O24.3

Using a bioenergetic model to address carbon sequestration of shellfish farming

Camilla bertolini[1], Ilaria Bernardini[2], Daniele Brigolin[3], Valerio Matozzo[2], Massimo Milan[2], Roberto Pastres[1]

[1]Ca foscari university, Italy. [2]University of padova, Italy. [3]Iuav university, Italy

Abstract

Shellfish are increasingly been looked at as sustainable food sources that provide additional ecosystem services, such as water filtration and carbon sequestration. However, their role as CO2 sinks or sources is still highly debated: in order to quantify this, the shell accretion dynamics need to be taken into account. Bioenergetic models that investigate bivalve growth are mostly focused on the growth of the soft tissues, with the shell component usually calculated with allometric scaling relationships. Partitioning of energy into soft tissue and shell allows to investigate energy investment in relation to site specific environmental conditions. As part of this study, shell accretion was added as a state variable in a bioenergetic model of the Manilla clam (Ruditapes philippinarum). A keyparameter for energy allocation into shell growth was calibrated for four sites located in the Venice lagoon, where clams from the same cohort were monitored for one year during a transplant experiment. The model was then used to calculate CO2 fluxes resulting from respiration and shell calcification, taking in account CaCO3 stocked in the shell and CO2 emission. The function Ψ, that relates the amount of CO2released with respect to CaCO3 formed, was estimated usingenvironmental forcing functions (temperature, salinity, pH and alkalinity) observed in the proximity of each site. The findings show that the energy invested towards shell accretion varies slightly among sites and that clams play a role as a moderate sink of CO2 when the whole year is considered. Fluxes were characterized by a marked seasonal variability: due to respiration, clams were net sources of CO2 in wintertime, when growth slowed down. The model presented provides a useful framework for site selection in the context of balancing optimal food production and sustainability taking in account environmental variables, which can find a use coupled with climate forecasts.

Keywords

Carbon budget, Shellfish, Aquaculture