

Book of Abstracts
5th International Conference on Fisheries and
Aquaculture 2018
(ICFA 2018)

23rd and 24th August 2018

Colombo, Sri Lanka

Committee of the ICFA - 2018

The International Institute of Knowledge Management (TIKM)

Tel: +94(0) 11 3132827

info@tiikm.com

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Official website of the conference

www.aquaconference.com

Book of Abstracts of 5th International Conference on Fisheries and Aquaculture 2018
(ICFA 2018)

Edited by Prof. S.C. Jayamanne

ISBN 978-955-3605-06-1

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Published by The International Institute of Knowledge Management (TIIKM), No:
531/18, Kotte Road, Pitakotte ,10100, Sri Lanka

Tel: +94(0) 11 3098521

Fax: +94(0) 11 2873371

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MESSAGE FROM SUPPORTING MINISTRY ICFA 2018

I am happy to issue this message for the 5th ICFA Fisheries and Aquaculture Conference scheduled to be held in Colombo on 23rd August 2018. I appreciate the initiative take by the Conference Organizers to disseminate new knowledge generated by scientists on fisheries and aquaculture through this conference. As I understand this is the 5th of a consecutive series of annual conferences conducted for development of fisheries and aquaculture by this organization.

Fisheries and aquaculture are important economic activities that have a long tradition. Ensuring the sustainability of fisheries and aquaculture is essential for sustainable development of the economy of the country. Currently these industries contribute around 1.5 % to the GDP at current market prices, provide employment to around 600,000 persons, and support an export industry that earns around USD 250 million annually. The two industries also play important roles in achieving the targets, such as, no poverty, zero hunger, good health and well being, sustainability of life below water, etc. included in the 2030 UN Agenda for Sustainable Development adopted by the UN General Assembly in 2015. Sri Lanka has committed to implement the 2030 UN Agenda.

The country has further potential to develop fisheries and aquaculture within sustainable levels. To realize the potential, the Government has adopted a new fisheries and aquaculture policy, which is focused on sustainable development of resources with equitable distribution of benefits. The Policy envisages in creating a “blue economy” in the country by optimizing the use of ocean resources and establishing new marine industries.

To achieve the objectives of the new policy, undertaking research, and exchange and dissemination of the knowledge so generated is essential. Doing research and dissemination of information needs not be left alone to the Government. The private sector also has an important role to play in this regard. In this context, I appreciate the efforts taken by ICFA 2018 organizers to conduct this important international conference in Sri Lanka. I send my best wishes for a successful conference.

Send my best wishes for a successful conference.

Ms. Renuka Ekanayake

Secretary,

Ministry of Fisheries & Aquatic Resources Development and Rural Economy,
Sri Lanka.

MESSAGE FROM THE CO - HOSTING PARTNER ICFA 2018

On behalf of the ICFA-2018 organizing committee, I am honored and delighted to welcome you to the 5th International Conference on Fisheries and Aquaculture -2018, Sri Lanka. The theme this year is “Facing the Global Fisheries and Aquaculture Challenges” and the technical programme is enriched with two keynote speeches and three plenary speeches.

The Faculty of Animal Science and Export Agriculture offers a B. Sc. Degree on Aquatic Resources and Technology which shares similar interest with the conference theme “To promote effective gathering and dialogue among those involved in research and development activities in fisheries and aquatic resources nationally and internationally”.

Hence the University hosted the International Conference on Fisheries and Aquaculture, organized by the International Institute of Knowledge Management (TIKM) and the University hopes that the forum will make a platform for scientists and other personnel to discuss issues and policies related to development and conservation of aquatic resources. The University wish all the success for the conference which will be held in 23–24 August and wish to continue the collaborations with the TIKM.

Dr. Jayantha Lal Ratnasekera,
Vice Chancellor,
Uva Wellassa University,
Sri Lanka.

MESSAGE FROM CO – HOSTING PARTNER ICFA 2018

Building a scientific atmosphere can be done through the exchange of information on quality research results. Seminars and conferences are among the rides that can be done for it. Thus, the dissemination of research results with an international standard can also occur. It will be useful for researchers who do need the information. We on behalf of the University of Muhammadiyah Malang, Indonesia as the Co-Hosting partner of TIIKM ICFA 2018 congratulate on the international implementation of this conference.

We are confident that ICFA 2018 will work smoothly and successfully because TIIKM has an internationally recognized reputation. Therefore, as a Hosting partner in this conference, we would like to thank TIIKM for its trust for the second time to become an academic partner. Hopefully, in the future, TIIKM will be more successful and more produce scientific documents qualified.

Prof. Dr. Syamsul Arifin,
Vice Rector of Academic Affairs,
University of Muhammadiyah Malang,
Indonesia.

CONFERENCE CHAIR ICFA 2018



On behalf of the ICFA-2018 organizing committee, I am honored and delighted to welcome you to the 5th International Conference on Fisheries and Aquaculture - 2018, Sri Lanka.

The theme this year is “Facing the Global Fisheries and Aquaculture Challenges” and the technical programme is enriched with a keynote speech, a guest speech, 3 plenary speeches by the experts in the fields of Fisheries and Aquaculture. This year we received a total of 90 submissions from 17 countries; Australia, Bangladesh, China, Cote d’Ivoire, Egypt, Indonesia, India, Israel, Kenya, Nigeria, Pakistan, South Africa, South Korea, Sri Lanka, Thailand, Oman, Philippines. From these, 42 submissions have been accepted and have been divided into 8 thematic areas for Oral presentations and 06 were selected for poster presentations. The presentations cover many aspects in the field of Aquaculture and Fisheries opening eyes for the future development of the field.

We thank the authors who responded to our call for papers, the reviewers who ensured a very high quality program by their thorough and timely reviewing of the papers and the Organizing Committee members who have all worked extremely hard for the details of important aspects of the conference programs and social activities. The conference will fulfill our aim of promoting effective gathering and having a dialogue among those involved in research and development activities in fisheries and aquatic resources nationally and internationally and the proceedings will be published online with ISSN and best papers will have the opportunity to be published in supporting journals.

Congratulations TIIKM for a successful conference.

Professor S.C. Jayamanne,
Conference Chair ICFA 2018,
Dean/Animal Science and Export Agriculture,
Uva Wellassa University,
Sri Lanka.

PLENARY SPEECHES

	Aquatic Ecosystems and Anthropogenic Influence: A System Perspective	03
	<i>D. Wickramasinghe</i>	
	Application of Immunostimulants in Aquaculture	04
	<i>K. Marimuthu</i>	

ORAL PRESENTATIONS

AQUACULTURE ECONOMICS, AQUACULTURE ENGINEERING, CLIMATE CHANGE AND AQUATIC ECOSYSTEMS (A)

A1	01	Economical Analysis of Paddle Wheel and Spiral Aerators for Application in Aquaculture	07
		<i>S.M. Roy and B.C. Mal</i>	
A2	02	Modulation of Gut Microbiota, Immune Responses and Mucosal Parameters of Zebrafish by Dietary Supplementation of Chitosan Nanoparticles	08
		<i>H.P.S.U. Chandrarathna, S.H.S. Dananjaya, C. Nikapitiya, J. Lee and M. De Zoysa</i>	
A3	03	Assessment of Adaptation Measures of the Sundarban Mangrove Resource Users under Changing Climate in Southwestern Part of Bangladesh	09
		<i>S. Chakma, A.K. Paul and B.D. Mithun</i>	

AQUACULTURE DEVELOPMENT (B)

B1	04	Role of Aquatic Quarantine Facility (AQF) in Quarantining of <i>P. Vannamei</i> and Supplement for Steady Growth of Shrimp Production in India <i>O.C.S. Prem, V.R.K. Kanth, M.C. Remany, C. Daly, D. Kannan, E.S. Babu, K.L. Nararyana, K.S. Kumar, A.K. Panda and S. Kandan</i>	10
B2	05	Effect of Seasonal Changes in Breeding Performance of Genetically Improved Farmed Tilapia (GIFT) in India <i>P. Srinivasarao, A.B. Naidu, V. Mathews, U. Gunasekaran, M. Gnanavel, G. Senthil, A. Mandal and S. Kandan</i>	11
B3	06	Asian Seabass (<i>Lates calcarifer</i>) Culture in Earthen Pond in Three Phases <i>G.K. Dinakaran, V.S. Aravind, B. Suresh and S. Kandan</i>	12
B4	07	Four Rearing Systems for Mud Crab Larvae (<i>Scylla paramamosain</i>): A Comparison Based on Survival, Growth and Quality of Megalopa <i>Q.M. Ong and T.T.T. Ho</i>	13
B5	08	Selective Breeding and Broodstock Production of <i>Penaeus vannamei</i> : Experiences from a Collaborative Project in India <i>A. Kumar , S. Kumar, K. Aswini, A. Mandal, S. Kandan, D. Moss and S. Moss</i>	14
B6	09	Successful Seed Production from Natural Spawning of Silver Pompano (<i>Trachinotus blochii</i>) <i>G. C. Eapen , J.T. Varghese, K. Dhandapani, P.N. Damodar, T.V. Johny, P.S.S. Kumar, T.G.M. Kumar and S. Kandan</i>	15
B7	10	Skill Development Programme for Aquaculture by RGCA and its Impact in Diversified Aquaculture in India <i>N. Baburao, D.V.S.N. Raju, V.S. Arasu, V. Iyyappan, S. John and S. Kandan</i>	16
B8	11	Culture of Black Tiger Shrimp <i>Peneaus monodon</i> in Recirculation Aquaculture System (RAS) with Probiotics Application <i>M. Shailendar, D.T. Santhar, B. Srikanth, P. Bangarraju, G. Sivakrishna, K.P. Sarmal and D. Silambarasan</i>	17

B9	12	Dynamics of TAN, NO ₂ and NO ₃ against Temperature, Do and P ^H During Broodstock Development of Pacific White Leg Shrimp <i>Litopenaeus vannamei</i> in Recirculating Aquaculture System (RAS)	18
		<i>V. Laxmi, D.V.S.N. Raju, K. Anand, S. Kandan and T.G.M. Kumar</i>	
B10	13	Production of <i>Artemia</i> Cysts by Using High Saline Water in Earthen Ponds at Tuticorin, Southeast Coast of India	19
		<i>M.S. Kannan, S. Balachandar, S. Moovendhan and S. Kandan</i>	
B11	14	Mechanical Raker Designed by RGCA is a Boon for Intensive <i>Artemia</i> Farming	20
		<i>M.S. Kannan, S. Moovendhan, S. Balachandar and S. Kandan</i>	
B12	15	Nursery Rearing of Mangrove Mud Crab (<i>Scylla Serrata</i>) in Earthen Ponds	21
		<i>B. Suresh, G.K. Dinakaran, V.S. Aravind and S. Kandan</i>	
B13	16	Relationship of Fecundity to Length and Weight of Wild Caught Tiger Shrimp <i>Penaeus monodon</i> from Andaman Nicobar Islands Coast, India	22
		<i>S. Nagaraj, B. Srikanth, M. Shailendar, S. Kishore, K.P. Sarmal, D.T. Santhar and S. Kandan</i>	

POLLUTION AND WASTE MANAGEMENT IN AQUATIC ECOSYSTEMS (C)

C1	17	Study on Microplastic Accumulation Levels in Selected Invertebrates along Western Coastal Belt of Sri Lanka	23
		<i>T.O.H. Perera, G.G.N. Thushari, J.D.M. Senevirathna and S.C. Jayamanne</i>	
C2	18	Study on Applicability of Giant Salvinia (<i>Salvinia Molesta</i>) and Blue Swimming Crab (<i>Portunus pelagicus</i>) Shells for Heavy Metal Removal in Wastewater	24
		<i>U.S. Samarasinghe, A.P. Abeygunawardana, J.D.M. Senevirathna, G.G.N. Thushari and N.P.P. Liyanage</i>	
C3	19	Investigation of Vulnerabilities and Capacities for Natural Coastal Hazards in Negambo D.S.	25
		<i>M.M.S.S.M. Fernando, K.W. Indika and D. Wickramasinghe</i>	

C4	20	Identification of Sources of Coastal Debris Accumulation along the Western Coastal Belt of Sri Lanka: Preliminary Approach toward the Coastal Zone Management	26
		<i>T.O.H. Perera, G.G.N. Thushari, J.M.D.R. Jayawardana, J.D.M. Senevirathna and S.C. Jayamanne</i>	

BIOTECHNOLOGY, GENETICS AND ENVIRONMENTAL IMPACTS ON AQUACULTURE (D)

D1	21	Genotype by Environment (GXE) Interaction for Growth Traits in 4 Generations Post Selection Climbing Perch <i>Anabas testudineus</i> (Bloch, 1792) in 8 Farms of Thailand	27
		<i>J. Duangwongsa, S. Leesanga, S. Jul-a-dung, M. Tipbunpot, T. Ungsethaphand and P. Akaboot</i>	
D2	22	Development of PCR-RFLP Markers for Tilapia Fish Identification and Authentication	28
		<i>E. Anandajothi, M. Santhiya, L. Ruban, K.M. Anjali, A. Mandal and S. Kandan</i>	
D3	23	Contemplating Enzymatic Profile (LDH, CPK, SGPT, ALK PHOSP) of Fresh Water Fish, Grass Carp (<i>Ctenopharyngodon idella</i>) under Toxicological Impinge of Atrazine (Herbicide)	29
		<i>A. Khan, N. Shah, M. Adnan, S.M. Jawad and A.M. Yousafzai</i>	
D4	24	Regulating Aquaculture in Sri Lanka: A Critical Evaluation of the Environmental Impact Assessment and Suggestions for Reform	30
		<i>A.H.M.D.L. Abeyrathna</i>	

FISHERIES MANAGEMENT (E)

E1	25	Factors Influencing Catching of <i>Macrobrachium rosenbergii</i> (De Man, 1879): A Case Study in Five Perennial Reservoirs in Northern Province, Sri Lanka	31
		<i>R. Rajeevan, U. Edirisinghe and A.R.S.B. Athauda</i>	

E2	26	To Fish or Not to Fish-Opportunities and Constraints to Youth Involvement in Aquaculture and Capture Fisheries	32
		<i>I. Arulingam, L. Nigussie, L. Debevec and S.S. Sellamuttu</i>	
E3	27	Long Run versus Short Run Estimates of Sustainable Yield: A Case of Small-Scale Demersal Fisheries in Oman	33
		<i>J.B. Yousuf and S. Bose</i>	

BIOLOGY, IMMUNOLOGY AND PHYSIOLOGY OF AQUATIC ORGANISM (F)

F1	28	Hematological Variations in Catfish <i>Rita rita</i> from Indus River Near Jamshoro, Sindh, Pakistan	34
		<i>S. Jalbani, N.T. Narejo, Y.M. Jalbani and A.S. Jatoi</i>	
F2	29	Annual Oogenesis of Female Swamp Eel, <i>Monopterus albus</i> (Zuiew, 1793) Broodstock, Khon Kaen, Thailand	35
		<i>S. Khajornkiat and P. Rakpong</i>	
F3	30	Comparative Study of Reproductive Biology of Vermiculated Sailfin Catfish <i>Pterygoplichthys disjunctivus</i> Weber 1991 (Family Loricariidae) in Victoria & Kalawewa Reservoirs in Sri Lanka	36
		<i>I.U. Wickramaratne</i>	
F4	31	Reproductive Performance of Asian Seabass (<i>Lates calcarifer</i>) with Recirculatory Aquaculture System	37
		<i>V.S. Arasu, S. Kandan, D.Y.S. Krishnamoorthy, Y.N. Swamy and M. Saravanan</i>	
F5	32	Relationship of Fecundity to Length and Weight of Wild Caught Tiger Shrimp <i>Penaeus monodon</i> from Andaman Nicobar Islands Coast, India	38
		<i>S. Nagaraj, B. Srikanth, M. Shailendar, B. Kishore, K.P. Sarmal, D.T. Santhar and S. Kandan</i>	

AQUACULTURE NUTRITION (G)

- | | | | |
|----|----|---|----|
| G1 | 33 | Growth, Serum Biochemical Response and Gut Health of Juvenile Barramundi <i>Lates calcarifer</i> Fed Fermented and Non-Fermented Poultry By-Product Meal Supplemented with Tuna Hydrolysate

<i>M.A.B. Siddik, R. Fotedar and J. Howieson</i> | 39 |
| G2 | 34 | Characterization and Classification of Proteases from the Digestive Organs in Different Sizes of Nile Tilapia (<i>Oreochromis niloticus</i> , L)

<i>T. Anukoolprasert, K. Srinuansom, T. Rukdontri, S. Nonkhukhetkhong and R. Petkam</i> | 40 |
| G3 | 35 | IMTA – Ulva and Periphyton as Plant-based Diets for <i>Siganus rivulatus</i> (Rabbit Fish) fingerlings

<i>R. Barkan and L. Guttman</i> | 41 |
| G4 | 36 | Suitability and Safety of the Protein Based Ingredients for Economical Feed Production for Asian Seabass (<i>Lates calcarifer</i>) in Sri Lanka

<i>G.S.C. Perera, D.M.S. Sugeeshwari, N.W.J.P. Kumara, A.J. Jayathissa and M. Indika</i> | 42 |
| G5 | 37 | Effect of Enriched Live Feed on Growth and Survival of Asian Seabass, <i>Lates calcarifer</i> (Bloch) Larvae

<i>Y. Narayanaswamy, M. Saravanan, D.Y.S. Krishnamoorthy, S. Kandan and V.S. Arasu</i> | 43 |
| G6 | 38 | Quality of Mangrove Crab (<i>Scylla serrata</i>) Broodstock Improves through Feeding Management

<i>K. Velmurugan, S. Viswanathan, S. Kandan, V.S. Arasu and M. Saravanan</i> | 44 |
| G7 | 39 | Effects of Linco-mycine and Phyto- additives <i>Allium cepa</i> & <i>Allium sativum</i> on Growth, Digestibility, Hematology, Body Composition & Enzyme Level of Juvenile <i>Labeo rohita</i> Using powdered vs. Pelleted Feed

<i>R. Iqbal</i> | 45 |

DISEASES IN AQUACULTURE AND AQUATIC HEALTH MANAGEMENT (H)

- H1 40 Immunostimulatory and Disease Resistance Potential of *Sargassum myriocystum* Methanol Extract on the Striped Murrel, *Channa striata* (Bloch) 46
S.K. Priyadarshini and R.D. Michael
- H2 41 The Specific Pathogen Free Sandworm (Polychaete: Nereididae) Farming in Thailand 47
S. Chunhabundit and T. Yeemin
- H3 42 Disease Survey of Cultured Shrimp *Litopenaues vannamei* in Nagapattinam District of Tamil Nadu, India 48
G. Sathiyaraj, B. Babu, S. Venu, K. Gayathri, S.D. Senthamil, K. Sinduja, R. Mithun, G. Satyaraj, K. K. Kannan, V.N. Biju, A. Mandal and S. Kandan

POSTER PRESENTATIONS (P)

- P1 43 CNPs for DNA Vaccine Delivery: Development of *Edwardsiella tarda* Flagellin DNA Vaccine Encapsulated CNPs 51
S.H.S. Dananjaya, C. Nikapitiya, H.P.S.U. Chandrarathna, J. Lee and M. De Zoysa
- P2 44 Exploration on Prevailing Diseases of Cage Cultured Asian Seabass (*Lates calcarifer*) Bloch in Western and North Western Provinces in Sri Lanka 52
A.D.W.R. Rajapakshe, R. Thanthriga, A.M.A.N. Adhikari and E.D.M. Epasinghe
- P3 45 Aspects of Tilapia Culture in Punjab, Pakistan 53
Z. Iqbal
- P4 46 Morphometric Variation among *Pterygoplichthys* Species in Victoria and Kalawewa Reservoirs, Sri Lanka 54
I.U. Wickramaratne

P5	47	Prevalence of Nematodes in Three Commercially Important Edible Marine Fish Species Reported from Pakistan	55
----	----	---	----

M. Ali and N. Afsar

PLENARY SPEECHES



**AQUATIC ECOSYSTEMS AND ANTHROPOGENIC INFLUENCE: A SYSTEM
PERSPECTIVE**

D. Wickramasinghe

University of Colombo, Sri Lanka

ABSTRACT

Aquatic ecosystems imply a holistic perspective with various biospheric, atmospheric and lithospheric interactions and influences that are of both natural and anthropogenic origin. Systems in nature are composed of many subsystems which are interconnected with and influenced by each other. Therefore, in the real world, it is impossible to understand such systems properly and managed effectively if they are considered of units with linear and unidirectional connections. This presentation describes a system dynamics model to demonstrate different possible feedback loops in a generalized aquatic ecosystem to highlight the impacts of anthropogenic drivers that include climate changes, pollution and habitat destruction. It also emphasizes the need of adopting “system thinking” in managing aquatic systems in order to achieve sustainable development.

APPLICATION OF IMMUNOSTIMULANTS IN AQUACULTURE

K. Marimuthu

Department of Biotechnology, Faculty of Applied Sciences, AIMST University, Malaysia

ABSTRACT

Globally fish culture is an important industry where the production of fish significantly increases every year. In intensive farming, stressors like overcrowding, transport, handling, size grading and poor water quality are common problems. The increased intensification of aquaculture has led to a high number of disease outbreaks with an increasing range of pathogens, resulting in high mortality and leading to great economic losses in aquaculture. It has been widely demonstrated that farmed fish are more susceptible to various pathogenic microbes. In order to improve health conditions of aquatic organisms, several technical strategies including improved husbandry, nutrition and better water quality, optimal stocking density and use of vaccines, probiotics, and immunostimulants have been proposed in recent years. Prophylaxis, based on sanitary isolation, is difficult to achieve and impractical due to the presence of other fish species, invertebrates or the water itself. Antibiotic therapy is a frequently used strategy in intensive rearing of fish but can result in enhanced microbial resistance, accumulation of residues in tissues and immuno-suppression in fish. Hence, the enhancement of the immune system of fish is considered the most promising method of preventing fish diseases in aquaculture. This enhancement can be achieved with the application of vaccines, which enhance the specific immune response of the fish and are considered to be the most effective agents. Further, the use of antibiotics and chemotherapeutics to combat fish diseases has several drawbacks such as the risk of generating resistant pathogens, bioaccumulation and environmental pollution. The available commercial vaccines are expensive for fish farmers and are specific against particular pathogens. In contrast to vaccines, immunostimulants enhance the non-specific immune response of fish. The use of immunostimulants as an alternative to the drugs, chemicals, and antibiotics which are currently being used to control fish diseases in aquaculture is attracting the attention of many farmers as well as researchers. The use of immunostimulants as dietary supplements can improve the innate defense of fish that providing resistance to pathogens in the periods of high stress during grading and reproduction. Several immunostimulants namely glucan, chitin, lactoferrin, levamisole and some medicinal plant extracts or biologically derived products have been used to control fish diseases. The major components of the innate immune system of fish are macrophages, monocytes, granulocytes and humoral elements, like lysozyme which are reported by many researchers in detail. Several biological and synthetic compounds have also been shown to enhance the nonspecific immune system of cultivated fish. In this context, numerous studies have focused on the use of medicinal plant products as potential therapeutic measures for modulating the immune response and are specifically to prevent and control fish diseases. This review will highlight the research being carried out on the utilization of animal and plant originated products or compounds that have been explored and shown to enhance the immune system of fish in aquaculture.

ORAL PRESENTATIONS



A1

[01]

**ECONOMICAL ANALYSIS OF PADDLE WHEEL AND SPIRAL AERATORS FOR
APPLICATION IN AQUACULTURE**

S.M. Roy¹ and B.C. Mal²

*¹Agricultural and Food Engineering Department, Indian Institute of Technology Kharagpur,
West Bengal, India*

²JIS University, West Bengal, India

ABSTRACT

Aeration cost is one of the most important parameters for an intensive aquaculture system. Over the years, different types of aerators have been developed specifically to enhance the production of aquatic species. As paddle wheel and spiral aerators are most commonly used in aquaculture, an economic analysis of these two aerators for different rotational speeds were carried out. Aeration cost includes capital cost, depreciation cost, electricity and labour costs. The performances of paddle wheel and spiral aerators were compared in terms of standard aeration efficiency (SAE). An economic analysis was performed assuming typical Indian major carp (IMC) culture ponds to determine the optimum rotational speed of the aerators at which the aeration cost is minimized for different pond sizes and initial dissolved oxygen concentration present in the pond. The result shows that for a typical Indian major carp (IMC) culture pond, the minimum aeration cost is achievable when rotational speed of the paddle wheel aerator is 80 rpm for pond volumes up to 700 m³ and for spiral aerator the value is 70 rpm for the same pond volumes. The optimum speed ranges from 120 to 220 rpm for pond volumes of more than 700 m³ for both the aerators.

A2

[02]

MODULATION OF GUT MICROBIOTA, IMMUNE RESPONSES AND MUCOSAL PARAMETERS OF ZEBRAFISH BY DIETARY SUPPLEMENTATION OF CHITOSAN NANOPARTICLES

H.P.S.U. Chandrarathna¹, S.H.S. Dananjaya¹, C. Nikapitiya², J. Lee² and M. De Zoysa¹

¹*College of Veterinary Medicine, Chungnam National University, Yuseong-gu, Daejeon, Republic of Korea*

²*Department of Marine Life Sciences, Jeju National University, Jeju Self-Governing Province, Republic of Korea*

ABSTRACT

In this study, metagenomics based approach was successfully applied to analyze the effects of CNPs (2% and 4%) incorporated diet on gut microbial profile, goblet cell density, gut morphometry and mRNA expression of immune related genes in zebrafish (*Danio rerio*). Metagenomics analysis showed clear change in composition of gut microbiota, especially increasing of phylum Fusobacteria and reduction of Proteobacteria in CNPs fed fish compared to control group. Moreover, notable increase in beneficial bacterial families such as Bifidobacterium and Lactobacillus were observed in 2% CNPs fed group. However, relative abundance of Aeromonadaceae and Mycoplasmataceae families were decreased in 4% CNPs fed fish. Total goblet cell density was significantly increased in CNPs supplemented group, indicating enhanced immune function in the gut. Furthermore, mRNA expression of immune related genes (*tlr2*, *tlr4*, *cxcl-18b*, *ccl-34a.4*, *mhc11*, *cd8a* and *iNOS*) was significantly induced in both gut and kidney of CNPs supplemented fish, compared to that of control. The CNPs supplemented zebrafish showed higher survival rate against pathogenic *Edwardsiella tarda* challenge. Therefore, the current study revealed that CNPs supplemented diet may enhance the hosts immunity and overall performance of gut through modulating gut microbial community, increasing the total goblet cell density as well as inducing transcriptional responses of immune related genes.

Keywords: Gut Microbiota, Metagenomics, Zebrafish, Immune Responses, Goblet Cells

A3

[03]

**ASSESSMENT OF ADAPTATION MEASURES OF THE SUNDARBAN
MANGROVE RESOURCE USERS UNDER CHANGING CLIMATE IN
SOUTHWESTERN PART OF BANGLADESH**

S. Chakma ¹, A.K. Paul ² and B.D. Mithun¹

¹Patuakhali Science and Technology University, India

²Chhuya Agro Products Ltd, India

ABSTRACT

An attempt was made to perceive the adaptation measures of the Sundarban mangrove resource users under changing climate. About 150 respondents were randomly selected from Sundarban west, Shyamnagar upazila, Satkhira from July 2013 to March 2014. They mentioned that the abundance of fishes, fuel woods, honey, golpata and shrimp PL was reduced considerably since few years ago. The resource users adapt themselves by changing their occupation (29.3 %) and 3.3 % respondents were almost work less, depend on other people of their family. Among the 29.3% occupation changed people, 6.7 % is day labor, 4.7 % brick worker, 4 % motor cycle driver, 3.3 % patty business, 3.3 % building maker, 2.7 % construction worker, 2.7 % carpenter and 2.0 % fish farmer. About 2.7 % people mentioned that their families members migrate towards town, 10 % people produce saline tolerant rice (BARI dhan 40, 41, BINA Dhan 7), fish (Tilapia, koi), carrot, sugar beat. About 10.7 % respondents are engaged in golpata collection, 8 %, 7.3 %, 6 % and 5.3 % respondent is engaged in PL collection, honey collection, shrimp culture and wood collection respectively. About 36 %, 33.3 %, 17.4 %, 11.3 % and 2 % resource users followed the above adaptation mechanism to adapt cyclone, flood, salinity intrusion, river erosion and drought respectively. The study mentioned the climate hazards and ongoing adaptation measures of the Sundarban mangrove resource dependent peoples with climate change.

Keywords: Sundarban, Fisheries, Natural Disasters, Occupational Changes, Climate Change

B1

[04]

ROLE OF AQUATIC QUARANTINE FACILITY (AQF) IN QUARANTINING OF *P. Vannamei* AND SUPPLEMENT FOR STEADY GROWTH OF SHRIMP PRODUCTION IN INDIA

O.C.S. Prem¹, V.R.K. Kanth¹, M.C. Remany¹, C. Daly¹, D. Kannan¹, E.S. Babu¹, K.L. Nararyana¹, K.S. Kumar¹, A.K. Panda¹ and S. Kandan²

¹*Aquatic Quarantine Facility for L. vannamei, Rajiv Gandhi Centre for Aquaculture, MPEDA (Ministry of Commerce and Industry, Govt. of India), Tamil Nadu, India*

²*Rajiv Gandhi Centre for Aquaculture, MPEDA (Ministry of Commerce and Industry, Govt. of India), Tamil Nadu, India*

ABSTRACT

India is the top shrimp producing country in the world in the year 2016-17 due to *L. vannamei* which is an exotic species introduced in India through stringent quarantining method. MPEDA has established Aquatic Quarantine Facility (AQF) for *L. vannamei* in the year 2009 and it is being operated by the Rajiv Gandhi Centre for Aquaculture, the R & D arm of Marine Products Export Development Authority, Govt. of India, located at Chennai and working under the guidelines of DADF, MOA, Govt. of India. The facility is established with 20 cubicles capacity of quarantining 4,12,500 nos of brooders per annum and above 10 lakhs brooders have been quarantined with a survival rate of >94%. The facility screens for 7 OIE & SOP listed pathogens - White Spot Syndrome Virus, Infectious Hypodermal and Haematopoietic Necrosis Virus, Necrotizing Hepatopancreatitis Proteo-Bacterium, Yellow Head Virus/Gill Associated Virus, Taura Syndrome Virus, Infectious Myonecrosis Virus & Acute Hepatopancreatic Necrosis Disease to ensure the SPF status. During a quarantine period of 9 years only a single lot was detected the presence of Infectious Hypodermal Haematopoietic Necrosis Virus and was confirmed by both nested and qPCR. The paper highlights the crucial role done by AQF for sustaining the shrimp sector by adopting stringent biosecurity measures.

Keywords: quarantine, cubicle, broodstock, aquatic quarantine facility, specific pathogen free, PCR

B2

[05]

**EFFECT OF SEASONAL CHANGES IN BREEDING PERFORMANCE OF
GENETICALLY IMPROVED FARMED TILAPIA (GIFT) IN INDIA**

P. Srinivasarao, A.B. Naidu, V. Mathews, U. Gunasekaran, M. Gnanavel, G. Senthil,
A. Mandal and S. Kandan

*Rajiv Gandhi Centre for Aquaculture, Tilapia Project, Manikonda Village, Krishna District
Andhra Pradesh, India*

ABSTRACT

The study was undertaken at GIFT tilapia project site of MPEDA-Rajiv Gandhi Centre for Aquaculture located at Manikonda village (LAT/LONG) of Krishna District, Andhra Pradesh for a period of 7 years from 2011 to 2017. The fishes were maintained in 20 mesh poly propylene net (10m x 3m x 1m) in earthen pond (2.5 acre). The stocking density and sex ratio, were 1.5 fish/m² and 1:2 male:female, respectively. Periodical sampling was done to estimate the fecundity and the collected eggs were kept in controlled environment to assess the hatchability. The analysis showed that, peak breeding performance, in terms of fecundity rate and hatchability, during November to January coinciding with low temperature (24-26 °C) and no spawning was noticed during April to June corresponding to high temperature.

Keywords: GIFT Tilapia, Seasonal Variation, Breeding Performance, Fecundity, Hatchability

B3

[06]

ASIAN SEABASS (*Lates calcarifer*) CULTURE IN EARTHEN POND IN THREE PHASES

G.K. Dinakaran, V.S. Aravind, B. Suresh and S. Kandan

Seabass and Mud Crab Demo Farm Facility, Karaikal, Rajiv Gandhi Centre for Aquaculture, MPEDA (Ministry of Commerce and Industry, Govt. of India), Tamil Nadu, India

ABSTRACT

The Asian seabass is the best candidate species for culturing in any bio categories. RGCA is involving in research in Asian seabass seed production and culture in commercial mode under diversified aquaculture programme for the past 17 years. As a part of research activities the seabass culture was done in three phases: nursery, pre-grow out and grow out culture to attain the maximum survival rate and best growth. In nursery phase, 4581 no's of averaging 1.4 g were reared for 40days in which 98% survival obtained. In pre –grow out cages 4489 no's of 10.4 cm seabass fingerlings of 3.5 kg biomass were stocked in 2×2×1.3 cm size cages and fed with nursery pellet feed. Grading was done once in every 15-20 days to avoid the cannibalism up to 146 days. Then the seabass in the size range of 96 - 330 g were transferred in pre-grow out pens in earthen pond and floating pellet feed was continued up to 54 days. The size range was about 190 – 450 g in three pens. The fishes were then released by opening the pen in to the open grow out pond and continued the culture for 189 days with pellet feed. During harvest, 3511 nos of fishes were above 1 kg (total weight 4501.5 kg), 771 no's of fish 0.5 kg above (642.1 kg) and 140 no of fishes were below 0.5 kg (67.9 kg) and all together 5211.5 kg were harvested with 98.5% survival. This result is encouraging that the nursery phase is very essential for finfishes and the three phase method is highly recommended one for marginal farmers in the earthen pond rather than cage culture which involves more cost.

Keywords: seabass, cannibalism, grading, pellet feed, phase culture

B4

[07]

**FOUR REARING SYSTEMS FOR MUD CRAB LARVAE (*Scylla paramamosain*): A
COMPARISON BASED ON SURVIVAL, GROWTH AND QUALITY OF
MEGALOPA**

Q.M. Ong¹ and T.T.T. Ho²

*¹School of Molecular and Life Science, Curtin University, Kent Street, Bentley, Perth,
Australia*

*²Department of Aquaculture, Faculty of Fisheries, Nong Lam University, Linh Trung Ward,
Vietnam*

ABSTRACT

This study was aimed to compare four rearing systems including clear water (control), green water, recirculating water and biofloc water systems for mud crab (*Scylla paramamosain*) larvae. Twelve 60-L plastic buckets filled with 50 L of disinfected seawater were stocked at 20 larvae L⁻¹. The larvae were fed both probiotics-enriched L-strain rotifers (*Brachionus plicatilis*) and probiotic-enriched *Artemia* (*Artemia franciscana*). The water quality parameters in all rearing systems during the experimental period were within the normal range for crab larval development. After 24 days of culture, green water system had increased survival of mud crab megalopa than the rest of the systems. While survival of megalopa reared under biofloc water system did not differ from those reared under the control (clear water system) but both these systems reached higher survival of megalopa than the recirculating water system. However, growth performance of megalopa were not affected by various rearing systems. In addition, newly moulted megalopa collected from these systems were independently exposed to 48h-LC₅₀ value of ammonia-N and air during 48 hours of transport, and survival after a stress test was considered as an indicator of larval quality. Ammonia stress test did not show any significant differences, but transport stress test did, in which high survival of megalopa obtained in the green water system. Therefore, green water system is recommend for rearing commercial mud crab larvae from Z1 to megalopa stage.

Keywords: Mud Crab, *Scylla paramamosain*, Green Water, Recirculating Water, Biofloc Water, Hatchery

B5

[08]

SELECTIVE BREEDING AND BROODSTOCK PRODUCTION OF *Penaeus vannamei*: EXPERIENCES FROM A COLLABORATIVE PROJECT IN INDIA

A. Kumar¹, S. Kumar¹, K. Aswini¹, A. Mandal¹, S. Kandan¹, D. Moss² and S. Moss²

¹ *Rajiv Gandhi Centre for Aquaculture, Marine Products Export Development Authority,
Govt. of India, Tamil Nadu, India*

² *Oceanic Institute of Hawaii Pacific University, Waimanalo, USA*

ABSTRACT

The ultimate goal of any selective breeding program is to improve production efficiency (e.g. faster growth, higher survival, etc.) of the target species. This is done by making the target species better adapted to the farming environment (referred to as domestication) and by improving commercially important traits. For the current global shrimp farming industry, the “perfect” shrimp is one that is Specific Pathogen Free (SPF), exhibits good nauplii and postlarvae production in the hatchery, grows fast and uniformly on the farm, is highly resistant/tolerant of all known shrimp pathogens, is tolerant of a wide range of environmental and farming conditions, and is tolerant of large, short-term environmental fluctuations. Due to the myriad of different farming practices/environments, difference in disease prevalence across regions, and industry preferences (growth vs survival, etc.), this perfect shrimp does not currently exist, nor will it in the future, despite the best efforts of breeders. In this context, the Marine Products Export Development Authority (MPEDA; Government of India)-RGCA and Oceanic Institute of Hawaii Pacific University (OI) initiated a project to develop a “customized” line of *Penaeus vannamei* selected for the traits of interest to the Indian shrimp farming industry. This program uses a family selection approach, with multiple cohorts of families being evaluated on commercial farms in India each year. Performance data is then used at a Nucleus Breeding Center (NBC) located at OI to select families for breeding: (1) to produce the next generation of families, and (2) to produce germplasm for broodstock production. A highly biosecure, Broodstock Multiplication Center (BMC) was constructed and this facility has remained disease free for the entirety of the project. The breeding program has consistently obtained improvements of 5% per generation for growth and, to date, the BMC has distributed 1, 63, 676 no. of SPF *P. vannamei* broodstock to the Indian industry.

Keywords: Broodstock, Selective breeding, Broodstock production, Specific Pathogen Free stock, Germplasm

B6

[09]

**SUCCESSFUL SEED PRODUCTION FROM NATURAL SPAWNING OF SILVER
POMPANO (*Trachinotus blochii*)**

G. C. Eapen, J. T. Varghese, K. Dhandapani, P.N. Damodar, T.V. Johny, P.S.S.
Kumar, T.G.M. Kumar and S. Kandan

*Marine Finfish Hatchery Project, Rajiv Gandhi Centre for Aquaculture (RGCA), (MPEDA,
Ministry of Commerce and Industry, Govt. of India), Kerala, India*

ABSTRACT

Successful seed production of Silver pompano Pompano (*Trachinotus blochii*) in captivity has been achieved in RGCA Marine Finfish Hatchery, Trivandrum. The Silver pompano juveniles collected from wild were domesticated, matured and after quarantine shifted to brood stock-spawning section of the hatchery. The fishes were stocked in a ratio of 1:2 in flow through of 25 ± 3 ppt water with a temperature range of 27.2 to 30.3oC. The roof of the brood stock-spawning section allows sunlight and moonlight penetration through polycarbonate transparent roofing sheets. Natural day lengths have been provided along with a prototype moonlight simulator at a height of 3.84 mtrs from the floor providing an illumination of 8.80 lux. The water quality parameters in the tanks, lunar illumination and day length in the area were measured and recorded. 12 natural spawning events occurred from thereafter and a total of 163026 marketable size fingerlings from these natural spawning has been produced and the mechanisms/parameters involved in triggering the natural spawning were analyzed.

The study revealed that Silver pompano will spawn even at a salinity range of 22 to 25 ppt .Natural spawning in Silver pompano is greatly limited to April, May and June in Southern Indian conditions due to the extended day lengths and the optimum water temperature 28.15 to 30.3oC. Lunar illumination does not possess a direct impact on induction of natural spawning. The study showed that only 1 pair in a spawning tank of multiple individuals will engage in spawning during a given day and suppresses the others. The study revealed that natural spawning cycles of Silver pompano follows the lunar phases but the triggering of the natural spawning is mainly contributed by extended day length than lunar light and the lux of 8.80 lx illumination is an essential limiting factor for the event. The study also revealed that natural spawning in Silver pompano can be induced by photo-thermal manipulation using moon-light simulator and provision of extended day length simulations.

Keywords: Marine fish, Silver Pompano, *Trachinotus blochii*, brood stock, natural spawning, seed production, moonlight simulation, extended day length, photo-thermal manipulation

**SKILL DEVELOPMENT PROGRAMME FOR AQUACULTURE BY RGCA AND
ITS IMPACT IN DEVERSIIFIED AQUACULTURE IN INDIA**

N. Baburao¹, D.V.S.N. Raju¹, V.S. Arasu¹, V. Iyyappan¹, S. John¹ and S. Kandan¹

¹Rajiv Gandhi Centre for Aquaculture, Tamil Nadu, India

ABSTRACT

Rajiv Gandhi Centre for Aquaculture (RGCA) in Tamil Nadu, India has been engaged in disseminating the improved technologies developed for diversified aquaculture at its various projects to the Indian aquaculture sector for over one decade. Indian aquaculture is shrimp centric. This study was carried out to assess the impacts of trainings provided by RGCA in diversified aquaculture and for improvement of livelihoods of marginal fish farmers. Trainings were provided in batches and in hands-on mode. Each batch was consisted of maximum of 20 participants to provide more practical exposures to the trainees. Nearly 150 batches were trained and more than 2000 participants were benefitted. Mangrove mud crab aquaculture is playing a pivotal role in diversification of Indian fisheries sector and benefitting marginal farmers. Till now 55 batches of mud crab aquaculture training completed and 730 farmers being benefitted. Through 46 training programmes, more than 530 participants received the know-how for best husbandry practices for Asian seabass. 400 farmers and entrepreneurs got hands on exposure through 32 training programmes to know the breeding, seed production and grow out farming of Genetically Improved Farmed Tilapia (GIFT). The paper provided details on other training programmes conducting by RGCA like open sea cage farming of Cobia, Artemia cyst & biomass production in land based aquaculture systems, live feed culture for hatchery operations, shrimp disease diagnosis and application of molecular markers in fisheries and aquaculture management etc. and discuss about their significant impact on Indian aquaculture sector.

Key words: diversified aquaculture, sustainable aquaculture production, marginal farmers, impact of hands-on trainings

B8

[11]

**CULTURE OF BLACK TIGER SHRIMP *Peneaus monodon* IN RECIRCULATION
AQUACULTURE SYSTEM (RAS) WITH PROBIOTICS APPLICATION**

M. Shailendar, D.T. Santhar, B. Srikanth, P. Bangarraju, G. Sivakrishna, K.P. Sarmal and
D. Silambarasan

*Domestication of Tiger Shrimp Project, Rajiv Gandhi Centre for Aquaculture, (MPEDA, Min
of Commerce and Industry, Govt. of India), Kodyyaghat, India*

ABSTRACT

RGCA's Domestication of Tiger Shrimp Project conducted twenty weeks trial culture to assess the growth of *Penaeus monodon* in raceway tank connected with Recirculation Aquaculture System (RAS) in Andaman & Nicobar Islands. Shrimp juveniles of *P. monodon* (17.05 ± 2.5 g) were stocked in two numbers of 100 ton raceway tanks with density of 05 numbers per m². The commercial probiotics; Bactocel Aqua-100 and Sanolife Pro-W were used during the culture period. After 15 weeks, no significant differences were found in mean dissolved oxygen, temperature, salinity, pH, total heterotrophic bacterial count, survival and final weight gained between the raceway tanks when compared with control. It was observed that during the culture period, addition of probiotics had significantly increased the shrimp growth in raceway tanks connected with RAS. Bactocel Aqua-100 addition was based on a percentage of the daily feed demand and application rate was 20% of total daily feed whereas the Sanolife Pro-W was applied during water exchange and the dosage rate was restricted to 2%.

Keywords: Juvenile Shrimps, *Penaeus monodon*, Probiotics, RAS, Bacterial Growth

B9

[12]

**DYNAMICS OF TAN, NO₂ AND NO₃ AGAINST TEMPERATURE, DO AND P^H
DURING BROODSTOCK DEVELOPMENT OF PACIFIC WHITE LEG SHRIMP
Litopenaeus vannamei IN RECIRCULATING AQUACULTURE SYSTEM (RAS)**

V. Laxmi¹, D.V.S.N. Raju¹, K. Anand¹, S. Kandan¹ and T.G.M. Kumar¹

¹Rajiv Gandhi Centre for Aquaculture, Marine Products Export Development Authority,
Govt. of India, LvMC, India

ABSTRACT

This paper describes the broodstock multiplication of Specific Pathogen Free (SPF) Pacific white leg shrimp *Litopenaeus vannamei* with special reference to the dynamics of toxic nitrogen metabolites produced in the rearing system during the studies conducted at *Litopenaeus vannamei* Multiplication Centre (Lv MC) of Rajiv Gandhi Centre for Aquaculture (MPEDA, Govt. of India). The aim of the study was to compare the dynamics of nitrogen metabolites produced during the rearing of post larvae of 20 to 70 mg up to 20 gm broodstock stage in RAS system, their removal with the help of bioreactors through biological nitrification process and influence of temperature, P^H and DO on the dynamic process. Efficiency of this cyclic procedure greatly influences the growth, survival and food conversion ratio (FCR) of the broodstock. Survival rates and growth obtained during the production of various batches of broodstock were discussed in this paper with the back drop of the quantities of nitrogen metabolites recorded during the study. The observations made through this study are useful in designing intensive broodstock production and supply system to meet the increasing demand of *L. vannamei* broodstock in India or elsewhere.

Keywords: Broodstock, Recirculating Aquaculture System, Biological Nitrification, Nitrogen Metabolites

Abbreviations: TAN - total ammonia nitrogen, NO₂- Nitrite, NO₃- Nitrate, DO- dissolved oxygen

B10

[13]

**PRODUCTION OF ARTEMIA CYSTS BY USING HIGH SALINE WATER IN
EARTHEN PONDS AT TUTICORIN, SOUTHEAST COAST OF INDIA**

M.S. Kannan, S. Balachandar, S. Moovendhan and S. Kandan

Rajiv Gandhi Centre for Aquaculture, Sirkali, Tamil Nadu, India

ABSTRACT

This paper briefly describes about experiences and findings in the development of technology for the production of Artemia in well designed and constructed earthen ponds by using high saline ground water. There has been a huge demand (250 to 300 tons of cysts/year) of Artemia cysts required to meet the requisites of more than 300 registered hatcheries in India. Rajiv Gandhi Centre for Aquaculture (RGCA) has established an Artemia production unit for the first time in India at Tharuvaikulam coastal village (Lat. 8° 44' 40.07''N; Long. 78° 07' 27.87''E) and started cyst production trials by October, 2007 with the prime objective to develop and standardize the technology for good quality Artemia cyst and biomass production on par with International standard. The Vinhchau (Vietnam) strain Artemia franciscana cysts has been selected for inoculation. Artemia attained adult stage in 10-12 days and initiated oviparous reproduction and subsequently reached to ovoviviparous reproduction in 13-15 days after inoculation. Surveillance study was conducted periodically to test that the farm produced cyst and biomass for free from WSSV or any other pathogens affects aquaculture sector especially shrimp seed production. Under optimal conditions, the Artemia cyst production attains 80-100 kg wet weight/ ha/ month. Sustaining this production in the coming years has become the prime important and key requisite for the global aquaculture industry. Due to high market demand and extensive farming of Litopenaeus vannamei, other finfish and shellfish seed production, it is highly essential to establish more Artemia cyst production unit along the coastal areas of India to fulfil the demand and self-sustainability in Artemia production.

Keywords: Artemia cyst, solar salt ponds, artemia culture

B11

[14]

**MECHANICAL RAKER DESIGNED BY RGCA IS A BOON FOR INTENSIVE
ARTEMIA FARMING**

M. S. Kannan, S. Moovendhan, S. Balachandar and S. Kandan

Rajiv Gandhi Centre for Aquaculture, Sirkali, Tamil Nadu, India

ABSTRACT

Artemia is an excellent live feed that has revolutionized aquaculture sector globally. Artemia used as prime food in the hatcheries of more than 85% of aquaculture species, mainly in shrimp hatcheries. Due to increasing demand of fast growing aquaculture sector, many countries like Viet Nam, Philippines, Egypt, Cuba, Bangladesh, Pakistan, Sri Lanka and India are involved in Artemia research and developed farming technology for the cyst production. Raking is one of the main pond management practices to avoid formation of algal mats called 'lab-lab' in Artemia farming. Contrary to fishponds, 'lab-lab' is undesirable in Artemia ponds and when it starts floating it can seriously affect the cyst harvesting of the cyst. Almost all over the world, raking is manually performed by dragging the chain raker and disturbing the pond bottom in Artemia ponds which is of course very labour intensive. To address this issue in raking, a simple cost effective mechanical raker was designed and successfully demonstrated in RGCA's Artemia Demonstration Farm, Uppoor, Ramanathapuram, Tamil Nadu, India. The device, mechanical raking systems help to keep the settled organic matters in suspension mode which is available as feed for Artemia as well as inorganic nutrients back into suspension for the development of algae within the Artemia ponds.

Keywords: Artemia culture, pond raking, mechanical raker

B12

[15]

NURSERY REARING OF MANGROVE MUD CRAB (*Scylla serrata*) IN EARTHEN PONDS

B. Suresh, G.K. Dinakaran, V.S. Aravind and S. Kandan

Seabass and Mud Crab Demo Farm Facility, Karaikal, Rajiv Gandhi Centre for Aquaculture, MPEDA (Ministry of Commerce and Industry, Govt. of India), Tamil Nadu, India

ABSTRACT

Scylla serrata commonly known as the mangrove mud crab or green crab, has a huge market demand all over the world, particularly in South East Asian countries. MPEDA-RGCA is involving in mud crab research for past 17 years and achieved 8% survival of crab instar production in hatchery which is against the global production of 3%. However the success of the grow-out is mainly lying on intensive nursery rearing. Of the several methods tried, the best one is: The crab instars of 0.3 - 0.5cm were transported in oxygenated bag from RGCA Mud crab hatchery and stocked in hapas (5×4×1 m) erected in the earthen pond. In each hapa 600 nos crab instars were stocked with 40% hideouts to avoid the cannibalism. The feed was given 100% of the body weight. The water quality parameters were monitored regularly at optimum level throughout the nursery rearing phase. After 15 days, 1st grading was done in which the survival rate was 80-90%. Restocking was done based on different size groups in different mess sized hapas. Second grading was done again after 15 days in which the survival obtained was 65-70% with size ranging of 1.6 - 2cm, 2.1 - 2.5cm and 2.6 - 3cm accordingly. After the nursery phase, the crab instar become crablet and synonymously known as 'match-box sized'. After attaining the size of the crablets, they were stocked in grow out pond directly for attaining marketable size (600 gm and above) with best survival rate and production.

Keywords: Crabinstar, hapa, crablets, cannibalism, hideouts

B13

[16]

**RELATIONSHIP OF FECUNDITY TO LENGTH AND WEIGHT OF WILD
CAUGHT TIGER SHRIMP *Penaeus monodon* FROM ANDAMAN NICOBAR
ISLANDS COAST, INDIA**

S. Nagaraj, B. Srikanth, M. Shailendar, S. Kishore, K.P. Sarmal, D.T. Santhar and S. Kandan

*Domestication of Tiger Shrimp Project, Rajiv Gandhi Centre for Aquaculture, (MPEDA, Min
of Commerce and Industry, Govt. of India), India*

ABSTRACT

Under domestication of black tiger shrimp project, RGCA is procuring matured shrimp broodstocks from various places of Andaman coastal waters to established Specific Pathogen Free (SPF) founder families. The present study analysed the relationship of broodstock fecundity of the indigenous species of tiger shrimp *P.monodon* to shrimp body weight (BW) and total length (TL).The ripened ovary tiger shrimp females were collected during the breeding season from July to September in three consecutive years and were examined. The total number of eggs in female was significantly varied among the size groups of the shrimps. In the minimum size group of shrimps (20-22 cm) having the mean fecundity was 551176.47 ± 46889.4 with a mean total body weight and length 110.12 ± 8.46 g and 20.32 ± 0.62 cm respectively. In maximum size class (24-26 cm) having the mean fecundity was 730784.70 ± 96277.66 with a BW and TL 138.01 ± 12.53 and 21.68 ± 0.6 respectively. The mean total number of eggs per female was increased with increasing length and weight. The maximum correlation co-efficient of total length and weight ($R^2=0.865$ and $R^2= 0.746$) value was recorded from size group (24-26 cm) and this R^2 indicate that the fecundity is linearly relation to the total length and weight of the shrimp.

Keywords: Fecundity, Length and Weight, *P.monodon*, Domestication

C1

[17]

**STUDY ON MICROPLASTIC ACCUMULATION LEVELS IN SELECTED
INVERTEBRATES ALONG WESTERN COASTAL BELT OF SRI LANKA**

T.O.H. Perera, G.G.N. Thushari, J.D.M. Senevirathna and S.C. Jayamanne

Department of Animal Science, Uva Wellassa University, Badulla, Sri Lanka

ABSTRACT

Coastal zone is polluted by different anthropogenic activities including coastal debris accumulation. Majority of coastal debris is composed of plastics which cause negative ecological and economic impacts. However limited literature records are available on effects of plastic pollution in western coastal belt of Sri Lanka. Thus, current study focused on investigation of microplastic accumulation rates in selected invertebrate species: Hooded Oyster - *Saccostrea cucullata*, Hard shelled mussel- *Mytilus coruscus* and Goose barnacles- *Lepas anserifera* of western coast in Sri Lanka. Selected invertebrates were sampled from Dehiwala and Mount-Lavinia coasts during September-November, 2017. Collected samples were subjected to chemical digestion process according to standard protocol for microplastic analysis. Hot needle test and Fourier Transfer Infrared (FTIR) spectroscopy were used for confirmation and identification of microplastic diversity in biota. According to the results, all biotic samples were affected by plastic pollution and average plastic contamination level ranged at 0.1-0.4 particles/g. Average microparticles contamination levels were highest in all invertebrate samples collected from Dehiwala beach (Hooded oyster: 0.47 particles/g, Mussels: 0.19 particles/g, Goose barnacles: 0.19 particles/g) compared to Mount-Lavinia. FTIR results revealed that Nylon fibers, Polyethylene and Styrofoam fragments were highly susceptible in accumulating in coastal invertebrates. Microplastic accumulation rate of biota is significantly varied with the feeding pattern of respective species and pollution level of sampling location ($p < 0.05$). Thus, Hooded oysters, Mussels and Goose barnacles act as indicator species in the coastal, intertidal habitats. Coastal management actions should be focused on controlling plastic pollution by recreational, fishing and domestic activities in Mount-Lavinia and Dehiwala coasts respectively.

Keywords: Coastal Zone Management, Coastal Invertebrates, Plastic Pollution, Microplastics Accumulation Level, Coastal Debris

C2

[18]

STUDY ON APPLICABILITY OF GIANT SALVINIA (*Salvinia molesta*) AND BLUE SWIMMING CRAB (*Portunus pelagicus*) SHELLS FOR HEAVY METAL REMOVAL IN WASTEWATER

U.S. Samarasinghe, A.P. Abeygunawardana, J.D.M. Senevirathna, G.G.N. Thushari and
N.P.P. Liyanage

*Department of Animal Science, Faculty of Animal Science & Export Agriculture, Uva
Wellassa University, Badulla, Sri Lanka*

ABSTRACT

Unsustainable anthropogenic activities cause discharging heavy metals directly or indirectly into the environment. Accordingly, heavy metal pollution has become a serious issue in aquatic ecosystems. Phytoremediation and biosorption act as effective and low-cost heavy metal treatment techniques in wastewater. Thus, current study focused on identification of application of Giant Salvinia (*Salviniamolesta*) and Blue Swimming Crab shell (*Portunus pelagicus*) wastes for integrated wastewater treatment. Ten integrated systems with pre-treated crab shell wastes and Salvinia (Ratios of shell powder: Salvinia- 2g/100g, 2g/200g, 4g/100g, 4g/200g, 6g/100g, 6g/200g, 8g/100g, 8g/200g, 10g/100g, 10g/200g) were used to test the removal efficiency of Cu, Cr and Cd (initial concentrations of each heavy metals: 0.5, 1.0, 1.5 mg/L) under similar experimental conditions for 4 days of retention period using Atomic Absorption Spectrometer. Final heavy metal levels ranged at (Cu -0.08-0.33 mg/L, Cr- 0.05-0.3 mg/L, Cd- 0.02- 0.25 mg/L) Best heavy metals removal efficiency was recorded for combined system with 4g of crab shell powder and 200 g of Salvinia at 0.5 mg/L of initial metal concentration (Cu- 85.25%, Cr- 90.15%, Cd- 96.10%). Key factors affecting on the significant heavy metal adsorption capacity are adsorbent dosage (plant weight and crab shell powder level), pH level, metal ion charge, ionic radius of metals and initial heavy metal concentration ($p < 0.05$). Salvinia is an Invasive Alien Species (IAS) in Sri Lanka and crab shells act as waste materials in seafood industry. Thus, this integrated waste water treatment system is useful in heavy metal removal in water, while controlling Salvinia abundance and accumulation of crab shell residues.

Keywords: Heavy Metal Removal Efficacy, Integrated Wastewater Treatment, Water Pollution, Biogenic Structures, Phytoremediation

C3

[19]

**INVESTIGATION OF VULNERABILITIES AND CAPACITIES FOR NATURAL
COASTAL HAZARDS IN NEGAMBO D.S.**

M.M.S.S.M. Fernando¹, K.W. Indika¹ and D. Wickramasinghe²

¹Institute of Human Resources and Advancement, University of Colombo, Sri Lanka

²Department of Zoology and Environmental Sciences, University of Colombo, Sri Lanka

ABSTRACT

This study was conducted to determine the vulnerabilities and capacities for natural coastal hazards (Tsunami, Cyclone, Flooding, Sea level rise and Salt water intrusion) of selected GN divisions of Negombo based on the standard set by UNHABITAT 2013. GIS data base was developed under three categories and was quantified to produce five Personal Profile indicators (PP), nine capacity indicators (CI) and ten vulnerability indicators (VI) and ranking of selected GNs was carried out. Pearson's Correlation Coefficient (PCC) values revealed an existence of positive moderate relationship between Educational level with Infrastructure and Cope up, Age Range with Technology and Cope up. A weak relationship was observed between Educational Level with wealth and Technology, Information with Status. Also a very weak negative relationship between Awareness and Gender with a very weak positive relationship between Educational level with Information and Institutional were also identified. It has been recommended that there is an unemployment rate of 18% in the DS Negombo which is a key issue to address which could be done by increasing the education, institutional skills and the computer literacy which is only 22% for the whole Negombo DS. Drainage facilities are the worst of all the infrastructure facilities, only 4% and need to be addressed by better and proper land use planning. Here implementation of proper land planning policies could be recommended. Overall by providing education, skills and capital needed to start new or alternative livelihood option also recommended.

Keywords: Capacity, Vulnerability, Coastal Hazards, Gender, Negombo, Disaster

C4

[20]

**IDENTIFICATION OF SOURCES OF COASTAL DEBRIS ACCUMULATION
ALONG THE WESTERN COASTAL BELT OF SRI LANKA: PRELIMINARY
APPROACH TOWARD THE COASTAL ZONE MANAGEMENT**

T.O.H. Perera, G.G.N. Thushari, J.M.D.R. Jayawardana, J.D.M. Senevirathna and
S.C. Jayamanne

Department of Animal Science, Uva Wellassa University, Badulla, Sri Lanka

ABSTRACT

Debris accumulation is a serious environmental and social issue in most of coastal ecosystems. Thus, current study investigated major coastal debris accumulation sources and attitudes of target stakeholders toward existing coastal management regime in Dehiwala and Mount Lavinia coasts of Sri Lanka. This study conducted using a pretested questionnaire-based survey for residents (n=81), tourists (n=83), hotels/restaurants owners (n=26), fishermen (n=90) and small-scale vendors (n=37) in both sites during September-November, 2017. Plastic litter items disposal rate was higher in both sites (Dehiwala-50.2%, Mount Lavinia-72.1%). Polythene bags, bottles, buoys, ropes, netting material, appliances and building material were recorded as major litter items(65.9%) in Dehiwala, while cutlery, food wrappers and smoking related items were highly discarded litter items(62.2%) in Mount Lavinia. Results of Chi-square and Mann Whitney tests indicated that, coastal debris disposal pattern was significantly different according to beach location linked with economic activities and beach users in two sites ($p<0.05$). Fishermen (67.1%) mainly contribute to debris accumulation in Dehiwala, while 69.3% anthropogenic activities of tourists and beach vendors are mainly contributed on debris accumulation along Mount Lavinia coastline. Residential activities also have a significant effect on higher debris level in both sites. Results indicated that local stakeholders are not satisfy (Dehiwala-80.54%, Mount Lavinia-88.6%) with existing management measures. Coastal management actions in Dehiwala beach should focus on fishery; while tourism related actions of small-scale vendors and visitors need to be considered on coastal pollution control in Mount Lavinia. Site specific coastal pollution control mechanisms are recommended to reduce debris accumulation in beaches.

Keywords: Coastal Pollution, Disposal Rate, Coastal Management, Anthropogenic Activities, Site Specific Pollution Issues

D1

[21]

**GENOTYPE BY ENVIRONMENT (GXE) INTERACTION FOR GROWTH TRAITS
IN 4 GENERATIONS POST SELECTION CLIMBING PERCH *Anabas testudineus*
(BLOCH, 1792) IN 8 FARMS OF THAILAND**

J. Duangwongsa¹, S. Leesanga², S. Jul-a-dung³, M. Tipbunpot³, T. Ungsethaphand¹ and
P. Akaboot⁴

¹*Faculty of Fisheries Technology and Aquatic Resources, Maejo University, Chiang Mai,
Thailand*

²*Inland Fisheries Research and Development Division, Department of Fisheries, Bangkok,
Thailand*

³*Chumphon Aquaculture Genetics Research and Development Center Department of
Fisheries, Chumphon, Thailand*

⁴*Department of Animal Science, Prince of Songkla University, Songkla, Thailand*

ABSTRACT

The objective of this study was to investigate the effect of genotype by environment (GXE) interaction on growth traits of 4 generations post selection climbing perch. Records of 625 fish in 8 provinces from 4 parts of Thailand including Chumporn (Nucleus farm, year 2005), Nakhon Si Thammarat and Chomporn (Southern part, year 2013), Ratchaburi and Suphan Buri (Central part, year 2013), Sakon Nakhon (Northeastern part, year 2013) and Uttaradit and Chiang Mai (Northern part, year 2016). $G \times E$ of single and multiple traits as well as phenotypic correlations (r_p) were analyzed for 9 growth traits by SAS. The result showed no $G \times E$ interaction between genetic (source) and years. However, female had significantly higher Body Width (BW), Total Length (TL), Eye Diameter (ED), Body Length (BL), Ratio between Head and Body length (H/B) and Average Daily Gain (ADG) than male ($P < 0.05$). Phenotypic correlations among fish source, farms and sex were higher than 0.85 showing that BW related to ADG, TL related to Head Length (HL) and Head Width (HW) related to Head Depth (HD), BW and Body Depth (BD). In conclusion, $G \times E$ between sources and year was low so, there was no need to separate breeding programs for growth traits in climbing perch.

Keywords: Environment Interaction ($G \times E$), Climbing Perch, Phenotypic Correlations

DEVELOPMENT OF PCR-RFLP MARKERS FOR TILAPIA FISH IDENTIFICATION AND AUTHENTICATION

E. Anandajothi¹, M. Santhiya², L. Ruban¹, K.M. Anjali¹, A. Mandal¹ and S. Kandan¹

¹*Central Aquaculture Genetics Laboratory, Rajiv Gandhi Centre for Aquaculture (RGCA),
Tamil Nadu, India*

²*Department of Biotechnology, A.V.C College (Autonomous), Tamil Nadu, India*

ABSTRACT

Species identification using molecular markers has become increasingly important for the aquaculture sector because of the growing interest of consumers. A PCR-RFLP method was developed for identification and authentication of tilapia species commonly available in Indian water bodies. The *Oreochromis mossambicus* was collected from natural habitat from Tamil Nadu. Two other strains of exotic species *Oreochromis niloticus* (GIFT and red tilapia) were procured from the RGCA's tilapia project, Vijayawada. Total genomic DNA was extracted with phenol-chloroform method. Polymerase chain reaction (PCR) of mitochondrial COI region yielded a 704bp product in all the tilapia samples. PCR-RFLP was carried out using five selected restriction enzymes to digest amplified PCR product. Restriction endonucleases *HinfI* and *BsaJI* showed the different fragment size variation among the three tilapia group. *HinfI* produced two fragments of 290 bp and 414 bp size in *O. mossambicus*; 304 bp and 400 bp in GIFT, and 338 bp and 366 bp in red tilapia. *BsaJI* generates four fragments viz., 50bp, 120 bp, 260 bp and 274 bp in *O. mossambicus*; 120 bp, 274 bp and 310 bp in GIFT; whereas it does not digest the COI product in red tilapia. The PCR-RFLP profile generated through present study could be useful for developing specific markers to differentiate and authenticate various tilapia strains by collecting and testing with more samples from different geographical location from India and other countries.

Keywords: Species Identification, Tilapia, PCR-RFLP, Molecular Markers, Restriction Enzymes

D3

[23]

CONTEMPLATING ENZYMATIC PROFILE (LDH, CPK, SGPT, ALK PHOSP) OF FRESH WATER FISH, GRASS CARP (*Ctenopharyngodon idella*) UNDER TOXICOLOGICAL IMPINGE OF ATRAZINE (HERBICIDE)

A. Khan¹, N. Shah¹, M. Adnan², S.M. Jawad³ and A.M. Yousafzai³

¹ Department of Zoology, University of Swabi, Khyber Pakhtunkhwa (KP), Pakistan

² Department of Agriculture, University of Swabi, Khyber Pakhtunkhwa (KP), Pakistan

³ Department of Zoology, Islamia College Peshawar, Khyber Pakhtunkhwa (KP), Pakistan

ABSTRACT

Current agricultural practice compelled the utilization of herbicides on a large scale with the hope of high crop yield, resulting in pushiness of these organics toward the aquatic bodies causing detrimental effects on biomarkers of aquatic fauna. So in this regard present study was experimented for the purpose to contemplate the chronic toxicity of atrazine (herbicide) on enzymatic profile including LDH, CPK, SGPT and Alk Phosp of freshwater grass carp, (*Ctenopharyngodon idella*). Above 15 μ L⁻¹, the LC₅₀ was recorded revealing sensitivity of grass carp to atrazine. Grass carp was exposed to atrazine for 10(06 μ L⁻¹), 15(04 μ L⁻¹) and 25(02 μ L⁻¹) days/concentration for scrutinizing chronic toxicity. Fish Blood was analyzed via Merck micro lab 300 biochemistry analyzer. Control group concentration for LDH, CPK, SGPT and Alk Phosp was 342 IU/ml, 7513.3 IU/ml, 46mmol/l and 126.6 IU/ml respectively. After treatment LDH concentration was 718.3, 682.6 and 643.6 IU/ml respectively. CPK concentration was 2641.6, 2212.6 and 3585 IU/ml respectively. SGPT concentration was 32.3, 26.3 and 20.3 mmol/l respectively and Alk Phosp concentration was 76.6, 49.6 and 39.7 IU/ml respectively. Enzymatic activity was alter as compared to control group due to liver malfunctioning like maximum inclined ($P \leq 0.001$) in concentration of LDH was observed after 10 days exposure showed acute liver damage result in increased the membrane permeability causing enhanced leaching out of the enzymes, while other enzymatic components like CPK, SGPT and Alk Phosp showed kindred attribute in their result like all parameters concentration showed perpetual decline ($P \leq 0.001$) in their concentration indicating reduced enzymatic activity due to reduction in the permeability forcing the enzymes to accumulate in the cells or may be decreased in enzyme synthesis against toxicant.

D4

[24]

**REGULATING AQUACULTURE IN SRI LANKA: A CRITICAL EVALUATION OF
THE ENVIRONMENTAL IMPACT ASSESSMENT AND SUGGESTIONS FOR
REFORM**

A.H.M.D.L. Abeyrathna

Faculty of Law, University of Colombo, Sri Lanka

ABSTRACT

Aquaculture enables the Sri Lankan government to reach out to local and international investors, while ensuring that natural resources are protected for the future generations. Sri Lanka has several laws and regulations which are imposed by several institutions to manage these projects, based on the public trust doctrine. Environmental Impact Assessment (EIA) is a procedure introduced under National Environmental Act No. 47 of 1980 (as amended in 1988) and the Ministry of Fisheries and Aquatic Resources plays a major role in this procedure according to the National Environmental (Impact Assessment) Regulations 1992. The purpose of this research is to examine the effectiveness of current aquaculture EIA procedure and to suggest recommendations for reform. This research identified several shortcomings in the current aquaculture EIA process. Mainly; (a) the potential ecological damage in an area since these projects are evaluating independently; (b) current EIA process gives attention only towards the limited prescribed projects and (c) unethical conduct of the professionals involve in EIA process. By looking into all the facts in conclusion, the research paper strongly advocates amending the current EIA process for smooth functioning. Main suggestions are (i) introduce a mechanism to consider cumulative impact of aquaculture projects in an area; (ii) expand the prescribed projects and (iii) introduce a code of conduct. For this purpose, a desk review of existing domestic and international environmental law standards will be followed by interviews with key informants in the field to capture the ground realities of aquaculture EIA process.

Keywords: Aquaculture, Investments, Public Trust Doctrine, Environmental Impact Assessment

E1

[25]

FACTORS INFLUENCING CATCHING OF *Macrobrachium rosenbergii* (DE MAN, 1879): A CASE STUDY IN FIVE PERENNIAL RESERVOIRS IN NORTHERN PROVINCE, SRI LANKA

R. Rajeevan, U. Edirisinghe and A.R.S.B. Athauda

Postgraduate Institute of Agriculture, University of Peradeniya, Sri Lanka

ABSTRACT

Factors influencing *M. rosenbergii* catches in Vavunikulam, Muthayankattu, Puthumurippu, Kalmadu and Muhathankulam perennial reservoirs in Northern Province, Sri Lanka were studied. Catch data were collected at the landing sites from the gillnets of the fishers. Individual weight and total number were taken. Since catch of *M. rosenbergii* get affected simultaneously by reservoir morphometry, fishing intensity, stocking density, rainfall, gear specification, species composition and water quality parameters, a multiple regression analysis was carried out. Comparison of reservoirs based on the studied parameters were used in multidimensional scaling (MDS). Pearson's correlation coefficient indicated a strong positive correlation between stocking density, gear specification, species composition and fishing intensity. In all the five reservoirs, fish yield was dominated by regularly stocked species, which composed of 71.9–99.8% of the total yield. Every reservoir possessed unique characteristics, and the recommendations had to be reservoir-specific. It was observed that the significantly higher fishing pressure had been applied on the bottom area mainly targeting for *M. rosenbergii* due to higher market value. A modified gillnet should be designed for *M. rosenbergii* fishing. It was also found necessary to develop a rational stocking program and limit fishing pressure in breeding and nursery grounds of the other fish populations, which would ensure sustenance of natural populations. Through detailed studies recommendations in respect of stocking and optimum effort levels for each reservoir have to be developed.

Keywords: *Macrobrachium rosenbergii*, Factors Influencing Catch, Fishing Intensity, Reservoir Fisheries, Gillnet, Stocking Density

TO FISH OR NOT TO FISH-OPPORTUNITIES AND CONSTRAINTS TO YOUTH INVOLVEMENT IN AQUACULTURE AND CAPTURE FISHERIES

I. Arulingam¹, L. Nigussie¹, L. Debevec¹ and S.S. Sellamuttu¹

¹*International Water Management Institute (IWMI), Sri Lanka*

ABSTRACT

While fisheries and aquaculture have huge potential for youth employment across Africa and Asia, many opportunities are lost due to a lack of supportive policies and programs. Our paper presents results of a short study conducted in eight selected countries in Africa and Asia to explore youth engagement across a selection of activities in aquaculture and capture fisheries production systems and value chains under the CGIAR Research Program on Fish Agri-Food Systems. The purpose of the study was to address the existing gaps and map a way forward that will be more youth-inclusive. The study included i) a systematic review of policy documents, national survey reports and publications from projects and ii) key informant interviews from the focal countries, to look at existing initiatives in this regard. Using this information, the paper highlights challenges and opportunities of participation of youth in the sector.

Key findings of the study include: i) most of the African countries meet their fish demand through importation, ii) youth appear to be more attracted to engaging in aquaculture production than small scale fisheries, given the overexploited nature of certain small scale fisheries and rapid development of the aquaculture sector and the perception of aquaculture as a more ‘modern’ activity ii) there are attempts by stakeholders to encourage participation of youth in aquaculture production, iii) limited participation of youth in the sector due to limited access to inputs, infrastructures for post-harvest management, market and, limited technical knowhow on aquaculture production. Recommendations include formulate youth inclusive policies, support and coordinate youth targeted initiatives (particularly in aquaculture), allocate sufficient funds for effective implementation of plans for youth, and invest more on infrastructure, innovation and entrepreneurship.

Keywords: Youth, Aquaculture, Small Scale Fisheries Africa, Asia

E3

[27]

**LONG RUN VERSUS SHORT RUN ESTIMATES OF SUSTAINABLE YIELD: A
CASE OF SMALL-SCALE DEMERSAL FISHERIES IN OMAN**

J.B. Yousuf and S. Bose

*Department of Natural Resource Economics, College of Agricultural and Marine Sciences,
Sultan Qaboos University, Muscat, Sultanate of Oman*

ABSTRACT

The importance of reference points in fisheries management is well documented in the existing literature as they play crucial role in the assessment of stocks sustainability in the context of both single and multi-species fisheries. Although crucial, the derivation of such reference points for small-scale fisheries in developing countries is a challenging task due to the lack of detailed data. However, annual catch and effort data are routinely collected and regularly published for small-scale fisheries by the respective management authorities.

Using annual catch and effort data for five commercially important demersal species covering the period 1992-2016, the present paper aims at estimating both long and short-run target reference points under equilibrium (Schaefer and Fox models) and non-equilibrium (Pella and Tomlinson, 1969) models. The long-run equilibrium models were estimated using cointegration techniques and subsequently checked for short run deviation using second stage error-correction mechanisms. In addition, a non-parametric test is used to check if the estimates of the models are significantly different from each other.

The results showed the presence of long run equilibrium relationship for each species under the Schaefer and Fox models. Moreover, the empirical analysis revealed that there was a significant deviation in the short-run. The results of the non-parametric test showed that the long run and short estimates were significantly different from each other. Given that risk and uncertainties are pervasive to fisheries, it is proposed that fishery managers should preferably be guided by short run reference point estimate for the considered species.

F1

[28]

**HEMATOLOGICAL VARIATIONS IN CATFISH *Rita rita* FROM INDUS RIVER
NEAR JAMSHORO, SINDH, PAKISTAN**

S. Jalbani ¹, N.T. Narejo ², Y.M. Jalbani ³ and A.S. Jatoi ⁴

¹*Department of Aquaculture and Fisheries, Faculty of Bio science, Shaheed, Benazir Bhutto,
University of Veterinary and Animal Sciences, Sakrand, Pakistan*

²*Department of Freshwater Biology and Fisheries, University of Sindh, Jamshoro, Pakistan*

³*Department of Dairy Technology, Faculty of Animal Production and Technology, Benazir
Bhutto University of Veterinary and Animal Sciences, Sakrand, Sindh, Pakistan
Pakistan*

⁴*Department of Poultry Production Faculty of Animal Production & Technology Shaheed,
Benazir Bhutto University of Veterinary and Animal Sciences, Sakrand, Sindh, Pakistan*

ABSTRACT

To study hematological variation of *Rita rita*, blood samples of 100 fish size ranged 21.0-33.5 cm were collected from heart puncture and preserved in EDTA bottles for subsequent studies. Blood parameter such as Hemoglobin concentration (Hb%), Erythrocyte Sedimentation Rate (ESR), Red blood Cell count (RBC), White Blood Cell Count (WBC) and Packed cell volume (PCV) were taken into consideration for both male and female separately. Results of parameters like Hb (% hemoglobin) and ESR (Erythrocyte Sedimentation rate) indicated significant difference among the sexes. Male were found to be healthy in comparison to female exhibited (Hb% 13 and 7.3) respectively. On the contrary female possess significantly higher values of Erythrocyte Sedimentation rate (4.5 and 5.5) respectively. Rest of the parameters showed no significant difference between the sexes. Finally decided that the male of *Rita rita* were found healthier in comparison to female.

Keywords: Hematology, Hemoglobin concentration, Erythrocyte Sedimentation Rate, *Rita rita*, Indus River

F2

[29]

ANNUAL OOGENESIS OF FEMALE SWAMP EEL, *Monopterus albus* (ZUIEW, 1793) BROODSTOCK, KHON KAEN, THAILAND

S. Khajornkiat ¹ and P. Rakpong ²

¹*Faculty of Fisheries Technology and Aquatic Resources, Maejo University, Chiang Mai, Thailand*

²*Department of Fisheries, Faculty of Agriculture, Khon Kaen University, Khon Kaen, Thailand*

ABSTRACT

This study was aimed to characterize annual oogenesis and oocyte development for a precise identification of sex maturity of female *Monopterus albus* broodstock and to define its breeding season. A total of 60 female broodstock with 60 to 200 g body weight (BW) were obtained monthly from a local market in Khon Kaen, Thailand during December 2015 to November 2016. Individual BW was recorded and the ovaries was removed and weighed for calculating the gonadosomatic index (GSI). Ovaries were collected for gonadal histology analysis. Oocyte development were divided into 4 stages includes perinucleolar, cortical alveoli, vitellogenic and maturation stage. In December to January, the dominant oocytes were perinucleolar and cortical alveoli oocyte, while in February to April, remaining oocytes were in cortical alveoli and vitellogenic oocyte. Oocyte diameter and GSI value gradually increased from 0.06+0.02 mm and 0.24+0.13 to 1.88+0.04 mm and 1.42+1.08 in December to April, respectively. Besides, last vitellogenic oocyte and mature oocyte were found at the beginning of April to August. This period, mature oocyte diameter varies from 1.58+0.11 mm to 2.00+0.32 mm which was close to the ripe eggs with a diameter of 2.50-3.00 mm. The biggest oocyte diameter and highest GSI value were 2.00+0.32 mm and 3.43+2.39 in May, respectively. In September to November, oocytes turned into perinucleolar and cortical alveoli stages. Based on the stage of oocyte development, oocyte diameter and GSI value, this could be concluded that sex maturity and breeding season of female broodstock reared in captivity is from April to August.

Keywords: Swamp Eel, *Monopterus albus*, Oogenesis, Oocyte Development

F3

[30]

**COMPARATIVE STUDY OF REPRODUCTIVE BIOLOGY OF VERMICULATED
SAILFIN CATFISH *Pterigoplichthys disjunctivus* WEBER 1991 (FAMILY
LORICARIIDAE) IN VICTORIA & KALAWEWA RESERVOIRS IN SRI LANKA**

I.U. Wickramaratne ¹

¹*Department of Animal Science, Faculty of Animal Science & Export Agriculture, Uva
Wellassa University of Sri Lanka, Badulla, Sri Lanka*

ABSTRACT

Pterigoplichthys disjunctivus had been accidentally or intentionally introduced to Sri Lankan freshwaters possibly through ornamental fish trade. *Pterigoplichthys disjunctivus* which is native to South America has established populations in many water bodies in Sri Lanka including Victoria & Kalawewa reservoirs. Live specimens of *Pterigoplichthys disjunctivus* obtained from commercial catch from 2015 to 2017 & 2016 to 2017, respectively, and total length measured to nearest 0.1cm and weighed to nearest 0.1g and dissected *in situ* in order to obtain the gonads which were preserved in 5% buffered formalin. A maturity scale was identified on the macroscopic/microscopic characteristics of gonads for both male and female by examining transparency, overall color, vascularization, visibility of oocytes and size of gonads. Gonadosomatic (GSI) indices, total fecundity (TF) and relative fecundity (RF) were also studied. Mean gonad weight of females and males are 7.604±9.107; 12.784±16.699 & 0.516±0.5373; 0.9012±1.0778 of Victoria and Kalawewa, respectively. Mean GSI for females and males are 0.04109±0.0522; 0.0436.1±0.05042 & 0.002347±0.002105; 0.002362±0.00191 of Victoria and Kalawewa, respectively. Mean fecundity is 956±261; 1856±817 of Victoria and Kalawewa, respectively. Mean relative fecundity is 4.3783±1.3242; 6.564±2.841 & mean egg diameter is 1712±955.8; 1747±884.8, of Victoria and Kalawewa, respectively. *Pterigoplichthys disjunctivus* show extended reproductive period from April to October. Harvesting this species during its spawning season may aid in controlling population size.

Keywords: Invasive, *Pterigoplichthys disjunctivus*, Reproductive Biology, Controlling

F4

[31]

**REPRODUCTIVE PERFORMANCE OF ASIAN SEABASS (*Lates calcarifer*) WITH
RECIRCULATORY AQUACULTURE SYSTEM**

V.S. Arasu, S. Kandan, D.Y.S. Krishnamoorthy, Y.N. Swamy and M. Saravanan

*Seabass Hatchery Facility, Thoduvai, Rajiv Gandhi Centre for Aquaculture, MPEDA
(Ministry of Commerce and Industry, Govt. of India), Tamil Nadu, India*

ABSTRACT

The present study describes the large-scale production of eggs and larvae of Asian seabass (*Lates calcarifer* Bloch; Family:Centropomidae) to produce viable eggs throughout the year by manipulation of photoperiod and temperature in Recirculatory Aquaculture System (RAS) in connection with lunar period. Two tanks having capacity of 15 tons was connected with recirculatory system. One tank connected with heater and chiller unit (T1) another one was without heater and chiller unit (T2). The rearing temperature was maintained 29.5°C – 30.5°C in T1 and 27°C -32°C in T2 during spawning. Photoperiod of 12 hrs with light and 12 hrs without light was also maintained in both the tanks (T1 and T2). Selected males and females were stocked in 1:2 ratio at 3 kg/m³ biomass. Natural spawning was not observed during the study period of one year. Therefore, hormone LHRHa- was induced for selected males and females at 1:2 ratio during lunar period of full moon, new moon and semi lunar period. After induced with LHRHa, egg was released with peak during the lunar period of full moon and new moon. It was fewer during semi lunar period. During the study period successful spawning of 6 cycles were produced in T1 and 2 cycles in T2. These results optimize the use of temperature, photoperiod and LHRHa to stimulate gonad maturation and spawning so that seabass seeds are made available year round in hatchery operation. Heater and Chiller unit were also used to control optimum temperature in T1 and the photoperiod were normal which advanced by 2 to 3 months per cycle.

Keywords: RAS, LHRHa, Lunar Period, *Lates calcarifer*, Spawning

F5

[32]

**RELATIONSHIP OF FECUNDITY TO LENGTH AND WEIGHT OF WILD
CAUGHT TIGER SHRIMP *Penaeus monodon* FROM ANDAMAN NICOBAR
ISLANDS COAST, INDIA**

S. Nagaraj, B. Srikanth, M. Shailendar, B. Kishore, K.P. Sarmal, D.T. Santhar and S. Kandan

*Domestication of Tiger Shrimp Project, Rajiv Gandhi Centre for Aquaculture, (MPEDA, Min
of Commerce and Industry, Govt. of India), South Andaman, India*

ABSTRACT

Under domestication of black tiger shrimp project, RGCA is procuring matured shrimp broodstocks from various places of Andaman coastal waters to established Specific Pathogen Free (SPF) founder families. The present study analysed the relationship of broodstock fecundity of the indigenous species of tiger shrimp *P. monodon* to shrimp body weight (BW) and total length (TL). The ripened ovary tiger shrimp females were collected during the breeding season from July to September in three consecutive years and were examined. The total number of eggs in female was significantly varied among the size groups of the shrimps. In the minimum size group of shrimps (20-22 cm) having the mean fecundity was 551176.47 ± 46889.4 with a mean total body weight and length 110.12 ± 8.46 g and 20.32 ± 0.62 cm respectively. In maximum size class (24-26 cm) having the mean fecundity was 730784.70 ± 96277.66 with a BW and TL 138.01 ± 12.53 and 21.68 ± 0.6 respectively. The mean total number of eggs per female was increased with increasing length and weight. The maximum correlation co-efficient of total length and weight ($R^2=0.865$ and $R^2=0.746$) value was recorded from size group (24-26 cm) and this R^2 indicate that the fecundity is linearly relation to the total length and weight of the shrimp.

Keywords: Fecundity, Length and Weight, *P. monodon*, Domestication

G1

[33]

**GROWTH, SERUM BIOCHEMICAL RESPONSE AND GUT HEALTH OF
JUVENILE BARRAMUNDI *Lates calcarifer* FED FERMENTED AND NON-
FERMENTED POULTRY BY-PRODUCT MEAL SUPPLEMENTED WITH TUNA
HYDROLYSATE**

M.A.B. Siddik, R. Fotedar and J. Howieson

Curtin University, Bentley, Australia

ABSTRACT

To investigate the effects of complete substitution of fishmeal (FM) by poultry by-product meal (PBM) on growth, biochemical response and digestive health of juvenile barramundi *Lates calcarifer*, two isonitrogenous and isocaloric diets based on 90% PBM and 90% fermented poultry by-product meal (FPBM) supplemented with 10% tuna hydrolysate (TH) were prepared. A FM based diet without TH supplementation was treated as control. The PBM was fermented by incorporating 10% of *Saccharomyces cereviceae* (Instant dried yeast, Lowan®) and 5 % of *Lactobacillus casei* skim milk product (Yakult®) under anaerobic conditions for four days. A triplicate group of juvenile barramundi (initial pool weight 12.15 ± 0.16 g) were fed the experimental diets three times a day for 10 weeks. After the feeding trial, fish fed on FPBM supplemented with TH showed higher final body weight, weight gain and feed intake than fish fed the control diet, while fish fed the PBM with the addition of TH was not significantly different from the control. No significant differences were observed in serum creatinine, creatinine kinase, urea, uric acid and alanine aminotransferase of fish fed on either PBM or FPBM. Results from hindgut histopathology confirmed no changes in fish under all feeding treatments. It can be concluded that addition of 10% TH in both diets including PBM and FPBM, complete replacement of FM in barramundi is possible.

Keywords: Poultry by-Product, Fermentation, Growth Performance, Biochemical Response, Barramundi

G2

[34]

CHARACTERIZATION AND CLASSIFICATION OF PROTEASES FROM THE DIGESTIVE ORGANS IN DIFFERENT SIZES OF NILE TILAPIA (*Oreochromis niloticus*, L)

T. Anukoolprasert, K. Srinuansom, T. Rukdontri, S. Nonkhukhetkhong and R. Petkam

Department of Fisheries, Faculty of Agriculture, Khon Kaen University, Khon Kaen, Thailand

ABSTRACT

Studies of proteolytic enzymes in Nile tilapia (*Oreochromis niloticus*, L.) contribute to a better understanding and improve protein utilization in feed. The investigation of proteolytic enzymes from digestive organs (stomach, proximal intestine, distal intestine and liver) using two different sizes of tilapia (6.44 ± 0.86 g. and 31.67 ± 2.31 g.). The effect of different pH (2.0-13.0) and incubated temperature (30, 45, 60 and 75°C) on protease activities using crude enzyme extract was measured by the increase in cleavage of short chain polypeptide which used azocasein as a substrate. Protease was classified by specific inhibitors. The protease activity of all organs in both sizes was highest at pH 9.0 and 45 °C. In addition, small fish showed highest acidic protease activity at pH 3.0. The protease activity of proximal intestine, distal intestine from both sizes and small fish liver were strongly inhibited by PMSF, TLCK and SBT, the serine protease inhibitors specifically for trypsin. Except in the protease activity of liver from the large fish was inhibited by EDTA (carboxypeptidase inhibitor). Meanwhile, pepstatin A, pepsin inhibitor, inhibited the acid protease activity in stomach extracts from both fish sizes. Results suggested that the present of proteases were differed among digestive organs. Knowledge gained from this study provided important information for further protease digestibility and feed formulation

Keywords: Nile Tilapia (*Oreochromis niloticus*, L.), Proteases, Stomach, Intestine, Liver, Specific Inhibitors

G3

[35]

IMTA – ULVA AND PERIPHYTON AS PLANT-BASED DIETS FOR *Siganus rivulatus* (RABBIT FISH) FINGERLINGS

R. Barkan^{1,2} and L. Guttman¹

¹ *Israel Oceanographic and Limnological Research, The National Center for Mariculture, Eilat, Israel*

² *Department of Life Sciences, Ben-Gurion University of the Negev, Eilat, Israel*

ABSTRACT

Fish feed and effluent treatment are major operational expenses in aquaculture, holding crucial issues regarding system sustainability. In Integrated multi-trophic aquaculture (IMTA) systems, waste of a given organism is being used by other organisms of different trophic level (nutritional and functional). In the current study, we examined the potential of marine periphyton and *Ulva lactuca*, derived from biofilters of an IMTA system at The National Center for Mariculture (Eilat, Israel), to replace portion of commercial feed in the diet of *Siganus rivulatus* fingerlings. Fish were fed for 100 days with only 60% of the required commercial feed (following feeding ratio of 2.7% of body weight day⁻¹) while supplementary fresh *Ulva lactuca* or marine periphyton were provided. Fish in the control treatment were fed with 100% of commercial feed. Fish growth performances (rates and yields) as well as the biochemical composition of feed and fish were measured. Bacterial community composition in different regions of fish digestive tract was analyzed via high-throughput sequencing. Lower weight gain was measured in fish that were fed with *Ulva lactuca* and periphyton. However, growth performances correlated with the provided nutrients. Feed conversion ratio was 2.0 in the control group and 1.9 in the Ulva treatment. Protein efficiency ratio in fingerlings fed with *Ulva lactuca* was 1.51, similar to that in fish fed with commercial feed. Moreover, protein level in fish that were fed with either Ulva or periphyton was higher comparing to that in fish fed with the commercial feed (52.17%, 51.16% and 48.93%, respectively).

Keywords: IMTA, Aquaculture, Fish Nutrition, *Ulva*, Periphyton, *Siganus rivulatus*

G4

[36]

**SUITABILITY AND SAFETY OF THE PROTEIN BASED INGREDIENTS FOR
ECONOMICAL FEED PRODUCTION FOR ASIAN SEABASS (*Lates calcarifer*) IN
SRI LANKA**

G.S.C. Perera¹, D.M.S. Sugeeshwari², N.W.J.P. Kumara², A.J. Jayathissa² and M. Indika²

¹National Aquatic Resources Research and Development Agency (NARA), Panapitiya,
Waskaduwa, Sri Lanka

²National Aquatic Resources Research and Development Agency (NARA), Crow Island,
Colombo 1, Sri Lanka

ABSTRACT

Feeding of Seabass is current issues in Sri Lanka because of the seasonally available and poor quality thrash fish which is commonly used for feeding. This may even lead to a food safety risk due to the use of commercial feeds contaminated with harmful chemicals and microbes. Therefore this study was undertaken to identify the optimum and available protein based ingredients and to ensure the safety of the feed. Four locally available fish meals (Danish, Maldives, Local 1 and Local 2) were tested for the presence for *Salmonellae*. Kjeldhal method was used to determine the crude Protein contents where the levels were 70.2%, 60.07%, 38.82% and 47.26% respectively and cost per protein unit were 0.55, 0.37, 0.34, and 0.27 in Sri Lankan Rupees. Though both local fish meals were economical, their ash levels were found to be higher. (30.47% and 27.45%) Crude protein level of Krill meal was 58.24% and price was Rs: 700-800 per Kg. Due to the higher price of Krill meal, as an alternative, freely available shrimp heads having crude protein percentage of 43.92% was tested to be used as an attractant. In order to have a fish meal replacement source to produce budget feeds, a commercial protein source with percentage crude protein of 83.53% available in the market was tested. Both local fish meals, plant meal and shrimp head could be used to produce economical fish feeds and further research is needed to find out the digestibility and acceptability of the above economical and suitable ingredients. The feed samples were randomly checked for the presence of *Salmonella* as a contaminant. All samples were tested according to the ISO 6579-1:2017, Horizontal method. All the feed samples were found negative for *salmonellae*.

Keywords: Asian Seabass, Proximate Analysis, Feed Safety, *Salmonellae*

G5

[37]

EFFECT OF ENRICHED LIVE FEED ON GROWTH AND SURVIVAL OF ASIAN SEABASS, *Lates calcarifer* (BLOCH) LARVAE

Y. Narayanaswamy, M. Saravanan, D.Y.S. Krishnamoorthy, S. Kandan and V.S. Arasu

*Seabass Hatchery Facility, Thoduvai, Rajiv Gandhi Centre for Aquaculture, MPEDA
(Ministry of Commerce and Industry, Govt. of India), Tamil Nadu, India*

ABSTRACT

The aquaculture sector needs high quality and healthy seeds for successful and sustainable production. The high quality seed production can be achieved through the enrichment of live feed rather than conventional methods. The present study investigated the effect of DHA Protein Selco (commercial product) and live microalgae (*Nannochloropsis oculata*), enriched with rotifers and Artemia diet on the survival, growth and metamorphosis of Asian seabass larvae *Lates calcarifer* (Bloch) into healthy fry. The seabass, were reared intensively (50 individuals/litre) in 2 larval rearing tanks of 8 ton capacity. The larvae of 2 DPH(2 days post hatching) were fed with the rotifer enriched with microalgae (*N. oculata*) in one tank (T1) and with rotifer enriched with DHA Protein Selco in the other tank (T2). The larvae fed with rotifer thrice in a day, the density were maintained at 20-25 Nos /ml in both the experiment tanks. After 9 DPH seabass larvae started to feed Artemia nauplii enriched with microalgae in T1 and enriched with DHA Protein Selco in T2. The larvae fed Artemia nauplii thrice in a day, the density were maintained at 0.5 - 3.0 Nos/ml in T1 and T2. The metamorphosis of larvae was recorded at 22±1 DPH in T1 and 17±1 DPH in T2. The growth and survival of larvae were also recorded 55% in T1 and 75% in T2. The study revealed that the growth, survival rate and metamorphosis of the larvae fed with rotifer and Artemia enriched with DHA Protein Selco were enhanced when compared with the larvae fed rotifer and Artemia enriched with microalgae only.

Keywords: Microalgae, DHA Protein Selco, Rotifer, Artemia, Seabass (*Lates calcarifer*), DPH

QUALITY OF MANGROVE CRAB (*Scylla serrata*) BROODSTOCK IMPROVES THROUGH FEEDING MANAGEMENT

K. Velmurugan¹, S. Viswanathan¹, S. Kandan¹, V.S. Arasu¹ and M. Saravanan¹

¹*Mangrove Crab Hatchery Facility, Thoduvai, Rajiv Gandhi Centre for Aquaculture, MPEDA (Ministry of Commerce and Industry, Govt. of India), Tamil Nadu, India*

ABSTRACT

Production of mangrove crab (*Scylla serrata*) instars in hatchery is always facing high mortality in the early stages due to lacunae in breeding technology. The aim of this study is to increase the survival rate of mangrove mud crab during the early larval stages generated from improved quality Broodstock through different rearing treatments i.e. farm reared (FR) & natural habitat (NH) and feeding methods. The selected brood stocks were fed with fresh feed (fish, squid and oyster at 2% of body weight in alternate day) and artificial diet. Treatments were maintained in 2 ton capacity circular tanks with water volume of 1.5 ton. Two females per tank were reared in 4 tanks with different feeding regimes. Throughout the culture period the water quality parameters was analyzed. High quality egg, good survival rate and improved growth rate of early larval stages by treated broodstocks were obtained. The crabs fed with fresh feed have developed matured ovaries within 10 ± 3 days, spawning and embryo incubation is within 9 ± 2 days with hatching percentage of $93\pm 3\%$. The crabs fed with artificial diet had matured within 13 ± 2 days, spawning and embryonic incubation within 12 ± 1 days and hatching percentage at $78\pm 2\%$. This indicates that the natural feed is the suitable one when compared with artificial diet. For stabilizing the crab culture sector it is highly essential to have well formulated diet based on the feeding habits of mangrove mud crabs.

Keywords: Broodstocks, *Scylla serrata*, Survival Rate, Breeding, Spawning, Artificial Diet

G7

[39]

EFFECTS OF LINCO-MYCINE AND PHYTO- ADDITIVES *Allium cepa* & *Allium sativum* ON GROWTH, DIGESTIBILITY, HEMATOLOGY, BODY COMPOSITION & ENZYME LEVEL OF JUVENILE *Labeo rohita* USING POWDERED VS. PELLETTED FEED

R. Iqbal

Institute of Pure and Applied Biology, Bahauddin Zakariya University, Pakistan

ABSTRACT

Due to elevated plea of fish meat to meet nutrient need of humans , use of different supplements (Natural & Synthetic) are in use now a days to enhance growth rate .Fish feed is also trending new technologies To evaluate effects of Phyto-additives (garlic & onion) and Antibiotic (Linco-mycine) on growth, blood parameters and body composition was carried out.80 fingerlings of *Labeo Rohita* were housed in 8 tanks for eight treatments with 2 replicates of each. Treatment were divided into 4 groups depending on their form T1, T2, T3, T4 were fed on powdered feed while T5, T6, T7 and T8 were fed on pelleted feed. T1 and T5 were control group with 25% CP level and no additives, T2 and T6 were fed on 25% CP level diet containing 5g kg⁻¹ garlic and onion each. Fish T3 and T7 were fed on 30% CP containing diet plus 5g kg⁻¹ diet, T4 and T8 were fed on 35% CP with inclusion of 200mg kg⁻¹ of Linco-mycine. Statistical analysis revealed significant rise in growth and survival in T8, T7 shows significant improvement in comparison to other treatments and control group .but inclusion of Linco-mycine shows significant reduction in RBC's, WBC's. Hb, and Hematocrit but phyto-additives shows significant improvement in blood parameters. Linco-mycine also shows significant drop in enzymatic activity of amylase & lipase. Biochemical analysis shows significant decrease in protein, fat and phosphorus but significant rise in fiber. It is concluded that Linco-mycine may enhance growth but not safe to use due to its negative effects on hematology and body composition, whereas phyto-additives also promote growth in comparison to control group so, phyto-additives are safe to use in aquaculture diet as supplement.

Keywords: Phytoadditives, Feed, Pelleted, Powdered, *Labeo rohita*, Fish

H1

[40]

**IMMUNOSTIMULATORY AND DISEASE RESISTANCE POTENTIAL OF
Sargassum myriocystum METHANOL EXTRACT ON THE STRIPED MURREL,
Channa striata (BLOCH)**

S.K. Priyadarshini¹ and R.D. Michael²

¹ *Department of Biotechnology, Lady Doak College, Madurai, India*

² *Centre for Fish Immunology, School of Life Sciences, Vels University, Chennai, India*

ABSTRACT

Macroalgal based extracts or their byproducts have rich source of metabolites. In order to explore the immunostimulatory potential of the marine macroalgae, the methanol extract (ME) of *Sargassum myriocystum* (Patent filed) was intraperitoneally administered at different doses (viz., 0, 2, 20 or 200 mg kg⁻¹ body weight) to different groups of *Channa striata* (n=10, each). A reference positive control (MacroGard 20 mg kg⁻¹ body weight) was parallelly maintained for comparison. A cascade of nonspecific immune mechanisms were assessed in terms of serum lysozyme, peroxidase, antiprotease, alternate complement, and intracellular reactive oxygen species (ROS) and reactive nitrogen species (RNS) production in the peripheral blood leucocytes on post treatment days 0, 5, 15 and 20. The overall functional immunity in terms of disease resistance (LD₅₀ dose) against live virulent *A. hydrophila*, *Pseudomonas aeruginosa* and *Edwardsiella tarda* challenge was performed. In general, all the doses of ME and macrogard caused a significant increase (P<0.05) in serum lysozyme, peroxidase and antiprotease activity on most of the post treatment days tested than the control group. On the other hand, ME (200 mg Kg⁻¹) and macrogard alone showed significant enhancement of serum alternate complement activity on post treatment day 15. The intracellular production of ROS and RNS were significantly (P<0.05) enhanced by ME similar to the macrogard on most of the days tested. The methanol extract (all the doses) and macrogard showed significant (P<0.001) reduction in percentage mortality and increased relative percent survival (RPS) value against all the fish pathogens tested. Thus, the present investigation indicated that *Sargassum myriocystum* (ME) serves as a promising candidate for use as an immunostimulant in the juvenile striped murrel, *Channa striata*, thereby offers economic benefits.

H2

[41]

**THE SPECIFIC PATHOGEN FREE SANDWORM (POLYCHAETE: NEREIDIDAE)
FARMING IN THAILAND**

S. Chunhabundit and T. Yeemin

Department of Biology, Faculty of Science Ramkhamhaeng University, Thailand

ABSTRACT

Sandworm was the marine polychaete in Family Nereididae habited along coast of the Gulf of Thailand and the Andaman Sea. The Nereid worm are nutritionally adequate as maturation diets for shrimpsince they contain an appropriated fatty acids profile with high levels of ecosapentaenoic acid (EPA) and docoxahexaenoic acid (DHA). Nowadays, the use of wild harvested worms has in several instances been associated with EMS in shrimp farms. Wild captured worms are likely to be the hosted of shrimp diseases namely parasites, viruses or bacteria caused on WSSV, AHPND and EHP which are transferred to broodstock and their offspring. The protocol SPF rearing system were investigated for 3 species of nereid worms distributed in Thailand. The results showed the difference characteristic in the production, manipulation, and costs of investment.

Keywords: Sandworm, Maturation Diet, EPA, DHA, Diseases, SPF

H3

[42]

**DISEASE SURVEY OF CULTURED SHRIMP *Litopenaues vannamei* IN
NAGAPATTINAM DISTRICT OF TAMIL NADU, INDIA**

G. Sathiyaraj, B. Babu, S. Venu, K. Gayathri, S.D. Senthamil, K. Sinduja, R. Mithun, G. Satyaraj, K. K. Kannan, V.N. Biju, A. Mandal and S. Kandan

*Central Aquaculture Pathology Laboratory, Rajiv Gandhi Centre for Aquaculture, MPEDA
(Ministry of Commerce and Industry, Govt. of India), Tamil Nadu, India*

ABSTRACT

NABL accredited Central Aquaculture Pathology Laboratory of RGCA is a part of the National Surveillance Programme for Aquatic Animal Diseases (NSPAAD) running at India and conducts surveillance for shrimp diseases in Nagapattinam district of Tamil Nadu since 2013. The disease survey carried out in *L. vannamei* farms of Nagapattinam district of Tamil Nadu for the period of 2013-2018 is presented here. Totally 608 farms were surveyed and screened for major OIE pathogens along with *Enterocytozoon hepatopenaei* (EHP). Shrimps which show clinical symptoms like, red and pink coloration of body, weak animals with pale hepatopancreas, shunted growth, white spots on the carapace and bent in the rostrum were collected for PCR analysis. The result demonstrates that 33% of collected shrimps were infected with EHP, 21.5% for WSSV & 4.4 % of the shrimps were affected by co-infection of EHP and WSSV. The study also confirmed that the EHP, which is an emerging microsporidian parasite, caused slow growth in shrimps whereas WSSV infection caused mortality up to 100 % causing huge economic loss to the farmers.

Key words: surveillance, NSPAAD, *Litopenaues vannamei*, EHP, WSSV

**POSTER
PRESENTATIONS**



P1

[43]

**CNPS FOR DNA VACCINE DELIVERY: DEVELOPMENT OF *Edwardsiella tarda*
FLAGELLIN DNA VACCINE ENCAPSULATED CNPS**

S.H.S. Dananjaya¹, C. Nikapitiya², H.P.S.U. Chandrarathna¹, J. Lee² and M. De Zoysa¹

¹*College of Veterinary Medicine and Research Institute of Veterinary Medicine, Chungnam
National University, Republic of Korea*

²*Department of Marine Life Sciences, Jeju National University, Republic of Korea*

ABSTRACT

DNA vaccination is one of the promising alternatives over traditional vaccines such as live attenuated, killed, and recombinant for many bacterial infections. In this study, we constructed the DNA vaccine using plasmid vector (pEGFPN2) and flagellin gene of *Edwardsiella tarda*. Then pEGFPN2-flagellin was encapsulated to chitosan nanoparticles (CNPs) according to a complex coacervation method and it was named as pDNA-flagellin-CNPs. The pDNA-flagellin-CNPs had irregular shape morphology, high stability, a mean diameter of 165.26 nm and zeta potential of +14.25 mV. Encapsulation efficiency of pDNA-flagellin into CNPs was 93.24 % \pm 3.24 %. Transfection results showed that stable expression of flagellin in fish cells (FHM-CCL-42) and human cells (HEK 293T). Additionally, safety of pDNA-flagellin-CNPs was tested using cell cytotoxicity assay. The transcriptional expression of *tlr5a*, *tlr5b*, *myd88*, *nf-kb*, *tnf-a*, *il-1 β* , *il-6*, *il-8* and *il-12* were significantly upregulated after immunization of pDNA-flagellin-CNPs in zebrafish kidney and muscle. In addition, *E. tarda* challenged zebrafish at 7 day post vaccination had higher relative percent survival (55%) compared to control. This study suggested that CNPs could be potential gene carrier for DNA vaccines.

Keywords: Chitosan Nanoparticle, DNA Vaccine, *Edwardsiella tarda*, Flagellin

P2

[44]

EXPLORATION ON PREVAILING DISEASES OF CAGE CULTURED ASIAN SEA BASS (*Lates calcarifer*) BLOCH IN WESTERN AND NORTH WESTERN PROVINCES IN SRI LANKA

A.D.W.R. Rajapakshe¹, R. Thanthriga¹, A.M.A.N. Adhikari¹ and E.D.M. Epasinghe¹

¹*National Aquatic Resources Research & Development Agency, Crow Island, Mattakkuliya, Sri Lanka*

ABSTRACT

Asian Sea bass (*Lates calcarifer*) is an ideal candidate for aquaculture as it can tolerate the variable salinity levels. *L. calcarifer* culture is being popularized in Sri Lanka with the existence of high farm gate price. As the shrimp industry affected from diseases, the growing sea bass aquaculture sector in the country is also suffering from diseases and health related problems. The objective of this study was to investigate the disease condition prevail in sea bass culture and propose recommendations to mitigate the prevailing conditions. Conducted sea bass disease monitoring in selected sites in Chilaw and Negombo area within the period of November 2015 to December 2017. Sampling was conducted in fish culture cages (500 fish A/cage) fed with trash fish twice per day. Cultured fish were investigated for parasitic, bacterial and viral infections in two culture areas and water quality parameters (pH, Dissolve Oxygen, Salinity, Water temperature, Ammonia, Nitrite Nitrate and Phosphate) were monitored adjacent to the cages. Clinical symptoms were monitored and skin scraping and gills were observed for parasitic investigations under the microscope. Investigations also conducted bacterial and viral infections. The average water quality parameters except pH (6.35) levels in Negombo sites were within the acceptable levels of fish culture. *Trichodina* and gill flukes were encountered in both sites but there was no severe infection. Mass mortality was recorded due to *Aeromonas hydrophila* in Chilaw site. The PCR investigations revealed that the viral infection (Lymphosystis) was not recorded during the investigation period. Parasitic infections are the major prevailing disease condition while sudden mortalities could be occurs due to site specific conditions and management issues.

Keywords: *Lates calcarifer*, Diseases, Cage Culture, Water Quality

P3

[45]

ASPECTS OF TILAPIA CULTURE IN PUNJAB, PAKISTAN

Z. Iqbal

Department of Zoology, University of the Punjab, Quaid-i-Azam Campus, Lahore, Pakistan

ABSTRACT

Tilapia culture is growing gradually in the province of Punjab, Pakistan. The monosex culture of tilapia, *Oreochromis niloticus* is practiced on semi-intensive fish farming system. Both locally produced and imported monosex tilapia seed is stocked in earthen ponds (stocking density 6250-10000 fry/ha). The fish is fed on high quality floating tilapia feed (30% protein). The fish is reared from April onwards and harvested in winter. The fish yield varies from 4400-7000kg/ha. This yield variation may be due to fish farm management and input administrated by the farmers. The tilapia has high local demand. The price of fresh iced fish depends on size of the fish. This year fish (600-700g) fetched good price (US\$ 2.0/kg). However, last year the price of fish was almost half than this year price. The polyculture of monosex tilapia with major carp; *Labeo rohita* is also practiced by some fish farmers. The yield of these two species in polyculture is very high (average weight 900g and 3100g for *O. niloticus* and *L. rohita* respectively). Tilapia culture is growing fast in Southern and Central Punjab. Yet, fish farmers have raised the issues of high priced fish feed, low fry survival, fish health issues, fish processing and marketing. The aspects of tilapia culture in the province of Punjab, Pakistan are discussed.

Keywords: Tilapia, Monosex Culture, Polyculture, Semi Intensive, Fish Farming

P4

[46]

**MORPHOMETRIC VARIATION AMONG *Pterygoplichthys* SPECIES IN VICTORIA
AND KALAWEWA RESERVOIRS, SRI LANKA**

I.U. Wickramaratne

*Department of Animal Science, Faculty of Animal Science & Export Agriculture, Uva
Wellassa University of Sri Lanka, Badulla, Sri Lanka*

ABSTRACT

Pterygoplichthys pardalis and *P. disunctivus* are two recorded invasive species in Sri Lankan water bodies, yet information on identification of these two species are lacking locally. Morphological landmarks were used to identify *Pterygoplichthys* species correctly to assign them into distinct genetic groups. 34 morphometric measurements were made on Victoria & Kalawewa reservoirs with 134 & 111 fish specimens respectively. The fish specimens were grouped into five categories according to their abdominal spots and vermiculations. All measurements were standardized by dividing those with standard lengths of each fish specimen and with the equation, $LTs_{(i)} = \log_{10} LT_{(i)} [\log_{10} TL_m / \log_{10} TL_i]$ where TL is the total length, LT(i) is the truss length of ith fish, TL_m is the overall mean total length and b is the slope, within areas of the geometric mean regression on the logarithms of LT and TL (Fernando and Amarasinghe 2011). Five groups were correctly analysed using discriminant analysis with Minitab software 2016. From the principal component analysis, the differences between the species in two reservoirs resulted mainly from predorsal length, head length, head-dorsal length, cleithral width length, head-pectoral length, thorax length, pectoral spine length, abdominal length, pelvic spine length and postanal length. Use of discriminant analysis correctly identified 123 of 134 fish and 105 of 111 fish of the five categories in Victoria (Proportion Correct = 0.918) and Kalawewa (Proportion Correct = 0.946) reservoirs, respectively. Morphological studies on fishes can potentially contribute to better management and conservation strategies for a population.

Keywords: Invasive, *Pterygoplichthys* spp., Morphological Landmarks

P5

[47]

**PREVALENCE OF NEMATODES IN THREE COMMERCIALY IMPORTANT
EDIBLE MARINE FISH SPECIES REPORTED FROM PAKISTAN**

M. Ali and N. Afsar

(IMS) Institute of Marine Science, University of Karachi, Karachi, Pakistan

ABSTRACT

To investigate the prevalence of Nematode parasites in marine fish, total of 42 fish specimens belonging to 3 different fish species *N. japonicus*, *Acanthopagrus arabicus* and *Pomadasys maculatus* were sampled from Karachi fish harbor during September & October 2015. 137 nematodes were recovered from 17 fish specimens. Overall prevalence was recorded as 40.48% and Intensity was 8.06%. In this study, Fifty two (52) Anisakis L3 type II parasites were collected from the liver, intestines and pyloric ceca of *N.japonicus* with the Prevalence and intensity of 66.67%, 5.20% respectively. The highest number of Ascaridoid nematodes was observed in *A.arabicus* sp. prevalence was calculated as 13.33% with the intensity of 38.50%. While 2 specimens of *A.arabicus* was infested by 3 *Capillaria acanthopagri* larva with the prevalence of 20% and the intensity of 66% respectively. Similarly, 5 ascaridoid isolated from 3 specimens of *P.maculatus*. Prevalence was recorded as 25% and intensity was 1.67% respectively.

Keywords: Nematodes, Prevalence, *Capillaria acanthopagri*, Karachi Fish Harbour, Pakistan

