

19-27161

REPORT

OF

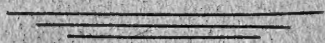
~~7-12-20~~

FISHERIES AND FISH CULTURAL
CONDITIONS

ON THE

EASTERN SHORE OF MARYLAND

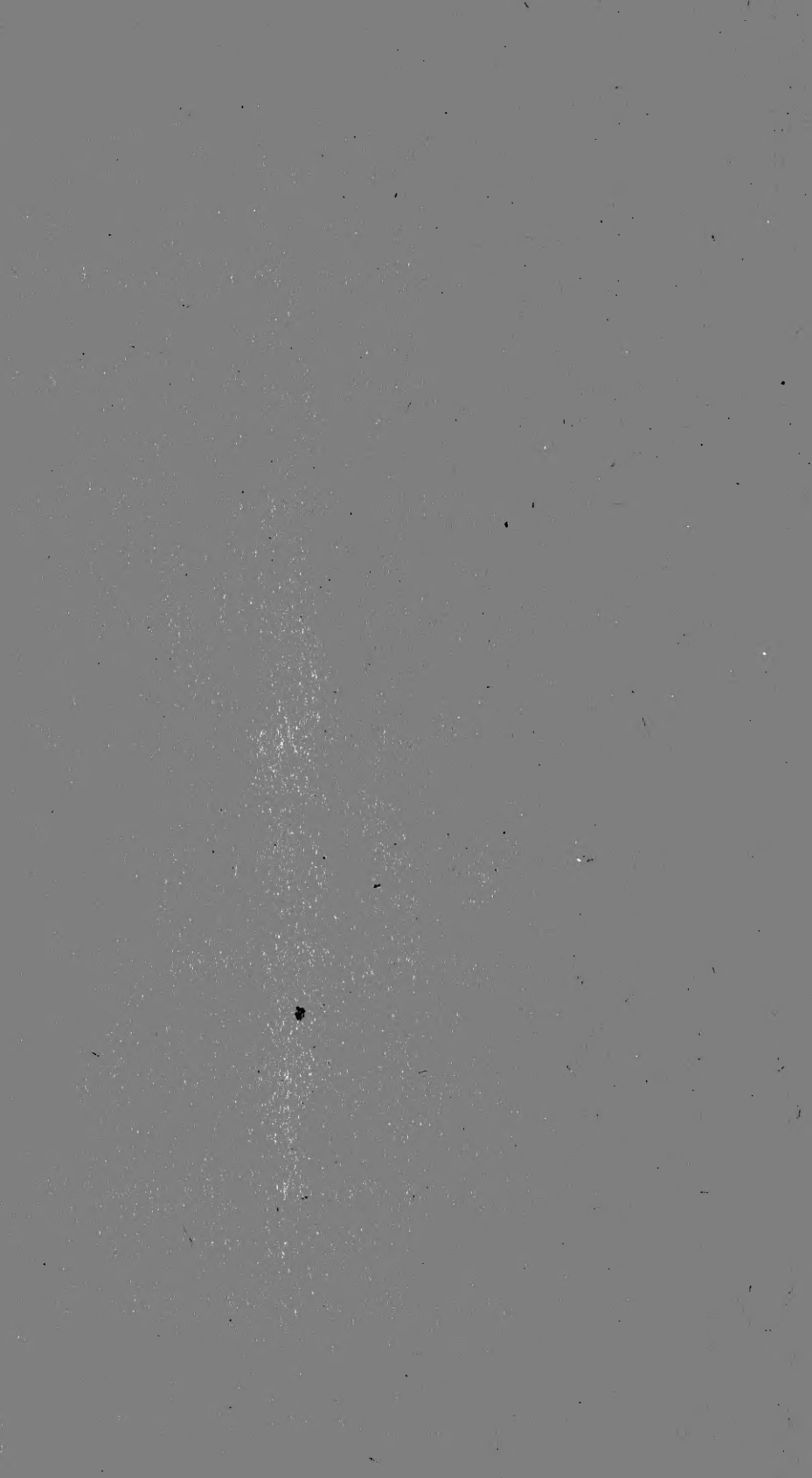
1917



BY

J. P. SNYDER, FISH CULTURIST

U. S. BUREAU OF FISHERIES



REPORT
OF
FISHERIES AND FISH CULTURAL
CONDITIONS
ON THE
EASTERN SHORE OF MARYLAND

1917

BY

J. P. SNYDER, FISH CULTURIST
U. S. BUREAU OF FISHERIES

SHIT
M 28



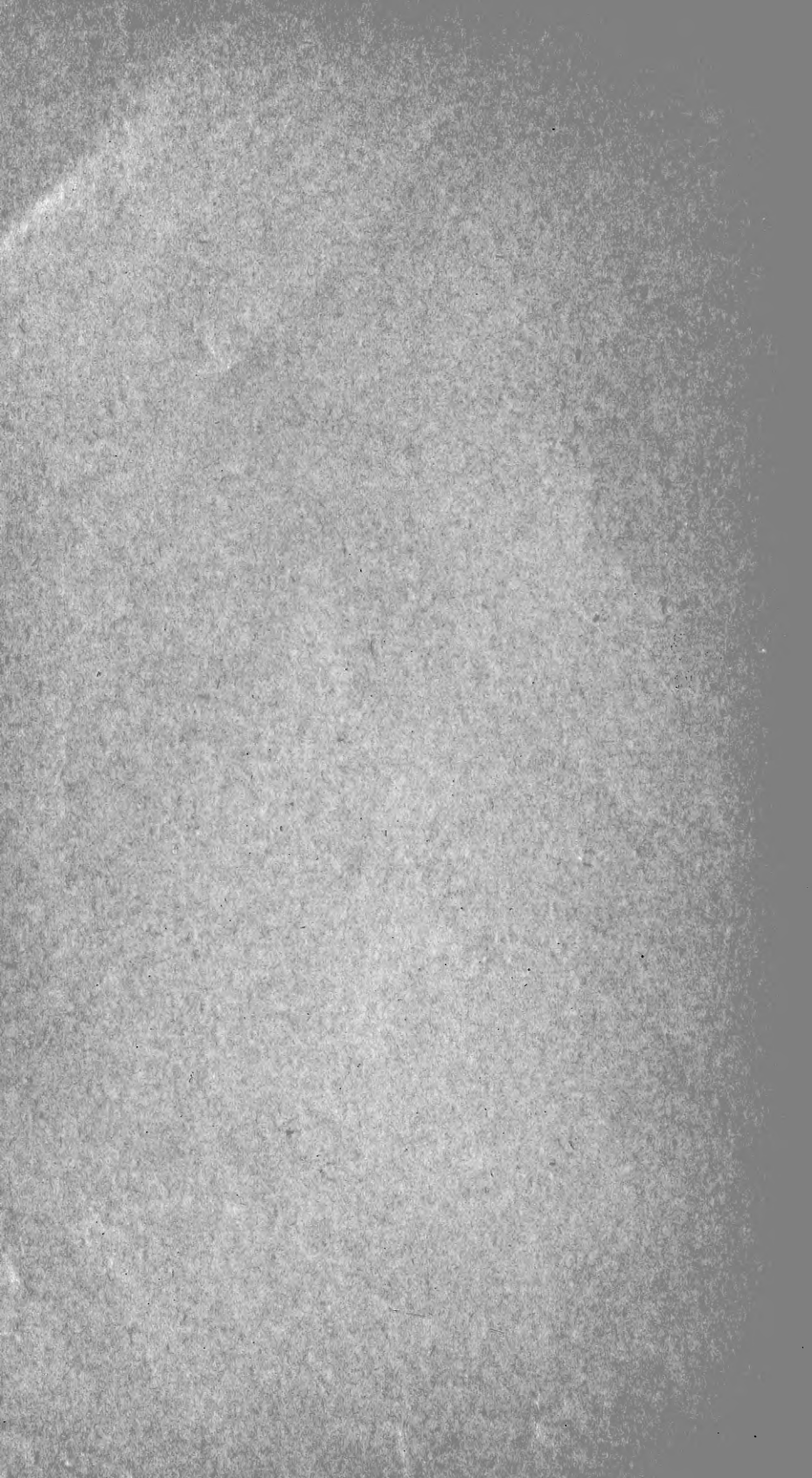
D. of D.
JUN 28 1917

INTRODUCTION.

The Conservation Commission of Maryland recognizing the great possibilities of the fish industry in the waters of the State, determined to make an exhaustive study of the problems in order to plan for a systematic development.

The United States Bureau of Fisheries was asked to assist in this work and assigned Mr. J. P. Snyder, one of their expert culturists, to investigate the fisheries and fish cultural conditions on the Eastern Shore. His work covered a period of about nine weeks during March, April and May, 1917, and discloses conditions so alarming that it seems advisable to give his report wide circulation in order to acquaint the people of the State with the need of remedial legislation to rehabilitate one of Maryland's great natural resources; we are therefore submitting, to the interested public through this pamphlet, his full report to this Commission with all criticisms and recommendations.

CONSERVATION COMMISSION OF MARYLAND.



DEPARTMENT OF COMMERCE,
BUREAU OF FISHERIES,
WASHINGTON.

Address all communications to
Commissioner of Fisheries,
Washington, D. C.

Washington, May 31, 1917.

*The Conservation Commission of Maryland,
Baltimore, Md.*

GENTLEMEN:—Permit me to present for your consideration the following report as to fish cultural possibilities of yellow perch, white perch and shad on the Pocomoke, Wicomico, Nanticoke, Choptank, Tuckahoe and Chester Rivers—all on the Eastern Shore of Maryland. This report is confined to those parts of the above mentioned rivers that are natural spawning beds of shad. No effort was made to obtain data as to yellow perch and white perch cultural possibilities on other waters or on the above waters except as indicated above.

POCOMOKE RIVER.

On this river shad spawn on a section from a few miles below Pocomoke City to three or four miles above Snow Hill, a distance of about 22 miles. This is governed somewhat by the volume of fresh water coming down the river. During heavy freshets spawning shad are found farther down the river than during droughts. This same variation is found on the other rivers mentioned.

On this section of the river shad are taken only in hoop nets (skin nets) except that four pounds are set about four miles below Snow Hill. These bow nets are fished from rowboats or dugouts. The fishing is done by two men drifting with the tide. One man sits in the bow of the boat and holds the net submerged in the water and the other man sits in the stern and keeps the boat straight and pushes it along just fast enough to keep the bag of the net extended. When a fish enters the net and strikes the webbing it imparts to the net, including the

handle, a vibration or jar that is sensible to the man holding it and the net is immediately drawn up and the fish removed, then the net is again submerged and the fishing continued.

To determine just what the shad cultural possibilities are on this river I personally interviewed 17 men who have fished for shad on this section of the river more or less during the past 15 years. In these interviews I asked each man to give me the smallest catch he made last year in any one day, his largest catch and his average catch for the season for each day he fished, then I asked each one to go back 15 years ago and give me as nearly as he could recall his smallest catches, his largest catches and his average catches. A summary of these interviews is herewith submitted in tabulated form.

From this report it would appear that about one-seventh as many shad returned to these spawning beds on this river as returned there 15 years ago, but this is not strictly true for only about half as many men fished on these waters last year as fished there 15 years ago. This unquestionably tended to increase the catches of the men fishing last year beyond what they would have caught had the number of fishermen been doubled so that it seems certain that only about one-tenth as many shad return to their spawning beds on this river as compared with 15 years ago. Nor is this all for it is well known that the run of shad on all these rivers had been rapidly decreasing for years prior to 1901. By this tabulated sheet it will readily be seen that very little shad cultural work can be done here under present conditions.

Practically no yellow perch are taken on this section of the river. Some white perch (locally called black perch) are taken in gill nets and in the four pounds below Snow Hill, but not enough to justify fish cultural operations. Catfish, striped bass, herrings and bullheads are rapidly disappearing. See addendum, Report No. 1.

Report No. 1, Shad Catch, Pocomoke River.

Smallest catch.....	1901— 16	1916— 1
Largest catch.....	1901—125	1916—30
Average catch.....	1901— 33	1916— 5

This represents experience of 17 fishermen of record.

WICOMICO RIVER.

In this river shad spawn from a point about two miles below Salisbury to eight miles below that city. See attached tabulated Report No. 2 showing the shad caught on this section of the river as compared with years ago. From this tabulated report it will readily be seen that only about one-twentieth as many shad spawn here as in previous years and I am convinced from personal observation and contact with these men during the season just closed that this tabulated report is no exaggeration of the decline of the shad industry at this place, nor is this condition confined to shad alone, but to herrings, rock and sturgeon.

About 50 men drift gill nets on this section of the river. These nets are about 60 yards long and some men use several nets. These men are mostly farmers and laborers living along this part of the river. Years ago several haul seines were operated here. Mr. S. M. Smith, Capt. Henry Todd and Mr. Elijah Townsend told me that at one time these seines frequently caught as many as 600 shad per haul but that when they were discontinued five or six years ago a catch of 25 shad was considered a large catch. All of these seining shores have been abandoned as the run of shad and herring and rock became so small that enough fish to cover the expense could no longer be taken.

Mr. S. P. Jenkins, one of the men employed as a spawntaker at that place last year, told me that they had six spawntakers on this front of the river, that they regularly attended all the fishermen and that they obtained during the season less than 100 spawning fish. This was verified by my interviews with fishermen. From these reports and the attached tabulated report it will readily be seen that very little shad cultural work can be done here under present conditions. Some yellow perch are taken in gill nets, but not many, and at times fair catches of white perch are taken in the same way. White perch and yellow perch are also taken in pound nets farther down the river, but nowhere in large numbers.

Report No. 2, Shad Catch, Wicomico River.

Smallest catch.....	1901— 10	1916— 1
Largest catch.....	1901—100	1916—12
Average catch.....	1901— 36	1916— 3

This represents experience of 19 fishermen of record.

A number of other fishermen gave similar data, but they seemed suspicious of me and refused to give me their names.

NANTICOKE RIVER.

On this river ripe shad spawn from Sharptown, Md., to a point about four miles above Woodland, Del., a distance of about 12 miles. These fish also spawn in a creek entering the Nanticoke River, about three miles below Woodland. The fish are taken in gill nets, pound nets and haul seines. The gill nets used are from 125 to 175 yards long and most men use two nets. No pound nets are set above the Delaware line, about two miles above Sharptown. Formerly eight haul seines were operated on these spawning beds, but at this time only one is used. This seine is about 450 yards long and is fished about one mile above Woodland, Del. During the season just closed less than 40 shad per day's fishing were taken in this net. Years ago on this same beach more than a thousand shad per day were taken in a similar seine, and at this same place the decline in the herring fishing is even more marked, especially branch herring.

Seine and pound-net men whom I interviewed told me that branch herring once so numerous here were almost extinct; there is still a run of glut herring, but only about one-tenth as large as 15 years ago.

Some fish cultural work had for many years been conducted on this river, but from the reports obtained almost no eggs of any species were obtained in recent years. Mr. A. S. Boyce, who operates the seine just above Woodland, Del., told me that he caught approximately 50 spawning shad last season, an average of less than two per day during the spawning season. Some ripe shad are also taken in gill nets, but the catches are so small that but few eggs can be obtained from these men and the cost would be prohibitive. See attached tabulated report giving catches in recent years as compared with years ago.

From the reports obtained and in view of the facts that each year less and less men fish in these waters for shad and the further fact that those that do fish are using two nets to each boat where but one was used years ago, it seems certain that not more than one-twelfth or one-fifteenth as many shad spawn here as compared with 15 years ago.

As no pound or fyke nets are used above the Delaware line and during drouths brackish water ascends to Riverton, Md., a

village five miles below Sharptown, it will be seen that the section in which yellow perch and white perch eggs can be obtained is quite limited. In fact but few yellow perch are caught in this section of the river. Good catches of white perch are taken and it is believed about fifty million eggs could be collected.

The eggs collected at this place were incubated in a small hatchery situated below a dam on a tributary of the Nanticoke River. Mr. J. H. Bennett, who had charge of this work in recent years, told me that the water in this dam became very warm and injuriously affected the eggs and fry.

Report No. 3, Shad Catch, Nanticoke River.

Smallest catch.....	1901— 15	1916— 1
Largest catch.....	1901—200	1916—45
Average catch.....	1901— 47	1916— 7

This represents experience of 20 fishermen of record.

FINAL REPORT, CHESTER RIVER.

On this river shad spawn from Chestertown, Md., to a point two miles below Millington, Md., a distance of about 12 miles. On this stretch their abundance is greatest for a distance of three miles above Crumpton, Md. Some years ago a channel was dredged in this section of the river and in this narrow ditch shad in some seasons have been quite plentiful. They are taken principally in gill nets set across the channel and held in place by stakes. In the upper stretch of the river the nets are set and lifted each evening. Between Crumpton and Chestertown they let them set day after day, lifting them twice each day on low water. Along this section it is safe to say that most of the ripe eggs within the shad taken in these nets become food for eels, for if shad are permitted to remain long in anchored nets they are almost invariably sucked by eels. Some eggs could be collected in the upper section of the river and some may also be collected in the vicinity of Chestertown if the fishermen could be induced to lift their nets more frequently. See addendum report.

It was found that the 1917 run of yellow perch and white perch on this river was the largest in recent years. This was true at all the points visited. It was learned that many millions of their eggs could have been obtained in the vicinity of Centreville. Seven men fish at this place and at one time they had over 7,000 yellow perch penned waiting for a better market. Many of these fish spawned in the pens and buckets of eggs could have been obtained. These men could be induced to hold all the green perch taken if they were paid a reasonable sum for the eggs collected from them. Doubtless from 50 to 100 million yellow perch eggs could be collected here and from the reports obtained a large number of white perch might be obtained. These eggs if desired could be transferred to Crumpton, Md., where even larger collections of yellow perch and white perch eggs could be made. Many fyke nets (so-called pound nets) are fished in the vicinity of Crumpton. One man alone had 50 of these nets set in the river at the time of my visit, April 18, 1917. Many of the white perch taken on that date were ripe and from this man alone (H. H. Hartley) on that date several million of white perch eggs could have been taken from the fish he caught. On the same date at Chestertown I saw large numbers of ripe white perch, tons of yellow perch and white perch were daily taken at Crumpton and other tons were taken by men living along the river and at Chestertown. It seems certain more of these eggs could be collected along this section of the Chester River and at Centreville than at any of the other rivers visited by me. The fishermen at Crumpton would be willing to pen the hard yellow perch taken in their nets and collect the spawn before selling the fish.

All these men report a great decrease in the number of herring taken. From the reports obtained it seems certain that not more than one-tenth as many herring reach their spawning beds on the Chester River as compared with 15 years ago.

Rock and catfish are also getting very scarce. See addendum, Report No. 4.

Report No. 4, Shad Catch, Chester River.

Smallest catch.....	1901— 10	1917— 1
Largest catch.....	1901—300	1917—46
Average catch.....	1901— 58	1917— 9

This represents experience of 16 fishermen of record.

One fisherman reported that his entire catch of shad for 1917 season only 398.

CHOPTANK RIVER AND TUCKAHOE CREEK.

On the Choptank River shad spawn from Williston, Md., to a point seven miles above Denton, Md., a distance of ten miles and on the Tuckahoe Creek from a point one mile below Cowards' Point to a point six miles above that place. On these beds the fish are taken almost entirely with gill nets that are drifted with the tides. These are short nets averaging about 70 yards long and each fisherman usually fishes about four nets. Although more shad are taken on the spawning beds of these waters than on the spawning beds of the other rivers visited from interviews with the fishermen and from personal observation of the catches made during the season just closed there can be no question; but only about one-tenth as many shad spawn here as compared with 15 or 20 years ago. The average catch per boat per day's fishing with three, four and five nets did not exceed 10 shad. Years ago an average of 40 or 50 shad per day were taken with one net.

On these waters the catch of yellow perch and white perch is becoming less and less showing a gradual decrease in their number. Rock fish are rapidly disappearing as well as whitecat and bullheads.

Almost no branch herring spawn on these beds where years ago all the shallow waters and every stream was alive with them. They came up here in endless numbers, now almost none are seen. In these waters as in the other rivers visited there is still a limited run of glut herring, but here too they are very rapidly disappearing and unless drastic measures are immediately taken to permit these fish to return to their natural spawning beds they too will soon be practically extinct.

On the Choptank and Tuckahoe for some years past the State has done some fish cultural work and although every effort was made during the past season to obtain the eggs from all the ripe fish taken in the fishermen's nets only 4,215,000 shad eggs were obtained. This is very discouraging. In view of the small number of eggs available for propagation and the expense attached thereto the wisdom of continuing the work here becomes doubtful until remedial legislation is passed permitting more shad to reach these spawning beds.

See addendum report covering hatchery work on these waters.

TUCKAHOE AND CHOPTANK HATCHERY WORK SEASON, 1917.
YELLOW PERCH.

On March 14th arrangements were made for opening the Tuckahoe Hatchery with a view to collecting yellow perch, white perch and shad eggs from fish caught by commercial fishermen on that creek, also for handling any eggs of these species that could be obtained from men fishing on the Choptank River. To do this work a few men were employed and two small gas boats were transferred to the station. From March 22nd to April 2nd a total of 45,050,000 yellow perch eggs were collected and placed in hatching boxes. All of these eggs were in good condition and it is estimated that 98 per cent. of them produced fish. See addendum, Reports Nos. 5 and 6, covering collections and distribution. More of these eggs could have been obtained had the collections been started earlier and had the employees made a greater effort to attend all the fishermen. Although the foreman had been directed to attend the fishermen on the Choptank River in the vicinity of Denton, Williston and Ganey's, it was later found he had not done so. The eggs received from that river were collected independently of the hatchery crew and later turned over to the State's employees. Many more of these eggs could have been collected on this river for the following fishermen: Pinkine, Frazer and Deal told me that they could and would have furnished large numbers of these eggs had the State's employees attended these nets or furnished them with the proper equipment for collecting the eggs.

See addendum, Reports Nos. 5 and 6.

*Report No. 5, Collection of Yellow Perch, Tuckahoe and
Choptank Rivers, Season 1917.*

Tuckahoe River.....	21,400,000
Choptank River.....	23,650,000

Report No. 6, Yellow Perch Distribution, Season 1917.

<i>Number</i>	<i>Waters Stocked</i>	<i>Locations, etc.</i>
1,000,000....	Moore's Creek.....	Talbot County
1,000,000....	Watts' Creek.....	Caroline County
400,000....	West fork, Nanticoke R....	Caroline County
400,000....	West fork, Nanticoke R....	Dorchester County
400,000....	Nanticoke River.....	Dorchester County
400,000....	Mardella Creek.....	Wicomico County
600,000....	Horse Shoe Bend Creek....	Caroline County
600,000....	Wye Creek.....	Queen Anne County
600,000....	Chester River.....	Kent County
1,500,000....	Elbins' Creek.....	Caroline County
1,500,000....	Deep Creek.....	Caroline County
400,000....	Fowland Creek.....	Caroline County
400,000....	Williston Creek.....	Caroline County
20,000,000....	Tuckahoe River.....	Vicinity of Hatchery
600,000—	West fork, Nanticoke R....	Caroline County
600,000....	Choptank River.....	Caroline County
		(Carter's Bridge)
5,000,000....	Choptank River.....	Caroline County
6,050,000....	Tuckahoe River.....	Caroline County
200,000....	Patuxent River.....	Anne Arundel Co.
		(Bristol)
100,000....	West River.....	Anne Arundel Co.
100,000....	South River.....	Anne Arundel Co.
100,000....	Rhode River.....	Anne Arundel Co.
300,000....	Severn River.....	Anne Arundel Co.
200,000....	Back River.....	Baltimore County
200,000....	Middle River.....	Baltimore County
200,000....	Big Black Water.....	Dorchester County
200,000....	Little Black Water.....	Dorchester County
200,000....	Transquakin River.....	Dorchester County
200,000....	Chicaomico River.....	Dorchester County

43,450,000 Total

45,050,000 Eggs Collected

1,600,000 Lost

TUCKAHOE AND CHOPTANK HATCHERY WORK.
WHITE PERCH.

Ripe white perch were seen as early as March 25th. At that time men were making fairly large catches of these fish, but as only three men had been employed and they were engaged in collecting and looking after yellow perch eggs, the foreman made no effort to collect any white perch eggs during my absence inspecting fish cultural conditions on other rivers. He reported, however, that he could have gotten a good many millions of these eggs, but said he failed to do so because none of the hatching boxes were fitted with suitable wire for retaining the fry. Upon my return to the Station I went with him on April 2nd and personally visited a number of fishermen and found that a large percentage of the white perch being caught were in a spawning condition. I directed him to attend as many of the fishermen as possible and to secure all the eggs he could, also directed him to arrange with the fishermen where possible to take the eggs themselves, to pay them not alone for the eggs taken but for their time while so engaged and to make every effort to get as many of these eggs as practicable with the men at his disposal. The following day I went to Washington. Some days later upon my return to the station I found he had collected but 800,000 of these eggs, that the smaller gas boat was out of commission, needing repairs, and that he had let one of the employees go home in the larger boat. This man failed to return until April 12th. By this time the white perch season was practically over. Sometime then was lost in the distribution of yellow perch fry, but as soon as this was done I relieved him of attending any of the fishermen on the Choptank River, except those at Ganey's, but later I found he did not go near Ganey's and had attended but a single fisherman on the Tuckahoe named Wilson. When I remonstrated with him for not attending other men he said he couldn't, for all the men lifted their nets at the same time. It never seemed to occur to him to divide his men, leaving one man to attend Wilson while the other two men attended other fishermen, and this in spite of the fact that I had specifically directed him to do so. It is true one of the men at his command was unexperienced and that the boats

were old, in bad condition and liable to get out of commission at any time. It is also true that the catch of white perch was the smallest in years, but in spite of these disadvantages many more of these eggs could have been obtained had a proper effort been made to get them.

A total of 5,950,000 eggs were collected, of these 3,950,000 were collected on the Choptank and 2,000,000 on the Tuckahoe. These produced a total of 2,750,000 fry, which were planted as follows: Choptank River, 1,158,000; Tuckahoe, 1,292,000.

See addendum, Report No. 7.

Report No. 7, White Perch Hatchery Work, Season 1917.

Spawn collected on Choptank River.....	3,950,000
Spawn Collected on Tuckahoe River.....	2,000,000
Total collection	5,950,000
Total hatched	2,450,000

Distributed in Choptank and Tuckahoe Rivers.

HATCHERY WORK. SHAD.

This work was conducted both on the Tuckahoe Creek and Choptank River. The number of men engaged in catching shad on their spawning beds on these rivers has decreased until at this time no haul seines are used and only a few men continue gilling. These men are mostly farmers or colored men who go out from time to time when not otherwise engaged. The fishing of all kinds is simply local in character and of little importance. On the Tuckahoe Creek the three spawntakers engaged attended all the fishermen and it is believed they collected all the shad eggs that were available. On the Choptank floating boxes as temporary egg receptacles were placed at all the fishing shores and the fishermen were supplied with the necessary spawning equipment and instructed in taking eggs and all agreed, in the absence of the station's employees, to take and did take all the eggs available. The two spawntakers attended as many fishermen as practicable and regularly collected all the eggs taken so that the eggs from practically all the ripe fish taken were re-

ceived. On the Choptank a total of 1,246,000 eggs were taken and on the Tuckahoe a total of 2,969,000 eggs, a combined total of 4,215,000 eggs. As the number of shad that reach the spawning beds are decreasing each year there is no reason to hope that larger collections can be made in the future.

The equipment used in hatching the eggs was very crude and although the eggs were carefully measured before placing them in the boxes there was no practical way of determining the number of fry resulting therefrom. The numbers of fry produced in all cases were simply guessed at instead of being estimated by careful measurements as is done where more up-to-date hatchery equipment is used. It is estimated that the 1,246,000 eggs collected on the Choptank produced 952,000 fry and the 2,969,000 eggs collected on the Tuckahoe produced 2,177,000 fry, a combined total of 3,129,000 fry.

See addendum, Reports Nos. 8 and 9, for detailed collections and distribution.

*Report No. 8, Shad Hatchery Work, Choptank River,
Season 1917.*

Total fish received	39
Total eggs collected	1,246,000
Total fry hatched	952,000

Planted in Choptank, Nanticoke and Transquakin Rivers.

*Report No. 9, Shad Hatchery Work, Tuckahoe River,
Season 1917.*

Total fish taken	92
Total eggs collected	2,969,000
Total fry hatched	2,177,000

Planted in Tuckahoe, Deep Creek, Knotts Creek, Snows Creek, and Chester, Sassafras, Transquakin and Pocomoke Rivers.

HATCHERY WORK. HERRING.

In view of the economic importance and rapid decline in the catch of these food fish an effort was made to collect and hatch

as many of these eggs as practicable, but as there was but a single small pound and no fykes set for these fish in the vicinity of the hatchery and the catch in this pound averaged less than 100 fish per day a total of but 6,600,000 eggs were collected. These produced 5,280,000 fry which were planted in the Chop-tank River, near Denton, Md. As these fish are still taken in pounds in fairly large numbers at Crumpton, I would recommend, if hatchery work is taken up there, that every effort be made to propagate as many of these fish as possible. It is believed there are other places in the State where large numbers of these eggs for propagating purposes can be obtained.

SUMMARY.

Shad (*alosa Sapidissima*).—It is evident that less than one-tenth as many shad return to their natural spawning beds on the rivers of the Eastern Shore of Maryland, as compared with 15 or 20 years ago.

Branch Herring (*Pomolobers pseudoharengus*).—The outlook of the perpetuation of the branch herring industry is very discouraging. Reports everywhere show that very few of these fish, once so numerous, return to their spawning beds. Years ago these fish in great numbers spawned in the shallow waters of all these rivers, creeks and rivulets. In these same waters today they are nearly extinct.

Glut Herring (*Pomolobers aestivalis*).—The Glut herring which normally keep in the deeper water of the rivers and bays and spawn in deeper water than the branch herring have fared somewhat better, but even they are rapidly disappearing so that from reports obtained it is certain that they are reproducing in very greatly diminished numbers as compared with years ago.

Striped Bass or Rock Fish (*Roccus lineatus*).—Very few of these fish are taken in the spring of the year, showing that but few spawn here as compared with years ago. In recent years some isolated large catches of rock have been made in several of these rivers in the fall of the year where normally they have not been taken in large numbers. The explanation of this is not to be found in an increase in the stock of rock fish, but in a decrease of food supply due to extensive menhaden and crab fish-

ing. For the same reason large numbers of sea trout have recently been taken in waters not normally inhabited by them.

Common Sturgeon (*Acipenser Sturio*).—These were once very numerous but are now nearly extinct.

White Cat (*Ameiurus Catus*).—These fish are taken in pounds, fykes and other nets during their migrations to their spawning beds and are rapidly disappearing.

Bull Heads (*Ameiurus nebulosus*).—This common food fish is also becoming scarce.

Yellow Perch (*Perca Flavescens*).—In some rivers these fish are taken in large numbers and some fishermen are inclined to think they are not diminishing, but these large catches in recent years as compared with catches made years ago is not necessarily due to as large a stock of fish as then as it is to improved methods in fishing and a greater effort being made to catch them because of the great increase in their market value. This is true of all these fishes; as they become scarcer and scarcer and their market value higher and higher their pursuit on the part of those who have continued fishing becomes keener and keener. In other rivers, for instance, the Nanticoke, Wicomico, Pocomoke and Choptank there can be no question but that these fish have greatly diminished in numbers. Yellow perch is one of those species of fishes that under natural conditions fertilize a very high percentage of the eggs deposited and a very large percentage of the eggs hatch. They are a hardy fish and when let alone a few years rapidly increase in numbers.

White Perch (*Morone Americana*).—On all the Eastern Shore rivers these fish have decreased in numbers with the possible exception of the Chester River. On some of the rivers, for instance, the Wicomico and Choptank their numbers have greatly diminished, while on the Chester River abnormal catches were made during the past season.

CRITICISMS AND RECOMMENDATIONS.

The fish cultural work as conducted by the State has been of a very unscientific, unprogressive and primitive character. This has been true, not only in methods and equipment used, but in the personnel employed.

The duties of a fish culturist are so varied that only by years of close observation, study, experience and instruction under the direct supervision of experienced and progressive fish culturists does he become efficient. He not only must have some knowledge of the fishes he intends propagating, their economic value to the State, their habits, migrations, growth, food, environment, enemies, natural reproduction which necessarily includes some knowledge of the character of the water in which this takes place, such as temperature, depth, nature of bottom, nest building, if any, etc., the character of the eggs, such as adhesive, buoyant, heavy, semi-buoyant, length of incubations, character of the young, their enemies, food, growth, nets or traps of various kinds used in catching fish, best methods of taking, fertilizing and caring for eggs in the field, their transfer to the hatchery, their handling therein, together with a full knowledge of the most approved hatching equipment, the care of the fry, their transfer to planting beds, and if rearing is done he must have full knowledge of the time to begin feeding, the food to be used, its preparations, preservations and presentations, rearing equipment, fish diseases and the most approved methods and remedies in combating them, sorting and a thousand and one things that can be learned only by close observation and experience. He must also have some knowledge of physics and be some sort of a civil engineer to be able to use good judgment in the construction of racks, screens, traps, filters, ponds, reservoirs, flumes, dams, etc. Nor is this all, for he must have imagination to create and adaptability to apply many and varied devices to meet the many problems constantly presenting themselves to the practical fish culturist. He must be able to make close observations, careful experiments and keep correct records. He must have some administrative ability to be able to direct the work of his assistants. He must be a diplomat and teacher in order to command the good will, assistance and cooperation of fishermen and sportsmen as well as that of the public in general. It is needless to say that the services of such a man cannot be obtained except at an exorbitant salary if his tenure of office is to be determined by political favoritism or exigencies and the value and benefits to be derived from progressive fish culture by the great State of Maryland is far too

important to be entrusted to any one other than the most competent fish culturist that can be obtained.

The equipment on hand is not only obsolete, but nearly all of it is in very bad condition, being a discredit to the State and a reflection upon the cause of fish culture in that intelligent men seeing the bad condition of the equipment, such as cans, boats, buildings, boxes, etc., the unsanitary and filthy condition of quarters and bedding, the crude methods of handling eggs and fry, the guesswork used in estimating the eggs taken and fry produced, the lack of fish cultural knowledge on the part of the men employed, these things must necessarily unfavorably impress all who come in contact with the work. The State cannot afford to permit such conditions to exist any more than can a business house or corporation expect to prosper and command the respect of the public that uses obsolete equipment, loose methods, untrained employees and unsanitary buildings and quarters.

The boats of all kinds should be thoroughly overhauled and repaired, painted and put in good condition. The power boats should be supplied with lights, life preservers, fire extinguishers, horns, suitable water-tight lockers for batteries, tools, fish cultural equipment, such as pans, buckets, dippers, oilskins, etc., and in a proper receptacle on each boat should be a suitable kit of tools, packing and duplicate parts of everything on the engine that is liable at any time to give way, such as springs, firing pins, spark plugs, etc.

All the hatching boxes in good condition should be retained for use in handling yellow perch eggs and for distribution along the river as temporary receptacles for holding eggs as indicated elsewhere in this report. All other boxes should be destroyed. All the cans should be condemned as all are in bad condition. New 10-gallon cans should be purchased. These should be painted outside and stenciled with the name of the State and station in which they belong.

Arrangements or agreements should be entered into with all the public carriers of the State for transferring fish. All pans, buckets, dippers, screens, aquaria, tables, tubing, tubes, nets, jars, trays, shipping boxes, tanks, etc., should be as nearly stan-

dard in size as possible and should be purchased with a view to their adaptability to their respective intended purposes.

A comprehensive up-to-date hatchery should be constructed and equipped in accordance with approved plans and under the direct supervision of an experienced fish culturist. The location of the hatchery and its equipment must be determined by the kinds of fish it is desired to propagate and their abundance. It should be located as near their spawning beds as possible, but regard must also be given to transportation facilities, ease of securing supplies, suitable and abundant water for hatching purposes, cost of pumping or securing gravity flow, etc.

It seems certain that more shad eggs can be obtained on the Tuckahoe Creek than elsewhere from the Eastern Shore waters, but as the number of shad eggs that can be obtained even on this creek and in view of the fact that even this number is certain to decrease unless very radical measures are taken to permit shad in increased numbers to return to their spawning beds, I cannot recommend the continuation of shad cultural operations, except as a side issue to other fish cultural work, anywhere on the rivers or creeks mentioned in this report. On the Tuckahoe Creek aside from the limited number of shad eggs that can be obtained no eggs in large numbers from other fish can be obtained. Practically no herring and only very limited numbers of yellow perch and white perch are taken on this creek. In fact the fishing on this creek has declined to such an extent that no pound nets and only about a dozen hedge fykes are set on the spawning beds of yellow perch and white perch. The same condition exists on the spawning beds of the Choptank River.

As no extensive white perch, yellow perch or herring cultural work and only a very limited amount of shad cultural work can be done on either the Choptank River or Tuckahoe Creek, I respectfully recommend that an effort be made to collect these eggs in the vicinity of Crumpton, Md., on a section of the Chester River from Chestertown, Md., to Millington, Md. It is certain that a greater number of yellow perch, white perch and herring eggs can be obtained at this place than elsewhere on the Eastern Shore. Some shad eggs can be obtained at this place, but not as many as on the Tuckahoe. Large numbers of yellow perch and white perch eggs can also be obtained at Centreville, Md., on a

branch of the Chestertown River. These eggs could be transferred to Crumpton by boat or auto. If work is taken up at this place I would recommend that in advance of the season arrangements should be made with the fishermen in the vicinity of Crumpton and at Centreville to hold all the unspent yellow perch in live cars until after they have cast their eggs, the eggs to be collected from time to time and transferred to the hatchery. These men, as well as all other fishermen along all that part of the Choptank River in question, should be provided with floating boxes as temporary receptacles for holding fish eggs of any species collected until they are transferred to the hatchery. To carry out this transfer work the Commission should have suitable power boats of sufficient speed and room.

In the case of all eggs the fishermen should be instructed in taking them—to this end all hatchery employes should be experienced spawntakers—and induced to take them—thereby relieving the Commission from the expense of employing a lot of men. It may not be practicable to interest all the fishermen in doing this the first season, but it should be the aim and purpose of the Commission as these men can learn to take the eggs and do it with but little loss of time or trouble, but it will be necessary for the Commission to make this as easy as possible and to this end the fishermen should be provided with the necessary spawning equipment, such as pans, buckets and dippers.

The basis of payment should in all cases be the number of good eggs received and in no case should the men be paid for the number of fish handled and no tickets should be given the fishermen other than a daily statement of the number of eggs received. A correct record of the number of good eggs received from each man should be kept and this record used as the basis for payment at the end of each month, or better still, at the end of the season only.

I would recommend that payment be made on the following basis:

<i>Species</i>	<i>Rate Per Quart</i>	<i>No. Eggs Per Quart</i>
Yellow Perch.....	\$.25	100,000
White Perch.....	6.00	1,600,000
Herring	1.25	600,000
Shad84	28,000

This would be at the rate of 3 cents per thousand eggs.

Should the market value of the fish remain abnormally high it might become necessary to change these prices in order to induce men to take the eggs, but under normal conditions these prices will be found to be reasonable and just both to the State and to the fishermen.

Should it be deemed desirable to continue shad cultural operations on Tuckahoe Creek this could be done as in the past, but if confined to shad but two or three men will be needed and then only from April 15th to June 1st. In no sense, however, will the number of shad eggs obtainable there justify the expense of establishing and operating an up-to-date hatchery.

Wherever hatchery work is permanently taken up it should be the aim of the Commission to well stock and build up the fishing in the waters from which eggs are collected before giving attention to other waters.

OBSERVATIONS OF VIOLATIONS OF THE LAW.

On March 19, 1917, about a mile above the Tuckahoe Fish Hatchery a man in a boat was seen to throw overboard hundreds of small white perch at least 90 per cent. of which were dead.

On March 22, 1917, about two miles below the Tuckahoe Fish Hatchery at a bridge, a man was seen to throw overboard hundreds and hundreds of undersize dead white perch. At the same time he was seen to deliver to a local trader several bushels of white perch at least half of which were under size.

On April 2d and again on April 11th a man on the Choptank at a point near Denton was seen after fishing his nets to sort the larger white perch from the small ones. The larger ones were sold on the streets in Denton, while the small ones were put in baskets and when last seen were in the cabin of his boat. Disposition unknown. These were the most flagrant violations seen by the writer, but upon other occasions at other places I saw large numbers of dead undersized white perch lying along the river bank where fish had been culled or floating upon the surface of the water in the vicinity of nets that had been fished, showing that little or no regard is paid to the law forbidding taking or killing perch under seven inches long. In all cases the excuse was offered that it was impracticable to avoid killing a lot of these undersized fish when taken in fyke nets.

REMEDIAL.

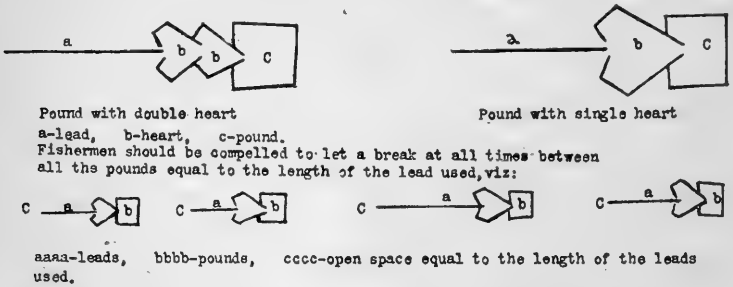
The fishing industry of the State as pertaining to the anadromous fishes has reached a condition where its salvation is to be found in nothing less than radical legislative action and rigid enforcement. Important as fish culture is the fish culturist is helpless unless the brood fish are permitted to reach their natural spawning beds. Only after the fish reach the spawning beds do their eggs become sufficiently developed to be susceptible to natural reproduction or to fish cultural methods.

The foundations of all legislative action should be to permit the parent fish to reach their spawning beds. The ideal law is that which permits every fish to reach maturity and reproduce itself before being used for food. Herein is found the only possible remedy for the unsatisfactory condition of the State's fishing industry. The wholesale slaughter of your anadromous fishes en route to their spawning beds must inevitably result in disaster and that this condition is rapidly approaching admits of no doubt as shown by the records in this report; nor is this condition of the anadromous fishes confined to the Eastern Shore of Maryland, but exists all along our Atlantic Seaboard and in all the States directly affected the nation's representatives are urging remedial legislation.

The one thing more than any other one thing that is responsible for the present unsatisfactory condition of the fishing industry is the excessive use of pound nets in taking fish.

There should be no extension in the use of these nets and laws should be enacted forbidding the use of these nets, except during every other week, and that the law might be easily enforced the open and closed weeks should be the same in all parts of the State. During the closed weeks the fishermen should be compelled under heavy penalties to lift and keep lifted all pounds and hearts thereto. It is not enough that the pounds or traps proper be lifted, but the hearts too for these are easily converted into traps and the law that was once on the Statute Books which compelled fishermen to lift and keep lifted all pounds from Saturday night until Monday morning soon came into disrepute, and was repealed because the fishermen made traps out of the

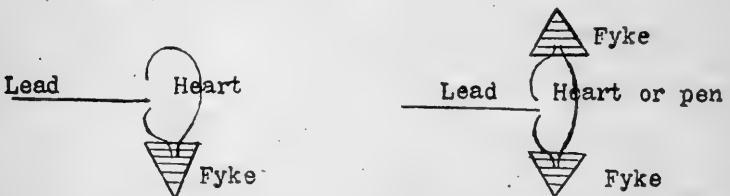
hearts and forebays of their pounds thereby making the intent of the law without effect. In fact a pound net heart either single or double is an effective trap in itself. See Sketch.



These so-called hoop pounds, or fyke nets or hedge fykes or trap nets (there seems to be no distinctive name for them) that are extensively used in all the Eastern Shore rivers should be forbidden by law, except during the months of November, December, January, February and March when the water is cold and fish are hardy.

It is understood these nets came into use to avoid paying a pound-net license. The objections to these nets is found in that nearly all the shad and many of the herring and white perch that enter them soon die, and unless the nets are frequently lifted, these dead fish soon became unfit for food or are eaten by eels, besides the fishermen almost without exception say it is impossible to comply with the State law forbidding taking or killing undersized white perch and yellow perch when fishing these nets in warm weather.

These nets are set in various ways, but the fundamentals remain the same, viz. :



They are simply fykes having leads and forebays or hearts. The use of trammel nets (so-called buck nets) in taking rock should be forbidden, especially the use of these nets in surrounding schools of rock.

All rock weighing more than 10 pounds should be protected at all times, except those taken by angling with hook and line. A law should be passed forbidding taking rock in any manner under 10 inches long.

All white perch and yellow perch less than eight inches long should be protected at all times.

It should be unlawful to set any pound net within several miles of the mouth of rivers nor anywhere in the main channels of rivers or streams.

Pound nets should not be permitted on the spawning beds of shad except for fish cultural purposes under special permit from State or national representatives. Staked or anchored gill nets for shad should be strictly forbidden in any waters of the State, except for fish cultural purposes under special permit from State or national representatives and then only between the hours of 3 P. M. and 10 P. M. and in no case should any crew of two or three men, one of which should be an experienced spawntaker, be permitted to set more than 600 yards of net and then only at such places where the nets can be frequently overhauled for spawning fish.

A law should be passed requiring a license for each and every net of any kind used in taking fish for any purpose whatever in any waters of the State and it should be unlawful to use any net of any kind without having attached to it a metal tag having stamped thereon the name and address of the owner, and the Commission, and its representatives, should have full authority to confiscate any net set or used in any waters of the State that is not so marked.

The importance of licensing all nets is twofold—to provide adequate funds for the propagation of fishes and for the enforcement of protective laws.

There should be embodied in every license a provision requiring the lessee at all times to permit the State's or Nation's representatives to take fish eggs for fish cultural or scientific purposes or the same to be done by the lessee when directed to do so. As the fishermen are most directly benefited by fish propagation and protection, they should bear the burden of said protection and propagation.

The fees for these licenses should be graduated according to the kind and size of nets used. For the small nets used by farmers and others at irregular intervals in taking fish for home consumption, the cost of the license should not exceed the cost of recording the same. The burden should fall upon those men who take fish in large numbers for commercial purposes. In regard to these licenses valuable information can be obtained from an examination of the licenses and laws governing the same in New York and Michigan, also as embodied in the laws of the Province of Ontario, Canada.

The Commission should be empowered to issue special licenses for the use of any kind of net at any time in any open or closed waters of the State for fish cultural or scientific purposes, under such restrictions as they may deem advisable.

In the absence of sufficient funds from licenses a specific and adequate appropriation should be made by the State for the propagation of fishes.

Adequate funds from licenses or otherwise should be provided for the detection of violations of the laws as pertaining to fishes and their enforcement.

A law should be passed, together with heavy fines or imprisonment, for any one to offer for sale, or to purchase, or to have in possession any undersized white perch, yellow perch or rock or any other fish not of lawful size.

A law should be passed forbidding black bass to be taken in nets at any time in any of the waters of the State, and it should be unlawful to take them less than 10 inches long in any way at any time. As large mouth black bass (*Micropterus Salmoides*) and small mouth black bass (*Micropterus Dolomieu*) are strictly game fishes it should be unlawful to sell them or take them in any way, except by hook and line.

SUPPLEMENTAL REPORT.

•FISH CULTURAL.

Shad.—Shad spend practically all their life in salt water, but make yearly migrations to fresh water to mature and deposit their eggs. Each female shad deposits about 30,000 eggs, but under natural conditions only a very small percentage of the eggs deposited are fertilized and many of those are lost during incubation. The eggs are semi-buoyant, nearly transparent and average about 28,000 per quart when fully expanded. Most shad spawn and the best results are obtained at a water temperature from 55 to 65 Fah. They hatch in about one week. The fry are about three-eighths of an inch long, very delicate and almost transparent. In artificial hatching McDonald or Downing jars give best results. These are arranged on tables around glass and slate aquaria in which the fry as they hatch collect and are held until planted.

Yellow Perch.—These fish are found in fresh and in brackish water, but all resort to fresh water to deposit their eggs. The average female deposits about 25,000 eggs. They spawn in early spring in a water temperature from 38 to 45 degrees and hatch in about 16 days. The eggs are semi-buoyant, small, averaging about 100,000 per quart, semi-transparent and are held together in a mass by a semi-gelatine like ribbon. They are very hardy and stand almost any kind of handling. In a state of nature the eggs are cast among bushes, weeds, etc., and a very high percentage of the eggs are fertilized and produce fish. The fry are small but hardy. The eggs can be successfully incubated in jars or boxes, but if handled in boxes the eggs and fry should be planted as soon as the egg mass separates, for in boxes there is no practicable way of separating the fry from the egg shells which decompose and cause many fry to die if left in the boxes.

White Perch.—These fish are found in both fresh and brackish water, but all resort to fresh water to spawn. They cast their eggs in spring at a temperature from 48 to 60 degrees and hatch in two or three days. The eggs are heavy, very adhesive, semi-transparent and very small averaging about 1,600,000 eggs per quart. They are hatched in jars but require a greater flow of water than shad eggs to keep them moving. The fry are very

small and transparent, so small that the finest wire cloth or linen scrim screens are needed to retain them in the aquaria. Floating boxes are worthless as a hatching device for these eggs.

Rock Fish.—Rock spend most of their life in salt or brackish water, but resort to fresh water to spawn. The females are usually very much larger than the males. They deposit their eggs at a temperature of 68 to 75 Fah. and the eggs hatch in about 36 hours. The eggs at first are very small and are bright green in color, but when expelled they absorb a great amount of water which makes them semi-bouyant and quite transparent. A fish weighing 50 pounds will deposit as many as 4,000,000 eggs, but in nature only a very small percentage are fertilized. When fully expanded they average about 35,000 per quart. They are hatched in jars. The fry are very delicate and can be retained but a few days after hatching.

Herring.—These fish spend all their life in salt water resorting to fresh water only to spawn. The eggs are heavy, adhesive, small and semi-transparent. They average about 600,000 per quart and the fry hatch in a few days.

Catfish and black bass are propagated in ponds under entirely different conditions from the other species mentioned in this report. Both the basses and catfishes are nest builders. The former deposit their eggs on gravel or on the roots of bushes, the latter in holes or under rocks or projecting roots. Both the basses and catfishes deposit but a few thousand eggs. The parent fish guard the eggs and fry until the schools break up.

ARTIFICIAL FERTILIZATION.

In this the eggs from the female and milt from the male is ejected into a moist pan and immediately the pan is tilted from side to thoroughly incorporate the eggs with the milt. If necessary to do this a little water may be added. The milt must taken from a live fish or one still showing some signs of life, but the eggs may be taken from a fish that has been dead for 10 or more minutes. When the eggs are ejected they begin to expand by the absorption of any fluid around them and fertilization is produced by one or more living spermatazoa being drawn through the micropyle of the egg's shell and brought in contact

with the germinal vesicle of the ovum within the shell. The eggs and milt must be quickly brought in contact for fertilization can only take place while the egg is expanding by absorption and the milt dies within a few minutes after ejection. From this it will readily be seen why so few eggs are fertilized naturally by shad, rock and many other fishes that cast their eggs without any seeming regard to the presence of male fish.

After the eggs in the pan have been incorporated with the milt the pan should be set aside for a couple minutes, then the milt should be washed off by carefully pouring water in the pan, then draining it off and repeating the process until the milt is removed. In the case of shad, rock and yellow perch the eggs require no further attention, except to shake the pan every 10 or more minutes and give them enough water for absorption. When absorption is completed the eggs can be placed in the hatching jars. In the case of white perch and herring the eggs must be stirred during the entire period of absorption to overcome their adhesiveness before being placed in jars. The eggs are estimated by measuring them in a glass graduate or by the use of a scale after being placed in the jar. The fry are estimated in the same way. Dead eggs decompose and form a coating above the good eggs in the jars and are easily removed by small siphons. Just enough water is turned into each jar to keep the eggs in slow but continuous motion. The fry escape from the jar with the discharged water and are retained in the aquaria by fine wire or scrim screens. See attached ground plan for 96-jar hatchery. Scale about $4\frac{1}{2}$ feet per inch. Capacity at any one time—

Shad, 80,000 eggs per jar.....	7,680,000
Yellow Perch, 200,000 eggs per jar....	19,200,000
White Perch, 800,000 eggs per jar.....	76,800,000
Rock Fish, 90,000 eggs per jar.....	8,640,000

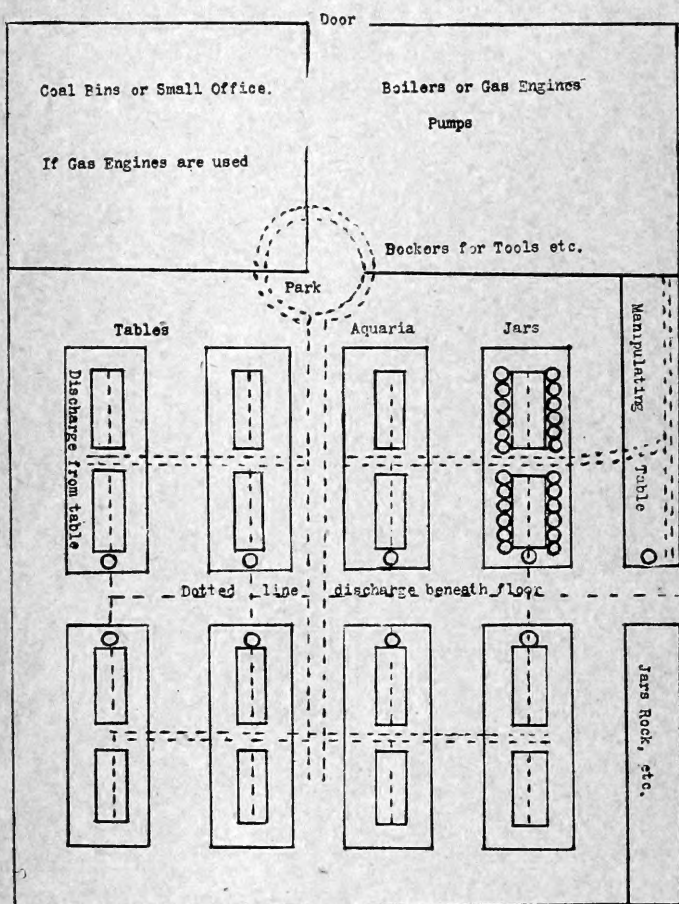
This capacity, of course, can be greatly increased by crowding more jars on the table.

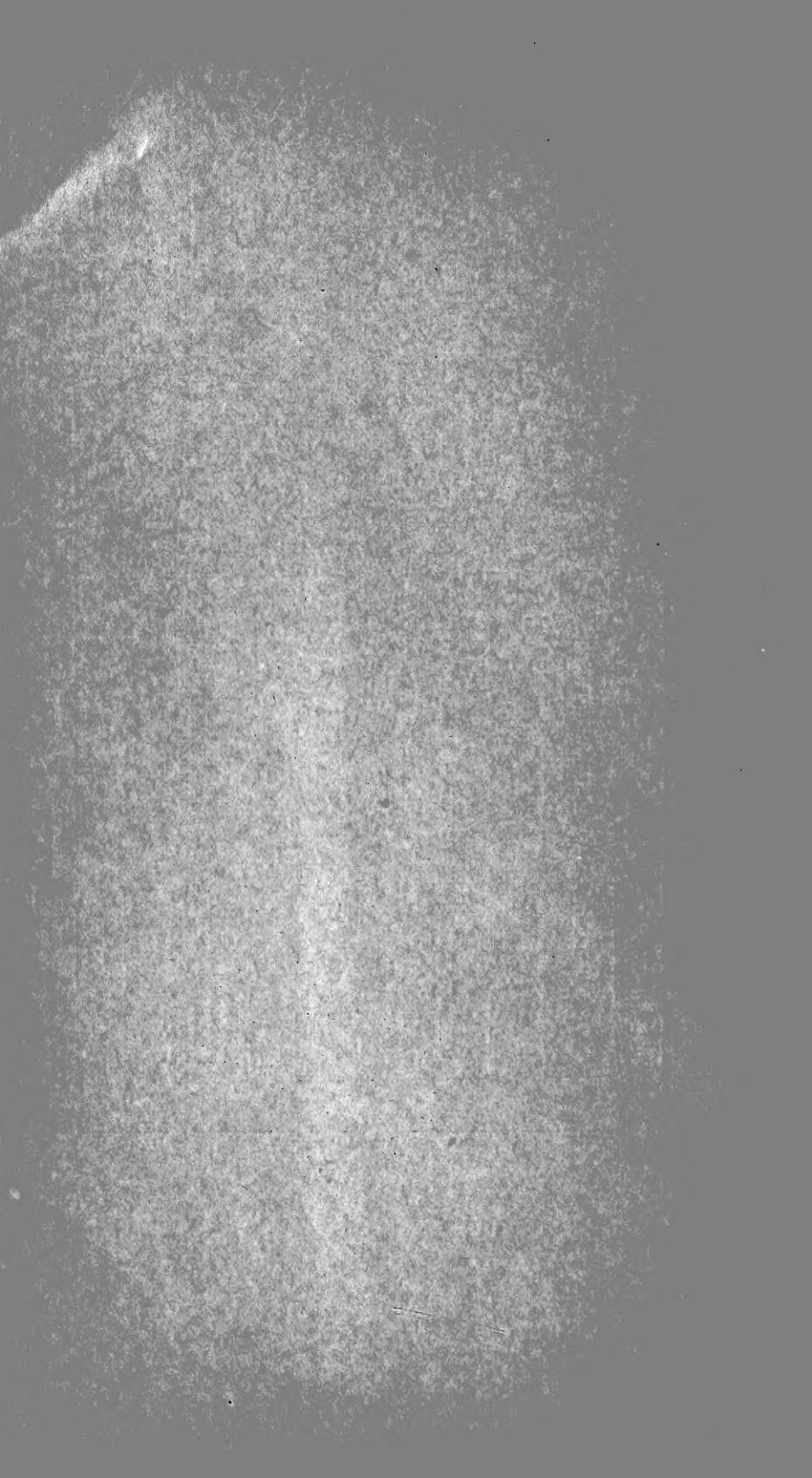
Very respectfully submitted,

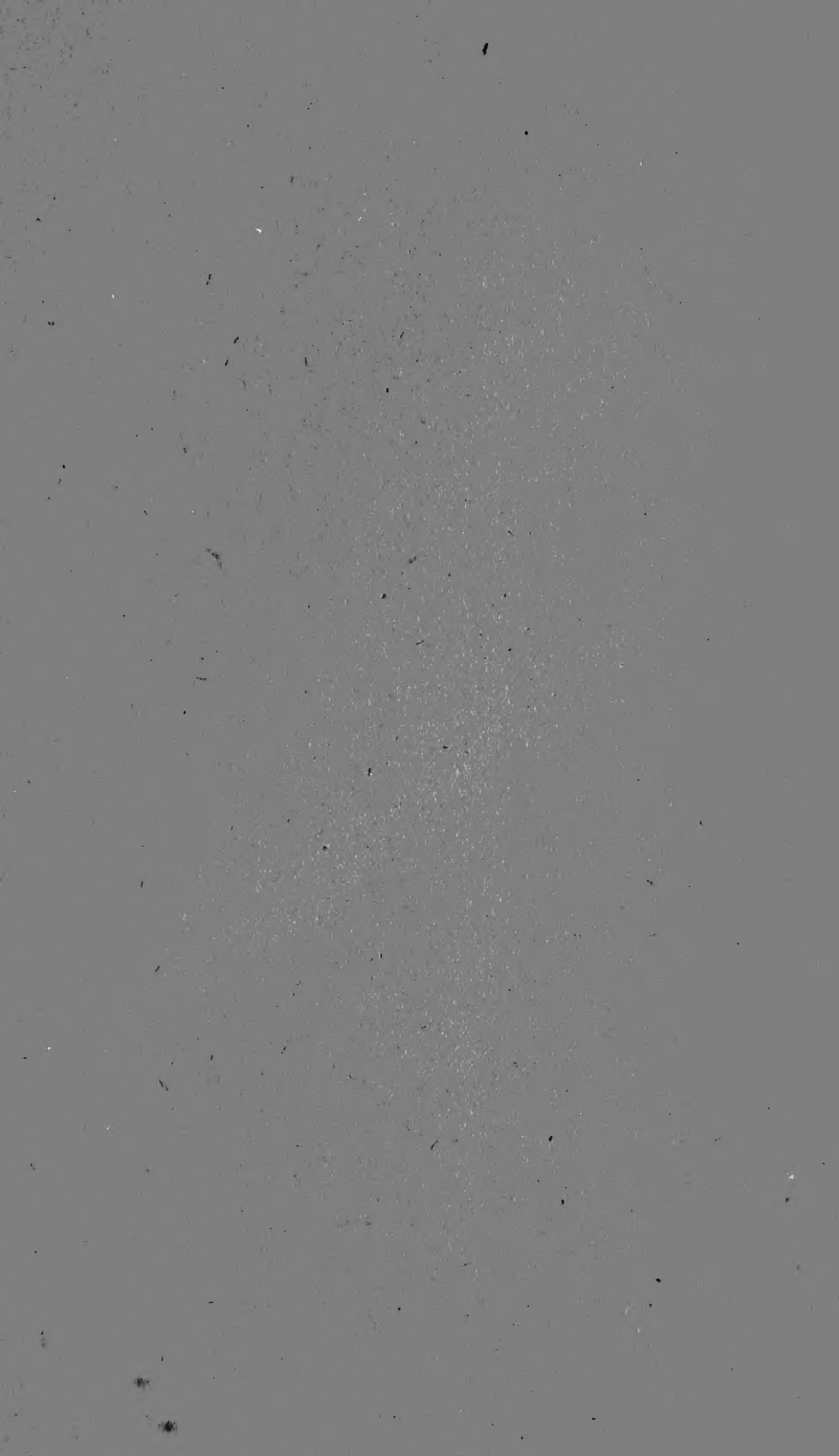
J. P. SNYDER,

U. S. Bureau of Fisheries.

SUGGESTED PLAN OF HATCHERY.

Scale $4\frac{1}{2}$ ft. per inch.





LIBRARY OF CONGRES



0 002 858 031 9