine waters as long as they are in compliance with current licensing requirements. Conservation management decisions shall be fair and equitable, carried out in such a manner that no individual person, corporation or entity acquires an excessive share. The right to fish does not convey any property right or ownership in the fishery resource. (That addresses the issue of whether there is a property right under the 5th and 14th Amendments of the Federal Constitution, and Article 1 of the State Constitution, taking of property for public purposes without payment or due process.) Under (c), the legislature further recognizes that the state's marine fisheries resources need to be managed so as to be sustained biologically, as well as to continually produce a maximum yield of social and economic benefits. To this end, restrictions on legal fishing methods to harvest finfish, shrimp, oysters, crabs, and other marine fish species, may become necessary. The Department shall recommend — and that's mandatory — the elimination or restriction of any fishing gear that may be used presently in recreational or commercial fisheries in order to carry out its management responsibilities and/or in any response to any emergency. When elimination or restriction may have uneven impact on different groups of fishermen, these proposed measures should be applicable to all people of the state. It requires that, in addition to available biological data, social and economic data as Dr. Roberts described, also be involved.

The Triche bill, Section 3, is something people should look at because it basically deals with provisions of law that are being repealed. They just state the provision and say it is being repealed, and there are several listed. This includes Section 406, which I mentioned earlier. The Triche bill does not have Section 4 which says "the provisions of this act shall supersede all laws or parts of laws regulating or restricting the use of gill nets, trammel nets, strike nets, or seines in freshwater or saltwater areas of the state to the extent that they are in conflict with the provisions of this act."

Senator Lauricella's bill and House Bill 1919 are about the same as the ones I've reviewed. House Bill 657 by Representative Murray would prohibit the use of gill nets, strike nets, trammel nets, and seines in all state waters, freshwater, and saltwater. House Bill 658 would prohibit the use of gill nets in all state waters.

Several bills have moratoria in them. Representative Siracusa's House Bill 370 is a moratoria on certain new gear licenses and renewals. It amends Section 305(c) and it says: "No commercial gear licenses for gill nets, trammel nets, and purse seines shall be issued to any nonresident whose domiciliary prohibits the use of those nets in commercial fishing. Any commercial gear license issued in violation of this paragraph is hereby revoked and declared to be null and void and subject to immediate confiscation by the Department." Then it adds (f): "Effective May 1, 1995, the Department shall not issue any new commercial gear licenses for gill nets, trammel nets, seines in the saltwater or freshwater areas of the state. However, the Department shall issue a renewal license to any person who has a valid license for the year 1994." None of these bills on these moratoria things have income requirements.

Representative Mitch Theriot of LaRose has a bill that allows LDWF to issue regulations to provide for limitations, restrictions, and qualifications including moratoria or deleting. It requires that on or before January 1, 1996, the Commission adopt rules and regulations to limit the issuance of commercial fishing licenses for the harvest of saltwater finfish. I won't go into all the details of that.

Representative Odinet of Arabie has House Bill 998, entitled Moratorium on Issuance of Saltwater Gillnet Licenses, which amends Section 322.1. It basically cites public trust. "There is hereby established a moratorium to go into effect immediately and continue until three years from the date on which this Section becomes law. During the period of moratorium, the Department shall not issue any resident or nonresident saltwater gill net licenses unless he had the license in two of the four calendar years 1992, '93, '94, and '95." During the period of the moratorium, the Department shall not issue any resident or nonresident trammel and gear licenses.

Representative Triche has a bill that basically defines a limited entry fishery for commercial rod and reel fishery. If the Bankston-Triche Bill becomes law and they create a commercial rod and reel fishery, those people who had gear (seine, strike, trammel net) licenses during '93, '94, '95, would basically be grandfathered into getting these rod and reel licenses and there would be a moratorium on anyone else coming in.

House Concurrent Resolution Number 42 by Representative Odinet was written to create a special task force to study the use of gill nets, trammel nets, and seines in saltwater areas of the state. It says the legislature would create a task force confined to developing a limited entry plan for managing the saltwater finfishery by limiting the total number of gill net, trammel net, and seine licenses that may be issued in the state, and it sets up a membership. It calls for this task force to report 30 days prior to the beginning of the '96 regular session.

House Bill 1660 would set a 120-day saltwater finfish season, and establish a permit for gill nets. HR1580 would limit issuance of licenses to saltwater fishery nets, limit fishermen to two nets.

I am sure there are others. I'm sure there are going to be other bills. It's anyone's duty as a citizen to be informed about these things. You can get copies of the bills from the legislative office, right as you go into the Senate wing where the committee rooms are, or through your organizations, or through the Extension Agents. Thank you all for your attention.