

UMCES Tech. Ser. No: TS-XXX-XX-CBL

Ref:[UMCES]CBL XX-XXX

DRAFT FINAL REPORT

Design of a Recreational Fishing Survey and Mark-Recapture Study for the Blue Crab, *Callinectes sapidus*, in Chesapeake Bay

I. Recreational Survey

Submitted to: Mr. Derek Orner
Chair, Chesapeake Bay Stock Assessment Committee,
NOAA Chesapeake Bay Office
410 Severn Avenue, Suite 107A
Annapolis, MD 21403

Submitted by: Drs. Thomas J. Miller and Michael J. Fogarty
Chesapeake Biological Laboratory
University of Maryland Center for Environmental Science
1 Williams Street
Solomons, MD 20688

and

Drs. Romuald Lipcius and John Hoenig
Virginia Institute of Marine Science
Gloucester Point, VA 23062

Submitted on: December 21, 2000

1. INTRODUCTION

1.1 RATIONALE

The blue crab, *Callinectes sapidus*, supports one of the most important fisheries in Chesapeake Bay with commercial landings in 1999 in excess of 60 million pounds. The commercial fishery is characterized by several distinct sectors with specific geographical ranges and modes capture (including pots, trotlines, poundnets, dredges, and scrapes).

Although effort and landings data are available for the commercial fishery, catch and effort from recreational fishing has never been fully assessed for this region. The recreational fishery also comprises diverse segments differentiated by access (private vs public), geographical location, and mode of capture (pots, baited line, hand nets). Preliminary estimates of the recreational harvest for the Maryland component of the fishery in 1983, 1988, and 1990 ranged from 11.5 to 41.1 million pounds, representing 25-80% of the reported Maryland commercial landings in those years (Stagg et al. 1991; Rugulo et al. 1997). These estimates clearly indicate the potential importance of the recreational sector to the overall fishery. Further, the full economic value of the blue crab in Chesapeake Bay can only be determined by a complete evaluation of both the commercial and recreational sectors.

The development of bay wide estimates of recreational harvest has been identified as a high priority by the Chesapeake Bay Scientific Advisory Committee (CBSAC) and by the Chesapeake Bay Program as reflected in the Chesapeake Bay Blue Crab Fishery Management Plan (Chesapeake Bay Program 1996). In addition, the BiState Blue Crab Commission (BBCAC), formed in 1996 by mandate from the legislatures of Maryland and Virginia to advise on crab management, has also recognized the importance of estimating the levels and trends in catches in the recreational fishery. Recently, the BBCAC has adopted limit and target biological reference points. These analyses have been predicated on assumptions regarding the relative magnitude of the recreational and commercial catch. The reference points depend on determination of the total number of crabs removed from the population. In essence, the number removed by the various fishery sectors, represents a minimum estimate of the population size. If a major fishery sector is not represented, the total population will be accordingly underestimated. If the relative contribution of the unrepresented sector is constant over time and harvests the same components of the population as the other sectors, it may be argued that the population estimate derived from the other sectors is biased but still adequately represents trends in population size over time. If either of the two constraints mentioned above is not met, the validity of relative trends over time is suspect. With the recent increases in the human population in the Chesapeake Bay watershed, there is reason to be concerned that the recreational catch may not have been a constant proportion of the total harvest over time. It is important to assess the catch characteristics and the magnitude of the recreational fishery to evaluate this potential bias.

Several aspects of the biology and life history of blue crabs are critical to estimating the impact of the recreational catch on the population. The life history of the blue crab is complex, with distinct stages characterized by different ecological requirements and distribution patterns.

Well defined ontogenetic shifts in distribution related to size and sex have been identified. These characteristics define the vulnerability of different segments of the population to different fisheries and gear types. An understanding of the catch characteristics of all components of the fishery is therefore necessary to evaluate the full impacts on the population of the commercial and recreational fisheries.

1.2 RECREATIONAL FISHING SURVEY DESIGNS

One of the most important tools for estimating catch and effort in recreational fisheries is the angler survey e.g., the Marine Recreational Fishery Statistical Survey (MRFSS). These surveys can be used in the simplest to the most complex fisheries through the use of complemented survey types. Although angler surveys are often viewed as monolithic, they actually rely on several important types of surveys, e.g. on-site versus off-site, used singly or combined. Off-site surveys are the least expensive because they obtain information from anglers by telephone, mail or from diaries, but are also the least reliable for obtaining accurate catch data. In contrast, on-site surveys, in which anglers are questioned at public access sites or while they fish, can obtain accurate data on catch because the survey agent sees it. However, on-site surveys rely on trained personnel and, hence, are expensive. Additionally, in fisheries such as the blue crab in Chesapeake Bay which have considerable private access (homeowners' private docks, backyards along tributary streams, etc.) getting accurate catch and effort data is even more difficult. Such a complex recreational fishery --characterized by public and private access, and with demands for accurate catch and effort --will require a carefully planned survey to provide the best data at a reasonable cost.

Some fundamental work has already been done in developing a recreational survey of the bay-wide blue crab fishery. Several important studies were funded by Virginia Sea Grant, and by the Chesapeake Bay Stock Assessment Committee (CBSAC) in the late 1980's and early 1990's that solved some major impediments in designing an accurate and efficient survey. Not the least of these problems were the difficulties in estimating catch in on-site surveys where the angler is questioned while fishing -- an excellent way to obtain catch data from fisheries rich in private access, as is the Bay. In the study funded by Virginia Sea Grant, Wade et al. (1991) developed logistical methods to provide virtually unbiased estimates for on-site surveys where interviewers rove through the fishery and intercept anglers as they fish. In the studies funded by CBSAC, Jones and her colleagues (Jones et al. 1995, Hoenig et al. 1997, Pollock et al. 1997) determined how catch rates and therefore catches must be calculated. Although this was a superficially simple problem, the correct catch-rate choice had remained unsolved for 40 years and impeded the use of one of the most efficient on-site survey types for fisheries with great amounts of private access. Not all problems of estimation have been solved, but those that remain are much simpler and will not impede design for the bay-wide survey of recreational blue crab fishing.

Besides knowledge of estimation procedures, an efficient bay-wide survey will rely on adequate understanding of the diverse components of recreational fishing. Although we generally know the components of blue crab fishing ("chicken-necking" along tidal creeks, crab potting from

private docks, ancillary crabbing while fin-fishing, etc), we do not know their importance or the variability of their catch rates. From a previous telephone survey of recreational license holders in Virginia, we do know that fishing, overall, is done from private access 40% of the time. If this is also true for recreational fishing of blue crab, it will force use of a complex survey design. Even if private use is this high for blue crabs, if the catch rates are identical for private and public usage we would recommend a less costly public-access survey to obtain catch rate estimates for the entire fishery. These questions must be addressed before a bay-wide survey is implemented. To do otherwise would be both fiscally wasteful and technically unwise.

2. OBJECTIVES

The broad objective was to provide a sound statistical framework for implementing a full baywide recreational survey for blue crabs in aid of improved management. Initial design-phase work centered on the development of new sampling frames and strategies in an attempt to overcome known deficiencies in past sampling approaches. We evaluated the availability and appropriateness of various lists as inputs into a multiple list sampling frame. Our evaluation suggested that the most appropriate sampling design would entail separate treatment of private access (property-owners) and public access participants. The waterfront property owners list in Maryland provides a relatively complete frame for the private-access component. Unfortunately, comparable information is not available for Virginia. Our evaluation indicated the possibility of using the existing licence lists for blue crab recreational harvesters and boat owners as partial frames for the public access component and to use an access-intercept component to estimate participants not covered by any of the frames identified above.

We focused particularly on developing estimates of the adequacy of alternative sampling frames and the extent to which different sampling frames overlapped, evaluation of logistical constraints and considerations and guidance of required samples sizes to meet specified levels of precision in a full survey. We also paid particular attention to comparing catch and effort from private and public access points.

To address these general objectives, we established four specific objectives. Our objectives were to:

- (1) Conduct a limited random digit dialing telephone survey of representative areas (St. Mary 's and Dorchester Counties, MD and Gloucester County, Norfolk and Virginia Beach, VA) to estimate levels of participation and effort in the recreational fishery by region and gear.
- (2) Conduct a limited random digit dialing telephone survey of representative areas (St. Mary 's and Dorchester Counties, MD and Gloucester County, Norfolk and Virginia Beach, VA) to estimate the representation of participants in the recreational fishery among overlaps among different sampling frames that might be the basis of a subsequent baywide survey.
- (3) Conduct a limited intercept survey of representative areas (St. Mary's and Dorchester

Counties, MD and Gloucester County, Norfolk and Virginia Beach, VA) to estimate levels of participation in the recreational fishery by region and gear. The intercept survey was designed to provide estimates of catch per unit effort and biological attributes of the catch.

(4) Conduct a limited log-book survey of waterfront property owners in representative regions (Calvert, Dorchester and St. Mary's Counties, MD) to estimate participation, effort and catch in the recreational fishery from private access sites.

3. METHODS

3.1. DATA COLLECTION METHODS

3.1.1 Random digit dialing survey

We conducted a random digit dialing telephone survey to estimate participation and fishing effort, catch, and catch rate. The telephone survey was conducted between July 12, 1999 and October 3, 1999. To improve reliability in recall and reporting, we used a short 'wave' period of two weeks in contrast to the 2 month interval used in previous blue crab recreational surveys. The dates of the six waves used in the survey are provided in Table 1.

We contracted with QuanTech (Arlington, VA) to conduct the random digit dialing telephone survey. All interviewing was conducted through a Computer Assisted Telephone Interviewing (CATI) system. The CATI system increased provides accurate data entry and built-in probes and error checks. The sample frame for the telephone household survey included all full-time, occupied housing units within the coastal counties included in the dialing area for each wave. The telephone numbers were checked to avoid duplication and to ensure that no households were included in the sample more than once during any single wave. Occupied housing units do not include institutional housing such as boarding schools, college dorms, military barracks (although homes on military bases may be included), prisons, halfway houses, and monasteries.

Once the sample for an individual wave was determined, all numbers in the sample were contacted and resolved to fishing and non-fishing households or ineligible number (business, institutional housing, etc.). All data collection was made in a one-week period at the end of each wave and focused only on crabbing activity that occurred during the specified wave. All calls were made by experienced, trained telephone interviewers. A minimum of five calls to each number were attempted. A minimum of five scheduled callbacks per household were made to obtain interviews with crabbers in known fishing households.

The following procedures were used to obtain fishing trip information from dialed residential households:

1. Households were screened to determine if any member of the household had been recreational crabbing during 1999 and whether anyone had gone in the previous two weeks. If any person had gone blue crab fishing in the previous two weeks, then he/she

- was determined to be an eligible respondent.
2. All eligible crabbers were asked to recall their total number of fishing trips made in the past two weeks, and then were asked for details on each trip, including their fishing trip dates, durations and modes together with the areas of fishing, beginning with the most recent and working backwards in time for 2 weeks. The number of crabs caught during each trip was recorded.
 3. If the crabber could not recall details about all the trips within the 2-week period, the interviewer attempted to determine the mode of all remaining trips.

The telephone questionnaire used in the study, together with response codes is included as Appendix I.

3.1.2. Intercept Survey

The intercept survey was conducted over the same dates as the RDD survey (Table 1). The initial design of the intercept survey was based largely sites and on fishing pressure estimates derived from the MRFSS. It was planned to sample access sites within each stratum in proportion to relative levels of fishing effort from the MRFSS. The initial allocation included a requirement that 60 percent of the intercept interviews should be conducted on weekends (Saturday and Sunday) and holidays; the remaining 40 percent should be conducted on weekdays. Effort was allocated in assignments. An assignment was defined as a 2-8 hour effort to intercept and interview crabbers at a site on a given day of the week. Assignments were drawn before a wave began and were based on an specified probability of selection. On a given assignment, an interviewer visited up to two alternate access sites if he/she determined that he/she was unable to obtain one usable interview per hour at the originally assigned site. An alternate site was the next nearest fishing site with fishing anticipated.

We contracted with QuanTech (Arlington, VA) to conduct the intercept survey. QuanTech applied the survey design identified above during waves 1 and a part of wave 2. However, during the survey it was apparent that the use of MRFSS sites and pressure estimates were completely unsuitable as a basis for intercepting recreational crabbers. Accordingly, the survey design was relaxed and a wider range of sites were included to increase the number of interviews. Sites were selected on the basis of the local knowledge of the interviewer. If selected sites proved unsuccessful new sites were selected. We strove to increase the number of interviews at the cost of abandoning aspects of the proportional allocation scheme.

Interviews were conducted at access sites, and involved questioning crabbers some of whom has completed their fishing trips and some whom intended to continue fishing after their interview. Interviews consisted of an initial set of screening questions to select marine recreational crabbers, followed by a series of questions designed to provide the data required to produce estimates of total catch and its biological characteristics. Interviews were conducted by trained personnel. Data gained during the interview included:

1. The date, fishing mode, and primary geographical location of the fishing trip.

2. State and county of residence of each crabber.
3. Gear used, trip duration, and hours fished during the trip for which the crabber is interviewed.
4. Fishing activity by the respondents in the past 14 days and in 1999.
5. Numbers of blue crabs available for identification.
6. Respondent's estimates of numbers of crabs caught but not available for identification, including those released alive.
7. Disposition of the catch.
8. Carapace width (point to point) and weight of a random subsample of 10 crabs available for identification.

Appendix II contains a sample of the interview sheet used in the intercept phase of the survey.

3.1.3 Survey of Private Access Participation.

A parallel telephone survey was conducted by Chesapeake Biological Laboratory staff to specifically target recreational effort from private access sites. The sampling frames used were the boat license holders and owners of waterfront property for Maryland. To be compatible with the telephone and intercept surveys, we focused on Dorchester and St. Mary's County, MD. However, to increase the number of interviews we also included Calvert County, MD in the survey. Names of potential interviewees were drawn at random from the sampling frames. In each case, the electronic database provided only the candidate's name and address. A Perl™ script file was used to obtain the phone number for the name and address selected from an internet search.

Individuals to be interviewed were selected from the sampling frame for each two-week wave. Five attempts were made to contact the selected individual. If no contact was made the next individual in the list was selected. The earliest interview occurred on June 18, 1999, the latest on December 2, 1999

The interviewer used the same survey tool as the random digit dialing survey (Appendix I) to collect data. Respondents were asked whether they would agree to be re-interviewed at successive points over the summer. Those respondents who agreed to be reinterviewed were contacted every 14 days. On each interview they were asked the same set of questions as in the original interview.

In this part of the survey we focused on obtaining estimates of effort and catch per unit effort. We requested the survey participant identify the gear type, the amount of gear used, the number of crabs caught and the number of crabs retained.

3.2. DATA ANALYSIS

3.2.1 Random digit dialing.

Interviews were considered to be independent and drawn at random. The survey was analyzed to estimate participation by recreational crabbers by region (state and county), gear and wave for each potential sampling frame. For these calculations participation was defined as having crabbed in the 1999 season. The proportion of respondents that came from an individual sampling frame was:

$$P_{ijkl} = \frac{1}{n_{jkl}} \cdot \sum_{x=1}^n x_{ijkl}$$

where i is the sampling frame, j the state and county, k the wave and l the mode.

We calculated the proportion that had crabbed in the last two weeks for each sampling frame by region (state and county), gear and wave using a similar approach to above. From these respondents we also collected data on the catches in the last five trips. To reduce recall bias we have only analyzed the data for the most recent trip. For these data we calculated the number of trips by gear type, region and wave. We also calculated the aggregate catch during the most recent trip by gear type, region and wave. From these last two data sources we then calculated the expected catch per trip for the most recent trip by gear type, region and wave.

3.2.2 Intercept Survey

We calculated the distribution of completed interviews by wave, day and time of day. For completed we calculated the proportion of respondents that came from each potential sampling frame.

We identified catches by whether the respondent indicated that the trip was completed. For incomplete trips we expanded the catch based upon estimates of catch per hour specific to each gear type, region and wave to adjust for the number of additional hours the respondent anticipated fishing. We then combined data from complete and incomplete trips to estimate the total harvest. These data were combined with estimates of the number of trips per gear type, region and wave to calculate expected catches per trip by gear type region and wave. We also calculated the average carapace of crabs available for inspection by gear type region and wave.

3.2.3 Private Access Survey

The private access survey provided detailed information on the catch and effort by participants in the recreational fishery using private access. All of the respondents indicated that their used either crab pots or trotlines. For both gear types we calculated the frequency distribution of the amount of gear used, the number of trips in the previous 14 days, and the

average catch per trip for each participant.

RESULTS

4.1 RANDOM DIGIT DIALING SURVEY

4.1.1. Representation in Sampling Frames

Between July 26 - October 18, 1999 we made 20,229 telephone calls which resulted in 6,797 (33.6%) completed interviews. Number of interviews differed among waves and regions (Table 2). The lowest number of interviews conducted in a single region was 77 in Virginia Beach during the first wave, the largest number of interviews was 370 conducted in Dorchester County during the fifth wave.

Based on the 6,792 interviews completed, we examined the proportion of the sample that would be included in several potential sampling frames: crab licensees, fishing licensees, boat owners, licensed boat owners, waterfront land owners.

Between 0 - 9.9% of respondents would have been sampled based on a crab fishing license sampling frame (Table 3). The highest incidence of crab fishing licensees in the random digit dialing frame was 4.4% in St. Mary's County, the lowest incidence was 0.3% in the Virginia Beach urban area. There was no clear trend in the incidence of crab fishing licensees in the survey over the course of the sample.

The sampling frame of sport fishing license holders was better represented in the RDD survey, but still did not represent a large proportion of respondents. On average 6.2% of respondents held fishing licenses (Table 4). This figure varied from a low of approximately 3% in both of the urban areas in Virginia to 10.5% in St. Mary's County, MD. The incidence of fishing licensees in the RDD survey peaked in September.

A very similar pattern in the proportion of the RDD survey that were sport fishing licenses were also boat owners (Table 5). It is not surprising that these two potential sampling frames show wide overlap. However, there is less similarity when the data are partitioned to reflect just those who have registered boats. (Table 6).

Typically less than 5% of the respondents in the RDD survey were waterfront property owners (Table 7). As expected there was a higher proportion of waterfront property owners in the three more rural areas (Dorchester, St. Mary's and Gloucester counties). In these areas the proportion of respondents who owned waterfront property was 4-4.5% (Table 7). In the two more urban areas 1.5 - 2 % of respondents owned waterfront property. There was no clear trend in the fraction of the RDD survey respondents who owned waterfront property over the course of the survey. The data do show changes in the reported usage of waterfront property for crabbing

however (Table 8). There is a peak in usage of waterfront property for recreational crabbing in September, likely associated with the Labor Day holiday. The start of our survey was delayed and so we were not able to see whether similar increases occurred over the Independence Day holiday. It also appears from the data presented in Table 8 that a higher proportion of waterfront property owners in Virginia Beach used their property as a base for recreational crabbing than in the Norfolk area. Levels of usage for Virginia Beach waterfront property is similar to those observed in the three rural counties.

4.1.2 Participation and Effort

Participation in the recreational fishery by respondents in the survey was determined based on whether respondents indicated that they crabbed recreationally at any time during the 1999 crabbing season up to the date of the interview, and whether they had crabbed in the two weeks immediately prior to the interview. Overall, as gauged by participation in the crabbing season in 1999 averaged 10.2% over all waves (Fig. 1). Participation was higher in the three most rural counties (Table 9), in which participation was in excess of 10%. In contrast, in the two more urban areas, participation was approximately 6%. A similar pattern was observed when participation was gauged solely on the basis of having crabbed in the two weeks prior to the interview (Table 10). Data for those respondents who crabbed in the two weeks prior to the interview provides a clearer picture of how participation varies seasonally (Fig. 2). Levels of participation were low at the beginning of the survey (average = 1.07%). Subsequently, levels of participation climbed to peak at an average of 3.5% in early September. Thereafter, participation again declined to approximately 1%. The general pattern held for all regions. However, levels of participation peaked between early August and September in all regions. Levels of participation in Maryland counties (4-8%) was higher than for the Virginia county and urban areas (0-3%). A similar difference between the states was seen in the participation estimates for those who reported crabbing recreationally at any point during the season.

We also analysed the extent to which recreational crabbers remained in the fishery. We did this by calculating the proportion of people who reported having participated in the fishery in the previous two weeks as a proportion of only those people who had reported as participating in the fishery at some point during the year. When analysed in this fashion, it is clear that the majority of people do participate in the recreational fishery for an extended period of time (Table 11). In Dorchester County, 37.4% of all respondents who reported any recreational crabbing activity, reported in the previous two weeks. Similarly 23.1% of respondents in St. Mary's County who reported recreational crabbing during some part of the year, reported activity in the previous two weeks. Values were less, at between 10.3 - 19.8%, for the three regions in Virginia.

Those respondents who indicated that they had participated in the recreational fishery for crabs during the preceding two weeks were asked to provide further details of their pattern of crabbing. We collected data on the number of total number of trips during the preceding two weeks. For the five most recent trips during this period we also asked respondents to provide information on the mode of access, type of gear and catch. In this fashion we collected information from 183 people on their recreational crabbing activity. In total, these 183 people undertook 746 trips to catch crabs in the previous two week period. The average number of trips per person involved in the recreational fishery varied among regions (Table 12). The average number of trips

per fortnight ranged from 4.32 in Gloucester County, Va to 1.3 in the city of Norfolk. The overall average number of trips was 3.01 ± 9.8 per person per fortnight throughout the entire season. Several individuals, notably in in Virginia Beach in July, Gloucester County in August, and Dorchester County in September contributed to this high variability.

Responses from individual recreational crabbers for the five trips for which we asked data were consistent. Individual rarely used multiple gear. For examples, if the most recent trip involved trotlines, it was most common to find all five trips reporting use of trotlines. This was true for all gear types. Accordingly we focused on the most recent trip to reduce recall bias. Combining all regions, the most popular gear type was crab pots which accounted for 32.8% of all trips (Table 13). The modal number of pots fished was 2, although some respondents reported fishing up to 350 pots (Fig 3). Only nine respondents reported fishing more than 10 pots. Trips using crab pots were about twice as common as trips involving trotlines, the second most common gear which accounted for 16.6% of all trips. However, the overall regional pattern did not accurately reflect patterns of gear useage within each region (Fig. 4). In Dorchester County, MD, the predominate gear reported were trotlines which was used on 30% of all trips. The second most abundant gear was the crab pot which accounted for 20% of all trips. All gear types were used on at least one trip in Dorchester County. In St. Mary's County, MD, the crab pot was the dominant gear, being used on 26.1% of all trips. Use of other gear types was relatively even. The second most common gear was the dipnet which was used in 16.9% of trips, while the third, fourth and fifth most common gears each accounted for about 12% of all trips. Trotlines were not used in any of the three regions in Virginia (Fig. 4). In all three areas the crab pot was the most commonly used gear, accounting for approximately 60% of all trips.

We also queried respondents on their mode of access into the recreational fishery. The majority of trips for any one individual employed the same mode of access. Accordingly, we focused on the most recent trip to reduce reported bias. Two modes of access dominated the data (Table 14). Boat access accounted for 42.9% of all trips and 36.8% of all trips were from private property. Access gained from public piers accounted for 9.1% of all trips. All other modes of access accounted for less than 5% of all trips. The overall regional pattern was representative of the pattern in modes of access within each region (Fig. 5). In each region boat and private access dominated all other modes.

4.1.3. Catch per unit effort

Based on these data, we also estimated catch per unit effort by gear type (Table 15). Overall, catch per unit effort was highest for trotlines (92.4 ± 30.89 crabs per trip) and crab pots (76.5 ± 82.8 crabs per trip) (Fig 6). However, the figure for crab pots were heavily influenced by two anomalously high reported catches of 3,000 and 2625 crabs in single trips in Gloucester County from boats using crab pots in waves 4 and 5. If these numbers are removed from the analysis cpues change to 20.15 ± 8.02 for crab pots. In both instances, the respondent indicated using 300 pots. Catch per unit efforts for all other gear were less than 35 crabs per trip. When examined on a seasonal basis, cpues for the entire survey increased over the season up to the beginning of October (Fig 7).

We also examined whether recreational activity varied according to membership in possible sampling frames (e.g., waterfront property owners, fishing license holders etc.). The sample sizes in some of the possible sampling frames were sufficiently low to preclude statistical testing. Thus we simply compared trips and catch rates between waterfront property owners and non-waterfront property owners. The only substantial difference we found was in the catch rates of waterfront property owners using crab pots in Gloucester County, VA. Catch rates were much higher for waterfront property owners, although these data were biased by one or two individuals were reported using in excess of 300 pots.

4.2 INTERCEPT SURVEY

In preparation for Wave 1 of the intercept survey, QuanTech developed lists of potential crabbing sites, field materials, and recruited and trained field staff. Effort in the intercept survey was measured by assignments and interviews. An assignment is a directive to a local interviewer to go out and interview potential recreational crabbers. An assignment is usually a restricted time period in terms of days, and hours within a day. The distribution of assignments, and interviews resulting from the assignments is provided in Table 16.

During the first wave, a total of 60 assignments were completed yielding 191 completed interviews. In wave 1, the number of persons refusing to be interviewed was negligible. Only six refused initially and there was one language barrier. There were no missed eligibles. In order to enhance productivity of interviewing, field staff were allowed to visit alternate sites. During the 60 Wave 1 assignments, a second site was visited 30 times, a third site was visited 14 times, a fourth site 4 times and a fifth site 3 times. Interview times were distributed throughout the day, with 35.6 percent of the interviews obtained between 8 a.m. and noon, 56.5 percent between noon and 4 p.m., and 7.9 percent after 4 p.m. The mean reported hours fished was 4.3 hours per person. The average reported days crabbing this year was 3.5 while the average days crabbing in the past two weeks was only 1.0. Most of those who went crabbing caught one or more crabs. There were 97 trips of the 191 for which the respondent had caught one or more crabs that were not kept. In addition, there were 119 trips for which crabs were kept.

During Wave 2, a total of 65 assignments were completed yielding 228 completed interviews. In wave 2, the number of persons refusing to be interviewed was also negligible. Only one person refused initially. There were no missed eligibles. In order to enhance productivity of interviewing, field staff were allowed to visit alternate sites. During the 65 Wave 2 assignments, a second site was visited 30 times, and a third site was visited 17 times. Interview times were distributed throughout the day, with 34.6 percent of the interviews obtained between 6 a.m. and noon, 46.9 percent between noon and 4 p.m., and 18.4 percent after 4 p.m. The mean reported hours fished was 3.4 hours per person. The average reported days crabbing this year was 3.6 while the average days crabbing in the past two weeks was only 1.0. Most of those who went crabbing caught one or more crabs. There were 110 trips of the 228 for which the respondent had caught one or more crabs that were not kept. In addition, there were 212 trips for which crabs were kept.

During the Wave 3, a total of 52 assignments were completed yielding 142 completed interviews. In wave 3, no-one refused to be interviewed. There were no missed eligibles. In order to enhance productivity of interviewing, field staff were allowed to visit alternate sites. During the 52 Wave 3 assignments, a second site was visited 22 times, and a third site was visited 9 times. Interview times were distributed throughout the day, with 35.9 percent of the interviews obtained between 7 a.m. and noon, 45.8 percent between noon and 4 p.m., and 18.3 percent after 4 p.m. The mean reported hours fished was 4.6 hours per person. The average reported days crabbing this year was 4.6 while the average days crabbing in the past two weeks was only 1.9. Most of those who went crabbing caught one or more crabs. There were 75 trips of the 142 for which the respondent had caught one or more crabs that were not kept. In addition, there were 129 trips for which crabs were kept.

During Wave 4, a total of 54 assignments were completed yielding 153 completed interviews. No one refused to be interviewed in Wave 4. There were no missed eligibles. Two interviews were missed because of language barriers. In order to enhance productivity of interviewing, field staff were allowed to visit alternate sites. During the 54 Wave 4 assignments, a second site was visited 17 times, and a third site was visited 7 times. Interview times were distributed throughout the day, with 27.5 percent of the interviews obtained between 7 a.m. and noon, 56.8 percent between noon and 4 p.m., and 15.7 percent after 4 p.m. The mean reported hours fished was 3.9 hours per person. The average reported days crabbing this year was 5.5 while the average days crabbing in the past two weeks was only 1.9. Most of those who went crabbing caught one or more crabs. There were 66 trips of the 153 for which the respondent had caught one or more crabs that were not kept. In addition, there were 130 trips for which crabs were kept.

During the Wave 5, a total of 59 assignments were completed yielding 59 completed interviews. Only one person refused to be interviewed in Wave 5. There were no missed eligibles. One person could not be interviewed because of a language barrier. In order to enhance productivity of interviewing, field staff were allowed to visit alternate sites. During the 59 Wave 5 assignments, a second site was visited 15 times, and a third site was visited 8 times. Interview times were distributed throughout the day, with 20.3 percent of the interviews obtained between 7 a.m. and noon, 59.4 percent between noon and 4 p.m., and 20.3 percent after 4 p.m. The mean reported hours fished was 3.9 hours per person. The average reported days crabbing this year was 8.1 while the average days crabbing in the past two weeks was only 1.6. Most of those who went crabbing caught one or more crabs. There were 30 trips of the 59 for which the respondent had caught one or more crabs that were not kept. In addition, there were 52 trips for which crabs were kept.

During Wave 6, a total of 61 assignments were completed yielding 74 completed interviews. One person could not be interviewed because of a language barrier. In order to enhance productivity of interviewing, field staff were allowed to visit alternate sites. During the 61 Wave 6 assignments, a second site was visited 16 times, and a third site was visited 8 times. Interview times were distributed throughout the day, with 39.2 percent of the interviews obtained between 7 a.m. and noon, 51.3 percent between noon and 4 p.m., and 9.5 percent after 4 p.m. The mean reported hours fished was 4.3 hours per person. The average reported days crabbing this

year was 6.5 while the average days crabbing in the past two weeks was only 1.0. Most of those who went crabbing caught one or more crabs. There were 38 trips of the 74 for which the respondent had caught one or more crabs that were not kept. In addition, there were 60 trips for which crabs were kept.

4.2.1 Representation in Sampling Frames

Based on a total of 1,147 interviews conducted between July 26 and October 10, we determined the proportion of interviews that would be included in several potential sampling frames. Overall representation in all possible sampling frames was considerably higher in the intercept portion of the survey than in the RDD portion. For example an average of 17% of interviewees reported holding recreational crab licenses (Table 17), 41.5% reported holding sport fishing licenses (Table 18), 19.0% owned boats (Table 19), and 5.7% owned waterfront property (Table 20).

There were differences in the representation in the different possible sampling frames among the five regions. For example while 23.2% of interviewees in Dorchester County, and 43.2% of interviewees in St. Mary's County held recreational crabbing licenses, less than 10% of interviewees in each of the Virginian regions held such licenses (Table 17). It is clear from these data that while the recreational crabbing license holder frame is a better starting point for selecting interviewees in future surveys, this frame would still miss more than half of the participants in the recreational fishery for crabs. There was no seasonal trend apparent in the probability that a recreational crabber would hold a noncommercial crab license.

Over thirty percent of all interviewees held sport fishing licenses in all regions except Virginia Beach, VA (Table 18). In fact for St. Mary's County, 73.7% of all participants in the recreational crab fishery that were interviewed held sport fishing licenses (Table 13). This suggests that the sport fishing license holder list would be a more consistent potential sampling for a baywide survey. There was no clear seasonal trend in the proportion of the participants in the recreational fishery who held sport fishing licenses. The average for each of the first five waves (July - September) was 30-40%. However, in October, this figure increased to 67.6%. This may reflect the seasonal declines in tourism, leaving only boat-owning locals on the boat ramps later in the season.

The percentage of participants in the recreational fishery that owned boats varied among the five regions, from a high of 39.6% in St. Mary's County to a low of 5.6% in Norfolk (Table 19). Seasonally however, the proportion of participants in the recreational crab fishery who owned their own boat was relatively constant at between 17-27%.

The proportion of interviewees who were also waterfront property owners was the lowest of all of the possible sampling frames (Table 20). The proportion of waterfront property owners varied from 19.7% in Virginia Beach to less than 1% in Gloucester County. The differences among the regions likely reflects the extent of access to water that waterfront property provides in the different regions. For example, most waterfront property in Gloucester County is likely to offer access to the recreational fishery either through a pier from which to hang pots, or dock a

boat, or suitable shallow water habitat from which to run a line. In contrast, waterfront property in Virginia Beach likely does not provide access to suitable habitats for crabs directly. In addition the proportion of waterfront property that is serviced by its own pier in this region is also likely to be lower.

4.2.2 Participation and Effort

The average number of days fished in the previous 14 by participants in the recreational fishery was 2.21 (Table 21). The average for Norfolk and St. Mary's Counties were higher (3.19 and 2.94 d respectively) than the three other regions, for which previous effort was approximately 1.5d (Table 21). In addition to this difference in participation and effort among the regions, there was also substantial differences seasonally (Fig 8). Recreational effort in Gloucester County, and in the Norfolk area was highest for the wave beginning September 7, 1999. This likely reflects increased effort over the previous holiday weekend. Effort in St. Mary's County was highest in late July. Effort in both Dorchester County and Virginia Beach was low and consistent throughout the period of the survey.

We also queried the interviewees extensively on the activity during the day on which they were interviewed. We estimated the proportions that were involved in the recreational crab fishery by gear type, and then estimated the average number of hours that each trip represented. We subsequently examined the number of days that recreational crabbers fished in the previous 14 days based upon the type of gear they used on the day of the interview to see whether particular types of fishers were more active.

The most common mode of recreational crabbing in the intercept survey was hook and line which accounted for 57.1% of all interviews (Table 22). The next most common gear was the crab pot which accounted for 20.7% of all interviews. No other single gear accounted for more than 10% of the interviews. There did not appear to be any clear seasonal trend in the use of a particular gear type. The rank order of the proportion of interviews accounted for by each gear type remained constant throughout the intercept survey. Only on one date (9/20/1999) did interviews with people who reported fishing with hook and line not dominate the number of interviews conducted. There is a distinct regional pattern in gear usage at public access sites. In Dorchester County crab pots predominate (Table 22), representing an average of 53.5% of all interviews. In sharp contrast in all three regions in Virginia, hook and line fishing dominates and crab potting from public access sites is relatively rare. In the three regions in Virginia hook and line fishing accounted for between 65 - 100% of all interviews.

We estimated the number of hours fished by gear type for each region and wave from the data provided to the interviewers (Table 23). Overall all gear types, regions and waves, the average crabbing trip was 3.15 ± 1.84 hours. There was relatively little difference among the different gear types in the length of fishing trips. For all gear types the average length of fishing trip varied from 2.17 - 4.45 hours. In addition, there was relatively little variation seasonally in the time invested in a single crabbing trip, beyond those patterns already noted about absolute differences in gear usage.

4.2.3 Catch.

We estimated the total number of crabs caught by each gear type identified in the intercept survey. Estimates were adjusted to reflect the additional hours that respondents reported as intending to fish.

The total number of crabs reported as harvested during the intercept survey was 10,221 (Table 24). The majority of the crab caught were caught either in pots (53.3%) or by hook and line (34.8%). No other gear accounted for more than 7% of the total catch. The reported catch was highest in the first wave (late July) and declined thereafter. This may indicate that we began the survey too late in the year to capture fully the dynamics of the recreational fishery. However, on closer inspection, this pattern reflects an unusually high catch in the recreational pot fishery in the first wave. If this catch had not been so high, then the pattern of relatively high catches would have extended to the end of August, with a steady decline thereafter (Table 24). The region with the highest reported catch was Dorchester County, MD which accounted for 48% of the catch. However, the figure for Dorchester County is heavily influenced by the high catches in the recreational pot fishery in late July. In the absence of this, catches would have been relatively equal in Dorchester and St. Mary's Counties in MD, and Norfolk and Virginia Beach in Virginia. Catches in Gloucester County were substantial lower than in the other regions (Table 24).

We combined the data on the number of trips, with the data on the total harvest to examine gear-specific patterns in catch per trip in the different regions over the season (Table 25). The overall average catch per trip was 12.1 crabs per trip. However, there were substantial differences among the gear types with respect to catch per trip. The production in the pot component of the recreational fishery was highest, with an average of 30.9 crabs per trip. The next highest production was from the trap fishery at 9.6 crabs per trip. All other components were characterised by catches per trip of 7 and under. There appeared to be no strong seasonal signal in the catch per trip data (Table 25). When examined on a regional basis, the two Maryland counties exhibited substantially higher average catches per trip than any of the three Virginia regions. This reflects the higher crab pot effort in the two Maryland counties. When similar gear types are compared across the five regions there only minor differences in catches per trip.

A sample of all crabs available for inspection were measured to determine carapace width. These data indicate that the average size of crab harvested in the recreational fishery was 270 mm (Table 26). There were no substantial differences among gear types. However, there was a seasonal pattern with a general decrease in size over the course of the season.

4.3. PRIVATE ACCESS SURVEY

4.3.1 Catch and Effort

We collected data on 296 separate recreational crabbing trips for which crab pots were the principal gear, and 46 trips for which a trotline was the principal gear. Data were collected over 12 two-week waves from June 18, - Dec 2, 1999 (Table 27).

The data on pot trips indicate that these were all trips involving fishing from a private pier. The modal number of pots fished was two, although people reported fishing as many as four (Fig. 10). The modal number of times the pots were checked each trip was one, although some people reported checking more than 10 times (Fig 11). The majority of the effort recorded was in Calvert and Dorchester Counties (Table 28). Seasonally, the distribution of trips in the three counties were broadly similar. There was a peak in activity in each county from late July - mid September, thereafter the number of trips reported decreased (Fig. 12). Catch per unit effort in all three counties averaged 4 crabs per trip (Table 29). The catch rate was highest in St. Mary's County at 8.5 crabs/trip, and lowest in Dorchester County at 2.15 crabs/trip.

The data on trot line trips indicate that these were all boat trips that originated from a private pier. The average length of trotline fished was 1,056'. The shortest length reported as being used was 300' and the longest length deployed was 2,400'. There were no substantial differences in the lengths of trotline used in the three counties. The majority of the effort recorded was for Calvert County (78.2% - Table 30). The limited number of samples make definitive statements about the distribution of sampling effort difficult. However, the few samples do support a similar pattern in recreational trotline effort from private access as in the recreational pot fishery from private access. Most effort was recorded in August. The average catch per trip was 52.7 crabs (Table 31).

5. DISCUSSION

We conducted a targeted pilot survey of recreational crabbing activity in three rural counties and two urban areas bordering the Chesapeake Bay. Based on a random digit telephone survey, we estimated participation in the recreational fishery for crabs in 1999 was approximately 10%. However, this estimate reflects people who participated on at least one occasion during the season. A more conservative estimate of participation is to count only those who participated in the previous two weeks. When calculated in this way the level of participation in the recreational fishery was much lower at approximately 2.3%. None of the possible sampling frames considered provided a sound basis on which to base a full bay wide survey. It will be necessary to combine frames to get adequate representation of all components. This is particularly true in light of the differing catch rates among the different gear types and modes of access.

The telephone survey data indicated that in the population as a whole the most popular mode of access was by boat. The second most popular mode was from private property. The most popular gears were crab pots, trotlines, dipnets and hook and line. There are substantial differences in the estimated catches per trip among these common gear types between the three different survey instruments. For example, the catch per trip for crabs pots is 76.5 in the telephone

survey, 30.9 in the intercept survey and 4.0 in the private access survey. Similar differences are evident in the other gear types. Clearly accurately partitioning effort and catch among the different survey elements will be a significant challenge to any baywide survey. Solving these complications will be difficult, but essential as we must be able to expand the estimates of effort and catch per effort to estimate total recreational harvest.

The random digit telephone survey presented us with the least difficulties. The properties of such surveys are well known and there is broad experience in conducting them. Typically the telephone segment of a complemented survey design is used only to provide effort estimates. We also used our survey to estimate catch. We believe that the short wave duration provided an accurate estimate of catch, but have no way of confirming this contention. With the improved estimates of participation that have been developed in this pilot survey it should be possible to design an efficient baywide telephone survey.

The intercept component of the survey proved much more problematical. We began the survey with a site list based on the existing MRFSS site list and with input from the Marine Police in both states. The initial design called for sampling effort to be proportional to the intensity of use of the different sites. However, this initial site list proved to be woefully inadequate to sample recreational crabbing effort. The inadequacies result from two issues. First much activity in the recreational crab fishery is not from boat ramps - as we have shown, a considerable proportion is from private access and from non-traditional sites such as bridges and boat rental facilities. To increase the number of interviews, we had to relax the sampling design and allow the interviewers to use their local knowledge and advice from recreational crabbers who had been interviewed. It is also clear from the data on the distribution of gear types by region that we may be missing substantial portions of the recreational effort in the intercept survey. For example, almost two-thirds of the effort in Gloucester County in the telephone survey was reported as being invested in pot effort. Yet, in the intercept survey no potting effort or catch was measured in Gloucester County. Thus there is a critical need for any baywide survey is to develop a credible list of access sites. This will require an investment in manpower to survey both potential sites, and also to survey participants by telephone to determine their mode of access.

The survey of the private access participants provided detailed information on catch per trip for waterfront property owners. It is clear from these data that many waterfront property owners expend considerable effort over the course of the season. However, it is also clear that the catch rates in this component of the recreational fishery is relatively low. Yet almost three percent of respondents in the telephone survey reported as owning waterfront property and two-thirds of those reported that they used their property to crab. Thus even with low catch rates, the total impact of the private access component may be large. It is also clear from this preliminary effort that a log-book scheme would be feasible as a survey instrument for the private access sites. This could be either as a formal log book, or by a longitudinal telephone survey as we conducted here.

It would be possible to expand the effort and catch per unit effort estimates developed in this survey to estimate the total recreational catch for the five regions considered. We have chosen not so to do for several reasons. First, region-specific estimates of recreational catch may not be a

good estimator of total baywide harvest. Second, there remain concerns over what estimates of catch per trip to use to complete the effort expansion. Further work needs to be completed to determine how to deal with the catch data from the different survey implements.

Table 1. Dates of waves used in telephone and intercept surveys conducted in 1999 in five regions bordering the Chesapeake Bay

Wave	From	To
1	26 July	7 August
2	8 August	22 August
3	23 August	5 September
4	6 September	19 September
5	20 September	3 October
6	4 October	17 October

Table 2. Number of calls and completed interviews in the random digit dialing survey by wave and region. Waves are identified by their beginning date.

Wave	Region					Total
	Dorchester	St Marys	Gloucester	Norfolk	VA Beach	
26-Jul	157	160	127	39	77	560
9-Aug	365	332	334	168	253	1452
23-Aug	365	332	334	168	253	1452
6-Sep	318	323	303	106	206	1256
20-Sep	370	356	335	142	252	1455
4-Oct	156	148	156	62	100	622
Total	1731	1651	1589	685	1141	6797

Table 3. Proportion of respondents in the random digit dialing survey who held recreational crabbing licenses. Data are reported by region and by wave (as represented by the beginning date of the wave).

Wave	Region					Average
	Dorchester	St Mary's	Gloucester	Norfolk	VA Beach	
26-Jul	0.025	0.044	0.016	0.026	0.000	0.022
9-Aug	0.033	0.039	0.009	0.000	0.000	0.016
23-Aug	0.033	0.039	0.009	0.000	0.000	0.016
6-Sep	0.069	0.056	0.026	0.009	0.010	0.034
20 -Sep	0.051	0.051	0.018	0.021	0.012	0.031
4-Oct	0.013	0.041	0.006	0.000	0.000	0.012
Average	0.037	0.045	0.014	0.009	0.004	0.022

Table 4. Proportion of respondents in the random digit dialing survey who held sport fishing licenses. Data are reported by region and by wave (as represented by the beginning date of the wave).

Wave	Region					Average
	Dorchester	St Marys	Gloucester	Norfolk	VA Beach	
26-Jul	0.051	0.125	0.039	0.026	0.013	0.051
9-Aug	0.074	0.090	0.048	0.036	0.028	0.055
23-Aug	0.074	0.090	0.048	0.036	0.028	0.055
6-Sep	0.104	0.115	0.096	0.057	0.039	0.082
20-Sep	0.108	0.121	0.084	0.042	0.048	0.080
4-Oct	0.077	0.095	0.051	0.000	0.050	0.055
Average	0.081	0.106	0.061	0.033	0.034	0.063

Table 5. Proportion of respondents in the random digit dialing survey who owned a boat. Data are reported by region and by wave (as represented by the beginning date of the wave).

Wave	Region					Average
	Dorchester	St Marys	Gloucester	Norfolk	VA Beach	
26-Jul	0.070	0.119	0.094	0.026	0.013	0.064
9-Aug	0.079	0.090	0.048	0.012	0.012	0.048
23-Aug	0.079	0.090	0.048	0.012	0.012	0.048
6-Sep	0.104	0.105	0.092	0.047	0.019	0.074
20-Sep	0.100	0.098	0.093	0.014	0.044	0.070
4-Oct	0.045	0.061	0.090	0.016	0.040	0.050
Average	0.080	0.094	0.078	0.021	0.023	0.059

Table 6. Proportion of respondents in the random digit dialing survey who owned a registered boat. Data are reported by region and by wave (as represented by the beginning date of the wave).

Wave	Region					Average
	Dorchester	St Marys	Gloucester	Norfolk	VA Beach	
26-Jul	0.070	0.106	0.087	0.026	0.013	0.302
9-Aug	0.074	0.081	0.048	0.012	0.012	0.227
23-Aug	0.074	0.081	0.048	0.012	0.012	0.227
6-Sep	0.101	0.093	0.086	0.038	0.019	0.336
20-Sep	0.092	0.087	0.081	0.014	0.044	0.317
4-Oct	0.038	0.054	0.083	0.016	0.030	0.222
Average	0.449	0.503	0.072	0.117	0.130	1.631

Table 7. Proportion of respondents in the random digit dialing survey who owned waterfront property. Data are reported by region and by wave (as represented by the beginning date of the wave).

Wave	Region					Average
	Dorchester	St Mary's	Gloucester	Norfolk	VA Beach	
26-Jul	0.019	0.069	0.047	0.051	0.013	0.040
8-Aug	0.044	0.030	0.030	0.006	0.020	0.026
23-Aug	0.044	0.030	0.030	0.006	0.020	0.026
6-Sep	0.044	0.056	0.043	0.038	0.019	0.040
20-Sep	0.051	0.048	0.054	0.014	0.020	0.037
4-Oct	0.038	0.041	0.071	0.000	0.010	0.032
Average	0.040	0.046	0.046	0.019	0.017	0.033

Table 8. Proportion of respondents in the random digit dialing survey who owned waterfront property and used it to participate in the recreational crab fishery. Data are reported by region and by wave (as represented by the beginning date of the wave).

Wave	Region					Average
	Dorchester	St Marys	Gloucester	Norfolk	VA Beach	
26-Jul	0.333	0.545	0.500	0.500	1.000	0.576
8-Aug	0.625	0.600	0.800	0.000	0.800	0.565
23-Aug	0.625	0.600	0.800	0.000	0.800	0.565
6-Sep	0.714	0.944	0.769	1.000	0.500	0.786
20-Sep	0.895	0.941	0.889	1.000	0.400	0.825
4-Oct	0.833	0.833	0.727	0.000	1.000	0.679
Average	0.671	0.744	0.748	0.417	0.750	0.666

Table 9. Proportion of respondents in the random digit dialing survey who reported participating in the recreational crab fishery on at least one occasion during the 1999 season. Estimates of participation are shown segregated by region and wave (defined by the beginning date).

Wave	Region					Average
	Dorchester	St Mary's	Gloucester	Norfolk	VA Beach	
26-Jul	0.096	0.188	0.126	0.051	0.026	0.097
8-Aug	0.101	0.127	0.075	0.048	0.043	0.079
23-Aug	0.101	0.127	0.075	0.048	0.043	0.079
6-Sep	0.157	0.192	0.152	0.123	0.092	0.143
20-Sep	0.138	0.197	0.143	0.070	0.083	0.126
4-Oct	0.096	0.149	0.109	0.016	0.080	0.090
Average	0.115	0.163	0.113	0.059	0.061	0.102

Table 10. *Proportion of respondents in the random digit dialing survey who reported participating in the recreational crab fishery during the two weeks prior to the date of the interview during the 1999 season. Estimates of participation are shown segregated by region and wave (defined by the beginning date).*

Wave	Region					Average
	Dorchester	St Mary's	Gloucester	Norfolk	VA Beach	
26-Jul	0.019	0.019	0.016	0.000	0.000	0.011
8-Aug	0.060	0.042	0.018	0.018	0.008	0.029
23-Aug	0.060	0.042	0.018	0.018	0.008	0.029
6-Sep	0.047	0.077	0.033	0.009	0.010	0.035
20-Sep	0.046	0.031	0.027	0.014	0.012	0.026
4-Oct	0.019	0.007	0.019	0.000	0.000	0.009
Average	0.042	0.036	0.022	0.010	0.006	0.023

Table 11. *Proportion of respondents in the random digit dialing survey who reported participating in the recreational crab fishery during the two weeks prior to the date of the interview as a fraction of those reporting having participated at any point during the 1999 season. Estimates of participation are shown segregated by region and wave (defined by the beginning date).*

Wave	Region					Average
	Dorchester, MD	St. Mary's, MD	Gloucester, VA	Norfolk, VA	Virginia Beach, VA	
26-Jul	0.200	0.100	0.125	0.000	0.000	0.085
8-Aug	0.595	0.341	0.240	0.375	0.182	0.347
23-Aug	0.595	0.341	0.240	0.375	0.182	0.347
6-Sep	0.306	0.403	0.222	0.077	0.111	0.224
20-Sep	0.347	0.159	0.188	0.200	0.143	0.207
4-Oct	0.200	0.045	0.176	0.000	0.000	0.084
Average	0.374	0.232	0.199	0.171	0.103	0.216

Table 12. Average number (\pm SD) of crabbing trips over the two weeks prior to the date of the interview reported by respondents in a random digit dialing survey who reported having crabbed during that period.

Wave	Region					Average
	Dorchester	St Mary's	Gloucester	Norfolk	VA Beach	
8/8/99	3.09 (4.98)	2.93 (3.84)	3.50 (5.68)	1.00 (1.0)	9.50 (14.54)	4.03 (7.54)
8/23/99	2.89 (4.14)	2.27 (2.94)	11.82 (31.29)	2.50 (3.24)	1.0 (.)	4.09 (14.25)
9/6/99	2.67 (4.25)	5.56 (20.11)	1.30 (1.48)	1.0 (.)	1.0 (1.)	2.30 (9.23)
9/20/99	8.41 (25.07)	1.82 (2.2)	2.67 (3.83)	2.0 (2.83)	1.33 (1.53)	3.25 (11.47)
10/4/99	2.67 (3.27)	2 (.)	2.33 (2.89)	0 (.)	0 (.)	1.4 (1.95)
Average	3.94 (11.82)	2.91 (9.3)	4.32 (14.4)	1.3 (1.97)	2.57 (6.55)	3.01 (9.8)

Table 13. Distribution of effort by gear type and mode as represented by the frequency distribution of the most recent trips by fishing gear and wave (defined by the beginning date of the wave) reported in a random digit dialing survey of the recreational crab fishery in 1999.

Wave	Gear										Grand Total	
	crab pot	trotline	dip net	trap	line and dipnet	hook and line	line	by hand	refused	don't know		
All regions												
26-Jul	1	2			2	1	1					7
9-Aug	14	7	6	6	5	3	2	1	1	1		46
23-Aug	14	7	6	6	5	3	2	1	1	1		46
6-Sep	19	9	5	3	4	1	5	3	3			52
20-Sep	15	7	5	4		7	1	1				40
4-Oct	2	1	3				1					7
Grand Total	65	33	25	19	16	15	12	6	5	2		198
Dorchester County, MD												
26-Jul		1			1							2
9-Aug	4	5	3	4	1	3	1			1		22
23-Aug	4	5	3	4	1	3	1			1		22
6-Sep	3	6	3		1		1	1				15
20-Sep	4	6	1	2		3						16
4-Oct	1	1	1									3
Grand Total	16	24	11	10	4	9	3	1		2		80
St. Mary's, MD												
26-Jul	1	1				1						3
9-Aug	2	2	3		4		1	1				13
23-Aug	2	2	3		4		1	1				13
6-Sep	9	3	2	2	1		4	1	2			24
20-Sep	3	1	2	1		3	1					11
4-Oct			1									1
Grand Total	17	9	11	3	9	4	7	3	2			65
26-Jul					1		1					2
9-Aug	5			1								6
23-Aug	5			1								6
6-Sep	5			1	2	1			1			10
20 Sep	6		1	1		1						9
4-Oct	1		1				1					3
Grand Total	22		2	4	3	2	2		1			36
Norfolk, VA												
26-Jul												
9-Aug	2								1			3
23-Aug	2								1			3

6-Sep	1			1
20-Sep		1		1
4-Oct				
Grand Total	5	1	2	8

Virginia Beach, VA

26-Jul				
9-Aug	1	1		2
23-Aug	1	1		2
6-Sep	1		1	2
20-Sep	2		1	3
4-Oct				
Grand Total	5	2	2	9

Table 14. Distribution of modes of access for the most recent fishing trips reported by recreational crabbers surveyed in a random digit dialing survey during the 1999 season.

Wave	Mode of Access							Grand Total	
	bank	beach	boat	bridge	don't know	private property	public pier		
All regions									
26-Jul				5		1		1	7
9-Aug		1	1	20	2	3	15	4	46
23-Aug		1	1	20	2	3	15	4	46
6-Sep			1	15	3		26	7	52
20-Sep		1		22			15	2	40
4-Oct		1	1	3			2		7
Grand Total		4	4	85	7	7	73	18	198
Dorchester County, MD									
26-Jul				2					2
9-Aug				9	2	2	8	1	22
23-Aug				9	2	2	8	1	22
6-Sep				7	3		4	1	15
20-Sep				9			7		16
4-Oct				2			1		3
Grand Total				38	7	4	28	3	80
St. Mary's County, MD									
26-Jul				3					3
9-Aug		1	1	6		1	3	1	13
23-Aug		1	1	6		1	3	1	13
6-Sep			1	4			15	4	24
20-Sep				6			4	1	11
4-Oct		1							1
Grand Total		3	3	25		2	25	7	65
Gloucester County, MD									
26-Jul						1		1	2
9-Aug				3			2	1	6
23-Aug				3			2	1	6
6-Sep				3			6	1	10
20-Sep				5			3	1	9
4-Oct			1	1			1		3
Grand Total			1	15		1	14	5	36
Norfolk, VA									
26-Jul									
9-Aug				1			1	1	3
23-Aug				1			1	1	3

6-Sep			1	1
20-Sep			1	1
4-Oct				
Grand Total		2	3	8

Virginia Beach, VA				
26-Jul				
9-Aug		1	1	2
23-Aug		1	1	2
6-Sep		1	1	2
20-Sep	1	2		3
4-Oct				
Grand Total	1	5	3	9

Table 15. Average catch per trip estimated for the catch information on the most recent trip by recreational crabbers who reported participating the fishery in the two weeks prior to the interview period.

Wave	Gear										Average CPUE	SD(CPUE)	
	crab pot	trotline	dip net	trap	line and dipn	hook and line	line	by hand	refused	don't know			
All Regions													
26-Jul	5.000	67.500			12.000	12.000	0.000					19.300	24.523
9-Aug	27.571	77.571	16.667	11.833	32.600	10.000	68.000	12.000	6.000	0.000		26.224	25.070
23-Aug	27.571	77.571	16.667	11.833	32.600	10.000	68.000	12.000	6.000	0.000		26.224	25.070
6-Sep	153.368	125.778	91.600	9.000	18.000	12.000	9.200	19.667	10.333			49.883	54.227
20-Sep	225.600	62.571	17.800	68.000		91.429	40.000	30.000				76.486	65.093
4-Oct	20.000	144.000	28.333				24.000					54.083	51.997
Average CPUE	76.519	92.499	34.213	25.167	23.800	27.086	34.867	18.417	7.444	0.000		42.033	
SD(CPUE)	82.898	30.893	29.027	24.757	9.052	32.184	26.503	7.384	2.043	0.000		20.043	
Dorchester County, MD													
26-Jul		70.000			24.000							47.000	23.000
9-Aug	13.000	76.800	18.667	17.250	36.000	10.000	100.000			0.000		33.965	33.318
23-Aug	13.000	76.800	18.667	17.250	36.000	10.000	100.000			0.000		33.965	33.318
6-Sep	8.000	158.333	144.000		20.000		25.000	36.000				65.222	61.464
20-Sep	14.000	68.000	2.000	28.000		185.333						59.467	66.746
4-Oct	4.000	144.000	60.000									69.333	57.535
Average CPUE	10.400	98.989	48.667	20.833	29.000	68.444	75.000	36.000		0.000		51.492	
SD(CPUE)	3.826	37.267	51.371	5.068	7.141	82.653	35.355	0.000		0.000		14.172	
St. Mary's County, MD													
26-Jul	5.000	65.000				12.000						27.333	26.787
9-Aug	115.500	79.500	14.667		31.750		36.000	12.000				48.236	37.335
23-Aug	115.500	79.500	14.667		31.750		36.000	12.000				48.236	37.335
6-Sep	13.556	60.667	13.000	10.500	4.000		5.250	20.000	15.500			17.809	16.919

Average				
CPUE	11.25	2	16.5	10.25
SD(CPUE)	12.43734	0	13.5	9.490126

Table 16. *Distribution of interview effort in the intercept survey by wave and region.*

County	Wave 1		Wave 2		Wave 3		Wave 4		Wave 5		Wave 6	
	Assign.	Ints.	Assign.	Ints.	Assign.	Ints.	Assign.	Ints.	Assign.	Ints.	Assign.	Ints.
Dorchester	19	54	12	28	14	28	14	32	15	31	21	25
St. Mary's	4	4	9	8	19	31	15	19	15	11	11	18
Gloucester	14	6	17	23	8	20	13	19	15	11	10	14
Norfolk	19	106	7	81	3	19	11	78	14	6	17	14
Virginia Beach	4	21	20	88	8	44	1	5	0	0	2	3
Total	60	191	65	228	52	142	54	153	59	59	61	74

Table 17. *Proportion of respondents in the intercept survey who held recreational crabbing licenses. Data are reported by region and by wave (as represented by the beginning date of the wave).*

Date	Region					Average
	Dorchester	St Marys	Gloucester	Norfolk	VA Beach	
7/26	0.263	0.000	0.000	0.017	0.095	0.103
8/8	0.333	0.400	0.000	0.000	0.000	0.138
8/23	0.111	0.457	0.000	0.000	0.200	0.207
9/6	0.143	0.400	0.000	0.000	0.000	0.135
9/20	0.229	0.694	0.000	0.000		0.297
10/4	0.342	0.444	0.000	0.000	0.000	0.236
Average	0.232	0.432	0.000	0.004	0.078	0.173

Table 18. Proportion of respondents in the intercept survey who held sport fishing licenses. Data are reported by region and by wave (as represented by the beginning date of the wave).

Date	Region					Average
	Dorchester	St Marys	Gloucester	Norfolk	VA Beach	
7/26	0.479	0.750	0.333	0.459	0.286	0.465
8/8	0.508	0.867	0.261	0.340	0.018	0.385
8/23	0.181	0.631	0.300	0.514	0.024	0.324
9/6	0.175	0.600	0.053	0.488	0.000	0.361
9/20	0.266	0.750	0.182	0.333		0.402
10/4	0.633	1.000	0.786	0.538	0.000	0.676
Average	0.369	0.737	0.319	0.449	0.034	0.416

Table 19. Proportion of respondents in the intercept survey who were boat owners. Data are reported by region and by wave (as represented by the beginning date of the wave).

Date	Region					Average
	Dorchester	St Marys	Gloucester	Norfolk	VA Beach	
7/26	0.169	0.000	0.167	0.237	0.048	0.173
8/8	0.311	0.400	0.217	0.013	0.258	0.215
8/23	0.111	0.157	0.150	0.000	0.360	0.177
9/6	0.111	0.600	0.000	0.000	0.000	0.185
9/20	0.188	0.694	0.000	0.000		0.279
10/4	0.167	0.389	0.071	0.000	0.000	0.174
Average	0.172	0.397	0.101	0.057	0.206	0.194

Table 20. Proportion of respondents in the intercept survey who were owned waterfront property. Data are reported by region and by wave (as represented by the beginning date of the wave).

Date	Region					Average
	Dorchester	St Marys	Gloucester	Norfolk	VA Beach	
7/26	0.010	0.000	0.000	0.068	0.095	0.039
8/8	0.015	0.000	0.000	0.006	0.157	0.044
8/23	0.000	0.049	0.050	0.000	0.076	0.038
9/6	0.000	0.100	0.000	0.004	0.444	0.103
9/20	0.021	0.056	0.000	0.000		0.025
10/4	0.083	0.067	0.000	0.000	0.333	0.078
Average	0.020	0.056	0.008	0.018	0.198	0.058

Table 21. Average number (\pm SD) of days fished in the two weeks prior to the interview date of respondents in the intercept survey. Estimates of participation are shown segregated by region and wave (defined by the beginning date).

Date	Region					Average
	Dorchester	Gloucester	Norfolk	St Marys	VA Beach	
7/26	0.710 (0.484)	1.167	1.033 (0.281)	2.250	1.238	1.055 (0.520)
8/8	2.023 (1.067)	1.000	2.441 (1.986)	7.633 (11.059)	0.828 (0.300)	2.843 (4.860)
8/23	1.325 (1.177)	0.900	2.750 (0.901)	2.388 (1.125)	0.879 (1.144)	1.710 (1.244)
9/6	0.820 (0.969)	5.895	7.069 (6.461)	2.200 (1.891)	1.667 (2.887)	3.709 (4.621)
9/20	1.859 (1.429)	0.818	0.667 !	2.417 (1.296)		1.699 (1.205)
10/4	0.844 (0.582)	0.429	0.808 (0.272)	1.022 (0.367)	3.667	1.131 (0.968)
Average	1.239 (0.998)	1.701 (2.069)	3.196 (4.147)	2.947 (4.399)	1.258 (1.517)	2.209 (3.249)

Table 22. *Frequency distribution of trips by gear in the intercept survey of the recreational crab fishery in 1999. Estimates of participation are shown segregated by gear, region and wave (defined by the beginning date).*

Date	Gear						Grand Total
	crab pot	dip net	hand	hook and line	line	trap	
All Regions							
7/26	40	12		105	10	24	191
8/8	26	10	8	165	9	10	228
8/23	23	11		83	14	11	142
9/6	40	12	4	70	19	8	153
9/20	25			25		9	59
10/4	22	5		36	3	8	74
Grand Total	176	50	12	484	55	70	847
Dorchester County, MD							
7/26	26			5	1	22	54
8/8	22			4		2	28
8/23	9	3		10		6	28
9/6	21			9		2	32
9/20	16			6		9	31
10/4	12	5				8	25
Grand Total	106	8		34	1	49	198
St. Mary's County, MD							
7/26				4			4
8/8		2		5		1	8
8/23	13	1		11	2	4	31
9/6	12	1		2	2	2	19
9/20	9			2			11
10/4	10			6	2		18
Grand Total	44	4		30	6	7	91
Gloucester County, VA							
7/26				6			6
8/8				23			23
8/23				20			20
9/6				19			19
9/20				11			11
10/4				14			14
Grand Total				93			93
Norfolk, VA							
7/26	14	12		69	9	2	106
8/8		2	8	63	1	7	81
8/23		2		9	8		19
9/6	7	8	4	39	16	4	78
9/20				6			6
10/4				13	1		14

Grand Total	21	24	12	199	35	13	304
Virginia Beach, Va							
7/26				21			21
8/8	4	6		70	8		88
8/23	1	5		33	4	1	44
9/6		3		1	1		5
10/4				3			3
Grand Total	5	14		128	13	1	161

Table 23. Average of hours fished during completed individual trips reported during an intercept survey of the recreational crab fishery in 1999. Average trip duration is reported for each gear type and for each wave (defined by the beginning date of the wave).

Date	Gear						Grand Total
	crab pot	dip net	hand	hook and line	line	trap	
All regions							
7/26	4.299	4.500		3.416	3.194	4.727	3.835
8/8	3.909	1.611	3.375	3.333	2.250	2.390	2.773
8/23	4.338	2.750		2.731	3.167	3.986	3.285
9/6	5.566	1.326	2.375	3.015	2.365	2.333	2.901
9/20	4.061			2.064		1.667	2.578
10/4	4.058	1.700		3.740	2.000	7.000	3.578
Grand Total	4.455	2.168	2.875	3.060	2.624	3.404	3.155
Dorchester County, MD							
7/26	4.135			5.600	3.500	5.455	4.672
8/8	3.818			1.075		3.100	2.664
8/23	5.167	2.000		2.550		8.833	4.638
9/6	9.019			2.667		0.500	4.062
9/20	4.844			0.833		1.667	2.448
10/4	4.917	1.700				7.000	4.539
Grand Total	5.316	1.850		2.545	3.500	4.426	3.919
St. Mary's County, MD							
7/26				3.000			3.000
8/8		2.500		4.000		1.000	2.500
8/23	3.346	6.000		2.455	2.500	3.125	3.485
9/6	4.250	1.000		3.000	2.000	4.000	2.850
9/20	3.278			2.000			2.639
10/4	3.200			2.000	1.500		2.233
Grand Total	3.518	3.167		2.742	2.000	2.708	2.850
Gloucester County, MD							
7/26				3.000			3.000
8/8				2.239			2.239
8/23				2.100			2.100
9/6				1.842			1.842
9/20				1.591			1.591
10/4				1.500			1.500
Grand Total				2.045			2.045
Norfolk, VA							
7/26	4.464	4.500		3.435	2.889	4.000	3.858
8/8		1.000	3.375	3.500	1.500	3.071	2.489
8/23		2.000		4.278	4.375		3.551
9/6	3.429	1.813	2.375	3.564	3.094	2.500	2.796
9/20				3.833			3.833
10/4				10.292	2.500		6.396
Grand Total	3.946	2.328	2.875	4.817	2.872	3.190	3.445
Virginia Beach, VA							

7/26			2.048			2.048
8/8	4.000	1.333	5.851	3.000		3.546
8/23	4.500	1.000	2.273	2.625	0.000	2.080
9/6		1.167	4.000	2.000		2.389
10/4			1.167			1.167
Grand Total	4.250	1.167	3.068	2.542	0.000	2.497

Table 24. The total number of crabs harvested by gear type and wave for each of the regions in the intercept survey. Catches have been expanded to reflect the number of additional hours that respondents reported intending to fish for incomplete trips.

Wave	Gear						Grand Total
	crab pot	dip net	hand	hook and line	line	trap	
All Region							
Jul 26	2468.000	53.429		513.500	64.333	417.667	3516.929
Aug 8	496.000	35.500	44.333	1161.000	70.417	33.000	1840.250
Aug 23	477.000	72.667		1423.800	22.667	78.154	2074.287
Sep 6	790.000	29.000	4.000	221.000	40.500	26.381	1110.881
Sep 20	865.000			162.333		79.200	1106.533
Oct 4	358.000	17.500		80.000	80.400	36.000	571.900
Grand Total	5454.000	208.095	48.333	3561.633	278.317	670.401	10220.780
Dorchester County, MD							
Jul 26	2413.000			71.000	11.000	417.667	2912.667
Aug 8	460.000			6.000		20.000	486.000
Aug 23	145.000	15.000		64.800		60.154	284.954
Sep 6	175.000			103.500		16.000	294.500
Sep 20	695.000			60.000		79.200	834.200
Oct 4	114.000	17.500				36.000	167.500
Grand Total	4002.000	32.500		305.300	11.000	629.021	4979.821
St. Mary's County, MD							
Jul 26				22.500			22.500
Aug 8		2.000		12.000		0.000	14.000
Aug 23	332.000	10.000		60.000	4.000	18.000	424.000
Sep 6	614.000	16.000		50.000	15.000	7.714	702.714
Sep 20	170.000			21.333			191.333
Oct 4	244.000			67.000	75.000		386.000
Grand Total	1360.000	28.000		232.833	94.000	25.714	1740.548
Gloucester County, MD							
Jul 26				69.000			69.000
Aug 8				61.000			61.000
Aug 23				124.000			124.000
Sep 6				30.000			30.000
Sep 20				80.000			80.000
Oct 4				9.000			9.000
Grand Total				373.000			373.000
Norfolk, VA							
Jul 26	55.000	53.429		336.000	53.333	0.000	497.762
Aug 8		1.000	44.333	924.000	0.000	13.000	982.333
Aug 23		0.000		0.000	0.000		0.000
Sep 6	1.000	3.000	4.000	37.500	18.000	2.667	66.167
Sep 20				1.000			1.000
Oct 4				4.000	5.400		9.400
Grand Total	56.000	57.429	48.333	1302.500	76.733	15.667	1556.662
Virginia Beach, VA							
Jul 26				15.000			15.000

Aug 8	36.000	32.500	158.000	70.417		296.917
Aug 23	0.000	47.667	1175.000	18.667	0.000	1241.333
Sep 6		10.000	0.000	7.500		17.500
Oct 4			0.000			0.000
Grand Total	36.000	90.167	1348.000	96.583	0.000	1570.750

Table 25. Average catch per trips by gear type and wave for each of the regions in the intercept survey. Catches have been expanded to reflect the number of additional hours that respondents reported intending to fish for incomplete trips.

Date	Gear						Average
	crab pot	dip net	hand	hook and line	line	trap	
All Regions							
26-Jul	61.700	4.452		4.890	6.433	17.403	18.413
8-Aug	19.077	3.550	5.542	7.036	7.824	3.300	8.071
23-Aug	20.739	6.606		17.154	1.619	7.105	14.608
6-Sep	19.750	2.417	1.000	3.157	2.132	3.298	7.261
20-Sep	34.600			6.493		8.800	18.755
4-Oct	16.273	3.500		2.222	26.800	4.500	7.728
Average	30.989	4.162	4.028	7.359	5.060	9.577	12.067
Dorchester County, MD							
26-Jul	92.808			14.200	11.000	18.985	53.938
8-Aug	20.909			1.500		10.000	17.357
23-Aug	16.111	5.000		6.480		10.026	10.177
6-Sep	8.333			11.500		8.000	9.203
20-Sep	43.438			10.000		8.800	26.910
4-Oct	9.500	3.500				4.500	6.700
Average	37.755	4.063		8.979	11.000	12.837	25.151
St. Mary's County, MD							
26-Jul				5.625			5.625
8-Aug		1.000		2.400		0.000	1.750
23-Aug	25.538	10.000		5.455	2.000	4.500	13.677
6-Sep	51.167	16.000		25.000	7.500	3.857	36.985
20-Sep	18.889			10.667			17.394
4-Oct	24.400			11.167	37.500		21.444
Average	30.909	7.000		7.761	15.667	3.673	19.127
Gloucester County, MD							
26-Jul				11.500			11.500
8-Aug				2.652			2.652
23-Aug				6.200			6.200
6-Sep				1.579			1.579
20-Sep				7.273			7.273
4-Oct				0.643			0.643
Average				4.011			4.011
Norfolk, VA							
26-Jul	3.929	4.452		4.870	5.926	0.000	4.696
8-Aug		0.500	5.542	14.667	0.000	1.857	12.128
23-Aug		0.000		0.000	0.000		0.000
6-Sep	0.143	0.375	1.000	0.962	1.125	0.667	0.848
20-Sep				0.167			0.167
4-Oct				0.308	5.400		0.671
Average	2.667	2.393	4.028	6.545	2.192	1.205	5.121
Virginia Beach, VA							
26-Jul				0.714			0.714

8-Aug	9.000	5.417	2.257	8.802		3.374
23-Aug	0.000	9.533	35.606	4.667	0.000	28.212
6-Sep		3.333	0.000	7.500		3.500
4-Oct			0.000			0.000
Average	7.200	6.440	10.531	7.429	0.000	9.756

Table 26. Average carapace width (mm) of crabs measured during the intercept survey as a function of the gear type used and the wave in which they were caught.

Wave	Gear						Average
	crab pot	dip net	hand	hook and line	line	trap	
Jul 26	263.64	288.65		309.81	240.98	247.56	278.50
Aug 8	295.11	289.97	273.80	293.01	286.06	292.05	290.35
Aug 23	279.43	281.44		281.02	276.22	288.27	280.84
Sep 6	262.60	256.34	257.63	262.82	259.61	265.25	261.58
Sep 20	248.91			249.37		252.86	249.74
Oct 4	241.55	245.79		239.75	239.86	244.94	241.42
Average	266.04	276.62	265.71	275.93	261.78	268.12	270.64

Table 27. The beginning and ending dates of waves used in the private access survey of recreational crabbing effort and catch.

Wave	Beginning	Ending
1	6/18/99	7/1/99
2	7/2/99	7/15/99
3	7/16/99	7/29/99
4	7/30/99	8/12/99
5	8/13/99	8/26/99
6	8/27/99	9/9/99
7	9/10/99	9/23/99
8	9/24/99	10/7/99
9	10/8/99	10/21/99
10	10/22/99	11/4/99
11	11/5/99	11/18/99
12	11/19/99	12/2/99

Table 28. *Distribution of trips in the private access survey of recreational potting effort in three Maryland Counties..*

Wave	Calvert County	Region		Grand Total
		Dorchester	St. Mary's	
18-Jun-99	12	7	5	24
2-Jul-99	24	4	4	32
16-Jul-99	9	2	1	12
30-Jul-99	16	20	5	41
13-Aug-99	12	19	5	36
27-Aug-99	23	20	4	47
10-Sep-99	13	17	6	36
24-Sep-99	8	18	3	29
8-Oct-99	3	7	3	13
22-Oct-99	1	10		11
5-Nov-99	1	4	1	6
19-Nov-99	1	6	2	9
Grand Total	123	134	39	296

Table 29. Catch per unit effort in the recreational pot fishing from private access sites as reported in a survey of waterfront property owners in three Maryland Counties.

Wave	Region			Average
	Calvert County	Dorchester County	St. Mary's County	
18-Jun	9.333	8.857	17.200	10.833
2-Jul	5.833	11.000	2.000	6.000
16-Jul	2.000			2.000
30-Jul	10.125	0.800	20.000	6.780
13-Aug	3.000	1.263	9.600	3.000
27-Aug	3.609	5.600	19.000	5.766
10-Sep	0.538	1.412	2.667	1.306
24-Sep				
8-Oct	1.333			1.333
22-Oct				
5-Nov				
19-Nov		1.000		0.667
Average	4.569	2.149	8.564	4.000

Table 30. Distribution of trips in the private access survey of recreational trotline effort in three Maryland Counties

Wave	Region			Grand Total
	Calvert	Dorchester	St. Mary's	
18-Jun-99	1		1	2
2-Jul-99	2			2
16-Jul-99	5	1		6
30-Jul-99				
13-Aug-99	5	2		7
27-Aug-99	9	1	1	11
10-Sep-99	7	3	1	11
24-Sep-99	2			2
8-Oct-99	2			2
22-Oct-99	3			3
Grand Total	36	7	3	46

Table 31. Catch per unit effort in the recreational trotline fishery from private access sites as reported in a survey of waterfront property owners in three Maryland Counties.

Wave	Region			Grand Total
	Calvert	Dorchester	St. Mary's	
Jun 18	108.000		18.000	63.000
Jul 2	134.000			134.000
Jul 16	47.200	140.000		62.667
Jul 30				
Aug 13	48.000	67.500		53.571
Aug 27	44.056	50.000	48.000	44.955
Sep 10	11.143	83.333	12.000	30.909
Sep 24	0.000			0.000
Oct 8	12.000			12.000
Oct 22	140.000			140.000
Grand Total	49.181	82.143	26.000	52.685

Figure 1. Participation in the recreational crab fishery estimated from the proportion of respondents in a random digit dialing survey that reported having participated on at least one occasion during the 1999 season.

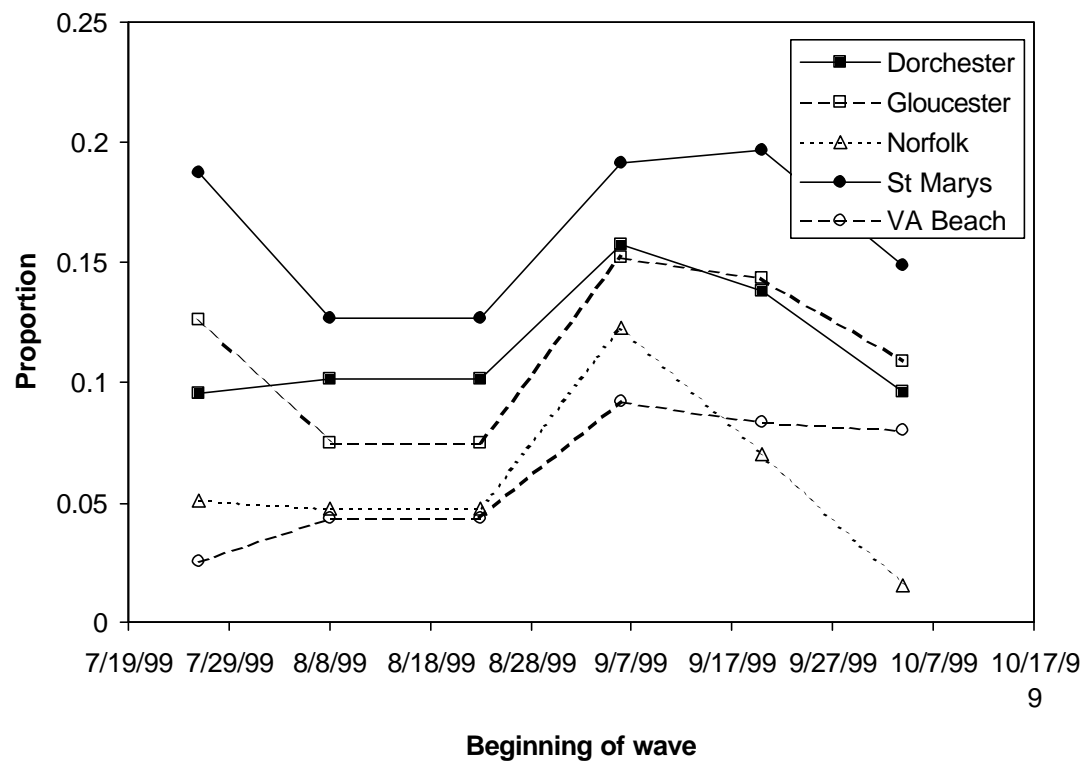


Figure 2. Participation in the recreational crab fishery estimated from the proportion of respondents in a random digit dialing survey that reported having participated during the two weeks previous to the date of the interview.

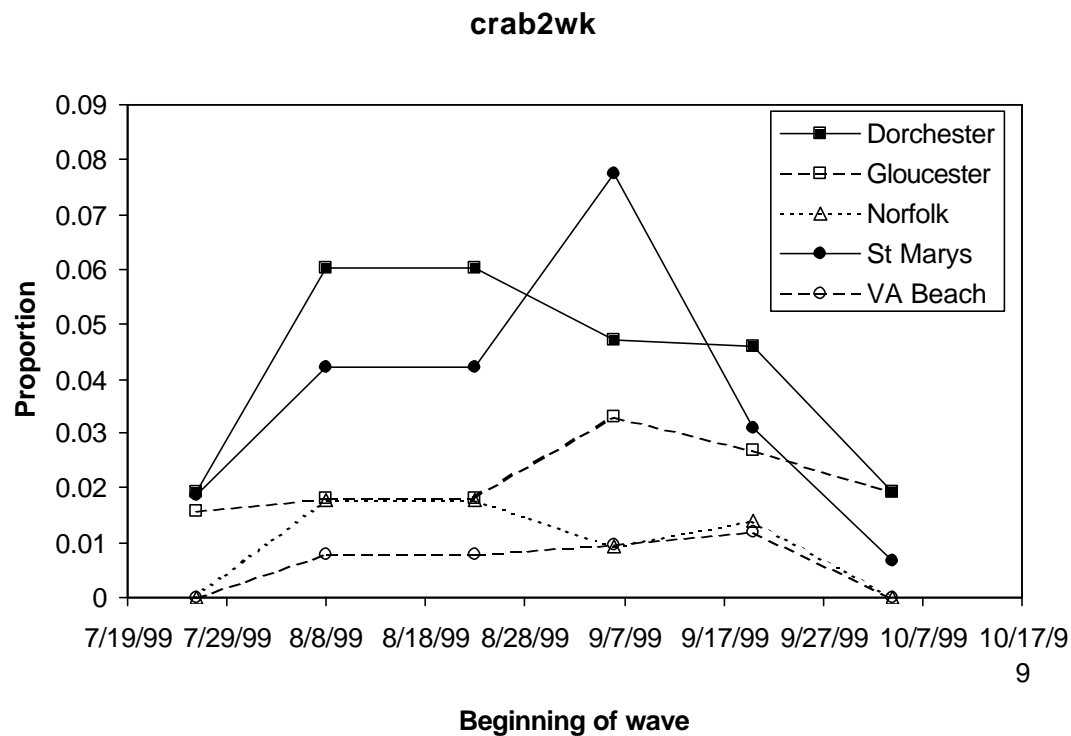


Figure 3. The frequency distribution of the number of pots used as reported in a random digit dialing survey of the recreational crab fishery in 1999.

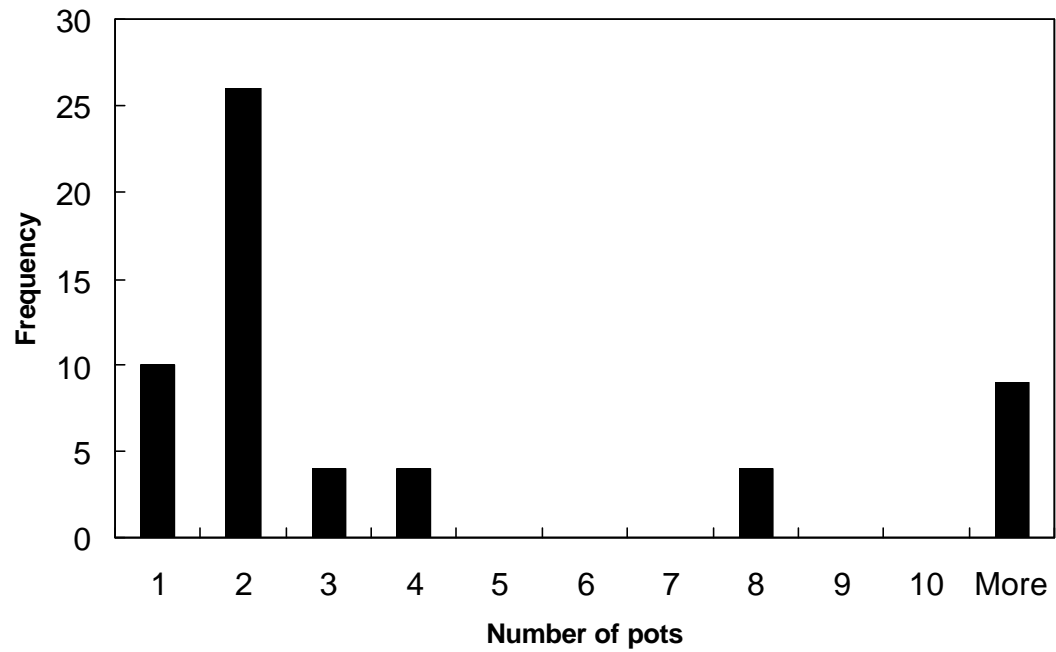


Figure 4. Frequency distributions of the number of trips by gear type based on the most recent trips by fishing gear and wave (defined by the beginning date of the wave) reported in a random digit dialing survey of the recreational crab fishery in 1999 for A) Dorchester County, MD, B) St. Mary's County, MD, C) Gloucester County, VA, D) Norfolk, VA and E) Virginia Beach, VA.

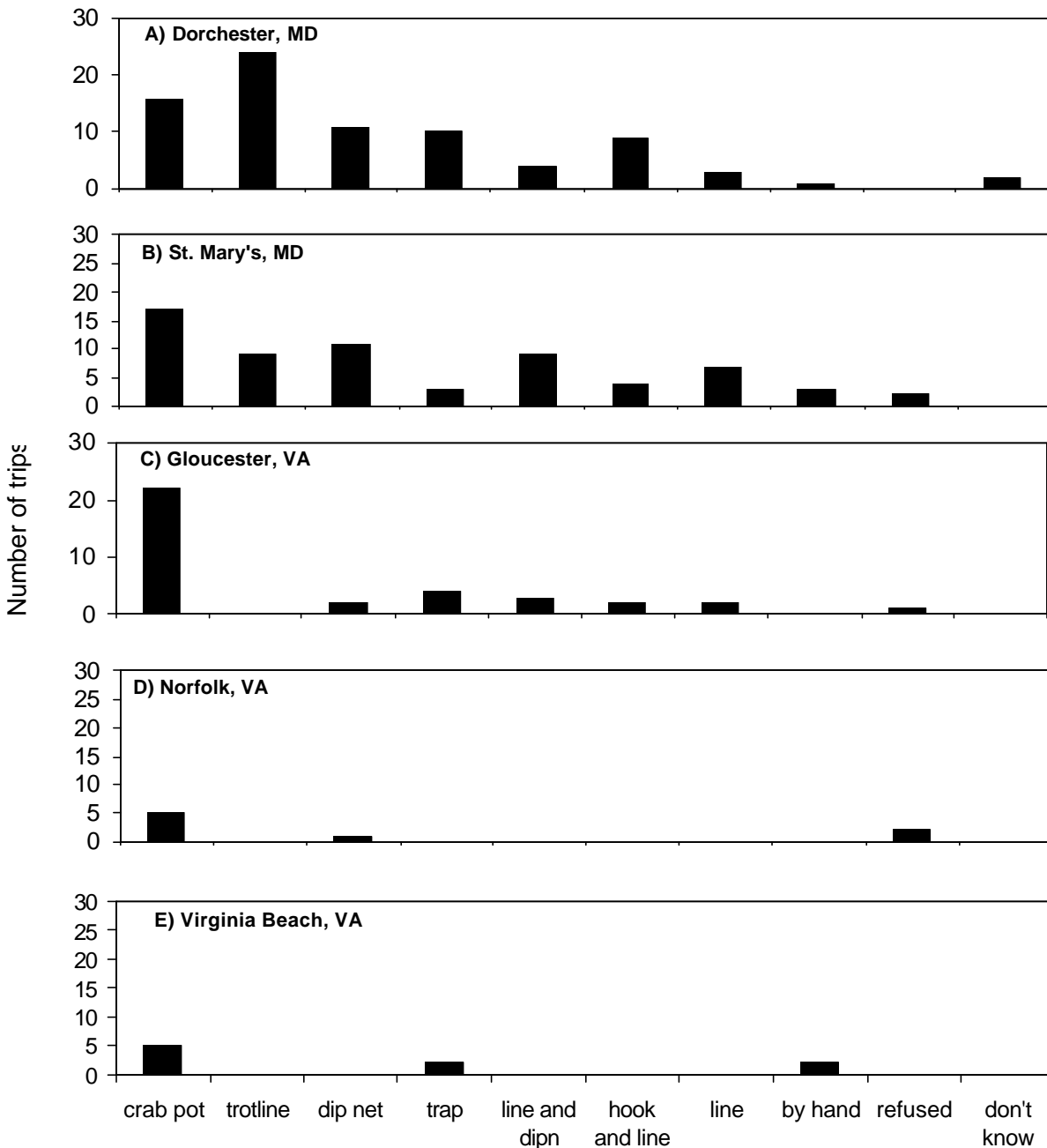


Figure 5. Frequency distributions of the number of trips by mode of access based on the most recent trips by fishing gear and wave (defined by the beginning date of the wave) reported in a random digit dialing survey of the recreational crab fishery in 1999 for A) Dorchester County, MD, B) St. Mary's County, MD, C) Gloucester County, VA, D) Norfolk, VA and E) Virginia Beach, VA.

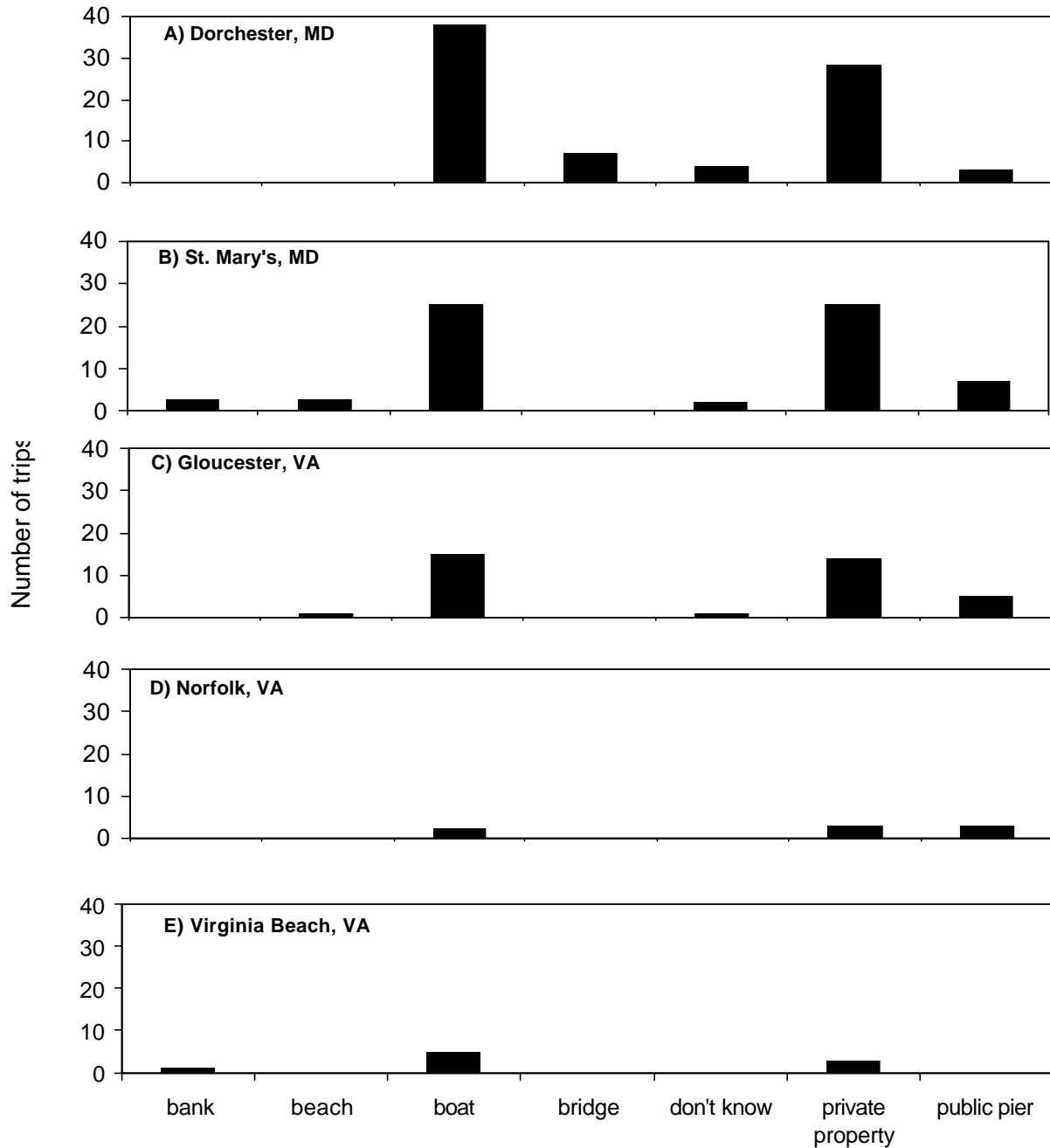


Figure 6. Frequency distribution of average catch per trip (\pm SD) based on the catch for the most recent trips reported in a random digit dialing survey of recreational crabbing activity in 1999.

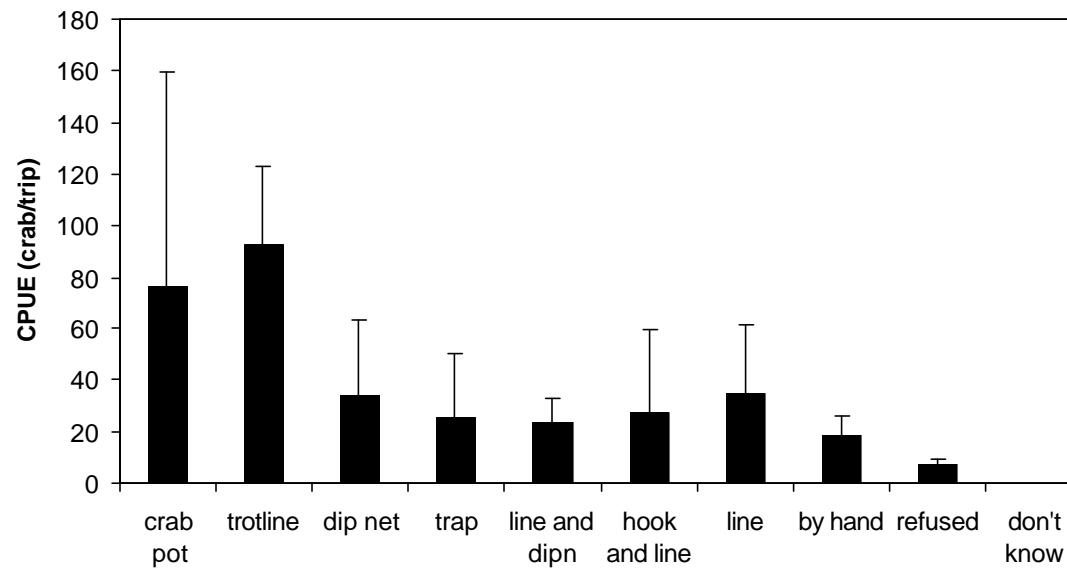


Figure 7. Frequency distributions of the average catch per trip based on the most recent trips by fishing gear and wave (defined by the beginning date of the wave) reported in a random digit dialing survey of the recreational crab fishery in 1999 for A) Dorchester County, MD, B) St. Mary's County, MD, C) Gloucester County, VA, D) Norfolk, VA and E) Virginia Beach, VA.

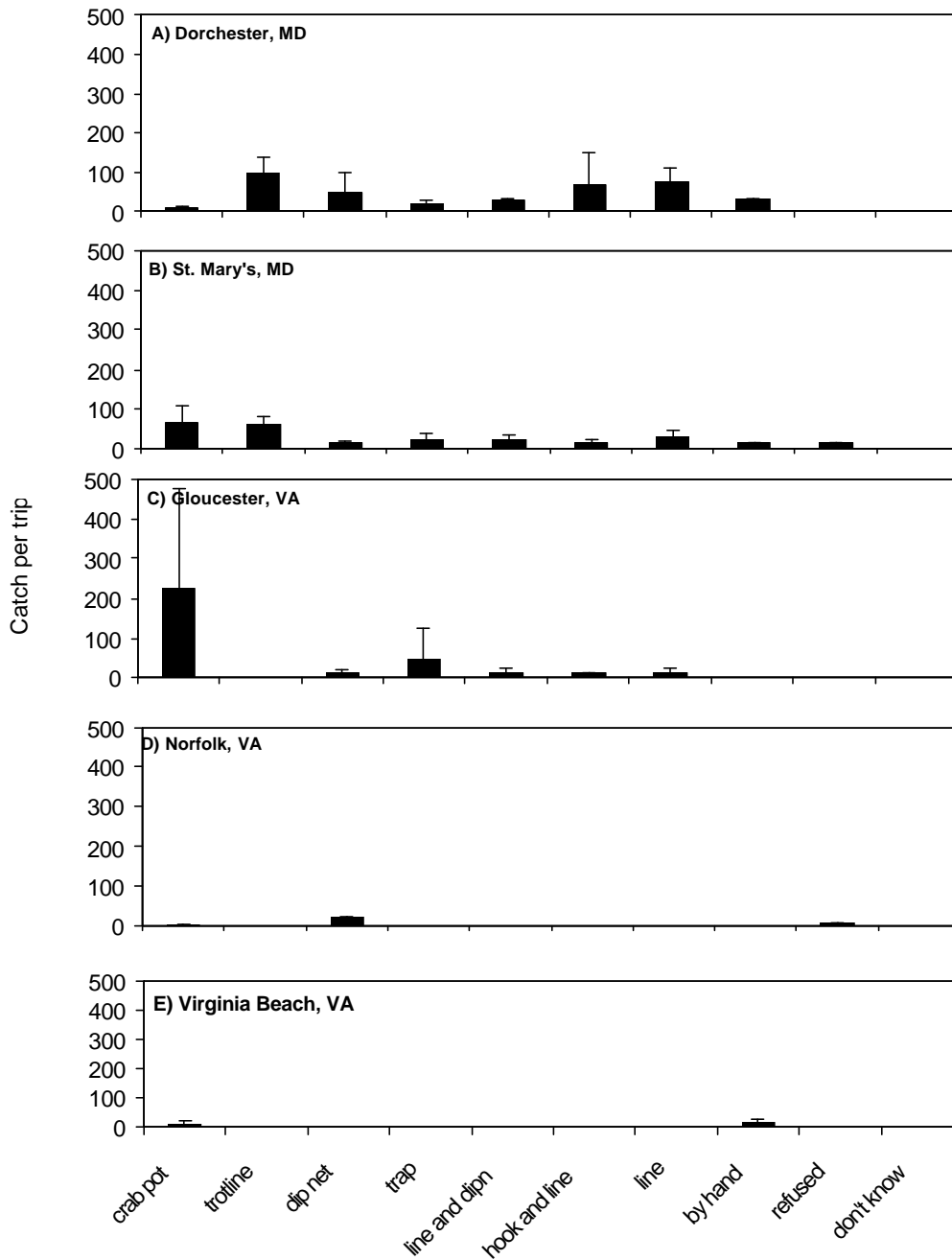


Figure 8. Catch per trip in the recreational fishery in 1999 as gaged in the intercept survey for all gear types and all regions combined.

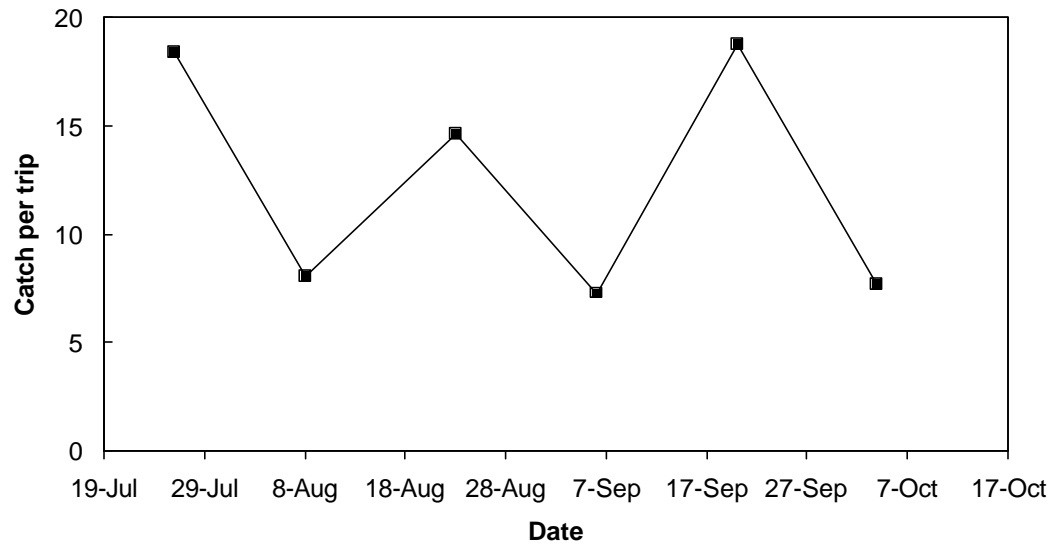


Figure 9. Average number of days fished (\pm SD) in the last 14 days by interviewees in the intercept survey of recreational crabbing activity in 1999.

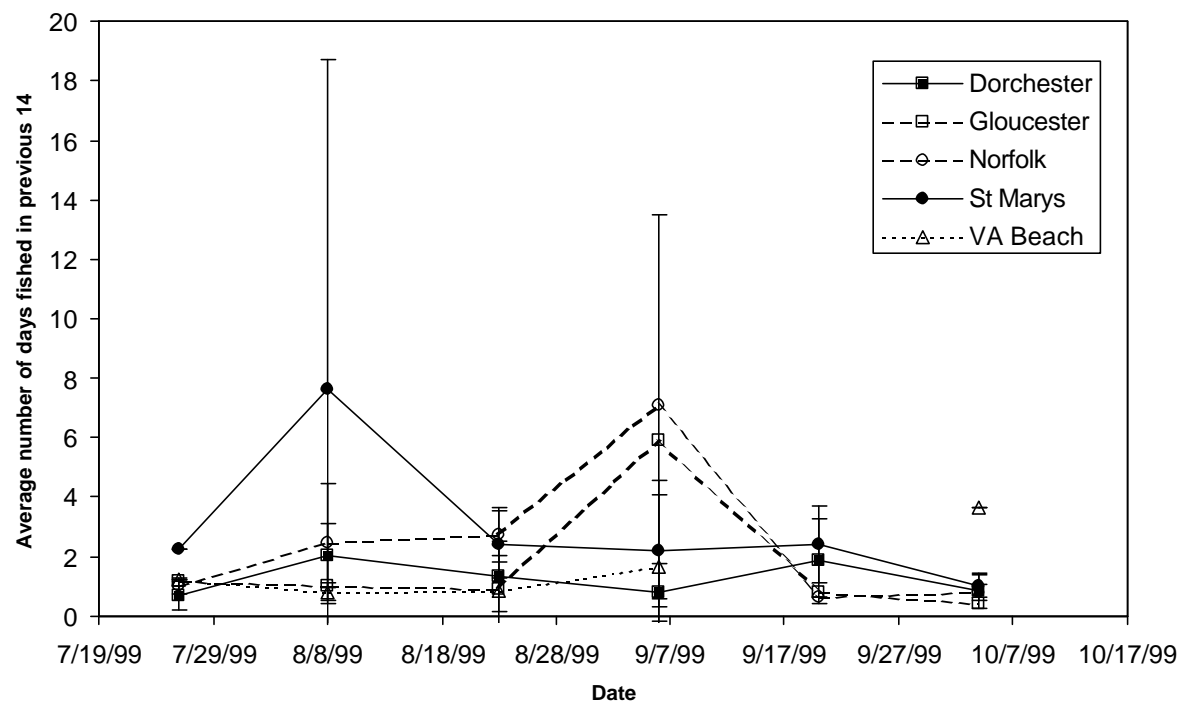


Figure 10. Frequency distribution of the number of pots fished by respondents in a survey of waterfront property owners in 1999.

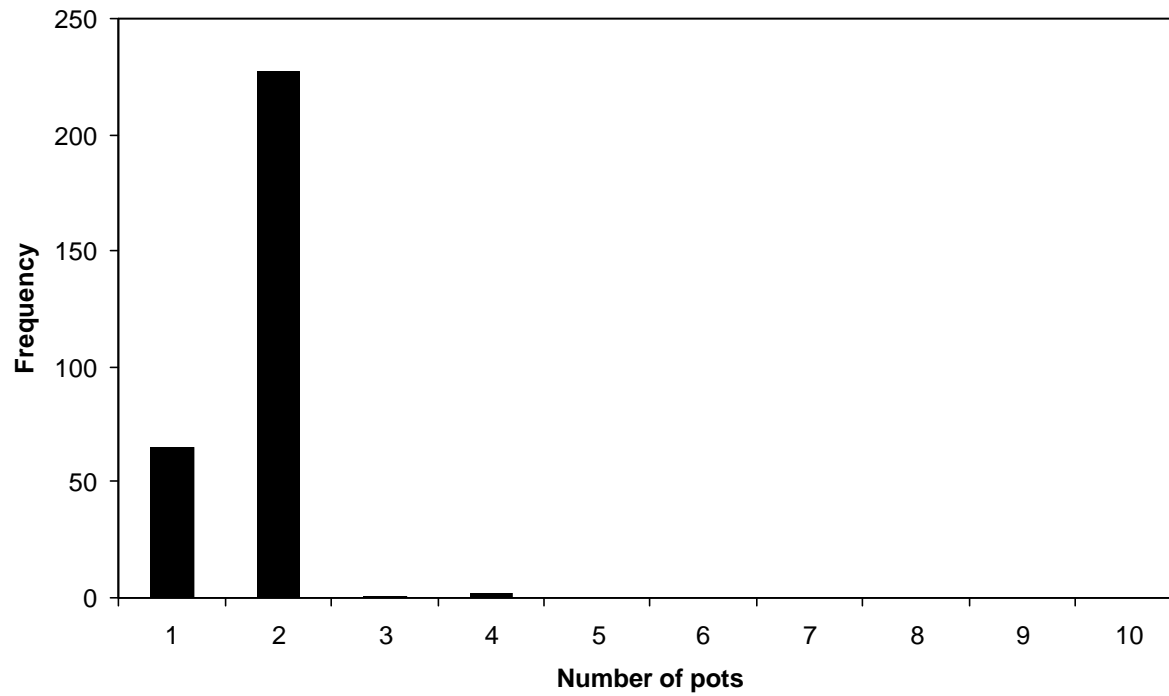


Figure 11. Frequency distribution of the number of hauls of crab pots made per trip by waterfront property owners participating in the recreational crab fishery in 1999.

