

An evolutionary perspective on reproductive individual heterogeneity in a marine vertebrate: how to tackle complex questions with real data in the presence of multiple sources of uncertainty?

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Key words: evolutionary ecology, population dynamics

Abstract: Individual heterogeneity in vital rates has been evidenced in several wild animal populations but its evolutionary consequences (fitness, heritability) have remained virtually unstudied. Addressing such aspects proves very challenging because large amounts of data are needed and different sources of uncertainty must usually be taken into account. In particular, when heterogeneity in vital rates is quantified through individual random effects, there is inherent uncertainty (demographic stochasticity, sampling variation) associated with these trait values. Here, using long-term monitoring data from Weddell seals, we addressed the fitness consequences of heterogeneity in female reproductive rate and quantified the heritability of this trait. Fitness consequences were assessed using data on offspring recruitment in combination with simulations, and heritability was estimated through a mother-daughter regression. The uncertainty associated with individual reproductive rate values was fully incorporated and accounted for in our inferences, by using the full posterior distributions previously obtained for these quantities, instead of point estimates. There was no evidence for a trade-off, at the among-individual level, between a female's reproductive rate and her offspring recruitment characteristics, but some heritability in female reproductive rates was

evidenced. These two results support the hypothesis of true variation in female 'quality'. Besides its interest for evolutionary ecology, this study emphasizes the use of adequate modelling approaches to account for various sources of uncertainty. The adoption of similar approaches in other study systems could be beneficial by facilitating the investigation of equally complex ecological and evolutionary questions for a broader range of taxa.