Student Code:

## 24<sup>th</sup> International Biology Olympiad

14<sup>th</sup>-21<sup>st</sup> 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						
	Α	В	С	D		
separation	sealed	sealed	porous	porous		
size	different	matched	different	matched		
Replicate 1	13	25	10	19		
Replicate 2	17	50	10	7		
Replicate 3	30	29	22	21		



 $\rightarrow$  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

	Α	В	С	D
separation	sealed	sealed	porous	porous
size	different	matched	different	matched
mean				
variance				



→ 4 points

for each correct calculation = 0.5 points



total variance within groups  $V_{tot}$ 



→ 1 points

for the correct calculation = 1 point



overall mean across all replicates M



Q4

→ 1 points

for the correct calculation = 1 point



Experimental setup		Difference in size of males		
sealed	porous	Different	matched	



Q5

Mean within category



1 point

1 point

→ 4 points

for each correct calculation



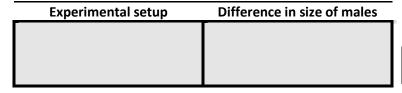


Variance explained by factor  $V_X$ 

Q6

→ 2 points

for each correct calculation =





Test statistic F<sub>x</sub>

Q7

→ 2 points

for each correct calculation

Experimental setup Difference in size of males



鑺

p-value <

Q8

→ 2 points

for each correct calculation

Experimental setup	Difference in size of males



= 1 point



Explains part of the total variance

Q9 Does **not** explains part of the total variance

→ 2 points

Experimental setup Difference in size of males



for each correct calculation = 1 point



Q10

	true	taise
Males of N. pulcher use visual cues of a competing conspecific to adjust their		
aggressive response.		
Males of <i>N. pulcher</i> 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					
Α	В	С	D		
sealed different	Sealed Matched	porous different	porous matched		
0	13	3	23		
0	17	0	7		
0	12	0	12		
	A sealed different 0	A B sealed Sealed Matched  0 13 0 17	A B C  sealed Sealed porous different Matched different  0 13 3  0 17 0		



→ 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.	٧	
The results are in line with <i>N. pulcher</i> males using puffed throat behavior to bluff about their size, which is most effective if males are of equal size.	٧	



→ 4 points

If both answers are correct = 4 points

If one answers are correct = 3 point



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



→ 9 points

for each true number = 3 points



	Breeding male Breeding female		Helper individual	
egg caring for < 5s	٧			
egg caring for > 5s and < 30s		٧		
egg caring for > 30s			٧	



## → 6 points

If all three answers are correct = 6 points

If two answers are correct = 3 point

If one answer is correct = 1 point



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.	٧	
large-bodied breeding males are crucial to maintain breeding caves by digging big quantities of sand.		٧
the presence of helpers allows the breeding female to spend most of their time patrolling the territory rather than on territory maintenance.		٧
helper individuals tend to please the large breeding male by following it and maintaining the cave currently occupied by it.		٧



## → 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.

Q15

End of practical exam.