

Existence and Asymptotic Behavior of Solutions to Broadcast Spawning PDE models

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Both reactions and chemotaxis are involved in many biological phenomena like coral broadcast spawning. In this talk, we consider following partial differential equations involving diffusion, advection, chemotaxis and reactions with egg and sperm densities.

$$\begin{cases} \partial_t e + (u \cdot \nabla)e - \Delta e = -\epsilon(se), \\ \partial_t s + (u \cdot \nabla)s - \Delta s = \chi \nabla \cdot (s \nabla \Delta^{-1} e) - \epsilon(se), \end{cases} \quad \text{in } (x, t) \in \mathbf{R}^d \times (0, \infty), \quad (1)$$

where $e \geq 0$, $s \geq 0$, and u denote the density of egg gametes, sperm gametes and divergence free sea velocity of sea fluid, respectively. In the above, χ and ϵ are positive constants.

We prove the global-in-time existence of regular solution with some assumptions on the reaction. Furthermore, we show that in three dimension, the total mass of egg and sperm density has a positive lower bound even if time goes to ∞ . Also we show that this lower bound approaches 0 as the chemotactic sensitivity χ approaches ∞ . This is the joint work with Professor Kyungkeun Kang (Yonsei U.) and Myeongju Chae (Hankyung Nat.U.).