

Pulling Your Weight: Do Male Northern Pipefish (*Syngnathus fuscus*)

Contribute More to Pregnancy than Females?

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Figure 1. Initial tank set up



Figure 2. Field collection



Figure 3. Female pipefish



Figure 4. Eggs under microscope (4X)

- ❖ Sexual selection is the selection of traits through competition for and the acquisition of mates¹.
- ❖ Typically female investment exceeds that of male investment, with males exhibiting either forms of intra- and inter-sexual behaviors².
- ❖ One common explanation for the direction of sexual selection stems from differences in parental investment².
- ❖ Seahorse and pipefish are rare examples in which males exhibit a form of pregnancy³.
- ❖ Previous research has shown that males provide nutrient provisioning to developing embryos in the brood pouch. The full extent of this provisioning is unclear⁴.
- ❖ Research on a Virginia population of *S. fuscus* showed that this species produces nutrient-poor eggs in comparison to other pipefish species⁵.
- ❖ The Northern Pipefish (*S. fuscus*) (Fig. 3) was chosen as a model. Females exhibit strong banding patterns during courtship and compete for the acquisition of males.

Introduction

Aims & Hypothesis

- ❖ **Aim 1** → Quantify maternal investment and compare female size to size of eggs produced.
 - Hypothesis: Larger females will produce larger eggs.
- ❖ **Aim 2** → Quantify relative reproductive investment of males compared with female reproductive investment.
 - Hypothesis: Males are actively contributing to the development of embryos.

Methods

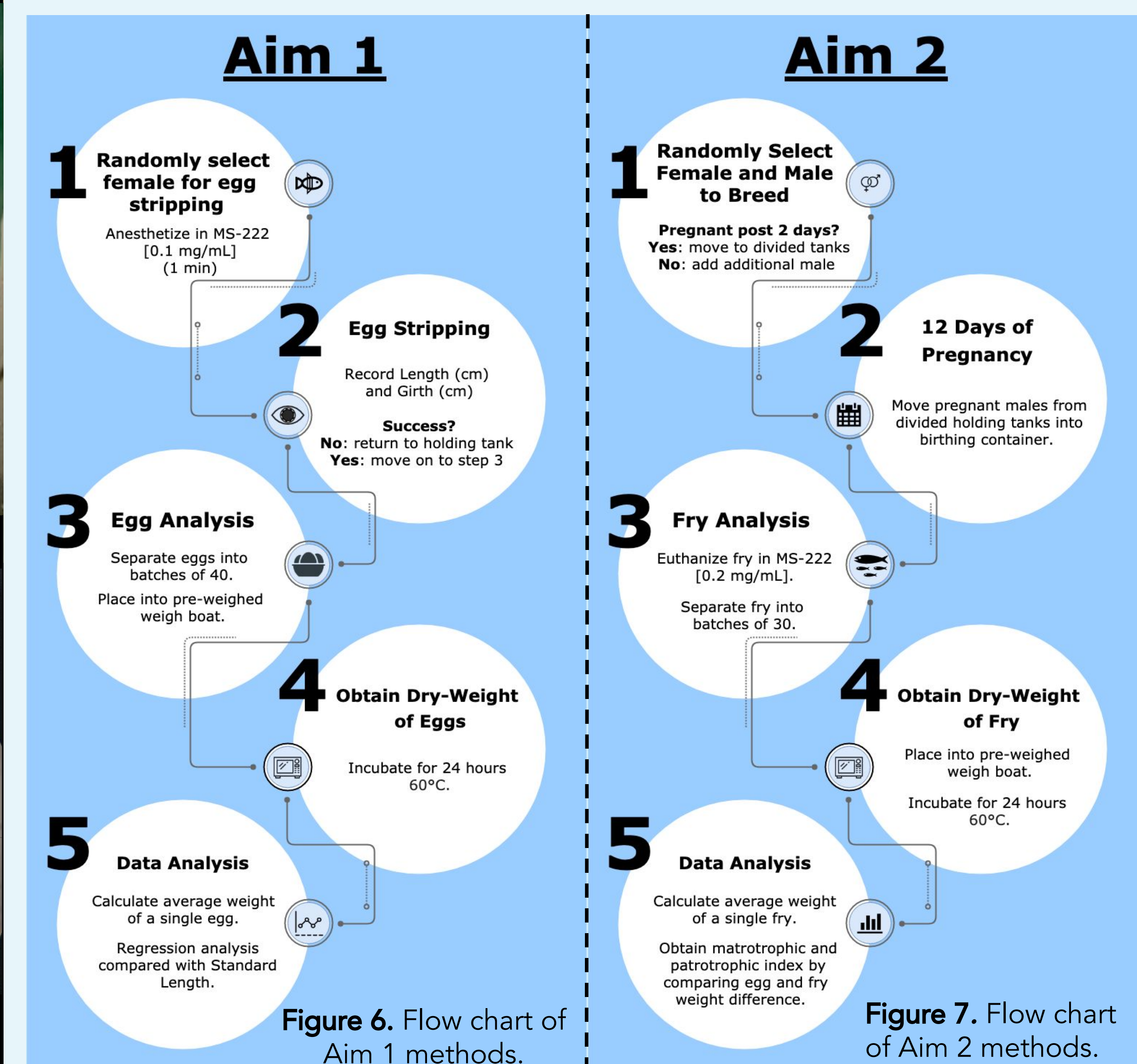


Figure 6. Flow chart of Aim 1 methods.

Figure 7. Flow chart of Aim 2 methods.

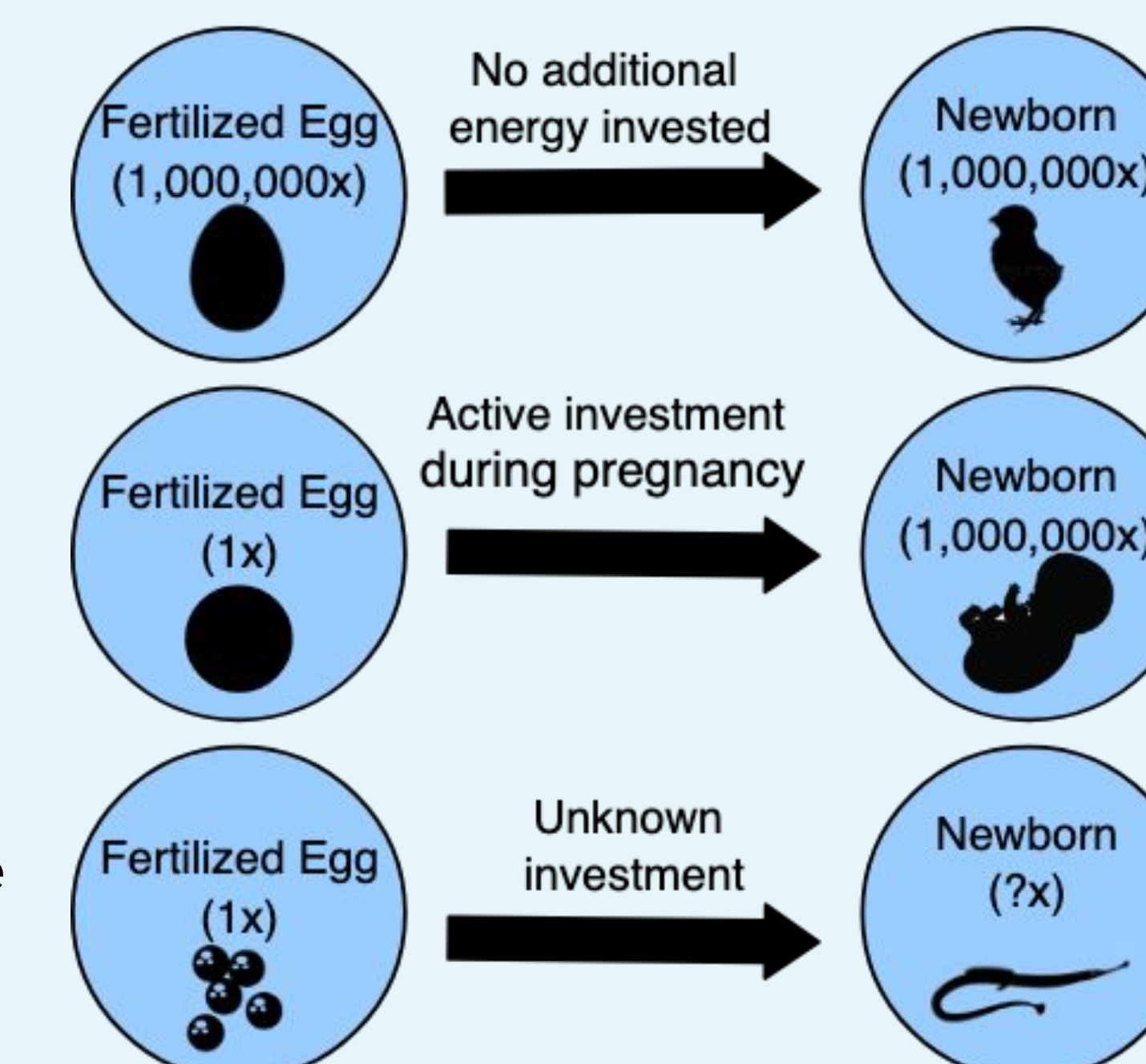


Figure 5. Diagrams represent varying degrees of energy investment in internal and external offspring development.

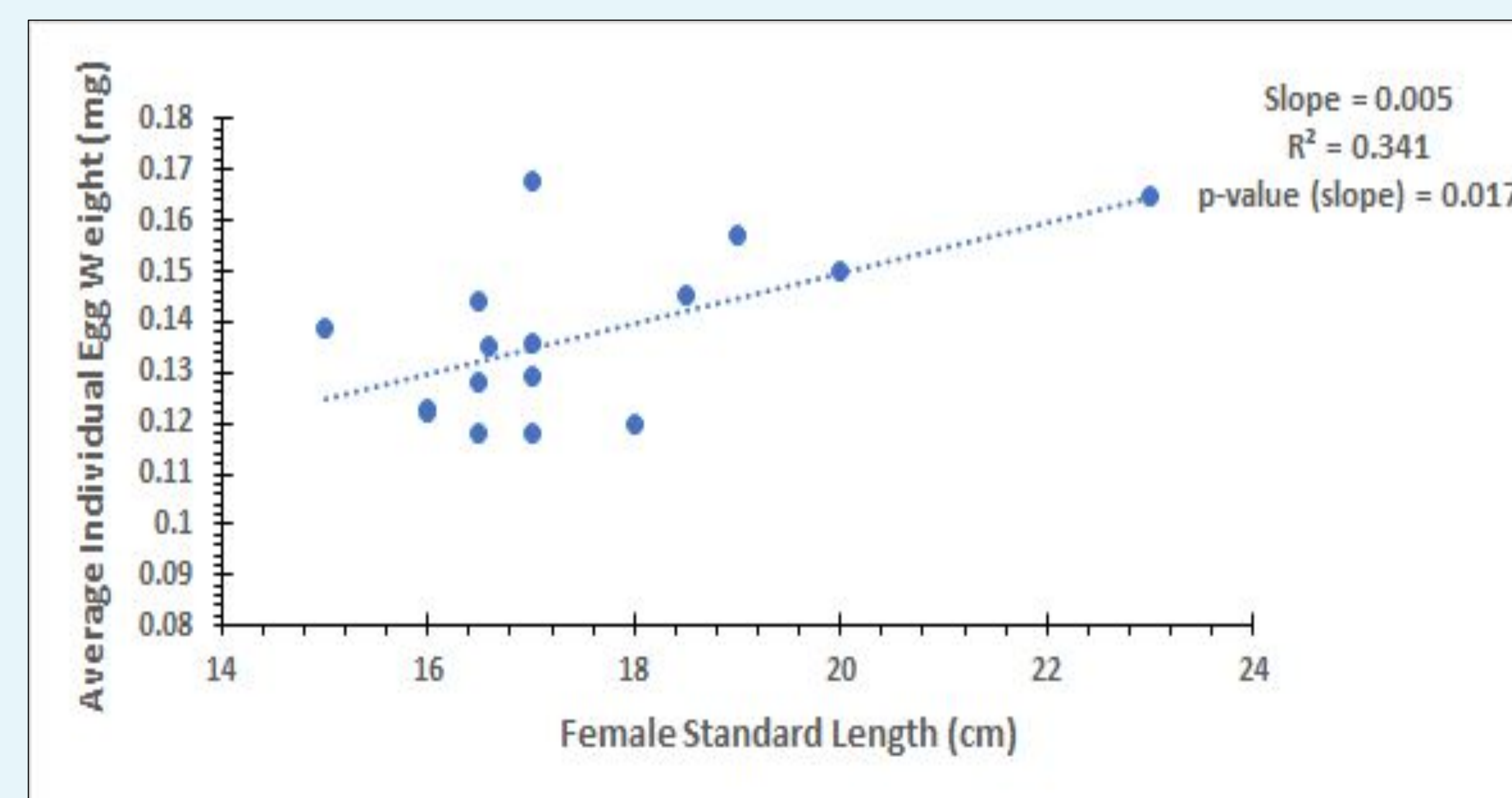


Figure 8. Linear regression analysis of individual egg weight (mg) as a function of female standard length (cm). Egg size is positively correlated with female size in *S. fuscus*. Trendline equation and R-squared values are displayed.

Results

Breeding Pair	Male	Female	Genetic Parentage	Other Data
BP 1 & 1.1	M_01 & M_05	F_01	M_03 & M_05 / Wild Female	Pregnancy Duration
BP 2 & 2.1	M_02 & M_06	F_02	No fry	
BP 3*	M_07	F_03	M_07 / F_03	15.91 +/- 4.85 days (n=11)
BP 4	M_08	F_04	M_08 / Wild Female	
BP 5*	M_10	F_05	TBD	
BP 6*	M_13	F_06	TBD	Clutch Size
BP 7	M_12	F_07	No fry	
BP 8	M_09	F_1.1	No fry	314.4 +/- 38.6 fry (n=5)
BP 9*	M_11	F_2.1	TBD	
BP 10*	M_03	F_3.1	TBD	

Table 1. Identification of males and females, clutch size, and pregnancy duration of breeding pairs used in Aim 2. * Represents breeding pair used in quantifying parental investment (Fig. 9).

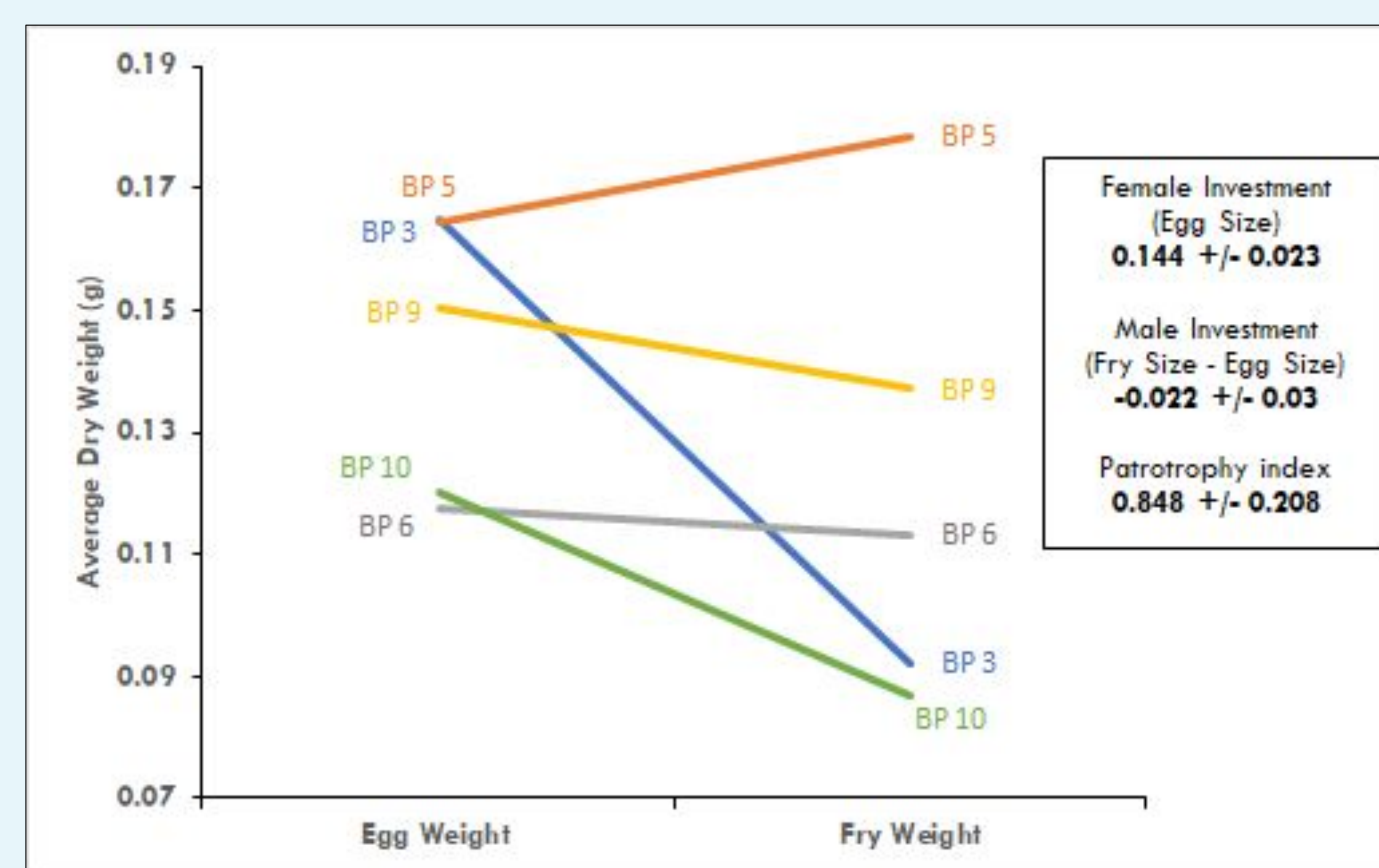


Figure 9. Offspring growth during male pregnancy. Dry weights of eggs and fry over pregnancy of five pipefish mating pairs.

Conclusions

- ❖ **Aim 1:** Larger females produce larger eggs. Low R-squared value (R² = 0.341) indicates unaccounted variability in egg weight (Fig. 8).
 - Future Work:
 - ➔ Extend study with an increased sample size.
 - ➔ Add additional replicates for dry-weight egg analysis.
- ❖ **Aim 2:** Male energetic investment in *S. fuscus* is clearly less than that in females. While the patrotrophy index exceeds that found in lecithotrophic species, there is significant variation across broods (Fig. 9).
- ❖ Future Work:
 - ➔ Extend study with increased sample size.
 - ➔ Nutrient analysis comparing energy contents (carbohydrates, lipids, proteins) of unfertilized eggs and newly released fry may help to illuminate specific aspects of the male contribution.

This research was sponsored by the National Science Foundation's Research Experience for Undergraduates (Grant No. 1659537).

Extended thanks to the BUCE program, the Wilson lab, and Rob Dickie for their support and advice.



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