RAJARATA UNIVERSITY OF SRI LANKA
FACULTY OF APPLIED SCIENCES

B.Sc. (Special) Degree in Applied Biology
Third Year Semester II Examination – April/May 2015

ZOO 4203 – WILDLIFE MANAGEMENT & CONSERVATION

Time: Two (2)hours

Answer four (04) questions including question number 1.

1. Tables 1, 2, 3 and 4 and Figure1 summarize key findings of a study by Peterman et al., (2015) published in *Conservation Genetics* (2015) 16:59-69, comparing genetic differentiation between multiple populations of two sympatric pond breeding salamanders *Ambystoma annulatum* and *A. maculatum* in Missouri, USA. Both salamander species are generally dependent on forested habitat and prefer to breed in fishless ponds. The investigators sampled multiple populations of the two species and genotyped both species at 19 species-specific microsatellite loci. In addition, for each population of both species, the investigators measured the pairwise Euclidian (direct) distances between ponds and also calculated, allelic richness (A_R), expected heterozygosity (H_e), observed heterozygosity (H_o), inbreeding coefficient (F'_{IS}) and pairwise fixation indices (F'_{ST}). Using these tables, figures and concepts discussed in class, answer the questions given below.

   a) Why do most species exist as spatially separated populations?

   b) Which of the two species in this study has populations that show a high level of genetic differentiation and give reasons for your answer.

   c) Comment on how genetic differentiation in the populations of the two species change in relation to Euclidean (direct) distance between populations (ponds). Suggest behavioral, ecological, environmental or other plausible causes for this pattern. Based on this information, which species may require closer monitoring?

   d) Briefly discuss the factors that drive genetic differentiation in isolated populations of the same species and what impact might these processes have on a population that undergoes sudden reduction in size.

Table 1. Population genetic summary statistics for *Ambystoma maculatum*

Population	N	A_R	H_O	H_E	F'_{IS}
2	21	3.54	0.610	0.643	0.051
11	25	3.39	0.619	0.636	0.026
122	23	3.42	0.628	0.629	0.002
152	35	3.03	0.542	0.576	0.059
200	10	2.74	0.559	0.575	0.027
228	35	3.04	0.605	0.604	−0.001
229	33	3.12	0.586	0.603	0.028
238	49	3.20	0.585	0.609	0.040
246	41	3.27	0.581	0.600	0.032
251	17	2.92	0.608	0.605	−0.004
264	43	3.24	0.589	0.605	0.026
274	47	2.90	0.557	0.578	0.035
294	10	2.70	0.616	0.548	−0.124
356	12	2.86	0.583	0.586	0.005
387	51	3.04	0.573	0.580	0.011
393	30	3.11	0.577	0.600	0.038
407	32	3.13	0.592	0.604	0.020
408	15	3.01	0.578	0.592	0.024
415	10	2.86	0.533	0.555	0.039
66	14	3.06	0.599	0.588	−0.020
71	35	2.96	0.592	0.586	−0.011
8	54	3.21	0.611	0.603	−0.014
Avg	29.18	3.08	0.587	0.596	0.013

Table 2. Population genetic summary statistics for *Ambystoma annulatum*

Population	N	A_R	H_O	H_E	F'_{IS}
120	35	3.71	0.724	0.705	−0.027
127	40	3.66	0.624	0.688	0.093
152	32	3.67	0.694	0.704	0.014
228	10	3.34	0.653	0.694	0.059
229	11	3.51	0.655	0.713	0.082
238	15	3.10	0.609	0.646	0.058
246	13	3.14	0.641	0.666	0.038
264	12	3.27	0.637	0.660	0.034
315	10	3.11	0.674	0.662	−0.018
331	30	3.58	0.629	0.681	0.076
380	15	3.87	0.711	0.715	0.006
400	32	3.47	0.603	0.685	0.120
407	13	3.14	0.631	0.640	0.015
66	23	3.51	0.643	0.655	0.018
71	15	3.52	0.709	0.694	0.009
Avg	20.40	3.44	0.656	0.681	0.038

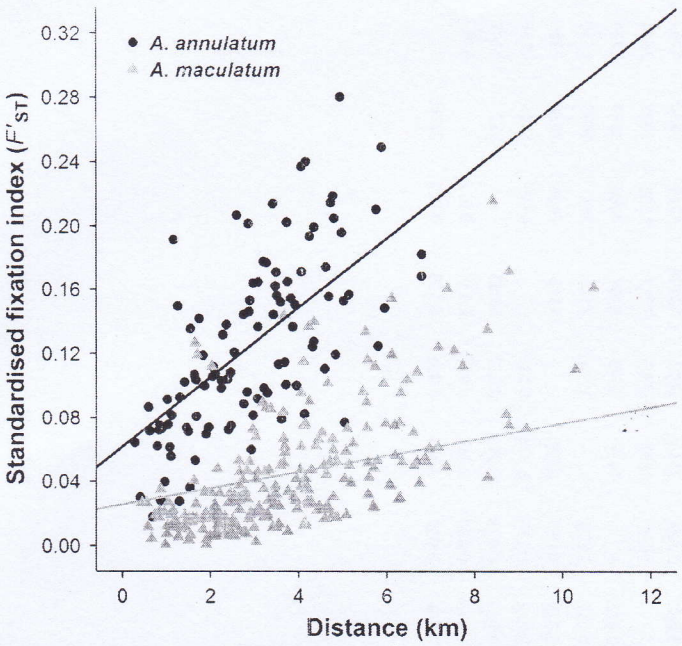

Figure 1. Scatter plot demonstrating the relationship between geographic distance (direct) between two given ponds and the respective pairwise F'_{ST} value (Based on Tables 4 and 5).

Table 3. Pairwise distances among *Ambystoma maculatum* ponds. F'_{ST} is in the lower triangle and Euclidean distance (meters) is in the upper triangle.

Pond	2	11	122	152	200	228	229	238	246	251	264	274	294	356	387	393	407	408	415	66	71	8
2	–	577	2219	2494	5592	3547	2623	2164	2134	6750	5572	8705	6460	8297	5704	6354	5146	2440	2036	4284	3489	4140
11	0.012	–	2568	3068	5707	3883	3031	2699	2706	7176	6075	9171	6697	8770	6059	6870	5568	2640	1708	4703	3940	4646
122	0.013	0.014	–	2101	3655	1328	555	1271	2385	4634	3751	6685	4288	6305	3495	4591	3029	742	4238	2170	1511	2414
152	0.016	0.046	0.025	–	5528	2821	1901	830	663	5031	3474	6700	5734	6264	4459	4142	3584	2832	4225	2872	2062	2143
200	0.043	0.049	0.067	0.090	–	2728	3646	4762	5967	4109	4777	6112	1656	5926	2655	5451	3368	3173	7382	3251	3678	4385
228	0.013	0.031	0.011	0.029	0.041	–	1033	2107	3316	3419	2915	5538	3028	5188	2178	3755	1864	1435	5564	1100	1015	1919
229	0.010	0.041	0.027	0.020	0.084	0.027	–	1116	2324	4145	3197	6166	4061	5778	3099	4036	2537	1176	4659	1672	960	1862
238	0.013	0.030	0.005	0.018	0.067	0.023	0.020	–	1211	4761	3428	6608	5104	6188	3969	4194	3209	2005	4111	2401	1549	1999
246	0.018	0.030	0.014	0.004	0.076	0.028	0.018	0.016	–	5691	4132	7357	6293	6920	5077	4783	4228	3066	3676	3489	2657	2805
251	0.039	0.062	0.023	0.042	0.075	0.012	0.035	0.019	0.025	–	1839	2159	2756	1874	1526	1910	1608	4853	8781	2473	3268	2890
264	0.032	0.038	0.009	0.037	0.060	0.021	0.036	0.025	0.013	-0.002	–	3226	3927	2791	2300	848	1408	4222	7538	1828	2240	1433
274	0.082	0.073	0.053	0.052	0.154	0.074	0.075	0.071	0.049	0.048	0.046	–	4573	448	3661	2657	3680	6972	10709	4521	5232	4618
294	0.104	0.109	0.047	0.112	0.127	0.068	0.096	0.073	0.077	0.009	0.028	0.050	–	4442	1632	4421	2629	4058	8405	2956	3681	4051
356	0.043	0.075	0.030	0.029	0.102	0.039	0.053	0.056	0.052	0.033	0.033	0.027	0.066	–	3399	2209	3324	6617	10294	4149	4836	4193
387	0.024	0.038	0.011	0.025	0.038	0.006	0.024	0.023	0.019	0.017	0.007	0.051	0.040	0.029	–	2853	1025	3552	7732	1588	2428	2541
393	0.052	0.055	0.017	0.042	0.096	0.034	0.047	0.036	0.031	0.001	0.000	0.046	0.022	0.033	0.017	–	2124	5070	8289	2660	3083	2229
407	0.050	0.052	0.003	0.050	0.085	0.017	0.031	0.018	0.026	0.018	0.019	0.058	0.029	0.047	0.012	0.023	–	3294	7180	865	1679	1550
408	0.032	0.053	0.019	0.046	0.090	0.012	0.013	0.033	0.023	0.018	0.035	0.061	0.037	0.050	0.025	0.059	0.020	–	4348	2486	2020	2985
415	0.112	0.119	0.090	0.137	0.161	0.116	0.102	0.115	0.144	0.172	0.122	0.161	0.216	0.111	0.112	0.135	0.124	0.140	–	6319	5516	6110
66	0.027	0.052	0.014	0.052	0.086	0.012	0.026	0.027	0.032	0.009	0.010	0.070	0.073	0.076	0.015	0.028	0.035	0.027	0.095	–	852	1147
71	0.032	0.042	0.004	0.018	0.058	0.008	0.021	0.007	0.023	0.018	0.012	0.064	0.062	0.054	0.010	0.020	0.017	0.017	0.134	0.022	–	976
8	0.015	0.025	0.006	0.009	0.062	0.004	0.019	0.006	0.008	0.020	0.015	0.045	0.062	0.028	0.006	0.019	0.015	0.011	0.119	0.022	0.001	–

Table 4. Pairwise distances among *Ambystoma annulatum* ponds. F'_{ST} is in the lower triangle and Euclidean distance (meters) is in the upper triangle.

Pond	120	127	152	228	229	238	246	264	315	331	380	400	407	66	71
120	–	1301	2462	1076	689	1635	2747	3747	3085	3059	2255	2386	2888	2053	1529
127	0.093	–	2362	613	887	1748	2860	2457	4344	4339	3542	3488	1652	789	404
152	0.075	0.138	–	2821	1901	830	587	3474	4972	4834	3606	4676	3584	2872	2062
228	0.062	0.072	0.096	–	1033	2107	3265	2915	3919	3945	3296	2970	1864	1100	1015
229	0.018	0.073	0.070	0.076	–	1116	2280	3197	3730	3683	2749	3075	2537	1672	960
238	0.107	0.142	0.072	0.107	0.082	–	1165	3428	4241	4126	2957	3866	3209	2401	1549
246	0.144	0.202	0.087	0.177	0.132	0.192	–	4054	4940	4775	3501	4795	4157	3422	2593
264	0.165	0.108	0.162	0.060	0.178	0.144	0.237	–	6799	6796	5946	5884	1408	1828	2240
315	0.165	0.199	0.196	0.151	0.202	0.194	0.280	0.182	–	277	1500	1264	5759	5016	4612
331	0.092	0.128	0.119	0.100	0.115	0.083	0.219	0.168	0.064	–	1294	1451	5799	5035	4588
380	0.103	0.113	0.079	0.096	0.089	0.081	0.156	0.148	0.071	0.028	–	1957	5140	4307	3706
400	0.104	0.171	0.156	0.164	0.137	0.137	0.205	0.249	0.150	0.074	0.074	–	4722	4060	3820
407	0.153	0.053	0.152	0.100	0.121	0.099	0.240	0.102	0.211	0.125	0.157	0.215	–	865	1679
66	0.106	0.062	0.146	0.056	0.104	0.072	0.214	0.119	0.153	0.077	0.124	0.171	0.028	–	852
71	0.036	0.030	0.112	0.092	0.040	0.136	0.207	0.099	0.174	0.111	0.101	0.155	0.081	0.075	–

2. Briefly describe factors or processes that might contribute to a population's extinctionand how they are used in Population Viability Analysis (PVA).

3. Using appropriate examples, briefly describe why some species are more susceptible to human induced threats.

4. Write short notes on **four (04)** of the following;

a)Spatial scales of biodiversity
b) Population age structure and population growth
c) Species concepts and Evolutionarily Significant Units (ESU)
d) Source-sink dynamics
e)Species diversity and richness

5. Briefly comment on the causes and consequences of desertification and deforestation.