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Bacterial Diseases in Marine Environments and their Impacts on Fisheries Production: A Systematic Review

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Abstract

Background: Bacterial diseases in marine environments have become an increasing threat to global fisheries production. These pathogens, particularly *Vibrio spp*., *Aeromonas spp*., and *Tenacibaculum spp*., are responsible for significant outbreaks affecting fish and crustaceans of commercial value, especially in tropical and subtropical regions.

Objective: To systematically review the scientific literature published between 2000 and 2025 regarding the impacts of bacterial diseases on marine environments and their consequences for fisheries production.

Methods: A systematic search was conducted in PubMed, Scopus, Web of Science, ScienceDirect, and SciELO using the terms: ("Bacterial Diseases" OR "Marine Bacteria") AND ("Marine Environments") AND ("Effects" OR "Impacts") AND ("Fisheries Production" OR "Fish Yield"). After removing duplicates and screening titles, abstracts, and full texts, 12 studies met the inclusion criteria and were analyzed qualitatively.

Results: The included studies span regions in South America, Asia, and Africa, with most reporting Vibrio-related outbreaks. Impacts on production ranged from 20% to over 50% biomass loss, with economic consequences such as reduced exports, market devaluation, and food insecurity. Most affected species were tilapia, shrimp, croaker, and sea bass. A significant knowledge gap was identified regarding control strategies and preventive measures.

Conclusion: Bacterial infections in marine ecosystems have a direct and measurable impact on fisheries production. Strengthening epidemiological surveillance, implementing biosafety protocols, and investing in interdisciplinary research are essential to mitigate these effects and promote sustainable fisheries development.

Keywords: Bacterial diseases; Marine environments; Aquaculture; Fisheries production; *Vibrio spp*.; Aquatic animal health

Introduction

Bacterial diseases in marine environments have emerged as one of the main challenges to global fisheries production, particularly in the context of climate change, coastal pollution, and the intensification of aquaculture. Pathogenic microorganisms such as *Vibrio spp.*, *Aeromonas spp.*, and *Tenacibaculum spp.* have been associated with outbreaks resulting in high mortality rates among fish and crustaceans, directly affecting the productivity of fisheries and aquaculture chains [1-3].

These impacts are especially concerning in tropical and developing regions, where coastal communities are economically dependent on fishing and mariculture. In addition to economic losses, bacterial outbreaks also affect food security and ecological balance due to biodiversity loss and the decline of native species [4-6].

In this context, the objective of this systematic review is to gather scientific evidence published between 2000 and 2025 that addresses the effects of marine bacterial diseases on fisheries production. The aim is to identify the main pathogens involved, the most affected species, the regions of highest occurrence, and the reported impacts on productivity.

Methodology

This review followed the PRISMA 2020 guidelines. Searches were conducted from March to May 2025 in the following databases: PubMed, Scopus, Web of Science, ScienceDirect, and SciELO.

Search strategy

The search used the following keyword combination in English:

("Bacterial Diseases" OR "Marine Bacteria") AND ("Marine Environments") AND ("Effects" OR "Impacts") AND ("Fisheries Production" OR "Fish Yield").

Inclusion criteria

a) Original research articles published between 2000 and 2025

b) Studies linking bacterial diseases with fisheries or aquaculture production

c) Empirical studies (quantitative or qualitative), in English, Portuguese, or Spanish

d) Full-text availability.

Exclusion criteria

a) Laboratory studies with no direct application to fisheries production

b) Reviews, editorials, opinion pieces, and conference abstracts

c) Duplicates or inconclusive articles

Selection and analysis process

After screening and full-text reading, 12 studies met all inclusion criteria. Extracted variables included author, year, country, identified pathogen, affected species, reported impact on production, and study type. Data were organized into a descriptive.

Following the PRISMA methodology, a total of 327 records were initially identified. After duplicate removal, 295 records remained. Of these, 254 were excluded during title and abstract screening. A total of 41 full-text articles were assessed for eligibility, resulting in the exclusion of 29 articles with justification, and 12 studies were ultimately included in the final qualitative synthesis.

Among the 29 excluded articles during the eligibility phase: 12 addressed marine bacteria but focused solely on ecological or taxonomic aspects without assessing productive or economic impacts; 6 tested bacterial infections under artificial laboratory conditions, with no direct relevance to commercial fisheries or large-scale aquaculture; 4 investigated marine invertebrates (e.g., cnidarians, tunicates) not associated with fishing activity; 3 consisted solely of theoretical reviews or conceptual discussions without reporting measurable impacts (e.g., on production, mortality, or economic loss); 2 presented duplicate data already published in more detailed sources and 2 were inaccessible, with no institutional or direct access to the full text.

Results

The 12 included studies (Table 1) [7-18] covered various regions worldwide, particularly South America, Asia, and Africa. Most affected species were commercially important fish and crustaceans. The Vibrio genus was the most frequently reported pathogen, and impacts on production ranged from moderate losses to economic collapse.

Table 1: Studies included in the systematic review (2000-2025).

Year	Region	Pathogen	Affected Species	Impact on Production	Study Type	Reference
2004	Brazil	Vibrio anguillarum	Mullet (Mugil spp.)	38% production drop	Observational	[7]
2008	China	Aeromonas hydrophila	Tilapia	Large-scale mortality	Field experiment	[8]
2011	Japan	Tenacibaculum maritimum	Flounder	52% biomass reduction	Longitudinal	[9]
2014	Brazil	Vibrio vulnificus	Marine shrimp	Juvenile mortality	Economic assessment	[10]
2016	China	Photobacterium damselae	Red snapper	US$ 1.2 million loss	Case report	[11]
2017	Angola	Vibrio spp.	Sardine	20% catch reduction	Observational	[12]
2018	Spain	Vibrio harveyi	Sea bass	Larval culture loss	Clinical study	[13]
2019	Brazil	Aeromonas veronii	Catfish	Mortality and social impact	Ecological	[14]
2020	Myanmar	Vibrio parahaemolyticus	White shrimp	45% production drop	Intervention	[15]
2021	Peru	Vibrio spp.	Croaker	Decline in exports	Population assessment	[16]
2023	Brazil	Flavobacterium columnare	Tilapia	Productivity loss	Observational	[17]
2024	Nigeria	Vibrio alginolyticus	Nile tilapia	Mortality and economic losses	Mixed methods	[18]

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Discussion

The analysis confirms that bacterial outbreaks in marine environments cause significant losses in fisheries production, with Vibrio species being the most common etiological agents. These effects are more severe in tropical regions, characterized by environmental conditions favorable to bacterial growth and limited sanitary infrastructure [7-10].

Beyond direct mortality of cultivated or captured species, several studies reported indirect effects such as export declines, market devaluation, and food insecurity [11,12,16]. In Brazil, Myanmar, and Nigeria, outbreaks of Vibrio parahaemolyticus and Aeromonas spp. led to productivity losses of up to 45% [14-15,18].

Despite widespread recognition of these impacts, few studies reported effective prevention or control strategies. Biosafety practices, microbiological monitoring, and technical training remain scarce across most regions studied [5,6].

There is an urgent need for interdisciplinary approaches that integrate ecological, health, and socioeconomic data to support the development of public policies and management strategies aimed at mitigating the impacts of bacterial diseases in marine fisheries and aquaculture.

Conclusion

Bacterial diseases in marine environments represent a substantial threat to the sustainability of fisheries production, particularly in low- and middle-income countries. Outbreaks caused by *Vibrio spp.*, *Aeromonas spp.*, and *Tenacibaculum spp.* directly affect productivity and can compromise entire economic chains.

This review highlights the need to strengthen epidemiological surveillance, promote educational initiatives, and implement effective sanitary management programs. Investment in applied research, continuous monitoring, and targeted public policies is essential to mitigate the economic and ecological losses caused by these diseases.

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