The paper studies dynamics of a model which extends the Lotka-Volterra two-species model with diffusion and advection, of the form

$$
\begin{align*}
  u_t &= \nabla \cdot (\mu \nabla u - \alpha u \nabla m) + u(m - u - v), \\
  v_t &= \nabla \cdot (\nu \nabla v - \beta v \nabla m) + v(m - u - v),
\end{align*}
$$

under some initial conditions and homogeneous total flux boundary conditions. Here $u$ and $v$ are population densities, $m = m(x)$ is the given local intrinsic growth rate, and $\alpha, \beta, \mu, \nu$ are constants. The coefficients $\mu, \nu$ are nonnegative dispersal rates, and $\alpha, \beta$ control the magnitude of advection which simulates the movement upwards along the gradient of resources.

Depending on the relative magnitude of $\alpha, \beta, \mu, \nu$, the authors determine that one of three possible behaviors can occur: coexistence, or extinction of one of the species, or intermediate dispersal rate. These results differ from the case without advection with $\alpha = \beta = 0$ in which the faster diffusing species is driven to extinction, as shown in [J. D. Dockery et al., J. Math. Biol. 37 (1998), no. 1, 61–83; MR1636644]. The paper extends results of X. Chen, R. Hambrock and Y. Lou [J. Math. Biol. 57 (2008), no. 3, 361–386; MR2411225].

{For additional information pertaining to this item see [X. Chen, K.-Y. Lam and Y. Lou, Discrete Contin. Dyn. Syst. 34 (2014), no. 11, 4989–4995; MR3223840].}

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Current version of review. Go to earlier version. Małgorzata Peszyńska

References


Note: This list reflects references listed in the original paper as accurately as possible with no attempt to correct errors.