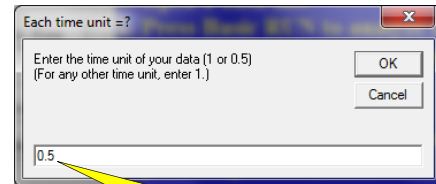# How to prepare data file for 0.5 d or 8 hour?

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Page 1

0.5 time unit

If you collect your data every 0.5 d (12 h), you can still use the TWOSEX to analyze your data.

Each time unit =?

Enter the time unit of your data (1 or 0.5)
(For any other time unit, enter 1.)

OK

Cancel

0.5

Enter 0.5 here.

Page 2

Data file for 0.5 d

…………..
3,5
F,Egg,Larva,Proto,Deuto,Female
M,Egg,Larva,Proto,Deuto,Male
N,Egg,Larva,Proto,Deuto,Unknown
Larva, Deuto
1,F,2,1,2,1,5,7,6,6,5,4,-1

2 time units (one day) in egg stage, 1 time unit (0.5 d) in larva stage, 2 time units in protonymph, 1 time unit (0.5 d) in deutonymph, 5 time units (2.5 d) in adult, ….

Page 3

Attention!

- If you use TWOSEX to analyze data collected every 0.5 d, the raw data will be listed in the output_Basic.txt file using 0.5 d.
- The finite rate and the intrinsic rate of increase will, however, be calculated using day as time unit.
- The data file for TIMING will be created for time unit 0.5 d.

Page 4

Critical thinking

If you collect data using time unit 0.5 d, you can organize your data using 0.5 d for life table analysis. You can also group your data using 1 d time unit. Will there be any difference between them?

Page 5

Answers

- The mean fecundity should be always the same, no matter what time unit you use.
- The net reproductive should be the same, too.
- Although the age-specific fecundity (m_x) and survival rate (l_x) prepared using finer time interval (0.5 d) look different from those using 1 d time unit, the net reproductive remains the same . You may not believe this. It is proved by your teacher (Prof. Dr. Chi) that

$$R_0 = \frac{N_f}{N} \times F$$

Page 6

Answers

■ But, when the age-specific fecundity (m_x) and survival rate (l_x) are prepared using finer time interval (0.5 d), there will be minor differences in λ, r, and T.

■ The smaller time unit gives a more precise description of the survival rate and fecundity. The age of the first reproduction affects the value of r and λ significantly.

Page 7

Dimensional analysis of R_0

$$R_0 = F \times \frac{N_f}{N}$$

$$[R_0] = \frac{[\text{Total offspring or eggs}]}{[\text{Total females}]} \times \frac{[\text{Total females}]}{[\text{Total individuals}]}$$

$$[R_0] = \frac{[\text{Total offspring or eggs}]}{[\text{Total individuals}]}$$

$$[R_0] = \frac{[\text{mean number of offspring or eggs}]}{[\text{individual}]}$$

It is clear. The correct unit for R_0 is "offspring per individual" or "eggs/individual". If we omit "individual", we can use "offspring" as unit.

Page 8

A straightforward answer

If you define the net reproductive rate as the total number of offspring that an average individual will produce during its life time, then the net reproductive rate will always be the same no matter what time unit (1 d, 0.5 d, 6 h, 1 h, 30 min, etc.) you use.

Page 9

Critical thinking

If you collect data using time unit 8 h, 6 h, or 4.8 h, can you still use TWOSEX to analyze your data?

How can you organize your data?

How can you prepare your figures?

Page 10

Yes! You can!

■ TWOSEX-MSChart can analyze any data file using any time unit.

■ Note well! The finite rate and intrinsic rate have the dimension "1/time unit". It means no matter what time length you used in your life table study (1 d, 0.5 d, 12 h, 8 h, 6 h, 4.8 h, etc.), they are all the same as "1 time unit".

■ You need only transform the x-axis to the time length you used.

Page 11

Yes! You can!

■ Because the mean fecundity F and the net reproductive rate R_0 will not be changed by the time unit. You don't need to do anything.

■ The shape of all curves (e.g., l_x, f_{xj}, m_x, $l_x m_x$, e_{xj}, v_{xj}, etc.) will not be affected by the time unit, when the x-axis is labeled as number of "time unit". Thus you can prepare the figure as usual. Then you transform the tick label of x-axis to the time length you prefer to express. If you used 8 h, then you transform it as $x \times 8/24$ (or $x/3$). Then the tick label will show the time length.

Page 12

Yes! You can!

- Because the mean fecundity F and the net reproductive rate R_0 will not be changed by the time unit. You don't need to do anything.
- The shape of all curves (e.g., l_x, f_{xj}, m_x, $l_x m_x$, e_{xj}, v_{xj}, etc.) will not be affected by the time unit, when the x-axis is labeled as number of "time unit". Thus you can prepare the figure as usual. Then you transform the tick label of x-axis to the time length you prefer to express. If you used 4.8 h, then you transform it as $x \times 4.8/24$ (or $x/5$). Then the tick label will show the time length.
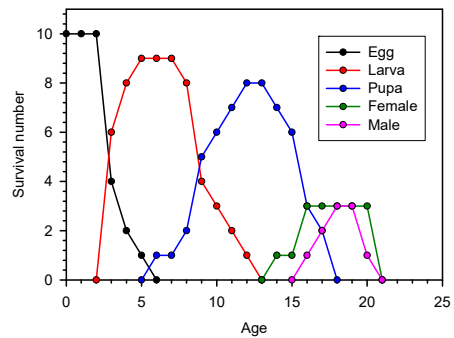
Page 13

Survival rate in time unit (8 h)

Page 14
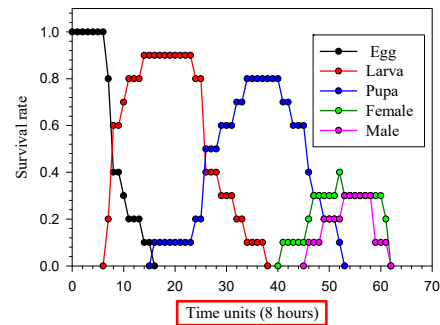
Survival rate in age (day)

Page 15
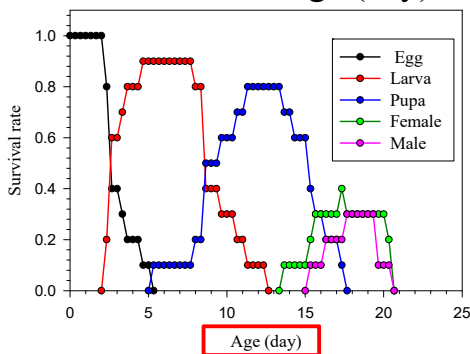
Larger time unit will not show the details

Page 16

If each time unit = 8 hours

The intrinsic rate and finite rate are calculated as the change rate per "time unit". For example, if you collect the survival and fecundity data per 8 h, then the intrinsic rate and finite rate are change rate "per 8 h". If you prefer to show them as "change rate per day", then you can transform them as:

$$(r_{8h}) \times 3 = r_{day} \quad (r_{x\,hour}) \times (24/x) = r_{day}$$

$$(\lambda_{8h})^3 = \lambda_{day} \quad (\lambda_{x\,hour})^{24/x} = \lambda_{day}$$

Page 17

If each time unit = 4.8 hours

If you collect the survival and fecundity data per 4.8 h, then the intrinsic rate and finite rate are change rate "per 4.8 h". Then you transform the tick label of x-axis of your curves as $x \times 4.8/24$ (or $x/5$). Then the tick label will show the time length as your record. If you prefer to show them as "change rate per day", then you can transform them as:

$$(r_{4.8h}) \times 5 = r_{day}$$

$$(\lambda_{4.8h})^5 = \lambda_{day}$$

Page 18

Mean generation time for 0.8 h

- Because R_0 will not change with the time unit but r and λ become greater at larger time unit, the mean generation time will be shorter when larger time unit is used to express T. But they are actually the same.

$$T_{1d} = \frac{\ln R_0}{r_{1d}} = \frac{\ln R_0}{\ln \lambda_{1d}} = \frac{\ln R_0}{5 \times r_{4.8}} = \frac{\ln R_0}{5 \times \ln \lambda_{4.8h}}$$

$$T_{4.8h} = \frac{\ln R_0}{r_{4.8h}} = \frac{\ln R_0}{\ln \lambda_{4.8h}}. \quad 5 \times T_{1d} = T_{4.8h}.$$

If $T_{1d} = 3\,\text{d}$, $T_{4.8h} = 15\,(4.8h)$, $5 \times 3\,\text{d} = 15\,(4.8h)$.


Note well!

Because the population will grow at the same rate no matter what time unit you use. $T_{4.8h}$ and T_{1d} remain the same but expressed in different time unit.

Three 8-h = One day

Attention!

- It is absolutely OK that you collect the life table data using 0.5 d, 8 h, 4.8 h, and then present your result using 1 d unit, because you have real detailed data.
- It is, however, not a good practice to present your data using a time unit smaller than the real one you used in data collection.
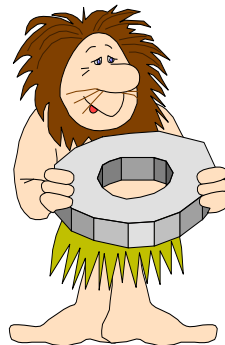
Teşekkür ederim!
سپاسگزارم
謝謝!
ขอบคุณครับ
Děkuji
Danke!
¡Muchas gracias!
Thank you!
ご清聴ありがとうございます！