

Impacts on Public and Shellfish Health - Potential for a One Health Approach to Monitoring?

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Presentation Overview

- ▶ Outline public health risks associated with bivalve molluscs and current controls
- ▶ Potential impacts of a changing world
 - ▶ Climate change
 - ▶ Globalisation
- ▶ Potential for one-health approach to monitoring?
 - ▶ Opportunities & barriers?

Public health focus on oysters and microbiology (particularly norovirus)

Competent Authority / regulatory view

Microbiological Contamination

Human



- **Norovirus**
- hepatitis A Virus
- Salmonella

Animal

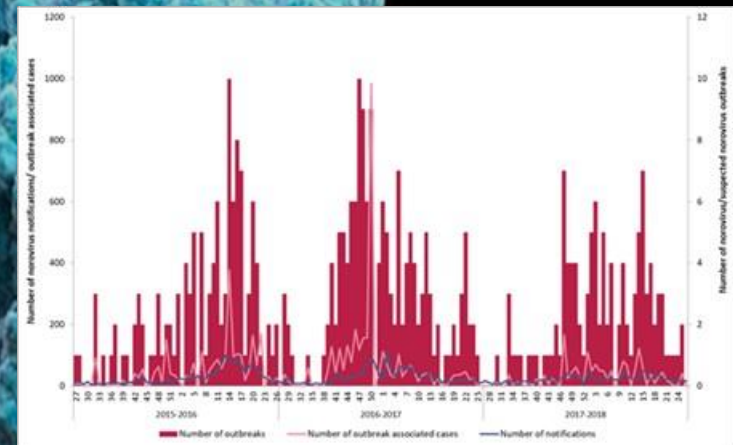
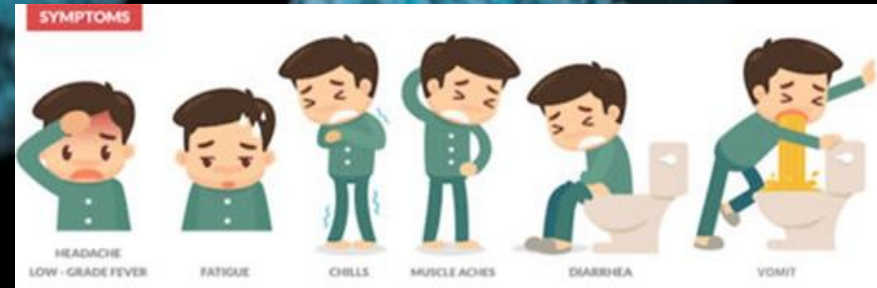


- *Cryptosporidium* sp.
- Giardia
- Enterotoxigenic (*E. coli* 0157)



What is norovirus?

- ❑ Causes a relatively mild” gastroenteritis
 - ❑ nausea, diarrhoea, vomiting, fever and abdominal pain
- ❑ The most common cause of infectious intestinal disease in the community
 - ❑ Approx. 685 million cases worldwide annually
- ❑ Seasonal distribution
 - ❑ “Winter Vomiting Disease”
- ❑ Person to person spread major route of infection
 - ❑ Hospitals, cruise ships, care settings, etc....
 - ❑ Strain diversity GI & GII, high shedding, low immunity
- ❑ Foodborne transmission e.g. oysters, increasingly recognised



Naturally Occurring Marine Bacteria

▶ *Vibrio parahaemolyticus*

- ▶ Causes gastroenteritis
- ▶ Pandemic strains
- ▶ Relatively rarely reported Europe



▶ *Vibrio vulnificus*

- ▶ Causes sepsis and necrotizing infections in wounds (Death)
- ▶ High temperatures required
- ▶ Problem in American Gulf States
- ▶ Very rarely reported in Europe



European control measures for Shellfish

Control of microbial pollution in shellfisheries



WF Directive
2000/60/EC

Classification and monitoring of harvesting areas



EU reg.
2004/854

Commercial processing
(depuration, relaying, cooking)



EU reg.
2004/853

End-product controls
(quality tests, traceability)



EU reg.
2004/853
& 2073/2005

EU Controls

Classification of shellfish harvest areas

Class.	<i>E. coli</i> (100g)	Treatment Required
A	<230	direct for consumption
B	< 4,600	Purification Relaying in class A area Cooking
C	< 46,000	Relaying in class A area cooking
Prohibited	>46 000	Harvesting not permitted

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doi: 10.2903/j.efsa.2019.5762

Analysis of the European baseline survey of norovirus in oysters

European Food Safety Authority (EFSA)

- norovirus – EFSA Report published and option for controls being discussed
 - A quantitative standard required – presence may not represent a risk
 - possible options for establishing a micro criterion for NoV in oysters
 - Would be first virus limit, first PCR limit, Summated result (2 genotypes) in EU
- Vibrios - no specific rules within Europe

A changing world - Climate Change?

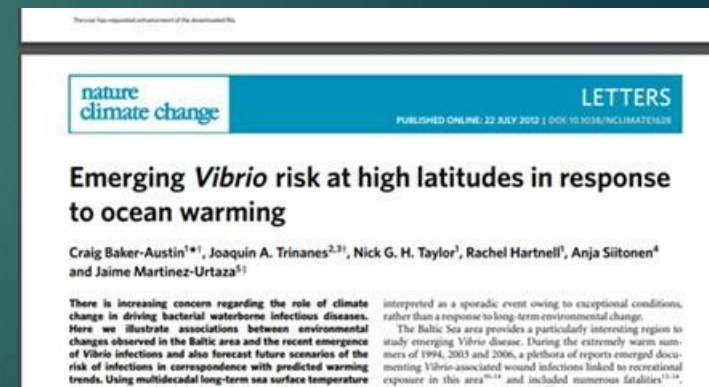
▶ Increasing storms

- ▶ Increased sewage overflows and flooding leading to increased microbial contamination



▶ Warming Seas and salinity changes

- ▶ Increased pathogen range and prevalence (particularly *Vibrios*)



▶ Impacts on shellfish health?

A changing world – globalisation and population growth?

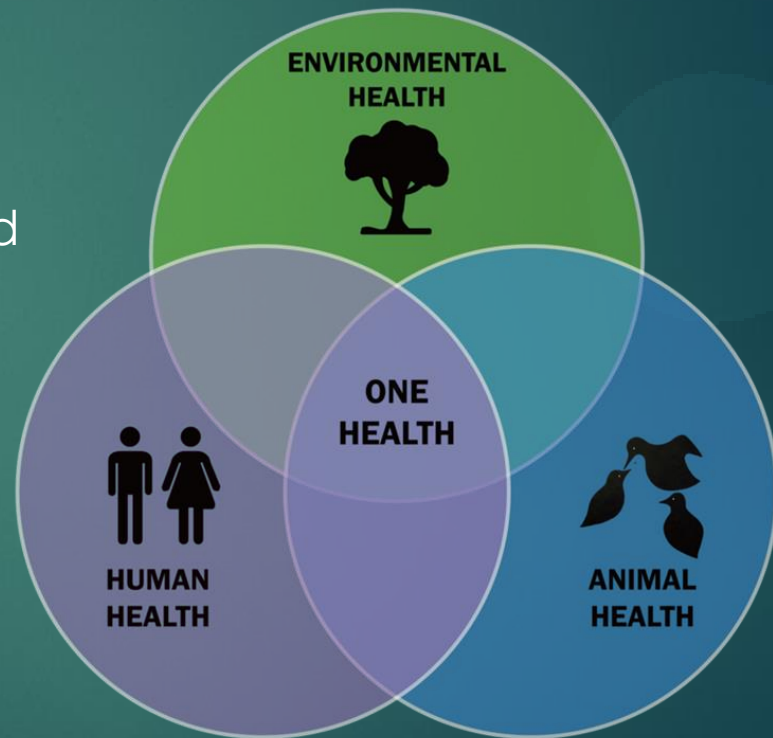
- ▶ Changing Markets
 - ▶ Increasing worldmarkets for European oysters
 - ▶ Spread of human pathogens to new populations
 - ▶ One driver for norovirus standard –facilitate trade
- ▶ Current population 7.9 billion set to rise to 9.8 billion by 2050 – *United Nations report 2017*
- ▶ Increasing pressure on sewerage systems leading to increasing aquatic environmental contamination
- ▶ Increased land use increased contamination from land run off

One Health Approach to Monitoring?

WHO.....

'One Health' is an approach to designing and implementing programmes, policies, legislation and research in which multiple sectors communicate and work together to achieve better public health outcomes.

areas of work in which a One Health approach is particularly relevant include food safety, the control of zoonoses combatting antimicrobial resistance.



Technical prospects for one health approach



- ▶ Next generation sequencing (WGS)
 - ▶ One step testing for pathogens (human and oyster)
 - ▶ Potential for detecting emerging disease

▶ eDNA testing

▶ Passive samplers

environmental microbiology 

Environmental Microbiology (2019) 00(00), 00–00 doi:10.1111/1462-2920.14750

Dynamics of the Pacific oyster pathobiota during mortality episodes in Europe assessed by 16S rRNA gene profiling and a new target enrichment next-generation sequencing strategy

Intervirology Intervirology 2016;59:285–300
DOI: 10.1159/000477808

Contribution of Next-Generation Sequencing to Aquatic and Fish Virology

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SCIENTIFIC REPORTS

OPEN **A universal primer-independent next-generation sequencing approach for investigations of norovirus outbreaks and novel variants**

Foodborne Pathogens and Disease, Vol. 13, No. 10 | Original Articles

Application of Next-Generation Sequencing to Evaluate the Profile of Noroviruses in Pre- and Post-Depurated Oysters

Saiki Imamura  Mika Haruna, Tomoko Goshima, Hiromi Kanezashi, Tsukasa Okada, and Keiko Akimoto

Published Online: 1 Oct 2016 | <https://doi.org/10.1089/fpd.2016.2150>

ved: 16 June 2016
rod: 21 March 2017
bed online: 11 April 2017

Barriers to one health approach

	Public Health (norovirus)	Shellfish Health	
		Herpesvirus	<i>V. aest.</i>
Sample matrix	Pooled digestive glands	Gill/mantle/whole animal	
Sampling	Market Ready oysters	Seed/juvenile	During Production
Seasonality	Winter	Spring/summer	Summer
Decision making	Quantitative level /g DG (micro criterion)		????
Standard methods	Real Time qPCR - ISO 15216	OIE recommended	-

Regulatory approach for norovirus likely to be based on final product testing (micro criteria)

Summary

- ▶ Extensive food safety regulation in place in EU
 - ▶ New norovirus standard being discussed
 - ▶ No specific regulation for *Vibrios*
- ▶ Climate change in particular is likely to increase the risk of microbial contamination and increase range of pathogens
 - ▶ Public health concern (oyster health)
 - ▶ *Vibrios* an increasing public health risk
- ▶ Significant differences exist in approaches to food safety and animal health surveillance and control making a common harmonised one-health approach to monitoring and control challenging?
 - ▶ Applying approach to *Vibrios* may be more promising?