1154-VF-1406 **Remi Drai*** (remi.drai@pepperdine.edu), Pepperdine University, Natural Science Division, 24255 Pacific Coast Highway, Malibu, CA 90263. *Inertial laws in population biology: The role of entropy.*

Among the mathematical approaches developed for population biology, two results have been often compared to Galileo's principle of inertia: Malthus' law of exponential growth and Hardy-Weinberg law in population genetics. In this work we show how these two laws can be derived from the minimization of functionals involving entropy. Our approach for the Malthusian principle uses V. Volterra's "quantity of life". Using calculus of variations and a formalism developed by E. Tonti and G. Strang, one can show that the classical exponential growth model corresponds to the minimization of the following entropic functional: $\int N \ln N + rX dt$ where: $X(t) = \int N(\tau)d\tau$ and r is the Malthusian growth factor.

Interestingly, another form of entropy: $\Sigma p_i ln p_i$ (Gibbs-Shannon entropy) plays a role in the other "inertial principle" of population biology: Hardy-Weinberg equilibrium law. Using the Entropy Maximization principle of Jaynes, one can show that the genotype frequencies $X = P(AA)$, $Y = P(Aa) + P(aA)$, $Z = P(aa)$, associated to the minimizing allele frequencies, p_i, satisfy the relation $Y^2 = 4XY$ i.e are in Hardy-Weinberg proportions. (Received September 15, 2019)