Re: A simple model exhibiting Haldane's limit

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- *From*: "Perplexed in Peoria" <jimmenegay@xxxxxxxxxxxxx>

- *Date*: Fri, 14 Jul 2006 12:29:06 −0400 (EDT)

"William Morse" <wdmorse@xxxxxxxxxxxx> wrote in message
news:e95ppkqea1@xxxxxxxxxxxxxxxxxxxxxx

> "Perplexed in Peoria" <jimmenegay@xxxxxxxxxxxxx> wrote in
> news:e939uh$2men$1@xxxxxxxxxxxxxxxxxxx:
>
> > I will also observe that reducing generation time does not directly
> > increase fitness (and would definitely not do so for a species with a
> > fixed number of offspring, like my slime mold cell. In fact,
> > shortening the generation time is a mistake in a situation in which
> > adaptation is not keeping up with a deterioration in the environment
> > and populations are decreasing. Even for my slime mold, decreasing the
> > generation time is a good idea only for those cells that are already
> > so fit that they almost never die while growing to reproductive size.
>
> Well, in that case would decreasing the generation time help when the
> population is rapidly increasing?

Yes. And if the selective expansion phase is followed by a non−selective population collapse (with the survivors being randomly selected without reference to differences in generation time), then you can repeat the expansion. And again, and again. In such a selective dynamic there can be long term selective pressure in favor of shorter generations.

(Of course, the selective dynamic favoring longer generations is just the opposite − a series of selective population declines with some non−selective population expansions to permit repetition. How to get a non−selective population expansion that doesn't automatically favor short generations? Well, colonization of a new environment by a small founding population without much genetic variation for generation time would do the trick.)

> The situation I am thinking of is after

> an extinction event. The remaining organisms might in this case be engaged in a Haldane limit rate race. It has been observed that the species in a family that survive an extinction event tend to be those with the smallest individuals. I have attributed this to a tendency for species with small individuals to have larger populations, and so be more likely to survive the crash phase of an extinction event. But perhaps it is in fact due to species with small individuals being more easily able to reduce their generation time, and thus being able to outcompete species with large individuals in a Haldane limit rate race to invade new niches during the rebound phase following an extinction event.

I'm not sure that bringing Haldane's limit into this discussion helps. And in any case, a species will only be able to evolve to a reduced generation time long after the extinction event. So better evolvability doesn't explain differential species survival through the extinction event. And, in any case, I don't see why it should be easier to reduce generation time from 4 years (say) to 3 than it is to reduce generation time from 8 years to 6. Why does being small help here?

I like your first explanation for why small species survive. Or, if you want an explanation for why small, short−generation−time species preferentially radiate after the extinction, it may be simply that they can most rapidly build up their populations and exploit the new opportunities. Evolution of life history properties may not come into it at all − at least not in the immediate aftermath of the extinction.

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