

# Potential hazards associated with bivalve shellfish

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# Types of hazard associated with bivalve shellfish

TYPE OF HAZARD	SOURCES	GUIDANCE
<b>CHEMICAL;</b> e.g. pesticides, heavy metals	Agricultural run-off, industrial discharges etc.	Codex Alimentarius, General Standard for Contaminants and Toxins in Feed and Food, 2009
<b>BIOTOXINS;</b> i.e. toxins produced by marine microalgae	Naturally occurring in seawater, blooms	Assessment and management of biotoxin risks in bivalve molluscs, FAO Technical Paper, 2011
<b>MICROBIOLOGICAL;</b> 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



# Chemical hazards

A variety of different toxic chemicals can accumulate in shellfish

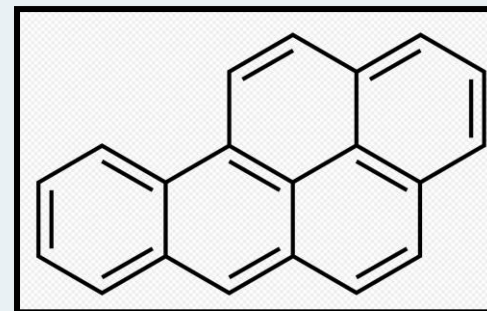
## HEAVY METALS

Lead (Pb), Cadmium (Cd), Mercury (Hg), Arsenic (As) etc.



## PERSISTENT ORGANIC POLLUTANTS

Polycyclic aromatic hydrocarbons (PAHs), polychlorinated biphenyls (PCBs), dioxins, furans etc.



## RADIONUCLIDES

Radioisotopes of Polonium (Po), Lead (Pb), Thorium (Th), Uranium (U) etc.



# Chemical hazards



- Toxic chemicals derive from heavy industry, waste disposal, mining, agriculture (pesticides) etc.
- Studies have shown heavy metals and organic pollutants in Senegalese shellfish





 Environment International  
Volume 32, Issue 3, April 2006, Pages 384-387  
  
ELSEVIER

Heavy metal concentrations in molluscs from the Senegal coast

Z. Sidoumou <sup>a</sup>, M. Gnassia-Barelli <sup>b</sup>, Y. Siau <sup>c</sup>, V. Morton <sup>b</sup>, M. Roméo <sup>b</sup>  

 Chemosphere  
Volume 84, Issue 3, June 2011, Pages 318-327  
  
ELSEVIER

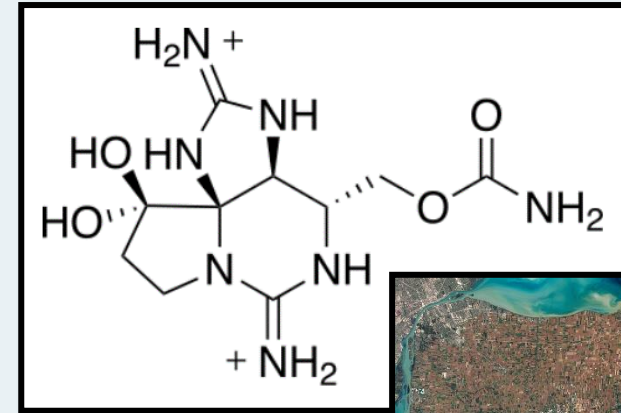
Are exploited mangrove molluscs exposed to Persistent Organic Pollutant contamination in Senegal, West Africa?

N. Bodin <sup>a, c</sup>  , R. N'Gom Ka <sup>b</sup>, F. Le Loc'h <sup>a, b</sup>, J. Raffray <sup>b</sup>, H. Budzinski <sup>c</sup>, L. Peluhet <sup>c</sup>, L. Tito de Morais <sup>b</sup>

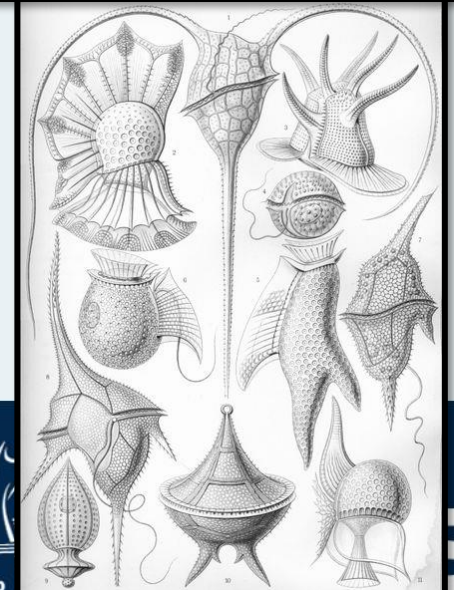


# Biotoxins

- Wide variety of toxins produced by naturally occurring “blooms” of marine algae (linked to environmental conditions)
- Cause a wide variety of illnesses

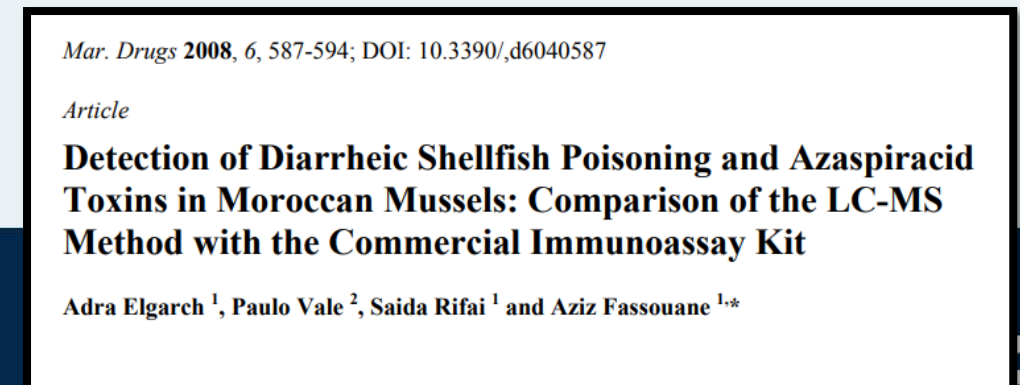
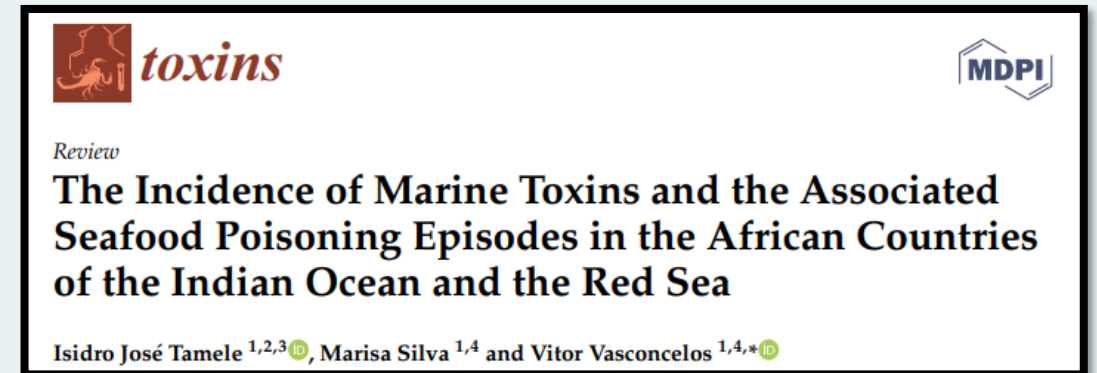


Type of Shellfish Poisoning	Main symptoms	Main toxin	Main algal source
Paralytic Shellfish Poisoning (PSP)	Neurological	Saxitoxin	<i>Alexandrium spp.</i>
Diarrhetic Shellfish Poisoning (DSP)	Gastrointestinal	Lipophilic toxins	<i>Dinophysis spp.</i>
Amnesic Shellfish Poisoning (ASP)	Neurological	Domoic acid	<i>Pseudo-nitzschia spp.</i>



# Biotoxins

- No reports on presence of algal biotoxins in Senegal
- Presence of biotoxins in shellfish reported in other African countries
- Small number of shellfish poisoning incidents reported
- Environmental conditions suitable – under-reporting possible?

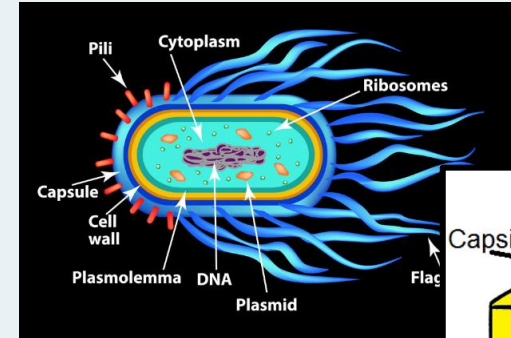


# Microbiological hazards

Numerous microbiological pathogens potentially linked to shellfish consumption

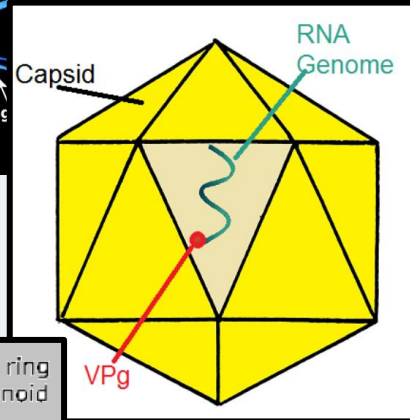
## BACTERIA

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



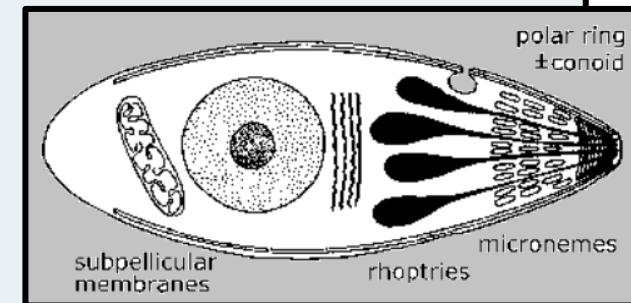
## VIRUSES

Norovirus, hepatitis A virus,  
sapovirus, hepatitis E virus



## PARASITES

*Giardia intestinalis*, *Cryptosporidium parvum*, *Schistosoma* spp.

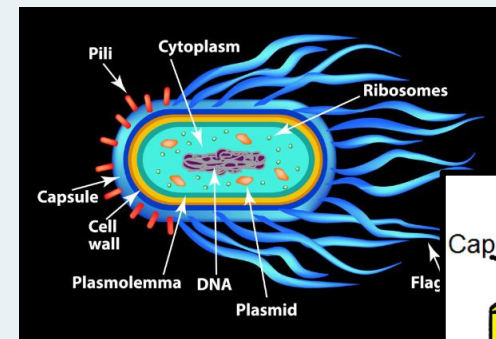


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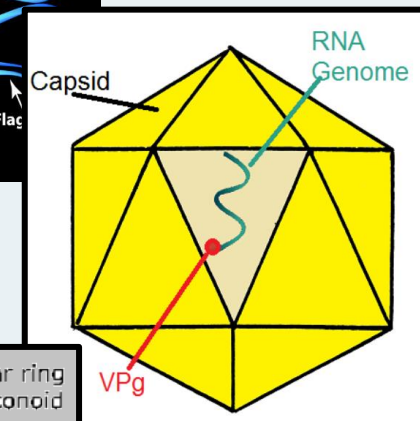
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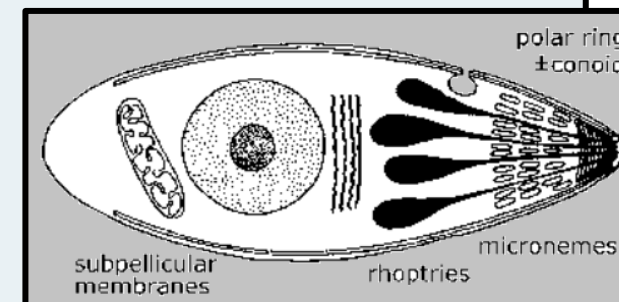
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## PARASITES

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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*

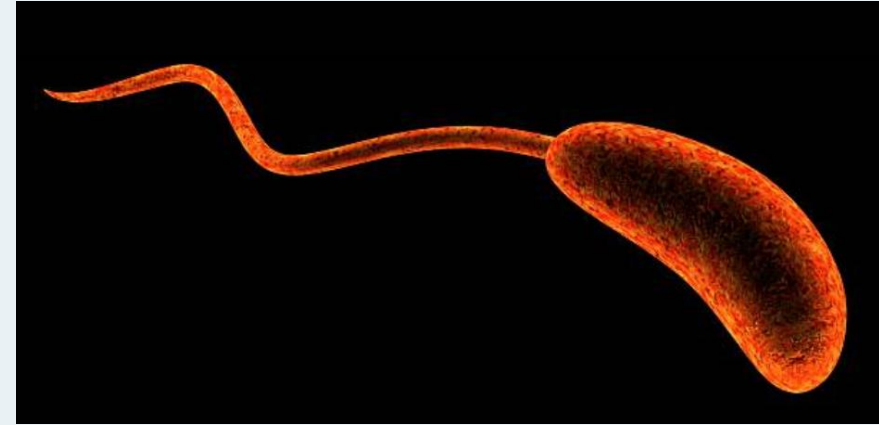
*TYPHOID FEVER DUE TO OYSTERS.; Wesleyan University Faculty's Explanation of the Recent Epidemic.*

Nov. 14, 1894



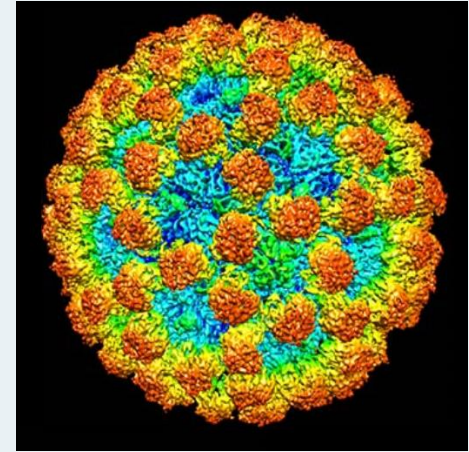
# *Vibrio spp.*

- Gram negative bacterium
- Depending on species, causes gastroenteritis (mild to severe illness) or sepsis (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 (*Vibrio parahaemolyticus*)



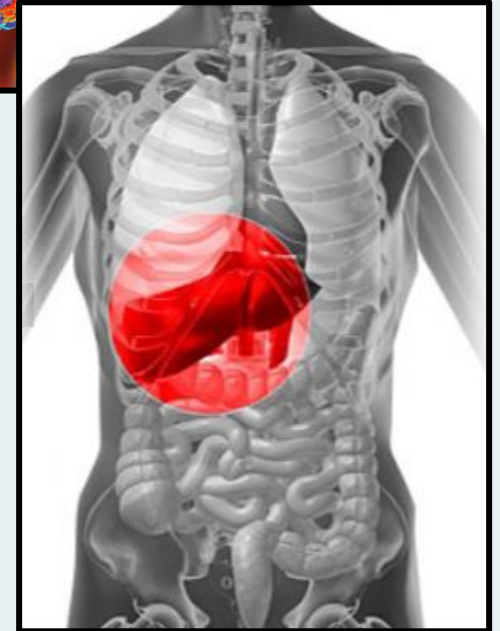
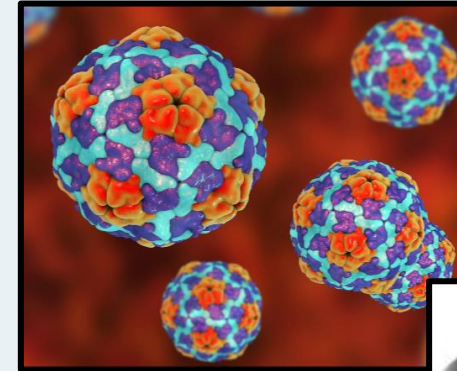
# Norovirus

- 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 Senegal

- No reports in scientific literature of shellfish-related transmission of microbial pathogens in Senegal
- All major shellfish-related pathogens found in the general population in Senegal (some detections in seafood)



# Salmonella spp.

## High incidence of typhoid fever in Senegal

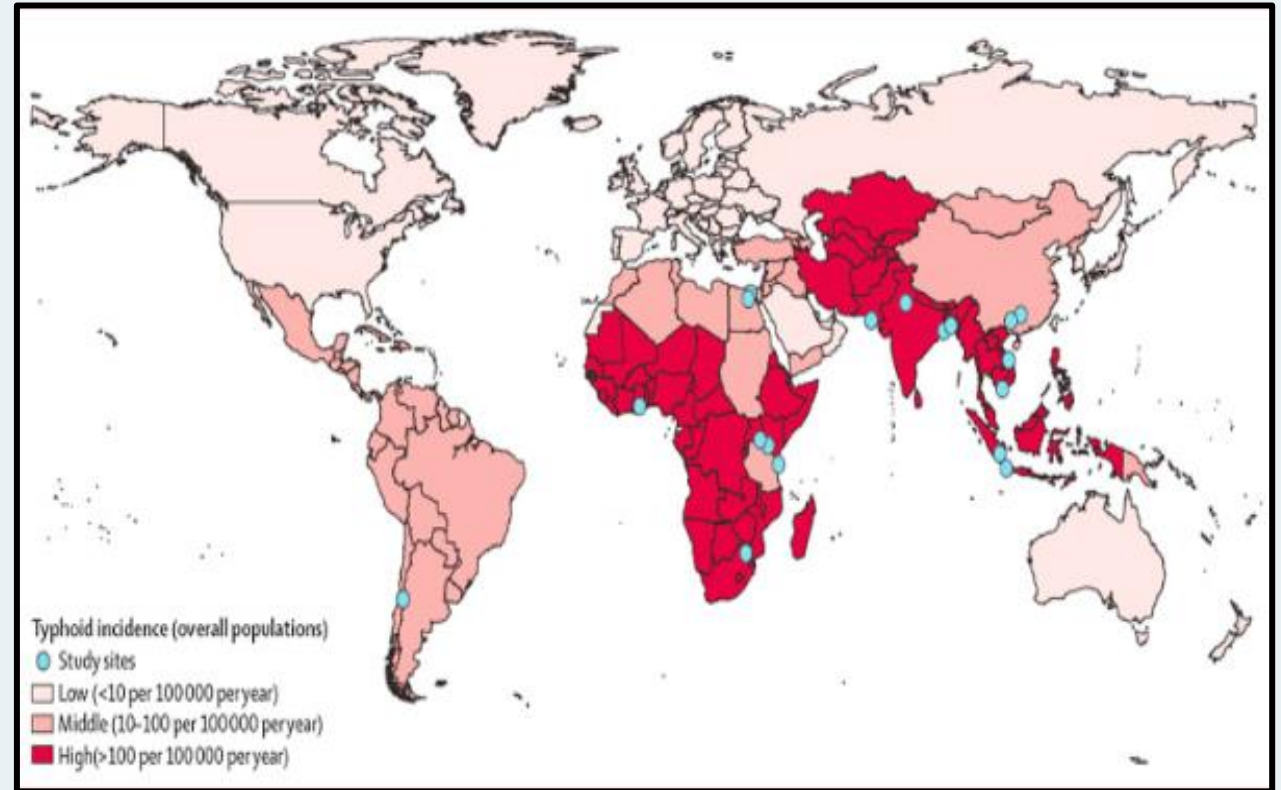
ORIGINAL ARTICLE

BACTERIOLOGY

### Prevalence and characterization of extended-spectrum $\beta$ -lactamase-producing clinical *Salmonella enterica* isolates in Dakar, Senegal, from 1999 to 2009

D. Harrois<sup>1,2,\*</sup>, S. Breurec<sup>2,3,\*</sup>, A. Seck<sup>2</sup>, A. Delaune<sup>1</sup>, S. Le Hello<sup>1</sup>, M. Pardos de la Gándara<sup>1</sup>, L. Sontag<sup>1</sup>, J.-D. Perrier-Gros-Claude<sup>2</sup>, J.-M. Sire<sup>2</sup>, B. Garin<sup>2,4</sup> and F.-X. Weill<sup>1</sup>

1) Institut Pasteur, Unité des Bactéries Pathogènes Entériques, Paris, France, 2) Institut Pasteur de Dakar, Unité de Bactériologie Médicale et Environnementale, Dakar, Senegal, 3) Institut Pasteur de Bangui, Laboratoire de Biologie Médicale, Bangui, République Centrafricaine and 4) Institut Pasteur de Madagascar, Laboratoire de Bactériologie Expérimentale, Antananarivo, Madagascar



# *Vibrio* spp.

*Vibrio* spp. detected in 30% of seafood samples from Senegal

🏠 Foodborne Pathogens and Disease > VOL. 10, NO. 12 | Original Articles

## ***Vibrio cholerae* and *Vibrio parahaemolyticus* Detected in Seafood Products from Senegal**

Ignace Coly ✉, Amy Gassama Sow, Malang Seydi, and Jaime Martinez-Urtaza

Published Online: 21 Nov 2013 | <https://doi.org/10.1089/fpd.2013.1523>



# Norovirus

## Norovirus a common cause of gastroenteritis in African countries including Senegal



COLLECTION REVIEW

### Norovirus Epidemiology in Africa: A Review

Janet Mans<sup>1\*</sup>, George E. Armah<sup>2</sup>, A. Duncan Steele<sup>3a</sup>, Maureen B. Taylor<sup>1</sup>

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

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Tropical Medicine and International Health

VOLUME 21 NO 1 PP 2–17 JANUARY 2016

Review

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

Jean Pierre Kabue<sup>1</sup>, Emma Meader<sup>2</sup>, Paul R. Hunter<sup>2,3</sup> and Natasha Potgieter<sup>1</sup>

<sup>1</sup> Department of Microbiology, School of Mathematical and Natural Sciences, University of Venda, Thohoyandou, RSA

<sup>2</sup> School of Medicine, Health Policy and Practice, University of East Anglia, Norwich, UK

<sup>3</sup> Department of Environmental Health, Tshwane University of Technology, Pretoria, RSA

### Prevalence and genetic characterization of noroviruses in children with acute gastroenteritis in Senegal, 2007–2010

Ousmane Kebe<sup>1</sup>, Maria-Dolores Fernandez-Garcia<sup>1</sup>, Boris-Enock Zinsou<sup>1</sup>, Amadou Diop<sup>2</sup>, Amary Fall<sup>1</sup>, Ndack Ndiaye<sup>1</sup>, Jan Vinjé<sup>3</sup>, Kader Ndiaye<sup>1</sup>

<sup>1</sup>Institut Pasteur, Dakar, Senegal

<sup>2</sup>Pediatric Hospital Albert Royer, Dakar, Senegal

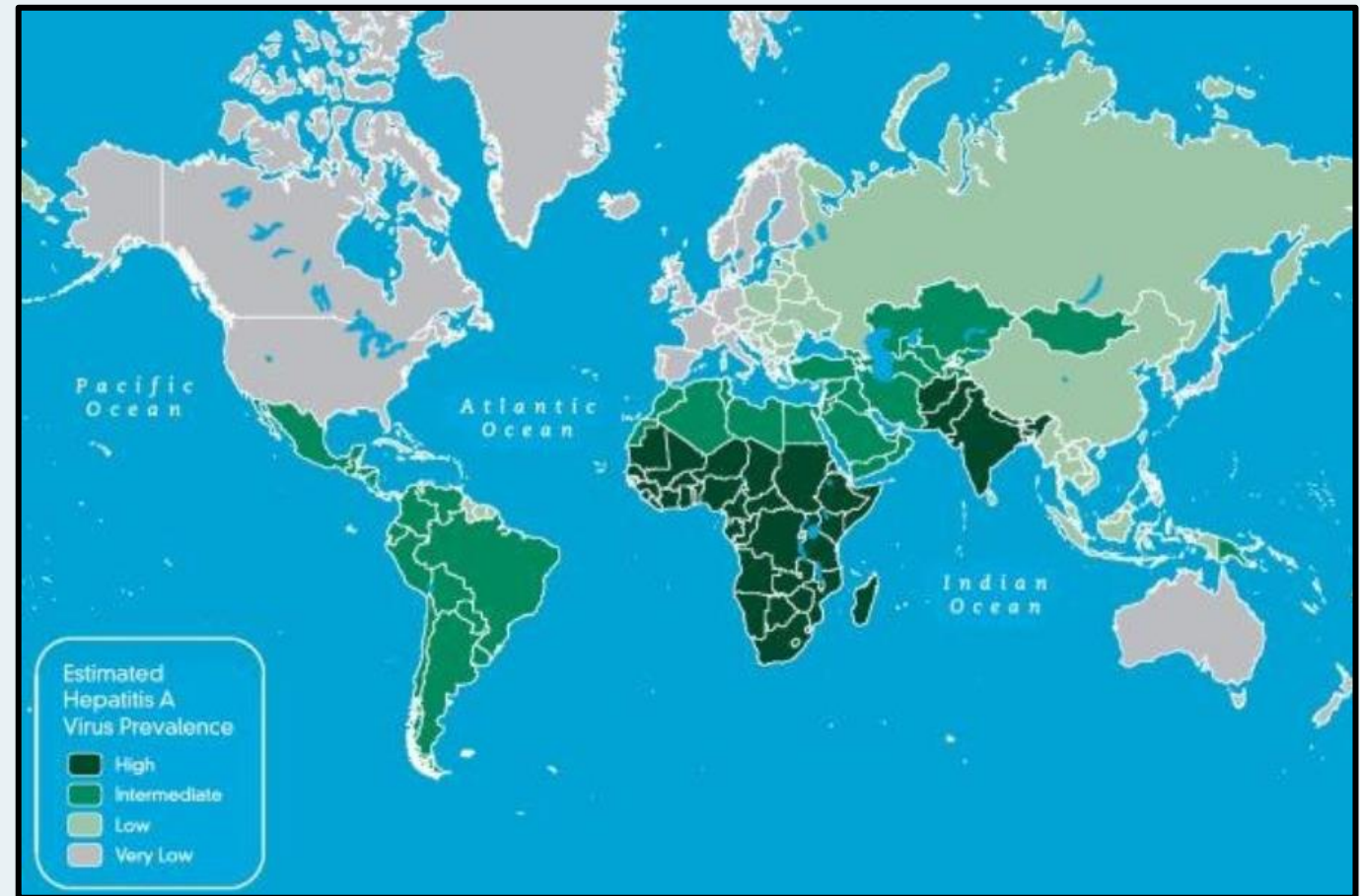
<sup>3</sup>Viral Gastroenteritis Branch, Division of Viral Diseases, Centers for Disease Control and Prevention, Atlanta, Georgia, USA





# Hepatitis A virus

- High prevalence of HAV in Senegal
- May be low levels of symptomatic HAV disease in Senegal due to high population immunity
- Export to low prevalence countries potentially risky e.g. exports from Peru have caused HAV outbreaks in Europe



# Shellfish-related pathogens in Senegal

- No reports in scientific literature of shellfish-related transmission of microbial pathogens in Senegal
- All major shellfish-related pathogens found in the general population in Senegal (some detections in seafood)
- Under-reporting probable – microbiological risks from shellfish in Senegal likely as significant as those in other regions



# 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
- Evidence of many shellfish-related hazards in Senegal or other countries in e.g. West Africa
- Risks posed by different hazards may depend on the characteristics of the growing area

