

INFORMATION ON ESTABLISHING A
SOFT SHELL CRAB OPERATION IN
SOUTH CAROLINA

"A REPORT TO THE FISHERMEN"

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INFORMATION ON ESTABLISHING A
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INTRODUCTION

The commercial fishery for blue crabs in South Carolina is second only to that for shrimp in terms of overall economic importance. At present, the bulk of South Carolina production is hard crabs taken by pots and, to a lesser extent, by otter trawls. The volume and value of commercial blue crab landings in South Carolina between 1969 and 1978 is presented in Figure 1. Although in the past soft shell crabs have been produced in the state, there have been no significant landings for them in the past twenty years. Soft shell crabs were produced in South Carolina from about 1936 until the 1950's (in 1940, 2,981 dozen soft shell crabs were reported for the State). During 1978, several commercial fishing operators in South Carolina experimented with shedding crabs, and a number of others expressed an interest in establishing a soft shell crab business.

Soft shell crabs are currently produced in Delaware, Maryland, Virginia, North Carolina and Louisiana on a fairly large scale. It is believed that they can also be produced on a commercial scale in South Carolina, provided suitable legal methods for catching adequate numbers of peeler crabs are developed.

Soft shell crabs are considered a delicacy by seafood gourmets, and wholesale prices are high (ranging from \$4 to more than \$14.00 per dozen) depending on size, and time of year. Direct sales by the producer to restaurants brings premium prices.

The purpose of this report is to provide information concerning the identification of peeler crabs, as well as on methods of handling and shedding peelers to produce soft shell crabs in the coastal area of South Carolina. It is also the intent herein to identify some of the risks and problems which may be encountered in establishing a soft shell crab operation in the State.

Recognizing Peeler Crabs

For the successful soft shell crab operation, it is essential that fishermen become familiar with identifying peeler crabs - those which are about to

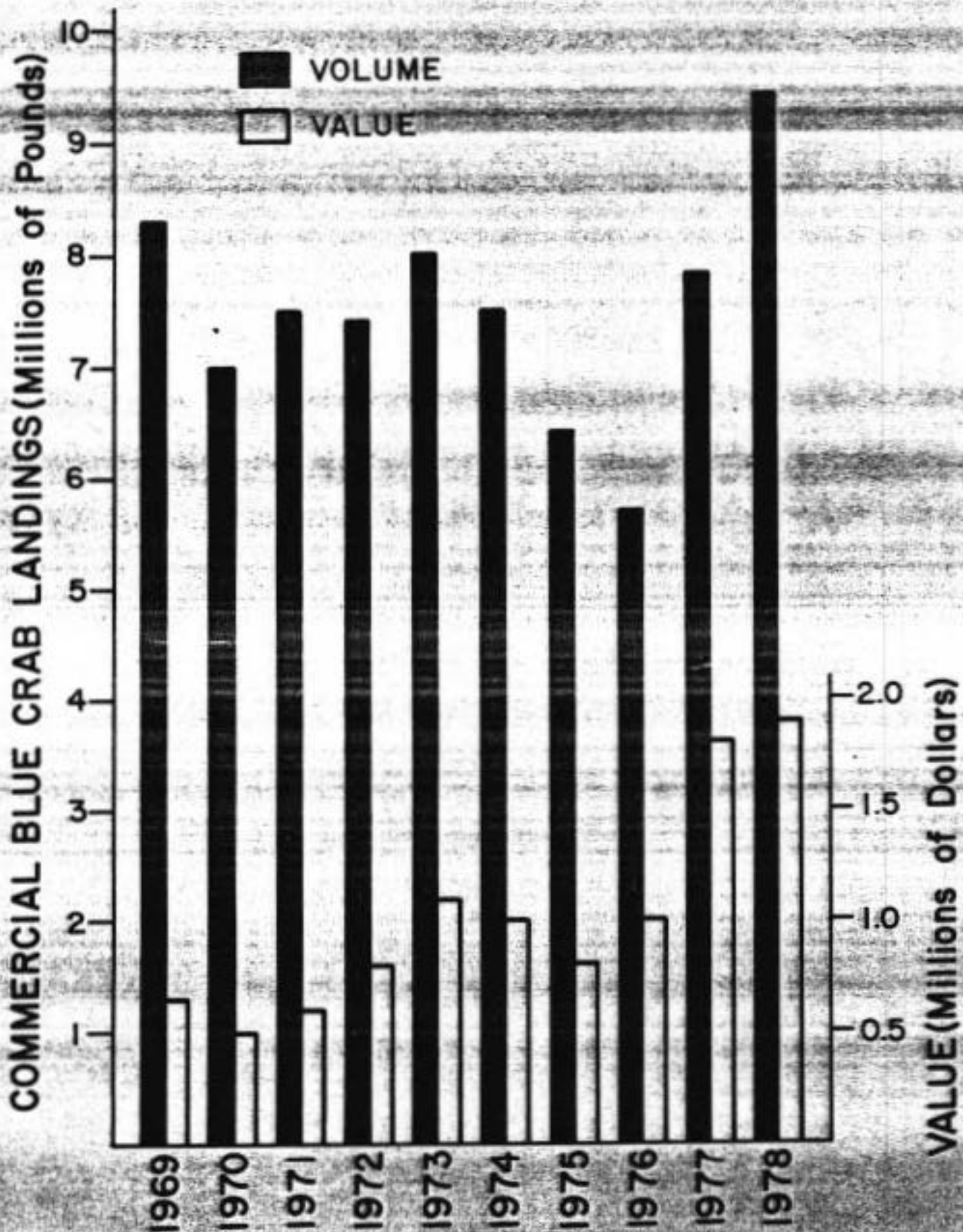


Figure 1. Volume (millions of pounds) and value (millions of dollars) of commercial blue crab landings in South Carolina, 1969-1978.

shed their shell. With practice, peelers can be readily recognized and separated as to stage of development.

As they grow, blue crabs increase in size periodically by shedding (molting) their hard outer shell (Figure 2). When a crab emerges from the old shell, it has a soft, new shell and is appropriately known as a soft shell crab. Within a few minutes after shedding, the crab absorbs water and gradually expands to full size, increasing in width by 25% or more.

Prior to shedding, the new shell begins to form under the hard shell of the crab. As this new shell develops, it gradually becomes darker and more visible through transparent parts of the hard shell. This color is best observed just inside the edge or margin of the last two segments of the swimming legs or flippers. Before the crab begins to become a peeler, the edge is green and the crab is spoken of as a "green crab". This stage is followed by the appearance of a white margin ("rim" or line) just inside the edge of the next to last and last segment of the flipper. The white margin is later replaced by a pink margin and then by a red margin. When the margin becomes dark red, a crack develops along the posterior margin of the crab's shell. It is through this separation that the soft shell crab will emerge from the old shell. This last stage prior to shedding is called a "buster" (Figure 3).

All of the above stages except the "green" crabs are called peeler or pre-peeler crabs. By observing the color of the line or margin on the last two segments of the flipper, the fisherman or soft shell crab operator can estimate the length of time before the peeler will shed. The following are approximate times required for shedding of each of the peeler stages.

White Line - 5-10 days

Pink Line - 2-5 days

Red Line - 1-3 days

Buster - 0-12 hours

It is also possible to recognize peelers by the pinkish coloration which develops on the underside of the body. This is especially true for immature females nearing their final molt as the triangular shaped apron becomes darker and distinctly pink or reddish tinged as shedding approaches (Figures 4, 5 and

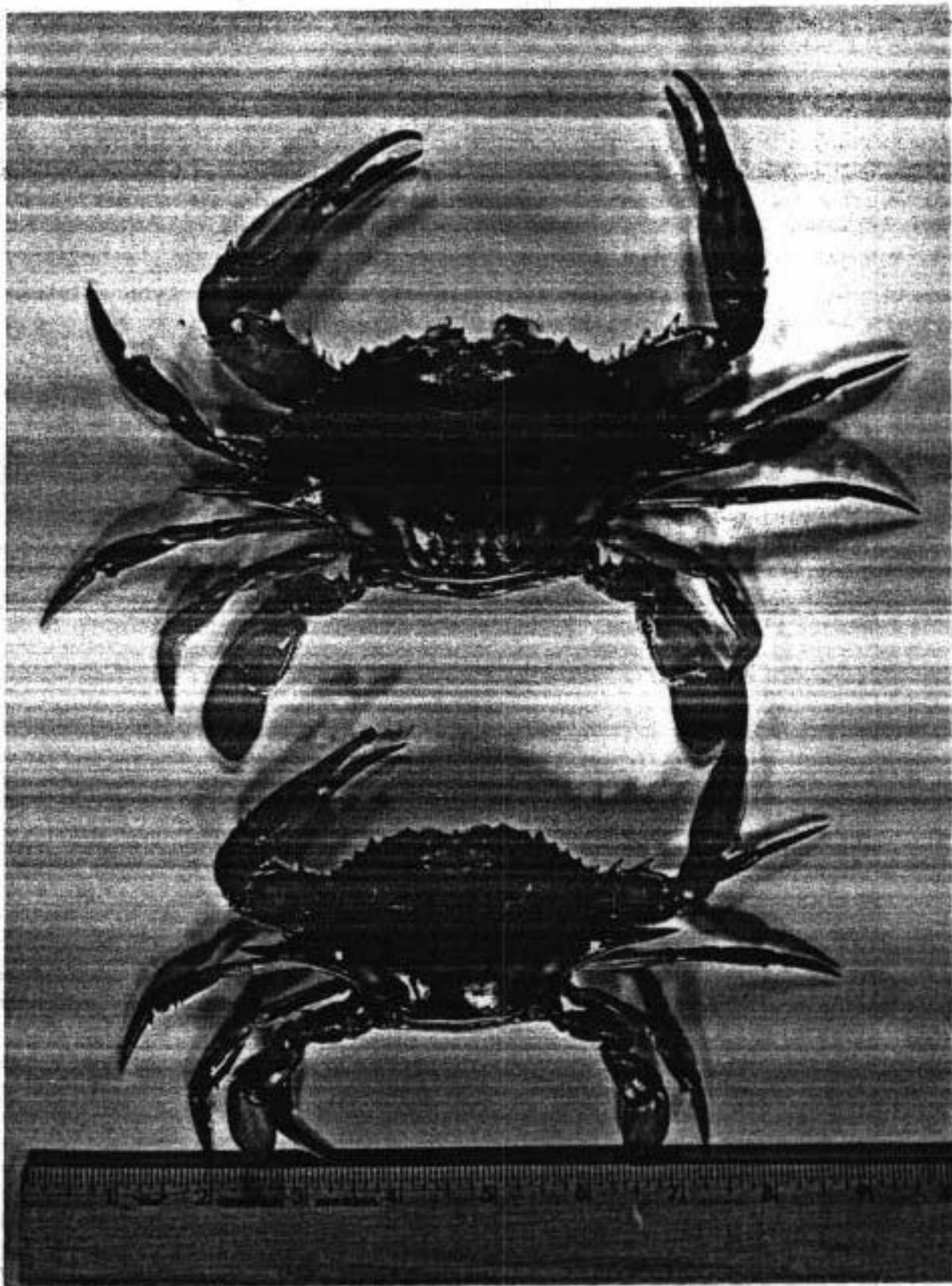


Figure 2. A newly molted blue crab (top) can increase in body size by as much as 25 percent. The crab at bottom represents the original size before molting.

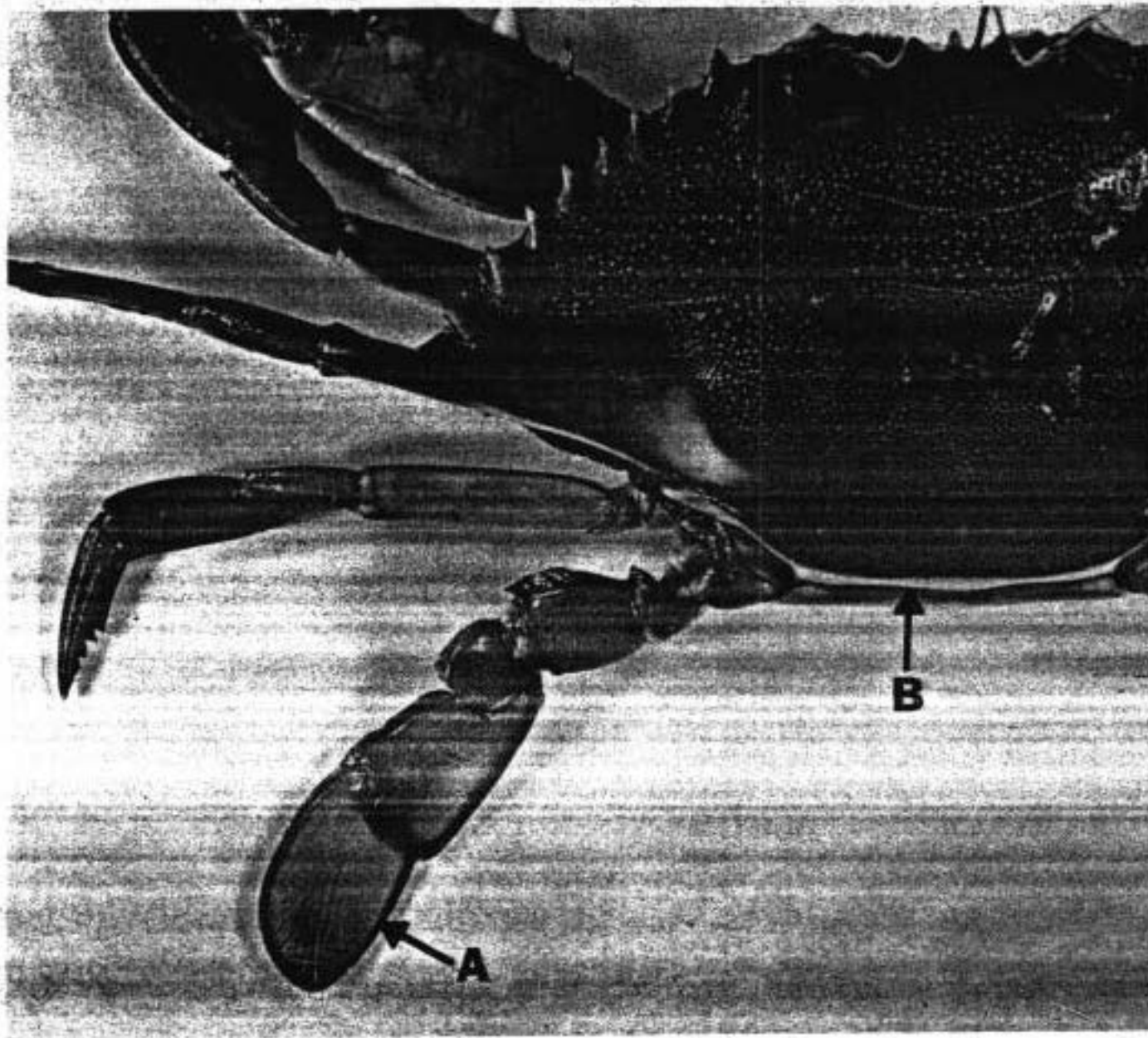


Figure 3. Photograph illustrating the location of the color sign (white, pink or red) located on the perimeter of the rear flipper (a). The buster line (b) is also illustrated on the posterior margin of the shell between both rear flippers.

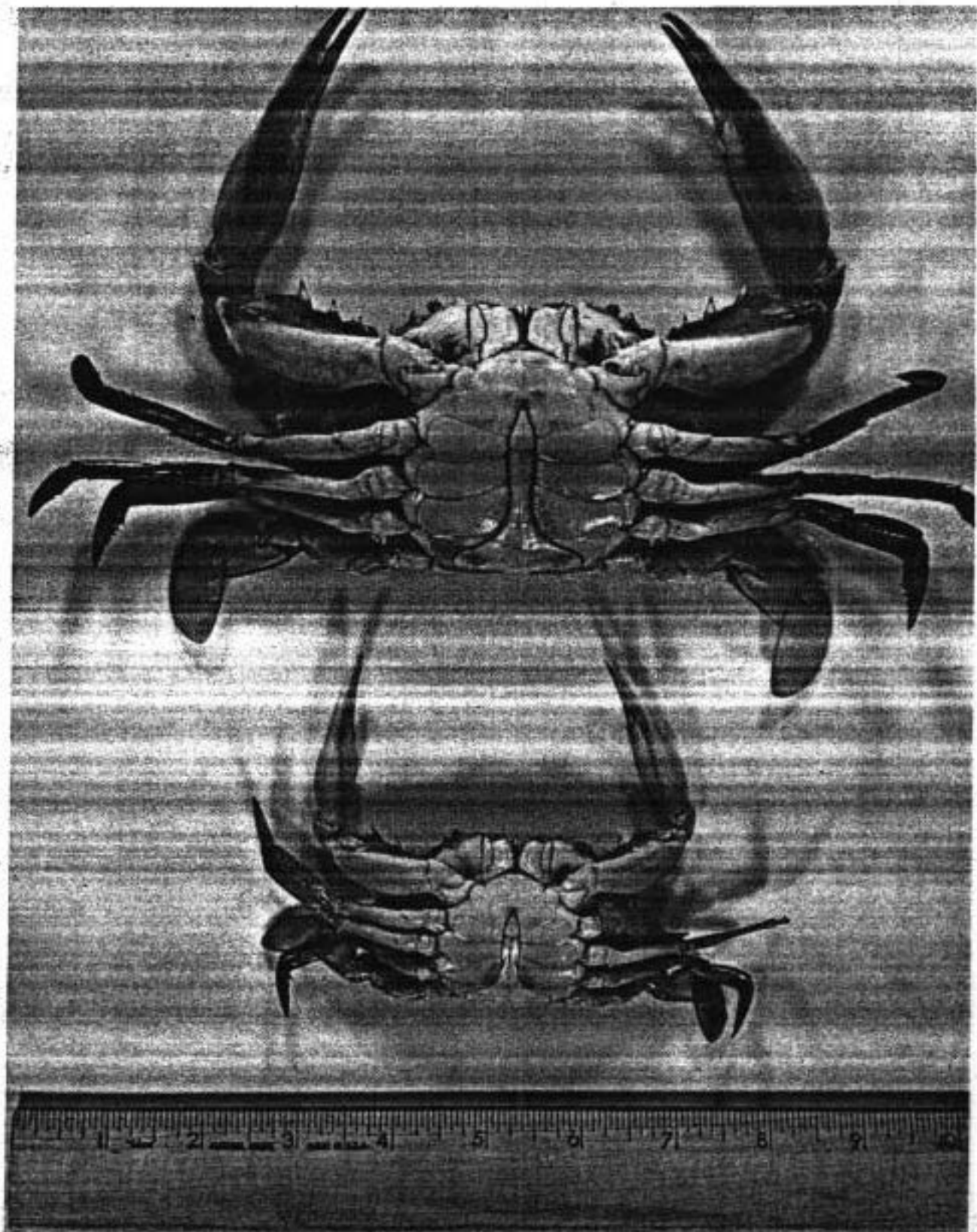


Figure 4. Ventral (bottom) view of a mature male blue crab (top) and immature male (bottom). Male crabs generally mature around 4 to 5 inches.

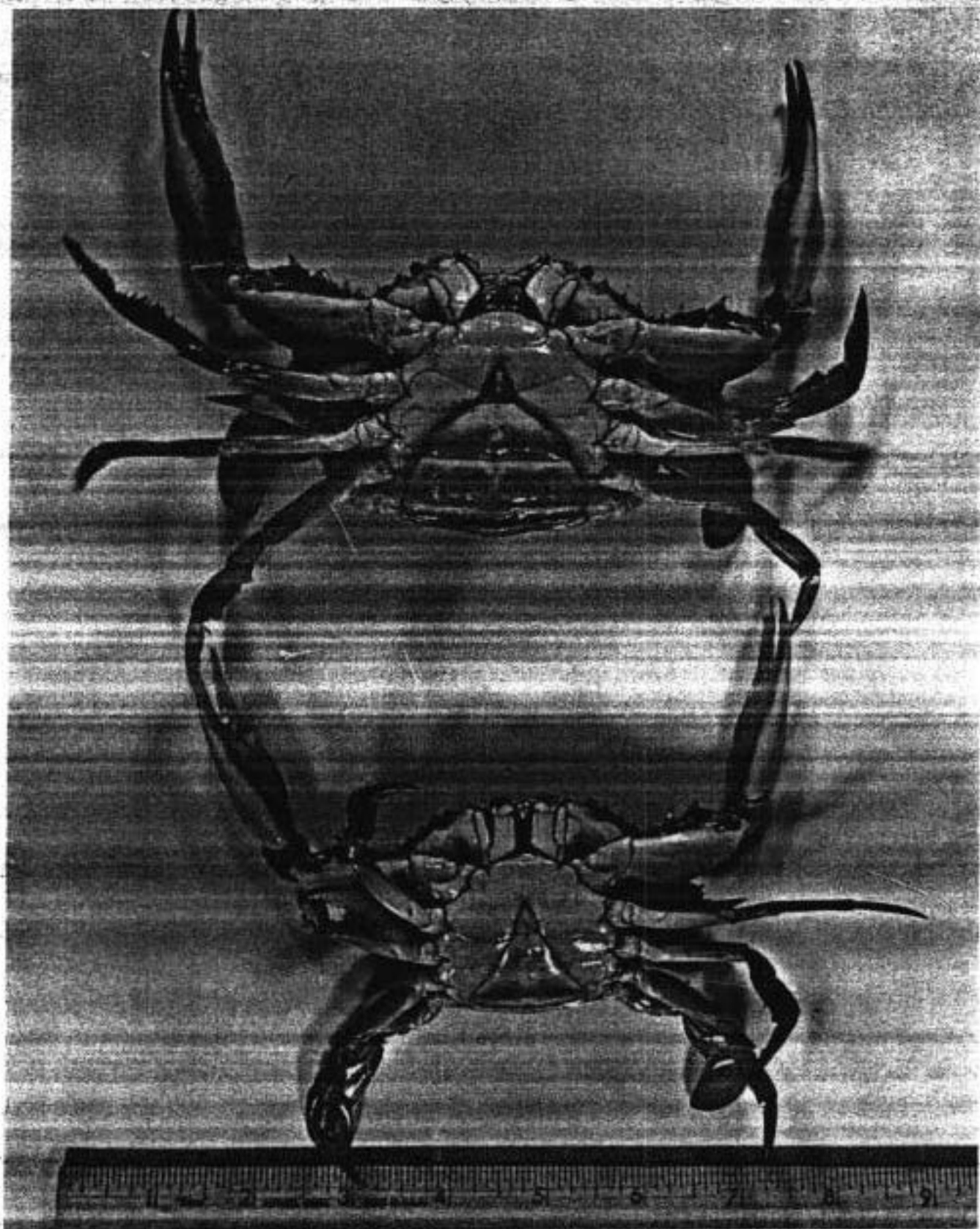


Figure 5. Ventral (bottom) view of a mature female blue crab (top) and immature female (bottom). The mature female has a rounded abdomen as compared to the more triangular shaped abdomen of an immature female. A female crab will not shed after reaching maturity.

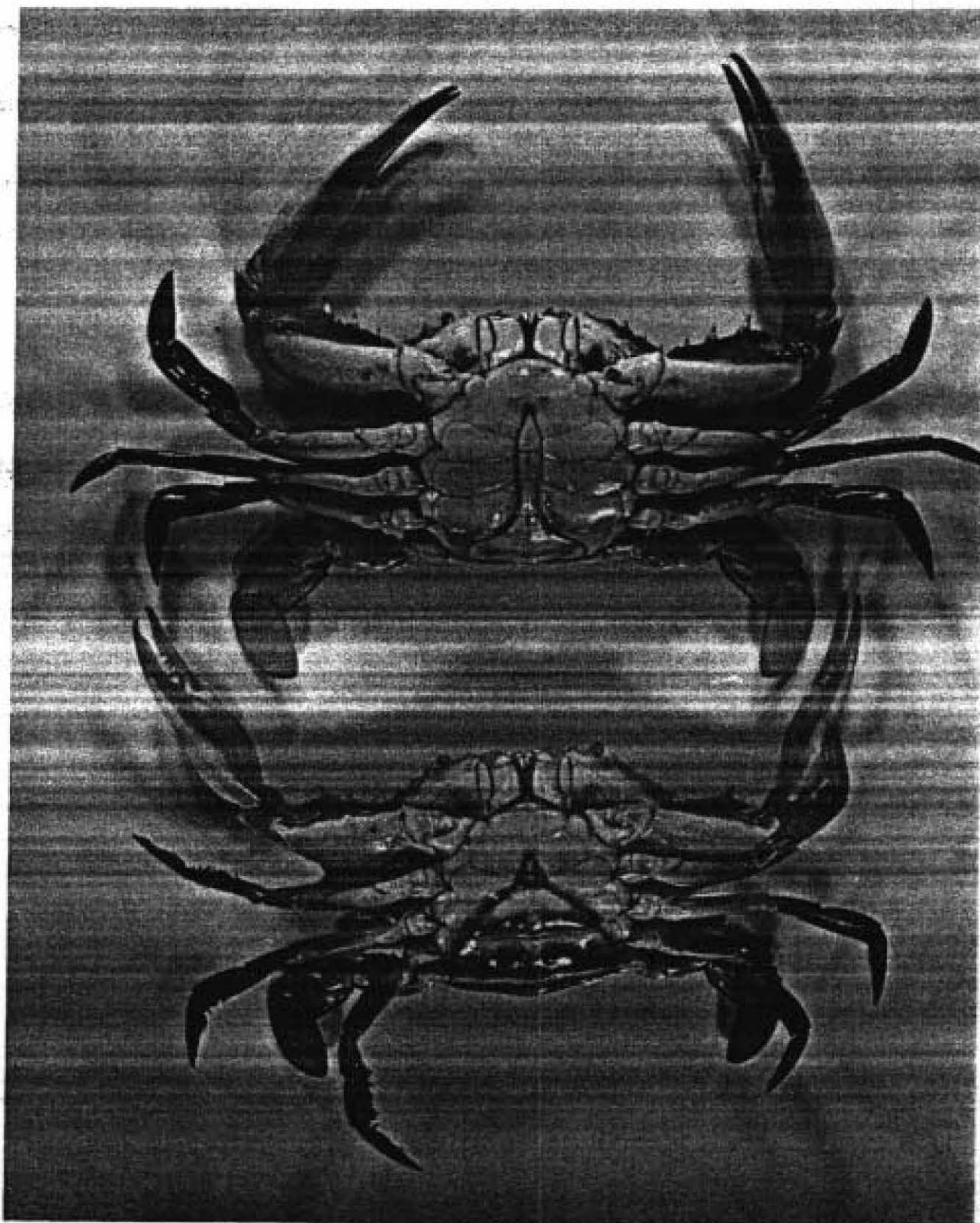


Figure 6. A male blue crab (top) can be distinguished by the inverted "T" shaped abdomen as compared to the much more rounded abdomen of a female crab (bottom). A mature male crab will continue to shed and grow after reaching maturity.

A shedding crab takes from a few minutes to 2 hours to emerge from the old shell, and immature females shed faster than larger males. Most shedding takes place at night. The soft shell stage lasts only a few hours if the crab remains in water, the length of time often depending on the size of the crab, water temperature and other factors. As the shell gradually hardens, the crab becomes a "papershell", and eventually a hard or "green" crab once again. Small crabs harden faster than large ones which may take several days after shedding to reach the hard crab stage (Figure 7).

Catching and Handling Peelers

Although soft shell crabs are occasionally caught in natural waters, a successful soft shell crab operation depends on a supply of peeler crabs for shedding in floats or tanks. One of the most significant problems in establishing a successful crab shedding operation in South Carolina is obtaining a steady and adequate supply of peelers during the year.

Peeler Fishing Methods

Some peeler crabs are taken by the typical commercial-type pots used for catching hard crabs, but this is not the most effective or desirable method. Peelers taken in hard crab pots are often cut or injured by other crabs which may either cause mortality or hinder shedding. Fishing gear used to capture peelers in other states includes the crab pound, peeler pot, trotline, trawl, scrape, dipnet, seine, bush line, and by hand. None of these gears has been adequately tested for taking peelers in South Carolina. The trawl, (at this time not legal gear in most estuarine areas where peeler crabs are abundant), seine, and the crab pound appear to have potentials for South Carolina waters, however.

The peeler pot is a standard crab pot or a slight modification thereof. One fishing method involves placing two or three large males (jimmies) in the upper chamber of a standard crab pot. Another variation is to place a special compartment in the pot containing a large, live jimmy. Peeler pots are not baited, and the live jimmy(s) apparently attracts immature female peelers. In the Chesapeake Bay area, it is reported that peeler pots are effective for

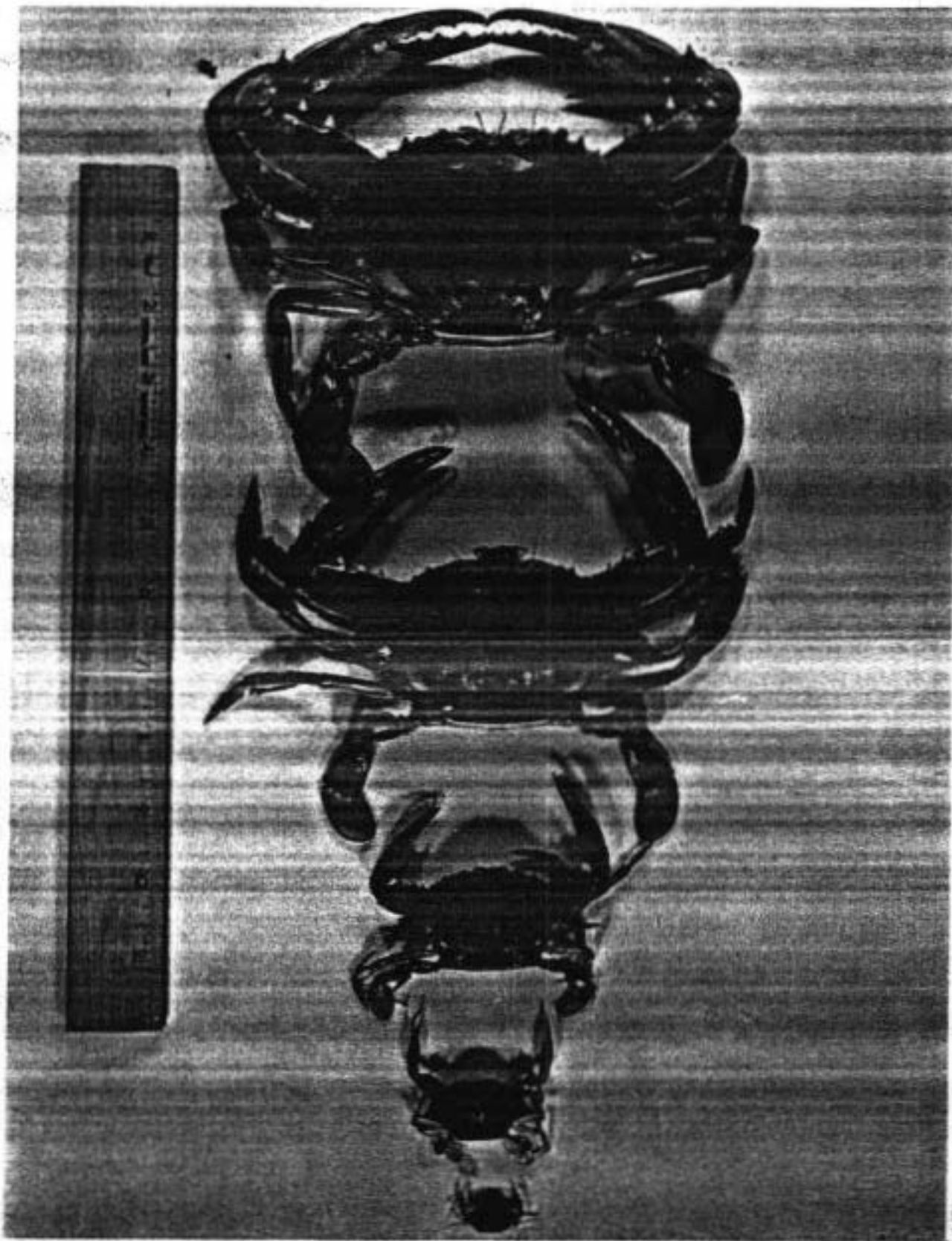


Figure 7. An adult blue crab may pass through 20 or more molts before reaching maturity. The crab at bottom represents approximately the 5th or 6th molt and is about three months old. The crab at top represents approximately the 20th molt and is about 14 years old.

taking large, red sign female peelers, but only during a short period in the spring of the year.

The crab pound consists of a 4-6 foot, one-inch mesh poultry wire fence or lead 100-300 feet long, running out from the highwater line on shore to a water depth of 1-3 feet at low tide. The lead runs to the funnel of a square, unbaited trap (pound) usually about 4' x 4' x 4' in size, and having a hinged top. The trap or pound is constructed of a wood frame covered with one-inch mesh wire and has attached to it a heart shaped wing arrangement of poultry wire through which the lead passes before reaching the funnel. The "heart" directs crabs back to the leader should they fail to enter the funnel the first time. The crab pound, with proper licenses and permits is legal gear in South Carolina but cannot be set across more than one-half the distance of a tidal stream, slough or other waterway at any stage of the tide. Peeler crabs moving along a shore or in and out of marsh areas can be caught with a crab pound on both flood and ebb tides.

Bush lines are long trot lines having bundles of salt myrtle attached at intervals which attract peeler crabs seeking cover. Bush lines are used largely in the Gulf of Mexico, where tidal currents are not strong.

The crab scrape is a lightweight, rectangular framed dredge about 4 feet in width and having a toothless lead bar and net bag. It is most often used in shallow water areas covered with eel grass in the Chesapeake Bay for taking peelers and soft shell crabs.

At the present time, obtaining peeler crabs from hard crab pot fishermen, supplemented by peelers taken by crab pounds or nets would appear to be the best approach for a soft shell crab operator until other methods can be developed.

Season and Areas for Peeler Crabs

In South Carolina, the major period of crab growth is during April through October when water temperatures are 68-70° and above. Major shedding activity usually occurs in the spring and early summer months during April, May and into June. This may vary somewhat from year to year depending primarily on water temperature. A second shedding peak occurs in the summer and fall months (late July through September or October) when "doublers" (mature males carrying immature female peelers which will undergo their final molt) are plentiful.

Peeler crabs are most abundant in moderate to low salinity waters of tidal

creeks and rivers and in shallow protected waters of bays, coves and marsh pot-holes. Advice as to more specific locations in various coastal areas where peeler crabs may be found and on current laws and permit requirements for taking peelers can be obtained from the Marine Resources Division, Office of Conservation, Management and Marketing.

Care and Handling of Peelers

Care and handling of peeler crabs once they are caught is very important to a soft shell crab operation. Proper handling results in a higher survival and shedding rate when crabs reach the shedding floats or tanks.

Immediately upon capture, peeler crabs should be separated and placed in shallow containers, rather than dumped on top of each other in barrels or baskets as is common practice in handling hard crabs. Containers with peeler crabs should be covered with damp burlap or other material to shade them and prevent drying out. They should not be exposed to direct sunlight, excess heat, motor fumes or gasoline. Live cars, (a bateau partially filled with water) or wells containing circulating water, such as those used by bait dealers, are excellent for keeping peeler crabs until they are transported to the shedding operation.

The Shedding Operation

The basic feature of a soft shell crab operation is either a series of floating pens (floats) or tanks filled with sea water in which the peelers are placed and allowed to shed (Figure 8). The number of floats or tanks used depends upon the size of the operation (volume of peelers handled). A minimum of two shedding floats or tanks is required, but at least 4 or 5 are desirable in order that peelers can be graded according to stages, with white line, pink line, red line and buster crabs being kept in separate floats. Experienced soft shell crab operators are able to distinguish more than four stages of peelers and separate them accordingly in individual floats or tanks. It is important to keep the various stages separate, since peelers which have not shed may feed upon those recently shed.

Pink line, red line and buster crabs are not usually fed while held in shedding tanks. If white line or green crabs are held for shedding they may require food such as raw fish. Some soft shell crab operators do not feel it is

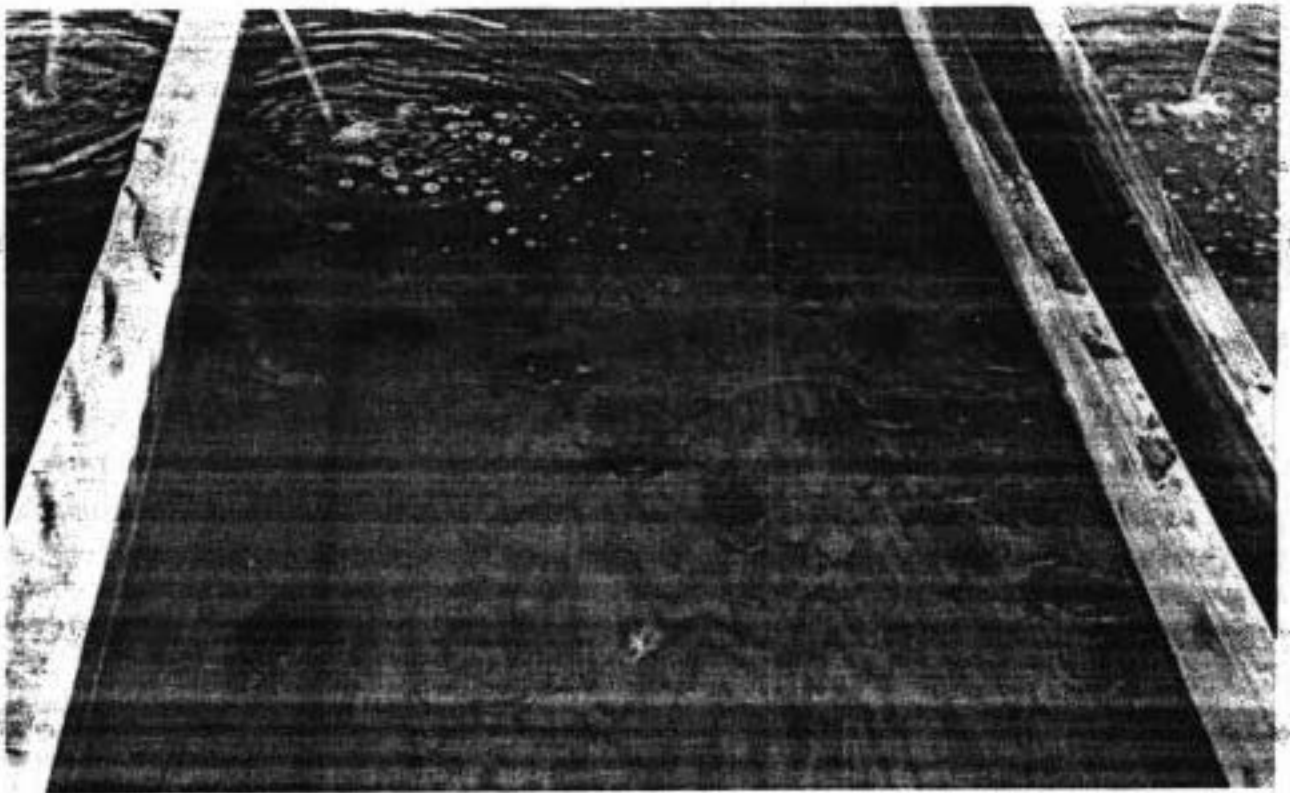
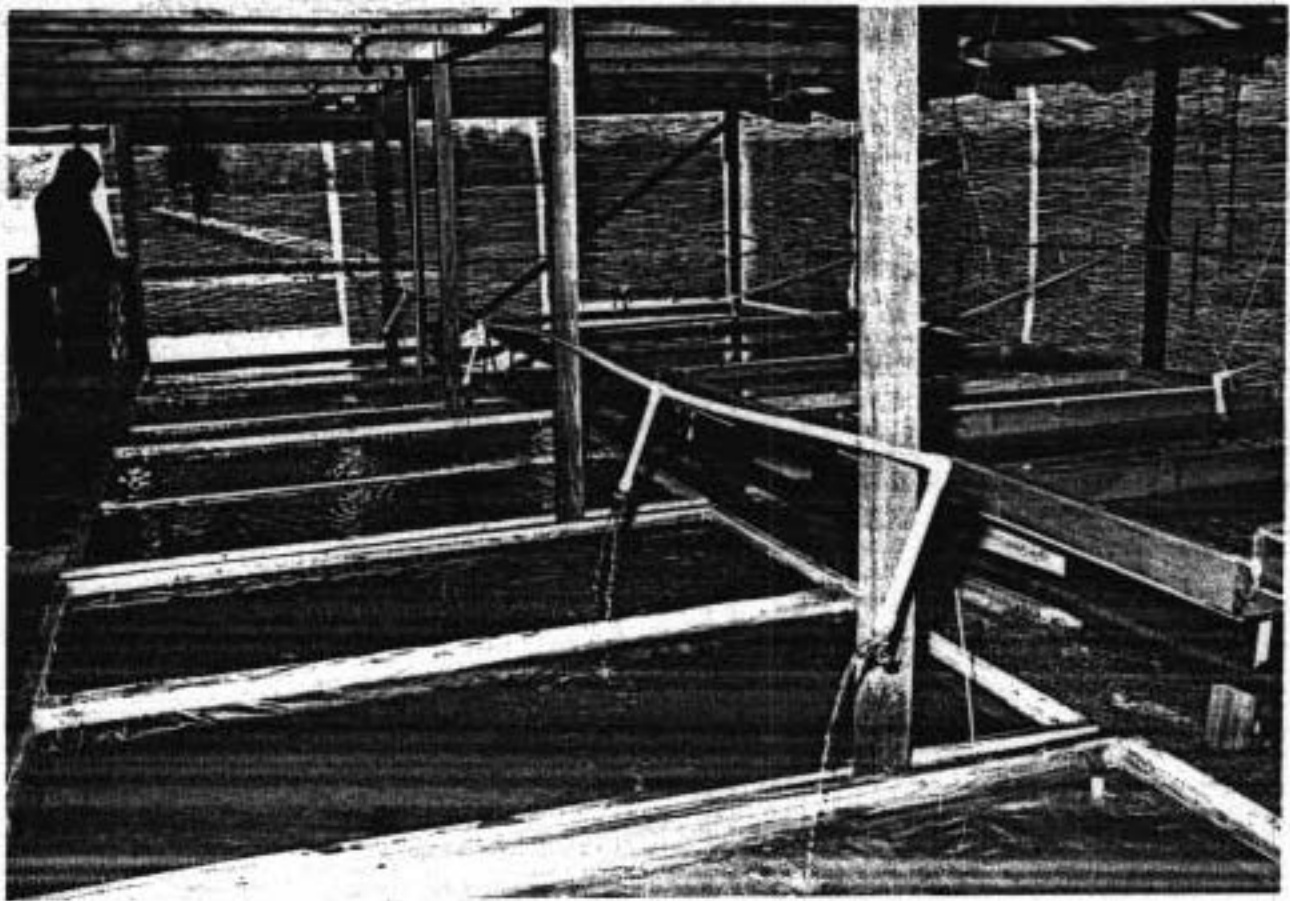


Figure 8. Illustration of a typical shedding tank operation for blue crabs. New water is pumped continuously through a series of shallow holding tanks and crabs are segregated as to molting stage.

practical to use green crabs as peelers since they require a long holding period and even with feeding the survival rate is low.

In order to prevent injury and cannibalism, it is common practice to dislocate the upper movable finger of each claw on peelers by forcing the finger inward with the thumbs while holding one claw in each hand, prior to placing them in the shedding floats or tanks. This practice (known as nicking) is not recommended. If not done with extreme care; nicking can damage the underlying muscle tissue, resulting in bleeding which may cause infection or death. Swelling may also occur, preventing the crab from shedding. Binding both claws with rubber bands or small pieces of surgical tubing applied with needlenose pliers are much more effective methods, but are time consuming and may not be practical for a large scale operation. Experienced soft crab operators feel that careful sorting of peelers as to stage and frequent culling is the best procedure to prevent injury or cannibalism.

Each shedding float can hold 200-400 peelers, depending on float size, crab sizes, and water temperatures. Overcrowding during the hot summer months can result in high losses of peeler crabs in the floats or tanks. Water temperatures ranging from 70° - 86° are common in locations where shedding floats are used (shedding normally ceases at water temperatures of less than 68°F). At higher temperatures, dissolved oxygen in the water decreases and mechanical aeration may become important in tanks or in floats held in protected waters. Low dissolved oxygen may not be as critical as high water temperatures however, and shading or other methods to reduce heat in the floats or tanks can be important during the summer months.

Fishing the Floats or Tanks

Proper "fishing" and separation of peelers in floats or tanks is very important, since the closer a peeler approaches shedding the less active it becomes. Busters and soft shell crabs left with red line peelers may be killed and eaten unless the crabs are properly sorted and culled frequently. Placing "green" crabs in floats or tanks should be avoided at all times. Dead crabs must be removed promptly from the floats or tanks to avoid contamination.

A newly shed crab is soft, wrinkled and defenseless. Crabs which have just shed should be allowed to remain in the float or tank for 1-2 hours until they

absorb water and reach full size. At this time they will no longer be wrinkled in appearance and will be soft and rubbery to the touch. This conditioning period also strengthens the crab, which is very important if they are to be shipped alive. Newly shed crabs should not be allowed to remain in the water for more than 2-4 hours, if possible, since their shell will harden to the extent that they lose their high market value.

Soft crabs removed from the tanks or floats are usually graded as to size ("Mediums", "Hotels", "Primes", "Jumbos", and "Whales"), and must be refrigerated immediately or cleaned and frozen until marketed. If refrigerated for shipping, they are kept alive and stacked in special containers between layers of ice, dry moss, special paper or other soft dry material (not wet, as this may induce hardening of the shell). They should not be placed directly in contact with ice, however. Soft shell crabs which are to be frozen for shipment are cleaned and placed in plastic bags, then packed in boxes by the dozen. The usual method for cleaning soft shell crabs is as follows:

- a) Using a pair of shears, lift the lateral points of the shell and cut off the gills (dead man).
- b) Lift and cut off the apron at it's base.
- c) Remove the mouth parts and eyes by making one cut across the front of the crab just behind the eye orbits and drain the fluids from the stomach.
- d) Wrap in plastic film or suitable size plastic bag before freezing.

Shedding Floats, Tanks and Related Equipment

Floats

The most common type of soft shell crab shedding operation involves the use of floating cages or pens (floats) constructed of wood or other non-toxic material. These floats are usually made of pine, and are commonly 12 feet in length, 3-3½ feet wide and 1½ feet deep. The float bottom is made of 6-inch wide boards which may be tightly fitted for holding white line or pink line peelers, and slightly spaced (¼ inch apart) for redlines and busters. The sides and ends of the float are constructed of vertical laths or slats regularly spaced to allow for water circulation (approximately 1/4-inch spaces between laths). The floats, sides and bottoms, may be covered with ratwire to prevent predators such as eels or mummichogs (mud minnows) from entering. Around the sides and

ends of the float, a wing shelf or flange of boards (6-8 inches wide) is placed to stabilize and buoy the float at a depth which will prevent crabs from escaping. This wing shelf is usually placed about 9 inches from the top of the floats. Most floats do not have tops, but some operators use screens or covers to prevent predation by raccoons, kingfishers, etc. Shedding floats are often placed near a dock or under a covered wooden shedding house supported on pilings.

In South Carolina, shedding floats are not practical in many tidal streams. Areas having strong currents, excessive wind and wave action are not suitable for holding live peeler crabs. Protected bays, man-made canals or lagoons, or saltwater impoundments may be more practical locations in S. C. for a shedding operation. Some of these protected areas, however, may have excessively high water temperatures, inadequate circulation and poorly oxygenated water during warm weather. In some situations, such as in an impoundment or lagoon, a floating mechanical aerator such as the electric-powered types used in fish farming operations, may be essential to provide for adequate water exchange and oxygenation. Such portable units are commercially available for \$200-300.

Tanks

Instead of shedding floats, a variety of types of tanks may be used for holding and shedding peeler crabs. Either an open system, involving pumped saltwater from a nearby water body, or a closed system, involving the recirculation of water through a system of tanks and filters, may be used. The closed system is used in areas where it is not possible or practical to pump from a natural saltwater supply such as a river or creek.

In either an open or closed system, the tanks, pumps, and many other features are similar. Tanks may be constructed of wood, fiberglass or concrete. Shedding tanks may be of varying dimensions, but those commonly used are approximately 4 ft. by 8 ft. by 9-10 inches deep. Water depth should not be kept at more than 4 inches in the tanks.

Tanks constructed of marine plywood or other wood should be coated with a non-toxic paint or resin. A durable epoxy resin such as GLUVIT, which waterproofs the wood and seals joints, is excellent. Coating with fiberglass cloth and resin is another alternative. Toxic paints containing copper or lead must be avoided. Concrete tanks also require a coating of non-toxic epoxy resin.

Fiberglass or heavy duty plastic tanks may be used, and have many excellent features, but are more expensive.

Tank supports are usually needed for shedding tanks, to facilitate removal of soft crabs, etc. Supports may be constructed of lumber or angle iron and should be heavy duty. A 30-inch high table, constructed with six 4 x 4-inch legs bolted to an upper framework of 2 x 6-inch lumber, having external 2 by 4-inch board crossbracing fastened to the 2 x 6-inch skirt is recommended by sources in Virginia. Unless tanks are indoors, they should be kept shaded to prevent excessive heating of the water during hot weather. Outdoor tanks may also require screens or covers on top to prevent predation by raccoons, birds, etc.

Pumps, Lines and Other Equipment

The pumps and pump lines selected for shedding tanks must be carefully chosen. It is advisable to contact a pump company representative before selecting this equipment, since vertical lift from water supply to pump, length of intake pipe, vertical discharge head or pump rate of flow, etc. will vary from one operation to the next. The size of the pump will vary with the volume of water in the overall shedding operation, but the higher the turnover rate of water in the tanks the more crabs can be held successfully. Adequate water exchange is essential to remove wastes and provide oxygen to the peelers. Turnover rate must be estimated from the volume of water needed for all tanks in the system. A 50 gallon per minute pump for example, would give at least 10 turnovers per hour for 4 standard size tanks.

Pumps designed for use in sea water are essential. In addition, pumps should not have an impeller or other internal parts which come in contact with the seawater made of toxic materials such as copper, monel, zinc or lead.

All pipes and fittings should be corrosion resistant and made of non-toxic material, such as PVC pipe. Stand pipes in the tanks themselves (overflow pipes) should be of PVC pipe and located at the opposite end of the tank from the water inflow. If drain pipes having a larger diameter than two inches are used (larger sizes provide for a smoother flow of water) they should be screened with plastic screening ($\frac{1}{4}$ - $\frac{1}{2}$ inch mesh) to prevent crabs from escaping.

In an open system, the water intake should be placed as deep in the water of the creek, etc. as possible, but not close enough to the bottom to pick up

mud or other sediments. Plastic window screening or other non-toxic screening should be used over the end of the pump intake line to prevent debris from entering the system. The outflow or overflow line should be placed well away from the intake line to prevent pumping used water and wastes back into the tanks.

Periodic shutdown and backflushing of the system with freshwater once weekly (or similar time period) throughout the shedding season may be required to kill fouling organisms such as barnacles and sea squirts in the lines. The need for frequent backflushing and shutdown warrants consideration of a double system of pumps and lines running to the tanks so that one system can be placed in operation while the other is being cleaned. A dual system is also useful in the event of breakdowns in one system.

All pump seals must be properly maintained and the plumbing system properly installed to prevent air being drawn into the system and compressed, thereby producing nitrogen gas at supersaturated levels in the water. This may result in "gas bubble disease" causing death of crabs in the tanks.

A closed shedding tank system is more difficult to operate and maintain than an open system; since it involves proper recirculation and adequate filtration. Before considering such a system, the Marine Resources Division should be contacted for further details concerning equipment and methods.

Considerations

As mentioned before, the purpose of the report is to provide what is hoped will be useful information to commercial fishermen and others interested in the possibilities of setting up a soft shell crab business in South Carolina. As with any other business, there are certain risks and problems involved, some of which are unique to our area. There is certainly no guarantee of success in a soft shell crab operation. A good working knowledge of capturing, recognizing and handling peeler crabs is essential, and considerable experience is required to successfully hold and shed them. Since soft crabs must be removed continually from the tanks or floats, much time and work is involved. Biological and physical conditions, as well as fisheries laws, are considerably different in South Carolina from other coastal States where soft shell crabs are produced, and new or modified methods for shedding operations and catching peelers may be necessary. The potential for soft shell crab production in the coastal area

of South Carolina is good, but those wishing to engage in such activity should not do so without careful planning beforehand.

In making a decision as to whether to enter the soft shell crab business in South Carolina, consideration should be given to: current laws and permit requirements; peeler supply and availability; methods for capturing peelers; location of the shedding operation, methods and equipment to be used; sanitation and other health requirements; local zoning and other ordinances; capital investment requirements, and market outlets. A thorough investigation of these aspects along with a good working knowledge of the techniques and procedures briefly described in this report are essential to a profitable soft shell crab operation. For those planning to engage in a soft shell crab operation for the first time, advice and help from an experienced source, (such as someone already having a soft crab business) is strongly recommended before proceeding.

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