NC STATE UNIVERSITY

Fine-scale reproductive and embryological differences between the two larval types of the poecilogonous annelid *Streblospio benedicti*

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Lecithotroph

Planktotroph

Introduction

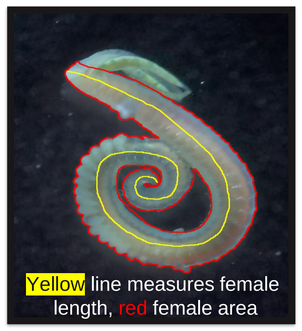
- *Streblospio benedicti* is a **poecilogonous** annelid, meaning there are two larval modes in a single species:
  - **Planktotrophic**- 250 (± 112) small embryos are produced and spend up to 4 weeks in the plankton eating before settlement
  - **Lecithotrophic**- 27.4 (± 16) large embryos are brooded by the mother and released in the water to settle in 1-2 days
- Larval type is heritable and wild populations tend to have only one type

Given all the possible trade-offs in life-history mode between these larval types, how does the total reproductive investment differ?

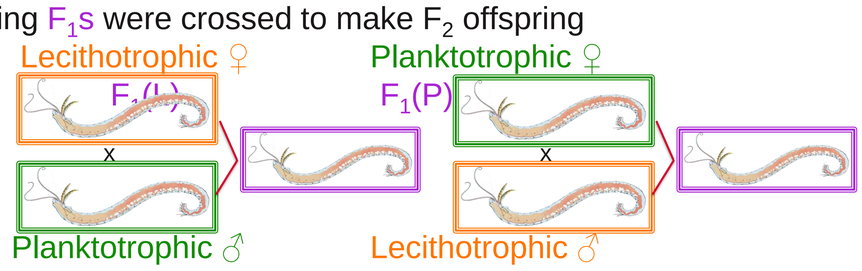
How similar is early embryo development between the two modes?

Methods

- Brooding female **length** and **area** were measured
- For each female, we recorded:
  - **number of embryos** per clutch
  - **mean area of 10 embryos per clutch**
  - Early embryo development, starting at one cell at 20°C

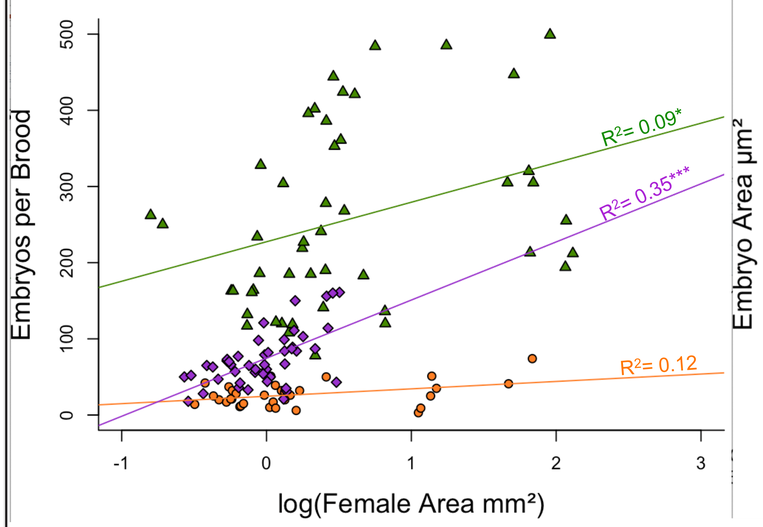


- F_1 were crossed in both directions between Planktotrophs (Bayonne, NJ) & Lecithotrophs (Long Beach, CA)
- Resulting F_1s were crossed to make F_2 offspring

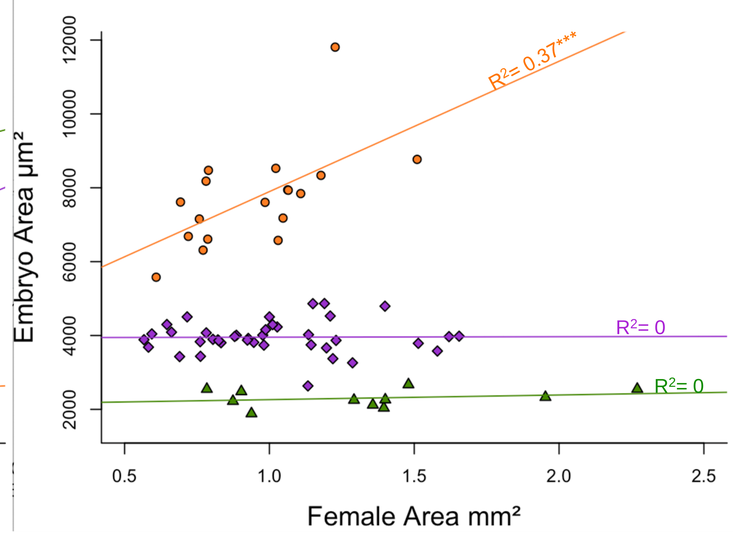


Maternal size changes offspring number and size differently depending on life-history mode

For **Planktotrophs** and **F_1s** female size is correlated with **number of embryos**

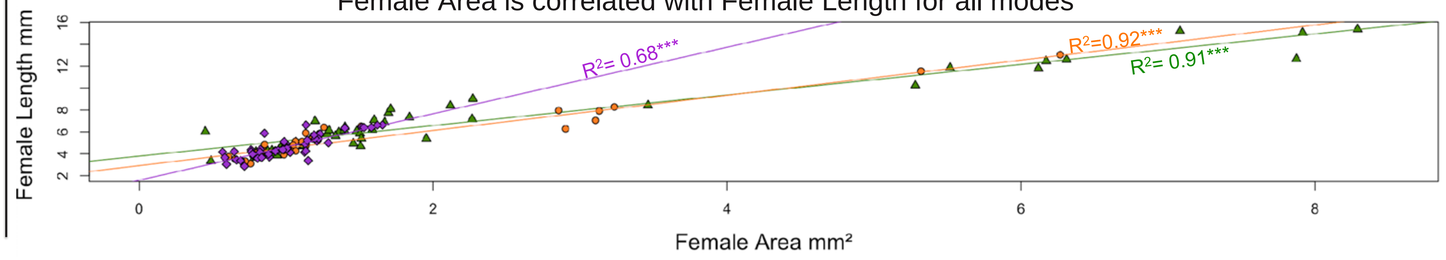


For **Lecithotrophs**: female size is correlated with **embryo size**

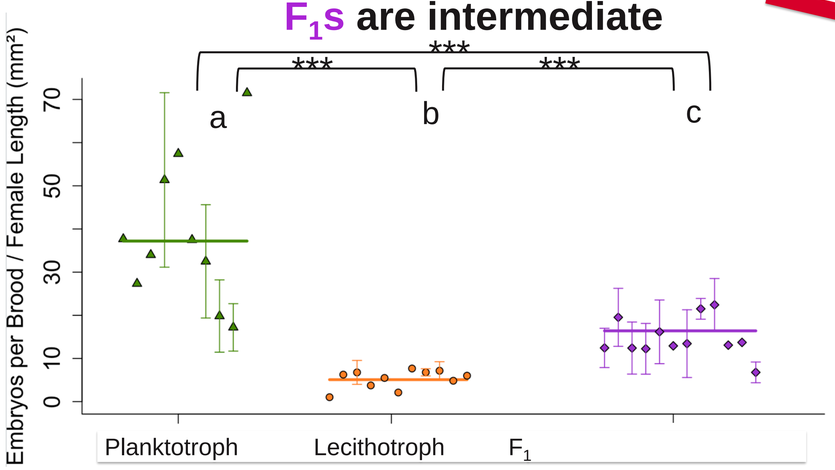


***= p<0.05, **= p<0.01, ***=p<0.001**

Female Area is correlated with Female Length for all modes

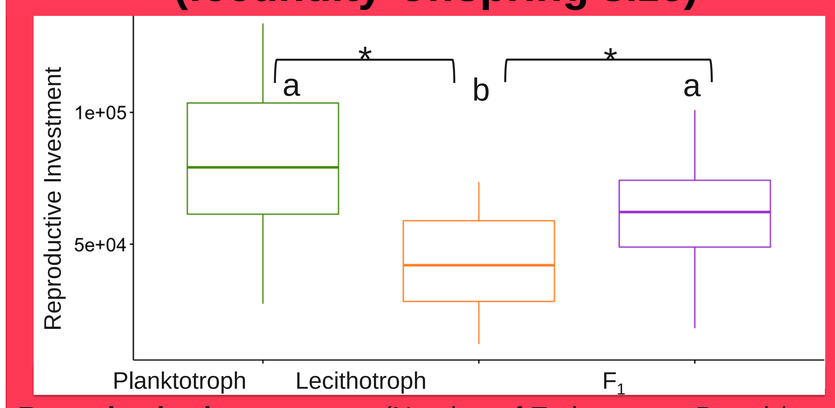


Planktotrophs have more embryos, F_1s are intermediate



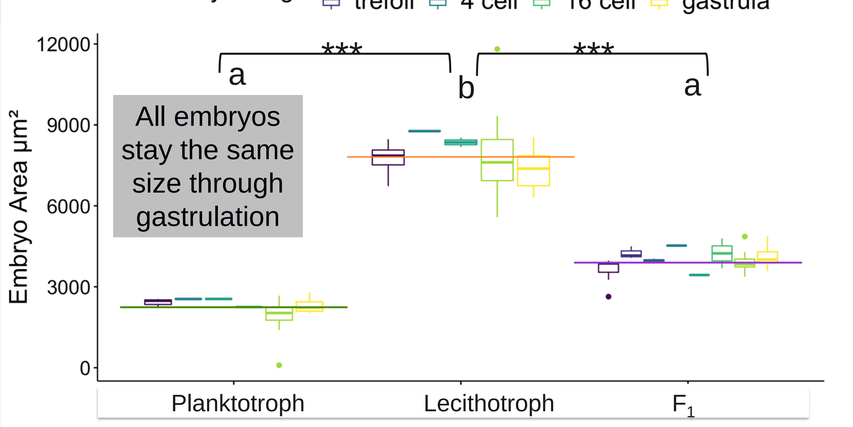
Embryos per Brood / Female Length. Each point represents a female. (mean number ± s.d. if a females has multiple broods), Bars are median. Non-parametric Kruskal Wallis followed by pairwise Wilcox.

Total reproductive investment for each larval mode (fecundity*offspring size)



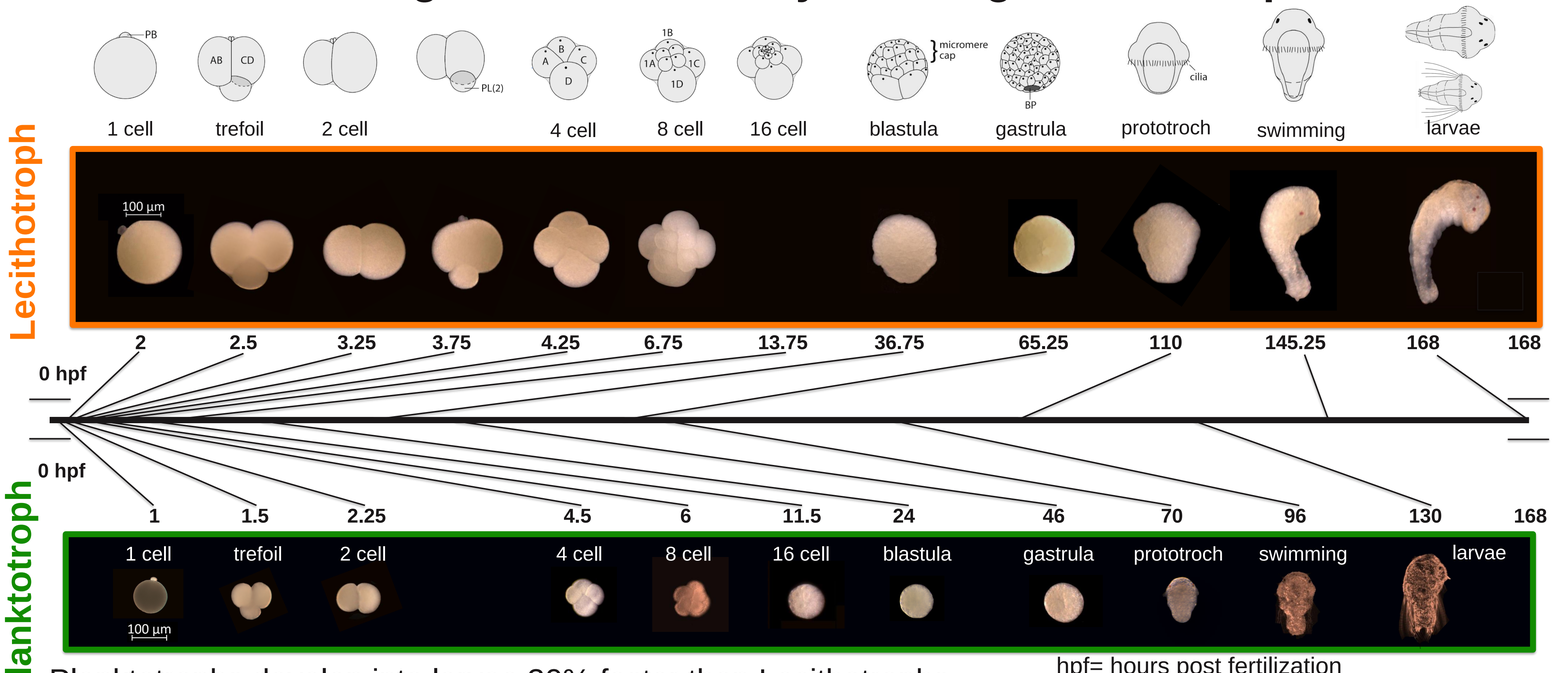
Reproductive investment = (Number of Embryos per Brood / Female Length) * Mean embryo Size (µm²)
ANOVA for R_i~ population, followed by pairwise Tukey test, shows Planktotrophs and F_1s are are different from Lecithotrophs

Lecithotrophs have larger embryos, F_1s are intermediate



2 way ANOVA for Embryo Area ~ Mode * Embryo Stage followed by pairwise Tukey test, shows larval modes are different), but no difference in embryo size between stages. Bars are median value.

Timing and size of embryonic stages in development



Planktotrophs develop into larvae 30% faster than Lecithotrophs

hpf= hours post fertilization
PB= polar body BP= blastopore PL= Polar Lobe

Conclusions

Life-history mode changes how maternal investment is allocated to embryos

- There is a maternal effect in how offspring are provisioned
- Lecithotroph: larger mothers = larger embryos
- Planktotrophic: larger mothers =more embryos
- F_1s are intermediate but more similar to planktotrophs

However, total reproductive investment is not drastically different across larval types

Caveat: Total number of times a single female broods not considered here

The larval types have equivalent development stages but different timing, where lecithotrophs take longer to develop.

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