

XX.—REPORT OF OPERATIONS AT THE WYTHEVILLE STATION,  
VA., FROM JANUARY 1, 1885, TO JUNE 30, 1887.

BY MARSHALL McDONALD.

The plans projected during 1884 for extending and improving the facilities for work at this station were carried out during the summer and fall of 1885, under the direction of the Commissioner of Fisheries for the State of Virginia, and the cost of the extensive improvements made was defrayed by the State Commission.

The station is now substantially complete in its equipment and appointments. Additional ponds will be needed from time to time to provide increased capacity for rearing trout and other species for distribution.

Much also remains to be done in providing access to and circulation through the grounds by the construction of good graded roads, in erecting substantial inclosures for protection from depredations, and in improving the amenities of the grounds by planting trees and shrubs, clearing up the undergrowth, and turfing bare and unsightly spots. But the station may now be regarded as fully equipped for its work; and a description of its location, buildings, ponds, and grounds, and its facilities for production and distribution of the Salmonidæ will well illustrate its importance and value to the work of the U. S. Fish Commission.

(1) *Location*.—The station is situated in southwestern Virginia, about 3 miles east of the town of Wytheville and immediately on the line of the Atlantic, Mississippi and Ohio Railroad, which, with its extensive connections northeast and southwest, traverses that broad belt of mountain region which stretches from New York to Georgia and Alabama and is the natural trout region of the Middle and South Atlantic States. The facilities thus afforded for expeditious and satisfactory distribution to the most distant points are all that can be desired.

A railroad siding, not a hundred yards from the station and accessible by a good graded road, affords every convenience for satisfactory distribution by car and messenger service.

(2) *Water supply*.—This, which aggregates 1,100 gallons per minute, is afforded by two bold springs, coming to the surface in an oval depression

sion or basin in the hillside to the north of the hatchery. The water supply for the hatching-house is drawn from the upper spring (see Plate I) through a 4-inch iron pipe conveying about 120 gallons of water per minute. The excess of water from the upper spring is conducted by shallow flumes, which also serve as spawning races, through the two ponds, 12 by 50 feet, which are reserved for the oldest breeding trout. Escaping from the lower of these the discharge unites with that from the lower spring and is conveyed by a tunnel under the hatchery to the sloping hillside south of this building, and the whole discharge from the springs is thus utilized for the supply of the succession of trout-rearing ponds constructed on the rather abrupt slope extending from the hatchery to the valley below.

The station, it will be seen (Plate II), presents remarkable advantages in the large water supply available for fish-cultural operations, and in the fact that the distribution both to the hatching-house and ponds can be made by gravity, thus eliminating one very considerable item in the cost of maintenance of stations where circumstances require the water to be pumped to a higher level before it can be utilized. One serious trouble relating to the water supply yet remains to be corrected.

During the seasons of heavy and prolonged rainfall the springs become muddy, and although the muddy water does not appear to be directly injurious, the fact that proper observation and attention can not be given to the eggs and young fish may give rise to serious losses. Where this muddy condition is prolonged the gills of the larger trout become congested or inflamed, and many of our losses of fish have doubtless originated from the abnormal condition of water, if not directly attributable to it.

It is expected to get rid of this trouble and embarrassment to the work either by the use of a settling reservoir or by devising effective methods of filtration. Experiments are now in progress with a view to determining the most convenient and available means to accomplish the desired end.

(3) *Hatchery*.—The building first occupied as a hatchery was an old, log still-house, fitted up with hatching troughs affording capacity for the development and hatching of 300,000 trout eggs. In the spring of 1886 this building was removed, and on its site was erected the present comfortable, convenient, and well-equipped station. It is shown in elevation in the general view of buildings, ponds, and grounds (Plate II). Details of interior construction and arrangements are given in Plates III, IV, V.

The building is 50 feet by 25 feet and two stories high. The basement or lower story is of stone, the floor of concrete, so that it may be flushed with water and thoroughly cleaned whenever necessary. This floor constitutes the hatchery proper, and is fitted up with troughs and hatching jars, as shown in Plate III. As at present arranged, about

800,000 trout eggs can be incubated conveniently; by crowding, provision could be made for 1,200,000 eggs. Under the hatching troughs and supplied by the overflow of the water from these are an equal number of nursing troughs for the young trout.

Experience has shown that it will not do to transfer them to the open-air ponds until they are several months old. It is proposed to make additional provision for twenty-five more nursing troughs in a separate building, and so increase the capacity of the station as to enable us to rear and furnish for distribution each season not less than 200,000 yearling trout.

The second story of the hatchery is framed, and the interior is arranged for office, storage, and quarters, as shown in Plate IV.

(4) *Work done.*—The work of the station was at first directed with the view of producing the eggs and young of the Rainbow Trout (*Salmo irideus*) for distribution. The breeding fish have been reared from eggs obtained from native wild fish at Baird Station, California. These spawned first in the winter of 1883-'84, and, in the winter of 1886-'87, we obtained from our own stock of the Rainbow Trout, 220,000 eggs. The work of the station has been by degrees extended and diversified so as to provide for the pond-culture of Carp, the Goldfish, the Rock Bass, and the small-mouthed Black Bass.

For the better economy and distribution of the work of the station, arrangements were begun in 1885 to accumulate a stock of the native or red-spotted trout of the Eastern States by the collection of wild fish from streams of Virginia and by hatching and rearing breeding fish at the station from eggs obtained both from Michigan and from the North-eastern States. The eggs from the West gave fry of feeble vitality, and the percentage reared was very small. The stock of breeding fish on hand consists of a few hundred of the native Brook Trout and about 2,500 one and two-year old fish reared from eggs hatched at the station. It is probable that a few thousand eggs will be obtained during the winter of 1887-'88. Only a small number, however, will mature enough to spawn before the winter of 1888-'89.

The current work of production and distribution for the fiscal year beginning July 1, 1886, is given in the following tables. The receipts of fish and eggs by collection from our breeding fish and from open waters and by transfer from other stations are given in Table I. The distribution of fish and eggs from the station during the fiscal year beginning July 1, 1886, is given in Table II.

TABLE I.—Receipts of fish and eggs at Wytheville Station for the year ending June 30, 1887.

Species.	Whence received.	Date.	Eggs.	Fish.
California trout	Central Station, by W. F. Page	Apr. 14		\$5,000
Do	Central Station, by W. A. Dunnington	May 4		\$5,000
	Collected at Wytheville Station		220,500	
	Total		220,500	8,000
Brook trout	Northville Station, by R. S. Johnson	Dec. 11		\$193
Do	Northville Station, by express	Jan. 2	26,508	
Do	Richard E. Follett, Windham, Conn.	Jan. 8	75,000	
Do	Central Station, by W. F. Page	Apr. 14		\$5,000
	Total		101,508	5,193
Brown trout	Fred. Mather, Cold Spring Harbor, N. Y.	Mar. 17	9,100	
Do	Central Station, by W. A. Dunnington	May 4		\$3,000
Landlocked salmon	Chas. G. Atkins, Grand Lake Stream, Me	Mar. 13	50,000	
Red-eye perch	Peak Creek, Pulaski County, Va.	Aug. 16		\$2,125
Do	do	Aug. 16		\$58
Do	Reed Creek, Wythe County, Va.	June 23		\$19
	Total			2,202
Black bass	New River, Giles County, Va.	Aug. 16		\$100
Do	Reed Creek, Wythe County, Va.	June 23		\$11
	Total			111
Carp (leather)	Central Station, Washington, D. C.	Nov. 11, 20		\$3,000
Do	do	Mar. 1		\$12
Do	do	Apr. 14		\$2
Do	do	May 4		\$3
Carp (scale)	do	Jan. 6		\$450
Do	do	Apr. 14		\$2
	Total			3,460
Tench	Central Station, Washington, D. C.	Jan. 6		\$450
Do	do	Apr. 14		\$2
	Total			452

\* Fry. † Brooders. ‡ Yearlings.

TABLE II.—Distribution of fish and eggs from Wytheville Station for the year ending June 30, 1887.

Species.	Where sent.	Date.	Eggs.	Fish.
California trout	H. C. Parsons, Natural Bridge, Va.	Aug. 11		\$100
Do	M. C. Treiber, Staunton, Va.	Aug. 11		\$100
Do	North River, Weyer's Cave, Va.	Aug. 11		\$497
Do	A. Y. Stevens, Nashville, Tenn.	Aug. 17		\$100
Do	Edward D. Hicks, Nashville, Tenn.	Aug. 17		\$50
Do	J. D. Eads, Warrensburgh, Mo.	Aug. 17		\$75
Do	Tributary of Maramec River, Mo.	Aug. 17		\$225
Do	Tributary of Gasconade River, Mo.	Aug. 17		\$750
Do	Tributary of Osage River, Mo.	Aug. 17		\$950
Do	Tributary of Neosho River, Mo.	Aug. 17		\$225
Do	Tributary of White River, Ark.	Aug. 17		\$1,110
Do	George L. Harman, Olympic, Va.	Aug. 20		\$50
Do	do	Aug. 21		\$50
Do	William Spangler, Speedwell, Va.	Sept. 2		\$20
Do	Stony Fork of Reed Creek, Wythe County, Va.	Sept. 20		\$100
Do	Eli F. Thomas, Grant, Va.	Sept. 21		\$25
Do	Headwaters of James River, Va.	Sept. 23		\$400
Do	Stony Fork of Reed Creek, Wythe County, Va.	Sept. 23		\$500
Do	Cacapon River, W. Va.	Oct. 12		\$400
Do	Henry Stewart, Highland, N. C.	Oct. 19		\$300
Do	D. B. Mackall, messenger, Washington, D. C.	Nov. 7		\$300
Do	J. W. Davis, Atkin's Tank, Va.	Nov. 13		\$25
Do	D. B. Mackall, messenger, Washington, D. C.	Nov. 15		\$250
Do	V. G. Shepard, Faber's Mills, Va.	Nov. 15		\$100
Do	Newton Simmons, messenger, Washington, D. C.	Jan. 6		\$225
Do	M. McDonald, Washington, D. C.	Jan. 21	5,000	
Do	Max von dem Borne, Berneuchen, Germany	Jan. 24	10,000	
Do	N. Jounet, Paris, France	Feb. 2	5,000	
Do	Deutsche Fischerer-Verein, Berlin, Germany	Feb. 7	15,000	
Do	do	Feb. 14	15,000	
Do	National Fish-Culture Association, London, England.	Feb. 21	10,000	

\* Yearlings. † Two years or more.

TABLE II.—Distribution of fish and eggs from Wytheville Station, etc.—Continued.

Species.	Where sent.	Date.	Eggs.	Fish.
California trout	M. V. Osborne, Cold Creek Hatchery, Ohio	Feb. 21	10,000	
Do.	E. G. Shortlidge, Wilmington, Del.	Feb. 21	5,000	
Do.	E. H. Fishman, Philadelphia, Pa.	Feb. 26	5,000	
Do.	J. W. Hoxie & Co., Carolina, R. I.	Feb. 26	3,000	
Do.	Charles F. Hardin, New York, N. Y.	Mar. 1	10,000	
Do.	G. W. Delawder, Baltimore, Md.	Mar. 1	5,000	
Do.	Long Meadow Run, near Hagerstown, Md.	Mar. 31		*622
Do.	Almshouse Run, near Hagerstown, Md.	Mar. 31		*622
Do.	Rush Run, near Hagerstown, Md.	Mar. 31		*622
Do.	Walker's Run, near Hagerstown, Md.	Mar. 31		*622
Do.	South Fork of Reed Creek, Wythe County, Va.	May 19		165
Do.	Holston River, near Marion, Va.	May 20		*500
Do.	Cove Creek, Wythe County, Va.	May 24		*250
Do.	Walker's Creek, Bland County, Va.	May 27		*250
Do.	North Fork of Reed Creek, Wythe County, Va.	June 1		1100
Do.	L. S. Allison, Wythe County, Va.	June 20		*250
	Total		98,000	12,230
Brook trout	Long Meadow Run, near Hagerstown, Md.	Mar. 31		*622
Do.	Almshouse Run, near Hagerstown, Md.	Mar. 31		*622
Do.	Rush Run, near Hagerstown, Md.	Mar. 31		*622
Do.	Walker's Run, near Hagerstown, Md.	Mar. 31		*622
Do.	Cove Creek, Wythe County, Va.	May 24		*250
Do.	Walker's Creek, Bland County, Va.	May 27		*250
Do.	L. S. Allison, Wythe County, Va.	June 20		*250
	Total			3,238
Lake trout	H. C. Parsons, Natural Bridge, Va.	Aug. 11		*100
Do.	M. C. Treiber, Staunton, Va.	Aug. 11		*100
Do.	Tributary of Gasconade River, Mo.	Aug. 17		*50
Do.	William Spangler, Speedwell, Va.	Sept. 2		*20
Do.	Eh F. Thomas, Grant, Va.	Sept. 21		*25
Do.	S. N. Hufford, Wytheville, Va.	Oct. 9		*25
Do.	D. B. Mackall, messenger, Washington, D. C.	Nov. 15		*250
Do.	do	Nov. 23		*600
Do.	Newton Simmons, messenger, Washington, D. C.	Jan. 30		*30
	Total			1,200
Landlocked salmon	Tributary of Shenandoah River, Staunton, Va.	Aug. 11		*1,007
Do.	South Fork of Shenandoah River, Waynesborough, Va.	May 19		*11,000
	Total			12,997
Red-eye perch	W. L. Bumgardner, Staunton, Va.	Aug. 11		*25
Do.	I. G. W. Steedman, St. Louis, Mo.	Aug. 17		*60
Do.	Cowpasture River, Bath County, Va.	Sept. 23		*600
Do.	Cacapon River, West Virginia	Oct. 12		*500
Do.	W. O. Watson, Charlottesville, Va.	Oct. 12		*200
Do.	W. E. Grant, Grantland, Va.	Oct. 15		*100
Do.	D. B. Mackall, messenger, Washington, D. C.	Nov. 7		*400
Do.	V. G. Shepard, Faber's Mills, Va.	Nov. 15		*100
Do.	L. S. Pendleton, Frederick's Hall, Va.	Nov. 15		*50
Do.	Fred Mather, Cold Spring Harbor, N. Y.	Dec. 12		*50
Do.	Newton Simmons, messenger, Washington, D. C.	Jan. 6		§6
Do.	E. M. Robinson, messenger, Washington, D. C.	Feb. 25		§12
	Total			2,103
Black bass	J. D. Eads, Warrensburgh, Mo.	Aug. 17		*48
Carp (leather)	Ninety-one applicants in southwest Virginia and east Tennessee.			1,925
Carp (scale)	South Fork of Reed Creek, Wythe County, Va.	Jan. 8		450
	Total			2,375
Tench	South Fork of Reed Creek, Wythe County, Va.	Jan. 8		*450
Goldfish	Mrs. O. J. Smythe, Wytheville, Va.	July 13		6
Do.	J. C. Ewald, Paris, Tex.	July 17		6
Do.	Mrs. Emma W. Gux, Glade Spring, Va.	Aug. 5		6
Do.	Miss Daisy Bedford, Vicksburg, Miss.	Aug. 10		6
Do.	E. M. Robinson, Fayetteville, N. C.	Dec. 21		8
Do.	Charles Hancock, Wytheville, Va.	Jan. 12		6
Do.	J. G. Hollbrook, Wytheville, Va.	Jan. 22		4
Do.	Charles Ewald, Wytheville, Va.	Mar. 6		6
Do.	Hon. C. F. Trigg, Abingden, Va.			4
	Total			50

\* Yearlings.

† Two years or more.

‡ Fry.

§ Breeders.

From the eggs hatched at the station during the season we have now in our ponds for distribution during the fall of 1887, according to the estimates of the superintendent of the station, about 60,000 California and Eastern brook trout, from 3 to 5 inches in length.

During the spring of 1887 our facilities for pond-culture were extended by the construction of a series of ponds covering about 2 acres, for the cultivation of the rock bass (*Ambloplites rupestris*), a species well adapted for pond-culture and rapidly growing in favor with those desiring a species of easy cultivation, with gamy characteristics and of good flavor.

The landlocked salmon bred during the season were held in ponds at the station until June, 1887, and then transferred to the headwaters of the Shenandoah River, in Augusta County, Va. They were from 2½ to 3 inches in length when planted, and about 25 per cent. only of the eggs received survived.

The stocking of the headwaters of the Shenandoah with salmon is to be regarded as an experiment in acclimation rather than assured fish-cultural work. It is hoped that by the selection of a variety of salmon that has largely lost its migratory instincts and by hatching it and constraining it to live for some months in a much higher range of temperature than is natural to it, it may become habituated to its new environment and become resident in the Potomac River basin. Should but a few survive and spawn it is probable that the young will exhibit considerable modification of habit and be in better accord with their environment, and after a succession of generations develop a distinct race, finding congenial habitat in streams with a higher range of temperature than is found in the natural salmon streams of the Northeast.

It is not possible to report even a fair measure of success in hatching eggs of the Brown Trout of Europe (*Salmo fario*). From the Deutsche Fischerei-Verein we obtained about 2,000 fish, which, at the age of six months, are from 4 to 6 inches long and growing rapidly. The very large percentage of loss occurred during the period intervening between hatching and beginning to feed.

(5) *Provision for pond culture.*—In the oval depression north of the hatchery (Plate I) are two ponds, 12 by 50 feet, provided with spawning races. These are reserved for our breeding trout. They are constructed entirely of plank, sides and bottom, and at first the sides projected above the level of the soil. The considerable losses occurring among the breeders during the hot weather of summer indicated unhealthy conditions, which were attributed to the exposed sides, which became heated during the day, thus causing a considerable rise in the temperature of the water. This was remedied by banking up the sides with earth and sodding the slopes. The plank bottoms at the upper ends of the ponds were also covered by broken stone and coarse gravel. These changes were marked by the greater improvement in the condition of the fish in the ponds. Losses are now comparatively rare, and are almost entirely confined to the males, being usually the result of injuries

inflicted in the fierce fights they wage with each other during the breeding season.

A general view of the series of ponds to the south of the hatchery is given in Plate VI. The four ponds lying upon the slope immediately below the hatchery are each 8 feet by 50 feet, and are reserved for the larger trout which are being reared at the station to maintain the succession of breeders or for distribution after attaining considerable size.

The eight ponds at the base of the hill, between the superintendent's house and Tate's Run, are also appropriated to the rearing of trout for distribution. All of these ponds have earth sides and bottom, and each has an independent water supply and drainage. The series of four large ponds on the opposite side of Tate's Run, near the railroad, is appropriated to the pond culture of the carp and other species requiring warm waters for their successful cultivation. The water supply for this series of ponds is conducted from the springs in a 4-inch pipe, and, with the view of securing the warming of the water as much as possible by exposure to summer temperature, the water supply is reduced to an amount barely sufficient to replace the losses by evaporation and leakage. The extent of surface exposed to the air and the presence of abundant vegetation in the ponds are relied upon to maintain the water in healthy condition.

A series of six ponds, covering about 3 acres, has been constructed in the area of ground lying between Tate's Run and the series of carp ponds. These are not shown in the general view of ponds in Plate VI.

They have been constructed especially with a view to the breeding of the red-eyes and the small-mouth black bass for distribution. The water supply is drawn from Tate's Run, and carries into the pond an abundant supply of food both for the parent fish and the young.

(6) *Capabilities of the station.*—As now equipped this station may safely be looked to to furnish each season 400,000 or 500,000 eggs of the rainbow trout for distribution or for hatching and rearing. Equally good results may be expected from the work with Eastern brook trout in a year or two.

The trout ponds at the station are of sufficient extent to permit the carrying of 150,000 fish up to the age when they are of sufficient size to permit their introduction with safety into open waters infested by predaceous fish. The arrangements for pond culture are sufficiently extensive and the results of such work well enough assured to enable us to look with confidence to the Wytheville station to provide for all demands for the streams and ponds of Virginia, North Carolina, Tennessee, Maryland, and West Virginia. The distribution of trout fry from this station has been conspicuous by the failure to secure appreciable results in the improvement of the streams stocked. Rarely did we find any evidence of success from such work, so far as it has come under my observation.

The change in our methods of handling the trout, namely, rearing them at the station and distributing after they have attained a length of 5 inches to 6 inches has, on the other hand, met with most encouraging success. The *irideus* has been established in several of the streams of southwest and Piedmont Virginia, and in Maryland and in a number of ponds in Virginia and Tennessee.

A remarkable comparison of the different results of the two methods is given by the experiments conducted under my own observation and direction with a view of stocking the natural trout stream flowing through the grounds of the station. For several years in succession this stream was stocked with the fry of both the California and Eastern brook trout. The aggregate number planted was not much short of 100,000. No appreciable results followed from this work. In August, 1886, about 400 fingerling trout from 4 to 5 inches in length were released into the stream. During the ensuing fall and winter about 100 of these were captured at the head of a little fishway fed by the waste water discharged from the ponds. They had attained a length of 7 to 8 inches, and the brightness and clearness of their color were in marked contrast to the duller hues of the fish of same age in the ponds. An examination of the stream subsequently showed that the trout were still quite numerous in the stream in the vicinity of the hatchery.

The important lesson to be drawn from these experiments is that in stocking streams infested by small predaceous fish we can only assure success by stocking with trout of sufficient size to dominate the water. Under the circumstances indicated experience shows that several hundred yearling trout are sufficient to stock a stream presenting suitable habitat. On the other hand, we can rarely expect success in stocking such waters with any number of the fry, however great. It may be assumed as a rule that a pair of yearling trout are fully the equivalent of several thousand fry in stocking streams presenting the conditions to be found in the trout region of Pennsylvania, Maryland, Virginia, and States farther to the south.

WASHINGTON, D. C., *November 19, 1887.*

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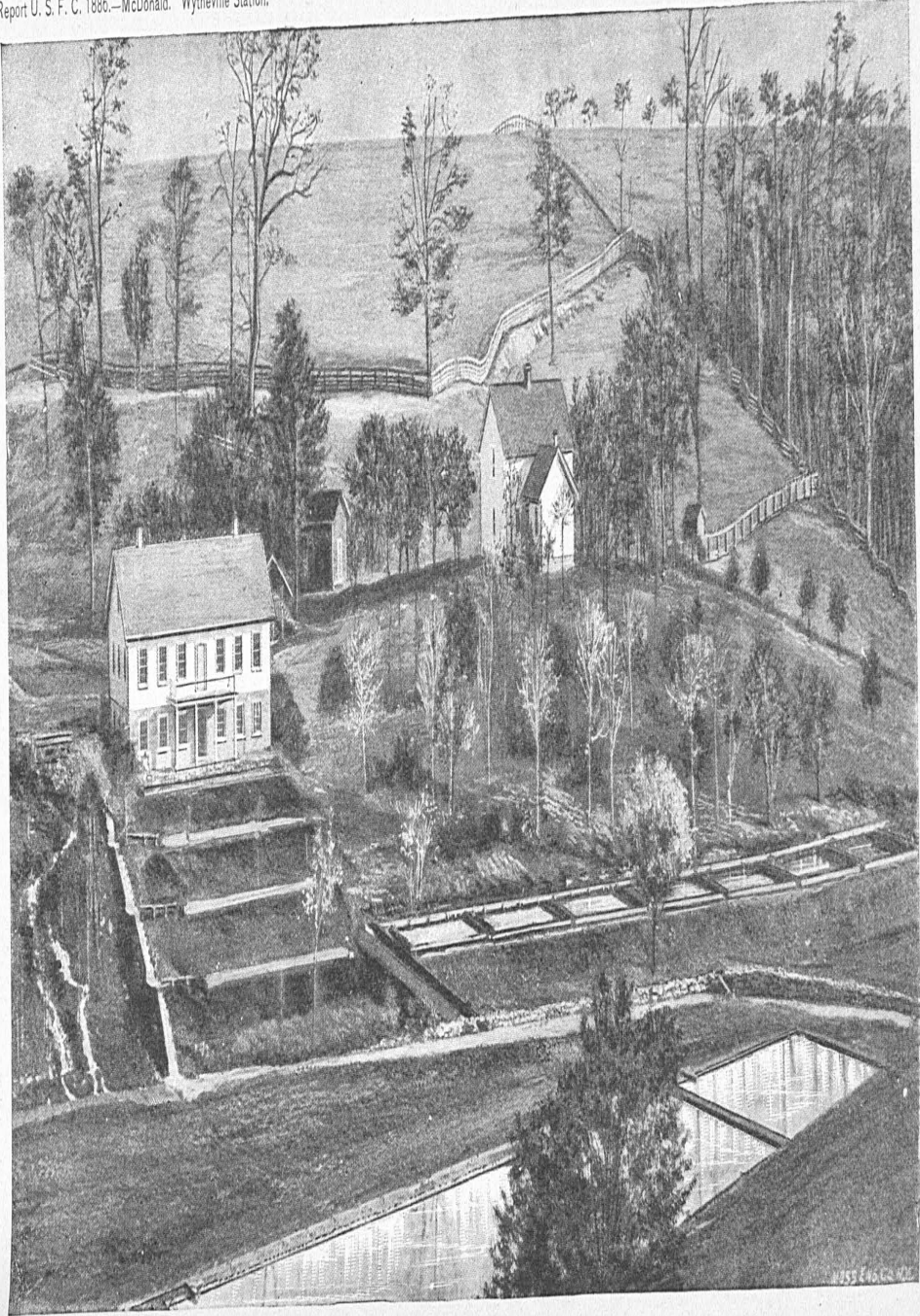
#### LIST OF PLATES.

- PLATE I.—Water supply and ponds for brood fish.  
 II.—General view of buildings and grounds.  
 III.—Plan of hatchery, first floor.  
 IV.—Plan of hatchery, second floor.  
 V.—View of interior, showing details of equipment.  
 VI.—General view of ponds.

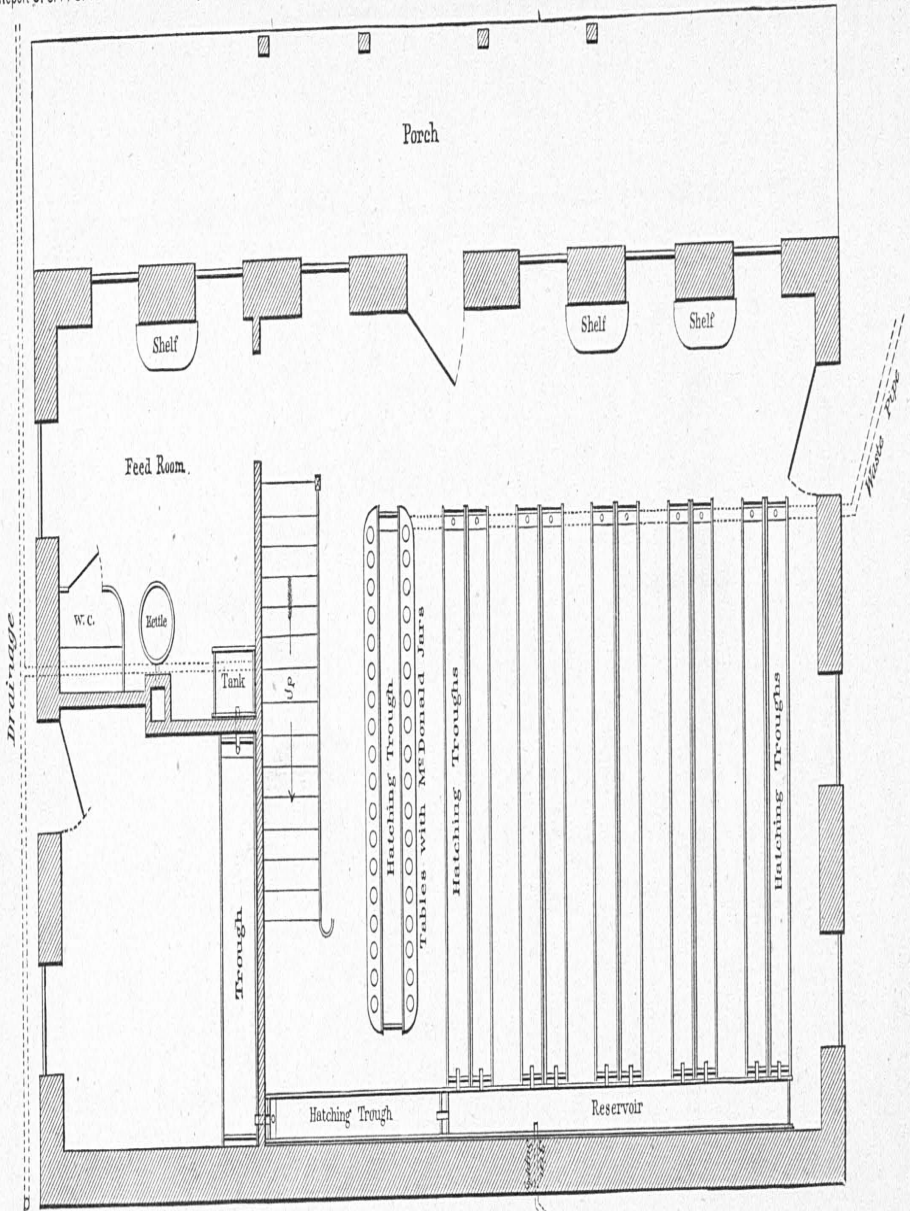




WATER SUPPLY AND PONDS FOR BROOD FISH.

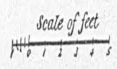


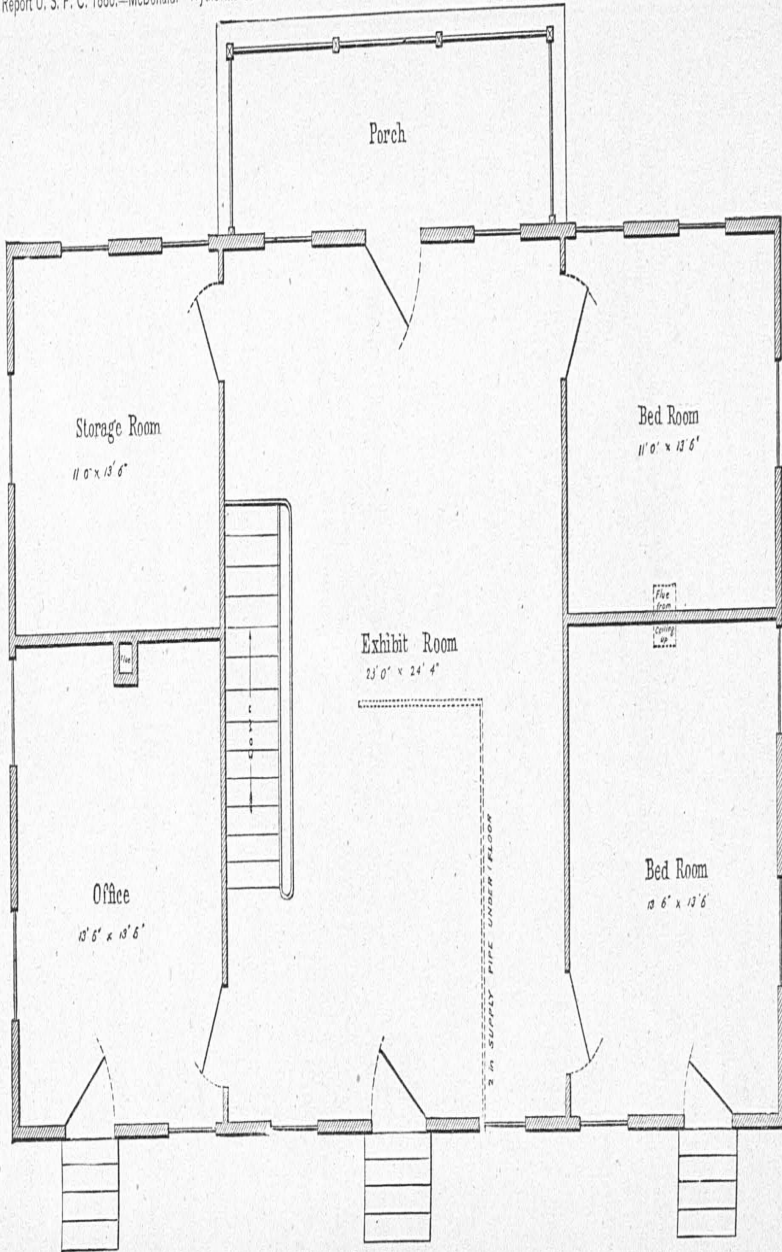
GENERAL VIEW OF BUILDINGS AND GROUNDS.



### WYTHEVILLE HATCHERY

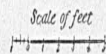
Plan of First Floor.

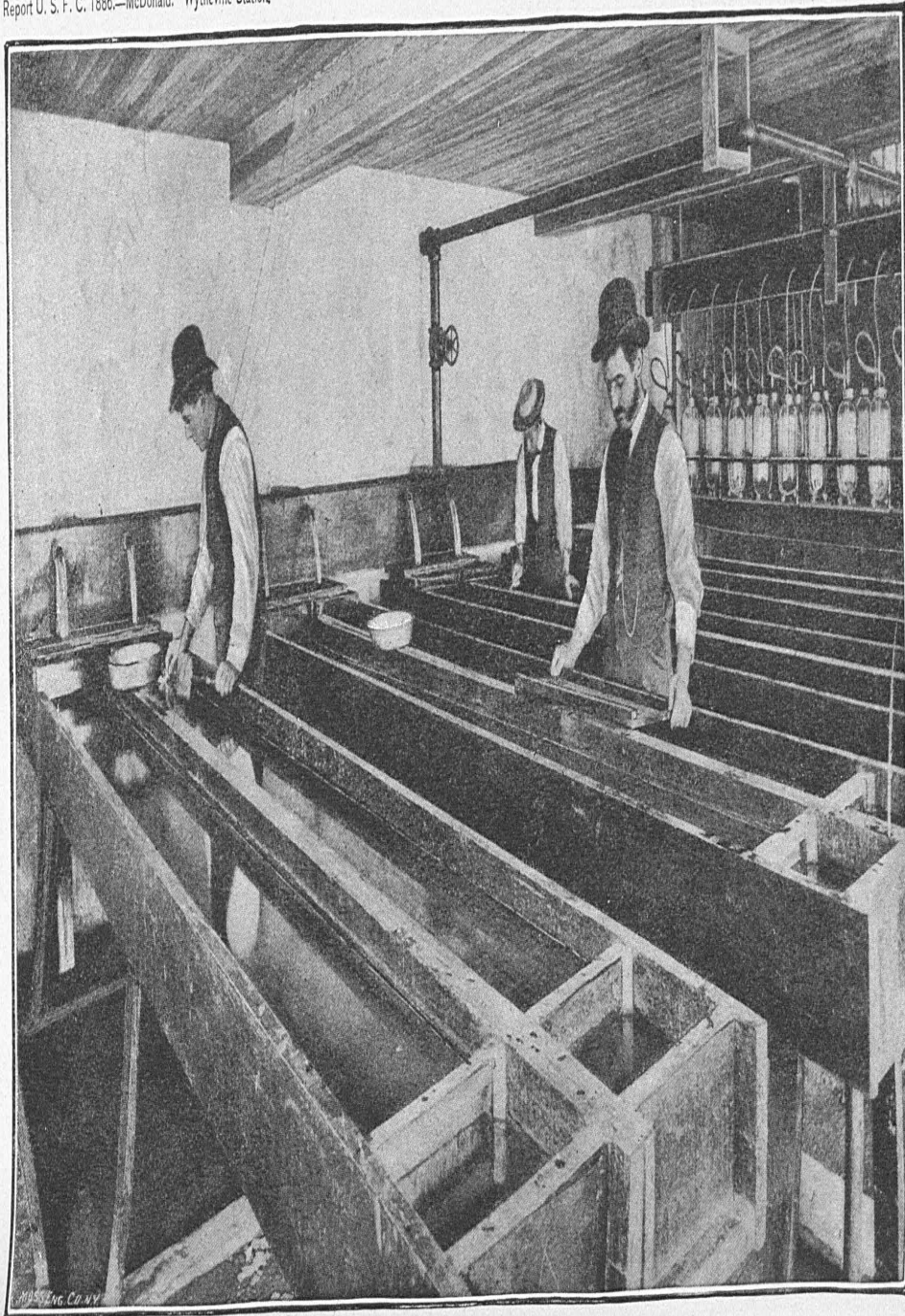




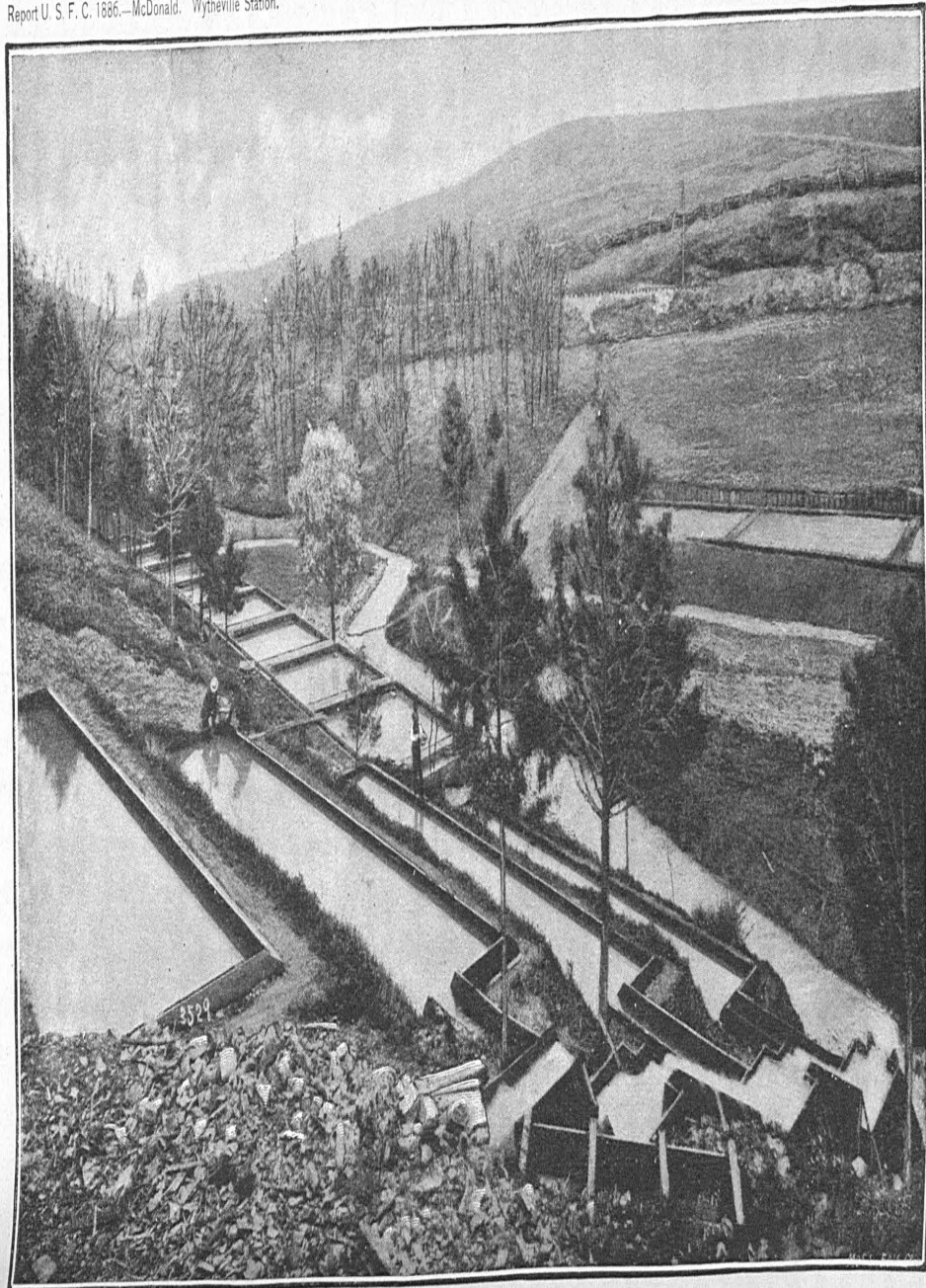
WYTHEVILLE HATCHERY

Plan of Second Floor.





VIEW OF INTERIOR SHOWING DETAILS OF EQUIPMENT.



GENERAL VIEW OF PONDS.