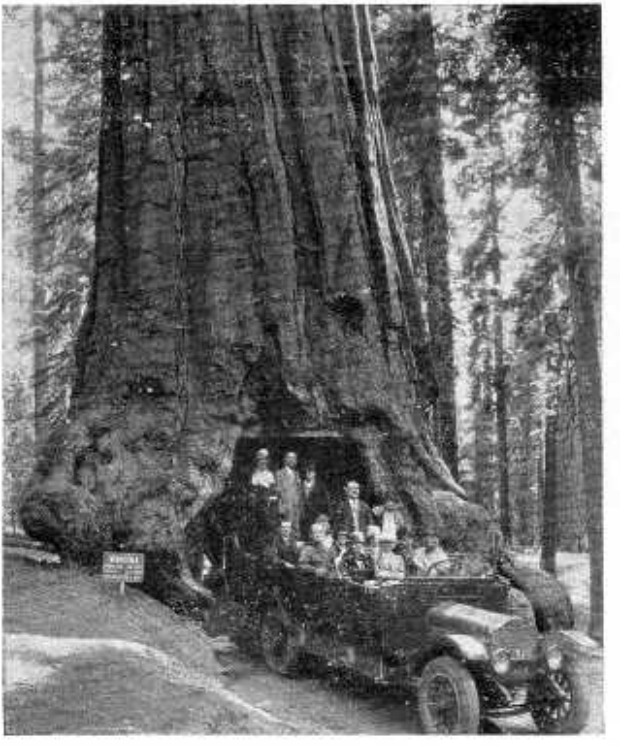
YOSEMITE NATURE NOTES



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The Why and Wherefore of Fall Coloring

(Jr. Park Naturalist C. A. Wagner)

Since the leaves on deciduous trees change color at approximately the same time that we have our first frosts, it is the common belief that the frost causes this change. This implies that it is the low temperatures alone which turn the green to yellow and red, but the truth of the matter is that the frost does not cause or enhance it, but kills the leaves and thus prevents it!

What causes leaf color. The answer to this question is pigments, of which there are generally three present in the leaf throughout the year—green, yellow and orange, although the latter two in small amounts. Green pigment, chlorophyl, is the most abundant and therefore masks the other two. Yellows are produced by the flavone pigments and orange by the carotin pigments. Red is the one color which is not already present, but is the result of the formation of the pigment anthocyanin after the green color has disappeared.

Color change in the fall and the falling of the leaves is due to the same cause. At other seasons of the year color changes may be due to such things as drought, temperature, disease or insects. The full change is a result of the growing inward of a layer of corky cells, known as the abscission layer, at the junction of the petiole of the leaf and the twig which bears it. Towards the end of summer this layer starts growing inward in an ever-contracting ring and eventually cuts the leaf from the branch. When this layer has grown far enough to cut the vessels which lead from the leaf to the tree it does two things—it stops the movement of water from the tree to the leaf, and that of sugar from the leaf to the tree. The sugar is formed in the leaf by the changing over of starch, which is manufactured by

the green chlorophyl from water and carbon dioxide in the presence of light.

Normally this starch is converted to sugar by enzymes (chemical activators) in the leaf and then transferred to the stem. After the conduction vessels have been cut off by the corky layer the sugar is once again acted upon by an enzyme and is changed to glucoside and this by combining with water, forms flavone, the yellow pigment. Further oxidization of the flavone will produce anthocyanin, which is blue in the presence of alkalies and red in the presence of acids. As the sap in the leaves is acid, it gives them a red color.

On some species of trees the color never goes beyond yellow (this is true of the maples and cottonwoods) while on others the leaves will turn orange and red under the proper conditions (poison oak, azalea and dogwood). In all probability the trees on which the leaves turn only yellow the change is due mostly to the unmasking of pigments already present, but in the case where the leaves turn red, it is due to the formation of the pigment anthocyanin in the manner described.

Next time you are outdoors you can prove to yourself that it is not the frost which causes the color. Notice how the trees which grow in sunny, warm locations are much brighter colored than those which grow in the cool, shady spots.

Fish Planting in Yosemite

Ranger-Naturalist Harold E. Perry

(The writer wishes to acknowledge his indebtedness to Mr. Archie Thompson, foreman of the Yosemite Fish Hatchery, and to Ranger William Reymann, for much of the factual material used in the preparation of this article.)

The fish hatchery located at Happy Isles in Yosemite Valley is maintained and operated by the California Fish and Game Commission. It was established experimentally in 1918 to test Yosemite water for fish culture and the results proved so satisfactory that the present structure was built on land leased from the Department of the Interior and began functioning in 1927.

The Yosemite hatchery is maintained at the expense of the California Fish and Game Commission and under the terms of its contract 50 percent of the fish hatched from eggs collected outside of the Park boundaries may be taken by the Commission for use elsewhere, although this is not mandatory. So far all of the fish thus taken have been planted in waters adjacent to the Park area. All fish hatched from eggs collected in Yosemite are to be planted in the Park. The planting operations of the Yosemite

hatchery cover some 250 miles of streams and approximately 100 lakes inthe Park area, and because of the fact that a state hatchery is back of this work, state fishing licenses are required of all persons who fish in this territory, even though it is a national park.

The story of fish culture begins back in the higher mountains where the egg collecting stations are located. As the trout come up stream to spawn, they are caught in holding pens, or "live cars," males to one holding pen and females to another where they are segregated into "ripe" and "green" groupings. When the female trout is "ripe," or ready to spawn, the operator holds her in a gloved hand and with a slight stroking and pressure exerted by his bare hand, he strips her of eggs, which fall into a pan of water. Rainbow trout will average about 700 eggs, and Eastern Brook about 1,200. The male trout by a similar method is stripped of milt, which falls into the pan containing eggs and fertilizes them, fertilization needing to occur within a minute or a minute and a half or it will not take place at all. The eggs are porus at first, but when they strike the water they begin to swell slightly and the pores soon close, making tardy fertilization impossible. Trout mature in from two to three years and after that time they will spawn every year. Males may be stripped several times a year, but females just once.

The newly fertilized eggs are allowed to remain in the pan of water about an hour to "water harden" them and thus prevent them from sticking together. Where the shipping distance is short, eggs may be transported in water within the first day or two after fertilization. Otherwise they are kept in baskets in running water and under dark screens until the "eyed" stage is reached, when the eyes of the trout may be seen developing within the egg. For the first few days the eggs are repeatedly picked over to remove infertile and diseased ones. During the time of development to the "eyed" stage, the eggs must be handled very carefully. If the thin white line which develops within the egg at this time is broken, the egg will not hatch.

Water temperature largely governs the rate of development within the eggs, cold water retarding development more than warmer water. Because of this fact it is difficult to state definitely just how much time is required to reach the various stages. Ordinarily it is safe to say that about 60 days must elapse between the fertilization and hatching of the eggs, and possibly half of that time is required to reach the "eyed" state.

When the eggs are "eyed" they are ready for shipment and packing is as follows. Twenty trays about 14 inches square are placed in a standard case. Each tray is arranged with a layer of moss, then

a layer of cheesecloth, and finally a layer of eggs (possibly 10,000—depending on the size of the eggs). More cheesecloth and more moss are placed on top and the 20 trays are placed one on top of another in the case. There is a space around them for additional moss and a block of ice is placed in a perforated pan in the top of the case so as to drip through the eggs and moss during shipment and retard development.

When the eggs arrive at the Yosemite Hatchery, they are emptied into wire baskets of coarse mesh and these are hung in troughs of running water and are covered with dark screens. As the eggs hatch, the time required depending upon previous development, the tiny trout slip through the mesh of the baskets and lie rather inactively on the botton of the troughs. When hatched, each baby trout has its egg sac attached to it and the contents of this sac serve as its food supply for the first three or four weeks. With the disappearance of the egg sac, it becomes necessary to feed the little trout several times a day, finely ground beef liver proving to be the most satisfactory food.

By the end of the 1935 season, the Yosemite hatchery, with the aid of rangers, will have planted this year nearly 1,500,000 trout—600,000 Rainbow, 400,000 Eastern Brook, 400,000 Loch Leven, and 50,000 Golden. Of the Rainbow eggs, 500,000 were collected at the Big Bear station and were "eyed" at the Forest Home hatchery, the other 100,000 coming from Utah. The Eastern Brook eggs were collected at the Walker lake station and were "eyed" at the Mt. Whitney hatchery, as were also the Golden trout eggs which were collected at the Cottonwood Lakes station. The Loch Leven eggs were collected at the domestic ponds of the Mt. Shasta htchery and were "eyed" there.

The Rainbow is the only native trout in the Yosemite area. It is a lover of rushing, turbulent water. The Eastern Brook, a native of the eastern part of the United States, is planted in still waters of high elevation, such as Tuolumne Meadows. The Loch Leven, a native of Scotland, is also a lover of quiet waters, but it is usually planted at lower elevations than is the Eastern Brook. The Golden Trout is a native of the headwaters of the Kern river and has had a limited planting in the high mountain lakes of Yosemite. Eastern Brook and Loch Leven spawn late in the year when water temperatures are falling, whereas Rainbow and Golden trout spawn in the spring of the year with rising temperatures. While other species of trout have been planted in the Yosemite area during the past, the four listed above make up the major plantings at the present time.

Trout are held at the Yosemite hatchery from three to five months before they are planted, the length of time depending somewhat upon

congestion at the hatchery. When the time for planting arrives, the rangers transport the fish and do the planting. From 1,000 to 3,000 trout, depending on the size, are placed in 10-gallon cans and rushed by auto truck to the point on the road nearest the selected planting area. The trout are given no food for a period of from 24 to 36 hours

YOSEMITE FISH HATCHERY

Erected in 1927 by the California Fish and Game Commission.

previous to this trip so that they will not become "seasick" and foul the water during shipment. It is essential that the water be aerated frequently during the trip and ice is added when necessary. The cans are transferred to horses at the end of the truck run and are thus taken to areas which are not accessible by truck.

When the stream or high mountain lake is reached where the planting is to be made, it is necessary to equalize the temperature of the water in the cans with that of the lake or stream, otherwise the shock resulting from a sudden change of temperature might kill a large proportion of the trout. The actual planting is done in the shallow water at the edge of the stream or lake in order to protect the tiny trout from the large ones found in deeper water, and the small trout usually remain in the shallow area until they are large enough to look out for themselves.

Until the coming of white men into this region, no fish were found in the area east of Yosemite Valley or Hetch Hetchy. Today, because of the activity of the California Fish and Game Commission, this same region is a fisherman's paradise. One of the interesting details in this story of changed conditions is the fact that by the artificial methods present in hatchery practices, man has been able to outdo nature in efficiency. Under natural conditions in the streams, it is estimated that no more than 10 or 15 percent of the eggs deposited ever hatch, but with the artificial methods used in hatcheries, this percentage is raised to 85 or 90. So behind the trout which the fisherman catches in the mountain lakes and streams of the Yosemite area is a thrilling drama of highly organized human effort.

MUSEUM NOTES

Nature Games

(Ranger-Naturalist Paul W. Nesbit)

Nature walks are old standbys, but variety is still the spice of life. Also, progress comes from trying something new. With these ideas in mind and a background of similar successful trials in connection with school work, the writer pioneered, to the best of his knowledge, some new methods in national park educational work. The setting was Tuolumne Meadows, where a select crowd of outdoor enthusiasts is always available, but in limited numbers.

Nature games were announced for one afternoon in place of the regular nature walk, for young folks from 50 down. The group which gathered represented ages from eight to about eighty, but all entered into the spirit. As they arrived, each was given a minute to observe a group of objects laid out in a little cleared space, and then made a report. After this, the group went to the objects and each saw what he had missed. A discussion also gave an opportunity to learn about some rocks, twigs, cones, bark, and so forth. The game next played was Pass Word. While hiking along a trail, people were stationed at various trees, flowers and rocks, and each was told the name of his item. As another person came along, he was allowed to pass if he knew the correct name, but was given the station if he did not. Qoiet and active games alternated throughout the remainder of a three-hour period. Relay procedures, paired contestants, and spell downs were used in various ways.

Votes as to which game they liked best brought mention to every game. Everyone seemed to enjoy the afternoon, and all thought that the method should be developed. Some thought the educative value greater than by other methods. In arranging such a program, it is important to keep in mind the great variety of abilities and ages.

On a later afternoon 32 people appeared for a treasure hunt a la nature. They read a set of directions, part of which are quoted below, and set out at one-minute intervals.

"Once upon a time a certain man in uniform came to the conclusion that one of life's greatest treasures

is exercise; not only exercise of the muscles, but exercise of the senses and mind as well. He therefore hid a desirable treasure token—hid it in such a way that exercise would be necessary to find. Therefore sharpen thy wits and strive to show thy keenness in locating this unburied treasure . . . " Further directions were given concerning locating and following ducks and watching for directions posted upon trees.

Finally the treasure was found to be a box of assorted candy about 15 feet up in a tree. The trail continued right by it until a sign informed them that they had already passed it and must look more carefully along the trail they had just been over. One of the points stressed throughout the trail was keen observation. The trail was about a mile in length, and it took about two hours from the time the first one started until they had all found the treasure.

After the treasure was passed around, a discussion took place in which it was brought out how and why people had made their mistakes, and many doubtful situations were cleared up. The discussion seemed to impress all with how much they had learned, and how terribly dumb they had been in certain instances. The method was highly praised and its greater development urged. Its use in other educative work was commented upon and a great value proclaimed viz; one is rewarded for being correct at each turn of the trail, and must pay in trouble at each turn for a mistake. It seems to be a great incentive for accuracy.

Other such treasure hunts might end in something more abstract, like a spring of good water, or a wonderful view. I would not recommend such procedures as I have outlined to be used to any great extent, but I think they are worthy of consideration as occasional flavor in a naturalist program.