

## Article

# Microbiological and Toxicological Investigations on Bivalve Molluscs Farmed in Sicily

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**Abstract:** Bivalves can concentrate biological and chemical pollutants, causing foodborne outbreaks whose occurrence is increasing, due to climatic and anthropic factors that are difficult to reverse, hence the need for improved surveillance. This study aimed to evaluate the hygienic qualities of bivalves sampled along the production and distribution chain in Sicily and collect useful data for consumer safety. Bacteriological and molecular analyses were performed on 254 samples of bivalves for the detection of enteropathogenic *Vibrio*, *Arcobacter* spp., *Aeromonas* spp., *Salmonella* spp., and beta-glucuronidase-positive *Escherichia coli*. A total of 96 out of 254 samples, collected in the production areas, were processed for algal biotoxins and heavy metals detection. Bacterial and algal contaminations were also assessed for 21 samples of water from aquaculture implants. *Vibrio* spp., *Arcobacter* spp., *Aeromonas hydrophila*, *Salmonella* spp., and *Escherichia coli* were detected in 106/254, 79/254, 12/254, 16/254, and 95/254 molluscs, respectively. A total of 10/96 bivalves tested positive for algal biotoxins, and metals were under the legal limit. *V. alginolyticus*, *A. butzleri*, and *E. coli* were detected in 5, 3, and 3 water samples, respectively. *Alexandrium minutum*, *Dinophysis acuminata*, *Lingulodinium polyedra*, and *Pseudonitzschia* spp. were detected in water samples collected with the biotoxin-containing molluscs. Traces of yessotoxins were detected in molluscs from water samples containing the corresponding producing algae. Despite the strict regulation by the European Commission over shellfish supply chain monitoring, our analyses highlighted the need for efficiency improvement.

**Keywords:** food safety; shellfish; enteropathogenic *Vibrio*; *Arcobacter* spp.; *Aeromonas* spp.; *Salmonella* spp.; *Escherichia coli*; algal biotoxins



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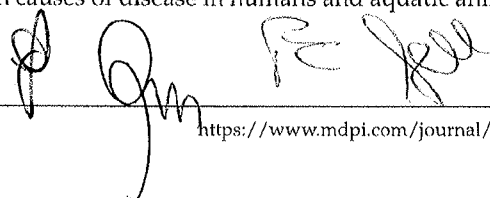


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## 1. Introduction

Since the start of aquaculture production's expansion in the 1990s, bivalve molluscs have been increasingly demanded by consumers for their nutritional value [1]. However, bivalve molluscs can concentrate viruses, bacteria, potentially harmful environmental pollutants, and large quantities of toxic microalgae, the presence of which on the coastlines is one of the greatest risk factors for human health [2–10].

The aforementioned issues pose a significant threat to human health, apart from the direct impact on bivalves, that can undergo severe mortalities associated with a variety of pathogens from different taxonomic clades [11]. The scientific literature reports that foodborne pathogens such as *Salmonella* [12] and pathogenic *Vibrio* [13,14] can benefit from warmer temperatures, so more frequent outbreaks can be expected due to climate change that is affecting our planet [14]. *Vibrio* spp. include enteropathogenic species such as *V. vulnificus*, *V. parahaemolyticus*, and *V. cholerae*, but also *V. alginolyticus* and *Vibrio* non O1-non O139, all of which are common causes of disease in humans and aquatic animals



g. Lili FE Au. 3 Jm

Possibili fonti di contaminazione degli alimenti

NON ESTRAITA

Sequenziamento genomico

NON ESTRAITA

FE Jm  
g. Lili

Validazione dei metodi analitici

g. Lili FE Jm  
Pep

Circuiti inter-laboratorio

g. Sclavo Pili  
Lili FE Q