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Is Pokémon Evolution Dangerous: The Lake of Rage

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Abstract

This paper will explore the effects of one of Team Rocket's schemes in the games *Pokémon HeartGold* and *SoulSilver* using values calculated in a previous paper "Is Pokémon Evolution Dangerous?". In these games Team Rocket use a radio signal to force Magikarp in a nearby lake to evolve into Gyarados. A model relating the Magikarp population in two lakes is deduced in order to find the total number of Magikarp evolved by Team Rocket. It is found that forcing the Magikarp to evolve would require 1.62×10^{21} J of energy, causing the Earth to go dark for 46.4 s.

Introduction

This paper aims to take the energy values calculated for Magikarp evolution in the previous paper [1] and use them to explore an in game event from *Pokémon HeartGold* [2] and *SoulSilver* [3] in which many Magikarp in a location known as the Lake of Rage are forced to evolve by Team Rocket. It was found previously that when a Magikarp evolves it has a mass increase of 225 kg which equates to requiring 2.025×10^{19} J, or 2.025×10^{10} GJ, of energy. It was also calculated that the Earth receives 3.4884×10^{19} J s⁻¹ from the Sun, all assumed to be in the form of electromagnetic radiation [1].

Calculating the Population Size

In *Pokémon Diamond* [4] and *Pearl* [5] Team Galactic drain a lake through largely undescribed means. The in-game tilesets of the lake before and after being drained allow a rough estimate of the density of Magikarp in a lake to be made.

Lake Valour [6] was found to have a surface area of 494 tiles, where one tile is the size of a single grass patch as seen in the bottom right of figure 1. In figure 2, 22 Magikarp can be seen. It has been assumed that not all of the Magikarp population survived with an estimated survival rate of 50%. In reality it is impossible to say for certain as the explosives used are unknown. 50% survival rate seems like a reasonable number to use. This gives a starting population in the lake in figure 1 of 44. Assuming that the density of Pokémon in a lake is

linearly proportional to its size, the number of Magikarp in the Lake of Rage [7] in the can be deduced.



Figure 1 – Lake Valour before being drained. Using the grass and trees for scale the approximate surface area of the lake was measured [6].



Figure 2 – The drained Lake Valour. Clear crates can be seen in the lake bed suggesting some form of explosive in the draining. Individual Magikarp can be seen lying on the lake bed [6].



Figure 3 – The Lake of Rage in *Pokémon HeartGold* [2] and *SoulSilver* [3]. The surface area of the lake was counted using trees for scale [7].

From figure 3 the Lake of Rage was found to have a surface area of 620 tiles. The only Pokémon present in the lake of rage when fishing are Magikarp and Gyarados, whereas in Lake Valour Magikarp and Gyarados have an encounter rate of 65% with Goldeen or Seaking taking up the other 35% depending on the level of the fishing rod used [8]. Assuming that Magikarp accounts for 65% of the organisms present in Lake Valour, a total population for Lake Valour can be calculated as being 68 individuals.

Equation 1, below, was used to find a constant of linear proportionality, hereafter referred to as the Karp constant, between lake size and total population:

$$\frac{N_t}{N_0} = K, \quad (1)$$

where N_t is the surface area of the lake in tiles, N_0 is the number of organisms in the lake and K is the Karp constant. The value of K was found to be 7.3, rounded to 1 decimal place. Dividing N_t of the Lake of Rage by K gives the number of organisms found in the Lake of Rage; 85. All of these are assumed to be Magikarp. This will not be exactly correct, but it is a close estimate.

The Impact of the 85 Magikarp Evolving

Using the values calculated in the previous paper [1] for the energy from the Sun and the energy requirement of Magikarp evolution the effect of the entire Lake of Rage Magikarp population evolving can

be determined. The same assumptions will be used in that the photons that are absorbed are exclusively from the Sun and other light sources can be disregarded.

Assuming Team Rocket's plan was completely successful in causing all of the Magikarp to evolve the total energy required would be 1.62×10^{21} J. Using the value of rate of energy received by Earth from the Sun, this phenomenon would take all solar radiation incident on the earth for 46.4 s. It would be reasonable to assume that Team Rocket would at very least have caused something close to a global eclipse and likely mass panic around the world. Life would likely not be threatened though and it would be ultimately pretty harmless still [9].

Of course, Pokémon evolution is assumed to be instantaneous, not taking 46.4 s to occur meaning that the Magikarp would either have to find new energy sources to drain or would simply be unable to evolve. Putting a different spin on this, it could be assumed that after absorbing all available photons that the instant of evolution, the Magikarp population then absorbs energy from its surroundings. In this case the most immediate of the surroundings is the water in which they are immersed. The volume of the lake cannot be calculated due to its unknown depth and so its energy content cannot be calculated meaning that this is a point for speculation. It would seem likely that the monumental amount of energy required by the magikarp would be able to bring the lake well below freezing temperature, which would clearly be detrimental to the local ecosystem.

It should also be considered that the sudden increase in the number of predators in the ecosystem will suddenly increase due to the influx of Gyarados. The extra volume occupied by organisms will also increase, altering the water level of the lake.

Conclusion

In conclusion, within the assumptions stated at the beginning of the paper Team Rocket's plan would not actually be particularly dangerous and would be more of an annoyance than anything else although the sudden outage of sunlight may cause some individuals to panic.

References

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