

It appears that we can safely generalize and say that *Pseudolabrus* responds to the warm season with a loss of temperature sensitivity.

Throughout this study I have sought to relate seasonal metabolic changes to thermal conditions. Although temperature history is generally conceded to be the most important single factor in bringing about such metabolic changes, it is certainly not the only one. Hoar and Robertson (1959) have demonstrated that length of photoperiod, with temperature as an experimental constant, could significantly change the upper lethal temperature limit. It is quite possible that light, or perhaps some other environmental factor, may have caused some of the enigmatic results in the present work—e.g., the contrasting temperature coefficients of Periods I and III in *Pseudolabrus*.

The present study is a descriptive one, and although I have tended to ascribe certain of the observations to effects of thermal history, I do so with caution. Firm conclusions as to cause and effect relationships will necessarily depend upon experiments on animals having carefully controlled laboratory histories.

ACKNOWLEDGMENTS

I am genuinely obliged to the John Simon Guggenheim Foundation and to the National Science Foundation for supporting (G-23319) this study. I am also grateful to Dr F. W. Munz and Dr B. T. Scheer for criticism of the manuscript, to Mr J. Moreland, of the New Zealand Dominion Museum, for identification of the fishes, and to Dr E. J. Batham, Director of the Portobello Marine Biological Laboratory, for providing research facilities and helpful advice.

LITERATURE CITED

- BRETT, J. R., 1956. Some principles in the thermal requirements of fishes. *Quart. Rev. Biol.*, 31(2): 75-87.
- BULLOCK, T. H., 1955. Compensation for temperature in the metabolism and activity of poikilotherms. *Biol. Rev.*, 30: 311-342.
- FRY, F. E. J., 1957. Aquatic respiration of fish. In: Brown, M. E. (ed.), *The physiology of fishes*. Academic Press, New York.
- HOAR, W. S., and ROBERTSON, G. B., 1959. Temperature resistance of goldfish maintained under controlled photoperiods. *Canad. Jour. Zool.*, 37: 419-428.
- MATHER, K., 1951. *Statistical analysis in biology*. Methuen and Co., London.
- MORRIS, R. W., 1961. Distribution and temperature sensitivity of some eastern Pacific cottid fishes. *Physiol. Zool.*, 34(3): 217-227.
- , 1962. Body size and temperature sensitivity in the cichlid fish, *Aequidens portalegrensis* (Hensel). *Amer. Nat.*, 96: 35-50.
- , 1963. A modified Barcroft respirometer for study of aquatic animals. *Turtox News*, 41(1): 22-23.
- SUHRMANN, R., 1955. Weitere Versuche über die Temperatur-adaptation der Karauschen (*Carassius vulgaris* Nils.). *Biol. Zentralbl.*, 74: 432-448.
- WOHLSCHLAG, D. E., and JULIANO, R. O., 1959. Seasonal changes in bluegill metabolism. *Limn. Oceanog.*, 4: 195-209.

PROFESSOR R. W. MORRIS,
Department of Biology,
University of Oregon,
Eugene,
Oregon, U.S.A.