

# Selection and Breeding Programs in Aquaculture

Edited by  
Trygve Gjedrem



Springer

# Selection And Breeding Programs In Aquaculture

**Joacim Rocklöv**



## **Selection And Breeding Programs In Aquaculture:**

**Selection and Breeding Programs in Aquaculture** Trygve Gjedrem, 2005-04-13 Although aquaculture as a biological production system has a long history systematic and efficient breeding programs to improve economically important traits in the farmed species have rarely been utilized until recently except for salmonid species This means that the majority of aquaculture production more than 90 % is based on genetically unimproved stocks In farm animals the situation is vastly different practically no terrestrial farm production is based on genetically unimproved and undomesticated populations This difference between aquaculture and livestock production is in spite of the fact that the basic elements of breeding theory are the same for fish and shellfish as for farm animals One possible reason for the difference is the complexity of reproductive biology in aquatic species and special consideration needs to be taken in the design of breeding plans for these species Since 1971 AKVAFORSK has continuously carried out large scale breeding research projects with salmonid species and during the latest 15 years also with a number of fresh water and marine species Results from this work and the results from other institutions around the world have brought forward considerable knowledge which make the development of efficient breeding programs feasible The genetic improvement obtained in selection programs for fish and shellfish is remarkable and much higher than what has been achieved in terrestrial farm animals

**Selective Breeding in Aquaculture: an Introduction** Trygve Gjedrem, Matthew Baranski, 2010-03-17 The foundation of quantitative genetics theory was developed during the last century and facilitated many successful breeding programs for cultivated plants and terrestrial livestock The results have been almost universally impressive and today nearly all agricultural production utilises genetically improved seed and animals The aquaculture industry can learn a great deal from these experiences because the basic theory behind selective breeding is the same for all species The first published selection experiments in aquaculture started in 1920 s to improve disease resistance in sh but it was not before the 1970 s that the first family based breeding program was initiated for Atlantic salmon in Norway by AKVAFORSK Unfortunately the subsequent implementation of selective breeding on a wider scale in aquaculture has been slow and despite the dramatic gains that have been demonstrated in a number of species less than 10% of world aquaculture production is currently based on improved stocks For the long term sustainability of aquaculture production there is an urgent need to develop and implement efficient breeding programs for all species under commercial production The ability for aquaculture to successfully meet the demands of an ever increasing human population will rely on genetically improved stocks that utilise feed water and land resources in an efficient way Technological advances like genome sequences of aquaculture species and advanced molecular methods means that there are new and exciting prospects for building on these well established methods into the future

**The Shrimp Book** Victoria Alday-Sanz, 2010-12-01 A comprehensive source of information on all aspects of shrimp production this reference covers not only the global status of shrimp farming but also examines shrimp anatomy and physiology From nutrition to health

management and harvesting issues to biosecurity this well researched volume evaluates existing knowledge proposes new concepts and questions common practices With an extensive review on worldwide production systems this compilation will be highly relevant to research scientists students and shrimp producers      *Selection and Breeding Programmes in Aquaculture* Nicholas Rowan,2012-08 Topics covered in this volume include characteristics of male marine mammal reproduction characteristics of female marine mammal reproduction location of breeding sites fish breeding spawning methods tips for effective fish breeding raising fry and failed breedings      *Shellfish Safety and Quality* Sandra E. Shumway,Gary E Rodrick,2009-01-28 Shellfish are a very popular and nutritious food source worldwide and their consumption has risen dramatically Because of their unique nature as compared to beef and poultry shellfish have their own distinct aspects of harvest processing and handling Edited by leading authorities in the field this collection of review papers discusses issues of current interest and outlines steps that can be taken by the shellfish industry to improve shellfish safety and eating quality Opening chapters provide an overview of the key issues associated with microbial and biotoxin contamination Parts two and three then address in more detail methods to improve molluscan shellfish and crustacean quality and safety Chapters focus on detection of algal toxins monitoring and mitigation of the effects of harmful algal blooms metals and organic contaminants biofouling disease control and selective breeding Part four reviews legislation regulation public confidence in shellfish and risk management Chapters on post harvest issues such as depuration storage and packaging complete the volume With its distinguished editors and international team of experts Shellfish safety and quality is an essential reference for those in the shellfish industry managers policymakers and academics in the field Reviews the latest research on significant hazards such as microbial and biotoxin contamination Discusses effective management of shellfish safety and quality including emerging methods Examines improved packaging methods      **The Shrimp Book II** Victoria Alday-Sanz,2021-12-31 As the world's population continues to grow so does the demand for seafood Technological advances have enabled shrimp farming to change from traditional small scale businesses into a global industry This has contributed to problems with serious disease outbreaks which have already caused several regional wipe outs of farm shrimp populations The shrimp farming industry continues to grow and there is a need for a source of reliable and detailed information on shrimp farming best practice and new developments aimed at the shrimp industry to facilitate future sustainable growth of the industry The Shrimp Book published in 2010 was written from the academic perspective The Shrimp Book II's focus is towards the industry perspective 5m Books      **Marker-assisted Selection** Food and Agriculture Organization of the United Nations,2007-01-01 A comprehensive description and assessment of the use of marker assisted selection for increasing the rate of genetic gain in crops livestock forestry and fish including the related policy FAO's tradition of dealing with issues of importance to agricultural and economic development in a multidisciplinary and cross sectoral manner      NOAA Technical Report NMFS. ,1984      **Development of Aquatic Animal Genetic Improvement and Dissemination Programs** ,2006

**Breakthroughs in Fisheries and Aquaculture** Gaurav Shekhar, 2025-02-20 Breakthroughs in Fisheries and Aquaculture Genetics and Biotechnology is a groundbreaking exploration into the dynamic and evolving world of aquatic science. This comprehensive book presents the latest developments, innovations, and sustainable practices in fisheries and aquaculture, serving as an essential resource for researchers, practitioners, and enthusiasts. Delve into cutting-edge research with insights into emerging technologies, methodologies, and scientific breakthroughs reshaping the landscape of fisheries and aquaculture. Discover sustainable practices from responsible aquaculture and ecosystem-based fisheries management to conservation initiatives ensuring the long-term health of aquatic ecosystems. Explore technological innovations like precision aquaculture, recirculating systems, and AI applications for fisheries monitoring and disease detection. Gain a global perspective through case studies and success stories highlighting shared challenges and collaborative efforts towards sustainable fisheries and aquaculture worldwide. The book integrates interdisciplinary insights from biology, ecology, engineering, economics, and social sciences, providing a holistic view of the field. Address the impacts of climate change with adaptive strategies, mitigation approaches, and the role of the blue economy in fostering resilience.

**Genomics in Aquaculture to Better Understand Species Biology and Accelerate Genetic Progress** José Manuel Yáñez, Ross Houston, Scott Newman, 2016-09-15 From a global perspective, aquaculture is an activity related to food production with large potential for growth. Considering a continuously growing population, the efficiency and sustainability of this activity will be crucial to meet the needs of protein for human consumption in the near future. However, for continuous enhancement of the culture of both fish and shellfish, there are still challenges to overcome, mostly related to the biology of the cultured species and their interaction with increasingly changing environmental factors. Examples of these challenges include early sexual maturation, feed meal replacement, immune response to infectious diseases and parasites, and temperature and salinity tolerance. Moreover, it is estimated that less than 10% of the total aquaculture production in the world is based on populations genetically improved by means of artificial selection. Thus, there is considerable room for implementing breeding schemes aimed at improving productive traits having significant economic impact. By far, the most economically relevant trait is growth rate, which can be efficiently improved by conventional genetic selection, i.e., based on breeding values of selection candidates. However, there are other important traits that cannot be measured directly on selection candidates, such as resistance against infectious and parasitic agents and carcass quality traits, e.g., fillet yield and meat color. However, these traits can be more efficiently improved using molecular tools to assist breeding programs by means of marker-assisted selection, using a few markers explaining a high proportion of the trait variation, or genomic selection, using thousands of markers to estimate genomic breeding values. The development and implementation of new technologies applied to molecular biology and genomics, such as next-generation sequencing methods and high-throughput genotyping platforms, are allowing the rapid increase of availability of genomic resources in aquaculture species. These resources will provide powerful tools to

the research community and will aid in the determination of the genetic factors involved in several biological aspects of aquaculture species. In this regard it is important to establish discussion in terms of which strategies will be more efficient to solve the primary challenges that are affecting aquaculture systems around the world. The main objective of this Research Topic is to provide a forum to communicate recent research and implementation strategies in the use of genomics in aquaculture species with emphasis on 1 a better understanding of fish and shellfish biological processes having considerable impact on aquaculture systems and 2 the efficient incorporation of molecular information into breeding programs to accelerate genetic progress of economically relevant traits.

*Sea Cucumbers: The Sustainability of Emergent and Historical Resources* Pedro M. Félix, Christopher M. Pearce, Arnold Rakaj, Ana Pombo, 2025-03-13

Sea cucumbers are echinoderms with key ecological roles in marine ecosystems. They are fished worldwide as food and for their various nutraceutical and pharmacological properties. Over the years poorly managed fisheries in many countries have led to overexploitation and resulted in local population declines. Nonetheless sea cucumber demand shows an increasing trend and consequently fishing grounds have expanded to new regions targeting new species and aggravating the problem. It is important to acknowledge that present and future stock depletion is a reality under current exploitation conditions in many countries. Aquaculture can have a crucial role in supporting the conservation of natural resources through reduced fishing pressure and wild stock re seeding and thus help meet global sea cucumber demand. The historic low economic relevance of sea cucumbers in new fishing regions has left a knowledge gap regarding the biological and ecological aspects of species in those regions. Knowledge that is crucial for stock management and for developing appropriate rearing techniques. Successful approaches to the management of sea cucumbers need to incorporate robust management strategies and mitigation measures that include aquaculture options for potential restocking or for enhanced production potential. All these measures need to be developed, prepared and applied across diverse user groups. The global status and course of sea cucumber exploitation rationalizes the need for an increase in sea cucumber R D. Topics like population status, demographics, habitat preferences, distribution patterns, growth strategies, reproductive cycles and behavioural or life history traits are understudied but paramount for successful stock management and sustainable fisheries. Additionally the development of sea cucumber aquaculture as an alternative to fisheries to supply international markets has led to a plethora of recent research on the subject. Advances in the successful integration of deposit feeders such as sea cucumbers into rearing systems with organisms at other trophic levels in what is commonly known as Integrated Multi Trophic Aquaculture (IMTA) have occurred and offer the promise of more efficient and sustainable production methods. All these topics require novel research approaches for the validation and application of these methodologies.

*Fish Diseases* Galina Jeney, 2017-02-11

Fish Diseases: Prevention and Control Strategies provides essential information on disease prevention and treatment by the most experienced fish culturists in the industry. The book presents both traditional and novel methodologies of identifying and

addressing fish disease risk along with preventative and responsive insights to the challenges impacting fish production today Both specific vaccination and non specific immunostimulation approaches are explored from maintaining optimal environmental conditions to understanding how stressors in fish affect their immune system Includes relevant information on government restrictions on drug usage in aquaculture to address the strict demand for fish products free of pollutants antibiotics Presents best practices in fish farming to prevent disease and promote good health status and fish disease management Provides the most recent research on fish diseases prevention the pathogens most studied and options for methods of treatment

**Book of Abstracts of the 68th Annual Meeting of the European Federation of Animal Science** EAAP scientific committee,2023-09-04 This Book of Abstracts is the main publication of the 68th Annual Meeting of the European Federation of Animal Science EAAP It contains abstracts of the invited papers and contributed presentations of the sessions of EAAP s eleven Commissions Animal Genetics Animal Nutrition Animal Management and Health Animal Physiology Cattle Production Sheep and Goat Production Pig Production Horse Production and Livestock Farming Systems Insects and Precision Livestock Farming

**Success Factors for Fish Larval Production** Luis Conceicao,Amos Tandler,2018-03-19 A comprehensive and authoritative synthesis on the successful production of fish larvae Success Factors for Fish Larval Production is a vital resource that includes the most current understanding of larval biology in the context of larval production The text covers topics such as how external environmental and nutritional and internal molecular developmental physiological behavioral genetic factors interact in defining the phenotype and quality of fish larvae and juveniles The expert contributors review broodstock genetics and husbandry water quality larval nutrition and feeding growth physiology health metamorphosis underlying molecular mechanisms including epigenetics for development larval behavior and environmental conditions Compiled by members of a European Union funded consortium of top researchers Success Factors for Fish Larval Production provides a wide range of authoritative information for the aquaculture industry and academia In addition to a wealth of information the authors review research and commercially applicable larval quality indicators and predictors The successful production of good quality fish larvae is of vital importance for fish farming and stock enhancement of wild fisheries Includes contributions from a consortium of noted researchers and experts in the field Deals with on how to improve egg quality and larval production via broodstock management and nutrition Suggests ways to control the phenotype of juveniles and table size fish via manipulations of the conditions of larval rearing e g epigenetics Includes ideas for optimizing diet composition formulation and technology Integrates knowledge and practical experience in order to help advancing excellence in aquaculture Success Factors for Fish Larval Production offers fish biologists developmental biologists physiologists and zoologists the most current and reliable information on the topic All those working in fish aquaculture facilities and hatcheries in particular will find great interest to their commercial operations within this book

**Proceedings of a Workshop on the Development of a Genetic Improvement Program for African Catfish**

**Clarias Gariepinus** Raoul W. Ponzoni, 2008      Frontiers in Aquaculture Biotechnology W.S. Lakra, Mukunda Goswami, Vance L. Trudeau, 2022-11-26 Frontiers in Aquaculture Biotechnology presents a broad spectrum of topics covering different key aspects of aquaculture With the rising importance of aquaculture research evidence based information is integral in advancing this field This book provides a solid resource of information on DNA barcoding for fish species authentication and seafood labelling and cell culture including stem cell culture in vitro research using fish cell lines such as in vitro fish meat reproductive biotechnology including surrogate technology gene editing and genetically modified aquaculture species biofloc technology and omic technologies such as proteomics artificial intelligence and biobanking This book will be a valuable resource to students researchers and entrepreneurs interested in a better understanding of this emerging field of aquaculture Presents hot topic information such as cell line repositories for the conservation of important fish genetic resources Includes information on climate resilient production systems to improve fish production Provides the latest research on genome editing in aquaculture species

**The State of the World's Aquatic Genetic Resources for Food and Agriculture** Food and Agriculture Organization of the United Nations, 2019-07-24 The conservation sustainable use and development of aquatic genetic resources AqGR is critical to the future supply of fish The State of the World's Aquatic Genetic Resources for Food and Agriculture is the first ever global assessment of these resources with the scope of this first Report being limited to cultured AqGR and their wild relatives within national jurisdiction The Report draws on 92 reports from FAO member countries and five specially commissioned thematic background studies The reporting countries are responsible for 96 percent of global aquaculture production The Report sets the context with a review of the state of world's aquaculture and fisheries and includes overviews of the uses and exchanges of AqGR the drivers and trends impacting AqGR and the extent of ex situ and in situ conservation efforts The Report also investigates the roles of stakeholders in AqGR and the levels of activity in research education training and extension and reviews national policies and the levels of regional and international cooperation on AqGR Finally needs and challenges are assessed in the context of the findings from the data collected from the countries The Report represents a snapshot of the present status of AqGR and forms a valuable technical reference document particularly where it presents standardized key terminology and concepts

**Advances in Genetics** Theodore Friedmann, Jay C. Dunlap, Stephen F. Goodwin, 2012-09-27 The field of genetics is rapidly evolving and new medical breakthroughs are occurring as a result of advances in knowledge of genetics This series continually publishes important reviews of the broadest interest to geneticists and their colleagues in affiliated disciplines Includes methods for testing with ethical legal and social implications

*Looking Fish in the Eye - Cataract as a Problem in Fish Farming* Nina Peuhkuri, Nordic Council of Ministers, 2009 Increasing frequencies of cataracts i.e opacities in eye lens have been diagnosed in farmed salmonids during past years Cataracts have proven a pronounced problem in fish farming because it leads to reduced eyesight and even total blindness of the fish Norway has been leading research on cataracts



because of the economic significance of Atlantic salmon farming Other issues in respect of stocking and animal welfare have been considered There are still knowledge gaps on the causes of cataract as well as on its consequences Furthermore quantitative information on the severity of the problem is still largely lacking The report presents results from a number of case studies that have been conducted by the project group and collaborators The project has shown cataracts to be relatively common in all the six salmonid species included in surveys from Finland and Sweden The prevalence and severity coverage of eye lens were however variable often related to an exposure to *Diplostomum* spp parasites that use fish as their intermediate hosts The result contrasts with findings from Norway about the importance of nutritional imbalance and environmental abiotic factors in predisposing fish to cataract development

## Decoding **Selection And Breeding Programs In Aquaculture**: Revealing the Captivating Potential of Verbal Expression

In a time characterized by interconnectedness and an insatiable thirst for knowledge, the captivating potential of verbal expression has emerged as a formidable force. Its power to evoke sentiments, stimulate introspection, and incite profound transformations is genuinely awe-inspiring. Within the pages of "**Selection And Breeding Programs In Aquaculture**," a mesmerizing literary creation penned by way of a celebrated wordsmith, readers embark on an enlightening odyssey, unraveling the intricate significance of language and its enduring effect on our lives. In this appraisal, we shall explore the book's central themes, evaluate its distinctive writing style, and gauge its pervasive influence on the hearts and minds of its readership.

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