PART 1 GENETIC IMPROVEMENT AND REPRODUCTION

Genome-based technologies for aquaculture research and genetic improvement of aquaculture species
Z Liu, Auburn University, USA
- Introduction
- DNA marker technologies
- DNA sequencing technologies
- Gene discovery technologies
- Genome mapping technologies
- Genome expression analysis technologies
- Acknowledgements
- References

Genetic improvement of finfish
G Hulata, Agricultural Research Organization and B Ron, Israel Oceanographic and Limnological Research Ltd., Israel
- Introduction: current status of aquaculture genetics
- Key drivers for genetic improvement of finfish
- Case studies - risks associated with selective breeding programs
- Future trends
- Sources of further information and advice
- Acknowledgement
- References

Genetic variation and selective breeding in hatchery-propagated molluscan shellfish
P Boudry, Ifremer, France
- Introduction
- Monitoring genetic diversity and risks related to inbreeding
- Inheritance of traits important for aquaculture
- Current status of established molluscan shellfish breeding programs
- Present needs and future trends: use of marker assisted selection and genomics
- References

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C Mylonas, Hellenic Center for Marine Research, Greece and Y Zohar, University of Maryland Biotechnology Institute, USA
- Introduction
- The fish reproductive cycle and its control
- Reproductive strategies and dysfunctions in captivity
- Hormonal therapies for the control of reproduction
- Induction of oocyte maturation and ovulation
- Induction of spermiation
- Spontaneous spawning versus artificial insemination
- Future trends
- Source of further information and advice
- References

Producing sterile and single-sex populations of fish for aquaculture
T Benfey, University of New Brunswick, Canada
- Introduction
- Sterile populations
- Single-sex populations
- Future trends and further reading
- References
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X Guo, Y Wang, Z Xu, Rutgers University and H Yang, Louisiana State University Agriculture Center, USA
- Introduction
- Principles and methods of chromosome set manipulation
- Triploid shellfish
- Tetraploid shellfish
- Gynogenesis, androgenesis and aneuploids
- Summary and perspectives
- Acknowledgements
- References

PART 2 HEALTH

Advances in disease diagnosis, vaccine development and other emerging methods to control pathogens in aquaculture
A Adams, University of Stirling, UK
- Introduction
- Key drivers to improve disease diagnosis and vaccine development
- Limitations of current diagnostic methods
- Advances in methods of disease diagnosis (mainly for bacterial diseases)
- Advances in vaccine development
- Other emerging methods to control pathogens
- Future trends
- Sources of further information and advice
- References

Controlling parasitic diseases in aquaculture: new developments
C Sommerville, University of Stirling, UK
- Introduction
- Effects of parasitic disease in aquaculture
- Advances in the understanding of parasite biology and host-parasite interactions
- Advances in methods of identifying parasites
- Advances in methods of controlling parasites
- Future trends
- References

Controlling viral diseases in aquaculture: new developments
T Renault, Ifremer, France
- Introduction
- Overview of viral diseases in aquaculture
- Limitation of current management techniques
- Advances in understanding of immunity of aquacultured species to viral diseases
- New methods to control viral diseases in aquaculture and future trends
- References

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F J Gatesoupe, INRA-Ifremer, France
- Introduction
- Fighting the pathogens
- Improving welfare
- Improving feed
- Concluding remarks
- Sources of further information and advice
- References
PART 3 DIET AND HUSBANDRY

Fish larval nutrition and diets: new developments
S Kolkovski, Dept of Fisheries, Australia, J Lazzo, Fish Nutrition Laboratory, Mexico, D Leclercq, ACUI-T, France, M Izquierdo, Grupo de Investigación en Acuicultura, Spain
- Introduction
- Determination of nutritional requirements of larvae
- Nutritional requirements of fish larvae
- Feed identification and ingestion
- Amino acids versus hydrolysates as feed attractants: pros and cons
- Ontogeny of digestive capacity in marine fish larvae
- Digestion system capacity
- Diet manufacturing methods
- Microdiet characteristics
- Feeding system
- Dosage system
- Future directions
- References

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R Hardy, University of Idaho, USA
- Introduction
- Sustainability of feed ingredients
- Safety of farmed fish products from harmful residues and pollutants
- Categories of environmental pollutants and residues comprising risks to the safety of farmed fish products
- Alternate protein and lipid sources
- Future trends
- Sources of further information and advice
- References

Ingredient evaluation in aquaculture: digestibility, utilisation and other key nutritional parameters
B Glencross, CSIRO Marine and Atmospheric Research, Australia
- Introduction
- Characterisation and preparation of ingredients
- Defining ingredient digestibility
- Ingredient palatability
- Defining effects on growth and utilization
- Ingredient functionality and feed technical qualities
- Frontier technologies for ingredient evaluation
- References

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I Lupatsch, Swansea University, UK
- Introduction
- Quantification of nutritional requirements
- Feed ingredient evaluation
- Feed formulation and feeding strategies
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D Davis, Auburn University, USA, T Nguyen, Nong Lam University, Vietnam, M Li, National Warmwater Aquaculture Center, D M Gatilin III, Department of Wildlife and Fisheries Sciences and T O’Keefe, Aqua-Food Technologies, Inc, USA
Advances in aquaculture feeds and feeding: basses and breams
M Booth, New South Wales Department of Primary Industries, Australia

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S Refstie, Nofima AS and Aquaculture Protein Centre (APC) and T Åsgård, Nofima AS, Norway

Monitoring viral contamination in shellfish growing areas
F S Le Guyader and M Pommepuy, Ifremer, France and R L Atmar, Baylor College of Medicine, USA

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Y Matsuyama, National Research Institute of Fisheries and Environment of Inland Sea, Japan and S Shumway, University of Connecticut, USA

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M R Tredici, N Biondi, Università degli Studi di Firenze, G Chini Zittelli, Istituto per lo Studio degli Ecosistemi, E Ponis and L Rodolfi, Università degli Studi di Firenze, Italy
- Microalgae for aquaculture feed
- Microalgae as dietary supplements, animal feed and nutraceuticals
- Microalgae as source of pharmaceuticals and probiotics
- Wastewater reclamation and biofuel production by algae-bacteria consortia
- Future trends
- Sources of further information and advice
- References

**PART 4 ENVIRONMENTAL ISSUES**

**Predicting and assessing the environmental impact of aquaculture**
*C Crawford and C MacLeod, University of Tasmania, Australia*
- Introduction
- Interactions between aquaculture and the environment
- Site selection and carrying capacity
- Considerations in developing an environmental monitoring and assessment program
- Monitoring and assessment techniques
- Recent technological advances and future trends
- Sources of further information and advice
- References

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*L G Ross, N Handisyde, D C Nimmo, University of Stirling, Scotland*
- The spatial planning context
- Database construction and project methodology
- Decision support systems and tools
- Selected applications and examples of geographical information systems in aquaculture
- Case study: climate change
- Case study: multi-site coastal zone planning
- Summary and future trends
- Acknowledgements
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**Zooremediation of contaminated aquatic systems through aquaculture initiatives**
*S Gifford, G R Macfarlane, C E Koller, R H Dunstan, University of Newcastle, Australia and W O’Conner, NSW Department of Primary Industries, Australia*
- Introduction
- Zooremediation of pollutants
- Zooremediation and pearl aquaculture: a case study
- Future trends
- Sources of further information and advice
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**PART 5 FARMING NEW SPECIES**

**Farming cod and halibut: biological and technological advances in two emerging cold-water marine finfish aquaculture species**
*V Puvanendran and A Mortensen, Nofima Marine, Norway*
- Introduction
- Atlantic cod
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- Future trends
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E McLean, G Salze, Virginia-Maryland Regional College of Veterinary Medicine, M H Schwarz, Virginia Seafood AREC and S Craig, Virginia Cobia Farms LLC, USA
- Introduction
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- Larval rearing
- Juveniles and on-growing
- Emerging issues and future trends
- References

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C Jones, Queensland Department of Primary Industries and Fisheries, Australia
- Introduction
- Current situation and constraints
- Advances in culture
- Production systems
- Product issues: markets
- Future trends
- Sources of further information and advice
- References

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B D Paterson, Queensland Department of Primary Industries and Fisheries, Australia
- Introduction
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- Product issues
- Production systems
- Future trends
- Sources of further information and advice
- References

Aquaculture and the production of pharmaceuticals and nutraceuticals
K Benkendorff, Flinders University of South Australia, Australia
- Introduction
- Marine pharmaceuticals
- Marine nutraceuticals
- Diversifying the aquaculture industry
- Current case studies
- Steps towards commercialization
- Future trends
- Acknowledgments
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PART 6 AQUACULTURE SYSTEMS DESIGN

Opportunities and challenges for offshore farming
R Langan, University of New Hampshire, USA
- The context for off-shore farming
- Characterization and selection of off-shore sites
- Finfish species cultivated in off-shore cages
- Off-shore mollusc culture
- Environmental concerns
Advances in technology for off-shore and open ocean aquaculture
A Fredheim, SINTEF Fisheries and Aquaculture, Norway and R Langan, University of New Hampshire, USA
- Introduction: historical development of fish farming technology
- Floating fish farm design
- Current status and technical limitations
- Novel fish farm systems
- Supporting technologies for off-shore and open ocean fish farming
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T Losordo, D DeLong and T Guerdat, North Carolina State University, USA
- Introduction
- Components in recirculating systems design
- Types of particulate waste solids
- Tank, water input manifolds, and drain design
- Settleable solids capture components
- Suspended solids capture components
- Biological filtration
- Oxygenation components and processes
- Sterilization components and processes
- Comparing freshwater and marine systems design
- An example of a modern approach to a complete systems design
- References

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C E Boyd and S Chainark, Auburn University, USA
- Introduction
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- Production methodology
- Liming and fertilization
- Feeds and feed management
- Dissolved oxygen management
- Pond amendments
- Pond bottom treatments
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- Pond effluents
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C L Browdy, J A Venero, A D Stokes and J Leffler, Marine Resources Research Institute, USA
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- Components of superintensive bio-floc-based shrimp production systems
- Current research priorities
- Conclusions
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P Edwards, Asian Institute of technology, Thailand
- Introduction
- Definitions and principles
- Traditional aquaculture systems
- Recent changes to traditional practice
- Research and development for improved traditional practice
- Recent development of semi-intensive aquaculture
- Bridging traditional and modern practice
- Future trends
- Sources of further information and advice
- References

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J Bostock University of Stirling, UK
- Introduction
- Information and communications technology (ICT) for productivity and effectiveness
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G L Allan and D S Fielder, New South Wales Department of Primary Industries, Australia, K M Fitzsimmons, University of Arizona, USA, S L Applebaum, Jacob Blaustein Institute for Desert Research BGU, Israel and S Raizada, Central Institute of Fisheries Education Rohtak Centre (I.C.A.R.), India
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- Saline groundwater from interception schemes to protect agriculture
- Coal bed methane waste water
- Chemistry and remediation
- Case studies
- Future trends
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M P Schreibman and C Zarnoch, City University of New York, USA
- Introduction
- Goals
- Technology
- Potential urban aquaculture programs
- Challenges to urban aquaculture development
- The economics: siting, processing, and marketing for economic success
- Marketing and competition
- The role of the university
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