Overview of hazards associated with bivalve mollusc consumption: Hazard characterisation and risk assessment

Workshop of the FAO Reference Centre for Bivalve Mollusc Sanitation
Hotel Ole Sereni, Nairobi, Kenya, 11 – 12 November 2019

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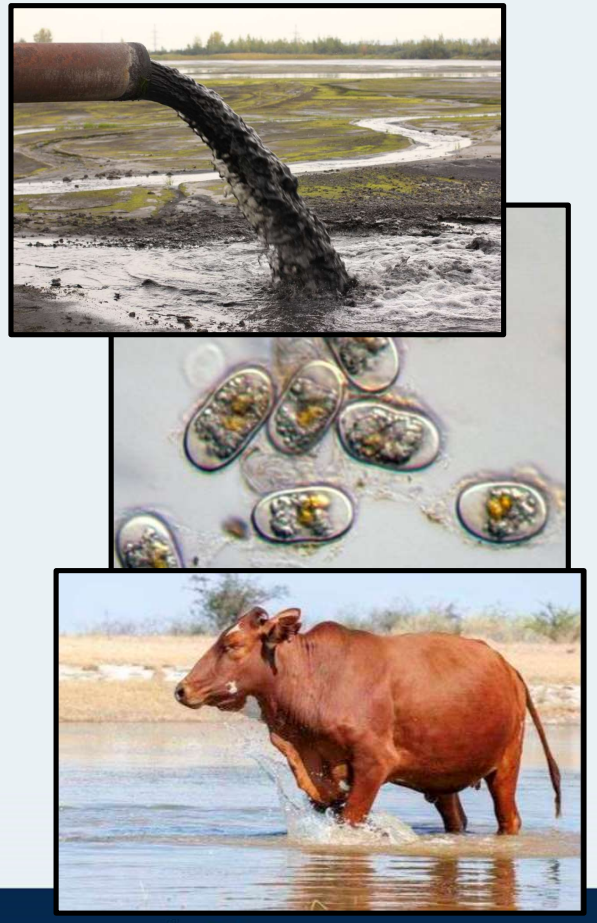
Food and Agriculture Organization of the United Nations

Cefas

Types of hazard associated with bivalve shellfish

TYPE OF HAZARD	SOURCES	GUIDANCE
CHEMICAL; e.g. pesticides, heavy metals	Agricultural run-off, industrial discharges etc.	Codex Alimentarius, General Standard for Contaminants and Toxins in Feed and Food, 2009
BIOTOXINS; i.e. toxic chemicals produced by marine microalgae	Naturally occurring in seawater, blooms	Assessment and management of biotoxin risks in bivalve molluscs, FAO Technical Paper, 2011
MICROBIOLOGICAL; i.e. pathogenic bacteria, viruses, parasites	Human sewage, animal faeces, some naturally occurring in seawater	FAO/WHO Technical Guidance for the Development of Sanitation Programmes **– <u>this workshop</u>**



Microbiological hazards

Numerous microbiological pathogens potentially linked to shellfish consumption

BACTERIA

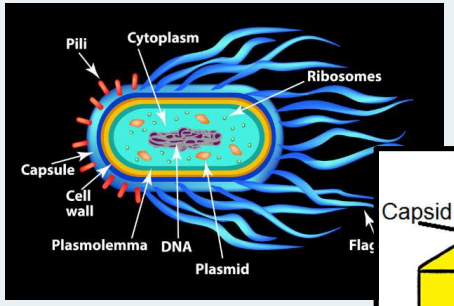
Salmonella spp., *Vibrio* spp., *Campylobacter* spp., *Listeria monocytogenes*

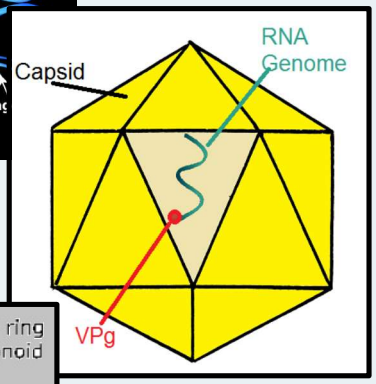
VIRUSES

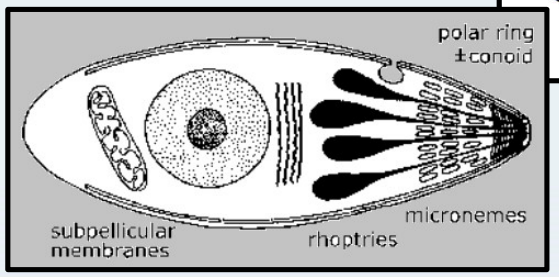
Norovirus, hepatitis A virus, sapovirus, hepatitis E virus

PARASITES

Giardia intestinalis, Cryptosporidium parvum, Microsporidia







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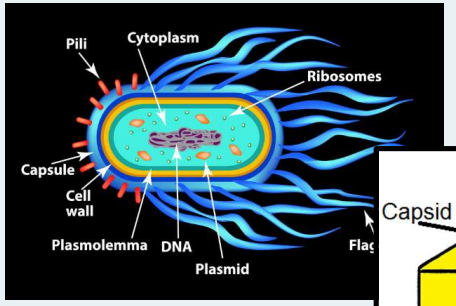

VIRUSES

Norovirus, hepatitis A virus,
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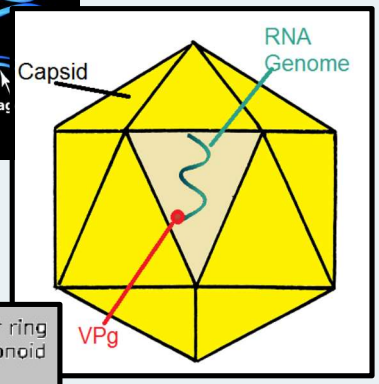

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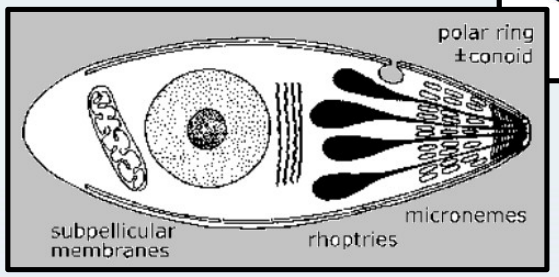
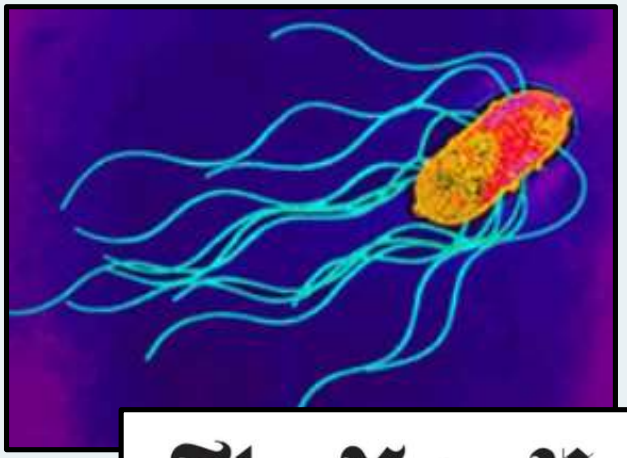


Salmonella enterica serovars Typhi & Paratyphi

- Gram negative bacterium
- Causes enteric fever (severe illness)
- Transmitted in human faeces
- First recorded outbreak due to shellfish consumption in **1894**



The New York Times

TYPHOID FEVER DUE TO OYSTERS.; Wesleyan University Faculty's Explanation of the Recent Epidemic.

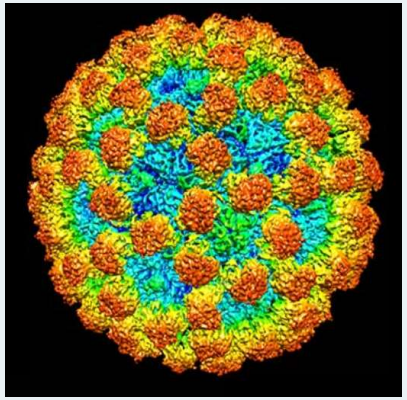
Nov. 14, 1894

Vibrio parahaemolyticus and *V.vulnificus*

- Gram negative bacterium
- Causes gastroenteritis (Vp; mild illness) or sepsis (Vv; severe illness with high mortality in susceptible cases)
- Naturally occurring in marine environment; associated with low salinity, high temperature coastal waters
- Commonest shellfish–related pathogen in e.g. USA (Vp)

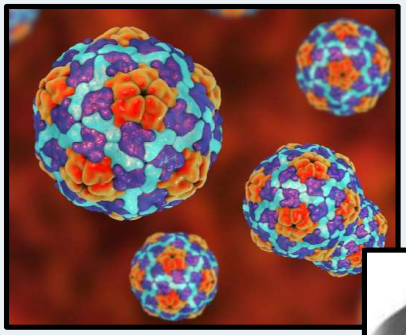
Norovirus

- Single stranded RNA virus
- Causes gastroenteritis (normally mild illness)
- Transmitted in human faeces
- Widespread worldwide
- Commonest shellfish-related pathogen in e.g. Europe
- Highly seasonal occurrence **in some regions**



Hepatitis A virus

- Single stranded RNA virus
- Causes hepatitis (moderate illness)
- Transmitted in human faeces
- Frequency in human populations varies widely across the globe



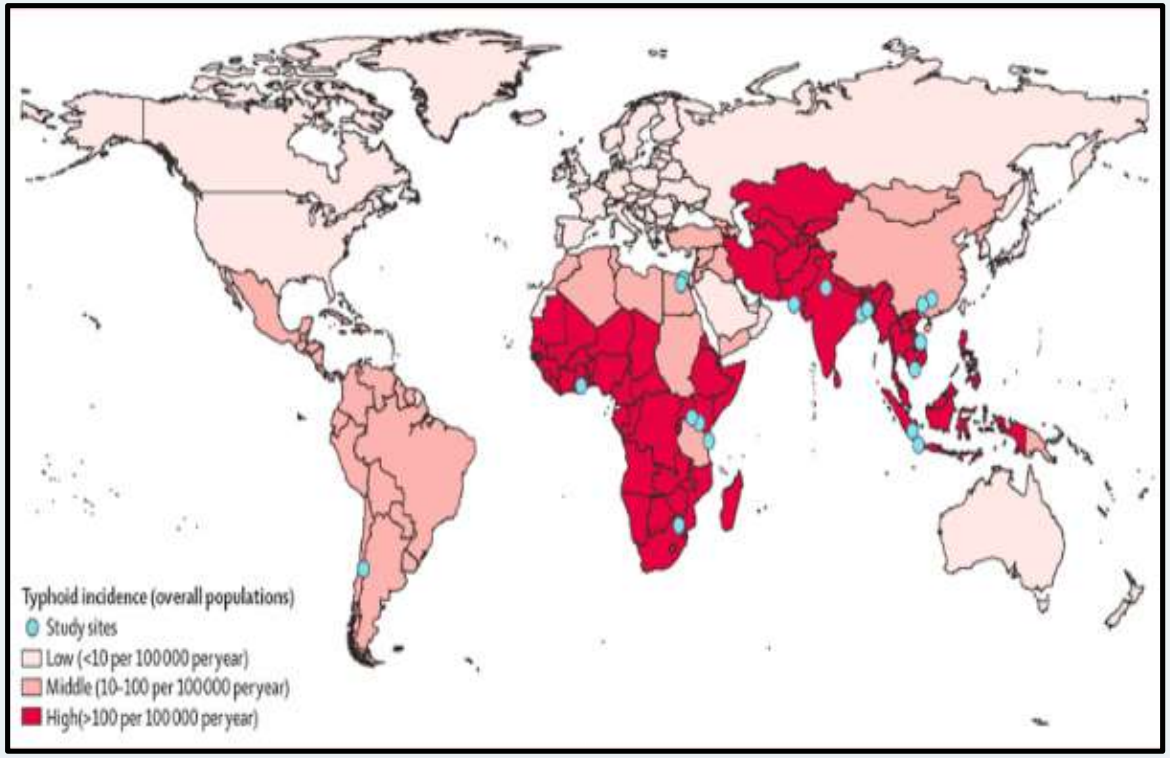
Shellfish-related pathogens in Africa

- Very few reports in scientific literature of shellfish-related transmission of microbial pathogens in Africa

- All major shellfish-related pathogens found in the African general population

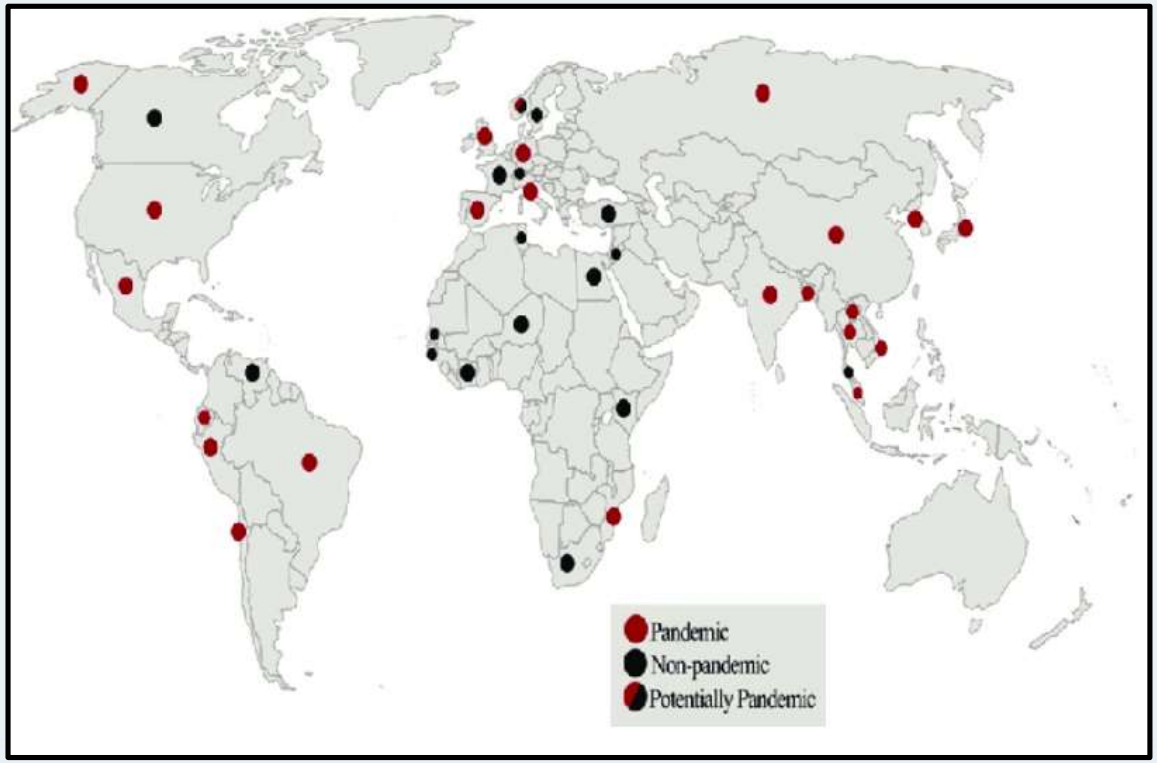
Salmonella spp.

High incidence of typhoid fever in Africa



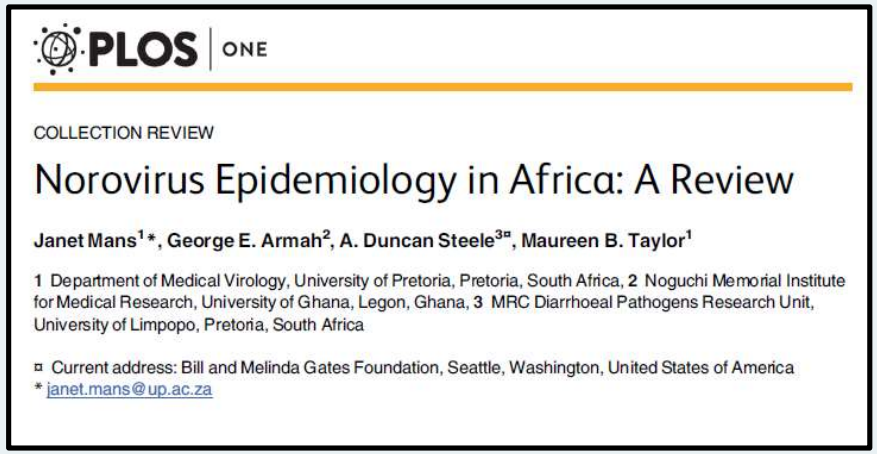
Vibrio spp.

Vibrio parahaemolyticus recorded in many African countries (including pathogenic strains)



Norovirus

Norovirus a common cause of gastroenteritis in Africa



PLOS ONE

COLLECTION REVIEW

Norovirus Epidemiology in Africa: A Review

Janet Mans[1]*, George E. Armah[2], A. Duncan Steele[3¤], Maureen B. Taylor[1]

1 Department of Medical Virology, University of Pretoria, Pretoria, South Africa, 2 Noguchi Memorial Institute for Medical Research, University of Ghana, Legon, Ghana, 3 MRC Diarrhoeal Pathogens Research Unit, University of Limpopo, Pretoria, South Africa

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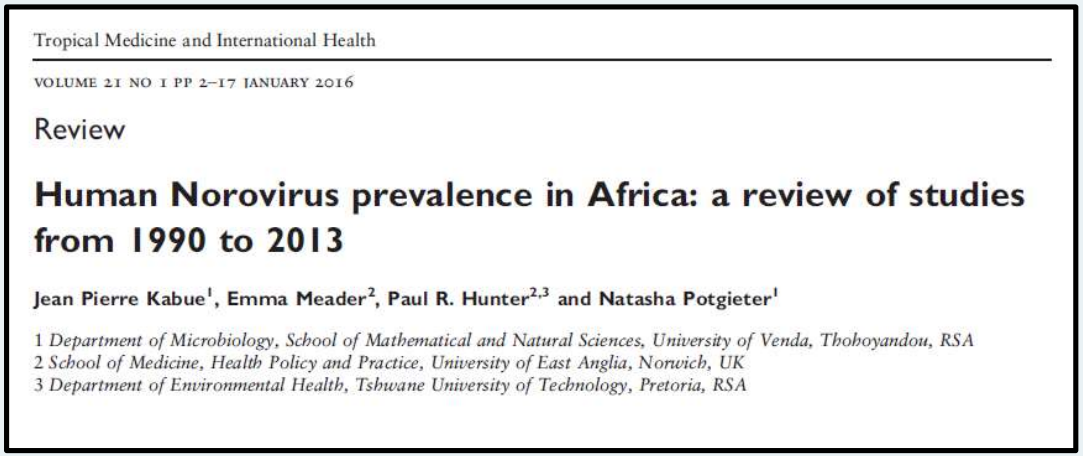

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Review

Human Norovirus prevalence in Africa: a review of studies from 1990 to 2013

Jean Pierre Kabue[1], Emma Meader[2], Paul R. Hunter[2,3] and Natasha Potgieter[1]

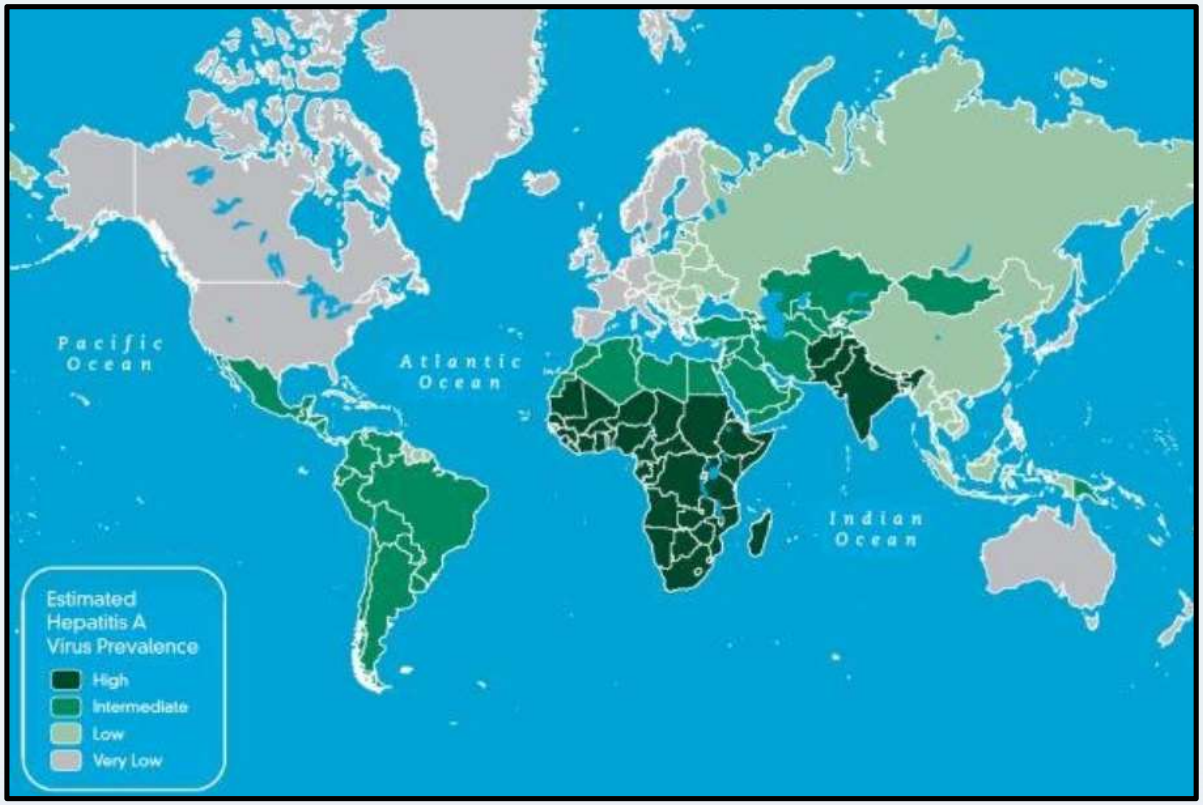
1 *Department of Microbiology, School of Mathematical and Natural Sciences, University of Venda, Thohoyandou, RSA*
2 *School of Medicine, Health Policy and Practice, University of East Anglia, Norwich, UK*
3 *Department of Environmental Health, Tshwane University of Technology, Pretoria, RSA*

"In conclusion, NoV is a common pathogen in children with diarrhoea in Africa, with considerable carriage in asymptomatic children. There is however, a paucity of data on NoV infection in adults."

"Unreported sporadic gastroenteritis cases of Human Norovirus are common in Africa. Most are community-associated infections. Possible environmental transmission routes have been documented."

Hepatitis A virus

High prevalence of HAV in Africa



Shellfish-related pathogens in Africa

- Very few reports in scientific literature of shellfish-related transmission of microbial pathogens in Africa
- All major shellfish-related pathogens found in the African general population
- Under-reporting probable – microbiological risks from shellfish in Africa likely as significant as those in other regions

Risk assessment

- As part of the Growing Area Risk Profile, the relative risk posed by different hazards should be assessed based on relevant factors e.g.:-
  - Pollution sources affecting the growing area (human sewage, agricultural, industrial etc.)
  - Seasonality of harvest
  - Water temperature and salinity
  - Method of processing of finished shellfish
  - Epidemiological data on pathogens in population – **NOTE absence of data does not necessarily imply absence of risk**

Hazard Survey

- Depending on the results of the Growing Area Risk Profile, it may be necessary to include a hazard survey as part of the Growing Area Assessment

- Hazard survey involves testing samples of shellfish (or water) samples for pathogens

- Methods can be complex and require specialist equipment

Methods

Norovirus and Hepatitis A virus	**ISO 15216-1**	**Quantification using real-time RT-PCR**
***Salmonella* spp.**	**ISO 6579-1**	**Detection by growth on selective bacteriological media – confirmation using biochemical/serological tests**
***Vibrio* spp.**	**ISO 21872-1**	**Detection by growth on selective bacteriological media – confirmation using biochemical/PCR tests**

Hazard Survey

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- Hazard survey involves testing samples of shellfish (or water) samples for pathogens
- Methods can be complex and require specialist equipment
- Laboratory accreditation to ISO 17025 desirable

Summary

- Wide variety of chemical, biotoxin and microbiological hazards associated with shellfish consumption
- Microbiological hazards include bacteria (Salmonella, Vibrio), viruses (norovirus, hepatitis A virus), parasites
- Risks posed by different hazards may depend on the characteristics of the growing area
- Specific testing for hazards may require specialist laboratories