Received: 8 July, 2024 | Revised: 21 July, 2024 | Accepted: 29 July 2024

MANUSCRIPT ID: CoAS_V2IS2_01

POPULAR ARTICLE

Chronicle of Aquatic Science

# Prevention and Management of Infectious Diseases in Abalone Farming

Gourav Jakhar*[1] | Bhavya G[1] | Isha kumari[1] | Aniket. R. Funde[1] | Manupati Sneha[1]

[1]Department of Aquatic Health Management ICAR- Central Institute of Fisheries Education, Mumbai-400061, Maharashtra, India

**Correspondence**

Gourav Jakhar, ICAR- Central Institute of Fisheries Education, Mumbai-400061, Maharashtra, India

Email: jakhargourav27@gmail.com

**Publisher's Note**

The opinions presented in this article are the exclusive views of the authors and do not necessarily reflect the views of their affiliated organizations, the publisher, editors, or reviewers. The publisher does not guarantee or endorse any product evaluated in this article or any claim made by its manufacturer.

**Conflict of Interest**

The authors assert that the manuscript was developed without any commercial or financial associations that could be interpreted as a potential conflict of interest.

**Authors Contribution**

All listed authors have contributed significantly, directly, and intellectually to the work and have endorsed it for publication.

## Abstract

Abalone, a marine gastropod inhabiting rocky and coral reef environments, is highly valued, particularly in Asia. The demand for abalone has surged while natural populations have declined over the past 10-15 years, leading to increased prices and expansion of aquaculture. Abalone aquaculture, practiced mainly in Asian countries like Japan, China, and Taiwan, has proven economically viable but remains challenging and time-consuming, with most species taking 4-6 years to reach marketable size. The industry faces several challenges, including various diseases like Withering Syndrome, caused by Candidatus Xenohaliotis californiensis, and Abalone Viral Ganglioneuritis (AVG), caused by abalone herpesvirus. Effective disease management involves biosecurity measures and water quality management. Additionally, enhancing abalone immunity through methods such as immune priming is an area of active research. Techniques like the raft method and careful site selection are employed to optimize production.

## KEYWORDS

Abalone, Withering syndrome, biosecurity, Abalone viral Ganglioneuritis

## INTRODUCTION

Abalone is a marine gastropod (single-shell mollusk) that lives in rocky and coraRl reef environments, which are in demand in Asia and around the world. Seaweed is the primary source of nutrition for abalone. Over the past 10-15 years the supply of abalone has decreased rapidly due to decline in the natural population, while demand has been increasing. This situation has resulted in illegal taking, high market prices and expansion of aquaculture. Abalone aquaculture is not a new activity, it has been followed for many decades. It is mainly followed in Asian countries (Japan, China, Taiwan) for recuperation purposes (Wang, 2004). However, today abalone aquaculture for human consumption has proven economically profitable, even though farming is still difficult and time-consuming. Abalone Aquaculture has expanded to several continents and most species require 4 to 6 years to reach marketable size. However, tropical and subtropical species reach marketable size within 2 year, and various diseases are also originating in abalone culture, reduce the impact of disease following biosecurity management approach. Different production techniques such as raft method have been used for abalone culture. been adopted in each country depending on the cost of land, labor cost, available feed or material for construction of pond.

## BREEDING OF ABALONE

Breeding season – The breeding season and its duration vary according to species and breeding and are also closely related to the environment condition of the habitat. it generally has a positive relationship with water temperature. In many places the abalone breeding season start from July to September.

## DISEASES OF ABALONE

The Knowledge of infectious diseases in abalone has gone nearly absent to prolific, largely as product of investigation of mass mortality events in cultured populations. viruses, bacterial protozoa and metazoan pathogen and pests have all been shown to be important influencers of abalone health.

### Bacterial disease

**1. Withering syndrome:** This disease is caused by intracellular bacterium “Candidatus Xenohaliotis californiensis also known as (withering- syndrome Rickettsia like organism (WS-RLO).” It is primarily impacts the digestive tract and glands of abalone, particulary the (*Haliotis cracherodii*) species found along the coasts of California (Friedman et al., 2003). Particulary susceptibility varies among species, with up to 99% losses of black abalone Haliotis cracherodii in USA no losses among the small abalone. Diagnosis of WS requires identification of infection accompanied by morphological changes that characterize this disease (digestive gland atrophy and digestive gland metaplasia).

#### Characterstic sign

1.Shrunken foot muscle

2.Mental retraction

3.Pedal atrophy

**Prevention and control:** Oxytetracycline injection have been shown to halt disease progression.

#### Vibriosis

*Vibrio parahaemolyticus* has also been isolated from *H. diversicolor supertexta* in Taiwan showing signs of withering syndrome. Vibrio harveyi has caused up to 80% mortality of wild and cultured *Haliotis tuberculata* on the coast of France.

#### Mycobacteria

It has shown pathogenic activity and experimental transmission has been shown to 6 species of abalone.

| Species | Class of Pathogen | Name of Pathogen | Sign and symptoms |
|---|---|---|---|
| Haliotis tuberculata | Gram negative bacterium | Vibrio harveyi | 80% mortality |
| Haliotis diversicolor supertexta | Gram negative bacterium | Vibrio parahaemolyticus and Vibrio alginolyticus | Post larval and adult mortality |
| Haliotis rufescens | Gram negative bacterium | Vibrio alginolyticus | Larvae and post larval mortality |
| Bulinus jousseaumei | Gram negative bacterium | Unclassified | Tumour – no obvious pathogenicity |
| Biomphalaria glabrata | Mycobacteria | Unclassified | Tumour – no obvious pathogenicity |
| Helisoma anceps | Mycobacteria | Unclassified | Pathogenic |

## Viral disease

1. **Abalone viral Ganglioneuritis (AVG):** It is also known as infection with abalone herpesvirus (AbHV), infection with haliotid herpesvirus 1 ( HaHV-1 ) and abalone viral mortality

**Host:** The main abalone species affected are Greenlip abalone – *Haliotis laevigata*, Blacklip abalone – *H. rubra*. Other susceptible species include the brownlip abalone.

**Clinical sign:** irregular peripheral concave elevation of the foot . Minimal movement of the pedal muscle. Excessive mucus production. Reduced pedal adhesion to the substrate. 'Hard foot' or tetany ( a condition marked by intermittent muscular spasms .

**Epidemiology:**

- AVG affects the nervous system of abalone
- Horizontal transmission has been demonstrated by AVG :
- Exposing healthy abalone to water containing disease abalone in the same tank , but without direct contact between the diseased and healthy abalone
- Mortality can occur within 4 days of infection and within 1 to 2 days

**Fig.1: Green lip abalone (Haliotis laevigata) with AVG: Swollen and protruding mouth part (Source-Victorian Department of Primary Industries)**

**Control and prevention** – No treatment is available for AVG. implement high level of biosecurity on farm and in live holding facility.

### Protozoan parasite disease

1. ***Perkinsus olseni***: *Perkinsus olseni* is a protistan parasite that infects numerous mollusks. It was initially discovered in several species of the gastropod abalone (Haliotis) along the Australian coastline. The Life cycle is direct from host to host and all stage are infective. Target site connective tissue of all organs and hemocytes; microscopic pathology: multifocal lesions in connective tissue containing *P. olseni* . haemocytes infiltration.

#### Treatment

Cheemotherapy – Cyclohexamide, pyrimethamine, deferoxamine (DFO) Inhibit the growth of *P. olseni* in vivo and DFO also inhibit the growth in-vitro.

### Metazoan disease

1. **Boring sponge Cliona celata**- It can indeed have deleterious effect on abalone species. When abalone is affected by this disease, signs of atrophy in the foot muscle and gonadal tissues, lead to emaciation and lethargy. Eventually, weekened abalone may become dislodged from their substrate, making them vulnerable to wave action and predation. Additionally, other shell-boring organisms, such as parasitic *Sabellid polychaete*( *Terebrasabella heterouncinata* ), can inhibit abalone growth and cause shell deformities.

## PREVENTION AND MANAGEMENT STRATEGIES

### Site selection and water quality management

**Site selection:** Site selection: pick an area with the least amount of pollution and the best water quality.

- Steer clear of the high risk of contamination from agriculture and industrial runoff .
- Water quality Monitoring – Regular monitoring water quality parameters like temperature , salinity, Ph , dissolve oxygen and nutrient level .Abalone are more sensitive to change in water quality, which can stress them and make them more susceptible to disease .
- Water exchange and filtration- Ensure adequate water Exchange to prevent the buildup waste product . use filteration system to remove contamination.

#### Quarantine and biosecurity measure

**Quarantine new stock:** Isolate new abalone stock for a period of time before introducing them to the main culture system to prevent the introduction of disease.

**Biosecurity protocol**: Implement strict biosecurity measure, including controlling access to the facility, disinfecting equipment and tank, and using protective clothing.

### Nutrition and feeding practices

- **Balanced Diet:** Provide a balanced diet to ensure the abalone are healthy and have strong immune systems. Poor nutrition can make them more susceptible to disease.
- **Fresh and clean feed:** Use fresh and clean feed to prevent contamination with pathogens. Avoid overfeeding to prevent water quality deterioration.

### Exploring the ways to Enhance the immunity in abalone?

Abalone like oyster lack a specific immune system to produce antibody against specific viruses. However, researcher are exploring way to enhance the immunity against threats like abalone viral Ganglioneuritis (AVG), which is related to the herpes virus.

1. **Priming with pathogen** – Exposure to pathogen can enhance the immunity of abalone. Researchers found priming abalone with different concentrations of pathogen can up-regulate genes and improve immune response. It could be a game changer immune priming stimulate the immune system through injection of synthetic non-viral nucleic acid , which cause a non-specific or innate immune response that protect the abalone. If same immunity pass through progeny knows as transgenerational immune priming.
2. **Vector protection** – Preventing the virus from entering farm is crucial . Abalone farm need a safeguard against ocean water as a vector for AVG . Measures include monitoring water source and minimizing risks.

## CONCLUSION

The global demand for abalone, driven by its high market value and culinary popularity, particularly in Asia, has led to a decline in natural populations and an increase in illegal harvesting. Effective abalone farming requires a comprehensive understanding of breeding seasons, disease management, and preventive strategies. Disease management is crucial, as abalone are vulnerable to bacterial, viral, and parasitic infections, which can significantly impact their health and survival rates. Prevention and management strategies include careful site selection, rigorous water quality monitoring, quarantine measures, biosecurity protocols, and balanced nutrition. Enhancing abalone immunity through methods such as pathogen priming and vector protection shows promise in improving disease resistance.

## REFERENCE

Crosson LM, Wight N, VanBlaricom GR, Kiryu I, Moore JD, Friedman CS (2014) Abalone withering syndrome: distribution, impacts, current diagnostic methods and new findings.

Corbeil, S., (2020). Abalone viral ganglioneuritis. Pathogens, 9(9), p.720.

Nie, Z. and Wang, S., (2004). The status of abalone culture in China. Journal of Shellfish Research, 23(4), pp.941-946.

Goggin, C.L. and Lester, R.J.G., (1995). Perkinsus, a protistan parasite of abalone in Australia: a review. Marine and Freshwater Research, 46(3), pp.639-646.

Friedman, C., Hedrick, R.P. and Moore, J.D., (2003). Tools for management of Withering syndrome in abalone, Haliotis spp: PCR detection and feed-based therapeutic treatment.

**How to cite this article:** Jakhar G, Bhavya G, Kumari I, Funde AR and Veena R. Prevention and Management of Infectious Diseases in Abalone Farming. Chron Aquat Sci. 2024; 2(2): 1-5