PART 1 SHELLFISH SAFETY: AN INTRODUCTION

Microbial contamination and shellfish safety
S Jones, University of New Hampshire, USA
- Introduction
- Major microbial contaminants of shellfish
- Impacts of microbial contamination of shellfish on human health
- Effects of microbial contamination on the international shellfish industry
- Incidence of microbial contamination in shellfish waters
- Contamination sources and their identification
- Future trends
- Sources of further information and advice
- References

Biotoxin contamination and shellfish safety
H Hégaret, University of Connecticut, G H Wikfors, NOAA Northeast Fisheries Science Center and S E Shumway, University of Connecticut, USA
- Introduction
- Origins of phycotoxins
- Trophic dynamics of phycotoxins in molluscan shellfish
- Human health impacts
- Management responses
- Economic impacts of harmful algal blooms (HABs)
- Conclusions
- Future trends
- References and further reading

PART 2 IMPROVING MOLLUSCAN SHELLFISH SAFETY AND QUALITY

Viral contaminants of molluscan shellfish: detection and characterisation
A Bosch and R M Pintó, University of Barcelona, Spain and F S Le Guyader, Laboratoire de Microbiologie, France
- Introduction: human enteric viruses and their fate in the environment
- Shellfish-borne transmission of virus infections
- Effects of viral contamination of molluscs on the international shellfish industry
- Methods for detecting viruses in molluscan shellfish and associated problems
- Improving detection of molluscan shellfish virus contamination using new molecular-based methods
- Depuration of viral contaminants in molluscan shellfish
- Future trends in virus studies in shellfish
- References

Monitoring viral contamination of molluscan shellfish
M Pompey, J C Le Saux, D Hervio-Heath and S F Le Guyader, IFREMER, France
- Introduction
- Identifying sources of pollution
- Identifying the conditions responsible for microbial contamination of shellfish
- Potential strategies for reducing microbial contamination in shellfish harvesting areas
- Improving risk management strategies for shellfish harvesting areas
- Conclusions and future trends
- References and further reading

Algal toxins and their detection
G Boyer, State University of New York, USA
- Introduction
- Major algal toxins found in shellfish and their sources
- Current methods for detection of algal toxins in shellfish
- New techniques and future trends
- References

**Monitoring of harmful algal blooms**
*P Andersen, Orbicon A/S, Denmark*
- Introduction
- Action plan design
- Regulation of mandatory harmful algal monitoring programs
- Methods and techniques used to forecast and monitor harmful algal blooms
- Future trends
- Sources of further information and advice
- References and further reading

**Mitigation of effects of harmful algal blooms**
*M Sengco, Smithsonian Environmental Research Center, USA*
- Introduction
- Novel techniques to mitigate the effects of harmful algal blooms
- Ethos of harmful algal bloom (HAB) control
- Future trends
- Sources for further information and advice
- References

**Modelling as a mitigation strategy for harmful algal blooms**
*J Blanco, Centro de Investigaciónes Mariñas, Spain*
- Introduction
- Why model the accumulation of toxins in bivalves? Historical use and development of toxin/toxicity accumulation models
- Models of the kinetics of accumulation and transformation of toxins in shellfish
- Applications of modelling for improved shellfish safety and quality
- Future trends
- Sources of further information and advice
- References

**Metals and organic contaminants in bivalve molluscs**
*W-X Wang, HKUST, Hong Kong*
- Introduction
- Metal concentrations in bivalve molluscs
- Internal speciation of metals in bivalve molluscs
- Exposure routes and application of the kinetic model
- Uptake and transfer of metals
- Safety standards
- Detection, management and risk assessment
- Future trends
- Acknowledgements
- References

**Managing molluscan shellfish-borne microbial diseases**
*T Soniat, University of New Orleans, USA (formerly of Nicholls State University, USA)*
- Introduction
- Microbial indicators and pollution-associated pathogens
- Enteric viruses
- Naturally occurring pathogens
- Pathogens associated with handling, processing and distribution
- Management of pollution-associated pathogens
- Management of naturally occurring pathogens
- Management of pathogens associated with handling, processing and distribution
- Future trends
- Sources of further information and advice
- Acknowledgements
- References

**Disease and molluscs quality**
*S Corbeil, Commonwealth Scientific and Research Organisation (CSIRO), Australia and F C J Berthe, Animal Health and Welfare Unit, Italy*
- Introduction
- Major pathogens and diseases of molluscs causing significant economic losses in molluscan aquaculture
- Diagnostic methods
- Effects of shellfish disease on the international shellfish industry
- Reducing disease in molluscan aquaculture
- Future trends
- Sources of further information and advice
- References

**Hazard analysis and critical control point programs for raw oyster processing and handling**
*V Garrido and S Otwell, University of Florida, USA*
- Introduction
- HACCP for oyster production and safety
- HACCP plan for processing of frozen raw oysters
- Hazard analysis
- Identify the critical control points (CCP)
- Define the critical limits (CL)
- Designate monitoring procedures
- Corrective action (CA)
- Specify verifications (and validation) procedures
- Specified records
- References
- Appendix: Annex 1 - examples of HACCP and sanitation records

**Biofouling and the shellfish industry**
*D I Watson University College Cork, Ireland, S E Shumway and R B Whitlatch, University of Connecticut, USA*
- Introduction
- Biofouling and shellfish
- Problems and benefits of biofouling
- Current removal/treatment methods
- Future trends
- Sources of further information and advice
- Acknowledgements
- References and further reading

**PART 3 IMPROVING CRUSTACEAN SAFETY AND QUALITY**

**Optimization of crustacean quality through husbandry and adherence to post-harvest standards for processing**
*L R D’Abramo, J L Silva and T Kim, Mississippi State University, USA*
- Introduction
- Land (site) selection
- Water source, conservation, and preservation of quality
- Fertilization and semi-intensive systems
- Formulated feeds, bio-flocs, and intensive pond culture systems
- Substrate
- Water quality management
- Collection during harvest
- Harvest and post harvest treatment
- Safety and quality standards
- Conclusions
- References

Development of vaccines and management of viral diseases of crustaceans
M C W van Hulten, Intervet International BV, The Netherlands and A C Barnes and K N Johnson, Queensland University, Australia
- Introduction: disease and the foundations for preventative healthcare in aquaculture
- Using the RNA interface to target shrimp viruses
- Developing vaccines to manage viral disease in shrimp
- Using vaccines as part of health management strategies
- Future trends
- Sources of further information and advice
- References

Specific pathogen-free shrimp stocks in shrimp farming facilities as a novel method for disease control in crustaceans
D V Lightner and R M Redman, University of Arizona and S Arce and S M Moss, Oceanic Institute, USA
- Introduction
- The concept of domesticated SPF shrimp: a historical perspective
- Events leading to development of Litopenaeus vannamei as the dominant species in the Americas
- Adaptation of the SPF concept to domesticated shrimp stocks
- International principles for responsible shrimp farming
- Biosecurity and the culture of wild seed/broodstock
- Biosecurity through environmental control and best management practices
- Conclusions
- Acknowledgements
- References

Selective breeding of penaeid shrimp
S M Moss and D R Moss, Oceanic Institute, USA
- Introduction
- Selective breeding
- Conclusions
- References

PART 4 REGULATION AND MANAGEMENT OF SHELLFISH SAFETY

Legislation, regulation and public confidence in shellfish
C Askew, Shellfish Association of Great Britain, UK
- Introduction: public confidence in shellfish
- Hygiene legislation and public confidence
- Environmental legislation for the quality of shellfish growing waters
- Limitations of the regulatory approach
- Self-regulation and good management practice (GMP)
- Dietary and health advisories
- Public perception of health benefits and risks associated with shellfish
- Future trends
- The risk-averse marketplace
- References

**Risk management of shellfisheries**
*L H Murray, Food Standards Agency and R J Lee, Cefas Weymouth Laboratory, UK*
- Interaction between public health controls and industry
- Identification of the need for improved bases for, and application of, risk management in practice
- Optimizing risk management
- Improved application of risk management to microbiological and biotoxin problems
- Official and industry roles in risk management
- Future trends
- Interaction of research, legislation and risk management
- Shared resources and working together
- Conclusions
- Sources of further information and advice
- References

**PART 5 POST-HARVEST ISSUES**

**Molluscan shellfish depuration**
*K R Schneider, J Cevallos and G E Rodrick, University of Florida, USA*
- Introduction
- Types of depuration plants
- Importance of seawater quality
- Types of seawater treatment
- Rules and guidelines for controlled purification
- Depuration plant location, design and construction
- Source of shellfish to be depurated
- Equipment construction and depuration facility design
- International depuration
- Shellfish relaying
- References

**Slaughter, storage, transport and packaging of crustaceans**
*G J Flick, L A Granata and L S Marsh, Virginia Tech, USA*
- Introduction
- Slaughter/cooking
- Packaging and preservation
- Contaminants
- Conclusions
- References

**Packaging, storage and transport of molluscan shellfish**
*V Garrido, Institute of Food and Agricultural Sciences and G E Rodrick, University of Florida, USA*
- Introduction
- Product specification
- Packaging formats and materials
- Product labeling and tagging
- Product size standards
- Accepting shellfish shipments
- Conclusions
- References