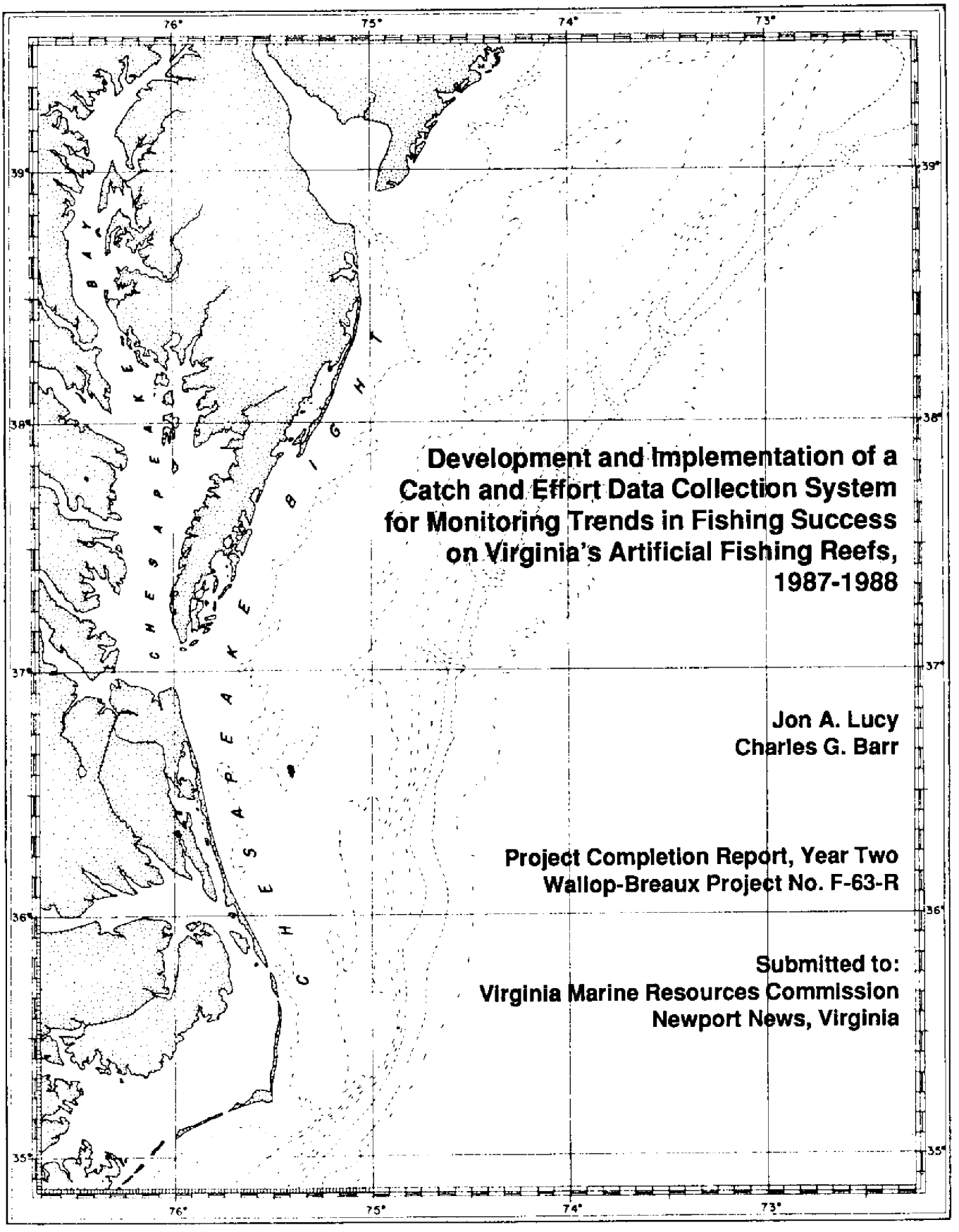

Development and Implementation of a Catch and Effort Data Collection System for Monitoring Trends in Fishing Success on Virginia's Artificial Fishing Reefs, 1987-1988

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Project Completion Report, Year Two
Wallop-Breaux Project No. F-63-R

Submitted to:
Virginia Marine Resources Commission
Newport News, Virginia

Department of Marine Advisory Services, Virginia Institute of Marine Science, School of Marine Science, College of William and Mary, Gloucester Point, Virginia

Project Completion Report
(Year Two of Two-Year Project)

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For the Period: January 1, 1988 - December 31, 1988
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TABLE OF CONTENTS

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Mr. Meier of the VMRC was particularly helpful in discussing various aspects of the study throughout the project and readily supplied names of fishermen to the researchers for inclusion in the study's sample population of reef fishermen. Mr. Jack Travelstead, Head of VMRC's Fisheries Division was also most helpful through his role as administrator of Virginia's "marine" Wallop-Breaux projects. Of particular assistance to the project was Mr. Travelstead's convening of a meeting in early June 1987 involving the principal investigator, Mr. Meier, and Dr. David Feigenbaum of Old Dominion University. Discussions of early results of the project initiated the idea for adding a question to fishermen's interviews concerning their rating the overall quality of their fishing experiences on wreck and reef

sites. This information proved to be extremely helpful to the researchers in evaluating circumstances at sites which contributed to good or bad fishing experiences. In addition to participating in the described meeting, Dr. Feigenbaum has proven helpful on other occasions throughout the study with regard to exchanging ideas on various aspects of the study.

The data analysis and preparation of report tables could not have been completed without the assistance of Ms. Nancy Chartier, Project Specialist and Mr. Edward Heist, Graduate Assistant in VIMS Department of Marine Advisory Services. A similar contribution to the project was made by Ms. Maxine Butler, Secretary in VIMS Department of Marine Advisory Services. In addition to her many diverse and difficult duties, Ms. Butler found the energy and patience to rework drafts of the project report and to produce the final copy for printing. Her assistance, like that of Ms. Chartier and Mr. Heist, was critical to the successful completion of the project. The final report was printed by Ms. Sylvia Motley of VIMS Print Shop. Ms. Cheryl Teagle, Office Services Supervisor of the Department of Marine Advisory Services, and Ms. Jane Lopez of VIMS Finance Office provided administrative assistance to the project.

Numerous Virginia fishing clubs and marina/tackle shop operators helped the researchers identify wreck and reef fishermen utilizing certain artificial reef sites. The Deltaville Fishing and Conservation Club was of major assistance to the project. In addition to providing names of its members who fished the Gwynn Island Test Reef, the Club also printed signs displayed at local businesses encouraging Gwynn Island reef fishermen to establish contact with the Club or VIMS researchers to become incorporated into the sample population of fishermen for the project. Mr. James Wharton, club president, Mr. Gene Sidoli, Captain Tabb Justis, and Mr. Pat Watson

were particularly helpful in spreading the word on the researchers' need to identify fishermen utilizing the Gwynn Island Reef site. Mr. Wharton also graciously invited the researchers to join him on a fishing trip to the reef, an experience which helped the researchers better interpret interview information obtained from fishermen during the study.

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In a similar manner, most of the fishermen interviewed during the project gave freely of not only their catch information but also of their time in providing useful information about fishing situations they experienced on various wrecks and artificial reefs. While the latter information was impossible to quantify, it provided a very useful framework for researchers to use in evaluating some of the project's results. A special "thank you" is due to all fishermen who provided their names for use in the project's sample population of wreck and reef fishermen, as well as

to those who were interviewed during the course of the season. The study could not have been done without their willingness to assist the researchers in quantifying fishing success rates on Virginia's more popular wreck fishing sites.

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INTRODUCTION

Recreational fishing opportunities in Virginia for species associated with hard bottom habitats such as natural oyster reefs and man-made structures have been enhanced since the early 1970's through an artificial reef construction program coordinated by the Virginia Marine Resources Commission (VMRC). This program evolved under the Commission in response to private interests initiating reef development projects beginning as early as 1959. As more interest developed in establishing reef sites there became a growing need for state assistance in coordinating permits and the placement of reef materials on subaqueous bottoms under the jurisdiction of the Commonwealth and the federal government (Lucy 1983; Meier et al. 1985). Virginia's growing artificial reef program led the VMRC to contract with Old Dominion University (ODU) for a three year study (1983-85) of potential reef sites in Chesapeake Bay and offshore waters. The study effort provided an assessment of two test reefs established inside Chesapeake Bay and one site offshore Wachapreague on the Eastern Shore. The test reef sites were monitored by researchers using rod and reel fishing techniques designed to compare the results of fishing effort on each reef site and adjacent "control" areas not containing reef materials (Feigenbaum 1984; Feigenbaum et al. 1985a; Feigenbaum et al. 1985b; Feigenbaum et al. 1986). As part of the study, recommendations were made for future artificial reef development in Virginia (Feigenbaum et al. 1986).

This project is intended to complement the previous studies, establishing a data base of recreational fishermen's catch success rates on major reef and other popular "wreck fishing" sites. By systematically collecting and analyzing catch and effort data from recreational fishermen

utilizing such sites, as well as recording observations about how the sites are most effectively fished, researchers seek to provide the VMRC with information that will assist in better placement and design of productive reef sites. This study will also help document current use patterns and the relative popularity of various reef and other wreck fishing sites among recreational fishermen.

OBJECTIVE

The basic objective of the study was to identify a core population of recreational fishermen owning private boats and fishing one or more Virginia artificial reefs or other popular wreck fishing sites (Figure 1 and Table 1) with some degree of regularity (making a minimum of two or three reef trips per season). This population of fishing boat owners would be sampled randomly, by either telephone or fishing log books, to determine fishing effort and catch rates characterizing trips made to specific reef and other popular wreck fishing sites during the 1987 fishing season. Examination of the resulting data would determine whether fishing activity on all, or a limited number of reef and wreck fishing sites, would be sampled during the study's second year. The sample population of reef and wreck fishermen would also be expanded in year two of the study.

METHODS

A chart showing the locations of Virginia's three test reefs and four major reefs was printed, including the listing of LORAN C coordinates of major materials on each site. On the reverse side of the chart were spaces

for reef and wreck fishermen to provide Virginia Institute of Marine Science (VIMS) researchers with their names, mailing addresses, and telephone numbers, in order to assist with the reef study (Appendix A). These charts, with associated wreck fishermen identification forms on the back, were sent to major saltwater fishing clubs of coastal Virginia, requesting that they encourage reef and wreck fishing members to participate in the study. In addition, the charts, with stamped return envelopes, were sent to major marinas in the port areas serving artificial reef sites and the majority of official weigh stations certified by the Virginia Saltwater Fishing Tournament. In addition to these efforts, the researchers addressed fishing clubs, visited docking and launching facilities, promoted the study at the Virginia Sport Fishermen's Forum in 1987 and 1988, prepared news releases for major metropolitan newspapers (Appendix B), and highlighted the need for fishermen's participation in the study and study results in VIMS "Marine Resource Bulletin" (a Sea Grant quarterly newsletter with circulation of over 6,800) (Appendix C and D). A mailing of reef charts was again made to recreational fishing clubs early in 1988 to obtain names of new members targeting wrecks and reefs. The popular "Chart of Wrecks and Artificial Reefs in Virginia Waters", a cooperative publication of VIMS Sea Grant Marine Advisory Program and VMRC's Artificial Reef Program, was re-formatted and expanded in area to cover lower Chesapeake Bay such that all existing reef sites were located on the chart (Lucy 1988). Through these techniques a population of boat-owning reef and wreck fishermen was established and regularly expanded for sampling purposes. Based upon experience gained with studies of the offshore recreational pelagic fishery (Bochenek et. al. 1989;

Lucy et al. 1988b), it was decided to sample the identified population of fishermen using a random telephone interview technique.

General Sampling Program for Lower Chesapeake Bay and Offshore Wreck Fishing Sites

Two week (14 day) telephone sampling "wave date" intervals were established for the general reef and wreck sampling program, with the first random telephone calls made on April 13-15 for the fishing (sampling) period of March 30-April 12 during the study's first year. In 1988 telephone interviews for the general sampling period were initiated in the third week of April for the fishing period April 4-17. Each sampling period extended from Monday through the second week of the two week time frame. Two weekends, the time of most private boat fishing activity, were covered in each telephone sample. For each sampling period a random selection of letters was made from the alphabet using a random numbers table. These letters were used to determine from which alphabetical group of fishermen's names interviewees would be selected. Fishermen's names were then randomly chosen from within each group of last names beginning with the randomly selected letter. Calls were made to the 25-30 randomly selected fishermen until 20 fishermen had been reached. When contacted, fishermen were asked about reef or wreck fishing trips they might have taken aboard their boat during the specified sampling period. Telephone calls were predominately made in the evenings to home telephone numbers supplied by study participants, but calls were also made to work locations during the day, whenever such numbers were provided by fishermen. All calls were generally

completed on Mondays through Wednesdays of the week immediately following the sampling period.

Catch data on reef or wreck fishing trips made one to two weeks prior to the specified fishing period were also recorded and included in the appropriate sampling period's data set. Such trips helped to supplement the small total number of artificial reef trips generally accounted for in each sampling period and provided broader coverage of numerous non-reef "wreck fishing" trips made by fishermen. If anglers were unsure about the details of fishing trips, the data were not used.

Fishermen's names were not reused in the telephone sampling list for at least one month in the general sampling program. This reduced the number of repetitive calls to the same fisherman, while also helping to insure that the majority of the population of identified fishermen would be contacted at least once during the fishing season (Bochenek et al. 1989).

Special Sampling Program for Gwynn Island Test Reef Site

The Gwynn Island Test Reef Site was of special interest to researchers because of the relatively poor catch performance rating it received in the ODU study (Feigenbaum et al. 1985a; Feigenbaum et al. 1986). The study results contrasted with reports from fishermen in the local area indicating that the site was fairly popular, producing reasonable catches of trout and spot during the summer months and some tautog in the fall (Feigenbaum et al. 1985a; Deltaville Fishing and Conservation Club, personal communication).

Telephone interviews for the first four general sampling periods in 1987, a total of 80 fishermen, produced no trips taken to the Gwynn Island Test Reef. Researchers were concerned that sufficient data would not be

obtained during the season to document catch trends at this particular reef. A new sampling strategy was designed to address this concern. With assistance from the Deltaville Fishing and Conservation Club and marina operators and tackle shops in the Deltaville-Gwynn Island-Mathews County area, a more concerted effort was initiated to identify a larger number of boat owners fishing the Gwynn Island Test Reef. A random telephone sampling of ten such fishermen per two-week period was begun June 1-3, 1987 for the sampling (fishing) period May 18-31, a schedule that alternated this special sampling effort with the general sampling schedule initiated for all reef sites beginning in April.

Because the population of Gwynn Island fishermen was small, especially at the beginning of the newly established special sampling program, names of such fishermen were only withheld from the random drawing of names for one sampling period before being put back into the Gwynn Island Reef population of fishermen. The designated "Gwynn Island fishermen" were also left in the total population of fishermen from which random interviews continued to be made during 1987 in the general sampling effort for all reef sites. This provided the opportunity at the end of the season to compare the size of resulting data sets (number of usable interviews) recorded for the Gwynn Island Test Reef site from the two distinctive sampling efforts. The revised sampling protocol was continued into November 1987 (last fishing period sampled was November 2-15).

Sampling effort for the Gwynn Island Test Reef was doubled in 1988 to increase sample size for each month and the season overall. Sampling began in the second week of April for the fishing period March 28-April 10. As in 1987, boat owners were interviewed randomly but at no greater frequency than

every other interview period (approximately once each month) to enhance contacting the most fishermen (Lucy et al. 1988a).

Regarding fishing trips to the Gwynn Island Test Reef and other wreck fishing sites, particular care was taken by researchers to include in the analysis only trips during which fishing activity was either concentrated directly on the the reef materials (structure) or within approximately 325 yards (approximately 300 meters) of the reef's periphery. Bohnsack and Sutherland (1985), in their review paper on reef research, indicated that the "enhanced fishing zone" around reefs was generally accepted as being 200-300 meters wide for midwater and surface fishes and up to 100 meters wide for benthic fishes. Since both categories of fish were caught at this site, the 325 yard zone concept was utilized in determining which recorded trips , although occurring in the vicinity of the reef, should not be considered strictly "reef" trips for purposes of the study's analysis. As expected, reef fishermen sometimes had difficulty in estimating how far away from the reef or other structure they fished. As researchers interviewed fishermen and explained the distance problem and its importance, fishermen became more accustomed to the study's requirements and more precise in describing the ways in which they fished sites, including estimating distances fished from structrues at the site.

Data Collected and Analysis

In both sampling programs records of fishing effort (number of fishing trips) were maintained for each sampling period and basic catch data recorded for each reef and wreck fishing trip adequately recalled (see telephone interview instrument, Appendix E). Concerning catches, fishermen

were asked to list what fish(es) they were trying to catch (targeted species), all types of fish caught, the number kept and released of each species, and the estimated average weight of fish kept and released by species. In early July 1987, a question rating the overall quality of each fishing trip experience was added to the telephone interview instrument as a result of discussions with the project coordinator, Mr. Jack Travelstead of VMRC. Since the recall periods were only 14-18 days long, the majority of fishermen contacted responded quickly and in excellent detail to the interviewer's questions. Interviewing was terminated in late November of each year when weather constantly prevented fishermen from making reef or wreck fishing trips and the majority of such fishermen indicated they were "finished fishing for the season". Since data recorded in 1987 for Gwynn Island Test Reef fishing trips were collected in the same random manner for both the general sampling program (14 trips) and special program (46 trips), the data sets were combined (60 trips) for the comprehensive monthly and seasonal analysis of the Gwynn Island site for that year.

Catch data recorded from fishing trips was organized by general target species groups for comparison between years and locations within years. The rationale for this approach was based upon the fact that fishermen seldom fished for just anything that was available but rather specifically sought (targeted) certain species. Grouping catch data otherwise would seriously bias catch rate calculations (one index of fishing success), e.g., it would be erroneous to include fishing effort associated with trips targeting trout to the CBBT Islands in calcuations for catch rates of tautog at the location. Bait selection and fishing techniques are significantly different for each of these species, therefore fishermen would not likely catch one species while fishing for the other. While exceptions may occur, i.e. an

occasional trout caught while one's line is going down rigged for tautog, the concept of analyzing catch data by appropriate targeted species or species groups is felt to be the most valid mechanism for meaningful interpretation of the study results.

All data were entered on the VIMS Prime mainframe computer and analysis conducted using SPSS-X software packages (SPSS Inc., 1986). Hours of fishing time were rounded off to the nearest even hour (e.g., 6.5 hrs. was rounded off to 6 hrs.). When a range of average fish weight was given for catches, the average of the "range" was used (e.g., 10 tautog caught with an average weight of 4-6 pounds, the weight was entered into the computer as 5 pounds).

RESULTS AND DISCUSSION

Sample Population of Fishermen

Implementation of various strategies to contact and identify boat owners fishing artificial reefs and other popular wreck fishing sites in the Chesapeake Bay and offshore waters resulted in an initial sample population of approximately 125 fishermen in April 1987 when sampling began. By the end of the first year's sampling in late November 1987, the identified population of wreck fishermen had been approximately doubled to 250 boat owners (Lucy et al. 1988a). The Gwynn Island Test Reef sample population consisted of 66 fishermen at the end of the 1987 fishing season, reflecting the special sampling effort initiated to increase data from that site. The sample population of boat-owning fishermen continued to be expanded in 1988, totaling 427 individuals by early December 1988 when sampling was completed for the second and final year of the study. The increased sample population

in 1988 (70% greater than 1987 overall) included 97 boat-owning fishermen associated primarily with fishing the Gwynn Island Test Reef. This specific group of fishermen, 62% larger than in 1987, was sampled more intensely in 1988 to determine whether such sampling would produce clearer patterns of fishing preferences (species targeted) and catch rate patterns (see Methods).

The general sampling program for lower Chesapeake Bay and offshore sites, excluding the Gwynn Island Test Reef, captured data on 124 and 188 fishing trips in 1987 and 1988, respectively. These trips were made by 56 different boats in 1987 and 110 boats in 1988. The special Gwynn Island Test Reef sampling effort obtained data on 60 and 83 fishing trips in 1987 and 1988, respectively, representing successful interviews with 40 and 45 different boat owners in each respective season.

General Sampling Program for Lower Chesapeake Bay and Offshore Sites

The general sampling program collected data on fishing trips to approximately 40 specific wreck fishing locations during each year of the study. The fifteen most commonly fished sites, indicated in Figure 1 and Table 2, accounted for 77% and 82% of all trips captured in the general sampling program in 1987 and 1988, respectively. The Chesapeake Bay Bridge Tunnel Islands (CBBT Islands) ranked first among all wreck fishing sites each year, accounting for 18% of all sampled trips in 1987 and 24% in 1988.

The most frequently fished artificial reef was the Chesapeake Light Tower Reef ranking third overall in relative use compared to all other sites targeted by boat owners in both study years. Efforts in 1988 to identify more fishermen utilizing the newest reef, the East Ocean View Reef, were somewhat successful. The site moved from a very low ranking in frequency of

trips in 1987 (2% of all trips sampled) to the fourth most frequently fished site in 1988 (8% of all trips sampled). This increase in use may also have been partially the result of the reef being one year old in July 1988, thereby being more "mature" and more likely to attract fish, at least in the minds of fishermen. "The Cell", a popular wreck fishing site for fishermen from both sides of Chesapeake Bay, accounted for 11% of fishing trips sampled in 1988, ranking it second in popularity only behind the Chesapeake Bay Bridge Tunnel Islands that year. Data on fishing success rates at this site should provide a useful baseline against which to compare future fishing experiences if plans for enhancing the site by VMRC are implemented (M. Meier, personal communication).

Fishing effort parameters (anglers per trip, rod hours fished, etc.) generally remained more consistent over the two years of the study for sites in the lower Bay compared to offshore sites (Table 3). Mean fishing effort (rod hours per trip) varied little between years for sampled trips targeting the Chesapeake Bay Bridge Tunnel and the Ocean View Reef. Trips to the Cell exhibited longer fishing periods in 1988 compared to 1987, resulting in an apparent increase in mean fishing effort at the site in the second year. Large variances associated with the mean fishing effort estimates, however, indicated no significant differences likely existed between years. Examining mean fishing effort per trip for combined trips to key lower Chesapeake sites, as compared to combined trips to offshore sites, better distinguished broad differences in fishing patterns between the inshore and offshore areas (Table 3).

The five most popular lower Bay sites exhibited mean fishing effort per trip of approximately 13 rod hours during the study years. In contrast, combined trip data for popular offshore sites indicated greater effort per

trip occurred in 1987 compared to 1988. The major factor causing this distinction in effort between years appeared to be that, on the average, more fishing rods were fished per fishing party in 1987 (5.0 rods per trip) than in 1988 (3.4 rods per trip). Man hours fished per trip in 1987 were also slightly greater than in 1988 (Table 3).

Fishermen's observations on the number of other boats fishing a given site exhibited large variations for the sample sizes available, making such estimates useless. Therefore no index was calculated for boat density at given sites for the season, as attempted in the first study year.

Catch Patterns

Fishermen utilizing wreck fishing sites in Virginia targeted a relatively small number of species known to have some affinity for submerged structures. The species in question may use the structure for protection, orientation, or as a "feeding station" or for any combination of these factors. The distribution pattern of sampled fishing effort by primary species targeted clearly illustrates that the species of highest priority for wreck fishermen was tautog, Tautoga onitis, particularly in the spring and in late fall (Tables 4 and 5). Tautog generally occur in both desirable numbers and sizes (approximately 1-5 pounds) inside Chesapeake Bay and offshore, unlike an associated species the black sea bass, Centropristis striata. Both species were generally mentioned by fishermen as the target species group being sought on offshore sites, however, inside the Bay sea bass generally are young fish and run small in size (a pound or less). Their numbers inside the Bay are also generally less consistent than offshore.

During late spring and summer, other species groups besides tautog-seabass begin to be sought by wreck fishermen. This shift in the overall pattern of targeted species was most noticeable in 1988 (Table 5). A greater proportion of wreck fishing trips occurring inside Chesapeake Bay was captured in the general sampling program that year (52% of all trips sampled occurred at the more popular lower Chesapeake Bay sites listed in Table 2 in 1988 compared to only 32% in 1987). Inside the Bay, wreck fishermen began to shift away from fishing for tautog in May and June, focusing more on gray trout (weakfish, Cynoscion regalis) and summer flounder (Paralichthys dentatus). Neither of these species are commonly thought of as "wreck fish" per se but are known to feed around and orient to structure as well as other types of bottom environment. As fishing progressed into the warm summer months, spot (Leistomus xanthurus) and croaker (Micropogonias undulatus) also began to receive more attention from wreck fishermen at lower Bay sites, these species attracting the greatest relative effort in August and September (Table 5). From mid September into October, wreck fishermen inside the Bay began to shift their emphasis back to trout, flounder and tautog. At offshore sites sea bass and tautog continued to be the major targeted species.

One principal exception to the offshore pattern of fishing involved amberjack (greater amberjack, Seriola dumerili), which were targeted by fishermen, especially at the Chesapeake Light Tower, during July and August and even into September and October. This species represents a relatively new target fishery for Virginia's offshore fishermen and its growing popularity was recognized in 1988 by the Virginia Saltwater Fishing Tournament. For the first time in its history the Tournament program offered release citations for amberjack having a minimum length of 44

inches. Over 450 release citations for amberjack were awarded by the Tournament for 1988, the largest number of citations for any release category (VSFT 1988).

Other less significant exceptions to traditional offshore wreck fishing for sea bass and tautog concerned some bluefish (Pomatomus saltatrix) trips targeting the Chesapeake Light Tower and lower Chesapeake Bay sites in spring 1988 (Tables 5 and 13). In addition wreck fishermen targeted king mackerel (Scomberomorous cavalla) and Spanish mackerel (S. maculatus) on a few trips to lower Bay sites and the Light Tower Reef (Tables 5 and 15).

The seasonal (annual) pattern of fishing effort according to species targeted also was strongly influenced by the relative increase in lower Bay trips captured during the 1988 general sampling program. The sea bass-tautog species group was targeted on nearly 90% of all trips sampled in the 1987 general program compared to only 45% in 1988 (Table 4 and 5). Flounder and gray trout together were targeted on a total of 25% of all trips sampled in 1988 while spot and croaker trips accounted for 9% of the total (this latter species group only accounted for 1% of sampled trips in 1987's general sampling program). Amberjack was targeted on 7% of the 1988 sampled trips compared to 4% in 1987. Bluefish trips, while not recorded in 1987, accounted for 4% of 1988 trips. The availability of significant numbers of legal size (24 inch) striped bass (Morone saxatilis) to Chesapeake Bay Bridge Tunnel wreck fishermen in November 1988 accounted for 3% of all trips sampled in that year (Table 5).

Several lower Bay and offshore wreck fishing sites were represented by enough trips in the general sampling program to allow examination of the relative contribution made by various species to the overall catch (Table 6). Considering only fish which were kept by fishing parties, tautog

represented approximately 21% and 40% of total kept fish on 1988 trips to the Chesapeake Bay Bridge Tunnel and The Cell, respectively, but contributed nothing to catches at the Ocean View Reef (insufficient trips to The Cell and Ocean View Reef were captured in the 1987 sampling program to warrant comparisons). Black sea bass, while making only small contributions to kept catches at lower Bay sites (approximately 2-13%), accounted for 60%-90% of kept fish taken at the Chesapeake Light Tower Reef and Triangle Wrecks Area (includes the Triangle Reef). Tautog correspondingly made smaller contributions in 1988 to offshore site catches than for trips made inshore to The Cell and CBBT Islands, the only year in which sufficient trips were captured in the sampling program to make general comparisons. During 1988 flounder contributed approximately 11%-40% by number to total kept catches at the three inshore wreck fishing sites, being particularly important in trips to the Cell (40% of kept catches). Croaker strongly dominated 1988 catches only at the Ocean View Reef (76% of kept catch) with flounder the other major contributing species (16%). Spot and croaker catches together accounted for approximately 14% of kept catches at the CBBT Islands but were insignificant at The Cell. Gray trout was significant only at the CBBT Islands in 1988, representing approximately 22% of all kept fish, similar in relative importance to tautog catches at the site.

As expected, sea bass catches dominated offshore reef sites with some contribution also made by tautog, the two species principally targeted at such sites. Tautog made major contributions in 1988 to two of three Bay wreck fishing sites for which sampling captured enough trips to allow meaningful comparisons. Flounder contributed significantly to catches at all three Bay sites in 1988 with gray trout being a strong component of catches only at the CBBT Islands. Spot, croaker and bluefish made small

contributions to catches at the CBBT Islands and the Cell while croaker accounted for over 75% of kept fish at the Ocean View Reef. Striped bass catches at the CBBT Islands in November 1988 added a new component to that site's fishing, resulting in a contribution to overall catches comparable to that made by either sea bass, spot, croaker, bluefish or flounder.

Catch rate data compiled in the general sampling program is organized by appropriate target species groups; sea bass-tautog, spot-croaker-trout-flounder, spot-croaker, trout, flounder, amberjack, spanish mackerel, king mackerel and bluefish (Tables 7-15). These data groups best represent the pattern of wreck fishing observed on reefs and wreck fishing sites in the Bay and offshore. The spot-croaker-trout-flounder group is a catch-all group for Bay sites since any one of the four species has a reasonable likelihood of being caught while bottom fishing for the other species.

Catch data for all reef and the more popular wreck fishing sites are presented in Tables 7-15. Small sample sizes for many of the sites cannot be considered truly representative of a season's fishing at the location. Such data is shown primarily to provide reef managers with what data was captured in the study and to allow cursory visual comparisons among a spectrum of wreck fishing sites. Only those fishing locations for which six or more fishing trips were captured in the sampling programs during 1987 or 1988 will be discussed in detail, unless otherwise noted.

Sea Bass and Tautog

This species target group was sought at all major reef and wreck fishing sites in both study years with the exception of the sampling program not recording such trips to The Cell or the Ocean View Reef in 1987 or the

Parramore Reef in 1988 (Table 7). Trips generally occurred most frequently during the months of April through May (sometimes June) and September through November, although trips during July and occasionally August were also captured in the sampling program.

Locations for which sufficient fishing trips were sampled to warrant comparisons from year to year and between locations within either year were: CBBT Islands, The Cell, Cape Henry Wrecks, Chesapeake Light Tower Reef, Triangle Wrecks Reef, Triangle Wrecks Area, combined lower Chesapeake Bay Sites and combined Offshore Sites (Table 7). Sea bass mean catch rates (fish per rod hour) were greater in 1988, compared to 1987, at the Chesapeake Light Tower Reef, the Triangle Wrecks Reefs and Triangle Wrecks Area. Correspondingly, mean pounds of fish kept per rod hour at these sites were also greater in 1988 than 1987. Yearly differences in sea bass mean catch rates were not observed at lower Chesapeake sites (CBBT Islands and the Cape Henry Wrecks. This distinction in yearly catch patterns between lower Bay sites and offshore sites (Chesapeake Light Tower Reef, Triangle Wrecks Reef and Triangle Wrecks Area) was further strengthened by similar results for yearly comparisons between combined trips to major sites in each zone. Catch rates (number fish caught and pounds kept per rod hour) were significantly higher in 1988 than 1987 for combined trips to major offshore sites (Table 7).

Sea bass catch rate comparisons were also made between locations within each study year. Popular lower Bay site comparisons were limited in 1987 to those between the CBBT Islands and Cape Henry Wrecks since no trips targeting sea bass-tautog were captured by the sampling program for The Cell or Ocean View Reef. Sea bass catch rates (fish per rod hour) were greater on trips made to the Cape Henry wrecks than to the CBBT Islands. Greater

catch rates (pounds of fish kept per rod hour) were also experienced in 1987 offshore at the Triangle Wrecks Area in comparison to the CBBT Islands (Table 7). The difference in catch rates was not the result of higher catch rates at the Triangle Wrecks Area (mean fish per rod hour catch comparisons were not significant) but attributed to larger fish being caught, the expected situation with sea bass.

A greater range of site comparisons for sea bass catches was possible in 1988. While no differences in catch rates could be demonstrated between lower Bay sites (CBBT Islands, The Cell, and Cape Henry Wrecks), significant differences in catch rates (fish caught and pounds of fish kept per rod hour) were observed in most comparisons between inshore and offshore sites (Table 7, footnote F). Offshore sites demonstrated greater mean catch rates for numbers caught and pounds kept of fish compared to lower Bay sites. The Triangle Wrecks Area (includes the Liberty Ships Reef) produced mean catch rates of 4.0 sea bass per rod hour (5.6 pounds of fish per rod hour) compared to catches of 1.2-1.3 fish per rod hour at the CBBT Islands and Cape Henry Wrecks sites (Table 7).

Tautog were caught and kept in greater numbers than sea bass at two lower Bay sites, the CBBT Islands and The Cell (1988 data only), while the reverse trend occurred at the Cape Henry Wrecks, somewhat intermediate in its Bay-offshore orientation. No significant yearly differences in catch rates were detected at specific major sites inshore or offshore. A significant decline in mean number of fish caught per rod hour was observed, however, between years when comparing combined trips to offshore sites (Table 8). More "citation size fish" (minimum weight of 9 pounds) are caught offshore than in the Bay. Records of the Virginia Saltwater Fishing Tournament indicate tautog citations declined 98% from 1986 through 1988

(VSFT 1986-1988), lending support to the decline in catch rates noted in this study. Catch rates at major lower Bay sites (number of fish and pounds of fish kept per rod hour) were greater than at most offshore sites in 1988 and to some extent in 1987. The CBBT Islands supported catch rates higher than all other major sites tested except for The Cell (1988 data only) and Cape Henry Wrecks (number of fish caught per rod hour in 1988) (Table 8). Tautog catch rates in 1988 were greater for lower Bay sites (trips combined) than Offshore Sites (trips combined) but this was not the case in 1987. Capturing sea bass-tautog trips to The Cell in 1988 likely contributed to the differences observed between lower Bay and offshore sites in that year.

Spot, Croaker, Trout and Flounder

This composite group of "bottom fish" was targeted only at lower Bay sites, excluding the Cape Henry Wrecks. Trout and flounder were each specified separately as target species while spot and croaker were generally mentioned as a two-species target unit. Compared to the fishing pattern for tautog and sea bass at Bay sites, sciaenids and flounder were principally targeted during summer months (June-August) with trips also made in May and the September-October period.

Species preference patterns differed seasonally at lower Bay sites, particularly during the 1988 season. October 1988 was a major fishing period for trips to the CBBT Islands targeting flounder and to The Cell targeting spot and trout. Other temporal differences in species preference patterns at the CBBT Islands and The Cell also occurred in 1988. Fishermen principally targeted gray trout in May through July at the CBBT Islands but targeted flounder at The Cell in June and July. Flounder and croaker were

targeted during June-July at the Ocean View Reef. These different fishing patterns at Bay sites demonstrated the diversity of fishing opportunities provided fishermen seasonally by the existing mixture of reefs and wreck fishing sites in the lower Bay area.

No significant yearly differences in mean catch rates were observed for spot at any of the Bay sites (excluding comparrisons with GwynnIsland Test Reef), although sample sizes only provided meaningful comparisons for the CBBT Islands and combined Lower Chesapeake Bay sites (Table 9). No differences in catch rates could be demonstrated among the CBBT Islands, The Cell and The Ocean View Reef in 1988, the only year in which sample sizes were adequate for statistical comparisons.

Spot catch data, like that of croaker, trout and flounder, was examined from two perspectives: (1) catches made during trips targeting any of the four species of the "bottom fish" target group and (2) catches made on trips targeting only spot-croaker (Table 9). While sample sizes were not sufficiently large in either study year to warrant statistical comparisons between the two trip categories at given locations, the data indicate refinements in catch rate comparisons might be achieved by such data aggregations. For example, breaking out trips targeting only spot-croaker (Table 9, lower section) demonstrated that catch rates might have been higher at the CBBT Islands for such trips than when catch rates were calculated based upon a broader target spectrum of bottom fish. Sampling effort capabilities and rate of capture of fishing trips targeting certain species would determine how much data disaggregation can occur in providing the most meaningful analysis of catch rates for desirable species.

Croaker catch rates exhibited yearly differences at the CBBT Islands, the only location with large enough sample sizes each year to justify a

comparison (Table 10). Significantly higher 1987 catch rates were also observed for yearly comparisons between combined trips to major lower Chesapeake Bay sites. Mean numbers of fish caught and, correspondingly, pounds of fish kept were significantly greater in 1987 compared to 1988. Significant differences in mean catch rates (number and pounds per rod hour) between sites were observed in 1988. The Ocean View Reef produced better croaker catches than the CBBT Islands or The Cell for trips targeting the bottom fish group of species. Insufficient sample sizes were available to making similar site comparisons for trips targeting only spot-croaker (Table 10).

Gray trout (weakfish) mean catch rates did not differ between years for the CBBT Islands and combined trips to major lower Bay sites (Table 11). As with spot and croaker small samples sizes in 1987 at The Cell and Ocean View Reef prohibited yearly comparisons at these two sites. Virginia Saltwater Fishing Tournament records documented a 49% reduction in Virginia citations for gray trout (12 pound minimum) from 1986 through 1988 (VSFT 1986-88). Since the average weight of trout kept on trips sampled in the two years studied ranged from 1.6-1.8 pounds, study results did not reflect the obvious decline in "trophy" fish. More intensive sampling in 1988 indicated that mean catch rates for gray trout at the CBBT Islands exceeded those at the Ocean View Reef (number per rod hour). In terms of pounds of kept fish per rod hour, CBBT Island trips produced better catch rates than those to both the Ocean View Reef and The Cell (Table 11). While few in number, eight trips targeting gray trout specifically at the CBBT Islands produced mean catches of 2.5 fish per rod hour and 3.1 pounds of kept fish per rod hour.

Flounder catch rates at wreck fishing sites did not vary significantly between years at the CBBT Islands or over combined trips to lower Bay sites (Table 12). Neither were differences in catch rates observed between lower Bay sites in 1988 when better sample sizes were obtained. Mean weights of fish kept were approximately two pounds in both study years and only a very small percentage of catches were released (Table 12). The number of flounder citations (six pound minimum weight) remained stable during the study period (VSFT 1986-1988), a trend supporting the constant catch rates of this study for 1987 and 1988.

Bluefish

Bluefish were targeted on only two wreck fishing trips captured in the 1987 sampling and four trips in 1988 (Table 13). Since bluefish, when around wrecks or reefs, may be caught incidentally to targeted wreck fish species, catch rates were determined for the species. Larger bluefish were caught at offshore than inshore sites. Catch rates ranged only from 0.1 fish per rod hour for non-bluefish trips to 2.0 fish per rod hour when the species was targeted at a wreck fishing site. Wreck fishing sites are not normally targeted for bluefish but the species will congregate at a site to feed on bait fish. Sometimes such congregations of bluefish become a nuisance to offshore wreck fishermen who may have sea bass catches damaged by bluefish.

Amberjack

Fishing trips targeting amberjacks, principally at the Chesapeake Light Tower, have increased in frequency during the past few years. The species was also sought over offshore wrecks and the Chesapeake Light Tower Reef, a few such trips being captured in the sampling program each year (Table 14). One of the larger species to frequent wreck and other structures offshore except for sharks, amberjack provided wreck fishermen with average weights of keep fish of 40-58 pounds. Generally most fished were released, particularly since in 1988 the Virginia Saltwater Fishing Tournament began offering release citations of fish over 44 inches in length (VSFT 1988). The Chesapeake Light Tower produced 1988 catch rates of 0.6 fish per rod hour, based upon seven trips captured in the sampling program. The majority of amberjack trips were made in July and August. Statistical comparisons for mean catch rates were not made between years or locations within years because sample sizes were too small.

Spanish Mackerel and King Mackerel

A few trips targeting Spanish and king mackerel were captured in the sampling program (Table 15). Four Spanish mackerel trips were sampled in 1988 (none were captured in 1987), the third consecutive year that the species has been abundant in Virginia inshore and offshore waters (VSFT 1988). Three Spanish mackerel trips at the CBBT Islands produced a mean catch rate of 0.9 fish per rod hour and the fish averaged 2.4 pounds each (Table 15).

King mackerel trips captured in the sampling program occurred principally at the Cape Henry Wrecks and Chesapeake Light Tower Reef. Mean catch rates were low, ranging from 0.1-0.2 fish per rod hour with fish averaging 7 to 15 pounds each. Yearly and within year catch rate comparisons were not warranted because of small sample sizes.

Striped Bass

Striped bass trips were only captured in the 1988 sampling program. A regulation moratorium was in place on the species from December 1, 1988 through May 31, 1989. After May 31, fish caught inside Chesapeake Bay could only be kept if they measured a minimum of 24 inches in total length. A bag limit was also imposed on recreational fishermen of five such legal size fish per angler per day (VMRC 1987). Five trips in November 1988 targeting the CBBT Islands were sampled (Table 15). The mean catch rate was 1.3 fish per rod hour with kept fish averaging 12.4 pounds each. A release rate of 34% was observed. The possible re-opening of this fishery in July 1990 may extend and diversify wreck fishing opportunities at the CBBT Islands and other sites in lower Chesapeake Bay.

Quality Ratings of Fishing Experiences

Fishermen's ratings of fishing experiences for trips to wreck fishing locations provided a qualitative index of fishing expectations and success rates at certain popular sites (Table 16). Since fishermen's target species preferences differed at various wreck fishing sites and even within the season at a given site, some measure of fishing satisfaction was required to take such differences and associated expectations into account when

evaluating the relative fishing productivity of sites. As with the catch data analysis, quality rating responses were assessed based on all trips sampled to a given site and also on the basis of trips targeting certain species or species groups. The assessment of quality ratings distribution was seriously hampered by small sample sizes (number of trips made) associated with some species target groups for certain sites. Only the more popular wreck fishing sites could be evaluated for quality ratings of fishing trips because of this limitation.

Without regard to species targeted on trips, the CBBT Islands rated highest in quality of 1987 fishing experiences, having 30% of 23 trips rated as being fair to good, 26% as very good, and 26% as excellent. Quality rating questions were not asked fishermen during interviews until late June. The resulted in such data being unavailable for many trips to other locations, e.g. The Cell (on 73% of trips fishermen specified no quality rating) and the Triangle Wrecks Area (88% of trips were not rated).

Sample data for quality ratings of trips for the 1988 fishing season was better than in 1987. The Ocean View Reef received a poor rating on 56% of its 16 trips, the highest percentage of poor ratings for any site analyzed (Table 16). The fact that this site was only one year old in the summer of 1988 may have been at least partially responsible for its poor rating. Fishermen also indicated some problems in holding bottom when anchoring on the site, another factor that might have contributed to its poor rating. The Chesapeake Light Tower Reef, the CBBT Islands and The Cell all received relatively low percentages of poor ratings for trips (11%-19%). The CBBT Islands and the Chesapeake Light Tower Reef both had 45% of their 45 and 18 trips, respectively, rated as producing fair to good fishing. No other sites rated as high in these combined categories.

The best measure of a site's performance over a fishing season is likely the proportion of trips which produced "very good" to "excellent" fishing in the opinions of fishermen. The Cell led these combined rating categories with 52% of 21 trips so-rated in 1988 (Table 16). This site was followed in the combined very good to excellent categories by the CBBT Islands and the Chesapeake Light Tower Reef. The Ocean View Reef and Triangle Wrecks Area were each rated as "very good" on 23%-25% of the 1988 season's trips but received no trip ratings of "excellent". Chesapeake Light Tower experienced 20% very good to excellent trips, the lowest relative rating in these combined categories for the six sites analyzed. Weighting ratings (Table 16B) indicated that when target species sought on trips were not considered, the sites ranked in fishing quality as follows: The Cell, CBBT Islands, Chesapeake Light Tower Reef, Triangle Wrecks Area, Ocean View Reef, and Chesapeake Light Tower.

Contrasting 1988 combined trips to lower Bay sites with those made to offshore sites, the two broad areas were closely matched in "poor" ratings (26% and 22%, respectively). In the fair to good combined categories, the two areas also compared favorably in relative ratings. Lower Bay sites had relatively more trips (37%) rated in the very good to excellent combined categories compared to trips to offshore sites (22%), but 18% of trips to offshore sites were not rated in interviews compared to only 3% for lower Bay sites. Weighted rating totals indicated that overall combined trips to lower Bay sites ranked slightly higher in fishing quality than trips to offshore sites (Table 16A).

Rating of wreck fishing locations based upon trips targeting sea bass and tautog produced somewhat similar results to those observed when target species were not taken into consideration. Examining very good to excellent

combined ratings for sites, the top rated site for sea bass-tautog trips was The Cell (60%). Ranking second behind The Cell was the Triangle Wrecks Area followed by the CBBT Islands and the Chesapeake Light Tower Reef. The Ocean View Reef and Chesapeake Light Tower tied for last in the weighted ranking of sites although too few trips for sea bass and tautog were made to these sites for meaningful comparisons. Lower Bay sites (combined) again ranked better than offshore sites (Table 16A).

The 1988 rating analysis for trips targeting spot, croaker, trout and flounder was mixed and difficult to interpret. The Ocean View Reef received the largest percentage of poor ratings (36%) compared to the Cell (27%) and the CBBT Islands (17%). Only the CBBT Islands received excellent ratings (17%) but The Cell received very good ratings for 45% of trips compared to the Ocean View Reef (36%) and the CBBT Islands (4%). Weighted rating totals indicated The Cell again received the highest relative rating in this target species group followed by the CBBT Islands and Ocean View Reef, each of which were ranked approximately the same.

Trips targeting spot-croaker, trout, and flounder respectively were too few in number for meaningful comparisons among sites. Weighted combined lower Bay site ratings, however, indicated that flounder fishing trips in 1988 provided higher rated fishing experiences than either spot-croaker or trout trips (Table 16A). Trips targeting striped bass in November 1988 and offshore species, i.e. Spanish and king mackerel and amberjack, were too few in number at the sites fished for these species to provide meaningful assessments of fishing quality ratings.

Special Sampling Program for Gwynn Island Test Reef

Doubling the number of fishermen interviews from ten per sampling period in 1987 to twenty per period in 1988 produced usable data for 83 trips. This represented a 38% increase in sample size for the site (Table 17). Comparing the relative frequency of seasonal fishing effort captured each month between years indicated that major increases in sample size occurred primarily for the months of July, August and September but not for April, May and June.

Many fishermen indicated during interviews that windy weather prevented fishing trips planned to the site from mid April through early May. Fishermen trying to locate the test reef in May discovered that its buoys had been carried away in storms over the winter. Small temporary buoys were not placed on the site until late June because of boat scheduling and weather problems (M. Meier, personal communication). In addition to the site being difficult to locate for fishermen early in the year, fishermen also indicated in interviews that they were following up on good fishing reports from the lower Piankatank and Rappahannock Rivers. They planned to try the test reef later when fishing at the site would likely be more productive than during mid spring. The considerable relative decline in fishing effort in October 1988, in contrast to the previous year, was attributed to a combination of windy weather, few reports of good tautog fishing at the site, and the buoys disappearing once again.

Fishing effort parameters (anglers per trip, hours fished, rods fished, etc.) for each month and the season overall changed somewhat between years (Table 18). Relative declines in mean fishing effort (rod hours fished per trip) between years were apparent in June, August and September. Large variances associated with mean estimates of fishing effort indicated that

the slight overall seasonal decline in mean fishing effort was not significant

Fishing patterns relative to species targeted over the season were slightly different between years (Table 19). The 1987 sampling program captured one trip targeting tautog in May and several trips targeting trout in June and July. A dissimilar pattern was observed in 1988 with only a few trips targeting flounder, bluefish and spot captured in the sampling effort during May and June. Trips targeting trout did not appear in sample interviews until August, continuing into October when tautog trips began to occur. The few trips sampled in November 1988 all targeted tautog, following the same pattern as in 1987 (Table 19).

Bait use patterns at the Gwynn Island Test Reef were not examined in detail for 1988 since a broad spectrum of baits was consistently utilized by fishermen. In general, fishermen targeting spot, croaker or trout used bloodworms, cut bait, squid and peeler crab (or hard crab). Bloodworms, as as in 1987, were by far the most frequently used bait at the site (Lucy et al. 1988a). When fishing for tautog in the fall, fishermen utilized hard crab for bait or occasionally clam.

Numbers of boats fishing the site were not estimated during each month of the season in 1988, as had been attempted in 1987 (Lucy et al. 1988a). As with fishermen's estimates of numbers of boats fishing lower Bay and offshore sites, too much variation occurred in the observations to make the data reliable.

Targeted species preferences at the site were also reflected in the distribution of species comprising major components of "kept" catches (Table 20). During both study years spot dominated catches throughout most of the fishing season. Croaker and trout catches also contributed consistently to

catches in the first half of the 1987 season but not to the same degree in 1988. Trout accounted for a larger proportion of August through October catches in 1988 compared to the previous year. As previously mentioned, fishermen were slower to fish the reef in May 1988 compared to 1987 and primarily targeted flounder or bluefish. This change in fishing pattern was reflected in the composition of May 1988 catches. Tautog contributed to catches in October in both years, making a stronger contribution in 1988 than 1987. Black sea bass were not caught on the reef in 1988, making tautog the only species recorded in November 1988 catches. For the season as a whole spot accounted for approximately 79%-82% of all kept fish with trout in a distant but consistent second place. Croaker supplied approximately 5% of the catch in 1987 and 2% in 1988 while tautog also contributed 2% of the kept catch in 1988. While not caught in great numbers in 1988, scup, whiting and northern puffers were also taken at the reef from July into October, occurring in greater numbers than in 1987.

Catch Patterns

Catch rates for major species sought at the Gwynn Island Test Reef were analyzed based upon the same target species groups utilized for lower Bay sites. Spot, the major species contributing to catches at the Gwynn Island site, generally exhibited consistent mean catch rates between years for each month of the season for combined trips targeting spot, croaker, trout and flounder. Catch rates (pounds of fish kept per rod hour) in September 1987, however, were greater than those for the same month in 1988 (Table 21). Since mean weights of fish kept were only slightly different in the two study years for September catches (0.8 pounds in 1987 and 0.7 pounds in 1988), the differences can only be attributed to catches of a few large spot

in 1987. The one month of distinctive catch rates between years for spot did not result in significantly different catch rates for the season overall. Breaking out trips targeting spot and croaker only indicated that, while catch rates were slightly improved over the more general target species grouping, significant differences in catch rates between years did not exist (Table 21).

Croaker, caught in much fewer numbers than spot, also exhibited a pattern of mean catch rates over the season similar to that for spot. Significant differences in mean catch rates (number caught and pounds kept per rod hour) only occurred between years in September for combined trips targeting the composite "bottom fish" group (Table 22). Catch rates were higher in September 1987 compared to the same period in 1988. Average weights of kept croaker were also greater in September 1987 than September 1988. The one month of different catch rates was not sufficient to result in significant differences in catch rates between years for the season as a whole, regardless of target species preferences.

Gray trout catch patterns were slightly more distinctive between years than either spot or croaker (Table 23). Mean catch rates (number caught and pounds kept per rod hour) were significantly different between years for July catches at the test reef. The higher catch rates of July 1987 resulted in significant differences between 1987-1988 seasonal catch rates for trout when examining combined trips targeting spot, croaker, trout and flounder. Analyzing the small number of trips specifically targeting trout did not reveal distinctive seasonal catch rates between years (Table 23). This may have been partially the result of smaller sample sizes in the latter analysis.

Because fishermen targeted the reef site for bluefish on several trips and incidental bluefish catches occurred when they were bottom fishing for sciaenids and flounder, bluefish catch rates were examined separately (Table 24). Catch rates were low with catches occurring primarily in May and June. A few fish averaging four to eight pounds each were caught at the site during this period in 1988 compared to only August 1987 catches of small bluefish, all of which were released. Bluefish contributed to the diversity of catches in spring 1988 but were largely incidental to the major fishing activity at the site.

Sea bass and tautog, principally the latter species, were targeted at the reef only in October and November, except for one trip made in July 1988 when no fish were caught (Tables 25 and 26). Unfortunately only a small number of such trips were captured in the sampling program each year. The population of fishermen who pursue tautog at the site in the cooler and more windy fall weather is much smaller than that fishing the site during summer months. In addition, weather conditions reduce the frequency of trips that can be made to the site by those seeking tautog. This combination of factors naturally produced small sample sizes in the random sampling program.

Mean catch rates for tautog (number of fish caught and pounds kept per rod hour) appeared to improve from 1987 to 1988 but the small sample sizes failed to demonstrate statistically significant differences in catch rates between months or the seasons overall for the two years of the study (Table 26). For the few trips targeting tautog captured in the sampling program each season, mean catch rates were three times higher in 1988 and fish averaged four pounds compared to 0.6 pounds in 1987. Improved catches in 1988, although not shown to be statistically higher than those in 1987, were

also suggested by reports obtained from R&R Bait and Tackle shop in Hudgins, Virginia, where tautog fishermen bought bait and compared fishing experiences (R. Belcher, personal communication).

Incidental sea bass catches also occurred at the reef in 1987 when fishermen were seeking tautog with the majority of the catches released because of fish averaging less than one pound in weight. No catches of even small sea bass were recorded in the 1988 sampling program (Table 25).

Quality Rating of Fishing Experiences

Fishermen's quality ratings for trips to the test reef site indicated that when not considering targeted species preferences, 1988 produced slightly better quality fishing for the season than in 1987 (Table 16 A,B). The fact that quality ratings were not requested from fishermen until late in June 1987 affected the yearly comparison. If the fishing quality question had been included in interviews at the beginning of the 1987 sampling program, the comparative seasonal ratings would have been closer. For example, if the 27% of 1987 trips for which quality ratings were not specified had been rated only as "fair" by fishermen interviewed, the 1987 total seasonal rating would have been the same as that for 1988. Therefore it must be concluded that, in general, fishing quality during 1987 was rated approximately as high as in 1988.

The same pattern existed for quality rating comparisons between years for the bottom fishing target species group of spot, croaker, flounder and trout (Table 16 A,B). Examining trips specifically targeting only spot and croaker indicated that slightly better satisfaction was gained by fishermen seeking these species during 1987 compared to 1988, even when allowing for 1987 trips for which quality ratings were not obtained. This result may be

affected by the "very good" spot catches made on the reef in October 1987 (Table 21) which were not matched by catches in the same period in 1988. Unfortunately small sample sizes in October '88 prevented detecting significant differences in mean catch rates for the months between years.

Quality ratings for trout trips to the reef indicated that fishermen were better satisfied with catches in 1988 although, in general, catch rates were slightly higher in 1987 (Table 16 A,B). Release rates were lower in 1988, possibly contributing to the slightly better rating (Table 23).

Ratings for sea bass-tautog trips, primarily targeting tautog in actuality, were difficult to compare between years because of small sample sizes and the fact that half of the 1987 trips were not rated for quality. In spite of these problems, it can be stated that 1988 likely produced somewhat higher satisfaction for tautog fishermen than the previous year, given the observed weights of fish caught that year (Table 26). This conclusion is based upon the observation that if all of the three 1987 tautog trips had been rated "very good" for fishing, the total rating for the season (28.3) would still have been less than that for 1988 (Table 16 A,B). Only if these 1987 trips had each been rated as "excellent" would the 1987 total rating for tautog trips (33.3) have exceeded that for 1988.

Gwynn Island Test Reef, Lower Bay and Offshore Sites

The Gwynn Island Test Reef, being further up Bay than other popular wreck fishing sites sampled in the study, was compared to other sites to determine whether catch rates of targeted species were similar or different within each study year (Table 28). During 1988 spot catch rates (mean fish per rod hour) were higher at the Gwynn Island site than at other lower Bay sites having large enough sample sizes for meaningful comparisons, i.e. The

Cell, Ocean View Reef, CBBT Islands and combined trips to these sites. Spot were targeted on a greater percentage of trips to the Gwynn Island Reef (53%-1987, 76%-1988) than at other sites in the lower Bay (Table 5 and 19). Corresponding to higher catch rates for spot in terms of numbers of fish caught per unit fishing effort, the Gwynn Island sites also produced more pounds of spot caught per rod hour than other lower Bay sites. Spot catch rates at the Gwynn Island Test Reef in 1987 were only significantly higher than those for combined trips to lower Bay sites and not different from those at the CBBT Islands (Table 28).

Croaker and trout catches at the Gwynn Island site were not as consistent as spot, nor were these species targeted as frequently by fishermen. Comparisons with lower Bay sites indicated the test reef produced lower mean catch rates for croaker than the Ocean View Reef in 1988 and at the CBBT Islands and combined trips to lower Bay sites in 1987 (Table 28). Mean catch rates for croaker in 1988 were not different from those determined for trips to the CBBT Islands, The Cell and lower Bay sites combined. Trout catch rates at the Gwynn Island Reef in 1988 exhibited a similar pattern to croaker when compared to other lower Bay sites. In 1987 no differences in trout catch rates were observed between the Gwynn Island Test Reef, the CBBT Islands and combined trips to lower Bay sites (Table 28). Comparisons for flounder were not warranted since the species was only caught on several trips at Gwynn Island in each study year.

Sea bass and tautog catch rates at the Gwynn Island site were more difficult to compare to other lower Bay and offshore sites because of small sample sizes at the test reef. Sea bass were only caught in small numbers at Gwynn Island in 1987 and none caught in trips sampled during 1988. Because sea bass catches were also sporadic in both years at other lower Bay

sites, no significant differences could be shown for sea bass catches between any of the Bay sites. In 1988 the Gwynn Island Test Reef produced no sea bass catches, this "zero catch rate" being significantly lower than those at the Chesapeake Light Tower Reef and Triangle Wrecks Areas offshore.

The same problems occurred with tautog catch rate comparisons between lower Bay and offshore sits. Only in 1987 were tautog catch rates significantly lower at the Gwynn Island Test Reef compared to those at the CBBT Islands. Otherwise, significant differences could not be demonstrated between the test reef and other sites (Table 28). Larger sample sizes were needed at the test reef site to make meaningful comparisons between tautog catch rates at the various lower Bay and offshore sites.

Comparing fish quality ratings for trips made to the Gwynn Island Test Reef and other lower Bay and offshore wreck fishing sites indicated that the site ranked about in the middle of group when target species were not considered (Tables 16B and 27B). Since quality ratings were not obtained during interviews in the early portion of the 1987 fishing season, the 1988 season provided better comparisons between sites. Ignoring target species preferences and combining all trips for respective sites in 1988, the Gwynn Island Test Reef exhibited a weighted total quality rating of approximately 24 (Table 27B). This rating was exceeded by comparable ratings given The Cell, the CBBT Islands and the Chesapeake Light Tower Reef. The Gwynn Island site weighted rating exceeded that for the Triangle Wrecks Area, the Ocean View Reef and the Chesapeake Light Tower (Table 16B).

Comparing fishing quality ratings on a target species basis indicated that the Gwynn Island site ranked slightly lower than other lower Bay sites combined. This was the case for trips targeting "bottom fish" (spot, croaker, trout and flounder), spot and croaker, trout only, and flounder

only (Tables 16B and 27B). Comparisons based upon sea bass-tautog trips ranked the Gwynn Island Test Reef higher than all sites except The Cell. Ratings for such trips were obviously responsible for pulling up the ranking of the site when target species preferences were ignored.

Comparing 1987 Study Results with Monitoring Study

Fishermen were interviewed for this study during the 1987 fishing season while a monitoring study of the test reef site was also being undertaken by researchers from Old Dominion University (Feigenbaum et al. 1988). The objectives and designs of the two studies were quite different but some brief comparisons of results are appropriate. Fourteen randomly scheduled trips to the reef site in the monitoring study (Feigenbaum et al. 1988), taking into account month and tidal cycle, produced catch rate data on the reef for key species similar in magnitude to that documented for fishermen (Lucy et al. 1988). Spot catch rates (mean number of fish caught per rod hour) ranged from 1.0 to 5.2 in the study targeting fishermen with a seasonal rate of 3.2 fish per rod hour (Lucy et al. 1988) compared to catch rates of 1.9-2.3 spot per rod hour in the monitoring study (Feigenbaum et al. 1988). Seasonal croaker catch rates (0.2 fish per rod hour) were lower in the study of fishermen's catches than in the monitoring study (1.2 croaker per rod hour) but sea bass catch rates were similar in magnitude (0-1.2 fish per rod hour from August through November compared to 0.4-0.8 fish per rod hour in the monitoring study). A higher seasonal catch rate of "desirable species" (spot, croaker, gray trout, flounder, bluefish, sea bass and tautog) was observed in the study of fishermen's catches (4.2 fish per rod hour) compared to 1.7 desirable fish per rod hour in the monitoring study. The difference is likely attributed to the fact that fishermen

specifically targeted certain species and fished the test reef site longer during trips than possible in the monitoring study. The former study was also able to obtain data from fishermen on 60 trips during the season compared to the monitoring study's 14 trips.

The monitoring study documented oyster toadfish utilizing the test reef sites (Feigenbaum et al. 1988). Catches of this "trash fish" were not mentioned in 1987 random telephone interviews of fishermen (Lucy et al. 1988). It was found that fishermen did not consider catches of toadfish to be worthy of mention in 1987, but by specifically asking about such catches in 1988, mean catch rates of up to 0.2 toadfish per rod hour were documented with all but an occasional fish released.

In general fishing patterns and seasonal availability of species were found to be similar in both studies. Both studies documented the popularity of the site for local fishermen. The study of fishermen's experiences on the test reef indicated that the quality of fishing was rated fair to good (Lucy et al. 1988), an element not measured in the monitoring study (Feigenbaum et al. 1988). The results of the two studies complimented each other and helped clarify some of the local aspects of reef fishing which make a site useful to fishermen.

CONCLUSIONS

The sampling program initiated by the study has provided the VMRC Artificial Reef Program with a workable system for assessing fishing success rates on existing and newly established artificial reefs. The concepts developed in the study also provided a mechanism for comparing recreational fishermen's experiences on artificial reefs with those customarily obtained

at other popular "wreck fishing" sites. This facet of the project opened up new opportunities for evaluating fishing productivity of artificial reef sites as viewed through the eyes and fishing experiences of reef users.

Distinctions in target species preferences of fishermen were clearly demonstrated for various reef sites in the Bay as well as offshore. The important contribution of sciaenids (spot, croaker and trout) to Bay reef fishing was documented, particularly for the Gwynn Island Test Reef and Ocean View Reef. The lack of sea bass and tautog at the Ocean View Reef indicated that the igloo structures forming the reef do not provide the necesary habitat to attract and hold these species. A mix of structures and materials at different test reef sites attract both species in the Bay, particularly tautog in the fall. The study results suggested that diversifying materials on the Ocean View Reef could enhance the mix of species available there.

The fishing experience quality rating component of the study provided valuable insight into how fishermen evaluate wreck fishing experiences. Catch rates, consistency of the site in producing desirable fish, and size of fish caught all played important roles in determining the quality of fishing experiences at a site. Remarks from fishermen utilizing the Ocean View Reef and Gwynn Island Test Reef also indicated that difficulties encountered in locating or fishing a site, i.e. buoys missing, bottom hard to hold, etc., affected use rates and quality of fishing experiences. Ranking popular wreck fishing sites in terms of their fishing quality rating strongly supported planned enhancement of The Cell site by the VMRC Reef Program. This site consistently ranked above existing artificial reefs in the Bay in terms of quality of fishing experiences.

Increasing the sampling effort for the Gwynn Island Test Reef and concentrating efforts on identifying a greater number of lower Bay fishermen targeting wreck fishing sites produced better sample data in 1988 for the Gwynn Island site as well as the CBBT Islands, Ocean View Reef and The Cell. The increased sampling effort at the Gwynn Island site, however, was not able to overcome weather and missing buoy problems in 1988 to produce larger sample sizes for May, June and October. This indicated the negative impact such factors can have on implementing any sampling program dependent upon obtaining catch data from fishermen. On the positive side, identifying more fishermen targeting The Cell in 1988 provided an excellent opportunity to compare future fishing experiences at the proposed enhanced site with those documented in 1988.

Analyzing catch data in the study by species groups provided a mechanism to compare fishing sucess rates at sites in a way that may prove meaningful to fishermen and fishery managers. This concept provided another tool that reef managers can utilize to evaluate established sites and, more importantly, explain the results of their projects to fishermen. This type of analysis also pointed out the need to expand sample sizes to derive better information from data collected.

The study also provided much new visability for Virginia's Artifiical Reef Program. It also established a core of wreck fishermen which, once updated, could be utilized in the future to provide catch assessments on existing, modified or new reef sites. The study results established a baseline of catch information on popular wreck fishing sites, including artificial reefs, which should prove useful in examining fishing benefits associated with reef site modifications planned for the future.

Figure 1. Locations of artificial reefs and other popular wreck fishing sites in lower Chesapeake Bay and offshore waters of Virginia.

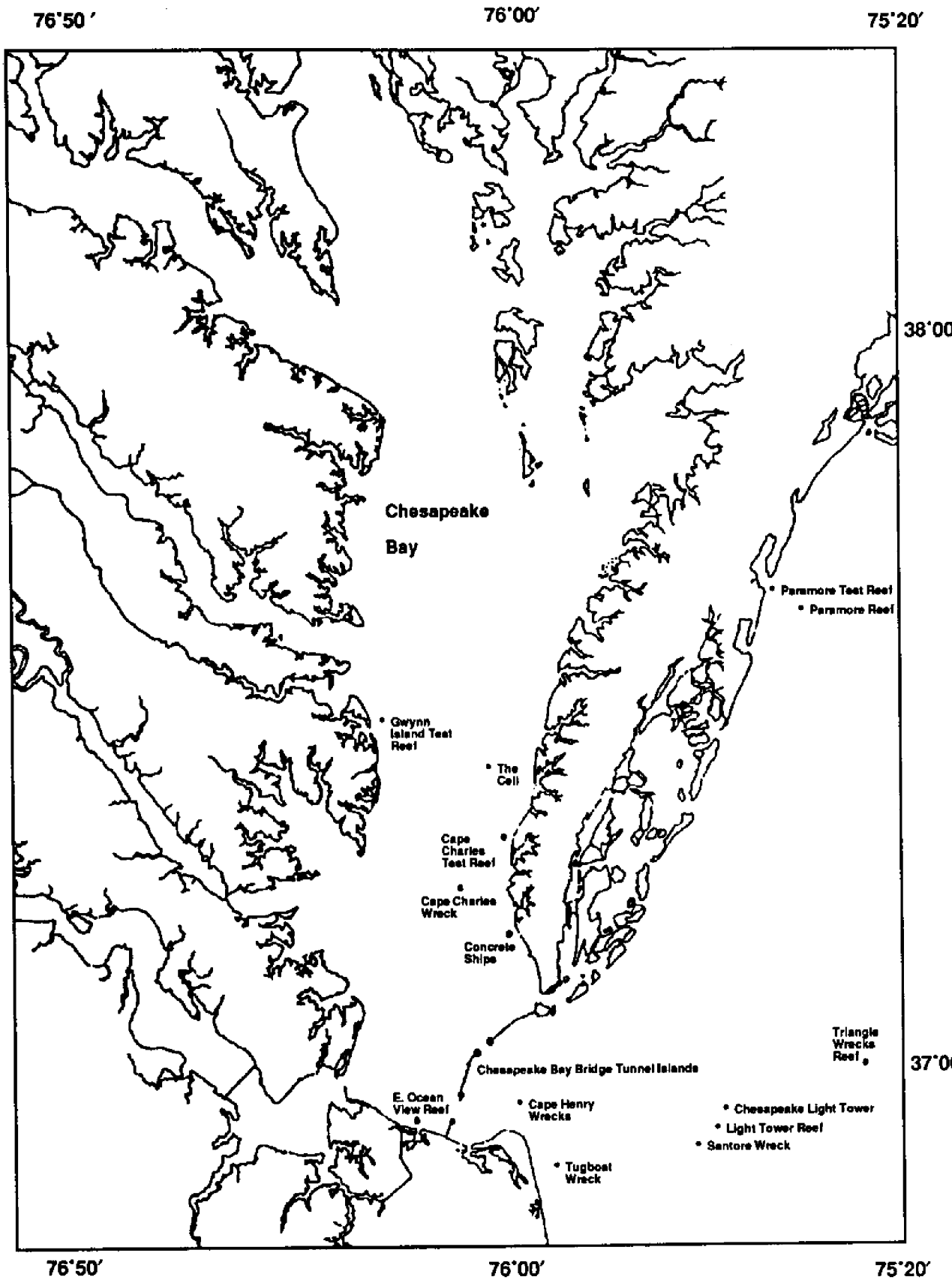
76°50′
76°00′
75°20′
38°00
Chesapeake
Bay
Paramore Test Reef
Paramore Reef
Gwynn Island Test Reef
The Cell
Cape Charles Test Reef
Cape Charles Wreck
Concrete Ships
Triangle Wrecks Reef
37°0
Chesapeake Bay Bridge Tunnel Islands
E. Ocean View Reef
Cape Henry Wrecks
Chesapeake Light Tower
Light Tower Reef
Santore Wreck
Tugboat Wreck
76°50′
76°00′
75°20′

Table 1. Description of Chesapeake Bay and offshore "wreck fishing" sites and artificial reefs targeted most frequently by fishermen interviewed in 1987 and 1988.[a]

Fishing Site	Location	Water Depth (Ft.)	Material-Structure
Ches. Bay Bridge Tunnel	Mouth of Ches. Bay (N36°54.3'; W75°42.8') NOAA Chart 12221	25'-100'	Completed 1964; 17.6 miles long; 12 miles trestled roadway; 2 mile-long tunnels with granite boulder islands at ends (4 islands)
The Cell	Buoy R"WT2" off mouth of Hunger Creek, Eastern Shore (LORAN C 41598/27245 approx.) NOAA chart 12221	44' with as little as 3' clearance	Navy degauzing station abandoned late 1940's or early 1950's; concrete, timber, pipes
Ches. Light Tower Reef	Center of Reef approx. 0.6 nm WSW of Ches. Light Tower; (LORAN C 41286.2/27103.0 - 4 60'X 80' drydock sections); NOAA Chart 12221	60'-80'	Established in 1970 and expanded periodically; variety of structures, e.g. tire-in concrete units, drydocks, landing craft, pontoon sections etc; VMRC Reef Program took over from Tidewater Artificial Reef Assoc. of VA
E. Ocean View Reef	2500 yards west of entrance to Little Creek, Norfolk and 900 yards off beach; originally known as "ODU" reef; (N36°56.5'; W76°12.2') NOAA Chart 12256	28'	40 concrete igloos set in clusters of 3-4 units over 5 acre site; igloos have 7 foot profile; established 1987 by VMRC Reef Program
Triangle Wrecks Reef	Vicinity of "GA" Buoy marking NE corner of reef (N37°00';W75°21.5') NOAA Chart 12200	100'	4 Liberty Ships sunk in mid 1970's (Webster, Garrison, Haviland, Clark) by VMRC Reef Program
Triangle Wrecks Area	Vicinity of "GA" Buoy marking NE corner of area, including Liberty Ships Reef (N37°00'; W75°21.5'); area approx. 3 miles x 2 miles; NOAA Chart 12200	100'	John Morgan (Liberty Ship); Lillian Luckenbach bulk carrier sunk in collisions 1943 plus other wrecks, Navy landing craft, etc.; 4 Liberty Ships sunk as reef 1974-1977
Ches. Light Tower	Approx. 13 nm off Virginia Beach, Rudee Inlet (N36°54.3'; W75°42.8') NOAA Chart 12221	45'-55'	Built 1965 to replace Chesapeake Light Ship; stands on 4 piles 117' above water

Table 1. (continued)

Fishing Site	Location	Water Depth (Ft.)	Material-Structure
Santore Wreck	Approx. 3.3 nm west of Ches. Light Tower; LORAN C - 41277.7/ 27117.1; NOAA Chart 12221	47'	Freighter sunk 6-17-42 by mine from German U-boat
Concrete Ships	Immediately offshore of Kiptopeke forming breakwater for former ferry dock, just north of Cape Charles, Eastern Shore; NOAA Chart 12221	27'	Concrete hull ships made during World War II
Cape Henry Wrecks	Wrecks and obstructions located N to NE of Cape Henry Light approx. 2 nm off beach; Chilore - LORAN C 41294.2/27180.3) marked by "2CH" Buoy; NOAA Chart 12221	50'	Chilore wreck - bulk carrier sunk 7-24-42 (550' long)
Tugboat Wreck	Approx. 4-5 nm off Cavalier Hotel, Virginia Bch.; N36°51.8'; W75°53.8' NOAA Chart 12221	50'	Shown as two obstructions on chart
Cape Charles Wreck	Approx. 2.5 m NW Plantation Light (approx. LORAN C 41487/27233; NOAA Chart 12221	40'-60'	May be steel hull vessel Peconic sunk 7-15-50
Parramore Reef	Approx. 8.7 nm from Parramore Coast Guard Tower immed. NW of "R-10" Buoy off Wachapreague Inlet, Eastern Shore; LORAN C 41746.3/ 27095.5 (Page); 41744.0/ 27096.0 (Mona Island); NOAA Chart 12210	72'-75'	2 Liberty ships sunk in mid 1970's by VMRC Reef Program with assistance of Seaside Sports Fishing Improvement Assoc.
Parramore Test Reef	Approx. 3.8 nm from Parramore Coast Guard Tower; LORAN C 41747.5/ 27125.2 and 41741.0/ 27126.1; NOAA Chart 12210 appears to have sanded in and difficult to locate for many fishermen	72'-75'	Established by ODU as experimental site in June 1983 under contract to VMRC; concrete pipe stacks and 6 concrete igloos

Table 1. (continued)

Fishing Site	Location	Water Depth (Ft.)	Material-Structure
Cape Charles Test Reef	NNW of entrance to Cherrystone Inlet and east of Buoy C-12; LORAN C 41541.2/27231.0 and 41539.4/27230.8; buoys hard to maintain and difficult to locate for many fishermen; NOAA Chart 12221	29'-38'	Established by ODU as experimental test reef site June 1983; 6 concrete igloos and stacks of concrete pipe
Gywnn Island Test Reef	Approx. 1.3 nm NE of "Hole in the Wall" off southern tip of Gwynn Island; LORAN C - 41637.2/ 27299.4; NOAA Chart 12235	22'	Established by ODU as experimental test reef in June 1984; 89 tire in concrete units, 6 concrete igloos, modified tire modules

[a]Information compiled from Lucy (1983,1988); Meier et. al. (1985); Feigenbaum et. al. (1986); VMRC (1989); C. Ward (personal communication); U.S. Coast Guard (personal communication); Chesapeake Bay Bridge and Tunnel District Office (personal communication); background information on local wrecks compiled by J.G. Robinson, Peninsula Salt Water Sport Fishermen's Association in 1970 (mimeograph, personal communication); listing of mid-Atlantic wrecks compiled by J. Cummings (personal communication).

Table 2. Distribution of fishing effort among lower Chesapeake Bay and offshore "wreck fishing" sites targeted most frequently by boat owners interviewed during 1987 and 1988 (excluding trips to Gwynn Island Test Reef[a]).

Targeted Fishing Sites	Fishing Trip Interviews[b]			
	1987 (N=124 trips)		1988 (N=188 trips)	
	No.	Rel. Freq.	No.	Rel. Freq.
Ches. Bay Bridge Tunnel Islands	23	18%	45	24%
The Cell	4	3	21	11
Chesapeake Light Tower Reef	11	9	18	10
E. Ocean View Reef	3	2	16	8
Triangle Wrecks Area (Liberty Ships & other wrecks)	16	13	13	7
Triangle Wrecks Reef	10	8	5	3
Chesapeake Light Tower	4	3	10	5
Santore Wreck	1	1	8	4
Concrete Ships	2	2	5	3
Cape Henry Wrecks	9	7	6	3
Tugboat Wreck (off Va. Beach)	7	5	0	--
Cape Charles Wreck	1	1	4	2
Parramore Reef	2	2	0	--
Parramore Test Reef	2	2	3	2
Cape Charles Test Reef	1	1	1	1

[a] In 1987 boat owners identified as targeting the Gwynn Island Test Reef were included in the general sampling program for all wreck-fishing sites, as well as singled out and sampled separately (Lucy et al. 1988); in 1987 the general sampling program captured 14 trips targeting the Gwynn Island Reef (11% of the total trips captured in sampling); in 1988 sampling of Gwynn Island Reef fishermen remained totally separate from that for all other wreck fishing locations.

[b] Relative distribution of fishing effort among all wreck-fishing sites targeted by fishermen during the sampling program in 1987 and 1988, respectively; non-artificial reef sites receiving less than three trips in either year's sampling program are not listed (23% and 18% of all trips sampled in 1987 and 1988, respectively).

Table 3. Fishing effort parameters of sampled trips targeting lower Chesapeake Bay and offshore "wreck fishing" sites in 1987 and 1988.

Location	Total[a] Trips	Fishing Effort Parameters (mean and S.D.)							
		Anglers Per Trip		Hours Fished Per Trip		Rods Fished Per Trip		Rod Hours Per Trip	
		1987	1988	1987	1988	1987	1988	1987	1988
Ches. Bay Br. Tunnel Islands	23/45	2.8 (0.6)	2.8 (1.2)	4.6 (1.8)	4.0 (1.9)	3.2 (1.4)	3.1 (1.8)	14.5 (10.4)	13.1 (7.3)
The Cell	4/21	2.8 (1.0)	3.2 (1.1)	4.2 (1.7)	5.2 (2.3)	3.0 (1.8)	3.6 (1.2)	11.0 (6.2)	19.0 (10.6)
Ches. Light Tower Reef	11/18	2.8 (1.3)	2.8 (1.2)	3.9 (1.5)	3.2 (1.9)	4.4 (2.6)	3.4 (1.7)	18.6 (16.1)	12.3 (13.0)
E. Ocean View Reef	3/16	2.0 (0)	2.9 (1.2)	2.7 (1.5)	2.3 (1.8)	2.7 (0.6)	3.0 (1.0)	7.7 (5.1)	7.6 (8.0)
Triangle Wrecks Reef	10/5	3.8 (1.1)	3.6 (1.1)	4.8 (1.6)	5.6 (1.8)	5.8 (4.0)	3.6 (1.1)	25.2 (12.0)	20.4 (9.6)
Triangle Wrecks Area	16/13	3.5 (1.0)	3.5 (1.7)	5.4 (2.1)	5.0 (2.2)	5.6 (3.5)	3.5 (1.5)	30.3 (22.4)	18.8 (12.0)
Ches. Light Tower	4/10	2.8 (1.0)	2.7 (1.4)	3.0 (0.8)	2.9 (1.4)	4.2 (2.6)	2.9 (1.2)	13.8 (12.2)	9.1 (7.0)
Santore Wreck	1/8	2.0 (---)	3.0 (0.9)	3.0 (---)	3.9 (2.1)	4.0 (---)	3.6 (2.0)	12.0 (----)	13.0 (8.4)
Concrete Ships	2/5	2.5 (0.7)	2.6 (0.6)	5.5 (3.5)	3.8 (3.0)	3.5 (0.7)	2.6 (0.6)	20.5 (16.3)	9.2 (5.8)
Cape Henry Wrecks	9/6	2.4 (0.5)	3.3 (0.5)	3.4 (1.9)	2.7 (1.0)	3.0 (0.9)	3.5 (0.6)	11.0 (8.3)	9.0 (2.4)
Tugboat Wreck	7/0	3.3 (1.0)	---	4.1 (2.0)	---	5.3 (2.1)	---	20.6 (8.7)	----
Cape Charles Wreck	1/4	3.0 (---)	2.8 (1.0)	1.0 (---)	4.2 (2.4)	3.0 (---)	3.2 (1.0)	3.0 (----)	12.5 (6.2)
Parramore Reef	2/0	4.0 (0.7)	---	2.0 (0)	---	4.5 (0.7)	---	9.0 (1.4)	----
Parramore Test Reef	2/3	3.0 (0)	5.0 (1.0)	1.0 (0)	4.0 (2.0)	3.0 (0)	6.7 (3.1)	3.0 (0)	12.5 (26.6)

Table 3. (continued)

Location	Total[a] Trips	Fishing Effort Parameters (mean and S.D.)							
		Anglers Per Trip		Hours Fished Per Trip		Rods Fished Per Trip		Rod Hours Per Trip	
		1987	1988	1987	1988	1987	1988	1987	1988
Lower Ches. Bay Sites[b]	41/93	2.6 (0.7)	2.9 (1.1)	4.2 (1.9)	3.9 (2.2)	3.1 (1.2)	3.2 (1.4)	13.2 (7.8)	13.0 (10.2)
Offshore Sites[c]	39/49	3.2 (1.1)	3.0 (1.4)	4.4 (1.9)	3.7 (2.0)	5.0 (2.9)	3.4 (1.6)	23.1 (18.2)	13.5 (11.3)

[a] Total trips sampled in 1987 and 1988, respectively.

[b] Combined trips to CBBT Islands, The Cell, E. Ocean View Reef, Concrete Ships, Cape Henry Wrecks.

[c] Combined trips to Ches. Light Tower Reef, Triangle Wrecks Reef and Area, Ches. Light Tower, Santore Wreck, Tugboat Wreck.

Table 4. Distribution of 1987 fishing effort by targeted species for trips made to lower Chesapeake Bay and offshore "wreck fishing" sites[a] (excludes Gwynn Island Test Reef).

Month	Total Trips	Targeted Species[b] - 1987							
		Sea Bass	Tautog	Flounder	Trout	Spot	Croaker	Amberjack	Other
February	1	--%	100%	--%	--%	--%	--%	--%	--%
March	3	--	100	--	--	--	--	--	--
April	18	--	94	--	6	--	--	--	--
May	17	12	69	19	--	--	--	--	--
June	13	31	54	--	--	8	--	8	--
July	16	50	50	--	--	--	--	--	--
August	12	50	25	--	--	--	--	25	--
September	13	23	38	--	--	--	--	8	31[c]
October	26	35	62	--	--	--	--	--	4[c]
November	5	2	80	--	--	--	--	--	--
Season	123	27	61	2	1	1	--	4	4[c]

[a]Includes trips to sites listed in Table 1 (96 trips) and trips to less frequented sites captured in the sampling program, e.g. the Tiger, Powell, and Hanks wrecks offshore and locations in the Bay such as a barge (C-10 buoy) and plane wreck off Cape Charles, etc.

[b]If several "targeted species" were specified during an interview, the first species mentioned was considered the principal species sought.

[c]King mackerel trips (4% of sample for season).

Table 5. Distribution of 1988 fishing effort by targeted species for trips made to lower Chesapeake Bay and offshore "wreck fishing" sites[a] (excludes Gwynn Island Test Reef).

Month	Trips	Targeted Species[b] - 1988							
		Sea Bass	Tautog	Flounder	Trout	Spot	Croaker	Amberjack	Other
April	13	8%	66%	--%	--%	--%	--%	--%	31%[c]
May	35	17	63	--%	17	--	--	--	3[c]
June	19	16	11	53	11	5	5	--	--
July	21	14	5	19	29	5	14	14	--
August	19	5	5	11	--	16	11	37	16[c]
September	23	35	4	--	9	22	--	9	17[d]/4[e]
October	32	41	9	28	9	3	--	3	6[c]
November	25	32	36	4	5	--	--	--	1[c]/20[f]
Season	187	23	25	14	11	6	3	7	11[c-f]

[a]Includes trips to sites listed in Table 1 (155 trips) and trips to other less frequented sites captured in the sampling program, e.g. the Tiger, Ricks, and Doxy Girl wrecks offshore and locations in the Bay such as a plane wreck off Cape Charles, obstructions near Fort Monroe, the Hampton Roads Bridge-Tunnel islands, etc.

[b]If several "targeted species" were specified during an interview, the first species mentioned was considered the principal species sought.

[c]Bluefish trips (4% of sample for season).

[d]King mackerel trips (2% of sample for season).

[e]Spanish mackerel trips (2% of sample for season).

[f]Striped bass trips (3% of sample for season).

Table 6. Relative contribution of species to the total "kept" catch for the E. Ocean View Reef, Chesapeake Bay Bridge Tunnel Islands, Chesapeake Light Tower Reef, and Triangle Wrecks Area.

Location	No.[a] Trips	No. Kept[b] Fish	Relative Frequency (%) Tautog 1987	Tautog 1988	Sea Bass 1987	Sea Bass 1988	Spot 1987	Spot 1988	Croaker 1987	Croaker 1988	Bluefish 1987	Bluefish 1988	Other 1987	Other 1988
E. Ocean View Reef	3/16	NA[c]/171	---	0	----	4.6	---	3.5	---	76.0	---	0	---	15.7[d]
Ches. Bay Br. Tunnel Islands	23/45	1307/1002	35.8	21.4	13.0	6.8	5.2	8.6	31.7	5.6	3.9	7.4	1.0[d]	50.0[e]
The Cell	4/21	NA/291	---	39.8	----	1.7	---	0.6	---	1.7	---	5.5	---	50.5[f]
Ches. Light Tower Reef	11/18	289/558	37.4	6.9	60.6	88.0	0	0	0	0	0.3	0	1.7[g]	5.0[h]
Triangle Wrks. Area	16/13	382/1023	11.3	1.4	88.7	92.8	0	0	0	0	0	1.0	0	4.6[i]

[a] Number of fishing trips sampled in 1987 and 1988, respectively.
[b] Total number of fish recorded as "kept" for trips sampled in 1987 and 1988, respectively.
[c] Not appropriate since sample size too small to be representative of site.
[d] Flounder.
[e] Gray trout - 21.6%; flounder - 11.2%; striped bass - 8.4%; Spanish mackerel - 5.0%; sea mullet - 1.6%; oyster toadfish - 0.8%; sand shark - 0.4%; conger eel (Conger oceanicus) - 0.4%; false albacore (Euthynnus alletteratus) - 0.2%.
[f] Flounder - 40.2%; porgy (scup, Stenatomus chrysops) - 5.2%; gray trout - 4.4%; northern puffer (Sphoeroides maculatus) - 0.6%.
[g] Spanish mackerel.
[h] Spanish mackerel - 3.8%; amberjack - 0.5%; king mackerel - 0.4%; spiny dogfish (Squalus acanthias) - 0.4%.
[i] Ling cod (Urophycis chuss) - 4.2%; gray trout - 0.4%.

Table 7. Sea bass catches on trips targeting sea bass-tautog at lower Chesapeake Bay and offshore "wreck fishing" sites in 1987 and 1988.

	SEA BASS--TARGET SPECIES: SEA BASS-TAUTOG													
	No. Trips		No. Rod Hours		Total Kept		Mean Wt. Kept (lbs)		Release Rate (%)		Catch[a] Rate (lbs)		Catch[b] Rate (#)	
Location	1987	1988	1987	1988	1987	1988	1987	1988	1987	1988	1987	1988	1987	1988
Ches. Bay Br. Tun. Is.	15	14	253	118	65	49	1.4	1.5	56	68	0.4[e]	0.6[f]	0.6[e]	1.3[f]
The Cell	0	10	---	146	---	0	---	---	---	100	---	0[f]	---	0.2[f]
Ches. Light Tower Reef	9	12	161	139	175	438	1.2	2.2	15	4	1.2	7.1[*f]	1.3	3.3[*f]
Ches. Light Tower	3	1	47	15	41	0	1.5	---	0	0	1.3	0	0.9	0
E. Ocean View Reef	0	3	---	12	---	0	---	0	---	100	---	0	---	0.5
Tri.Wrks.Rf.	9	5	236	102	192	500	2.0	1.5	0	12	1.6	7.4[*f]	0.8	5.6[*f]
Tri. Wrks. Area	14	13	460	244	291	884	2.0	1.5	0	9	1.3[e]	5.6[*f]	0.6	4.0[*f]
Santore Wrk.	0	6	---	76	---	90	---	1.3	---	43	---	1.5	---	2.1
Cape Henry Wrecks	7	6	51	54	84	66	1.2	1.0	34	0	2.0	1.2[f]	2.5[e]	1.2[f]
Cape Charles Wreck	1	3	3	34	0	0	---	---	0	---	0	0	0	0
Parramore Test Reef	2	3	6	88	15	550	2.0	0.9	73	24	5.0	5.5	9.2	8.2
Parramore Reef	2	0	18	---	125	---	1.0	---	32	---	6.9	---	10.0	---

Table 7 (continued).

Location	SEA BASS--TARGET SPECIES: SEA BASS-TAUTOG													
	No. Trips		No. Rod Hours		Total Kept		Mean Wt. Kept (lbs)		Release Rate (%)		Catch[a] Rate (lbs)		Catch[b] Rate (#)	
	1987	1988	1987	1988	1987	1988	1987	1988	1987	1988	1987	1988	1987	1988
Lower Ches. Bay Sites[c]	22	34	304	336	149	115	1.3	1.2	46	54	0.6	0.4[f]	1.0	0.9[f]
Offshore Sites[d]	32	32	808	474	521	1412	1.7	1.7	8	11	1.1	5.2[*f]	0.7	3.4[*f]

[a]Pounds caught per rod hour (kept fish only).

[b]Catch per rod hour for kept and released fish combined.

[c]Combined trips to CBBT Islands, The Cell, E. Ocean View Reef, Cape Henry Wrecks.

[d]Combined trips to Ches. Light Tower Reef, Ches. Light Tower, Triangle Wrecks Reef and Area, Santore Wreck.

Statistical test results (Mann-Whitney U-Test, corrected for ties).

[*]Catch rates significantly different between years ($P \leq 0.05$).

[e]1987 catch rates significantly different ($P \leq 0.05$): CBBT Is. vs. Cape Henry Wrecks; CBBT Is. vs. Tri. Wrks. Area.

[f]1988 catch rates significantly different ($P \leq 0.05$): CBBT Is. vs. Ches. Light Tower Reef and Tri. Wrks. Area; Ches. Light Tower Reef vs. Cape Henry Wrecks and The Cell; The Cell vs. Tri. Wrks. Reef, Tri. Wrks. Area, and Offshore Sites; Lower Ches. Bay Sites vs. Offshore Sites.

Table 8. Tautog catches on trips targeting sea bass-tautog at lower Chesapeake Bay and offshore "wreck fishing" sites in 1987 and 1988.

	TAUTOG--TARGET SPECIES: SEA BASS-TAUTOG													
	No. Trips		No. Rod Hours		Total Kept		Mean Wt. Kept (lbs)		Release Rate (%)		Catch[a] Rate (lbs)		Catch[b] Rate (#)	
Location	1987	1988	1987	1988	1987	1988	1987	1988	1987	1988	1987	1988	1987	1988
Ches. Bay Br. Tun. Is.	15	14	253	118	418	214	2.7	3.7	3	9	4.5[e]	6.7[f]	1.7[e]	2.0[f]
The Cell	0	10	---	146	---	116	---	3.7	---	2	---	3.0[f]	---	0.8[f]
Ches. Light Tower Reef	9	12	161	139	108	39	3.5	3.7	3	0	2.3	1.0[f]	0.7[e]	0.3[f]
Ches. Light Tower	3	1	47	15	4	0	3.5	---	82	0	0.3	0[f]	0.5	0[f]
E. Ocean View Reef	0	3	---	12	---	0	---	---	---	0	---	0	---	0
Tri.Wrks.Rf.	9	5	236	102	23	0	3.2	---	36	100	0.3[e]	0[f]	0.2[e]	0.1[f]
Tri. Wrks. Area	14	13	460	244	39	15	4.6	5.5	40	40	0.4[e]	0.3[f]	0.1[e]	0.1[f]
Santore Wrk.	0	6	---	76	---	21	---	5.0	---	0	---	1.4	---	0.3
Cape Henry Wrecks	7	6	51	54	6	31	2.5	3.0	0	0	0.3[e]	1.7[f]	0.1[e]	0.6
Cape Charles Wreck	1	3	3	34	0	32	---	2.7	100	29	0	2.5	0.3	1.3
Parramore Test Reef	2	3	6	88	2	30	3.0	4.5	0	17	1.0	1.5	0.3	0.4
Parramore Reef	2	0	18	---	0	---	---	---	0	---	0	---	0	---

Table 8 (continued).

Location	No. Trips 1987	No. Trips 1988	No. Rod Hours 1987	No. Rod Hours 1988	Total Kept 1987	Total Kept 1988	Mean Wt. Kept (lbs) 1987	Mean Wt. Kept (lbs) 1988	Release Rate (%) 1987	Release Rate (%) 1988	Catch[a] Rate (lbs) 1987	Catch[a] Rate (lbs) 1988	Catch[b] Rate (#) 1987	Catch[b] Rate (#) 1988
	TAUTOG--TARGET SPECIES: SEA BASS-TAUTOG													
Lower Ches. Bay Sites[c]	22	34	304	336	424	361	2.7	3.6	3	6	3.8	1.1[f]	1.4	3.9[f]
Offshore Sites[d]	32	32	808	474	285	75	3.4	4.4	17	12	1.2[e]	0.7[f]	0.4[e]	0.2*[f]

[a]Pounds caught per rod hour (kept fish only).

[b]Catch per rod hour for all kept and released fish combined.

[c]Combined trips to CBBT Islands, The Cell, E. Ocean View Reef, Cape Henry Wrecks.

[d]Combined trips to Ches. Light Tower Reef, Ches. Light Tower, Triangle Wrecks Reef and Area, Santore Wreck.

Statistical test results (Mann-Whitney U-Test, corrected for ties).

*Catch rates significantly different between years ($P \leq 0.05$).

[e]1987 catch rates significantly different ($P \leq 0.05$): CBBT Is. vs. Cape Henry Wrecks, Ches. Light Tower Reef, Tri. Wrks. Reef, Tri. Wrks. Area, and Offshore Sites; Cape Henry Wrecks vs. Offshore Sites; Ches. Light Tower Reef vs. Tri. Wrks. Reef; Lower Ches. Bay Sites vs. Tri. Wrks. Reef and Tri. Wrks. Area.

[f]1988 catch rates significantly different ($P \leq 0.05$): The Cell vs. Tri. Wrks. Reef, Tri. Wrks. Area, and Offshore Sites; CBBT Is. vs. Cape Henry Wrecks, Ches. Light Tower Reef, Tri. Wrks. Reef, Tri. Wrks. Area, and Offshore Sites; Lower Ches. Bay Sites vs. Tri. Wrks. Reef, Tri. Wrks. Area, and Offshore Sites.

Table 9. Spot catches for trips targeting "bottom fish" (spot-croaker-trout-flounder) and spot-croaker only at lower Chesapeake Bay "wreck fishing" sites in 1987 and 1988.

Location	No. Trips 1987	No. Trips 1988	No. Rod Hours 1987	No. Rod Hours 1988	Total Kept 1987	Total Kept 1988	Mean Wt. Kept (lbs) 1987	Mean Wt. Kept (lbs) 1988	Release Rate (%) 1987	Release Rate (%) 1988	Catch[a] Rate (lbs) 1987	Catch[a] Rate (lbs) 1988	Catch[b] Rate (#) 1987	Catch[b] Rate (#) 1988
SPOT--TARGET SPECIES: SPOT-CROAKER-TROUT-FLOUNDER														
Ches. Bay Bridge Tunnel Is.	7	23	72	323	68	63	1.1	0.8	42	39	1.1	0.2	1.6	0.3
The Cell	2	11	14	253	0	2	---	0.8	0	0	0	0[c]	0	0[c]
E. Ocean View Reef	3	11	23	77	0	6	---	0.5	0	0	0	0[c]	0	0.1
Concrete Ships	1	4	9	40	0	0	---	---	0	100	0	0	0	0.2
Lower Ches. Bay Sites[d]	13	49	118	693	68	71	1.1	0.7	42	40	0.6	0.1	1.0	0.2
SPOT--TARGET SPECIES: SPOT-CROAKER														
Ches. Bay Bridge Tunnel Is.	3	4	29	41	68	50	1.1	0.8	27	44	2.6	0.9	3.2	2.2
The Cell	0	3	---	62	---	2	---	0.8	---	0	---	0[c]	---	0[c]
E. Ocean View Reef	2	7	21	45	0	6	---	0.5	0	0	0	0.1	0	0.1
Concrete Ships	0	0	---	---	---	---	---	---	---	---	---	---	---	---
Lower Ches. Bay Sites	5	14	50	148	68	58	1.1	0.7	27	41	1.5	0.3	1.9	0.7

[a] Pounds caught per rod hour (kept fish only).
[b] Catch per rod hour for kept and released fish combined.
[c] Fish caught but catch rate ≤ 0.05 (catch rates rounded off to nearest 0.1).
[d] Combined trips to CBBT Islands, The Cell, E. Ocean View Reef, Concrete Ships.

Table 10. Croaker catches for trips targeting "bottom fish" (spot-croaker-trout-flounder) and spot-croaker only at lower Chesapeake Bay "wreck fishing" sites in 1987 and 1988.

CROAKER--TARGET SPECIES: SPOT-CROAKER-TROUT-FLOUNDER

Location	No. Trips 1987	No. Trips 1988	No. Rod Hours 1987	No. Rod Hours 1988	Total Kept 1987	Total Kept 1988	Mean Wt. Kept (lbs) 1987	Mean Wt. Kept (lbs) 1988	Release Rate (%) 1987	Release Rate (%) 1988	Catch[a] Rate (lbs) 1987	Catch[a] Rate (lbs) 1988	Catch[b] Rate (#) 1987	Catch[b] Rate (#) 1988
Ches. Bay Bridge Tunnel Is.	7	23	72	323	413	44	1.8	1.1	11	41	10.2	0.2*[e]	6.5	0.2*[e]
The Cell	2	11	14	253	0	5	---	1.5	0	0	0	0[ce]	0	0[ce]
E. Ocean View Reef	3	11	23	77	125	130	1.5	0.9	0	20	8.2	1.6[e]	5.4	2.1[e]
Concrete Ships	1	4	9	40	0	2	---	0.8	0	0	0	0[c]	0	0[c]
Lower Ches. Bay Sites[d]	13	49	118	693	538	181	1.7	1.0	9	26	7.8	0.3*	5.0	0.4*

CROAKER--TARGET SPECIES: SPOT-CROAKER

Ches. Bay Bridge Tunnel Is.	3	4	29	41	405	44	1.8	1.1	8	41	24.9	1.2	15.1	1.8
The Cell	0	3	---	62	---	5	---	1.5	---	0	---	0.1	---	0.1
E. Ocean View Reef	2	7	21	45	125	74	1.5	1.0	0	30	8.9	1.7	6.0	2.4
Concrete Ships	0	0	---	---	---	---	---	---	---	---	---	---	---	---

Table 10 (continued).

CROAKER--TARGET SPECIES: SPOT-CROAKER-TROUT-FLOUNDER

Location	No. Trips 1987	1988	No. Rod Hours 1987	1988	Total Kept 1987	1988	Mean Wt. Kept (lbs) 1987	1988	Release Rate (%) 1987	1988	Catch[a] Rate (lbs) 1987	1988	Catch[b] Rate (#) 1987	1988
Lower Ches. Bay Sites	5	14	50	148	530	123	1.7	1.1	6	34	18.2	0.9*	11.3	1.2*

[a]Pounds caught per rod hour (kept fish only).

[b]Catch per rod hour for kept and released fish combined.

[c]Fish caught but catch rate $\leq$ 0.05 (catch rates rounded off to nearest 0.1).

[d]Combined trips to CBBT Islands, The Cell, E. Ocean View Reef, Concrete Ships.

Statistical test results (Mann-Whitney U-Test, corrected for ties).

*Catch rates significantly different between years ($P \leq 0.05$).

[e]1988 catch rates significantly different ($P \leq 0.05$): CBBT Is. vs. E. Ocean View Reef; The Cell vs. E. Ocean View Reef.

Table 11. Gray trout catches for trips targeting "bottom fish" (spot-croaker-trout-flounder) and gray trout only at lower Chesapeake "wreck fishing" sites in 1987 and 1988.

Location	No. Trips 1987	No. Trips 1988	No. Rod Hours 1987	No. Rod Hours 1988	Total Kept 1987	Total Kept 1988	Mean Wt. Kept (lbs) 1987	Mean Wt. Kept (lbs) 1988	Release Rate (%) 1987	Release Rate (%) 1988	Catch[a] Rate (lbs) 1987	Catch[a] Rate (lbs) 1988	Catch[b] Rate (#) 1987	Catch[b] Rate (#) 1988
GRAY TROUT--TARGET SPECIES: SPOT-CROAKER-TROUT-FLOUNDER														
Ches. Bay Bridge Tunnel Is.	7	23	72	323	103	216	2.0	1.5	47	17	2.9	1.0[f]	2.7	0.8[f]
The Cell	2	11	14	253	0	13	---	3.6	0	0	0	0.2[f]	0	0[c]
E. Ocean View Reef	3	11	23	77	0	0	---	---	0	0	0	0[f]	0	0[f]
Concrete Ships	1	4	9	40	23	13	1.0	2.0	0	0	2.6	0.7	2.6	0.3
Lower Ches. Bay Sites[c]	13	49	118	693	126	242	1.8	1.6	42	15	2.0	0.6	1.8	0.4
GRAY TROUT--TARGET SPECIES: GRAY TROUT														
Ches. Bay Bridge Tunnel Is.	1	8	12	102	102	214	2.0	1.5	47	17	17.0	3.1	16.0	2.5
The Cell	1	2	8	20	0	9	---	3.9	0	0	0	1.8	0	0.4
Lower Ches. Bay Sites	3[d]	12[e]	29	142	125	230	1.8	1.6	42	16	7.8	2.5	7.4	1.9

[a]
[b]Pounds caught per rod hour (kept fish only).
[c]Catch per rod hour for kept and released fish combined.
[d]Combined trips to listed sites.
[e]Includes one "trout" trip to the Concrete Ships.
[f]Includes one "trout" trip each to the Concrete Ships and the E. Ocean View Reef.
1988 catch rates significantly different ($P \leq 0.05$): CBBT Is. vs. The Cell and E. Ocean View Reef

Table 12. Flounder catches for trips targeting "bottom fish" (spot-croaker-trout-flounder) and flounder only at lower Chesapeake Bay "wreck fishing" sites in 1987 and 1988.

Location	No. Trips 1987	No. Trips 1988	No. Rod Hours 1987	No. Rod Hours 1988	Total Kept 1987	Total Kept 1988	Mean Wt. Kept (lbs) 1987	Mean Wt. Kept (lbs) 1988	Release Rate (%) 1987	Release Rate (%) 1988	Catch[a] Rate (lbs) 1987	Catch[a] Rate (lbs) 1988	Catch[b] Rate (#) 1987	Catch[b] Rate (#) 1988
TARGET SPECIES: SPOT-CROAKER-TROUT-FLOUNDER														
Ches. Bay Bridge Tunnel Is.	7	23	72	323	10	100	1.9	2.1	29	8	0.3	0.6	0.2	0.3
The Cell	2	11	14	253	14	117	1.5	2.4	0	0	1.5	1.1	1.0	0.5
E. Ocean View Reef	3	11	23	77	0	22	---	2.4	0	19	0	0.7	0	0.4
Concrete Ships	1	4	9	40	0	49	---	2.5	0	0	0	3.1	0	1.2
Lower Ches. Bay Sites[c]	13	49	118	693	24	228	1.7	2.3	14	5	0.3	1.0	0.2	0.4
TARGET SPECIES: FLOUNDER														
Ches. Bay Bridge Tunnel Is.	3	11	31	180	5	99	3.1	2.1	0	5	0.9	1.1	0.5	0.6
The Cell	1	6	6	171	14	116	1.5	2.3	0	0	3.5	1.6	2.3	0.7
E. Ocean View Reef	1	3	2	24	0	10	---	3.1	0	17	0	1.3	0	0.5
Concrete Ships	0	3	---	28	---	48	---	2.5	---	0	---	4.3	---	1.7
Lower Ches. Bay Sites	5	23	39	403	19	273	1.9	2.3	0	2	0.9	1.5	0.5	0.7

[a] Pounds caught per rod hour (kept fish only).
[b] Catch per rod hour for kept and released fish combined.
[c] Combined trips to listed sites.

Table 13. Bluefish catches for trips targeting desirable species (spot-croaker-trout-sea bass-tautog-flounder-bluefish-Spanish mackerel-king mackerel-amberjack) and bluefish only at lower Chesapeake Bay and offshore "wreck fishing" sites where bluefish were caught in 1987 and 1988.

	BLUEFISH--TARGET SPECIES: ALL DESIRABLE SPECIES													
Location	No. Trips 1987	1988	No. Rod Hours 1987	1988	Total Kept 1987	1988	Mean Wt. Kept (lbs) 1987	1988	Release Rate (%) 1987	1988	Catch[a] Rate (lbs) 1987	1988	Catch[b] Rate (#) 1987	1988
Ches. Bay Br. Tun. Is.	21	41	301	493	36	74	1.5	2.0	0	41	0.2	0.3	0.1	0.3
The Cell	3	21	34	399	1	16	7.0	1.5	0	0	0.2	0.1	0[c]	0[c]
Ches. Light Tower Reef	11	18	205	221	1	0	9.0	---	0	0	0[c]	0	0[c]	0
Ches. Light Tower	4	10	55	91	0	32	---	9.9	0	20	0	3.5	0	0.4
Concrete Ships	2	5	41	46	1	0	3.2	---	67	0	0.1	0	0.1	0
Triangle Wrks. Reef	7	5	168	102	12	11	15.5	10.7	0	0	1.1	1.2	0.1	0.1
Triangle Wrks. Area	13	13	401	244	12	11	15.5	10.7	8	0	0.5	0.5	0[c]	0[c]
Cape Henry Wrecks	9	6	99	54	24	0	2.0	---	0	0	0.5	0	0.2	0
Lower Ches. Bay Sites[d]	38	88	498	1085	62	90	1.8	1.9	3	37	0.2	0.2	0.1	0.1
Offshore Sites[e]	36	49	817	660	13	43	15.0	10.1	7	16	0.2	0.7	0[c]	0.1

Table 13 (continued).

	BLUEFISH--TARGET SPECIES: BLUEFISH													
Lower Ches. Bay Sites	2[f]	2[g]	52	6	2	12	5.1	1.2	50	0	0.2	2.5	0.1	2.0
Ches. Light Tower	0	2	---	8	---	8	---	6.5	---	50	---	6.5	---	2.0

[a]Pounds caught per rod hour (kept fish only).

[b]Catch per rod hour for kept and released fish combined.

[c]Fish caught but catch rate $\leq$ 0.05 (catch rates rounded off to nearest 0.1).

[d]Combined trips to CBBT Islands, The Cell, E. Ocean View Reef (3 trips - 1987; 15 trips - 1988, on which no bluefish were caught), Concrete Ships, Cape Henry Wrecks.

[e]Combined trips to Ches. Light Tower Reef, Light Tower, Triangle Reef Wrecks and Area, Santore Wreck (1 trip - 1987; 8 trips - 1988 on which no bluefish were caught).

[f]Combined trips to Concrete Ships (1) and The Cell (1).

[g]Combined trips to CBBT Islands (1) and E. Ocean View Reef (1).

Table 14. Amberjack catches for trips targeting amberjack at offshore "wreck fishing" sites in 1987 and 1988.

AMBERJACK--TARGET SPECIES: AMBERJACK

Location	No. Trips 1987	No. Trips 1988	No. Rod Hours 1987	No. Rod Hours 1988	Total Kept 1987	Total Kept 1988	Mean Wt. Kept (lbs) 1987	Mean Wt. Kept (lbs) 1988	Release Rate (%) 1987	Release Rate (%) 1988	Catch[a] Rate (lbs) 1987	Catch[a] Rate (lbs) 1988	Catch[b] Rate (#) 1987	Catch[b] Rate (#) 1988
Santore Wreck	0	1	---	12	---	9	---	35.0	---	0	---	26.2	---	0.8
Ches. Light Tower	1	7	8	68	0	3	---	58.0	0	93	0	2.6	0	0.6
Ches.Light Tower Reef	1	3	36	63	0	3	---	50.0	0	50	0	2.4	0	0.1
Tri. Wrks. Area	2	0	25	---	4	---	40.0	---	50	---	6.4	---	0.3	---
Offshore	4[c]	11[c]	69	143	4	15	40.0	42.6	50	73	2.3	4.5	0.1	0.4

[a]Pounds caught per rod hour (kept fish only).

[b]Catch per rod hour for all fish (kept and released).

[c]Combined trips to listed sites.

Table 15. Spanish mackerel, king mackerel and striped bass catches for trips targeting these species, respectively, at "wreck fishing" sites in 1987 and 1988.

Location	No. Trips 1987	No. Trips 1988	No. Rod Hours 1987	No. Rod Hours 1988	Total Kept 1987	Total Kept 1988	Mean Wt. Kept (lbs) 1987	Mean Wt. Kept (lbs) 1988	Release Rate (%) 1987	Release Rate (%) 1988	Catch[a] Rate (lbs) 1987	Catch[a] Rate (lbs) 1988	Catch[b] Rate (#) 1987	Catch[b] Rate (#) 1988
SPANISH MACKEREL--TARGET SPECIES: SPANISH MACKEREL														
Ches. Bay Br. Tun. Is.	0	3	---	50	---	47	---	2.4	---	0	---	2.2	---	0.9
Santore Wreck	0	1	---	16	---	2	---	2.0	---	0	---	0.2	---	0.1
KING MACKEREL--TARGET SPECIES: KING MACKEREL														
Santore Wreck	1	0	12	---	4	---	12.0	---	0	---	4.0	---	0.3	---
Cape Henry Wrecks	2	0	48	---	8	---	7.0	---	0	---	1.2	---	0.2	---
Ches. Light Tower Reef	1	2	8	16	0	2	---	15.0	0	0	0	1.9	0	0.1
Offshore Sites	3[c]	2[d]	24	16	4	2	12.0	15.0	0	0	2.0	1.9	0.2	0.1
STRIPED BASS--TARGET SPECIES: STRIPED BASS														
Ches. Bay Br. Tun. Is.	0	5	---	107	---	89	---	12.4	---	34	---	12.0	---	1.3

[a]Pounds caught per rod hour (kept fish only).

[b]Catch per rod hour for all fish (kept and released).

[c]Combined trips sites listed plus Tugboat Wreck (1).

[d]Chesapeake Light Tower Trips (2).

Table 16A. Distribution of fishing quality ratings for certain lower Chesapeake Bay and offshore "wreck fishing" sites with and without consideration for species targeted on trips in 1987 and 1988 (sites fished less than 10 times overall in the sampling program are not listed).

Location	No. Trips[a]	Relative Frequency of Fishing Quality Rating											
		Poor		Fair		Good		Very Good		Excellent		Unspecified	
		1987	1988	1987	1988	1987	1988	1987	1988	1987	1988	1987	1988
TARGET SPECIES NOT CONSIDERED													
Ches. Bay Br. Tun. Is.	23/45	4%	16%	13%	29%	17%	16%	---%	4%	26%	31%	39%	4%
The Cell	4/21	---	19	25	10	25	19	---	38	---	14	50	---
Ches. Light Tower	4/10	25	30	---	---	---	30	---	10	---	10	75	20
Ches. Light Tower Reef	11/18	9	11	9	28	9	17	---	17	---	17	73	11
E. Ocean View Reef	3/16	---	56	---	---	67	19	---	25	---	---	33	---
Tri. Wrks. Area	16/13	---	38	---	---	6	31	---	23	6	---	88	---
Lower Ches. Bay Sites[b]	41/93	7	26	12	17	24	16	2	18	17	19	37	3
Offshore Sites[c]	39/49	8	22	2	16	8	20	---	14	2	8	79	18
TARGET SPECIES: SEA BASS-TAUTOG													
Ches. Bay Br. Tun. Is.	15/14	7	21	13	38	13	7	---	7	27	14	40	14
The Cell	0/10	---	10	---	20	---	10	---	30	---	30	---	---
Ches. Light Tower	3/1	---	100	---	---	---	---	---	---	---	---	100	---
Ches. Light Tower Reef	9/12	---	8	11	42	11	---	---	8	---	17	78	17
E. Ocean View Reef	0/3	---	100	---	---	---	---	---	---	---	---	---	---

Table 16A (continued).

Location	No. Trips[a]	Relative Frequency of Fishing Quality Rating: Poor 1987	Poor 1988	Fair 1987	Fair 1988	Good 1987	Good 1988	Very Good 1987	Very Good 1988	Excellent 1987	Excellent 1988	Unspecified 1987	Unspecified 1988
TARGET SPECIES: SEA BASS-TAUTOG (continued)													
Tri. Wrks. Area	14/13	---	38	---	---	---	31	---	23	7	---	93	8
Lower Ches. Bay Sites	22/34	14	29	14	24	14	10	4	21	23	17	31	10
Offshore Sites[c]	32/32	---	19	3	22	3	16	---	12	---	9	94	22
TARGET SPECIES: SPOT-CROAKER-TROUT-FLOUNDER													
Ches. Bay Br. Tun. Is.	7/23	---	17	14	35	29	26	---	4	14	17	43	---
The Cell	2/11	---	27	50	---	---	27	---	45	---	---	50	---
E. Ocean View Reef	3/11	---	36	---	---	67	27	---	36	---	---	33	---
Lower Ches. Bay Sites[d]	13/49	---	24	15	18	31	24	---	22	8	10	46	---
TARGET SPECIES: SPOT-CROAKER													
Ches. Bay Br. Tun. Is.	3/4	---	25	---	---	67	50	---	---	20	25	---	---
The Cell	0/3	---	67	---	---	---	---	---	33	---	---	---	---
E. Ocean View Reef	2/7	---	29	---	---	100	43	---	29	---	---	---	---
Lower Ches. Bay Sites[e]	5/14	---	36	---	---	80	36	---	21	20	7	---	---

Table 16A (continued).

Location	No. Trips[a]	Relative Frequency of Fishing Quality Rating: Poor 1987	Poor 1988	Fair 1987	Fair 1988	Good 1987	Good 1988	Very Good 1987	Very Good 1988	Excellent 1987	Excellent 1988	Unspecified 1987	Unspecified 1988
TARGET SPECIES: TROUT													
Ches. Bay Br. Tun. Is.	1/8	---	25	---	25	---	25	---	---	---	25	100	---
The Cell	1/2	---	50	100	---	---	50	---	---	---	---	---	---
Lower Ches. Bay Sites	3/12[f]	---	25	33	25	---	25	---	8	---	17	67	---
TARGET SPECIES: FLOUNDER													
Ches. Bay Br. Tun. Is.	3/11	---	9	33	55	---	18	---	9	---	9	67	---
The Cell	1/6	---	---	---	---	---	33	---	67	---	---	100	---
E. Ocean View Reef	1/3	---	67	---	---	---	---	---	33	---	---	100	---
Lower Ches. Bay Sites[c]	5/23	---	17	20	26	---	17	---	30	---	9	80	---

[a]Number of trips sampled in 1987 and 1988, respectively, for targeted species groups indicated.

[b]Includes sites listed plus trips to Concrete Ships and Cape Henry Wrecks.

[c]Includes sites listed plus trips to Santore Wreck and Tugboat Wreck (1987 only).

[d]Combined trips to listed sites.

[e]Includes one "trout" trip to Concrete Ships.

[f]Includes one "trout" trip each to Concrete Ships and E. Ocean View Reef.

Table 16B. Weighted quality ratings for certain lower Chesapeake Bay and offshore "wreck fishing" sites with and without consideration for species targeted on trips in 1988.

Location	Weighted Quality Ratings[a] Poor	Fair	Good	Very Good	Excellent	Total	Rank
			TARGET SPECIES NOT CONSIDERED				
Ches. Bay Br. Tunn. Is.	1.6	5.8	4.8	1.6	15.5	29.3	2
The Cell	1.9	2.0	5.7	15.2	7.0	31.8	1
Ches. Light Tower	3.0	---	9.0	4.0	5.0	21.0	6
Ches. Light Tower Reef	1.1	5.6	5.1	6.8	8.5	27.1	3
E. Ocean View Reef	5.6	---	5.7	10.0	----	21.3	5
Tri. Wrks. Area	3.8	---	9.3	9.2	----	22.3	4
Lower Ches. Bay Sites	2.6	3.4	4.8	7.2	9.5	27.5	1
Offshore Sites	2.2	3.2	6.0	5.6	4.0	21.0	2
			TARGET SPECIES: SEA BASS-TAUTOG				
Ches. Bay Br. Tun. Is.	2.1	7.6	2.1	2.8	7.0	21.6	3
The Cell	1.0	4.0	3.0	12.0	15.0	35	1
Ches. Light Tower	10.0	---	---	---	----	10.0	5
Ches. Light Tower Reef	0.8	8.4	---	3.2	8.5	20.9	4

Table 16B (continued).

Location	Weighted Quality Ratings[a] Poor	Fair	Good	Very Good	Excellent	Total	Rank
TARGET SPECIES: SEA BASS-TAUTOG (continued)							
E. Ocean View Reef	10.0	---	---	--	----	10.0	5
Tri. Wrks. Area	3.8	4.4	4.8	4.8	4.5	22.3	2
Lower Ches. Bay Sites	2.9	4.8	3.0	8.4	8.5	27.6	1
Offshore Sites	1.9	4.4	4.8	4.8	4.5	20.4	2
TARGET SPECIES: SPOT-CROAKER-TROUT-FLOUNDER							
Ches. Bay Br. Tun. Is.	1.7	7.0	7.8	1.6	8.5	26.6	2
The Cell	2.7	---	8.1	18	----	28.8	1
E. Ocean View Reef	3.6	---	8.1	14.4	----	26.1	3
Lower Ches. Bay Sites	2.4	4.8	7.2	8.8	5.0	28.2	
TARGET SPECIES: SPOT-CROAKER							
Lower Ches. Bay Sites	2.4	3.6	7.2	8.8	5.0	27.0	-
TARGET SPECIES: TROUT							
Lower Ches. Bay Sites	2.5	5.0	7.5	3.2	8.5	26.7	-
TARGET SPECIES: FLOUNDER							
Lower Ches. Bay Sites	1.7	5.2	5.1	12	4.5	28.5	-

[a] Weighted values obtained by assigning values of 10,20,30,40,50 to respective quality rankings (poor, fair, good, very good, excellent) and multiplying assigned values times relative frequencies in Table 16A.

[b-d,f] Same as in Table 16A.

Table 17. Distribution of fishing effort sampled at Gwynn Island Test Reef in 1987 and 1988.

Month	Fishing Effort							
	No. Trips		Rel. Freq.		Rod-Hours		Rel. Freq.	
	1987	1988	1987	1988	1987	1988	1987	1988
May	4	4	6.7%	4.8%	10	31	1.4%	3.8%
June	7	5	11.7	6.0	104	44	14.9	5.4
July	11	22	18.3	26.5	88	207	12.6	25.6
August	11	21	18.3	25.3	157	247	22.5	30.5
September	7	22	11.7	26.5	93	180	13.3	22.2
October	17	6	28.3	7.2	227	66	32.6	8.2
November	3	3	5.0	3.6	18	34	2.6	4.2
Season Total	60	83			697	809		

Table 18. Fishing effort parameters of sampled trips targeting the Gwynn Island Test Reef in 1987 and 1988.

Month	Total[a] Trips	Fishing Effort Parameters (mean and S.D.)							
		Anglers Per Trip		Hours Fished Per Trip		Rods Fished Per Trip		Rod Hours Per Trip	
		1987	1988	1987	1988	1987	1988	1987	1988
May	4/4	2.5 (0.6)	2.0 (0.0)	1.8 (1.0)	3.0 (1.4)	2.5 (0.6)	2.5 (0.6)	2.5 (1.4)	7.8 (4.9)
June	7/5	3.6 (2.0)	2.4 (2.1)	3.7 (2.0)	2.8 (1.1)	3.7 (1.8)	2.8 (1.8)	14.9 (11.7)	8.8 (8.7)
July	11/22	2.8 (1.3)	3.1 (1.3)	2.6 (1.3)	2.7 (1.1)	2.9 (1.3)	3.4 (1.5)	8.0 (6.5)	9.4 (6.0)
August	11/21	3.6 (1.2)	3.2 (1.6)	3.6 (1.9)	3.1 (1.7)	3.7 (1.1)	3.4 (1.8)	14.3 (9.1)	11.8 (10.8)
September	7/22	3.4 (1.5)	3.0 (1.3)	3.4 (1.8)	2.7 (1.7)	3.7 (1.4)	2.9 (1.3)	13.3 (8.9)	8.2 (6.3)
October	17/6	3.3 (1.4)	3.7 (1.0)	3.5 (1.7)	2.8 (1.3)	3.4 (1.4)	3.8 (0.8)	13.4 (10.8)	11.0 (5.8)
November	3/3	2.3 (0.6)	2.3 (0.6)	2.7 (1.2)	4.3 (3.2)	2.3 (0.6)	2.3 (0.6)	6.0 (2.0)	11.3 (11.0)
Season	60/83	3.2 (1.4)	3.0 (1.4)	3.2 (1.7)	2.9 (1.5)	3.3 (1.3)	3.2 (1.4)	11.6 (9.3)	9.8 (7.7)

[a]Total trips sampled in 1987 and 1988, respectively.

Table 19. Distribution of Gwynn Island Test Reef fishing effort by targeted species in 1987 and 1988.

Month	Total[b] Trips	Target Species[a]									
		Sea Bass		Tautog		Trout		Spot		Other	
		1987	1988	1987	1988	1987	1988	1987	1988	1987	1988
May	4/4	--%	--%	25%	--%	--%	--%	25%	--	50%[c]	100%[d]
June	7/5	--	--	--	--	29	--	43	80	29[e]	20[f]
July	11/22	--	--	--	5	9	--	64	95	27[e]	--
August	11/21	--	--	--	--	27	10	64	86	9[e]	5[e]
September	7/22	--	--	--	--	14	18	86	82	--	--
October	17/6	6	--	6	33	24	33	47	33	18[g]	
November	3/3	--	--	100	100	--	--	--	--	--	--
Season	60/83	2	--	8	7	18	10	53	76	18	7

[a]If several "targeted species" were specified during an interview, the first species mentioned was considered the principal species sought.

[b]Total trips sampled in 1987 and 1988, respectively.

[c]"Bottomfish"

[d]25%-flounder; 25% bluefish; 50%-unspecified.

[e]Unspecified target species.

[f]Bluefish

[g]12%-flounder; remainder unspecified.

Table 20. Relative contribution of species to total "kept" catch for the Gwynn Island Test Reef in 1987 and 1988.

Month	No.[a] Trips	No. Kept[b] Fish	Relative Frequency (%) Tautog 1987	Tautog 1988	Sea Bass 1987	Sea Bass 1988	Spot 1987	Spot 1988	Croaker 1987	Croaker 1988	Trout 1987	Trout 1988	Other 1987	Other 1988
May	4/4	45/41	0	0	0	0	22.2	0	60.0	0	17.8	0	0	100[c]
June	7/5	235/93	0	0	0	0	51.9	84.9	17.9	7.5	30.2	4.3	0	3.2[d]
July	11/22	419/815	0	0	0	0	82.1	92.5	8.1	3.6	9.8	0.4	0	3.1[e]
August	11/21	437/630	0	0	0	0	84.0	87.1	0	1.9	15.8	7.3	0.2[f]	3.6[g]
Sept.	7/22	440/625	0	0	0	0	89.8	72.8	5.2	1.4	5.0	13.4	0	12.3[h]
Oct.	17/6	873/88	0.8	10.2	2.4	0	83.0	73.8	0.7	0	12.9	11.4	0.3[i]	4.5[j]
Nov.	3/3	23/37	43.5	100	52.2	0	0	0	0	0	0	0	4.3[f]	0
Season	60/83	2472/2329	0.7	2.0	1.3	0	79.4	81.6	5.3	2.4	13.1	6.4	0.2	7.5[k]

[a] Number of fishing trips sampled in 1987 and 1988, respectively.
[b] Total number of fish recorded as "kept" for trips sampled in 1987 and 1988, respectively.
[c] Flounder - 85.4%; bluefish - 14.6%.
[d] Bluefish.
[e] Bluefish - 1.3%; "sea mullet" (whiting, Menticirrhus sp.) - 1.3%; sand shark (likely juv. Carcharhinus milberti) - 0.2%; oyster toadfish (Opsanus tau) - 0.2%; puffers (Sphoeroides maculatus) - 0.1%.
[f] Flounder
[g] Sea mullet.
[h] Sea mullet - 5.1%; porgy (scup, Stenatomus chrysops) - 4.3%; bluefish - 1.9%; puffers - 1.0%.
[i] Flounder - 0.1%; sea mullet - 0.2%.
[j] Sea mullet - 3.4%; bluefish - 1.1%.
[k] Sea mullet - 3.0%; flounder - 1.5%; bluefish - 1.4%; porgy - 1.2%; oyster toadfish - 0.1%.

Table 21. Spot catches for trips targeting "bottom fish" (spot-croaker-trout-flounder) and spot-croaker only at the Gwynn Island Test Reef in 1987 and 1988.

TARGET SPECIES: SPOT-CROAKER-TROUT-FLOUNDER

Month	No. Trips 1987	No. Trips 1988	No. Rod Hours 1987	No. Rod Hours 1988	Total Kept 1987	Total Kept 1988	Mean Wt. Kept (lbs) 1987	Mean Wt. Kept (lbs) 1988	Release Rate (%) 1987	Release Rate (%) 1988	Catch[a] Rate (lbs) 1987	Catch[a] Rate (lbs) 1988	Catch[b] Rate (#) 1987	Catch[b] Rate (#) 1988
May	3	1	12	15	10	0	1.0	---	38	---	0.8	0	1.3	0
June	7	4	106	40	122	79	0.6	0.6	0	0	0.6	1.2	1.2	2.0
July	11	21	88	182	344	754	0.6	0.7	8	6	2.1	2.7	4.2	4.4
August	11	21	157	247	364	549	0.7	0.6	0	37	1.6	1.3	2.3	3.6
September	7	22	93	180	395	455	0.8	0.7	8	47	3.4	1.8*	4.6	4.8
October	15	4	188	54	725	65	0.9	0.9	21	0	3.5	1.1	4.9	1.2
November	0[c]	0	---	---	---	---	---	---	---	---	---	---	---	---
Season	54	73	644	718	1960	1902	0.8	0.7	12	29	2.3	1.7	3.5	3.8

TARGET SPECIES: SPOT-CROAKER

May	2	0	6	---	1	---	1.0	---	86	---	0.2	---	1.2	---
June	5	4	72	40	92	79	0.5	0.6	0	0	0.6	1.2	1.3	2.0
July	10	21	78	182	326	754	0.6	0.7	8	6	2.3	2.7	4.6	4.4
August	8	18	109	216	340	497	0.7	0.6	0	39	2.1	1.4	3.1	3.8
September	6	18	91	156	386	439	0.8	0.7	8	42	3.4	2.0	4.6	4.8
October	9	2	78	24	692	58	0.9	1.0	21	0	8.3	2.4	11.2	2.4
November	0	0	---	---	---	---	---	---	---	---	---	---	---	---
Season	40	63	434	618	1387	1827	0.8	2.0	12	27	3.2	2.0	4.8	4.0

[a]Pounds caught per rod hour (kept fish only).
[b]Catch per rod hour for kept and released fish combined.
[c]No trips made for targeted species.
*Catch rates signficantly different between years ($P \leq 0.05$), Mann-Whitney U-Test.

Table 22. Croaker catches for trips targeting "bottom fish" (spot-croaker-trout-flounder) and spot-croaker only at the Gwynn Island Test Reef in 1987 and 1988.

CROAKER--TARGET SPECIES: SPOT-CROAKER-TROUT-FLOUNDER

Month	No. Trips 1987	No. Trips 1988	No. Rod Hours 1987	No. Rod Hours 1988	Total Kept 1987	Total Kept 1988	Mean Wt. Kept (lbs) 1987	Mean Wt. Kept (lbs) 1988	Release Rate (%) 1987	Release Rate (%) 1988	Catch[a] Rate (lbs) 1987	Catch[a] Rate (lbs) 1988	Catch[b] Rate (#) 1987	Catch[b] Rate (#) 1988
May	3	1	12	15	4	0	1.2	---	0	---	1.2	0	0.3	0
June	7	4	106	40	42	7	1.5	1.5	0	0	0.6	0.3	0.4	0.2
July	11	21	88	182	32	30	0.8	0.9	0	46	0.3	0.2	0.4	0.3
August	11	21	157	247	0	12	---	0.7	100	64	0	0[c]	0[c]	0.1
September	7	22	93	180	23	9	1.3	0.5	58	86	0.3	0[c]*	0.6	0.4*
October	15	4	188	54	6	0	1.2	---	0	---	0[c]	0	0[c]	0
November	0[d]	0	---	---	---	---	---	---	---	---	---	---	---	---
Season	54	73	644	718	107	58	1.2	0.9	27	64	0.2	0.1	0.2	0.2

CROAKER--TARGET SPECIES: SPOT-CROAKER

Month	No. Trips 1987	No. Trips 1988	No. Rod Hours 1987	No. Rod Hours 1988	Total Kept 1987	Total Kept 1988	Mean Wt. Kept (lbs) 1987	Mean Wt. Kept (lbs) 1988	Release Rate (%) 1987	Release Rate (%) 1988	Catch[a] Rate (lbs) 1987	Catch[a] Rate (lbs) 1988	Catch[b] Rate (#) 1987	Catch[b] Rate (#) 1988
May	2	0	6	---	1	---	1.2	---	0	---	0.2	---	0.2	---
June	5	4	70	40	25	7	1.9	1.5	0	0	0.7	0.3	0.4	0.2
July	10	21	78	182	32	30	0.8	0.9	0	46	0.3	0.2	0.4	0.3
August	8	18	109	216	0	12	---	0.7	100	64	0	0[c]	0.1	0.2
September	6	18	91	156	23	9	1.3	0.5	58	86	0.3	0[c]*	0.6	0.4
October	9	2	78	24	6	0	1.2	---	0	---	0.1	0	0.1	0
November	0	0	---	---	---	---	---	---	---	---	---	---	---	---
Season	40	63	434	618	87	58	1.3	0.9	32	64	0.3	0.1	0.3	0.3

[a] Pounds caught per rod hour (kept fish only).
[b] Catch per rod hour for kept and released fish combined.
[c] Fish caught but catch rate $\leq$ 0.05 (catch rates rounded off to nearest 0.1).
[d] No trips made for targeted species.
* Catch rates significantly different between years ($P \leq 0.05$) Mann-Whitney U-Test.

Table 23. Gray trout catches for trips targeting "bottom fish" (spot-croaker-trout-flounder) and gray trout only at the Gwynn Island Test Reef in 1987 and 1988.

GRAY TROUT--TARGET SPECIES: SPOT-CROAKER-TROUT-FLOUNDER

Month	No. Trips 1987	No. Trips 1988	No. Rod Hours 1987	No. Rod Hours 1988	Total Kept 1987	Total Kept 1988	Mean Wt. Kept (lbs) 1987	Mean Wt. Kept (lbs) 1988	Release Rate (%) 1987	Release Rate (%) 1988	Catch[a] Rate (lbs) 1987	Catch[a] Rate (lbs) 1988	Catch[b] Rate (#) 1987	Catch[b] Rate (#) 1988
May	3	1	12	15	8	0	2.5	---	11	100	1.7	0	0.8	0.1
June	7	4	106	40	71	4	1.1	1.5	0	0	0.7	0.2	0.7	0.1
July	11	21	88	182	41	4	1.1	1.4	0	20	0.5	0[c*]	0.5	0[c*]
August	11	21	157	247	69	46	1.3	1.0	3	2	0.6	0.2	0.4	0.2
September	7	22	93	180	22	84	1.7	1.2	44	7	0.4	0.6	0.4	0.5
October	15	4	188	54	37	10	2.1	1.0	23	0	1.3	0.2	0.8	0.2
November	0[d]	0	---	---	---	---	---	---	---	---	---	---	---	---
Season	54	73	644	718	332	148	1.6	1.2	15	6	0.8	0.2*	0.6	0.2*

GRAY TROUT--TARGET SPECIES: GRAY TROUT

May	1	0[d]	6	---	8	---	2.5	---	0	---	3.3	---	1.3	---
June	2	0	34	---	11	---	1.5	---	0	---	0.5	---	0.3	---
July	1	0	10	---	12	---	0.8	---	0	---	0.9	---	1.2	---
August	3	3	48	31	1	36	0.8	1.0	67	0	0[d]	1.2*	0.1	1.2
September	1	4	2	24	4	57	0.9	1.3	0	0	0.9	3.1	2.0	2.4
October	4	2	78	30	38	4	3.3	1.0	0	0	1.6	0.1	0.5	0.1
November	0	0	---	---	---	---	---	---	---	---	---	---	---	---
Season	12	9	178	85	74	97	2.4	1.2	3	0	1.0	1.4	0.4	1.1

[a] Pounds caught per rod hour (kept fish only).
[b] Catch per rod hour for kept and released fish combined.
[c] Fish caught but catch rate $\leq$ 0.05 (catch rate rounded off to nearest 0.1).
[d] No trips made for targeted species.
* Catch rates significantly different between years ($P \leq 0.05$), Mann-Whitney U-Test.

Table 24. Bluefish catches for trips targeting desirable species (spot-croaker-trout-sea bass-tautog-flounder-bluefish) at the Gwynn Island Test Reef in 1987 and 1988.

BLUEFISH--TARGET SPECIES: ALL DESIRABLE SPECIES

Month	No. Trips 1987	No. Trips 1988	No. Rod Hours 1987	No. Rod Hours 1988	Total Kept 1987	Total Kept 1988	Mean Wt. Kept (lbs) 1987	Mean Wt. Kept (lbs) 1988	Release Rate (%) 1987	Release Rate (%) 1988	Catch[a] Rate (lbs) 1987	Catch[a] Rate (lbs) 1988	Catch[b] Rate (#) 1987	Catch[b] Rate (#) 1988
May	4	4	16	31	0	6	---	8.4	0	45	0	1.6	0	0.4
June	7	5	106	44	0	3	---	4.5	0	0	0	0.3	0	0.1
July	11	22	88	207	0	11	---	1.7	0	0	0	0.1	0	0[c]
August	11	21	157	247	0	0	---	---	100	0	0	0	0[c]	0
September	7	22	93	180	0	12	---	1.5	0	0	0	0.1	0	0.1
October	17	6	227	66	0	0	---	---	0	0	0	0	0	0
November	3	3	18	34	0	0	---	---	0	0	0	0	0	0
Season[d]	58	82	673	794	0	32	---	3.1	100	14	---	0.1	0[c]	0[c]

[a]Pounds caught per rod hour (kept fish only).

[b]Catch per rod hour for kept and released fish combined.

[c]Fish caught but catch rate $\leq$ 0.05 (catch rates rounded to nearest 0.1).

[d]Only one May and one June trip captured in the 1988 sampling program targeted bluefish; no trips targeting bluefish were recorded in 1987.

Table 25. Sea bass catches for trips targeting sea bass-tautog at the Gwynn Island Test Reef in 1987 and 1988.

SEA BASS--TARGET SPECIES: SEA BASS - TAUTOG

Month	No. Trips 1987	No. Trips 1988	No. Rod Hours 1987	No. Rod Hours 1988	Total Kept 1987	Total Kept 1988	Mean Wt. Kept (lbs) 1987	Mean Wt. Kept (lbs) 1988	Release Rate (%) 1987	Release Rate (%) 1988	Catch[a] Rate (lbs) 1987	Catch[a] Rate (lbs) 1988	Catch[b] Rate (#) 1987	Catch[b] Rate (#) 1988
May	1	0	4	---	0	---	---	---	0	---	0	---	0	---
June	0	0	---	---	---	---	---	---	---	---	---	---	---	---
July	0	1	---	25	---	0	---	---	---	0	---	0	---	0
August	0	0	---	---	---	---	---	---	---	---	---	---	---	---
September	0	0	---	---	---	---	---	---	---	---	---	---	---	---
October	2	2	39	12	6	0	1.0	---	83	0	0.2	0	0.9	0
November	3	3	18	34	12	0	0.8	---	45	0	0.5	0	1.2	0
Season	6	6	61	71	18	0	0.8	---	69	0	0.2	0	1.0	0

[a]Pounds caught per rod hour (kept fish only).

[b]Catch per rod hour for kept and released fish combined.

Table 26. Tautog catches for trips targeting sea bass-tautog at the Gwynn Island Test Reef in 1987 and 1988.

TAUTOG--TARGET SPECIES: SEA BASS - TAUTOG

Month	No. Trips 1987	No. Trips 1988	No. Rod Hours 1987	No. Rod Hours 1988	Total Kept 1987	Total Kept 1988	Mean Wt. Kept (lbs) 1987	Mean Wt. Kept (lbs) 1988	Release Rate (%) 1987	Release Rate (%) 1988	Catch[a] Rate (lbs) 1987	Catch[a] Rate (lbs) 1988	Catch[b] Rate (#) 1987	Catch[b] Rate (#) 1988
May	1	0	4	---	0	---	---	---	0	---	0	---	0	---
June	0	0	---	---	---	---	---	---	---	---	---	---	---	---
July	0	1	---	25	---	0	---	---	---	0	---	0	---	0
August	0	0	---	---	---	---	---	---	---	---	---	---	---	---
September	0	0	---	---	---	---	---	---	---	---	---	---	---	---
October	2	2	39	12	2	9	4.5	4.0	0	0	0.2	3.0	0[c]	0.8
November	3	3	18	34	10	37	3.0	6.7	0	0	1.7	7.3	0.6	1.1
Season	6	6	61	71	12	46	3.2	6.2	0	0	0.6	4.0	0.2	0.6

[a]Pounds caught per rod hour (kept fish only).

[b]Catch per rod hour for kept and released fish combined.

[c]Fish caught but catch rate $\leq$ 0.05 (catch rates rounded off to nearest 0.1).

Table 27A. Distribution of fishing quality ratings for the Gwynn Island Test Reef with and without consideration for species targeted on trips in 1987 and 1988.

Month	No. Trips[a]	Relative Frequency of Fishing Quality Rating											
		Poor		Fair		Good		Very Good		Excellent		Unspecified	
		1987	1988	1987	1988	1987	1988	1987	1988	1987	1988	1987	1988
TARGET SPECIES NOT CONSIDERED													
May	4/4	--%	--%	--%	25%	--%	50%	--%	25%	--%	--%	100%	--%
June	7/5	--	20	29	40	--	40	--	--	--	--	71	--
July	11/22	18	32	9	23	64	23	9	9	--	14	--	--
August	11/21	36	52	9	10	18	19	18	14	9	5	9	--
September	7/22	--	45	--	--	57	23	29	23	--	9	14	--
October	17/6	41	50	6	17	6	--	18	17	12	17	18	--
November	3/3	--	33	33	--	--	--	--	--	--	67	67	--
Season	60/83	22	40	10	13	23	22	13	14	5	11	27	--
TARGET SPECIES: SPOT-CROAKER-TROUT-FLOUNDER													
Season	50/73[b]	24	41	6	14	28	22	16	15	6	8	20	--
TARGET SPECIES: SPOT-CROAKER													
Season	39/63	18	43	3	13	31	21	21	21	14	8	10	21
TARGET SPECIES: TROUT													
Season	9/9	33	33	22	11	22	33	--	22	--	--	22	--
TARGET SPECIES: SEABASS-TAUTOG													
Season	6/6	17	50	33	--	--	--	--	--	--	50	50	--

[a] Number of trips sampled during 1987 and 1988, respectively.
[b] Number of trips for which indicated species were targeted by fishing party.

Table 27B. Weighted quality ratings for overall seasonal fishing experiences at the Gwynn Island Test Reef with and without consideration for species targeted on trips in 1987 and 1988.

Weighted Quality Ratings[a]											
Poor		Fair		Good		Very Good		Excellent		Total	
1987	1988	1987	1988	1987	1988	1987	1988	1987	1988	1987	1988
TARGET SPECIES NOT CONSIDERED											
2.2	4	2	2.6	6.9	6.6	5.2	5.6	2.5	5.5	18.8	24.3
TARGET SPECIES: SPOT-CROAKER-TROUT-FLOUNDER											
2.4	4.1	1.2	2.8	8.4	6.6	6.4	6.0	3.0	4.0	21.4	23.5
TARGET SPECIES: SPOT-CROAKER											
1.8	4.3	0.6	2.6	9.3	6.3	8.4	8.4	7.0	4.0	27.1	25.6
TARGET SPECIES: TROUT											
3.3	3.3	4.4	2.2	6.6	9.9	---	8.8	---	---	14.3	24.2
TARGET SPECIES: SEA BASS-TAUTOG											
1.7	5.0	6.6	---	---	---	---	---	---	25.0	8.3	30.0

[a]Weighted values obtained by assigning values of 10, 20, 30, 40, 50 to respective quality rankings (poor, fair, good, very good, excellent) and multiplying assigned values times relative frequencies in Table 27A.

Table 28. Catch rate comparisons between Gwynn Island Test Reef and other major "wreck fishing" sites with consideration for certain target species in 1987 and 1988.

Location	Mean Catch Rates: No. Trips 1987	No. Trips 1988	Lbs. Kept Per Rod Hr. 1987	Lbs. Kept Per Rod Hr. 1988	No. Caught Per Rod Hour 1987	No. Caught Per Rod Hour 1988
SPOT--TARGET SPECIES: SPOT-CROAKER-TROUT-FLOUNDER						
Gwynn Island Test Reef	54	73	2.3#	1.7*	3.5#	3.8*
The Cell	2	11	---	0b*	---	0.1*
E. Ocean View Reef	3	11	---a	0b*	---	0.1*
Ches. Bay Br. Tun. Is.	7	23	1.1	0.2*	1.6	0.3*
Lower Ches. Bay Sites[c]	13	49	0.6#	0.1*	1.0#	0.2*
CROAKER--TARGET SPECIES: SPOT-CROAKER-TROUT-FLOUNDER						
Gwynn Island Test Reef	54	73	0.2#	0.1*	0.3#	0.2*
The Cell	2	11	---	0b	---	0b
E. Ocean View Reef	3	11	---	1.6*	---	2.1*
Ches. Bay Br. Tun. Is.	7	23	10.2#	0.2	6.5#	0.2
Lower Ches. Bay Sites	13	49	7.8#	0.3*	5.0#	0.4
TROUT--TARGET SPECIES: SPOT-CROAKER-TROUT-FLOUNDER						
Gwynn Island Test Reef	54	73	0.8	0.2*	0.6	0.2*
The Cell	2	11	---	0.2	---	0b
E. Ocean View Reef	3	11	---	0*	---	0*
Ches. Bay Br. Tun. Is.	7	23	2.9	1.0	2.7	0.8
Lower Ches. Bay Sites	13	49	2.0	0.6	1.8	0.4

Table 28 (continued).

Location	No. Trips 1987	No. Trips 1988	Mean Catch Rates: Lbs. Kept Per Rod Hr. 1987	Lbs. Kept Per Rod Hr. 1988	No. Caught Per Rod Hour 1987	No. Caught Per Rod Hour 1988
SEA BASS--TARGET SPECIES: SEA BASS-TAUTOG						
Gwynn Island Test Reef	6	6	0.2	0*	1.0	0*
The Cell	0	10	---	---	---	0.2
Ches. Bay Br. Tun. Is.	14	14	0.4	0.6	0.6	1.3
Cape Henry Wrks.	7	6	2.0	1.2	2.5	1.2
Lower Ches. Bay Sites[d]	21	34	0.7	0.4	1.0	0.7
Ches. Light Tower Reef	9	12	2.3	1.0*	0.7	0.3*
Tri. Wrecks Area	11	13	0.5	0.3*	0.2	0.1*
TAUTOG--TARGET SPECIES: SEA BASS-TAUTOG						
Gwynn Island Test Reef	6	6	0.6	4.0	0.2#	0.6
The Cell	0	10	---	3.0	---	0.8
Ches. Bay Br. Tun. Is.	14	14	4.3	6.7	1.6#	2.0
Cape Henry Wrks.	7	6	0.3	1.7	0.1	0.6
Lower Ches. Bay Sites[d]	21	34	3.6	1.1	1.4	3.9
Ches. Light Tower Reef	9	12	2.3	1.0	0.7	0.3
Tri. Wrks. Area	11	13	0.5	0.3	0.2	0.1

[a] Insufficient trips sampled to adequately represent fishing activity.
[b] Fish caught but catch rate $\leq$ 0.05 (catch rates rounded off to nearest 0.1).
[c] Combined trips to CBBT Is., The Cell, E. Ocean View Reef, Concrete Ships.
[d] Combined trips to CBBT Is., The Cell, E. Ocean View Reef, Cape Henry Wrecks.
Statistical test results (Mann-Whitney U-Test, corrected for ties).
1987 catch rates are significantly different between G.I. Test Reef and other indicated site(s), ($P \leq 0.05$), Mann-Whitney U-Test.
* 1988 catch rates are significantly different between G.I. Test Reef and other indicated site(s), ($P \leq 0.05$), Mann-Whitney U-Test.

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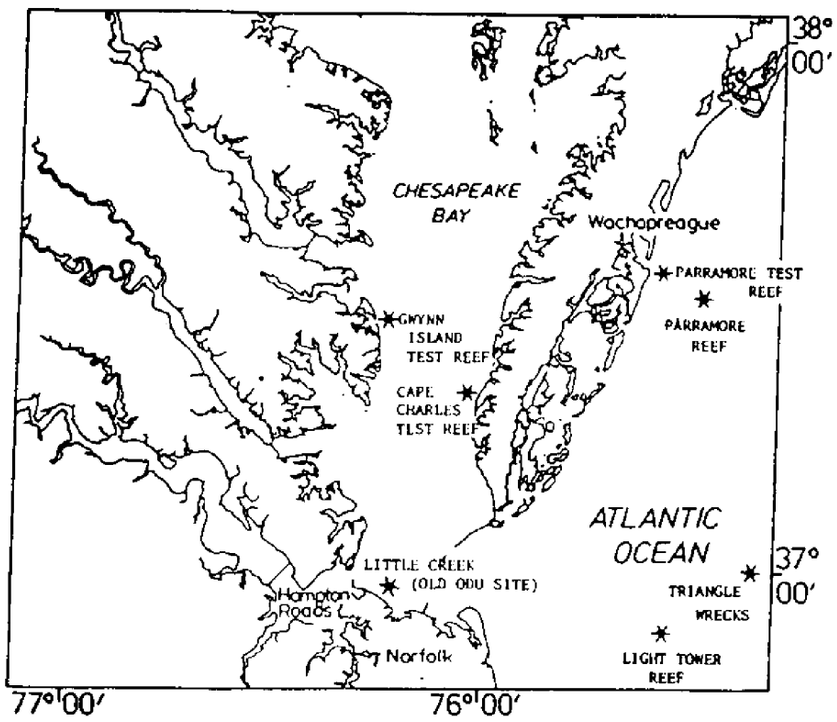
ARTIFICIAL REEF FISHING STUDY
Virginia Institute of Marine Science, Gloucester Point, VA 23062
(Funded by Sport Fish Restoration (Wallop-Breaux) Funds
Through the Virginia Marine Resources Commission)



ARTIFICIAL REEF AND WRECK STUDY SITES
(Sites to be Re-Buoyed By Late Spring 1987)

LOCATION	LORAN BEARINGS	REEF MATERIAL
PARRAMORE TEST REEF 3.8 N.M. from Parramore Coast Guard Tower on Course 115 degrees T	41784.1/27125.4 41741.0/27126.0 41747.5/27125.2 41744.0/27125.2 41738.0/27126.3	Concrete Pipes Concrete Igloos Concrete Pipes Tire Modules Tire Modules
PARRAMORE REEF (Buoy "R-10") 8.7 N.M. from Parramore Coast Guard Tower on Course 102 degrees T	41746.3/27095.5 41744.0/27095.0	Vessel: Walter Hines Page Vessel: Mona Island
TRIANGLE WRECKS (GA Buoy) 18 N.M. from Chesapeake Light Station on Course 071 degrees T	41391.4/27020.2 41390.7/27020.5 41389.6/27020.0 41386.2/27018.9	Vessel: Webster Vessel: George P. Garrison Vessel: James Haviland Vessel: Edgar Clark
LIGHT TOWER REEF S.W. of Chesapeake Light Station	41286.2/27103.0	60′ X 80′ Drydock
GWYNN ISLAND TEST REEF 1.35 N.M. NE of "Hole-in-the-Wall"	41637.2/27299.4	Tire Modules/Concrete Igloos
CAPE CHARLES TEST REEF N/NW of Entrance to Cherrystone Inlet immediately east of Buoy "C 12"	41541.2/27231.0 41539.0/27231.2 41539.4/27230.8	Concrete Igloos Tire Modules Concrete Pipes
LITTLE CREEK (after Aug. 1, 1987) 900 yds. off Ocean View Beach W. of Little Creek Entrance	41259.8/27225.3 41259.7/27225.0	Concrete Igloos Concrete Igloos

Appendix A. Chart showing locations of artificial reef study sites.

ATTENTION
WRECK & ARTIFICIAL REEF FISHERMEN

WE NEED YOUR HELP! The Virginia Institute of Marine Science (VIMS) is beginning a two-year study to develop catch and effort information for determining trends in recreational fishing on Virginia's artificial fishing reefs. Offshore and Chesapeake Bay sites will be studied. (See chart, reverse side).

The study will help document fishing success rates of experienced fishermen on the reef sites. Study results will be useful to the Virginia Marine Resources Commission (VMRC) in maintaining and expanding its reef program. Primary funding for the study is provided by Sport Fish Restoration (Wallop-Breaux) Funds administered by VMRC.

PARTICIPATION BY PRIVATE BOAT FISHERMEN IS NEEDED! If you occasionally fish reef sites, please fill in a line below so we can contact you several times during the fishing season about your catches. We promise to be brief and appreciate your help!

NAME	ADDRESS	PHONE NO.	BOAT NAME

Appendix A (cont.) Form for soliciting names and addresses of boating owning wreck and reef fishermen.

VIMS needs help to see if anglers catch fish at reefs

Jay Mundy

Fishing

GLOUCESTER POINT — Researchers at the Virginia Institute of Marine Science need our help. They need to know if we're catching fish on the artificial reefs that's been planted around the lower Chesapeake Bay.

For the past dozen years, the Marine Resource Commission has spent roughly $350,000 building artificial reefs in the Atlantic at such locations as the Chesapeake Light Tower, some 15 miles east of the Chesapeake Bay Bridge, and the Triangle Wrecks, another 15 miles beyond the Light Tower.

Today these reefs are not only providing excellent recreational fishing for such species as black sea bass and tautog, but also provide a sizable commercial catch for watermen.

Since 1983, VMRC has planted four reefs in the bay itself, with a fifth scheduled to be completed on the old ODU site off east Ocean View by August of this year. Two more are located in the Atlantic just off Parramore on the Eastern Shore.

Jon Lucy, coordinator for the VIMS project, said the reefs inside the bay are perfect for such species as croaker, spot and flounder, but there is little proof that fish have taken up residence.

"Part of the problem may be the sites are really test sites and rather small in size, and anglers simply can't locate them," he said.

For example, the Gwynn Island site, located at the southern tip of the mouth of the Rappahannock River a little more than a mile northeast of the "Hole-in-the-Wall, " the passage between the island and the mainland, is only about 50 yards by 75 yards.

"We know this site marks well on a fish finder," Lucy said. "We know also that some spot, croaker and even flounder have been caught there, because we've already spoken with some fishermen who had good results fishing there.

"What we need to know now," he added, "is if the fish have started to hang around the reef all season, like they do on the offshore reefs, or if they're just moving in and out, say with the tide, or when they're chasing baitfish."

The Gwynn Island site, as with all the sites, were constructed of the best material known at this time, according to Mike Meier, reef director for VMRC.

The Gwynn Island site was constructed from concrete igloos and old tires, and fashioned after designs perfected by the Japanese, world leaders in artificial reef construction.

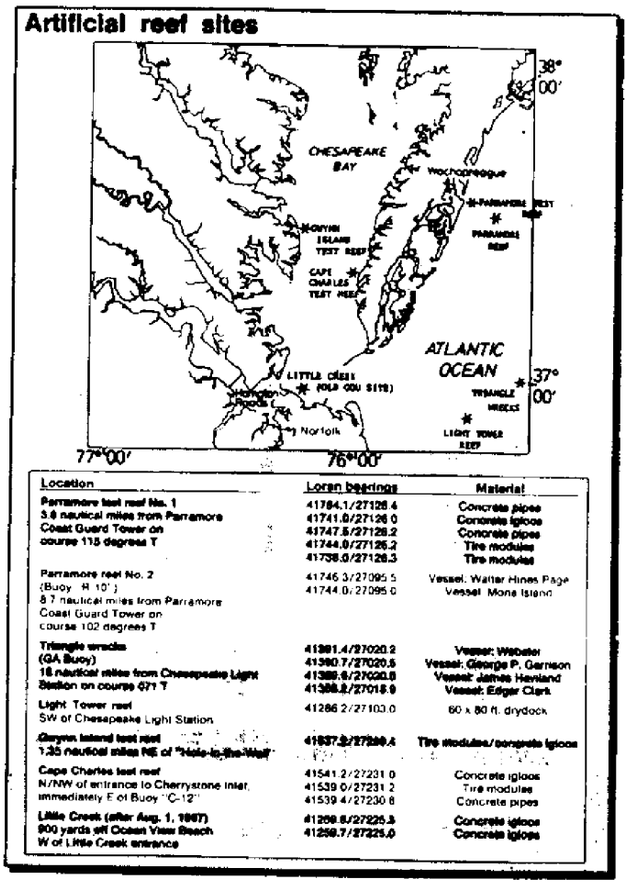
They're laid out in a ragged line, much like the ballast rocks that make up the foundation for Bluefish Rock, a popular fishing spot located just off Grandview Beach in Hampton. The water depth around the Gwynn Island site is about 20 feet.

The reef is normally marked with three small, white spar buoys bearing the words "Gwynn's Island Reef." At the moment there are only two of the buoys in place, the third having blown away with the last northeaster.

"In fact," Meier said, "our biggest problem right now is keeping the buoys on the site. Anytime you notice one is missing or damaged, please call me."

Meier said the buoys will be replaced this spring.

Lucy said it's interesting to note that more croaker are caught off the concrete igloos than the tires.



Location	Loran bearings	Material
Parramore test reef No. 1 5.8 nautical miles from Parramore Coast Guard Tower on course 115 degrees T	41784.1/27128.4 41741.0/27126.0 41747.5/27128.2 41744.0/27125.2 41738.0/27128.3	Concrete pipes Concrete igloos Concrete pipes Tire modules Tire modules
Parramore reef No. 2 (Buoy "R 10") 8.7 nautical miles from Parramore Coast Guard Tower on course 102 degrees T	41746.3/27095.5 41744.0/27095.0	Vessel: Walter Hines Page Vessel: Mona Island
Triangle wrecks (GA Buoy) 18 nautical miles from Chesapeake Light Station on course 071 T	41381.4/27020.2 41380.7/27020.5 41388.6/27020.8 41388.2/27018.9	Vessel: Webster Vessel: George P. Garrison Vessel: James Heviland Vessel: Edgar Clark
Light Tower reef SW of Chesapeake Light Station	41286.2/27103.0	60 x 80 ft. drydock
Gwynn Island test reef 1.35 nautical miles NE of "Hole-in-the-Wall"	41837.2/27280.4	Tire modules/concrete igloos
Cape Charles test reef N/NW of entrance to Cherrystone Inlet, immediately E of Buoy "C-12"	41541.2/27231.0 41539.0/27231.2 41539.4/27230.8	Concrete igloos Tire modules Concrete pipes
Little Creek (after Aug. 1, 1987) 900 yards off Ocean View Beach W of Little Creek entrance	41268.6/27225.3 41268.7/27225.0	Concrete igloos Concrete igloos

"I don't know why at this time," he said. "Maybe you fishermen have an idea."

Speculation is because the igloos, which measure nine feet by seven feet, stand higher off the bottom than the tire modules.

"Anything standing off the bottom will grow barnacles and such much quicker, which attract bottom-feeder likes croaker," Lucy said.

The other site in the lower bay is located north/northwest of the entrance to Cherrystone Inlet on the Chesapeake side of the Eastern Shore, immediately east of Buoy C-12.

The buoys there have all blown away said Meier.

The reef lies in 25 to 35 feet of water and is laid out in more of a square than the Gwynn Island reef.

"There's a little different situation here than on the western side of the bay," Meier noted. "The Cape Charles site has produced a few more fish than Gwynn's Island, especially small sea bass, called Black Wills."

Neither marine expert could say if the reefs were attracting large species such as bluefish, red and black drum, or cobia.

To reach Lucy or Charles Barr, a graduate student helping on the project, call VIMS at Gloucester Point (804) 642-7166 during work hours, or after hours leave a message on the institute's answering machine, at 642-7000.

Meier can be reached at VMRC's headquarters in Newport News by calling 247-2263.

Appendix B. Newspaper and periodical articles on Wallop-Breaux reef study

VIMS seeks information on fishing reefs

The Institute's Sea Grant Marine Advisory Services Program is conducting a reef fishing study to provide the Virginia Marine Resources Commission with an analysis of catch and fishing effort data. The study will assist in evaluating the maintenance and expansion of exisiting as well as new reef sites. Jon Lucy, professor of marine science, is coordinator for the study and is being assisted by Charles Barr, a graduate student on the project. The work is primiarily funded from Sport Fish Restoration (Wallop-Breaux) Funds administered by VMRC.

The Virginia Institute of Marine Science has begun collecting catch information from recreational fishermen using Virginia's artificial fishing reefs.

VIMS

Continued from p. 2.

Lucy is requesting that fishermen who fish the reef sites contact him at VIMS. Fishermen who call will be randomly contacted at various times during the fishing season. All information on catches will be kept confidential and only summarized in the study report.

Lucy and Barr recently mailed flyers to marinas and Virginia Saltwater Fishing Tournament weight stations in another attempt to reach fishermen.

Fishermen may also contact Lucy at the following address: Reef Fishing Study, Virginia Institute of Marine Science, Gloucester Point, 23062. He can be reached by phone during working hours at 642-7166. After hours, callers may leave a message with the Institute's answering service at 642-7000.

Appendix B. (cont.)

Richmond Times-Dispatch, Tuesday, May 5, 1987 C-3

Harlow's determination lands 22-pound turkey

News from all over

• Here's one of those interesting things that can happen to you if you'll get out in the woods during spring turkey season instead of lying in bed dreaming about Jane Pauley.

David Harlow of Richmond was in the woods near a Goochland County lake a few mornings ago at 5:30 a.m.

"At that time of day (day?), hoot owls are still calling and you can bump into trees without even suspecting they're there.

"Just after dawn, David heard a gobbler tune up across the lake. He called and called. The gobbler would answer but wouldn't walk around the lake.

"David decided to go to the gobbler, so he sneaked around the lake, then called again.

"A hen came to the call and walked right past him and into the brush. Then she started clucking for David, so to speak. "I decided to shut up and see how well she could do," he said.

"The gobbler came to her, but got between the real hen and David. David began to think he'd better start sounding good again. It was now or never.

"This time, hen and gobbler came to David's call. "She was leading him," said David.

"They were still out of range when something went wrong. They saw David bat an eye or maybe just got suspicious. Both flew.

"David waited half an hour, then walked to where the birds had flushed. He hit the caller once; the gobbler answered.

GARVEY WINEGAR

It took 30 minutes to work him back but finally, after that three-hour game of musical chairs, the gobbler returned to David.

He was a beaut — 22 pounds with an 11-inch beard.

If at first you don't succeed, ...

• Woo Daves keeps racking up points in national bass fishing competition.

This past weekend, the Chester resident caught 37½ pounds of fighting largemouth bass during the $137,000 Bassmaster Invitational tournament at Guntersville, Ala.

That was good enough to take 15th place in a field of 40 of the country's top bass fishermen. Daves' seven bass were worth $1,500 prize money.

With only one more tournament to go before the Bass Classic in Louisville, Ky., in August, Daves' outstanding year of competitive bass fishing has assured him a place in what is often called the World Series of angling.

Also, he was in fourth place for bass angler of the year award going into the Alabama contest.

The Alabama tournament was won by Texan Ricky Clunn. First place was worth $32,000.

• The fishing game, or something closely related, has recognized another Virginian.

Martin Clavert of Virginia Beach beat a field of seven finalists with a cast of 692 feet (that's more than two football fields laid end to end) to win the Du Pont Stren Longcasting Virginia/Carolinas regional tournament.

Don Kohlman of Newport News made a cast of 650 feet to finish second.

The winners went home with a truckload of fishing gear and outdoor merchanise. In addition, Calvert won $500 in cash. He now advances to the June final in Montana.

• As part of a national campaign called "Take Pride in America," refuge personnel at the Great Dismal Swamp National Wildlife Refuge near Suffolk are making an effort to better acquaint visitors with the lore, history and wildlife of the swamp.

On Saturdays and Sundays in May, staff members will be stationed at Dismal Town parking lot on Washington Ditch to provide information and answer questions. Hours are from 11 a.m. to 7 p.m.

Information will available on public use programs, group tours and slide presentations. Access to Lake Drummond will be permitted if weather allows.

• If you fish saltwater, specifically the ship wrecks and artificial reefs in Virginia waters, The Virginia Institute of Marine Science (VIMS) at Gloucester Point needs your help.

VIMS is conducting a reef study. The purpose is to analyze how much the reefs are being used by anglers, as well as attempt to measure the success of the reef program in helping fish populations.

"We need to identify a cross-section of charter and private boat fishermen who fish wrecks and artificial reefs for the study to be successful," said Jon Lucy, VIMS coordinator for the study.

Over the past several years, a variety of artificial reefs have been formed off the Virginia coast and in the Chesapeake Bay by sinking barges of tires and even old Liberty ships.

Lucy asks fishermen who fish the reefs to contact him. He in turn will randomly call anglers at various times during the fishing season for brief information about wreck or artifical reef trips. All information will be kept confidential.

Contact Jon Lucy, Reef Fishing Study, Virginia Institute of Marine Science, Gloucester Point 23062. Lucy can be reached during the work week at 804-642-7166, or after work or on weekends at the VIMS answering service at 804-642-7000.

A chart of reef sites and their Loran coordinates is available free from VIMS.

The reef study is being funded primarily through Sport Fish Restoration (Wallop-Breaux) funds raised through an excise tax on fishing equipment.

REEF FISHING STUDY NEEDS FISHERMEN

The Virginia Institute of Marine Science of the College of William and Mary recently began collecting catch information from recreational fishermen fishing the Commonwealth's artificial fishing reefs. The Institute's Sea Grant Marine Advisory Services Program is conducting a Reef Fishing Study to help provide the Virginia Marine Resources Commission (VMRC) with an analysis of catch and fishing effort data from experienced fishermen utilizing the state's reef sites. The study will assist VMRC's Artificial Reef Program in evaluating the maintenance and expansion of existing as well as new reef sites.

"We need to identify a significant cross section of charter and private boat fishermen who fish wrecks and artificial reefs for the study to be successful," said Jon Lucy, coordinator for the study.

The work is primarily funded through Sport Fish Restoration (Wallop-Breaux) Funds administered by VMRC.

Lucy and Charles Barr, a graduate student working on the project, have identified approximately 100 fishermen who periodically fish the various wreck and artificial reef sites. A much larger cross section of fishermen is required for the study to meet its objective of defining utilization and productivity of the sites.

Lucy is requesting that fishermen, who fish the reef sites, contact him at VIMS. Fishermen who contact Lucy will be randomly called at various times during the fishing season for brief information about recent wreck or artificial reef trips. All information on catches will be kept confidential and only summarized in the study report.

Lucy and Barr recently mailed flyers to marinas and Virginia Saltwater Fishing Tournament weigh stations concerning the study's need to identify fishermen. Fishermen who have yet to be contacted by the researchers are encouraged to place their name on these flyers, which then will be returned to VIMS. Fishermen may also contact Lucy at the following address: Reef Fishing Study, Virginia Institute of Marine Science, Gloucester Point, VA 23062. Lucy can also be reached during the work week at (804) 642-7166 or after work hours and on weekends by leaving a message on the Institute's answering service (804) 642-7000.

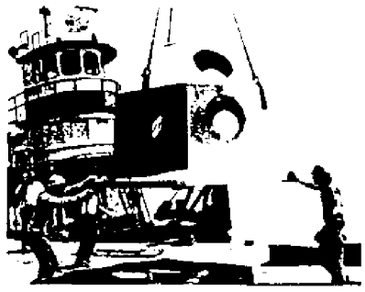
Reef sites included in the study are the Light Tower Reef, Triangle Wrecks Reef, Parramore Reef and the test reef sites established by Old Dominion University under contract to VMRC. One test reef site is located off Parramore Island on the Eastern Shore. Others are located inside Chesapeake Bay just north of Cape Charles and off Gynn's Island near Deltaville. A diagramatic chart of reef sites and their Loran coordinates is available free upon request.

Appendix B. (cont.) The Fisherman, Delaware, Virginia, Maryland Edition, DELMAF Publ. Corp. Sag Harbor, N.Y.

after-school seminars for teachers who are interested in furthering their knowledge for future teaching about the Bay. There is no cost to the classroom teacher, and participating teachers receive packets of information about the Bay. According to Lee Lawrence, the Bay Team is a "foot in the door" in bringing water resources education into Virginia's curriculum.

The Bay Team has achieved national recognition from the Environmental Protection Agency (EPA) as one of eight outstanding environmental education programs. The Bay Team is administered by the Virginia Institute of Marine Science through a grant from Virginia's Council on the Environment. For more information or to request an in-school visit, write to: The Bay Team, Virginia Institute of Marine Science, Gloucester Point, VA 23062.

New Artificial Reef Site for Virginia Fishermen



Bob Gammisch

Virginia's artificial reef program recently expanded fishing opportunities for recreational fishermen in the lower Chesapeake Bay. Coordinated by the Virginia Marine Resources Commission (VMRC), the reef program used "Wallop-Breaux" Sport Fish Restoration Funds to establish its third bay reef site in July. Consisting of forty concrete igloo structures and designated as the East Ocean View Reef, the buoyed site is located 2,500 yards west of the entrance to Little Creek off the Ocean View area in Norfolk (site is shown on NOAA Charts No. 12220, 12221, 12256).

The new reef is located on the site of an earlier experimental reef project initiated in the late 1960's by Old Dominion University (ODU) and local recreational fishing interests. Approximately one hundred wrecked car bodies and at least one menhaden vessel were initially placed on the site. Prior to deployment of the igloos, a side-scan sonar survey of the site was conducted by the Virginia Institute of Marine Science (VIMS). ODU researchers dove on the site to take sediment samples and to help verify the sonar survey results. As expected, only portions of the original materials remained in the area. By fall the site is expected to begin attracting sea bass and tautog. Spot, croaker and trout may also be attracted to the reef.

The design of the concrete igloos is the result of a three-year study conducted on test reefs established by ODU under contract to VMRC. These 11,000-pound, dome-shaped structures, approximately twelve feet in diameter at the base and seven feet high, have proven to be stable, staying in place on test reef sites in the Bay off Gwynn's Island and Cape Charles, as well as off Parramore Island on the Eastern Shore. "The redevelopment of this site is especially significant in that the concrete igloos were specifically developed for use as artificial reef structures," according to Mr. Mike Meier, fisheries reef manager for VMRC.

As part of an ongoing Wallop-Breaux funded study of fishing success rates on the state's artificial reefs, VIMS' researchers are seeking to identify fishermen using the East Ocean View Reef.

The VIMS study, beginning in the late fall of 1986, has to date obtained fishing information from over two hundred boat owners who fish the state reefs. Through random telephone interviews, VIMS' scientists are seeking to learn which reef sites are producing the most successful fishing trips. The telephone interviews are brief, no longer than 5 to 7 minutes, and are designed to gain information on fishing trips made to any reef site during the two-week period preceeding the call. Interviewers ask questions such as how long the reef site was fished, how many rods were used, what was caught, the state of the tide and current, water temperature and depth of the water. Also, researchers are interested in learning which part of the reef was fished: Were catches made directly over the reef structure or around the perimeter of the reef?

VIMS needs to broaden its existing list of identified boat owners fishing reef sites both in the Bay as well as those offshore (the Light Tower, Triangle Wreck, and Parramore Reefs). The study requires information from a large cross-section of reef/wreck fishermen to adequately document how the reefs are performing. "The VIMS' study is designed to take advantage of fishermen's knowledge and fishing experience," says the study's coordinator, Mr. Jon Lucy. "By permitting VIMS' researchers to contact them about reef fishing trips, recreational fishermen are contributing to future improvements in the artificial reef program."

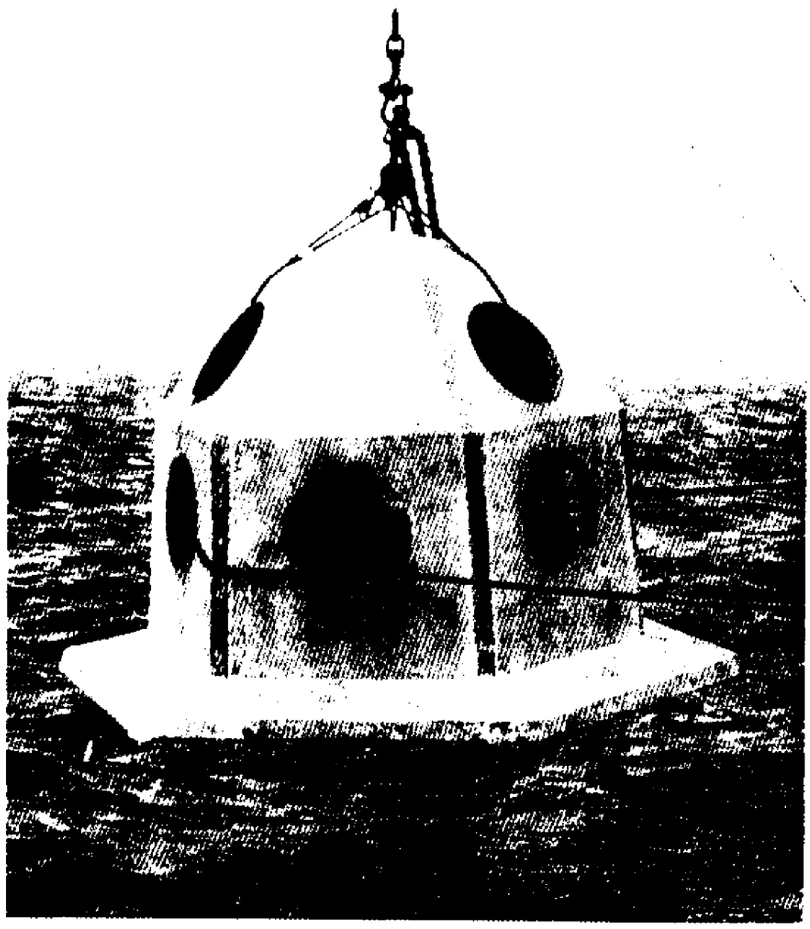
If not already contacted by Lucy or graduate assistant, Charles Barr, boat owners periodically fishing the Bay or offshore artificial reef sites are requested to get in touch with the VIMS' researchers. Charts with Loran coordinates of the reef sites, as well as locations of major wrecks and obstructions found out to 30 miles offshore of Virginia Beach, can be obtained by contacting: Artificial Reef Study, Sea Grant Advisory Services, Virginia Institute of Marine Science, Gloucester Point, VA 23062, (804) 642-7166.

For more information about the reef program, contact Mr. Mike Meier, Fisheries Reef Manager for VMRC, P. O. Box 756, Newport News, VA 23607, (804) 247-2263.

Appendix C. Virginia Marine Resources Bulletin article on Wallop-Breaux reef study. Va. Mar. Res. Bull. 19(3) Fall 1987: 20-21, VA. Sea Grant College Program, VIMS

WHERE'S THE REEF CONTACT
VIRGINIA'S ARTIFICIAL REEF PROGRAM
MARINE RESOURCES COMMISSION (804) 247-2200

Artificial Reefs Enhance Recreational Fishing



Mike Meier

Any number of structure types can be used in artificial reef construction. Above is an "igloo", a concrete structure weighing about 11,000 pounds.

Data amassed by Marine Advisory Services (MAS) is providing a clearer picture of how artificial reefs attract *both* fish and those who fish. The study, conducted over the past two years, is being used by the Virginia Marine Resources Commission (VMRC) in evaluating its artificial reef program; the purpose of the VMRC reef program is to enhance fishing, provide fishing in easy reach of anglers, and to diffuse the fishing effort, so that no one particular area is fished too heavily. MAS' role has been to document the use of these sites, and also the species to be found there. Jon Lucy, MAS Marine Recreational Specialist, and Charles Barr, a graduate student, conducted the study at MAS.

Succinctly put, made-made or natural materials placed in salt or fresh water attract fish. The surface of the reef becomes colonized by encrusting plants and animals, which, in turn, provide food for fish and other organisms; the reef structure provides a point of orientation and a feeding station for larger predator fish.

2 Appendix D. Virginia Marine Resource Bulletin, Vol. 20, No. 3, Winter 1989: 2-6, Virginia Sea Grant College Program, VIMS.

Rudimentary artificial reefs have been used for centuries. However, the technology and the methods for testing the effectiveness of these structures have rapidly evolved only since around the 1950's. Japan has a long history of heavy seafood utilization, and it comes as no surprise that it would energetically pursue reef construction and technology. The other major country involved in artificial reef construction, the United States, had far less of a need to be so systematic.

In the U.S. it was primarily private concerns—that is, individuals, sportfishing clubs and diving clubs—which initiated artificial reef construction in the past. Building on the early efforts of the Tidewater Artificial Reef Association of Virginia (which dates from 1959), the VMRC began looking into reef construction in the 1960's.

In the last two years, the Virginia MAS study focused on these sites (also see the map): Triangle Wrecks Reef, Light Tower Reef, Gwynn Island Test Reef, Cape Charles Test Reef, Ocean View Reef, and Parramore Test Reef and Parramore Reef. Researchers have also been interested in fishing results from the Chesapeake Bay Bridge tunnel. Although it was obviously not intended as an artificial reef, the bridge tunnel, which spans the mouth of the Bay, acts as one.

In the MAS study, researchers went directly to the source for their information: the recreational fishermen. A data base of fishermen's catch success rates on major reef sites was created. This involved systematically collecting and analyzing catch and effort data from recreational fishermen utilizing the reef sites, and recording observations about how reefs are most effectively fished. The core population of this study consisted of recreational fishermen who own private boats, and who fish one of the Virginia artificial reef sites at least twice a season. Boat owners were called in a random fashion to ensure a mix typical of the actual fishing population. Of the 450-500 fishermen in the general survey, 20 were contacted each week.

Predictably, the reefs were effective in attracting fish and anglers. The species commonly found included: gray trout, flounder, spot, croaker, sea bass, tautog, bluefish, sea trout, and weakfish. Offshore, there were some amberjack, Spanish mackerel and sharks, the latter found especially near shipwrecks.

Test results indicate that some recreational fishermen do target artificial reefs, but often the structures served as an alternate fishing spot. Anglers usually have special fishing "holes", but stop by reefs when the usual spots are not as productive as normal.

There are a number of different approaches to artificial reef construction; the main objective is to use a non-toxic, durable structure which will be stationary, and which will attract fish.

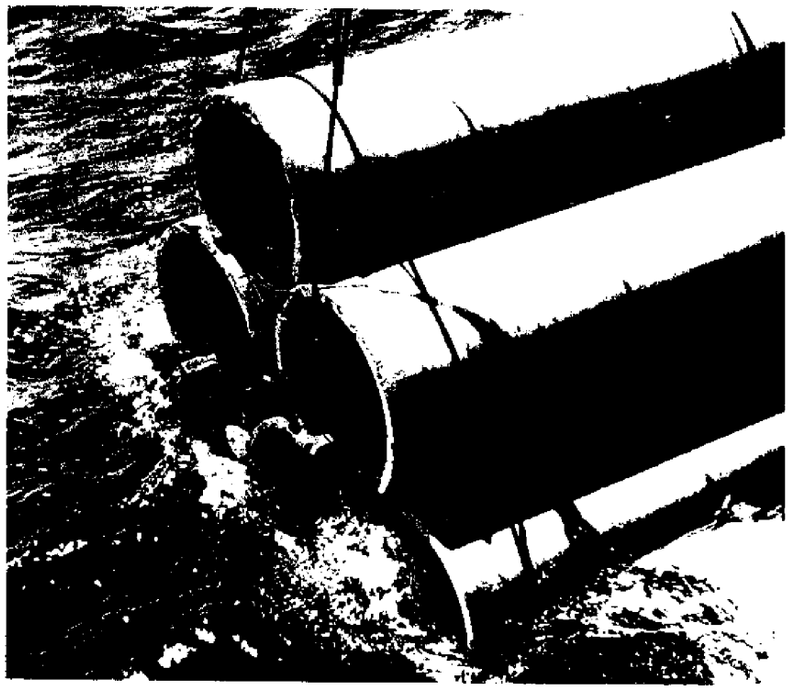
Igloos weigh about 11,000 pounds and stand seven feet tall. Igloos proved stable, and they maintained their structural integrity through storms.

Concrete pipe stacks were made of concrete pipes (inside diameter two feet) and were stacked in a 3-2-1 configuration; a 7/8" steel cable held them together and the total weight was close to an igloo: 12,000 pounds. These modules didn't appear to work as well as igloos; the strapping sometimes loosens, causing the load to shift during deployment.

Tires, either lashed together with cable or embedded in concrete, were also used. Keeping these modules stationary was the biggest challenge. In this category, tires in concrete did the best. The concrete base actually settled into the sediments and was, as a consequence, more stable.

A reef is often made up of many structures; for instance, at Gwynn Island there are six igloos, eight stacked tire units and 89 tire-in-concrete units.

Funding for this study was from a variety of sources, including Sport Fish Restoration (Wallop Breaux), Sea Grant and the Virginia Institute of Marine Science. Countless individuals, organizations and businesses went out of their way to help MAS. ❖

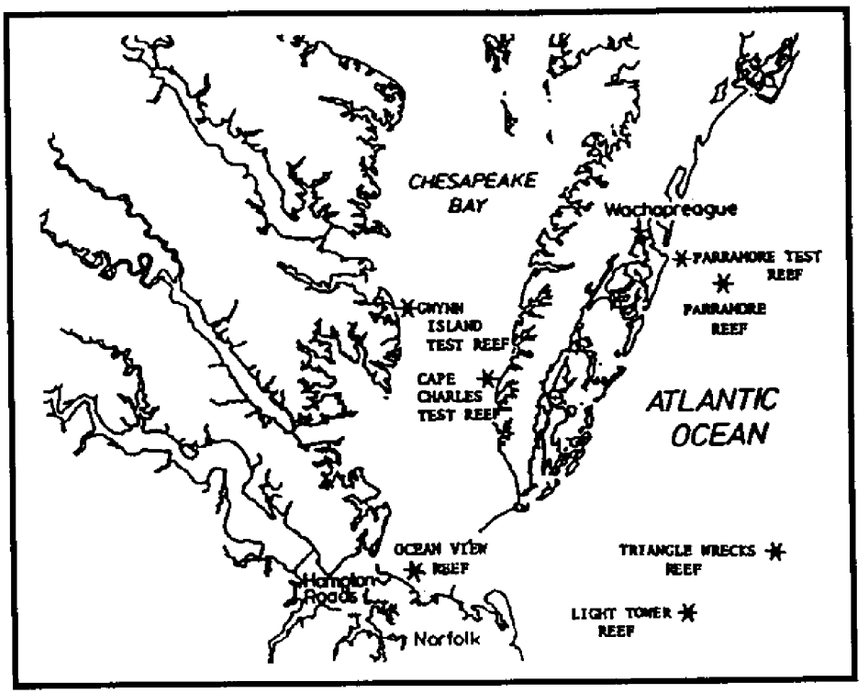


Mike Meier

This artifical reef structure is a concrete pipe stack. Artificial reefs serve as shelter for smaller fish, as a point of orientation for fish, and – importantly for anglers – a feeding station for larger predator fish.

ARTIFICIAL REEF FISHING STUDY

Virginia Institute of Marine Science, Gloucester Point, VA 23062
Funded by Sport Fish Restoration (Wallop-Breaux) Funds
Through the Virginia Marine Resources Commission



ARTIFICIAL REEF AND WRECK STUDY SITES

(Adapted from Feigenbaum and Blair 1986)

LOCATION	LORAN BEARINGS	REEF MATERIAL
PARRAMORE TEST REEF 3.8 N.M. from Parramore Coast Guard Tower on Course 115 degrees T	41784.1/27125.4 41741.0/27126.0 41747.5/27125.2 41744.0/27125.2 41738.0/27126.3	Concrete Pipes Concrete Igloos Concrete Pipes Tire Modules Tire Modules
PARRAMORE REEF (Buoy "R-10" - Liberty Ships) 8.7 N.M. from Parramore Coast Guard Tower on Course 102 degrees T	41746.3/27095.5 41744.0/27095.0	Vessel: Walter Hines Page Vessel: Mona Island
TRIANGLE WRECKS REEF (GA Buoy - Liberty Ships) 18 N.M. from Chesapeake Light Station on Course 071 degrees T	41391.4/27020.2 41390.7/27020.5 41389.6/27020.9 41386.2/27018.9	Vessel: Webster Vessel: George P. Garrison Vessel: James Haviland Vessel: Edgar Clark
LIGHT TOWER REEF S.W. of Chesapeake Light Station	41286.2/27103.0	60' X 80' Drydock
GWYNN ISLAND TEST REEF 1.35 N.M. NE of "Hole-in-the-Wall"	41637.2/27299.4	Tire Modules/Concrete Igloos
CAPE CHARLES TEST REEF N/NW of Entrance to Cherrystone Inlet immediately east of Buoy "C 12"	41541.2/27231.0 41539.0/27231.2 41539.4/27230.8	Concrete Igloos Tire Modules Concrete Pipes
OCEAN VIEW REEF 900 yds. off Ocean View Beach W. of Little Creek Entrance	41259.8/27225.3 41259.7/27225.0	Concrete Igloos Concrete Igloos

4

Appendix D (cont.)

Artificial Reef Catch Trends: The Survey Results

Virginia anglers fishing wrecks, artificial reefs, and other structures principally targeted tautog, seabass and amberjack on offshore reefs, according to a study conducted by Marine Advisory Services of the Virginia Institute of Marine Science. Tautog and seabass were also sought at sites in the lower Bay, while anglers found good quantities of spot and grey trout at Gwynn Island Reef.

Preliminary 1988 Results

Based upon preliminary analysis of the 1988 catch data compiled by fishermen utilizing offshore and Bay reef sites, the following observations can be made:

Offshore Reefs—Seabass catch rates, while still relatively low, were up somewhat on offshore reefs during 1988 compared to 1987, but average weights of fish were still small (1.5-2 pounds); tautog catch trends between years were mixed with slightly better catch rates and larger fish on the average occurring this season at the Triangle Wrecks, while the Light Tower Reef provided lower 1988 catch rates but also larger tautog than during 1987. The Light Tower Reef was rated by fishermen as fair to good.

Chesapeake Bay Bridge Tunnel—Tautog catch rates were down and seabass catches about the same in 1988 compared to 1987; tautog kept by fishermen in 1988 averaged about one pound less than those taken last year. While spot catch rates remained fairly constant between years and croaker catches were down in 1988, trout catch rates improved slightly between years, however the fish kept averaged only one pound. Striped bass catches during the summer drew new attention to the Bridge-Tunnel, and November catches were good for legal size fish (24 inch minimum).

Bay Reefs—In the lower Bay the Ocean View Reef received less attention from fishermen than expected, being used primarily as a stopping off point when other more favorite areas, e.g. the Bridge-Tunnel, were not as productive as anticipated. For the few fishermen targeting the site in the spring and again in the fall, some good flounder catches were made in the vicinity of the reef. Croaker catch rates were lower at the Ocean View Reef in 1988 than the previous year, but some good catches were recorded in September. The mid-Bay Gwynn Island Reef provided similar catch rates for spot in both years from June through September and for croaker (July through October). Spring provided better flounder and bluefish catches than last year, and fall (October-November) produced good catches of tautog. Tautog catch rates were three times those in 1987, resulting in fish averaging over five pounds each, twice the average size of fish reported at the Bridge-Tunnel.

1987 Results

Fishermen customarily fishing popular offshore wrecks and reefs early in the season reported poor catches of tautog and seabass, when catches were normally expected to be good. A cool spring and heavy freshwater runoff from Chesapeake Bay were felt to be negatively influencing offshore wreck fishing. The Virginia Saltwater Fishing Tournament Program reported a significant decline in citations for tautog during 1987, further substantiating low catches for the season.

Mean tautog catches ranged from 0.03 fish per rod hour at the Gwynn Island Reef to 1.4 fish per rod hour at the third island of the Bay Bridge Tunnel. No tautog trips were recorded in the spring and summer months for the Gwynn Island site, only for late October and November. Comparable to tautog catches at the Chesapeake Bay Bridge Tunnel (CBBT) third island, catches elsewhere along the Bridge Tunnel complex averaged 1.0 fish per rod hour. The Tugboat Wreck site off Cape Henry produced tautog catch rates of 1.3 fish per rod hour while the Chesapeake Light Tower Reef provided catch rates of 0.8 fish. The Triangle Wrecks exhibited low catch rates of 0.2 per tautog per rod hour, and a relatively high release rate of fish. The only location with a higher release rate was the Chesapeake Light Tower (the tower structure itself), where only half as many trips resulted in 82% of all tautog caught being released, the released fish weighing generally less than one pound.

Spot

Of tautog kept, average weights ranged from 2.0 pounds at the Gwynn Island site to 3.9 pounds on the Triangle Wreck-Liberty Ships.

Seabass catch rates also appeared somewhat low at the targeted fishing areas, ranging from 0.1 fish per rod hour at the Gwynn Island site to 2.4 fish per rod hour at the Triangle Wreck-Liberty Ships. As with tautog, no seabass catches were recorded at the Oceanview Reef, but trips to the site recorded in the sampling effort occurred just before and after the site was enhanced with 40 large concrete igloos. Some tautog were caught on the site by a few anglers in the fall. In contrast to seabass catches on other sites, the Parramore Reef produced catches of 10.1 fish per hour. Unfortunately, only four trips were recorded in the sampling effort, making it impossible to know whether this catch rate was typical for the site over the entire season. Seabass catch rates at the Parramore Reef were two to ten times as great as those for tautog at the Gwynn Island Reef, the Chesapeake Light Tower Reef, Cape Henry Wrecks, Chesapeake Light Tower (structure only), and both portions of the Triangle Wrecks. At most fishing sites, more small seabass were caught and released in comparison to tautog catches.

Most seabass kept by fishermen weighed 1-2 pounds each. Combined catch rates of tautog and seabass ranged from 0.1 fish per rod hour at Gwynn Island, to 3.4 fish per rod hour at the Triangle Wrecks. The Oceanview and Parramore Reef sites were the exception to these catch rates, exhibiting respective catches of zero and 10.1 tautog-seabass per rod hour.

For those fishing areas where tautog and seabass were among the principal targeted species for the entire fishing season—CBBT-third island; Cape Henry Wrecks; Tugboat Wreck; Chesapeake Light Tower Reef; Triangle Wrecks, all trips combined; and the Parramore Reef—the mean quality rating of the fishing experience for the trips recorded ranged from 2.0 to 3.7. Since tautog and seabass were the most often sought species at these sites, the quality rating largely reflects fishermen's satisfaction with catches of these species. (A rating of 1 indicates that the overall fishing experience for the day was rated "poor"; 2 indicates "fair"; 3, "good"; 4, "very good", and 5, "excellent".)

Spot, Croaker and Gray Trout Catches

As expected, spot, croaker and gray trout were primarily caught only at wreck/reef fishing areas in the mouth of the Bay and further up the estuary. Catch rates for spot and croaker ranged from 0.0 to 5.4 fish per rod hour, with trout exhibiting catches of 0.0 to 0.9 fish per rod hour. The lowest catch rates for spot were at the CBBT (third island), where the fish was not actually targeted by anglers (only tautog, seabass and flounder were targeted), and the Oceanview Reef, where none were caught. The Gwynn Island Reef produced the highest mean catch rates for spot (2.9 fish per rod hour). While only one croaker was included in the CBBT (third island) catches, 125 fish were caught in two trips on the Oceanview Reef, producing the highest catch rate for croaker among all areas from which trips were recorded.

Significant numbers of gray trout were recorded only in catches for trips made to non-third island areas of the CBBT and the Gwynn Island Reef. Only one or two trout occurred in catches recorded at the Cape Henry Wrecks and CBBT (third island).

In comparing species preference patterns between the Gwynn Island Reef, Bridge Tunnel, and the Cape Henry Wrecks, fishermen targeted seabass or tautog in over 60% of the trips and king mackerel in 33% of the trips to the latter site. In contrast, Gwynn Island reef fishermen targeted tautog in the spring (May) and fall (late October into November), then shifted their efforts almost totally to spot, croaker and/or trout from June through early October. Flounder were also sought by fishermen at the site during October, but no catches were recorded in trip interviews.

Bluefish, Flounder and Combined Catches of Desirable Species

In light of their low catch rates, bluefish and flounder were almost incidental catches at those sites where catches occurred, although flounder were mentioned occasionally as targeted species for trips to the CBBT, Gwynn Island Reef and the Oceanview reef. Flounder were only recorded in catches for trips to the CBBT, the mean catch rates for the season being low (0.1 fish per rod hour). Bluefish were never targeted by wreck fishermen in any of the trip interviews. A few bluefish were caught at the CBBT, the Chesapeake Light Tower Reef, the Cape Henry Wrecks, the Triangle Wrecks, and the Chesapeake Light Tower, with mean seasonal catch rates being 0.006 to 0.3 fish per rod hour. The fish were generally sought by fishermen targeting seabass, trout, or flounder at the CBBT; seabass or tautog at the Light Tower Reef; king mackerel at the Cape Henry Wrecks; and amberjack at the Triangle Wrecks, as well as at the Chesapeake Tower.

An examination of mean seasonal catch rates for all desirable (customarily edible) species and fishing experience catch ratings indicated that only about half of the wreck/reef sites produced catches considered "good". Species generally not considered desirable (and generally released) were small "sand sharks" and "spiny" dogfish, most likely *Squalus acanthias*. The majority of the major fishing areas targeted by wreck/reef fishermen produced overall catch rates of 1.2-5.7 desirable fish per rod hour. The one exception was the Parramore Reef (10.3 fish per rod hour), for which only four trips were recorded. The Gwynn Island Reef produced mean catch rates for desirable species of 3.7 fish per rod hour, a rate only exceeded by the CBBT non- third island areas (5.7 fish per rod hour), the Oceanview (5.4 fish per rod hour, based upon croaker caught during two trips), and the previously mentioned Parramore Reef. ❖

ARTIFICIAL REEF STUDY INTERVIEW LOG

DATE_____ CAPT_____ BOAT_____ LENGTH_____

PRIVATE___CHARTER___PORT_____ TARG SPEC_____ # ANGLERS_____

AREA1_____ H2O TEMP_____ DEPTH (FT) _____ #OTHER BOATS FISHING REEF_____

TOTAL # RODS USED_____ #HOOKS/ROD_____ BAIT_____

TIME STARTED FISHING_____ HOURS: ANCHORED_____ DRIFT_____ TROLL_____

STAGE OF TIDE (FLOOD,EBB,HI/LO SLACK)_____

SEA COND'S./WATER CLARITY/CURRENTS:_____

AREA2_____ H2O TEMP_____ DEPTH (FT) _____ #OTHER BOATS FISHING REEF_____

TOTAL # RODS USED_____ #HOOKS/ROD_____ BAIT_____

TIME STARTED FISHING_____ HOURS ANCHORED_____ DRIFT_____ TROLL_____

STAGE OF TIDE (FLOOD,EBB,HI/LO SLACK)_____

SEA COND'S./WATER CLARITY/CURRENTS:_____

SPECIES HOOKED	# KEPT	AVG. WT.	# RELEASED	AVG. WT.	CATCH/AREA FISHED
Sea bass					
Tautog					
Flounder					
Oyster toadfish					
Searobins					
Gray trout					
Spot					
Croaker					
Bluefish					
Amberjack					
King Mackerel					
Spanish Mackerel					
Shark:_____					
Other:_____					
_____					
_____					

FISHING STRATEGY EACH AREA:_____

AREA A. FISHING EXPERIENCE QUALITY RATING:
POOR ( ) FAIR ( ) GOOD ( ) VERY GOOD ( ) EXCELLENT ( )

AREA B. FISHING EXPERIENCE QUALITY RATING:
POOR ( ) FAIR ( ) GOOD ( ) VERY GOOD ( ) EXCELLENT ( )

Appendix E. Telephone survey instrument for the 1987 and 1988 sampling programs.