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LETTER TO THE EDITORS

The significance of the response of pelagic marine animals to solar eclipses

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Dear Editors,

I WOULD like to comment on the article written by Dr. Elizabeth Kampa about the response of a sonic-scattering layer during the total solar eclipse of June 30, 1973 (KAMPA, 1975). In her article, Dr. Kampa cites several previous studies, including that of BRIGHT, FERRARI, MARTIN and FRANCESCHINI (1972), of the March, 1970, eclipse. Although she mentions the response at totality by certain epipelagic zooplanktonic crustaceans, namely *Nannocalanus minor*, *Scolecithrix danae*, *Undinula vulgaris*, and *Stylocheiron carinatum*, observed by BRIGHT, FERRARI, MARTIN and FRANCESCHINI (1972), I would like to emphasize the important observation noted by them during the night following that eclipse. At that time the distributions of the above-mentioned species, as well as *Pleuromamma gracilis*, *P. piseki* and all the euphausiids, differed from those of the night preceding the eclipse in that very few animals were collected at 25 m. The differences in distributions of these species during the three periods of darkness (pre-eclipse night, total eclipse at local solar noon, and post-eclipse night) lead to two conclusions. The response of these epipelagic crustaceans at totality indicates that, if given an opportunity, they will exhibit an exogenous reaction to perturbations in their light environment. The distributions during the following evening, which also differ distinctly from the distributions at totality and markedly from those of the previous evening, lead me to believe that the diel migratory behavior of these animals is governed by an endogenous rhythm. This hypothesis was first suggested by EASTERLY (1917). Thus although a single perturbation in the *zeitgeber* (time-giver) cannot reset a biological clock, here the perturbation in the light cycle seems to have disrupted the subsequent entrained behavior. This disruption was manifested in the anomalous distributions of the animals during the following evening. I believe Dr. Kampa also observed the result of such a disruption in the animals of the sonic-scattering layer during the evening following the eclipse. BRIGHT, FERRARI, MARTIN and FRANCESCHINI (1972) could not observe the eventual resolution of these anomalous distributions through succeeding evenings because of lack of study time.

Although the mechanism of vertical migration is maintained by an endogenous rhythm that is entrained by the *zeitgeber* (the rising and setting of the Sun), the cause of migration must be the response by the animals to their particular biological needs. The location and capture of food and the location of a mate during the reproductive cycle would be two of the most important needs. That vertical migrations can be roughly correlated with the external cycle of the *zeitgeber* should not be interpreted as the cause and effect relationship as has often been done (RUSSELL, 1927).

I join Dr. Kampa in her suggestion that additional attention be given to studies of pelagic animals during solar eclipses. In the future I suggest that several days should be spent on station before the event to survey pre-eclipse distributions and the study should also be extended for several days after totality to determine the temporal extent of any post-eclipse changes.

FRANK D. FERRARI
Oceanographic Sorting Center,
Smithsonian Institution,
Washington D.C. 20560, *U.S.A.*

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