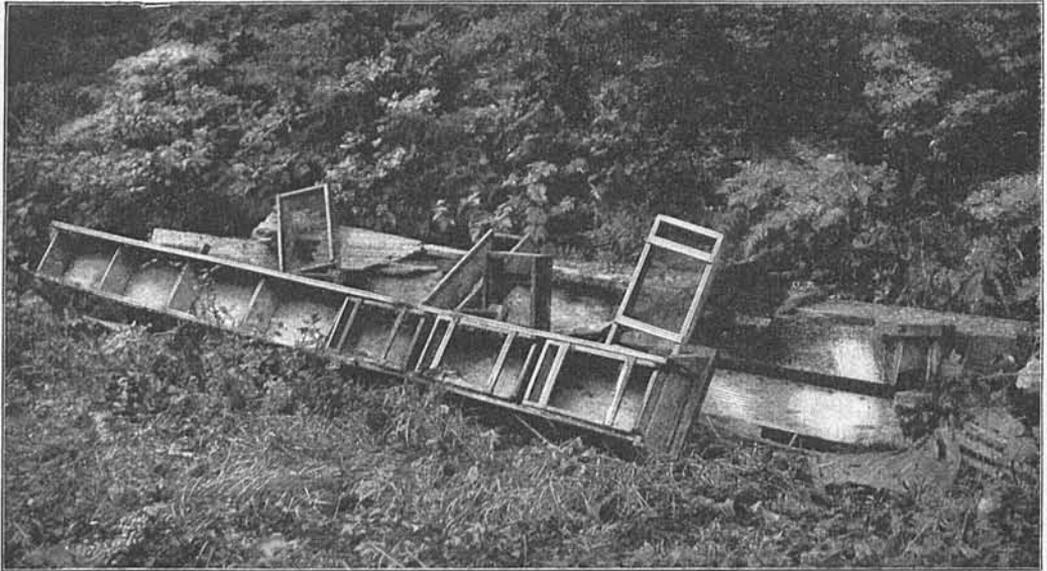


Mr. John C. Callbreath has been a resident of Alaska for many years; he was the manager of the Point Ellis cannery until it was destroyed by fire in 1892, and has lately been engaged in the transportation business on the Stikine River and in trading, making his home at Wrangell. He is a representative citizen, enterprising, and devoted to salmon culture.

In 1892, in connection with the Point Ellis cannery, he started the hatchery referred to under that stream heading. Having seen the rise of the salmon industry,



Ruins of trough and baskets, Callbreath's old hatchery.

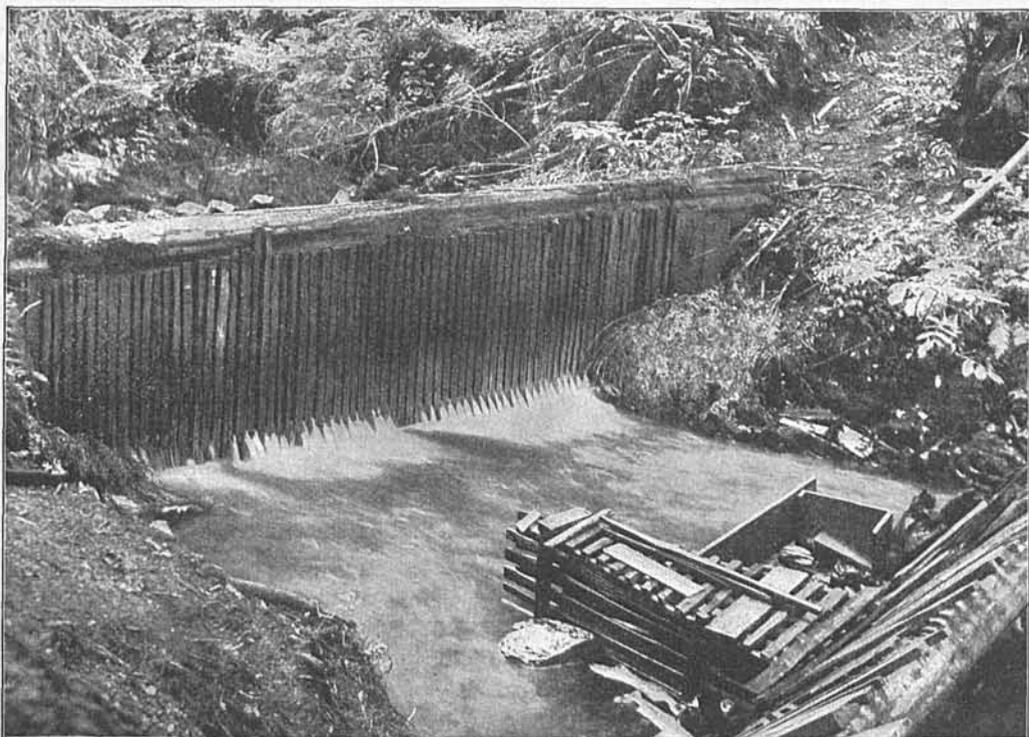
and knowing, as all must know who are familiar with the question, that the abusive and excessive fishing and total disregard of the law by the fisheries must slowly but surely exterminate the salmon for commercial purposes, he determined to take a salmon stream that under normal conditions carried a few thousand redfish, and by artificial propagation increase the production to hundreds of thousands. He hoped that, if successful, a law would be framed making all the increase his own property.

The hatchery is a private enterprise, unconnected with any cannery or fishery, and based upon the widely prevailing belief that the salmon return to the parent stream in four years after they are hatched. As this time has passed, however, without any apparent return, Mr. Callbreath has extended his period to ten years.

In establishing the hatchery a stream was sought satisfying the conditions imposed, and one was found at the head of McHenry Inlet. It is small, about one-

half mile in length, and flows over a rocky and bowldery bed between heavily wooded shelving banks. At its head is a small lake 42 feet above tide water, slightly L-shaped, about three-fourths mile long by one-fourth wide, and bordered by low wooded banks. The stream was never known to supply more than from 3,000 to 5,000 redfish, a number too small to attract the attention of the commercial fisheries. In fact, it was known as a "cultus chuck" or worthless stream.

After making satisfactory arrangements with the Indians claiming the stream, a hatchery was built in 1892 on the right bank about 200 yards from the mouth, and suitable dams were thrown across the stream to impound the fish. The hatchery water was taken from the stream, conveying it by a flume from a point near the



Trap pen and barrier in lower course of stream, Callbreath's Hatchery, McHenry Inlet.

lake, where a dam was built. After operating the hatchery during the latter part of the season in 1892 and turning out about 600,000 fry, it was seen that the breeding fish could not be impounded properly in the stream, many dying, probably from exhaustion in attempting to pass the barrier; it was also found that the stream water used in the hatchery was unsuitable, not only on account of the wide range in temperature, but the organic matter it contained smothered the eggs and caused fungus. An excellent site having been found on the lake in the vicinity of the streams forming the natural spawning-beds, with a spring giving an abundant supply of pure water of very equable temperature, the hatchery was moved in the spring of 1893 to its present site. It was operated that year and every year until 1900, when the pro-

jector decided that his means would not permit him to continue the work unless some return was made.

From its first inception it was determined that, in order to obtain the best results, only the most desirable species should be admitted to the lake, and that all enemies must be removed and excluded. In order to carry this into effect dams were built across the stream with racks below them, as shown in the sketch, at a point about 100 yards from salt water, where an islet divides the stream into two parts. The dam and fence on the western side of the islet allow nothing to pass. The fence on the eastern side has a trap opening, admitting fish to the foot of the dam. Here the redfish and cohoes are lifted by dip nets to the pool above, from which point they can ascend quickly to the lake. Nothing can enter the lake which is not passed over the dam by hand. The humpbacks, dog salmon, Dolly Varden trout, and all enemies, are carefully excluded, and the lake is therefore free of undesirable and predatory species. The lake has been carefully fished, and all enemies to the fry, such as cut-throats and other trout, sticklebacks, bullheads, sculpins, etc., have been removed, so that it is comparatively clear of enemies.

The hatchery is located on the northern side of the lake, about three-eighths mile from the head of the outlet, and midway between a series of 11 springs and feeders, the extreme distance being less than one-fourth mile from the main building. The hatching-house stands on the border of the lake, partly over a small feeder, and back of it is a substantial and comfortable log dwelling, 20 feet by 36 feet. Strung along the lake are two houses for the hatchery hands, each 12 feet by 16 feet, a smoke-house for smoking the stripped fish, and a tool-house. The original cost of the plant, and all expenses connected with it to date (September, 1900), amount to \$16,000.

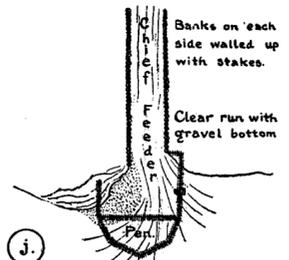
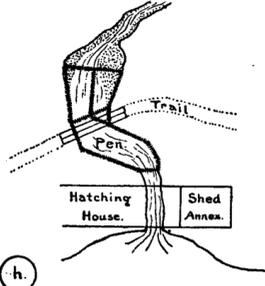
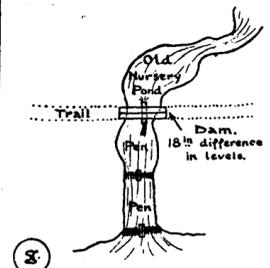
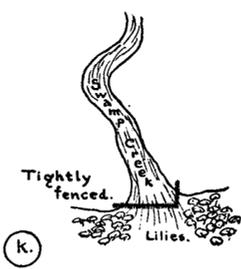
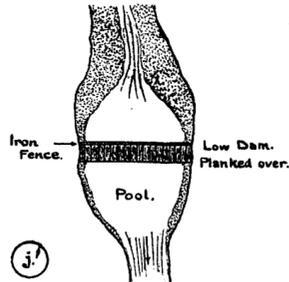
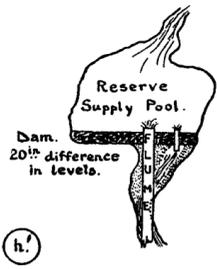
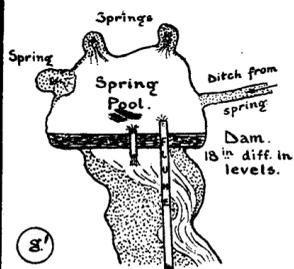
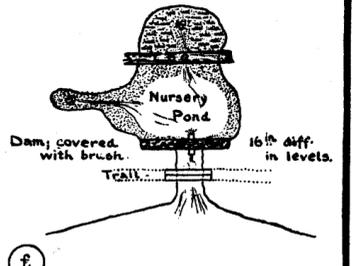
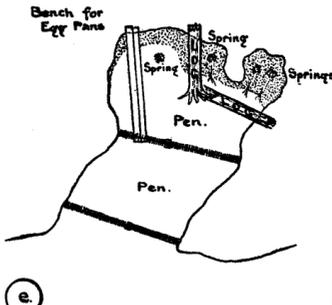
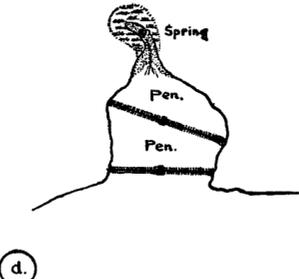
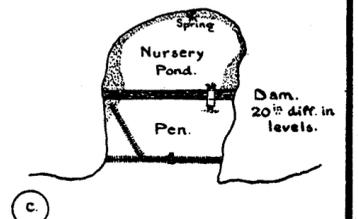
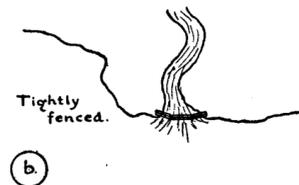
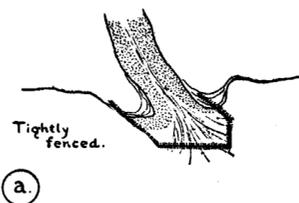
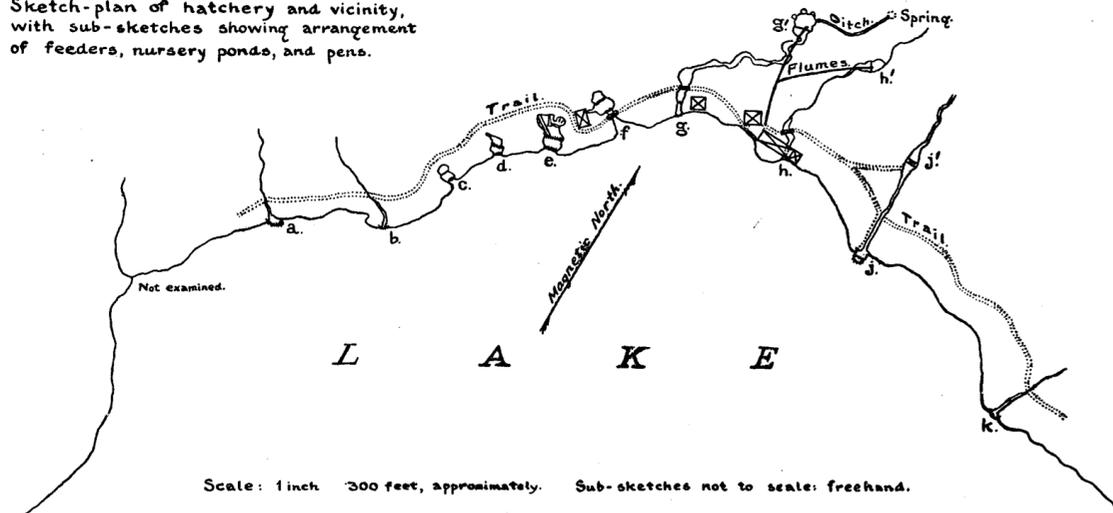
The hatchery usually opens July 1, when preparations are begun for the season; stripping generally commences September 1; the place is closed about March 1.

The hatchery building is 75 feet long, east and west, by 11 feet in width; south wall 11 feet high, north wall 6 feet high; shed roof, with windows on the south side only; on the east end is an open shed annex, 18 feet by 11 feet.

The troughs are 16 feet by $13\frac{1}{2}$ inches by $5\frac{1}{2}$ inches, inside measurement, made of planed lumber, $\frac{1}{2}$ -inch bottom, $1\frac{1}{4}$ -inch sides, covered with asphalt varnish. In the main building are 2 lines of troughs arranged in pairs, with 8 troughs in a line, making a total of 16, arranged with a passage around the lines as shown in the sketch. Each pair of troughs has a drop of 1 inch in its length, with a fall of 4 inches to the next. The first compartment in each trough is 8 inches in length, and receives and aerates the water; then come 7 basket divisions, each 24 inches long, separated by the Williamson system of division plates, 2 inches apart; the last space is 4 inches. The annex will accommodate 4 troughs, but it has seldom been used.

The baskets are of the usual wire webbing, five-eighths inch by one-sixth inch for redfish eggs, and five-eighths inch by one-fifth inch for cohoes, and are $23\frac{1}{4}$ inches by $12\frac{1}{4}$ inches by $4\frac{1}{4}$ inches, and have no wooden rims. They are supported an inch from the bottom of the trough by broad-headed nails and tin clips. All are well lacquered. A full basket contains 60,000 redfish eggs, or 30,000 to 35,000 coho eggs. The capacity of the hatchery is therefore 6,720,000 redfish eggs, and the annex 1,680,000 of the same species, but it is doubted if the latter can be regarded as a reliable factor in estimating the capacity.

Sketch-plan of hatchery and vicinity, with sub-sketches showing arrangement of feeders, nursery ponds, and pens.



Compass sketch of Lake and Stream by Ens. C. S. Kempff, U.S.N. Hatchery details by H. C. Fassett, U. S. Fish Commission. September 1900.

ALASKA ETOLIN ISLAND

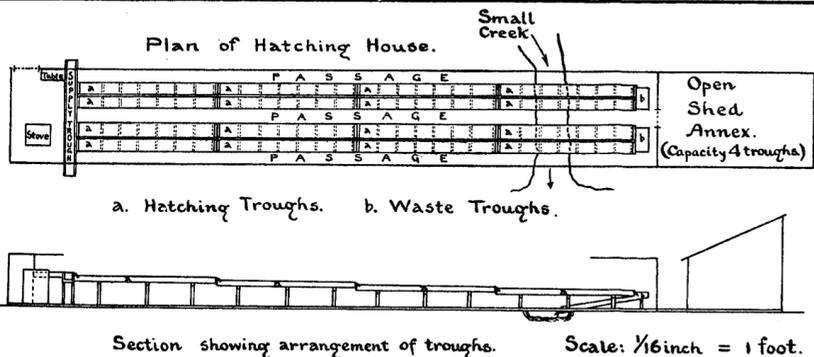
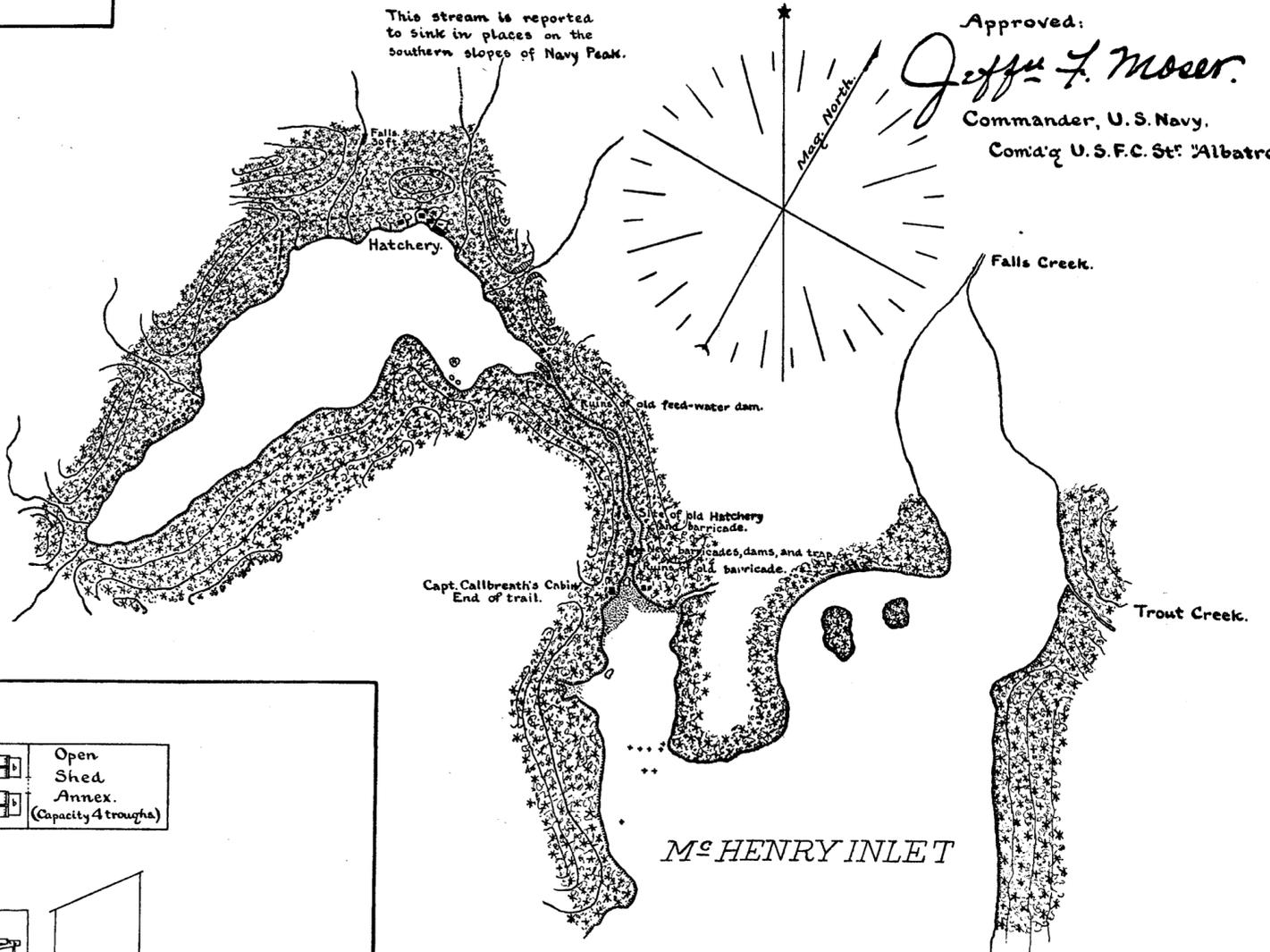
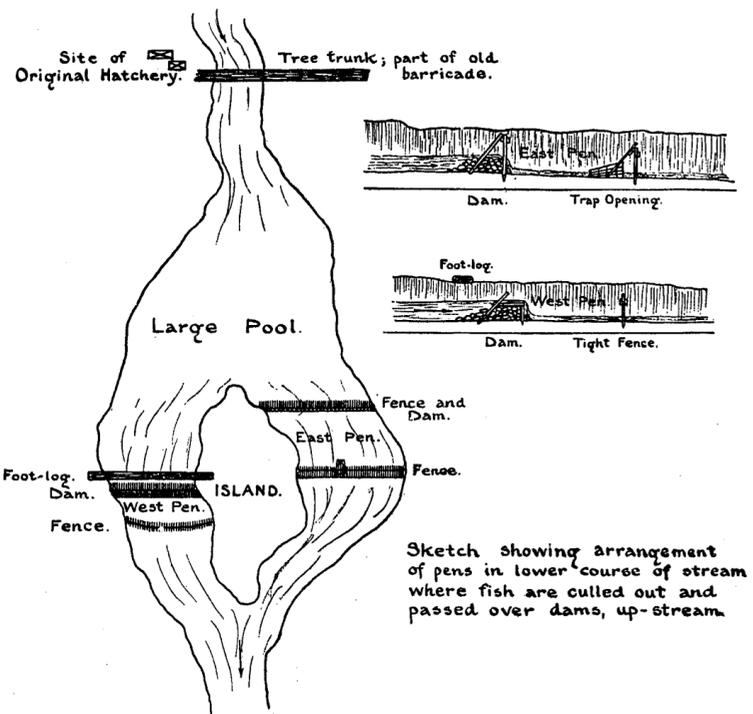
Sketch of
LAKE and STREAM
at the Head of
M^c HENRY INLET

Showing location
of
Captain J. C. Callbreath's
SALMON HATCHERY.

Scale: 1 Nautical Mile.

This stream is reported to sink in places on the southern slopes of Navy Peak.

Approved:
Jeffrey F. Moser
Commander, U. S. Navy.
Comd'g U. S. F. C. St. "Albatross"



The hatchery water is received from a pool about 150 yards north of the hatchery, which is supplied by three springs (see sketch *g*) in the immediate vicinity, augmented by an additional spring, which is connected with the pool by a ditch. From the pool the water is conveyed by a covered flume to the west end of the hatchery building and is then distributed, as shown in plate xxix. The flow is regulated at the closed end of the flume in the pool by means of holes in the bottom plank, in which plugs may be inserted, increasing or decreasing the supply as may be necessary. The main flume, midway in its length, is joined by a flume running from a reserve pool to the eastward, which may be used if necessary. The water is very clear and evidently quite pure, as no trouble has ever been experienced from fungoid growth. It is not filtered, but there are screens in the upper end of the flume to strain out foreign particles which may fall into the pool. The water is very equable in temperature and is said never to freeze. The lowest temperature observed in midwinter is recorded as 38° F., and the highest in midsummer 46° F. These are the extremes, the average range running from 39° to 45° F. During moderate winter weather the temperature of the water runs from 40° to 43° F.—never above the latter. While the temperature of the water is frequently taken during the season, there is no daily record from which curves may be drawn. The following may be noted as fair averages: July 25, 1898, 45° F.; September 14, 1898, 43° F.; lowest during the winter of 1898-99, 39° F.; April 15, 1899, 41° F. The lake water ranges from the freezing point in winter to 60° F. in midsummer. It is claimed that the present hatchery supply is sufficient for 15,000,000 eggs and that there are additional springs in the vicinity which, at small expense, can be utilized. In the hatchery the same water is used through four troughs, and if the annex is used, through five. It then passes by a sluice to the small creek under the hatchery.

The arrangements seem crude, and all fittings and appliances are constructed at the least expense, yet it all indicates an intelligent endeavor in a direction where there was but little previous experience in the work. Judging from the output, however, the hatchery has been very successful, and is a striking example of what may be done in this line of work if undertaken in an intelligent manner. Mr. Call-breath certainly deserves great credit, not only for the work he has accomplished, but for the proof he has given that a hatchery may be operated successfully for very little money.

Feeders, ripening pools, and nurseries.—The redfish and cohoes after entering the lake remain in its waters until ripe, a period varying from two to six weeks, sometimes longer, depending upon the condition of the fish as they enter from the sea; and when ripe they seek the feeders to spawn. In the immediate vicinity of the hatchery there are six feeders and springs which form natural spawning-beds and are arranged for taking ripe fish, and also several nursery ponds. The mouths of these feeders are fenced and have trap openings, which admit the fish, but do not permit them to leave.

Feeders *a*, *b*, and *k* are tightly fenced to prevent adult fish from entering, as they are full of obstructions on which the fish might injure themselves. *c*, *d*, *e*, and *f* are spring pools, which have been cleared and improved, opening on the lake. The pool *c* is separated by a dam into two ponds, the inner one forming an excellent nursery. *d* is not considered very good. *e* is the best pond, and secures

the largest number of breeders except *j*. *f* is a nursery pond; an inclined fence of brush surmounts the dam and partly shades the pool, which is believed to benefit the fry. *g* is the outlet for the overflow from the hatchery reservoir pool; it has several small pools, formed by widenings in the stream, where fry were one year planted but did not do very well. The lower of these pools, shown on the sketch, was also used as a nursery, but was unsatisfactory. *h* is the overflow from the auxiliary pool for hatchery supply, and receives the hatching-house waste; at times a few fish are permitted to enter and are spawned as needed to fill up baskets. *j* is the chief feeder entering the lake, and is about 100 yards east from the hatchery; the mouth is fenced with the usual trap opening, and from this point for about 70 feet upstream the banks are walled up with vertical slabs. At *j'* the stream has been dammed to make an upper pool in which, and in the upper reaches, fry are released. The ripe fish are stripped on the west bank of the lower reach.

Spawning.—The ripe fish enter the pens through the traps and are taken by dip nets; they average about 7 pounds in weight. Spawning begins about September 1, and continues actively for about six weeks; a few ripe fish keep running until late in the winter, the latest arrivals having the most perfect eggs.

In spawning the wet process is used; a pan is half filled with water, into which the ova are stripped and the milt added; these are mixed with the fingers, and then set aside for one hour, after which the eggs are thoroughly washed, transferred to buckets, and carried to the hatchery where they are placed in the baskets.

It is found that impregnation will take place up to 3 minutes after the ova have been ejected, and that the best results are obtained by adding the milt between $\frac{1}{2}$ and $1\frac{1}{2}$ minutes after ejection.

Size of eggs.—The number of eggs of both redfish and cohoes has been frequently counted, and it has been found that a full healthy female of each species contains 3,500 eggs, but it is rare that the full number is obtained. As frequently some are left in the fish, and others are not in good condition, the count is made on 3,000 eggs to the full fish, or 20 redfish, or 10 to 12 cohoes, to the basket, the eggs of the latter being about twice the size of the former. When a large number of fish mature at the same time it is frequently found that some eggs have been voided, and in such cases it will take two and sometimes three fish to make one "count" fish.

In counting the eggs a condensed-milk can is used as a measure. This measure, by repeated counting, has been found to contain 1,904 redfish or 848 coho eggs. A quantity of eggs from a healthy, normal, ripe female redfish was secured and measured with the following results: Forty covered 2 square inches and 20 in a line against a straight edge occupied a length of exactly $4\frac{1}{2}$ inches, giving a single egg a diameter of 0.225 inch. It has been observed that brilliantly colored or unusually large or small eggs are apt to prove failures.

Several hundred cohoes are usually stripped each year and the eggs hatched. They run about six weeks later than the redfish.

The picking of eggs is done with ordinary tin forceps and is commenced six to eight weeks after the eggs are placed in the baskets. It is claimed that the percentage of bad eggs is very small, and that very little, if any, fungus appears. The delicate period is unknown here. It is probably covered during the time the eggs remain undisturbed.

Period of incubation.—The temperature records are not at all complete, and no attempt has been made to determine the thermal hatching unit. Generally it may be said that with a temperature of 45° F., the average highest, to 39°, the average lowest, the eye-spots appear in from 30 to 38 days. A few are earlier, and a few are 45 days before they are well eyed out. In 90 days they are hatching rapidly; in 100 days two-thirds are hatched; in 110 days four-fifths are out, and the remainder straggle along for several months. As the hatchery closes March 1 the unhatched eggs are buried in the gravel, simulating the natural conditions. The cohoes hatch about 10 days earlier, and an experiment made with a basket of humpback eggs showed that they hatched in 70 days under conditions in which the redfish hatched in 90 days.

Eggs which hatch out well in advance of the mass ("prematures") and those equally late, produce usually very weak fish or "freaks." It has been the experience here that it is useless to waste time on these fish, as they invariably die. It has been found that the fry just hatched collect in the lower end of the troughs, and to prevent loss they are removed as early as possible, within a day or two after hatching, and placed in the nursery, the upper ponds of the feeders, and sometimes in the lake, where the bottom is grassy or covered with pond lilies.

The yolk-sac is absorbed in from forty-five to fifty days, but shows plainly at sixty days, though skinned over and in the belly. After this has taken place they are taken from the nursery and some are placed in the feeders and others in the lake, where the natural conditions are most favorable for their protection.

The loss varies from 8 to 12 per cent, depending upon the season; if there is an abundance of rain, permitting the fish to ascend without injury, the eggs are found in good condition and the loss is small. During a dry season the fish are kept from ascending until the fall rains, and as they partially ripen in the salt or brackish water the eggs are more easily injured. Realizing the advantage in having the fish arrive in the lake in a healthy, vigorous state, considerable work has been done at the outlet to remove obstructions and to improve the natural conditions.

Barren lakes.—Mr. Callbreath lays considerable stress upon the use of what he terms barren lakes in connection with hatchery work. These lakes have in their sea connections high falls or cascades preventing the passage of fish from the sea and usually are quite clear of the enemies of salmon fry. Mr. Callbreath has planted redfish fry in two of these barren lakes, both discharging their water into Burnett Inlet. In 1894 and 1896, 1,000,000 redfish fry were planted each year in Burnett Lake, about 13 miles from the hatchery, and in 1895, 2,000,000 redfish fry were planted in Francis Lake, about 11 miles from the hatchery. The following coho fry have been planted in Falls Creek, previously referred to: 1893, 66,000; 1894, 50,000; 1896, 135,000; 1899, 60,000. The rest of the hatchery output has been planted in the home lake and feeders. The fry are transported as soon after hatching as the weather permits and before the egg sac is absorbed, as they then require fewer changes of water. Coal-oil cans are used for transportation cans; a screw-top mouthpiece, 1½-inch opening, is soldered to the top of the can and the fry are poured in through a funnel having a large opening. A 5-gallon can will hold 30,000 redfish fry, or about 15,000 coho fry, and two such cans placed in the original case make a load for one man carried on the back with pack straps and, if the weather is cold, wrapped in blankets.

The following data, representing the output from this hatchery from July, 1892, to September, 1900, was furnished by Mr. Callbreath:

Year.	Redfish.					Cohoos.				
	Number adults passed over dam.		Total number of fry hatched.	Number of fry planted and locality.		Number adults passed over dam.		Total number of fry hatched.	Number of fry planted and locality.	
	Males.	Females.		Hatchery lake.	Other lakes.	Males.	Females.		Home lake.	Falls Creek.
1892...	13,000	(?)	600,000	600,000						
1893...	13,010	(?)	1,888,000	1,888,000						
1894...	2,438	2,016	4,928,000	3,928,000	\$1,000,000	1,151	(?)	416,000	350,000	66,000
1895...	2,799	2,497	4,960,000	2,960,000	\$2,000,000	256	230	363,000	313,000	50,000
1896...	1,617	2,008	3,880,000	2,780,000	\$1,100,000	134	204	516,000	515,000	
1897...	1,817	1,572	2,000,000	2,000,000		374	338	510,000	375,000	135,000
1898...	1,189	821	1,800,000	1,800,000		590	500	526,000	526,000	
1899...	1,058	1,175	1,385,000	1,385,000		158	142	250,000	250,000	
						991	963	950,000	890,000	60,000
	10,918	10,089	21,441,000	17,341,000	4,100,000	2,503	2,377	3,530,000	3,219,000	311,000
1900...	1,991	1,863	None stripped; fish allowed to seek natural spawning beds.			526	482	None stripped; fish allowed to seek natural spawning beds.		

¹ Both sexes; not included in total.

² Not known.

³ To Burnett Lake.

⁴ To Francis Lake.

In this record it should be remembered that the number of fish passed over the dam is not the number stripped. The number recovered for spawning purposes varies so much that no percentage can be stated, and what becomes of those not stripped is a mystery to the hatchery people. For instance, in 1899 there were passed over the dam between July 16th and October 26th 1,175 female and 1,058 male redfish, a total of 2,233, and from August 29th to November 14th 963 female and 991 male cohoes, making a total of 1,954; of this number 1,367 redfish and 1,231 cohoes were recovered; this includes not only all spawned fish, but all found dead along the shores after diligent and repeated search.

The following experience at the hatchery may be of interest and worthy of record: On September 23, 1898, about 20 spawners were allowed to enter one of the hatchery ponds and spawn. On April 13, 1899, nearly seven months later, these spawning-beds were turned over and a number of young fish found with the egg-sac not yet absorbed. The same run of fish stripped and hatched in the troughs had the egg-sacs absorbed two months prior to that time. It is the opinion at the hatchery that the young go to sea in from 10 to 15 months after they are hatched, though some remain in the lake until they are from 20 to 24 months old.

Mr. Callbreath is positive that his fish will return, but he now believes the time has not yet arrived for the first output to mature. It is earnestly hoped he may realize all he anticipates, for the zeal and enthusiasm which he displays should meet with ample reward. In the meantime he is carrying on a very interesting experiment; if his fish return he will have demonstrated that salmon *do return to the parent stream*, he will have thrown much light on the age of fish, and he will have proved that a stream running a few fish can be made to yield abnormally. If this is demonstrated a law should be passed permitting the leasing of small streams for hatchery purposes and recognizing ownership in fish thus hatched. This would mean a great deal to southeastern Alaska, as it would draw settlers who could make a very good living by operating a hatchery and cultivating the little patches of land that are favorably located.