

in the size of the ova. From larger ova finer and rapidly growing fry are produced; consequently, by a judicious selection of breeding fish, races may be improved, while it is only where segregation is efficiently carried out that such selection is possible.

96.—EFFECT OF SUNLIGHT UPON SHAD EGGS.

By W. F. PAGE.

In May, 1881, at Gunston, Va., on the Fish Commission barges, I observed for the first time the peculiar and astonishing effect of direct sunlight falling on shad eggs. Having occasion to make an unusually large deposit of embryo shad in the channel of the river at a time when our buckets and cans were in use, I used a large shallow tin pan in which to transport the "leavings" of the cones. Previous to taking the row-boat out to the channel, I placed the pan on the outer deck of the barge and went back to some work in the hatchery. Returning in a few minutes, I was surprised to see the pan alive with fish, and it occurred to me that this might be brought about by the direct sunlight falling upon the eggs. Since that time I have had abundant opportunity to test this phenomenon, and have adduced the following facts: (1) That the time of hatching any particular lot of shad eggs can be shortened from twelve to fifteen hours by judiciously exposing them to direct sunlight in shallow, highly-polished pans; and (2) that the fish so procured are fully equal in vitality to those allowed their full time in the eggs. During the spring of 1884, I made a practice at Central Station, when a car shipment was wanted by a given time, of placing the youngest eggs where the greatest amount of direct sunlight would fall on the hatching jars, at the same time giving the older eggs less light as development was more advanced. This was done with a view to hastening the younger eggs and retarding the older, so that the fish for the entire shipment might all hatch about the same time. By this means I have, on several occasions, been enabled to hatch out at the same time different lots of eggs having a variation in their ages of as much as thirty hours. In my reports of the work at Central Station for the seasons of 1883 and 1884 it will be observed that there are considerable variations in the time of the incubation of eggs of the same age; which is to be explained by the difference in the amount of light the hatching jars received. I have not been able to observe with the thermometers at my command any increase of temperature in the water employed in the work with the pans, and the pans painted black are entirely useless for the purpose. Though many fish-culturists deprecate the effect of direct sunlight on fish eggs as having a weakening effect on the embryo, experience has demonstrated that the fish assisted in this way are as strong and travel as well as those allowed their full time in the egg.

WASHINGTON, D. C., July 1, 1884.