

SIZE-FREQUENCY DISTRIBUTION
C. EQUESETIS

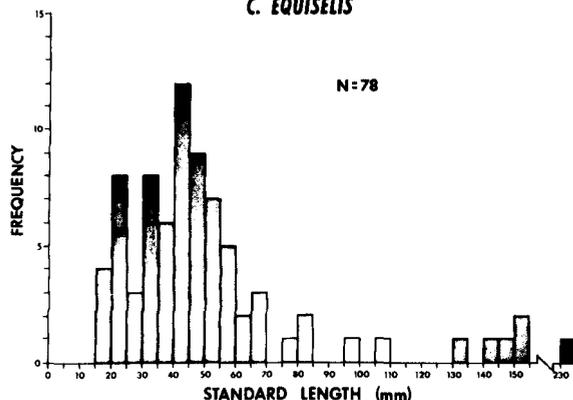


FIGURE 3.—Size-frequency distribution of *Coryphaena equisetis* which were attracted to the night light and caught in dip net during ATEX aboard the RV *Discoverer*, February 1969.

data, I infer that the species spawns in the tropical mid-Atlantic during January and February.

My specimens are presently stored at the Tropical Atlantic Biological Laboratory, Miami, Fla.

I thank Drs. Bruce B. Collette, Robert H. Gibbs, Jr., and Robert V. Miller for reviewing the manuscript, and Grady W. Reinert for preparing the illustrations.

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RESPIRATORY, BEHAVIORIAL, AND
ENDOCRINE RESPONSES OF A TELEOST
TO A RESTRICTED ENVIRONMENT

It is common practice when measuring fish respiration or activity to allow a varying length of time for the fish to become accustomed to the restrictions imposed by the apparatus and to allow time for any oxygen debt to be repaid (Fry, 1957). The following observations indicate that such a procedure may introduce complications in the interpretation of results since the acclimation process results in changes in respiration, behavior, and endocrine activity.

Poecilia reticulata males were placed in groups of 10 in the 100-ml chamber of a continuous flow respirometer. Animals were maintained at 25° C with a 12-hr daylength and fed daily at the start of the light period. Measurements of oxygen were made with the wide bore dropping mercury electrode (Briggs, Dyke, and Knowles, 1958) or by the micro Winkler method (Fox and Wingfield, 1938).

A daily cycle of routine respiratory activity in such an apparatus has already been described (Sage, 1968). The minimum of oxygen consumption occurs at the end of the dark period 23 hr after the last feed and this rate approximates to the standard metabolic rate. Measurement of this rate at daily intervals indicates a progressive fall in standard oxygen consumption (Table 1). A similar fall in respiratory rate

TABLE 1.—Effect of number of days in respirometer on standard rate of oxygen consumption of a group of 10 fish.

Days	Oxygen uptake mm ³ /g/hr
1	212
2	156
3	126
4	109

to a base line of approximately 100 mm³/g/hr was observed with four other groups of fish whereas control animals from large containers

maintained a standard respiratory rate of approximately 200 mm³/g/hr.

On removing these fish from the apparatus, their behavior was seen to be very different from control animals kept in 30-liter aquaria and similar to the previously described behavior of fish treated with thyroxine (Sage, 1968). Thus all fish jumped during a 15-min period after transfer from the respirometer to a 50 × 25 cm aquarium with a depth of 2.5 cm of water while only 17% of control animals jumped (Table 2). Similarly all fish kept for 7 days in 500-ml containers and fed ad libitum jumped when transferred to shallow water. The response was therefore to the restricted containers and not to the abnormal once-per-day feeding regime imposed in the respirometer.

TABLE 2.—Effect of maintenance conditions or thyroxine on frequency of jumping.

Treatment	Percentage jumping (number of individuals)
4 days in 100-ml respirometer	100 (30)
7 days in 500-ml container	100 (30)
28 days with thyroxine (1 in 2 × 10 ⁶) in 30-liter container (Sage, 1968)	37 (28)
Control fish in 30-liter container	17 (28)

Sections through the proximal pars distalis showed a degranulation of the TSH cells in the pituitary glands of both groups of fish that had been kept in restricted environments. This was not seen in control animals. Stimulation of the thyroid gland is thus a probable cause of the observed changes in behavior and may also account for the respiratory changes. A fall in standard respiratory rate has been previously observed and attributed to progressive starvation (Fry, 1957). This cannot explain the present results since all respiratory measurements were made an equal time after a feed.

The responses reported here were obtained with container to fish volume ratios of 100 and 500:1. These are larger than the chambers used in most fish respiration studies. Thus Geyer and Mann (1939) suggested a ratio of at least 10:1 for *Perca*.

The present observations indicate that acclimating fish to a restricting apparatus may stimulate the TSH cells and thyroid and produce

changes in behavior and respiration. This may be particularly confusing where seasonal changes are being investigated since thyroxine has been implicated in processes of acclimation (Hoar, 1959) and seasonal changes in fish thyroid activity are widespread (Matty, 1960; Swift, 1960) and may be related to seasonal changes in respiratory rate (Fisher, 1958).

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