

Personality and its effect on fitness in the Adélie penguin (*Pygoscelis adeliae*)



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Background

Potentially determined genetically, individual personality traits are also likely to be influenced by the environment. We should observe a certain degree of variability of these traits at both the intra- and inter- individual level, which might affect individual fitness. Despite their importance in evolutionary ecology and their implication in the adaptive capacity of individuals and populations to environmental changes, very few studies in the wild have focused on these traits so far. Here, we studied some personality traits and their variability, as well as potential relationships between these traits and breeding habitat quality, individual quality and fitness.



Methods

- 7 years of automated transponder-based monitoring → phenology/fitness (Fig. 1)
- Personality traits → focal observation: activity & aggressiveness
→ capture: boldness & activity
- Individual parameters → sex, morphometry, condition indices
- Environmental parameters on land → temperature, humidity, central/periphery, breeder density, protected/exposed

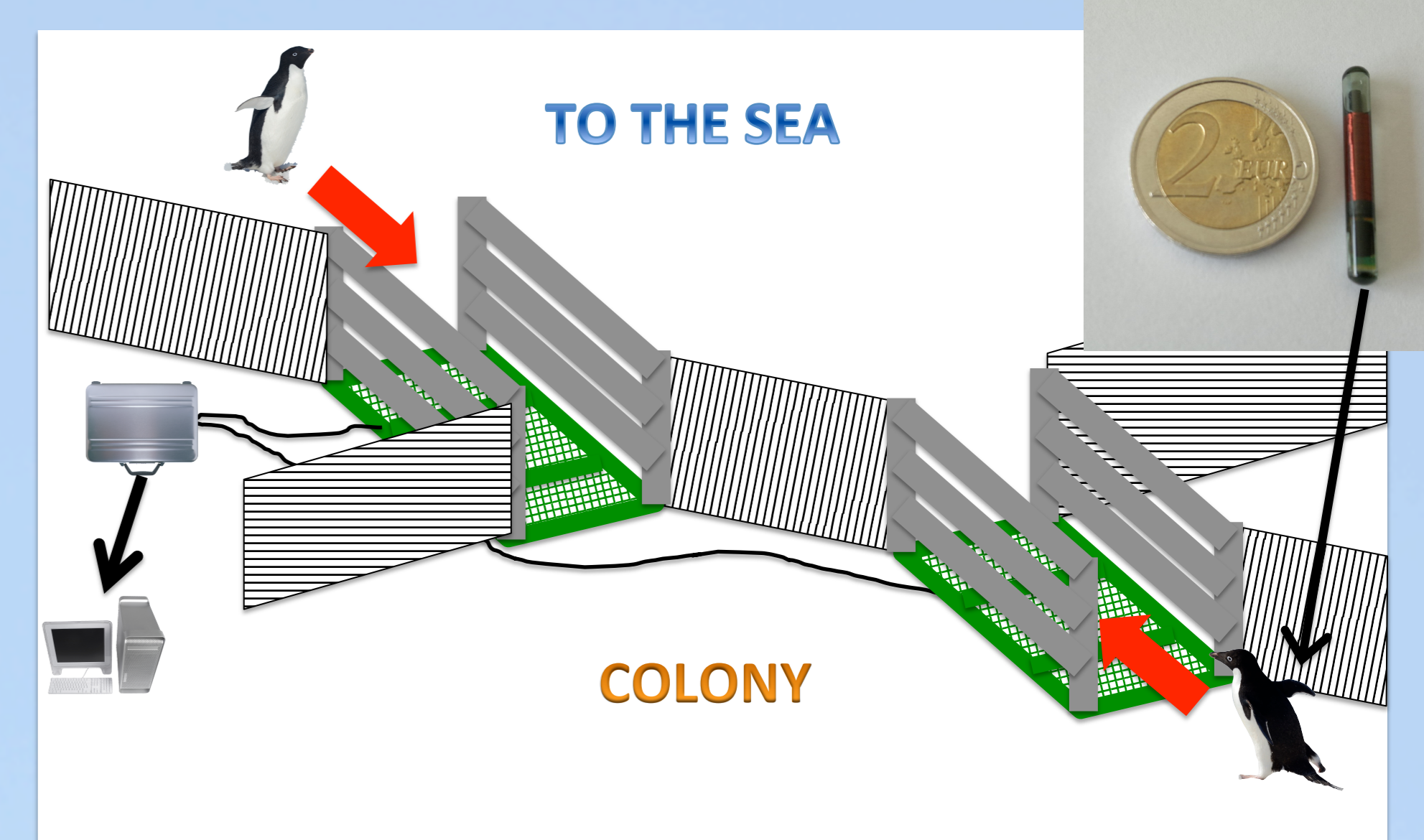


Fig. 1

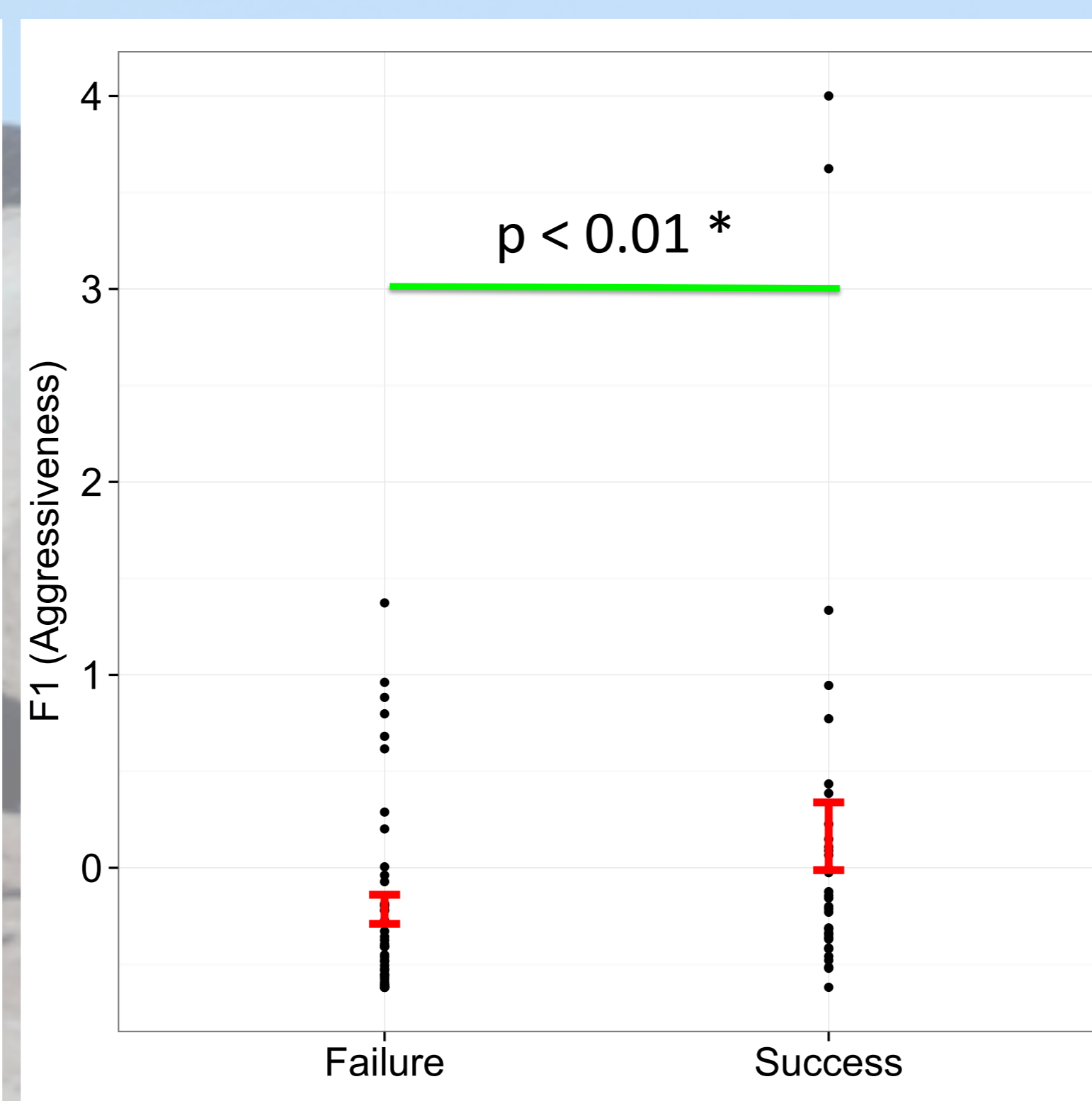
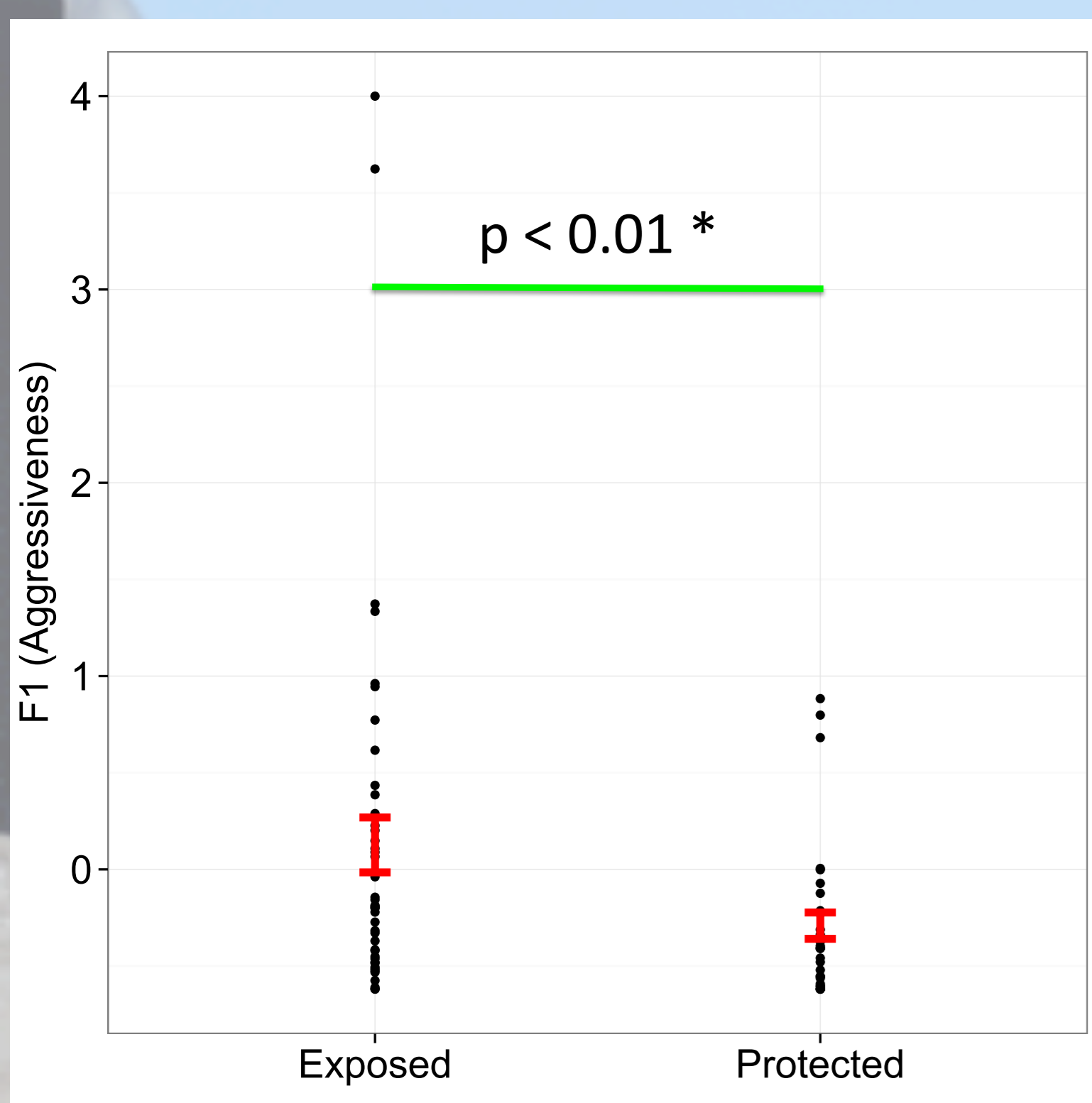
Results

- Principal Component Analysis (PCA) on continuous focal observation variables:
 - * Axis 1, 2 and 3 (later called F1, F2 and F3) explained respectively 27%, 23%, and 17% of variance.
 - * **F1** was mainly loaded with variables linked to **aggressiveness**, **F2** with variables linked to **activity** and **F3** with **vocalisation** variables.
- Significant intra- and inter-individual repeatabilities of behavioural variables according to identity of individuals, breeding habitat, individual characteristics and fitness (Table 1).

Table 1

Repeatability Indices	Individual	Exposed	Protected	Exposed/Protected to the passage by Habitat	Male	Female	Sex	Failure	Success	Breeding Output at brooding
F1	0.06 (<0.05)	0.04 (ns)	0.05 (ns)	0.15 (<0.01)	0.03 (ns)	0.09 (<0.05)	-0.03 (ns)	0.02 (ns)	0.07 (<0.05)	0.17 (<0.01)
F2	0 (ns)	0 (ns)	-0.02 (ns)	0 (ns)	0.01 (ns)	0 (ns)	0.01 (ns)	-0.04 (ns)	0.02 (ns)	-0.03 (ns)
F3	0.04 (ns)	0.07 (<0.05)	-0.01 (ns)	0.13 (<0.05)	0.07 (<0.05)	0 (ns)	0.07 (t)	0.04 (ns)	0.04 (ns)	-0.03 (ns)

p-values in brackets obtained using a Kruskal-Wallis rank sum test, ns = not significant, t= tendency



- Birds breeding in habitat exposed to the passage of other individuals were significantly more aggressive than birds breeding in protected habitat (Fig. 2). Moreover, birds in breeding success at brooding were significantly more aggressive than birds in breeding failure (Fig. 3).

* *p*-values obtained using Wilcoxon sum rank tests

Fig. 2

Fig. 3

- Males significantly bite or try to bite more during manipulation than females (Fig. 4) and thus were considered bolder. Moreover, birds breeding in habitat exposed to the passage of other individuals were approached significantly closer before reacting than birds breeding in protected habitat (Fig. 5).

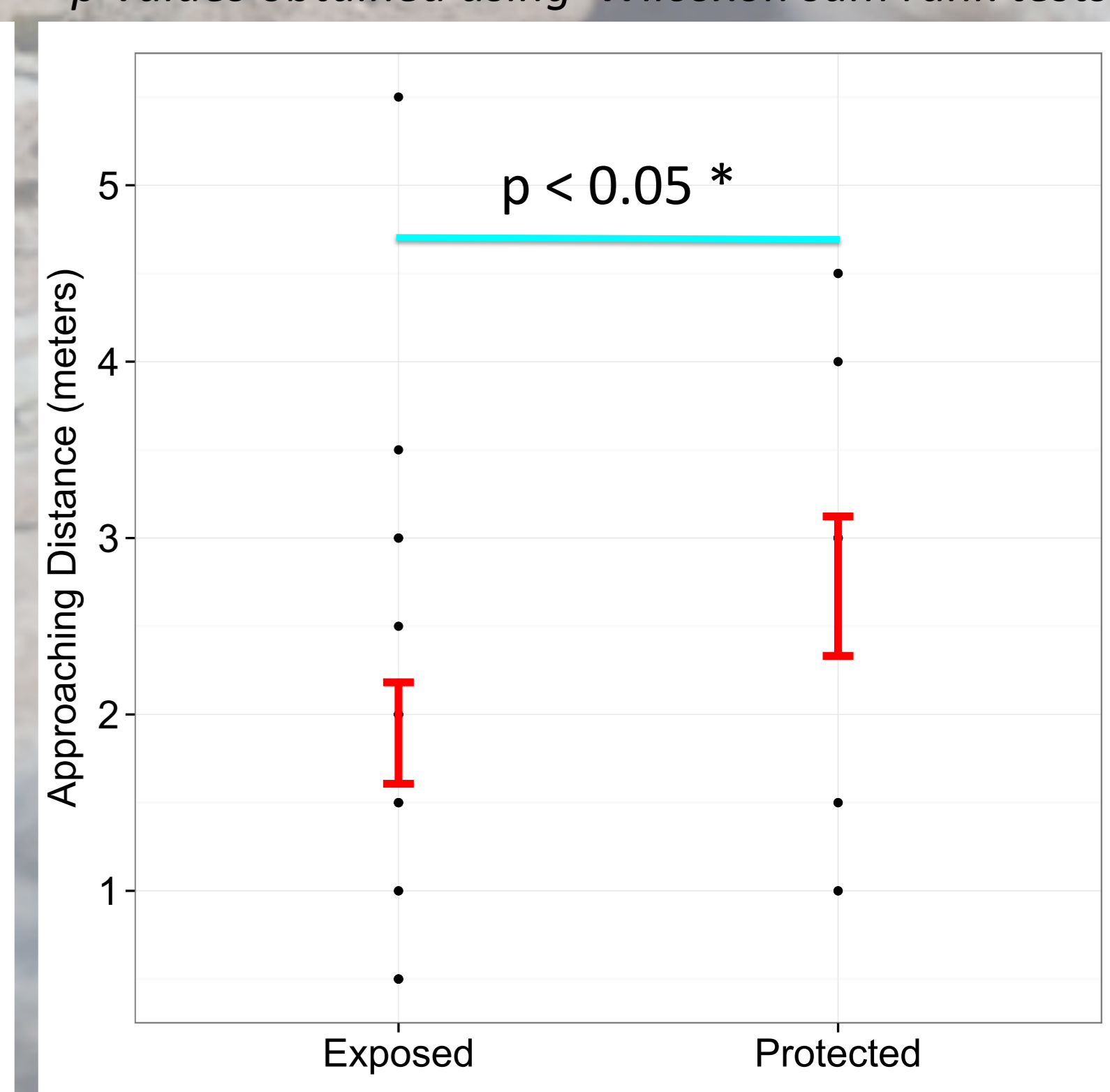
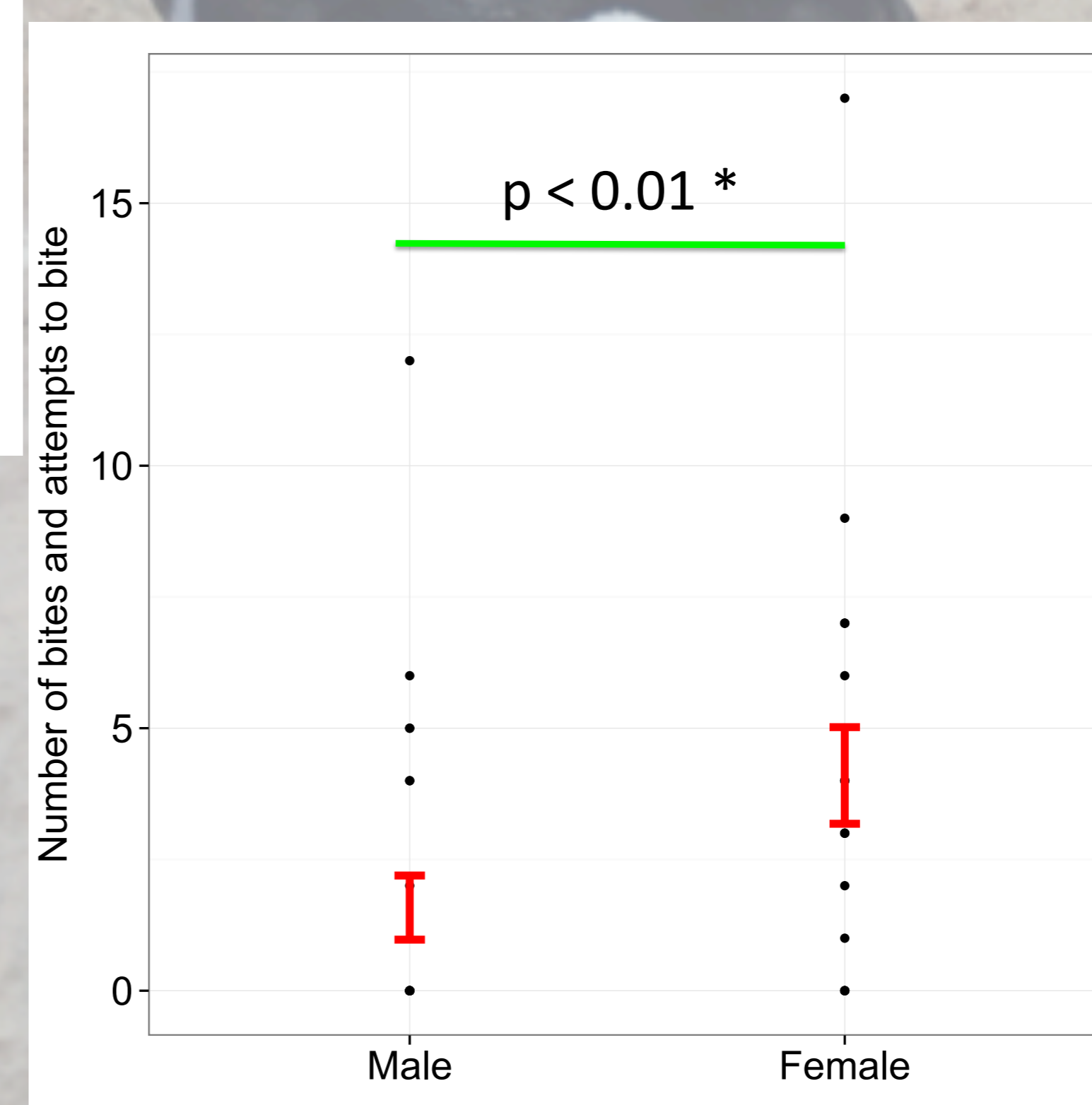


Fig. 4

Fig. 5

Conclusion

Aggressiveness is repeatable between individuals and thus can be considered as a personality trait for this population. Moreover, our results show that individual behavioural traits varies according to habitat and individual characteristics, and that personality impacts fitness even if we still have to elucidate the underlying mechanisms. Understanding how behaviour, individual quality and environment impact each other and impact fitness of individuals is crucial to understand how birds cope with environmental changes.