INTER-POPULATIONAL VARIATION IN THE REPRODUCTIVE BEHAVIOUR OF THE PEACOCK BLENNY

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Introduction:

The inter-populational variation in the reproductive behaviour of the peacock blenny *Salaria pavo*, particularly the influence of the ecologic environment, was investigated in the present work. Two populations of this species inhabiting contrasting environments were studied: the Ria Formosa population, a coastal lagoon with sandy/muddy substrate located in the south of Portugal, and the Gulf of Trieste, an area presenting rocky substrate located in the northern Adriatic sea.

This species presents high sexual dimorphism: males are larger than females and exhibit conspicuous secondary sex characters, like a head crest and anal gland, that consists of modified rays of the anal fin. These characters develop mainly in the breeding season. The mating system is promiscuous, with exclusive male parental care. In rocky shore populations, males nest in crevices or holes in the rock and defend a courting territory around the entrance of the nest where they perform elaborate courtship displays, assuming a bourgeois reproductive tactic. Females usually have a passive role in courtship, responding with changes in colouration and a few displays before they enter the nest to spawn.

The Ria Formosa population, however, presents severe changes to this pattern. In this coastal lagoon, nesting substrates are scarce and the only adequate sites to establish nests are bricks located in artificial reefs, used by clam culturists to delimit their fields. During the breeding season, nests are highly aggregated, rendering the maintenance of the typical bourgeois territory impossible. Sex-role reversal has been described for this population, with females displaying intense and elaborate courtship and males assuming an almost passive role in courtship. In the Ria Formosa there is also a high proportion of small parasitic males that mimic female morphology and courtship, and try to achieve parasitic fertilizations during sapwning episodes. These alternative reproductive tactics are sequential and males that assumed a parasitic tactic in one breeding season usually acquire a nest in the next season.

In the present study, some questions regarding the emergence of these behavioural differences between populations were addressed. The main hypothesis was that the variations in the mating system should be due to high behavioural plasticity under the influence of the ecological environment, namely the abundance and dispersion of nesting sites. More precisely, the following questions were studied:

1. Are the sex-roles dynamic in this species and can they be modulated through experimental manipulation of nest-site aggregation?
2. How does the mating system work in populations inhabiting sites with different nest availability and dispersion? Are there alternative reproductive tactics in populations where nest-sites are abundant?
3. Are there morphological changes in females and different male morphs between populations? What are the endocrine correlates of such differences?
4. What are the differences in the neuroendocrine regulation of reproductive behaviour between the two populations?

Methods:

An integrative approach was used to address these questions: transects (to quantify abundance and dispersion of nest sites), behavioural observations in the field and in the lab (to assess behavioural differences between populations and the ecological factors responsible for them), morphometry (to identify correlates of sexual preference and condition-dependent traits), radio-immuno assays and quantitative RT-PCRs (to identify the underlying physiological factors in control of reproductive behaviour).

Results and Discussion:

The results point to a high behavioural plasticity in this species, with a strong influence of nest-site abundance and dispersal in the modulation of the mating system and reproductive behaviour. In fact, the aggregation and scarcity of nest sites in Ria Formosa apparently promote a strong competition for access to nests sites, favouring larger males and probably promoting the development of more pronounced secondary sex characters as intra and intersexual signalling. As only the largest males acquire nests, the operational sex-ratio (number of mature females/ number of males qualified to mate) will be biased towards females, limiting their reproductive potential and causing sex-role reversal. On the other hand, a large proportion of sexually mature males cannot breed and the smallest adopt alternative reproductive tactics.

Although bourgeois males in the Gulf of Trieste are smaller and have less developed secondary sex characters than in Ria Formosa, they present relatively larger gonads. It is probable that sperm competition is higher in the Gulf of Trieste. This can be explained by the longer periods outside of the nest that bourgeois males from this population spend, increasing the chance for nest-takeovers or stealing fertilizations by rivals.

The analysis of circulating levels of androgens revealed higher concentrations of 11-keto-testosterone in bourgeois males from Ria Formosa, suggesting on one hand a correspondence between this hormone and the development of secondary sex characters, and on the other that androgens are highly sensitive to the social environment. The study on the aromatase enzyme, that converts testosterone into estradiol and is involved in the regulation of courtship and aggressive behaviours, reveals a higher expression of this enzyme in the brains of bourgeois males from Ria Formosa. A higher local testosterone-estradiol conversion rate may be down-regulating the aggressiveness and courtship in these males, allowing them to cohabitate with neighbours.

Conclusion:

The data present in this work allow an integrated understanding of some of the mechanisms that regulate behavioural plasticity in *S. pavo*, whose expression of reproductive behaviours seem to be closely related to ecological factors.