BEHAVIOURAL SYNDROME, BUT NOT INVASIVE SYNDROME, FOUND IN HYBRID *XIPHOPHORUS HELLERI* POPULATIONS

Danny M. D'Amore

Ohio University, Department of Biological Science, Athens, OH

Introduction

- A behavioural syndrome (bold-aggressive) was previously detected in a species of swordtail fish, *Xiphophorus multilineatus* (1).
- Life history traits of invasive species have been well studied but behavioural syndromes have not.
- An "invasion syndrome" is a behavioural syndrome that could explain the success of an invasive population (2).
- *X. helleri* hybrids are successful invasive freshwater fish found worldwide (3), despite both parent species being only native to Mexico.

Questions

1) Do *X. helleri* and *X. helleri* hybrids exhibit behavioural syndromes?
2) Do the *X. helleri* hybrids exhibit a behavioural syndrome?

Methods

- Native fish were captured from Veracruz, Mexico. Invasive hybrids were collected in Kauai, Hawaii and were kept in individual tanks for identification. Domestic population was purchased in Athens, Ohio.
- Native fish ('Mexico'), invasive hybrid fish ('Hawaii'), + domestic hybrid fish ('Spot') measured as follows:

Exploration → Aggression → Boldness

- **Exploration test:** novel environment, measuring latency to move, number of movements, movement to new area, and areas used were counted.
- **Aggression test:** conducted in the home tank, measuring latency to approach, approaches, and bites at a mirror.
- **Boldness test:** conducted in the home tank. Fish were fed a novel food item + were surprised and chased by a net. Time to first feeding, time to re-emerge after attack, and time to resume feeding after 'attack' were measured.
- Data analyses conducted in R. Measures analyzed in NMDS plot (metaMDS; vegan, Fig. 1) to chose associated behaviours. Repeatability calculated with best fit linear mixed effect model and calculating ICC (lme; nlme). Finally, association between behaviours was investigated with generalized linear models (glm; nlme).

Results

Table 1. Factors explaining the variation of boldness.

Factor	df	t-value	p-value
Model	75	5.416	<0.001
Exploration	75	0.880	0.312
Aggression	75	3.319	0.001
Origin: Mexico	72	-3.020	0.004
Origin: Spot	72	1.079	0.284

Table 2. Factors explaining the variation of aggression.

Factor	df	t-value	p-value
Model	74	4.705	<0.001
Exploration	74	0.413	0.681
Boldness	74	1.105	0.273
Ex-Bold Interaction	74	1.208	0.231

Table 3. Factors explaining the variation of exploration.

Factor	df	t-value	p-value
Model	76	5.282	<0.001
Aggression	76	3.719	<0.001
Origin: Mexico	72	-2.450	0.016
Origin: Spot	72	-0.951	0.345

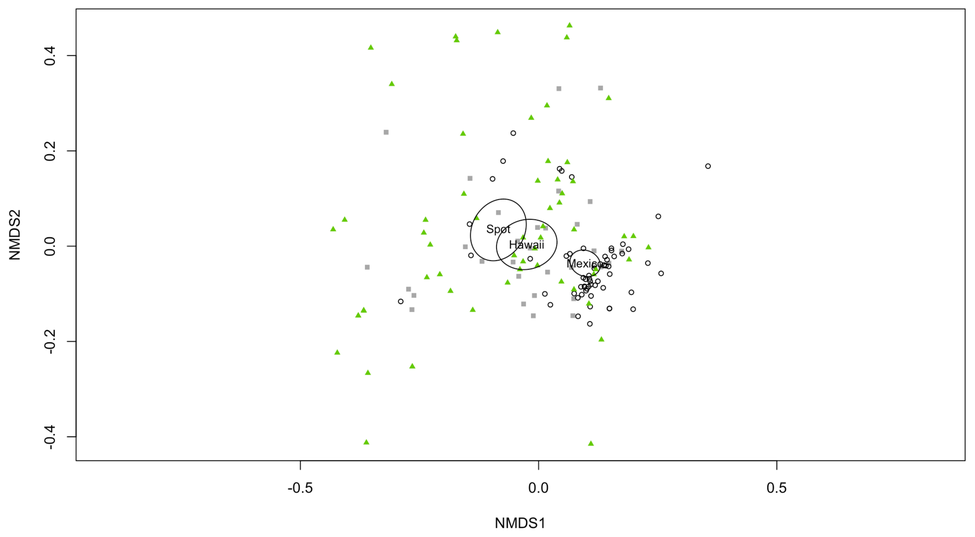

Figure 1. Hybrid populations overlap in behavioral space.

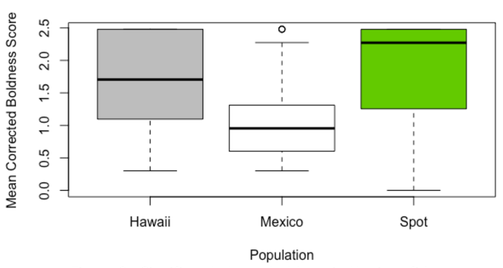

Figure 2. Significantly lower boldness in Mexican fish.

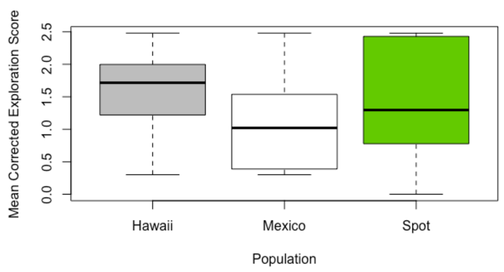

Figure 3. Higher exploration in invasive Hawaiian hybrids.

Discussion

- A behavioural syndrome (exploration-aggression-boldness) was detected in all three populations.
- We cannot call this an invasive syndrome because the same correlation is found in all three populations.
- There is a significant difference in mean behavioural scores between native + hybrid populations in boldness ($H=31.911$, $p<0.001$) and exploration ($H=14.492$, $p<0.001$). This suggests that the trapping method used in breeding pools may be selecting for boldness in the hybrids (4), which influences aggression in swordtails (1).
- Our study indicates that aggression influences exploration *X. helleri* and *X. helleri* hybrids as well (Table 3).
- Future directions: *X. maculatus* as the other parent species + the effect of linebreeding on *X. helleri* hybrid behaviours.
- **Take Home:** Behavioural syndromes aren't everything in invasive success – selection for specific traits (i.e. trapping bias for boldness) may influence behaviour of individuals introduced.

References

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Acknowledgements

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Get in Touch!

I would love to discuss my research more! If I'm not at my poster, please come find me at ABS – or leave me a message! Reach me at 1-740-517-2940 or shoot me an email at swordtaildanny@gmail.com -- looking forward to hearing from you!