

weeks of larval life. The cylindrical glass jars in which the eggs of many species are hatched, though cleanly and convenient, are wholly unadapted for holding the fry, and the more rapidly the young fish are enabled to pass from the dazzling glare of the crystal vases to the more shady and gloomy surroundings of the large receiving tanks the better for the fish. Assistants in hatching establishments rarely realize the harm that may be done by allowing fry to remain a few hours, or it may be a whole day, exposed to glaring light, and they should be strictly instructed on no account to keep fry longer than can be avoided in the blinding light which beats upon them after they emerge from the eggs in hatching jars. There is not this danger in the case of fry which are hatched out upon trays: but towards the close of the period of egg-incubation, hatchery officers should keep a sharp eye upon the hatching jars in which whitefish, or shad, or pike-perch (*doré*) are developing to see that the current is adjusted sufficiently to carry the fry off without any delay. Experienced men are frequently puzzled by the apparent weakness and lack of vitality in whole batches of fry, while others are robust and strong. The explanation is not far to seek, for in most cases it will be found that the weakly fish were delayed too long in the glaring environment of the hatching jars.

Again, it must be remembered that larval fishes possess extremely delicate hearing organs. The ears, one on each side of the head, a little in front of the breast fins, are of an oval shape, like an egg-shaped sac or chamber, filled with clear fluid or endolymph, and containing one or two, sometimes three, small limy pellets, the ear stones or otoliths. Several sensitive cushions of nervous matter, studded with hairs or delicate bristles, occur inside the chamber of each ear. These cushions are connected with the auditory nerve, or nerve of hearing. The ear is completely closed up, and receives vibrations or sound waves through the delicate walls and skin covering the head. Shaking the fish rudely, rough handling of any kind, and loud hammering, or other violent noises, cause the ear fluids inside the earsacs to vibrate too vigorously. This produces concussion of the otoliths or ear stones, which may even be knocked out of their places, damaging the delicate auditory cushions of nervous matter, and producing serious disorganization.

Damage done to the ears may result in sickness and rapid death. The intelligent fish-culturist will take every means to avoid all perils and risks, and will bear in mind that fishes when newly hatched have hearing organs of special delicacy and sensitiveness.

A further point, which is often overlooked in hatcheries, is the character of the skin in young fishes. It is not provided with scales, as in adult fishes generally, or dense and leathery as in catfish, the leather carp and many mature forms, but in all young embryo fishes it is naked and very thin, and often as transparent as glass. Indeed, as the Michigan State Fish Commissioners remark in their 12th Biennial Report, 'The fry of whitefish are so transparent for several weeks after hatching that, when confined in glass aquaria in a well lighted room, the presence or absence of food in the stomach may be determined almost at a glance. The presence of their natural food is especially noticeable, as it casts a reddish tinged line throughout the food canal.' Many larval fishes, moreover, are provided with external sensory organs arranged in a series along each side of the body. In some the tips of the jaws and the front end of the snout have similar organs of feeling or touch. These organs are usually like small mounds or bunches of nervous cells, surmounted by a group of projecting hairs. I have counted as many as seven to ten pairs of such organs in the body of a young fish. Some fish have more, some less, but in all cases they are so sensitive that they cannot fail to be seriously injured by rough treatment or violent concussion. Hence fish larvae must always be gently manipulated. In emptying large quantities from one vessel to another, they should not be violently poured out, with accompanying splashing and concussion, nor should they be suddenly transferred from a high to a low temperature. The skin and delicate sense organs of fishes are as sensitive as the eyes or the tip of the tongue in ourselves, and all harsh or hurtful influences and trying conditions render the fish less likely to survive, or may even prove immediately fatal.

It is a good provision to test the temperature of the water in which the fry are contained and the temperature of the water into which they are to be emptied. In