BLEEDING AND HEAT DEATH IN THE SOUTHERN OYSTER [1/]

By Milton Fingerman* and Laurence D. Fairbanks*

In a previous investigation (Fingerman and Fairbanks 1956) the authors postulated that (1) the oyster (Crassostrea virginica) has very little ability to control the volume of its body fluids and (2) one of its responses to physiological stress is a generalized bleeding, loss of body fluids. The experiments described below were designed in order to test this hypothesis by determining if application of heat evokes the bleeding reaction.

Fig. 1 - Examining oysters under a microscope. In the rear are holding tanks with oysters.

In the first series of experiments oysters were heated at different rates. The number of survivors and weight changes were noted. The slower the rate of temperature increase the lower was the temperature required to kill 50 percent of the oysters. With rapid temperature increase, 13.2° C. per hour, 50 percent of the oysters were killed at 47.5° C.; whereas with a temperature rise of 0.74° C. per hour, 50 percent were killed at 41° C. Thus the upper lethal temperature of the oyster depends upon the rate of temperature rise. The oysters also lost body fluids in response to the heat shock. The amount of fluid lost varied inversely with the rate of temperature rise, i.e. oysters heated slowly lost more body fluids than oysters heated rapidly.

In the second series of experiments oysters were placed directly into constant temperature baths thus utilizing an abrupt rather than a gradual thermal change as was done in the first series of experiments (fig. 3). No heat death occurred among oysters maintained at 35° C. Twenty-nine percent were killed after three hours at 40° C. Fifty percent were killed after 25 minutes at 45° C. The higher the temperature of the water bath, the faster the oysters were killed. The loss of body fluids was also determined at the time the oysters were removed from the water baths. The results (fig. 4) indicated a relationship between exposure time, temperature, survival, and body-fluid loss. However, the relationship is not a simple one for an oyster does not die when it has lost a definite percentage of its original body weight as body fluid. A higher temperature, e.g. 45° C., caused greater fluid loss and more rapid death than did a lower temperature 42° C. Furthermore, for the same exposure period, greater survival and less fluid loss was evident at 42° C. than at 45° C. At the 50-percent survival level more body fluid was lost by oysters maintained at 45° C. than at 42° C. Oysters replaced in the holding tanks after removal from the water baths were able to take back some of the fluid they had lost.

Fig. 2 - Examining oysters in the holding tanks.

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The results of these experiments support the hypothesis that generalized bleeding is one of the responses of oysters exposed to injurious stimuli. Apparently oysters have not evolved protective mechanisms since they are able to shut their shells and isolate themselves from injurious agents in their environment. However, when they are unable to counteract the harmful stimuli, the generalized response appears to be a loss of body fluids.

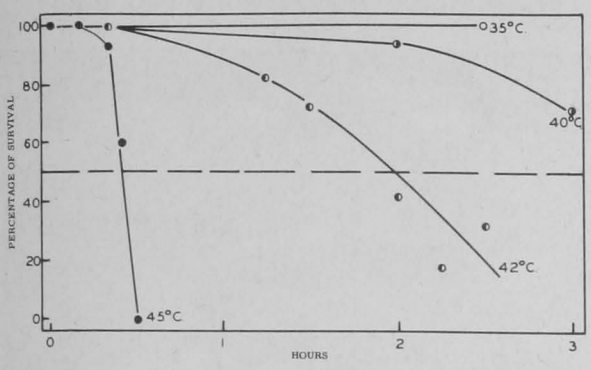

Fig. 3 - Effect of water temperature and duration of immersion on the survival of southern oysters.

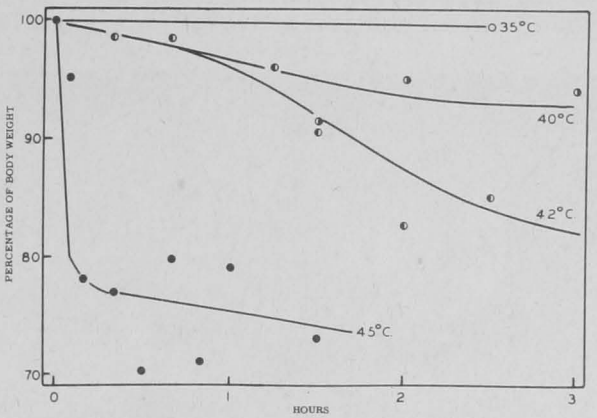

Fig. 4 - Effect of water temperature and duration of immersion on the loss of body fluids in southern oysters.

During some preliminary experiments the observation was made that not all the oysters killed by the heat shock gaped as had been assumed by another investigator. The more rapid the rate of temperature rise, the greater the percentage of oysters that are killed with their shells closed tightly. Commercial users of oyster-shucking machines are faced with a problem in this regard because the machines are designed on the theory that all steamed oysters will gape.

LITERATURE CITED

Fingerman, M. and Fairbanks, L. D.
1956. Some Factors Affecting Fluid Loss in Southern Oysters. Commercial Fisheries Review, vol. 18, no. 1, (January), pp. 10-11.

DESCRIBING THE STATE OF THE SEA

The state of the sea may be expressed according to the following scale:

Height of Wave	Description of Sea
0 or less than one foot	Calm sea
1 to 2 feet	Smooth sea
2 to 3 feet	Slight sea
3 to 5 feet	Moderate sea
5 to 8 feet	Rough sea
8 to 12 feet	Very rough sea
12 to 20 feet	High sea
20 to 40 feet	Very high sea
40 feet and over	Precipitous sea

--Sea Secrets, The Marine Laboratory, University of Miami, Coral Gables, Fla.