SURVEY
OF THE
SOUTH CAROLINA
SHRIMP BAITING FISHERY,
1988

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Marine Resources Division
Office of Fisheries Management
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Abstract

Information on the 1988 shrimp baiting fishery was obtained by means of a mail questionnaire sent to 5509 shrimp baiting license holders. Sport shrimpers were asked to voluntarily provide data on catch, effort, participation, boat ramp usage and locations shrimped. In addition, shrimpers were given an opportunity to comment on the season and shrimp baiting laws.

Overall response rate was 63.3%, with baiters being well represented by returns from all sectors of the legal shrimp baiting population. Estimates derived from survey returns show that 17,749 participants made 35,609 boat trips and caught 1.16 million pounds of whole shrimp during the 60-day season. The average licensed baiter caught 22.12 qts. of heads-on shrimp per trip, made approximately 7 trips during the season and had an average of 2.5 different people helping him while casting over bait.

Most of the shrimp baiting activity in 1988 took place in Charleston county (59.0%), followed by Beaufort County with 34.5%. Launch sites that received the heaviest usage were public boat ramps located adjacent to primary shrimping areas with high population densities in those two counties.

Results obtained in this survey show that both catch rate and participation were lower than estimates derived from the 1987 survey. This may have been due in part to the 48 quart catch limit, $25.00 license fee and an overall poorer shrimping season. Compared with the 1988/89 commercial shrimping season, there was roughly a 68.5%/31.5% split in the reported landing of white shrimp between commercial shrimpers and recreational shrimp baiters, respectively.

The prevalent concerns and comments voiced by shrimpers responding to the survey pertained to season length, catch limits, law enforcement, numbers of shrimp baiting poles, distance between poles and the selling of shrimp taken over bait. Another category that ranked high was the general comment that the season went well.

Acknowledgements

We would like to thank the 3472 licensed shrimp baiters who were interested and concerned enough about the resource and shrimp baiting fishery to respond to this survey. Without their cooperation and input this study could not have been accomplished.

Special thanks go to Bryan Stone, Rick Bennett, Urbie West, Bill Oldland, Greg Aiken, John Ulmer, and Ms. Pat Causby for their assistance on tasks that ranged from stuffing envelopes to coding and editing computer files. Wyatt Coon and Ms. Lourene Rigsby provided invaluable help in data processing.

We also thank Andy Applegate for providing commercial landings information and Dale Theiling for information concerning the 1987 shrimp baiting survey.
We are also grateful to Messrs. David Cupka, Charles Bearden, Dale Theiling, David Whitaker and Dr. Robert Low for their critical reviews and constructive suggestions regarding this manuscript. This study was funded in part from funds generated from the sales of shrimp baiting licenses during 1988.

Introduction

The history, suspected impact and problems associated with shrimp baiting in South Carolina have been documented in several reports and articles (Theiling, 1988; Fee, 1988; and Whitaker and Wenner 1988). Because of the increasing popularity of this activity and the undetermined impact it was having on a resource already being exploited by commercial trawling efforts, it became necessary to begin documenting various aspects of the fishery. In 1987, survey efforts estimated that 1.7 million pounds of whole shrimp were taken by sport-shrimpers casting over bait in South Carolina. This equated to approximately 29% of the entire white shrimp catch for that year (Theiling, 1988). Participation in the 1987 fishery was believed to exceed 21,700 people that utilized an estimated 6406 boats.

During 1987, a host of problems and controversy surfaced surrounding this practice. Commercial shrimpers viewed baiting as a direct assault on their livelihood and blamed baiters for reduced catches and poor prices due to illegal sales. Shrimp baiters claimed that casting was environmentally more acceptable than trawling, with little damage to the bottom and very small by-catches of other species. However, baiters were often found arguing over baiting territory and in some cases displaying shows of force to hold claim to what they considered prime shrimping areas. Recreational boaters often complained of unattended poles in the waterways, which posed a potential safety hazard and hindered navigation.

To address these problems, establish a set of rules and regulations, and document and control a rapidly expanding consumptive pursuit, the Shrimp Baiting Act of 1988 (Act No. 301) was enacted into law. This act set strict penalties for illegal baiting practices. The legislature placed a 48 quart (heads-on) per boat per day limit on shrimp catch, limited the number of poles (10) that could be used to mark bait and established set distances that could be occupied per boat for baiting purposes. A 60-day shrimp baiting season was established, and the law required at least one participant per boat to possess a state issued license and tags. With the establishment of this licensing system, it then became possible to obtain a more accurate account of participation, and a means was provided to directly access a finite population of resource users.
The purpose of this project was to document certain aspects of the 1988 shrimp baiting fishery. Three objectives were investigated:

1. To estimate the catch, effort and participation of licensed shrimp baiters using boats during the 1988 season.

2. To determine where most shrimp baiting activity took place and which boat ramps/launch sites received the most usage.

3. To obtain input from the shrimp baiting community, which may help fishery managers identify problems and needed changes.

Materials and Methods

Information on catch, effort and participation in the 1988 shrimp baiting fishery was obtained by means of a mail questionnaire (Appendices 1a and 1b). The questionnaire, with a short letter of transmittal printed on one side, was sent to all 1988 shrimp baiting license holders (5509) from 18 November to 21 November 1988, closely following the end of the 1988 season. Each questionnaire was coded with an identification number that was used to check a respondent's mailing address off a master list once the survey form was returned. Recipients were asked to voluntarily provide estimates on the number of baiting trips they had made, estimates of their overall average catch per night, general locations shrimped and boat ramps that were most often used. Shrimpers were also asked to comment on perceived problems and suggest changes that still may be needed.

A follow-up mail survey was conducted approximately two months after the initial survey. The second mail-out was sent to all nonrespondents. The follow-up served as both a reminder to nonrespondents that their input was still needed and provided a means to test the effect of nonrespondent biases on various survey parameters. The questionnaire used for the second mailing asked two additional questions concerning county of residence and age (Appendices 2a and 2b). The cover letter accompanying the second questionnaire was also changed slightly to reemphasize the importance of the survey and to verify confidentiality.

Survey forms were printed on white 70 pound offset paper. Forms and pre-stamped self-addressed No. 9 return envelopes were sent using first-class postage. The use of first-class postage and quality paper have been shown to increase return rates and improve the overall impression recipients have of the project (Linsky, 1975; Dillman, 1978).
Results

Overall Response Rate

The survey was terminated on 26 February 1989, approximately one and one-half months following the second mail-out. Three thousand, four hundred seventy-two (3472) questionnaires were returned, 2493 from the first mail-out and 979 as a result of the second mail-out (Fig 1). Several questionnaires were returned by the postal service due to insufficient address, caused in part by clerical errors. Others were returned due to a change of residency and/or letters that were refused or left unclaimed. Attempts were made to correct addresses and zip codes where possible, and these questionnaires were redistributed as part of the second mail-out; however, a minimum of 26 shrimpers never received the first or second mail-out. Based on these figures, the return rate for this survey (3472 returns out of 5483 delivered questionnaires) was 63.3%.

All returns were thoroughly scrutinized for clarity and accuracy. Returns were discarded if incomplete or if discrepancies were found. A total of 3455 returns were deemed totally or partially usable and were included in the final workup and analysis. Because this survey attempted to measure the catch of lawful shrimp baiters using boats in South Carolina, 15 respondents reporting their baiting activities had been from either a dock or shore were eliminated from further analysis. Their comments were summarized and they were included in the participation estimate as non-boating license holders. Ten (10) dock baiters that reported averaged 7.3 trips during 1988, typically were accompanied by one other helper, and caught an average of 8.6 qts. of heads-on shrimp per trip.

Nonresponse Bias

The failure of some shrimpers to return survey forms may introduce a bias into the sample if respondents do not adequately represent the total population of shrimp baiters. The overall response rate of 63.3% appears to be large enough to minimize the influence of nonresponse. To further test for the effects of nonresponse, responses from the first and second mail-out were treated as independent samples. All survey forms received on the third day following the second mail-out and thereafter were tabulated as a separate file. In actuality only 74 (7.6%) of the responses received after that date were on forms used for the first mail-out. This fact and an evaluation of the trend suggested in Fig 1 lead the authors to believe that most of the survey forms received after 16 Feb 89 would not have been returned if a second mailing had not taken place. A comparison of the main parameters of importance from the first and second mail-out and both mail-outs combined is provided in Table 1. A t-test (SAS, 1979) was used to detect the presence or absence of significant differences in catch rate, numbers of trips and numbers of people helping the licensed baiter between the first
Figure 1. Frequency of Survey Returns by Week.

- 1st MAILOUT: 657 returns
- 2nd MAILOUT: 2493 returns
- 3rd MAILOUT: 979 returns

Legend: NOV. 18, 1988 - JAN. 13, 1989
Table 1. Comparison of General Characteristics of the 1988 Shrimp Baiting Survey by Mail-out.

<table>
<thead>
<tr>
<th></th>
<th>1st Mail-out</th>
<th>2nd Mail-out</th>
<th>Statistically Significant Difference</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. Usable Returns</td>
<td>2480</td>
<td>975</td>
<td></td>
<td>3455</td>
</tr>
<tr>
<td>Number of Trips by Boat</td>
<td></td>
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<td></td>
<td></td>
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<td>Mean</td>
<td>6.96</td>
<td>7.08</td>
<td>No</td>
<td>6.99</td>
</tr>
<tr>
<td>Range</td>
<td>1-45</td>
<td>1-45</td>
<td></td>
<td>1-45</td>
</tr>
<tr>
<td>Number of Participants</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>assisting Licensed Baiter</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mean</td>
<td>2.57</td>
<td>2.33</td>
<td>Yes</td>
<td>2.50</td>
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<tr>
<td>Range</td>
<td>0-17</td>
<td>0-15</td>
<td></td>
<td>0-17</td>
</tr>
<tr>
<td>Average Quarts per Trip for the Season*</td>
<td>22.51</td>
<td>21.07</td>
<td>Yes</td>
<td>22.12</td>
</tr>
<tr>
<td>Mean</td>
<td>0-101</td>
<td>0-50</td>
<td></td>
<td>0-101</td>
</tr>
<tr>
<td>Number of times 48 qt. Limit was Reached by Baiters</td>
<td>1.52</td>
<td>1.52</td>
<td>---</td>
<td>1.52</td>
</tr>
<tr>
<td>Mean</td>
<td>0-30</td>
<td>0-30</td>
<td></td>
<td>0-30</td>
</tr>
</tbody>
</table>

* Quarts are reported as heads-on shrimp.
and second mail-out. The means appear to differ little, however, t-tests revealed significant differences between the average catch ($t_s = 2.7203$, degrees of freedom (df) = 3143) and average number of helpers ($t_s = 3.3946$, df = 3171) taken from the first and second mail-outs. Because significant differences were found between mail-outs, each mail-out was treated as a separate unit for analyses.

Residency

The county of residence for 1988 license holders is listed in Table 2, along with the frequency of returns from the first and second mail-outs. Although baiting licenses were purchased by residents from 43 of 46 South Carolina counties, residents from the 9 coastal counties purchased the majority of licenses (82.9%), with 41.2% of all licenses sold to Charleston County residents. The frequency distribution of usable returns typically followed the pattern of license sales, with little exception. Biases associated with a disproportionate response rate from a given sector of the state appear to be small and were not considered further.

It has been shown that differences in catch rate and effort may occur between various segments of the population. This may be particularly true in the case of coastal versus non-coastal residents. Data presented by Theiling (1988) suggest a difference in the mean number of trips between Category I (coastal) and Category II (non-coastal) participants. Comparisons of coastal and non-coastal responses from the 1988 survey reveal slight differences in almost every area (Table 3). Coastal residents averaged more trips than non-coastal residents, but caught less per trip than their non-coastal counterparts. T-tests show significant differences in mean number of trips ($t_s = 9.6418$, df = 3171), mean catch ($t_s = 2.0907$, df = 3143) and average number of helpers ($t_s = 4.9251$, df = 3171). Based on these findings, responses from coastal and non-coastal counties were analyzed and expanded separately.

Catch

Catch, effort and participation statistics appear in Table 4 by mail-out and residency. The overall catch and participation estimates for 1988 were derived by expanding the values in each cell and summing them. The overall mean catch/boat/season was 22.12 qts. of heads-on shrimp. Coastal residents averaged slightly less per trip than non-coastal residents. Reported catches ranged from 0 to 101 qts./night/season. One respondent admitted he consistently took 2-3 limits per night. Most shrimpers averaged 17 to 24 qts./night (Fig 2). Over forty-seven percent (47.2%) of the respondents reported catching the 48 qts./night limit at least once (Fig 3), while approximately 4.2% caught their limit every trip.

Twenty-seven (27) respondents reported that they went shrimping over bait and caught nothing. As a group, these baiters represent approximately 0.8% of the total number of
Table 2. License sales and survey returns by county of residence.

<table>
<thead>
<tr>
<th></th>
<th>License Sales</th>
<th>Survey Returns</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>#</td>
<td>%</td>
<td>First Mail-out</td>
<td>Second Mail-out</td>
<td></td>
</tr>
<tr>
<td>Coastal Counties</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Beaufort</td>
<td>568</td>
<td>10.3</td>
<td>271</td>
<td>10.9</td>
<td>103</td>
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<tr>
<td>Berkeley</td>
<td>517</td>
<td>9.4</td>
<td>206</td>
<td>8.3</td>
<td>132</td>
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<td>Charleston</td>
<td>2271</td>
<td>41.2</td>
<td>958</td>
<td>38.6</td>
<td>357</td>
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<td>Colleton</td>
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<td>119</td>
<td>4.8</td>
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<td>Dorchester</td>
<td>379</td>
<td>6.9</td>
<td>174</td>
<td>7.0</td>
<td>58</td>
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<td>Georgetown</td>
<td>134</td>
<td>2.4</td>
<td>63</td>
<td>2.5</td>
<td>22</td>
</tr>
<tr>
<td>Hampton</td>
<td>218</td>
<td>4.0</td>
<td>98</td>
<td>4.0</td>
<td>36</td>
</tr>
<tr>
<td>Horry</td>
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<td>0.3</td>
<td>9</td>
<td>0.4</td>
<td>6</td>
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<tr>
<td>Jasper</td>
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<td>3.4</td>
<td>89</td>
<td>3.6</td>
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<td><strong>Subtotal</strong></td>
<td><strong>4570</strong></td>
<td><strong>82.9</strong></td>
<td><strong>1987</strong></td>
<td><strong>80.1</strong></td>
<td><strong>801</strong></td>
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<tr>
<td>Non-Coastal Counties</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td>Aiken</td>
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<td>61</td>
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<td>1.2</td>
<td>31</td>
<td>1.3</td>
<td>13</td>
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<td>Anderson</td>
<td>9</td>
<td>0.2</td>
<td>3</td>
<td>0.1</td>
<td>1</td>
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<td>Bamberg</td>
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<td>1.5</td>
<td>43</td>
<td>1.7</td>
<td>11</td>
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<td>Barnwell</td>
<td>73</td>
<td>1.3</td>
<td>37</td>
<td>1.5</td>
<td>18</td>
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<td>Calhoun</td>
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<td>0</td>
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<td>Clarendon</td>
<td>8</td>
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<td>4</td>
<td>0.2</td>
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<tr>
<td>Darlington</td>
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<td>0.1</td>
<td>3</td>
<td>0.1</td>
<td>2</td>
</tr>
<tr>
<td>Edgefield</td>
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<td>&lt;0.1</td>
<td>0</td>
<td>0.0</td>
<td>3</td>
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<td>Fairfield</td>
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<td>2</td>
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<tr>
<td>Florence</td>
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<td>0.2</td>
<td>4</td>
<td>0.2</td>
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<td>Greenville</td>
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<td>4</td>
<td>0.2</td>
<td>2</td>
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<td>137</td>
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<td>McCormick</td>
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<td>Orangeburg</td>
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<td>106</td>
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Table 2 (cont.). License sales and survey returns by county of residence.

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<th>Survey Returns</th>
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<th></th>
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</thead>
<tbody>
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<td>#  %</td>
<td>First Mail-out</td>
<td>%</td>
<td>Second Mail-out</td>
</tr>
<tr>
<td>Non-Coastal Counties</td>
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<td></td>
<td></td>
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<td>Pickens</td>
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<td>1 0.0</td>
<td>0 0.0</td>
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<td>Richland</td>
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<td>50 2.0</td>
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<td>Saluda</td>
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<td>1 0.0</td>
<td>1 0.1</td>
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<td>2 0.1</td>
<td>1 0.1</td>
<td></td>
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<td>6 0.2</td>
<td>2 0.2</td>
<td></td>
</tr>
<tr>
<td>Union</td>
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<td>3 0.1</td>
<td>3 0.3</td>
<td></td>
</tr>
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<td>5 0.5</td>
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<td>5509 100.0</td>
<td>2480 100.0</td>
<td>975 100.0</td>
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Table 3. Comparison of General Characteristics of the 1988 Shrimp Baiting Survey by Residency.

<table>
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<th></th>
<th>Coastal Residents</th>
<th>Non-Coastal Residents</th>
<th>Statistically Significant Difference</th>
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<tr>
<td>No. Usable Returns*</td>
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<td>Number of Trips by Boat</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Mean</td>
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<tr>
<td>Range</td>
<td>1-45</td>
<td>1-30</td>
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</tr>
<tr>
<td>Number of Participants assisting Licensed Baiter</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mean</td>
<td>2.58</td>
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<tr>
<td>Range</td>
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<td>0-10</td>
<td></td>
</tr>
<tr>
<td>Average Quarts per Trip for the Season</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mean</td>
<td>21.88</td>
<td>23.13</td>
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<tr>
<td>Range</td>
<td>0-101</td>
<td>0-50</td>
<td></td>
</tr>
<tr>
<td>Number of times 48 qt. Limit was Reached by Baiters</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mean</td>
<td>1.61</td>
<td>1.17</td>
<td></td>
</tr>
<tr>
<td>Range</td>
<td>0-30</td>
<td>0-25</td>
<td></td>
</tr>
</tbody>
</table>

* For twenty (20) returns, county of residence was not obtained. These data were included as non-coastal residents. Quarts are reported as heads-on shrimp.
Table 4. Comparison of General Characteristics of the 1988 Shrimp Baiting Survey by Mail-out and Residency.

<table>
<thead>
<tr>
<th></th>
<th>1st Mail-out</th>
<th>2nd Mail-out</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Coastal Residents</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number of Trips by Boat Mean</td>
<td>7.44</td>
<td>7.43</td>
</tr>
<tr>
<td>Number of Participants</td>
<td></td>
<td></td>
</tr>
<tr>
<td>assisting Licensed Baiter Mean</td>
<td>2.65</td>
<td>2.38</td>
</tr>
<tr>
<td>Average Quarts per Trip for the Season* Mean</td>
<td>22.33</td>
<td>20.75</td>
</tr>
<tr>
<td>Number of times 48 qt. Limit was Reached by Baiters Mean</td>
<td>1.62</td>
<td>1.57</td>
</tr>
<tr>
<td>Estimated No. Active License Holders</td>
<td>3035</td>
<td>1181</td>
</tr>
<tr>
<td><strong>Non-Coastal Residents</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number of Trips by Boat Mean</td>
<td>4.99</td>
<td>5.28</td>
</tr>
<tr>
<td>Number of Participants</td>
<td></td>
<td></td>
</tr>
<tr>
<td>assisting Licensed Baiter Mean</td>
<td>2.23</td>
<td>2.04</td>
</tr>
<tr>
<td>Average Quarts per Trip for the Season* Mean</td>
<td>23.24</td>
<td>22.78</td>
</tr>
<tr>
<td>Number of times 48 qt. Limit was Reached by Baiters Mean</td>
<td>1.14</td>
<td>1.22</td>
</tr>
<tr>
<td>Estimated No. Active License Holders</td>
<td>644</td>
<td>197</td>
</tr>
</tbody>
</table>

* Quarts are reported as heads-on shrimp.
Figure 2. Distribution of the Recreational White Shrimp Catch Over Bait for 1988.

- 1988 VALUES ARE ESTIMATED AVERAGE CATCH PER BOAT FOR THE ENTIRE SEASON

N=3139
Figure 3. Number of Times Shrimpers Reported Catching the 48 Quart Limit over Bait during the 1988 Season.