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Trawls and traps capture red crabs of good quality off the Atlantic coast.

Observations on Distribution and Abundance of Red Crabs in Norfolk Canyon and Adjacent Continental Slope

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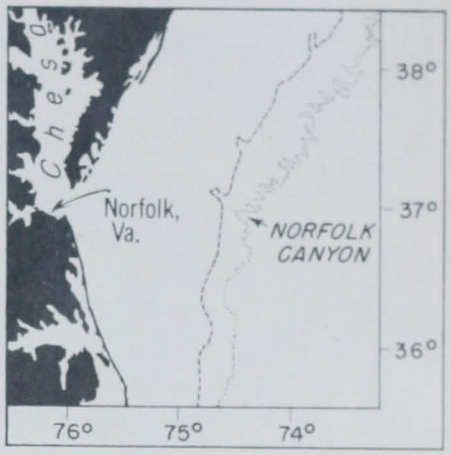
ABSTRACT

The results of June, 1973 trawl and trap sets in the Norfolk Canyon and adjacent slope area are summarized with respect to red crab (Geryon quinquedens) *distribution and abundance. Red crabs ranged in depth from 145 to 870 fathoms but were most abundant from 145 to 280 fathoms. This species was more abundant on the adjacent slope area than in Norfolk Canyon. Crabs caught ranged from 2 to 6 inches in carapace width. Most of the crabs were in the hard shell condition but a few peeler, soft, and papershell crabs were also caught, indicating that molting was occurring. The crabs were segregated with regard to sex. Deeper catches had more males; shallower catches had more females. A few ovigerous females were caught in both the canyon and slope area.*

INTRODUCTION

The red crab, *Geryon quinquedens* (Figure 1), occurs at depths from 100 to 1,000 fathoms in the western Atlantic Ocean from Nova Scotia to Cuba (Chace, 1940; Schroeder, 1959) and from 200 to 800 fathoms in the Gulf of Mexico (Pequegnat, 1970). *Geryon* is a relatively large crab, reaching a carapace width of 7 inches and a weight of more than 2.5 pounds (Wilder, 1966). A commercial processor in New England has realized a 23 percent meat yield (Galus, 1973).

Historically the red crab has been little-known and seldom utilized (Schroeder, 1959; McRae, 1961). Exploratory trawl fishing has confirmed the presence of concentrations of red crabs between 200 and 300 fathoms east to southeast of Ocean City, Md. (McRae, 1961). More recent explorations established that the red crab could readily be captured by pot or trap fishing gear in 250-500 fathoms near Hudson, Block, and Baltimore Canyons (*Delaware* Cruise Report 68-3, *Delaware II* Cruise Report 70-8). In fact, Meade (1970) has optimistically suggested that commercial quantities of red crabs exist in our offshore waters; what remains to be done is to develop that resource into a fishery. A more recent article (Galus, 1973) has brought attention to the paradox of a short supply of a superabundant resource. New England's first commercial producer of red crabs is finding it difficult to obtain a steady supply of crabs for its operation, due to the lack of fishing effort, either directly or indirectly, for red crabs.



From June 4 to June 16, 1973, scientists from the Virginia Institute of Marine Science conducted a trawl survey of the Norfolk Canyon and adjacent continental slope aboard the University of Miami research vessel *Columbus Iselin*. Data concerning the red crab resulting from this cruise are reported here.

AREA FISHED

Trawling was conducted within the Norfolk Canyon (lat. 37°00′-37°10′N; long. 74°10′-74°45′W) and on an adjacent slope area (lat. 36°32′-36°48′N; long. 74°25′74°46′W). A total of 47 half-hour trawls was made in depths ranging from 40 to 1,100 fathoms. Effort was distributed as follows: 25 trawls in the canyon (6 in less than 85 fathoms, 14 between 85 and 500 fathoms, and 5 deeper than 500 fathoms); 22 trawls on the slope (6 in

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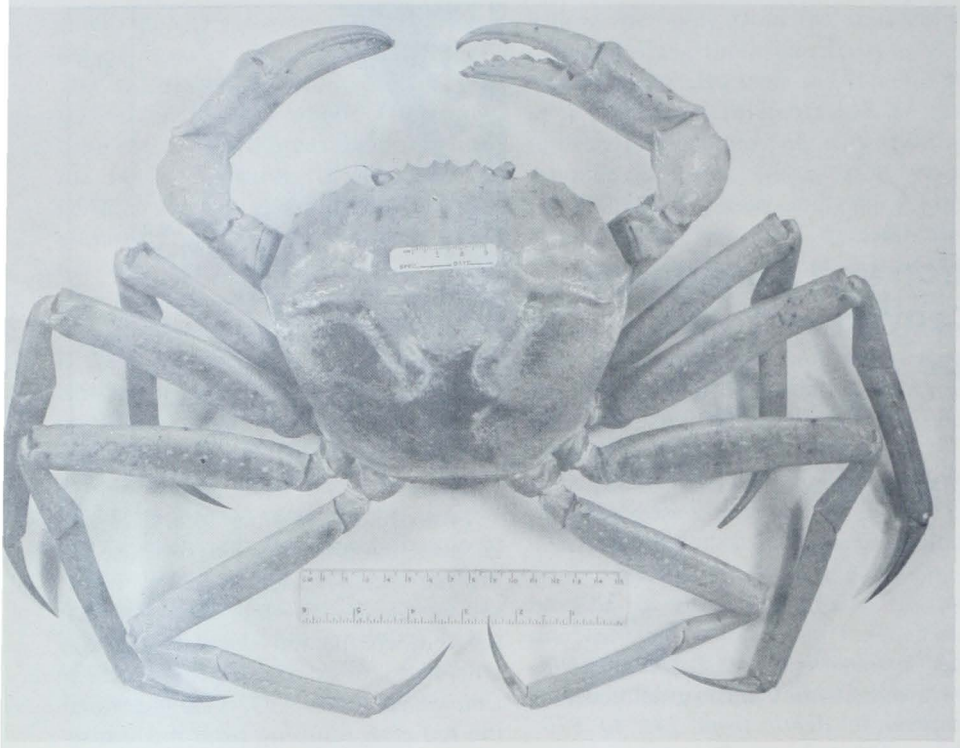

Figure 1.—A male specimen of red crab, *Geryon quinquedens*. A crab of this size can weigh as much as 2 pounds.

less than 85 fathoms, 12 between 85 and 500 fathoms, and 4 in 500 fathoms or more).

FISHING GEAR

The trawl gear used was 45 foot semi-balloon, four-seam otter trawls equipped with plastic mud-rollers, metal floats, and China-V doors. The trawl nets were constructed of nylon webbings of the following stretched mesh sizes: body, 1¾-inch; intermediate, 1½-inch; cod end, $1^{7}/_{16}$-inch with ½-inch inner liner.

In addition to trawling, 12 aluminized wire lobster pots (Figures 2 and 3) were set along the axis of the canyon in depths from 85 to 640 fathoms. The traps, provided by Ocean Research Corporation[1] of Kennebunk, Me. were of two sizes: 48 × 22 × 14 inches with a parlor on either side of a central bait chamber (kitchen) and 60 × 30 × 18 inches with two parlors in series behind the terminal bait chamber. Each trap was weighted to 110 pounds in air, fitted with a bridle and a $^{5}/_{16}$-inch braided nylon/polypropylene hauling line. A radar staff and two inflatable buoys were secured to the warp of each trap. Each trap was baited with four hake (*Phycis chesteri*) in two bait bags, and set for approximately 48 hours. Haul-back was accomplished with the aid of a hydraulic capstan but the line had to be hand-coiled into the storage tubs. Depending on the length of warp, from 30 to 60 minutes were required to haul each trap.

[1] Reference to firm name does not imply endorsement by the National Marine Fisheries Service, NOAA.

FISHING RESULTS

Nineteen of the 47 trawl catches had 706 crabs weighing 901 pounds. Individual catches ranged from 1 to 197 crabs (0.7 to 319 pounds; an average of 47.5 pounds per half-hour tow). The largest catch occurred on the slope area south of Norfolk Canyon in a trawl depth range from 192 to 254 fathoms.

Eight trawls in Norfolk Canyon netted 236 pounds for an average of 29.5 pounds per tow. Two of these drags, between 178 and 278 fathoms, accounted for 152 pounds or 64 percent of the canyon catch. Five trawls, between 330 and 580 fathoms, netted 84 pounds or 35.4 percent of the catch. Only one crab (less than one pound) was caught in 800-870 fathoms.

Eleven trawls on the adjacent slope accounted for 665 pounds for an average of 60.5 pounds per tow. Six tows between 145 and 280 fathoms resulted in 450 pounds, or 67.6 percent of the slope catch; five drags between 330 and 500 fathoms netted 215 pounds or 32.4 percent.

Nine of 11 traps caught red crabs (one trap was lost during haul-back). Of a total *Geryon* catch of 116.6 pounds, 63.4 percent (73.9 pounds) was taken in five small traps with a mean catch of 14.8 pounds; four large traps caught 42.7 pounds (36.6 percent and a mean of 10.7 pounds).

Four traps (two large, two small) set in 520-740 fathoms caught 47.7 pounds or 40.8 percent of the total. The small traps were slightly more productive (27.6 pounds, average 13.8; 23.7 percent of the total catch) than the 60-inch traps (20.1 pounds, average 10.1, 17.2 percent).

Three 48-inch traps in 325-480 fathoms accounted for 46.3 pounds, an average of 15.4 pounds per trap and 39.7 percent of the total. The two 60-inch traps at this depth caught 22.6 pounds, an average of 11.3 pounds—19.4 percent of total catch.

Two of the nine traps containing *Geryon* also caught deep water sharks, *Centroscymnus coelolepis*, and one trap caught a hake, *Phycis chesteri*. The two traps which did not contain *Geryon* were set in 89 and 98 fathoms. They were very successful in trapping jonah crabs, *Cancer borealis*, and rock crabs, *C. irroratus;* 15.4 pounds in the large one, 28 pounds in the 48-inch. The latter small trap also contained one 3-pound lobster, *Homarus americanus*.

SIZE OF CRABS

Crabs caught by trawl ranged from 1.75 to 6.25 inches in carapace width and weighed from one ounce to 2.5 pounds, respectively. The mean widths of crabs from both canyon and slope trawls were similar, i.e., approximately 4.5 inches. The traps were more selective as to size of individual crabs: 3.75 to 6.1 inch range with a mean width of 4.9 inches. The 0.4 inch difference in mean width between the trap- and trawl-caught crabs reflects an average weight difference of about 4 ounces.

We were concerned initially that the dimensions (5.5 by 7.5 inches) of the entrance funnel to the traps would limit the size of red crabs caught. In fact, the largest crab taken in the traps was 6.1 inches, slightly larger than that trawled in the canyon (6 inches) but smaller than that on the slope (6.25 inches).

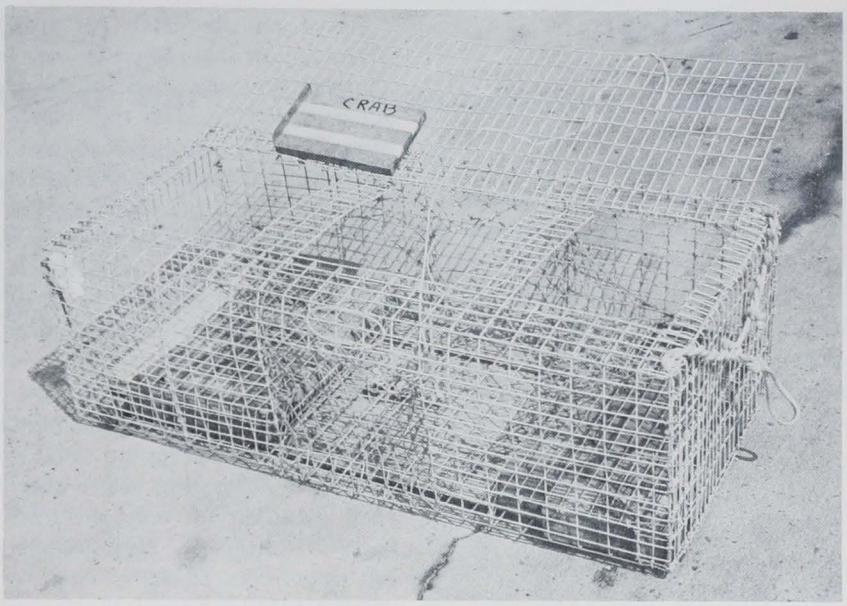

Figure 2.—Small aluminized wire lobster trap (48 x 22 x 14 inches) ballasted with bricks. Note central position of kitchen. The measuring board resting on the lid is 10 inches long.

REPRODUCTIVE ASPECTS

Crabs were segregated by sex. Rarely was a 1:1 male to female ratio approached. The trawl catches had more males (3:1 to 16:1) in the deeper strata (220-550 fathoms) and more females (1:2 to 1:3) in the shallower strata (80 to 220 fathoms). A few ovigerous females were captured on both canyon and slope and were present in both depth strata.

These ratios were somewhat reflected in the trap catches. Seven of eight traps between 400 and 640 fathoms contained all male crabs; the eighth trap contained eleven males and two females, one of which was berried. The trap set at 325 fathoms contained eight females (three ovigerous) and three males. The overwhelming number of males in the traps partially explains the larger mean size of crabs caught by traps as compared with those caught by trawls. Since females are smaller than males on the average, their presence in larger numbers in trawl samples would lower the expected mean.

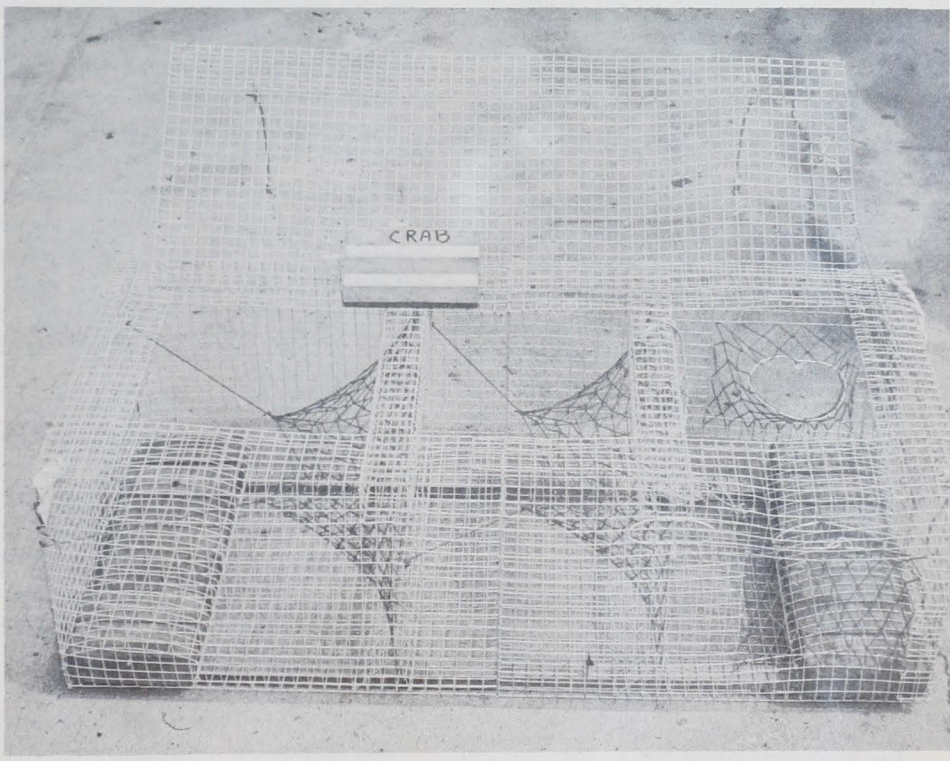

Figure 3.—Large aluminized wire lobster trap (60 x 30 x 18 inches) ballasted with bricks. Note the terminal position of the bait chamber (kitchen). The measuring board resting on the lid is 10 inches long.

INTERMOLT STAGE

All of the crabs caught in the traps were in the hard shell condition; no peeler or papershell specimens were observed. Most of the crabs taken in the trawl fishery were also in the hard shell stage, but a few peeler as well as soft and papershell stage crabs were also observed, indicating that some molting does occur in June.

QUALITY

There was a marked difference in condition of the crabs caught with the two types of gear. Those taken in the trawls were relatively inactive and required extensive washing to be rid of the mud which often filled the cod end of the net. Crabs in the traps were clean, and very active.

The larger crabs were steamed and eaten. The meat was easily picked and was rated very good to excellent in taste by nearly everyone on board the research vessel. The crabs were prepared as follows: the carapace was lifted off the fresh crab, the viscera and gills washed out and the mouth parts and abdominal apron removed. The body of the crab was then split in half lengthwise (an easy task). This method reduced the volume of material that had to be placed in the cooker and, subsequently, in freezer storage. Furthermore, the potential for bacterial growth and/or flavor deterioration of the meat was reduced by removing the internal organs. The frozen picked meat as well as the meat from frozen crab parts was also judged excellent in taste after at least three weeks in frozen storage.

DISCUSSION

Earlier exploratory studies reported the best fishing for red crabs to be between 200 and 300 fathoms (McRae, 1961; *Delaware II* Cruise Report 70-8). The most productive depth range encountered during trawling on the *Columbus Iselin* cruise was similar, i.e., 145-280 fathoms.

Based on the catch per trawl, it would appear that red crabs were more abundant on the slope than in the adjacent canyon. The trap catch records, however, strongly suggest that red crabs are available and vulnerable to traps at much greater depths, i.e., to 640 fathoms, at least in the canyon. Unfortunately, there was insufficient ship time to set and haul traps on the adjacent slope to compare the two areas.

Deep-sea trawling is very time consuming, a disadvantage that may limit or prevent its use as an economical means of harvesting red crabs. One must consider not only the time the trawl is fishing the bottom, but also the time required to set the net at the desired depth and to retrieve it. Furthermore, trawl-caught crabs are in relatively poor condition, particularly if the haul is loaded with mud. This, of course, was our experience with trawls lined with ½-inch mesh. Commercial gear equipped with larger mesh would probably not accumulate mud to the extent of a lined trawl, but the quality of the crabs might still present a problem if they are to be transported alive to shore facilities for processing. Shipboard processing would eliminate the problem because there is no difference in quality of the meat of trawl- and trap-caught crabs.

An efficiently handled trap fishery as presently conducted by several offshore lobster operations may be the most productive fishery investment. Since jonah crabs and lobsters are not abundant at the depths where red crabs are most abundant, fishermen could set pots at those depths which would provide the greatest economic return. Such a broad-based fishery would avoid the danger of seasonal changes in availability of any one species and would allow profitable use of vessels and gear year-round. Pots can be used on rough bottom where lobsters often congregate but are unavailable to a trawl. (This particular advantage of pot over trawl does not appear to apply to the red crab which prefers mud bottoms.)

Past experience on RV *Eastward* suggests that mortality is often high when red crabs are refrigerated in air or water and that larger crabs die first. Packing in ice may, as mentioned by Wilder (1966), be a solution, but onboard processing would seem to be a better method of handling red crabs, caught either by trap or trawl.

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