Figure 3.1 The relationship between ages (●) and age classes (■) in population growth models. (From Caswell 1989.)
Survivalship Curves

(a) Log number of survivors
- Hippopotamus
- Elephant
- Waterbuck

(b) Number of survivors
- Xantusia vigilis
- Eumeces fasciatus
- Sceloporus obsoletus

(c) Survival ($s_0$)
- Seed
- Seedling
- Palm tree Euterpe globosa
- Young tree
- Mature, subcanopy
- Canopy

(d) Log number of survivors ($s_{10}$)
- Buffalo

(e) Log number of survivors ($s_{20}$)
- Zebra

(f) Log number of survivors ($s_{30}$)
- Warthog
Practical problems in measuring $lx$ - fig.

**Fig. 2.1.** (A) Logarithms of numbers of bluegills of successive ages, in a sample from Muskeg Lake, Ind., 1942; (B) Logarithms of the percentage representation of successive age-classes of pikepicks in the catch from California waters, season 1941–42. (Redrawn from Silliman 1943.)
Figure 1. Cross-sectional data on the life history of rural Gambians, based on data collected by Sir lan McGregor from Keneba and Manduac villages between 1950 and 1975. (a) Average annual weight gain as a proportion of total weight, between birth and 25 years of age for males and females. (b) Annual mortality hazard for males and females over the life span. (c) Age-specific fertility (number of live births per year) for males and females over the life span (3-year running means).

Figure 2. Kaplan-Meier plots of the first births to women of known age, from the villages of Keneba and Manduac, The Gambia, between 1968 and 1975. (a) Proportion of women not yet reproduced as a function of age in months, according to whether their mothers were alive or dead at the time of that birth, or in 1975 if not yet reproduced. (b) Survival of first-borns, as a function of age in months, according to whether their maternal grandmothers were alive at the time of their birth.
BLUE TILAPIA
INTRODUCED TO FLORIDA

\[ F = 9.663 \times 10^{-5} \cdot TL^{2.943} \]
\[ R^2 = 0.69 \]

\( M_x \) (average number of eggs)

\text{TOTAL LENGTH (TL, mm)}

\text{(n age)}
Costs of Reproduction: Experimental Approaches

A) Energy expenditure (proximate cost)

Fig. 13.7 Effects of brood size manipulations on mass-specific DEE in three species of birds: the savanna sparrow, Passerculus sandwichensis (Williams, 1987), kestrel, Falco tinnunculus (Deerenberg et al., 1995) and great tit, Parus major (J. M. Tinbergen, in preparation).

B) Residual Reproductive Value (ultimate cost)

Fig. 13.8 Kestrel residual reproductive value plotted as a function of their parental effort (hours of flight per day). (From Daan et al., 1990a.)
Figure 8.12. Trade-offs between current reproductive effort and expectation of future offspring at any particular instant (or age). Four curves relate costs in future progeny to profits in present offspring (and vice versa), with a dot marking the reproductive tactic that maximizes total possible lifetime reproductive success. Concave upward curves lead to all-or-none “big-bang” reproduction, whereas convex upward curves result in repeated reproduction (iteroparity). Figures 8.13 and 8.14 depict these trade-offs through the lifetime of a typical iteroparous and a semelparous organism, respectively. [From Fjanka (1976b).]
Figure 8.16. Fitness per progeny ($A'$ and $B'$) and total parental fitness, the sum of the fitnesses of all offspring produced ($A$ and $B$), plotted against clutch and litter size under the assumptions of Figure 8.15. Total investment in reproduction, or reproductive effort, is assumed to be constant. Note that parental fitness peaks at an intermediate clutch size under assumption $B$; optimal clutch size in this example is five.

**Optimal Clutch Size**

*in great tits*
ASSUMPTIONS OF LIFE-TABLE ANALYSIS

Table 4.3 Cohort life table for red deer hinds on the island of Rhum that were calves in 1957. (After Lowe, 1969.)

<table>
<thead>
<tr>
<th>Age (years)</th>
<th>Proportion of original cohort surviving to the beginning of age-class x</th>
<th>Proportion of original cohort dying during age-class x</th>
<th>Mortality rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>x</td>
<td>( L_x )</td>
<td>( d_x )</td>
<td>( q_x )</td>
</tr>
<tr>
<td>1</td>
<td>1.000</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>2</td>
<td>1.000</td>
<td>0.061</td>
<td>0.061</td>
</tr>
<tr>
<td>3</td>
<td>0.939</td>
<td>0.185</td>
<td>0.197</td>
</tr>
<tr>
<td>4</td>
<td>0.754</td>
<td>0.249</td>
<td>0.330</td>
</tr>
<tr>
<td>5</td>
<td>0.505</td>
<td>0.200</td>
<td>0.396</td>
</tr>
<tr>
<td>6</td>
<td>0.305</td>
<td>0.119</td>
<td>0.390</td>
</tr>
<tr>
<td>7</td>
<td>0.186</td>
<td>0.054</td>
<td>0.290</td>
</tr>
<tr>
<td>8</td>
<td>0.132</td>
<td>0.107</td>
<td>0.810</td>
</tr>
<tr>
<td>9</td>
<td>0.025</td>
<td>0.025</td>
<td>1.000</td>
</tr>
</tbody>
</table>

Figure 4.15 Two survivorship curves for red deer hinds on the island of Rhum. As explained in the text, one is based on the cohort life table for the 1957 calves and therefore applies to the post-1957 period; the other is based on the static life table of the 1957 population and therefore applies to the pre-1957 period. (After Lowe, 1969.)
Figure 16-5
Population age structure of Sweden in 1965 and of Costa Rica in 1963. Because Sweden's population has grown slowly, its age structure is distributed toward older ages. Declining birth rates during the Depression and the baby boom that followed World War II are responsible for irregularities in the age structure. Costa Rica's rapid population growth, caused by a high birth rate, has resulted in a bottom-heavy age structure. (After data in Keyfitz and Flieger 1968.)