

# 11.—REPORT UPON THE PARTICIPATION OF THE U. S. FISH COMMISSION IN THE CENTENNIAL EXPOSITION, HELD AT CINCINNATI, OHIO, IN 1888.

By J. W. COLLINS.

## ORIGIN AND OBJECTS OF THE EXPOSITION.

The occurrence of the one-hundredth anniversary of the settlement of Cincinnati, and the desire of the public-spirited men of that city to fitly commemorate that important event in its history, originated the attempt to hold an exposition. A resolution having been passed that "the one-hundredth anniversary of the settlement of Cincinnati, occurring in 1888, be properly celebrated," a committee was appointed, which promptly organized and developed plans for holding an extensive fair of more than ordinary local importance, which was denominated "The Centennial Exposition of the Ohio Valley and Central States, including the States of the Northwest Territory and those which border upon the Ohio and even farther South."

Invitations were extended to other States and Territories to participate in the exposition, the object of which was announced to be chiefly the illustration of the development of the region designated as the "Ohio Valley and Central States" during the century ending in the celebration of the settlement of Cincinnati. It is scarcely pertinent to this report to more than allude, in passing, to the importance of thus demonstrating the material progress of a section of our country which is celebrated for its great natural resources and the industry, energy, and business activity that have always characterized its people.

*Exposition buildings, etc.*—Cincinnati provided for the exposition by assigning to its use the Music Hall and the so-called "permanent exposition" building; also by granting the use of Washington Park, situated directly opposite the above-named structures, for the purpose of erecting, temporarily, the main exposition buildings. An elevated arched walk, crossing Elm street, connected the temporary buildings with the Music Hall and the permanent exposition, while in the rear of the latter an additional structure was erected along the line of the Miami Canal for the accommodation of manufacturing machinery. The

area covered by the exposition buildings afforded a floor space of 400,000 square feet in round numbers, with an additional wall space of 142,500 square feet.

*Participation of States and action of the Ohio legislature.*—In response to the invitations extended, several States decided to participate in the exposition. The enterprise was heartily indorsed by the neighboring towns of Covington and Newport, while the Ohio legislature appropriated money for a State representation, authorized the appointment of honorary commissioners, and also directed the governor, on behalf of the State, to invite “the assistance and coöperation of the Federal Government,” etc.

*Authorization of exhibit by the Federal Government.*—As a result of this legislation the governor of Ohio extended to the President and Congress an invitation for the Federal Government to participate in the exposition. There was some delay in the action of Congress, but eventually the following measure was passed by both Houses, and was signed by the President :

Whereas, the States which comprise the Northwest Territory and the adjacent States will hold at Cincinnati, Ohio, from July 4 to October 27, 1888, a centennial exposition commemorative of the organization of the Northwest Territory, under the ordinance of 1787, in which exposition all the States and Territories of the United States and the General Government have been invited to participate, the object being in said exposition to present a panorama of the nation's resources and present state of progressive development, by an exhibition of the products of agriculture, of the various industries and fine arts; also the results of advancement made in the sciences; the whole illustrating the opportunities secured to and the possibilities which wait upon the citizens of this Republic; and

Whereas, the citizens of the Ohio Valley and the several States adjacent thereto have made suitable and adequate preparation and arrangements for holding said exposition and are desirous—and it being fit and proper—that the several Executive Departments of the Government, the Department of Agriculture, the Smithsonian Institution, including the National Museum and Commission of Fish and Fisheries, should participate in such exhibition; therefore,

*Be it enacted, etc.,* That the head of each of the several Executive Departments of the Government, the Commissioner of Agriculture, and the Smithsonian Institution, including the National Museum and Commission of Fish and Fisheries, under the direction of the President of the United States, be; and they are hereby, authorized and directed to prepare and make suitable exhibits at the said centennial exposition of the Ohio Valley and Central States, to be held at Cincinnati, beginning on the 4th of July and closing October 27, 1888.

That there shall be appointed a committee of Congress composed of ten members, five to be appointed by the President of the Senate, and five by the Speaker of the House of Representatives. Said committee is authorized and directed to visit said exposition and make such report to Congress in that behalf as they may deem needful and proper: *Provided*, That the President may in the exercise of his discretion allow such documents and exhibits as relate to early settlement at Marietta, Ohio, and the establishment of civil government in the territory northwest of the Ohio River, to be taken to Marietta and exhibited during the time from July 15 to 19, 1888, inclusive, under such care and custody as he may direct.\*

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\* It was not practicable for the Fish Commission to participate in the exhibit at Marietta, for reasons that appear elsewhere, and also because the collections included nothing specially suitable for the occasion.

That to enable the several Executive Departments of Government, the Department of Agriculture, and the Smithsonian Institution, including the National Museum and the Commission of Fish and Fisheries, to participate in said exposition, to be held as aforesaid, there is hereby appropriated, out of any money in the Treasury not otherwise appropriated, \$147,750, apportioned as follows:

For the War Department, \$7,150.

For the Navy Department, \$15,000.

For the State Department, \$2,500.

For the Treasury Department, \$7,500.

For the Interior Department, \$36,100.

For the Department of Agriculture, \$20,000.

For the Post-Office Department, \$5,000.

For the Department of Justice, \$2,000.

For the Smithsonian Institution, including the Commission of Fish and Fisheries, \$50,000.

For the expenses of the Committee of Congress, \$2,500.

That the President may, if in his judgment it shall be deemed necessary and expedient in order to secure the best results with greatest economy, transfer a part of the fund hereby apportioned to one Department or bureau to another Department or bureau. The term bureau wherever used herein shall be construed to include the Agricultural Department, the Smithsonian Institution, and Commission of Fish and Fisheries.

That the President of the United States is hereby authorized to detail an officer of the Pay Department of the Army or Navy to disburse the fund appropriated by this act.

The payments on account of expenses incurred in carrying out and into effect the provisions hereof shall be made on itemized vouchers approved by the representative of the Department incurring the liability and a person to be designated by the President to make final audit of said accounts: *Provided*, That payment of the expenses incurred by the committee of Congress shall be made on vouchers approved by the chairman of said committee.

That the head of each of said Executive Departments and of the Department of Agriculture, Smithsonian Institution, and Commission of Fish and Fisheries shall, from among the officers or employes thereof, appoint a suitable person to act as representative of such Department or bureau, and said representative shall, under the direction and control of the head of the Department or bureau, supervise the preparation and conduct of the exhibits herein provided for.

That no officer or employe appointed as aforesaid shall be paid extra or additional compensation by reason of services rendered in virtue of such employment; but nothing herein shall be so construed as to prevent the payment of the just and reasonable expenses of any committee, officer, or employe appointed or employed under or by virtue of the provisions of this act.

That all articles imported from the Republic of Mexico or the Dominion of Canada for the purpose of being exhibited at said exposition shall be admitted free of duty, subject, however, to such conditions and regulations as the Secretary of the Treasury may impose and prescribe.

*Additional explanatory legislation.*—The decision on the part of the Auditor that the law, as enacted, did not give authority for the purchase of new material by the Departments or bureaus to complete exhibits, and the fact that he held that only such collections or materials as were then on hand could legitimately be utilized for exhibition purposes, led to the passage by Congress of supplementary legislation declaring the meaning of the previous act and authorizing the purchase of suitable material, etc.

*Appointment of auditor and disbursing officer.*—In compliance with the provision of the law regarding the audit and payment of the expenses of the Government in connection with the exposition, and soon after the passage of the bill, the President designated Hon. Anthony Eickhoff, Fifth Auditor of the Treasury Department, as special auditor to make final audit of the accounts, and directed that Maj. John S. Witcher be detailed as disbursing officer.

PREPARATION OF THE FISH COMMISSION EXHIBIT.

The following is a list of persons connected with the preparation and conduct of the exhibit of the U. S. Fish Commission :

Marshall McDonald, U. S. Commissioner of Fish and Fisheries.

Joseph William Collins, representative of the U. S. Fish Commission, in general charge.

COLLABORATORS.

Richard Rathbun, assistant, in charge of the division of scientific inquiry, U. S. Fish Commission, Washington, D. C.

John A. Ryder, PH. D., professor of comparative embryology, University of Pennsylvania, Philadelphia, Pa.

Dr. William H. Dall, curator of the department of mollusks, U. S. National Museum, Washington, D. C.

Dr. R. E. C. Stearns, adjunct curator, department of mollusks, U. S. National Museum, Washington, D. C.

Stephen G. Worth, superintendent of Central station, U. S. Fish Commission, Washington, D. C.

I. S. K. Reeves, passed assistant engineer, U. S. Navy, consulting engineer of the U. S. Fish Commission, Washington, D. C.

James A. Henshall, M. D., secretary Cincinnati Society of Natural History, Cincinnati, Ohio.

Charles H. Gilbert, professor of natural history, University of Cincinnati, Cincinnati, Ohio.

S. P. Bartlett, M. D., secretary Illinois State fish commission, Quincy, Ill.

George H. H. Moore, superintendent of distribution, U. S. Fish Commission, Washington, D. C.

Herbert A. Gill, disbursing agent, U. S. Fish Commission, Washington, D. C.

Newton W. Simmons, in charge of car No. 1, U. S. Fish Commission, Washington, D. C.

Frank L. Donnelly, messenger, U. S. Fish Commission, Washington, D. C.

John B. Williams, superintendent of Baird station, U. S. Fish Commission, Baird, California.

Sherman F. Denton, artist, U. S. Fish Commission, Washington, D. C.

Charles B. Hudson, artist, U. S. Fish Commission, Washington, D. C.

H. R. Center, U. S. Fish Commission, Washington, D. C.

P. T. Yeatman, U. S. Fish Commission, Washington, D. C.

Henry Horan, superintendent U. S. National Museum, Washington, D. C.

C. A. Stuart, assistant superintendent U. S. National Museum, Washington, D. C.

W. J. Huddleston, game warden, Hamilton County, Ohio.

IN CHARGE OF SPECIAL EXHIBITS.

*Fishes and mollusks* : Tarleton H. Beau, M. D., ichthyologist of the U. S. Fish Commission.

*Aquarial exhibit* : William P. Seal, aquarial expert, U. S. Fish Commission.

*Fish-culture:* William F. Page, fish-cultural expert, U. S. Fish Commission.

*Collection illustrating scientific research:* M. P. Greenman, microscopist, University of Pennsylvania, Philadelphia, Pa.

GENERAL ASSISTANTS.

Edward C. Bryan, stenographer, U. S. Fish Commission, in charge of accounts.

William H. Abbott, U. S. Fish Commission.

Robert E. Lewis, U. S. Fish Commission.

William P. Sauerhoff, expert fish-culturist, U. S. Fish Commission.

William H. Morgan, expert fish-culturist, U. S. Fish Commission.

F. J. Barry, machinist, U. S. Navy, detailed to duty in U. S. Fish Commission.

W. H. Horan, U. S. Fish Commission.

*Appointment of the representative.*—On June 9, in conformity with the act of Congress, the Commissioner, Col. Marshall McDonald, formally designated me as the representative of the U. S. Fish Commission and instructed me to assume responsible charge and direction of the preparation, installation, etc., of the exhibit to be made by the Commission. Pending this, however, I had practically assumed, under the direction of the Commissioner, the duties of representative.

*Funds available.*—As will be seen by reference to the act of Congress, a lump sum of \$50,000 was appropriated "for the Smithsonian Institution, including the Commission of Fish and Fisheries." By an arrangement between the Commissioner and the Secretary of the Smithsonian Institution a division of this appropriation was made, by which the Fish Commission received \$10,000.

*Preliminary visit to Cincinnati.*—Before the scope and character of the Fish Commission exhibit could be satisfactorily determined it was necessary to obtain definite information from official sources concerning the area and location of space that could be obtained for the display. It was specially important that the location should be such as to afford every practicable facility for obtaining a large supply of water, since, if this requisite could be secured, it was proposed to make a display of living fish and other aquatic forms, including plants, a marked feature of the exhibit. It was also necessary to have a considerable amount of water for the proper display of various forms of fish-cultural apparatus, models of fish-ladders, etc., while it was, of course, indispensable for hatching fish. Therefore, as soon as preliminary arrangements could be made for the preparation, during my absence, of certain material for the exhibit, I went to Cincinnati on a trip of observation and for the purpose of meeting the exposition authorities and securing from them the information which was desired. Leaving Washington June 2, I arrived at Cincinnati the following evening.

Mr. R. E. Earll, deputy representative of the Smithsonian Institution, had gone to Cincinnati a few days previously for a purpose similar to my own. As soon as practicable after my arrival, we visited the exposition buildings together, where we had a conference with the management, including President James Allison. Upon inspection, it

was seen that the wing of the Park Building, which had been provided for the accommodation of the Government exhibits, was entirely inadequate for the purpose, it having only about 13,000 feet of floor space, no more than was required by the Smithsonian Institution and the U. S. Fish Commission. But the management were not only quick to appreciate what was needed, but prompt to act. It was immediately decided to provide the requisite space, so far as the limits of the Park would permit, by constructing additional buildings; plans were prepared and contracts made with the least possible delay, while the assurance was given that the "Government Annex" would be completed sufficiently early to permit the installation of the exhibit before July 4, the date fixed upon for the opening of the Exposition.

The plans contemplated as a part of the annex the construction of a wing running north from the structure originally intended for the use of the Government, and since the northern end of this was to be near the large water pipes entering the exposition grounds it was deemed a favorable location for the Fish Commission exhibit. It was learned that the management would afford to the aquarial display all practicable facilities, among which may be mentioned all the electric lights required for lighting the aquaria. Arrangements were made for storing boxes, trucking material, and much useful information was obtained concerning the terminal facilities of different railroads, and such other matters as were directly connected with the transportation and installation of exhibits.

I returned to Washington on June 8, and immediately set to work to prepare the exhibit.

*Organization of a board.*—Previous to my appointment in charge of the Fish Commission exhibit the representatives of the other Departments had informally met and organized as a board, this action being taken to facilitate the transaction of certain business connected with the Government display in which all the Departments had a common interest. Col. Cecil Clay, representative of the Department of Justice, was selected by the board for its chairman; Mr. Haughwout Howe, representative of the State Department, as secretary, and Mr. Marcus Gardner, representative of the Department of the Interior, was appointed in charge of the preparation of certain forms of stationery.

Because of some indefiniteness in the law and a misunderstanding resulting therefrom concerning the status of the Fish Commission there was at first some difficulty in securing for it the proper recognition, though the matter was satisfactorily arranged after proper explanations had been made.

The organization of the board was generally beneficial, since the several Departments, acting in an organized manner, could facilitate the accomplishment of business common to all and generally carry it on more economically than if each had acted independently.

*Plan and scope of the Fish Commission exhibit.*—The object of the ex-

hibit was to show, as far as practicable, the results accomplished in the scientific investigation of the waters, in the study of the methods, relations, and statistics of the fisheries, and in the artificial propagation and acclimatization of fishes, whereby certain important industries are chiefly maintained. The plan of the exhibit, which I submitted to the Commissioner June 13, 1888, was substantially carried out. The following extracts show the general scope :

(1) The scientific investigations and explorations which have been and are now being conducted by the Fish Commission.

(2) The history, present methods, and importance of fish-culture, together with the system of distribution of fish and fish eggs, which may be properly considered under the head of fish-culture. In connection with this it seems to me desirable that there should be an exhibition of live fish in aquaria, chiefly representing species which have been propagated by the efforts of the Commission. Also, it is important to show the most improved system of fishways, since these have an intimate relation with the question of propagation, which might be seriously impeded, if not rendered absolutely abortive, unless some successful method is devised to enable fish to ascend rivers during their breeding season.

(3) Fisheries, including (a) specimens of the more important economic species; (b) apparatus, photographs, paintings, crayons, etc., illustrating the capture of fishes; (c) vessels, boats, photographs, sketches, etc., illustrative of the flotilla employed in the fisheries of the United States.

The plan and scope of the display were limited by the space and means available for the installation. By agreement with the representatives of the other Departments, it was decided to place the Fish Commission exhibit in the north end of the "Park Building;" but the space allotted was less than 3,000 feet of floor area, rectangular in form, 95 by 31 feet.\* The wall space, however, was comparatively ample, measuring 31 feet in length on each side and 95 feet across the end of the building. Additional space of this kind was afforded by the screens separating the Fish Commission section from that occupied by the Smithsonian Institution and National Museum. The wall space was especially important, since it afforded the requisite background for the aquaria and gave opportunity for the proper display of numerous pictures and maps illustrative of fisheries, fish-culture, etc.

*Work on the collections, etc.*—The time available for the preparation and assembling of the collections was exceedingly short. The scope of the exhibit was not determined until after my return from Cincinnati, June 8. The arrangement for a division of the appropriation between the Fish Commission and the National Museum was not arrived at until after June 20.

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\* The total available space for the Government exhibits amounted to 42,000 square feet of floor. Of this, the following assignments were arranged by the board: State Department, 750 feet; Treasury Department, 4,250 feet; War Department, 4,000 feet; Navy Department, 4,750 feet; Interior Department, 6,000 feet; Department of Agriculture, 4,000 feet; Post-Office Department, 2,500 feet; Department of Justice, 750 feet; Smithsonian Institution and National Museum, 12,000 feet; U. S. Commission of Fish and Fisheries (about) 3,000 feet.

Several of the chief assistants were absent from Washington and consequently could not assume the duties assigned them until late in June. As the exposition opened on July 4, and much new material had to be prepared, packed, shipped, and installed, the outlook was discouraging.

Mr. Seal had charge of the aquaria, and began making necessary arrangements for a live-fish display soon after the passage of the bill authorizing the Commission to participate in the exposition and considerably in advance of the preparation of other material. All the preparatory work was pushed with the utmost vigor; day after day every one labored late into the night until the collections were ready.

The exhibit illustrating the scientific work of the Commission was brought together through the assistance of Mr. Rathbun, on whose recommendation Mr. M. P. Greenman was appointed to have charge of it; the fish-cultural exhibit was prepared under the joint direction of Mr. Worth and Mr. Page, and Dr. Bean acted as chief assistant in assembling and installing the material illustrative of the methods and relations of the fisheries, including the objects of fishery, statistics, etc.

The preparation of the exhibit was facilitated by the withdrawal of certain material from the National Museum, together with a few cases and screens.\* Early in July the material for the aquarial exhibit was shipped from Washington, and shortly thereafter the bulk of the other collections were forwarded.

#### INSTALLATION AND CONDUCT OF EXHIBIT.

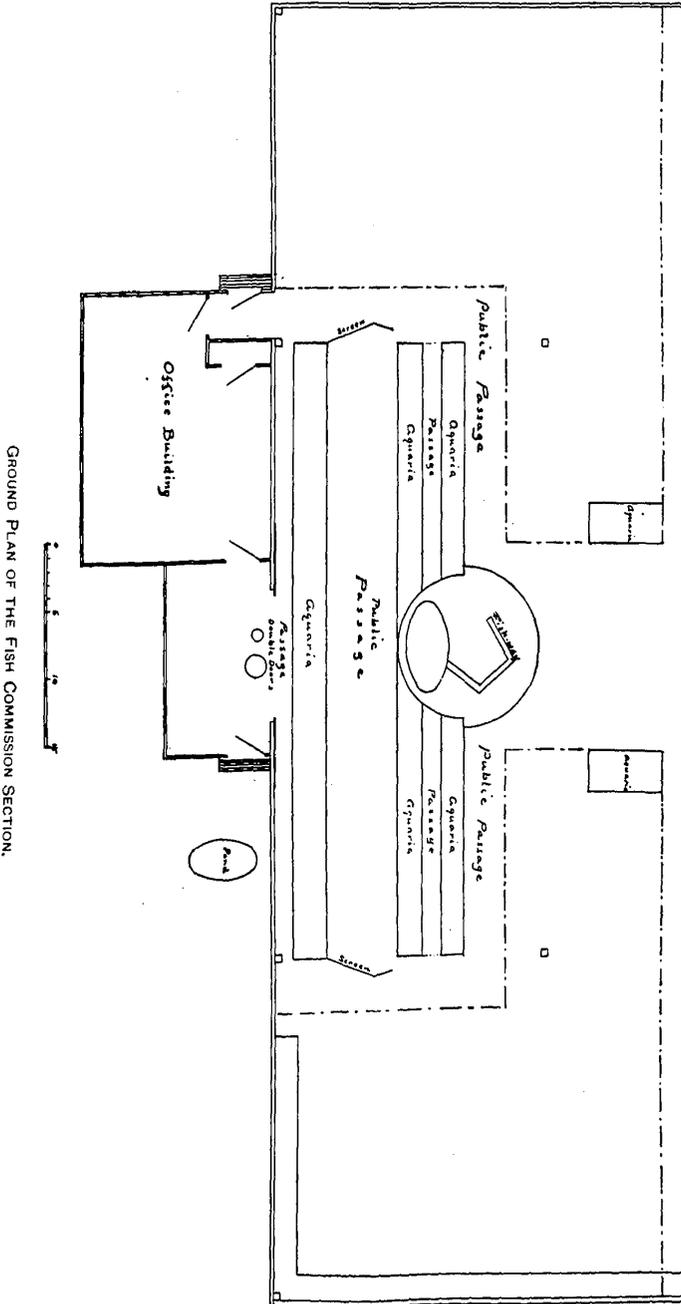
*Allotment of space.*—The space allotted to the exhibit was so much less than was required that crowding of the collections was unavoidable. The arrangement of the collections had to conform, in a large measure, to the requirements of the live-fish exhibit. It had been decided that the most satisfactory location for this was against the wall of the north end of the annex, where a central space 45 feet long by 16 feet wide was allotted to it, in addition to the area required for a pond and additional aquaria, as shown on the plan. The scientific and fish-cultural collections were placed on the east of the main entrance to the Fish Commission space, while the material illustrative of fisheries, etc., occupied the other side.

The accompanying plan shows the relative positions of the several sections and the area covered by each.

*Offices, etc.*—With the permission of the exposition authorities small annexes were built, wherein were located the filters, tools, and ice required for the aquarial display, and also a small office room.

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\*Almost without exception, the material withdrawn from the Museum constituted a part of the fisheries collection brought together by the Fish Commission, or included specimens obtained by the Commission in its scientific explorations and subsequently deposited in the Museum.



Considerable difficulty was met with in arranging the live-fish display. In accordance with the plan for this part of the exhibit a structure representing a section of a rocky sloping hillside was erected for the reception of the aquaria, a row of which was arranged around the front, while two rows were placed on either side of a grotto-like passageway (6 feet wide) that ran from end to end beneath the hill. There were twenty-one tanks in all thus located, besides which two larger tanks were placed on trestles on each side of the main avenue connecting the Smithsonian and National Museum exhibit with that of the Fish Commission. In the center of the hill a tiny rivulet tumbled down the steep and broken declivity, fell into a basin below, and thence passed through a McDonald fishway (or ladder) to a miniature pond on the floor.

It will readily be understood that, even under the most favorable conditions imaginable, the erection of such a structure, the installation of aquaria, the building of a miniature pond, the preparation for lighting the aquaria by electricity, and the arrangements for filtering and regulating the temperature of the water required much labor and special skill. The building of the structure was, however, pushed forward with all possible diligence. A double force was employed, one gang working during the day and the other at night. On account of the nature of the materials used in making the imitation rock-work, considerable time was consumed in getting the grotto into shape to admit visitors. It was completed in the latter part of July. The chief difficulty, however, lay in obtaining a sufficient supply of filtered water. The excessively muddy condition of the water made it imperative to filter all that was used, and the supply needed was large, since a continuous circulation had to be kept up to maintain the fish in a healthy condition.

The most efficient method of obtaining a water supply and proper aeration of aquaria is that of having a very small stream delivered with strong pressure, and which, penetrating the surface of the water in the tanks, carries in with it a large amount of air that is dispersed in minute bubbles. The method of filtration must be adapted to this purpose. Certain unexpected obstacles were developed before the details were finally and satisfactorily completed, which not only delayed the work, but for a time appeared to make a successful exhibit of live fish impossible.

The pressure of water from the city mains at Cincinnati is very great, ranging from 60 to 75 pounds to the square inch. The chief difficulty, however, was due to an elevator run by hydraulic power, located not far from the Fish Commission exhibit, the operations of which caused excessive and rapid fluctuations of pressure, varying in an instant from

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\* There were 53 rainy days during the exposition period, and the Ohio River, usually low and comparatively clear during summer, was very high and phenomenally muddy during all this time. Nevertheless, after the conditions were fully understood and means found to control them, it was practicable to provide water of perfect clearness and brilliance.

60 to 120 pounds. The effect on the filters was like sledge-hammer blows, and resulted in breaking the diaphragms on three occasions, which allowed free alum to be circulated through the whole series of aquaria thus supplied. Nearly all of the fish were killed. Many attempts were made to control the pressure, but all efforts proved ineffectual until it occurred to Mr. Barry to apply a steam safety-valve to the supply pipe, and this solved the problem most satisfactorily.

On July 25 a large consignment of various species of trout was received from the Wytheville station and transferred to the aquaria. Fish and numerous aquatic plants were received from Washington at the same time. Later, additional supplies of trout were brought from Northville, Mich., while other species were received from the rivers in the vicinity of Quincy, Ill. The installation was completed July 25, when the first shipment of fish and plants was received, and considering all the disadvantages under which the work was accomplished, it may be considered creditable that such results were accomplished in less than three weeks from the time the first of our material reached Cincinnati.

The exhibit of the Commission was broadly grouped under three general heads: scientific inquiry, fish-culture, and fisheries; though the aquarial display, which was intimately associated with and related to each of the above-mentioned divisions, might be appropriately considered a separate section.

Under the head of scientific inquiry were exhibited models, photographs, and illustrations of the coast laboratories and the vessels used by the Commission for scientific research, including a special series of views of the station at Wood's Holl, Mass., and the scenery in the immediate vicinity. There were also full-sized specimens of apparatus employed in marine investigation, together with charts and models of the ocean showing results of exploration. Next came alcoholic and dried specimens of various forms of fishes, crustaceans, etc., and specimens of many small forms of life mounted on slides for the microscope; these, together with sections of fish eggs, sponges, etc., constituted a very interesting microscopical display. The publications of the Commission were also placed under this section. The fishes and other animals, mentioned elsewhere as "objects of fisheries," may appropriately be referred to here, since they have also been objects of scientific inquiry.

Under fish-culture was included an historical collection of apparatus used for the artificial propagation and distribution of fish; also photographs, transparencies, etc., showing the same in action. This collection embraced the most approved forms—full-sized specimens and models of apparatus now used for artificial hatching and for distributing fish and ova. Associated with these were models and illustrations of hatching houses, etc., including floating barges and steamers; a lay figure and numerous photographs, transparencies, and other devices, illustrating the methods of fish-culture; statistical charts showing the

results of artificial propagation of the shad, and models and other representations of fishways or fish-ladders for assisting anadromous fish in reaching their spawning grounds at the headwaters of streams in which artificial obstructions are placed. Many living specimens and casts of fishes which had been artificially hatched and raised were exhibited.

The fisheries section embraced the following :

(1) Objects of fisheries, such as marine mammalia, reptiles, batrachians, fishes, and mollusks. The former were shown by casts, paintings, photographs, lithographs, etc.; the reptiles and batrachians by living specimens, illustrations, etc.; the fishes by living specimens, casts, color sketches, etc., and the mollusks by living and dried specimens of the more important species.

(2) Series of large maps showing distribution of the most valuable species of fish and mollusks used for food and bait in the northwestern Atlantic, from Cape Hatteras to Labrador.

(3) Models, photographs, and illustrations of the various kinds of American fishing vessels and fishing boats, embracing an historical series of models.

(4) Photographs showing process of net making and mending.

(5) Charts of North Atlantic fishing-grounds.

(6) Illustrations of economic condition of fishermen, embracing photographs of fishermen, views in and about fishing towns and harbors, fishermen's dwellings and boarding houses; also dwellings of fishery capitalists who were formerly fishermen.

(7) Methods of fishing in the following branches illustrated by photographs, lithographs, and sketches :

(a) Fur-seal fishery; (b) whale fishery; (c) Beluga or white-whale fishery; (d) blackfish fishery; (e) porpoise fishery; (f) terrapin fishery; (g) flounder fishery; (h) halibut fishery; (i) cod fishery; (j) mackerel fishery; (k) bluefish fishery; (l) smelt fishery; (m) whitefish fishery; (n) salmon fishery; (o) shad fishery; (p) herring fishery; (q) eulachon fishery; (r) menhaden fishery; (s) dogfish fishery; (t) market fishery; (u) oyster fishery; (v) clam fishery; (w) crab fishery; (x) lobster fishery; (y) sponge fishery.

(8) The statistics of the fisheries of the United States were shown on a large map.

The aquarial display included numerous kinds of fresh-water fishes, among which were the following that had been artificially hatched and raised :

Rainbow trout ( <i>Salmo irideus</i> ).	Scale, leather, and mirror carp ( <i>Cyprinus carpio</i> ).
Brook trout ( <i>S. fontinalis</i> ).	
Brown or Von Behr trout ( <i>S. fario</i> ).	
Loch Leven trout ( <i>S. levenensis</i> ).	
	Paradise fish ( <i>Macropodus unustus</i> ).
	Golden ide ( <i>Idus auratus</i> ).

Besides these there were many varieties of goldfish. In addition to the fishes, the aquaria contained numerous species of fresh-water shells and aquatic plants; also soft-shelled turtles, etc., which have been, to

a greater or less extent, subjects of inquiry by the Fish Commission. Explanatory labels were placed on all the tanks containing live fish.

The live-fish exhibit attracted marked attention and may be called a decided success, notwithstanding adverse conditions. Should circumstances permit a live-fish exhibit in the future, under more favorable auspices, I would feel it to be my duty to heartily recommend the undertaking. It is doubtful if in any other way knowledge of our economic fishes can be so readily conveyed to the people. The educational advantages offered by such an exhibit are beyond computation. But in addition to the value of such a display to the public, in this particular instance much was learned by the experts of the Commission through the experimental work at Cincinnati that will probably prove advantageous in the future. Most worthy of note was the fact developed that brook trout (*Salvelinus fontinalis*) will live in water with a moderately high temperature if the water is clear and well aerated. Mr. Seal succeeded in keeping trout in good condition in water having a temperature of 70°.

*Deputy representative appointed, etc.*—On August 2, Dr. T. H. Bean was placed in charge of the exhibit as deputy representative and acted in that capacity during my absence in the East on special duty until September 12.

*Decrease of force.*—Early in September four of the assistants were withdrawn from the exhibit. This reduction of the force, which was small enough before, added materially to the labors of those who remained. This was perhaps most noticeable in connection with the clerical duties incident to the accounts and correspondence, which devolved upon Mr. Bryan, who, in addition to his duty as stenographer, attended to all the accounts and gave much assistance elsewhere. It is scarcely necessary to add that, practically with no exception, his labors extended far into the night during the entire progress of the exposition, as well as for weeks after its close.

*Collecting indigenous fish, etc., for aquaria.*—In addition to the fish received from the U. S. Fish Commission stations and from Quincy, Ill., indigenous fishes and other aquatic animals were collected from the waters near Cincinnati, thus saving expense in transportation and securing more frequent additions to our aquaria. Mr. Page visited the Ohio River, near Lawrenceburg, Ind., on August 21, and brought back on the evening of the same day quite a variety of living specimens, among which was a blue catfish (*Ictalurus ponderosus*) weighing about 50 pounds. About once a week a party, usually in charge of myself, went out for this purpose, though additional collections were obtained by Mr. Seal and others from time to time. A great many species were collected, and the fish that were injured so that they were unfit for our purposes were given to Dr. James A. Henshall, secretary of the Cincinnati Museum of Natural History, or to Prof. Charles H. Gilbert, of the University of Cincinnati, both of whom accompanied us on some of

our trips and entered heartily into the work of collecting. Some specimens were also presented to the Cuvier Club of Cincinnati.

Several gentlemen who owned or controlled ponds near the city very generously gave us the opportunity to seine them, and it was specially gratifying that these friendly offers were made voluntarily and generally as a result of having seen our exhibit of live fish. In some cases the proprietors of ponds sent us specimens of living fish. For instance, on September 15 we received three fine, large specimens of buffalo fish from Mr. J. D. Rosse, proprietor of Rosse Lake, near Elmwood.

The best locality for obtaining collections was found to be on Little Miami River, near Remington, some 20 miles or so from Cincinnati. In this work not only was the privilege of seining in the waters near Cincinnati cheerfully accorded to the Fish Commission, but efficient aid was rendered by Mr. W. J. Huddleston, game warden of Hamilton County, through whose efforts and coöperation a creditable exhibit of live fish was maintained.

*Trip to Lake Erie.*—My proximity to the Great Lakes afforded a good opportunity for personally observing the methods of fishing and of handling fishery products in that region, so far as this could be done in a brief visit. For this purpose the Commissioner instructed me to go to the lakes, and I left Cincinnati on the evening of October 4 for Sandusky, Put-in Bay, and the Bass Islands. Many interesting observations were made at these places and considerable information was obtained which will be of value in connection with future investigations in this region. Having accomplished all that was deemed desirable, I returned to Cincinnati October 9.

*Hatching salmon.*—The continuance of the exposition into late autumn afforded a good opportunity to give a practical illustration of artificial propagation of fish. Therefore, in compliance with instructions from the Commissioner, 45,000 eggs of the California salmon (*Oncorhynchus chouicha*) were shipped September 17 and 19, from the station at Baird, Cal. These eggs were received about a week later in good order, and were transferred to the McDonald hatching jars in the fish-cultural section. So far as I am aware, this was the first attempt to hatch salmon in the McDonald jars, and the success attained, even with the muddy water, made the experiment a very valuable one. At first the result of this experiment was somewhat doubtful because of the muddy condition of the water, but on October 2 the young fry began to appear and on the 13th all had been successfully hatched. Eighty-nine per cent of the eggs hatched, which was a better result than is usually obtained under the best conditions.

This successful attempt to hatch California salmon was one of the most attractive exhibits, being a fine illustration of the work of fish-culture and a never-failing source of interest after the young fry appeared. Crowds gathered around the tables to watch the movements of the fry or the embryos breaking from the eggs, and so absorbingly interested

did many become that all else seemed forgotten and newcomers often found difficulty in getting near the point of attraction.

From Mr. Page's report on the hatching and distribution of these salmon it appears that the temperature of the hydrant water was at first reduced by the ice coil from a maximum of 78° to 60° F. From October 18 to October 28 considerable mortality was caused among the fry by muddy water and an epidemic disease. Upon the recommendation of Mr. John H. Bissell, commissioner of Michigan fisheries, 34,000 fry were planted in Traverse Bay, Michigan, October 29. The remaining fry were distributed in small lots to parties in the vicinity of Cincinnati. In the summer of 1889, Mr. Joseph Schlosser, of Covington, Ky., who had received a few hundred of the salmon and placed them in cold, spring-fed ponds, stated that they had thriven beyond expectation.

*Distribution of fish.*—As the exposition drew near its close many people at Cincinnati and vicinity expressed their desire to receive live fish from the exhibit when the display was ended. The principal demand was for goldfish and carp, and as we did not have enough to meet this demand the Commissioner arranged to send 1,500 carp and 200 goldfish for distribution at Cincinnati about the date when the exposition closed. Thus the numerous applications filed in the office of the Fish Commission exhibit at the exposition were complied with. Most of the species, however, particularly those of the Ohio Valley, were sent to Washington for installation in the aquaria maintained by the Commission at Central Station for study.

*Distribution of publications.*—The interest aroused by the exhibit caused frequent demands for publications relating to fish-culture and the general work. At my request the Commissioner sent reports of this kind to the exposition, where they were distributed to persons especially interested in the operations of the Commission.

Every effort was made by the Fish Commission experts to convey information to the public concerning the fisheries, the work of the Commission, and the use of various devices employed in fish-culture and scientific explorations; and the appreciation of the exhibit was doubtless due to a better understanding gained in this way of the material displayed.

#### CLOSE OF EXPOSITION, ETC.

*Change in date of closing.*—It was the original intention to close the exposition on October 27, the date named in the bill authorizing the participation of the Federal Government. However, as the exposition neared its close it was determined by the management to continue it open until November 15, and a resolution passed Congress October 20, authorizing the exhibition of the Government collections until the date of closing. Later it was decided by the management to close the exposition on November 8, and that was the actual date of closing.

This change in the date of closing caused me much anxiety, for all

estimates for the exhibit had been based on the expectation that the exposition would close on October 27. By the closest economy it had been found possible to make the allotment of \$10,000 suffice for our needs and the return of the material to Washington, but that was all, and it was evident that a continuance of the exhibit beyond the original date would involve expenditures which we had no means of defraying. The matter was promptly laid before the Commissioner and, upon proper representations having been made by him, the President decided to allot to the use of the Fish Commission exhibit the additional sum of \$1,500.

*Deputy representative appointed, etc.*—My plans in connection with the work of the Division of Fisheries had been formed on the assumption that the exposition would close on October 27, and the pressing nature of some important affairs relating to the division made it impracticable for me to remain in Cincinnati much beyond that time. Therefore I left Cincinnati for Washington on November 4, and on the same date appointed Mr. E. C. Bryan a deputy representative in charge of the exhibit, to act under my direction, with instructions to pack and ship the collections as promptly as possible after the close of the exposition. This was satisfactorily accomplished, and on November 22 Mr. Bryan and party left Cincinnati for Washington.

On account of my absence from Washington, Mr. Bryan had charge, under the general direction of the Commissioner, of unpacking and renovating the collections and reinstalling such material as had been taken from the National Museum. This work was done in the most painstaking and creditable manner. In addition Mr. Bryan rendered very important service in connection with the correspondence and other clerical duties connected with the exhibit.

*Disposition of material.*—Some misunderstanding arose on the part of the officials of the Treasury and War departments concerning the disposal of material purchased for the exhibit of the Commission. However, when the proper explanations had been made, the matter was arranged to the entire satisfaction of all, for the officials concerned quickly saw the advantage to the Government of retaining valuable collections that might be needed at any time (besides being useful additions to the permanent exhibits in Washington), and for which only the most meager returns could be expected, if sold at auction, as at first contemplated.

As a matter of fact, all the material belonging to the Commission which it was intended to return to Washington was en route for that city before the representative was informed by Maj. Witcher of the order (270) of the War Department. Such material as was not deemed of special value to the Commission was turned over to Maj. Witcher; that which had been taken from the National Museum was reinstalled, and the remainder was, by direction of the Commissioner, turned over to the superintendent of Central station, Washington, D. C.

The great haste with which the exhibit was prepared made it unusually difficult to comply with the extraordinary demands in settling up affairs after the close of the exposition, when it became necessary to show in an itemized statement every individual object purchased and, as far as possible, the particular exhibit it was obtained for. Nevertheless, this duty was satisfactorily performed, though the labor involved was so great that the work was not completed until late in the winter following the close of the exposition.

*Press comments.*—The press showed a praiseworthy disposition to publish instructive and reliable articles on the fisheries, some of which were well illustrated. In this way tens of thousands became familiar with the fisheries who had known little or nothing of them before, and many persons were thus led to visit the exposition for the purpose of adding to their knowledge of these industries, as well as to become better informed as to the work and functions of the U. S. Fish Commission. There can be no question of the beneficial effect on the fisheries of thus bringing the citizens of our interior States to understand and appreciate their importance to the nation and the peculiar perils and hardships which attend their prosecution.

*Material sent to Augusta Exposition.*—On September 17 the Augusta National Exposition Company, through its commissioner, Charles S. Hill, requested that the Fish Commission, after the close of the Cincinnati Exposition, send certain collections illustrative of its workings to the national exposition to be held at Augusta, Ga., October 10 to November 17, 1888. In compliance with instructions from the Commissioner the material selected by Mr. Hill was sent to Augusta. The most important object sent was the collection of photographs illustrative of fisheries, which had attracted much attention at Cincinnati.

*Courtesies.*—I have pleasure in acknowledging, on behalf of the Fish Commission, the following courtesies:

The U. S. National Museum placed at the disposal of the Commission certain collections, cases, etc., while its experts were permitted to accept temporary employment from the Commission for the purpose of packing the more fragile material.

The U. S. Hydrographic Office furnished for exhibition a full set of its charts of the fishing banks off the northeast coast of America, many of which had recently been issued on a much improved plan. The series also included the coasts and harbors of Canada, Newfoundland, and Labrador, off which the fishing banks lie, and which are much frequented by American fishermen.

Acknowledgments are due Prof. John A. Ryder for the assistance given by him in the preparation of the microscopical exhibit.

Dr. Dall, curator, and Dr. Stearns, adjunct curator, of the Department of Mollusks, U. S. National Museum, both gave attention to the selection of a collection of mollusks representing the most important commercial species.

Prof. Gilbert and Dr. Henshall accompanied the expeditions sent out to collect live fish near Cincinnati, and both entered heartily into the work. Their knowledge of the waters and fauna of the region was of much assistance.

Dr. Bartlett, who had his headquarters at Quincy, Ill., where Mr. Moore spent some time in collecting fish, rendered material aid to the agents of the Commission.