VIBRIO PARAHAEMOLYTICUS

A Guide for Tasmanian Shellfish Growers

oysters TASMANIA

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SUMMARY

Vibrio bacteria occur naturally and globally in the marine environment. Occasionally Vibrios will cause foodborne illness, as evidenced by the *Vibrio parahaemolyticus* (Vp) illness that has been associated with eating some Tasmanian oysters.

Industry members should not wait until illness occurs in their area before taking control measures, as illness has occurred in a range of Tasmanian oyster growing areas in recent years. Industry should take a precautionary approach by using harvest and storage practices aimed at managing Vp numbers in oysters.

Vp proliferate in marine sediments and seawaters, particularly when the seawater is warmer than 14°C. There are no methods to reduce the levels of Vp in the water, so it is essential that farmers take steps to reduce opportunities for growth of the bacteria where possible.

Some farming practices such as timing of harvest and keeping stock cool on barges are important steps to reduce the risk of illness.

Post-harvest temperature management is the most critical point to manage Vp numbers.

After harvest, the key to Vp control is to:

Make sure the oyster's internal temperature is reduced to under 10°C as soon as possible.

Maintain the cold chain until the oyster is eaten.

The risk of illness will be increased if stock is not handled correctly by transporters, consumers and wholesalers. This is generally beyond the control of industry, but Oysters Tasmania has recognised the importance of engaging the entire supply chain and will use this guideline as a basis for educational materials for these audiences.

The key to Vibrio control is to remember any temperature increase during transport, storage or processing will increase the Vp loading and possibly, the risk of illness.

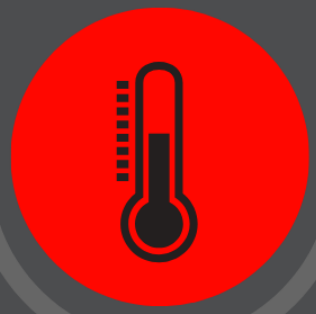
Quality Oysters; from lease to table

Vp Management

A summary of potential risk reduction methods

- Hold oysters on lease at least two tidal cycles after handling.
- Move stock to deeper, cooler water for at least 7 days.
- Relay to lower risk area for at least 7 days.

- In warmer periods harvest in the early morning.
- For Inter-tidal leases; harvest ASAP after the oysters are exposed by the tide.
- Keep oysters cool on the boat using shading, air circulation, or sprinkler systems.



Get stock below 10°C as soon as possible after harvest.

- Maintain cool chain to keep stock below 10°C
- Make sure delivery is acknowledged on arrival and oysters are placed into refrigeration quickly.
- Check temperature of stock on arrival.

- Eat quickly after purchase or put in a fridge/on ice.
- Shucked oysters must be stored below 4°C
- For the elderly/immune compromised, cooking to over 65°C will kill Vp.

1. INTRODUCTION

There are many species of Vibrio bacteria, but only some cause human health problems. The media often focuses on *Vibrio vulnificus*, which can cause dramatic and quick deaths. However, most of these fatalities are sporadic cases linked to the Gulf of Mexico (USA) seawater and shellfish. In Tasmania, only *Vibrio parahaemolyticus* (Vp) related illness has been associated with local shellfish consumption, this species generally only causes gastro related symptoms.

Vp is a salt-loving, mobile microbe that occurs in tropical and temperate coastal environments throughout the world. Their presence in the marine ecosystem is a natural phenomenon, unrelated to human pollution sources. Vp bacteria are often free living in seawater and sediments, but can also be attached to suspended matter, for example plankton, or embedded in the shells of marine animals[1]. All Vibrio species, including Vp, can be transported around the world's marine environments by ship ballast water, migratory bird and fish species, tidal currents and imported and exported seafood[2,3]. As a result, Vp is often present in the seafood species, such as fish, crustaceans and bivalve shellfish, commonly eaten by humans.

While most Vp strains do not pose a human health risk, some strains occasionally cause foodborne illness. The most common Vp clinical syndrome is gastroenteritis; vomiting, nausea, abdominal pain, and diarrhoea[4], which occur 4-96 hours after eating.

In the USA and Canada most vibriosis (illness caused by Vp) is associated with raw oyster eating, while in Japan and Europe illness is associated with a wider variety of seafood species. In Tasmania vibriosis, including a 2016 outbreak of 10 Vp cases, has been caused by eating local oysters.

Any Tasmanian harvest area linked to vibrio related illness is required by the Tasmanian government's Primary Produce Safety Program to implement a Vibrio Control Plan.

Industry should not wait until illness occurs before taking control measures. There are practical steps at oyster harvest, transport and process plants that can minimise the vibriosis risk. Oysters Tasmania has prepared this document with the aim of providing some best practice options your business should be adopting.

2. TASMANIAN OYSTERS AND VP

Vp illness linked to the seafood eating is a global food safety problem, which unfortunately has also involved Tasmanian oysters.

To help work out if your oysters have the potential to cause vibriosis consider the following questions;

- **Do you harvest oysters when the seawater temperature is at or above 15°C?**
- **Do you grow oysters in the intertidal zone?**
- **Do you use any land-based farming activity during the oyster's life cycle e.g. sorting, rumbling and grading?**
- **Do you have a delay between harvesting and placing oysters in a refrigerated environment?**
- **Do you market fresh, live, whole and raw half-shell oysters?**

If you answered yes to any of these questions you need to consider how to manage the risk of Vibrio in your operation

Tasmania's temperate marine environment provides a suitable habitat for Vp populations. No matter how pristine the growing area oysters will often naturally contain Vp, with the highest populations and strain varieties occurring when the seawater is warmest or during early autumn (December – April).

The following section provides advice on what you can do to reduce the risk of illness, while Section 4 explains the current state of knowledge about Vp's preferred environmental conditions

3) CAN WE CONTROL VP LEVELS IN OYSTERS?

Unlike other microbial pollutants, such as E. coli, it is not possible to reduce or eliminate Vp from the growing waters. Therefore, the industry's only control point is with the oyster itself by using practices to minimize and reduce the oyster's Vp loading.

Alternatively, post-harvest food technologies can be used to eliminate viable Vp, but such technologies also change the oyster's attributes so the final product will no longer be alive or raw. (See Section 3.5).

Tasmania is world famous for providing delicious and safe natural oysters.

To continue to provide this to our customers the following sections look at on farming and harvesting methods that can minimize Vp levels in oysters.

3.1 MINIMIZING VP LEVELS IN OYSTERS PRE-HARVEST

Other countries have identified farming practices which can reduce Vp levels in oysters prior to harvest, including relaying, deep water suspension and re-submerging.

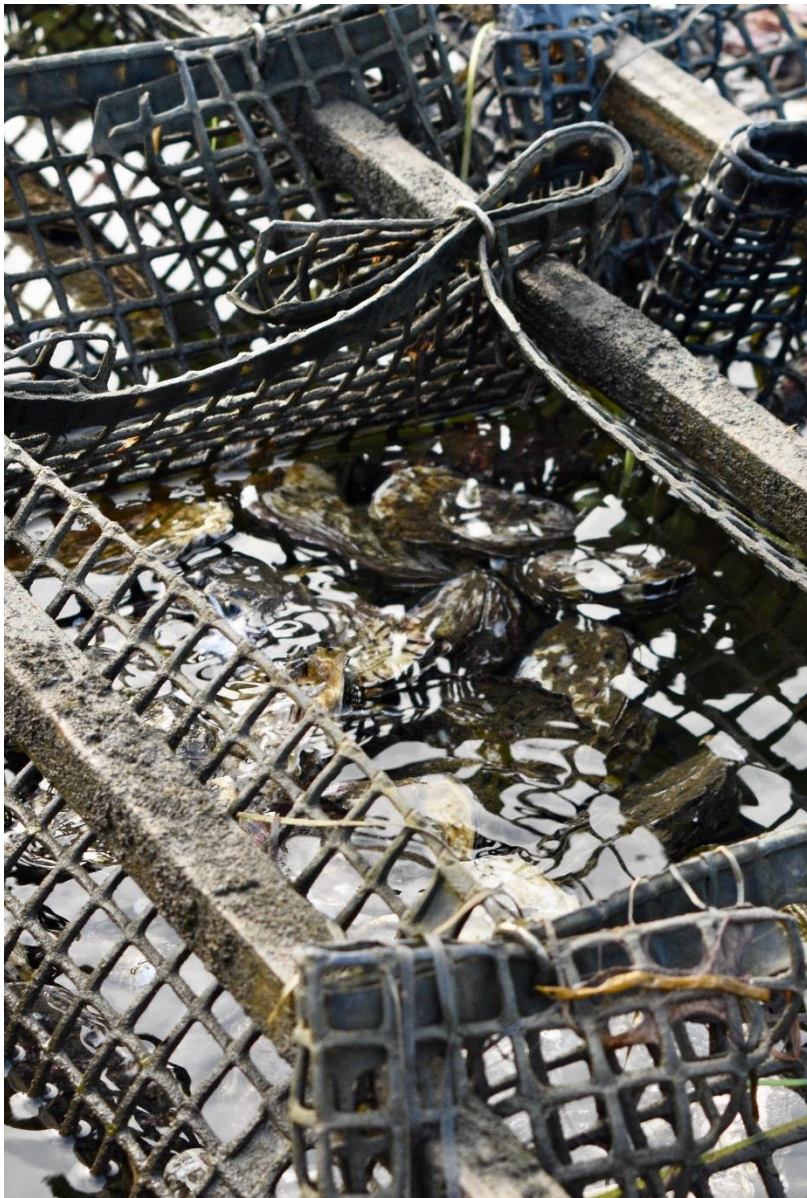
Vp will thrive in marine sediments and seawaters, particularly when the seawater is warmer than 14°C

FARMING PRACTICES

Producing a quality oyster usually requires regular land-based operations throughout the animal's growth, for example sorting, rumbling and grading. Such operations will stress the oyster and have the potential to increase the Vp load.

After land-based oyster handling activities It is recommended oysters be returned to the growing area for at least two tidal cycles before harvesting for human consumption.

This time allows the oyster to recuperate, filter feed and reduce any increased Vp burden.



If oysters are shifted from waters containing a high level of Vp to waters with no or minimal levels the oysters' Vp loading is generally reduced after seven days.

Recent studies have found that relaying to higher salinity and/or cooler waters shows promise for reducing Vp levels.

RELAYING

The practice of 'relay' is internationally recognised as the transfer of shellfish from a growing area to another growing area for farm management purposes or alternatively to reduce pathogens or other contaminants by using the ambient marine environment as the treatment process.

There is limited information on the success of relaying as a Vp treatment step.

DEEP WATER PURGING

Placing oysters in deeper, cooler water can reduce the Vp load.

This practice has been successfully used in Alaska and Washington State (USA), where oysters are relayed from Vp risk areas to deeper, cooler water (12- 15°C). In these situations, studies have verified that regardless of Vp loadings at the time of relay, **within seven days all oysters show a significant reduction.**

Pre-Harvest Vp Management Summary

- **After land-based oyster handling activities It is recommended oysters be returned to the growing area for at least two tidal cycles before harvesting for human consumption.**
- **If oysters are relayed from waters containing a high level of Vp to waters with no or minimal levels the oysters' Vp loading is reduced after seven days.**
- **Placing oysters in deeper, cooler water before final harvest can reduce the Vp load.**

3.2 BEST HARVESTING PRACTICES

During oyster harvesting the following steps can reduce the risk of vibrio illness

HARVESTING TIMES

If harvesting continues through the higher risk Vp periods (warmer months). It is important to consider the best times for harvest, such as early morning (before the heat of the day) and within specified tidal parameters to ensure oysters are not exposed for long time periods at low tide.

Remember Vp in oysters will start multiplying as soon as the oyster closes and stops filtering so it is preferable that oysters are harvested as soon as possible after emerging from the ebb tide.

CONDITIONS ON THE HARVESTING VESSEL

Time and temperature are the critical factors affecting Vp growth rates.

It is important to ensure harvesting is an efficient and timely process, limiting the oysters' exposure to warm ambient temperatures.

Shading oysters from direct sunlight, good air circulation and seawater sprinkler systems are all temperature management options which may minimise Vp growth.

Harvest Practices Vp Management Summary

- **Harvest early in the morning before the heat of the day.**
- **Harvest as soon as possible once oysters are exposed by the tide on inter-tidal leases.**
- **Keep oysters cool on the boat using shading and/or sprinklers and allowing air flow.**
- **Make sure harvest operations are as efficient as possible to limit the oyster's exposure to the warm air.**

Any external sediment (mud, sand and weed) should be removed from the oyster as soon as possible after harvesting. Sediment often contains significant numbers of bacteria and can contaminate the oyster, thereby reducing its quality and food safety status.

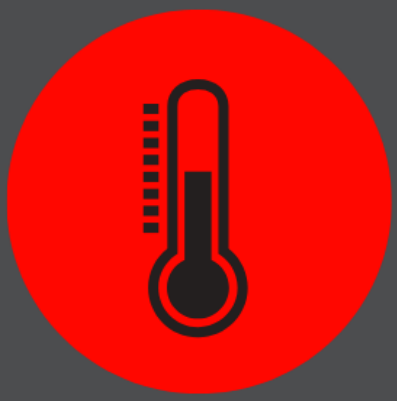
3.3 POST-HARVEST TEMPERATURE MANAGEMENT

Natural environmental conditions determine the Vp strains and population numbers within the oyster when they emerge from the sea. However, from that point humans have control over further microbial increases.

Vp multiplies in oysters when their temperature is above 10°C

This can occur on harvesting vessels, landside storage when waiting for transport, in transport vehicles, at the processing and retail premises, even in the oyster eater's private car and home.

- **After harvest the oyster's internal temperature should be reduced below 10°C as quickly as possible.**
- **The oyster cold chain must be maintained until the oyster is eaten.**



Get stock below 10°C as soon as possible after harvest.

Ways to achieve temperature control include;

- **Shading oyster from direct sun**
- **Good air circulation**
- **Water sprays**
- **Ice slurry**
- **Refrigeration**

Post-harvesting temperature management is important, not only to prevent Vp growth, but to minimise all bacterial growth. Prompt chilling will therefore improve the oyster's quality and minimise all food safety risks.

This is the reason The Australian Shellfish Quality Assurance Program Operations Manual requires all shellfish, intended for consumption as raw product, be placed under ambient refrigeration at 10°C or less within twenty-four hours of being harvested.

If your area has a compulsory vibrio control plan you must follow these post-harvest temperature rules;

- **November 1st - April 30th the time from harvest to cool chain must not be greater than 12 hours.**
- **When ambient air temperature is greater than 30°C the time from harvest to cool chain must not be greater than 7 hours.**
- **When water temperature at the depth where oysters are harvested is greater than 19°C the time from harvest to cool chain must not be greater than 7 hours.**
- **This time will commence as soon as the first oyster comes out of the water, regardless if this is due to the receding tide or harvesting.**
- **Oysters harvested the day prior to pack out must be maintained below 10°C.**
- **If you sell oysters directly to the general public or local businesses from your farm, you must ensure that the oysters have been refrigerated and less than 10°C when sold.**

NOTE: that most refrigerated trucks or shipping containers are designed to maintain temperature, not to cool stock down. Growers should consult with a refrigeration specialist if unsure of the suitability of specific equipment.

The time taken for oysters to cool once under refrigeration depends on the efficiency of the cooling system, the quantity of product to be cooled and their arrangement in the cool room[28]. So even when placed in a chilled environment, such as a refrigerated transporter or cool store, it is important to stack product so that there is maximum air circulation and cooling.

As a cooling option an ice slurry is very efficient at cooling oysters quickly; however, this can sometimes result in oyster mortalities and reduced shelf life. If a business decides to use this method, trials should be conducted to work out suitable dip times and temperatures to achieve the best outcome. If used, care must also be taken to ensure the slurry mix is replaced regularly to prevent cross-contamination.

Once under temperature control, this should be maintained, other than for short periods when reloading vehicles along the commercial transport chain.

The key to Vp control is to remember any temperature increase during transport, storage or processing will increase the Vp loading and possibly, the risk of illness.

3.4 THE SUPPLY CHAIN

After oysters have left the control of the grower, poor handling practices from other parts of the supply chain can increase the risk of illness. While industry has little control over this, we can do our best to educate everyone involved in the process to deliver the best product possible to our customers. Oysters Tasmania has developed some messages and materials to help in this process.

KEY MESSAGES FOR TRANSPORTERS

- **Ensure cool chain is maintained during transport**
- **Load oysters onto truck so not subject to warm drafts if doors are opened**
- **Do not turn off refrigeration system during transport**
- **When reaching the delivery point make sure oysters are acknowledged and placed into refrigeration quickly**

KEY MESSAGES FOR RETAILERS

- **Ensure cool chain is maintained**
- **Make sure consumers are aware of need to keep oysters cool**
- **If consumers are not going to eat the oysters quickly recommend storing in a fridge or cooler with ice**

KEY MESSAGES FOR WHOLESALERS & PROCESSORS

- **Check the temperature of stock on arrival**
- **Move oysters into the cold room asap after delivery**
- **Ensure cool chain is maintained**

3.5 POST-HARVEST ELIMINATION STEPS

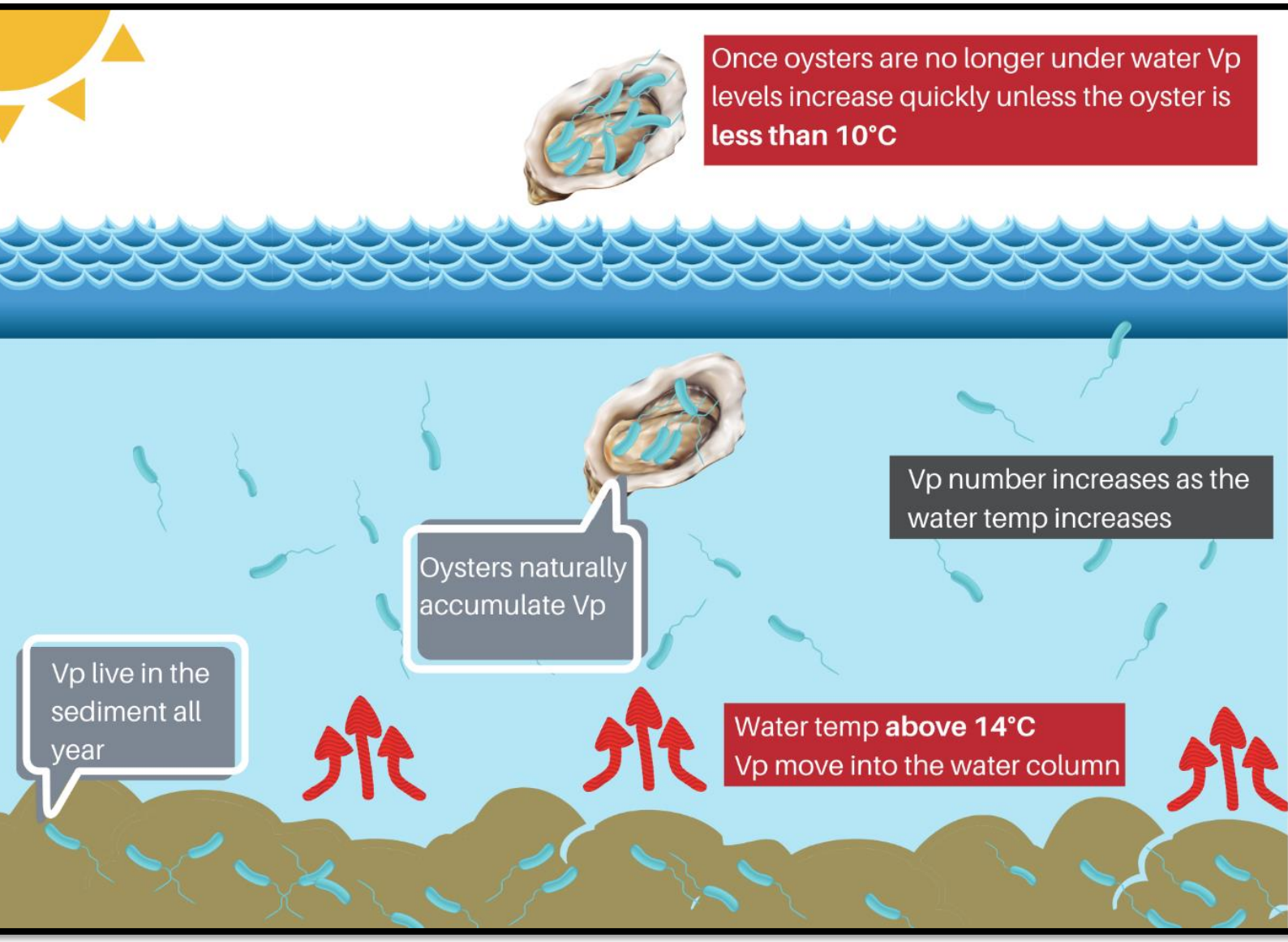
Vibrios are readily destroyed by cooking, even when the oysters are highly contaminated, provided the internal temperature reaches 65°C[29]. Many oyster recipes used at home include cooking steps that will reach this temperature. However, when oysters are quickly grilled after the addition of toppings e.g. Oyster Kilpatrick, the lethal heat temperature may not be reached. In any case, it is unusual for cooked oysters to cause Vp illness.

On a commercial basis science has validated post-harvest food technologies capable of reducing Vp to non-detectable levels in oysters. Such technologies include; High Pressure Processing, individual quick freezing (IQF) with extended storage and irradiation[30]. Each of these technologies requires sophisticated, and often expensive, processing equipment. But more importantly these technologies often change the oyster's taste and texture and it will no longer be a live, raw animal.

Oyster eating has a long history throughout the world. There are numerous traditional and modern oyster recipes, including marinating, smoking and cooking. However, for many oyster lovers, raw and natural remains the preferred product.

4) WHAT WE KNOW (AND DON'T KNOW) ABOUT VP

Japanese scientists first identified Vp in the 1950's and since then scientists around the world have studied the bacteria, along with its environmental relationships and linkages with oysters and humans.



4.1 VP'S PREFERRED ENVIRONMENT

As described, Vp are found naturally in marine waters, sediments, and marine species. In temperate waters where Vp has been detected, their presence usually follows a distinct seasonal cycle, with highest concentrations occurring in summer and autumn, then lowest counts in the winter. Several environmental factors have been explored with the aim of determining how and when Vp illness will occur.

Vp bacteria are rarely found in seawater below 10°C, they are released from marine sediments into waters at temperatures above 14°C.

TEMPERATURE

Conditions become more favourable for Vp growth as temperatures increase and particularly at temperatures above 20°C. The concentration of Vp can reach 100 cells/ml when seawater temperatures increase to 25°C[5,6].

Usually Vp numbers are highest in seawater during summer and lowest during winter. However, sometimes the highest densities occur in early autumn when summer temperatures start to cool[7].

Vibrio bacteria are constantly evolving and in the Northern hemisphere some strains have adapted to live in colder waters (1-11°C)[8].

It should be noted that the number of Vp strains in the environment does usually increase with the water temperature[9.10].

The relationship between water temperature and the number of Vp pathogenic (illness-causing) strains is not well established but there is some evidence to suggest a positive correlation. However, higher background Vp numbers and higher ambient temperatures do not necessary equate to a greater risk of Vp illness.

Vp illness is often not associated with temperature peaks, rather during periods of change.

For example, in Massachusetts illness often occurs when the water starts to cool in late summer as opposed to the season's highest temperature.

There is a general concern about the ocean-warming effects of climate change on the distribution and abundance of Vp [11,12,13,14,15].

Climate change will also affect the salinity of coastal and estuarine systems due to changes in rainfall[16]. Warmer temperatures certainly appear to be the cause of Vp extending into areas such as Alaska, Europe and Chile[12,17,3,13].

Recently scientists have identified that the greatest Vp threat appears when a pathogenic strain invades higher latitudes during climate anomalies, such as occurred in Chile and Alaska in 2004[7].

SALINITY

The relationship between salinity and Vp appears to be variable and complex, changing from region to region[18,19].

Other environmental factors, including salinity and turbidity, have also been linked to Vp environmental prevalence but the relationships are inconsistent and are also likely to be site specific.

OTHER ENVIRONMENTAL EFFECTS ON VP

It has not been possible to establish a relationship between Vp and other environmental parameters such as suspended particulate matter, chlorophyll *a* and dissolved organic carbon. As with salinity, any relationship is probably specific to an area.

In the USA it has been noted that the Vp prevalence may differ with the type of ocean floor; with notable differences between gravel, mud and mixed substrates[7].

The harder, stonier substrates had the highest levels of Vibrio bacteria during the summer months[7], while sediments will harbour Vp during the winter months.

The relationship between Vp and marine substrates has yet to be researched in countries outside of the USA.

Many Vp strains have been identified and most are likely not dangerous to humans. It is not yet possible to accurately predict which strains, or when and where Vp will cause foodborne illness.

The best approach is a precautionary one, using harvesting and storage practices aimed at reducing Vp numbers in oysters.

4.2 VP'S RELATIONSHIP WITH OYSTERS

When Vp are free-swimming in seawater oysters will uptake them, either passively due to being in the same environment, or actively when the oyster is filter feeding.

The oyster's Vp population can multiply further during intertidal exposure, and at any harvesting, storage or processing step when the oyster temperature is 10°C or higher.

Oysters will naturally bioaccumulate Vp to concentrations higher than the surrounding waters.

PREHARVEST

Once an oyster ingests Vp, the bacteria are found in the gills, digestive glands (including stomach, digestive ducts and digestive diverticula), adductor muscle and mantle cilia[20].

The concentration of Vp in the oysters is mainly influenced by water temperature and salinity.

Additional factors include the level of dissolved oxygen, number of plankton in the water and the tidal flushing rate of the growing area. These factors influence both Vp populations and the feeding behaviour of oysters (i.e. how much Vp they take up)[21,22].

Natural processes such as shellfish immunity, predatory bacteria and bacteriophages also affect the presence and concentration of Vp in oysters. Increased concentrations of Vp have also been measured in oysters experiencing one or more causes of stress, e.g. heat[23].

Oysters grown suspended in the water generally have lower Vp concentrations than oysters grown on the seafloor and in contact with sediments[24].

Oysters taken from the seafloor can potentially have higher concentrations of *Vibrio spp*. than those harvested from aquaculture operations in the same water body.

Vp naturally depurate (cleanse) from the oyster but the rate of depuration from oysters living in growing waters is probably variable. The length of time any Vp cell remains inside an individual shellfish residing in its growing area is not well defined and is probably difficult to predict.

Vp will grow and multiply in oysters when they are out of the water if the temperature is suitable (≥10°C).

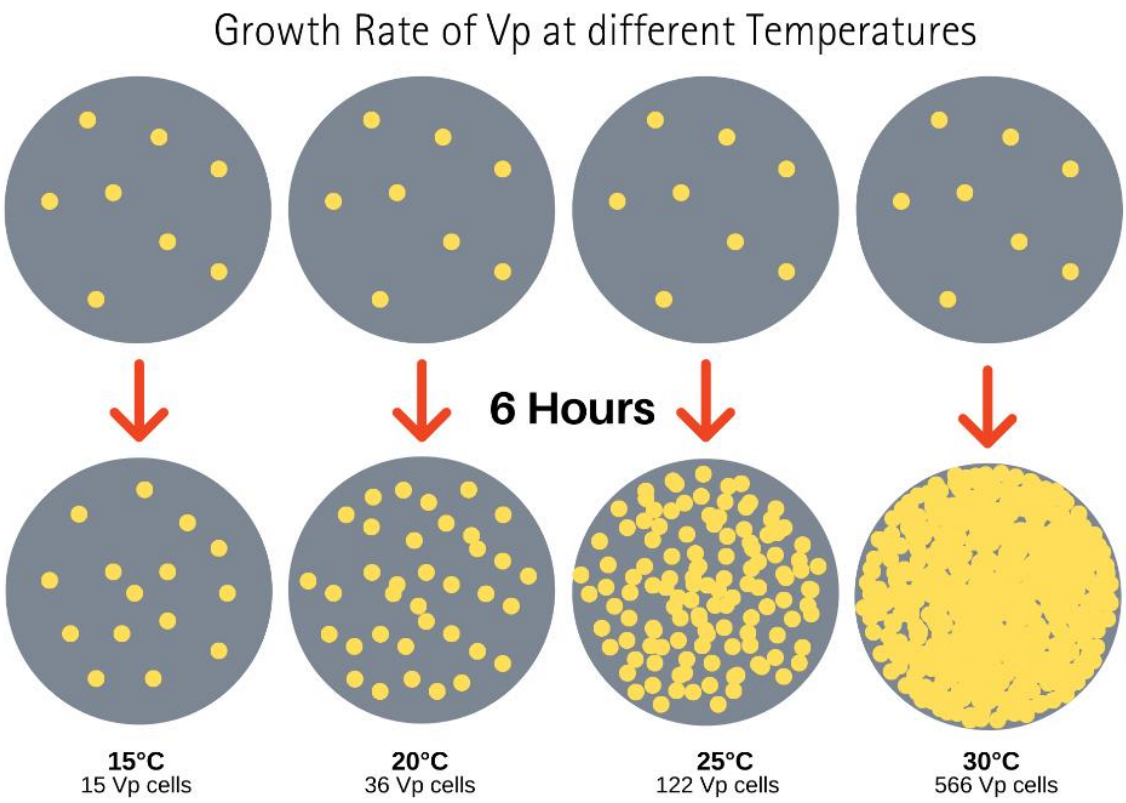
During hot conditions oysters exposed by the tide can be up to 10°C above the air temperature, meaning Vp numbers in oysters can be 4-8 times higher than before intertidal exposure.

Once the oysters re-submerge under the in-coming tide and filter feeding starts, the Vp numbers again decrease[25,26].

POST-HARVEST

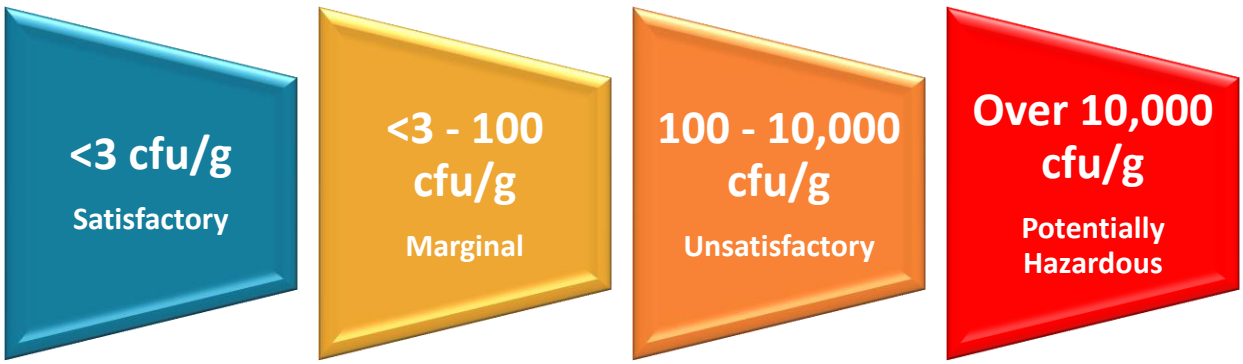
After harvesting, Vp within seafood has the potential to survive and multiply. The multiplication rate depends on the ambient temperature – the warmer the temperature the faster Vp numbers increase, for example;

- **Vp will not grow in oysters stored at 10°C or lower.** The concentration has been observed to remain stable or decrease at these cool temperatures. Survival for up to three weeks has been reported.
- Vp dies under frozen storage but can survive for up to six months. The data suggests that death is more rapid at -10 or -18°C compared with -30°C. This has been attributed to the formation of larger intracellular ice crystals at the higher temperatures, causing greater cell damage[27].



Background levels observed in Tasmanian growing areas during summer that have been monitored for Vp to date have generally ranged between <3 and 100 cfu/g. This number will increase rapidly when the oyster is closed, and the temperature is above 10°C.

There is no known definite infectious dose for Vp, the infectious dose can vary greatly depending on the individual and the Vp strain. There are however guidelines for interpretation of results published by Food Standards Australia New Zealand (FSANZ). These are as follows;



CONCLUSION

The presence of Vp in the marine environment and within oysters is a natural occurrence.

The numbers and strains of Vp will vary throughout the year, with warmer seas often associated with higher populations. Global warming has already made an impact with Vp bacteria moving into new global territories, such as Alaska, the Baltic Sea and the Southern Ocean.

Wherever they live Vp are active, constantly evolving and adapting. It is recognised that only some Vp strains cause human foodborne illness, but unfortunately it is not yet possible to predict when and where Vp illness will occur.

It is wise to consider all Vp organisms potentially problematic and undertake best practices steps to reduce or eliminate Vp numbers in oysters.

Growing and flushing oysters in cooler waters may reduce Vp numbers. Sound harvesting practices, such as reducing oyster stress and cleaning off sediment will also minimise Vp numbers.

The primary and most important Vp post-harvest control is temperature management.

Vp growth stalls below 10°C, therefore every effort should be made to reduce the oysters' internal temperature as soon as possible after harvest.

It may be necessary to adapt oyster harvesting practices, around the time and tide, to minimize temperature increase.

After harvesting growers must undertake active steps to ensure that temperature is managed.

This guideline emphasises the importance of maintaining best practice throughout the supply chain to minimise the occurrence of illness. There are varying degrees of direct industry involvement with parts of the cool chain in the journey from farm to plate, but Oysters Tasmania recognises the need to engage with these stakeholders.

The principles of post-harvest controls contained in this guideline will be communicated to the wider supply chain.

Modern food safety programs recognise that for some pathogens risk cannot be fully eliminated, only reduced to a level considered acceptable by regulators, businesses, and consumers. This is especially true in the case of Vp where following best practice guidelines can drastically reduce the risk of illness but still provide no guarantee.

Even with the best farming practices, every now and again oysters will be harvested already containing a dose of illness causing Vp.

RECOMMENDED READING

- Vibrio Control Plan, Section 13 of the *Food Safety Management System for Live Tasmanian Farmed Bivalve Molluscs (OYSTER TEMPLATE) – V.6 March 2019*
- Oysters Tasmania Industry Update 29 March 2019 https://mailchi.mp/5c4f429690bb/industry-update-28-march-2019
- McCoubrey (2018). Harvesting and handling practices used to mitigate *Vibrio parahaemolyticus* illness, *MPI Technical Paper No: 2018/03.* https://www.mpi.govt.nz/dmsdocument/27729/send
- King *et. al.* (2018) Risk Profile: *Vibrio Vulnificus* In Bivalve Molluscan Shellfish, *New Zealand Food Safety Technical Paper No: 2018/03.* https://www.mpi.govt.nz/dmsdocument/30020/direct
- *FAO Microbiological Risk Assessment Series Number 16 Risk Assessment of Vibrio parahaemolyticus in seafood* (2011). http://www.fao.org/3/i2225e/i2225e00.pdf

OYSTER PRODUCER VIBRIO MANAGEMENT CHECKLIST

Assessment	Yes	No	N/A	Comments
Have you considered Vibrio risk in your Food Safety Management System?				
Are your relevant staff trained in the management of vibrio risk?				
Do you have current Standard Operating Procedures for harvesting during warmer periods?				
Do your harvest records capture all the information in Harvest Record (VCP) Form 2A (Appendix 1)				
Pre-Harvest				
Do you have documented on-lease stock holding periods following handling activities?				
Do you have documented on-lease stock holding periods following relay?				
Do you move stock to a set location on the lease prior to harvest i.e. deeper/cooler water or to improve harvest efficiency				
Harvesting				
Are harvesting times consistent with best practice for vibrio management during summer i.e. early in morning, as soon as oysters are exposed by tide				
Is temperature managed on the harvest vessel? i.e. shading, sprinklers, air flow, efficiency				
Are oysters cleaned of any mud or detritus soon after harvest?				
Post-Harvest				
Do you have a plan to get stock below 10°C as soon as possible after harvest?				
If required are you following the conditions of a Vibrio Control Plan (implementation recommended for all operators regardless of status)				
Are you maintaining temperature control once stock has entered the cool chain?				
Supply Chain				
Are you minimising the use of non-refrigerated transport during warmer months?				
Have you advised your transporters of the importance of maintaining cool chain?				
Have you advised any receivers of stock to check temperature on arrival and to keep cool?				
If you sell direct to consumers are you making sure oysters are under 10°C before sale?				
Are you advising any customers to keep stock below 10°C or to consume quickly?				

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APPENDIX 1

Harvest Record (VCP) Form 2A

DATE…….. Name of Supervisor……

		Initial
Check environmental conditions comply with Open Status Criteria	Yes / No	
Rainfall Reading (Last 24 Hrs)		
Salinity Level		
Harvest Start Time		
Harvest Finish Time		
Tide level (Optional for Subtidal Zones)	High Low	
Air Temp		
Water Temp		
Vehicle or boats checked for fuel leaks	OK / Not OK	
Time into Coolroom		
Despatch Temp		
Despatch Time		
Batch No.		

Baskets Removed			
Rack	Qty	Position	Lease No (Zone)

- Except where noted below, from November 1st - April 30th the time from harvest to cool chain must not be greater than 12 hours.
- When ambient air temperature is greater than 30^0 C the time from harvest to cool chain must not be greater than 7 hours.
- When water temperature at the depth where oysters are harvested is greater than 19^0 C the time from harvest to cool chain must not be greater than 7 hours.