

# Chapter 16

## Sanitary Status and Environmental Influence on Fecal Contamination in Commercial Bivalve Molluscs From Mediterranean Coast of Morocco: First Characterization and Seasonal Trends

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### ABSTRACT

*This study focuses on the bacteriological quality of bivalve molluscs (*Mytilus galloprovincialis* & *Chamelea galina*) of the Mediterranean coast of east Morocco. A total of 109 samples have been analyzed by the method of the enumeration of *Escherichia coli*  $\beta$ -glucuronidase positive and the search and identification of the different types of total floras such that the Enterobacteriaceae (ENT), the Mesophilic Flora Total Aerobic (FMAT), the Flora Moderate Halophile (FHM), Flora Producer of Hydrogen Sulphide (FHS) and Flora Psychrotroph (FP). The results of the enumeration of *Escherichia coli*  $\beta$ -glucuronidase positive by 100g CLI denote values which present no risk of contamination according to the circular 1508 /12 of the Minister of Agriculture and Fisheries on health conditions for the production and placing on the market of live bivalve molluscs. The results of research and identification of different types of total floras show a bacterial diversity of bivalve molluscs of the studies regions, with a dominance of *Staphylococcus*, *Streptococcaceae* and *Acinetobacter*.*

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## INTRODUCTION

The Mediterranean coast of Morocco is a region of significant ecological and economic importance, characterized by its rich marine biodiversity and substantial fishery resources. In 2017, the region's fish production reached approximately 21,584 tons, with an additional 688 tons of shellfish harvested (NBF, 2016). This marine wealth has historically served as a cornerstone for social and economic development in the region. However, rapid urbanization along the coastline, driven by tourism and industrial activities, has led to a dramatic increase in pollutant discharges into the marine environment (Asli & Burcu, 2017). Among these pollutants, bacterial contamination poses a particularly pressing concern due to its direct impact on both marine ecosystems and public health.

Bacterial pollution in coastal waters is primarily attributed to untreated or inadequately treated wastewater discharges, agricultural runoff, and industrial effluents. These contaminants can lead to the proliferation of pathogenic microorganisms, which are subsequently accumulated by marine organisms, particularly bivalve molluscs (Belivermiş et al., 2016). Bivalves, such as mussels, clams, and oysters, are highly effective filter feeders, capable of processing large volumes of water and retaining particulate matter, including bacteria and viruses (Kalkan & Altug, 2015). This unique feeding mechanism makes them particularly susceptible to contamination by fecal bacteria and other pathogens, which can persist in their tissues and pose significant health risks to consumers (Turetken & Altuğ, 2016).

The role of bivalve molluscs as bioindicators of water quality has been well-documented in scientific literature. Their ability to accumulate and concentrate pollutants, including fecal bacteria, facilitates the detection of contaminants that may be present in water at very low concentrations (Lamparelli et al., 2015, Ochoa-Herrera et al., 2019). This characteristic has led to their widespread use in monitoring programs aimed at assessing the microbiological safety of coastal waters and seafood products (Carlos et al., 2013). Furthermore, the relationship between bivalves and planktonic microorganisms is functionally important to aquatic ecosystems, as it influences nutrient cycling and microbial dynamics (Bilgin & Esin, 2017).

Despite their ecological and economic value, bivalve molluscs are also a potential vector for the transmission of foodborne illnesses. Consumption of contaminated shellfish has been linked to outbreaks of gastrointestinal infections, hepatitis, and other diseases caused by pathogenic bacteria such as *Escherichia coli*, *Salmonella spp.*, and *Vibrio spp.* (Iwamoto et al., 2016; Belivermiş et al., 2016). These health risks underscore the importance of stringent regulatory standards for shellfish harvesting and processing. Internationally, guidelines such as those established by the European Food Safety Authority (EFSA) and the World Health Organization (WHO) provide frameworks for assessing and managing the microbiological safety of bivalve molluscs (EFSA, 2020; WHO, 2017). However, the implementation and enforcement of such standards vary across regions, particularly in developing countries, where monitoring infrastructure may be limited.

In Morocco, the Mediterranean coastline, spanning from Al Hoceima to Saïdia, is a critical area for shellfish production and consumption. However, the region faces growing challenges related to bacterial contamination due to increasing anthropogenic pressures. Despite the economic importance of bivalve molluscs, there is a paucity of data on the microbiological quality of these organisms in Moroccan coastal waters. This gap in knowledge hinders the development of effective management strategies to ensure the safety of shellfish products and protect public health.

The aim of this study was to investigate and identify hygienic indicator bacteria in bivalve molluscs collected from the Mediterranean coast of Morocco, specifically in the Al Hoceima and Saïdia regions. By assessing the levels of fecal bacteria and other pathogens in these organisms, this research seeks to

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