Student Code:

24th International Biology Olympiad

14th-21st July, 2013

Bern, Switzerland

BERN 2013 International Biology Olympiad

Practical Exam 3

Evolutionary Ethology

Answer Key

Total points: **100**

Duration: **90 minutes**

Q1

Ramming and biting attacks

separation size	A sealed different	B sealed matched	C porous different	D porous matched
Replicate 1	13	25	10	19
Replicate 2	17	50	10	7
Replicate 3	30	29	22	21

→ 30 point (max)

per count which differs less than 10% rounded to the next integer of the given value = 2.5 points

per count which differs between 10% and 15% rounded to the next integer = 1.25 points

per count which differs between 15% and 20% rounded to the next integer = 0.5 points

Q2

separation size	A sealed different	B sealed matched	C porous different	D porous matched
mean				
variance				

→ 4 points

for each correct calculation = 0.5 points

Q3

total variance within groups V_{tot}

→ 1 points

for the correct calculation = 1 point

Q4

overall mean across all replicates M

→ 1 points

for the correct calculation = 1 point

Experimental setup		Difference in size of males	
sealed	porous	Different	matched

Q5 Mean within category

→ 4 points

for each correct calculation = 1 point

Q6 Variance explained by factor V_X

Experimental setup	Difference in size of males

→ 2 points

for each correct calculation = 1 point

Q7 Test statistic F_x

Experimental setup	Difference in size of males

→ 2 points

for each correct calculation = 1 point

Q8 p-value <

Experimental setup	Difference in size of males

→ 2 points

for each correct calculation = 1 point

Q9

Experimental setup	Difference in size of males
Explains part of the total variance	
Does **not** explains part of the total variance	

→ 2 points

for each correct calculation = 1 point

Q10

	true	false
Males of *N. pulcher* use visual cues of a competing conspecific to adjust their aggressive response.		
Males of *N. pulcher* use olfactory cues of a competing conspecific to adjust their aggressive response.		

→ 2 points

If both answers are correct = 2 points

If one answers are correct = 0.5 point

Q11

Puffed throat behavior

	A	B	C	D
separation size	sealed different	Sealed Matched	porous different	porous matched
Replicate 1	0	13	3	23
Replicate 2	0	17	0	7
Replicate 3	0	12	0	12

→ 21 points (max)

per count which differs less than 10% rounded to the next integer of the given value =1.75 points

per count which differs between 10% and 15% rounded to the next integer of the given value =0.5 points

per count which differs between 15% and 20% rounded to the next integer of the given value =0.25 points

Q12

	true	false
These results are in line with N. pulcher males using visual cues of a competing conspecific to adjust their aggressive response.	√	
The results are in line with *N. pulcher* males using puffed throat behavior to bluff about their size, which is most effective if males are of equal size.	√	

→ 4 points

If both answers are correct = 4 points

If one answers are correct = 3 point

Q13

	Breeding male	Breeding female	Helper individual
Total number of digging behavior displayed	1	8	2

→ 9 points

for each true number = 3 points

Q14

	Breeding male	Breeding female	Helper individual
egg caring for < 5s	√		
egg caring for > 5s and < 30s		√	
egg caring for > 30s			√

→ 6 points

If all three answers are correct = 6 points

If two answers are correct = 3 point

If one answer is correct = 1 point

Q15

Assuming that the observed social group is a good representation of the majority of social groups in nature, we would conclude that …	**true**	**false**
… helpers are likely to have a larger effect on the survival rates of clutches of breeding pairs after an oligotrophic environment was suddenly converted into a highly eutrophic (hypertrophic) environment.	√	
… large-bodied breeding males are crucial to maintain breeding caves by digging big quantities of sand.		√
... the presence of helpers allows the breeding female to spend most of their time patrolling the territory rather than on territory maintenance.		√
... helper individuals tend to please the large breeding male by following it and maintaining the cave currently occupied by it.		√

→ 4 points

If all four answers are correct = 4 points

If three answers are correct = 2 point

If two answers are correct = 1 point

True: hypertrophic conditions means excess of nutrients what most likely lead to increased fungus growth and the development of thick biofilms on all kind of structures like breeding cave or eggs. According to the film sequence helper spend by far most time for egg cleaning whereas the breeding female cleaned the clutch only once and the male visited the clutch only once. Furthermore oxygen is highly limited in hypertrophic water, what would make fanning crucial. Fanning is also done by the helper – this can also be assumed since it is to only individual spending enough time in the breeding cave to make fanning efficient.

False: Breeding cave seems to be mainly maintained by the breeding female and to a smaller amount be the helper. According to the film sequence effects of the breeding male is marginal.

False: In the film sequence, females spend a lot of time and energy in digging sand what is part of territory maintenance.

False: in the film the helper spends most of time in the breeding cave whereas the breeding male is sitting in another cave. There are no hints why it should be conclude that helpers search the closest possible proximity to the breeding male.

End of practical exam.