

THE CONTRIBUTE OF THE MANILA CLAM TO THE SECONDARY PRODUCTION OF THE BENTHIC COMPARTMENT IN THE VENICE LAGOON

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Abstract

A first attempt to quantify the contribute of the Manila clam (*Ruditapes philippinarum*) to the secondary production of the benthic compartment of the lagoon of Venice is described. The potential exploitable production, based on available data about the clams distribution and annual catches, has been estimated on a spatial basis within the main fishing grounds and compared with experimental data about the secondary production of the macrobenthic community of the lagoon, recorded in areas not interested by the clam harvesting activity.

Keywords: Bivalves, Alien species, Secondary Production, Lagoons, Adriatic Sea

Introduction

As previously described by other authors [1], the introduction of the Manila clam - *Ruditapes philippinarum* (Adams & Reeve, 1850) - in the lagoon of Venice and the subsequent demographic explosion directly affected the ecosystem functioning. Among the other effects, an increase of the benthic compartment production has been recorded, as reflected by the 40000 tons of catches per year reported at the end of the last century. Therefore, the voluntary introduction of the Manila clam represented the most successful event for the Italian shellfish aquaculture and, at present, Italy results to be the main clam producer in Europe. For this reason, this species can represent a good model to analyse ecological effects related to an alien species introduced for commercial purposes in a marine ecosystem. The aim of the paper is to use the secondary production as a proxy to assess the effects on ecosystem functioning due to the non-native species, *Ruditapes philippinarum*. By using available data from different sources, the clam potential exploitable production, for each one of the main fishing grounds, has been estimated on a spatial basis and compared with secondary production estimates for the macrobenthic community, experimentally obtained for different areas of the lagoon.

Material and methods

In the context of the present situation, characterized by local administrations efforts to enforce the management policy, allocating resources and fishermen in small portion of the lagoon, a lack of reliable and well structured databases about Manila clam have been recorded. To estimate the potential exploitable production on a spatial basis, the most recent biomass density data collected within the main fishing grounds [2, 3, 4,] were used as proxy for production distribution. Biomass values (wet weight, $g \cdot m^{-2}$) for each area were interpolated by using ordinary kriging on a 10 m square cells grid, after fitting the best model on the experimental variogram, using the 'gstat' library [5] of R software packages. For each area, a relative biomass index was then computed by dividing biomass of each cell by the total biomass of the area. The production distribution in each area was obtained by multiplying the annual production for the area by the relative biomass index. Estimated production values, transformed in ash free dry weight, were finally interpolated on a 100 m square cells grid. This interpolation was used to estimate the contribute of the Manila clam to the production of the benthic compartment by using, as reference, the mean value of $27.5 g AFDW m^{-2} y^{-1}$, recorded in areas outside clam fishing grounds and outside seagrass meadows [6].

Results and discussion

Obtained results highlight a significant contribution (from 1 to 4-5 times the value recorded outside the fishing grounds) of the Manila clam to the benthic compartment secondary production (Fig. 1). This could find explanation in terms of an optimization of the resources exploitation, as suggested by the benthic-pelagic coupling increase. The Manila clam is, indeed, characterized by a general 'rusticity'. Moreover, in the fishing grounds the population is maintained in the 'young phase' (with high r values) by the fishing activity itself. Finally, the presence of positive feedbacks with the fishing activity, due to the re-suspension of organic matter from the sea-bottom, has been described [7]. Estimates here presented, allowed for a first quantification of positive effects of the Manila clam on goods and services of the Venice lagoon, which in some way, represent the other side of the medal when assessing the global effect of non-native species on the ecosystem functioning.

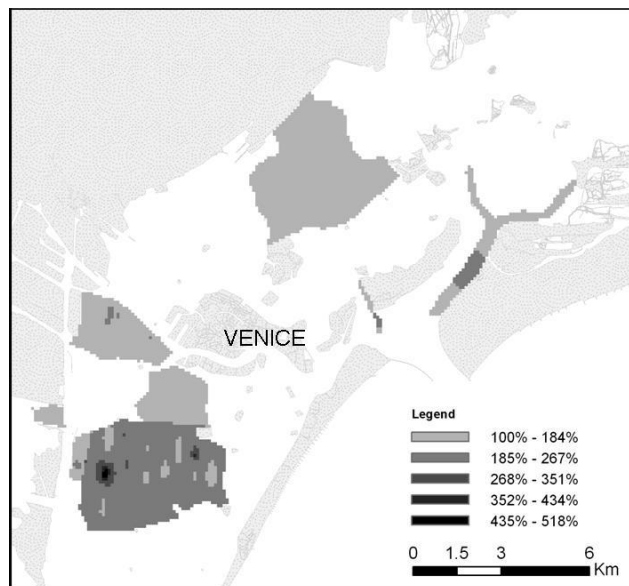


Fig. 1. Contribution of the Manila clam to Secondary Production of the benthic compartment. Data are expressed as percentage referred to the mean production experimentally recorded outside the clam fishing grounds

References

- 1 - Pranovi F., Franceschini G., Casale, M., Zucchetto M., Giovanardi O. and Torricelli P., 2006. An ecological imbalance induced by a non-native species: the Manila clam in the Venice Lagoon. *Biol. Inv.*, 8: 595-609.
- 2 - Provincia di Venezia - Agriteco., 2006. Valutazione dei quantitativi e della distribuzione della vongola *Tapes philippinarum* di taglia commerciale nella macroarea del bacino centrale della laguna di Venezia. Relazione del 17/03/2006.
- 3 - G.R.A.L. - Provincia di Venezia - Agriteco., 2007. Verifica quantitativa e qualitativa sulla presenza di *Tapes philippinarum* in aree circoscritte della Laguna di Venezia e parere tecnico-scientifico sull'opportunità di effettuare una campagna di raccolta emergenziale nel periodo novembre 2006 - gennaio 2007. Relazione del 20/11/2006.
- 4 - G.R.A.L. - Agriteco., 2007. Valutazione dei quantitativi e della distribuzione del seme di vongola filippina *Tapes philippinarum* nelle aree nursery della laguna centrale e valutazione dei quantitativi e della distribuzione della vongola filippina *Tapes philippinarum* di taglia commerciale. Relazione del 08/03/2007.
- 5 - Pebesma E.J., 2004. Multivariable geostatistics in S: the 'gstat' package. *Computers & Geosciences*, 30: 683-691.
- 6 - Tagliapietra D., Cornello M. and Pessa G., 2007. Indirect estimation of benthic secondary production in the Lagoon of Venice (Italy). *Hydrobiologia*, 588: 205-212.
- 7 - Pranovi F., Libralato S., Raicevich S., Granzotto A., Pastres R. and Giovanardi O., 2003. Mechanical clam dredging in Venice Lagoon: effects on ecosystem stability evaluated with a trophic mass-balance model. *Mar. Biol.* 143: 393-403.