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An Analysis of Successive Spawns of Orange Chromides, *Etroplus Maculatus*

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ABSTRACT

Successive spawns of the Orange Chromide, *Etroplus maculatus*, were analyzed for changes in the lipid weight per egg, total weight per egg and total egg number. These factors were used to describe investment in egg production of females through three successive reproductive cycles. There were no significant differences between the number of eggs produced or in the average weight per egg from each of the three reproductive cycles. Lipid weight per egg, however, decreased significantly from the first through third cycle. The adaptive significance of the drop in lipid weight is discussed.

INTRODUCTION

Lipids are important for reproduction as indicated in several studies. They contain more than twice as much energy per milligram as carbohydrates or proteins (Hill, 1976). Lipids are used as an energy source during development of many insects. For example Yurkiewicz and Oelsner (1969) examined Indian meal moths, *Plodia interpunctella*, and found that triglycerides decreased during the period from egg laying to egg hatching. Lipsitz and McFarlane (1970) found the same pattern in the house cricket, *Acheta domesticus*. Lipids deposited in the yolk of developing oocytes of the migratory locust, *Locusta migratoria migratoides*, decreased during development (Allais et al., 1964). The importance of lipids in the development of fish has not been examined.

Eggs of the cichlid fish, *Etroplus maculatus* (the orange chromide), were used to examine the significance of lipids in fish eggs. This substrate brooder can be spawned repeatedly after removal of eggs. This may simulate what might occur in nature if a brood was lost. This study examined lipid investment in eggs through three successively forced reproductive cycles.

Orange chromide females spawn repeatedly (approximately three times per month) in the laboratory if the eggs are removed after spawning. There are only two distinct breeding seasons per year in nature; they probably spawn only once during each season (Ward and Samarakoon, 1981). Eggs removed from successive spawns were analyzed for changes in lipid weight per egg, total weight per egg and total egg number. These factors were used to describe investment in egg production of females through three successive reproductive cycles.

MATERIAL AND METHODS

Orange chromides were imported from Negombo Lagoon, Sri Lanka by Mr. V. Perera, proprietor Lumbini Aquarium, Mt. Lavinia, Sri Lanka. They were placed in 480 litre stock aquaria. Specimens were maintained on a .5/12.0/.5 (simulated dawn/ light/ simulated dusk) light cycle. Aquaria contained deionized water with 1 g marine salt/litre and .5 g commercial baking soda ($NaHCO_3$)/litre as a buffer. Temperature and pH were maintained at 26-28 C and 7.0-8.0 respectively. Light was supplied by overhead 30-watt flourescent bulbs. All experiments were conducted in 75 litre tanks. Photoperiod, salinity, buffering, pH and temperature were identical to conditions in the stock aquaria. Each experimental aquarium contained a slate spawning tent and two plastic plants. Pairs were fed bite size tablets made from ground TetraMin Tablets and methyl cellulose twice daily at 1030 h and after 1300 h.

Four pairs were randomly selected from stock aquaria such that the male was 0.1-1.0 g larger than the female. These pairs remained together until they spawned. The eggs and male parent were removed one day after spawning. The female was transferred on the same day to a second experimental aquarium. A second mate was then introduced. The new pair was allowed to spawn and the procedure was repeated a third time with the same female and a new mate. Eggs were counted after each spawning. They were then freeze dried for 24 h in a lypholyzer (Virtis Research Equipment, Gardiner, New York) and a dry weight determined.

Eggs were divided into 4-6 groups of 35 eggs each depending on the size of the spawn. Each group was ground and suspended in 4 ml of petroleum ether for 24 h in 10 ml centrifuge tubes. Contents of these tubes were resuspended by gentle shaking and then centrifuged for 5-10 min at 2,000 rpm. The supernatant was transferred to pre-weighed 10 ml glass vials by suction pipeting. The precipitate was washed with 3 ml petroleum ether and centrifuged as before. This supernatant was then added to the vials with the first supernatant. The washing process was repeated a second time. The vials were then placed in an exhaust hood where the ether evaporated overnight. Finally, vials were weighed to the nearest ten thousandth of a gram to determine lipid content by weight for each group.

RESULTS AND DISCUSSION

A chi-square analysis was used to examine variance among the groups of each spawn. Linear regression was used to analyze trends of egg number, total weight per egg and lipid weight per egg through successive reproductive cycles. There was no significant differences between either the number of eggs produced or in the average weight per egg from each of the three reproductive cycles. The slopes for egg number and average egg weight plotted per reproductive cycle for a simple linear regression model were not significantly different from zero. Lipid weight per egg, however, decreased from the first cycle through the third. The slope of the regression line was significantly different from zero and negative. The equation of the line was $y = 1.239 \times 10^{-4} - 1.617 \times 10^{-5} x$. The coefficient of determination was .7166.

The drop in lipid weight per egg reported above has adaptive significance. Embryos from eggs containing greater amounts of lipid may survive better than embryos from eggs, of the same weight, with less lipid but more carbohydrate or protein. The latter would contain less energy for use by the developing embryo. Blem (1976) suggested high lipid levels may be important in the development of precocial birds. Perhaps high lipid levels in fish allow for development with greater survival. Ward and Samarakoon (1981) suggested that orange chromides spawn only once each breeding season. The evidence reported here supports this hypothesis. Females successively reproducing a second and third time may produce eggs with low survivorship. This would favor the production of just one spawn per breeding season.

Future experiments will follow the same experimental design. However, the survivorship of the offspring will be examined.

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