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Light as a factor in fish dispersal.

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During the summer of 1922, certain observations and experiments were made at the Woods Hole Laboratory of the Bureau of Fisheries that add to our ability to interpret the behavior of fishes in the field.

Ten fish at a time, males of the species *Fundulus heteroclitus,* about 9 centimeters in length were placed in each of twin troughs 10 feet x 4½ inches x 4 inches, with glass plates at the ends and with a middle intake at the bottom and the outlet under a glass plate which could be changed in position.

The troughs were conspicuously marked off in feet and records of the position of the fish were taken at intervals of 15 minutes during the course of the experiments. The records were for example—2 P. M. 6 (fish) at 4 (feet from illumination); 4 at 7.

Light adaptation was secured by means of a 200 watt Mazda light suspended above the troughs; while dark adaptations were accomplished by leaving the fish overnight in running water, available in the troughs at all times, or by the use of light proof shades for shorter periods of preliminary adaptation.

Light stimuli were applied by means of two 40 watt Mazda lights of equal intensity, placed in twin lamp houses, which like the troughs, were blackened inside and outside and which were equipped with rectangular slits, ½ inch in width and 2 inches in length, so that light could be directed in a narrow beam through the clear glass ends of the troughs or through the Eastman monochromatic filters that were sometimes interposed.

The experiments to be here recorded are as follows:

I. Temperature uniform, current stopped 15 minutes prior to experiments.

1. Dark adaptation 12 hours (over night), room darkened, light stimulus applied for 10 trials at left and 10 trials at right of trough.

Temperature	Positive heliotropism
20.5°C.	63.3 per cent.
18. °C.	80. per cent.

These experiments serve to indicate that migration in the cooler water may be influenced somewhat by the action of light, and may even be in part due to light. However, the well-known fact that hibernating fish come out and swim around under thin sheets of ice, after the sun has risen, may be directly correlated. It is quite possible that before the sun has warmed the water, its rays may serve to stimulate surface swimming. The clear sky contributes to attractiveness of the shallower waters offshore.

Alewives are known to rest in small pools at night and to travel only by daylight. On the other hand, shad, although they travel by daylight, evince great fear of shadows. Light sensitivity is well marked in many of the migratory fishes, although it is quite variable.

2. Dark adaptation 12 hours, room darkened, monochromatic lights used.

When monochromatic lights were used, the reactions to red, blue and green seemed attributable to intensity rather than to color. The investigations of White, Reeves, Reighard and others will be discussed in another more complete resume of the subject of fish responses.

3. Light adaptation 3 hours, room darkened at time of experiment.

The average percents of positive heliotropism were so remarkably low in the case of both the normal temperature of 20.5°C. and the lower one of 18°C. that the movements were considered as random movements. After one-half hour of darkness, the fish began to react definitely to light stimuli. Since the fish were in their troughs undisturbed by agitation, the distinctly negative results thus obtained may be considered as more reliable than those reported by Hess under exaggerated stimuli from moving the aquaria to the window and then into a dark-room.

II. Temperature of troughs graduated from left to right; fish dark adapted 12 hours, illumination stimuli changed from warmer end to cooler end.

Temperature		Positive heliotropism	
Left	Right	Left illuminated	Right illuminated
32 C.	28 C.	60 per cent.	70.25 per cent.
30 C.	26 C.	65 per cent.	72.5 per cent.
17 C.	21 C.	60 per cent.	75. per cent.

It is evident that when given a choice of temperature and light combinations, the fish used is influenced somewhat by the attractiveness of light, even toward water much warmer than the optimum at the season. It is also evident that responses to light in fish are not remarkably accelerated by water warmed as much as 10 degrees above the normal of 20.5C. at the time these experiments were made.

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The pharmacology of Tang Kuei.

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Tang Kuei, identified by E. H. Holmes as the root of Angelica Anomala, var. Chinensis, is used in native medicine in the treatment of menstrual and puerperal disorders and sterility in women, being sold as thin slices of a woody root, having a sweetish taste and an aromatic odor. It is on the western market under the name of "Eumenol." Previous investigators[1, 2] ascribed its action to volatile ingredients, being unable to isolate from it an alkaloid, glucoside, or other active principle.

A simple extract of the drug, injected intravenously in anesthetized dogs, uniformly caused: (a) marked circulatory depression; (b) prolonged and striking diuresis; (c) contraction of uterine, bladder and intestinal muscle.

After removal of volatile material by distillation, the residue was still effective; the distillate sometimes caused contraction of uterus or gut, but large doses were required.

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1 Buffalini, *Annali di farmacologia*, 1900, 140.

2 Sakai, *Tokyo Igakeekai Zosshi*, 1916, xxx, 19.