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**A STUDY OF THE CRAB POT AS A  
FISHING GEAR**

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# A STUDY OF THE CRAB POT AS A FISHING GEAR

CHARLES C. DAVIS

The crab pot as a fishing gear was introduced in Maryland waters, following some years of greatly expanded use in Virginia, during the 1939 season, and was widely used during 1940. The 1941 session of the Maryland Legislature, however, illegalized the crab pot. Since that time the device has been given up almost entirely by Maryland fishermen, its attempted use in a commercial way having persisted in diminishing numbers in only one region of the state.

A very considerable controversy has developed among the crabbers throughout the Chesapeake Bay area concerning the use of the crab pot as a fishing gear, not only as to its efficiency in catching crabs, but also as to its possible destructiveness to the crabs caught and to diamondback terrapin and certain of the fin fishes that are trapped in it. Heretofore this controversy has proceeded without the benefit of detailed observations, the only previous study, a very limited one, having been reported briefly in the annual report of the Chesapeake Biological Laboratory for 1940. Consequently, a wide range of statements has been made, based largely upon the economic interests of the persons making them, rather than upon factual information. The purpose of the study reported here was to provide facts upon which sound policies of management of the fishery can be based. These policies must be such as will best serve the interests of the crabbers and the consuming public, thereby to contribute to the betterment of the socio-economic aspects of the Chesapeake Bay country.

*PROCEDURE:* Studies were started in the middle of June, 1942, and continued through October of the same year. Standard crab pots were used, that is, those used by commercial crabbers in Maryland and Virginia. In the latter state some 40,000 pots were operated in 1941 according to reliable estimates. This type of gear was described, but only briefly, in the Annual Report of the Chesapeake Biological Laboratory for 1940. The standard pot is constructed of one-inch mesh double galvanized chicken wire in the shape of a cube twenty-four inches on a side. The cube is divided horizontally into two compartments, the lower nine inches deep and the upper fifteen inches deep, by a platform of chicken wire. In the middle eight inches this platform (see accompanying sketch) is raised six inches higher than it is on the sides, the elevated portion being rounded. This elevated portion constricts the upper compartment until it has a depth of only nine inches in the middle. In the center of the bottom of the lower compart-



toadfish and other fish, while few crabs are attracted. Furthermore, the use of small crabs as bait would defeat the purpose of the law prohibiting these small crabs from being taken commercially.

The commercial pot has these further characters: In the middle of each of the four sides of the bottom compartment, two and one-half inches from the bottom, there is a funnel (F) opening from the outside into the bottom compartment of the pot. Each funnel is smaller towards the center of the pot than towards the outside, being two inches high by five inches broad within and three inches high by seven inches broad without. At the inner end of each funnel the cut ends of the wire project into the bottom compartment. This arrangement allows crabs to enter the lower compartment of the pot with ease, but prevents them from escaping easily. Toward each end of the raised portion of the horizontal platform separating the lower compartment from the upper there is an opening (O) two inches wide by seven inches long. These openings are constructed by making a simple slit in the wire mesh and bending the cut ends up into the upper compartment. The crabs which enter the lower compartment are unable to take the wire-protected bait and enter the upper compartment, where they remain until the crabber removes them. The crabs are removed from the pot through an opening along one of the edges of the top of the upper compartment. In constructing the pot this edge is left unclosed, and the crabber closes it temporarily with clothes pins (C-C-C) when setting the pot. Finally, a cord (R) is attached to the middle of the upper surface, or at times to one corner, and this leads up to the surface of the water where a cork or other float marks the position of the pot. A cord attached to the middle of the upper surface of the pot and leading down through the pot to the top of the bait compartment helps to give the pot rigidity and prevents pulling it out of shape while hauling it to the surface. When a pot is in operation it is sometimes immobilized by means of weights such as bricks, or other heavy objects.

During most of the season a series of pots was established in two locations within a convenient distance of the laboratory. One of these locations was in the Patuxent River near Fishing (Deep) Point, where a series of ten pots, in about twenty feet of water, was set parallel to the shore. The other location was in shallower water in Back Creek, where five pots were set. In these locations the pots were fished daily except Sunday, and a record was made of the daily catch. Legal males, illegal males, adult females and virgin females were listed separately. Also, a record was kept of the number and the sex of the dead crabs that were taken from the pots. In addition to the above two locations, two pots were set for a short time

in Punch Island Creek in the Taylors Island region of the Eastern Shore. The distance of these pots from the laboratory made it difficult to care for them adequately and, due to strong tidal currents characterizing that body of water, they were lost. However, the limited results obtained are of sufficient interest to be included in the present discussion.

During September it was decided to compare the crab pot as a fishing gear with the trot-line as used by commercial fishermen. To this end a string of ten pots was set in Mill Creek, between the towns of Solomons and Olivet, and arrangements were made with Captain John Jones of Solomons to fish daily his trot-line set parallel to the pots. Three days of valuable data, taken over a period of five days, were obtained at this location to show a comparison between these two types of gear. Later, from ten to twenty-one pots were set in the Chesapeake Bay just north of the mouth of Punch Island Creek, and Captain Charlie Phillips, of Honga, Maryland, highly skilled and experienced in the operation of both types of gear, cooperated on a commercial basis in which he set his trot-line near and parallel to the pots. Eight days of valuable records were obtained on this basis over a period of fifteen days. In the experiments with trot-lines much more thorough data were recorded than earlier in the season. Various sizes of males were distinguished, and "fat" crabs were differentiated from "poor" ones. A careful record was kept of peelers, as well as of badly injured and dead crabs. Also a record was kept of the fin fishes that were trapped in the pots.

In October further experiments were conducted in the Patuxent River from one to two miles up the river from Fishing Point. An attempt was made to determine whether any difference would be noticeable in the catch obtained by the use of stiff new pots and flimsy old ones, by setting pairs of pots side by side, one of the pair being new and one old.

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members of the staff of the Chesapeake Biological Laboratory who aided by fishing the pots from time to time.

*RESULTS AND DISCUSSION:*

A. *Legal and illegal crabs:* The Annual Report of the Chesapeake Biological Laboratory for 1940, reported on a limited number of records in the Patuxent River as follows: "Uniformly good catches of excellent quality crabs were made. . . ." It was found that only 0.9 per cent of the crabs were smaller than legal size. The present investigations in the Patuxent River indicate a somewhat higher percentage of illegal crabs, as shown in the accompanying Table, No. I. The data given in this table show that, over the entire season, ninety-one per cent of the captured crabs were of legal size. Further, the data show that there was an increase in the proportion of legal crabs as the season progressed, from 86.5 per cent in June to 96.3 per cent in October.

TABLE NO. I  
Patuxent River—legal and illegal crabs.

	Season June 17-30	July 2-31	Aug. 2-Sept. 1	Oct. 8-31	
Total crabs captured	1869	200	563	672	434
Legal crabs captured	1700	173	503	606	418
% of legal crabs	91.0	86.5	89.3	89.9	96.3
Illegal crabs captured	169	27	60	66	16
% of illegal crabs	9.0	13.5	10.7	9.8	3.9

In Back Creek a much larger proportion of illegal crabs was captured, as shown in Table II. These data show that in Back Creek, from June 17 to Sept. 1, only 58.6 per cent of the captured crabs were of legal size. Legal

TABLE NO. II  
Back Creek—legal and illegal crabs.

	June 17-Sept. 1	June 17-30	July 2-31	Aug. 2-Sept. 1
Total crabs captured	1499	167	778	554
Legal crabs captured	879	108	405	366
% of legal crabs	58.6	64.7	52.1	66.1
Illegal crabs captured	620	59	373	188
% of illegal crabs	41.4	35.3	47.9	33.9

crabs ranged from 52.1 per cent in July to 66.1 per cent in August, with June intermediate. It is a common observation among crabbers that there are many more small crabs in the creeks than elsewhere, and the present results seem to bear this out.

Many crabbers claim that the crab pot consistently captures a larger percentage of legal crabs than the trot-line, and, as far as these observations extend, this appears to be true. Observations were made at two localities, namely in Mill Creek and in Chesapeake Bay off the mouth of Punch Island Creek. The results of these observations are detailed in Table III,

and show that in Mill Creek and Chesapeake Bay alike a much smaller percentage of the crabs captured in the pots were of an illegal size than

TABLE NO. III

Legal and illegal crabs captured with crab pots and trot-line.

	Mill Creek		Chesapeake Bay	
	trot-line	pots	trot-line	pots
Total crabs captured	827	175	4749	2240
Legal crabs captured	606	158	4452	2186
% of legal crabs	73.3	90.3	93.7	97.6
Illegal crabs captured	221	17	297	54
% of illegal crabs	26.7	9.7	6.3	2.4

was the case with the trot-line. In Mill Creek 73.3 per cent of the crabs captured on the trot-line were of legal size, whereas 90.3 per cent of those captured by the pots were legal. Off Punch Island Creek, in the Bay, there were fewer illegal crabs present in the water, and the trot-line captured 93.7 per cent legal crabs. However, in this case the pots likewise captured a higher percentage of legal crabs, that is, 97.6 per cent. In the case of Mill Creek it should be mentioned that, in addition to the crabs considered in the above figures, large numbers of small-size crabs that came up clinging to the bait were lost because they were too small to be held in the two-inch mesh dip net of the crabber. These small crabs did not appear in the pots at all, although most of them were large enough to be retained in the one-inch mesh wire of the pots. Apparently none of these smaller crabs was present off Punch Island Creek.

The record of daily catches, both in Mill Creek and off Punch Island Creek, with the exception of the record for September 23 in the latter location, further shows that the tendency of the pots is to catch a higher proportion of legal crabs, as indicated in Table IV. Although no data are at hand to prove the point, the explanation given by crabbers seems a logical one: "When a big 'Jimmy' gets into the pot, the little crabs in the neighborhood keep their distance out of respect for the size of his claws."

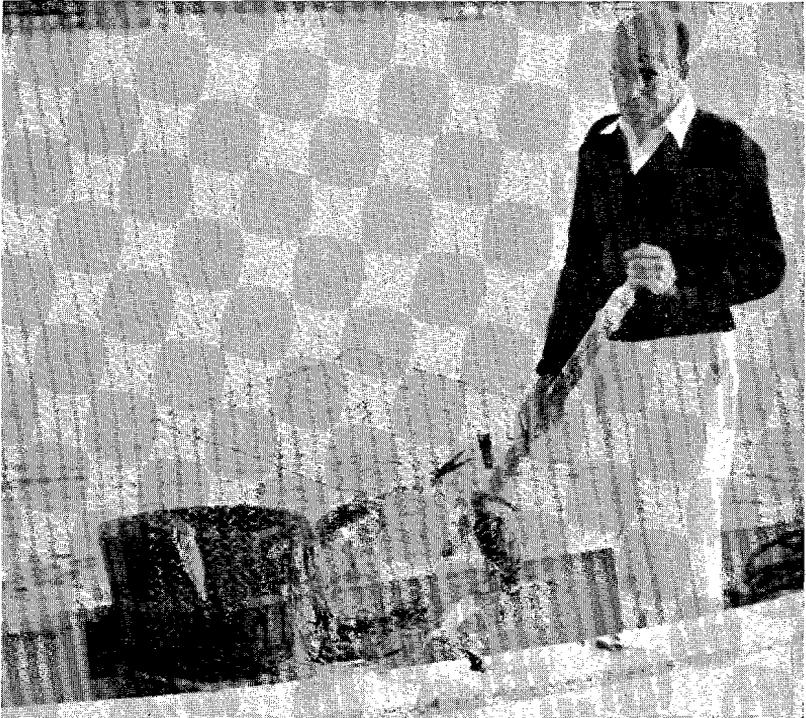
TABLE NO. IV

Daily record of legal crabs—trot-line and pots.  
Expressed in per cent of total crabs captured.

Date	9-4*	9-5*	9-8*	9-15	9-16	9-17	9-18	9-22	9-23	9-24	9-25
Trot-line	71.4	73.4	74.2	97.4	80.7	95.1	97.8	95.8	98.3	91.5	91.5
Pots	88.5	90.6	93.2	100.0	97.5	97.0	98.3	100.0	96.9	98.6	95.7

\*These records are from Mill Creek, all others are from off Punch Island Creek.

B. *Proportion of males and females:* The proportion of adult females in the catch of both the Patuxent River and Back Creek was low. This is not unusual considering the time of year and the distance from the mouth of the Bay. Table V shows that during August and October in the Patuxent River, and during August in Back Creek, where only limited records were



—From 1940 Annual Report, Chesapeake Biological Laboratory  
CRAB POT WITH CATCH

TABLE NO. V

Males and adult females from the Patuxent River and Back Creek.  
Expressed in per cent of the total catch.

	Patuxent River		Back Creek	
	% adult females	% males	% adult females	% males
June 17-Sept. 1	12.4	82.6	6.8	73.0
June 17-Oct. 31	16.9	79.2	.....	.....
June 17-30	8.0	81.5	7.2	79.0
July 2-31	8.2	87.4	4.8	70.8
Aug. 2-Sept. 1	17.1	77.7	9.9	76.9
Oct. 8-31	29.7	69.4	.....	.....

obtained later than September 1, the proportion of adult females increased as compared to the previous months, due to the seasonal migration of females towards the mouth of the Bay, as previously shown by the Ches-

peake Biological Laboratory in its crab tagging experiments (see Annual Report of the Chesapeake Biological Laboratory for 1936, pp. 2-4). In the Patuxent River the proportion of adult females rose from 8.2 per cent in July to 17.1 per cent in August and to 29.7 per cent in October, while in Back Creek the increase was from 4.8 per cent in July to 9.9 per cent in August. Limited observations only were made in the Patuxent River and Back Creek in September, and these indicate that in the Patuxent River the percentage of adult females was intermediate between August and October, namely 19.0 per cent, while in Back Creek the percentage had risen from 9.9 per cent in August to 36.1 per cent in September.

Frequently crabbers claim a certain selectivity of crab pots as between males and adult females, though they have no ready explanation for such a phenomenon. Table VI gives comparative data obtained from crab pots and trot-line and these data show that there may be a selectivity, at least

TABLE NO. VI

Comparison of legal females and males captured by trot-line and pots.

	Mill Creek		Chesapeake Bay	
	trot-line	pots	trot-line	pots
Total legal crabs	606	158	4453	2186
Males over 5 in.	388	103	1067	1300
% males over 5 in.	64.0	65.2	24.0	59.5
Adult females	201	53	3344	867
% adult females	33.2	33.5	75.1	39.7

at times. In Mill Creek there was no significant difference between the percentages of adult females captured by the trot-line and the pots. The trot-line captured 33.2 per cent adult females, while the pots captured 33.5 per cent. On the other hand, off Punch Island Creek there were large numbers of adult females present in the water, and the results were much more striking. On the trot-line 75.1 per cent of the legal catch consisted of adult females, while in the pots only 39.7 per cent of the legal catch was adult females. As shown in Table VII, the daily catch records confirm these observations, with the exception of one instance in Mill Creek, where a larger percentage of females was obtained in the pots.

TABLE NO. VII

Date	Daily comparison of per cent of legal crabs that were adult females.										
	9-4*	9-5*	9-8*	9-15	9-16	9-17	9-18	9-22	9-23	9-24	9-25
Trot-line	40.4	36.2	27.2	72.8	60.2	75.3	75.5	80.3	80.9	79.1	75.4
Pots	31.9	50.0	17.1	45.5	35.7	34.6	23.1	33.9	56.4	44.2	51.2

\*These records are from Mill Creek, all others are from off Punch Island Creek.

C. *Size differentials*: During the earlier part of the season no records were kept of the size of individuals caught, other than to determine whether

or not they were of legal size. During October, however, and during the period when comparisons were being made with the trot-lines, more complete records were kept. As the results obtained in the Patuxent River during October are isolated, they will not be discussed in detail here. Suffice it to say that of the total males obtained, 10.3 per cent were over seven inches from tip to tip of the lateral spines, 50.8 per cent were between six and seven inches, 34.9 per cent were from five to six inches, 3.7 per cent were from four to five inches, and 0.3 per cent were from three to four inches. These results show greater percentages of the larger size crabs than would be normal at other times of the year.

The largest percentage of the legal crabs captured, both by the trot-line and the pots; was in the group between five and six inches in width. For example, in the pots these amounted to 48.5 per cent of the total legal males in Mill Creek and 63.5 per cent off Punch Island Creek. Comparatively few captured crabs were more than seven inches in width. As shown in Table VIII, there was a marked tendency both in Mill Creek and off

TABLE NO. VIII

Size groups of legal males, expressed in per cent of total legal males.

	Mill Creek		Chesapeake Bay	
	trot-line	pots	trot-line	pots
Over 7 in.	3.4	3.9	2.8	1.8
6-7 in.	38.4	47.6	28.3	34.6
5-6 in.	58.2	48.5	68.8	63.5

Punch Island Creek for the pots to catch larger percentages of the group between six and seven inches than did the trot-lines. This gain was at the expense of the smaller crabs between five and six inches. Thus the crab pots, as used in the present experiments, not only captured a larger percentage of males than females, but also captured a larger size of males.

D. "*Poor*" and "*fat*" crabs: A "poor" crab is one which has recently shed its shell. As the crab, when it sheds, increases its original dimensions by about one-third, the "poor" crab tissues are watery and yield a comparatively small quantity of meat. Pickers in many cases throw such crabs into the refuse where they are a complete waste. Because of this fact it was considered worth while to determine the catch of "poor" crabs in the crab pots.

No record was kept of "poor" and "fat" crabs during the major portion of the season, but during October in the Patuxent River such records were kept. Of the males captured in this month at this locality only 0.7 per cent were "poor", and not a single "poor" female was encountered. Thus, of all the crabs captured, both males and females, only 0.5 per cent were

"poor". This is probably a lower percentage than would have been found at other times of the year.

During the period when comparison was being made with the trot-line crabs off Punch Island Creek a careful record was made in the case of the male crabs. The time available for counting the crabs was insufficient to allow for a similar consideration of the females. Tables IX and X show

TABLE NO. IX

"Poor" males captured by trot-line and pots off Punch Island Creek.  
Expressed in per cent of total legal males.

	legal size	5-6-in.	6-7 in.	over 7-in.
Trot-line	17.3	11.8	5.1	0.4
Pots	2.7	1.4	1.2	0.0

TABLE NO. X

Daily record of "poor" males captured by trot-line and pots off Punch Island Creek.  
Expressed in per cent of total legal males.

Date	9-15	9-16	9-17	9-18	9-22	9-23	9-24	9-25
Trot-line	19.0	27.8	12.5	7.5	16.4	20.5	15.6	8.5
Pots	0.0	4.9	1.6	2.9	10.0	3.0	2.0	1.3

that a much smaller proportion of "poor" crabs is obtained by the use of the crab pots than by the use of the trot-line. Of all the legal males, 17.3 per cent were "poor" in the trot-line catch, whereas only 2.7 per cent were "poor" in the pot catch. The daily catch record shows the same phenomenon every day without exception, ranging up to a difference on one day (September 16) of 22.9 per cent between the per cent of "poor" crabs caught by the trot-line and the pots.

The trot-line also captured a greater proportion of "poor" males in the undersize groups than did the pots. Of the males between three and five inches in width, 42.6 per cent were "poor" in the trot-line catch, whereas only 7.0 per cent were "poor" in the pot catch. A conceivable explanation of the apparent selectivity of the pots with regard to "poor" crabs would be that these crabs, having recently come from the helpless soft stage, are still relatively weak as compared to the older hard crabs, and hence avoid localities close to other hard crabs.

E. *Peelers and soft crabs:* The crab pot is not an efficient instrument for the capture of crabs that are about to shed their shells, or which have just shed, for in these periods the crabs have little or no desire for food, and consequently do not seek the bait. Crabbers do not use the pots as such an instrument. However, an occasional peeler does wander into a pot, and if left sufficiently long may shed its shell and become a soft

crab. Also, male hard crabs carrying last stage immature female peelers ("hard doublers") preliminary to mating, or carrying soft adult females ("soft doublers") in the act of mating, may enter the pot. Any soft crab impounded in a pot with hard crabs or with such enemies of the crab as the toad fish, *Opsanus tau*, and the puffer, *Tetraodon maculatus*, is in grave danger of being eaten, as attested to by the records obtained during the course of these observations. During the season the pots set in the Patuxent River yielded fourteen soft crabs, of which six were adult females and thus protected by their hard-shelled mates. In addition, there were nine cast shells found in the pots without corresponding soft crabs, an indication that they had been destroyed by predators. In one case a toad fish regurgitated the remains of one of these nine soft crabs. In Back Creek six soft crabs were found, of which three were adult females, and there were four cast shells without corresponding soft crabs. In neither Mill Creek nor off Punch Island Creek were any soft crabs found in the pots.

Peelers were found in too small numbers, especially male peelers, to be of any great significance, amounting, for example, off Punch Island Creek to only 0.25 per cent of the total legal crabs, most of them being female peelers (0.20 per cent). On the trot-line, similarly, 0.94 per cent of the legal catch consisted of peelers, of which practically all were obtained as the female half of "hard doublers". An interesting correlation with the relative lack of undersize crabs in the crab pots is to be seen in the fact that on the trot-line, of the immature females greater than three inches in width, 27.7 per cent were peelers, whereas in the crab pots, of the immature females greater than three inches in width, 45.5 per cent were peelers. The undersize immature females tended to avoid entrance into the pots except when they were protected by large males in the "hard doubler" state.

F. *Badly injured and dead crabs*: One of the complaints that had previously been made against the use of the crab pot as a crab-fishing gear was that a great many crabs are killed while in the pots, and thus are wasted as a source of human food. However, the annual report of the Chesapeake Biological Laboratory for 1940, on the basis of limited data obtained in the Patuxent River stated: "The death rate of the pot impounded crabs was .7 per cent, a result in contrast to opinion held in certain sections where it is claimed that the mortality, either directly or through injury that leads to death, runs as high as forty per cent."

The results of the present investigation in the Patuxent River and in Back Creek bear out this observation. In the Patuxent, the proportion of dead crabs found in the pots during June, July, August and October amounted to 0.7 per cent, while in Back Creek during June, July and August

it amounted to only 0.5 per cent. In Mill Creek, in September, the percentage of mortality was likewise very low, namely 1.1 per cent.

On the other hand, in the pots set off Punch Island Creek in the Bay, the percentage of dead crabs was comparatively high, namely 12.2 per cent as an average for the eight days on which the pots were fished. In Punch Island Creek itself, however, there were no deaths whatsoever, although the meager data from that locality do not lend themselves to thorough analysis. Table XI gives a daily record of the per cent of the total catch of crabs from the pots set off Punch Island Creek that were dead and badly injured. Percentages of dead crabs ranged from 2.4 per cent to 61.2 per cent, and of badly injured crabs from 5.2 per cent to 30.9 per cent. The very high percentages obtained on September 22 came after the pots had

TABLE NO. XI

Daily record of dead and badly injured crabs from pots off Punch Island Creek.  
Expressed in per cent of total crabs captured.

Date	9-15	9-16	9-17	9-18	9-22*	9-23	9-24	9-25	Ave.
Dead	16.8	6.6	6.4	3.3	61.2	23.6	2.4	9.4	12.2
Badly injured	6.9	9.9	12.8	10.2	30.9	18.7	5.2	18.5	13.6

\*On this date the pots had remained unfished for four days, thus accounting for the extremely high percentages.

been left baited in the water for four consecutive days without fishing them. The pots were baited on Friday. Normally the crabbers can find no market for crabs on Saturday or Sunday, and hence leave the pots overboard until Monday. This was done in the present case to obtain results comparable to those obtained commercially. In addition, stormy weather, in this particular case, prevented the fishing of the pots on Monday, with the consequence that they remained out an extra day. High percentages were also obtained, however, on two other days, namely, September 15 and 23, when the pots had been left only approximately twenty-four hours. Since the packers normally, under the present degree of enforcement of pure food laws, do not cull the crabs when received from the crabber, but, instead, rely upon the pickers to throw out spoiled crabs, the presence of dead crabs in the catch may represent a danger to the consumer. The badly injured crabs do not represent a loss, for the meat is in good condition despite the weakened state of the crabs. A large percentage of the badly injured crabs, however, would not be able to stand the adverse conditions to which they are subjected on the trip to the crab-picking house, and would be received by the packer dead, although typically not spoiled.

The death and injury of crabs appear to have been caused only to a limited extent through the impounding of many crabs together in a small

enclosed space, although this is a contributory factor, as can be seen by the fact that many crabs show fresh injuries that could be caused only by the pincers of other crabs. On the other hand, most of the damage seems to have been due to the presence of predatory forms trapped in the pots with the crabs, especially the toad fish and the puffer or swell toad, and possibly the common eel, *Anguilla rostrata*. This relationship is shown in Table XII, where the numbers of toad fish and puffers per pot are com-

TABLE NO. XII

Daily record of the number of toad fish (*Opsanus tan*) and puffers (*Tetraodon maculatus*) per pot compared with the per cent of total crabs that were dead and injured.

Date	9-4*	9-5*	9-8*	9-15	9-16	9-17	9-18	9-22†	9-23	9-24	9-25
Toad fish	0.4	0.2	0.0	1.1	1.0	1.2	0.7	4.4	1.9	0.4	1.4
Puffers	0.1	0.0	0.0	13.3	5.8	5.1	3.3	5.1	9.3	3.3	2.2
Dead	0.0	1.9	2.3	16.8	6.6	6.4	3.3	61.2	23.6	2.4	9.4
Badly injured	.....	.....	.....	6.9	9.9	12.8	10.2	30.9	18.7	5.2	18.5

\*These records are from Mill Creek, all others from off Punch Island Creek.

†On this day the pots were fished after being untended for four days.

pared with the percentages of death and injury among the crabs. On those days, such as September 15 and 23, when the numbers of toad fish and puffers were large, the degree of death and injury among the crabs was also large, whereas in such cases as September 18, where the numbers of predators were small, the degree of injury was likewise small. The damage caused by predators is even more strikingly shown when the catch of individual pots is considered. The average for ten pots which contained more than two toad fish and more than ten puffers, or contained more than one toad fish and more than fifteen puffers, was 21.3 per cent badly injured and 34.6 per cent dead, whereas the average for ten pots which contained less than one toad fish and less than five puffers was 5.5 per cent badly injured and 0.0 per cent dead crabs. These results were from records of individual pots selected at random, omitting the atypical records from September 22.

Further evidence was provided by an examination of the stomach and intestinal contents of toad fish and puffers that had been impounded in the pots. Puffers in a ratio of five to four contained the remains of crab legs in the stomach or intestine, as did nine out of thirteen toad fish. One toad fish examined contained the whole of, or the remains of eleven crab legs.

It is probable that the conditions obtaining off Punch Island Creek were unusually favorable to greater numbers of predators. In the first place, the experiment was initiated in September. By far the most numerous predators found with the crabs in the pots were puffers, and these, evidence obtained

in the Patuxent River shows, do not make their appearance until about August, and then diminish in numbers again in October. In the second place, the observations were made immediately after the pots were set in a new locality. Evidence from the Patuxent River shows that the population of toad fish soon becomes thinned if they are destroyed systematically when captured by the pots. For instance, in the Patuxent River, at the first of the season, toad fish were captured in large numbers. They were used to rebait the pots, and thus destroyed. Later on in the season the fish became so scarce in the pots that there was difficulty in obtaining a sufficient number for bait. That this decrease in numbers was not due to the progress of the season is shown by the fact that when, in early September, the pots were removed to a new locality in the river for a few days, a large number of toad fish was again captured. In the third place, the particular locality chosen off Punch Island Creek may have been unusually heavily infested with predators, catches in individual pots set for approximately twenty-four hours having run as high as twenty-seven puffers and three toad fish. Another single pot contained seventeen puffers and eight toad fish, and most of the pots had large numbers of these two predators. In Punch Island Creek itself, in the Patuxent River, and in Mill and Back creeks the number of predators captured was much smaller.

Many of the dead crabs found had the muscle tissues, the "meat", sucked out from under the carapace in such a manner that they were nothing more than empty shells. This could not have been done by other crabs, toad fish or puffers. However, it may have been done by eels, which were common in the locality, and most of which were able to slip in and out of the pots undetected, only the larger individuals being retained. It is possible that this damage was not done in the case of live and active crabs, however, but only in the case of crabs that were already killed by other enemies, or at least those greatly weakened by injury and the loss of blood.

G. *Other organisms captured by the pots:* In addition to toad fish and puffers a number of other organisms may regularly or occasionally be captured by the crab pots. It has been claimed that the pots will capture and drown the commercially important diamondback terrapin, *Malaclemmys concentra concentrata*, when set in such localities as creeks, guts, salt-water ponds and along marshy shores. In order to test this possibility, two pots were set in Punch Island Creek, a body of water known to be productive of diamondback terrapin. Although the results in Punch Island Creek are rather limited, it was definitely established that the pots will capture terrapin. In the five days that satisfactory results were obtained with at least one pot in the creek, three large diamondback terrapin, with a plastron length of from five to seven inches were captured. No smaller sizes were

taken. Two of the terrapin were drowned in the pots, and the third likely would have drowned had the pot not been partially protruding from the water, so that it was possible for the animal to obtain air.

A regular captive of the pots was the spot, *Leiostomus xanthurus*, an important Chesapeake Bay food and sport fish. This fish was captured throughout the season in all localities except Punch Island Creek, and sometimes as many as eleven spot were found in a single pot. Frequently a toad fish, in the excitement of being shaken out of the pot, would disgorge a partially digested spot, and it is evident that numbers of this fish may be destroyed in this manner in the pots. Even when toad fish were not present, the crabs would often bite them and injure them seriously. The crabbers normally throw all captured fish overboard, whether they are dead or alive. It has been observed by pound net fishermen and others that small spot were especially abundant during the season of 1942, and the large numbers obtained in the crab pots apparently were unusual.

The sand perch, or mademoiselle, *Bairdiella chrysura*, was a frequent captive, as was the sea bass, or black will, *Centropristes striatus*. The destruction of neither of these by the pots was as serious as destruction of the spot, due to their being fewer in number. Other fish that were occasionally captured were the white perch, *Morone americana*, the summer flounder, *Paralichthys dentatus*, the tautog, *Tautoga onitis*, the hog choker *Achirus fasciatus*, and the eel, *Anguilla rostrata*, the last of which had to be large to be retained by the meshing of the pots. One specimen of the kingfish, *Menticirrhus americanus*, was obtained off Punch Island Creek.

H. *The number of pots equivalent to a commercial trot-line:* In comparing the trot-line and the pots as a method of crabbing it was of interest to determine the approximate number of pots necessary to equal in yield one trot-line used by commercial crabbers. The number of crab pots which would have been necessary to capture the same number of crabs in twenty-four hours as were captured in its fishing period by the trot-line set parallel to the pots varied considerably from day to day. For example, on September 25 off Punch Island Creek, 8.7 pots captured the same number of crabs as did the trot-line on that day, while on September fifteenth, 75.7 pots would have been necessary to capture the number of crabs captured by the trot-line. The average number of pots equivalent to one commercial trot-line was essentially the same in Mill Creek and off Punch Island Creek, being 33.2 in Mill Creek and 34.3 off Punch Island Creek. The conditions of the experiment prevented the cooperating crabbers from "following the crabs" and forced them to cast their lines in the same place each day regardless of the suitability of the location. Thus under commercial conditions the

number of pots equivalent to one trot-line may be somewhat larger than these figures would indicate.

I. *The relative effectiveness of old and new pots:* The claim has been made by certain crabbers that stiff, new crab pots capture a larger number of crabs and fewer predators than old, flimsy pots. In order to test this statement a maximum of five pairs of pots was set in the Patuxent River during the month of October. One pot in each pair was a new pot in good condition, and the other pot was an old one. The pairs were fished each day and the results from old and new compared, a total of seventy pairs being fished during the month. The results of this investigation, which should be checked at other times of the year and at other localities, are detailed in Table XIII. They show that the old pots captured a total of

TABLE NO. XIII

Comparison of old and new pots.

	legal ♂	illegal ♂	legal ♀	illegal ♀	total crabs	toad fish	puffers
Old pots	122	2	48	0	172	54	9
New pots	131	7	70	4	212	80	7

only 172 crabs, while the new pots captured a total of 212 crabs. At the same time the old pots captured 54 toad fish, while the new pots captured 80. This indicates that old, flimsy pots are somewhat more inefficient in catching both crabs and predators than are the new pots, but indicates no harmful results from the use of old pots.

J. *Unsolved problems:* The necessity for further studies concerning the effect of the crab pots upon crabs and other organisms is obvious. Important problems that suggest themselves, and that will be attacked in later seasons are the following:

1) Further studies should be made on the destruction of crabs in the pots at various localities and at various times during the crabbing season.

2) A careful study should be made of the distribution and numbers in Maryland and Virginia waters of the toad fish and the puffer.

3) The effectiveness and practicability of crab pots made of a coarser-meshed wire should be investigated, looking to free egress of small crabs and most of the fish that enter the pots. Studies should be made on possible modifications of the standard construction of the pots with a view to improvements in the design.

4) Studies should be made to determine further details regarding the destructiveness of the enemies of the crabs when these are confined in the pots with the crabs.

5) A study should be made of the relative effectiveness of various baits in attracting crabs, as well as in deterring the enemies of the crabs.

6) Further studies should be made of the relative catches in stiff new pots and old flimsy ones at other times of the season and at other localities.

*SUMMARY:* The crab pot is an efficient instrument for the capture of crabs. It captures a large percentage of legal-size crabs, both male and female. In this respect it is superior to the trot-line as a conservation factor, since it captures a smaller percentage of illegal crabs than does the trot-line. Such small crabs are frequently accidentally destroyed during crabbing operations, with consequent waste. Moreover, pots require less specialized and less costly types of bait. Also, the pots tend to select a larger-size crab among those of legal size than do trot-lines, and the crabs that enter the pots tend to be "fatter", with a consequent reduction in the waste of commercially worthless "poor" crabs at the crab-picking house. It was found also that, in Maryland waters, where there is a relatively large percentage of male crabs in the water, crab pots may be superior to trot-lines in that at times they show a certain amount of selectivity for males. This limited protection of adult females, whether recently mated or egg bearing, is obviously good procedure in conservation, as virtually all females of the blue crab are inseminated.

On the other hand, the pots are appreciably destructive to soft crabs, although few crabs shed their shells to become soft while in the pots. Also, due to the presence of toad fish and crabs, the pots are destructive of a certain number of spot and other fish that are trapped.

When the pots are set in such localities as creeks and shallow rivers many small crabs are trapped, and may be destroyed, either by enemies, or by the crabber, in contrast to the open bay and deeper rivers where a much larger percentage of legal-size crabs is caught. Furthermore, in localities such as guts, salt-water ponds, certain creeks and along marshy shores where diamond-back terrapin live, these animals are trapped and drowned to a marked extent.

The evidence concerning the destruction of crabs by the pots is variable. It was found that in most cases the destruction was negligible (one per cent or less of the crabs were dead when the pots were fished), but in the observations made off Punch Island Creek in Chesapeake Bay the number of dead crabs was much higher, averaging 12.2 per cent for the period observations were carried on. At this locality, however, no chance had been given to fish out the predators, the number of which was unusually heavy. Thus the results may not be entirely typical although in the commercial use of pots fishermen may change their locations according to season, abundance of predators, or for other reasons.

No evidence was found that old flimsy pots are more destructive to crabs

than new ones, although the old pots were less effective in the capture of both crabs and predators.

Further studies are to be made on the destruction of crabs by the pots, on the distribution and abundance of toad fish and puffers in Maryland waters, on the effectiveness and practicability of new designs of crab pots and of pots made of coarser-mesh wire, on the relative effectiveness of various baits, and on the relative catches in stiff new and flimsy old pots.

*CONCLUSION:* These studies indicate that the crab pot is a clean-cut and efficient fishing gear that requires less time and labor in its operation, as compared with the more orthodox method, the trot-line. From the viewpoint of crab conservation, the effect of the pot on the industry, in taking crabs in the same quantities as the trot-line, pound for pound, is somewhat on the constructive side if used only in operations in the open Bay and in the deeper rivers. It promises to be a distinctly destructive implement if used in the shallower waters of creeks and along marshy shores.

It would appear from these studies that the question of whether or not the crab pot is legalized in Maryland should be decided upon the basis of (1) location of set in terms of type of water body and (2) the limitation that is placed on the total number of pots to be used. It is possible to determine from the licenses issued by the State the number of fishermen operating in the industry. It has been possible in the course of this work to establish the crab pot equivalent, in catch, of that of the trot-line. Over-fishing, with a consequent too low brood reserve, seems to be the primary cause of the recurring declines in yields in the Chesapeake fishery. If crab pots were fished without limitation as to numbers, and to supplement the already low catches of the trot-line fishermen, the result inevitably would contribute to the acceleration of the decline in the fishery with resulting socio-economic implications.