Sexual selection and sexual dimorphism trends in cytheroid ostracodes from the U.S. Coastal Plain

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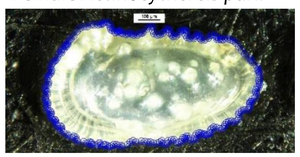
INTRODUCTION

- Sexual selection often causes species to evolve costly traits
- Whether these costly sexually dimorphic traits increase or decrease species' adaptability, and ultimate longevity, is debated[1]
- Unlike most fossils, male and female cytheroid ostracodes can be distinguished by their shape, and they have been abundant since the Mesozoic[2]
- We measure sexual dimorphism in 26 species of cytheroid ostracodes from the Late Eocene and compare their dimorphism to that in the Paleocene and Cretaceous
- We test whether there was extinction selectivity with respect to dimorphism in the Eocene, as there was in the Cretaceous[1]

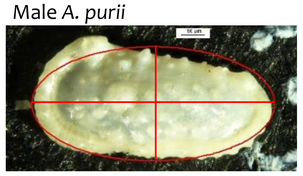
METHODS

Female *Actinocythereis purii*



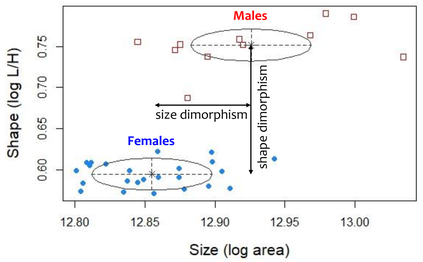
- Photograph each valve
- Outline each valve atop the photo
- Fit an ellipse to each outline

Male *A. purii*



- Calculate shape: the ellipse's major to minor axis ratio
- Calculate size: the outline's area

A. purii sex clusters



- Fit sex clusters to each population based on size and shape[7]
- Males are always longer in shape, but the direction (±) of size dimorphism varies
- Record stratigraphic occurrences of late Eocene to early Oligocene species from the literature[3,4,5]
- Compare models of extinction probability as a function of time and/or dimorphism (Capture-Mark-Recapture[6])

RESULTS

Dimorphism trends

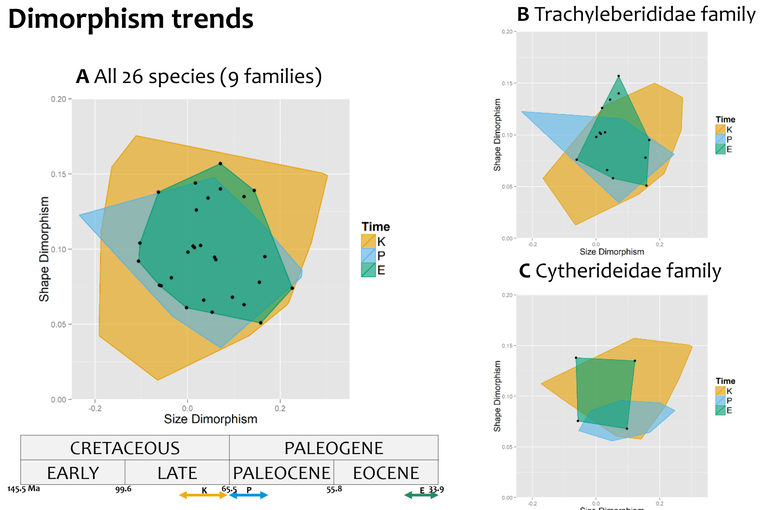


Figure 1: Distribution of size and shape dimorphism observed in the Cretaceous, Paleocene, and Eocene for (A) all species measured, (B) the family Trachyleberididae, (C) the family Cytherideidae

Extinction Selectivity

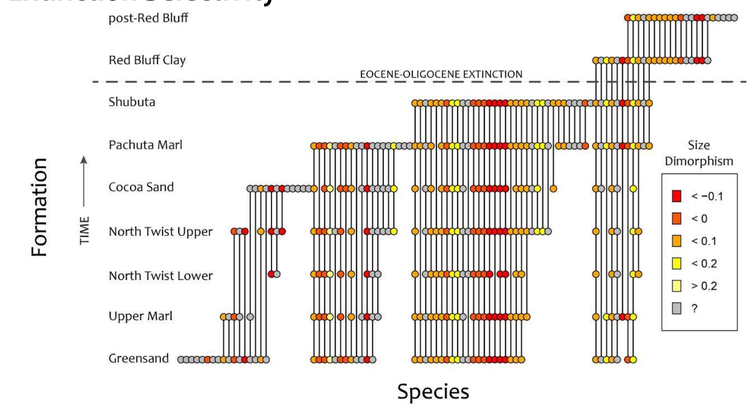


Figure 2: Stratigraphic occurrences of 106 species from the Eocene[3,4,5] (Greensand to Shubuta formations) to the Oligocene (Red Bluff Clay and younger formations) show a major extinction at the Eocene/Oligocene boundary. The extinction was not significantly selective based on size dimorphism (indicated by color).

CONCLUSIONS

- Strong size dimorphism did not evolve again in the 30 million years after the Cretaceous, suggesting either sexual selection for sperm competition waned or extinction selectivity against dimorphism persisted
- Size dimorphism has decreased within families, so the overall decline in dimorphism is not due to a change in which major taxa dominate
- Dimorphism did not affect species' likelihood of going extinct in general. Extinction rate increased at the Eocene-Oligocene boundary, with some indication that high dimorphism became less favorable at this time
- If there is no pervasive selectivity against dimorphism, then the lack of extreme dimorphism in the Eocene suggests there was no longer strong sexual selection favoring extreme body size in males

FUTURE WORK

- In order to be confident extinction selectivity against dimorphism occurs in the Cretaceous but not the Eocene, our sample should span more time and taxa, so we have comparable statistical power for both intervals
- In order to understand why size and shape dimorphism vary independently, we would like to better understand how sexual selection affects the extremity of shape dimorphism
- We are also interested in testing for extinction selectivity against parthenogenic (asexual all-female) populations in the Cretaceous, Paleocene, and Eocene

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