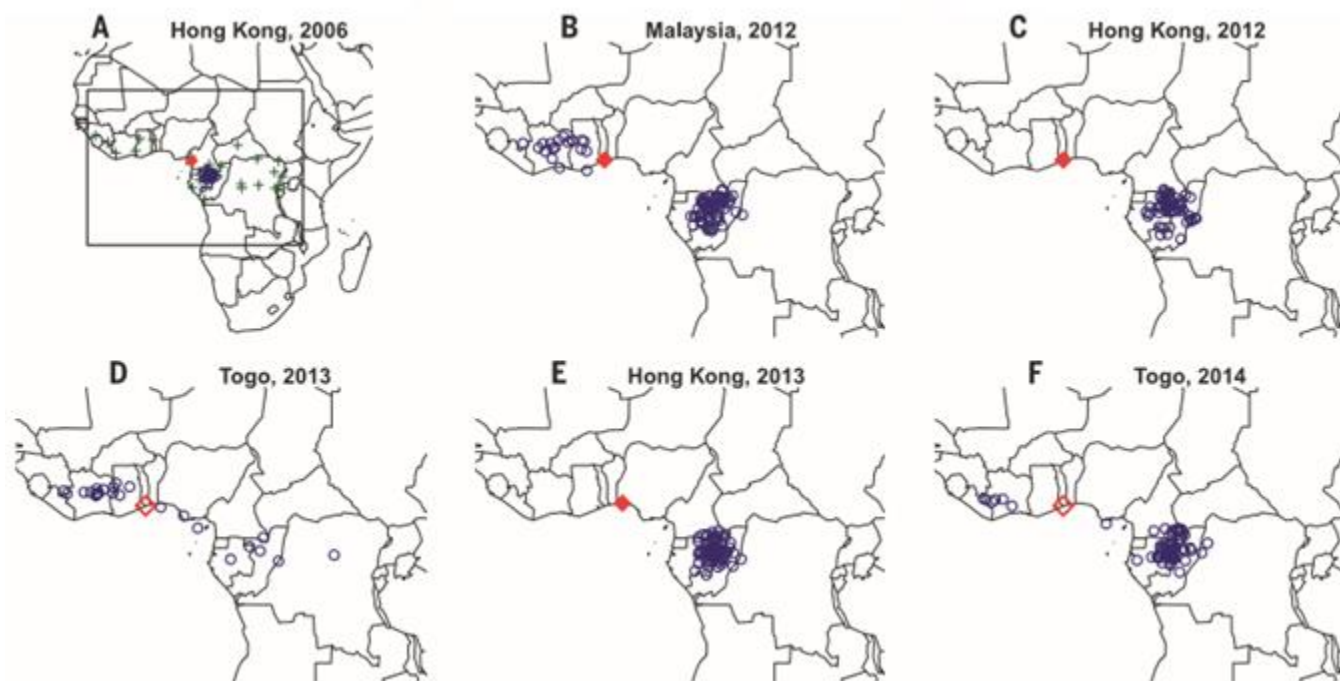




Using Genetic Evidence to Identify Ivory Poaching Hotspots

HOW TO USE THIS RESOURCE

Show the figure below to your students along with the caption and background information. The “Interpreting the Graph” and “Discussion Questions” sections provide additional information and suggested questions that you can use to guide a class discussion about the characteristics of the graph and what it shows.



Caption: Series of maps showing the locations where forest elephants were likely poached, based on genetic evidence from ivory seizures conducted between 2006 and 2014. Each panel indicates the location and date of the ivory seizure. In panel A, the green crosses indicate locations where several forest elephant dung samples were collected to determine population-based genetic profiles. The black box represents the area enlarged in the maps shown in panels B-F. Blue circles represent the most likely origin of the ivory based on comparing the genetic profile of the seized ivory to those of the sampled populations. Solid red diamonds indicate the port from which the ivory was shipped before it was confiscated overseas. Open red diamonds represent the port where ivory was confiscated before it was shipped.

BACKGROUND INFORMATION

The international trade of ivory has been banned since 1989, yet African elephants continue to be poached for their ivory at alarming rates. It is estimated that as many as 50,000 African elephants are killed each year for their ivory tusks, out of a population of less than 400,000. Dr. Sam Wasser and colleagues analyze the DNA from seized ivory to determine where the ivory came from. This information is extremely valuable for law enforcement officials to protect vulnerable elephant populations.

The researchers began by creating a map of genetic profiles of different elephant populations across Africa. To do this, they collected 1,350 elephant dung samples from 71 locations, each location representing a different elephant population. They analyzed the DNA from each sample to construct a genetic map of allele frequencies at 16 loci for each population they sampled. Populations that are closer to one another geographically are more

likely to have similar genetic profiles and allele frequencies than populations that are farther apart. The researchers used this knowledge to build a statistical model that allows them to predict the genetic profiles of populations for which they do not have DNA samples. Next, they obtained DNA samples from 28 large shipments of illegal ivory that were seized at ports in Africa and Asia between 1996 and 2014. They compared the pattern of alleles from each ivory sample to their population-based map and assigned the origin of that ivory sample to the most likely location. The figure above only shows the data related to populations of forest elephants in Africa. Other figures in the original publication show the data for savanna elephants.

INTERPRETING THE GRAPH

The blue circles are clustered into two geographical areas, regardless of the year the ivory was seized. These two areas are 1) the TRIDOM (Tri-National Dja-Odzala-Minkébé) ecosystem, which includes parts of Gabon, Republic of Congo, and Cameroon as well as the adjacent Dzanga-Sangha Reserve in the Central African Republic; and 2) West Africa, including Ghana, the Ivory Coast, and Togo. All six seizures of ivory from forest elephants contained ivory that originated from the TRIDOM ecosystem, while three of the six seizures also had ivory that originated in West Africa.

Teacher Tip: Prompt your students to explain the parts of the graph as applicable: (provide answers)

- **Figure Type:** Map of the origin of illegal ivory from forest elephants.
- **Data Represented:** The map shows the locations of the dung samples used to create a map of population-based genetic profiles (green crosses) of forest elephants, the likely origin of the seized ivory (blue circles), and the ports where ivory was exported or seized before export (red diamonds).

DISCUSSION QUESTIONS

- Do the maps reveal any patterns in the origin of the seized ivory? If so, what are they? What do you conclude from these patterns?
- Why is it necessary to collect DNA samples from elephant populations at different locations across Africa?
- Based on the results, how would you suggest that efforts to combat poaching be focused?
- The researchers obtained samples from 28% of all large ivory seizures made between 2006 and 2011, and 61% of all seizures made between 2012 and 2014. What potential problems might arise from not collecting DNA samples from 100% of the ivory seizures?

SOURCE

Figure 3 from:

Wasser, S.K., *et al.* Genetic assignment of large seizures of elephant ivory reveals Africa's major poaching hotspots. 2015. *Science*. 349(6243): 84-87.

View Article:

<http://science.sciencemag.org/cgi/content/full/349/6243/84?ijkey=lmhdZ/6DnBP&keytype=ref&siteid=sci>

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