Mathematical Model of Swimmer's Itch with Praziquantel Treatment

Kelly Buch

Abstract

Swimmers itch is a water-borne, emerging disease caused by parasites known as avian schistosomes. Typically, these parasites use birds as definitive hosts, but will mistakenly infect a wide-range of dead-end hosts, including humans. When parasite larvae penetrate the skin of humans they initiate an allergic reaction that causes itching and discomfort that can last for weeks to months. Previous research has shown that the Common Merganser serves as a key host for schistosomes in the Midwest, with infection rates exceeding 60% in some regions. While most efforts at schistosome control have focused on other hosts in the parasites life cycle (snails), recent attempts have been made to target waterfowl using the anti-parasitic drug, Praziquantel. Based on this novel approach, we developed a mathematical model to explore the effects of Praziquantel dose and treatment frequency on the occurrence of swimmers itch in a typical Midwestern lake. We modeled susceptible and infected mergansers (both juvenile and adult), and snails using first order differential equations and introduced aspects of Praziquantel treatment into the system. Results from this model help to identify treatment regimes which lower merganser infection rates and ultimately reduce the occurrence of swimmers itch.