

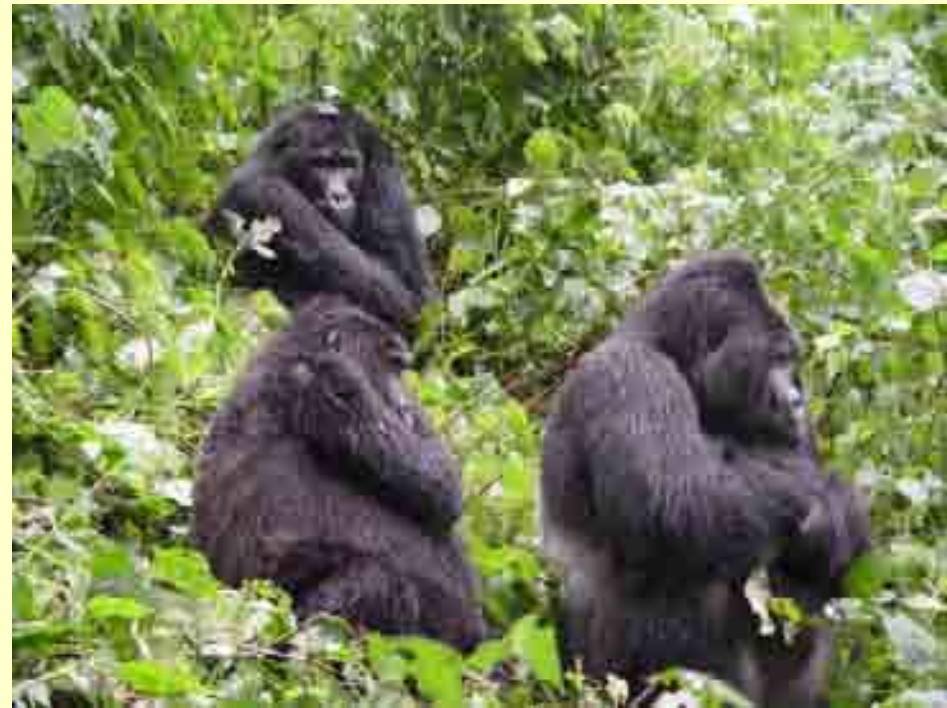
Bwindi Mountain Gorillas: How many are there, what is the population growth rate, and what can we do to help?



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Why study population dynamics and life history patterns?

- informs us whether a population is increasing, decreasing or stable.
- allows us to predict future trends of a population.
- Provides critical information for conservation & management strategies for endangered species.



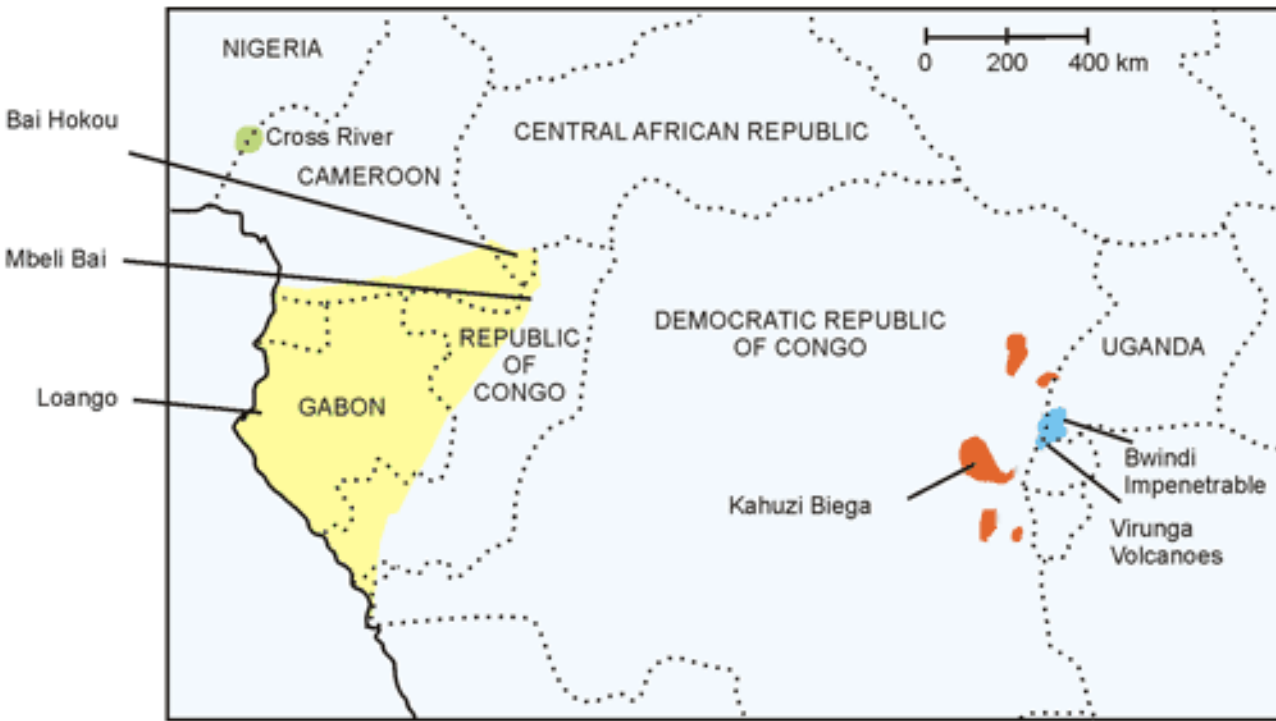
Two methods for demographic studies:

-- census measurements:

**provides a snapshot view of an entire population;
if repeated, can monitor change over time**

-- long term monitoring of known individuals:

**-provides a longitudinal evaluation of individual life histories
-provides information for making projections of
population growth**



- Western lowland gorilla (*Gorilla gorilla gorilla*)
- Cross River gorilla (*Gorilla gorilla deihli*)
- Grauer's gorilla (*Gorilla beringei graueri*)
- Mountain gorilla (*Gorilla beringei beringei*)

Virunga Volcanoes:
~1% growth rate

Karisoke:
~3% growth rate

Gorillas living in an environmental extreme.



Bwindi Mountain Gorillas: How many are there?

Indirect Methods to Count Animals are not without problems!

Guschanski, K, Vigilant, L, McNeilage, A, Gray, M, Kagoda, E, and Robbins, MM. 2008. Counting elusive animals: comparing field and genetic census of the entire mountain gorilla population of Bwindi Impenetrable National Park, Uganda. *Biological Conservation*.

Use a 'Sweep census' technique for mountain gorillas

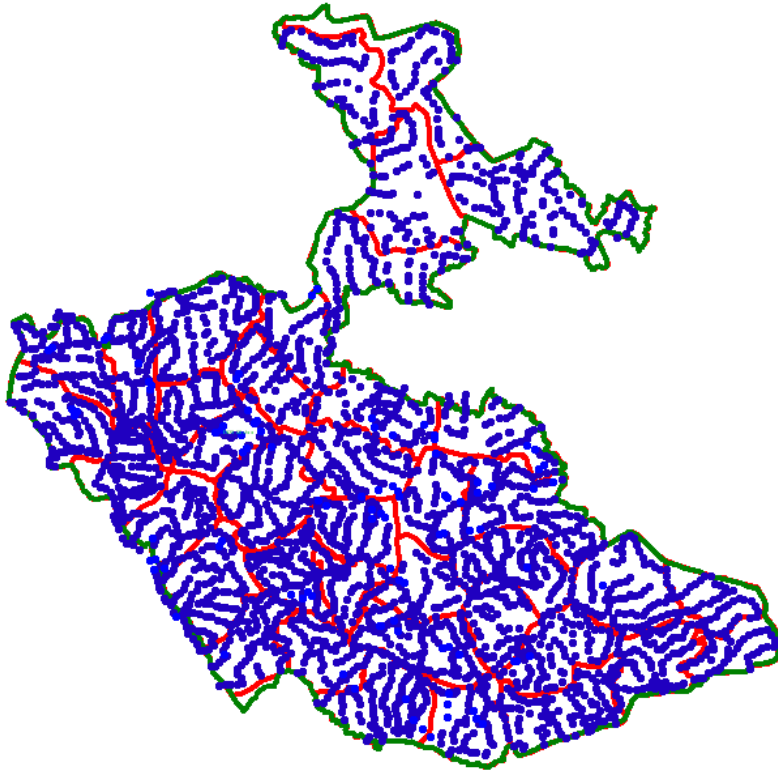
Potential inaccuracies:

- we assume gorillas make only one nest per night.**
- number of nests found from same group can vary.**
- dung of young infants nesting with mothers can be missed.**
- possibility of double counting groups.**

How to reduce the inaccuracies?

- concurrently conduct a 'genetic census' using genetic identities of individuals obtained from fecal samples.**

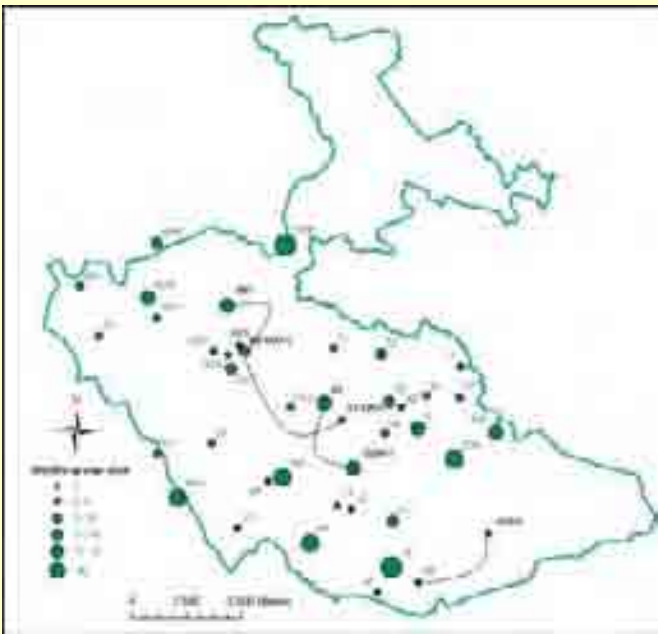
2006 Census -- Teams 'swept' ~600 km



For Genetic Analysis:

- 840 fecal samples collected.
- 384 fecal samples genotyped at 16 microsatellite loci.





~ 340 gorillas using 'Sweep' method

300 gorillas with the genetic results

Why the discrepancy?:

- **Gorillas sometimes make more than one nest per night**
- **Double counting of groups & solitary males**

While field methods are still largely accurate, the genetic results provide a more accurate, refined estimate of the number of gorillas in Bwindi.

These results do not indicate that the population has been declining!

Bwindi Mountain Gorillas: What is the rate of population growth?



Robbins, MM, Gray, M, Kagoda, E, and Robbins, AM. In preparation. Demography of the Bwindi Mountain Gorillas.

Bwindi Population Size:

~300 gorillas for the past 20 years:

1986-1993 - routine surveys– 300 gorillas

1997 - sweep method– 300 gorillas

2002 - sweep method– 320 gorillas

2006 - sweep & genetic – 300 gorillas

-Due to the possibility of overcounts or undercounts in the previous censuses, we cannot determine if the population has been increasing or decreasing over the past decade.

Bwindi Population Estimate:

If it was growing at a 3% growth rate:

-300 gorillas in 1986, would have resulted in 540 gorillas in 2006.

-Back-counting from 300 gorillas in 2006, would have resulted in only 140 gorillas in 1986.

If it was growing at a 1% growth rate:

-300 gorillas in 1986, would have resulted in 366 gorillas in 2006.

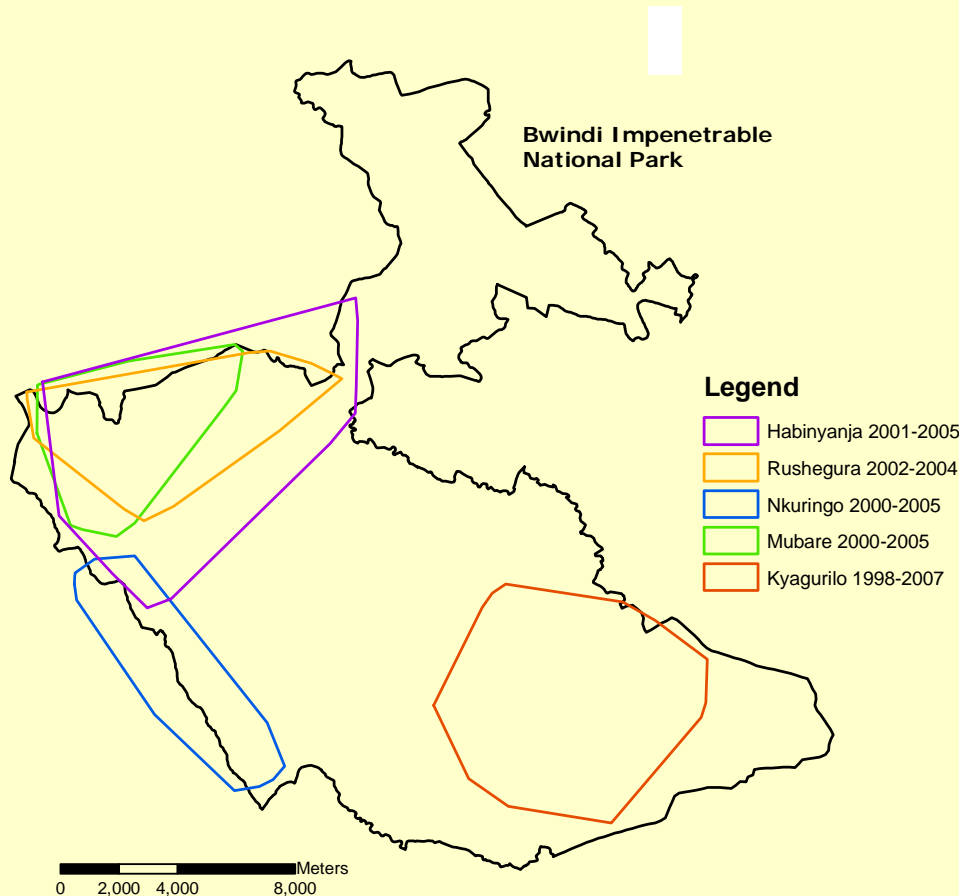
-Back-counting from 300 gorillas in 2006, would have resulted in only 256 gorillas in 1986.

Goal: Use demographic data from habituated groups in Bwindi to assess:

- estimates of birth & mortality rates**
- estimates of annual growth rate**

**DataSet:
1993-2007**

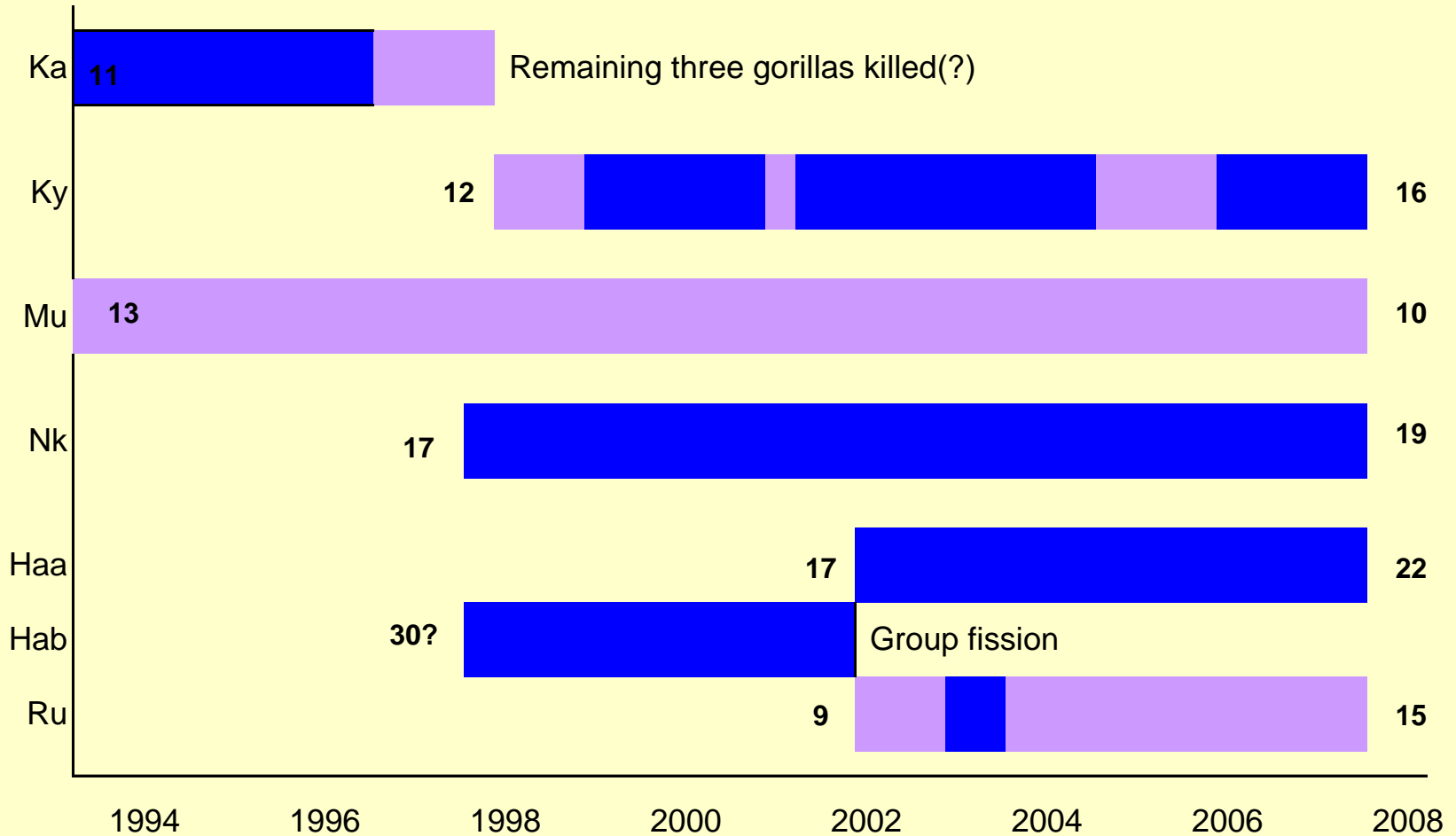
**5 tourist groups
1 research group**



Monitoring of known individuals:

- Births**
- Deaths**
- Immigrations & Emigrations**

140 gorillas spanning 50 group-years.

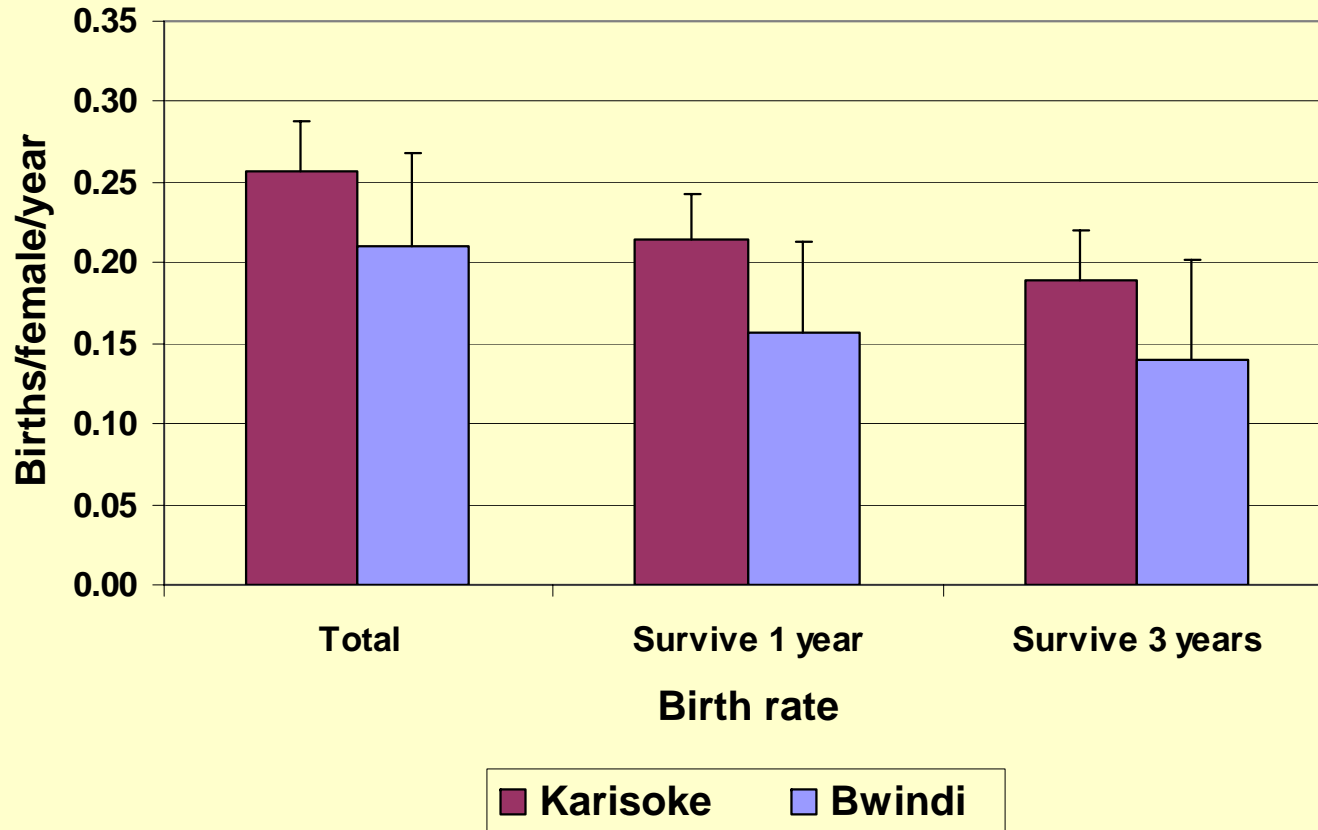


(numbers are group size)

Purple = One Male Group
Blue = Multimale Group (50% of time)

Birth Rate

18-26% lower in Bwindi

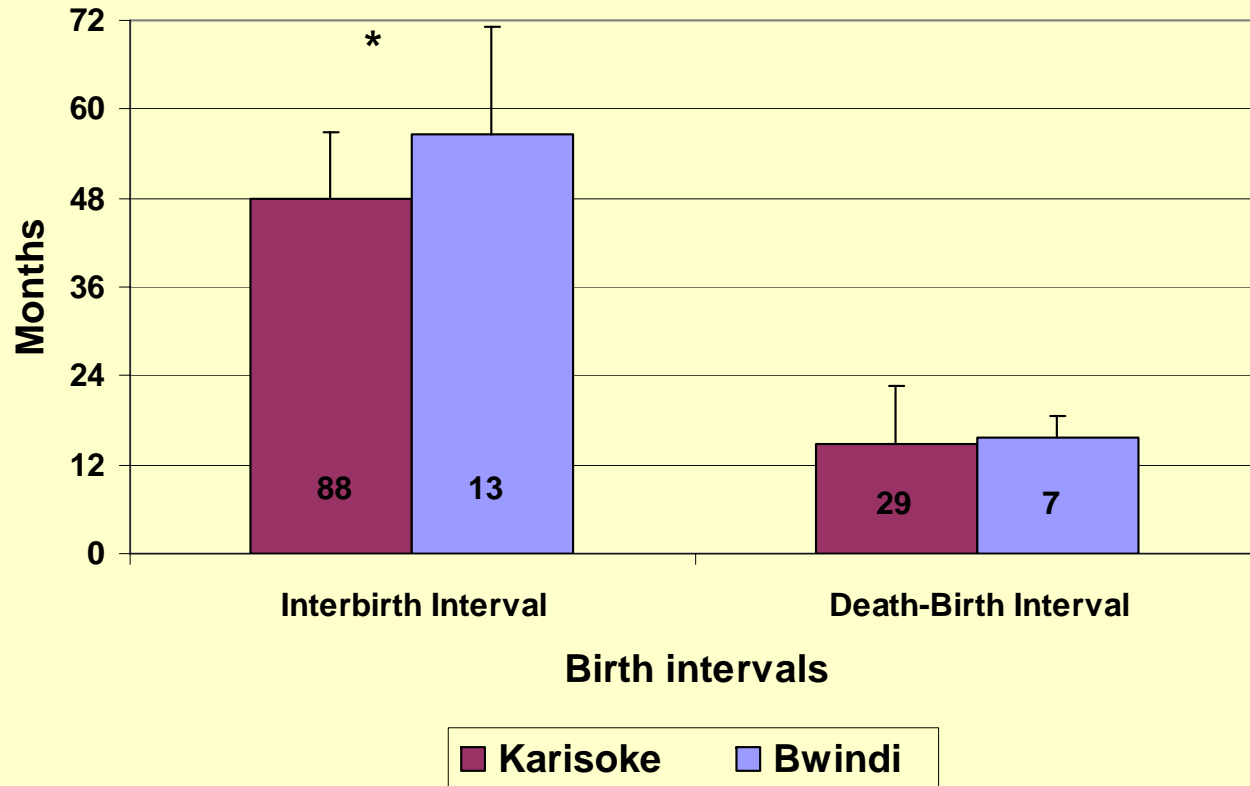


Bwindi: 51 births, 29 females, in 242 adult female years; 26% infant mortality

Karisoke data: Robbins et al. (2007) – 212 births in 824 female years; 27% infant mortality

Interbirth Interval

18% longer in Bwindi



Mann-Whitney U: IBI, U = 806, p = 0.017

DBI, U = 149, p = 0.057

Karisoke data courtesy of Dian Fossey Gorilla Fund International

Deaths = 20

Infant = 13

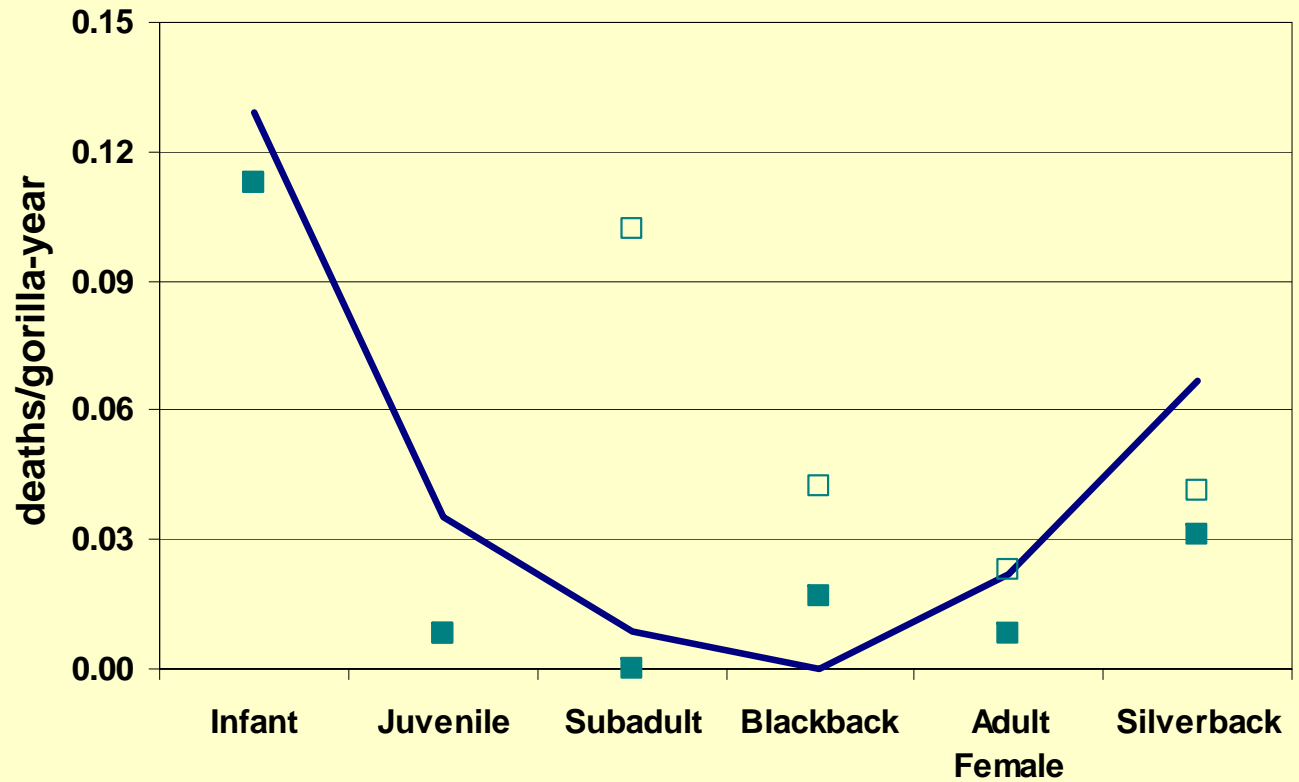
Juvenile = 1

Subadult = 0

Blackback = 1

Adult Female = 2

Silverback = 3



Filled squares – assume that ‘disappearances’ are dispersal

Empty squares – assume that ‘disappearances’ are deaths

Blue line = Karisoke values

Population Growth --- Habituated Groups

1993: 24 gorillas

2007: 82 gorillas (27% of the population)

Growth: Births -- 51

Immigrations -- 4

Habituation -- 55

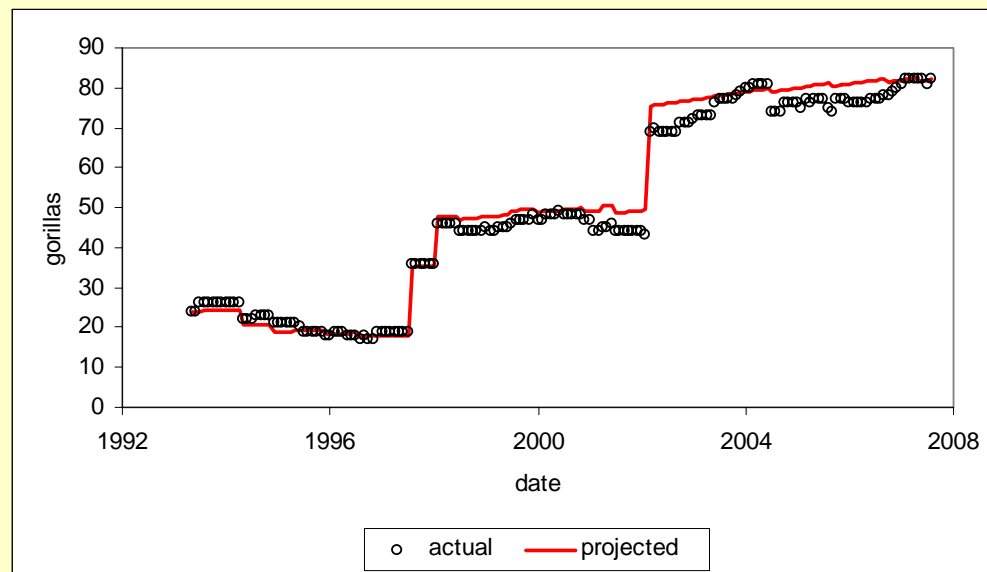
Decline: Deaths (and disappearances) – 30

Emigration – 19

End of group monitoring – 3

**After controlling for habituation
& dispersal:**

~ 2.5 – 4.4 % annual growth rate



Use birth and mortality rates to project growth (Leslie Matrix Model):

**If use birth rates for Bwindi (0.211 instead of 0.257),
but mortality rates from Karisoke:**

Bwindi = 2 % annual growth rate

Karisoke = 3 % annual growth rate

40% of difference can be explained by difference in birth rate.

Growth of Bwindi Gorilla Population:

Using population-wide estimates: 0 – 1% annual growth rate

Using demographic data from known individuals: 2 - 4% annual growth rate

Projected Growth: ~ 2% annual growth rate

Conclusions & Recommendations

-Strengths & Weaknesses of Ranger Based Monitoring

- deaths vs. dispersal

- accurately sexing immature gorillas

- provides more data on habituated groups throughout the park

-Are these groups representative of the entire population?

- habituation biased towards larger, multimale groups

-Need more long-term data.

-Need more direct comparisons of ecological conditions & impact of illegal activities within and among populations.



Recommendations

-Conduct another census in 2010-2011.



Move the road!

-5% of Bwindi is on other side of road

-good gorilla habitat.

-area used by 2 habituated groups

Would benefit local communities.

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**All of the rangers, guides, assistants
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**All the organizations who provided financial &
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