

# Software M code for modelling virus dynamics in multispecies ecosystems

Familusi Oluwatosin Adekunle<sup>a,b,c</sup>, Gorka Bidegain<sup>b,c</sup>, Tal Ben-Horin<sup>d</sup>

<sup>a</sup>*Institut des Sciences de la Mer, L'Université du Québec à Rimouski, Allée des Ursulines, Rimouski, 3300, Qc, Canada*

<sup>b</sup>*Department of Applied Mathematics, University of the Basque Country (UPV/EHU), Plaza Europa 1, Donostia, 20018, Gipuzkoa, Spain*

<sup>c</sup>*Research Centre for Experimental Marine Biology and Biotechnology, Plentzia Marine Station, University of the Basque Country (PiE-UPV/EHU), Areatza Pasealekua, Plentzia, 48620, Bizkaia, Spain*

<sup>d</sup>*North Carolina State University, College of Veterinary Medicine, 303, College Circle, Morehead City, NC 28557, North Carolina, USA*

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## Abstract

We present an M-code (MATLAB) modeling toolkit for waterborne viral transmission in mixed-species communities. The framework couples host processes—growth, background mortality, and filtration/clearance—with viral processes—shedding/release, environmental transport, and decay—and supports both mono- and co-culture configurations. In contexts lacking co-culture infection data, parameters can be calibrated to monoculture observations and then explored across species mixtures. We verify mathematical consistency and realistic behavior across wide composition gradients (e.g., 90/10 to 10/90). Using an oyster–herpesvirus (OsHV-1) case study with *M. gigas* and *C. virginica*, simulations show that adding a second, more tolerant host does not halt epidemic progression in the susceptible host; peak mortality still occurs but is delayed, consistent with saturation of viral particles in the water column that limits dilution benefits. The toolkit replicates observed monoculture dynamics and generalizes to multispecies scenarios, enabling hypothesis testing about species introductions, husbandry strategies, and environmental controls on transmission. Overall, it provides a transparent, extensible platform for investigating pathogen dynamics in multispecies ecosystems and for evaluating management options in aquaculture and beyond.

**Keywords:** Modelling, *Ostreid Herpesvirus 1*, co-culture, *C. virginica*, *M.*

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1 **1. Publication**

2       This code was developed and applied for the study "Coculture with East-  
3 ern oysters is unlikely to reduce OsHV-1 impacts to farmed Pacific oysters: A  
4 modelling approach" published in Aquaculture Reports (Elsevier) [https://](https://www.sciencedirect.com/science/article/pii/S2352513424006550)  
5 [www.sciencedirect.com/science/article/pii/S2352513424006550](https://www.sciencedirect.com/science/article/pii/S2352513424006550). This  
6 modelling work and parameter estimates are based on empirical research.