Ebola Outbreak Killed 5000 Gorillas

Magdalena Bermejo,1,2* José Domingo Rodríguez-Teijeiro,2 Germán Illera,1
Alex Barroso,2 Carles Vilà,3 Peter D. Walsh4

Over the past decade, the Zaire strain of Ebola virus (ZEBOV) has emerged repeatedly in Gabon and Congo. During each human outbreak, carcasses of western gorillas (Gorilla gorilla) and chimpanzees (Pan troglodytes) have been found in neighboring forests (1). Opinions have differed as to the conservation implications. Were these isolated mortality events of limited impact (2)? Or, were they part of a massive die-off that threatens the very survival of these species (4)? Here, we report observations made at the Lossi Sanctuary in northwest Republic of Congo, where ZEBOV was the confirmed cause of ape die-offs in 2002 and 2003 (5). Our results strongly support the massive die-off scenario, with gorilla mortality rates of 90 to 95% indicated both by observations on 238 gorillas in known social groups and by nest surveys covering almost 5000 km². ZEBOV killed about 5000 gorillas in our study area alone.

Starting in 1995, we habituated gorillas to our presence, and by 2002 we had identified 10 social groups with 143 individuals (fig. S1). In late 2001 and early 2002, human outbreaks of ZEBOV had flared up along the Gabon-Congo border (1). In June 2002, a gorilla carcass was found 15 km west of the sanctuary. By October, gorilla and chimpanzee carcasses began appearing inside the sanctuary. In the next 4 months, we found 32 carcasses. Twelve of the carcasses were assayed for ZEBOV, and 9 tested positive (5). From October 2002 to January 2003, 91% (130/143) of the individually known gorillas in our study groups had disappeared.

In June 2003, one fresh carcass appeared south of the sanctuary. In September, we identified seven new social groups with home ranges straddling and to the east of the two rivers and monitored their sleeping nests on a biweekly basis. Then in October carcasses again appeared within the sanctuary. Ten carcasses were found in the following 3 months. From October 2003 to January 2004, Ebola spread sequentially from north to south, killing 91 of the 95 individuals (95.8%) in the newly monitored groups. One remarkable feature of this spread was that the onset of ZEBOV deaths in each group was predicted by the number of home ranges separating it from the first group to experience deaths (Fig. 1A). In particular, the estimated time lag between deaths in successive groups (11.2 days) was very similar to the typical length of the ZEBOV disease cycle of about 12 days (6). Assuming deaths were caused by spillover from a north-south reservoir epizootic, assuming other reservoir epizootic trajectories did not improve fit (C). Gorilla nest distribution during 2004 to 2005 surveys (after ZEBOV die-offs). Shading of each dot proportional to number of gorilla nests found on a 5-km survey segment. Blue line at 14.55°E longitude separates eastern from western sampling zones. Lossi Sanctuary in gray, savannas in yellow, and roads in brown. Chimpanzee nest distribution in 2004 to 2005 surveys.

Fig. 1. (A) Last day at which each group was at full size plotted against number of home ranges separating that group from the first group to suffer deaths. (B) Day of last full group size was not well predicted by latitude, as might be expected with spillover from a north-to-south reservoir epizootic. Assuming other reservoir epizootic trajectories did not improve fit. (C) Gorilla nest distribution during 2004 to 2005 surveys (after ZEBOV die-offs). Shading of each dot proportional to number of gorilla nests found on a 5-km survey segment. Blue line at 14.55°E longitude separates eastern from western sampling zones. Lossi Sanctuary in gray, savannas in yellow, and roads in brown. (D) Chimpanzee nest distribution in 2004 to 2005 surveys.
Ebola Outbreak Killed 5000 Gorillas
Magdalena Bermejo, José Domingo Rodríguez-Teijeiro, Germán Illera, Alex Barroso, Carles Vilà and Peter D. Walsh (December 8, 2006)

Editor's Summary

This copy is for your personal, non-commercial use only.

**Article Tools**
Visit the online version of this article to access the personalization and article tools:
http://science.sciencemag.org/content/314/5805/1564

**Permissions**
Obtain information about reproducing this article:
http://www.sciencemag.org/about/permissions.dtl