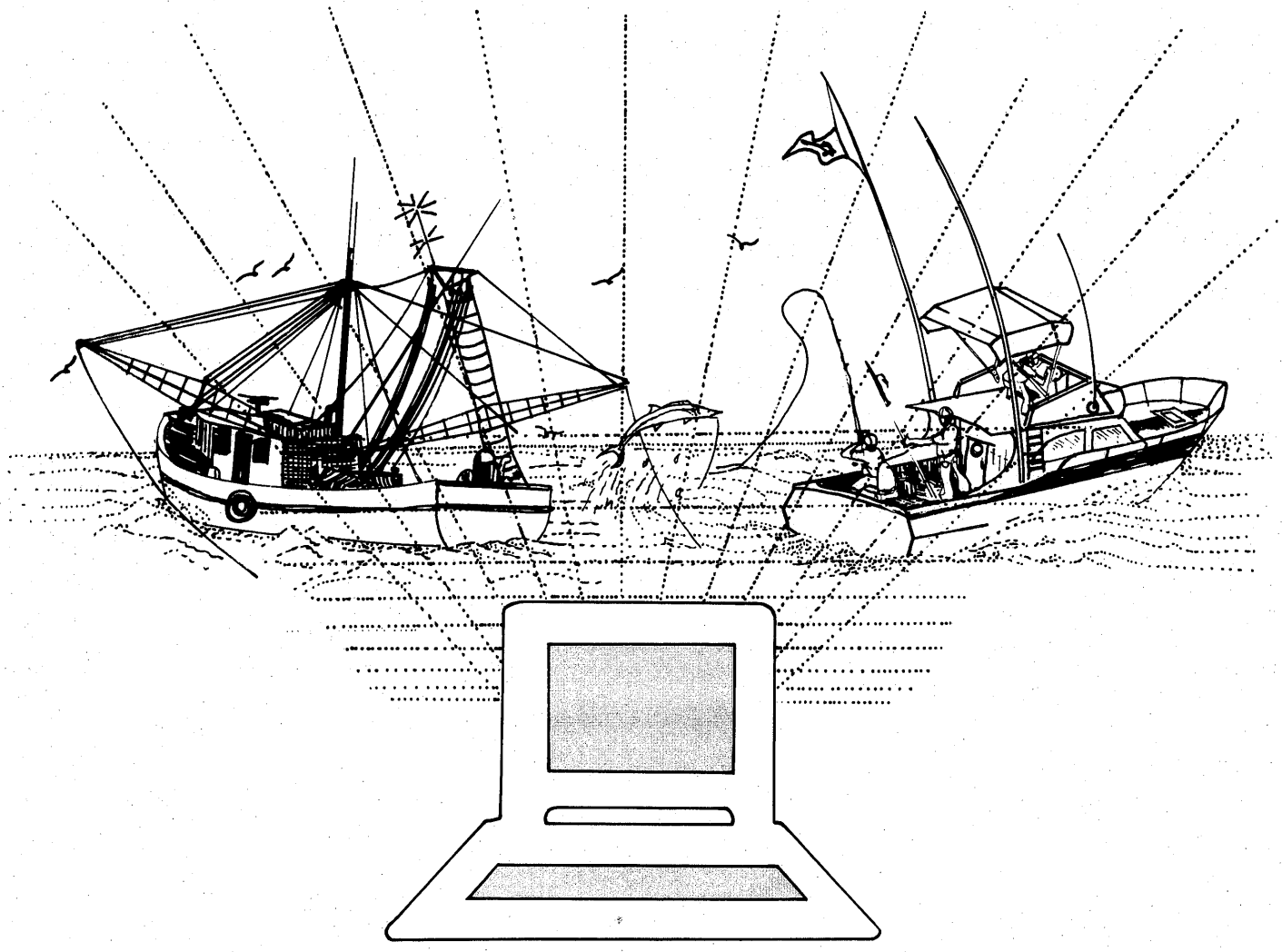
Proceedings:

DESIGN, COLLECTION, AND ASSESSMENT OF ANGLER VOLUNTEERED INFORMATION PROGRAMS



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PROCEEDINGS OF THE STATISTICAL SYMPOSIUM:

"DESIGN, COLLECTION, AND ASSESSMENT OF ANGLER VOLUNTEERED INFORMATION PROGRAMS"

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Sponsored by

GULF STATES MARINE FISHERIES COMMISSION

35th Annual Spring Meeting
Mobile, Alabama

March 14, 1985

PREFACE

A symposium on the "Design, Collection, and Assessment of Angler Volunteered Information Programs" was held on March 14, 1985 in conjunction with the 35th Annual Spring Meeting of the Gulf States Marine Fisheries Commission in Mobile, Alabama. The symposium addressed such topics as survey design and analysis, the National Recreational Fishing Survey, fishery data management, the validity of volunteered information and problems with existing federal data collection programs.

Angler volunteered information is collected by State, Federal, and university programs and is used for a variety of research and management functions. Coordination, design, administration, and data management of the information gathered by these diverse groups adopt rather different forms. The purpose of this symposium was to bring together these different groups in an effort to pool knowledge and discuss common problems.

It is not a unique failing for any of these fishery data collection groups to be lax in publication of the information gathered or the techniques developed. In view of currently reduced federal funding for fisheries projects and the prospect for further reductions in the future, all of the Gulf States are interested in finding ways to reduce the costs of their fishery-dependent sampling programs, all of which rely primarily on angler volunteered information.

The Proceedings of the symposium are based on six papers and two abstracts covering the areas of survey design to data collection, analysis, and interpretation. The undertone through the papers seemed to be one of critical program evaluation in an effort to obtain the same or better information at a reduced cost. It is hoped by all concerned with the symposium and its proceedings that the information presented will aid in the understanding of angler volunteered information systems and stimulate researchers at all levels to evaluate their design, collection, and assessment programs.

Appreciation is gratefully extended to the Gulf States Marine Fisheries Commission (GSMFC) for supplying the funding required to hold the symposium and publish its Proceedings, to Larry B. Simpson, Lucia B. O'Toole, and the GSMFC staff for their professional help at all stages of the symposium. Appreciation is also extended to all members of the TCC Statistical Subcommittee for their support of the symposium and their patience with the pace at which the Proceedings were edited.

The Editor

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INTRODUCTORY REMARKS

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This is the first of what I hope will develop into a series of Gulf States Marine Fisheries Commission-sponsored symposia and workshops dealing with the collection and analysis of fisheries data in the Gulf of Mexico. More specifically, this symposium will deal with the worth of angler volunteered information.

Sir Francis Galton once said "I have a great subject (statistics) to speak upon, but feel keenly my literary incapacity to make it easily intelligible without sacrificing accuracy and thoroughness." Fortunately I do not have this problem. Even though the subject matter is generally the same, my opening remarks will be clear and intelligible. I will leave matters of accuracy and thoroughness to the distinguished panel of experts that will follow.

As one whose statistical background is of a purely mathematical nature, I was never before confronted by having to reconcile the dilemma between the volume and detail that a fisheries biologist might desire in his data and the resources and money that are allocated to the work. In a sense then, the question of "worth" was inconsequential. No one ever asked me if the data was worth anything.

Webster defines "worth" as deserving or worthy of, and "value" as excellence attributed to something with reference to its usability.

From a fisheries management perspective, that is something we can sink our teeth into. The value of information can be characterized in terms of three main qualities -- representativeness, reliability, and validity. Regardless of the use that the data will be put to, it is desirable that it rank highly in each of these categories.

Is the data indeed representative of the sampled population? Does the method of data collection produce the same results when repeated? And finally, does the question being asked the fisherman really measure what it is intended to measure?

These are all critical factors in the creation of any statistically valid sampling design and will be the focus of our deliberations today.

As a fisheries manager by profession, mathematician by education, and avid recreational fisherman, I find the subject matter of angler volunteered data most intriguing.

While I would not go so far as to question the integrity of my fellow fisherman, a few tongue-in-cheek examples will serve to demonstrate the difficulties faced in obtaining volunteered data. As will become quite apparent, the old saying "Ask me no questions and I will tell you no lies" takes on real meaning here.

The necessity for achieving representativeness in sampling design is met head on by the adage that "10 percent of the fishermen catch 90 percent of the fish," or, if you prefer, the problems associated with what is known as "skill bias." Effort data, in particular, will be affected by the fisherman's abilities to first locate fish and then his adeptness at actually catching them. These are all learned techniques that require skill acquired only through experience. Unfortunately merely asking "are you a good fisherman" will not resolve the problem.

Reliability is matched against every fisherman's tendency to overexaggerate. Some exaggerate more than others, but exaggerate they will. Even fish that are weighed and measured will be exaggerated: a 3-lb, 2-oz fish becomes just over 3 pounds, then just under 4 pounds, and before you know it, you're dealing with a 4-lb memory. Oh yes, then there is the problem of memory. There is obviously a considerable amount of what might be termed "recall bias" with respect to the angler's estimation of such things as weight and length of fish caught and time actually spent fishing. The longer the time lag between survey and catch, the worse the recall bias.

And finally, the matter of validity seems to be entirely dependent upon mutual agreement. In order for a question to be valid, there must be some agreement on the topic to be evaluated. What, for example, constitutes "quality fishing"? To some this might mean catching plenty of fish, to others it might mean catching a few large fish. And, as the Lowenbrau commercials have made perfectly clear, it might mean enjoying a beer in some secluded spot without being bothered by the fish. Thus, the fisheries statistician is faced with yet another problem.

Superimposed on all of these problems is the fisherman's understandable and perhaps inborn inclination to secrecy and/or downright baldfaced lying.

Even among fishermen who are my friends, these chicanerous principles are well understood. In answer to the often-posed question "any luck?", "not a thing" is usually interpreted as "they're biting like heck and I'd be obliged if you left." "Catch anything?" -- "Oh just a few little ones," he might say, hoisting a 10-lb speck out of the ice chest...

"What did ya catch 'em with?" or "What are they hitting?" draws some of the best responses of all. It is quite clear, from your question, exactly what it is you want to know and perhaps even more clear why you want to know it. I believe it's called begging the question, evading the issue, or something similar. In any case, fishermen are very good at it, I can assure you. In fact, from a statistical viewpoint, there seems to be no valid method of obtaining the desired information unless, of course, the fish was caught on live-bait and it is abundantly and obviously clear that you do not have any live-bait.

With all these possible sources of obtaining erroneous information and introducing bias into a survey, the importance of survey design becomes rather apparent.

Furthermore, since survey results are generally used in the prediction of everything from fishing patterns to relative stock abundances, their accuracy can be directly proportional to the effectiveness of the management regimes depending upon them.

And effective fisheries management is, after all, the objective of everyone in this room. We have gathered here a number of experts in the areas of survey design, analysis, and interpretation; and I am certain that before the day is over, everyone will be much enlightened on the subject at hand.

FRESHWATER EXPERIENCE WITH SURVEY DESIGN AND WITH COLLECTION AND ANALYSIS OF SURVEY INFORMATION: APPLICABILITY TO MARINE SYSTEMS

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The science of fishery biology centers on assessing the interaction between fish stocks and man so that appropriate management policy ensues. Our ability to adequately assess, and thus manage, is dependent on: 1. proper definition of objectives (what information to collect); 2. proper techniques for collecting the information (which methods/designs are effective for providing representative data and reducing sampling variation); and 3. appropriate analytical frameworks (meaningful techniques for quantitatively integrating data and interpreting the situation).

At present, improvements, or more creative approaches, are warranted in all three areas to fully explore and exercise our options with respect to recreational fishery management, regardless of the environment, marine or freshwater. Objectives must be expanded to routinely include socioeconomic assessment, as well as traditional biological considerations. We must strive to take advantage of statistical analysis options available through use of valid survey sampling designs, e.g., measuring components of variance and using covariables to not only improve chances of documenting the effects of management, but also to improve the sampling designs themselves. Multidisciplinary integration of data will offer avenues for addressing, in a practical sense, the concept of "optimum sustained yield" and for understanding our clientele (the fishermen) more fully in order to expand our ideas about, and our options for, more effective management. Only in this way can we hope to bring increased benefits to people through fishing and to increase public support for our fishery assessment and management programs.

MARINE RECREATIONAL FISHERY STATISTICS SURVEY

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ABSTRACT Beginning in 1979 the National Marine Fisheries Service (NMFS) has conducted annual surveys of marine recreational fishing along both coasts of the continental United States. The main objective of these surveys has been to estimate catch within an error rate of 10 percent at the 95 percent confidence level for all finfish species within each of seven regions. Marine Recreational Fishery Statistics Survey (MRFSS) methodology involves two complementary surveys: a telephone survey of households to collect effort information, and an intercept survey of fishermen at fishing sites to collect catch per trip data. The 1985 sampling allocations for the Gulf of Mexico region are 17,000 telephone households and 9,000 intercept interviews.

Although the MRFSS is intended to provide catch estimates at the regional level, the design can easily provide estimates at the State level. However, error rates associated with these State level estimates are generally much higher than those at the region level due to decreased sample size. For example, in 1982 the Gulfwide catch estimate for spotted seatrout had a coefficient of variation (CV) of 17 percent, while the corresponding CV's by State were: 31 for Florida (West), 54 for Alabama, 28 for Mississippi, 14 for Louisiana, and 26 for Texas.

State agencies have indicated a desire to improve State level estimates by increasing the number of samples collected. This has been accomplished by many States in past and current surveys through a variety of means. The most useful approach is for States to fund the collection of additional intercept samples by either their own personnel or by the NMFS data collection subcontractor. Participating States have had significant input into the allocation of samples in time and space to better accommodate their needs.

The cooperative approach in the MRFSS benefits both State and Federal partners. For a minimal investment, States can adapt an existing survey methodology to collect needed data which would be costly to gather on their own. The NMFS benefits from State personnel's knowledge of the local fisheries and reduced error rates associated with the regional catch estimates. The Gulf States Marine Fisheries Commission (GSMFC) Technical Coordinating Committee Statistical Subcommittee provides an excellent forum for future State-Federal recreational fishery statistical work.

INTRODUCTION

The NMFS initiated a series of surveys in 1979 to obtain annual estimates of catch, effort, and participation by recreational fishermen in the marine waters of the United States. This presentation provides a historical perspective of the design and implementation of these surveys, including the principal objectives of the research. This is followed by a brief review of the current methodology. The relationship of the NMFS survey to State objectives for data on marine recreational fisheries (MRF) is then discussed. Survey results are used to demonstrate the existing levels of statistical reliability and the means to meet alternative objectives. Opportunities for cooperative State-Federal approaches to MRF data collection are presented along with a recommended role for the Statistical Subcommittee of the GSMFC Technical Coordinating Committee.

HISTORY AND OBJECTIVES

The NMFS and its predecessor agencies have been involved in the collection of MRF statistics since the 1950's. Over time, the needs for recreational data have changed and the NMFS has adapted to these new requirements. An additional statutory authority came with each new requirement. The three principal authorities NMFS currently uses for MRF data collection are: The

Fish and Wildlife Coordination Act of 1956; the Migratory Marine Game Fish Act of 1959; and the Magnuson Fishery Conservation and Management Act of 1976.

An overall objective has been derived from these authorities: to develop a program for the continuous collection of data on U.S. marine recreational fisheries. This objective was endorsed in 1981 when an official NMFS policy on MRF was implemented with this objective as its first recommendation.

The specific data required to meet this objective include catch by species in number and weight, fishing effort in number of trips and catch per trip, number of unique participants in the fisheries and their associated socioeconomic characteristics. These data are needed and used by a variety of user groups for many purposes. The NMFS has a need for national performance data to support its missions of developing and managing the nation's fisheries resources to the best advantage of the public, and to respond to Congressional and constituency needs. Regional fishery management councils and coastal States have their own set of data needs for regional and State fisheries management. Thus, NMFS serves a wide variety of needs and users of MRF data.

METHODS

The NMFS major MRF data collection effort is the Marine Recreational Fishery Statistics Survey (MRFSS). The current statistical design of this survey evolved from extensive experience with prior survey designs and two years of direct methodological work to establish an optimum MRF survey design. Problems with species identification, recall errors and number biases were identified in the methodological studies. The chosen approach minimizes these response biases by using a complemented design that combines data collected from independent telephone and field intercept surveys.

The telephone survey screens randomly generated telephone numbers for households in coastal counties. The prevalence of fishing households is determined by interviewing each household member who fished in saltwater in the last two months. Calls are made six times per year at the end of every two month period to minimize recall bias. Data on a trip by trip basis are obtained from each fisherman and include the date, fishing mode, and fishing area of the trip. No catch information is obtained during the telephone interview because of fishermen's inability to identify species and accurately estimate the number and size of fish caught.

The field intercept interviews are conducted at probabilistically assigned sites with fishermen who have completed their trip for the day. These sites, such as marinas, launching ramps, jetties, and stretches of beach, are sampled continuously during the year. Information obtained includes identification and counts of fish landed, length and weight measurements, details about the trip itself and the residence of the fisherman.

Data from the two surveys are combined in data processing with census information on the number of households by county. A summary of the categories of data collected is shown in Figure 1. A more detailed description of the methodology can be found in National Marine Fisheries Service (1985).

COOPERATIVE DATA COLLECTION

The NMFS set out to meet its MRF data needs through the MRFSS. Since regional estimates of catch were desired, the sample sizes selected were chosen to produce estimates for a region with about a 10 percent error. Overall, the resultant estimates approach this goal.

However, other management agencies have their own data needs. In many cases the kinds of information needed are quite similar to those needed by the NMFS. The basic differences in these needs are the level of detail and precision needed. For example, a State may need estimates of catch with a 10 percent error at a county level, while the NMFS may need catch data with the same level of reliability for the same species but at a regional level. These circumstances make it apparent that several objectives could be met through cooperative statistics programs.

The first objective that could be met would be the collection of fishery-wide data on inter-jurisdictional species. Finfish cross various State, Federal, and local boundaries during their lives, and comprehensive data are necessary to manage such species properly. A cooperative statistics approach would permit managers to apply a stock/population approach to research. Such an approach provides a forum for unified resource management to implement complementary management actions in State and Federal waters.

A second objective that could be met would be a synergistic improvement in data quality. By sharing the responsibility for data collection, each contributor brings to the effort the benefits of their past experiences. Such an exchange of knowledge often leads to the introduction of new ideas and techniques that may not have happened if the participants continued to work in isolation.

Finally, a cooperative statistics approach allows for a minimization of costs. Duplicative collections are eliminated to save money and economies of scale are used to obtain more information for the same or less money. In addition, resources need not be spent to research and develop survey methodologies as participants can take advantage of the methodological work already available from proven survey designs.

The next section describes some of the statistical details of sample surveys before presenting results from the MRFSS. These results are starting points for a discussion of how Gulf States could participate with NMFS in an MRF cooperative data collection program.

Figure 1. Representative data elements by survey method.

Categories of Data Collected in the Intercept Survey	Categories of Data Collected in the Household Telephone Survey
• Finfish catch, weight and length by species	• Presence of marine recreational fishermen in the household
• Fishing mode	• Number of fishermen per household
• County/State of residence	• Number of finfishing trips in 2-month period
• Avidity level	• Location of each trip
• Area of fishing	• Location of household
• Species sought	• Mode of each trip

STATISTICAL RELIABILITY OF ESTIMATES

The estimated results from any statistical survey have a given level of reliability associated with them. This enables users of the data to know how "good" the results are. One way to measure the "goodness" of an estimate is through the use of the CV. The CV is the standard error expressed as a percentage of the estimate. A small CV indicates a more precise estimate than does a large CV. For example, if our estimate of red drum in Alabama is 60,000 fish with a CV of 25 percent, then we can be reasonably certain that the true catch is between +25 percent, or between 45,000 and 75,000. However, if the same estimate of 60,000 has a CV of 10 percent, then the true catch is most likely between 54,000 and 66,000.

Although the focus of the MRFSS is to estimate regional catches, the design easily permits estimation of catch at the State level. This is because estimates and variances produced for each State, wave, mode, area, and species combination are additive within each region. Error rates of State estimates are generally higher than regional estimates because they are generated from a smaller number of samples.

Average CV's for selected Gulf species from four years of data (1979-82) illustrate the error rates of estimates at the region and State levels (Table 1). While average regional estimates for individual species are all below 26 percent, State level estimates range from 26 to 69 percent. For example, in 1982 the Gulfwide catch estimate for spotted seatrout had a CV of 17 percent, while the corresponding CV's by State were 31 for Florida (West), 54 for Alabama, 28 for Mississippi, 14 for Louisiana, and 26 for Texas.

TABLE 1.

Average coefficients of variation (CV), estimates of catch in number (EST), and number of intercepts (N) at selected Gulf species occurred, 1979-82.

Species	Average CV Gulf	Average CV State	Gulf EST (millions)	Gulf N
Spotted seatrout	11	26	18	938
Red drum	17	37	6	527
King mackerel	25	69	1	122
Red snapper	23	54	5	204
All species combined	8	12	151	6182

REDUCTION OF ERROR RATES

Catch estimates are derived from two separate components of the MRFSS. Mean catch per trip from the intercept survey is multiplied by the estimated number of trips from the telephone survey to estimate catch. The variability associated with each of these components contributes to the variability of the final estimate. The intercept portion of the survey contributes more to the variability of the

estimate than the telephone portion. With a constant telephone sample size, increasing the number of intercepts reduces the CV of the estimate greatly (Figure 2). However, keeping the number of intercepts constant and increasing the telephone sample size yields relatively little reduction in CV (Figure 2). The law of diminishing returns applies somewhere around three to four times the current intercept sampling level. Although sampling at six times the base level will reduce the CV by 50 percent, the gain in precision may not be worth the cost.

The theoretical model in Figure 2 is supported by actual data in Maryland. In 1979 and 1980 approximately six times the number of intercept samples were collected compared to later years. Telephone sampling remained constant all years. Statistical theory predicts that the CV's of 1979 and 1980 samples should be 50 percent lower than later years. This was generally observed for a variety of species. For example, bluefish CV's of 13 and 16 percent in 1979 and 1980 were approximately 50 percent lower than 35 and 30 percent CV in 1981 and 1982.

The sampling strategy that minimizes error rates for the most efficient expenditure is a relatively large increase in intercept sampling and a small increase in telephone sampling. Our recommendation is to increase intercept sample sizes 200-300 percent and telephone sample sizes 50 percent. These increases should reduce the error of catch estimates approximately 40 percent.

ABILITY TO DETECT SIGNIFICANT DIFFERENCES

Fishery managers may need to know whether MRF catches are statistically different from one year to the next. One way to do this with MRFSS data is to examine catch per trip data. Sample sizes needed to detect differences between two catch per trip values can be estimated at a variety of confidence levels. For example, at the 90 percent confidence level, approximately 2500 intercepts are needed to detect a 10 percent difference in catch per trip for a species with a CV of 50 percent (Figure 3). At the 80 percent confidence level, approximately 2000 intercepts are needed. Other confidence levels and percentage differences can also be studied.

CONCLUSIONS

A cooperative approach to the collection of MRF statistics benefits both State and Federal partners. States benefit in that they can adapt an existing methodology and take advantage of the economies of scale of a large survey to produce statistically reliable State level catch estimates. The cost-benefit ratio of participation in MRFSS is much better than that of designing and implementing an individual State survey. States would also have a compatible data set available from neighboring States for stock assessment purposes. The NMFS benefits in that the error associated with regional estimates is reduced through increased sampling in participating States. Both cooperators benefit from increased data quality resulting from active State participation.

The GSMFC Technical Coordinating Committee Statistical Subcommittee is an excellent forum for coordinating future State-Federal MRF statistical work. Survey design and preliminary results could be technically reviewed on a regular basis at Subcommittee meetings. The Subcommittee could also define requirements for survey output specific for the Gulf subregion.

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Figure 2. Reduction in Variability of Estimates.

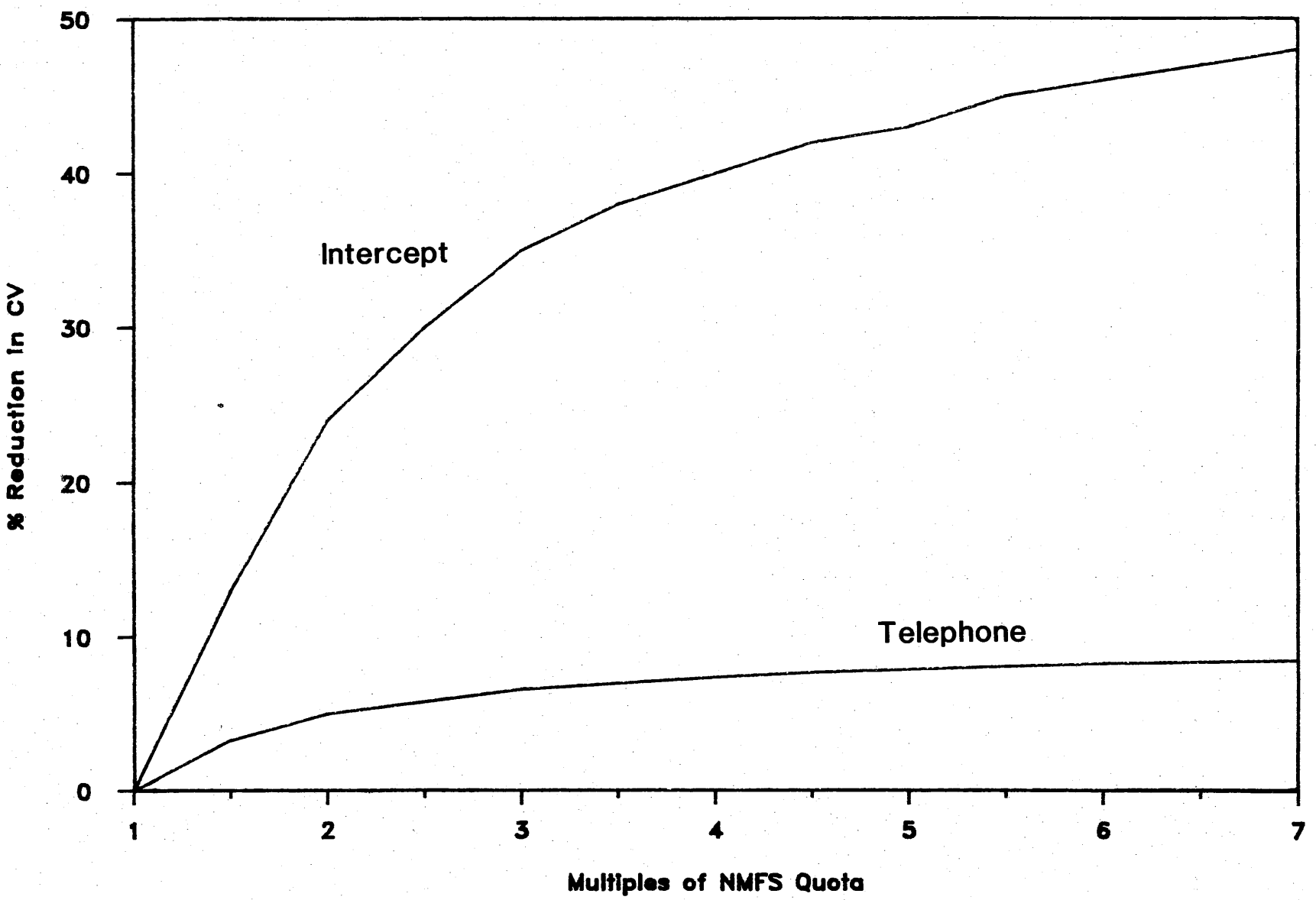
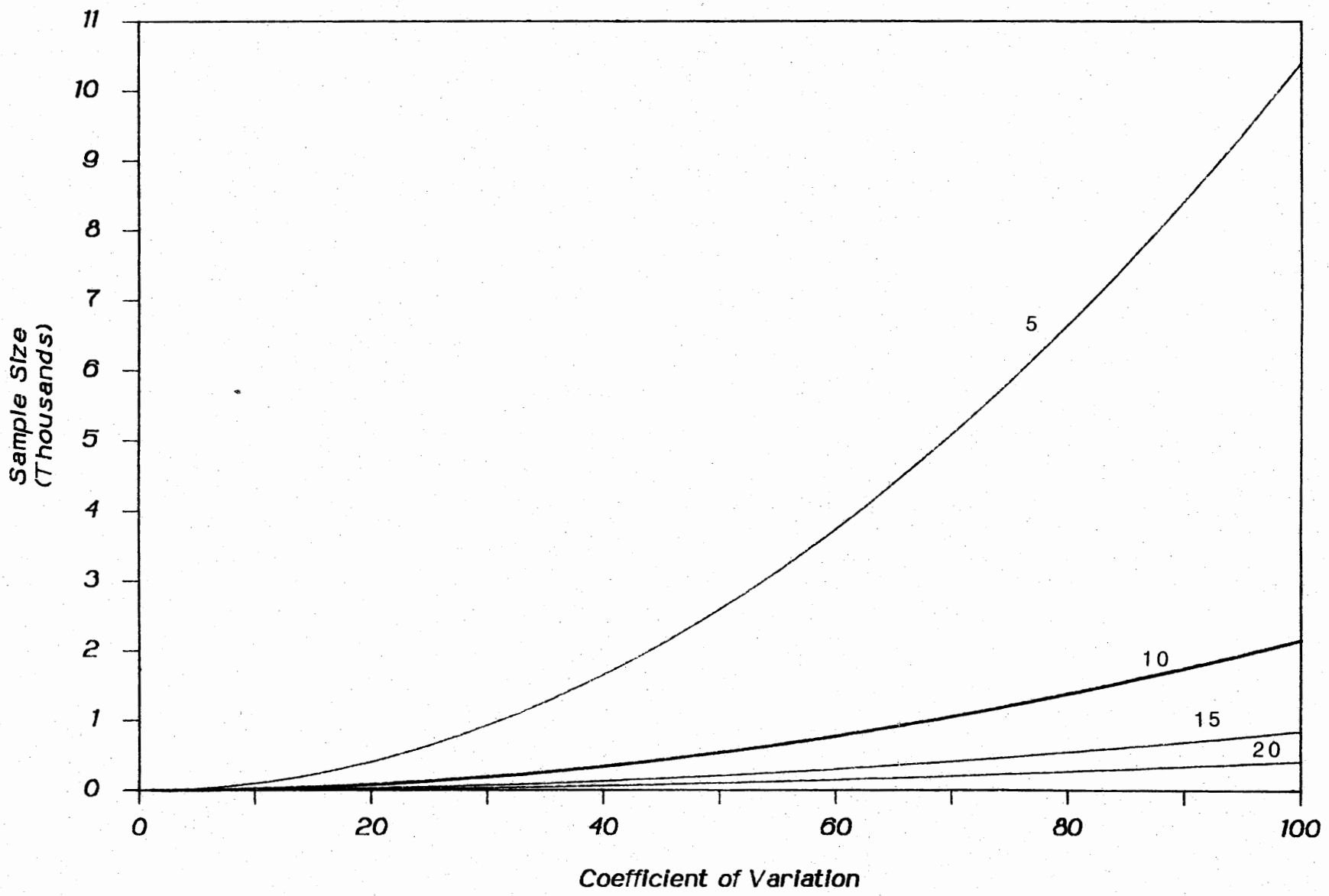


Figure 3. Estimated Sample Size Needed to Detect a Difference of x% (90% confidence limits).



STATE OF TEXAS MARINE RECREATIONAL FISHING SURVEY-- DESIGN, IMPLEMENTATION, AND USE OF THE DATA

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ASPECTS OF THE FISHERY

Marine recreational fishing in Texas is economically, biologically, and socially important. The recreational fishery is a diverse composite of fishermen and fishing areas. Along the 360 linear miles of the Texas coast are situated a series of eight major bay systems (Figure 1) and several smaller ones which encompass 1.4 million acres of estuarine waters surrounded by 2500 miles of shoreline. Another 2.5 million acres in the Gulf of Mexico falls within the 9 nautical mile jurisdiction of Texas. A notable diversity of aquatic habitat is found within these bay systems and in the Gulf, ranging in extremes from the relatively deep, low salinity, and turbid waters of Galveston Bay to the shallow, high salinity, and clear waters of the Laguna Madre. These bay systems and the Gulf are distinguished by a multitude of sport fishing access points.

The variety of anglers utilizing these recreational fishing opportunities include private boat fishermen launching at boat ramps, marinas, or private residences; tournament boat fishermen; charter fishermen on large headboats and on small party boats; wade/bank fishermen; and pier and jetty fishermen. There are an estimated 1.6 million saltwater anglers in Texas who make over 7 million saltwater fishing trips each year. Approximately 2 million of these trips involve private fishing boats.

Each marine angling party spends an average of $45 to $50 per trip for actual expenses. This value does not include an average of nearly $400 worth of fishing equipment, excluding boats, owned by each fisherman. Expenditures for boats and motors in Texas approach $200 million each year. The total economic value generated by the recreational fishery in Texas through tourism, manufacturing, and other services is more than $1.1 billion.

The social and personal benefits of fishing are more difficult to quantify but clearly are of great importance. Gulf States marine anglers, responding to a recent survey, indicated that relaxation was the single major purpose of their fishing trips. By an overwhelming majority, fishing was shown to be an activity which involved family and friends.

This is not to say that catching fish is not a primary pursuit of marine anglers. Catching fish and attempting to catch fish was the dominant reason for going fishing when these two individual categories were combined in the survey. This desire to harvest fish and other marine animals recreationally results in landings in Texas of nearly 8 million pounds of seafood annually.

The demands placed on the marine resources by recreational fishermen can only be expected to increase. Boat registrations in Texas increased over 50% from 1972 to 1981. Coastal populations continue to grow as well as the number of licensed anglers.

TEXAS PARKS AND WILDLIFE DEPARTMENT GOALS AND OBJECTIVES

Given the substantial value of and the increasing demands on the saltwater fishery, it is the responsibility of the State, as steward of all public resources, to protect the fishery from being over-exploited but also to maximize fishing opportunities. In Texas, the Legislature has authorized the Parks and Wildlife Commission to regulate fully the means, methods, manners, places, and periods of time in which it is lawful to take or possess fish, crabs, oysters, and shrimp.

The Coastal Fisheries Branch of the Texas Parks and Wildlife Department (TPWD) provides the Commission and the Legislature fishery management recommendations, including long-range management plans to determine optimum yield for select species. The Coastal Fisheries Branch has its headquarters in Austin with field laboratories situated near each of our major bay systems. We have a staff of 101 permanent positions with a total operating budget of $3.6 million.

Effective management decisions must be based on reliable and legally defensible data. Our coastal fisheries' programs are based on statistical approaches, are defensible in court, and are designed to satisfy specific objectives. Our programs can be partitioned into four major activities:

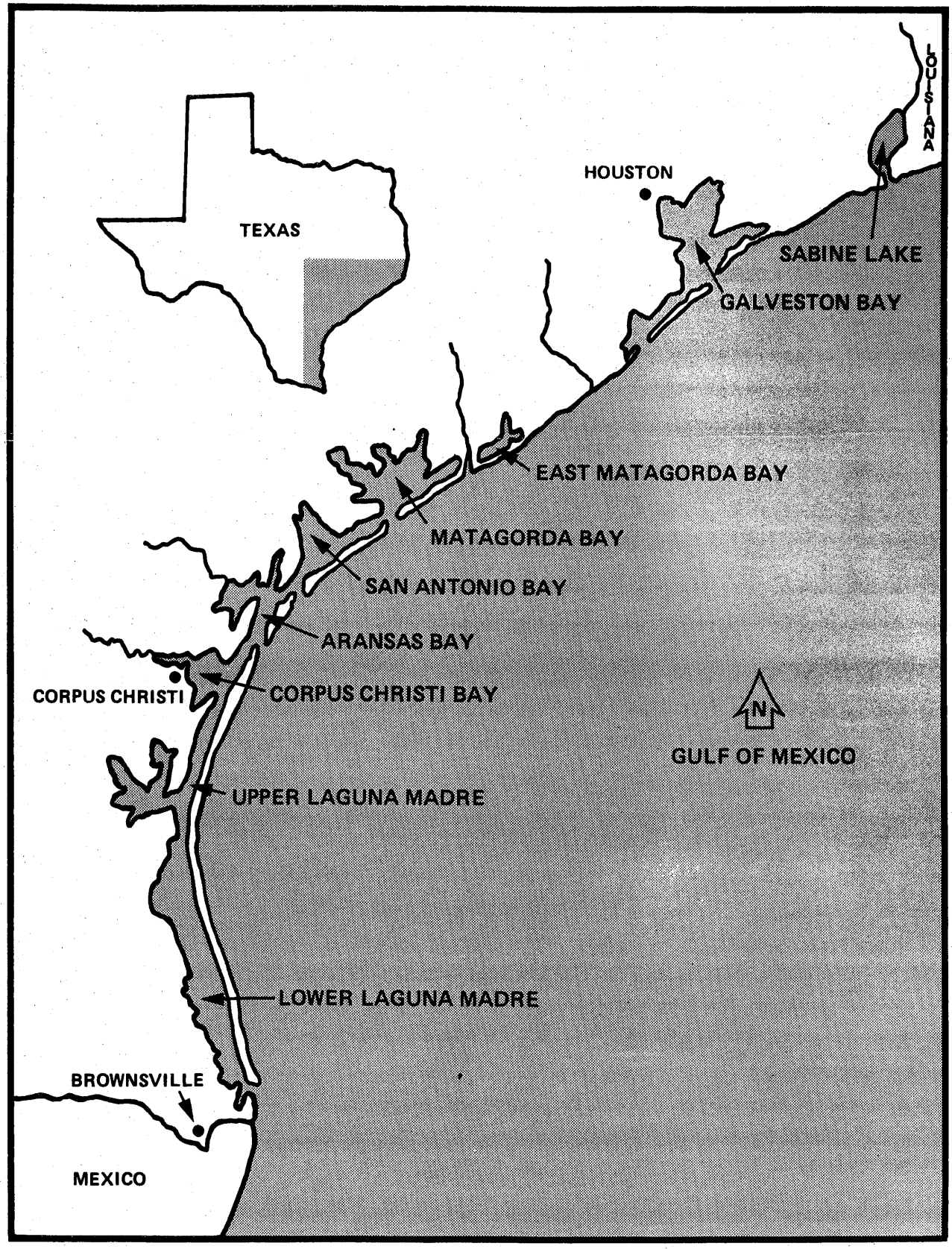

Figure 1. Map of the Texas Coast.

1) Monitoring the abundance of finfish and shellfish in Texas bay systems and the Gulf of Mexico utilizing sampling methods which are independent of user group bias.

2) Enhancing existing populations through stocking of hatchery-reared organisms and assisting in habitat enhancement.

3) Enhancing marketing and consumption of seafood products.

4) Monitoring the commercial and recreational harvest of finfish and shellfish from Texas bay systems and the Gulf of Mexico, and determining the social and economic characteristics of these fisheries.

MARINE RECREATIONAL HARVEST MONITORING PROGRAM

The TPWD marine recreational fishing monitoring program was initiated in 1974 to develop long-term trend information on species composition, size, number landed, and catch per unit effort of finfish caught in Texas bays by recreational fishermen. The general methodology included the use of on-site surveys to collect interview data and boat trailer wet-slip or angler counts obtained by a roving clerk to determine fishing pressure at each site. Boat access sites, including boat ramps, marinas, and other public launching areas, are continuously inventoried and surveyed in each bay system each year by a team of two or three biologists and technicians. Currently, survey sites are selected at random but are weighted according to mean adjusted roving counts obtained over the previous three years. Roving counts for a site are adjusted by the mean percent of sport boat fishing activity associated with that site based on the interview data. These adjustments result in boat access sites with high fishing activity being surveyed more often than those with low activity. Although survey sites are selected to maximize the number of sport boat fishing interviews, all user groups utilizing the site are interviewed at the completion of their trip, thus providing data for a wide range of coastal boating activities.

We also randomly sample the bay headboat fishery in each applicable bay system. Coastal Fisheries personnel accompany a preselected headboat and obtain harvest information through on-board interviews including measurements and enumeration of all species landed. Pressure estimates are obtained by telephoning all bay headboat operators to determine the total number of trips made on the survey day.

In addition to our ongoing survey programs, we have identified and collected short-term creel survey data on a number of specialized recreational fisheries. These include the spring black drum, the fall red drum, and the fall flounder fisheries; the winter spotted seatrout fishery; and the nighttime fishery using lightplants.

The specifics of our program procedures have been and will continue to be modified to improve the efficiency of data collection without a loss of estimating precision. Modifications are implemented when it has been clearly demonstrated that the comparability of the data to past years will not be jeopardized. The prudent fishery manager will realize, of course, that unforeseen budgetary constraints may force the streamlining of data acquisition programs. Wise interpretation of previously collected data can indicate where reduction of effort will least disrupt the development of long-term trend information.

For example, our original 1974 creel survey included wade/bank and bay lighted pier fishermen. Data from these early surveys, along with a repeat of the same study in 1979 to 1980, demonstrated that sport boat fishermen accounted for two-thirds of the overall finfish landings. Our survey efforts since 1980 have concentrated on interviewing sport boat fishermen. We are still able to estimate the total annual recreational finfish landings using multiple regression techniques. Regression equations have been developed which predict the total bay landings for eight sport fishes, as well as for all finfish combined based on several variables we measure each year. These variables include the estimated number of fish landed by sport boat fishermen on weekend days, the estimated number of sport boat man-hours fished on a weekend day, and the total number of lighted pier and wade/bank fishing areas available in each bay system.

DATA COLLECTION DETAILS

Our sampling year is divided into a high and low use season, each approximately 6 months long. The high use season is 15 May to 20 November and the low use season is 21 November to 14 May. Sampling is stratified so that nearly three times as many survey days are done during the high use season than during the low use season. This stratification was based on an analysis of the mean distribution of sport boat fishing pressure throughout the year. Mean roving counts among ten different time periods in a year were compared to adjacent time periods to determine which could be pooled. The result of this analysis was a two season sampling stratification.

The number of days that we survey each season is the result of a sample size estimation based on data from past years. The variances from original survey landings estimates were used to calculate a sample size which would provide annual landings estimates for each bay system with coefficients of variation of no more than $\pm$ 10 percent. The annual coastwide private boat fishing landings estimate for 1983-84 had a coefficient of variation of $\pm$ 6 percent.

The number of assigned creel survey days in the high use season is 66 weekdays and 31 weekend

days in every bay system except San Antonio Bay where fewer boat access sites allow a sample size of 46 weekdays and 26 weekend days. The low use season sample size in every bay system is 24 weekdays and 12 weekend days.

The original creel program required the sport boat fishing landings to be calculated as the product of the mean catch rate times the estimated fishing pressure. The roving count effort had to be evenly but randomly distributed over two different 8 hour periods among all sites in the bay system to estimate the mean fishing pressure at any given site for a 16-hour period. Gasoline shortages in the late 1970's prompted the development of a survey design less dependent on the extensive use of an automobile. Data collected since 1974 were used to estimate pressure that occurred at specific sites within an average fishing day. Sport boat fishing landings in the bay system for any survey day were then estimated by dividing the actual number of fish observed at the survey site by the estimated proportion of the total fishing activity in the bay system that occurred at that site. The actual number of fish observed is also adjusted upwards by the proportion of interviews missed during a survey. Means are calculated for these daily landings and extended by the number of days in the interval for which landings are being estimated.

Currently, the objective of each roving count is to assess the relative distribution of fishing pressure among all the boat access sites. Since roves are attempting to make an instantaneous count of the number of empty trailers or empty but rented wet slips at each site throughout a bay system, they can be conducted in 1/3 to 1/6 the time previously required. Ten roves are conducted in each bay system during the high use season and six during the low use season. They are stratified between weekend and weekdays and are distributed among the months of each season to insure complete representation. Since personnel conducting roves cannot know the activity of the boaters whose empty trailers or wet slips they are counting, the mean roving count for each site must be adjusted by the proportion of sport boat fishing parties interviewed at the site during previous on-site surveys.

Angling activity at a site is used to select the survey sites prior to each sampling season, thus assuring that sites with higher fishing pressure are surveyed more often. The resulting landings estimates are more precise than those from strictly random sampling schemes.

The interview period for all survey days is 10 am to 6 pm. A continuous 8-hour daylight interview period was found in our earlier survey work to be the most efficient and economical use of survey personnel, based on coastwide diurnal surveys in which the number of anglers completing their fishing trip at randomly selected survey sites were counted each daylight hour. Tests of independence were used to determine which of several continuous 8-hour periods contained the highest percent of boating parties completing their trip. The 10 to 6 period yielded a 90 percent or greater value in each season and bay system coastwide.

Our interview period has recently been modified to reduce the unproductive time spent by survey personnel at boat access sites which receive little or no sport boat fishing activity on an assigned weekend survey day. Previous interview data were used to calculate the percent of sport boat fishermen interviews and retained fish which would have been missed had the interview period terminated early on weekend survey days when no angling interviews were conducted prior to some specific hour. Our pre-analysis criterion for accepting an early survey termination procedure was that a coastwide average of no more than 5 percent of the total number of angling interviews and retained fish would be missed. Statistical analyses confirmed that surveys can be terminated at 2 pm on weekend survey days throughout the year if no sport boat fishermen are interviewed prior to these times. We anticipate that 5-16 percent of the weekend survey days in the summer months and 10-67 percent in the remaining months can be terminated early, thus allowing survey personnel to perform more constructive duties without significantly reducing the precision of our landings estimates. Analyses are currently being conducted to determine if an early termination procedure can also be utilized on weekday surveys.

Additional increases in program efficiency have also been realized for both weekend and weekday survey days during the low use season following the completion of analyses assessing the possibility of cancelling surveys on "bad" weather days. It can now be predicted when a scheduled survey day will yield on average no more than two angling interviews; survey personnel can then be assigned other duties on that day without a loss in precision of landings estimates. Measurements of air temperature, wind speed, and the occurrence of rain, which have been recorded for each creel survey day since 1974, were subjected to multiple regression analysis, thus allowing the development of nomographs which are now used by survey personnel to assess the potential for survey cancellation. Initial results indicate that as much as 27 percent of the low use season survey days may qualify for cancellation in some bay systems.

DATA TABULATION

The data sheets used to record survey data are standardized for all creel teams. Three different data sheets are used to record data as it is collected in the creel program:

1) The roving count data sheet, used to record the number of empty trailers and empty boat slips at each site during roves.

2) The meteorological-hydrological data sheet, used to record pertinent weather information at the beginning and end of each survey.

Weather related information recorded at each survey site includes wind speed and direction; occurrence of cloud cover, precipita- tion, and fog; wave height and tide status; barometric pressure; and air temperature.

3) The marine resource harvest data sheet, used to record responses to interview questions and counts and measurements of landed species.

Harvest information recorded for each party interviewed includes the boat registration number, time of the interview, total length of the boat trip, the number of persons in the party and their county or state of residence, the specific activity the party was engaged in, the minor bay where the majority of the activity took place, the location of their boat trailer if one exists, the gear and bait types used, whether they bought or caught shrimp for bait, whether they found a tag in any fish caught, whether they fished near an oil or gas platform, the number of each species landed, and lengths of up to six individuals for each species landed. Individual fish weights are no longer required since the development of weight-length regression equations from previous survey data. We found that taking a maximum of six lengths per species will provide measurements for at least 75 percent of all fish encountered in surveys.

DATA PROCESSING

Processing of the data sheets begins with the coding and preliminary editing of the recorded information by the field biologists. The data sheets are submitted within 7 days to the harvest program leader who also edits the data and then submits it in monthly batches to Austin for computer entry. Printouts of the data are returned within a month to the field biologists who cross-check all the computerized data against the original data sheets. The editing process continues until the detail file data are error-free. A printout summarizing the results of each survey is run quarterly and is used to verify that all survey data sets are present prior to calculating our sport boat fishing landings and pressure estimates. The detail and summary data files can also be accessed by SAS and other statistical routines to perform special data analyses.

As previously mentioned, the proportional fishing pressure data from the roving counts and the fishing landings and pressure data from the on-site interviews are utilized to calculate mean daily landings and pressure in a bay system. These means are expanded by the number of fishable days in the season to yield the total estimated sport boat fishing landings and pressure. These estimates are provided individually and combined by species, day type, season, bay system, and areas fished. Areas fished include the bays, the passes, the Texas Territorial Sea and the Fishery Conservation Zone. Other values calculated along with the landings and pressure estimates are catch (landings) per unit effort, mean weights and lengths per species, mean fishing trip length and party size, and the percent of interviewed anglers from various categories of residential origin.

The landings and pressure estimates are published each year to satisfy our federal aid requirements. In addition, our own annually published Management Data Series provides tabulated comparisons of these estimates for the full ten continuous years of the creel program. These long-term monitoring summaries have been invaluable to fishery managers in Texas in assessing the need for and the impact of saltwater fishing regulations. Some of our recreational creel analyses have also been published in widely-read national and international scientific journals. Unpublished portions of the creel data are also frequently reviewed and cited as our Department responds to fishery questions from our Commission, the Legislature, the Gulf States Marine Fisheries Commission, the Gulf of Mexico Fishery Management Council, and the general public.

FUTURE PROGRAM IMPROVEMENT

Our marine recreational harvest program has evolved to its present status through a systematic appraisal of its objectives and the deficiencies in satisfying those objectives. The problems we have identified in the program are being addressed as rapidly as man-power and budget constraints allow.

For example, we realize that nearly 22 percent of all sport boat fishing trips are not accessible to our survey teams. The majority of these anglers have been identified from a mail-survey as those initiating their trips from private residences, generally canal subdivisions. Consequently, we have inventoried all of these boating access sites and are exploring the possibility of surveying them as well, perhaps through the use of interview personnel in boats stationed at the canal entrances.

The relatively high man-power requirements of the program continue to be a factor for resolution. Over 1200 man-days at a program cost of $400,000 were needed to provide the landings and pressure estimates in 1983-84. Our procedures for cancelling scheduled surveys on bad weather days or for terminating surveys early when no angling activity is encountered could yield significant savings in man-power. Other time and cost reduction measures are also being sought.

Another program problem, whose resolution is still in the planning stage, deals with the landings and pressure estimations for non-targeted activities and areas of fishing. Our proportional distribution of fishing pressure at each site is currently based on private boat fishing in the bays. This user group makes up the bulk of the total fishing pressure, but the predominance of

this user group leads to less precise landings estimates for smaller user groups such as party boat fishermen and Gulf fishermen. Examination of historical data may allow a reapportionment of the total survey days to include these groups in a more consistent and efficient sampling frequency.

An additional concern of our Department is the failure of the National Marine Fisheries Service (NMFS) to fully utilize the landings and pressure estimates we have provided for sport boat fishermen in Texas marine waters. Despite the greater precision of these estimates, NMFS duplicates our survey efforts on sport boat and charter boat fishermen in State waters. NMFS should concentrate on shoreline based fishing modes as called for in our cooperative statistics agreement and on sport boat fishermen in the FCZ as mandated by the Magnuson Fishery Conservation and Management Act. It is hoped that this problem can be resolved soon and that NMFS will better promote Federal-State cooperation by focusing their sampling efforts within their mandated area of responsibility.

SUMMARY AND CONCLUSION

The marine recreational fishery in Texas is a dynamic force on the biological resources and it affects the overall economy of the State. It provides a unique source of leisure for over 1.5 million people each year. To preserve the quality of this fishing experience requires a firm commitment by the resource managers and by those who fund these managers. Saltwater fishing is a sport for all generations. Scientific research to understand and regulate this sport to assure the continuance of these resources must also span the generations. In Texas, we have just begun to provide the kind of data base necessary to assess accurately what the fishery is, what it is doing, and where it should be going. Through the development of long-term harvest and relative abundance information, TPWD hopes not just to preserve but to improve the prospects for future generations to enjoy marine recreational fishing in Texas.

THE ADMINISTRATIVE, TECHNICAL, AND LEGAL ASPECTS OF SETTING UP AND USE OF AN INFORMATION SYSTEM --WEST COAST EXPERIENCES

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Since 1974, the Pacific Marine Fisheries Commission (PMFC) has worked actively with its member States and Federal fisheries agencies to improve the quality and timeliness of fisheries data collection, processing, and analysis and to produce regionally coherent data summaries required for regional fisheries conservation and management purposes. This effort had its formal inception in recommendations of albacore fishing industry leaders that Pacific Coast fisheries agencies organize and consolidate into coastwide coherent form West Coast fish landings and effort data, and information concerning vessel characteristics, for all Pacific Coast fisheries. Those leaders recognized that summation of separate State summaries can lead to serious misconceptions because of major differences in definitions and methods; also that any such summations produce misleading conclusions for highly mobile fisheries such as salmon and albacore (e.g., vessels may be counted several times if they land fish in two or more states).

This coastwide data coordination and consolidation effort received major impetus from enactment of the Magnuson Fisheries Conservation and Management Act of 1976, which established Regional Fishery Management Councils charged with management of regional fishery resources as units throughout the range of the species on the basis of the best available scientific and statistical information. Regionally comprehensive and coherent fisheries data clearly are needed on a timely basis to provide the information base required by these Regional Fishery Management Councils.

Regional fisheries data coordination requires effective cooperation and mutually supportive interactions among State fisheries agencies, which on the Pacific Coast collect all landing statistics and associated fisheries data from domestic fishermen, and among Pacific area NMFS Regions and Centers, which have responsibilities for foreign fisheries and for various special biological and economics data collection projects and programs. To assure effective communication and cooperation among those State and Federal entities, the Pacific area has been served since 1974 by a sequence of regional coordinating committees comprised of representatives from those participating agencies. First, there was the Albacore Coordination Committee and its Data System Task Group, which was superceded under NMFS sponsorship by the Coastwide Data Task Force, then by the Committee on Goals and Guidelines for Regional Fisheries Data Collection, and restructured in 1980 as the Pacific Coast Fisheries Data Committee.

The Pacific Coast Fisheries Data Committee consists of 14 members appointed by the directors of each participating agency. The participating agencies are: the Alaska, California, and Idaho Departments of Fish and Game; the Oregon Department of Fish and Wildlife; the Washington Departments of Fisheries and Game; the five Centers and Regions of the NMFS; the Pacific and North Pacific Fishery Management Councils (PFMC and NPFMC); and the PMFC.

This Data Committee was chartered in 1980 with four goals in mind:

1) To implement and manage a Pacific Fisheries Information Network (PacFIN) that aggregates summarized State and Federal fisheries data for use by fishery managers and associated agencies.

2) To provide data management consultation and technical advice to the Councils' Management Teams and participating agencies upon request.

3) To establish priorities and coordinate plans to improve the efficiency, effectiveness and timeliness of the data acquisition and delivery with a minimum of unnecessary duplication.

4) To promote the development and implementation of coastwide data collection standards to facilitate the merging of fisheries data in the PacFIN.

Financial support for Data Committee Activities is provided by the NMFS. At present, the bulk of the funding is provided by the Northwest Regional Office. Since 1981, the Data Committee has met nine times. At these semi-annual meetings, a wide range of topics concerning coastwide data are discussed and decisions regarding directions and priorities are conveyed to the PacFIN System Manager. The Data Committee currently provides direction to four major efforts: The PacFIN Research Data Base (RDB); the Inseason Salmon Reporting System; the

Joint-Venture Logbook project; and the PacFIN Management Information System (MIS).

The PacFIN RDB consists of individual fish ticket and vessel records provided annually by CDFG, ODFW, and WDF. The 1981 and 1982 data sets have been submitted, with 1983 data to be added in the very near future. This data base resides at the NMFS Southwest Fisheries Center (SWFC). There are no standard set of reports associated with this data base, since each research project has unique requirements. This data base contains data for all fish commercially landed in the three states. The vessel files provided by each state and a NMFS vessel file are merged producing a single file with one entry per vessel. The primary users of this data base seem to be economists, individuals investigating limited entry concepts, and other studies involving characterization of the fleets and using various vessel attributes.

The Inseason Salmon Reporting System consists of weekly catch and effort data provided by CDFG, ODFW, and WDF to a central data base. The data base for this system is maintained on a CDC computer system at the University of Washington by the Washington Department of Fisheries Harvest Management Division. The PacFIN Office developed and maintains a reporting system which combines this inseason data with historical data for the same time periods, as well as aggregating the data by management areas independent of State boundaries. During the season the NMFS' Northwest and Southwest regional offices, the PFMC, and the PFMC Salmon team retrieve this report to obtain the latest salmon catch and effort data.

The Joint-Venture Logbook project is a voluntary project initiated in 1983. Copies of logbooks maintained on catcher vessels or processor vessels are periodically mailed to the PacFIN Manager's office. These data, which contain information about individual tows, are entered into a data base at the Northwest and Alaska Fisheries Center (NWAFC).

The PacFIN MIS is the primary concern of the Data Committee. All of the directives concerning the MIS are implemented through the PacFIN Central Processing Office in conjunction with designated coordinators within the agencies participating in this MIS. The staff of the PacFIN office consists of a system/manager and a computer aide, and is located at the NWAFC in Seattle.

The Central Data Base has been implemented on a Burroughs B7811 dual processor computer system with 6 million bytes of main memory at the NWAFC. It was developed using the Burroughs DMSII data base management system (DBMS) and the Burroughs Algol programming language. The data base currently consumes approximately 250 million bytes of on-line disk storage. One of the features of the design is that certain summarized data are maintained in this on-line data base, thus minimizing the time required for report generation. Each year (1981 through 1984) included within the data base contains approximately 600,000 summary points (or records). The index-sequential access method provided by the DMSII DBMS allows for very fast retrieval of any one of those 600,000 records. All PacFIN activities on the B7811 account for about 5 percent of the total computer resources used.

The system has been operational since the fall of 1981. At that time CDFG, ODFW, WDF, and NWAFC were participants in the system. In April of 1984 ADFG began providing data also. The system designer developed the specification for the system with input from the PFMC Groundfish Team and members of the Data Committee. All agencies that provide data to the central data base do so based on this system specification. This system specification provides a well-defined interface between each agency's data system and the PacFIN Management Data Base.

The system specification initially called for data input via magnetic tape. By the spring of 1984 a data acquisition system had been implemented that allows for the transfer of data files from each state agency's computer directly to the Burroughs B7811 computer system. The system employs a microcomputer for capturing and forwarding of data. Using this type of system for monthly data collection makes the information available to managers 1 to 3 days sooner than via U.S. Mail or UPS. Magnetic tape is still used for large data files.

The central data base for this system consists of the latest landed catch and ex-vessel dollar value data for groundfish landed in the states of California, Oregon, and Washington. The data base currently includes data for commercially landed fish; data for recreational fisheries are not included. The latest landed catch information is also provided by the ADFG for their domestic groundfishery and by the NWAFC for all foreign and joint-venture fisheries. The data base currently contains information for groundfish species that are managed within the Pacific and North Pacific Councils' Groundfish Plans. All four states submit their data on a monthly frequency, while the NWAFC provides weekly udpates. With this frequency of input, the central data base is refreshed with the most recent information and that information can be provided to fisheries managers as they need it. The system can provide landed catch (and ex-vessel prices where available) stratified by month, species, area of catch, gear, and port of landing.

The primary users of the PacFIN MIS are the groundfish management teams of the Pacific and North Pacific Councils. The initial development of the system in 1981 focused on the information needs of the Pacific Council Team. More recent development efforts are atuned to satisfying the needs of the NPFMC groundfish teams. Although the fundamental purpose for this system is to support in-season management, the PacFIN MIS is also an historical data base as well, beginning with 1981. In fact, there are more individuals that request historical information than individuals that use

the system for in-season management. Various users have even asked that the Management Data Base be augmented with additional years prior to 1981.

Reports containing this management information are generated at the PacFIN office monthly and mailed to various individuals. Currently there are 34 recipients of the selection of reports that pertain to PFMC groundfish management. Thirty-two individuals receive NPFMC reports, while reports that contain information that is specific to California are distributed to 17 individuals; Oregon reports go to seven people; and six individuals receive reports containing data provided by WDF. A large selection of reports are also mailed to the PMFC office in Portland, where the staff distributes copies to interested individuals upon request. Some managers use the remote retrieval facility of the system to obtain particular reports via computer terminals connected to the NWAFC's computer system.

In addition to State and Federal fisheries agencies, a partial list of PacFIN MIS users include: the Army Corps of Engineers; the Japanese Longliners Association; the Department of Fisheries and Oceans, Canada, Marketing Services Branch; the Fisherman's Marketing Association; Fisherman's News; Marine Resources, Inc.; Pacific Fishing Magazine; Pacific Pearl Seafoods; Seafood Business Report; and the West Coast Fisheries Development Foundation.

The Data Committee's intent has always been to avoid legal problems as much as possible. Most of the legal problems on the West Coast seem to be involved with the confidentiality of fishers' and processors' business information. The PacFIN system is a cooperative where information is shared among State and Federal agencies via a central data base. Since the system is a cooperative one, the only data provided to the system are those data which each agency agrees to provide. In general all data provided to the central data base are aggregated in order to meet the confidentiality requirements of that agency. There are a few exceptions. One notable one is the joint-venture fishery off the Washington-Oregon-California coast. There was for sometime, only one joint-venture company operating in that fishery. So, to report the joint-venture catch of pacific whiting, even on an annual basis, would divulge that company's business volume.

The Management Database is intended to be non-confidential. The Research Database however, is inherently confidential. The primary reason that the RDB resides at the SWFC in La Jolla, is that California law does not allow confidential information to leave the state for any purpose. Oregon and Washington law, while disallowing the release of confidential information to the general public, allows for the transfer of potentially confidential information to Federal and State agencies for research purposes. As a practical matter, the type of data that would be published from the RDB would be highly aggregated, and thus non-confidential. In any case, information released from the RDB would meet Federal confidentiality standards, which are consistent with California's, Oregon's and Washington's.

The Data Committee has made contingency plans for establishing a RDB-North. This data base would reside at the NWAFC and would include Alaska, Washington, and Oregon data. The State of Alaska requires that un-aggregated confidential information can only be handled by an employee of the State of Alaska. A State of Alaska employee currently resides at the NWAFC.

Although the PacFIN MIS has been operational for sometime the system continues to be expanded and enhanced. Projects that are in progress or that have been approved by the Data Committee include:

1) Additional species and changes to various standard reports for the NPFMC GF Teams.

2) Expansion of the system to include an annual data feed containing landed catch, ex-vessel dollar value, and effort for the salmon fishery.

3) Merging the PMFC Data Series system with the PacFIN MIS, including the incorporation of Canada's domestic groundfish data.

That is the end of my prepared comments. I will be happy to try to answer any questions that you might have in the time remaining.

ASSESSING THE VALIDITY OF INFORMATION PROVIDED BY TAGGING STUDIES

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ABSTRACT Studies performed by Texas Parks and Wildlife Department (TPWD) have found fish identification volunteered by recreational anglers to agree 96 percent of the time with identifications made by biologists. TPWD also found fish lengths volunteered by anglers were not biased towards being too short or too long, however, there was a bias to report lengths to the nearest inch, half inch, and quarter inch. This phenomena results in mean lengths estimated from volunteered angler data to be more variable. TPWD has also found that trip lengths reported by anglers immediately after a fishing trip are unbiased and that the average error of estimation is within 0.3 h of the actual time 68 percent of the time. Comparisons of length-weight relations calculated from fish handled only by biologists and relations calculated from fish handled by anglers shows that angler reported fish weights are biased high for short fish and low for long fish. TPWD marine fisheries managers conclude that with proper background studies angler volunteered data can be used in fisheries management.

These include estimates for fishing pressure, growth, length-weight relationships, exploitation rates, and identification of common species landed.

INTRODUCTION

This presentation is entitled "Data Volunteered by Anglers -- Can They be Used in Management?" Specifically to calculate length-weight relationships, growth rates, species composition, or fishing trip lengths. The answer is -- yes. After reading some of the abstracts, I'm sure most of you are relieved to hear this. However, our answer is qualified: it is, more accurately, yes -- provided you have checked the accuracy and precision and know what to expect from this data. The rest of this presentation deals with how we checked for accuracy and precision and what these checks revealed about angler data.

Over 1 million saltwater recreational anglers' harvest in excess of 8 million fishes from Texas bays and the Territorial Sea. From the bays the most common species harvested are -- spotted seatrout, red drum, Atlantic croaker, sand seatrout, and southern flounder. From the Territorial Sea, king mackerel, Spanish mackerel, and red snapper are the most common species harvested.

These anglers are fishing in over 4 million surface acres, from the Texas-Louisiana border in the northeast to the Texas-Mexico border in the south. Along this roughly 300 miles of shoreline there are approximately 1.5 million acres in bays and 2.5 million acres in the Territorial Sea.

The fishery independent monitoring programs conducted by TPWD with trawls, bag seines, and gill nets result in fishes being captured alive, tagged, and released.

TPWD's saltwater recreational intercept survey is conducted coastwide and data on fishing activity, origin of anglers, and species and size composition of the harvest are collected.

These two programs have resulted in three data types: 1) statistics from individual fish which have been handled exclusively by TPWD biologists, 2) statistics from tagged fish which were initially handled by TPWD biologists and at a later date information on the same fish is reported by an angler, and finally 3) fish which were caught by anglers but measured by TPWD biologists without the angler's knowledge. In this last data type, a biologist would measure the party's catch during a survey and place a tag at random in one fish while another biologist diverted the attention of the angler from the measuring activities. We then patiently waited to see if the angler would provide us any information on the fish. We refer to this as surreptitious data.

Anglers definitely have a tendency to report weight data to the nearest fraction of a pound, especially 1 and one-half pounds. This same tendency is evident in length data.

A comparison of weight-length relationships calculated from red drum data handled only by TPWD and red drum data volunteered by anglers shows heavier fish for a given length for anglers and a greater variance. This indicates less precision in measurements made by anglers and since mean lengths are not biased, as we will show later, a positive bias in the reporting of weights for small to medium size fish. From the surreptitious data we found 96 percent of the angler fish identifications were correct. However, one must keep in mind that 50 percent of the nine different species tagged were spotted seatrout.

We also found out that anglers reported only 30 percent of the surreptitiously tagged fish. Unfortunately, the reporting rate was not the same for all species. Black drum, sheepshead, and Atlantic croaker reporting rates were much lower. Nor were reporting rates the same from all areas. Upper Laguna Madre Bay anglers apparently were a selective group.

Comparing 53 lengths reported by anglers with lengths taken at the time the fish was surreptitiously tagged indicated no reporting bias of lengths, but the lack of precision mentioned earlier is evident from the 11 percent of all measurements differing by 2 inches or more.

The growth rates calculated from red drum data collected exclusively by TPWD biologists was 0.52 mm/warm day free. The coefficient of determination was 0.89.

Residuals showed no problems with the model and the standard deviation about the regression line was 26 mm. The growth rate calculated from red drum data collected at release by TPWD biologists and at recapture by recreational anglers was 0.59 mm/warm day free. The coefficient of determination was 0.86.

The residuals showed no real problem with the model and the standard deviation about the regression line was 39 mm. The growth rate calculated from data returned by commercial anglers is very similar to recreational data including the residuals.

There are no statistical differences among these three growth rates. The precision is obviously better in data handled by TPWD biologists. However, it is limited, too limited, to perform bay to bay comparisons or time series analyses and the range of lengths available was smaller.

One piece of information you might be interested in is, "How quickly do anglers report on harvest information?" A graph was developed from 96 mail-in responses from the surreptitious tag study which shows 90 percent are received in 2 months and 95 percent are received in 3 months.

Another piece of data we have checked is boatfish trip length reports. We were able to do this by recording boat identification numbers and time of launch when they begin a trip and then match them with the interview of the same fishing party as they pulled out at the end of a trip. We routinely ask anglers how long their trip was during the interview.

Residuals show there is no trip length bias from length of trip nor change in variance. This means catch rates calculated with reported trip lengths are not biased.

In conclusion, we have found data reported by anglers are accurate -- with the exception of weight data. In the literature, Hiett and Warral (1977) and Jensen (1963) reported similar findings. However, Duel (1973) reported that fishermen overestimated fish lengths by 8 percent. Obviously, the precision of data reported by anglers is less than that recorded by biologists. However, the magnitude of this difference is not so great that the use of angler reported data is automatically disqualified. Without such data it may not be possible to perform many important comparisons.

NMFS CHARTERBOAT SURVEYS IN THE SOUTHEAST UNITED STATES; PROGRESS, PROBLEMS, AND PLANS

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ABSTRACT Personnel of the Panama City Laboratory of the National Marine Fisheries Service (NMFS) have been involved in surveys to determine catch per unit effort (CPUE) in recreational fisheries since 1975. Three different types of surveys have been conducted and evaluating methods of obtaining CPUE data from charter boats was one of the goals of each. An objective of the first survey, conducted in Bay County, Florida, during 1975, was to test methods for increasing the response rate to mailed questionnaires. Postal cards were used to sample charterboats' CPUE of king mackerel. Methods used to promote the survey and enhance response rates were: (a) a prize system, (b) person to person contact, and (c) television, radio, and newspaper advertising; the charterboat response rate was 58 percent. The second survey was conducted to obtain CPUE on the most abundant species of fishes caught by charterboats in the northeast Gulf of Mexico; we placed log books on 91 boats and promoted the survey with 1975's prize system and remote (telephone and mail) communication. After six months, response rate declined to 24 percent overall and to 0 percent in some of the areas, so the survey was discontinued. The third survey, initiated in 1982 and ongoing, seeks to obtain daily CPUE data on all species caught by charterboats from North Carolina to Texas and in the U.S. Caribbean. In 1982 nine charterboat captains were contracted for $100 per month to maintain daily logs and return the logs weekly; over 90 percent of the logs were returned. In 1983 the southeast United States was divided into 16 areas, including the U.S. Caribbean, and 100 boats were contracted for $50 per month; over 94 percent of the logs were returned. In 1984 31 boats in eight areas were contracted and in addition several captains who were in the 1983 survey volunteered to maintain and submit logs without reimbursement. Contractors returned over 94 percent and volunteers over 50 percent of the logs after three months.

The goals of our contractual survey in 1983-1984 were to develop more efficient methods of conducting the survey, to evaluate costs, and to obtain CPUE data on several species over a broad geographic area from charterboats and to provide quick turnaround of these data. Methods to improve efficiency involved sample frame development and promotion of the survey. The population that we sampled was defined as all charterboat captains that volunteered to contract with us to provide CPUE data. This population was defined by contacting all captains that we were aware of, determining their interest, and obtaining a letter of intent; from this list the selections were made and the contractual agreements were made. High response rate is usually required if survey methods are to be efficient. High rates were maintained in our survey by (a) paying a fee, (b) maintaining frequency communications via telephone and a monthly newsletter, and (c) by quick provision of updated information. Further, the data were published within two months of the end of each survey year. Estimated costs to run the 100-boat survey in 1983 totaled $96.3 thousand for about 27,000 logged days: total costs in thousands of dollars by category were: contracts, 46.8; salaries, 41.0; supplies, 6.5; and

communications, 2.0. Data obtained from the surveys provided for the first time a standard data base to evaluate species composition and relative abundance among areas in the southeast United States and generated a data base for comparing abundance among years. Future plans of the survey include the evaluation of mandatory reporting as a method of obtaining catch and effort data from random samples of charterboat captains in the southeast United States.

PROBLEMS AND NEEDS WITH RESPECT TO THE NMFS COMMERCIAL LANDINGS SURVEY AND NATIONAL RECREATIONAL SURVEY

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ABSTRACT The National Marine Fisheries Service (NMFS) commercial landings survey has trouble with the management of the data once it gets out of the field. Users of the information only have limited access to the data via microcomputer telecommunications. Interactive programs designed to provide the users with requested information yield different results than when NMFS processes the users' requests. There exists no file tracking system on the NMFS Burroughs computer, at this time, which allows the users to know how complete an individual states' landings are. Data from various areas of the Southeast are stored in different formats making analysis difficult. A data management review committee has been formed to include Management Council and State users plus NMFS data management people for the review and solution of these and other problems.

The National Marine Recreational Survey conducted by the NMFS provides useful fisheries information on a Gulf-wide basis. When this information is taken down to a state level it becomes markedly less precise and, therefore, less useful for fisheries management. If States are considering using their Wallop-Breaux funds in supplementing the National Marine Recreational Survey they had best look closely at what they expect to gain from the investment. Detection of a 30 percent or less difference in catch or catch per unit of effort (CPUE) may not be possible without an unreasonable amount of funding.

PROBLEMS AND NEEDS WITH RESPECT TO THE NMFS COMMERCIAL LANDINGS SURVEY FROM A STATE'S VIEWPOINT

Until 1982 the commercial landings of shellfish and finfish in the Gulf were collected and distributed to the States exclusively by the NMFS. In 1982 a project was undertaken to work with the States, via State-Federal cooperative agreements, to collect the commercial landings. This was brought about by the reduction in funding to the NMFS in the statistics area. At the present time all but one of the Gulf States have cooperative agreements with the NMFS, with Texas coming online April 1, 1985. As part of these various cooperative agreements data collection and coordination personnel are supplied by the States to work in concert with NMFS collection personnel, already in place, to supply the commercial landings information to the NMFS data management group in Miami for verification and data processing. Once the data is processed by the data management group, it is made available to the individual states via NMFS supplied microcomputers with an interactive data retrieval program to a Burroughs' computer in either Miami, Florida or Seattle, Washington. Additionally, standard finfish landings reports are distributed monthly. Other types of reports are available on request.

The collection of the commercial landings information has progressed smoothly for the State of Alabama with a regular and timely flow of information to the NMFS data management group. It is at this point that the flow of commercial landings information breaks down. The items I will mention are ones that I have encountered in working with Alabama's data over the past 14 months, though other States and users have mentioned having similar problems:

1) Telecommunications -- a communications link between the microcomputers and the Burroughs computers, Telenet, has not been available for use the majority of the time. This was due to either a technical failure on Telenet's part and/or an administrative error on NMFS's part, thus making the data unavailable.

2) Interactive Programs -- it appears, after conversations with NMFS that data accessed by Alabama with interactive programs is not the same data that NMFS has access to, whether this is a problem with the programs or the data organization remains to be seen, in either case it has been the source of much confusion.

3) Data Formats -- commercial fisheries data are currently entered in three different formats which make the analysis of Gulf-wide data difficult.

4) Data Entry, Edit, and Reporting Software -- in the original and subsequent State-Federal cooperative agreements NMFS agreed to supply software (programs) for the on-site entry, editing, and reporting of shrimp and finfish landings. To date none of these programs have been supplied to Alabama, or any other Gulf States to my knowledge, this puts the burden of data entry and editing on the NMFS and further removes the data from the States who collected it.

The lack of on-site software and the inability of the States and other users to have timely and accurate access to their commercial landings data previously supplied to NMFS data management, causes problems.

The Gulf of Mexico Fishery Management Council has had problems with access to and working with the data on the Burroughs system. In a four-page letter to Mr. Darcey of the NMFS Southeast Fisheries Center in Miami, Florida, Mr. Douglas Gregory of the Gulf Council staff detailed a number of problems he had working with the commercial data. These problems included:

1) Telecommunications with the Burroughs.

2) Poor file structures for different years of data.

3) Florida species codes which are different from all the other States.

4) Certain gear and water body codes existing on the system which are not documented.

5) Moderately sized data files sometimes can not be saved due to limited disc space.

6) Telecommunication with the 300 baud modes is time consuming and 1200 baud modes are needed along with better communications software.

The NMFS is currently reviewing its data management under a project called A76. At the end of which NMFS will decide whether or not to contract out the NMFS data management responsibilities or keep them inhouse. Telecommunications between Burroughs computer and the Gulf States is not possible at this time. Two toll-free telephone lines, 800 numbers, are in the process of being setup by NMFS for the use of the States for communicating with the Burroughs computer. At sometime in the future, each State may be "hardwired" into the Burroughs system. The data entry, edit, and reporting software (to be supplied by NMFS) has been under development since January of 1984 and is scheduled to be delivered sometime this spring.

In 1984 a data processing review committee was formed by NMFS data management in Miami, Florida for internal review of data management problems and to plan for the future requirements of the users. This committee has been expanded this year to include: the chairmen of the Atlantic and Gulf States Statistical Committees, biostatisticians from the Atlantic and Gulf Councils, and a Sea Grant representative. At the expanded committees' first meeting held at the end of February, members discussed some of the NMFS internally identified data management problems, with the primary focus of the meeting being user specific problems with NMFS data processing support. Additionally, future hardware, software, and data processing support needs were discussed. It was generally felt by the majority of the non- NMFS personnel present that a solid framework was outlined for addressing some of the important data management problems just mentioned.

The Gulf of Mexico Fishery Management Council is currently considering a data collection FMP that would increase dependence on the NMFS data management group for commercial fisheries statistics. As timely and accurate data are critical to the development of fisheries management plans, and in light of the known and unknown problems associated with NMFS data management, it seems only logical that no further programs or projects be undertaken, at a State or Gulf level, that involve NMFS data management until the current problems are resolved to the satisfaction of the users of the information.

PROBLEMS AND NEEDS WITH RESPECT TO THE NMFS NATIONAL RECREATIONAL SURVEY

With the recent passage of the Wallop-Breaux Bill, also known as the extended Dingell-Johnson Bill, approximately $100 million in matching funds will be available to State conservation agencies for use in the area of recreational fishing. Some Gulf States are considering using their Wallop-Breaux funds for marine recreational surveys, though initially the majority are going to use the money for capital improvements as suggested by the U.S. Fish and Wildlife Service.

The NMFS by letter and through meetings in the fall and winter of 1984, has indicated a desire for the Gulf States to consider obligating part of their Wallop-Breaux funds for increasing the number of samples taken in their States as part of the National Marine Recreational Fishing Survey. The NMFS and Market Facts Inc., a firm contracted by NMFS to analyze the data from the National Marine Recreational Survey, feel that some States' needs for marine recreational fisheries statistics can be served by increasing the number of samples taken as a part of this survey. The additional samples may be taken by either NMFS contracted personnel or the individual States' personnel. From data presented to me by Market Facts, Inc. recently for the State of Alabama, it appears that taking 2,500 interview samples would enable the detection of a 10 percent difference in catch/trip for a species with a coefficient of variation (CV) of 50 percent at the

90 percent confidence level across years. The cost of each interview is $15.03, making the total interview cost $24,195. Additional tabulation costs would run $1,000 for tables every two months and a year-end summary plus $1,850 to process the 2,500 intercepts. This would make the total cost $27,145. The costs vary from state to state. The level of relative precision, CV, for most of the species of interest to the State of Alabama are above a CV level of 50 percent, i.e. spotted seatrout - 65 percent, red drum - 101 percent, red snapper - 55 percent, and southern flounder - 78 percent with only three of eleven species less than 50 percent. These percentages are from the 1980 data for Alabama provided by Market Facts, Inc. In 1981 all species had a CV less than 50 percent except for red snapper at 43 percent. CPUE in the survey is catch per trip rather than catch per angler hour. Catch is expressed as the number of fish caught rather than the weight, though weight is collected in the survey. The National Marine Recreational Survey is a site survey. Given the dispersed nature of marine recreational fishing a roving intercept survey, similar to the one being carried out in Alabama at the moment, previously discussed by Dr. Malvestuto, might be better suited to the marine areas of the Gulf. The roving survey over time might provide more accurate estimates and if non-uniform probability sampling were used, more precise ones. If a State conservation agency desires to increase the precision of its marine recreational fishery data then limited amounts of money put into the National Marine Recreational Survey might be the way to go, based on Alabama's data. The danger being that year to year differences may not be detectable. If a conservation agency, on the other hand, wanted to detect statistically significant differences in catch and CPUE at a species level from year to year, it should closely consider whether it should utilize either significantly enhanced data from the National Marine Recreational Survey or conducting its own recreational survey. If the national survey data is not adequate at the State level and a State can not afford to conduct its own survey then perhaps its Wallop-Breaux funds would be better spent on boat ramps and access points. The goal of this section of the talk is to make the Gulf States aware of the trade-offs associated with the National Marine Recreational Survey and to encourage them to closely consider what type of information they want from their marine recreational fisheries. This is not saying that the National Marine Recreational Survey is not adequate on a Gulf-wide basis and may not serve the requirements of other states.