

# A description of maternal effects on egg size and larval performance of medaka (*Oryzias latipes*)

Karl Sorenson<sup>1</sup> and Robert Leaf<sup>2</sup>

<sup>1</sup>Salem High School , Salem, VA

<sup>2</sup>Department of Fisheries and Wildlife Sciences, Virginia Polytechnic Institute and State University, Blacksburg, VA

## Introduction

Maternal effects (parental investment in developing progeny) are non-genetic factors that contribute, in part, to determining the phenotype of offspring. The role of maternal effects between generations has been documented: propagule (egg size) can influence later development. It is possible that the magnitude of maternal contribution to egg size may result in differential evolutionary fitness through ontogeny.

## Objectives

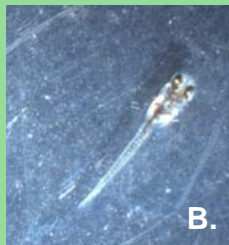
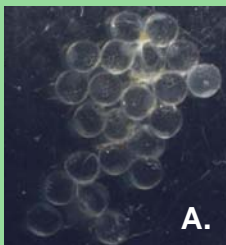
In this study we used medaka (*Oryzias latipes*) to:

- Examine how the amount of parental investment (measured as the size of eggs) produced by a female varied with the size (length and weight) and age of mature females.
- Described how egg size varied with the number of eggs produced.
- Described how larval performance (daily growth rate) varied as a function of the magnitude of parental investment.



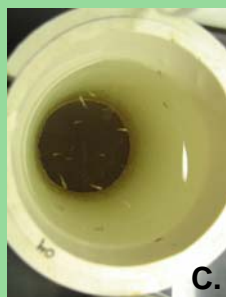
## Methods

We collected eggs from mature females ( $n = 66$ , age 74 to 132 days), counted, and determined their size using digital image analysis. We then incubated the eggs and monitored daily growth rate by measuring larvae using digital image analysis at hatching and at age seven days after hatching.



A. Eggs collected from a gravid female.

B. Newly hatched larvae, one day post hatch.



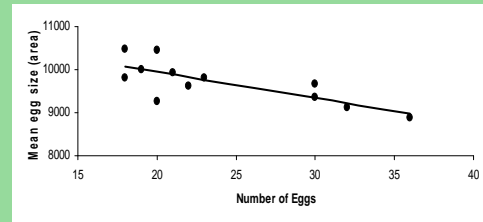
C. Larvae in incubation tube.

D. Experimental apparatus consisting of multiple incubation tubes.

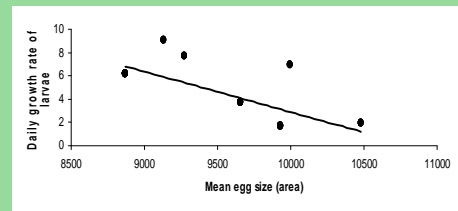
## Results

Using multiple regression we found that egg size decreased significantly with both age (days) and mass (grams) of females ( $R^2 = 0.15$ ,  $p < 0.005$ ).

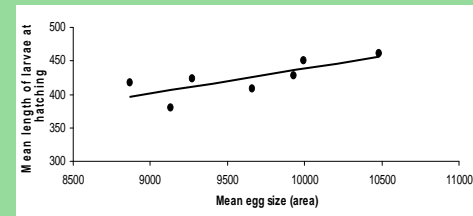
Mean egg area (weighted by number of sub-samples) was negatively correlated to the number of eggs produced ( $R^2 = 0.58$ ,  $p < 0.005$ ). Note: all egg and larvae sizes in our analysis is standardized as the number of pixels a given magnification ( $\times 0.63$ ).



Mean larval growth rate was negatively correlated with mean egg size of the clutch ( $R^2 = 0.48$ ,  $p < 0.005$ ).



The mean size of larvae at hatching was positively correlated with mean egg size ( $R^2 = 0.58$ ,  $p < 0.005$ ).



## Results and discussion

Our results indicate that female medaka produce eggs with variable sizes and that egg size is contingent on the age and weight of females during parturition. The negative correlation associated with egg size and number implies a tradeoff in the allocation of maternal resources. We document early differences in ontogeny (larval growth rate) as a function of egg size but it is not yet clear to what extent the differences influence lifetime fitness.

### Acknowledgments

This work was supported by a graduate research assistantship to RL under the direction of Dr. Yan Jiao, Department of Fisheries and Wildlife Sciences, Virginia Polytechnic Institute and State University. We also thank Drs. Bill Henley and Richard Neves for their generous use of equipment and laboratory space.

