UNIVERSITI SAINS MALAYSIA

Second Semester Examination
Academic Session 2005/2006

April/May 2006

# BST 203E/3 – Population of Community Ecology
## *[Ekologi Populasi dan Komuniti]*

Duration: 3 hours
*Masa : [3 jam]*

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Please ensure that this examination paper contains NINE printed pages before you begin the examination.

Answer FIVE out of SIX questions, in English or Bahasa Malaysia.

Each question carries 20 marks.

Sila pastikan bahawa kertas peperiksaan ini mengandungi SEMBILAN muka surat yang bercetak sebelum anda memulakan peperiksaan ini.

Jawab LIMA daripada ENAM soalan yang diberikan dalam Bahasa Inggeris atau Bahasa Malaysia.

Tiap-tiap soalan bernilai 20 markah.

...2/-

1. The following is diatom species distribution at two sites:

**Site A**

| Species | Abundance (no. of individuals per species, $n_i$) |
|---|---|
| *Achnanthes saxonica* | 11 |
| *A. minutissima* | 5 |
| *Amphora* sp. 1 | 2 |
| *Amphora* sp. 2 | 1 |
| *Amphora* sp. 3 | 2 |
| *Cymbella affinis* | 2 |
| *Cymbella lanceolata* | 4 |
| *Diatoma hiemale* | 3 |
| *Diatoma* sp. | 2 |
| *Eunotia arcus* | 3 |
| *E. meisteri* | 8 |
| *Gomphonema abbreviatum* | 4 |
| *G. olivaceum* | 4 |
| *G. parvulum* | 2 |
| *Meridion* sp. | 6 |
| *Navicula notha* | 4 |
| *N. peregrina* | 9 |
| *Opephora* sp. | 5 |
| *P. biceps* | 2 |
| *Pinnularia microstauron* | 2 |
| *Tabellaria* sp. | 3 |

...3/-

**Site B**

| Species | Abundance (no. of individuals per species, $n_i$) |
|---|---|
| *Achnanthes saxonica* | 3 |
| *Diatoma* sp. | 4 |
| *Fragilaria capucina* | 2 |
| *Fragilaria* sp. | 1 |
| *Gomphonema parvulum* | 23 |
| *G. olivaceum* | 2 |
| *G. subventricosum* | 17 |
| *Meridion* sp. | 6 |
| *Navicula cryptocephala* | 33 |
| *N. radiosa* | 7 |
| *Nitzshia palea* | 5 |
| *Pinnularia biceps* | 1 |

For each site, determine the community structural indices:

[a] Shannon-Wiener Diversity Index, H' (Shannon & Weaver, 1963).

(10 marks)

[b] Similarity value between these two communities based on Sorensen Similarity Index.

(10 marks)

...4/-

1. *Berikut adalah taburan spesies diatom di dua kawasan:*

***Kawasan A***

| ***Spesies*** | ***Kelimpahan (bil. individu per spesies, $n_i$)*** |
|---|---|
| *Achnanthes saxonica* | *11* |
| *A. minutissima* | *5* |
| *Amphora sp. 1* | *2* |
| *Amphora sp. 2* | *1* |
| *Amphora sp. 3* | *2* |
| *Cymbella affinis* | *2* |
| *Cymbella lanceolata* | *4* |
| *Diatoma hiemale* | *3* |
| *Diatoma sp.* | *2* |
| *Eunotia arcus* | *3* |
| *E. meisteri* | *8* |
| *Gomphonema abbreviatum* | *4* |
| *G. olivaceum* | *4* |
| *G. parvulum* | *2* |
| *Meridion sp.* | *6* |
| *Navicula notha* | *4* |
| *N. peregrina* | *9* |
| *Opephora sp.* | *5* |
| *P. biceps* | *2* |
| *Pinnularia microstauron* | *2* |
| *Tabellaria sp.* | *3* |

.../5-

***Kawasan B***

| ***Spesies*** | ***Kelimpahan (bil. individu per spesies, $n_i$)*** |
|---|---|
| *Achnanthes saxonica* | *3* |
| *Diatoma sp.* | *4* |
| *Fragilaria capucina* | *2* |
| *Fragilaria sp.* | *1* |
| *Gomphonema parvulum* | *23* |
| *G. olivaceum* | *2* |
| *G. subventricosum* | *17* |
| *Meridion sp.* | *6* |
| *Navicula cryptocephala* | *33* |
| *N. radiosa* | *7* |
| *Nitzshia palea* | *5* |
| *Pinnularia biceps* | *1* |

*Bagi setiap kawasan, tentukan indeks struktur komuniti:*

*[a]* *Indeks Kepelbagaian Shannon- Wiener, H' (Shannon & Weaver, 1963).*

*(10 markah)*

*[b]* *Nilai kesamaan antara dua komuniti tersebut berdasarkan Indeks Kesamaan Sorensen.*

*(10 markah)*

...6/-

2. Elaborate the Lotka-Volterra competition model to predict the outcome of interspecific competition.

(20 marks)

2. *Huraikan model persaingan Lotka-Volterra untuk meramalkan hasil persaingan antara-spesies.*

*(20 markah)*

3. Discuss the inhibition, facilitation, and tolerance models of succession. In your discussion, explain the changes in the characteristics of individual organisms associated with different successional stages.

(20 marks)

3. *Bincangkan model perencatan, permudahan dan ketoleranan sesaran. Dalam perbincangan anda terangkan perubahan ciri-ciri individu organisma yang berasosiasi dengan peringkat sesaran yang berbeza.*

*(20 markah)*

4. [a] Explain the true census and sampling estimates methods in estimating population numbers and with appropriate example for each method.

(10 marks)

[b] Write short notes on Removal Method in estimating population size and the assumptions of the method.

(10 marks)

...7/-

4. [a] *Terangkan kaedah pengiraan sebenar dan anggaran persampelan dalam penganggaran bilangan populasi dan berikan contoh bersesuaian untuk setiap kaedah.*

*(10 markah)*

[b] *Tuliskan nota ringkas tentang Kaedah "Removal" dalam penganggaran saiz populasi dan andaian-andaian untuk kaedah tersebut.*

*(10 markah)*

5. Table shows an example of alife table. The data in the *x* and *Lx* columns were obtained from a population of wild Malayan Wood Rat (*Rattus tiomanicus*). Then all other columns of data could be derived from them.

| Age (*yr*) | Cohort (age interval) *x* | Number in Cohort, $L_x$ | Number Living at Start, $l_x$ | Number of Dying during x, $d_x$ | Probability of Dying during x, $q_x$ | Probability of Surviving Interval *x*, $s_x$ | Animal-Years Live, $T_x$ | Live to Expectancy, $e_x$ (*yr*) |
|---|---|---|---|---|---|---|---|---|
| 0-1 | 0 | 33 | | | | | | |
| 1-2 | 1 | 16 | | | | | | |
| 2-3 | 2 | 9 | | | | | | |
| 3-4 | 3 | 4 | | | | | | |
| 4-5 | 4 | 1 | | | | | | |
| 5-6 | 5 | 0 | | | | | | |

Complete the life table by filling all the values of colums $l_x$, $d_x$, $q_x$, $s_x$, $T_x$ and $e_x$.

(20 marks)

.../8-

5. *Jadual di bawah menunjukkan satu jadual hidup. Data-data di dalam kolum x dan $L_x$ dicerap daripada satu populasi liar Tikus Belukar (Rattus tiomanicus). Kemudian data untuk kesemua kolum berikutnya boleh dikira daripada kolum sebelumnya.*

| *Age (yr)* | *Kohort (sela umur) x* | *Bilangan dalam kohort, $L_x$* | *Bilangan hidup pada permulaan sela, $l_x$* | *Bilangan mati semasa x, $d_x$* | *Kebarang-kalian mati semasa x, $q_x$* | *Kebarang-kalian mandiri pada sela x, $s_x$* | *Tahun-untuk masih hidup haiwan, $T_x$* | *Kejangkaan hidup, $e_x$ (yr)* |
|---|---|---|---|---|---|---|---|---|
| *0-1* | *0* | *33* | | | | | | |
| *1-2* | *1* | *16* | | | | | | |
| *2-3* | *2* | *9* | | | | | | |
| *3-4* | *3* | *4* | | | | | | |
| *4-5* | *4* | *1* | | | | | | |
| *5-6* | *5* | *0* | | | | | | |

*Lengkapkan jadual hidup tersebut dengan mengisi nilai-nilai kolum-kolum $l_x$, $d_x$, $q_x$, $s_x$, $T_x$ dan $e_x$.*

*(20 markah)*

.../9-

6. [a] Describe the ecological differences between *r*-species and *K*-species.

(10 marks)

[b] Describe the most suitable population model for the current trend in human population growth.

(10 marks)

6. *[a] Terangkan perbezaan-perbezaan ekologi antara r-spesies dan K-spesies.*

*(10 markah)*

*[b] Jelaskan model populasi yang paling sesuai untuk corak pertumbuhan populasi manusia pada masa kini.*

*(10 markah)*

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