

m_x : age specific birth rates (see Chp 12)

- Iteroparous – Season after season
 - Constant with age
 - Vary with age
 - Perennials
- Semelparous – Big Bang
 - Annuals
 - Other

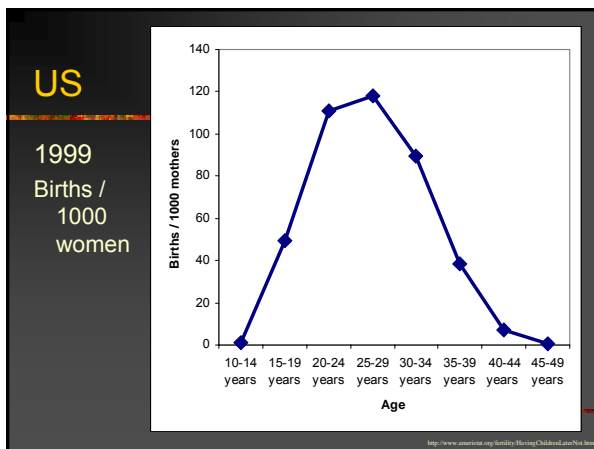
The slide features two photographs: a tall saguaro cactus in a desert landscape and a person harvesting an agave plant. Arrows point from the text descriptions to these images.

What about the m_x curve for humans? What term would be most appropriate for human reproductive patterns?

- A) Iteroparous
- B) Semelparous
- C) Neither
- D) Humans do not have an m_x curve

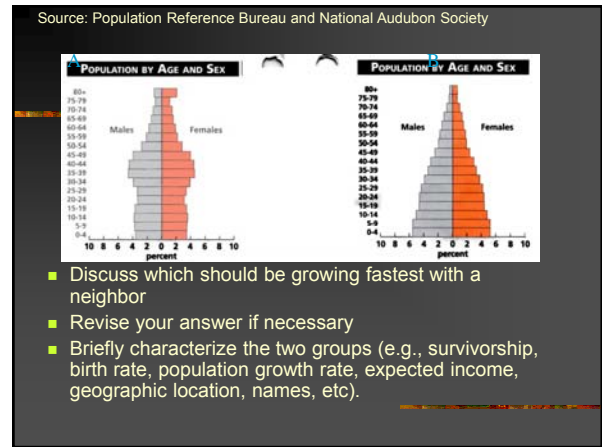
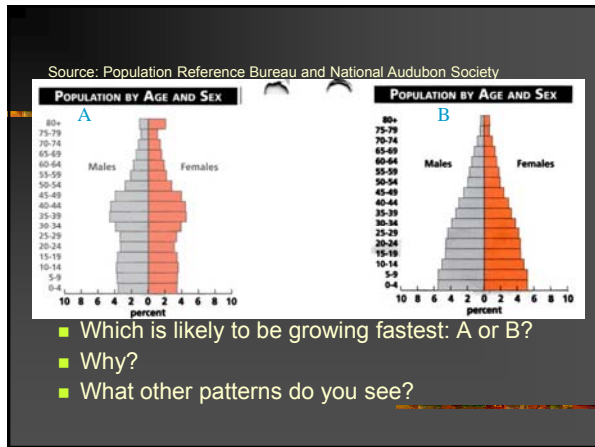
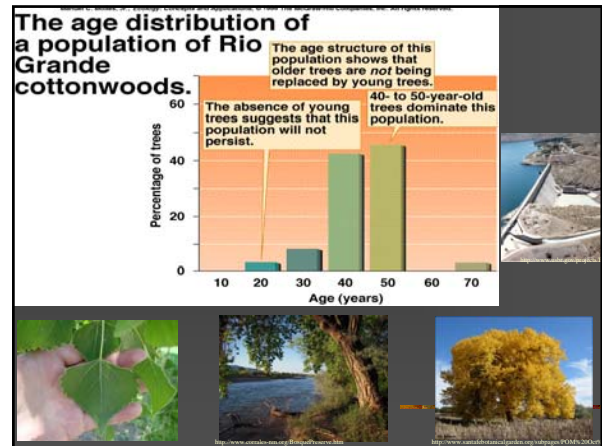
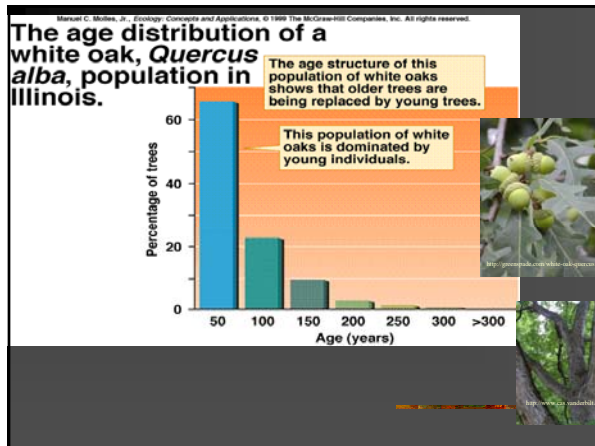
Sketch out what you think the curve would look like, and why you think that.

A blank graph with 'Births per 1000 women (m_x)' on the y-axis and 'Age' on the x-axis.



Age structure

- Populations can be characterized by the number of individuals in each age group
- For example – age structure for our class: CPS
 - A) < 19
 - B) 19-21
 - C) 22-23
 - D) 24-25
 - E) 26-27
 - F) >27



Visit census bureau

- <http://www.census.gov/ipc/www/idb/informationGateway.php>

Muddy Point Chp 11.

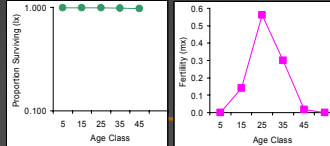
Due Monday Feb 28, noon

- After you've read **Chapter 11**, identify **one important point** that was unclear ("muddy") to you. Write out and send to me a sentence or two that explains
 - which concept is muddy
 - what is muddy about it
 - why this concept is important.
- Send your assignment to me
 - email: rm2@uakron.edu, put the words "MUDDIEST POINT" in the subject line;
 - or drop off at my office – ASEC 177; or my mailbox in the biology office)
- I will summarize these responses and prepare class based on your responses.
- If you have more than one muddy point you would like to have addressed, you may do so, but please clearly identify the one that is "most muddy".

Combining survivorship and fecundity

- Life table
 - Grid of age-specific survivorship and fecundity values (l_x and m_x)
 - Allow projection of population dynamics

age group	l_x	m_x
0-9	0.993	0.000
10-19	0.992	0.140
20-29	0.987	0.563
30-39	0.981	0.300
40-49	0.968	0.018
50+	0.000	0.000



Combining survivorship and fecundity

- Important summaries of a life table are:
 - R_0 (net reproductive rate)
 - T (Generation time)
 - r (per capita rate of increase)

R_0 = Net Reproductive Rate

- Average number of offspring left by each female
- Can calculate from survival and fecundity for each age class
- $R_0 = \sum(l_x m_x)$

age group	l_x	m_x	$l_x m_x$
0-9	0.993	0.000	0.000
10-19	0.992	0.140	0.139
20-29	0.987	0.563	0.556
30-39	0.981	0.300	0.294
40-49	0.968	0.018	0.017
50+	0.000	0.000	0.000
		1.021	1.006

T = Generation time

- Average time from being an egg to laying an egg (being a baby to having a baby)
- Calculate from the timing of births and deaths
- $T = \sum(x l_x m_x) / R_0$
 - X is the midpoint of the age class
 - Annuals: annual, $x=1$, and $T=1$
 - Perennials: x varies with age class

age group	x	l_x	m_x	$l_x m_x$	$x l_x m_x$
0-9	5	0.993	0.000	0.000	0.000
10-19	15	0.992	0.140	0.139	2.083
20-29	25	0.987	0.563	0.556	13.892
30-39	35	0.981	0.300	0.294	10.301
40-49	45	0.968	0.018	0.017	0.784
50+		0.000	0.000	0.000	0.000
			1.021	1.006	27.060

T	26.9
$= \sum(x l_x m_x) / R_0$	

r (per capita rate of increase)

- birth rate – death rate
 - B-D
- $r = \ln(R_0) / T$
 - ln is the natural logarithm
- Critical Values
 - $r > 0$: grow
 - $r < 0$: shrink
- In this case (US 1998), $r = 0.02\%/year$

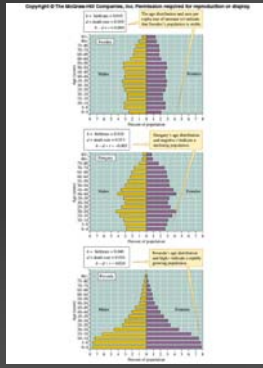
R_0	1.006	
$= \sum(l_x m_x)$		
T	26.9	
$= \sum(x l_x m_x) / R_0$		
r	$= \ln(R_0) / T$	0.00023

Life Table – see spreadsheet

age group	mid point age	Proportion surviving to this age	# female offspring / female / 10-years		
x		l_x	m_x	$l_x m_x$	$x l_x m_x$
0-9	5	0.993	0.000	0.000	0.000
10-19	15	0.992	0.140	0.139	2.083
20-29	25	0.987	0.563	0.556	13.892
30-39	35	0.981	0.300	0.294	10.301
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50+			0.000	0.000	0.000
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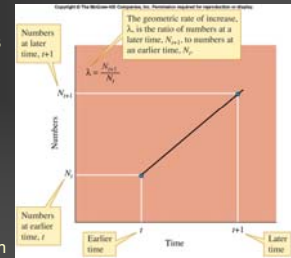
S.A.D.

- IF l_x and m_x stay constant, a population will eventually reach a **STABLE AGE DISTRIBUTION**.
- Each bar will be a constant proportion of the bar above it



λ (Geometric Rate of Increase)

- Ratio of the population sizes at two different times
- $\lambda = N_{t+1} / N_t$
 - If $N_t = 1$, and $N_{t+1} = 2$,
 - then $\lambda = 2$
 - Population will double
- Critical Values:
 - $\lambda > 1$: grow
 - $\lambda < 1$: shrink
- Most appropriate when growth occurs in 'pulses'
 - E.g., Yearly breeding season (deer, bears, annuals)



Conclusions

- A survivorship curve summarizes the pattern of survival in a population
- Patterns of births in a population can vary from semelparous to iteroparous
- Age distribution reflects the history of survival, reproduction, and the potential for future growth of a population
- A life table (l_x and m_x) can be used to estimate net reproductive R_0 (net reproductive rate), λ (Geometric rate of increase), T (Generation time), and r (per capita rate of increase)

Exam

- Mean = $70.2/92 = 76\%$