

South Carolina's Blue Crab Catch & Effort System: A Fisheries Management Aid for Industry & Government¹

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ABSTRACT

During 1972, a catch and effort sampling system for South Carolina's blue crab fishery was designed in cooperation with the State's major crab processor, Blue Channel Corporation of Port Royal, South Carolina. This system is adaptable for small-business computers and generates statistics which have been used for governmental and business management.

Weekly and monthly reports are generated from the Corporation's 8-K CPU computer using data from commercial transactions and interviews with crab fishermen. The weekly reporting system consists of two programs: an edit and a listing program. The listing program generates the following weekly statistics for each fisherman: (a) number of fishing days, (b) total catch (pounds), (c) average daily catch, (d) average price per pound, and (e) total value (dollars) of the catch. The monthly program produces a listing of the following statistics by fishing location (in addition to statistics discussed): (a) type of fishing gear used, (b) average number of pots per fisherman, (c) average daily catch per pot, and (d) total number of fishermen at a given location.

INTRODUCTION

South Carolina, like other South Atlantic states, has in the past depended upon the National Marine Fisheries Services (N.M.F.S.), Department of Commerce, for information on catches, employment and gear relevant to the blue crab, *Callinectes sapidus*, fishery. The N.M.F.S. system lists the number of operating units but does not generate daily or weekly catch per operating unit. The importance of collecting daily or weekly catch per unit of effort data for commonwealth crab management has been recognized in other states (Walburg, 1960, McHugh and Ladd, 1953), and South Carolina (McKenzie, 1970). During the massive blue crab mortalities of the late 1960s and subsequent research in the South Atlantic states (Mahood, et al., 1970), standardized catch and effort data for various river systems in these states definitely would have aided in the analysis of the reported commercial catch declines.

¹Contribution No. 008 from the South Carolina Marine Resources Center. This study was accomplished in cooperation with the U.S. Department of Commerce, NOAA, National Marine Fisheries Service, Public Law 88-309, Project 2-137-D.

Tagatz (1965) and Fischler (1965) have collected daily catch and effort data through field interviews, daily logbooks and dealer receipts for 1- or 2-year periods. This type of data collection on a voluntary basis requires intense sampling and has a relatively high cost compared to only collecting at the dealer or buyer level. A compromise between the intensive sampling and the N.M.F.S. program has been initiated in South Carolina using the computer facilities of the State's major crab processor, Blue Channel Corporation (BCC), Port Royal. Besides the convenience of the computer facilities, BCC purchased nearly 61% of the crabs (live pounds) landed in South Carolina during 1972. Consequently, these data represent a major portion of the catch by commercial crab fishermen.

Blue Channel Corporation's computer is an I.B.M. System 3, Model 10¹ digital computer utilizing RPG II language. It is a small-business oriented computer with an 8,000 digit central processing unit. The data input consists of 96 column cards (cc). The data output is facilitated by these cards and a 96 character per line printer.

INPUT

For every crab fisherman account at BCC, the fisherman responsible for that account is interviewed for the following information: (a) fishing location, (b) number of operating units, (c) type of gear, and (d) number of items of gear employed. An operating unit in this case is defined as the number of different boats or tonnage vessels usually employed during a calendar month by fishermen matched to an account. These data are summarized on a 3 x 5 card (Fig. 1). The data on the cards are keypunched, forming the records comprising the crabber account master file (CMF). For example, if a fisherman reports that he works with a group account where two fishermen in two different boats empty 100 traps each for a certain location, the number of traps used by the account would be 200 and the number of operating units would be two.

When the fishermen are interviewed, they are asked to name the creek, river or sound in which most of their traps are located. Each account is assigned a location code based upon fishing location. Each location is matched with a major drainage system which is usually a sound, bay or large river. For example, in South Carolina, Broad and Beaufort Rivers are considered part of the Port Royal Sound drainage system. The location code is comprised of four digits, and the first two digits from the left represent the major location's code.

The weekly catch and days fished for a given account are derived from a typical receipt or "recap" form used in daily business transactions between the processors and fishermen. The live crabs are weighed on the plant's scale and the appropriate account is credited with the catch. Every 2 or 3 days a "recap" form with total pounds for an account and the number of fishing days is forwarded to the BCC data processing staff. This and other information (i.e., supplies purchased and price per crab pound) are used by the processor in determining the credits and debits for a given account.

¹Reference to trade names in this publication does not imply endorsement of commercial products.

ACCOUNT NUMBER						LOCATION CODE				DATE	
9	0	3	2	1	4	1	2	0	4	9-18-73	
ACCOUNT NAME										CHANGES	
J O H N S M I T H										<input checked="" type="checkbox"/>	LOCATION
										<input type="checkbox"/>	TRAPS
										<input type="checkbox"/>	GEAR
										<input type="checkbox"/>	NUMBER OF FISHERMEN
NUMBER OF POTS										NUMBER OF FISHERMEN (NOT INCLUDING HELPER)	
60										01	
LOCATION											
B E A U F O R T R I V E R											
TYPE OF GEAR (CIRCLE)										NUMBER OF VESSELS TRAWLING	
POTS - TROT - TRAWL										50 60	
110 680 205											

Fig. 1. Format of the 3 x 5 card used to compile fishing location, gear and number of fishermen (operating units) for a given crab fisherman account at Blue Channel Corporation, Port Royal, South Carolina.

OUTPUT

Weekly Report

Daily records containing catch and fishing days for an account are first edited by computer for missing information or incorrect poundage. After editing the weekly data for each account, a summarization of all accounts during the pay week is printed (Table 1), and weekly summary cards for subsequent RPG programs are prepared by computer. This procedure isolates weekly catch and effort data from the normal account programming necessary for payroll preparation.

Statistics generated in the weekly report for a given BCC account have not been adjusted for the number of operating units responsible for the account's catch and fishing days. Average daily pounds (AVG. DLY. LBS.) in the weekly listing is the quotient produced by dividing the total fishing days during the week for an account into total crab pounds reported for said account. Average daily dollars (AVG. DLY DOLLARS) are calculated in the same manner except total gross dollars for an account is the dividend. The total number of accounts in which one or more fishing days occurred (TOTAL CRABBERS) is listed near the end of the report (Table 2). Total pounds, fishing days, dollars, the average weekly pounds and dollars, average daily pounds and dollars for all accounts are summarized. Average daily pounds or dollars for all accounts are calculated by dividing the sum of calculated daily parameters for each account by total number of active accounts. Average weekly pounds or dollars for all accounts are calculated by dividing total pounds or dollars for all accounts by the total number of active accounts.

Table 1. Typical example of a weekly report listing catch (pounds), effort (days), value (dollars), and average daily statistics for accounts (fishermen) selling their commercial catch to a South Carolina blue crab processor

FROG# SCRCRB01		BLUE CHANNEL CORP., PORT ROYAL, S.C. CRAB FISHERMEN WEEKLY STATISTICS BY S. C. WILDLIFE & MARINE RES. DEPT.						PAGE 1
ACCT. NO.	NAME	FISHING DAYS	PRICE LBS.	TOTAL LBS.	AVG. DLY. LBS.	TOTAL DOLLARS	AVG. DLY. DOLLARS	
00300	JOHN SMITH	05	.110	1,826	365	200.86	40.17	
02000	SAM RIVER	03	.110	1,150	383	126.50	42.17	
02800	ROBERT NORMAL	03	.120	784	261	94.08	31.36	
50000	WILLIAM DECK	03	.120	573	191	68.76	22.92	
60100	JOHN DOE	04	.110	2,323	581	255.53	63.88	
79000	MIKE DEER	06	.110	6,204	1,034	682.44	113.74	
	TOTALS	24		12,860	2,815	1,428.17	314.24	
TOTAL ACCOUNTS		006	AVERAGE WEEKLY DOLLARS PER MAN				223.93	
AVERAGE WEEKLY LBS. PER ACCOUNT		2,143	AVERAGE DAILY DOLLARS PER ACCOUNT				52.37	
AVERAGE DAILY LBS. PER ACCOUNT		469						

Table 2. Typical example of a monthly report listing: catch (pounds), effort (days), value (dollars), average daily statistics, and operating units by fishing location for accounts selling their commercial catch to a South Carolina blue crab processor. This example shows the last page in the listing, consequently all of the accounts contributing to the final statistics are not shown

BLUE CHANNEL CRCP., FORT ROYAL, S. C.											PAGE 6
CRAB FISHERIES MONTHLY STATISTICS											MONTHLY
BY S. C. WILDLIFE & MARINE RES. DEPT.											
LOC	ACCT. NO.	TOTAL LBS.	TOTAL DOLLARS	NO. DAYS	NO. POTS	AVG DLY DOLLARS	AVG DLY LBS.	AVG DLY LBS/PCT	OPERATING UNITS		
STONO INLET											
STONO RIVER	66001	1,706	159	8	25	20	213	8.5	01		
	66052	677	71	3	25	24	226	9.0	01		
SUB TOTALS		2,383	230	11	50						
SUB AVGS.		1,192	115	06	025	21	217	8.7	02		
MAJ TOTALS		2,383	230	011	50						
MAJ AVGS.		1,192	115	006	025	21	217	8.7	02		
FIN TOTALS		529,574	54,228	1451	5,118						
FIN AVGS.		5,574	571	015	054	37	365	6.4	95		
TOTAL NUMBER OF LOCATIONS			28							93	
OPERATING UNITS											
TROT	0									TOTAL TROT-DAYS	0
TRAWLERS	0									TOTAL TRAWL-DAYS	0
TRAPPERS	95									TOTAL TRAP-DAYS	82,617

Monthly Report

After matching weekly summary cards with the appropriate CMF records, the weekly data are summarized into a monthly report. In the case of BCC, the reporting month ends on the last Wednesday in the calendar month.

The statistics listed on the monthly report are derived from the weekly summary cards and the CMF records (Table 3). As discussed previously, the monthly report or listing is organized by locations within a major drainage system. The average daily pounds and dollars for a given account or location (SUB TOTALS, SUB AVGS., MAJOR TOTALS, MAJOR AVGS.) are calculated in a manner similar to the weekly report, except that the divisor is the product of fishing days and the number of operating units responsible for the account's catch. Average catch per trap-day (AVG. DLY. LBS. POT) for an account is calculated by dividing the total pounds for the reporting month by the product of the following: number of pots employed, number of operating units, and number of fishing days during the reporting month. For a location trap-days is the sum of trap-days for each account in that location, consequently the average catch per trap-day for the location is produced by dividing the total pounds caught by traps in that location by the trap-day sum. Except for average catch per trap-day, calculation of averages and totals for a location may include days and pounds from operating units other than crab traps (i.e., trot lines and trawls). During spring when crab trawling effort is high, catches by this gear are processed separately from the trap fishermen accounts.

Table 3. Commercial Catches of St. Johns River, Florida Commercial Blue Crab Fishermen during 1962 (Tagatz, 1965) and Commercial Catches Sold to a South Carolina Processor during 1973; Expressed in Mean Pounds per Trap (pot)-Day and Number of Fishermen Trapping (parentheses)

Month ¹	Data Source		Percent ²
	Tagatz (1965)	Processor	Difference
Feb.	3.4 (16)	3.7 (11)	8.1
March	2.7 (25)	2.6 (29)	3.8
April	4.1 (36)	2.6 (22)	57.7
May	4.4 (42)	5.2 (62)	15.4
June	4.3 (55)	6.3 (105)	31.7
July	6.2 (70)	5.9 (97)	5.1
Aug.	6.5 (74)	6.8 (75)	4.4

¹ Only the months available from the South Carolina processor are presented.

² Percent difference was calculated by dividing the absolute difference between paired observations by the processor's data and multiplying the quotient by 100 percent.

DISCUSSION

Evaluation of Methods

During summer and fall some fishermen may cull 20 to 30% by weight of their catch for large male crabs to sell to buyers other than local processors. Consequently, total pounds reported for an account may be significantly less than the actual catch. This type of account can usually be detected, since the processor generally pays less for culled or graded catches.

The fishing days are days on which fishermen emptied their traps at least once; therefore, fishing days listed in BCC's weekly and monthly reports do not incorporate the effect of fishermen who empty their traps more than once during a 24-hour period. Fishermen using this technique probably do not exceed 10% of the fishermen selling their catch to BCC during summer and fall (personal observation).

The specific location may be arbitrary in some cases, since fishermen or fishing groups sometimes operate traps in more than one river. Generally, seasonal changes in fishing location are confined to a major drainage system or estuary as defined previously. Fischler and Walburg (1962) have indicated, based upon a crab tagging study, that commercial-size blue crabs do not migrate between estuaries in South Carolina; consequently, the separation of major drainage systems appears reasonable.

The crabber master file is usually updated only once a month, so daily changes in the number of traps (pots) employed by a fisherman are not known. More (1969) reported that the number of crab pots used by Texas fishermen varied with season, but he indicated "... only a slight difference between years."

The influence of the number of Lewis crab traps on mean daily catch of commercial fishermen has been examined (Rhodes, 1973). Preliminary results indicate a significant difference between mean daily catch when comparing typical trap groupings used by South Carolina fishermen; 21-40, 41-60, and 61-80. The quantity of traps employed does appear to be relevant to average daily catch; therefore, average catch per trap-day was calculated. More (1969) and Tagatz (1965) used the same method except they defined catch per trap-day as "pounds per pot-day." Due to time limitations and the present computer's capacity, no attempt was made to standardize fishing effort as Fishchler (1965) did with Neuse River, North Carolina, catches. Future analyses of the BCC and other crab dealer data will be performed with a larger computer system.

The mean catch (pounds) per trap-day ranged from 2.0 to 4.4 in seven Texas bays between 1965 and 1967 (More, 1969). During 1961 and 1962 in St. Johns River, Florida, Tabatz (1965) reported that pounds per trap (pot)-day ranged from 2.7 to 6.5 (Table 2). The BCC catches ranged from 2.7 to 6.8 pounds during February to September, 1973; therefore, the BCC data is similar to reports of other investigations.

Use of System

This system offers immediate and long term advantages to the user group: (1) it assists the plant manager in production and purchasing decisions by docu-

menting the weekly flow of raw material (blue crabs) into the plant; (2) the system generates data which would be useful in analyzing the causes of commercial crab catch declines especially in cases involving claims of toxic material damage; (3) this system has been employed in estimating commercial crab fishing activities for environmental impact statements; and (4) the long term use of the BCC and other crab data sources will be necessary for evaluation of commercial blue crab prediction methods (e.g. Dudley and Judy, 1973) and management policies. The ability to predict the availability of commercial crab stocks would probably contribute to the production efficiency of this processor-oriented fishery.

This system attempts to reduce the cost of field interviews and manual record keeping by capitalizing on the unique advantages available from Blue Channel Corporation. The programs in the system generate simple statistics which may have immediate and long term uses by the blue crab industry. Although this system will be used in conjunction with annual predictions, the generation of weekly statistics seems especially valid as the accelerating use of our commonwealth resources rapidly precipitates minor crisis.

A copy of these programs and operator instructions can be obtained from the author.

ACKNOWLEDGMENTS

A deep appreciation is expressed to all Blue Channel Corporation employees who have cooperated in organizing and maintaining this system, especially Messrs. Walter Zachowski, President, and Stanley Waskiewicz, Vice-President.

Thanks are also extended to my programmer Alan E. Hall, I.B.M., Raleigh, North Carolina, and Charles M. Bearden, Chief, OMCMS, South Carolina Wildlife and Marine Resources Department.

Dr. Paul Sandifer and Mr. Peter Eldridge, of the South Carolina Wildlife and Marine Resources Department's Research Institute, offered many useful suggestions. Mr. I. B. Byrd and Mr. Don Geagan of the Regional Office, National Marine Fisheries Service were also helpful and cooperative during the study.

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