REPORTS OF STATE ACTIVITIES
THE SHEDDING POTENTIAL IN DELAWARE

JAMES F. SALEVAN, III
Marine Advisory Service
700 Pilottown Road
Lewes, Delaware 19958

PRESENT SITUATION

Although there are no recorded landings for soft crabs in Delaware, crabs are shed within the state. At the present time, Delaware has only five small shedding operations. Of these, there are no full-time operations. One is located in the northern part of the state, two are centrally located, and two are located in the lower end of the state. Shedding tables range in number from a low of two to a high of eight. All are open systems, although a closed system will be built in the northern part of the state this spring.

Most of the shedders in the state of Delaware rely on the peeler harvest from Delaware Bay. Herein lies the major problem for those in the shedding business. Although there are quite a large number of commercial crabbers, Delaware law severely limits the type of gear that is legal for crab harvesting. Consequently, Delaware does not have a large number of crabbers that produce peelers. This leads to the real crux of the Delaware situation, the potential for crab shedding within the state.

POTENTIAL

Delaware is located centrally in the mid-Atlantic region. Based on this fact alone, the problem of peeler supply is easily overcome. Several of the largest peeler-producing areas on the Eastern Shore are less than a 2-hour drive from almost any point in the state. Peelers may be obtained from any of the following locations in Maryland: Ocean City, Crisfield, Deal Island, Cambridge, Kent Island, or Chester-town. Buying the peelers from these areas will also permit the Delaware shedder to operate at the height of the season and effectively compete in the marketplace. Buying peelers from Maryland producers will also eliminate the lag time (approximately 2 to 4 weeks) between Maryland and Delaware harvest. During the 1984 season, one Delaware shedder was able to purchase peelers at $0.30 apiece from Maryland. It is felt that this type of arrangement could be found in each of those areas mentioned above which would provide a great deal of security in the event that the peeler harvest from Delaware Bay was small.

There are many locations within the state that are suitable for shedding operations. In the lower part of the state, real estate prices are at a premium. Consequently, the middle and northern portions of the state would require less capital for startup due to the lower costs for real estate. The majority of these areas are suitable for open systems.

Delaware's location is prime for the marketing of soft-shelled crabs. In the lower part of the state, there is an extremely large tourist industry. Quite a large part of this industry is made up of restaurants and seafood markets. Many of these businesses are seasonal and are always actively searching for sources of soft-shelled crabs. In terms of wholesale marketing, shedders in Delaware are less than 3 hours away from New York, Philadelphia, Baltimore, Washington, or Norfolk. Dual highways run the length of the state making truck travel quite easy. Many airports are also in close proximity to Delaware, thereby opening the possibilities of expanding the markets to other parts of the country.
CRAB SHEDDING IN MARYLAND: REFLECTIONS -- PREDICTIONS

JOHN N. HOCHHEIMER
Engineering Specialist
University of Maryland
College Park, Maryland 00000

INTRODUCTION

Soft crabs are many things to many people. To a waterman, soft crabs might be extra income during the crabbing season. To a waterman's wife and family, soft crabs might be more work and less sleep during the summer. To a crab sheller, soft crabs are a full-time job with many sleepless nights. Soft crabs are a favorite summertime meal for many seafood fanciers and are often frozen for wintertime consumption. Many species of fish also enjoy a tasty meal of soft crab, thus, soft crabs are a widely used bait by many sport fishermen.

In Maryland, soft crabs and their purveyors, peelers, have been an important part of the blue crab fishery for more than 100 years. A good year in Maryland might produce more than 3 million pounds (approximately $14.4 million) of soft crabs. Recent years have seen dramatic changes in the shedding industry as shedding systems have evolved technologically. The future is yet, unbounded as shedding systems continue to evolve, mortalities continue to decline, and the demand for soft crabs continues to rise.

There are two predominant methods currently used in Maryland to shed crabs: flow-through and closed systems. Flow-through systems are located along shorelines and rely on nature to furnish water of acceptable quality to the shedding crabs. Water is pumped from the estuary into the shedding tanks and drained back to the estuary. High water temperatures, excessive silt and, possibly, chemical pollutants are the major water quality problems associated with flow-through systems.

Closed systems are self-contained units that use a series of filters to clean recirculating water. Most problems associated with closed shedding systems center around a biological filter which uses nitrifying bacteria to remove toxic, nitrogenous crab wastes from the recirculating water. A major advantage of closed shedding systems is the system is self-contained, therefore, it can be located anywhere the crab sheller wants the closed system. The closed system also offers control over water quality; control that is not economically possible in a flow-through system.

HISTORY OF CRAB SHEDDING IN MARYLAND

Because written history often lacks perceived minor events, the original taster of soft crabs has probably been long forgotten. To provide a brief history of crab shedding in Maryland, a time line has been drawn to graphically show the progression of events (Figure 1).

There should be little doubt that the Crisfield/Deal Island area of Maryland was and still is a major contributing force in the soft crab industry. It is said that two events in 1870 revolutionized the soft crab industry: John Landon and Severn Riggin experimented with holding hard crabs in pounds, and L. Cooper Dize patented the crabs scrape. Efforts to hold hard crabs until they molted evolved from pounds to floats placed inside of pounds for protection from wind and wave action (Warner 1976). The combination of floats for holding large numbers of peelers and scrapes for gathering large numbers of peelers blossomed into a prospering industry for those willing to work hard and gamble with Mother Nature.

Business was good in the Crisfield/Deal Island area, so good that in 1910, some 13 million soft crabs valued at approximately $2 million were sold (Warner 1976). Most of these crabs were destined for New York's Fulton Market and points beyond. The consuming public demanded fresh soft crabs and, in the early 1900s, ice was used to ensure fresh shipments of soft crabs out of Crisfield. Warner (1976) reports that after World War I, the Chesapeake Bay area was the primary supplier to Fulton Market.

Crab mortalities were high at times, but the demand for soft crabs kept the shidders going. Often as many as 50% of the peelers placed in a float died (Warner 1976). In 1938, the mortality issue was studied by Beaven and Truitt (1938) at the Chesapeake Biological Laboratory. Poor post-harvest care to peelers before placing them in floats, poor pound locations, nicking (the breaking of the tip of the claw), and the use of green crabs were among the major reasons given by Beaven and Truitt (1938) for high mortalities in shedding floats. Beaven and Truitt (1938) estimated that approximately 5 million crabs were lost in the shedding process in 1938 and concluded: "...the recent practices in the industry [crab shedding] are definitely (sp) injurious."

Around 1950, Wellington Tawes moved his floats onto land, presumably to make the job of shedding a little easier and to improve the circulation of water through the floats by pumping the water (Warner 1976). The new method was probably slow to catch on initially, as old-timers scoffed the idea. After a few brave souls made a few extra dollars, use of the method spread quickly around the area. The Handy Company in Crisfield was the first to try a large
indoor flow-through system (Warner 1976). This new method, called flow-through systems by scientific types, slowly replaced floats placed overboard and now is probably the most popular system of shedding crabs.

Science and technology had a way of creeping up on crab shedding and in the early-to-mid 1970s, another system was developed to shed crabs using the same water over and over again. The creator of closed systems remains anonymous in Maryland, but one individual, Mike Paparella, was instrumental in providing much needed information about closed-system crab shedding. Paparella (1976, 1979, 1982) wrote several fact sheets explaining the various components of a closed shedding system.

The Marine Advisory Program in Maryland initiated its soft crab project in 1982. System design parameters are being studied and continually changed as more knowledge is gained about soft crabs. Crab shedders interested in establishing or modifying closed systems have been provided with engineering assistance. Water quality monitoring and testing procedures have been established and a water quality data base has been started. This data base will be used to determine the effects of water quality on shedding mortality. In 1984, a closed system crab shedding workshop, sponsored by Maryland and Virginia Marine Advisory Programs, was held in Salisbury, MD. Over 300 interested people attended the workshop to learn about closed system crab shedding.

A final bit of history which offers an important sense of perspective on crab shedding in Maryland, especially as it is related to the activities of those in the scientific and extension communities, is landings data. Table 1 shows crab landings for Maryland compared to several other states in total pounds and dollar value of the catch. Several interesting observations can be made from these data. When prices are compared, the southern states show a decided advantage. It is easy to see why the recent interests in crab shedding are spreading throughout the south. If landings are compared, then, at least in this time period, Maryland out-produces all other states combined. In Table 2, the Maryland landings from 1970 to 1983 are shown. One must note that, in 1981, a different reporting method was used to provide better estimates of the landings.

PRESENT EFFORTS IN MARYLAND

Both flow-through and closed systems can be successful for shedding crabs profitably, but both systems suffer periodic bouts of high crab mortalities. High water temperatures and silt appear to be the lethal elements in flow-through systems. Closed systems are deadly to crabs when improperly started up. Biofilter failures due to poor acclimation, clogging, and overloading are responsible for periods of excessively high mortalities.

At the present time, soft crab work in Maryland consists of several demonstration projects by an extension specialist. Research and extension efforts in the past have been sporadic; individual; and, for the most part, limited to minimal support. This trend is slowly changing as major research and extension programs are slowly emerging. Present support to the crab shedding industry includes:

- **Water Quality Monitoring** — A water quality monitoring program was started in 1983 to establish relationships between water quality and shedding mortalities in closed systems. Dissolved oxygen, water temperature, pH, ammonia, nitrite, nitrate, salinity, total number of crabs in the system, and mortality data were collected. This program will continue so that better models of the relationships among the various water quality parameters and mortalities can be formulated.

- **Demonstration Shedding Systems** — Two demonstration
CRAB SHEDDING IN MARYLAND

TABLE 1.
Crab landings – comparison of Maryland to other states.

<table>
<thead>
<tr>
<th>Year</th>
<th>New Jersey</th>
<th>Delaware</th>
<th>Maryland</th>
<th>Virginia</th>
<th>North Carolina</th>
<th>Louisiana</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>10^3 pounds</td>
<td>$/lb</td>
<td>10^3 pounds</td>
<td>$/lb</td>
<td>10^3 pounds</td>
<td>$/lb</td>
</tr>
<tr>
<td>1970</td>
<td>18</td>
<td>0.24</td>
<td>na</td>
<td>na</td>
<td>1,179</td>
<td>0.42</td>
</tr>
<tr>
<td>1971</td>
<td>15</td>
<td>0.33</td>
<td>9</td>
<td>0.56</td>
<td>1,530</td>
<td>0.48</td>
</tr>
<tr>
<td>1972</td>
<td>15</td>
<td>0.30</td>
<td>10</td>
<td>0.80</td>
<td>1,575</td>
<td>0.48</td>
</tr>
<tr>
<td>1973</td>
<td>23</td>
<td>0.67</td>
<td>18</td>
<td>0.72</td>
<td>1,513</td>
<td>0.50</td>
</tr>
<tr>
<td>1974</td>
<td>126</td>
<td>0.42</td>
<td>73</td>
<td>0.71</td>
<td>1,822</td>
<td>0.57</td>
</tr>
<tr>
<td>1975</td>
<td>39</td>
<td>0.41</td>
<td>34</td>
<td>0.71</td>
<td>1,654</td>
<td>0.53</td>
</tr>
<tr>
<td>1976</td>
<td>90</td>
<td>0.44</td>
<td>na</td>
<td>na</td>
<td>1,474</td>
<td>0.73</td>
</tr>
<tr>
<td>1977</td>
<td>5</td>
<td>0.53</td>
<td>na</td>
<td>na</td>
<td>1,512</td>
<td>0.92</td>
</tr>
</tbody>
</table>

Average
1970–1977 41 29 1,582 808 37 121

TABLE 2.

<table>
<thead>
<tr>
<th>Year</th>
<th>Landings (10^3 pounds)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1970</td>
<td>1,579</td>
</tr>
<tr>
<td>1971</td>
<td>1,530</td>
</tr>
<tr>
<td>1972</td>
<td>1,563</td>
</tr>
<tr>
<td>1973</td>
<td>1,497</td>
</tr>
<tr>
<td>1974</td>
<td>1,812</td>
</tr>
<tr>
<td>1975</td>
<td>1,642</td>
</tr>
<tr>
<td>1976</td>
<td>1,464</td>
</tr>
<tr>
<td>1977</td>
<td>1,141</td>
</tr>
<tr>
<td>1978</td>
<td>853</td>
</tr>
<tr>
<td>1979</td>
<td>933</td>
</tr>
<tr>
<td>1980</td>
<td>1,133</td>
</tr>
<tr>
<td>1981</td>
<td>897</td>
</tr>
<tr>
<td>1982</td>
<td>3,475</td>
</tr>
<tr>
<td>1983</td>
<td>3,526</td>
</tr>
</tbody>
</table>

closed crab shedding systems have been built. One, located at Horn Point Environmental Laboratory, was built for hands-on workshops and demonstrations of closed crab shedding systems, and for use as a testing facility to validate new proposed modifications in shedding systems. Another system was built in Kent County, Maryland, to provide the northern Eastern Shore counties with a local demonstration facility. More demonstration facilities will be sought in the future, especially on the lower Eastern Shore and Western Shore of Maryland.

- **Workshops and Personal Help** – Closed system design and water quality monitoring is conveyed to interested and prospective shedders in both workshop and one-on-one settings. With the demonstration facilities providing an excellent teaching aid, many questions are answered and problems analyzed. Water quality assistance is also available for those shedders with serious system problems.

- **Biofilter Conditioning and Recovery from Failure** – Techniques are being studied to aid crab shedders in the efficient start-up of closed systems. One of the major problems in closed system shedding is the heavy mortalities associated with starting the system at the beginning of the season. Artificial conditioning methods for the biofilter could be profitable to the crab shedder by decreasing initial mortalities at a time when soft crabs typically bring a premium price. A rapid, inexpensive method of restarting a failing biofilter is also being examined. Mid-season biofilter failure can cause several weeks of high mortalities.

- **System Design Criteria** – As new design criteria become available, technology updates are compiled and disseminated to keep established and potential shedders aware of these criteria.

- **System Management** – Closed system management techniques are being developed and disseminated to crab shedders. Once a system is built, the majority of the problems associated with closed system crab shedding involve system management decisions. These include, but are not limited to: water quality testing, system startup, biofilter maintenance, peeler purchasing strategies, and marketing strategies.

**FUTURE NEEDS – PREDICTIONS**

Closed system crab shedding will continue to evolve and be refined until close to ideal shedding success is achieved. This process of evolution can only occur if there is commitment between shedders and the scientific communities. At the present time, this linkage exists, but we must nurture the bond to continue the success record of the past few years.

Several major areas come to mind when the future is pondered. System management needs to become almost cookbook, instead of guesswork. Crab shedders need to learn how to manage their systems efficiently and economically, just because it was always done a certain way does not make it cost effective. Water quality testing needs to
become a daily routine. By watching the crabs, a shedder might be able to tell that something is wrong but he can rarely tell what specifically is wrong.

The trend to closed systems will continue as increased water quality control will lead to decreased mortalities. Closed systems will become more understood and design based on factual criteria rather than best guesses will be the rule. Flow-through systems will not be totally eliminated. In fact, they too will be refined and improved. As the waters of the Chesapeake recover from the years of abuse, flow-through systems will enable shoreline locations alternate possibilities for system design.

Sometime in the near future, all of those efforts to reduce mortalities will lead to additional problems in the area of marketing. New domestic and overseas markets need to be established. Marketing strategies also need to be developed. Concurrently, quality control measures and standards need to be established from within the industry and not dictated to it.

Processing techniques must be examined to determine optimal fresh and frozen products. Storage requirements need to be analyzed so that maximum shelf life and product quality are obtained.

The future will require the collective efforts of many individuals and groups. Industry people must get together, communicate, and organize. The potential exists for the traditional shedder to modernize yet retain the individuality and the traditions most sought by the waterfront community. Researchers must also continue to exchange ideas rationally as they are today. The future of crab shedding truly looks bright and promising.

BIBLIOGRAPHY

The following is a list of soft crab literature that provide good references for those interested in obtaining more information.


Paparella, Michael. 1976. Information tips to improve the processing of seafood. Marine Products Laboratory, Crisfield, MD, and Center for Environmental and Estuarine Studies.

———. 1979. Information tips to improve the processing of seafood. Marine Products Laboratory, Crisfield, MD, and Center for Environmental and Estuarine Studies.

———. 1982. Information tips to improve the processing of seafood. Marine Products Laboratory, Crisfield, MD, and Center for Environmental and Estuarine Studies.


Sieling, Fred W. The Maryland blue crab. State of Maryland, Dept. of Natural Resources, Public Information Serv.


REFERENCES CITED


Paparella, Michael. 1976. Information tips to improve the processing of seafood. *Marine Products Laboratory, Crisfield, MD, and Center for Environmental and Estuarine Studies*.

———. 1979. Information tips to improve the processing of seafood. *Marine Products Laboratory, Crisfield, MD, and Center for Environmental and Estuarine Studies*.

THE VIRGINIA SOFT CRAB FISHERY AND ASSISTANCE INITIATIVES

MICHAEL J. OESTERLING
Virginia Marine Advisory Service
College of William and Mary
Virginia Institute of Marine Science
Gloucester Point, Virginia 23062

The Virginia soft crab fishery ranks second nationally in poundage and value behind our Chesapeake neighbor Maryland. Historically, it is difficult to separate the development of the Virginia and Maryland soft crab industries. Their parallel development is evidenced by great similarities in the soft crab fisheries of the two states. As a result, whenever the total United States soft crab industry is discussed, the production of Virginia and Maryland are frequently combined and reported as Chesapeake Bay soft crab landings.

The Chesapeake Bay states are by far the major soft crab producers. For the 5 years from 1980 through 1984, Chesapeake Bay produced on the average of about 94% of the total U.S. poundage and about 92% of the value of all reported soft crabs. By states, Maryland produces about 74% of the reported pounds, Virginia 20%, and for value, Maryland 75% and Virginia 17%.

The word “reported” must be emphasized in reported soft crab landings. The landings data for soft crabs nationwide must be examined knowing that they do not accurately represent the magnitude of the industry. Virginia is no exception to this rule. Although the Virginia Marine Resources Commission (the state regulatory agency) recognizes the value of the soft crab fishery to the state and does make an effort to obtain accurate data, due primarily to monetary constraints, it has not adequately collected soft crab landings. A case in point, Virginia landings do not include any Tangier Island production. This is thought to be a substantial amount. The majority of Tangier production is sold in nearby Crisfield, MD, and, hence, gets reported as Maryland soft crabs.

With this in mind, for the past 5 years, the reported soft crab landings for Virginia have averaged 707,000 pounds, valued at $828,000. The production in 1984 was substantially more than the 5-year average, at 872,800 pounds, valued at over $1,012,000.

Soft crabs are produced throughout tidewater Virginia and its eastern shore. However, the eastern shore has the largest shedding facilities within the state. The Virginia soft crab industry is composed of a wide spectrum of operations, running the gamut from ma-and-pa to large businesses producing over 50,000-dozen soft crabs annually. The exact number of soft crab producers in Virginia is unknown. There are minimal licensing requirements for shedding facilities and, in some cases, no licenses at all are needed.

A continuing activity of the Virginia Marine Advisory Service has been to characterize the soft crab industry and to develop better economic information about its participants.

The harvesting of peelers is the number one constraint to the development of a soft crab fishery. Virginia is fortunate in having a history of peeler capture. Within Virginia many techniques are used to catch peelers. Peelers are harvested by pots (both regular hard crab and peeler pots), by peeler pounds (a type of shore fyke), by scrapes (a modified dredge without teeth), by dip-netting off of pilings, fish pound net leads or from the bottom, and by a method known as mud-larking (collecting peelers from pools in a marsh at low tide).

Soft crabs are shed in traditional wooden in-water floats, shore-based flow-through tanks, and closed recirculating water systems. Many times these methods are used in combination or at different times of the year. Some of the largest volume soft crab producers may use as many as 125, 4- x 8-ft shedding tanks, each capable of holding approximately 300 crabs at one time.

The Virginia Marine Advisory Service has a continuing commitment towards the soft crab fishery that began before the existence of the Sea Grant program. Prior to the inception of Sea Grant, soft crab producers could receive technical assistance through the Virginia Institute of Marine Science (VIMS). With the creation of the Sea Grant program and the placement of its Advisory Service at VIMS, it was natural for the Advisory Services to assume these activities. In fact, Virginia was the first Sea Grant program to begin directly assisting the soft crab industry. The first published instructional materials on soft crab production and closed systems came from the Virginia Marine Advisory Service in the early 1970’s. Then, last year it published the most comprehensive manual on soft crab production to date.

Current Advisory Service assistance to the soft crab industry falls into two broad areas: industry encouragement and industry expansion. The main goal of these is to increase the production capabilities of the soft crab industry. Toward this goal there are four categories of activities within which there are programs: basic education; diagnostic services; shedding facility design/construction; and product promotion. All of these categories are conducted in the
broad areas of encouragement and expansion, with just the
level of information being disseminated differing.

Basic educational activities are conducted in mass
gatherings such as seminars and workshops, and on a
one-to-one basis. Seminar activities have included programs
in Virginia as well as in other states and have been sponsored
either solely by Virginia or in cooperation with other states.
With the Chesapeake Bay soft crab industry being the
pattern everyone else is trying to copy, the Virginia Advisory
Service is called upon to share its expertise with other
states.

Much of Virginia's Advisory activities fall into the one-
on-one type of information exchange. This is regardless of
whether it is encouragement or expansion activities.
Individualized assistance is provided to prospective industry
members and established producers, on such topics as
facility construction, peeler capture, facility conversions
and marketing. These one-on-one information activities
spill over to diagnostic services. Free analysis of basic water
quality parameters within shedding facilities are provided
upon request to the soft crab producer.

Because Virginia has an established soft crab fishery, a
great deal of effort has been directed toward industry
expansion and facility conversions.

For the past few years Virginia has had an active pro-
gram assisting in the installation of recirculating systems.
Virginia closed systems employ a large, single-medium
biological filter and a protein skimmer to maintain water
quality. The biological filters are generally the bottom
half of a 500- to 1000-gallon septic tank, sunk in the
ground. Within this tank are placed trays of oyster shell
which serve as filter medium and buffering agents.

Protein skimmers are constructed of PVC pipe and
require no compressed air for foam generation. By elevating
the skimmer and using an orifice venturi, gravity and
atmospheric air generate foam and redistribute water.

The efforts in closed systems have been very successful.
The Virginia Marine Advisory Service has assisted producers
in increasing their soft crab survival by using closed systems
and people without waterfront property are shedding
Crabs commercially. At this time, the largest closed system
for soft crab production is located in Virginia. This system
has 81, 4 X 8-ft shedding tanks, with three biofilters and
three protein skimmers.

Even though Virginia has been successful in establishing
viable closed system production facilities, assistance efforts
continue. There are three areas in which there are currently
ongoing projects with recirculating systems. The first of
these is the fine tuning of the biological filters, looking at
such things as optimum size, configuration and medium
type. Along with this are activities dealing with the problem
of shock loading. The number of peelers caught in Ches-
apake Bay from one day to the next can fluctuate widely
and quickly. This means that the number of peelers added
to a closed system can change overnight from a few hundred
to a few thousand. This tends to overwork the biological
filter bacteria, decreasing their efficiency.

In the development of closed system crab shedding
there have been questions as to the need for protein
skimmers. Unfortunately, the effectiveness of skimmers
has never really been documented. Another project hopes
to identify how useful protein skimmers are for maintain-
ing water quality within shedding systems.

In somewhat of a departure from other programs, there
is a project promoting nontraditional use of shedding
systems. The Virginia shedding season only lasts from April
to November, leaving almost 6 months that shedding
facilities are unused. An exciting activity is the work on
rock crabs (Cancer irroratus) shedding. Rock crabs shed
during winter, a time when traditional soft crab producers
are idle. Through the efforts of the Marine Advisory Service
soft rock crabs are now being shed commercially in Virginia.
While the aforementioned manual on shedding did contain
a chapter on rock crabs, there will be a separate publication
on soft rock crab production available in the next few
months.

The United States may no longer be the only producers
of soft crabs. Our neighbors to the south, Mexico and
Central America, have been actively trying to develop a
soft crab fishery. When these areas enter into soft crab
production, they most likely will look to established
markets to sell their product. If past experiences with
other seafood items hold true, this means the United
States. For Virginia's industry to maintain its superior
market position, more emphasis must be placed on the
production and promotion of high quality soft crabs.
Additionally, the development of new markets and
marketing strategies must be pursued. Soft crabs are being
aggressively promoted domestically and overseas through
the efforts of the Virginia Marine Products Commission,
two fishery development foundations, the Virginia Marine
Advisory Service and private individuals.

The Virginia Marine Advisory Service and other agencies
offer a complete program for the soft crab industry,
providing assistance in every facet of the fishery from
initial production to final marketing.
NORTH CAROLINA SOFT CRAB INDUSTRY

C. WAYNE WESCOTT
Area Marine Specialist
N. C. Marine Resources Center
Manteo, North Carolina 27954

The soft crab industry in North Carolina has definitely had its ups and downs over the years. Although no one is sure just when the soft blue crab was first harvested and sold commercially, NC landings are recorded as far back as 1897. These landings were relatively stable from 1900 until the early 1950's with the exception of a bumper year in 1928 (629,000 pounds). In the late 1950's, emphasis shifted to the hard blue crab and continued through the 1960's and 1970's. Soft crab production fell drastically during those years with a low of 16,000 pounds recorded in 1977. It should be noted that the North Carolina Division of Marine Fisheries compiles landings statistics from landings of peelers that pass through crab dealers. Because most of the soft crab production in North Carolina is directly from the crabber to the shedder, recorded landings are grossly understated. However, recorded statistics were gathered in the same manner each year, therefore overall trends are reflected.

In the late 1970's, a few local soft crab shippers had very profitable years and an interest in soft crabs was rekindled. Recorded landings rose from 16,000 pounds in 1977 to 166,000 pounds through July 1984. Profits from the sale of soft crabs continued to be good and the fishery is continuing to expand. More and more local fishermen, dealers and private citizens wanted the latest information about peeler harvesting methods, peeler identification, soft crab shedding facility design, packaging and marketing.

In 1981, North Carolina's Sea Grant program, through the marine advisory personnel, began to gather soft crab information from local shippers, researchers, other state shippers, and their advisory people to meet the information needs of North Carolina. Before that time, information requests were usually handled by arranging appointments with existing shippers who, in turn, would answer the questions. Today, the interest in shedding crabs and the request for information has grown so large that all of the North Carolina commercial fishery agents are somewhat knowledgeable about the subject and one Area Marine Specialist dedicates 50% of his time exclusively to the soft crab industry.

Today in North Carolina the soft crab industry is on the rise. Crabbers use dip nets, trotlines, crab pots, peeler pots, onts pots, trawl nets, bushlines, and peeler pounds to harvest soft crabs and peelers. The peeler pot and peeler trawl are the most productive, however, in some areas, they are ineffective and the other types of gear must be used to harvest peelers.

Many shedders both catch peelers and buy them from commercial crabbers who supplement their incomes from hard crabs by selling the incidental catches of peelers. Some crabbers reap profits exclusively from peeler sales for a short 2- to 3-week season during the major or first run. Most of these peelers are shed in flow-through systems, but floating and closed or recirculating systems are also successful. In 1984, the fresh well-water, temperature-controlled recirculating systems were built and show excellent potential. This system permits the shedding of soft crabs early in the year because the water in the system can be warmed. Also, this system reduces mortality later in the summer because the water can be cooled. Both electrical and solar heating devices are used to warm the water and adding additional ground water is used to cool the system. Frequent dilution of the system prevents buildup of toxics resulting in low peeler mortality.

Before 1980, North Carolina's Sea Grant personnel distributed some printed materials and arranged site visits with existing shippers. Since that time, however, demand has necessitated the development of a more comprehensive soft crab program. Grants have been issued to study problems of crab mortality and alternative harvesting gear. Slide shows have been developed depicting peeler harvesting gear, identification, facility design, packaging and marketing of both live and frozen soft crabs. A Guide to Soft Shell Crabbing has been written and distributed to over 3,000 people. A number of local presentations, workshops, and regional seminars have been conducted and requests for information warrant their continuation.

Presently North Carolina's Sea Grant program is continuing research into causes of peeler mortality, effects of artificial grass within existing peeler pots, and the success and profitability of the fresh well water recirculating shedding system. Also, because more peelers are caught in crab pots than any other type of gear and returned to the deep because they are too small to sell as hard crabs, educating the hard crab fisherman is a must. This will provide the crabbers with substantial additional income and, at the same time, increase the availability of peelers and, thus, profits to the shedders.

In 1984, Dare County alone produced over 225,000 pounds of soft crabs and landings of hard crabs were not
impaired. We plan to share the latest research and technology with the other coastal communities of North Carolina where soft crab shedding is underutilized. We know that peelers are present, crabbers exist and numerous shedding sites are available. Development of the soft crab industry in central and southern North Carolina is our goal. Also, to improve the efficiency of existing soft crab facilities is a continuing endeavor.
SOFTSHELL CRAB INDUSTRY IN SOUTH CAROLINA

JACK M. WHETSTONE AND JOHN L. KEENER, JR.
South Carolina Sea Grant
P.O. Drawer 1100
Georgetown, South Carolina 29442

HISTORY

Production of softshell crabs has been documented in South Carolina since the 1930's. A peak production of 9,000 pounds was reported in 1936, but production steadily declined to 400 pounds in 1957 and no production was reported again until the late 1970's. The decline of the softshell crab industry coincides with an increase in hard crab landings with the introduction of crab pots to the South Carolina fishery in 1955. Hard crab production has continued to increase while softshell crab declined to a small incidental portion of the commercial hard crab fishery and no shedders operated.

In 1979 interest was again generated in shedding operations through two regional workshops in Charleston, SC, in 1977 and 1979. Production has increased to 10,000 pounds in 1984 exceeding the previous peak of 1936. Production has fluctuated in the period from 1979 to 1984 due to inconsistencies in shedding operations entering and exiting the industry.

In 1984, 13 licenses for softshell crab operations were issued and 10,000 pounds of softshell crabs were produced, valued at $50,000.

One major operator accounts for the majority of the production and has plans to remain in operation.

All of South Carolina's four major blue crab processing plants have been engaged in softshell crab production at some time during the past decade. No plant has maintained a sustained shedding operation. South Carolina crabmeat processors must utilize crabs with a legal size of 5 inches or greater; therefore, crab shedding is reduced due to the inherent biological reduction in molting as size increases.

No closed systems have been utilized in commercial production. Areas are available for shoreside facilities with good water quality and only flow-through systems or in-water systems (cages) have been utilized in South Carolina.

LICENSING AND PERMITS

Individuals entering the softshell crab shedding industry are required to obtain city, county and state business licenses and to conform to zoning requirements where applicable.

The South Carolina Wildlife and Marine Resources Department's Regulatory Section requires the appropriate individual land and sell and/or wholesale seafood dealer's license.

Shedding operations must also obtain a $75.00 one year permit renewable July 1. This permit entitles operators to catch, take, or transport peeler crabs or shed peeler crabs for the purpose of obtaining softshell crabs.

Shedders can then obtain, free of charge, Identification Cards to issue to individuals employed by the shedder to catch and transport peeler crabs to the shedding operation.

The Marine Resources Division and department law enforcement officers have the authority to inspect the business premises of shedding operations.

The division has the authority to specify: (1) the area from which peeler crabs may be caught or taken by gear other than crab pots; (2) the types of gear or fishing equipment used to take peeler crabs; (3) catch reporting requirements; (4) boat identification requirements; and (5) any other provisions the division deems necessary to carry out the provisions of this section.

First offense convictions are considered misdemeanors and carry a fine of $200.00 or imprisonment for 30 days. Second offense convictions allow for permit suspension for 30 days and any boat, equipment and rigging engaged in the taking of peeler crabs under permit suspension will be confiscated and sold upon conviction.

RESEARCH AND EXTENSION ACTIVITIES

In 1977 and 1979 regional workshops of softshell crab production were held in Charleston, SC. Workshops included individuals representing the commercial industry, regulatory agencies, seafood processing specialists, and Extension representatives.

A 3-year project funded by Coastal Plains Regional Commission was conducted by the South Carolina Wildlife and Marine Resources Department from 1979 through 1981. The project's major objectives were: (1) to provide information on peeler crab availability, distribution and abundance; (2) to establish effective and pragmatic techniques for capturing peeler crabs; and (3) to demonstrate a shedding operation in South Carolina.

Results of the project were: (1) peelers are available in commercial quantities but are not concentrated in any areas; (2) brushlines did not work for collecting peelers; (3) pounds worked, but tidal amplitude made them impractical; (4) peeler pots worked well for the spring run; (5) habitat pots made of plastic strips weaved through pot mesh captured both male and female peelers, and catch was consistent but low in numbers; and (6) crabs can be
shed in South Carolina successfully with good survival. Marine Extension work has been directed towards individual technical assistance. Spread sheet analysis of shedding operations has been conducted for interested individuals.

CURRENT PROBLEMS AND RESEARCH NEEDS

A meeting of shedding operators in South Carolina was held in December 1984, and the problems and research needs voiced by industry were: (1) South Carolina crabbers as a group have not maintained as high an image in the commercial fishing community as their counterparts in such states as Virginia and Maryland; (2) peeler supply to shedding operations is the major problem in maintaining a sustained industry in South Carolina; and (3) any research should be directed towards peeler crab harvesting gear taking into account the increased tidal amplitude and lack of eelgrass in South Carolina.

SOUTH CAROLINA SOFTSHELL CRAB LITERATURE


Office of Conservation, Management, and Marketing, South Carolina Wildlife and Marine Resources Dept., Charleston, SC.


SOFT SHELL CRAB FISHERY IN GEORGIA

TOM SHERLING
University of Georgia
P.O. Box Z
Brunswick, GA 31521

Prior to 1970, commercial soft crab production in Georgia was virtually nonexistent. The first successful shedding facility was established on Wilmington Island near Savannah in 1970. This was a flow-through system with a shallow well pump supplying water to 12 tanks which were made of concrete block.

The success of this facility created interest in soft crabs, but problems such as the cost of waterfront property, labor, high summertime water temperature, and inability to maintain a steady supply of peelers soon discouraged most crab fishermen. Two hard crab processing plants tried shedding crabs in the mid-1970's, but similar problems caused them to abandon the project.

In 1981, Marine Extension staff members set up a closed system at a local crabber's house in Brunswick. This system was an improvement over the flow-through system, because it let the crabber move the system away from high-cost waterfront property and close to home for ease of checking the peelers.

Because maintaining a steady supply of quality peelers is the key to having a successful shedding operation, Marine Extension staff members have directed considerable effort towards more productive harvesting techniques. We have tried scrapes, bushlines, and peeler pots with little or no success. Methods used in the Gulf and Chesapeake Bay do not work very well in Georgia where 6- to 9-foot tides are common.

In 1981, Marine Extension staff members conducted a study comparing seven different trap designs. Four were habitat traps, a Chesapeake peeler pot, and a standard hard crab trap. Trap 1 was a reduced habitat trap, 2 ft x 2 ft x 14 inches, with two throats, no baffle, no baitwell, and was constructed of 1.5-inch vinyl-coated crab pot wire. This trap had artificial "grass" tied in the bottom. The artificial grass was polypropylene string used in the manufacture of indoor/outdoor carpeting. Trap 2 was a habitat tray, 2 ft x 2 ft x 4 inches, constructed of 1-inch vinyl-coated baitwell wire with artificial grass tied in the bottom; one-quarter-inch line was tied at each corner and connected to form a four-point bridle. Trap 3 was a Maryland habitat pot which is the standard pot used to catch peelers in the Chesapeake Bay area. It was made of 1-inch galvanized baitwell wire. Trap 4 was a peeler pot, 2 ft x 2 ft x 17 inches, made of 1-inch baitwell wire with four throats, a baffle, and a compartment replacing the baitwell to hold 2 to 4 mature male crabs. Trap 5 was a standard, 2 ft x 2 ft x 17-inch, crab trap with two throats, a baffle, and baitwell. It was made of 1.5-inch vinyl-coated crab pot wire with strips of visqueen woven through the meshes on all four sides. Traps 6 and 7 were standard 2 ft x 2 ft x 17-inch hard crab pots made of 1.5-inch galvanized pot wire. One was used unbaited and the other was baited with Atlantic menhaden (Brevoortia tyrannus). All habitat traps were fished unbaited. The peeler pot was baited with two adult male crabs.

Results showed the reduced habitat trap to be the best producer of ripe peelers. The standard baited trap caught more peelers, but most were white line and it was not feasible to hold them.

Requests for assistance in starting new shedding facilities increased each year. We have assisted in setting up four new systems in the past 3 years, and have helped solve problems in several established facilities.

A closed recirculating system, with a protein skimmer, is being set up at the Brunswick lab. When completed it will have ten 3 x 8 x 1-foot fiberglass tanks housed in a 20- x 30-foot building. Possible projects at the facility include using different types of filter material and holding white line peelers until they shed. Chesapeake Bay shidders already do this with some success. We have about a 10 to 1 ratio of white-to-ripe peelers caught in our hard crab pot and need to find a way to take advantage of their abundance.

In the past, nearly all of the soft crabs produced in Georgia have been shipped out of state. We plan to work with local retail seafood dealers and restaurants to promote soft crabs locally.

Shedders in Georgia produced over 22,000 pounds of soft crabs in 1984, valued at over $28,000.
STATUS OF THE FLORIDA SOFT CRAB FISHERY

SCOTT ANDREE
Marine Extension Agent
Sea Grant Extension Program
Perry, Florida 32347

HISTORICAL PRODUCTION AND VALUE

The Florida soft crab fishery is relatively young when compared to the Chesapeake Bay fishery. Soft-shell blue crab production had been attempted many times in Florida, but few operations were successful and virtually none continued for more than a couple of years. A true commercial fishery for soft crabs did not begin until the mid-1950's following an experimental shedding project at Punta Gorda, FL, in 1953 (Young 1955). However, commercial operations in Florida did not generate any significant production until the 1960's. At that time, shedding operations were centered in southwestern Florida (Charlotte Harbor) and in the Panhandle (Apalachicola Bay).

Historically, production has varied drastically from year to year with an extreme slump period from 1968 to 1977 (Table 1). Since 1978, there has been a marked increase in production, with a record of 53,567 pounds reported in 1982 (National Marine Fisheries Service [NMFS] statistics). Production averages for the 1960's, 1970's and 1980's were 5,169, 3,645 and 30,863 pounds per year, respectively.

During the period from 1960 to 1982, exvessel price averaged $0.65 per pound (Table 1). However, in 1983 the exvessel price jumped to $2.22 per pound, with a small decline in production. This trend continued into 1984. The total exvessel value of this fishery in 1983 was reported to be nearly $80,000 (NMFS statistics). Unfortunately, the reported exvessel value combined the price paid to crabbers for premolt (peeler) crabs as well as the price received by those crabbers that produced the actual soft crab product before selling. For that reason, the inflated price per pound in recent years may only reflect that more crabbers are shedding crabs before selling them.

SEA GRANT EXTENSION ACTIVITIES

Florida Sea Grant involvement with the soft crab fishery began in 1978 with basic advisory service consultations and an intensive review of the literature and fishery as it existed nationwide (Otwell and Cato 1982). Early clientele interest was focused primarily in the St. John's River (northeastern Florida) and the Crystal River (central gulf coast) areas. This interest initiated a demonstration shedding project at Palatka, FL, using floats in the St. John's River during 1979. The demonstration project culminated in several publications and fact sheets (Otwell 1980, Otwell et al. 1980, Otwell et al. 1981), which were disseminated during a series of workshops held around the state from 1980 to 1983. These workshops (14 total) were held in the major blue-crab producing areas, including Apalachicola, Cross City, Crystal River, Punta Gorda, Palatka, and Fernindina Beach, reaching more than 400 interested persons. The number of soft crab shedding operations jumped markedly from one-half dozen in 1978 to near 30 by the end of 1982, resulting in the corresponding increase in production as previously noted. By 1983, Florida had become fifth nationwide in reported production of soft crabs (Table 2).

With the increased interest in soft crabs in Florida, several problem areas became evident that required further attention, in particular, shedding mortality and peeler harvest. To address the mortality issues a closed system demonstration project was started in 1983 at Punta Gorda, FL. Technology utilized in other states, particularly protein skimmers and biological filters, were incorporated to improve water quality in the shedding tanks, thereby decreasing shedding mortality. Preliminary results have been very encouraging and a Sea Grant report will be forthcoming. Consistent supply of peeler crabs has also been a constant problem for this fishery in Florida, and a peeler pound (or bank trap) demonstration project was initiated in 1984 near Ft. Myers to adapt this type of gear to Florida gulf coast habitats. Trap designs were patterned after those used in the Chesapeake Bay fishery, with modifications made to suit the extremely shallow slopes of the estuaries of southwestern Florida. This project is ongoing with a report expected by the end of 1985.

In addition to the demonstration projects, questions concerning the nutritional and microbial attributes of fresh soft crabs were examined, particularly in relation to shelf-life and handling requirements (Otwell and Koburger 1985).

DESCRIPTION OF THE FISHERY: A SURVEY

Florida Sea Grant, having been involved in the development of the Florida soft crab fishery since 1978, decided that an evaluation of the status of this fishery was necessary to determine to what extent Sea Grant Extension activities would be needed to further its development. To that end, this author, in cooperation with Florida Sea Grant marine extension agents and specialists, conducted a survey of the 1983 soft crab producers. Out of 28 identified blue crab shedding operations known to be producing soft shell
TABLE 1.

Total annual landings and value of soft blue crabs in Florida, 1960–1984

<table>
<thead>
<tr>
<th>Year</th>
<th>Total Pounds (Shedded)</th>
<th>Total Value ($) (Exvessel)</th>
<th>Value/Pound ($) (Exvessel)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1960</td>
<td>4,550</td>
<td>2,275</td>
<td>0.50</td>
</tr>
<tr>
<td>1961</td>
<td>5,511</td>
<td>2,756</td>
<td>0.50</td>
</tr>
<tr>
<td>1962</td>
<td>375</td>
<td>188</td>
<td>0.50</td>
</tr>
<tr>
<td>1963</td>
<td>4,200</td>
<td>2,100</td>
<td>0.50</td>
</tr>
<tr>
<td>1964</td>
<td>15,063</td>
<td>7,230</td>
<td>0.48</td>
</tr>
<tr>
<td>1965</td>
<td>12,643</td>
<td>9,229</td>
<td>0.73</td>
</tr>
<tr>
<td>1966</td>
<td>1,030</td>
<td>288</td>
<td>0.28</td>
</tr>
<tr>
<td>1967</td>
<td>7,487</td>
<td>4,171</td>
<td>0.63</td>
</tr>
<tr>
<td>1968</td>
<td>325</td>
<td>130</td>
<td>0.40</td>
</tr>
<tr>
<td>1969</td>
<td>504</td>
<td>186</td>
<td>0.37</td>
</tr>
<tr>
<td>10-yr avg.</td>
<td>5,169</td>
<td>2,910</td>
<td>0.49</td>
</tr>
<tr>
<td>1970</td>
<td>451</td>
<td>248</td>
<td>0.55</td>
</tr>
<tr>
<td>1971</td>
<td>35</td>
<td>14</td>
<td>0.40</td>
</tr>
<tr>
<td>1972</td>
<td>152</td>
<td>147</td>
<td>0.97</td>
</tr>
<tr>
<td>1973</td>
<td>0</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>1974</td>
<td>281</td>
<td>169</td>
<td>0.60</td>
</tr>
<tr>
<td>1975</td>
<td>2,106</td>
<td>1,664</td>
<td>0.79</td>
</tr>
<tr>
<td>1976</td>
<td>235</td>
<td>193</td>
<td>0.82</td>
</tr>
<tr>
<td>1977</td>
<td>205</td>
<td>242</td>
<td>1.18</td>
</tr>
<tr>
<td>1978</td>
<td>23,659</td>
<td>28,368</td>
<td>1.20</td>
</tr>
<tr>
<td>1979</td>
<td>9,328</td>
<td>5,031</td>
<td>0.54</td>
</tr>
<tr>
<td>10-yr avg.</td>
<td>3,645</td>
<td>3,608</td>
<td>0.71</td>
</tr>
<tr>
<td>1980</td>
<td>16,866</td>
<td>12,228</td>
<td>0.73</td>
</tr>
<tr>
<td>1981</td>
<td>22,631</td>
<td>14,530</td>
<td>0.64</td>
</tr>
<tr>
<td>1982</td>
<td>53,567</td>
<td>51,741</td>
<td>0.97</td>
</tr>
<tr>
<td>1983</td>
<td>35,908</td>
<td>79,878</td>
<td>2.22</td>
</tr>
<tr>
<td>1984</td>
<td>25,343</td>
<td>70,070</td>
<td>2.76</td>
</tr>
<tr>
<td>5-yr avg.</td>
<td>30,863</td>
<td>45,689</td>
<td>1.46</td>
</tr>
</tbody>
</table>

1Source: National Marine Fisheries Service, Statistical Department, Southeast Fisheries Center, Miami, FL.
2Value computed from reported total value data.
3Estimated from partial NMFS statistics

TABLE 2.

Florida soft crab fishery – 1983.

<table>
<thead>
<tr>
<th>Crab Size</th>
<th>Carapace Width (inches)</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Whales</td>
<td>&gt; 5.5</td>
<td>44.0</td>
</tr>
<tr>
<td>Jumbos</td>
<td>5.0 – 5.5</td>
<td>34.5</td>
</tr>
<tr>
<td>Primes</td>
<td>4.5 – 5.0</td>
<td>11.6</td>
</tr>
<tr>
<td>Hotels</td>
<td>4.0 – 4.5</td>
<td>2.5</td>
</tr>
<tr>
<td>Mediums</td>
<td>3.5 – 4.0</td>
<td>7.0</td>
</tr>
<tr>
<td>Smalls</td>
<td>&lt; 3.5</td>
<td>0.3</td>
</tr>
<tr>
<td>Fresh</td>
<td></td>
<td>7.0</td>
</tr>
<tr>
<td>Frozen</td>
<td></td>
<td>93.0</td>
</tr>
</tbody>
</table>

Remainder of this paper will be the findings of that survey.

**Shedding Operations**

Being a relatively young fishery, the experience level of the Florida producers was low as seen in the average number of years in business (3.75 years). Approximately three persons operate an average shedding facility in Florida and use about 16 wooden table tanks (4 ft x 8 ft x 8 in. box on legs) to hold their premolt crabs (peelers) to await their molt (shedding). Only two shedders interviewed utilized anything other than table tanks, that being cement tanks of varying dimensions. These were not preferred due to their expense in manufacturing and the difficulty experienced in sorting crabs from such systems.

The type of water-flow systems utilized are almost equally distributed among open, flow-through systems (36.4%), completely closed, recirculating systems (31.8%), and semi-closed systems (31.8%). The latter of which are open systems modified to act as a closed system for short periods of time.

Filter systems ranged from none (19%) to high-tech bio-disk filters with protein skimmers. The most common filter was simply some form of physical filtration (screens, foam rubber, spun glass, etc., 66.7%), followed by biological filtration (47.6%). Generally, physical and biological filters were combined (47.6%). Other forms of filtration used were protein skimmers (9.5%) and algal filters (9.5%).

**Harvesting Methods**

In general, 3 to 4 crabbens supplied peeler crabs to each shedding facility (mean, 3.45). Florida's peeler crab fishery has remained primarily a nondirected fishery with 85% of the soft crab operations acquiring some or all of their peelers incidental to traditional blue crab catch, using standard blue crab traps. However, many crabbens were beginning to use directed gear, such as peeler traps [baited with large male crabs (jimmies) or unbaited] and peeler pounds (bank traps). It was common to find a combination of trapping methods being used (70% of the operations), because most producers had trouble getting enough peelers to shed and needed to acquire them in as many ways as possible. In most cases, the operations that produced soft crabs consistently were ones in which the operator directly fished for peeler crabs.

The season for peeler crab harvest in Florida, as in other states, is controlled by environmental and biological parameters rather than by regulation. Generally, the season begins by mid-March, with a 4- to 6-week peak in April and May. A summer lull period occurs in July and August, followed by a short fall peak in September. One soft crab shedding facility did continue operations throughout the year in 1983, but most shutdown by the end of October.

**Product Types**

Six size grades of soft crabs are produced in Florida.
Almost 80% of the product is in the largest two size classes, whales and jumbos (Table 2). The other grades are primes, hotels, mediums and smalls.

The bulk of Florida's soft crabs were marketed frozen (93%). The remaining fresh product (7%) was marketed early in the season prior to the onset of the Chesapeake Bay run (generally by mid-May) and/or to local restaurants and retail seafood markets.

Production

The majority of the soft crabs were produced on the western coast of Florida, with the Big Bend region from Apalachicola to Cedar Key accounting for 45.4% of the 1983 production (48,070 lbs, Figure 1). Based on the survey results, the total soft crab production in Florida for 1983 was 105,969 pounds. This value is almost three times the reported production of 35,908 pounds according to NMFS statistics (Table 3). This was expected because a large percentage of Florida's production is from small-scale backyard operations run by individual crabbers. These operations are difficult to identify and to obtain data from by NMFS port agents. Nevertheless, the survey results do indicate that the soft crab fishery in Florida is much larger than previously estimated.

<table>
<thead>
<tr>
<th>State</th>
<th>Pounds</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maryland</td>
<td>3,525,591</td>
<td>79.7</td>
</tr>
<tr>
<td>Virginia</td>
<td>657,847</td>
<td>14.9</td>
</tr>
<tr>
<td>Louisiana</td>
<td>101,497</td>
<td>2.3</td>
</tr>
<tr>
<td>North Carolina</td>
<td>87,570</td>
<td>2.0</td>
</tr>
<tr>
<td>Florida</td>
<td>35,908</td>
<td>0.8</td>
</tr>
<tr>
<td>Georgia</td>
<td>11,251</td>
<td>0.3</td>
</tr>
<tr>
<td>South Carolina</td>
<td>3,691</td>
<td>0.1</td>
</tr>
<tr>
<td>Combined Alabama, Mississippi, Texas, and Delaware</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>4,423,355</strong></td>
<td></td>
</tr>
</tbody>
</table>

**Economics**

Soft crabs are sold by the dozen in Florida, as is the case in most states. Prices received per dozen varied throughout the year, depending upon supply and size. Average price-per-dozen ranged from $7.00 per dozen for smalls to a high of $24.00 per dozen for whales. Taking into account the number of dozen produced in each size class, the average price-per-dozen received overall was $13.93 (approximately $4.64 per pound), with total Florida sales at the wholesale level reaching nearly $476,000 in 1983.

Expenditures to operate the facility included rent or mortgagge, electricity, labor, supplies and miscellaneous. These expenses average $275.00 per month.

**Future Development Needs**

Three areas of need were commonly pointed out by soft crab producers during the survey. These were: (1) maintaining a consistent supply of peelers, (2) reducing shedding mortality, and (3) improving marketing. As stated earlier, Florida Sea Grant has begun to address mortality and peeler supply issues, although published information is not yet available. Technology and information from other soft crab-producing states has been distributed to producers upon request or during individual consultations to assist them with problems of these kinds. Concerning marketing, Florida Sea Grant has not taken an active role, leaving this area up to the industry itself and the Florida Department of Natural Resources, Bureau of Marketing and Extension. However, to educate potential buyers as to where soft crabs may be found in Florida, a soft crab producers list for Florida has been published since 1982 and is available from the Florida Sea Grant Extension Program.

Future Sea Grant involvement in this fishery will be devoted mainly to advisory services and individual consultations to improve efficiency of the already existing operations and encourage directed effort to the harvest of peeler crabs. Any future workshops would be focused on these specific topics. In addition, a possible in-depth economic analysis of this fishery has been discussed as a future project.

**REFERENCES CITED**


<table>
<thead>
<tr>
<th>REGION</th>
<th>POUNDS</th>
</tr>
</thead>
<tbody>
<tr>
<td>PANHANDLE</td>
<td>2,664</td>
</tr>
<tr>
<td>BIG BEND</td>
<td>48,070</td>
</tr>
<tr>
<td>CENTRAL GULF</td>
<td>21,930</td>
</tr>
<tr>
<td>SOUTHWEST</td>
<td>20,070</td>
</tr>
<tr>
<td>SOUTHEAST</td>
<td>105</td>
</tr>
<tr>
<td>NORTHEAST</td>
<td>13,130</td>
</tr>
<tr>
<td>TOTAL</td>
<td>105,969</td>
</tr>
</tbody>
</table>

Figure 1. Florida soft crab production, 1983.
SOFT-SHELL CRABS IN ALABAMA

RICK WALLACE
Alabama Sea Grant Advisory Services
3940 Government Blvd., Suite 5
Mobile, Alabama 36609

The soft-shell crab fishery in Alabama is very low keyed and the catch is mostly incidental to hard crab fishing activities. A few crabbers have small flow-through systems or in-water floats to hold a limited number of crabs for shedding. No statistics are kept on soft-shell crab production and the total volume is unknown.

Workshops on producing soft-shell crabs in 1980 and 1981 sponsored by the Alabama Sea Grant Advisory Service, with the help of the Alabama Department of Conservation and Natural Resources, Marine Resource Division and Harriet Perry of the Gulf Coast Research Laboratory (Ocean Springs, MS), inspired a few interested persons to build closed systems for shedding crabs. Two of these are still active and one may be reactivated in the near future.

Research and workshops, sponsored in part by the Mississippi-Alabama Sea Grant Consortium, in Mississippi and Louisiana during 1983 and 1984, sparked renewed interest for soft-shell crab information in Alabama. This led to two successful Alabama Sea Grant Advisory Service workshops with the help of Louisiana State University researchers and Harriet Perry. A survey of workshop participants indicated that 60% thought they could run a profitable, soft-shell crab business based on the information received at the workshop. Another 21% felt that maybe they could make a profit. Following these workshops, 16 people were interested enough to participate in a Sea Grant Advisory Service-sponsored field trip to see the soft-shell crab operation of Mr. Cultus Pearson in Louisiana. One participant has built a small closed system for the upcoming season and another is considering starting a major operation.

Existing producers and potential producers expressed concerns about monitoring water quality in closed systems. In response, the Alabama Sea Grant Advisory Service obtained water-quality testing equipment to further assist the development of the soft-shell crab industry. The availability of the equipment and personnel have been widely publicized in the fishing community.

Some workshop participants, after further consultation with the Advisory Service, felt that the supply of shedder crabs was too unreliable in Alabama to warrant a major investment. Indeed, with little or no tradition for sorting out peeler crabs and a relatively small crab fishery in the first place, the supply of peeler crabs is the major constraint to developing a large soft-shell crab industry in Alabama.

Despite these problems, the possibility of a small, successful soft-shell crab industry in Alabama remains a reality if the operators can establish good working relationships with existing crabbers or train new ones to provide a reliable supply of peeler crabs. The Alabama Sea Grant Advisory Service will continue to aid the development of the industry through workshops, publications, water-quality testing, and individual consultations.
As in other states harvesting the blue crab, traditional methods of shedding became less successful as coastal water quality declined. In the Gulf of Mexico, where crab fishermen are often limited by the availability of peelers, commercial viability is dependent on a high ratio of shedding success.

In 1974, concerted efforts began in Mississippi to develop a closed, recirculating-seawater system in which to shed crabs. The initial research was conducted by Harriet Perry, of the Gulf Coast Research Laboratory (GCRL), Ocean Springs, and Mr. Lee Seymour, a commercial crab shedder of Biloxi, MS. This was the first effort, to my knowledge, to develop a closed, commercial-scale recirculation system for holding and shedding crabs. By 1979, Seymour had a successful production system in operation which was producing 60- to 90-dozen soft shell crabs per day.

In the late 1970’s, Perry, along with Larry Nicholson and John Ogle, both of GCRL, began working with Mr. Cultus Pearson of Lacombe, LA. Pearson is a commercial crab fisherman who at that time was shedding crabs in an open system and also using holding pens in Lake Pontchartrain, LA. During the next two years, Pearson, Perry, Nicholson, and Ogle designed and implemented a closed, recirculating system that operated successfully for several years. Recognizing the potential value of and the tremendous interest in this fishery, the Sea Grant programs of Mississippi, Alabama and Louisiana began a multi-agency multidisciplinary project to establish production levels and operating parameters for closed systems currently in use in the fishery, and to investigate design changes to increase filter efficiency and carrying capacity. As a result of the 1982–83 effort, management guidelines for operating closed systems were developed and engineering-design changes increased filter efficiency with a subsequent increase in carrying capacity.

In 1984, the Louisiana effort was directed toward filter design, with research in Mississippi looking into the effects of ammonia and nitrite accumulations on blue crab shedding success. Funding of this project by the Mississippi-Alabama Sea Grant Consortium (MASGC) provided the engineers with data necessary to design a more efficient, economical filtration system. The development of these closed, commercial-scale, recirculating-seawater systems to hold and shed peeler crabs allowed for expansion on the industry independent of coastal water quality. Thus, the supply of peeler crabs became the major limiting factor in the growth of the fishery along the Gulf.

With this in mind, research efforts turned to development of technology to provide a consistent supply of peelers. A project conducted by GCRL with the support of the Mississippi Bureau of Marine Resources reviewed all available literature concerning systems design in an effort to develop a closed, recirculating system in which to hold intermolt blue crabs until shedding signs were visible. A publication from that study is now available entitled, Closed Recirculating Seawater Systems for Holding Intermolt Blue Crabs: Literature Review, Systems Design, and Construction.

In a study recently funded by the Mississippi-Alabama Sea Grant Consortium, Harriet Perry (GCRL) and Dr. John Freeman of the University of South Alabama will be studying the use of 20-hydroxyecdysone to initiate proecdysis in intermolt blue crabs. If a commercially acceptable technique to initiate pre-ecdysis is developed, it would assure a more constant supply of peelers to the soft-shelled crab producer.

With continued cooperative efforts, such as those described above, the soft-shell crab industry has the potential of becoming a valuable fishery in both the Gulf and Atlantic states.

Although Mississippi presently does not support a major soft-crab fishery, the early research efforts and ultimate success of the closed, recirculating-seawater system for shedding crabs developed in this state have done much to move the industry forward.

The Mississippi Cooperative Extension Service, Marine Advisory Program, continues to work closely with all research agencies to keep abreast of developments in the fishery and to distribute information as it becomes available.
STATUS OF THE LOUISIANA SOFT SHELL CRAB FISHERY

JERALD HORST
Associate Area Agent (Fisheries)
Louisiana Cooperative Extension Service
Louisiana State University Agricultural Center
1825 Bonnie Ann Drive
Marrero, Louisiana 70072

Louisiana, unlike the other Gulf states, has a long and successful history of commercial soft-shell crab production. Heavy production has been centered in four coastal parishes. Approximately two-thirds of the state’s production has historically come from Orleans, St. Tammany and northern Jefferson parishes which border on Lake Pontchartrain. Virtually all of the production from this area is marketed directly by the producer to the final consumer or restaurant. Because the National Marine Fisheries Service collects its landing information from wholesalers, this area’s production is almost completely unrecorded.

The remaining one-third of Louisiana’s production has, in the past, come from lower Jefferson Parish in the Barataria estuary. Much of this production moves through the hands of wholesalers and crab brokers and has been recorded.

This area, which is the best monitored area of the state for soft-shell crab production, has unfortunately exhibited the least increase in production. The fishery in this area is with bush lines, a method very successful there but no where else. Every crab caught with bush lines sheds within three days and because water quality in the shedding area has not degraded significantly, all the fishermen use float cars. Because the philosophy of the Marine Advisory Service is to promote the simplest successful method and to “not fix something if it isn’t broken,” we have not advocated the use of closed or open circulating systems here.

The areas of the state in which the efforts of the Marine Advisory Service have been most notable are the traditional soft-crab shedding area around Lake Pontchartrain mentioned earlier, and in the south-central portion of the state where soft-crab production has not taken place previously.

The parishes bordering Lake Pontchartrain have increasingly had to rely on medium technology systems (open circulating systems) and even more on high technology closed systems than ever before. The reasons for this change include urban sprawl which eliminates waterfront sites and degrades water quality which, of course, hampers production.

In this area, approximately 50% of the crab shedders have abandoned the use of float cars as their primary means of shedding crabs in the last three years. About one-half of these people use closed systems and the other one-half use open systems. In addition, the number of new crab shedders around Lake Pontchartrain has increased 15 to 20% in the last three years. Virtually, all of these people use closed systems. The technology which has made this possible has its roots in Mr. Cultus Pearson’s pioneering work, additional Sea Grant research, and the educational effort of the Marine Extension agents.

Float cars have not been completely abandoned, however, by most users of circulating systems. Some shedders use them to hold their green crabs (white sign) and for emergency overflow when they blow a system up or they catch too many peelers.

Some crabs have reported a 25% decrease in mortality after switching from float cars to closed systems. Some crabs have also reported real success stories with aeration of their filter beds, a recommendation based on research conducted by Dr. Ron Malone of Louisiana State University.

The other area of the state where the Marine Advisory Service has impacted the development of the soft-shell crab industry is the central portion: Lafourche, Terrebonne, St. Charles, and St. Mary parishes, where commercial soft-shell crab production has never before occurred. Here, not only have some crabs begun shedding crabs, but crabmeat factories have begun grading their hard crab catch for peelers. Almost all of these shedding use closed systems. The mortality rate is, of course, higher for crabs graded and shed at crab factories, but it has proven to be economically feasible.

One final method of crab production which is beginning to take hold is the shedding of crabs onboard shrimp vessels in open-recirculating systems. A shrimp boat can easily produce $500 worth of soft-shell crabs during a one-week shrimping trip.

The Marine Advisory Service has taken both a one-on-one and a mass-education approach in disseminating shedding technology information to users. Each May for the past two years, we, in conjunction with the Mississippi-Alabama Sea Grant Consortium and the Gulf Coast Research Laboratory (Ocean Springs, MS) have sponsored a soft-shell crab shedding workshop in Lacombe, LA. Attendance has been over 300 people each year. Current plans are to continue this program. In addition each of the 10 extension agents in the state provides hands-on assistance in constructing crab shedding systems for fishermen.
The Louisiana Sea Grant Program in conjunction with the Mississippi-Alabama Sea Grant Consortium has funded and is continuing to fund practical research projects at Louisiana State University. Research has included improving the efficiency of biological filters, alkalinity and salinity parameters, and microcomputer monitoring systems.

Research projects this year will be to examine salinity, temperature and light parameters in conjunction with hormone treatments to accelerate or synchronize shedding and the manipulation of physical parameters alone to synchronize shedding.

Another effort will involve the construction and operation of three closed systems built at 8% scale as demonstration units to be placed in high schools in coastal parishes. The purpose of this effort is to expose the technology of the system to young people who may be entering the fishery after high school.
SOFT-SHELL CRAB FISHERY IN TEXAS

CHARLES G. MOSS
Texas Agricultural Extension Service
Sea Grant Program
Texas A&M University System
Angleton, Texas 77515

Description or definition. Is there a significant difference? To describe the industry requires the use of the negative of activity, i.e., torpidity, comatose, hebetude, inappetency and stupor.

To define the industry requires the opposite of existence, i.e., nonexistent, null, void, or nil but not defunct, absent, lost or exhausted, which implies previous life.

Prior to the 1980's, the preceding statements are substantially accurate. Crab shedding in Texas was left to nature and the crabs. Any crab so unfortunate to shed while in the confines of a pot was summarily cannibalized which explained the excess carapaces (and the cursing crabber cried, "Why do they always eat the big ones?"). Shrimp fishermen found limp delicacies in their tows and promptly placed them on ice for future consumption. Any soft crab on the menu was supplied from the east coast and most probably from Crisfield, MD.


Impetus to develop an industry in Texas began with the Blue Crab Subcommittee of the Gulf States Marine Fisheries Commission and Harriet M. Perry of the Gulf Coast Research Laboratory (Ocean Springs, MS).

In 1981–82, Don Reynolds, Galveston County, began the construction of a shedding system and in the spring of 1983, produced approximately 500-dozen crabs which were marketed locally.

Eastern coast interests came to Texas in the winter of 1983 and in the spring of 1984 to investigate the potential of buying premolt crabs from hard-crab picking houses. Although a sincere effort was made, the results were disheartening and the Yankees returned home.

In May, 1981, a blue crab workshop was held at Texas A&M University at Galveston, with industry people, commercial crabbers, regulatory personnel from Texas Parks and Wildlife, and Texas Department of Health, Division Shellfish Sanitation Control.

Two years later, demonstration crab-shedding systems were being developed in Port Aransas and Seadrift with Sea Grant money providing some construction material.

The demonstration systems have not been successful. Crabs have been shed, but the supply of premolt crabs remains the problem which has not been solved.

Harvesting gear to provide the demonstration systems with "peelers" is currently being investigated and this spring should see some peculiar contraptions thrashing around the bays or lurking just below the water.

If the dollars are to be made, if the technology transfer takes, if everybody doesn't starve to death first, the next National Symposium may find Texas listed among the soft-shell crab-producing states.