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THE CHESAPEAKE BAY ROCK CRAB

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Scientists in VIMS' Department of Crustaceology are currently investigating certain aspects of the biology of the rock crab, Cancer irroratus (Figure 1) in light of its potential for a Chesapeake Bay fishery.

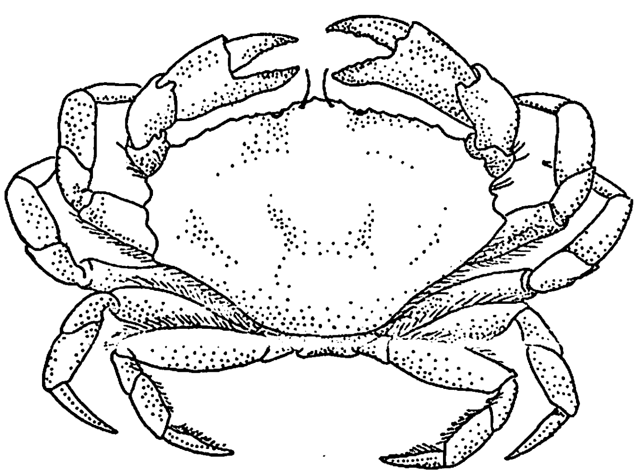

Fig. I. The rock crab, *Cancer irroratus*

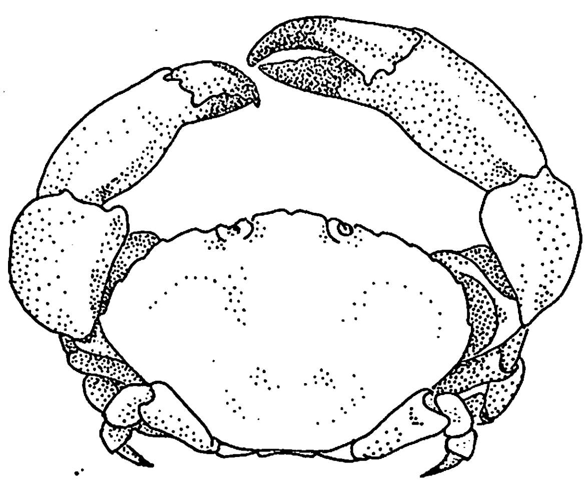

Fig. 2. The stone crab, *Menippe mercenaria*

The rock crab ranges from Nova Scotia to the South Atlantic States. Known locally as "stone crab," it should not be confused with Menippe mercenaria, the true stone crab (Fig. 2) which has a southern distribution. The rock crab is most abundant along the New England coast where it is the main source of edible crab meat. There is no large commercial fishery in that area primarily because of competition from the lobster industry, but there is no other reason why this crab could not be utilized as a food source. Large crabs reach 6 inches in width and contain a large quantity of meat, especially in the claws. The flavor equals that of the blue crab.

Chesapeake Bay is within the southern limit of the range of the rock crab, a fact obvious from their presence in the catch of the winter dredge fishery for blue crabs. Here rock crabs are now culled and discarded. Some areas of the bay are avoided by dredgers because of the preponderance of rock crabs over blue crabs.

Rock crabs of the lower Chesapeake Bay may be utilized four ways: 1) as picked crab meat; 2) as whole, fresh, or steamed hard crabs; 3) as peeler crabs to shed into soft crabs during the winter months; and 4) as peeler crabs for fishing bait.

Virginia dredge boat captains have been especially helpful by taking VIMS scientists with them during dredging for blue crabs which began November 30, 1970. First hand information has been obtained on the distribution and abundance of rock crabs compared with blue crabs, on the ratio of male to female rock crabs, on their average size, and whether they are hard, soft or papershells.

Most rock crabs caught in the dredge fishery of Chesapeake Bay are males and may be distinguished from the females by the shape and size of the abdomen or "apron" (Fig. 3). The crabs have been more abundant east of the Chesapeake Bay Bridge Tunnel and are usually found on hard bottom. Above the bridge tunnel they appeared to be more common on the eastern side of the bay.

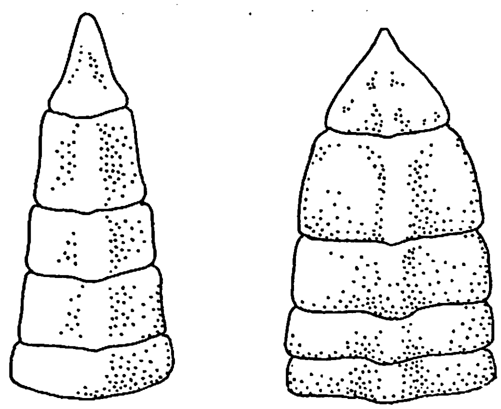

Fig. 3. The shape of the abdomen or "apron" of the male and female rock crabs.

Hard crabs have been kept alive and healthy for more than a month at the Institute in indoor tanks supplied with running seawater. Soft crabs have also been produced, particularly during January when a large percentage of the rock crabs caught have been peelers.

Soft rock crabs are "fatter" than soft blue crabs, that is, for any given width, rock crabs weigh substantially more than blue crabs. Four- and 5-inch wide blue crabs may weigh 2 to 4 ounces whereas the same size rock crabs weigh 4 1/2 to 10 ounces. If sold by weight, soft rock crabs would bring a higher market price than their blue crab counterparts.

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OCEANOGRAPHERS INVESTIGATE CHESAPEAKE BAY SURFACE FILMS

In response to needs in the field of oil-pollution control and abatement, a team of VIMS oceanographers have studied oil films on water inside the entrance to the Chesapeake Bay to determine the behavior of films in relation to winds and tidal currents and to document the biological and chemical composition of the oil films.

The area for operations was within roughly five nautical miles of the Chesapeake Bay Bridge and Tunnel. This area was selected because of the history of ship and barge collisions with the bridge, the heavy ship traffic and accompanying possibility of oil spills, and the fact that the bridge provided structures for position fixes.

Dr. Wyman Harrison, head of the Department of Physical Oceanography at VIMS, said that knowledge of oil-slick motion will be useful in determining what coastal areas will be affected in case of accidental oil spills, what cleanup activities should be used, and where the cleanup should be concentrated. Research also will help the oceanographers understand oil-slick "aging" or the chemical and biological changes which occur with time.

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Detection and determination of the sources of oil films is another important phase of the Chesapeake Bay film study. "We wish to know if the film is due to human negligence as opposed to natural causes, and if the responsible party can be determined," said Dr. Harrison. "An accurate technique -- if the slick is fresh -- is a chemical analysis of the film. Because of the need to monitor wide areas rapidly, it would also be desirable to be able to detect and distinguish film by remote sensing techniques."

The oceanographers also recognize the need for baseline information on the current frequency of oil slicks, their composition, and their effects on biological productivity. With this information they can estimate oil tolerance levels of water bodies and from them specify limits for various kinds of human activity which result in oil slicks.

The three main research objectives therefore have been:

1. Determination of the predictability of oil slick motion under the influence of winds, waves, and substantial surface currents (with the development of prediction equations if possible);

2. Determination of oil slick composition, especially the relative percentages of petroleum versus biologically-derived portion; and

3. Investigation of the feasibility of detection and distinction between films of petroleum and those of biological origin by means of remote-sensing techniques.

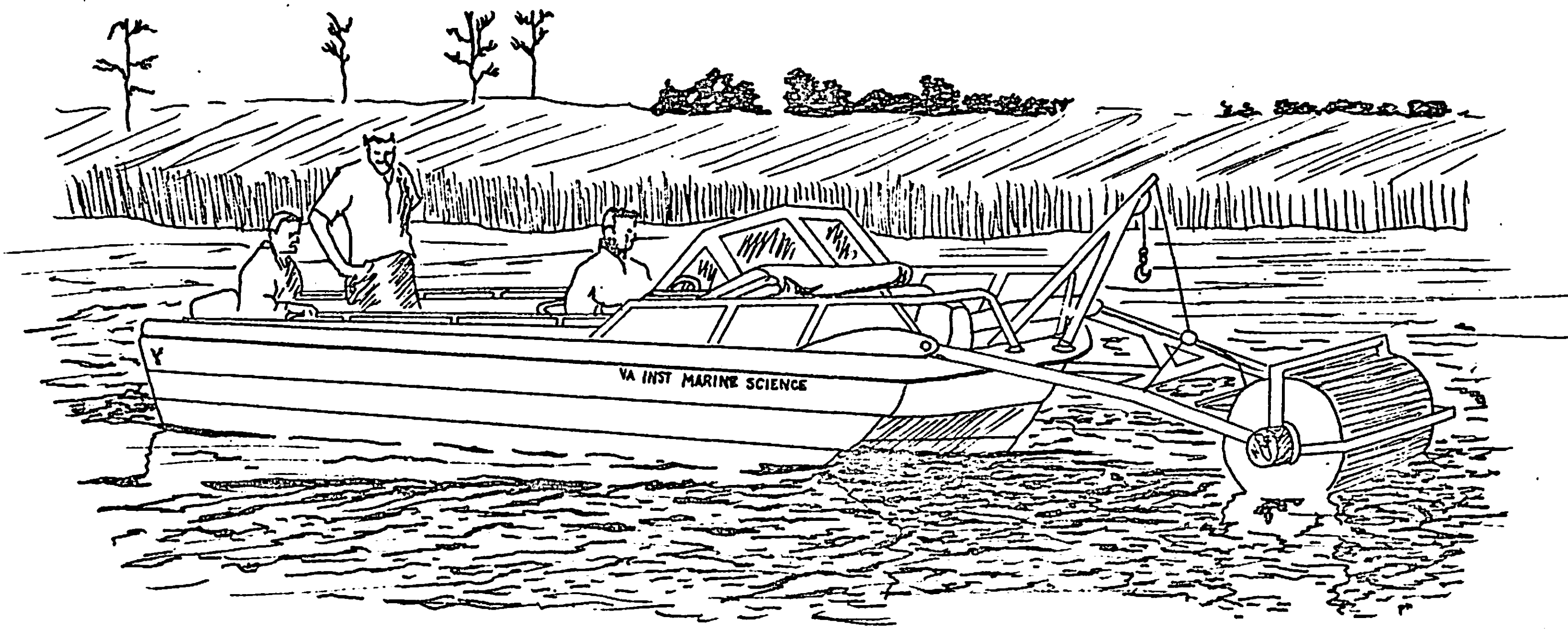
To meet the first objective, small volumes of oil were released, and the resulting oil slicks observed and tracked for several hours. It was found that motion of small volume oil slicks near the bay entrance was due mainly to surface currents.

"In comparing predicted paths and slick motions, one may utilize the finding that slick motion follows the current path plus a small percent wind factor," said Dr. Harrison. "The predicted paths do not match or bracket the observed motions in both direction and distance. The discrepancies are not regular in our statistically small data sample and they amount to several nautical miles in a single flood or ebb tide."

The conclusion of the study is that, for the Chesapeake Bay entrance, tidal-current tables may permit prediction of the general directions of slick travel, but are presently unsatisfactory for accurate prediction of oil-slick trajectories. The oceanographers feel that accurate predictions require detailed knowledge of both tidal currents and wind-generated currents.

To meet the second objective, a rotating-drum skimmer (a device designed to skim off a thin layer of the sea surface), and mesh screens have been used to obtain oil slick samples and a laboratory has been equipped for analyis of the collected material.

Dr. William G. MacIntyre, project director and head of the Chemical Oceanography Section, explained that the primary goal in this phase of the study was to chemically distinguish petroleum and natural oil slicks encountered at the Chesapeake Bay entrance. A secondary goal was a detailed analysis of the slicks directed toward more complete understanding of the chemical environment resulting from the presence of surface slicks.



Oil slick samples are obtained by use of a buoyant rotating drum. As the device is pushed along, the surface film adheres to the drum's polished metal surface. As the drum rotates, a stationary blade scrapes the material into a trough from which it is pumped into labeled containers.

Dissolved organic material in slicks was analyzed at VIMS, particulate residues were studied by NASA, Wallops Island, and phytoplankton abundance data were obtained by VIMS. Results from these investigations were combined to determine differences between surface samples taken in the presence or absence of visible slicks.

The team of oceanographers found that the collection, analysis, and characterization of sea slick material is practicable. Petroleum slicks can be distinguished from those of recent organic origin and further refinements of sampling technique and laboratory methods are under development.

For the third objective, arrangements were made for aircraft overflights of the oil releases with a capability for photography and infrared radiometry. But Dr. Harrison said that scheduling problems largely eliminated overflights and only a small degree of this objective has been accomplished. The oceanographers did find, however, that ordinary color and infrared color aerial photography were capable of remote detection of Bunker C oil and menhaden fish oil used in the study. Discrimination between these oils using color infrared film was successful for small volume slicks for altitudes of 200 to 500 feet. The study team is recommending that development of an oil slick remote-sensing capability should be continued, but only in coordination with a monitoring program for all types of water pollution.

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SEASONAL CYCLE OF OYSTER MEAT QUALITY INDEX

Oyster quality indices have been published monthly for public oyster rocks in the James, York and Rappahannock since February 1970. These data (shown for individual rocks) are of interest in showing differences and similarities in various locations in each river, and also trends in each river over four-month periods.

At the end of 1970, monthly data for all rocks in a river were averaged to determine the overall quality index. Ordinarily, this method of presentation will not be used since differences between regions in each river are obscured. The technique, however, is good in that it shows seasonal trends and major differences between rivers.

THE RAPPAHANNOCK RIVER - Oysters obtained in the Rappahannock during 1970 always had a quality index far above average and nearly always were of better quality than those in the York or James. In general, the highest quality and yield were reached in May and June and again in December and January. Lowest indices occurred during the spawning period in August and September. No great difference in quality was noted in the upper and lower Rappahannock.

YORK RIVER - Oysters in the York River up to November 1970 were average to above average in quality. They were, however, never equal in quality to those from the Rappahannock during 1970. Peak quality yield in the York for 1970 was in early July which was about one month later than usual. The decline in quality in August and September was typical and was associated with spawning. The typical fall increase in quality during October and November was low, and, in this respect, was typical of York oysters which usually have their highest index (yield) in late spring or early summer. The sudden decrease in index during December and January represented a very substantial drop and dealers confirmed this by reporting reduced yields. The reason for the sharp decline is not known. No great difference in quality was noted in the upper and lower York.

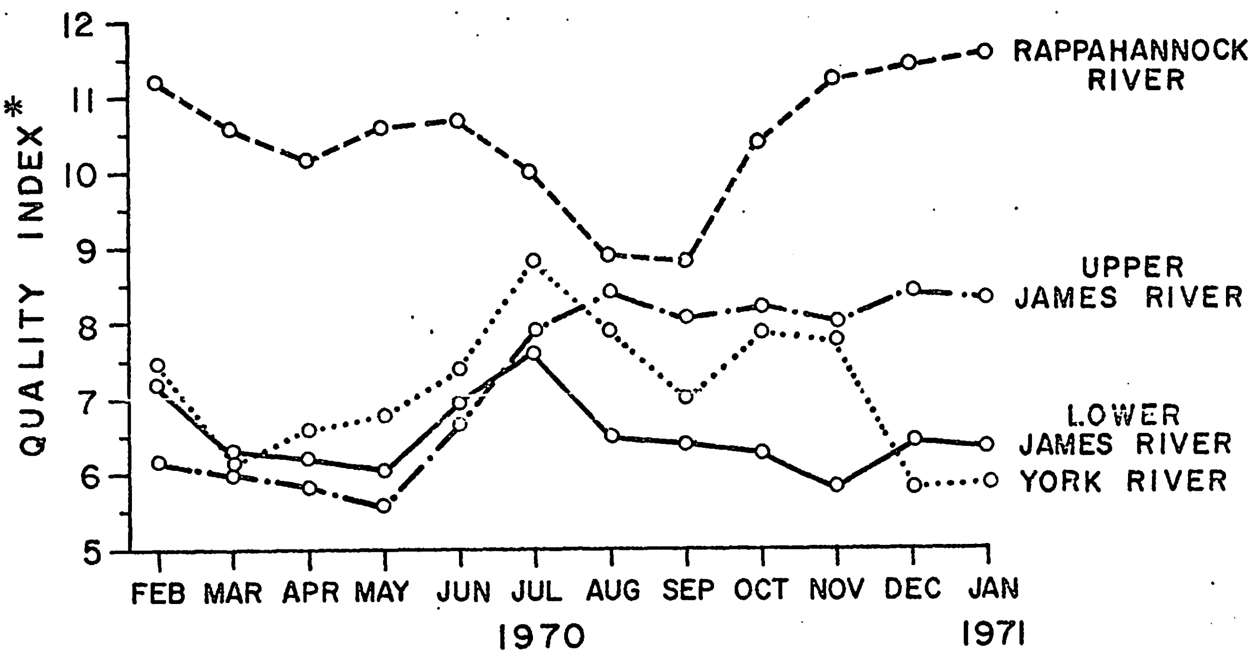
JAMES RIVER - Oysters in the James River showed a sharp difference in index in the upper and lower parts of the river. In the lower James, oysters were slightly lower than those in the York and they followed a more or less typical pattern with peak quality in July, which was about one month later than usual. There was a decline during August and September due to spawning, and thereafter a very slight downward trend to January 1971.

Oysters in the upper James did not follow the typical pattern of peak quality in the spring and the fall, along with the mid-summer decline in quality associated with spawning. The peak in quality occurred in August rather than in the spring and there was no decrease in quality in the summer. Quality (yield) remained above average with only a slight downward trend from August 1970 through January 1971.

In summary, oysters in the Rappahannock had the highest quality for the state in 1970. Those in the upper James were next, and those in the York and lower James were the least.

Timing in seasonal highs and lows in 1970 were not typical. The typical spring maximum occurred in July in the York and James, which is about one month later than usual. An unexplained feature of this years data was the sharp decrease in quality during December and January in the York River.

The seasonal cycle of Oyster Meats Quality Index is plotted on the following graph:



*KEY: LESS THAN 5.6 = BELOW AVERAGE, 5.6 TO 7.5 = AVERAGE, MORE THAN 7.5 = ABOVE AVERAGE.

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