COMPARISON OF SAMPLING DEVICES FOR THE JUVENILE BLUE CRAB, *CALLINECTES SAPIDUS*[1]

The behavior of the blue crab, *Callinectes sapidus* Rathbun, in the Chesapeake Bay varies considerably with age, temperature, and molting cycle. These behavioral differences make efforts difficult to sample effectively the population densities in the Chesapeake Bay and its tributaries. No single gear type appears to sample effectively the blue crab during winter and summer at all depths and types of bottom. During winter blue crabs burrow in the mud in the deeper channels of Chesapeake Bay (Churchill 1917). This pattern is the basis for an active winter dredge fishery in the lower portion of the bay (Van Engel 1962). During a 3-yr survey of blue crabs, Lippson[2] found that juveniles were also present in deeper waters in winter. Comparative effectiveness of two dredges for winter sampling of juvenile and adult blue crabs was reported by Sulkin and Miller (1975).

Blue crabs move about in relatively shallow water in warm weather presumably because of the abundance of food here and for protection among submerged aquatics while in the soft shell condition. During the summer 7.3 m otter trawls have been found to be an effective gear to sample the adult population of blue crabs (Lippson see footnote 2). The otter trawl, with a small stretch mesh (0.6 cm) liner in the cod end, is also effective for catching juveniles in deeper water; however, juveniles spend much of their time in shallow waters during the warmer months. The push net (Figure 1), beach seine, and small otter trawls have all been used with some degree of success in this shallow region.

It is the purpose of this study to compare the effectiveness of the push net, otter trawl, and crab scrape (Figure 2) in catching juvenile blue crabs in shallow water.

Methods and Results

Smith Island in the Chesapeake Bay has extensive grassy (*Zostera marina*) beds which are ideal habitats for juvenile crabs (Stevenson and Confer 1978). This region was chosen to compare the catch effectiveness among a 3.7 m otter trawl, 81.3 cm push net, and a 96.5 cm modified crab scrape during summer 1975.

The otter trawl opened to a working width of 3.6 m. The gear was towed by the RV *Chelae* in depths of 1-2 m for 0.7 km. The cod end was lined with 0.6 cm stretch mesh netting. The trawl door size was 30.5 cm × 61.0 cm and the length of the bridle was 45.7 m.

The push net had a steel frame 81.3 cm wide and 60.9 cm high fitted with a 0.6 cm stretch mesh bag. The leading edge had a 7.6 cm diameter pipe which

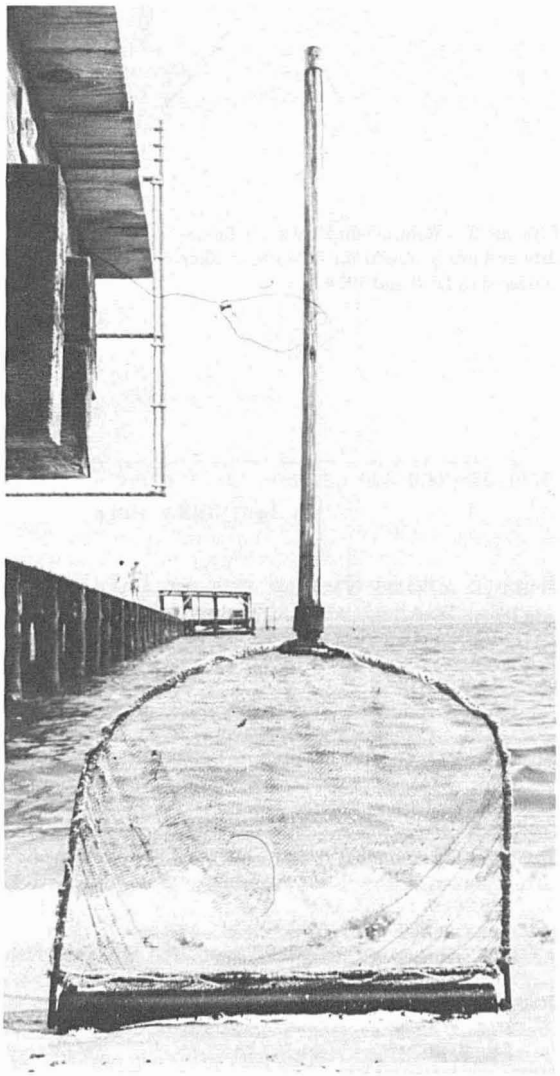

FIGURE 1.—Push net used for blue crab fishing with the roller bar on the leading edge.

[1]Contribution No. 992HPEL from the Center for Environmental and Estuarine Studies, University of Maryland.

[2]Lippson, R. L. 1969. Blue crab study in Chesapeake Bay-Maryland. Nat. Resour. Inst. Q. Prog. Rep. 3, Ref. No. 69-33B:1-13.

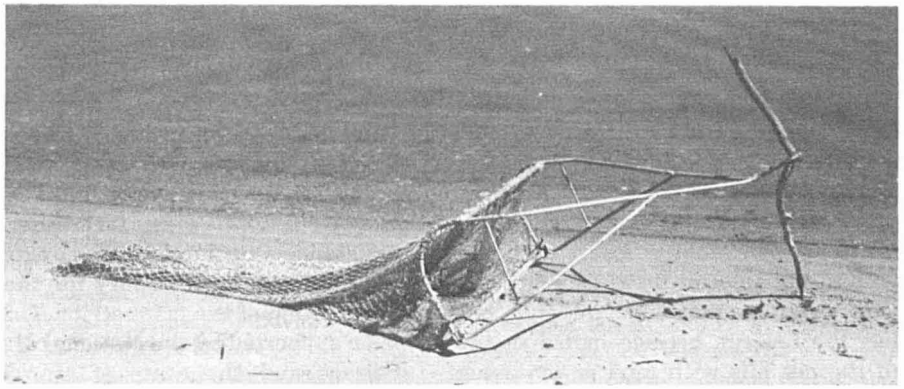

FIGURE 2.—The crab scrape used for blue crab fishing.

rolled over the bottom. The handle was 1.5 m long. The net was manually pushed along a 0.7 km course, waist to chest deep, and parallel to the shoreline.

The crab scrape, used commercially for catching shedding crabs, had a metal frame 96.5 cm wide and 38.1 cm high. The lead bar on the crab scrape has no teeth, a basic difference between it and a dredge. A 3.8 cm twine net 182.9 cm long was fitted to this frame. The crab scrape is towed from a shallow-draft boat over grassy beds. The crab scrape used in this study was modified by fitting it with a 0.6 cm stretch mesh net to retain small (>3 mm) crabs.

The otter trawl and crab scrape were towed simultaneously beside each other from two small outboard motorboats for 6 min at an engine speed of 2,000 r/min. The push net was then pushed parallel to the trawl and crab scrape tows over the same distance but closer to shore. The depths for the trawl and crab scrape tows ranged from 1 to 2 m whereas the push net sampled in depths of 0.6-1.1 m. Eighteen samples were collected for each gear type.

The sex and size class of crabs were determined after each tow. Crab size was determined using carapace width from one lateral spine tip to the other. Crabs >60 mm wide were excluded from consideration in this study because they were not in the most recent year class. Three size classes were used: class I measured 1 to 20.0 mm; class II, 20.1 to 40.0 mm; and class III, 40.1 to 60.0 mm.

The mean number of crabs per square meter is shown in Figure 3. It is apparent that the trawl is comparatively ineffective for classes I and II. The trawl and push net are about equally as effective for class III although neither is as effective as the modified crab scrape for classes I, II, or III. The crab scrape is the most effective gear for sampling juvenile blue crabs.

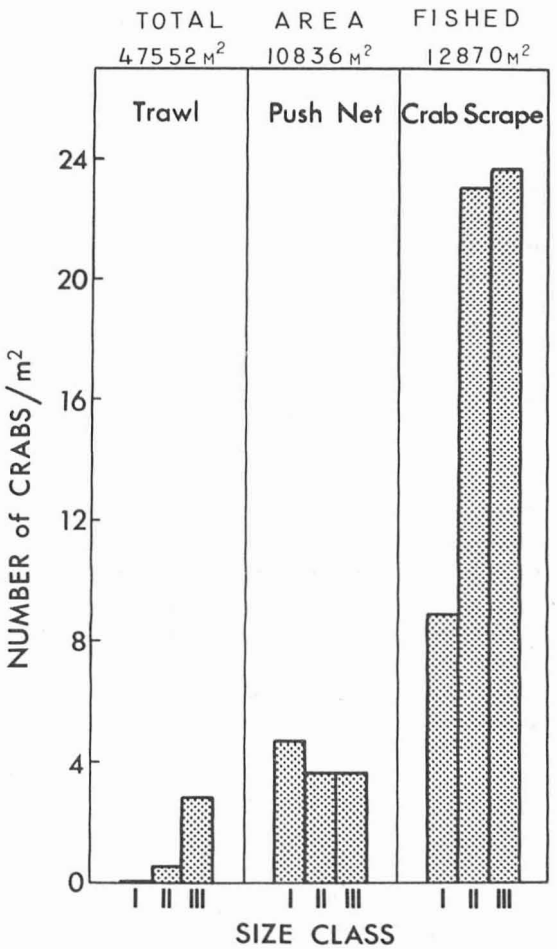

FIGURE 3.—Mean number of blue crabs per square meter for each haul and total area fished by each gear. Size class (carapace width) I = 1-20.0 mm, II = 20.1-40.0 mm, and III = 40.1-60.0 mm.

Discussion

In evaluating various gear for sampling juvenile blue crabs, a variety of factors should be considered, such as catch effectiveness, gear cost, ease of handling, and person hours.

It generally requires two persons to efficiently operate an otter trawl from a small outboard motorboat. Handling an otter trawl from a small outboard motorboat is not only difficult but dangerous as the net can become fouled in the propeller. If the net fills with mud or too much debris, it is impossible to bring the gear on board and the catch must be sacrificed. The push net is operable by one person and snags are infrequent. Mud, as well as high rooted aquatics, makes pushing the net difficult. The push net is effective in shallow water (Strawn 1954). Clear shallow water, however, decreases the effectiveness as many small crabs see the net approaching and swim out of its path (pers. obs.). The crab scrape can be easily handled by one person and seldom becomes snagged (pers. obs. and observations of commercial crabbers).

The cost of a 3.7 m otter trawl is about $150.00. The push net cost varies. They are not available commercially and must be constructed, usually by a local blacksmith. The bag may be cut from a ripped beach seine net. The approximate cost of the crab scrape is $55.00.

Although gear cost, ease of handling, and hours involved are considered in gear selection, the most important factor is catch effectiveness. The push net was more effective catching small blue crabs than the trawl but the modified crab scrape was more effective than either the push net or the trawl when sampling in shallow water.

Considering all pertinent factors, it would seem that the crab scrape is the preferred gear for quantitative studies of juvenile crab abundance.

Acknowledgments

We thank Fred Dobbs and Marion Ross for their valuable assistance during the field sampling, Frances Younger for her technical help in the preparation of the graphs, and Leo Minasian and Donna L. Smawley for their photographic assistance. Our thanks are also extended to Nancy Robbins and Ida Marbury for their help in the preparation of the manuscript. This research has been supported by the National Marine Fisheries Service and the State of Maryland Fisheries Administration (Project No. 3-186-R-2, Contract No. 04-5-043-43).

Literature Cited

CHURCHILL, E. P., JR.
1917. Life-history of the blue crab of the Chesapeake Bay. Off. Bull., Conserv. Comm. Md. 2:11-18.

STRAWN, K.
1954. The pushnet, a one-man net for collecting in attached vegatation. Copeia 1954:195-197.

SULKIN, S. D., AND R. E. MILLER.
1975. Modified commercial crab and oyster dredges as sampling devices for the blue crab *Callinectes sapidus* Rathbun. Chesapeake Sci. 16:137-139.

STEVENSON, J. C., AND N. M. CONFER.
1978. Summary of available information on Chesapeake Bay submerged vegatation. U.S. Fish Wildl. Serv., Off. Biol. Serv. FWS/OBS-78/66, 335 p.

VAN ENGEL, W. A.
1962. The blue crab and its fishery in Chesapeake Bay. Part 2 - Types of gear for hard crab fishing. Commer. Fish. Rev. 24(9):1-10.

ROBERT E. MILLER

Horn Point Environmental Laboratories
Center for Environmental and Estuarine Studies
University of Maryland
P.O. Box 775, Cambridge, MD 21613

DOUGLAS W. CAMPBELL
PAMELA J. LUNSFORD

Fisheries Administration
Maryland Department of Natural Resources
Tawes State Office Building
Annapolis, MD 21401