Life histories and evolutionary fitness

Educational Goals

Be familiar with these ideas and examples to illustrate:

• What is meant by life history
• Life history as evolutionary solution to environment, how constraints shape life history
• Trade offs (growth vs. fecundity, r-K, Grime’s triangle)
• Parity
• Parental investments
What is life history?

**Life history** is the

- 1st reproduction:
- Parity:
- allocation of energy to reproduction
- number (__________) and size of offspring
- life span (________________________)

Life Histories

2 birds of the same size:

- **Thrushes** –
  
- **Storm Petrels** –
What influences life histories?

• Body plan and life style
• Evolutionary responses to many factors, including:
  –

A Classic Study

David Lack –

• Songbirds: tropical lay less eggs than temperate counterparts
• Hypothesized:
Lack’s Proposal

Suggested that life histories are shaped by natural selection:
- because L.H. traits contribute to reproductive success
- L.H. vary consistently with factors in the environment
- Can experimentally test hypotheses

So, an experimental test

- Lack - artificially increase # of eggs per clutch:
  - shows

- This proposal has been tested repeatedly – e.g. magpies
Life histories balance tradeoffs.

- when should an individual begin to produce offspring?
- how often should an individual breed?
- how many offspring should an individual produce in each breeding episode?
Trade-offs: Growth and Fecundity  
(Table 10.3)

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
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</thead>
<tbody>
<tr>
<td><strong>Slow growth/high fecundity</strong></td>
<td></td>
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<tr>
<td>Body weight</td>
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<td>12</td>
<td>14.4</td>
<td>17.3</td>
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<td>23.0</td>
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<td>Growth increment</td>
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<td>2.4</td>
<td>2.9</td>
<td>3.5</td>
<td>4.2</td>
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<tr>
<td>Weight of eggs</td>
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<td>9.6</td>
<td>11.5</td>
<td>13.8</td>
<td>16.6</td>
<td>20.0</td>
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<tr>
<td>Cumulative weight of eggs</td>
<td>8</td>
<td>17.6</td>
<td>29.1</td>
<td>42.9</td>
<td>59.5</td>
<td>79.5</td>
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<td><strong>Rapid growth/low fecundity</strong></td>
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<tr>
<td>Body weight</td>
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<td>15</td>
<td>22.5</td>
<td>33.8</td>
<td>50.7</td>
<td>76.1</td>
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<tr>
<td>Growth increment</td>
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<tr>
<td>Cumulative weight of eggs</td>
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<td>23.8</td>
<td>40.7</td>
<td>66.1</td>
<td>104.2</td>
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</tbody>
</table>

The slow-fast continuum

- generalizations:
  - life history traits often vary consistently with
    ______________________
  - Correlations……..
The slow-fast continuum

<table>
<thead>
<tr>
<th></th>
<th>Slow (K)</th>
<th>Fast (r)</th>
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</thead>
<tbody>
<tr>
<td>Life span</td>
<td></td>
<td></td>
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<tr>
<td>Development</td>
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<tr>
<td>Age at maturity</td>
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<tr>
<td>Parental Investment</td>
<td></td>
<td></td>
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<tr>
<td>Reproductive rate</td>
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</tbody>
</table>

Grime’s Scheme for Plants: 3 extremes

- Competitive Strategy
- Stress-tolerant Strategy
- Ruderal Strategy
What do salmon and century plants have in common?

Parity

- **Semelparity** -
  - stored resources allocated to reproduction, *programmed death*:
- **Iteroparity** -
Bet-hedging vs. Timing in Agave

Why semelparity?
• Iteroparity
• Highly variable envts. → semelparity
• Advantages to ________________
to occasionally good years

Salmon?
• Semelparity also arises where preparation for reproduction is very costly
Senescence

• inevitable wearing out of the organism, the accumulation of molecular defects

Aging varies

• Aging may be subject to natural selection:
Significance

“Life history traits can be interpreted as solutions to the problem of allocating limited time and resources among various structures, physiological functions, and behaviors.”

R. Ricklefs