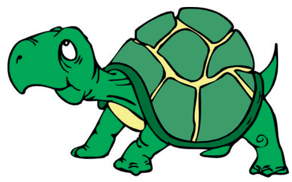
Carrying your Provisions



by **Colin Foster**

I was recently reading the autobiography of the broadcaster and naturalist David Attenborough (Attenborough, 2010). He described many of the difficulties associated with his many treks into remote areas, and commented:

> "If one person who is not carrying food is accompanied by two others carrying full loads of provisions, the three of them will have enough food to last a fortnight. If a march lasts any longer than that, the number of food carriers needed starts to escalate very rapidly indeed and eventually becomes impossible to meet."
>
> (Attenborough, 2010, p. 223)

What mathematical sense can we make of this? Attenborough describes having 2 carriers but 3 eaters, and says that they can last together for 14 days. We assume that they could last longer if they *all* carried food, and to simplify things we imagine that carriers consume the same amount of food as non-carriers. We can work out that if we had 3 carriers (and 3 eaters) we would have the same number of people but they would have half as much food again, and so be able to last for half as long again; i.e. 21 days. This means that one person on their own as a single carrier (and eater) would also be able to last for 21 days.

The formula to describe what is going on is then

$$\text{time}\left(\text{days}\right) = \frac{21 \times \text{number of carriers}}{\text{number of eaters}}$$

Let's suppose that Attenborough never carries (untrue, I'm sure!), but everyone else does. If we let n be the number of carriers, and t the time in days that they can all last out, then we have

$$t = \frac{21n}{n+1}, n > 0.$$

This is a rational function that approaches 21 days as $n \to \infty$.

Rearranging, we have

$$n = \frac{t}{21-t}, 0 < t < 21.$$

(Checking, when we substitute t = 14 days into this formula we obtain n = 2, which fits with the information Attenborough gave us.)

If we plot n against t, we can see the sudden increase in the number of people needed that Attenborough refers to as we move past about 14 days (Fig. 1).

This could be a nice mathematical model for pupils to formulate and then explore, because it does interesting and perhaps surprising things which can be made sense of in terms of the context. It is possible to make different assumptions and see the effects. It is a real-life situation – at least if you are an Attenborough! – but it avoids the dullness of 'gas-bill-maths' everyday contexts, because there's something exciting about trekking off into the jungle and wondering how you would survive.

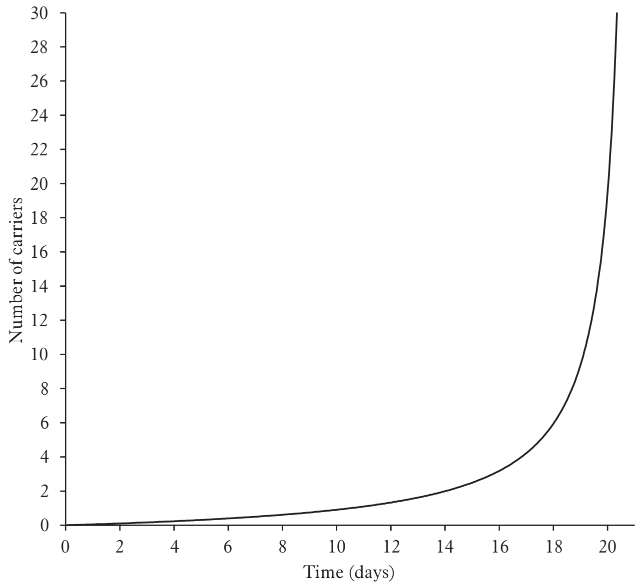


Fig. 1 The number of carriers needed for different lengths of trek

Reference

Attenborough, D. 2010 *Life on Air: Memoirs of a Broadcaster*, revised and updated edition. BBC Books, Bungay.

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