The pen was put into operation on January 15, 1960 an "15 newly trapped hares were placed in one unit. Numerous Norway spruce bo s were stacked for additional cover, and aspen saplings were cut and supplied r food. It was soon found that the nuisance of cutting fresh browse and removing t old, plus the attendant harassment of the hares, could be eliminated by feeding mmercial rabbit pellets. Also, snow accumulated to an extent that required an a[redacted]tonal 2 feet of fencing to prevent escape. When hares were later put in the secon unit, spruce and pine boughs were set butts down, three or four together, to form s 11 teepees. The hares readily accepted such shelter and the commercial food pel ts from weather-proof troughs

The first lot of 15 hares were held a week for bservation of behavior and condition. Then 20 hares were placed in the second nit of the pen. By this time those in the first unit were noticeably quieter and b ter adjusted than the new arrivals. They did, however, continue to "fight" the wire ecause of lessening shelter as the snow deepened and became more impacted. Befo e hares were placed in the third unit, slatted wooden snow fencing was fastened the inside of the poultry wire. This reduced the possibility of eye injury from t wire and increased the protective cover. Snow fencing was later installed in the oth r units and would be desirable even though 1-inch-mesh wire were used.

By the end of the winter of 1960 t hares had so chewed the wooden snow fence that some entanglement occurred betw en it and the outside poultry wire. Therefore, in 1961 a facing of 1 x 2-inch-mesh el tric-welded fencing was installed inside the snow fence. Any additional pens will b constructed of such electric-welded fencing 4 feet high surmounted by 4 feet of 1-in -mesh poultry wire. The snow fence outside this can be either per or seas al as desired. Gates or doors should be 1½ feet above the ground to facilitate e throughout the winter without excessive chopping of impacted snow. A small s w blower can be effectively used to clear pens before and between use periods.

From the experience of two seasons, a maximum of 20 hares per unit can be successfully held in a pen of is sort through mid-February. After that time, fighting induced by the mating se on can be expected. However, hares in a ratio of about 60 per cent females to 40 er cent males were held without trouble from March 7 to 17, 1961. While no visi le injuries from fighting were evident, this was probably due to adequate evergreen ough shelters.

Hares were seldo eld more than 2 weeks before being shipped. In catching the penned hares for ship ent, it was found that box trapping entailed less harassment than using a net.

Although the p ssibilities for predation were great, none occurred during the two years of operation en though coyotes ran ed w h'n 150 yards of the pen and fisher tracks were foun within ¼ mil [redacted]e s frequente and building area nearby. No evi ence of o was noted.

FEEDING DYES TO CARP[1]

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During the past three decades [redacted]e seen made to color fish and other animals for various reasons and with limited success. Lack of success has probably been the result of relatively meager effort. Thousands of dyes are available, but few have been tested. Thus, there is no reason to believe that fish could not be permanently marked if dipped in, fed, or injected with certain dyes. Experiments with coloration by injection and dipping have been made by several workers and at the Fish Laboratory at Livingston Manor (N. Y.). Dipping in several water-soluble dyes such as Rhodamine B, Bismark brown, and neutral red has produced coloration lasting for several days in adult carp. Injection of numerous substances has produced marks which have lasted for weeks or months, and one dye, Pontamine Fast Pink (Dupont), has produced local pink marks which have remained for over a year after first turning the entire fish a bright pink. The work reported here involved feeding

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dyes to fish in attempts to increase consumption of food and to cause coloration of trout and carp.

Certain species of fish appear to prefer foods which are red in color. This has been demonstrated for trout by various workers. F D & C Amaranth #2, a water-soluble certified dye, was used by Wolf (1953) to dye fish pellets red. Wolf concluded that the red pellets were picked off the bottom, while ordinary tan baits or those colored green, blue or yellow were often ignored. Red pellets have been used for a number of years in trout hatcheries with varying reported degrees of success. Brook trout in this laboratory definitely appear to be attracted strongly toward the colors red and yellow. Adult carp show no apparent color preference under laboratory conditions, but fingerlings do. Bright colors are favored, red especially. The use of certified food colors for increasing pellet consumption is preferable because they are inexpensive, harmless and tasteless. They also hold in doughy foods until the foods decay despite the fact that most are water-soluble.

Food dyes were fed to carp in an attempt to color the epidermis of the fish for long periods of time. The purpose was to determine the percentage of a carp population which might eat a poison bait. Various food dyes produced no external effect but were found to be useful in another way. The percentages of carp populations which ate various baits in ponds were determined by feeding water-soluble dyes. In this case the fish were killed some hours after feeding and the intestines examined for the presence of the brightly colored feces. Red proved to be the best for this purpose when dark foods were used. Yellow was suitable for light-colored foods only. Water-soluble food dyes proved to be completely palatable.

Almost any palatable dye will do for staining the intestine and feces. Other dyes fed to carp were as follows: F D & C Yellow #4, an oil-soluble food dye which was slightly unpalatable at a level of 2 per cent; F D & C Red #27, a slightly water-soluble dye which was also slightly unpalatable; cadmium red and cadmium yellow, both insoluble in water and palatable; indigotin, a blue, insoluble and palatable dye which was unsuitable for feces staining becauses it closely resembled the dark coloration of some natural foods; Sudan III, a red, oil-soluble and palatable dye fed at doses up to 280 milligrams per kilogram. None of these produced any external coloration of fish.

Another dye, alizarin red S, was fed to carp at a concentration of 5 per cent. Although slightly soluble it was readily eaten. No external coloration was produced. Alizarin is contained in madder root which was fed by Lawrence (1941) to rainbow trout over a period of six weeks to produce a red color in bones.

Rhodamine B, a reddish, very soluble powder, was fed to carp in two ways. Baits, each containing 2.6 milligrams of shellaced particles of dye, were ineffective because the particles were rejected although the remainder of the bait was eaten. The particles dissolved in a few hours, turning the tank water a bright pink.

Other baits consisting of 1 part of Rhodamine B to 9 parts of flour were shellaced and fed to carp. Four fish rejected the baits with shredding. One fish consumed several baits and was colored a dark pink for 5 days. On the 6th day the color had lightened and on the 7th it was just distinguishable.

Single feedings of the oil-soluble dye Sudan black (Solvent Black 3, Colour Index No. 26150) produced a blue coloration of all tissues but tooth enamel. The external blue coloration appeared first in the mouth some 24 hours after ingestion of a sufficiently high dose, and then spread to the chin and throughout the body. Carp were unaffected by the dye which, at a water temperature of 65° F., persisted for from several days to months depending on the dose ingested. The dye is completely insoluble in water, and is palatable. Several case histories may be pertinent.

Seven carp were fed as many 3/8-inch dyed flour baits (containing 2.7 per cent of Sudan black) as they could eat. All fish became dark blue in 24 hours and the color has persisted in diminishing degrees for 60 days at this writing. Similar feeding of I per cent baits produced a lighter blue which has persisted for 44 days.

Carefully administered doses to individual fish, either in single meals or over a number of days, showed that 75 mg/kg are necessary for sure external coloring. Accumulation in and loss from the tissues was demonstrated.

Neither a single meal of 19 mg/kg, or 37 mg/kg fed over a period of 12 days, produced external coloration. In the latter case the intestine was blue throughout. Single meals of 39, 47, and 58 mg/kg produced coloration of the mouth at the lowest dose and of both mouth and chin at the higher doses. In all three experiments the color disappeared in 2 weeks or less. At higher doses the coloration was more intense, extended over a greater portion of the body and also lasted for longer periods. Sixty-seven ing/kg produced heavy coloration of the entire head for 10 days at which time the fish was killed because of heavy fungus infection. Seventy-eight and 143 mg/kg produced intense coloration of the head and belly, the lower dose causing coloration for 30 days while the other fish was light blue at the end of that time. Obviously the dye is either lost from or changed within the body as time goes on.

Temporary accumulation in the body was demonstrated by feeding two fish varying amounts of dye over a period of time; 37 mg/kg fed over a 3-day period produced a light blue coloration of the mouth on the 4th day, and an additional 16 mg/kg on that day caused a darker coloration by the 7th day. The chin had lost its color by the 9th day, but the mouth was blue until the 17th day. Fifty-three mg/kg fed to the second fish over a period of 13 days did not cause external coloration. A total of 76 mg/kg by the 17th day produced a blue coloration of the mouth and chin by the 21st day.

Although Sudan black baits containing up to 4.8 per cent of the dye were palatable to carp this may not be true of some other species. The black color probably influences the degree of attractiveness. Pumpkinseed sunfish would not pick up the black baits although red baits were accepted. Most 6-inch brown trout would not accept the baits; five fish did and became blue. Single forcefeeding of large doses of baits caused a deep blue coloration of brook trout and brown trout in 6 and 4 days, respectively, at a water temperature of 47° F. Goldfish accepted the baits and became blue.

Injections of a solution of Sudan black and peanut oil into the body cavity and musculature of carp were without effect. The solution remained unchanged at the injection site until dissection after 10 days.

Use of Sudan black would, of course, be dependent to some extent on the effect upon humans and other animals that might eat dyed fish. Boiling carp flesh for 10 minutes did not destroy the dye, but decomposition quickly eliminated the color properties. Sudan black was fed in unknown quantity to three white rats at a concentration of 1 per cent. The bait was eaten readily within a few hours, after which watery black feces were formed. The feces were also eaten. The rats appeared to be somewhat affected by the dye, but no external tissue coloration was noted. The animals would not eat the dye thereafter. Sudan black, which stained fat in mice according to New (1959), might not be suitable for use in fish that may be consumed by humans. This can be determined only by additional tests. Dyes which can be used probably exist. Marking hatchery trout by mass production methods is a suggested use.

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INDEX FOR VOLUME 8