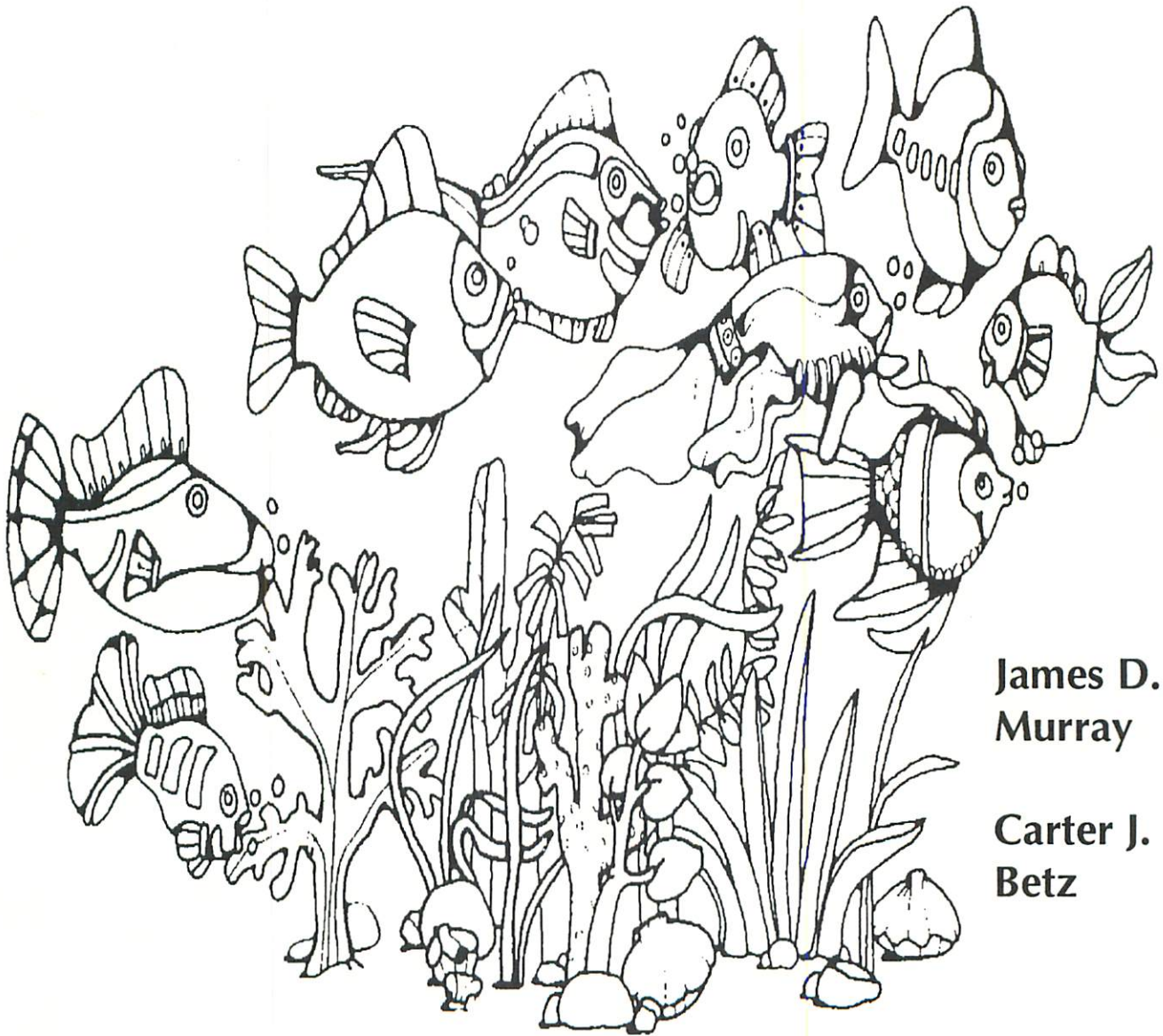


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User Views of Artificial Reef Management in the Southeast



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by

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Abstract

This paper reports on a survey of individuals representing sport fishermen, sport divers, commercial fishermen and environmentalists in North Carolina, Florida and Texas.

The purpose of the survey was fourfold:

- ❖ To document the awareness and use of artificial reefs by different user groups.
- ❖ To examine the priorities placed on artificial reef building activities in relation to other fishery issues.
- ❖ To identify major concerns of artificial reef programs by user groups.
- ❖ To report on the acceptance of various management measures which could be used to minimize artificial reef conflicts.

Of a total mailing of 1,654 questionnaires, 721 returns were received for a return rate of 43.6%. The report profiles artificial reef users, examines their general knowledge and use of artificial reefs, and identifies their views on artificial reef administration, funding, siting, construction, information, evaluation, conflict experiences and acceptance of management restrictions.

Executive Summary

For a variety of reasons — including growth in the number of saltwater anglers, a perceived reduction in catch per unit of effort by sport fishermen, and increased political activism by sport fishing groups — the number of artificial reef sites on the Atlantic coast has approximately doubled over the past decade (McGurrin, 1988).

The popularity of artificial reefs has led to increased pressure on state agencies to build new sites, and increased conflicts between and within user groups on existing sites. As competition for our fishery resources grows and artificial reef construction funding increases through Wallop-Breaux and/or saltwater fishing license receipts, fishery managers can anticipate increased conflicts. The purpose of this paper is fourfold:

- ◆ To document the awareness and use of artificial reefs by different user groups.
- ◆ To examine the priorities placed on artificial reef building activities in relation to other fishery issues.
- ◆ To identify major concerns of artificial reef programs by user groups.
- ◆ To report on the acceptance of various management measures which could be used to minimize artificial reef conflicts.

It reports on responses to a survey from 721 individuals representing four interest groups in three states (North Carolina, Florida and Texas) in the Southeast region.


A total of 1,654 surveys were mailed and 721 were returned and considered usable for a return rate of 43.6%. The sample consisted largely of club or association members. Commercial fishermen and environmentalists were included in the sample because it was hypothesized that they would view themselves as adversely affected by artificial reef development. Statistical analyses were conducted using SAS software. Comparisons were made between user groups and states using Chi-square tests of independence for nominal scale variables, and two-way analysis of variance (ANOVA) tests for ordinal and interval scaled survey items.

The typical artificial reef user was a 45.1-year-old male, who resided 52.1 miles from the nearest ocean waters, completed 16.1 years of school and had an annual household income of \$56,610. In general, commercial fishermen and environmentalists were less supportive of artificial reef benefits and construction than sport fishermen and sport divers, but no groups opposed artificial reef development.

SCUBA diving ranked as the most popular activity in the survey. A much higher percentage of diving trips (54.2%) versus fishing trips (15.5%) are made to artificial reefs.

Users were highly satisfied with the North Carolina and Florida artificial reef programs, but somewhat dissatisfied with the Texas program. The three agencies do not do a very good job of informing the public about their artificial reef activities.

The artificial reef user community is willing to pay for increased expenditures for artificial reef development. There was broad support among all groups and states for purchasing \$10 to \$15 artificial reef stamps, if the money were returned to the artificial reef program. There are no data to determine if conflict at artificial reef sites is increasing, but conflict is common. Only 78.6% of the respondents had experienced a conflict. The most frequent type of conflict was crowding followed by divers anchoring and prohibiting sport fishing. The conflicts relate to competition for use of a finite space. With the possible exception of commercial fishermen, the survey showed that the users overwhelmingly will accept manage-

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ment restrictions to preserve the resource and reduce conflict.

In the future, the challenge will be for fisheries agencies to develop regulations with input from the user community. With a favorable process in place, the user community will accept both new construction and restrictions, and the resource will be maintained.

A User Assessment of Southeastern Artificial Reef Programs

Chapter 1 - Introduction

□ Introduction

For centuries, artificial reefs have been constructed to enhance fisheries in Southeast Asia. In the U.S., reef building dates to the 1830's, but only recently have we seen dramatic increases in activity. As of 1987, 572 permitted artificial reef sites were documented in U.S. marine or estuarine waters (McGurrin, et al. 1989). Along the Atlantic Coast, the number of reef sites have approximately doubled over the past decade (McGurrin, 1988). Among the reasons for increased construction is a rapid increase in the number of saltwater anglers relative to the increase in the general population. Since 1955, the number of saltwater anglers has risen from 4 1/2 million to more than 17 million, a growth rate more than 2 1/2 times that of the general population (Chandler, 1984). In addition, greater affluence among the population has allowed improvements in offshore fishing capabilities through the use of larger, electronically equipped sportfishing vessels. This growth has fostered the development of a myriad of saltwater fishing tournaments, and anglers have become more politically active through membership in a burgeoning number of fishing clubs and associations.

Increasing catches by sport fishermen, added to a relatively stable commercial fishing catch, are impacting fishery resources in southeastern waters. Since the capacity of the marine environment to produce fish is relatively constant or possibly decreasing due to loss of habitat and water quality degradation, more fishing pressure has led to fewer fish per hour of fishing. One result of this situation is that anglers have called on government agencies to develop fisheries enhancement programs. Artificial reef development has been a particularly popular enhancement activity, and most coastal states have responded by increasing reef construction during the past decade. The 1986 expansion of the Dingell-Johnson Act provided a new source of revenue to state agencies from which to fund reef expansion. About \$160 million was available to the states in Fiscal Year 1988 from this source.

Although sport fishing is the use most commonly associated with artificial reefs, other interest groups such as sportdiving, commercial fishing and environmentalists are also affected. The growth in sportdiving has also been dramatic. Participants in this activity, which did not begin until the advent of SCUBA after World War II, have increased rapidly in the past decade. Although usually built for sportfishing or diving purposes, most states do not preclude commercial fishing activities in and around reefs. With growing public awareness over plastic debris and other forms of ocean dumping, artificial reef managers are becoming concerned

that environmental groups may oppose certain kinds of reef building in the future (Murray, 1989).

The National Fishing Enhancement Act of 1984 directed the Secretary of Commerce to develop and publish a long term national artificial reef plan to promote and facilitate responsible and effective artificial reef use based on the best scientific information available. The plan, published in 1985, stated "it is imperative that appropriate State agencies play a major role in the development of national and site-specific guidelines for artificial reefs." (Stone, 1985). Among the research needs identified in the plan were, "compile and evaluate the state of the art information on artificial reef research, development and management . . . document the social and economic values of artificial reefs," and develop information on "why do some fishermen use artificial reefs while others do not?"

In summarizing a 1987 conference on artificial habitats for fisheries, Seaman (1989) noted that we will see a further clarification of artificial reef goals as their popularity and the opportunity for conflict among users increases. In an analysis of the economic benefits of artificial reefs in Dade County, Florida, Milon (1987) noted, "Despite the growing awareness of and interest in artificial reefs, there has been relatively little formal research on user group perceptions of artificial reefs, the influence of siting and design features on user choice of reef sites versus natural habitat, and the economic benefits of reefs for user groups and the local community." Based on interviews with 12 artificial reef managers, Murray (1989) recommended studies be undertaken to evaluate the requirements and preferences of the user communities.

The costs of artificial reef construction activities in the Southeast by private, county and state agencies are estimated at several million dollars per year. Although some research has been conducted regarding various aspects of reef effectiveness, little systematic work has been done to assess the preferences, concerns and conflicts of reef user groups. As Bohnsack and Sutherland (1985) stated in a review of 417 artificial reef research papers,

"Too much emphasis is often given to amateur input especially in deciding where and where not to build reefs. Some programs appear to continually build reefs without having a well defined objective or end point." ... and "most artificial reef funds are spent on construction and installation. Research, which could lead to intelligent management decisions, has not been adequately funded."

Very few state agencies have developed formal mechanisms to solicit opinions from sport fishermen regarding artificial reefs. In a recent assessment of artificial reef programs from New Jersey to Texas, only one of twelve artificial reef managers actively used an advisory committee to obtain input from fishermen (Murray, 1989). Typically, reef managers make decisions in response to pressure from sportfishing groups and political interests or by attempting to minimize problems with other resource users, notably commercial fishermen. Under these circumstances reef managers are subject to capture by narrow interest groups at the expense of their broader constituency. For example, in the recent study by Murray cited above, several reef managers expressed concern that their program

was concentrating on offshore artificial reefs at the expense of more accessible inshore sites. The sport fishermen with larger vessels capable of fishing the offshore reefs, were better organized and more effective at lobbying both the agency and politicians to build reefs more suitable to their use.

As reef building activities increase, the frequency and diversity of conflicts among user groups will also increase. Conflicts such as materials breaking up and obstructing trawling operations are obvious, but other conflicts are more subtle and can occur both among and within user groups. Examples of these include:

- ▼ Competition for reef access among user groups (commercial versus sport fishermen versus SCUBA divers) and within these same groups (potters versus netters versus electric reel fishermen; trollers versus bottom fishermen; and sport divers versus spear fishermen).
- ▼ Concern over the production versus aggregation function of reefs. Environmental interests and conservation minded sport and commercial fishermen have opposed certain types of reefs because the reefs are perceived to only aggregate fish thus making them easier to catch without enhancing fisheries productivity.
- ▼ Conflict over gear restrictions and nominations for Special Management Zone classifications by the South Atlantic Fishery Management Council.
- ▼ Competition between offshore and inshore sport fishermen or site development.

Recreation resource user conflicts are not unique to the marine fishing environment. There is a growing body of literature in the outdoor recreation field which addresses why some people are not getting what they want from their recreation experience (Jacob, 1978). According to Jacob, conflict is defined as interference with goal attainment attributed to the behavior of another. In order to devise management strategies to minimize conflict, it is necessary to understand the goals of the various resource users and how other competing users may frustrate those goals.

Taxpayer monies are being used by public agencies to enhance the fishery for constituent groups. In many cases, the funds are generated from taxes on these constituencies (Wallop-Breaux, saltwater fishing licenses). In order to maximize the public benefits accruing from these programs it is imperative that reef managers and agency decision makers understand for whom they are building reefs and what their problems and preferences are for reef development. Since six of the eight states in the Southeast region do not have approved artificial reef management plans or policies, and five of these have indicated they will be developing plans, the information from this report should prove timely in order to help state planners better understand the needs of their constituencies. This ultimately should lead to improved state planning and management of artificial reef programs.

By nature, most public officials are more comfortable discussing issues with a relatively small network of vocal constituents. These individuals do not always accurately represent the opinions of the whole group (Johnson and Murray, 1990). This study examined the

perceptions of conflict from a broad sample of constituents both within and across interest groups in several states in the Southeast region. It is anticipated it will provide more extensive information to decision-makers about their public and should lead to a broader evaluation of alternative management schemes.

This paper documents the awareness and use of artificial reefs by different user groups, examines the public priorities placed on artificial reef building activities in relation to other fishery issues, identifies major concerns of artificial reef programs held by user groups and reports on user group acceptance of various management measures which could be used to minimize artificial reef conflicts. The report is based on 721 responses from 1,654 individuals representing four interest groups (sport fishermen, sport divers, commercial fishermen and environmentalists) in three states (North Carolina, Florida and Texas) in the Southeast region.

□ Objectives

The three principal objectives of the study were:

- ▼ To identify knowledge of and attitudes about artificial reefs by constituency groups in the Southeast region. Four affected constituent groups in three states were surveyed. Information was obtained on awareness of artificial reefs, usage patterns, priorities for artificial reef development in relation to other issues, priorities for types and funding of artificial reef development, and major concerns about artificial reefs.
- ▼ To determine the relative importance of various artificial reef conflicts and to assess strategies to minimize these. Numerous present and potential conflicts have been outlined in the literature and in a recent study of artificial reef managers by Murray (1989). Information on the types and extent of conflict and preferences for programs designed to minimize them was obtained from the survey.
- ▼ To develop recommendations and inform artificial reef managers about the management strategies most acceptable to their constituencies. The intended audience for this paper is fisheries managers. The conclusions and recommendations provide management scenarios based on preferences for and acceptance of types of artificial reef programs and regulations.

□ Methodology

A questionnaire was sent to representatives of the sport fishing, sport diving, commercial fishing and environmental communities. To facilitate analysis, most of the 37 questions were closed-ended. Eleven questions provided respondents an opportunity to provide additional information. Four of the questions used a Likert scale (Agresti and Agresti, 1979) (see Appendix I for the survey). The questionnaire contained eight sections on various aspects of user perceptions of artificial reefs including general knowledge and use, administration, funding, siting/construction, information evaluation, conflict resolution and a user profile. The questions in the sections

on administration, funding, siting/construction, information and evaluation were similar to questions asked of artificial reef managers in a related study (Murray, 1989) assessing policy and management of artificial reef programs in the Southeast and Mid-Atlantic states. Although beyond the scope of this paper, the similar format will allow the authors at a later date to compare and contrast user and manager opinions about artificial reef development and management. The section on conflict resolution was of special interest to managers at the Southeast office of the National Marine Fisheries Service, who are interested in the levels, types and acceptance of management options to minimize artificial reef conflict.

The initial draft of the questionnaire was reviewed by two artificial reef managers, the Chief of Recreational Fisheries at the Southeast Regional Office of The National Marine Fisheries Service, and several faculty members at North Carolina State University. After revision it was pretested on July 11, 1989 at the monthly meeting of the Raleigh Saltwater Fishing Club, whose members are familiar with artificial reefs. Nineteen members completed the questionnaire, which took them between 10 and 15 minutes. Except for one person who misinterpreted one question all participants interpreted all questions correctly. Following the pre-test, 1,654 copies of the questionnaire were sent in a first mailing on July 25, 1989. This mailing was followed by a postcard reminder approximately three weeks later. Another copy of the survey was sent to non-respondents two and one-half weeks after that. A total of 721 usable returns (43.6%) were received (Table I). The highest response rate came from sport divers (51.2%) while the lowest came from commercial fishermen (25.0%). Sport fishermen responded at a rate of 49.9%, while 44.6% of the environmentalists returned the survey. Thirty-two addresses were incorrect and 18 respondents completed the survey but removed the identification code.

To achieve geographic and artificial reef user diversity, the survey included a minimum of 100 representatives of sport fishermen, sport divers, commercial fishermen and environmentalists in North Carolina, Florida and Texas. The Southeastern study region encompassed the coast from the North Carolina/Virginia border to the Texas/Mexico border and was chosen to coincide with the jurisdiction of the Southeast Regional Office of NMFS. The choice of three states provided geographic diversity—one South Atlantic and one Gulf Coast state with Florida located centrally to both the Gulf and Atlantic coastline. The three states were also chosen because of their artificial reef programmatic diversity. As of 1989 the Texas program was relatively inactive. By contrast, Florida has built more reefs than any other state—much of it at the private or county level. North Carolina's program has been increasingly active and is managed by the state. The choice allowed comparisons of user attitudes between states with varying management schemes.

The four groups were chosen on the basis of their intensity of involvement, interest or potential to be affected by artificial reefs. The sport fishing and sport diving communities are the most obvious beneficiaries of artificial reef building. They have been vocal advocates for reef building activities. Commercial fishermen can be either positively or negatively impacted by artificial reefs. Improper

siting can reduce fishing area and movement of materials can obstruct nets. Commercial fishermen can also gain fishing grounds because some states permit commercial fishing activities in and around artificial reefs. Also, there is nothing to preclude commercial fishing organizations from either building reefs or having agencies construct reefs for commercial fishing purposes.

The decision to solicit the views of the environmental community came in part from artificial reef managers' concerns about the public associating reef building with ocean dumping, and in part from comments heard about ocean dumping concerns from public audiences when the senior author presented lectures on artificial reefs. In the past few years there has been increasing public alarm over ocean dumping, plastic debris in the marine environment and hypodermic needles washing up on the beaches. An objective of the study was to determine the level of concerns, if any, the environmental community might have over artificial reef development. Environmental concerns should also be of interest to agency decision-makers and could influence siting, material evaluation or informational program decisions.

The groups selected for the sample are shown in Table II. Since most of the groups provided mailing lists which exceeded the goal of a minimum sample size of 100 and the project budget allowed for increasing the sample, a sample size of up to 150 was used where possible. Instead of the minimum sample of 1,200 (3 states x 4 groups x 100 individuals/group), 1,654 surveys were mailed. The individuals sampled were selected because of their interest in the coastal environment or marine fisheries; their identification with one of the four major groups and, most importantly; their likelihood of having at least a passing knowledge about artificial reefs. The intent was to sample interested and informed individuals who would be impacted either positively or negatively by artificial reefs. The results indicated that this selection was a success. More than eighty-two percent (82.5%) of all respondents said they were either very (30.6%) or somewhat (51.9%) familiar with artificial reefs built off their state's coast. In addition, 62.7% of the respondents said they had used an artificial reef.

Experience has shown that members of clubs are often more highly involved in activities represented by their club and consequently more informed than non-club members. For example, a study of members of the Gulf Coast Conservation Association, Ditton and Holland (1984), found they "exhibited a pattern of enhanced involvement in fishing through magazines, club membership, tournament participation, boat ownership and higher self-reported skill and catch levels." For these reasons club members were chosen in each state. The breakdown of our sample by group, membership type, state and number sampled is shown in Table II. For sport fishermen, the state chapters of the Coastal Conservation Association were selected, named respectively in Texas, Florida and North Carolina, the Coastal Conservation Association, Florida Conservation Association and Atlantic Coast Conservation Association. For sport divers the sample chosen was from the Houston Underwater Club and South Florida SCUBA club, whose members do most of their diving in the nearby marine environment. Since there was not a similar club in North Carolina, a Cary, North Carolina dive shop's coastal mailing list was used.

For commercial fishermen, the interest was in clubs or associations representing fishermen who fished in offshore areas, where they would more likely be affected by artificial reefs. In Texas and Florida the membership lists of the Texas Shrimp Association and Offshore Fishermen of Florida were used. In North Carolina, a statewide list or club with 100 fishermen was not available. The North Carolina Division of Marine Fisheries provided us a random list of commercial fishing vessel license holders with vessels over 55 feet. This list was used for the sample. It was believed that this class of vessel was most likely to be fishing in offshore waters.

For the environmental community sample, the population of interest was the generic environmental group whose members mostly lived at or near the coast. Our objective was to determine the attitudes of environmentally conscious coastal citizens toward artificial reef development. Chosen were coastal chapters of the National Audubon Society in Texas and Florida, and, since the only coastal North Carolina Audubon chapter would not provide their mailing list, the North Carolina Coastal Federation. Specifically, the Audubon chapters included in the survey were the Houston chapter in Texas and the Jacksonville and Tampa chapters in Florida. Although the Audubon Society is perceived by some as a birding organization, it is a broad-based national environmental group. The N.C. Coastal Federation is an environmental interest group with statewide membership, but the large majority are coastal residents. Although its emphasis is on the coastal environment, it has taken positions on a variety of marine related issues and is not considered a single or narrow issue organization.

In all cases, the individuals sampled from the 12 groups were selected at random. Although there was participation by members of one group in activities associated with another group (e.g. most commercial fishermen, sport divers and environmentalists reported they also sport fished), the club sub-samples represented distinct populations. None of the 1,654 selected individuals appeared as a member of another club. Based on our sample, several cautions should be used when interpreting the data. First, the results cannot be generalized for the entire population they represent. For example, the views of what we refer to as environmentalists do not necessarily reflect the views of all environmentalists. Members of Greenpeace or Earth First! may have quite different opinions about artificial reef development. Second, the opinions of casual observers are not necessarily reflected in the study. Club or association members were chosen because they were more likely to be informed about artificial reefs. Less avid sport fishermen or divers who are not as likely to be represented may prefer to use marine related public monies for other uses such as beach access, boat ramps or fishing piers. Last, comparisons within groups and between states should be made with care. For example, members of the Texas Shrimp Association are mostly shrimp trawlers, while the membership of the Offshore Fishermen of Florida includes more diverse types of commercial fishermen, some of whom may longline or use fish traps and be more likely to benefit by artificial reefs.

❑ **Statistical Analyses**

Statistical analyses of the sample were conducted using Statisti-

**Table I
Survey Return Rates By Group**

	Total Mailed	Incorrect Addresses	Returned	% Returned
Environmentalists	449	10	196	44.6
Sport Fishermen	429	6	211	49.9
Commercial Fishermen	362	6	89	25.0
Sport Divers	414	10	207	51.2
Unidentified**	--	--	18	--
Total	1,654	32	721	43.6

****Unidentified means the survey was completed but the respondents removed the identification codes. These returns were used for the overall results, but could not be broken out by group.**

**Table II
The Sample by Group, State, Membership Type and Number Sampled**

<u>Group</u>	<u>State</u>	<u>Membership Type</u>	<u>Number Sampled</u>
Environmentalists	TX	Houston Chapter-Audubon Society	156
	FL	Jacksonville and Tampa Chapters-Audubon Society	151
	NC	The North Carolina Coastal Federation	142
		Subtotal	449
Sport Fishermen	TX	Coastal Conservation Association	159
	FL	Florida Conservation Association	120
	NC	Atlantic Coast Conservation Association	150
		Subtotal	429
Commercial Fishermen	TX	Texas Shrimp Association	100
	FL	Offshore Fishermen of Florida	150
	NC	Large Vessel (>55') Commercial Fishing License Holders	112
		Subtotal	362
Sport Divers	TX	Houston Underwater Club	154
	FL	South Florida SCUBA Divers Club	151
	NC	Coastal Divers from Reef and Ridge Sports, Cary, N.C.	109
		Subtotal	414
		Grand Total	1,654

cal Analysis System (SAS) software on the IBM mainframe computer at North Carolina State University. Data were transcribed from the questionnaires onto code sheets for data entry into the NCSU mainframe. An SAS program was written to define the variables and construct an SAS data set.

One of the purposes of the study was to compare differences between the four groups (GROUP) and the three states (STATE) sampled. This objective was desired for a variety of variables at the nominal, ordinal, and interval levels of measurement. A Chi-square test of independence was conducted on the nominal scale variables. The tests were designed so that the variable of interest was tested across GROUP, while holding STATE constant or vice versa.

For example, a question asked respondents if they would be willing to serve on an artificial reef advisory board (ADVIS). Closed-ended responses to this question were "yes", "no", and "need more information".

The null hypothesis was: GROUP and ADVIS are independent; the alternative hypothesis was: GROUP and ADVIS are *not* independent. This test was conducted separately for each STATE in order to determine the effect of the respondent's state of residence on the Chi-square test of independence. To illustrate, if the null hypothesis were rejected for Texas respondents but not for those from Florida and North Carolina, one would conclude that only in Texas did group type have any bearing on an individual's willingness to serve on an advisory board.

Ordinal-level measurements in the questionnaire were mostly Likert-type questions and were treated as interval-scaled data. Two-Way Analysis of Variance (ANOVA) tests were used to determine the influence of GROUP and STATE for the ordinal and interval scaled survey items. The Two-Way ANOVA allows for the comparison of means across one variable (GROUP), while holding constant the effect of a second variable (STATE). An example from the Artificial Reef Users Study is a Likert-type question dealing with prioritization of reef expenditures. Respondents were presented with the statement, "Enhancement of existing reef sites" and asked to indicate their perception of the level of importance of this type of expenditure on a five-point scale ranging from "very important" to "very unimportant".

Mean scores on this variable were computed by SAS for the overall sample, and by each of the four group types and three sampled states. Further, a 4 x 3 table of GROUP x STATE gives the mean value of each individual cell. The Two-Way ANOVA runs three separate tests with the following null hypotheses: a) mean scores are equal across the four group types, b) mean scores are equal across the three states, and c) there is no interaction between GROUP and STATE.

How the researcher proceeds depends on whether interaction is present. If the interaction test is significant at some prescribed level (usually $\alpha < .05$), then the conclusion is that interaction does exist, i.e., the pattern of mean values for one variable is not the same across the levels of a second variable. In cases of no interaction, means will undoubtedly be different across the levels of a second variable, but the order or pattern of those means will not be significantly different.

If interaction is significant, GROUP means cannot be compared across the STATE variable, but must be compared *within* each state. If there is no interaction, it is acceptable to compare GROUP means without regard to STATE, or similarly, to compare STATE means without regard to GROUP. To do either of these, however, the GROUP and STATE ANOVA tests must be significant at $\alpha < .05$. Once it is determined if the three ANOVA tests are significant, the next step is to select a multiple comparison test to determine "significant differences" in the mean scores across the categories of the classification variables.

For this study, Tukey's method of comparison was selected because it is a conservative test which reduces the probability that a Type I error will be made, i.e., rejecting the null hypothesis of no difference when in fact there is no difference. Tukey's is one of several multiple comparison techniques which are more rigorous when making a large number of comparisons (Agresti and Agresti, 1979).

Chapter II : Results

□ Profile of Users

The typical respondent was a 45.1-year-old male, who resided 52.1 miles from the nearest ocean waters, completed 16.1 years of school and had an annual household income of \$56,610 (Table III). The table shows the socio-economic profile of the respondents by group type. Sport divers were significantly younger (39.0 years) than the other three groups. The sample was overwhelmingly male, with the percentage of males ranging from a high of 99.5% of sport fishermen and low of 67.4% of environmentalists.

Sport fishermen lived the farthest from ocean waters (82.8 miles) while commercial fishermen lived the closest (15.2 miles).

Sport fishermen, sport divers and environmentalists averaged the equivalent of a college degree (16.3, 16.1, and 16.7 years of education, respectively), while commercial fishermen completed an average of 12.6 years of school which was significantly lower than the other three groups. There were also significant differences in income with sport fishermen reporting the highest annual household income level (\$66,907) and commercial fishermen the lowest (\$44,384).

□ General Knowledge and Use

In activities related to artificial reefs' environmentalists had participated for 8.0 years, sport fishermen for 24.5, commercial fishermen for 25.5 and sport divers for 9.6 years (Table IV). Although not shown in the table, there was much crossover by respondents between activities. For example, all four groups had high participation rates in sport fishing.

Overall, 82 percent of the respondents were either very or somewhat familiar with the artificial reefs built off their state's coast. As shown in Table V, the degree of familiarity was not evenly distributed between all four groups. Environmentalists had a significantly lower level of familiarity than the other groups but even for this group 69 percent were familiar with artificial reefs. Of the three states, the Texas sample had a lower degree of familiarity (70.2%) than North Carolina (84.5%) or Florida (90.3%).

Close to two-thirds (62.7%) of respondents had used an artificial reef in their state. The breakdown of use by group was: environmentalists, 45.3%; sport fishermen, 70.1%; commercial fishermen, 46.4%; and sport divers, 75.5. Texas respondents were less likely to have used artificial reefs (44.0%) than their Florida (71.4%) and North Carolina (69.7%) counterparts. The average user had used artificial reefs for 8.1 years. There was a significant difference among groups, with sport (24.4%) and commercial fishermen (24.9%) using artificial reefs longer than divers (15.0%) and environmentalists (17.7%). There was also a significant difference in the period of artificial reef use between the states, with duration of use by Texas respondents being significantly lower than North Carolina and Florida.

Table VI shows the mean number of fishing, diving and combined fishing/diving trips taken by group type and state in the last 12 months. It also shows the total number of those trips taken to artificial reefs. The average respondent took 14.8 fishing, 9.4 diving

and 7.4 combined fishing and diving trips during the previous 12 months. Of these, 2.3 of the fishing, 5.1 of the diving and 2.8 of the combined trips were to artificial reefs. Florida respondents showed significantly more fishing and diving trips than North Carolina and Texas, while Texas users had significantly fewer trips than North Carolina's. The Florida sample also showed significantly more fishing and diving trips to artificial reefs than the North Carolina or Texas samples. Overall, a higher percentage of diving trips (54.2 %) versus fishing trips (15.5%) are made to artificial reefs.

Artificial reef users believe that fishing success as measured by number of fish caught per hour is greater, and the quality of the catch is better over artificial reefs than over natural bottom (Tables VII and VIII). However, sport fishermen are much more likely to hold these opinions than commercial fishermen.

The respondents were asked to rate the importance of each statement about the major benefits of artificial reefs. A Likert scale was used ranging from 5 for strongly agree, to 1 for strongly disagree. The values were averaged for each of the 18 statements about artificial reefs and are presented in rank order in Table IX.

Column 1 Table IX shows the rank ordered Likert values for the total sample, while columns 2-5 show the ranking of Likert values for each statement within each group. Column 1 also denotes significant differences ($p < .05$) among group types, states and interactions between group type and state.

Intensity of agreement is not shown in the table. In general, sport fishermen and sport divers more strongly agreed with the benefit statements than environmentalists and commercial fishermen. For example, the four groups gave the following Likert weight to their top ranked benefit: sport fishermen (4.56), sport divers (4.53), environmentalists (4.16) and commercial fishermen (3.81). The level of intensity helps to explain the differences listed among group types and states. As shown in the table, "improves commercial pot fishing" was ranked sixteenth by all four groups, yet a statistically significant difference is shown. This is explained by the difference in intensity levels among the group types. Even though environmentalists had the statement ranked sixteen, they gave it an average value of 3.01, compared to the commercial fishermen value of 2.66. The difference is statistically significant.

Table IX shows that the major benefits are geographical. Artificial reefs provide more fishing locations within a given area and can be located closer to a home port. This is consistent across all four groups. Biological benefits were also ranked high. The respondents believed artificial reefs benefited natural reefs by helping to remove fishing pressure and that they increased overall productivity. Commercial fishing benefits ranked consistently at the bottom even by commercial fishermen. Additionally, respondents were unlikely to view the role of artificial reefs as benefiting our solid waste problem.

Table X shows in rank order the Likert values of how the respondents agreed with a set of statements about potential problems with artificial reefs. Similar to Table IX values from five to one were assigned to strong agreement and strong disagreement, respectively. Column one shows the Likert values for all groups. In general, the respondents were less likely to agree with the

problem statements than they were with the benefit statements. The top-ranked problem statement, "draws large crowds," had a Likert value of 3.3 indicating only neutrality or slight agreement, whereas the top-ranked benefit statement received a Likert value of 4.2 indicating strong agreement.

The top-ranked problems are largely associated with the success of artificial reefs. Four of the top five ranked problems relate to crowding or overuse. Respondents other than commercial fishermen did not agree that artificial reefs "put too much junk in the ocean". Even environmentalists tended to disagree with the statement.

The activities most often pursued while visiting an artificial reef are shown in Table XI. The table lists in order of frequency the first, second and third activities most often pursued. As expected, all of the activities listed are related to sport fishing and diving. In no cases did commercial fishing activities (trawling, gill netting, potting, longlining and purse seining) contribute more than one percent of the activity responses. They are included in the "Other" category.

Table XII lists a variety of reasons why people go fishing and diving. The respondents were asked to rate the relevance of each statement to their own situation. Again, a Likert scale was used with 5 indicating strong agreement on the high end and 1 representing strong disagreement on the low end. Experiential reasons ranked high among the motives for fishing and diving. These included: "to be outdoors" (1); "to be close to the sea" (3); and "to experience natural surroundings" (4). "Relaxation" (2) and "getting away from the routine" (5) were also important. Similar to other studies, obtaining fish for eating and selling ranked low for the overall sample (13 and 16 respectively), even when commercial fishermen were included.

Table XIII shows the species of fish most frequently fished for while visiting an artificial reef. King mackerel was identified as the favorite target species (21.4%) followed closely by grouper (19.4%) and snapper (17.5%). Table XIV shows the species of fish divers prefer to see while diving at an artificial reef. A great variety of species were identified as favorite fish. Grouper were preferred by (20.0%), followed by Queen Angel fish (15.3%) and Manta Rays (11.8%). The other category contained 48 responses with no single response identified more than twice.

□ Artificial Reef Administration

Table XV shows the respondents satisfaction level with their state's artificial reef program. Overall, the user community is satisfied with artificial reef administration in their respective states. Seventy-one percent of those who had an opinion indicated they were very satisfied or satisfied vs. 29% who were dissatisfied or very dissatisfied. Texas respondents were less likely to be satisfied with their state's program than the Florida and North Carolina samples. They were also more likely to have no opinion. In addition, there was a significant difference between the groups, with commercial fishermen being more likely to be dissatisfied with the program than the other three groups. But even in this case, commercial fishermen were evenly split between satisfaction and dissatisfaction. Table XVI lists what the respondents would do to

improve their state's program. Close to one-half of those responding (47.6%) wanted more reefs built. The miscellaneous category ranked second. Many of the miscellaneous comments related to recommendations for adding or improving an artificial reef at a specific site.

In another attempt to determine how reef users view their state's artificial reef program, we asked them to rate their state's program relative to other states. Table XVII shows the results. With the exception of Texas, the respondents believed their state had a much better or slightly better program than other states (25.2%). Only 11.1% thought that their state's program was slightly worse or much worse. Again, Texas respondents were more likely to rate their state's program as worse than Florida or North Carolina. In addition, approximately one-half of the respondents indicated they did not know how it compared, suggesting they do not know much about programs outside their state.

A sizeable minority of the respondents (38.5%) did not know who was responsible for building artificial reefs in their state. Another 18.7% believed state government was responsible while 7.9% thought it was the responsibility of private groups. Over one-quarter (26.6%) listed multiple responsibilities, and 6.2% thought it was a county responsibility. Only 1.2% thought it was the federal government's responsibility. Table XVIII shows who they would first contact if they experienced a concern about an artificial reef in their state. Close to one-half (49.7%) would contact their state's marine fisheries agency, followed by private groups (17.4%) and "do not know" (14.5%). The "do not know" percentage is probably understated, because 244 respondents did not answer the question, and most likely many of these did not know.

□ Artificial Reef Funding

Although almost one-half of the respondents (46.4%) did not have an opinion on the amount of spending on artificial reefs in their state, of those who answered most, 37.4% thought the spending was too low (Table XIX). More of the Texas sample than Florida and North Carolina answered "do not know" when asked about the amount of spending. There was also a significant difference between the groups, with a higher percentage of commercial fishermen believing spending levels were about right and a lower percentage answering that spending was too low.

By almost a three-to-one margin, the sample favored purchasing a stamp to fish or dive on artificial reefs, if the funds were earmarked for artificial reef programs (Table XX). Fifty-seven percent (57.1%) favored, 23.2% opposed and 19.7% were neutral in their reaction to purchasing a stamp. Among the three states, the Florida and North Carolina percentages favoring a stamp were similar (North Carolina-55.0%, Florida-54.4%), while Texas was somewhat higher (62.7%). Those opposing the stamp were also lower in Texas (14.9%) vs. Florida (27.4%) and North Carolina (25.8%). Within each state there were no significant differences among the groups with the exception of Florida, where sport fishermen were more likely to favor a stamp (66.0%) than sport divers (46.4%).

Table XX shows the willingness to pay for an artificial reef stamp. The mode is \$5, but the mean is \$11.81. There is a signifi-

cant difference between the states with Texas respondents willing to pay less than the other two states. There was also a significant difference between the groups with commercial fishermen willing to spend more than sportdivers and environmentalists.

Table XXI lists in rank order the priorities for types of reef expenditures, if more money were made available for artificial reef programs. A Likert scale was used with a value of 5 representing very important, 4-important, 3-neutral or do not know, 2-unimportant and 1-very unimportant. Column 2 shows that all 10 choices were rated on the important side of neutral, ranging from a high of 4.3 for construction of new reefs to a low of 3.4 for building more FADs. After building new reefs, the next four top ranked priorities all related to funding research to improve productivity and materials and understand the ecology and biological impact of artificial reefs.

For the top-ranked priority -- building new reefs -- sport fishermen and divers ranked it significantly higher than commercial fishermen and environmentalists. There was significant interaction between group type and state for the second priority, which was research to determine the biological impact of reefs. North Carolina commercial fishermen had this expenditure ranked significantly lower than other group types and states. Environmentalists rated research to understand reef ecology significantly higher than sport and commercial fishermen. Sport fishermen ranked research to improve productivity of artificial reefs significantly higher than commercial fishermen and commercial fishermen ranked research to test artificial reef materials significantly lower than the other three groups.

□ Artificial Reef Siting/Construction

When asked where they preferred to see new reefs located in their state, the respondents preferred offshore sites, defined as more than 12 miles offshore, over midshore and inshore locations. The percentages for the preferences are: estuaries (15.7%), adjacent to shoreside fishing sites, including fishing piers, bridges, public beaches (9.4%), inshore: 0-3 miles (22.4%; midshore: 3-12 miles (21.2%); and offshore: >12 miles (31.4%). There were no statistical differences in the preferences between states or groups.

Table XXII shows the respondents' preferences for types of artificial reef construction materials if more were built in their state. Clearly a majority of artificial reef users (52.2%) prefer reefs constructed from ships and barges. The second choice is obsolete oil rigs (12.7%). Although all groups preferred ships and barges, there was a significant difference in the intensity of the preference between groups with divers being statistically higher (66.7%) than environmentalists (37.3%). There were also significant differences between the states with respondents in North Carolina (61.4%) and Florida (58.9%) preferring ships and barges more than Texas (36.4%) respondents.

Table XXIII shows the respondents' attitudes about spending public monies on FAD's. Forty-two percent (42.0%) opposed FAD spending by public agencies, while 24.8% favored it. The remaining 33.2% were either neutral or did not know. There was a significant difference between the groups with sport fishermen favoring FAD building. Only 9.9% of the commercial fishermen

were in favor of FAD building.

□ Artificial Reef Information

Newsletters from fishing, diving or environmental organizations are the most important sources of information for learning about artificial reef programs. Table XXIV shows how the users rate the importance of information sources. The second most important source of information was club meetings (14.6%) followed by newspapers (11.3%) and magazines (10.8%).

The level of information received by the respondents was perceived as only fair. The percentage breakdown for the level of information for all groups is as follows: Excellent (3.6%), good (15.9%), adequate (22.3%), fair (28.0%) and poor (30.3%). The percentages were relatively consistent across groups with the exception of commercial fishermen who rated the level of information poorer than the other three groups.

In Table XXV, the respondents show the types of information they would like to have more access to. In each case there were significant differences between the groups. In six of the seven categories, smaller percentages of commercial fishermen desired more information than the other groups. The exception was LORAN-C information, which was of less interest to environmentalists. Environmentalists joined commercial fishermen with a lower percentage requiring charts than the other two groups. Both sport divers and commercial fishermen were less likely to desire information on fishing methods, while sport fishermen joined commercial fishermen in a lower preference level for species identification information.

□ Artificial Reef Evaluation

In an effort to determine if user groups would be willing to volunteer their time and effort to assist fisheries agencies to evaluate their artificial reef programs, we asked if they would be willing to assist agencies on an advisory or volunteer basis. Table XXVI shows the results. Those willing to serve on an advisory committee at the state or county level outnumbered those who would not by 40.7% to 26.6%. The remainder were not sure. They would need more information. A majority (50.6%) indicated they would be willing to assist with data collection about their fishing and diving activities. They outnumbered those who would not (26.6%) by almost two to one. In both cases, there were significant differences between the groups. Sport fishermen were more likely and environmentalists less likely to be willing to serve on an advisory committee, while sport fishermen and sport divers were more likely to volunteer to collect data than environmentalists or commercial fishermen.

□ Artificial Reef Conflict Resolution

The respondents were asked if they had experienced conflicts with other groups, while pursuing their goals visiting an artificial reef. Table XXVII shows the rank order of the frequency of reported conflicts. The frequencies and percentages are for the entire sample, and since only 62.7% of the sample had used an artificial reef, they are lower than would have been anticipated if we had only asked artificial reef users about conflicts they experienced.

The largest response category was from people who had not experienced conflicts (21.4%). Conflicts with sport divers (14.3%) and spear fishermen (10.8%) ranked second and fourth, while conflicts with power boaters (12.2%) ranked third. Sport fishing conflicts ranked fifth through seventh, while conflicts with commercial fishing activities ranked eighth through tenth. In several cases, there were significant differences between the groups. The differences are as expected with sport divers and environmentalists being less likely to experience a conflict with sport divers. Sport divers were more likely to experience a conflict with power boaters, spear fishermen, bottom fishermen, drift fishermen and cast fishermen, while sport fishermen were more likely to experience a conflict with trawlers, longliners and potters.

Table XXVIII shows the types of conflict experienced. The most common form of conflict experienced by 22.2% of the respondents was crowding. Sport divers reported significantly higher and environmentalists significantly lower levels of crowding than sport and commercial fishermen. Anchored sport divers interfering with fishing activities was listed as the second (12.5%) most frequently occurring conflict. Sport fishermen listed the conflict significantly higher than environmentalists and commercial fishermen, while sport divers were significantly lower. A total of 27.1% of all sport fishermen had experienced this type of conflict. The third most frequently mentioned conflict was commercial fishermen harvesting too many fish. Sport fishermen experienced this conflict more than the other three groups. Interestingly, 5.1% of the respondents claimed they experienced a conflict with charter or headboats who caught too many fish. Commercial fishermen were significantly more likely to report this conflict than the other groups. Although 55 respondents experienced "other" types of conflicts, they were largely miscellaneous or individual case versions of the conflicts shown in Table XXVIII.

Fisheries managers have several measures available to them to minimize conflict or overfishing on artificial reefs. Table XXIX shows the respondents attitudes about various management restrictions. With the exception of designating times of the day for specific uses, the sample was in favor of all the management measures by a measure of at least two to one. They were most in favor of restricting the size and number of certain fish take (79.9%), rotating reef closures to allow stocks to rebuild (74.5%) and greater enforcement (4.0%).

In all cases, there were significant differences between the groups in their support for the management measures. Commercial fishermen showed weaker support for all the management measures except for greater enforcement of existing laws. Sport fishermen had a significantly higher level of support for greater enforcement of existing laws than the other groups, while environmentalists were more likely to favor designating times of day for specific uses.

The respondents were asked to rank the importance of several issues as they look at artificial reef development over the next decade. Table XXX shows how the overall sample and individual groups rated the most important issues in artificial reef development. "Dumping too much junk in the ocean" was believed to be the most important issue (23%). Crowding at artificial reef sites

(20.0%) and overfishing of reef fish (19.2%) ranked second and third respectively. Although Table XXX shows only how the respondents rated the most important issue, they were also asked to rank the issues from one to five with five being the least important. Even though dumping was listed most often as the most important issue, it fell to sixth place for both the second and third most important issues. Overfishing of reef fish ranked first for both the second and third most important issues (22.6% and 19.9%, respectively). Overfishing pelagic fish (16.7%) and crowding (15.4%) ranked second and third for the second most important issue, while overfishing of pelagic fish (18.2%) and lack of attention to other parts of the ecosystem (18.0%) ranked second and third for the third most important issue. This may indicate that dumping is very important to a minority of users, but of lesser importance to the majority.

□ General Comments

At the conclusion of the survey, users were asked if there was anything else they would like to mention to us. We received 369 comments, with 249 respondents making at least one comment, 75 a second, 30 a third and 15 a fourth comment. Table XXXI shows a list of comments which occurred at least four times. The most frequently mentioned comments were positive statements about the survey, such as "Keep up the good work", "Thanks for the survey", and "Glad to be of assistance". Other than these kinds of comments, there were no discernible patterns.

Table III
Profile of Artificial Reef Users by Overall
Sample and Group Type (Means)

	Age (Years)	Sex		Distance Residing from Coast (miles)	Last Year of School Completed	Income* (\$)
		M	F			
Environmentalist	48.9	67.4	32.6	29.9	16.7	50,000
Sport Fishermen	47.4	99.5	0.5	82.8	16.3	66,907
Commercial Fishermen	46.5	94.1	5.9	15.2	12.6	44,384
Sport Divers	39.0	72.2	27.8	55.8	16.1	56,866
All Groups	45.1	81.8	18.2	52.1	15.9	56,610

*The income figures are based on means of the mid-point range estimates and should be considered approximate.

Chapter III :

Implications for Management

□ Discussion

Although there have been several other studies of artificial reef users, the research has been oriented toward determining economic impact of artificial reefs (Milon, 1987; Buchanan, 1973 and Liao and Cupka, 1979) or use patterns (Ditton et al., 1979). This survey of 1,642 potential artificial reef users is the first that addresses user views of artificial reef development and management. Since public monies are being spent for the benefit of the users, it is important that reef managers understand what their constituencies prefer before state and federal artificial reef plans are developed and implemented.

The purpose of this study has been to provide that information. Before using the results of the study for planning or management, several cautions should be pointed out. The sample represents the Southeast region and conditions may be considerably different in other regions. One of the reasons artificial reefs are popular in the Southeast is because there is limited natural bottom structure. In other regions with more structure, the intensity of demand for artificial reefs may be lower than shown in this study. Also, the Southeast region has relatively higher levels of fishing effort than other regions, which may increase the levels of conflict and willingness to accept management restrictions.

The study should be used with caution even in the Southeast. As Murray pointed out in his 1989 artificial reef managers study, each state has a very different artificial reef program and this study only sampled users from three of them. Although the authors believe the overall results are generally applicable to the Southeast region, managers in the five non-sampled states should use care when extrapolating the information to their specific situation.

The choice of sources to sample in the four group types resulted in a sample consisting largely of club members. Of the four groups and three states sampled, only the North Carolina commercial fishing and sportdiving samples represented non-club members. The choice of club members was by design, because we believed club members were more likely to be informed about artificial reef programs, but the results do not necessarily reflect the views of non-club members who are the large majority of the fishing and diving publics. For example, non-club members may be less avid fishermen and prefer to see artificial reefs located close to shore or artificial reef monies being spent on boat ramps or beach access.

The profile of users shows that with the possible exception of commercial fishermen, the respondents are highly educated with high household incomes. For example, the average sport fishermen in this sample is an ACCA member, has more than a four year college degree (16.3 years) and an annual household income of \$66,907 ± \$5,000.

Commercial fishermen and environmentalists were included in the sample because it was hypothesized that they would view themselves as adversely affected by artificial reef development. In

general, they were less intense than sport fishermen and sport divers in their support of artificial reef benefits and construction, but throughout the survey there was no indication the groups were opposed to artificial reef development. Environmentalists were more concerned about adverse affects on the biological community through overfishing and dumping junk, while commercial fishermen were concerned about materials interfering with their fishing operations. Proper planning and management should reduce these concerns. Adequate research programs and adoption of management measures should reduce concerns about overfishing. Careful selection of materials, coupled with materials engineering and siting research should placate concerns about construction.

With the possible exception of commercial fishermen, the user community believes artificial reefs function to improve sport fishing and sport diving. They thought that the numbers and types of fish caught improved over artificial reefs. They were more likely to agree with benefit than problem statements about artificial reefs.

The benefits which rated the highest related to increased fisheries productivity and reducing congestion by increasing the number of fishing and diving sites. In recent years, for a variety of reasons, perceived catch per unit of effort is down. Also, the number of saltwater sport fishermen and sport divers, especially in the Southeast region, has increased. Artificial reefs are believed by the users to address both these problems by increasing productivity as well as the number of fishing and diving sites. Also, catching more fish is not the primary motive for fishing, or a major benefit of artificial reefs (Graefe and Falk, 1985). Being outdoors and relaxing in a natural sea environment is the most important reason, and artificial reefs increase the number of fishing and diving locations, reduce crowding by geographically dispersing the activities and thereby enhance the outdoor recreation experience.

A variety of activities take place at artificial reef sites. These include not only different methods of sport fishing, but also several forms of underwater activity associated with sport diving — underwater photography, artifact and shell collecting and spear fishing. In fact, SCUBA diving ranked as the most participated in activity in the survey (36.2%), and a much higher percentage of diving trips (54.2%) versus fishing trips (15.5%) are made to artificial reefs.

In recent years, sport fishermen have led the effort to press for artificial reef development through political advocacy, volunteerism and financial support. Since the passage of the Sportfishing Restoration and Enhancement Act of 1986 (commonly referred to as Wallop-Breaux), many states have heavily funded their artificial reef programs through funds collected from excise taxes on sportfishing equipment and boat fuel initiated by the Act. The argument could be made that the sportdiving community is getting a free ride by not contributing to the user fees which pay for artificial reefs. Excise taxes could be expanded to include sportdiving equipment (wet suits, tanks, regulators, etc.) with the proceeds going through the Wallop-Breaux System to the states to fund artificial reef research and development activities.

The users were highly satisfied with the North Carolina and Florida artificial reef programs. These two states have active programs with good reputations. Managers in the state of Texas

had a series of bad experiences with artificial reefs in the mid-1970s (e.g. tire dispersal offsite), and until very recently had a largely inactive program. Accordingly, user groups in Texas were somewhat dissatisfied with the program.

The agencies do not do a very good job of informing the public about their artificial reef activities. Over one-third of the respondents (38.5%) did not know who was responsible for artificial reefs in their state, and many of those who voiced an opinion were either wrong or did not know the correct name of the agency in question. They also ranked providing more information as third in priority behind building more reefs and miscellaneous, when asked what one thing they would do to improve their state's artificial reef program. As previously discussed, the sample population is better informed than the general public, and this suggests the agencies have to do a better job with public relations and informational programs. As shown in the study, artificial reefs are popular with the user groups, and the agencies do not maximize their public relations potential.

In order to reach out-of-state fishermen, public information programs must also target the national and regional press. Over one-half of the sample (52.1%) were unable to compare their state's artificial reef program to others, in all likelihood because they did not know about other states. Local and state tourism boards and chambers of commerce who actively promote sport fishing from a marketing perspective could be requested to assist in this effort. Even though the National Artificial Reef Plan gave the major artificial reef role to the states, the National Marine Fisheries Service has responsibility for recreational fisheries management and development in the Exclusive Economic Zone. NMFS could assist the states with regional and national information about artificial reefs.

Although many did not know about the amount of spending on artificial reefs in their state, those believing it was too low (37.4%) outnumbered those who thought it was too high (3.5%) by 10 to one. Among artificial reef related expenditures, reef building had the highest priority for new spending. The next four priorities were all research related (research to understand the biological impact of reefs, to understand reef ecology, to improve productivity and test new materials). Managers are reluctant to spend much money on research because they believe the public wants tangible products. However, the results show that a reef program with a balance between reef construction and research would not only be accepted, but would be preferred by the user community. For research expenditures to be accepted by the public over the long term, it will be important for managers to communicate the results of the research to their constituency.

Spending new monies on building FADs ranked lowest. In addition, those opposed to FADs outnumbered those in favor of FADs by a wide margin. These results raise serious questions about the efficacy of public monies being spent on FADs. The relatively knowledgeable constituency sampled by this survey is concerned about maintaining resource productivity levels and view FADs as contributing to overfishing problems.

The artificial reef user community is willing to pay for increased expenditures for artificial reef development. There was broad support among all groups and states for purchasing an artificial reef

stamp, if the money were returned to the artificial reef program. A fee or stamp in the \$10 to \$15 range would be supported. The study provides further evidence for acceptance of a user fee or license for saltwater fishing. Additionally, the sportdiving community favored the license, and user taxes on this group could be an additional source of revenue for artificial reef activities. An artificial reef stamp would be easiest to administer in conjunction with a saltwater fishing license. For states such as Florida which have the administrative procedures in place to issue licenses, an artificial reef stamp may be a viable option. Enforcement of the stamp would be difficult for individuals, but could be purchased for vessels. A large decal, issued by the state at time of purchase could be displayed on the outside of the vessel, making illegal artificial reef fishing or diving conspicuous to marine police, or to other users who paid the fee and may have the incentive to notify the marine police by radio.

The preferred materials of the user community are consistent with materials preferred by professional reef builders. Ships and barges far outpaced other materials in order of preference. Next were obsolete oil rigs and bridge and highway rubble.

The user community is willing to volunteer their time and effort to assist artificial reef managers with their program. They would be willing to assist the state by serving on an advisory committee, or by volunteering to collect data, or report on buoy or material conditions. This survey has shown that the goals of the user community are consistent with sound resource management. It would behoove state agencies to actively seek involvement in their programs by the public. It would give the user community a sense of ownership in the program, provide valuable input to state agencies and improve public relations. As reported by Murray (1989) in his artificial reef managers study, only one of 12 state programs surveyed had an active advisory committee. This study shows there is a knowledgeable public who is willing to serve, and state agencies should take advantage of it. If used properly, the public would help back up the state on positions related to materials, expenditures, management measures or informational material production.

As previously discussed, the users would prefer to see greater expenditures on informational materials. They rated the level of information they receive as only fair. They receive most of their information from their own groups through newsletters and club meetings. It should be remembered that the sample is biased toward club members which reflects why these ways of obtaining information ranked high. The study gives some clues to other informational distribution methods which could reach the broader public. Other than the club, they received their information from magazines, newspapers and Sea Grant publications. Only 6.8% of the respondents ranked fisheries agencies as their most important source of information. Forty-five percent preferred more news items about artificial reefs, ranking second only to "want more maps". This further suggests that the public information office of the fisheries agencies needs to develop a better rapport with and increased flow of information to the press.

There are no benchmark data to determine if conflict at artificial reef sites is on the rise, but it does appear conflict is common.

Only 21.4% of the respondents had not experienced a conflict. The users reported 657 cases of conflict with a variety of groups. The number is understated because multiple conflicts with groups were not asked for. The respondents experienced the most conflicts with sportdivers while power boaters ranked second. The most frequent type of conflict was crowding, followed by divers anchoring and prohibiting sport fishing. The conflicts relate to competition for use of a finite space. Even within types of sport fishing, the users experienced the most conflict with bottom and drift fishermen. Both of these techniques are more stationary than trolling, and can interfere with it by tying up space. Problems with spear fishermen shooting or scaring off fish were reported most commonly by non-spearfishing sport divers. Given that the major reasons for visiting an artificial reef are experiential, increased crowding and conflicts threaten the experience. Similar to backcountry permitting for use of trails in national parks, in the future, fisheries agencies may have to reluctantly restrict free access to artificial reefs in order to maintain safety and preserve the quality of the recreational experience.

With the possible exception of commercial fishermen, the survey showed that the users overwhelmingly would accept most access and catch restrictions to preserve the resource and reduce conflict. The only restriction they would not accept is designating times of day for specific uses. There is very strong support for restricting the size and number of fish taken off artificial reefs and rotating reef closures to allow stocks to rebuild. Although there may be some enforcement difficulties, the South Atlantic states already have the Special Management Zone (SMZ) provision of the Snapper-Grouper Fishery Management Plan at their disposal to adopt these measures at artificial reef sites. Better research, monitoring and enforcement will be necessary to satisfactorily initiate these management restrictions. To gain the support for them from the user community, a better dialogue will need to develop between the users and the agency. An artificial reef advisory committee could further support the agency to publicly adopt restrictions.

Further concern about overfishing and crowding are reflected in the importance given to them as future issues. They were superseded as priority future issues only by concern for "dumping too much junk in the ocean." From a management perspective the two seem contradictory in that the user community is calling for more reefs to reduce crowding, but are concerned about dumping. Managers must pay heed to these concerns by placing more emphasis on materials research and site monitoring to make sure the materials are performing as envisioned. If a new material such as railroad cars is used, it is important to first test it on a pilot basis. Given the increasing public concern about ocean dumping, one bad experience could jeopardize artificial reef expansion throughout the region.

More research should be conducted on pre-fabricated reefs. They have the potential to remain durable and improve the "dumping junk in the ocean" image of artificial reefs. Recent work by Brock and Norris (1989) showed greater fisheries enhancement for designed reef modules than haphazard deployment of junk materials.

□ Conclusions

The four groups sampled in this survey (sport fishermen, sport divers, environmentalists and commercial fishermen) are supportive of artificial reef programs. Although sport fishermen and sport divers benefit the most, all four groups believed that reefs work as planned to improve fishing and diving, and increase the number of locations at which these activities can take place.

The fisheries agencies do a better job of reef building than communicating with the public. Better information distribution systems should be developed and greater citizen involvement in the program should be encouraged. The public is well informed and their preferences for types of artificial reefs and management systems are consistent with good resource management.

The user community is willing to pay for increased reef development and research programs if they benefit the resource. A variety of conflicts are taking place at artificial reefs. As recreational fishing growth continues, the frequency and seriousness of the conflicts will get worse. The public is highly supportive of management measures designed to minimize conflict and maintain the resource. In the future, the challenge will be for fisheries agencies to develop regulations with input from the user community. With a favorable process in place, the user community will accept both new construction and restrictions, and the resource will be maintained.

Literature Cited

- Agresti, Alan and B. F. Agresti. *Statistical Methods for the Social Sciences*. Dellen Publishing Co. San Francisco. 1979. 556 pages.
- Bohnsack, J. A. and D. L. Sutherland. *Artificial Reef Research: A Review with Recommendations for Future Priorities*. Bulletin of Marine Science, University of Miami. July 1985. Pages 11-40.
- Brock, Richard E. and James E. Norris. *An Analysis of the Efficacy of Four Artificial Reef Designs in Tropical Waters*. Bulletin of Marine Science, University of Miami. March 1989. Pages 934-941.
- Buchanan, Chester C. *Effects of an Artificial Habitat on the Marine Sport Fishery and Economy of Murrells Inlet, South Carolina*. Marine Fisheries Review. NMFS, Seattle, Washington. 1973. Pages 15-22.
- Chandler, A. D. "Mixing It Up with Sports". *National Fishermen*. July 1984. Pages 29-31.
- Ditton, Robert B., et. al. *Access to and Useage of Offshore Liberty Ship Reefs in Texas*. Marine Fisheries Review: NMFS, Seattle, Washington. September 1979. Pages 25-31.
- Ditton, Robert B. and Stephen M. Holland. *Understanding Involved Fishermen: A Survey of Members of the Gulf Coast Conservation Association*. Texas A&M Sea Grant, College Station, Texas. June 1984. 70 pages.
- Graefe, Alan R. and James M. Falk. *Coastal Fishing Tournaments:*

- A Review of Participants Characteristics, Motives and Spending Patterns.* Proceedings 1985 National Outdoor Recreation Trends Symposium II. U.S. Department of the Interior, National Park Service, Southeast Regional Office, Atlanta, Georgia. 1985. Volume II. Pages 43-57.
- Jacob, Gerald R. Conflict in Outdoor Recreation: A Bibliography of Relevant Literature. Utah State University. 1978. 22 Pages.
- Johnson, Jeffrey C. and James D. Murray. *Social Structure and Technology Applications in Extension.* Practicing Anthropology. Society for Applied Anthropology. Oklahoma City, OK. Vol. 12, No. 4, 1990. Pages 9-17.
- Liao, D. S. and D. M. Cupka. *Economic Impacts and Fishing Success of Offshore Sportfishing Over Artificial Reefs and Natural Habitats in South Carolina.* South Carolina Marine Resources Center, Charleston, South Carolina. May 1979. 27 pages.
- Milon, Walter J. *The Economic Benefits of Artificial Reefs: An Analysis of the Dade County, Florida Reef System.* Florida Sea Grant College, Gainesville, Florida. December 1987. 64 pages.
- McGurrin, Joseph and the ASMFC Artificial Reef Committee. *A Profile of Atlantic Artificial Reef Development.* Special Report Number 14 of the Atlantic States Marine Fisheries Commission, Washington, D.C. August 1988. 153 pages.
- McGurrin, Joseph M., et. al. *Profiling United States Artificial Reef Development.* Bulletin of Marine Science, University of Miami. March 1989. Pages 1004-1013.
- Murray, James D. *A Policy and Management Assessment of Southeast and Mid-Atlantic Artificial Reef Programs.* University of North Carolina Sea Grant College Program, Raleigh, North Carolina. 1989. 40 pages.
- Seaman, William, Jr., Raymond M. Buckley and Jeffrey J. Polovina. *Advances in Knowledge and Priorities for Research, Technology and Management Related to Artificial Aquatic Habitats.* Bulletin of Marine Science, University of Miami. March 1989. Pages 527-532.

References

- Johnson, Jeffrey C. and David C. Griffith. *Perceptions and Preferences for Marine Fish.* UNC Sea Grant, Raleigh, North Carolina. February 1985. 104 pages.
- Milon, Walter J. *Economic Evaluation of Artificial Habitat for Fisheries: Progress and Challenges.* Bulletin of Marine Science, University of Miami. March 1989. Pages 831-843.
- Milon, Walter J. *Artificial Marine Habitat Characteristics and Participation Behavior by Sport Anglers and Divers.* Bulletin of Marine Science, University of Miami. March 1989. Pages 853-862.
- Noble, E. B. *North Carolina Artificial Reef Master Plan.* North Carolina Department of Natural Resources and Community Development, Division of Marine Fisheries, Morehead City, NC. 1988. 57 pages.

- Phillips, S. H. *Artificial Reef and Fishery Conflicts: Problems and Opportunities for the Sportfishing Community*. Sportfishing Institute, Washington, DC. 1988. 62 pages.
- Samples, Karl C. *A Socioeconomic Appraisal of Fish Aggregation Devices in Hawaii*. University of Hawaii Sea Grant, University of Hawaii. May 1986. 54 pages.
- Samples, Karl C. *Assessing Recreational and Commercial Conflicts Over Artificial Fishery Habitat: Theory and Practice*. Bulletin of Marine Science, University of Miami. March 1989. Pages 844-852.
- Schreyer, Richard and Richard C. Knopf. The Dynamics of Change in Outdoor Recreation Environments—Some Equity Issues. *Journal of Park and Recreation Administration*. 1984. 2. Pages 9-19.
- Schreyer, Richard, David W. Lime and Daniel R. Williams. Characterizing the Influence of Past Experience on Recreation Behavior. *Journal of Leisure Research*. First quarter. 1984. Pages 34-50.
- Schreyer, Richard. *Conflict in Outdoor Recreation: The Scope of the Challenge to Resource Management*. Department of Forest Resources, Utah State University, Logan, Utah. September 1988. 18 pages.
- Stone, R. B. *National Artificial Reef Plan*. National Marine Fisheries Service, NOAA, Washington, DC. 1985. 39 pages.
- Todd, Sharon L. and Alan R. Graefe. *Conflicts Among Delaware River Canoeists*. Department of Recreation and Parks, Pennsylvania State University, University Park, PA. November 1988. 74 pages.

Table IV

**Mean Number of Years Respondents
Participated as a Member of Their Group
(N=Sample Size)**

<u>Group</u>	<u>Years</u>	<u>N</u>
Environmentalist	8.0	163
Sport Fishermen	24.5	210
Commercial Fishermen	25.5	79
Sport Divers	9.6	206

**Table V
Familiarity by Group and State of Artificial Reefs
Built Off Their State's Coast (In Percent)**

Group	Very	N	Somewhat	N	Unfamiliar	N
	Familiar		Familiar			
Environmentalist	16.8	32	52.4	100	30.9	59
Sport Fishermen	33.2	71	56.1	120	10.8	23
Commercial Fishermen	34.5	29	47.6	40	17.9	15
Sport Divers	39.1	82	47.6	100	13.3	28
State						
Florida	36.6	90	53.7	132	9.8	24
North Carolina	37.0	88	47.5	113	15.6	37
Texas	16.7	36	53.5	115	29.8	64
Total (all groups & states)	30.6	214	51.5	360	17.9	125

Table VI
Mean Number of Fishing and Diving Trips During Last 12 Months
(AR=Artificial Reef Site)
(N=Total Trips)

	<u>Fish- ing Trips</u>	<u>N</u>	<u>Fish- ing Trips to AR</u>	<u>N</u>	<u>Diving Trips</u>	<u>N</u>	<u>Diving Trips to AR</u>	<u>N</u>	<u>Com- bined Trips</u>	<u>N</u>	<u>Com- bined Trips to AR</u>	<u>N</u>
Environ- mentalists	5.5	137	1.6	9	1.3	82	.4	65	1.3	68	.5	60
Sport Fishermen	18.7	198	1.9	48	2.2	53	1.1	41	3.2	39	1.5	39
Commercial Fishermen	29.6	65	4.9	10	6.5	30	1.4	35	23.3	27	5.1	32
Sport Divers	10.1	96	2.7	9	15.7	183	8.7	176	10.2	60	4.8	53
State												
Florida	23.6	178	3.6	28	20.4	133	10.3	134	17.1	67	5.8	67
North Carolina	13.0	183	1.6	41	3.1	87	1.8	68	3.2	65	1.5	53
Texas	4.9	124	1.5	4	2.2	122	1.2	110	1.5	60	0.5	61
Total (all groups and states)	14.8	496	2.3	76	9.4	348	5.1	317	7.4	194	2.8	184

Table VII
**Comparative Perception of Catch of Fish Over Artificial Reefs vs. Natural
Bottom for Two Fishing Groups (Number of Fish Caught Per Hour)**

	<u>Less or About the Same</u>	<u>N</u>	<u>Greater</u>	<u>N</u>	<u>Do Not Know</u>	<u>N</u>
Sport Fishermen	26.4	47	46.1	82	27.6	49
Commercial Fishermen	28.6	18	22.2	14	49.2	31
Total* (all groups)	17.2	91	35.9	190	46.9	248

*Includes sport divers and environmentalists who responded to the question.

Table VIII
Comparative Perception of Catch By Types of Fish Caught Over Artificial Reefs vs. Natural Bottom for the Two Fishing Groups

	<u>Worse or</u> <u>About</u> <u>the Same</u>	<u>N</u>	<u>Better</u>	<u>N</u>	<u>Do Not Know</u> <u>Or</u> <u>Do Not Fish</u>	<u>N</u>
Sport Fishermen	30.1	53	42.6	75	27.3	48
Commerical Fishermen	29.2	19	24.6	16	46.2	30
Total* (all groups)	19.4	102	34.4	181	46.2	243

*includes sport divers and environmentalists who responded to the question.

Table IX
Rank Order and P Values of Major Benefits of Artificial Reefs by Group Type (Most to Least Important)

	1 Likert Value (All Groups)	2 Environ- mentalists	3 Sport Fishermen	4 Commerical Fishermen	5 Sport Diving
Increase # of Fishing Locations	4.2a	1	1	2	7
Provides Fishing/ Diving Closer to Home	4.2a	3	2	5	2
Removes Pressure from Natural Reefs	4.0a	5	5	9	6
Good Use of Tax \$	4.0a	4	4	14	5
Increases Productivity	4.0a	2	3	10	8
Provides Unique Diving Experience	3.9a,b	9	11	8	1
Easy to Locate	3.8	7	7	3	9
Gives Sport fishermen a Place to Fish Away From Trawling Areas	3.8a	6	8	4	11
Gives the Novice a Place to Fish	3.8a,b	10	6	1	12
Improves u/w Photography	3.7a,c	13	13	12	3
Improves u/w Scenery	3.6a,c	14	14	13	4
Makes Fish Easier to Catch	3.6c	8	10	7	13
Improves Spear-fishing	3.5c	12	12	6	10
Increases Total Catch	3.5a,b	11	9	11	14
Helps Solid Waste Problem	3.1	15	15	15	15
Improves Commercial Pot Fishing	2.8a	16	16	16	16
Improves Commercial Longlining	2.7a,c	17	18	17	17
Improves Commerical Gill Netting	2.6	18	17	18	18

a- Indicates a significant difference among group types p<.05

b- Indicates a significant difference among states p<.05

c- Indicates there is significant interaction among group types and states p<.05

Table X
Rank Order of Problems Associated With Artificial Reefs by Group Type

	1 Likert Value (All Groups)	2 Environ- mentalists	3 Sport Fishermen	4 Commercial Fishermen	5 Sport Diving
Draws Large Crowds Not for Commercial Fishermen	3.3a,b 3.2a	2 1	1 3	2 1	1 2
Leads to Overfishing Commercial Fishermen Interfere	3.0 2.9a,c	5 3	4 2	5 18	4 3
Trollers Interfere	2.8c	6	8	11	5
Too Far From Shore	2.7b	7	10	15	7
May Break Up /Move	2.7a,b	4	12	3	14
Poor Visibility	2.7a,c	8	6	13	13
Currents Too Strong	2.6a	11	7	10	10
Too Close to Shore	2.6c	15	11	8	9
Bottom Fishermen Interfere	2.6a,b,c	10	15	17	6
In Water Too Deep	2.6	14	13	12	8
Divers Interfere	2.5a,b	9	5	7	18
Competes With Other Projects	2.5	17	14	16	11
Dangerous to Dive	2.4a	12	9	9	17
Sport fishermen Interfere	2.4a	16	17	14	12
Cost Too Much to Build	2.3a	18	16	6	15
Puts Too Much Junk In Ocean	2.3a,c	13	18	4	16

a- Indicates significant difference among group types $p < .05$

b- Indicates significant difference among states $p < .05$

c- Indicates significant interaction among group types and states $p < .05$

Table XI
Activities Most Often Pursued While Visiting an Artificial Reef

Most Important Activity	freq. %	Second Most Important Activity	freq. %	Third Most Important Activity	freq. %
SCUBA Diving	183 36.2	Drift Fishing	121 26.0	Bottom Fishing	92 22.2
Trolling	116 22.9	Underwater Photography	83 17.8	Trolling	57 13.8
Bottom Fishing	103 20.4	Bottom Fishing	73 15.7	Drift Fishing	56 13.5
Drift Fishing	35 6.9	Trolling	39 8.4	Spearfishing	32 7.7
Casting	12 2.4	Spearfishing	34 7.3	Shell Collecting	29 7.0
Other	57 11.2	SCUBA Diving	29 6.2	Underwater Photography	25 6.0
		Casting	22 4.7	Scuba Diving	24 5.8
		Shell Collecting	17 3.7	Snorkeling	21 5.1
		Snorkeling	16 3.4	Casting	19 4.6
		Other	32 6.8	Artifact Collecting	17 4.1
				Other	42 10.2

Table XII
Rank Order of Reasons for Fishing and Diving

	1 Likert Value (All Groups)	2 Environ- mentalists	3 Sport Fishermen	4 Commercial Fishermen	5 Sport Diving
To Be Outdoors	4.4a	1	1	1	5
Relaxation	4.3a	3	2	5	2
Be Close to Sea	4.3a	4	3	3	4
Experience Natural Surroundings	4.3a	2	5	7	3
Get Away from Routine	4.2a	5	7	8	6
Experience New and Different Things	4.1a	6	11	9	1
Be With Friends	4.1a	8	8	11	7
Family Recreation	3.9a	7	10	6	9
Develop My Skills	3.8a	12	12	12	8
For the Challenge or Sport	3.8a	13	6	14	11
Get Away from Demands of Other People	3.7a	10	13	10	10
Experience of the Catch	3.7a	9	4	4	13
Obtain Fish for Eating	3.6a	11	9	2	12
Test My Equipment	2.9a	14	15	15	14
Obtain Trophy Fish	2.6a	15	14	16	15
Obtain Fish for Selling	2.2a	16	16	13	16

a- Indicates significant difference among group types ($p < .05$)

Table XIII
Species of Fish Most Frequently Fished for at an Artificial Reef

<u>Species</u>	<u>f</u>	<u>%</u>
Amberjack	6	1.4
Black Drum	1	0.2
Black Sea Bass	6	1.4
Blue Marlin	2	0.5
Bluefish	8	1.8
Bonefish	2	0.5
Cobia	8	1.8
Dolphin	18	4.2
Flounder	16	3.7
Grouper	84	19.4
King Mackerel	93	21.4
Red Drum	13	3.0
Sailfish	8	1.8
Sheepshead	2	0.5
Snapper	76	17.5
Spanish Mackerel	6	1.4
Spot	1	0.2
Spotted Sea Trout	34	7.8
Striped Bass	1	0.2
Tarpon	2	0.5
Wahoo	2	0.5
White Marlin	1	0.2
Yellowfin Tuna	3	0.7
Other	<u>41</u>	<u>9.5</u>
Total	434	100.0

Table XIV
Species of Fish Most Preferred to See While Diving at an Artificial Reef

<u>Species</u>	<u>f</u>	<u>%</u>
Amberjack	3	1.2
Barracuda	9	3.5
Dolphin	10	3.9
Grouper	51	20.0
Jewfish	6	2.3
Manta Ray	30	11.8
Queen Angelfish	39	15.3
Sharks	17	6.7
Tropicals	6	2.4
Other	<u>84</u>	<u>32.9</u>
Total	255	100.0

Table XV
Satisfaction Level With Their State's Artificial Reef Program (In %)

	Very Satisfied	Somewhat Satisfied	Somewhat Dissatisfied	Very Dissatisfied	No Opinion
Florida	17.5	43.6	11.1	7.7	20.0
North Carolina	19.6	43.1	9.1	5.7	22.5
Texas	4.8	23.5	18.2	13.4	40.1
Total	14.4	37.6	12.5	8.7	26.8

Table XVI
One Thing Respondents Would Do To Improve Artificial Reef Management

<u>Improvement Comments</u>	<u>Frequency</u>	<u>Percent</u>
More Artificial Reefs	217	47.5
Miscellaneous	90	19.7
More Information	45	9.8
Restrict Methods and Activities	25	5.4
More Buoys	23	5.0
More or New Funding	23	5.0
Better or Different Management	9	1.9
More Research	9	1.9
Eliminate or Reduce Artificial Reefs	9	1.9
Maintain Artificial Reef Program	6	1.3
	456	100.0

Table XVII
Respondent's Rating of Their State's Artificial Reef Program
Relative to Other States
 (%)

	<u>Much Better</u>	<u>Slightly Better</u>	<u>About the Same</u>	<u>Slightly Worse</u>	<u>Much Worse</u>	<u>Don't Know</u>
Florida	28.1	11.5	7.5	2.6	1.3	48.9
North Carolina	9.7	13.6	16.5	3.9	1.9	54.4
Texas	<u>2.7</u>	<u>6.9</u>	<u>11.2</u>	<u>10.1</u>	<u>15.4</u>	<u>53.7</u>
Total	14.3	10.9	11.6	5.3	5.8	52.1

Table XVIII
Group or Agency Respondent's Would First Contact With a Concern
About an Artificial Reef

<u>Agency or Group</u>	<u>Frequency</u>	<u>Percent</u>
State Fisheries Agency	237	49.7
Private Group	83	17.4
Do Not Know	69	14.5
Federal Agency	42	8.8
County Government	41	8.6
Miscellaneous	<u>5</u>	<u>1.0</u>
	477	100.0

Table XIX
Respondent's Attitudes About the Amount of Money Spent on
Artificial Reefs in Their State (Percent)

<u>State</u>	<u>Too High</u>	<u>About Right Amount</u>	<u>Too Low</u>	<u>Do Not Know</u>
Florida	4.4	13.2	43.6	39.1
North Carolina	4.8	16.8	33.7	44.7
Texas	<u>1.1</u>	<u>7.5</u>	<u>34.2</u>	<u>57.2</u>
Total	3.5	12.7	37.4	46.4
N=	22	79	233	289

Table XX
Willingness to Pay for an Artificial Reef Stamp by State (In Percent)

	<u><\$5</u>	<u>\$5</u>	<u>\$10</u>	<u>\$15</u>	<u>\$20</u>	<u>>\$20</u>
Florida	9.4	23.9	25.3	6.5	18.8	15.9
North Carolina	6.8	23.5	21.2	12.9	22.7	12.9
Texas	7.2	41.0	25.2	5.8	12.2	8.6
N=	32	121	98	34	73	51
Total (%)	7.8	29.6	24.0	8.3	17.9	12.5

Mode = \$5.00
 Median = \$10.00
 Mean = \$11.81

Table XXI
Rank Order and P Values of Expenditure Priorities on Artificial Reef by Group Type

	1 Likert Value (All Groups)	2 Environ- mentalists	3 Sport Fishermen	4 Commercial Fishermen	5 Sport Diving
Construction	4.3a	3	1	7	1
Research to Determine the Biological Impact of Reefs	4.0a,c	1	4	1	3
Research to Under- stand Reef Ecology	4.0a	2	5	2	2
Research to Improve Productivity of Artificial Reefs	3.9a	5	2	3	5
Research to Test Artificial Reef Materials	3.9a	4	6	6	4
Enhancement of Existing Reefs	3.8a	6	3	9	6
Better Monitoring to Evaluate Existing Sites	3.8a	6	7	4	8
Development of More Informational Materials	3.7	8	10	8	7
Better Administration and Management	3.6a	9	9	5	9
Building More FADs	3.4a	10	8	10	10

a- Indicates significant difference among group types p<.05
 c- Indicates significant difference among types and states p<.05

Table XXII
Artificial Reef Material Preference by Group (Percent)

	Environ- mentalists	Sport Fishermen	Commercial Fishermen	Sport Divers	Mean (All Groups)
Ships and Barges	37.3	51.4	48.4	66.7	52.2
Bridge and Highway Rubble	8.7	10.8	14.1	2.0	7.7
Rock or Gravel	7.1	2.7	10.9	2.0	4.4
Obsolete Oil Rigs	6.4	9.7	6.3	21.7	12.7
Railroad Cars	1.6	7.6	6.3	2.0	4.2
Pre-Fabricated Reef Modules	17.4	4.3	1.6	4.0	6.8
Scrap Tires	5.6	3.2	4.7	0.5	3.0
FADs	2.4	4.9	0	0	2.1
Concrete Blocks	4.8	2.2	4.7	1.0	2.6
Other	8.7	3.2	3.1	0	3.3

Table XXIII
Preference for Public Monies Being Spent to Build FADs (Percent)

	<u>In Favor</u>	<u>Opposed</u>	<u>Neutral or Do Not Know</u>
Environmentalists	17.0	54.4	28.6
Sport Fishermen	35.6	29.4	35.1
Commercial Fishermen	9.9	53.5	36.6
Sport Divers	25.3	41.1	33.7
N=	152	258	204
Total	24.8	42.0	33.2

Table XXIV
The Most Important Source of Artificial Reef Information by Group (Percent)

	All Groups	Environ- mentalists	Sport Fishermen	Commercial Fishermen	Sport Divers
Newsletters	27.6	23.8	26.5	12.1	36.1
Club Meetings	14.6	2.1	8.7	3.5	33.0
Newspapers	11.3	17.5	11.9	12.1	5.8
Magazines	10.8	11.2	22.2	3.5	1.6
Sea Grant Publications	9.5	11.9	9.7	19.0	4.7
Fishery Agencies	6.8	9.8	8.1	10.3	2.1
From Retailers	5.6	5.6	2.2	10.3	7.3
Television	5.2	6.3	1.1	12.1	6.3
From Friends	4.5	4.9	6.0	6.9	2.1
Other	2.1	3.5	1.1	6.9	0.5
Trade Shows/ Conferences	1.4	3.5	1.6	0	0
Radio	0.9	0	1.1	3.5	0.5
N=	577	143	185	58	191

Table XXV
Percentage and Types of Information Required by Respondents (All Groups)

<u>Information</u>	<u>% Wanting More</u>
Charts	51.6
News Items Updating	
Changes in the Reef Program	45.0
LORAN-C Numbers	39.9
Artificial Reef Ecology	35.9
Films or Video	24.9
Fishing Methods	16.7
Species Identification	16.7

Table XXVI
Willingness to Serve on an Advisory Committee or Voluntarily Collect Data About Fishing and Diving Activities (Percent)

	<u>Yes</u>	<u>No</u>	<u>Not Sure</u>
Advisory Committee	40.7	26.5	32.9
Volunteer	50.6	26.6	22.8

Table XXVII
Rank Order of Respondents Who Reported Experiencing Conflicts With the Following Groups (Frequency and Percent)

	<u>Frequency</u>	<u>%</u>
Have Not Experienced	154	21.4
Sportdivers	103a	14.3
Power Boaters	88a	12.2
Spearfishermen	78a	10.8
Bottom Fishermen	74a	10.3
Drift Fishermen	59a	8.2
rollers	57	7.9
Trawlers	43a	6.0
Longliners	39a	5.4
Potters	31a	4.3
Cast Fishermen	27a	3.7
Commercial Shipping	19	2.6
Sailors	10	1.4
Snorkelers	9	1.2
Artifact Collectors	8	1.1
Shell or Fish Collectors	8	1.1
U/W Photographers	4	0.6
Birdwatchers	0	0.0
Other	29	4.0

a denotes significant difference between groups (p<.05)

Note: Does not sum to 100% because respondents could check more than one conflict.

Table XXVIII
Rank Order of the Types of Conflict Experienced by the Respondents

	<u>Frequency</u>	<u>%</u>
Crowding (too many boats)	160a	22.2
Divers Anchored and Could Not Troll or Bottom Fish	90a	12.5
Commercial Fishermen Harvested Too Many Fish	70a	9.7
pearlfishermen Shooting or Scaring Fish	64	8.9
Charter or Headboats Dominated One Reef	64	8.9
Commercial Fishermen Came Too Close	48a	6.7
Charter or Headboats Catching Too Many Fish	37a	5.1
Trollers Came Too Close While Bottom Fishing	33	4.6
Sportfishermen Harvested Too Many Fish	27a	3.7
Divers Harvested Too Many Fish	22a	3.1
Bottom Fishermen Made It Difficult to Troll	16	2.2
The Reef Interfered with Commercial Trawling	6a	0.9
Other	55	7.6

a- denotes significant difference between groups (p<.05)

Table XXIX
Respondents Attitudes About Management Measures to Minimize Conflict (In Percent)

<u>Management Measure</u>	<u>All Groups</u>	<u>Environ- mentalists</u>	<u>Sport Fishermen</u>	<u>Commercial Fishermen</u>	<u>Sport Divers</u>
1) Restrict Size and Number of Fish Taken					
Favor	79.9a	76.0	86.2	62.8	81.5
Oppose	10.6	13.2	7.1	27.4	7.4
Uncertain	9.5	10.8	6.7	9.8	10.1
N=	528	121	167	51	189
2) Restrict Fishing Gear Used					
Favor	63.3a	65.8	62.7	46.0	66.8
Oppose	17.9	12.8	20.5	36.0	13.9
Uncertain	18.8	21.4	16.8	18.0	19.3
N=	515	117	161	50	187

(Table continued on next page)

Table XXIX Continued

Management Measure	All Groups	Environmentalists	Sport Fishermen	Commercial Fishermen	Sport Divers
3) Restrict Seasons					
Favor	53.1a	59.8	46.3	31.9	60.1
Oppose	27.2	19.7	32.5	48.9	21.9
Uncertain	19.7	20.5	21.2	19.2	18.0
N=	493	117	151	47	178
4) Prohibit Specific Uses of Reefs					
Favor	56.0a	59.8	62.9	30.0	54.7
Oppose	22.3	15.4	18.2	48.0	23.2
Uncertain	21.7	24.8	18.9	22.0	22.1
N=	507	117	159	50	181
5) Designate Reefs for Specific Uses					
Favor	66.2a	68.1	67.3	39.3	72.3
Oppose	20.9	16.0	17.5	50.0	18.5
Uncertain	12.9	15.9	15.2	10.7	9.2
N=	530	119	171	56	184
6) Rotate Reef Closures to Allow Stocks to Rebuild					
Favor	74.5a	83.2	75.0	54.7	73.9
Oppose	9.8	4.0	8.3	28.3	9.8
Uncertain	15.7	12.8	16.7	17.0	16.3
N=	530	125	168	53	184
7) Designate Times of Day for Specific Uses					
Favor	21.3a	31.5	20.0	6.4	19.9
Oppose	54.6	40.5	59.3	70.2	55.1
Uncertain	24.1	28.0	20.7	23.2	25.0
N=	484	111	150	47	176
8) Greater Enforcement of Existing Laws					
Favor	74.0a	70.5	84.9	64.8	69.0
Oppose	6.7	2.5	1.8	20.4	9.8
Uncertain	19.3	27.0	13.3	14.8	21.2
N=	526	122	166	54	184

a- denotes significant difference between groups $p < .05$

Table XXX
First Most Important Issue in the Next Decade of Artificial Reef
Development by Group (In Percent)

Issue	All Groups	Environmentalists	Sport Fishermen	Commercial Fishermen	Sport Divers
1) Dumping Too Much Junk in Ocean	23.0	29.4	13.5	32.1	24.9
2) Crowding at AR Sites	20.0	15.1	23.5	13.2	22.0
3) Overfishing of Reef Fish	19.2	17.5	25.9	9.4	17.0
4) Lack of Attention to Other Parts of Ecosystem	13.1	18.3	7.1	28.3	10.7
5) Increasing Conflicts Between Different Users	10.8	6.4	15.9	7.6	10.2
6) Overfishing of Pelagic Fish	9.9	8.7	11.8	3.8	10.7
7) Increases in Illegal Reef Building	4.0	4.8	2.4	5.7	4.5
N=	526	126	170	53	177

Table XXXI General Comments

<u>Comment</u>	<u>f</u>	<u>%</u>
1) Keep Up the Good Work	25	6.8
2) Not Qualified to Answer Survey	17	4.6
3) Thanks for the Survey	15	4.1
4) Build More Reefs	12	3.6
5) Too Much Pollution	12	3.6
6) Hope Survey Does Some Good	10	2.7
7) Would Like Copy of Survey Results	9	2.4
8) AR Work Well Given Proper Study	9	2.4
9) Sorry I Couldn't Be of More Help	7	1.9
10) Not a Sportfishermen or Diver— Am a Commercial Fisherman	7	1.9
11) User Conflict is the Primary Issue	7	1.9
12) Need Resource Protection for Future Generations	5	1.4
13) More Research is Necessary	5	1.4
14) Did Not Answer Some Questions Due to Lack of Information	5	1.4
15) Opposed to High Tech Commercial Fishing	5	1.4
16) Mainly a Shore Fisherman	4	1.1
17) Do Not Benefit Commercial Fishermen	4	1.1
18) Miscellaneous Comments (frequency <4)	211	57.1

**Appendix:
Artificial Reef Survey**



A Survey on Southeastern Artificial Reefs

By researchers from North Carolina State University

You have been chosen to participate in a survey on Southeastern artificial reefs. Your name was chosen randomly from lists representative of sport fishing, sport diving, commercial fishing or environmental interests. The results of this study will be published and presented to state and federal artificial reef managers. Please take 10 to 15 minutes to complete the questionnaire and return it within a week.

Your response is very important to us. All information will remain confidential. Thank you in advance for your cooperation. If you have any questions about the study, please contact me.

Sincerely,



Jim Murray, Project Director
UNC Sea Grant College Program
Box 8605
Raleigh, N.C. 27695-8605
(919/737-2454)

A Survey on Southeastern Artificial Reefs

Introduction

Artificial reefs are built to enhance fishery production or aggregate fish. A variety of materials are used to construct artificial reefs, including surplus ships and barges, scrap concrete, highway or bridge rubble, railroad cars and automobile tires. Some prefabricated structures are built for the sole purpose of providing artificial reefs.

There are two basic types of artificial reefs. Benthic or bottom reefs enhance fishery productivity as the surface of the reef becomes colonized by encrusting organisms and provides food and shelter for fish and other organisms. Fish aggregating devices, or FADs, are midwater reefs that concentrate certain species of fish and make them easier to locate and catch.

In recent years, the marine community has become interested in building artificial reefs. State and local government agencies and sportfishing and diving groups have built nearly 500 artificial reefs on the Atlantic coast. To ensure reefs are built, located and constructed with a minimum amount of conflict with other users of marine resources, the National Marine Fisheries Service developed a National Artificial Reef Plan in 1986. The plan called on the states to develop artificial reef management plans. Now many states are compiling plans.

We appreciate your willingness to participate in this survey. Please continue by answering the following questions.

Section I: General Knowledge and Use

1. How many years have you been (saltwater sport fishing) (saltwater sport diving) (commercial fishing) (a member of an environmental group) in your state?

Years saltwater sport fishing.
 Years saltwater sport diving.
 Years commercial fishing.
 Years as a member of an environmental group.

2. Are you familiar with artificial reefs that have been built off your state's coast?

Yes, very familiar.
 Yes, somewhat familiar.
 Unfamiliar with our state's artificial reefs.
 Until receiving this survey, I did not know what an artificial reef was.

If you did not know what an artificial reef was, please answer only questions 11, 12, 27, 28 and 33 through 37.

3. Have you used artificial reefs in your state?

Yes No

If yes, for how many years?

4. How many offshore fishing and/or diving trips did you take during the last 12 months?

Fishing trips.
 Diving trips.
 Combined fishing and diving trips.

5. On how many of these trips did you travel to artificial reef sites?

Fishing trips.
 Diving trips.
 Combined fishing and diving trips.

6. Compared to fishing over natural bottom, is your catch (number of fish caught per hour) over artificial reefs . . .

Less.
 About the same.
 Greater.
 Do not know.
 Do not fish.

7. Compared with fishing over natural bottom, is your catch (in terms of types of fish caught) over artificial reefs . . .

Worse.
 About the same.
 Better.
 Do not know.
 Do not fish.

8. In your opinion, what are the major benefits of artificial reefs? Please rate the importance of each statement about artificial reefs, by circling the appropriate response.

(SA) Strongly Agree, (A) Agree, (N) Neutral or do not know, (D) Disagree, (SD) Strongly Disagree

	(SA)	(A)	(N)	(D)	(SD)
Easy to locate.	5	4	3	2	1
Increase number of fishing locations.	5	4	3	2	1
Remove pressure from natural reefs.	5	4	3	2	1
Increase overall fisheries productivity.	5	4	3	2	1
Make fish easier to catch.	5	4	3	2	1
Increase my total catch.	5	4	3	2	1
Give the novice fisherman a place to fish.	5	4	3	2	1
Improve underwater scenery.	5	4	3	2	1
Improve underwater photography.	5	4	3	2	1
Improve spearfishing.	5	4	3	2	1
Provide a unique scuba diving experience.	5	4	3	2	1
Improve commercial pot fishing.	5	4	3	2	1
Improve commercial gill netting.	5	4	3	2	1
Improve commercial longlining.	5	4	3	2	1
Give sport fishermen a place to fish away from trawling areas.	5	4	3	2	1
Help our solid waste disposal problem.	5	4	3	2	1
A good use of our tax dollars.	5	4	3	2	1
Provides quality fishing and/or diving closer to home.	5	4	3	2	1

9. In your opinion what are the problems associated with artificial reefs? Please rate the importance of each statement about artificial reefs by circling the appropriate response.

(SA) Strongly Agree, (A) Agree, (N) Neutral or do not know, (D) Disagree, (SD) Strongly Disagree

	(SA)	(A)	(N)	(D)	(SD)
Lead to overfishing.	5	4	3	2	1
Draw large crowds.	5	4	3	2	1
Too far from shore.	5	4	3	2	1
Too close to shore.	5	4	3	2	1
Commercial fishermen interfere.	5	4	3	2	1
Cost too much to build.	5	4	3	2	1
Compete with other fisheries development projects.	5	4	3	2	1
Are dangerous to dive.	5	4	3	2	1
Placed in water too deep.	5	4	3	2	1
Poor visibility.	5	4	3	2	1
Currents too strong.	5	4	3	2	1
Reefs not built for commercial fishermen.	5	4	3	2	1
Put too much junk in ocean.	5	4	3	2	1
May break up and move.	5	4	3	2	1
Trollers interfere.	5	4	3	2	1
Bottom fishermen interfere.	5	4	3	2	1
Scuba divers interfere.	5	4	3	2	1
Sport fishermen interfere.	5	4	3	2	1

10. What types of activities do you most often pursue while visiting an artificial reef? Please rank in order of importance your top three activities: with one (1) being your most important reason for visiting the reef, (2) the second most important reason, and (3) the third most important reason.

- Trolling.
- Drift fishing.
- Bottom fishing.
- Casting.
- Trawling.
- Gill netting.
- Potting.
- Longlining.
- Purse seining.
- Scuba diving.
- Underwater photography.
- Spearfishing.
- Artifact collecting.
- Shell or fish collecting.
- Bird watching.
- Snorkeling.
- Sailing.
- Power boating.
- Other, please specify: _____

11. Below is a list of reasons why people go fishing and/or diving. Please rate the relevance of each statement to your own situation. Circle the appropriate response. (SA) Strongly Agree, (A) Agree, (N) Neutral or do not know, (D) Disagree, (SD) Strongly Disagree.

	(SA)	(A)	(N)	(D)	(SD)
To be outdoors.	5	4	3	2	1
For family recreation.	5	4	3	2	1
To experience new and different things.	5	4	3	2	1
For relaxation.	5	4	3	2	1
To be close to the sea.	5	4	3	2	1
To obtain fish for eating.	5	4	3	2	1
To obtain fish for selling.	5	4	3	2	1
To get away from the demands of other people.	5	4	3	2	1
For the experience of the catch.	5	4	3	2	1
To test my equipment.	5	4	3	2	1
To be with friends.	5	4	3	2	1
To experience natural surroundings.	5	4	3	2	1
To develop my skills.	5	4	3	2	1
To get away from the regular routine.	5	4	3	2	1
To obtain a "trophy" fish.	5	4	3	2	1
For the challenge of sport.	5	4	3	2	1

12. Please list the three species of fish that you either most frequently fish for or hope to see while diving at an artificial reef?

Fish for

Hope to see while diving

_____ Favorite fish.

_____ Favorite fish.

_____ 2nd Favorite fish.

_____ 2nd Favorite fish.

_____ 3rd Favorite fish.

_____ 3rd Favorite fish.

Section II: Artificial Reef Administration

13. Are you satisfied with your state's artificial reef program?

- Yes, very satisfied.
- Yes, somewhat satisfied.
- No, somewhat dissatisfied.
- No, very dissatisfied.
- No opinion or do not know.

14. What one thing would you like to see done to improve your state's artificial reef program?

15. Relative to other states' artificial reef programs, how would you rate your state's?

- Much better.
- Slightly better.
- About the same.
- Slightly worse.
- Much worse.
- Don't know about other states' programs.

16. In your state, who is responsible for building artificial reefs?

- The federal government.
- State government.
- County government.
- Local town and municipalities.
- Private groups.
- Do not know.
- Other, please specify:

17. If you experienced a concern about an artificial reef in your state, what agency or group would you first contact and why? Please specify:

Section III: Artificial Reef Funding

18. What are your feelings about the amount of spending on artificial reef programs in your state?

- Too high.
 About the right amount.
 Too low.
 Do not know.

19. A. How would you react to having to purchase a stamp to fish or dive on artificial reefs, if the funds were earmarked for artificial reef programs? Check one.

- For
 Neutral
 Against

B. If you are in favor of a stamp or license, please check how much you would be willing to pay.

<\$5 \$5 \$10 \$15 \$20 >\$20

20. If more money was made available for artificial reef programs, on a scale of 1 to 5 with 5 very important and 1 not important, how would you prioritize the use of these monies for the following types of reef expenditures? Please circle the appropriate response.

(VI) Very Important, (I) Important, (N) Neutral or do not know, (U) Unimportant, (VU) Very Unimportant.

	(VI)	(I)	(N)	(U)	(VU)
Better administration and management.	5	4	3	2	1
Construction of new reefs.	5	4	3	2	1
Enhancement of existing reef sites.	5	4	3	2	1
Research to better understand reef ecology.	5	4	3	2	1
Research to test new artificial reef materials.	5	4	3	2	1
Research to determine the biological impact of reefs.	5	4	3	2	1
Research to improve the productivity of artificial reefs.	5	4	3	2	1
Better monitoring to evaluate existing sites.	5	4	3	2	1
Development of more informational materials about artificial reefs.	5	4	3	2	1
Building more FADs (fish aggregating devices).	5	4	3	2	1

Section IV: Artificial Reef Siting/Construction

21. If more reefs were built in your state, where would you prefer to see them located? Please rank order from 1 to 5 with 5 indicating your top preference and 1 indicating your lowest preference.

___ Estuaries.
___ Adjacent to shoreside fishing sites (fishing piers, bridges, public beaches).
___ Inshore (0-3 miles).
___ Midshore (3-12 miles).
___ Offshore (more than 12 miles).

22. If more reefs were built in your state, what types of materials would you prefer to see them made from? Please rank your top three preferences for materials from 1 to 3 with 1 representing your first preference.

___ Ships and barges.
___ Bridge and highway rubble.
___ Rock or gravel.
___ Obsolete oil rigs.
___ Railroad cars.
___ Pre-fabricated reef modules.
___ Scrap tires.
___ Mid-water or floating fish aggregating devices (FADs).
___ Concrete blocks.
___ Other, please specify: _____

23. If FADs (fish aggregating devices) only function to make fish easier to see or catch would you be in favor of public monies being spent to build them? Check one.

___ In favor.
___ Opposed.
___ Neutral or don't know.

Section V: Artificial Reef Information

24. Please rank in order of importance from one to five (with one being the most important) the five most important sources of information to help you learn about your state's artificial reef program? In addition, check all sources you have used.

___ Newsletters from fishing, diving or environmental organizations.
___ Magazines.
___ Club meetings.
___ University or Sea Grant publications.
___ Trade shows or conferences.
___ From friends.
___ Newspapers.
___ Radio.
___ Television.
___ From retailers (fishing tackle, diving or net shops).
___ Fishery agency newsletters or magazines.
___ Other, please specify: _____

25. In general, how would you rate the overall level of information you receive about artificial reef activities?

___ Excellent.
___ Good.
___ Adequate.
___ Fair.
___ Poor.

If less than adequate, what are the deficiencies? _____

26. Please check the types of artificial reef information of which you would like to have more.

- Films or video.
- Maps.
- LORAN-C numbers.
- Fishing methods.
- Artificial reef ecology.
- News items updating changes in the reef program.
- Species identification.
- Other please specify: _____

Section VI: Artificial Reef Evaluation

27. Would you be willing to serve on an advisory committee at the state or county level if asked to do so?

- Yes.
- No.
- Not sure, need to know more about it.

28. In an effort to assist fishery agencies with monitoring and evaluating their artificial reef programs, would you be willing to volunteer to collect data about your fishing or diving activities?

- Yes.
- No.
- Not sure.

Section VII: Artificial Reef Conflict Resolution

29. As more people use artificial reefs the frequency of conflicts between and among user groups has increased. As you pursue your goals while visiting an artificial reef, have you experienced conflicts with any of the following user groups? Please check if yes.

- Trawlers.
- Trollers.
- Bottom fishermen.
- Drift fishermen.
- Cast fishermen.
- Longliners.
- Potters.
- Sailors.
- Divers.
- Spearfishermen.
- Power boaters.
- Commercial shipping.
- Have not experienced conflicts.
- Underwater photographers.
- Birdwatchers.
- Snorkelers.
- Artifact Collectors.
- Shell or fish collectors.
- Other, please specify: _____

30. What was the nature of any conflict you may have experienced? Please check the appropriate response(s).

- Crowding (too many boats).
- Divers anchored and could not troll or bottom fish in certain areas.
- Spearfishermen shooting or scaring fish.
- Bottom fishermen made it difficult to troll.
- Trollers came too close while bottom fishing.
- Commercial fishermen came too close.
- Commercial fishermen harvested too many fish.
- Sportfishermen harvested too many fish.
- Divers harvested too many fish.
- The reef interfered with commercial trawling.
- Charter or headboats dominating one reef.
- Charter or headboats catching too many fish.
- Other, please specify: _____

31. Management measures are available to minimize conflict or overfishing on artificial reefs. Would you favor or oppose the following types of restrictions at artificial reefs? Please write F-Favor, O-Oppose, U-Uncertain.

- Restrict the size and number of certain fish taken.
- Restrict the fishing gear used.
- Restrict seasons.
- Prohibit specific uses of reefs.
- Designate reefs for specific uses, for example, diving, sportfishing or commercial fishing only.
- Rotate reef closures to allow stocks to rebuild.
- Designate times of day for specific uses.
- Greater enforcement of existing laws.

32. As you look at the next decade of artificial reef development how would you rank the importance of the following issues? Please rank order the following issues from 1 to 5 with 1 indicating the most important and 5 indicating the least important.

- Crowding at artificial reef sites.
- Dumping too much junk in ocean.
- Overfishing of reef fish.
- Overfishing of pelagic fish.
- Lack of attention to other parts of the ecosystem.
- Increasing conflicts between different users.
- Increases in illegal (unpermitted) reef building.

Section VIII: Profile of Artificial Reef Users

The following questions will help us to learn more about the users of artificial reefs in the Southeast region. The information you provide will be kept strictly confidential and you will not be identified with your answers.

33. What is your age? ____

34. Are you? Male ____ Female ____

35. How far are the nearest ocean waters from your permanent home residence? ____ Miles.

36. What was the last year of school you completed? (Circle only one number).

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21+

37. What is your approximate annual household income before taxes?

- | | | | |
|--------------------------|----------------------|--------------------------|------------------------|
| <input type="checkbox"/> | under \$10,000 | <input type="checkbox"/> | \$60,000 to \$69,999 |
| <input type="checkbox"/> | \$10,000 to \$19,999 | <input type="checkbox"/> | \$70,000 to \$79,999 |
| <input type="checkbox"/> | \$20,000 to \$29,999 | <input type="checkbox"/> | \$80,000 to \$89,999 |
| <input type="checkbox"/> | \$30,000 to \$39,999 | <input type="checkbox"/> | \$90,000 to \$99,999 |
| <input type="checkbox"/> | \$40,000 to \$49,999 | <input type="checkbox"/> | \$100,000 to \$109,999 |
| <input type="checkbox"/> | \$50,000 to \$59,999 | <input type="checkbox"/> | \$110,000 or more |

Is there anything else you would like to mention to us?

Thanks!

Your time and effort are sincerely appreciated!

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