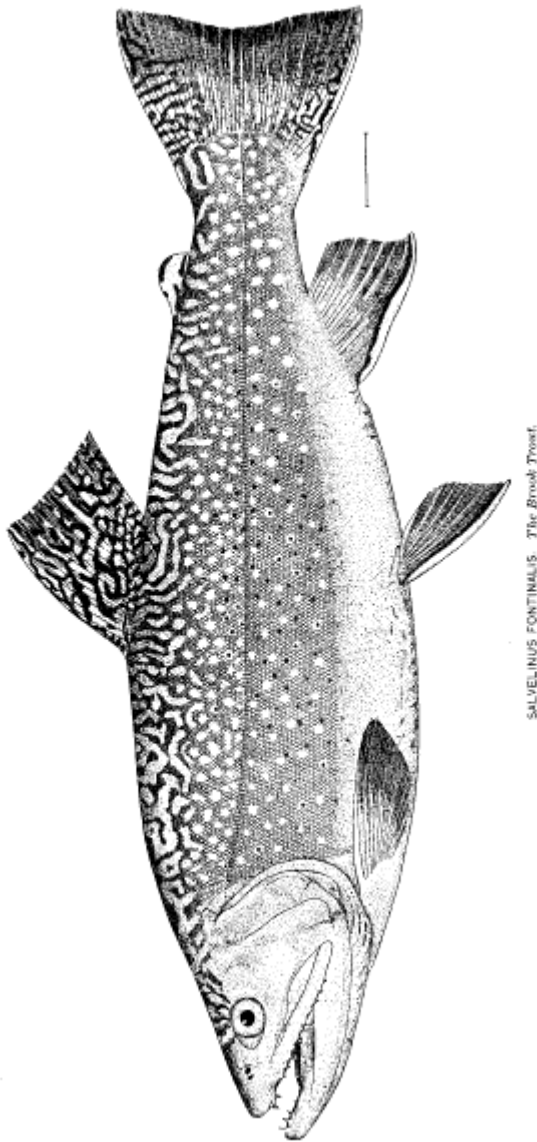


THE BROOK TROUT.

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PLATE 26.



SALVELINUS FONTINALIS. The Brook Trout.

DESCRIPTION.

The brook trout or speckled trout (*Salvelinus fontinalis*) is one of the most beautiful active, and widely distributed of the American bouts. It prefers clear, cold, rapid streams, and belongs to that group of trout known as charrs, characterized by the presence of round crimson spots on the sides of the body. Other members of this class are the saibling or charr (*Salvelinus alpinus*) of Europe and Greenland; the Sunapee trout (*S. alpinus aureolus*), found in parts of New Hampshire and Maine; the blueback trout (*S. oquassa*) of the Rangeley Lakes in Maine, and the Dolly Varden trout, red-spotted trout, or bull trout (*S. malma*) of the Pacific States and Alaska. The lake trout also belongs in the group.

The general form of the brook trout's body varies considerably, sometimes being elongated and sometimes rather short, but the usual depth is about one-fourth or one-fifth of the length. The head is large and blunt, and is contained 4 1/2 times in the body length. The large terminal mouth is provided with teeth on the jaws, tongue, and palate bones, and also with a small patch on the vomer. The eye is placed high in the head; its diameter is about one sixth the length of head. The gillrakers on the first arch number about 17, of which 11 are on the lower arm. The scales are very small and numerous; about 230 are in the lengthwise series, and 35 above and 35 below the lateral line. The dorsal and anal rays are 10 and 9, respectively. The tail is square or slightly lunate in the adult, forked in the young.

There is considerable variation in the color of the brook trout, dependent on local conditions, sex, and age. The head, back, and sides of the body, dorsal and caudal fins are of a grayish or greenish color; the back, head, dorsal, and base of caudal are mottled with dark green or black. In the male there is a reddish band along side of belly. Along the middle of the side there are numerous round light-red spots surrounded by whitish or light-brownish circular areas. The lower fins are dusky, with a pale or cream-color anterior border bounded by a black streak; remainder of fin often red in breeding males.

The brook trout may be distinguished from the other charts by the dark-brown or black marblings on the back and the general absence of spots on the back.

FOOD SIZE, ETC.

The brook trout has a voracious appetite and takes advantage of every opportunity to satisfy it except in the spawning season, when it takes no food at all. It is strictly a carnivorous fish, its food consisting chiefly of crustacea, mollusca, and various forms of insects and worms. When pressed with hunger it does not hesitate to devour its own kind.

The size of these fish varies in different localities, usually in proportion to the abundance of natural food and to the size of the body of water in which they are found. They seldom, however, exceed 2 pounds. The Au Sable River trout will rarely run as large as 2 1/2 to 3 pounds, but in other rivers of Michigan larger examples are occasionally found. In southern New York they seldom weigh over 2 pounds, while in the Rangeley Lakes, of Maine, they have been caught weighing 10 pounds. The rate of growth also varies with the surrounding conditions and is more rapid in water of higher temperature and with a plentiful supply of food. Under favorable circumstances an average growth for the first year is from 3/4 to 1 ounce, in two years 8 to 10 ounces, in three years about 1 pound.

While not of any considerable commercial importance, the brook trout is highly esteemed as a table delicacy on account of the flavor and quality of its flesh, and, as it is very game, it is much sought after by sportsmen. Those from clear, swiftly flowing streams do not grow so large as those found in quiet and deeper waters, but are superior in quality and appearance.

RANGE, SPAWNING, ETC.

The natural range of the brook trout in the United States is from Maine to Georgia and westward through the Great Lakes region to Minnesota, and in Canada from Labrador to the Saskatchewan. Owing to its hardy nature and ability to adapt itself to new surroundings, it may be successfully transplanted into suitable streams, and has been extensively introduced into waters to which it was not native, in Michigan, Wisconsin, and Minnesota, many of the waters of the Rocky Mountains and the Pacific Coast, the Eastern States, and the creeks and rivers of the Alleghany range of mountains. With the possible exceptions of the rainbow trout and steelhead it is the hardiest member of the salmon family and will make a brave struggle for existence even

with adverse surroundings. All streams can not be successfully stocked with this species; the temperature of the water must not be too high nor the flow too sluggish. Although an unfavorable temperature is no serious obstacle if the speed of the current is great enough to insure a sufficient aeration of the water, or if there are creeks fed by springs flowing into the main stream to which the fish can run. The best streams are those with a gravelly bottom, clear shallow water, and a steady current, and waters to be stocked must contain a sufficient amount of natural food and suitable places for spawning.



TROUT PONDS, NORTHVILLE, MICH.

The Michigan streams exemplify the practical results attained in the introduction of brook trout in new waters. The Au Sable River was long thought to be especially adapted for this species, but it abounded with grayling, and until this beautiful fish began to disappear no movement was made toward introducing the brook trout. The lumber interests of that section made it necessary to use the river for conveying logs to various points downstream, and, as the log-driving could be done only during the spring freshets, it came just at the time when the grayling were on their

spawning-beds. They were driven away and the beds destroyed by the plowing of logs through the river bottom each year, till the fish gradually began to disappear. The brook trout was suggested as the proper substitute, because its spawning season is in the autumn when the river is undisturbed, and the Michigan Fish Commission began the work by planting 20,000 fry in the year 1885. Though additional plants were made from time to time, both by the Michigan and United States Commissions, no results were observed for some years and it was thought that the work had been a failure. But the natural instinct of the fish had caused them to push from the main river into the small tributaries, where they multiplied and grew during these years till they finally crowded down into the river itself. Here they found as suitable a home as in the small streams, and their numbers gradually increased till now the stream is completely stocked.

In the autumn of 1895 a camp was established for the United States Fish Commission 9 miles below the village of Grayling for the purpose of taking spawn from wild fish. The work was confined to rod-and-line fishing until the spawning season opened, when it was found necessary to adopt some other plan, as at this time the trout refuse to feed. During the five weeks, in which the rod was used exclusively, 3,000 spawning fish were taken. A small seine was then used for capturing the fish, by hauling it at right angles to the current of the river, directly across the spawning-beds, which thickly dotted the river bottom in some places. By this method a tubful of trout at one haul was often taken, and during the period the fish were running between 8,000 and 10,000 were obtained. This illustrates the abundance in which this species is found in a river to which it has been transplanted. A conservative estimate would place the number of trout taken from this stream in the season of 1895 at 100,000, perhaps 25 per cent being rainbow trout. Other waters of the State have been successfully stocked, so that the northern half of lower Michigan now contains a network of trout streams, made by introducing this fish into waters where it was not indigenous.

In its native haunts, whether in lake or stream, the brook trout is usually found in the same clear, cold, spring water, and prefers brooks or streams flowing swiftly over gravelly bottoms. It pushes from the rivers into the small streams, seeking the headwaters, searching out the deep pools and eddies where it can lie concealed beneath the shelter of grassy banks or logs, and see without being seen. Under artificial conditions it endures higher temperature than in its native waters, where it is seldom found in water warmer than 60° to 65°. It thrives at much higher temperature in swift, well-aerated streams than in sluggish waters.

The brook trout spawns in autumn during the falling of the water temperature. The season, which usually lasts about two months, begins earlier in northern latitudes, in the Lake Superior region in September or even August, while in New York, New England, and lower Michigan it commences about the middle of October.

As the spawning time approaches the fish push up toward the shallower waters where the female selects a spot near the bank of the stream and prepares her nest by washing out the sand with her tail and pushing aside the gravel with her nose. After forming a slightly concave depression she deposits a part of her eggs on the newly cleansed gravel, and the male—which up to this time has been playfully swimming around the nest—emits milt upon them almost simultaneously. The female then covers the eggs with the loose gravel. The spawning, impregnating, and covering are repeated continuously until the eggs are all laid. After the spawning-ground is once selected it is hard to drive the fish away, the female especially returning to the same spot at the earliest opportunity. A female has been taken from her nest and marked and then returned to the water a mile down the stream, and the next morning was found on the same bed as though nothing had happened.

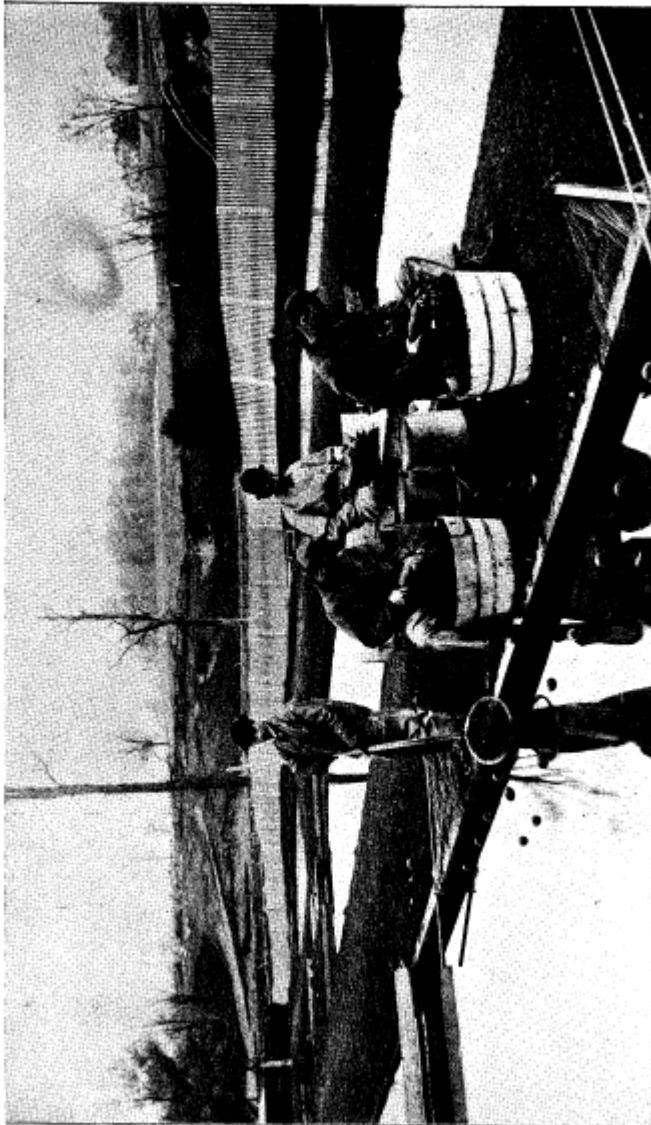
The eggs vary in size, but are usually one-sixth of an inch in diameter. The number yielded by one fish depends on its size and age, yearlings usually producing from 150 to 250, two-year-olds 350 to 500, and older fish 500 to 1,500. The time necessary for developing the eggs is dependent on the temperature of the water, varying from about 125 days in water at 37° F. to about 50 days in water at 50° F.

TROUT-CULTURE IN AMERICA.

The first attempt at artificial trout-culture in America was made in Ohio in 1853 and marked success attended the efforts. Further satisfactory trials were made in 1855 and 1859 in Connecticut and New York, and in 1864 a hatchery was established in New York which became a practical success in carrying on the work on a large scale. Somewhat later the work was taken up by the State and United States governments and is now very extensively carried on in all parts of the United States.

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PLATE 28.



SELECTING AND STRIPPING RIPE TROUT, NORTHVILLE, MICH.

The methods described in the following pages are those which have been found advantageous at the Northville station and are there pursued. In addition to the eggs obtained from brood fish held in ponds at the hatchery a field station for collecting eggs from wild trout is operated on the Au Sable River.

THE FIELD STATION.

For the egg-collecting station a point was selected on a tributary of the Au Sable, flowing about 1,000 gallons per minute, near where it empties into the river. A dam was thrown across the stream and 100 feet above a screen was built to prevent the fish from escaping in that direction. The dam is simply constructed by banking up mud, sand, and turf, and has a frame sluiceway 3 feet long, 2 feet wide, and 2 feet deep. In the sluiceway is inserted a double screen of 1/4-inch mesh wire netting, two screens being necessary to keep the overflow clear and reduce as low as possible any loss of fish through this outlet. The inclosure accommodates about 10,000 fish. For holding the eggs two pairs of troughs are placed on standards driven into the bed of the stream, with a passage between them wide enough to admit a man. Fish are obtained with rod and line, until they begin to run from the deep pools upon the spawning-grounds, when much better results are obtained with nets. With an ordinary seine at the approach of the spawning season, the fish can be taken in large numbers from their spawning beds. As the season advances and too many fish are caught that have already spawned, operations are suspended.

The water is received through two 1-inch orifices in a bulkhead about 9 feet long, situated at the head of these troughs and fed by a roughly-constructed raceway leading from a small spring about 6 rods distant on the hillside. The water from each of the openings feeds two troughs, so placed that the lower end of the upper one rests upon the head of the other, thus creating a fall of nearly the height of the troughs. Each trough is 14 feet long, 5 inches deep, and consists of a double row of boxes, each box 17 inches long, 15 inches broad, and 2 inches deep, giving a capacity of from 8,000 to 10,000 eggs.

As soon as ripe fish are found among those caught on the spawning-beds, the pond is hauled with a seine and the fish are looked over twice a week until all the eggs are taken. When the season is fairly opened the spawn may be taken from most of the fish immediately after they are caught, thus obviating the difficulty of transferring them from the point of capture to the pond, in some cases a distance of 3 or 4 miles.

TAKING THE SPAWN-DRY PROCESS.

A good spawn-taker can tell at a glance if a female is ripe, and only in such condition should an attempt be made to take her eggs. After the ripe males and females are placed in separate tubs or buckets, the spawn-taker is ready to take the eggs, the implements necessary being a feather and an ordinary milk-pan coated with asphaltum paint on the inside to prevent rust. The pan is first dipped in water and allowed to drain, leaving only the water that clings to the inside. Taking a female from the tub she is held as quietly as possible till all struggles cease, and then pressing gently with the thumb and forefinger a little above the ventral fins, the hand is passed down the belly to the oviduct, and the operation repeated till all the eggs are extruded. The eggs are immediately impregnated with milt, which is obtained from the male in similar manner, except that more force is necessary and the pressure is made at a point about midway between the ventral and anal fins.

The contents of the pan are next lightly stirred with a feather to insure impregnation of all the eggs possible. They now present a milky appearance and are washed in as many changes of water as is necessary to thoroughly cleanse them from the milt and other refuse, when the pan,

left half filled with fresh water, is placed in running water to keep the eggs at a low temperature. After from 30 to 60 minutes, according to the temperature of the water, the separation of the eggs ensues.

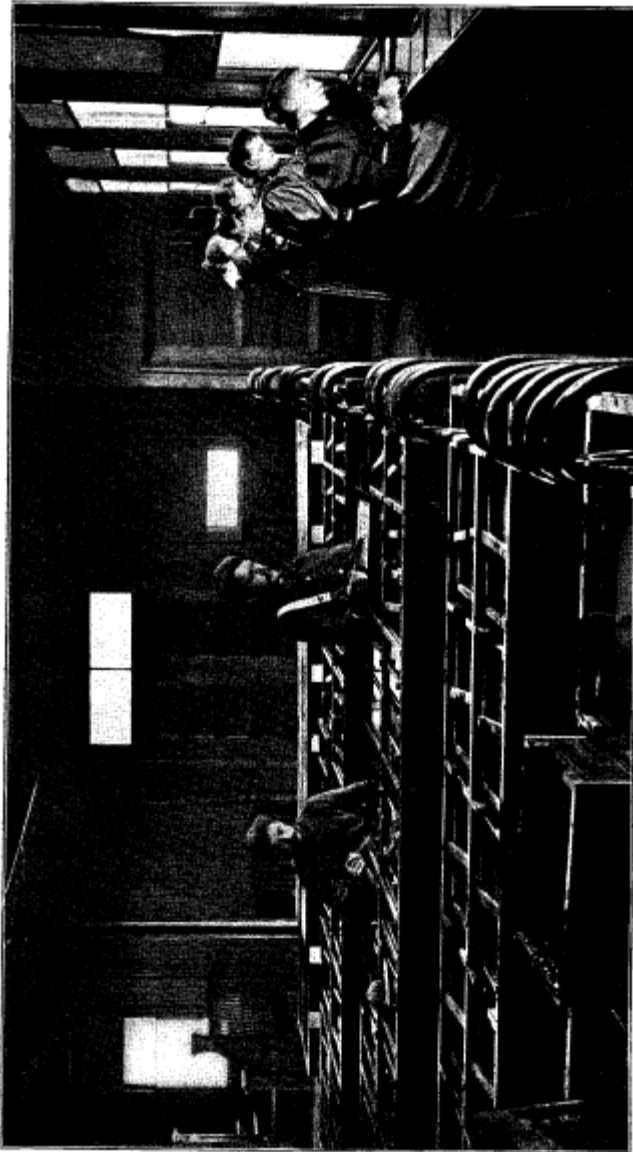
In the work on the Au Sable River, the eggs, after separating, are laid on gravel placed 1/2 inch deep in the boxes of the troughs. Here they remain till the eye-spots begin to appear, when they are prepared for shipment. During this interval of about thirty days the principal care consists in sorting out bad eggs, and, with a feather, gently changing the position of good ones to prevent sediment from collecting on them.

SHIPPING GREEN EGGS.

Green eggs can be safely moved at any time up to and including the eighth day. They are shipped from the field station to the hatchery in cubical boxes constructed from 1/2-inch pine lumber, just large enough to admit, with a surrounding air-space of 1/2 inch, 19 canton-flannel trays, 18 inches square on the inside, the frames of which are made from 7/8-inch square white pine. The eggs are drawn by means of a siphon from the gravel boxes into a tub or bucket which has been half-filled with water to prevent them from injury. Using a graduated dipper for the purpose of ascertaining approximately the number of eggs necessary to make them about two deep on the tray, the packer pours them upon the flannel and spreads them as evenly as possible with a feather. The tray is then placed in the box and the operation repeated until eighteen trays are filled with eggs. The nineteenth, or top tray, is usually left empty, but if the weather is very warm it is filled with fine ice. The cover is then fastened down, the box marked, and the eggs are ready for shipment to the hatchery.

THE HATCHING APPARATUS.

After a period of about thirty days on the gravel, the eggs are taken up and placed in the Clark hatching-box, for here they may be held without any appreciable loss through the escape of fish when hatching. This apparatus as used at Northville is arranged as follows: A tank 15 feet long, with a partition running its entire length, is so placed that its lower end rests upon the upper end of a similar one 13 feet long, which differs from the upper one only in that it contains two boxes less. Nine partitions, placed crosswise of the tank form, with the lengthwise partitions, a double row of eight compartments, each of which is 19 1/2 inches long and 15 1/2 inches wide, and is provided with a waste-water channel or sluiceway leading into the next compartment. In these compartments are placed the hatching-boxes proper.



INTERIOR VIEW OF NORTHVILLE HATCHERY: CLARK BOXES IN FOREGROUND; CLARK-WILLIAMSON BOXES IN BACKGROUND; GIRLS PICKING EGGS AT THE RIGHT.

The Clark box is 18 inches long, 14 inches wide, and 9 1/2 inches deep, and is made from 3/4-inch dressed whitewood lumber. On its under side the box is provided with feet, 1 1/2 inches square and 3/8 inch thick, to allow a free circulation of water under it and to prevent it from resting upon any sediment or refuse that may be deposited on the bottom of the tank; and on the inside in each bottom corner is fastened a block, 3/8 inch thick by 1 1/2 inches square, to support the trays. Five circular openings, 7/8 inch in diameter, permit the escape of water from the box. A slot is cut in one end of the box so that water from the compartment above can not flow into the one below without falling into and passing through this box. Upon the feet or risers inside the box rest 9 trays, made of perforated zinc or fine wire netting, tacked upon a frame 16 inches long and 12 inches wide. This frame is made from 3/4-inch pine, 1 1/4 inches wide. The trays are placed one upon the other in the box, the end which contains the slot fitting snugly against the upper end of the compartment, in which is fitted a tin over flow. The whole is held in place by a crossbar or binder, which fits in 3/8-inch grooves cut in both sides of the tank. The binder,

resting upon the box, keeps it from rising in the water, and is provided with feet so platted as to prevent the trays from floating in the box itself.

Upon the arrival of the green eggs at the hatchery they are transferred from the flannel trays to a large galvanized iron pan, and thence to the Clark hatching-boxes. The eggs are measured with a glass graduate and 5,000 placed upon each tray, the ninth or top tray being used only as a cover. The eggs from domesticated brook trout measure 350 to 450 per fluid ounce, depending on the age of the fish. Eggs from wild trout collected in the Au Sable River measure 450 to the fluid ounce.

CARE OF THE EGGS.

At intervals of from three to six days during the period of incubation, in order to remove the bad eggs, the trays are taken from the boxes and placed in a shallow picking-trough through which a stream of not more than 3 gallons per minute is flowing. This trough is only wide enough to allow perfect freedom in handling the trays when putting them into or removing them from it, and only of sufficient depth to allow the eggs to be fairly covered. Nailed to the bottom on each side is a 1/2-inch strip, 1 1/2 inches wide, and running the entire length of the trough. These strips permit the free passage of water beneath the trays, as otherwise the water would flow over the tops and a great many eggs would be lost. The bad eggs are removed with a pair of tweezers, the labor of sorting being usually performed by girls, who in time become so expert that one girl will often remove 100 bad eggs per minute.

After the incubation has reached a stage where the fish are beginning to break their shells, the hatching-box is taken out and reversed, the open end being fixed snugly against the lower wall of the compartment. The closed end of the box being thus placed upstream, the water is prevented from entering except through its former exit, the holes in the bottom of the box, and is thus forced up through the box, with an exit at the top which prevents the sacs of the hatching fish from being forced, by pressure from above, down through the screen, as would be the case if the box were left in its former position.

When the process of hatching is nearly completed the trays are removed and emptied into a large pan filled with water, where the dead shells and other refuse, being of low specific gravity, rise to the top and can be easily poured off. This is called washing the fish. The fish are then replaced upon the trays and returned to the hatching-boxes, where they remain until the food-sac is nearly absorbed, a period of from 25 to 40 days, according as the temperature varies from 50° to 38° F.

The young fry, deprived of their food supply by the absorption of this sac, must soon be placed where they can get their sustenance elsewhere. They may be planted in waters suitable to their nature, or reared for breeding or other purposes at the station.

PLANTING THE FRY.

In their natural state, as soon as the weight of the food-sac has diminished by absorption enough to permit their rising, the fish begin to take food, and by the time the sac is entirely gone they are probably taking it regularly. When very young fry are transferred to outside waters where there is natural food only, it should be done 8 or 10 days before the sac is entirely absorbed, for, if delayed till after the sac disappears, many will die before they become accustomed to finding food in their new home.

Brook-trout fry are usually transported in ordinary round-shouldered cans of 10 gallons capacity, the number of fish per can depending entirely upon the distance they are to be carried and the facilities for taking care of them en route, such as opportunities for changing the water,

supplying fresh ice, etc. For a short trip of from 5 to 10 hours duration, between 4,000 and 5,000 are carried in each can, but where they are to be on the road from 1 to 5 days, it is hardly safe to attempt carrying more than 2,500. The United States Fish Commission distributes fry by means of its cars, built especially for the purpose, in which either running water is kept upon them or fresh air introduced into the water to make it life-sustaining. Small shipments are made by a special messenger in a baggage car, the railway companies usually offering every available opportunity for changing water, etc. The fish, upon arrival at the railway point nearest their destination, are carried thence by wagon to the stream where they are to be planted, by distributing them in small lots in different places where there is shallow water and a good bottom.

REARING AND FEEDING.

If the fry are to be reared for breeding, one week before the food-sac is absorbed they are changed from the trays to a large pan and removed to the rearing-troughs. Gravel should not be used in these troughs, as the unconsumed food works down into it and, becoming fungussed there, causes a greater spread of disease and increases the labor of caring for the fish.

The time to begin feeding the fry is readily ascertained by trial. If they rise to minute particles of food thrown upon the water, they are then ready for regular feeding. The time and frequency of feeding young fish, the kind of food, and the manner of feeding them, are of the greatest importance. Liver gives better results than any artificial food, and its preparation is very simple. Beef livers are ground by a meat-chopper and then strained through a fine-meshed screen, a thick pudding being made by the addition of water. A small portion, only such an amount as the fish will readily eat at a time, is spread upon the surface of the water with a feather, and they are fed as often as six or eight times per day until they become used to the new diet. As they grow older the quantity of food may be increased but the fish are fed less frequently. At this stage the young fish have such a precarious hold upon life that too much attention can not be given to their care. Not more than 20,000 can be held with success in a feeding or rearing trough, and a regular stated supply of water is kept flowing through to prevent disease, and the fish are properly thinned out in order to prevent loss by suffocation when they increase in size. About 30 gallons of water per minute are sufficient for 20,000 fry, though this quantity is increased as the fish grow stronger and are able to breast a heavier current.

In the spring season, when the water begins to grow warm, the fish require more room than the feeding-troughs afford, and it is then necessary to transfer them to ponds. The Northville rearing-ponds are 5 feet by 20 feet, made from 2-inch pine boards and provided with a gravel bottom. A pond of this size accommodates from 10,000 to 20,000 fry till the middle of the summer, when the number is reduced to as low as 5,000. It is advisable to place not more than 5,000 in the pond at first to avoid the labor of reducing the number of fish at different times, and also because crowding into too small a space retards their growth.

At first the fish require coaxing to induce them to eat, as the change to their new abode has frightened them, and a great deal of patience is necessary in their treatment. They are fed at regular intervals three times per day. As their appetites are poor for the first few days, the liver will fall to the bottom and foul the pond, if great care is not exercised, and three fourths of an hour is not too long for feeding 5,000 fry. The time occupied in feeding is diminished and the amount of food increased according to the judgment of the fish-culturist; but their appetites should never be completely satisfied.

By early winter they will have grown to a length of from 3 to 6 inches, necessitating a change to a larger pond. The Northville breeding-ponds are 20 by 75 feet, and are constructed in the

same manner as the rearing-ponds. One of these larger ponds accommodates 10,000 yearlings, 5,000 two-year-olds, and about 3,000 fish from three to five years old. By the time the fish are three years old and over, less care is required in the preparation of their food, as the liver may be given to them in pieces half an inch in diameter.

PACKING EYED EGGS FOR SHIPMENT.

Eyed eggs prepared for shipment in the following manner have been sent from Northville to all parts of the United States with practically no loss: The trays upon which the eggs are to be shipped are made from the same materials as those upon which green eggs are carried, but are usually much smaller. Fewer eggs are placed upon a given surface than is the case with green eggs. For example, 10 trays, 12 inches by 12 inches, will carry 50,000 eggs; 8 trays, 10 inches by 10 inches, 32,000 eggs; and 5 trays, 8 inches by 8 inches, 12,500 eggs; or 5,000, 4,000, and 2,500 eggs per tray, respectively.

The trays are allowed to stand in cold water till thoroughly soaked, and are then drained off and taken to the packing-room. After the dead eggs have been removed from a box, the trays are taken out, drained, and removed to the packing-room. A 3/4-inch wooden frame, made to fit the inside of the cotton-flannel tray, is then inserted, the eggs are carefully brushed with a feather from the wire trays and spread as evenly as possible upon the flannel. The eggs have been previously measured at the time when they were removed from the gravel to the hatching-box, so the number to be placed upon each tray can be easily determined. After the eggs are spread upon the flannel, the inside wooden frame is taken out, leaving an inch margin around the inside of the tray. A square of mosquito netting large enough to lap over on all sides of the tray is laid upon the eggs and tucked down firmly along the inside. Sphagnum moss is scattered to a depth of about 3/4 inch upon this netting. The moss is prepared by removing sticks and other foreign matter; it is soaked in water a short time and then run through a clothes-wringer. In spreading it upon the netting the moss is picked apart and made as light and fluffy as possible, to give the eggs plenty of oxygen.

When the required number of flannel trays are packed they are placed one upon another and cleated together on all sides, with boards at the bottom and top. This crate is usually placed, if possible, where the temperature of the air is below freezing, so that the moss may be slightly frosted before the crate is put in the shipping-case.

A case is made large enough to allow a 4-inch space above, below, and around all sides of the crate when it is placed in position. Its bottom is filled with fine shavings, 4 inches deep, and the crate placed upon them as nearly as possible in the center of the case. Shavings are packed tightly around the crate, a few being thrown in and pounded down securely before more are added. This must be well done, as the shavings are the only means of preventing a change in the position of the crate. The top of the crate is then covered with closely packed shavings and the cover of the case screwed on. By means of rope or iron handles the case may now be moved about with ease, and is ready for shipment.

REFRIGERATOR BOX FOR SHIPMENTS ABROAD.

A double box is used for this purpose. The inside one is 2 1/2 inches larger on all sides than the crate of trays, and the outside one large enough to make a 5-inch space on all sides when the smaller box is placed within it. The trays of eggs are prepared as in ordinary shipments, and when crated are placed in the smaller box upon a frame which is constructed from a 1/8-inch strip, 2 1/2 inches wide, tacked at right angles to the inside and bottom of this box. In the chamber thus formed between the crate and the box is packed finely chopped ice, an exit for the

water resulting from its melting being provided by a half dozen openings in the bottom of the box. This box is now packed according to the same plan as that followed with the shipments for a short distance. Where there is an opportunity, it is well to have the case unpacked en route and new ice added.

Eggs have been sent in this manner to England, Mexico, New Zealand, Japan, and South America.

DISEASES.

Brook-trout fry are subject to diseases and epidemics, and extreme measures are often necessary to eradicate these evils. Many experiments have been made to discover some method of treatment that will prevent the introduction of disease. At Northville the troughs are flushed every day for five minutes with an extra supply of water, and twice a week they are thoroughly cleansed with a stiff brush or sponge. The fry are then treated with a weak solution of salt, which is allowed to remain until the fish show signs of discomfort, when the troughs are flushed for a few minutes and the water reduced to its regular flow. As the fish increase in size they may be thinned out in the trough and also at the first indication of disease.