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Possible biological effects of geomagnetic perturbations in the South Atlantic Anomaly

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The South Atlantic Anomaly (SAA), characterized by a significantly weakened geomagnetic field, provides a unique natural laboratory to study the biological and ecological consequences of altered magnetic shielding. This region exhibits a large magnetic potential gradient between its central depression (where surface intensity can be 47.8% weaker than the global average according to the CHAOS-8.2 model). Following geomagnetic storms, the SAA experiences enhanced particle precipitation, leading to pronounced atmospheric disturbances. These include prolonged ozone depletion and potential impacts on cloud microphysics and regional climate patterns. Furthermore, the anomalous magnetic environment may directly affect biology by disrupting magnetoreception in migratory species and influencing physiological processes. This synthesis highlights the critical interplay between geomagnetic activity, the distinct magnetic landscape of the SAA, and its multifaceted effects on ecosystems, offering insights into planetary habitability under evolving magnetic conditions.