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The Expansion of America's Soft-Shell Crab Industry: a Sea Grant success story

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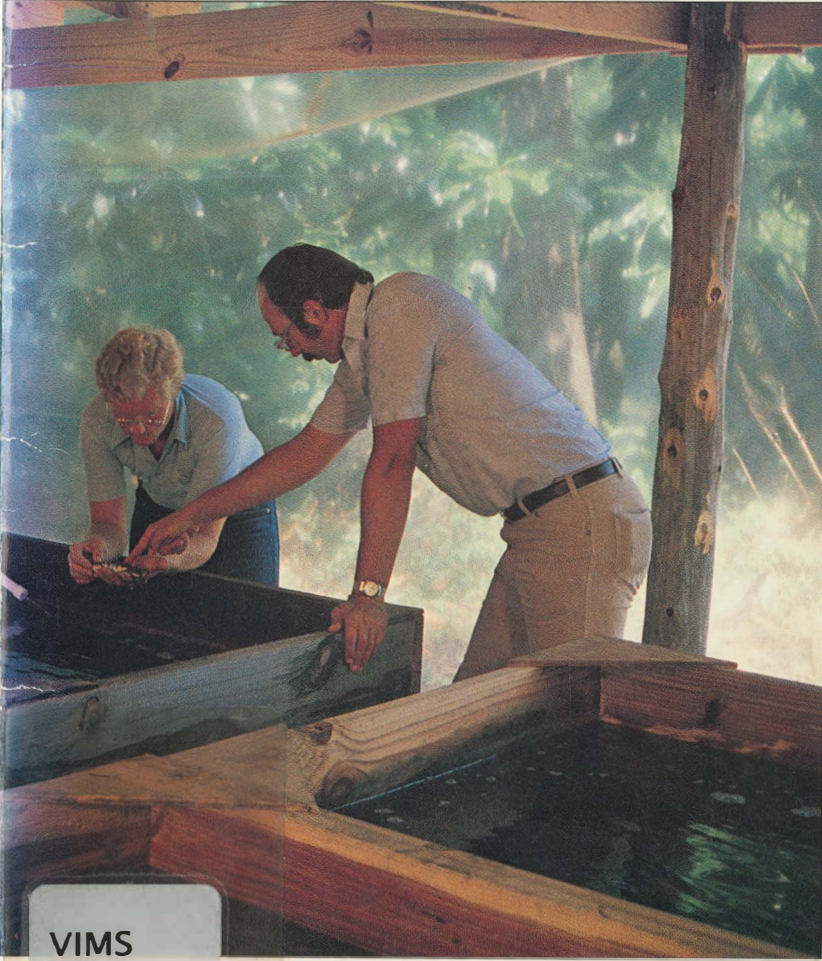
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The Expansion of America's Soft-Shell Crab Industry

A Sea Grant Success Story



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THE EXPANSION OF AMERICA'S SOFT-SHELL CRAB INDUSTRY —

A Sea Grant Success Story

CONTENTS

Introduction	2
The Soft-Shell Crab	3
The Soft-Shell Crab Industry	3
Sea Grant Steps In	5
MAS Specialists Find Solutions	6
Sea Grant Research Solves Problems	9
Toward a New Industry	10
MAS Specialist Listing	11



INTRODUCTION

Fifteen years ago, the soft-shell crab was known as a culinary delight only among seafood enthusiasts on the East and Gulf Coasts. Today, the succulent delicacy is in great demand by gourmet restaurants, seafood markets and consumers throughout the United States, Asia and Europe.

Soft-shell crabs are blue crabs that have shed their hard shells so they can grow. The new shell gradually hardens, but before it does almost the entire soft-shell crab is edible. The delicate meat is a gourmet delight that is fast bringing the nation's soft-shell crab industry into the limelight.

In 1984, approximately 2300 independent producers marketed 8.1 million pounds of soft-shell crabs, earning \$16 million in gross income and employing 4000 workers. Also in 1984, approximately 30,000 dozen soft-shell crabs were shipped to Japan. The demand for soft-shell crabs still exceeds the supply, though new producers enter the industry each year.

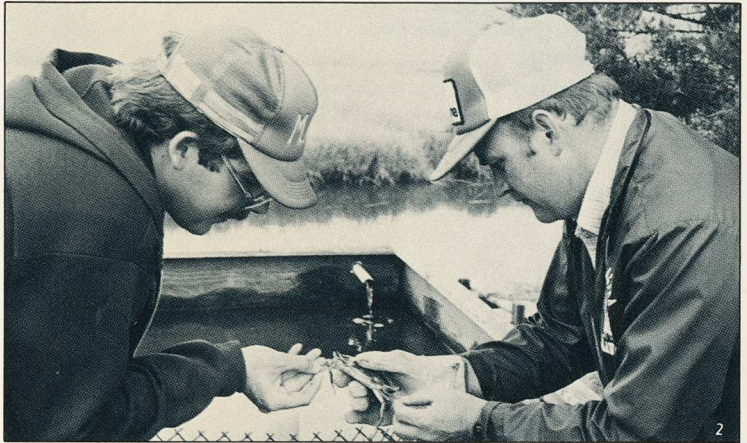


1 A molting blue crab backing out of its old shell.

- Virginia Sea Grant

2 Delaware Sea Grant Marine Fisheries Specialist Jim Salevan (l) assists a local crab shedder in identifying a peeler.

- Delaware Sea Grant



The soft-shell crab industry has not always been so productive. For nearly a hundred years, the production of soft-shell crabs functioned apart from the massive fishing industries along the East and Gulf Coasts. In fact, until the demand for soft-shell crabs began to increase in the 1970s and Sea Grant became involved, there were no accurate figures on the level of soft-shell crab production, the number of producers, or the value of the fishery. All that was known was that major markets were demanding more soft-shell crabs; producers had high mortality rates; and initial surveys by Sea Grant indicated that the "cottage-type" industry that existed could become a productive fishery with information and technical assistance.

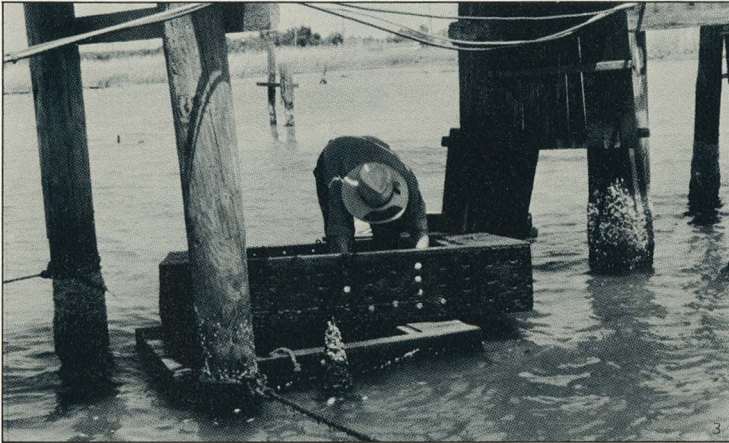
In 1970, only 2.6 million pounds of soft-shell crabs valued at \$1.1 million were marketed. The industry's successful expansion in domestic and foreign markets is largely due to the efforts of Sea Grant, a federally supported program which assists marine-related industries in the United States. Sea Grant recognized the potential of the soft-shell crab industry. Working through locally generated programs funded in part with matching state and university funds, Sea Grant began to address the problems and opportunities facing the industry. Local, state and federal agencies worked cooperatively with Sea Grant as did the Mid-Atlantic, Gulf and South Atlantic Fisheries Development Foundations.

This Sea Grant success story is a model for reaping economic, scientific and management rewards from a partnership of federal and state funding and manpower. It is also a tribute to the soft-shell crab producers whose commitment made this success possible.

THE SOFT-SHELL CRAB

Callinectes sapidus or the “beautiful swimmer” is known throughout the world as the blue crab. It is harvested all along the Atlantic and Gulf Coasts, but is most abundant in the Chesapeake Bay. Although its habitat has diminished, the hardy blue crab continues to provide over 200 million pounds of marketable products each year.

As with all members of the crustacean family, the blue crab has a hard external shell or exoskeleton. During its 2-3 year lifespan, the crab sheds or



molts its shell 18-22 times in order to grow. As molting approaches, the blue crab seeks the shallow vegetated areas near shore which offer shelter from predators. When the crab emerges from its old shell, not only is its entire body soft, but it is very weak, unable even to use its pincer claws. Within hours the crab's new shell begins to harden. It is only during the short period following molting that the “soft-shell” crab exists.

THE SOFT-SHELL CRAB INDUSTRY

The first commercial production of soft-shell crabs began in the 1850s in Crisfield, Maryland. During the next hundred years, the industry developed slowly. Only in the past ten years, primarily through Sea Grant-initiated advances, has the industry expanded dramatically.

In the first soft-shell crab shedding operations, hard crabs harvested from trot lines were put into fence-type holding pens and held until they molted. This process was extremely labor intensive, and large numbers of crabs usually died.

Over the years, soft-shell crab producers learned to identify peelers — those crabs ready to molt — and to isolate them in floating boxes, called crab floats, near shore. But problems with salinity level, temperature

3 Marcel Blondeau of Lake Pontchartrain, Louisiana, sheds crabs in traditional southern crab floats made of cypress.
— Louisiana Sea Grant

4 Virginia Marine Advisory Services Specialist Mike Oesterling pulls crab pots on board a local waterman's boat. Virginia Sea Grant activities have increased the state's annual soft shell crab production by 100,000 dozen crabs.
— Virginia Sea Grant

5 Terry Conway (r) of Handy Soft Crabs in Crisfield, Maryland, works out details for exporting soft-shell crabs with a representative of a trading company and restaurant supplier in Japan. Peter Law (l) of the Virginia Department of Agriculture and Consumer Services and Dr. William DuPaul of Virginia Sea Grant (not shown) also participated in the successful marketing initiative. This Sea Grant effort led to the annual exporting of 30,000 dozen crabs to Japan.
— Virginia Sea Grant

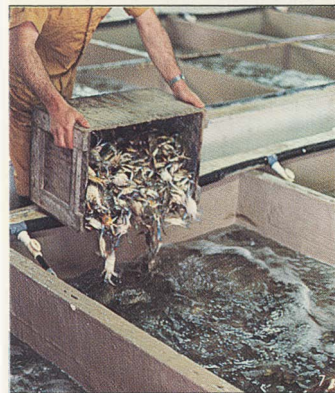
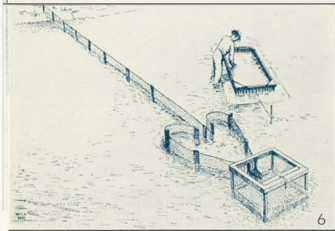


6 The peeler pound improved the harvesting of soft-shell crabs and helped reduce mortalities.
- Virginia Sea Grant

7 Peeler crabs are dumped into shedding tanks. More careful handling will prevent injuries.
- Virginia Sea Grant

and water quality, as well as disease, predation and stress adversely affected soft-shell crab production.

Eventually, the crab floats were moved away from shore and into deeper water where tidal currents would provide better water conditions for the crabs. About 20 percent of soft-shell crab producers still use this method. The better flow rate brings favorable results, but the floats offer no protection from eels and other predators. Further, changes in water quality, such as an upstream discharge of pollutants, can wipe out potentially good production. And because the producer must go out in a boat and lean over the side to tend the crabs, the crab float method is physically taxing.



8 Murray Bridges, North Carolina's largest commercial crab shedder, checks soft-shell crabs in his flow-through shedding system. Sea Grant provided guidelines for the design and construction of Bridges' shedding facility, and the waterman often speaks at workshops. Sea Grant activities in North Carolina have increased state soft-shell crab production by 15%.
- North Carolina Sea Grant

In the 1950s, producers developed a shore-based, flow-through float or tank system. About 58 percent of soft-shell crab producers currently use this system, which provides some protection for the peelers as well as less arduous work for the producers.

In the '70s, special shore-based traps specifically designed to attract and capture peelers were popularized. This "peeler pound" harvesting method took advantage of the crab's instinct to move into shallow water as molting approaches. Despite these advancements in harvesting methods, the majority of peelers were still captured incidentally by traditional hard crab methods. Because the more fragile peelers were handled in the same way as hard crabs, many of them died before they were sold to soft-shell crab producers.

By the 1970s, when the demand for soft-shell crabs began to increase, production was minimal, having disappeared from some states where new producers weren't entering the industry to replace those who retired. Many of the difficulties inherent in the harvesting and production techniques available at the time were responsible for this stagnation throughout the industry. Harvesting and shedding soft-shell crabs still

required long hours of hard work. While soft-shell crabs might bring \$1.00 apiece, soft-shell crab production literally required working 24 hours a day during shedding season. Also, shedding crabs required waterfront property with good water quality—an expensive commodity.

Also during the early 1970s, methods for packing, freezing, and marketing soft-shell crabs were not uniformly controlled for quality; consequently, restaurants and consumers often rejected out-of-season offerings. Markets for soft-shell crabs were confined to traditional wholesale centers such as Baltimore and New York, and few producers had the incentive or the ability to control or expand market channels.

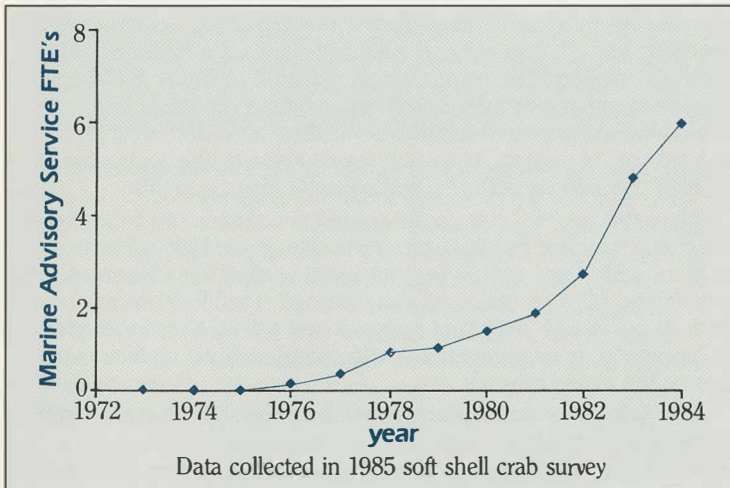
SEA GRANT STEPS IN

In 1966, Congress funded a marine program designed along the lines of the successful Land Grant College Program which has assisted farmers since the 1850s. Today, a total of 29 Sea Grant programs nationwide work through established colleges and universities to provide research, education and marine advisory services to marine-related industries.

The growth of the nation's soft-shell crab industry reflects successful Sea Grant program efforts in every state that commercially produces soft-shell crabs, and in some that didn't before Sea Grant initiatives were begun. This success has depended on the acceptance and help of the nation's commercial fishermen. Often, experiments required these individuals, whose profit margin was slim to begin with, to risk a portion of their harvest in trying new methods. It is important to keep this in mind, because Sea Grant has never been a program of unilateral federal assistance, but rather a working partnership between people in government, academia and industry.

Sea Grant Full Time Equivalents (FTE's) expended on soft-shell crab activities — total for all states

FTE's (one FTE equals one person full-time per year) are used because individual Marine Advisory Services specialists work on a number of different projects during the year.



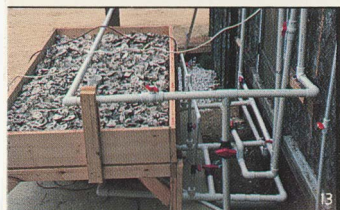
9 Information transfer between Sea Grant and commercial crab shedders is a vital component of industry growth. Here, Harriet Perry (r) of the Gulf Coast Research Laboratory and Louisiana crab shedder Cultus Pearson (c) examine peeler pounds in Virginia. Louis Whitaker (l) is a Virginia soft-shell crab producer.
— Virginia Sea Grant

10 Texas Sea Grant constructed this demonstration closed system as a means for encouraging the state's fledgling soft-shell crab shedding industry. The softshell crab industry in Texas today exists solely because of Sea Grant efforts.
— Texas Sea Grant



MAS SPECIALISTS FIND SOLUTIONS

Sea Grant Marine Advisory Services (MAS) specialists received calls for assistance from the soft-shell crab industry in the early '70s. While Sea Grant-funded basic research was already providing more knowledge of the blue crab and its habits, soft-shell crab producers wanted answers to questions concerning high mortality rates, water quality and biological, economic and market factors—in short, all aspects of their business.



12 John Stenely, Florida Marine Advisory Services Specialist (l), helps Joe and Mark Bianco check crabs for signs of shedding at the Bianco's inland soft-shell crab operation. Sea Grant activities have increased the number of crab shedding operations in Florida from 4 in 1978 to 30 in 1983.

—Florida Sea Grant

13 Harriet Pery (r) of the Gulf Coast Research Laboratory shows Malcolm Beaugez how to identify pre-molt crabs at the demonstration closed shedding system operated by Mississippi Sea Grant.

—Mississippi Sea Grant

13 A biological filter in operation at a crab shedding facility in Maryland.

—Maryland Sea Grant



Very little had been studied or recorded about the soft-shell crab industry in a coordinated national framework.

As MAS specialists compiled more and more information about the industry, they learned that certain problems were common throughout the soft-shell crab producing states. By communicating between states, MAS specialists were able to put together a national picture of the industry and identify common areas of concern as well as critical areas for immediate concentration.

As simple as it may seem, some new producers were unaware of the signs of imminent molt. As the time for molting approaches, a line along the inside edges of the last two segments of the paddle fins changes color. Two weeks before molting, the line is white; at one week the line turns pink; and 2-3 days before shedding, the line turns bright red. MAS specialists published this information, presented it clearly in workshops, and worked with individual soft-shell crab producers to assure that peelers were identified and sorted into shedding tanks according to expected time of molting. As a result, producers were able to increase soft-shell crab survival rates and, consequently, increase profits.

Since the late '60s, commercial producers had been experimenting with closed shedding facilities which recirculate water. Through Sea Grant research, these systems were improved to allow the adjustment of temperature, salinity, oxygen and waste disposal. The closed systems, which do not require waterfront property, were a boon to soft-shell crab producers who, as a result of this development, could set up their operations on less expensive land.

The first closed shedding systems were attempted in Maryland, but it was research in Mississippi that led to the development of the first successful commercial closed system. Other Sea Grant research led to advanced closed system technology including the development of

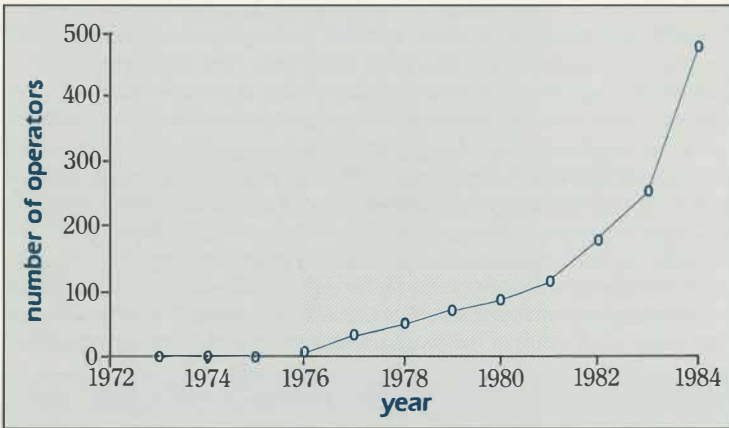
biological filters which convert nitrogenous waste products into less toxic forms, skimming processes to remove dissolved organic waste products, and improved aeration of the filters and tanks.

This improved shedding system technology was particularly useful in the Chesapeake Bay where peeler runs—a seasonal abundance of peelers—overload shedding systems every year. When a great number of peelers were added to a shedding system, the combination of increased wastes and decreased oxygen caused high mortalities at a time when producers should have been realizing their highest profits. With the results of Sea Grant research, MAS specialists taught soft-shell crab producers how to adjust their systems to meet the needs of the peelers.

Presently, 22 percent of shedding facilities employ closed systems, and the number increases each year. New soft-shell crab producers, in particular, are encouraged to set up closed systems because of their consistently successful production, lower cost and better return on labor. Although MAS specialists routinely help soft-shell crab producers improve existing floating systems or flow-through systems, efforts in most states have turned to the closed shedding system with its promise of increased production and profits.

Number of operators directly assisted by Sea Grant

The number of soft-shell crab shedding operations assisted by Sea Grant Marine Advisory Services specialists increased from 2 in 1975 to 474 in 1984.

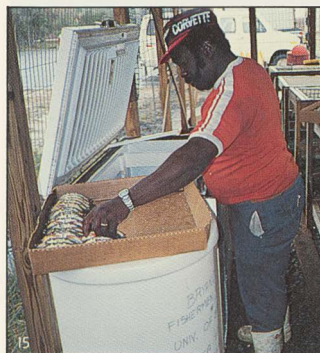


Demonstration shedding facilities, constructed and promoted by Sea Grant programs, have greatly increased interest in the soft-shell crab industry. In North Carolina, thousands of people have visited a full-scale demonstration shedding facility; and in Maryland, an informal field day, featuring a soft-shell crab shedding facility, drew over 250 visitors. Demonstration facilities in Texas and Delaware have encouraged the establishment of numerous crab shedding operations. In Louisiana, students at three coastal high schools are introduced to closed system shedding through small-scale systems, and in New Jersey, Sea Grant helped 4-H'ers build a crab shedding display for their county fair.

A variety of Sea Grant publications have stimulated the soft-shell crab industry and increased the general public's awareness of the product. Virginia Sea Grant's "Manual for Handling and Shedding Blue

14 Sea Grant provides guidance to soft-shell crab producers through all phases of their operations. Here, Virginia Sea Grant Marine Advisory Services Specialist Mike Oesterling advises a Virginia crab shedder on the construction of a closed shedding system.
—Virginia Sea Grant

15 Robert Jenkins grades soft-shell crabs at the Bryan Fishermen's Cooperative in Bryan County, Georgia. The co-op is a project of Georgia Sea Grant, the Gulf and South Atlantic Fisheries Development Foundation and local watermen. Due to Sea Grant activities, Georgia's soft-shell crab production increased 100% from 1983 to 1984.
—Georgia Sea Grant

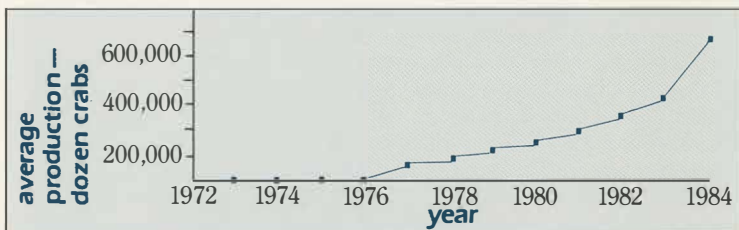


16 New Jersey Sea Grant assisted a local 4-H club in building and operating a crab shedding demonstration for the 1985 Cape May County 4-H Fair. Sea Grant activities in New Jersey have increased the state's soft-shell crab production by 100% over previous years.
-New Jersey Sea Grant

Crabs (*Callinectes sapidus*)" provided the first comprehensive approach to constructing and operating a soft-shell crab facility. The manual has been requested by individuals abroad as well as throughout the United States. North Carolina and Louisiana Sea Grant have also produced successful manuals for soft-shell crab shedders.

Average soft-shell crab production by operators directly assisted by Sea Grant

Total production from soft-shell crab operations assisted by Marine Advisory Services specialists increased from approximately 100 dozen crabs per year per producer in 1975 to approximately 652,750 dozen crabs per year per producer in 1984.



Sea Grant-sponsored workshops in all soft-shell crab producing states have encouraged many individuals to enter the industry. The largest of these workshops was the first National Symposium on the Soft-Shell Blue Crab Fishery, hosted by the Mississippi/Alabama Sea Grant Consortium in Biloxi, Mississippi, in 1985. The highly successful symposium, a cooperative effort of the Mid-Atlantic and Southeast MAS networks, brought together people from industry, government and academia to exchange information on the expanding soft-shell crab fishery.

An inadequate supply of peelers continues to be the limiting factor in production for many states. Sea Grant MAS programs have organized workshops and distributed publications to educate crabbers about peeler harvesting techniques. Florida MAS distributed over 3000 copies of a brochure on the harvesting and identification of peelers. Both Florida and North Carolina Sea Grant have set up demonstration peeler pounds to evaluate the commercial potential of peeler harvesting capacities in their states. As a result of this work, fishermen in North Carolina began using peeler pounds in 1985. In Georgia, where high tides make the peeler pound unsuitable, MAS specialists developed a prototype peeler trap to improve harvesting.

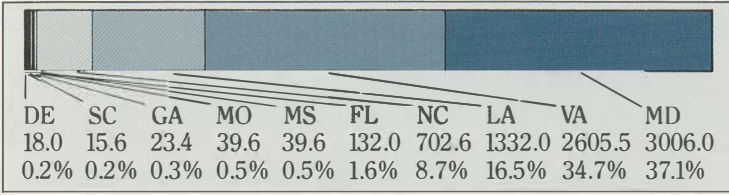
Sea Grant programs are now focusing on economic analysis and marketing of the growing soft-shell crab industry. North Carolina Sea Grant published a fact sheet which describes the cost of investing in soft-shell crab production and how to estimate net cash flows. Virginia Sea Grant is expanding the potential soft-shell crab market by maintaining easily accessible lists of buyers and by helping to establish export markets in Europe and Asia.

Throughout soft-shell crab producing states, Sea Grant is assisting harvesters and producers in improving the quality of their product. As markets expand, so will consumer expectations. By improving methods for catching, shedding, packaging, freezing and shipping, a consistent year-round market without geographical limitations can be established for soft-shell crabs.



Estimated soft-shell crab production in 1984 by state — calculated production in 1000 lbs. of crabs

Not shown: New Jersey—7.2% Alabama—6.0% Texas—4.8%



SEA GRANT RESEARCH SOLVES PROBLEMS

The cause of excessive mortalities in shedding facilities remains the focus of Sea Grant research efforts. Scientists in Virginia found that a naturally occurring bacteria, *Vibrio parahaemolyticus*, becomes prevalent whenever the peelers are stressed. Now Sea Grant scientists in North Carolina are expanding the Virginia studies in an attempt to better understand the bacteria's relationship to the blue crab. In addition, techniques for reducing stress on crabs in shedding facilities are currently being tested.

Other research into the physiology of the soft-shell crab has revealed the extraordinary changes in oxygen demand which occur during molting. These findings, when combined with engineering and research studies from the Gulf Coast, are leading to improved closed system design.

Sea Grant-sponsored research in Florida has determined safe shelf life and proper handling techniques for soft-shell crabs. These guidelines have been invaluable in improving the quality of the product that reaches consumers. Additional research in Florida detailed the nutritional quality of soft-shell crabs and their benefit as a source of calcium. This information was highlighted in a national television program on health care for the elderly.

Current Sea Grant-funded research includes a study of hormonally induced molting, which, if possible, would allow producers to regulate the crab's shedding process. Calcification studies which will define the shell-hardening process are also under way.

17 Cultus Pearson (holding crab) of Lacombe, Louisiana, shows his shedding facility to prospective soft-shell crab producers as part of a Sea Grant training workshop.
—Louisiana Sea Grant

18 Protein skimmers remove dissolved organic waste products during filtration in a crab shedding system.
—Maryland Sea Grant

19 North Carolina researcher James Jones removes hemolymph from a pre-molt crab for bacteriological analysis.
—North Carolina Sea Grant

20 Alabama soft-shell crab shedders built this on-shore flowthrough shedding system with the help of Alabama Sea Grant.
—Alabama Sea Grant



TOWARD A NEW INDUSTRY

21 North Carolina fisherman Ken Pearce checks his experimental shedding system for peeler crabs caught as a by-catch; the system was designed to be used on board commercial fishing vessels. This project was funded by the Gulf and South Atlantic Fisheries Development Foundation and North Carolina Sea Grant.
— North Carolina Sea Grant

22 Florida's growing soft-shell crab industry provides benefits to local economies as well as fishermen. Sea Grant Marine Advisory Services Specialist Steve Ottwell (l) shows a waterman how to grade peeler crabs in a float.
— Florida Sea Grant

Through research and applied technology, Sea Grant is actively assisting the soft-shell crab industry as it continues to expand. Because demand still exceeds supply, efforts continue to be directed toward increasing production and reducing mortalities.

Widening the markets for soft-shell crabs and helping producers improve the quality of the product that reaches those markets increases the profit potential of the industry. New producers, encouraged by the outlook, are continuing to enter the industry, thus assuring its future health.

The improvement of shedding facilities appears to be the single area with the greatest potential return on investment. If crabs can be placed in a non-stressful environment during the shedding process, mortalities will be lowered and profits will subsequently increase. Cost- and labor-saving refinements are being developed throughout the industry.

MAS specialists are now working with producers to examine alternate or off-season uses for their shedding facilities. Shedding rock crabs during the winter months or using tanks for depurating winter-dredged crabs offers potential year-round activity for soft-shell crab producers.

The future of the soft-shell crab industry depends on many people working together — scientists, seafood industry members, government agencies, Sea Grant MAS specialists and soft-shell crab producers. Together, they will continue to improve the industry. This Sea Grant success story has not ended; in fact, this is only the first chapter.



For further information about the soft-shell crab industry, please contact one of the following Sea Grant Marine Advisory Services leaders:

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Cover Note:

Mike Oesterling (*r*) of Virginia Sea Grant Marine Advisory Services (MAS) observes as soft-shell crab producer Randy Carr checks his shedding tanks for peelers. The 16-tank closed recirculating shedding facility in Hayes, Virginia, is typical of the modern soft-shell crab operations developed through Sea Grant research and MAS efforts.

—*photo by Gloria Walters*

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