Discrete Age Classes / Continuous Age

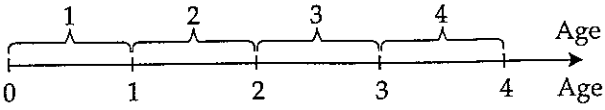
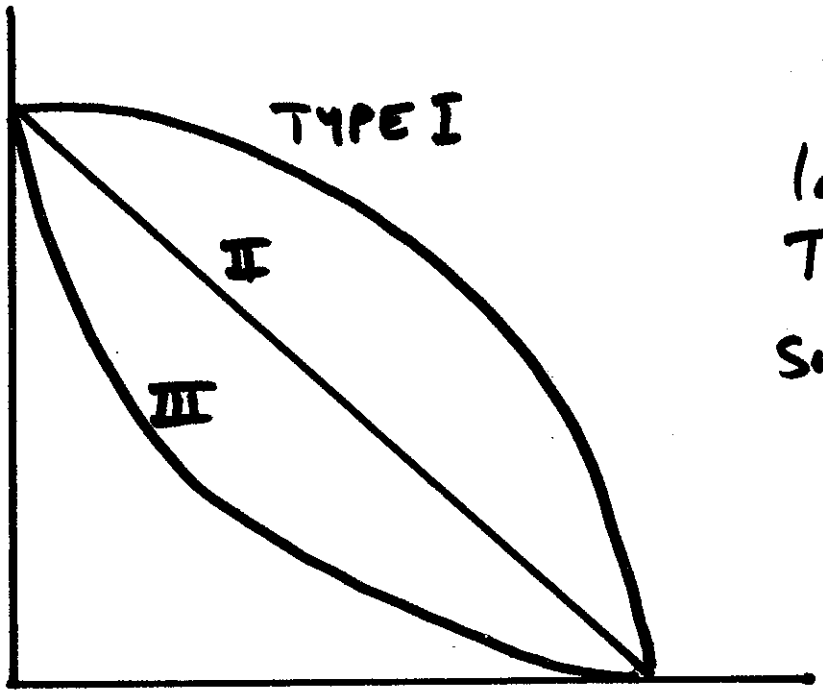


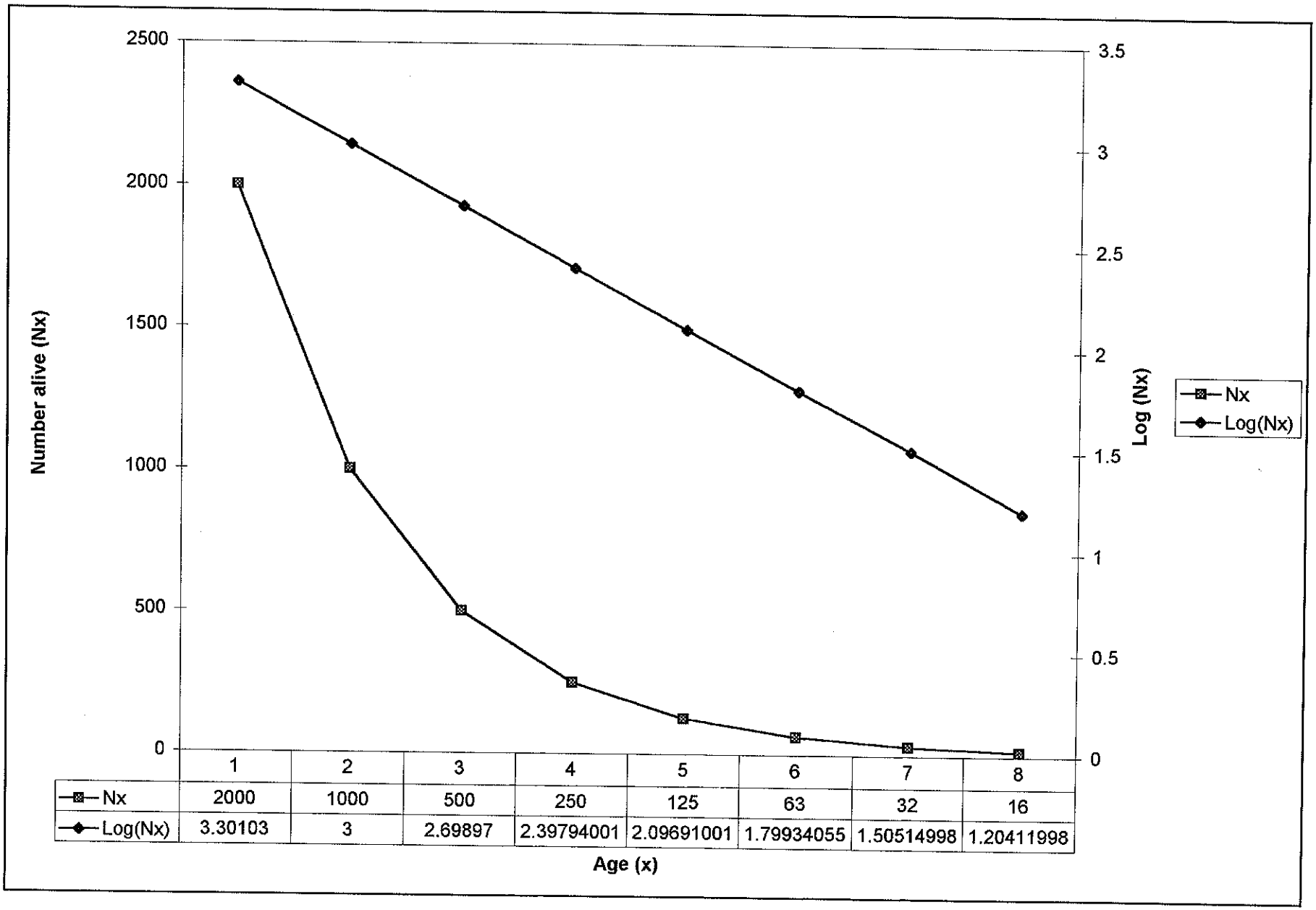
Figure 3.1 The relationship between ages and age classes in population growth models. (From Caswell 1989.)



log(N)

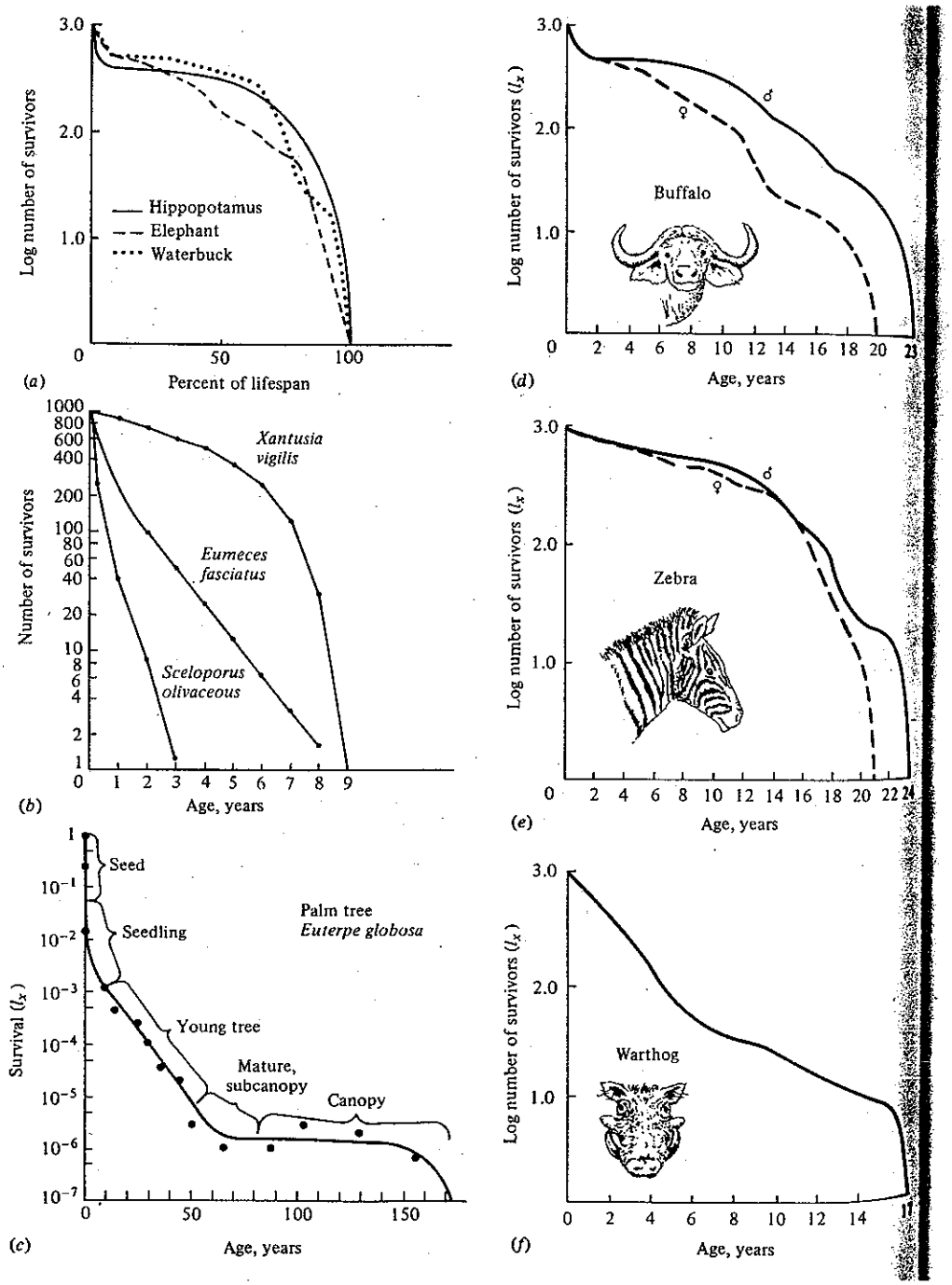
Idealized Types of Survivorship

Age

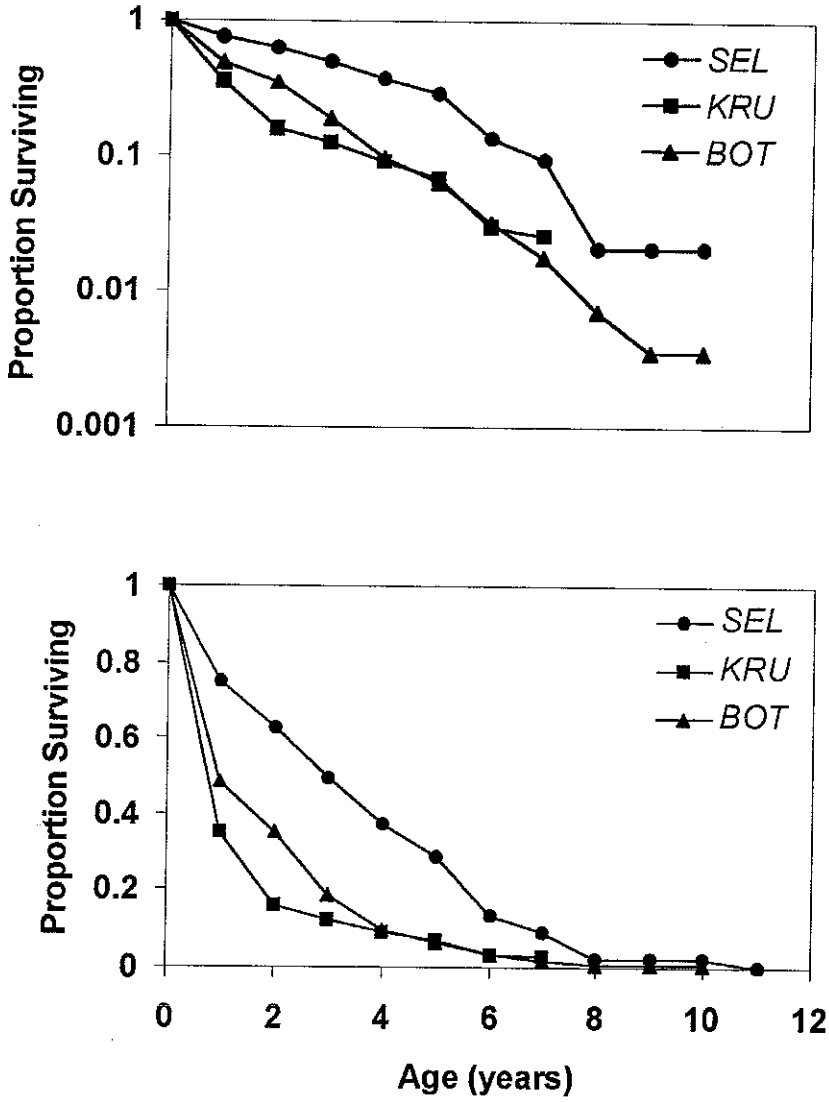


	1	2	3	4	5	6	7	8
Nx	2000	1000	500	250	125	63	32	16
Log(Nx)	3.30103	3	2.69897	2.39794001	2.09691001	1.79934055	1.50514998	1.20411998

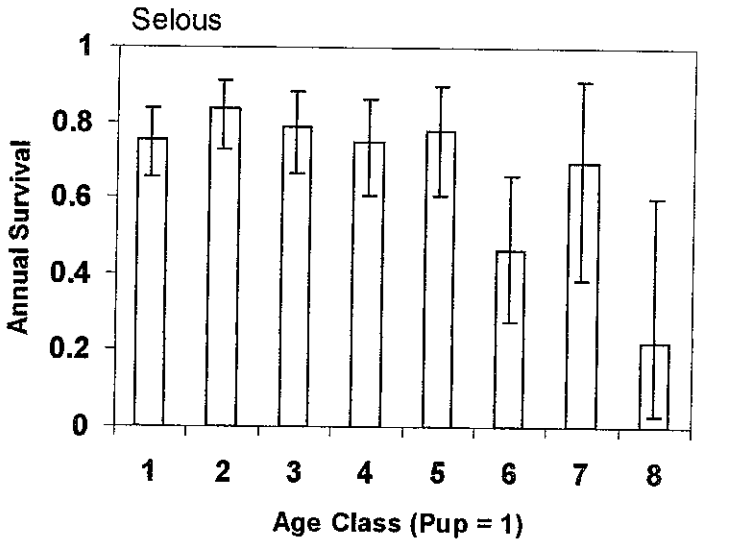
Survivorship Curves

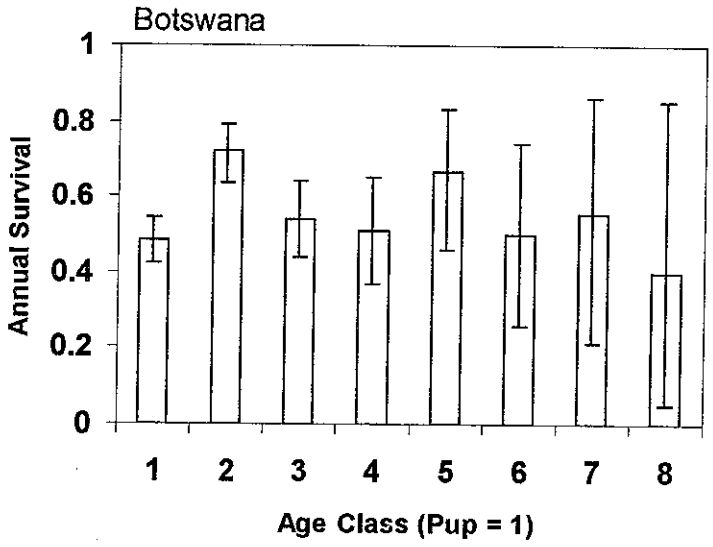


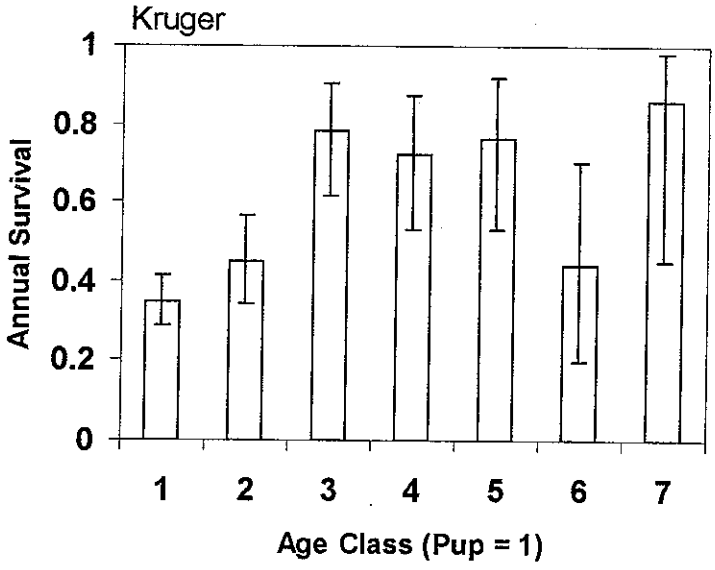
AWD


Proportion Surviving
1
0.1
0.01
0.001
SEL
KRU
BOT
Proportion Surviving
1
0.8
0.6
0.4
0.2
0
0
2
4
6
8
10
12
Age (years)

AWD


Selous
Annual Survival
1
0.8
0.6
0.4
0.2
0
1 2 3 4 5 6 7 8
Age Class (Pup = 1)


Botswana
Annual Survival
1
0.8
0.6
0.4
0.2
0
1 2 3 4 5 6 7 8
Age Class (Pup = 1)


Kruger
Annual Survival
1
0.8
0.6
0.4
0.2
0
1 2 3 4 5 6 7
Age Class (Pup = 1)

Practical problems in measuring lx - fish.

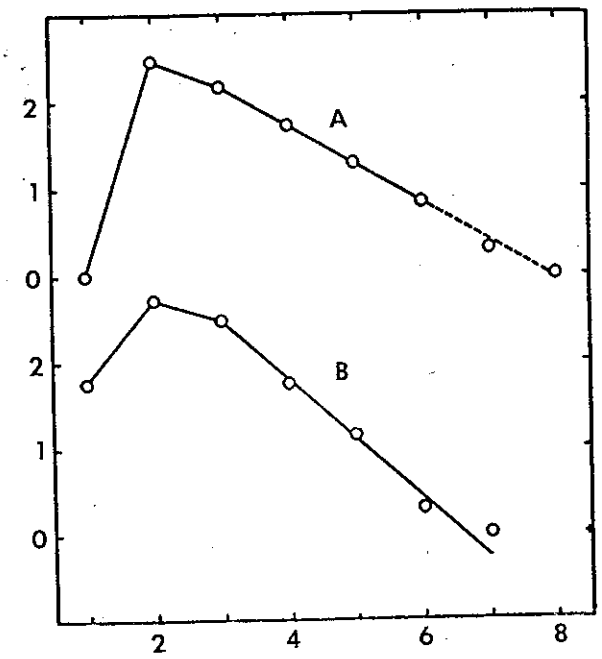


FIG. 2.1. (A) Logarithms of numbers of bluegills of successive ages, in a sample from Muskellunge Lake, Ind., 1942; (B) Logarithms of the percentage representation of successive age-classes of pilchards in the catch from California waters, season 1941–42. (Redrawn from Silliman 1943.)

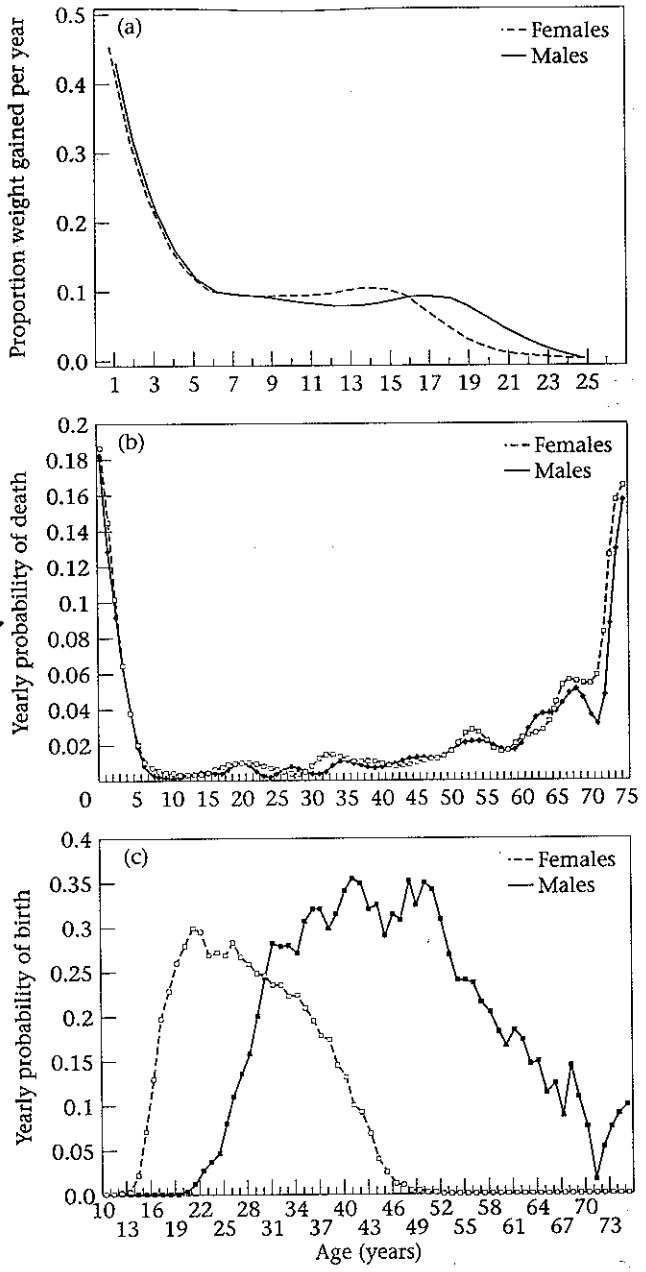


Figure 1. Cross-sectional data on the life history of rural Gambians, based on data collected by Sir Ian McGregor from Keneba and Manduar villages between 1950 and 1975. (a) Average annual weight gain as a proportion of total weight, between birth and 25 years of age for males and females. (b) Annual 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).

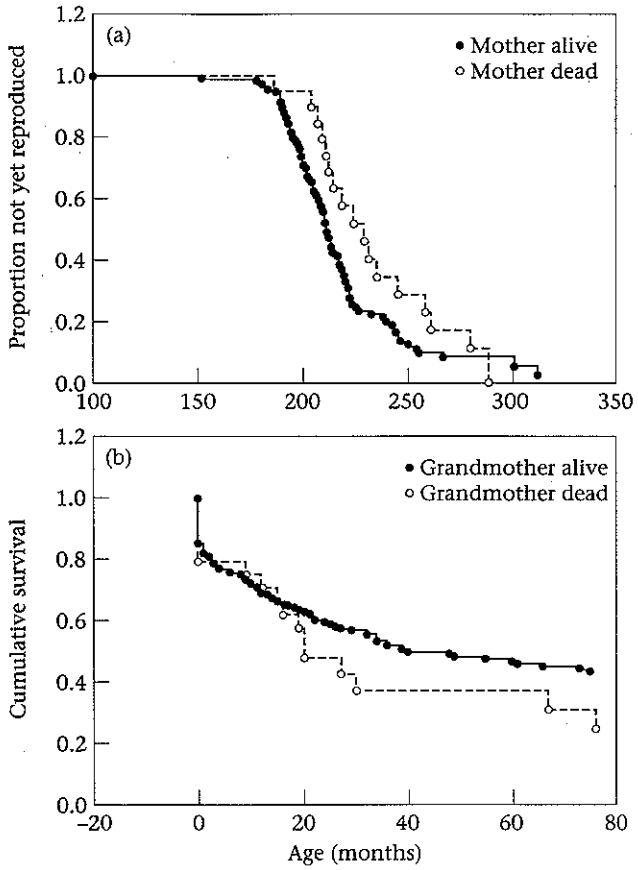
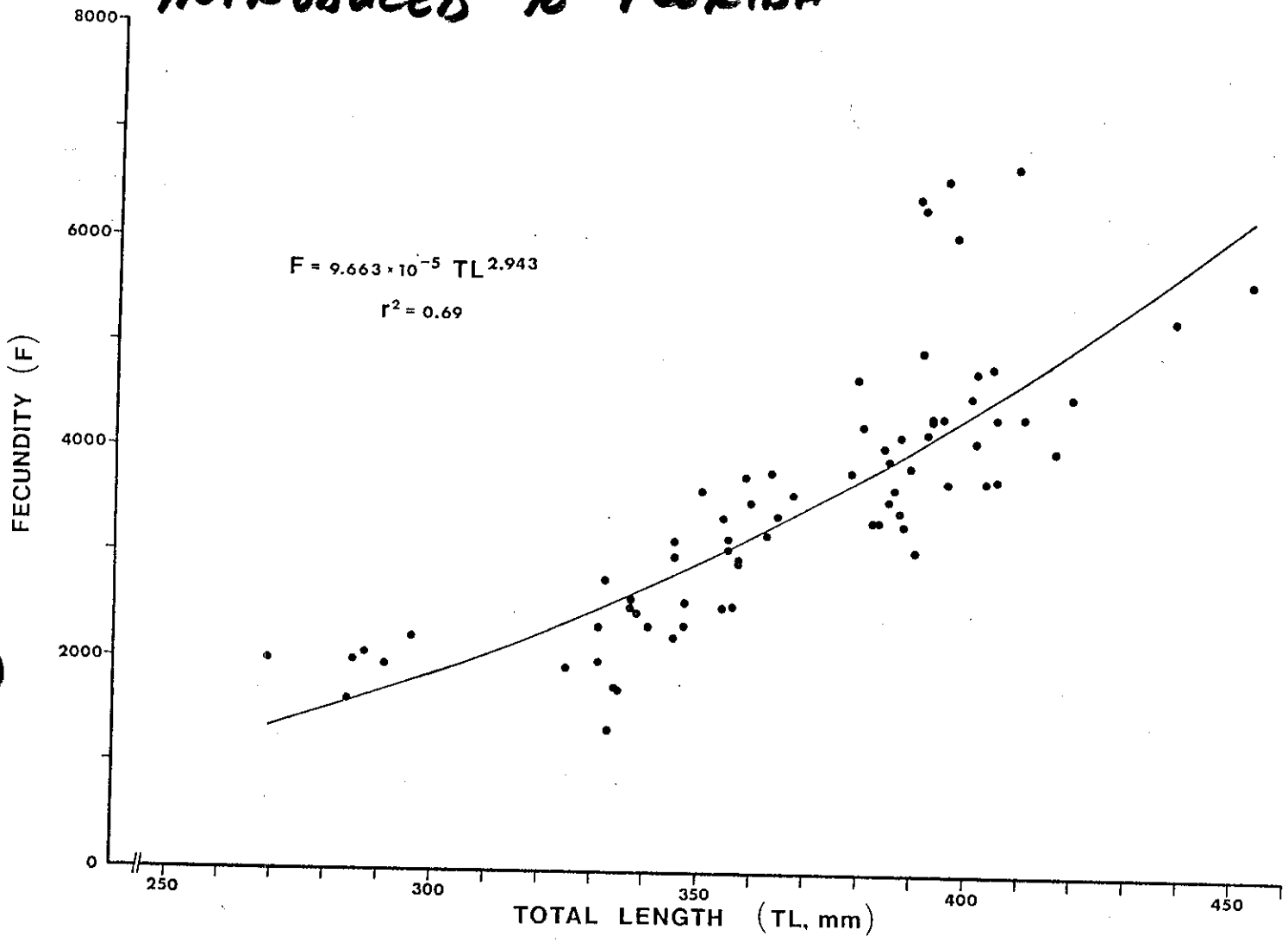


Figure 2. Kaplan–Meier plots of the first births to women of known age, from the villages of Keneba and Manduar, The Gambia, between 1968 and 1975. (a) Proportion of women not yet reproduced as a function of age in months, according to whether their mothers were alive or dead at the time of that birth, 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.

Human Demography from Gambia.

BLUE TILAPIA
INTRODUCED TO FLORIDA

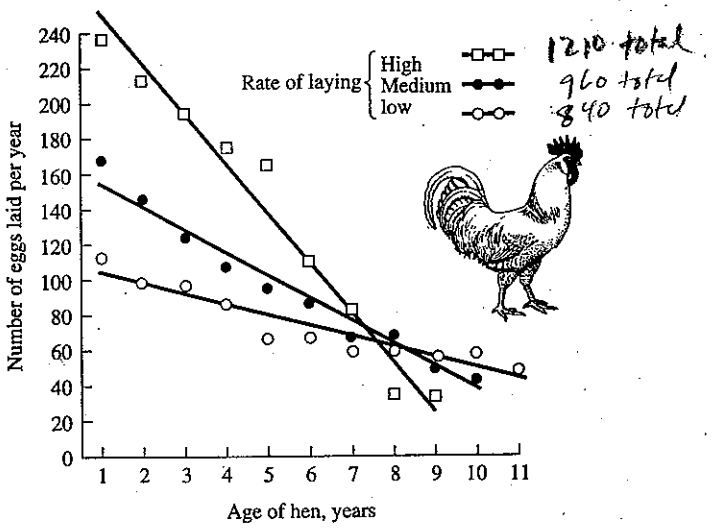


Mx
(# eggs)

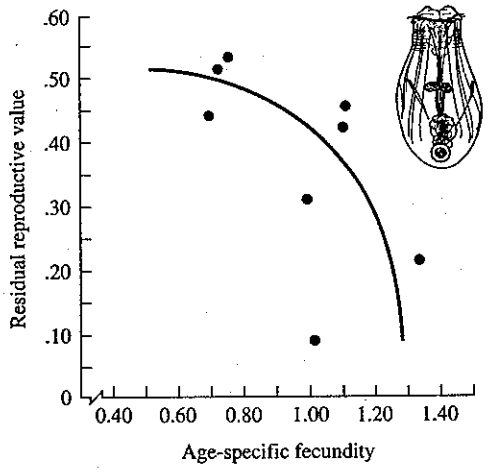
(~ age)

(2.2)

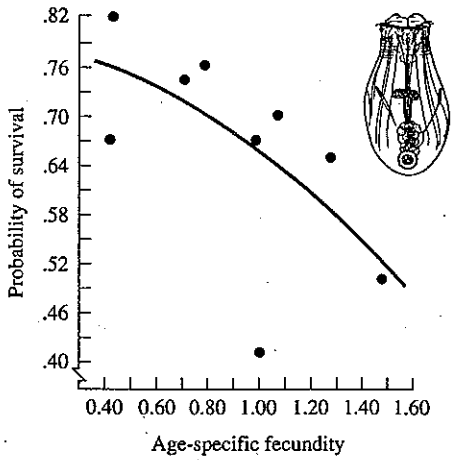
LIFE HISTORY TRADE OFFS



↑ early reproduction
↓ late reproduction



↑ m_x
↓ RRV



↑ m_x
↓ l_x

Costs of Reproduction: Experimental Approaches

A) Energy expenditure (proximate cost)

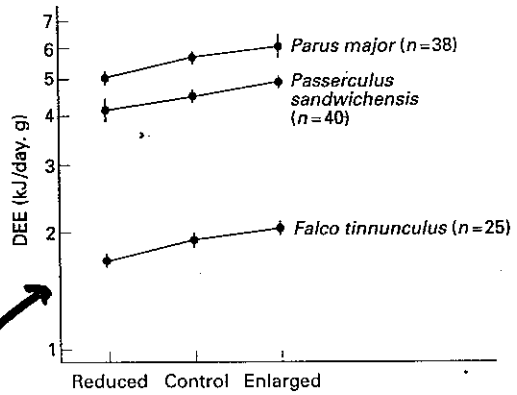
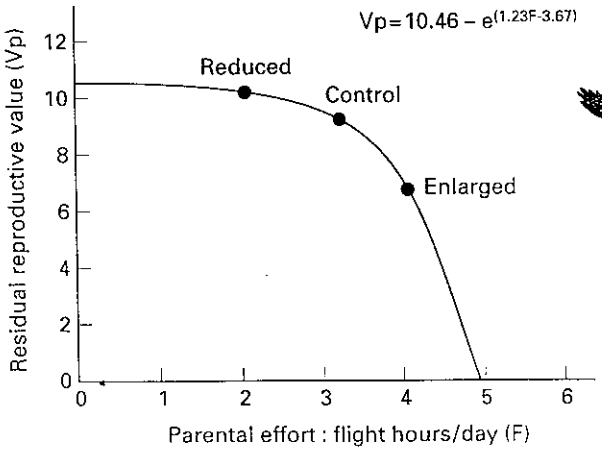


Fig. 13.7 Effects of brood size manipulations on mass-specific DEE in three species of birds: the savanna sparrow, *Passerculus sandwichensis* (Williams, 1987), kestrel, *Falco tinnunculus* (Deerenberg *et al.*, 1995) and great tit, *Parus major* (J. M. Tinbergen, in preparation).

Kestrel

B) Residual Reproductive Value (ultimate cost)



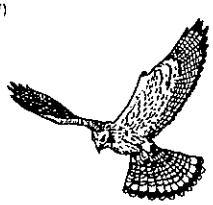


Fig. 13.8 Kestrel residual reproductive value plotted as a function of their parental effort (hours of flight per day). (From Daan *et al.*, 1990a.)

TRADE OFF BTWN CURRENT / FUTURE REPRODUCTION

12.8

RRV

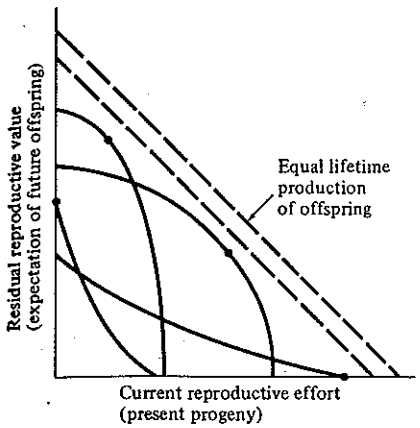
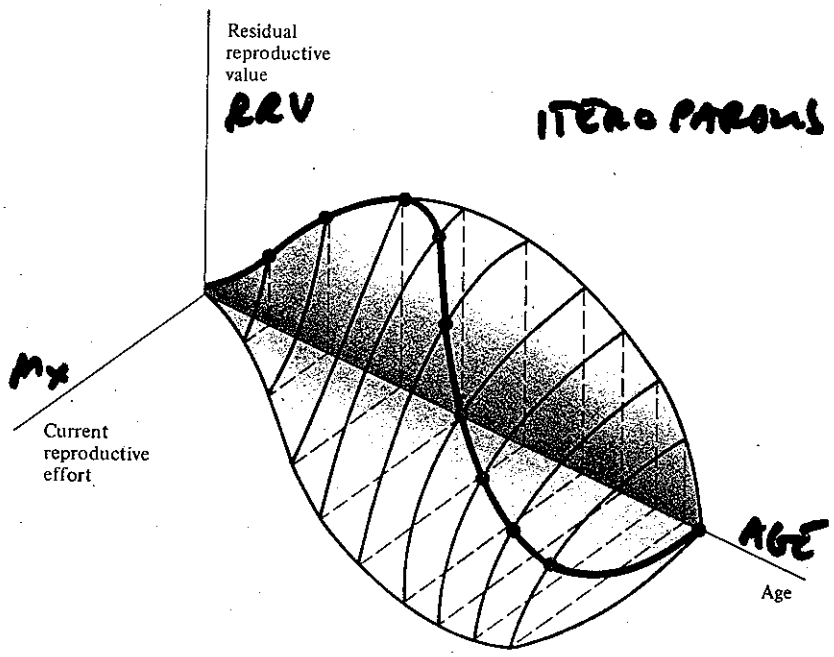


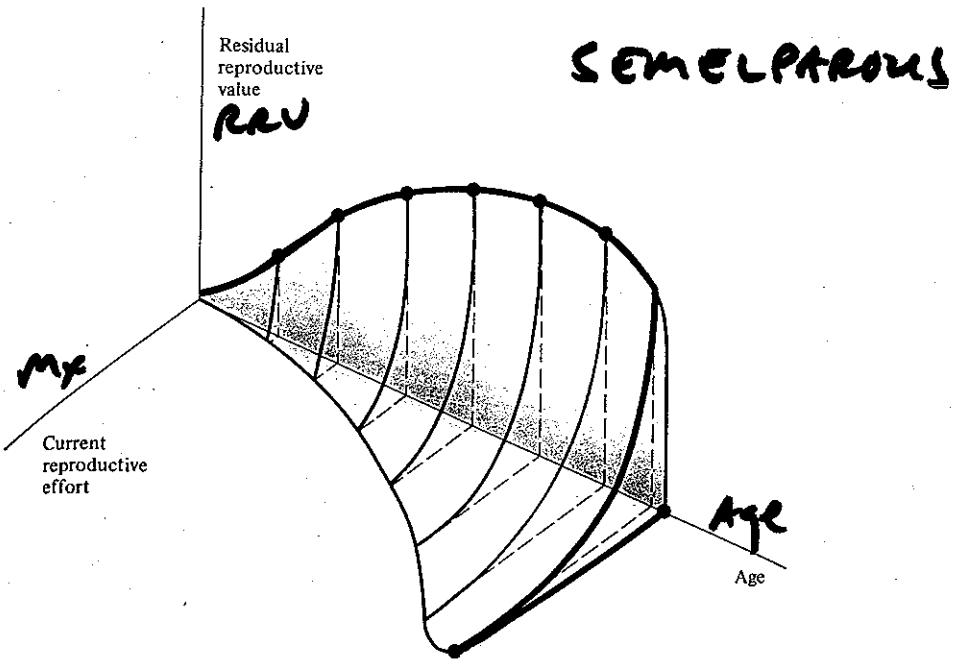
Figure 8.12. Trade-offs between current reproductive effort and expectation of future offspring at any particular instant (or age). Four curves relate costs in future progeny to profits in present offspring (and vice versa), with a dot marking the reproductive tactic that maximizes total possible lifetime 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 Pianka (1976b).]

← AT ONE SPECIFIC AGE

Mx



↙ ACROSS ENTIRE LIFESPAN ↓



Trade off btwn offspring # / offspring quality

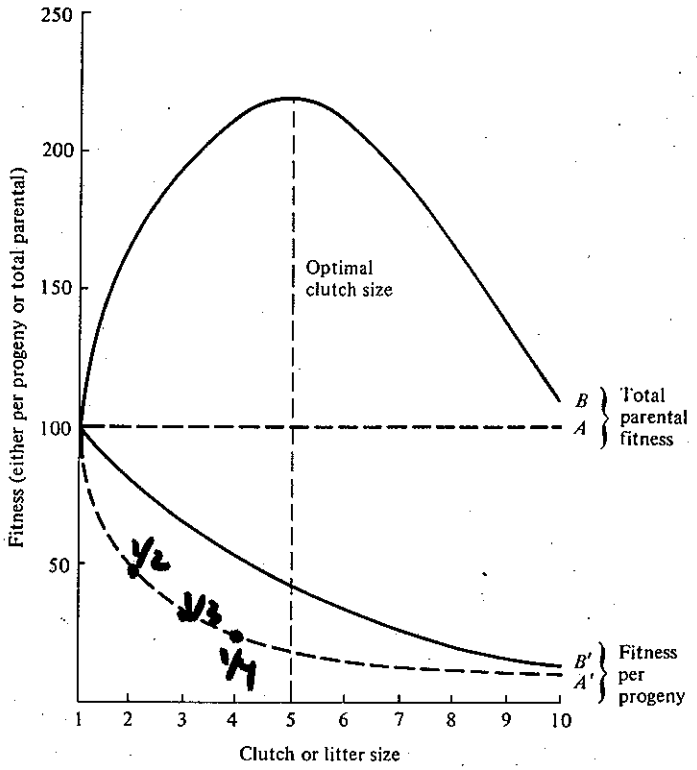


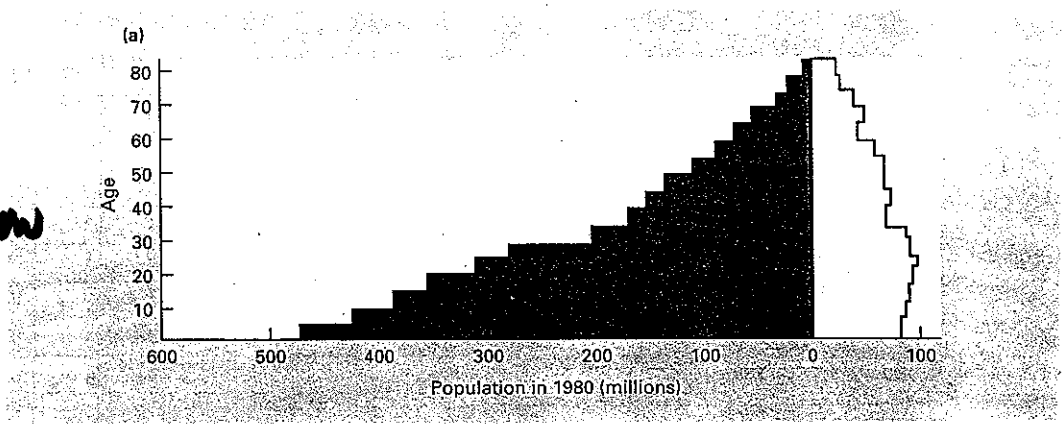
Figure 8.16. Fitness per progeny (A' and B') and total parental fitness, the sum of the fitnesses of all offspring produced (A and B), plotted against clutch and litter size under the assumptions of Figure 8.15. Total investment in reproduction, or reproductive effort, is assumed to be constant. Note 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

12.N

STABLE AGE DISTRIBUTION



effect of static vs. cohort tables

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

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

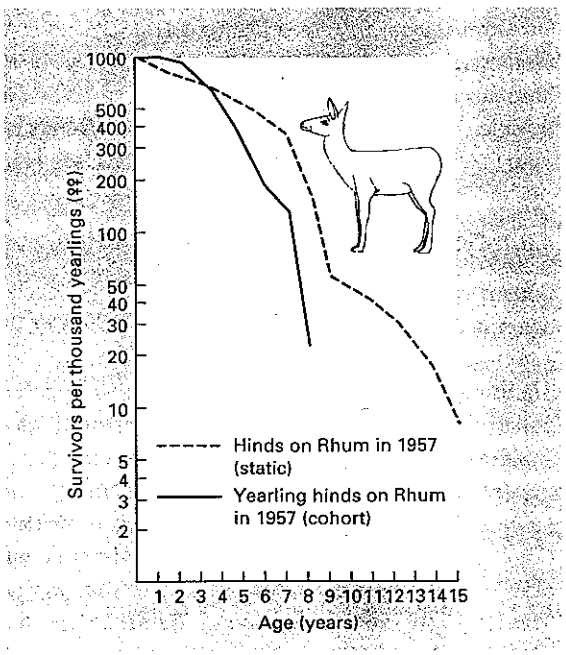


Figure 4.15 Two survivorship curves for red deer hinds on the island of Rhum. As explained in the text, one is based on the cohort life table for the 1957 calves and therefore applies to the post-1957 period; the other is based on the static life table of the 1957 population and therefore applies to the pre-1957 period. (After Lowe, 1969.)

Age distributions of stable and growing populations

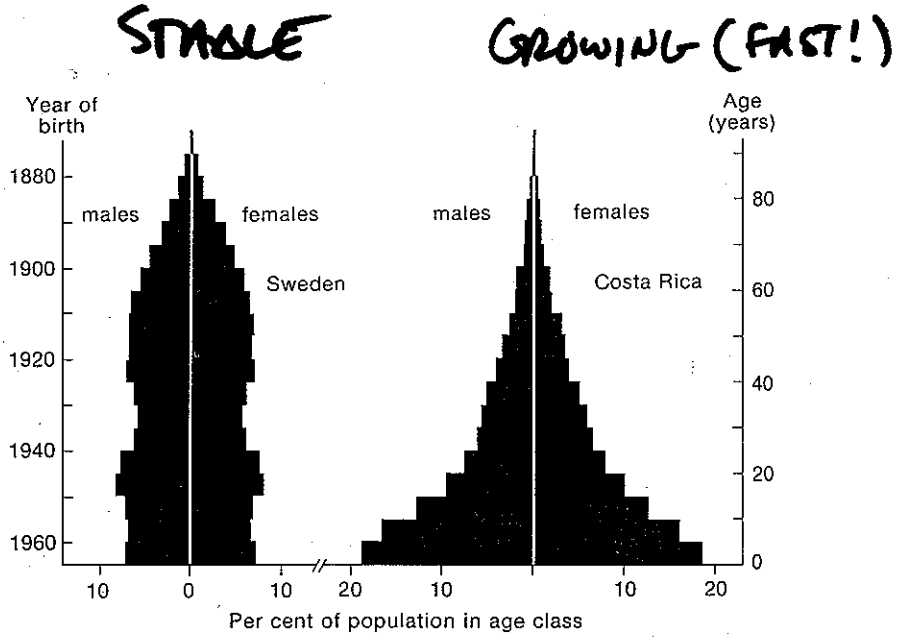
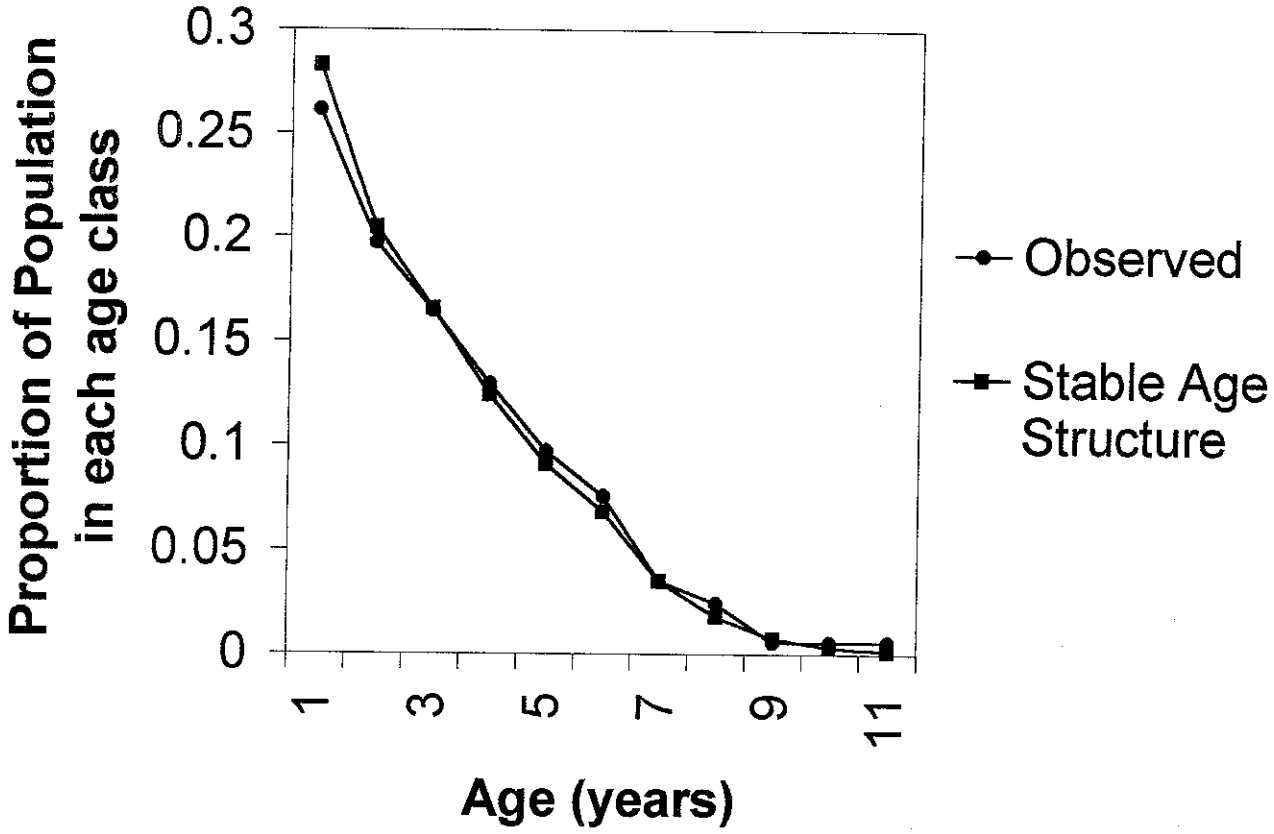


Figure 16–5
Population age structure of Sweden in 1965 and of Costa Rica in 1963. Because Sweden's population has grown slowly, its age structure is distributed toward older ages. Declining birth rates during the Depression and the baby boom that followed World War II are responsible for irregularities 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.)

AWD


Proportion of Population in each age class
0.3
0.25
0.2
0.15
0.1
0.05
0
1
3
5
7
9
11
Age (years)
Observed
Stable Age Structure