

EEMS Test Case Model Description

TC_Shellfish_Farm

1 Overview

This model reproduces the test cases presented by Kobayashi et al. [3] in “*A Population Dynamics Model for the Japanese Oyster, Crassostrea gigas*”. The objective is to use EFDC+ Explorer (EE) and EFDC+ to simulate the interactions between water quality conditions and shellfish growth, and to validate the model against measured oyster growth data. The goal is to better understand how water quality parameters – including temperature, salinity, and chlorophyll a – influence the growth of oysters as represented in EFDC+’s Shellfish Farm module.

2 Demonstration Feature

This test case showcases the Shellfish Farm module in EFDC+, highlighting its capacity to simulate oyster population dynamics in response to ambient water-quality conditions. The model follows the framework of Kobayashi et al. [3] for Japanese oyster (*Crassostrea gigas*) growth, incorporating the effects of phytoplankton availability (chlorophyll a), water temperature, and salinity on changes in dry weight and shell length. It provides a practical reference for applications in aquaculture modeling, shellfish restoration, and coastal or estuarine water-quality management.

By coupling biological growth processes with hydrodynamic and water-quality simulations, the test case demonstrates how EFDC+ represents oyster–environment interactions, extending concepts also examined by Cerco and Noel [1] in studies of nutrient dynamics and eutrophication in Chesapeake Bay. The governing equations and model formulations implemented in EFDC+ are documented in the [EFDC+ Theory Document](#) [2].

3 Model Description

The model configuration is summarized in Table 1. The model domain, shown in Figure 1, consists of 3 horizontal grid cells and 1 vertical layer, representing the simplified shellfish growth dynamics in this case. The following EFDC+ modules are activated in this test case:

- Hydrodynamics – provides the flow field for the simplified model domain
- Salinity – simulates salinity conditions that influence oyster growth rates and survival
- Temperature – simulates water temperature dynamics, a key driver of oyster metabolic rates and growth
- Water Quality – simulates phytoplankton (chlorophyll a) and nutrient dynamics that provide the food source for oyster filtration and growth
- Shellfish Farm – the primary module of interest, simulating oyster population dynamics including dry weight accumulation and shell length development in response to the ambient water quality conditions

Table 1 Model configuration summary

Dimensions	Horizontal cells	Vertical cells	Activated modules
2D	3 cells	1 layer	• Hydrodynamics • Salinity • Temperature • Water Quality • Shellfish Farm

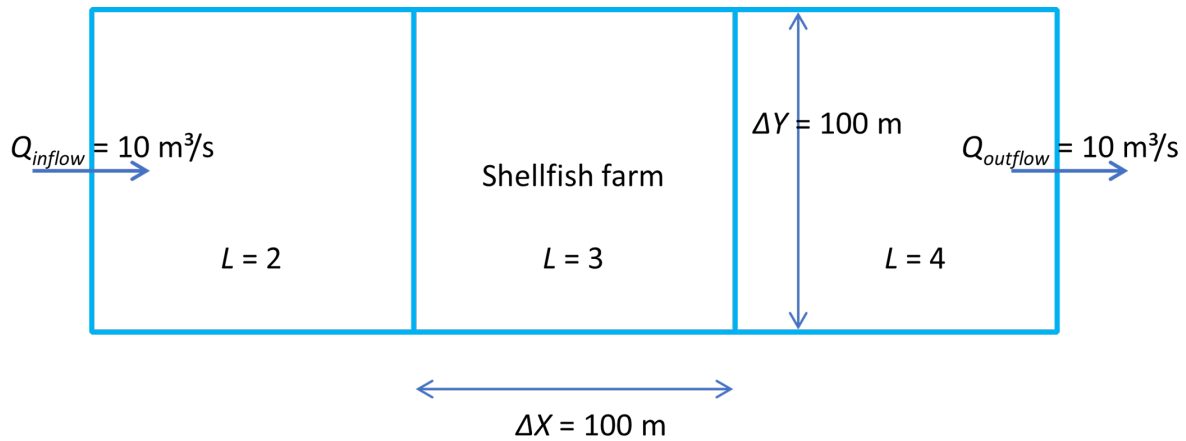


Figure 1 Model domain

4 Model Results

Figures 2 and 3 present direct comparisons of modeled and measured oyster dry weight and shell length over time. The observational values are taken from Kobayashi et al. [3]. The model results demonstrate good agreement between the EFDC+ simulated oyster growth metrics and the measured data, confirming that EFDC+'s Shellfish Farm module accurately reproduces the growth dynamics of *Crassostrea gigas* under the simulated water quality conditions.

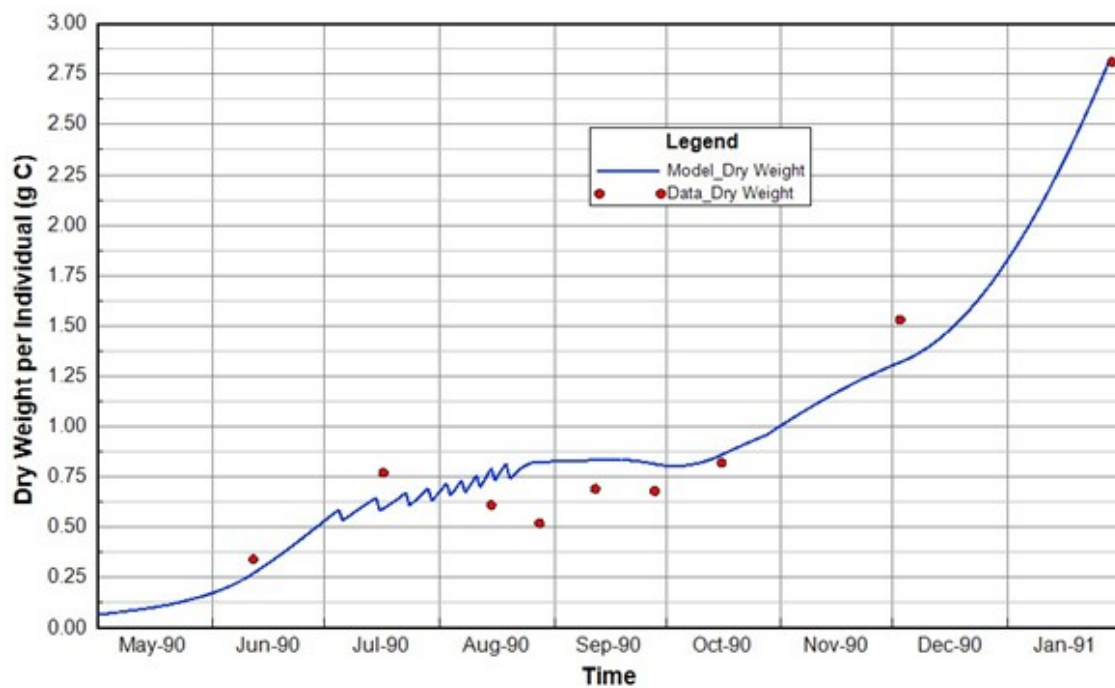


Figure 2 Time series of observed and simulated oyster dry weight per individual

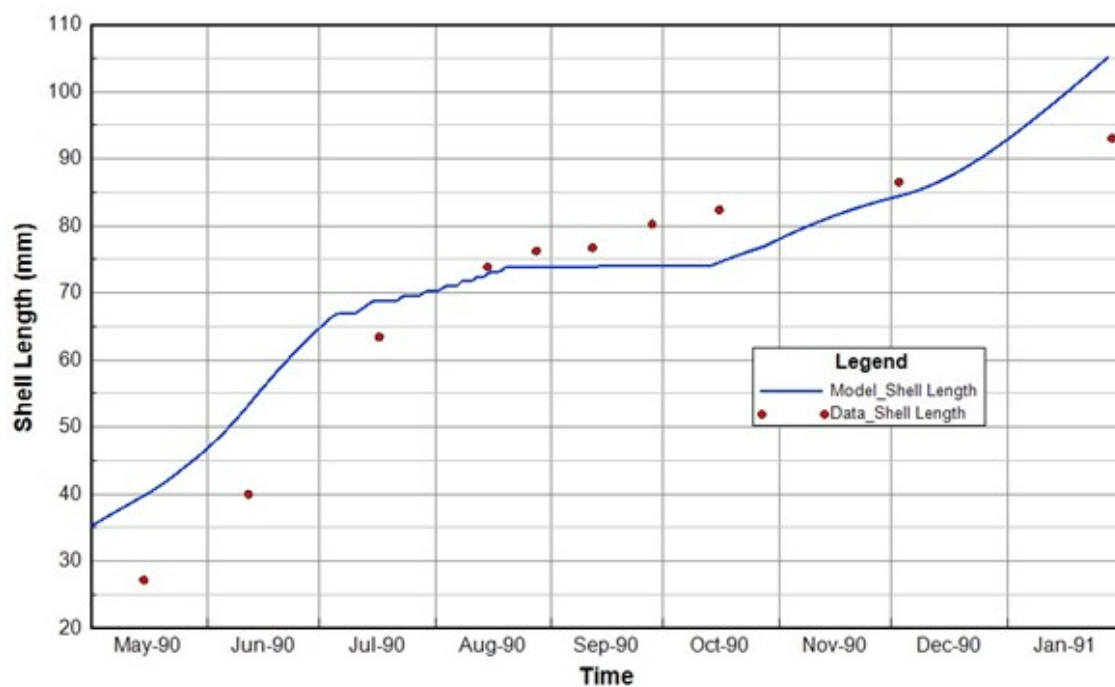


Figure 3 Time series of observed and simulated oyster shell length

References

- [1] Cerco, C. F. and Noel, M. R. (2007). Can oyster restoration reverse cultural eutrophication in chesapeake bay? *Estuaries and Coasts*, 30(2):331–343.

- [2] DSI LLC (2024). *EFDC+ Theory: Version 12*. DSI LLC, Edmonds, WA, USA. Accessed: 2026-04-06.
- [3] Kobayashi, M., Hofmann, E. E., Powell, E. N., Klinck, J. M., and Kusaka, K. (1997). A population dynamics model for the japanese oyster, *crassostrea gigas*. *Aquaculture*, 149(3-4):285–321.

Disclaimer: This model is provided to demonstrate that EFDC+ Explorer and EFDC+ can be used to better understand how to build this kind of model. The model is running as expected; however, it should not be considered final, as it can be modified and refined to obtain improved results.