WELCOME

2/25/300 Days /Speakers /Delegates

DEAR FRIENDS

Welcome to the first edition of the Middle East Aquaculture Forum. **"Towards Sustainable Aquaculture in the Middle East"** will be the theme of this first edition, which will focus on vital industry issues affecting the key Middle Eastern aquaculture producing countries.

Aquaculture has a pivotal role to play in global food future. Conservative estimates indicate that output from aquaculture must at least double to meet the demand for aquatic protein by 2050. With a current population of more than 400 million, the Middle East region has an increasingly important role to play in this future, on both the demand and the supply side. In order to meet that future opportunity, we must develop aquaculture responsibly.

With over 100 abstracts received and more than 30 sponsors confirmed, the first edition of the Middle East Aquaculture Forum, Dubai, 5-6 April 2015 promises to be an exciting platform for Middle East Aquaculture experts.

Contributions at MEAF from world renowned experts and local farmers on their hard earned lessons in issues such as rearing practices, disease management, diversification and markets will provide valuable information which will dramatically shorten the costly learning curve for new ventures in the region. This forum will be the first of many such meetings that will offer an important and timely opportunity for researchers, governments and investors to jointly develop a roadmap for sustainable aquaculture in the region

The Middle East Aquaculture Forum, Dubai, 5-6 April 2015 will be hosting workshops, industry presentations and an exhibition for aquaculture suppliers and producers and is sponsored by the European Aquaculture Society (EAS) and the World Aquaculture Society (WAS), with the Arab Aquaculture Society (AAS), the Pakistani Aquaculture Society (PAS) and the Saudi Arab Aquaculture Society (SAAS) as affiliate sponsors.

We hope you enjoy and remember your visit to Dubai. And most of all: we hope you enjoy the time with your colleagues and peers and make life-long friendships and business partnerships.

Your sincerely

Michael Schwarz
Programme Chairman

Mario Stael
Forum Chairman

COMMITTEES

This event is sponsored by the European Aquaculture Society and the World Aquaculture Society, with the Arab Aquaculture Society, the Pakistani Aquaculture Society and the Saudi Arab Aquaculture society as affiliate sponsors.

MEAF will strongly focus on the crucial developments of marine aquaculture in the Middle East . There will be a special presentation on "Trends in Global Aquaculture: focus on the Middle East", "Mechanisms of activating marine aquaculture in the Arab region: constraints and solutions" and "An outlook on the Resources, Strategic Potentials and Investment Opportunities of the Aquaculture and Algaculture Industries in the Middle East".

- Plenary talk - **Michael Schwarz** - Trends in global aquaculture: opportunities for the Middle East
- Plenary talk - **Eng. Ahmad Al Ballaa** - Towards a roadmap for sustainable aquaculture in the MENA region
- Plenary talk - **Albert Tacon** - Future feeds for a growing aquaculture sector in Hungry

Organising Committee

Mario Stael
Forum Chairman

Peter Engels
Logistics Chairman

Programme Committee

Michael Schwarz
Programme Chairman

Dr Imad Patrick Saoud – Lebanon
Dr Seyed Hossein Hoseinifar, Iran
Dr Fahad Saleh Ibrahim, Oman
Dr Jean-Yves Mevel, UAE
Dr Wenresti G. Gallardo, KSA
Dr Peter Pesch, KSA
Dr Hesham Hassanien, KSA
Dr Hussein Elghobashy, Egypt
Dr David Griffith, KSA
Dr Haydar Alsahtour, KSA
Mario Stael, Belgium

Plenary talks

09:30 - Eng. Ahmad Al Ballaa
TOWARDS A ROADMAP FOR SUSTAINABLE AQUACULTURE IN THE MENA REGION

MIDDLE EAST AQUACULTURE FORUM 2015

ORGANIZERS PROFILE

Mario Stael:
I am proud that MEAF has started to set its mark in Dubai. I want to thank both our sponsors, exhibitors and delegates for their major contribution to this first MEAF edition

Marevent is the world's leading aquaculture conference organiser

Creating a Middle East Aquaculture Forum was an ambitious but rewarding journey. Thanks to the support of the industry stakeholders who made it possible!

MarEvent is a leading information and organisation specialist on aquaculture.

Our services include print and electronic newsletter, conferences and exhibitions, seminars, etc.
A large efficient team ready to organise every detail with great care, so that you may sit back, relax and enjoy your

Find all future marevents on www.marevent.com or on linked-in: Mario Stael.
For detailed information contact:
mario@marevent.com

prime is a Professional Conference Organiser specialised in inspiring meetings

For us to pioneer an aquaculture meeting in Dubai gathering hundreds of delegates from all around the world is an inspiration in its own.

prime is a world leading PCO based in United Arab Emirates and Indonesia

prime was set up with the sole purpose of providing outstanding, "prime" services that inspire our clients, exceed their expectations, and go beyond the standard, off-the-peg MICE and leisure services.

With over 15 years of MICE and Travel industry experience, prime has successfully designed and managed a broad array of leisure programmes, conferences, meetings, incentives and events. The goal and outcome of all our meetings is straightforward: inspiring people and creating communities that outlast the short time span of the event.
More information on:
www.primemena.com

SPONSORS PROFILE

MEAF-15 will be the first edition of many such meetings that will offer an important and timely opportunity for researchers, governments and investors to jointly develop a roadmap for sustainable aquaculture in the region.

WAS has grown to more than 3,000 members.

The World Aquaculture Society was founded in 1969 as the World Mariculture Society.

The World Aquaculture Society (WAS) is strategically positioned to play an important role in assuring the progressive development of aquaculture worldwide by meeting the increased global demand for based information and technology. In order to meet the challenges of the future, WAS has a long-term vision and mission priorities with a renewed "Commitment to Excellence." The World Aquaculture Society, through this commitment to excellence in science, technology, education, and information exchange, will endeavor to contribute to the progressive and sustainable development of aquaculture throughout the world.

EAS is the leading aquaculture society in Europe for four decades.

EAS was established in Oostende, Belgium, in 1975.

As has four principal objectives
1. To promote contacts between all involved or interested in marine and freshwater aquaculture;
2. To facilitate the circulation of aquaculture related information;
3. To promote the sponsorship of multi-disciplinary research concerning aquaculture;
4. To enhance cooperation among governmental, scientific and commercial organizations and individuals on all matters dealing with aquaculture.

ACKNOWLEDGEMENT

The Middle East Aquaculture Forum organisers would like to sincerely thank the following sponsors for their support to the Forum.

1

Sponsors

European Aquaculture Society
World Aquaculture Society

Destination partner

Dubai Tourism

2

Exhibitors

Acqua & Co
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FMD Middle East
Ictyopharma
Marine Aquaculture Technology
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3

Media sponsors

AAN magazine
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Aquaculture North America
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Fish Farming Advocate
Global Aquaculture advocate
Infosamak
Panorama Acuicola
The FishSite

GENERAL INFORMATION

The pages below provide you with all the practical information you need to know about the MEAF15, the venue and the timings and will help you make the most out of your stay in Dubai.

Conference venue

The Middle East Aquaculture Forum takes place in the Dubai International Convention and Exhibition Centre (DICEC) located on Sheik Zayed Road, nearby the Dubai World Trade Centre metro station.

Accommodation

information on available hotels can be obtained from the registration desks. The selected hotels for MEAF are all located within proximity from the conference centre.

Badge

Participants are requested to wear their badge at all times during the Forum. Participants who lose their badge can obtain a replacement badge at the registration desk. A replacement fee of U$100 will be charged.

Conference secretariat

The MEAF secretariat is located at the on-site registration desks.
The secretariat will be open during conference hours (08:00 - 18:00) and can be reached on the following number: +971 56 684 8080

Banking services

Cash dispensers are available in Concourses 1 and 2 of the Dubai International Convention and Exhibition Centre (less than 2 minutes walk).

Catering

Coffee breaks are scheduled on:
* Saturday 5 April from 10:00-10:30 and 16:10-16:40
* Sunday 6 April from 10:20-10:50 and 16:10-16:40
No lunch is provided as part of the MEAF registration fee. Catering outlets on paid basis can be found in Concourse 1, 2 and at the Plaza, outside the convention centre, in front ot Al Multaqua Hall Happy hours are scheduled every day from 18:00 - 18:30 in the exhibition hall - Al Multaqua.

Cloakroom

The cloakroom is located near the Convention Gate Entrance and a nominal fee of AED 20 per item is applicable. During MEAF the cloakroom will be operational from 08:00 to 19:00.

Exhibition

The exhibition will be held in Al Multaqua Hall.
The opening hours:
Saturday 5th April - 08:30 - 18:00
Sunday 6th April - 08:30 - 18:00
Happy hours are scheduled every day from 18:00 - 18:30 in the exhibition hall - Al Multaqua.
For the exhibition plan, please see page 21.

GENERAL INFORMATION

The pages below provide you with all the practical information you need to know about the MEAF-15, the venue and the timings and will help you make the most out of your stay in Dubai.

Foreign currency

The official currency in United Arab Emirates is the UAE Dirham. Please note that only US Dollars as an alternative for AED will be accepted for onsite registration payments.

Happy Hour

A networking happy hour will be organised inside the exhibition hall, on a daily basis, between 18.00-19.00, allowing delegates to share ideas with peers and interact with the industry.

Lost and found

The Lost and found office is located on Level 1, above Hall 8 and is responsible for the safekeeping of items that have been found at the premises. Items will be returned to the righful owner upon presentation of reasoable proof of ownership. The office operates 24/7.

Poster presentations

Posters are displayed on a permanent basis inside Al Mutalqua Hall plenary room. **Putting up your poster:** speakers with a poster presentation should put up their posters on Saturday 4th of April between 16:00 - 18:00 or on Sunday 5th of April between 08:00 - 09:00. Please make sure to pick-up your badge first to enter Al Multaqua Hall. Poster sessions are scheduled throughout the day, during the programme breaks and presenters are expected to be at their poster during these breaks.

Speaker ready room

Speakers can review and edit their presentations at the dedicated speaker desk, located inside the Al Multaqua Hall . All speakers are requested to hand in their PPT presentation at least 4 hours before their presentation. Please be advised that presentations on personal laptops will NOT be allowed.

Insurance

The organisers of the Middle East Aquaculture Forum do not accept any liability for individual medical, travel or personal insurance and participants are strongly advised to take out their own personal insurance policies. The organisers of the Middle East Aquaculture Forum, also disclaim all responsibility for loss due to theft or negligence.

Opening ceremony

The Opening ceremony will take place in the Al Multaqua Hall plenary room on Saturday 5th of April at 08:30.

Registration

The Forum is open to all duly registered participants. The official participant name badge is required for admission to all conference and exhibition area. Registration to MEAF includes:
- Access to all sessions and exhibition
- Proceedings book
- 4 coffee breaks held in Al Multaqua hall
- 2 happy hours in Al Multaqua hall at 18:00 - 19:00

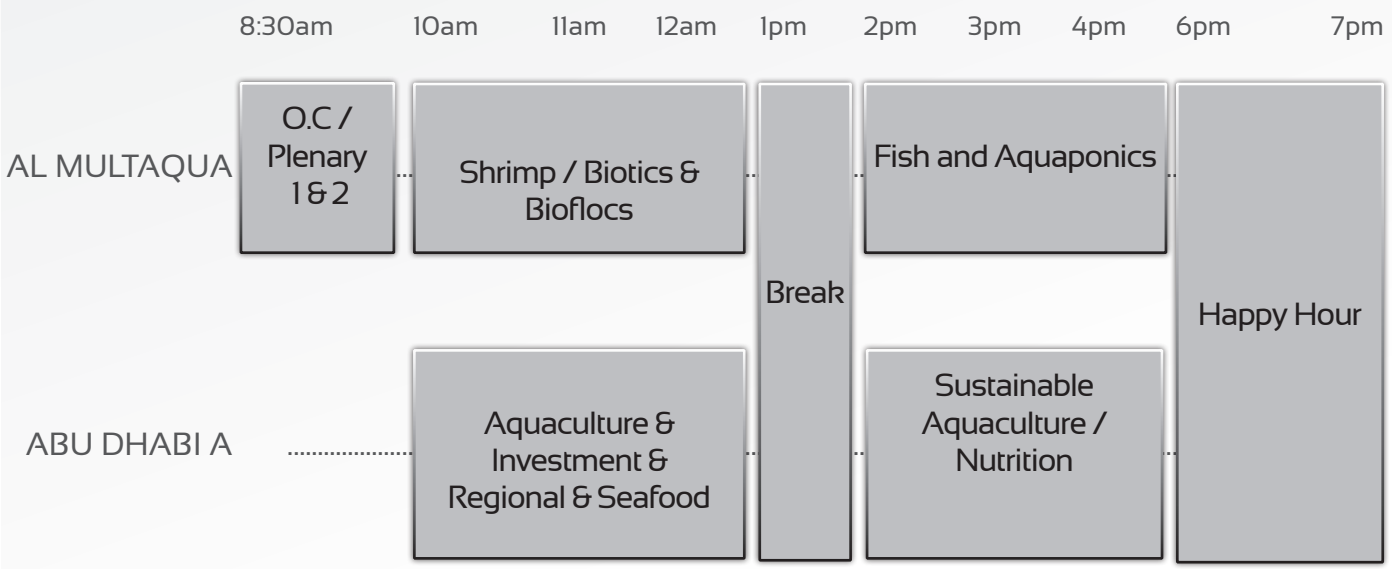
Opening hours:
Saturday 5th April - 07:30 - 18:00
Sunday 6th April - 07:30 - 18:00

MIDDLE EAST AQUACULTURE FORUM 2015

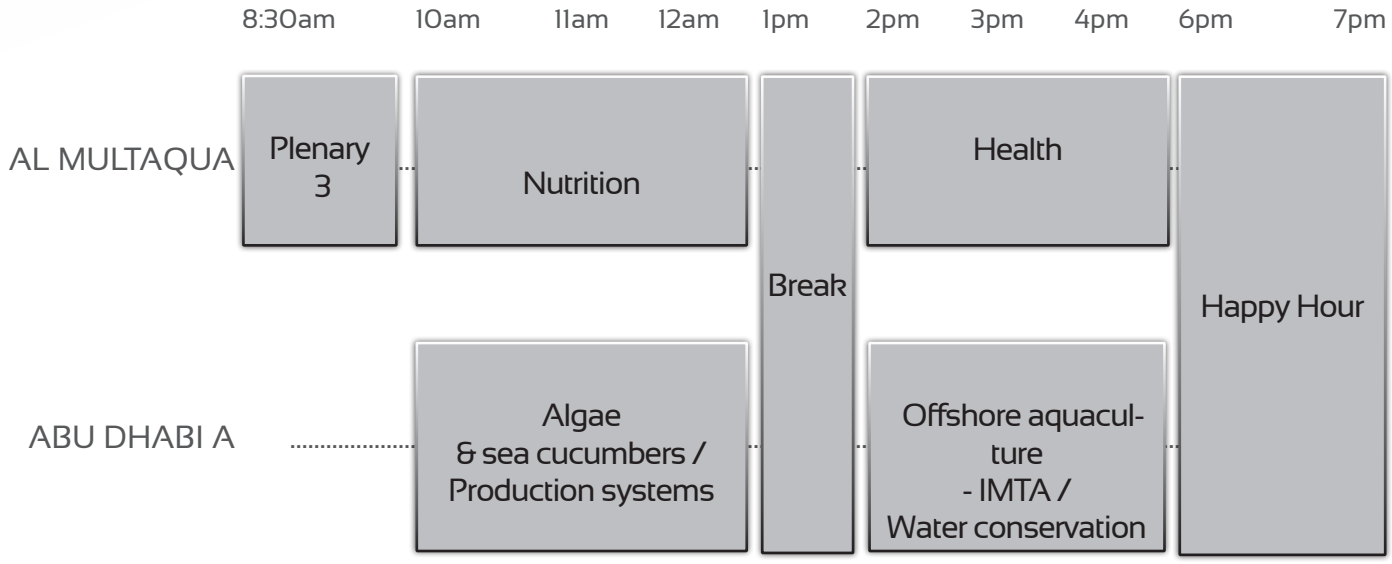
PROGRAMME DETAILS

The middle east aquaculture forum offers a unique platform to discuss burning issues related to the rapidly growing aquaculture sector in the middle east and how to develop it in a sustainable manner.

MAIN TIMETABLE - SUNDAY 5 APRIL



MAIN TIMETABLE - MONDAY 6 APRIL



MIDDLE EAST AQUACULTURE FORUM 2015

SUNDAY 5 APRIL 2015

The organisers would like to extend a special "thank you" to WAS and EAS for their major contributions to the MEAF scientific programme.

TIMETABLE PLENARY ROOM // AL MULTAQUA HALL

08:30 (30 min.)

Opening Ceremony and welcome address

09:00 (1 hr)

Plenary talks

09:00 - Dr Michael Schwarz
TRENDS IN GLOBAL AQUACULTURE: OPPORTUNITIES FOR THE MIDDLE EAST

09:30 - Eng. Ahmad Al Ballaa
TOWARDS A ROADMAP FOR SUSTAINABLE AQUACULTURE IN THE MENA REGION

10:00 (30 Min.)

Coffee break and poster presentations

10:30 (1 hr 20')

Shrimp session

10:30 - Farshad Shishehchian
037 - MIXOTROPHIC ™ SYSTEM

10:50 - David Griffith
093 - COMMERCIAL FARMING RECOVERY FROM WSSV: THE NAQUA EXPERIENCE

11:10 - Humberto Villarreal
083 - ADVANCES IN THE INTENSIVE CULTURE OF WHITE SHIMP Litopenaeus vannamei IN DESERT CONDITIONS IN NORTHWEST MEXICO.

11:30 - Shuaib T Muhammad
090 - SHRIMP HEALTH MONITORING IN NURSERIES AND GROW OUT FARMS – A PRACTICAL APPROACH

11:50 (40 min.)

Pro-Pre biotics

11:50 - Einar Ringo
012 - APPLICATION OF DIETARY SUPPLEMENTS (SYNBIOTICS AND PROBIOTICS IN COMBINATION WITH PLANT PRODUCTS AND β-GLUCANS) IN AQUACULTURE

12:10 - Seyed Hossein Hoseinifar
036 - PREBIOTICS RESEARCH IN MIDDLE EASTERN AQUACULTURE: ADVANCES AND CHALLENGES

MIDDLE EAST AQUACULTURE FORUM 2015

SUNDAY 5 APRIL 2015

The organisers would like to extend a special "thank you" to WAS and EAS for their major contributions to the MEAF scientific programme.

TIMETABLE PLENARY ROOM // AL MULTAQUA HALL

12:30 – 20 min.

Biofloc

12:30 - Ashraf Suloma
029 - BIOFLOC SYSTEM FROM LAB TO FIELD: MORE PROS THAN CONS

12:50 – 1 hr 40'

Lunch break and poster presentations

14:30 – 1 hr 40'

Fish session

14:30 - R.S.N. Janjua
074 - DEVELOPMENT OF TILAPIA AQUACULTURE INDUSTRY IN PAKISTAN (THE BLUE REVOLUTION)

14:50 - Khaled Al-Abdul-Elah
033 - PHOTOTHERMAL MANIPULATION FOR YEAR ROUND EGG PRODUCTION OF SOBAITY SEABREAM

15:10 - Imad Saoud
026 - ENVIRONMENTAL TOLERANCES AND REQUIREMENTS OF SIGANIDS

15:30 - Aftab Alam
070 - INTEGRATION OF AQUACULTURE WITH SEAWEED AND HALOPHYTE CROP PRODUCTION IN SAUDI ARABIA

15:50 - Michael Schwarz
WORLD AQUACULTURE SOCIETY: NETWORK FOR AQUACULTURE ACADEMICS & PROFESSIONALS

16:10 – 30 Min.

Coffee break and poster presentations

16:40 – 1 hr 20'

Aquaponics

16:40 - Jean Yves Mevel
091 - 2 YEARS OF AQUAPONICS RESEARCH IN UAEU, THE LESSONS

17:00 - Ms. Nahid Mohammadi
030 - MONITORING OF AQUAPONIC SYSTEM USING WIRELESS SENSOR NETWORK

17:20 - Wenresti G. Gallardo
086 - ACCUMULATION OF HEAVY METALS IN RECIRCULATING AND NON-RECIRCULATING AQUAPONIC SYSTEMS FOR GROWING NILE TILAPIA AND LETTUCE

17:40 - Ross Dodd
077 - THE SOUND OF SHRIMP EATING – PASSIVE ACOUSTIC FEEDING CONTROL TECHNOLOGY IMPROVES GROWTH, FOOD CONVERSION AND QUALITY WATER IN SHRIMP AQUACULTURE

18:00 – End

MIDDLE EAST AQUACULTURE FORUM 2015

SUNDAY 5 APRIL 2015

A special thanks to World Aquaculture Society and European Aquaculture Society for their scientific contributions into MEAF programme.

TIMETABLE PLENARY ROOM // ABU DHABI A

10:30
40 min.

Aquaculture & investment

10:30 - Haydar Alsahtout
THE PROSPECTS, STRATEGIC POTENTIALS, AND INVESTMENT OPPORTUNITIES OF THE AQUACULTURE AND ALGACULTURE INDUSTRIES

10:50 - Ahmed Mohamed Nasr-Allah
032 - THE ECONOMIC PERFORMANCE OF TILAPIA CULTURE IN EARTHEN PONDS IN EGYPT; COMPARISON OF THREE CULTURE SYSTEMS

11:10
1 hr 20'

Aquaculture in the Region

11:10 - Alaa El Dahhar
100 - ARAB AQUACULTURE SOCIETY - MECHANISMS OF ACTIVATING MARINE AQUACULTURE IN THE ARAB REGION ; CONSTRAINTS AND SOLUTIONS

11:30 - Sherif Sadek
058 - INTEGRATED AQUACULTURE-AGRICULTURE SYSTEMS IN ARID AREAS IN THE MIDDLE EAST.AGRICULTURE IN MIDDLE EAST.

11:50 - Jacob Bregnballe
038 - AQUACULTURE PROJECT DEVELOPMENT – FROM PROJECT IDEA TO PRODUCTION FOR MARKET

12:10 - Francesco Cardia
102 - THE IMPLEMENTATION OF THE FAO PROJECT: "STRENGTHENING AND SUPPORTING FURTHER DEVELOPMENT OF AQUACULTURE IN THE KINGDOM OF SAUDI ARABIA"

12:10
20 min.

Ornamentals

12:30 - Babak Moghaddasi
025 - EFFECTS OF THE DIETARY SYNBIOTIC 'BiominImbo' ON GROWTH AND FEEDING INDICES IN GOLDFISH (Carassius auratus)

12:30
20'

Seafood Processing

12:50 - T.K. Srinivasa Gopal
006 - ADVANCES IN SEAFOOD PROCESSING TECHNOLOGY USING THERMAL AND NON THERMAL PROCESSING

MIDDLE EAST AQUACULTURE FORUM 2015

SUNDAY 5 APRIL 2015

A special thanks to World Aquaculture Society and European Aquaculture Society for their scientific contributions into MEAF programme.

TIMETABLE BREAKOUT ROOM // ABU DHABI A

12:50 (1 hr 40')

Lunch break and poster presentations

14:30 (1 hr 40')

Sustainable Aquaculture

14:30 - Diego Mendiola
016 - STRATEGIC DEVELOPMENT OF OPEN OCEAN MUSSEL & OYSTER FARMING; A CASE STUDY FROM THE BAY OF BISCAY

14:50 - Muhammad Naeem Khan
007 - PROSPECTS OF CAGE AQUACULTURE ALONG THE PERSIAN GULF COAST OF UNITED ARAB EMIRATES

15:10 - Mehdi Soltani
035 - RESEARCH NEEDS IN IRAN AQUACULTURE

15:30 - Neil Auchterlonie
039 - REGULATION, SCIENCE & INNOVATION, AND VOLUNTARY APPROACHES AS THREE KEY ELEMENTS OF SUSTAINABLE aquaculture

15:50 - Adewumi Adejoke A.
008 - A CASE OF COMMERCIAL SHRIMP FARMING IN THE NIGER DELTA OF NIGERIA

10:00 (30 Min.)

Coffee break and poster presentations

16:40 (20 min.)

Nutrition

16:40 - Gafar al-Ajmi
078 - DEVELOPMENT OF FISHMEAL AND FISH OIL FOR AQUACULTURE FEEDS IN THE SULTANATE OF OMAN

17:00 - Philippe Sourd
092 - COMBINING MARINE HYDROLYSATES ASSETS FOR BETTER FEED PERFORMANCES AND SUSTAINABLE FISH MEAL REPLACEMENT ALL ALONG THE PRODUCTION CYCLE

18:00 End

17:20 - John Benemann
097 - MICROALGAE AQUAFEEDSALONG THE PRODUCTION CYCLE

MONDAY 6 APRIL 2015

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TIMETABLE PLENARY ROOM // AL MULTAQUA HALL

08:30
30 min.

Plenary talk

08:30 - Albert Tacon
053 - FUTURE FEEDS FOR A GROWING AQUACULTURE SECTOR IN HUNGRY

09:00
1 hr 50'

Nutrition

09:00 - Mohammad Y. Alsaiady
028 - EXTRUDED FEED FOR WARM WATER FINFISH AND SHRIMP

09:20 - Abdelhamid Mohamed Slah Eid
004 - PROTEIN REQUIREMENTS FOR FINGERLINGS GILTHEDHEAD SEABREAM (*SPARUS AURATA*)

09:40 - Mohammed Arshad Hossain
011 - EVALUATION OF DIFFERENT COMMERCIAL FEEDS ON GROW-OUT SOBAITY, *SPARINDENTEX HASTA* FOR OPTIMUM GROWTH PERFORMANCE, MUSCLE QUALITY AND COST OF PRODUCTION

10:00 - Naser Agh
091 - EFFECTS OF REPLACING FISH MEAL AND OIL WITH PLANT SOURCES ON PERFORMANCE, DIGESTIVE ENZYMES AND GUT MICROBIAL COMPOSITION OF *ACIPENSER PERSICUS AND ONCORHYNCHUS MYKISS*

10:20
30 Min.

Coffee break and poster presentations

Nutrition

10:50 - Noor Khan
095 - EFFECT OF Moringa oleifera MEAL ON THE GROWTH, BODY COMPOSITION AND NUTRIENT DIGESTIBILILITY OF Labeo rohita

11:10 - Ibrahim El Shishtawy Hassan Belal
013 - EVALUATION OF DATE PITS AS A REPLACEMENT FOR YELLOW CORN IN TILAPIA *OREOCHROMIS NILOTICUS FINGERLING* SEMI-PURIFIED DIET

11:30 - Muhammad Ashraf
015 - VARIOUS LYSINE TO ARGININE RATIO AFFECT GROWTH OF LABEO ROHITA (ROHU) FED ON HIGH PLANT PROTEIN DIETS

11:50 - John Sweetman
043 - ALLTECH'S ALGAE AND ORGANIC MINERAL TECHNOLOGIES BOOST OMEGA 3 UPTAKE

12:10 - Nasser K. Ayaril
047 - EFFECT OF A NOVEL FEED ADDITIVE ON LIPID VACUOLIZATION OF THE HEPATOPANCREAS AND PRODUCTION PARAMETERS OF TWO SPECIES OF WHITE SHRIMPPenaeus(Fenneropenaeus)indicusANDPenaeusvannameiINSAUDIARABIA

MIDDLE EAST AQUACULTURE FORUM 2015

MONDAY 6 APRIL 2015

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TIMETABLE PLENARY ROOM // AL MULTAQUA HALL

10:50 – 2 hrs

12:30 - Joseph P. Kearns
027 - EXTRUSION COOKING: METHOD OF PRODUCTION FOR HIGH QUALITY AQUATIC FEEDS, BOTH FRESH AND SALTWATER SPECIES

12:50 – 1 hr 40'

Lunch break and poster presentations

14:30 – 3 hr 30

Health

14:30 - Victoria Alday
098 - BIOSECURITY RISK FOR THE SHRIMP INDUSTRY IN THE MIDDLE EAST

14:50 - Mostafa Sharif Rohani
024 - APPLICATION OF "AVISHIT" INSTEAD OF " MALACHITE "TOWARDS GREEN AQUACULTURE AND HUMAN SAFETY

15:10 - Mehdi Soltani
034 - YERSINIOSIS IN FARMED RAINBOW TROUT IN IRAN AND EFFICACY OF LOCAL VACCINE TO THE EXPERIMENTAL DISEASE

15:30 - Laleh Roomiani
040 - BIOSECURITY IN AQUACULTURE; USE OF ESSENTIAL OIL IN CONTROL OF ZOONOTIC DISEASE

15:50 - Aliakbar Hedayati
014 - NECESSITY OF FISH WELFARE IN ACADEMIC STUDIES

16:10 – 30 Min.

Coffee break and poster presentations

Health

16:40 - Rahim Abdi
076 - STUDY ON GILL EPITHELIUM OF SOBAYTI, SPARIDENTEX HASTA WITH TEM ELECTRON MICROSCOPIC IN DIFFERENT SALINITY

17:00 - Azad I.S.
055 - POLYVALENT VACCINES: MEANS TO ACHIEVE SUSTABILITY IN AQUACULTURE

17:20 - Ahmed Gharieb Abdulwahab
061 - DISEASE DIAGNOSIS APPROACHES OF ON-GROWING MARINE FIN-FISH CAGES IN UAE.

17:40 - Felipe Ascencio
072 - IMMUNE RESPONSE OF Litopenaeus vannamei AFTER TREATMENT WITH A MINERAL EXTRACT FEED ADDITIVE THAT REDUCES WSSV AND Vibrio parahaemolyticus INFECTIONS

18:20 – End

18:00 - Chen Su
044 - RAPID, SPECIFIC, AND SENSITIVE ONSITE DIAGNOSIS OF WHITE SPOT SYNDROME VIRUS ON POCKITTM SYSTEM, A FIELD-DEPLOYABLE TOOL

MONDAY 6 APRIL 2015

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TIMETABLE PLENARY ROOM // ABU DHABI A

09:00
1 hr 20'

Algae & sea cucumbers

09:00 - Tawfiq Abu-Rezq
052 - PRE-COMMERCIAL SCALE PRODUCTION OF DUNALIELLA SALINA: INDUCTION AND EXTRACTION OF B-CAROTENE IN KUWAIT

09:20 - Mahnaz Rabbaniha
068 - HARMFUL ALGAL BLOOMS (HABS) AND RED TIDE PHENOMENON OF *COCHLODINIUM POLYKRIKOIDES* IN THE PERSIAN GULF - IRANIAN SIDE

09:40 - Bondada. S. Rao
071 - PRE CONCENTRATION OF ALGAE DUNALIELLA SALINA – USING SILICON CARBIDE MEMBRANE -A CASE STUDY

10:00 - Rossita Shapawi
082 - THE PERFORMANCE OF RED SEAWEED (RHODOPHYTES, KAPPAPHYCUS SPP.) CULTIVATED IN LAND-BASED CULTURE FACILITIES

10:20
30 Min.

Coffee break and poster presentations

10:50
1 hr 40'

Production systems

10:50 - Khalid Salie
041 - AN ASSESSMENT OF KNOWLEDGE TRANSFER AMONG FISH FARMERS TO IMPROVE INTEGRATED AQUACULTURE-AGRICULTURE IN SOUTH AFRICA

11:10 - Juliette Delabbio
049 - A POWERFUL NEW TOOL FOR SUSTAINABLE FISH FARMING: LIGHT-EMITTING DIODE (LED) LIGHTING SYSTEMS

11:30 - Dauda Akeem Babatunde
084 - COMPARATIVE EVALUATION OF POLYPROPYLENE AND PALM KERNEL SHELL AS BIOFILTER MEDIA FOR DENITRIFICATION OF FISH CULTURE WASTEWATER

11:50 - Fernando C. Malet Navarro
060 - AUTOMATION AND CONTROL SYSTEMS IN AQUACULTURE

12:10 - José Naranjo-Páramo
073 - INTENSIVE ZERO-WATER EXCHANGE TECHNOLOGY FOR FRESHWATER REDCLAW C. quadricarinatus APPLIED IN DESERT CONDITIONS

MONDAY 6 APRIL 2015

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TIMETABLE PLENARY ROOM // ABU DHABI A

12:50
1 hr 40'

Lunch break and poster presentations

14:30
1 hr 40'

Offshore - IMTA

14:30 - Fereidoon Owfi
063 - ECOLOGICAL ASSESSMENT MODEL FOR CAGE CULTURE SITE SELECTION

14:50 - Alessandro Ciattaglia
101 - THE IMPLEMENTATION OF THE FAO PROJECT: "STRENGTHENING AND SUPPORTING FURTHER DEVELOPMENT OF AQUACULTURE IN THE KINGDOM OF SAUDI ARABIA (UTF SAU/048/SAU)"

15:10 - J. Jed Brown
079 - LIFE CYCLE ANALYSIS FOR AN INTEGRATED SEAWATER AQUACULTURE/ AGRICULTURE PROJECT FOR BIOENERGY PRODUCTION IN THE MIDDLE EAST

15:30 - S. Abbas HAGHSHENAS
080 - FEASABILITY STUDY FOR DEVELOPING AN ENVIRONMENTALLY SUSTAINABLE INTEGRATED MULTI-TROPHIC MARICULTURE SYSTEM IN THE NORTHERN PERSIAN GULF AND GULF OF OMAN COASTLINES

15:50 - S. Abbas HAGHSHENAS
081 - APPLICATION OF MODIS SATELLITE IMAGERY TO INVESTIGATE GENERAL CIRCULATION PATTERNS IN THE OMAN SEA AS TO BE APPLIED IN SUSTAINABLE MARICULTURE DEVELOPMENT

16:10
30 Min.

Coffee break and poster presentations

16:40
1 hr 20'

Water conservation

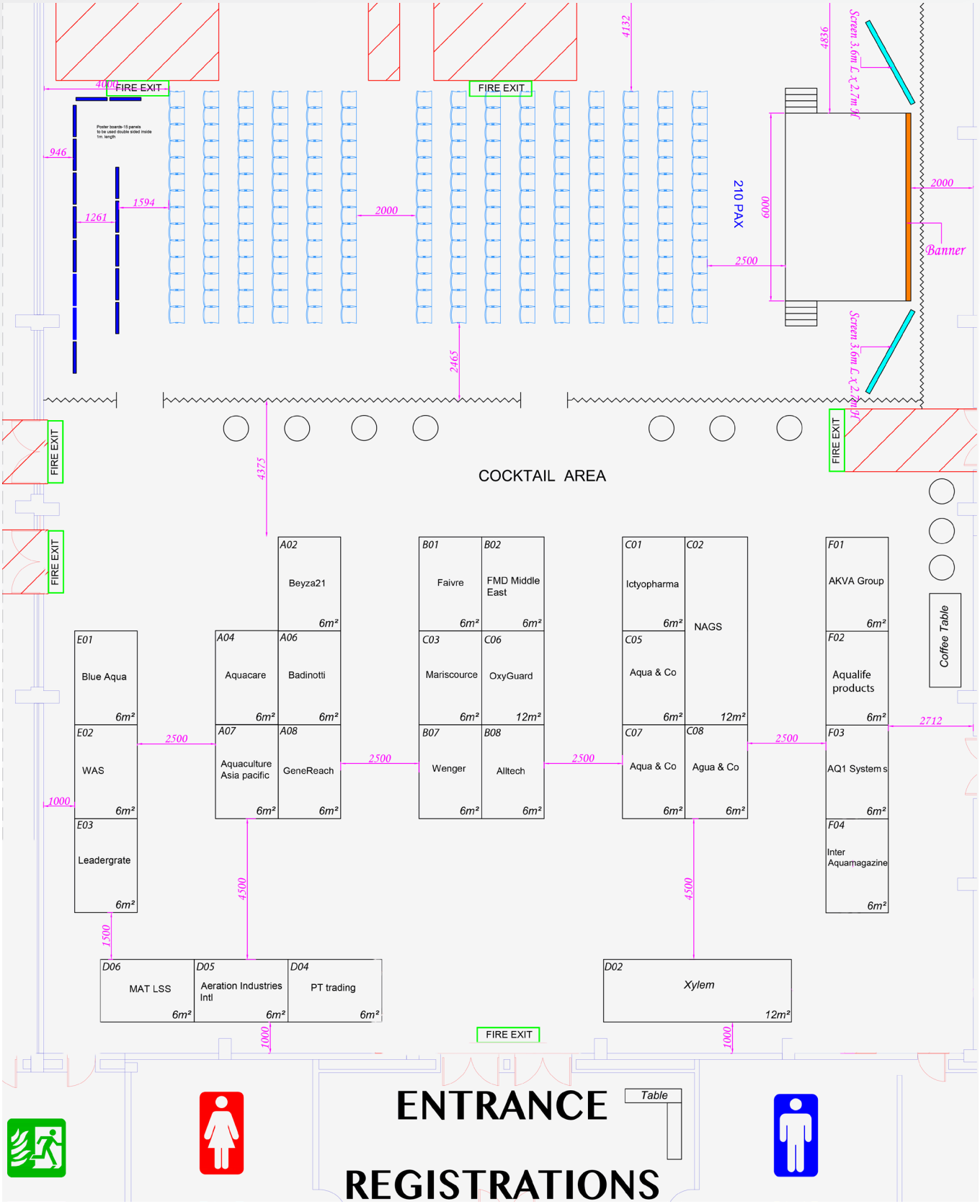
16:40 - Glenn R. Shiell
088 - USE OF ENVIRONMENTAL MODELS TO INFORM DEVELOPMENT OF SUSTAINABLE FIN-FISH AQUACULTURE IN WESTERN AUSTRALIA

17:00 - Mahmoud. H Ahmed
054 - USING SATELLITE IMAGES IN DELINEATION AND MAPPING THE EGYPTIAN LAKES

18:00
End

17:20 - Edward J.B.
010 - IMPACT OF PALM OIL MILL EFFLUENT ON PHYSICO-CHEMICAL PARAMETERS OF A SOUTHWESTERN RIVER, EKITI STATE, NIGERIA.

EXHIBITION AREA



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Ali Mohammadi
ali.mohammadi@goldengroup.fr
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010

Animal Science Health and diseases

TITLE: IMPACT OF PALM OIL MILL EFFLUENT ON PHYSICO-CHEMICAL PARAMETERS OF A SOUTH WESTERN RIVER, EKITI STATE, NIGERIA

Presenting author: Edward J.B.
Institute: Department of Zoology, Faculty of Science, Ekiti State University, Nigeria
Co-author(s): Idowu, E.O. and Oyebola, O.E.

Topic: Water Quality and Usage

Abstract:
The physico-chemical parameters of water and palm oil mill effluent (POME) samples of Ayanyan River, Ado-Ekiti, Ekiti State, Nigeria, was investigated between August 2009 and July 2010 to assess the impact of the POME on the water quality. The parameters tested were pH, temperature, alkalinity, total suspended solids, dissolved oxygen, biochemical oxygen demand, nitrate, phosphate, potassium, magnesium, lead, oil and grease. Standard methods of water and waste water analysis were used and compared with WHO permissible limit. The results showed that all the samples had values above the WHO standards which makes the river water unsafe to both human and aquatic life. As there is rising concern globally regarding POME as one of the sources of greenhouse gases, legislative measures are necessary to enforce laws and rules on land-use and waste regulation to control the location and management of palm oil mills, especially when cited near water bodies close to residential areas.

014

TITLE: NECESSITY OF FISH WELFARE IN ACADEMIC STUDIES

Presenting author: Aliakbar Hedayati
Institute: Department of Fisheries, Faculty of Fisheries and Environment, Gorgan University of Agricultural Sciences and Natural Resources, Gorgan, Iran

Topic: Animal welfare

Abstract:
Developing countries that are focused on studies understanding and conservation of fish and aquatic animals. These professional areas are associations of scientists and resource managers whose primary interests are fish and aquatic animals. Their policies and position statements are based primarily on information that has been developed through scientific processes, but they also reflect ethical concerns, including the conservation of the diversity and number of species and respect for age processes in all forms. Research studies of aquatic animals, the ecosystems in which fishes are found, the parameters influencing the health and wellbeing of fishes and the variety of human activities that depend upon and/or affect aquatic animals are core activities for all 3 societies. These societies, however, believe that their members are responsible not only for advancing scientific knowledge and understanding of fish and aquatics but for improving human appreciation for these species and the industries that they support.

All 3 societies actively promote research and the dissemination of informati-

on derived from that research. They also advocate respect for life processes, the forms of life that make up the various environments, and the humane treatment of fishes used in research study. The understanding and welfare of fish used in research can be served best by using a multidisciplinary approach in which data and expertise from several scientific disciplines, including such areas as aquaculture, toxicology, ecology, behavior, nutrition, genetics, physiology and fish health, are merged in order to address issues concerning animal care and use. Also it must be understood that study is conducted in a variety of human culture settings.

024

TITLE: APPLICATION OF "AVISHIT" INSTEAD OF " MALACHITE "TOWARDS GREEN AQUACULTURE AND HUMAN SAFETY

Presenting author: Mostafa Sharif Rohani

Institute: Iranian Fisheries Research Organization, Iranian Ornamental Fish Society

Topic: Drugs and Chemotherapeutics

Abstract:

Aquaculture is the fastest growing industry around the world , but there are various problems associated with aqua-cultural production. Due to the intensification of rearing methods and systems, diseases and pathogens have been an integral part and formidable obstacle to aquaculture industry worldwide. Many of the antibiotics and other synthetic drugs have serious side effects in biological system and therefore, natural products are safer because they are more in harmony with the biological system. Habitual use of antibiotics can lead to problems with bacteria resistance and with unacceptable residues in aquaculture products and environment. Resistant bacterial strains could have a negative impact on the therapy of fish diseases or human diseases and the environment of the fish farms. On the other hand, in regarding to executive program of export of aquaculture products to other points of the world, the use of natural chemical agents in aquaculture is necessary to establish the market.

Different medicinal plants and herbs and/or combinations of them are known to have properties such as anti-viral, anti-bacterial, anti-fungal, physiological systems (immune system, digestive system) supporting, hormonal balancing and many other properties. Moreover, these substances are nontoxic, biodegradable and biocompatible. No herbal resistance immunity has been found by any pathogen to date. It is well known and documented that medicinal herbs have strong antibacterial effects. Polysaccharides, flavonoides, phenolics and proteoglycans are known to play important role in preventing and/or controlling bacterial infections. Several plant products have been found to have potent antiviral activity against fish and shrimp viruses (IPN, VSH, IHN). In aquaculture several infectious diseases are reported mainly belongs to species of Pseudomonas, Aeromonas, Streptococcus and Vibrio species and a few parasitic organisms like Protozoan, Helminthes and Arthropods. Bacterial species causes high mortality and sever economic loss during its outbreak in cultured fish.

Many plant-derived compounds have been found to have non-specific immune stimulating effects, growth promoter and of antioxidant activity in aquatic animals, and also fertility enhancer in female broodstock, increasing fecundity and gonadal weight, effective on sperm quality of broodstock. Now, various medicinal plants have been evaluated in Iran to control fish diseases and have produced satisfactory results.Finally , We introduce new herbal drug with trade mark of " AVISHIT ' instead of malachite green and without any side effect for human safety and environment . AVISHIT , as a antimicrobial agent, derived from extract of "Zataria multiflora" and approved and stablished in Iranian veterinary pharmacopeia . Its dosage is 50 ppm for disinfection of incubatory period of trout eggs .

033

TITLE: PHOTOTHERMAL MANIPULATION FOR YEAR ROUND EGG PRODUCTION OF SOBAITY SEABREAM

Presenting author: Khaled Al-Abdul-Elah
Institute: Kuwait Institute for Scientific Research
Co-author(s): Salam Al-Ablani, Saleem El-Dakour, Tawfiq Abu-Rezq, Ahmad Al-Marzouk

Topic: Hatchery & Larvae Management

Abstract:
Year round availability of fingerlings is crucial for any commercially viable aquaculture operation. The objective of this preliminary work was to develop procedures for a continuous supply of high quality sobaity seabream (Sparidentex hasta) eggs, a prerequisite for uninterrupted mass fry production. Three indoor photoperiod units, each with two 25 m3 circular tanks (5 m in diameter) were used to conduct this work. Each tank was equipped with individual recirculating systems for testing three different photothermal regimes. One-hundred fifty sobaity breeders (3-4 years old, 2.3 - 6.1 kg in body weight, were transferred from the outdoor tanks to the indoor photoperiod tanks. Each tank was stocked with 25 fish, 15 females and 10 males.

The three photoperiod units were assigned to three treatments of photoperiod and water temperature regimes: control spawning (simulated ambient regimes, 11:00 hr. daylight and 19°C, unit 1), delay of spawning (unit 2), and advance spawning (unit 3). Successful spawning was achieved close to the expected timing of the three photoperiod and water temperature regimes during 2008 and was repeated in 2009,Table 1. The total quantity of spawned eggs in year 2009 from the three treatments was 130.43 million compared to 75.83 million spawned in year 2008. Table 2 presents the summary of the spawning data recorded for the three experimental treatments regimes during 2008 and 2009.

Variations in the spawning parameters between the three treatments in 2008 and 2009 were recorded. In general, more viable eggs, lower hatching and higher larval deformity percentages in 2009 than in 2008.

Table 1. The Achieved Spawning Dates for the Three Experimental Treatments During 2008 and 2009 Spawning Seasons.

Spawning regimes	Ambient Spawning		Delayed Spawning		Advanced Spawning	
Year	Ph1	Ph2	Ph3	Ph4	Ph5	Ph6
2008	5 Feb.- 29 Mar.	2 Feb.- 26 Mar.	13 May - 26 Jun	13 May - 20 Jun	15 Dec.- 22 Feb.	15Dec.- 17 Feb.
2009	15 Feb.- 27 Mar.	5 Feb.- 1 Apr.	26 Apr.- 31 May	27 Apr.- 27 May	1Dec.- 23 Jan.	2Dec.- 25 Jan.

Table 2. Summary of the Data Collected from Three Photoperiod Treatments During 2008 and 2009 Spawning seasons, Values are in Millions.

Spawning Year	Parameter	Ambient Spawning		Delayed Spawning		Advanced Spawning	
		Ph1	Ph2	Ph3	Ph4	Ph5	Ph6
2008	Viable Eggs	3.93	10.35	7.36	7.82	3.42	4.85
	Viable Egg Percentage	66.27	53.04	52.72	44.48	40.38	46.81
	Hatched larvae	2.9	7.7	5.01	5.35	2.1	2.9
	Hatching rate %	73.8	74.4	64	68.4	61.4	59.8
	Larval deformity %	4.0	3.0	8.6	7.9	3.9	5.4

Spawning Year	Parameter	Ambient Spawning		Delayed Spawning		Advanced Spawning	
		Ph1	Ph2	Ph3	Ph4	Ph5	Ph6
2009	Viable Eggs	11.42	44.16	3.7	5.7	11.24	9.54
	Viable Egg Percentage	71.02	86.38	34.64	31.49	58.82	62.19
	Hatched larvae	4.10	11.10	0.64	1.40	6.12	5.10
	Hatching rate %	35.9	25.1	17.3	24.5	54.4	53.5
	Larval deformity %	9.8	8.3	19.1	18.9	12.6	12.8

034

TITLE: YERSINIOSIS IN FARMED RAINBOW TROUT IN IRAN AND EFFICACY OF LOCAL VACCINE TO THE EXPERIMENTAL DISEASE

Presenting author: Mehdi Soltani
Institute: University of Tehran

Topic: Immunology

Abstract:

Development of the outbreaks by yersiniosis in Iranian farmed trout has caused a serious problem during since a few years ago. The objective of this study was to evaluate the disease outbreaks in farmed trout followed by evaluating the efficacy of local vaccine in this fish. Therefore, the phenotypic, molecular and serological features of a number of Yersinia ruckeri isolates obtained from affected farmed trout were first studied. The virulence level of these isolates were then evaluated in healthly fish. The formulated vaccine were then produced and fish were vaccinated via immersion route for 2 min at 12°C. The efficacy of vaccine was performed using relative percent survival (RPS) plus the antibody titer for 10weeks post-vaccination. The phenotypic studies resulted in characterization of 34 isolates of Yersinia ruckeri from different parts of the country. These bacterial isolates were also confirmed as Yersinia ruckeri using PCR works. The pathogenecity test of these isolates resulted in above 16-50□ mortality. The RPS of vaccinated fish reached in 72.7- 83.3□ via immersion route and up to 100% protection by injection route for up to 10 weeks post-vaccination. The immunized fish showed generally a significant enhance in some immune responses including antibody tier, leukocyte population and complement activity. This local produced vaccine can be used via both immersion and injection routes to reduce morbidity and mortality due to yersiniosis in farmed trout.

040

TITLE: BIOSECURITY IN AQUACULTURE; USE OF ESSENTIAL OIL IN CONTROL OF ZOONOTIC DISEASE

Presenting author: Laleh Roomiani
Institute: Department of Fisheries, Ahvaz Branch, Islamic Azad University, Ahvaz, Iran
Co-author(s): Mansoreh Ghaeni, M. Soltani

Topic: Biosecurity

Abstract:

Background and Aim: There is a growing interest of industry to replace synthetic chemicals by natural products with bioactive properties from plant origin. The aquatic zoonotic bacterial Streptococcus iniae represents a threat to the worldwide aquaculture industry, especially in areas of the world that preferentially prepare and consume raw fish. Over the past few years, the Gram-positive bacterium S.iniae has been associated with outbreaks of disease in several species of farmed freshwater and marine fishes.

Materials and Methods: The effects of R. officinalis, Z. multiflora and C. cyminum essential oils (EO) on fresh Rainbow trout (O.mykiss) fillets in control of S.iniae during storage at 4 °C were evaluated in present study. Treatments of essential oils included the following: A) Control (without EO); B) 0.005% EO; C) 0.135% EO; D) 0.405% EO.

Results: Results showed that the effects different concentrations of essential oils were statistically significant ($P<0.05$). 0.405% concentration of essential oils showed the highest effects on S.iniae that were statistically significant with other treatments ($P<0.05$). The essential oil of rosemary showed the strongest antimicrobial activity.

Discussion and Conclusion: Although antibiotics have been used to control bacterial infections in fish for many years, several antibiotics have been banned from use in aquaculture due to their adverse effects. In addition, products from aquaculture facilities using antibiotics are not accepted by many countries. Plant-derived essential oils due to their antimicrobial content possess potential significance as naturally occurring agents for food preservation. The use of essential oils may improve food safety and overall microbial quality. Among all oils analyzed in this work, the essential oil of rosemary was the most effective as an antibacterial agent. The antibacterial activity has been attributed to the presence of some active constituents in the oil.

044

TITLE: RAPID, SPECIFIC, AND SENSITIVE ON-SITE DIAGNOSIS OF WHITE SPOT SYNDROME VIRUS ON POCKITTM SYSTEM, A FIELD-DEPLOYABLE TOOL

Presenting author: Chen Su
Institute: GeneReach Biotechnology Corporation
Co-author(s): Hsiao-Fen Grace Chang

Topic: Biosecurity

Abstract:

White spot syndrome (WSS), an OIE-listed disease, has resulted in severe economic losses in the shrimp aquaculture industry worldwide. As vaccines are not available to help combat shrimp diseases, shrimp health management relies heavily on biosecurity to establish and maintain WSSV-free facility to help improve overall production. Rapid and easy diagnostic methods capable of sensitive and specific detection of WSSV, such as polymerase chain reaction (PCR), are essential for seed/stock screening, and routine surveillance of shrimp population and facility. Depending on the budget, location and resources of the facility, different PCR assays can be selected to fulfill the needs for WSSV detection. The POCKITTM Nucleic Acid Analyzer (GeneReach), a field-deployable tool based on fluorescent probe insulated isothermal PCR (iiPCR), is suitable for aquaculture facilities of small scales. The device automatically generates simple readouts from nucleic acid within one hour using lyophilized reagents, which could be shipped and stored without refrigeration. Working on POCKITTM, IQ PlusTM assays are available for various important shrimp diseases. Developed specifically for WSSV, the IQ PlusTM WSSV Kit with POCKITTM System assay had sensitivity similar to that of OIE-registered IQ2000TM WSSV in detecting WSSV DNA and did not cross-react with host genome, infectious hypodermal and haematopoietic necrosis virus, monodon baculovirus, and hepatopancreatic parvovirus. Accuracy analysis using 700 previously characterized and 100 random L. vannamei samples shows that this system had excellent sensitivity (93.5% [95% CI: 90.61–95.56%] and 100%, respectively) and specificity (97% [95% CI: 94.31– 98.50%] and 100%, respectively) in detecting WSSV in shrimp samples. Excellent reproducibility was demonstrated among three reagent batches with 64 samples analyzed in three different laboratories. IQ PlusTM WSSV Kit with POCKITTM System was certified by the OIE as fit for the diagnosis of white spot syndrome in 2013 and could serve as a useful on-site tool for timely biosecurity and management of WSSV.

055

TITLE: POLYVALENT VACCINES: MEANS TO ACHIEVE SUSTAINABILITY IN AQUACULTURE

Presenting author: Azad I.S.
Institute: Kuwait Institute for Scientific Research
Co-author(s): H. Al-Gharabally

Topic: Immunology

Abstract:

Aquaculture, unlike agriculture or animal husbandry, faces more intense interactions among the components of disease development process viz., the host, the environment and the pathogen. It is more likely that more than one pathogen is associated with the disease-related losses in aquaculture and more than one environmental parameter is affected when chemicals are used as disease management measures. The best way of tackling a disease has been the enhancement of immune capabilities of the host through immunostimulants and vaccines. Immunostimulants have a short lived beneficial effect while, the vaccines provide a long term protection to the host. As more than one pathogen is involved in many of the disease out breaks, there is a need for the use of multivalent vaccines in aquaculture for a meaningful protection and sustainable aquaculture. The Arabian Gulf Region has been witnessing expansion of aquaculture activities, particularly of marine finfish. The breams, sobaity, shaeim and the European seabream, cobia, Asian seabass, groupers in the marine sector are important species. The tilapias and carps in the freshwater sector are also being cultured. Though there are many monovalent vaccines are available for different pathogens, commercial multi valent vaccines are not available. Kuwait Institute for Scientific Research has developed a patent for a bivalent vaccine against a ciliated parasite and the Vibrio. The vaccine has been tested under a indoor aquaculture facilties to record a RPS of over 25 to 75. Pilot evaluation studies are under way for maximizing protection through improved antigen delivery methods.

072

TITLE: IMMUNE RESPONSE OF LITOPENAEUS VANNAMEI AFTER TREATMENT WITH A MINERAL EXTRACT FEED ADDITIVE THAT REDUCES WSSV AND VIBRIO PARAHAEMOLYTICUS INFECTIONS

Presenting author: Felipe Ascencio
Institute: Centro de Investigaciones Biológicas del Noroeste, S.C. (CIBNOR, S.C.), La Paz Baja California Sur México
Co-author(s): Adrian E. Velazquez, Humberto Villarreal

Topic: Immunology

Abstract:
Attempts to treat shrimp infections with chemical therapeutics and antibiotics in commercial farms frequently fail. There is a need for disease preventative measures to promote a more sustainable shrimp culture. The level of disease resistance can be enhanced by the use of immunostimulants introduced through enriched (functional) feeds. The objective of the study was to evaluate the onset and duration of immunity to WSSV and virulent V. parahemolyticus (VVP) in shrimp treated with a proprietary mineral extract used as feed additive (MEFA), and to study the molecular basis of the immunomodulatory effect. One group of shrimp was fed with a commercial feed supplemented with 5 mg MEFA/g of feed, and other group of shrimps was fed with the commercial fed. Significant differences in survival of MEFA treated shrimps was observed for both the VVP and WSSV challenges. cDNA from RNA pools of both shrimp groups was labeled with fluorescein probes, and further hybridized in the microarray slide with 61,000 specific L. vannamei genes printed in probes. Data from scanned microarray were analyzed using genArise v2.7 to determinate the Up and Down regulated genes, and to do the functional annotation and basic local alignment. Three reference genes and 8 target specific genes were selected from the microarray data for a further validation by RT-qPCR. The reference genes were evaluated for stability using geNorm, and the data were analyzed using the delta Cq method. We found 1,650 Up-regulated and 1,434 Down-regulated genes. The Up-regulated genes are related to Cellular Processes and Metabolic Processes based in GO-terms, while the Molecular Functions in Up-regulated genes were Binding and Catalytic Activity. The Biological Processes relevant found in Up-regulated genes were Proton Transport, Ion Transport and Monovalent Inorganic Cations Transport. The Down-regulated relevant processes were, Regulation of Protein Metabolic Process and Extracellular Region.

076

TITLE: STUDY ON GILL EPITHELIUM OF SOBAYTI, SPARIDENTEX HASTA WITH TEM ELECTRON MICROSCOPIC IN DIFFERENT SALINITY

Presenting author: Rahim Abdi
Institute: Khorramshahr University of Marine Science and Technology
Co-author(s): Abdulali Movahedinia, Hajar Papi
Topic: Physiology, Morphology & Histology
Abstract:
To determine the cellular changes and adaptations in mitochondria-rich cells under different environmental salinities, Sparidentex hasta as euryhaline fish species has been studied. In this case, a total number of 180 fish espoused directly to different concentrations of salt for 1 week. The concentration ranges were 5, 20, 40 and 60 ppt. Ultra-structural changes in gill mitochondria rich cells were studied in different environmental salinities during the adaptation period. Localization of the Na +, K +-ATPase (NKA) was performed by immunohistochemistry, using IgGα5. NKA localization showed that the mitochondria-rich cells exist more in the filament epithelium and rarely in lamellar epithelium. There activity of gill epithelium to the used antibodies during the treatment period at 5 and 60 ppt, showed an increasing trend. But at 20ppt treatment, it showed decreasing trend. Transmission electron micrograph studies showed that mitochondria rich cells have many mitochondria and plasma membrane basic-lateral groove. Results showed that in 60 ppt treatment the mean area of mitochondria in mitochondria-rich cells decreased but the density increased; and in 5 and 20ppt treatment, the mean area was increased but the density was decreased. Generally, tolerance and compatibility of Sparidentex hasta to salinity changes is due to rapid changes in mitochondria-rich cells to regulate the entry and exit of water and electrolytes. So that, to adaptation with new condition of environment some changes in the apical openings appear that regulate the amount of the carrier electrolyte enzymes in basolateral membrane. It also causes adaption of mitochondria activity with new condition.

090

TITLE: SHRIMP HEALTH MONITORING IN NURSERIES AND GROW OUT FARMS – A PRACTICAL APPROACH

Presenting author: Shuaib T Muhammad
Institute: National Aquaculture Group
Co-author(s): Victoria Alday Sanz
Topic: Biosecurity
Abstract:
In aquaculture systems, disease outbreak is often the result of an equation of three components, the animal, the pathogen and the environment. The early detection of signs of disease or poor health is crucial to take measures to minimize the economic impact of disease. Routine animal health monitoring allows the generation of this information for immediate decision taking such as feeding rate correction, water exchange or even emergency harvest. This presentation describes the criteria of morphological changes that indicate deviation from optimum health, covering from macroscopic to

microscopic changes, the possible causes that may lead to these changes and mitigation measures to decrease the risk of disease outbreak. It should be emphasized that health is directly related to productivity and therefore, close monitoring and optimization of animal health is a key tool for profitable farming.

093

TITLE: COMMERCIAL FARMING RECOVERY FROM WSSV: THE NAQUA EXPERIENCE

Presenting author: David R. W. Griffith
Institute: Shrimp Business Unit, NAQUA, Al Lith, KSA
Co-author(s): Victoria Alday, Nasser Ayaril

Abstract:
The National Aquaculture Group, formerly known as National Prawn Company, has operated shrimp farms in the Al Lith, KSA since XXXX. Since then, the company has switched between four different species of shrimp, (P. monodon, P. semisulcatus, F. indicus and most recently P. vannamei), changes driven in great measure by disease and in particular white spot syndrome virus, of WSSV. Outbreaks of this virus have severely hampered the sustainable development of the industry regionally and in the case of NAQUA meant the complete collapse from a peak of 14,000 MT in 2010 to nothing in 2012. However, with the adoption of a number of procedures focusing on biosecurity, production totaled slightly more than 13,000 MT between January 2014 and February 2015. This presentation will outline the processes used in driving this recovery, and discuss the pros and cons of each.

098

TITLE: BIOSECURITY THREATS AND CHALLENGES FOR THE SHRIMP INDUSTRY IN THE MIDDLE EAST

Presenting author: Victoria Alday-Sanz
Institute: NAQUA
Topic: Biosecurity

Abstract:
Diseases are known to have major economic impact in the shrimp industry worldwide. Such losses have threatened the sustainability of the industry and have had repercussion at national, business and domestic level economies. Shrimp farming is relatively a young industry with basically two models of production from the biosecurity point of view. There are intensive systems where a higher level of biosecurity control can be implemented and semi extensive/extensive systems where little or no control can be effectively implemented. Still, the earlier stages of culture including broodstock, nauplia and postlarvae production can and need to be carried with strict biosecurity measures that will ensure that stocked animals will be free of specific pathogens (SPF). A major challenge for maintaining this sanitary status is the use of fresh feed in maturation. The development of the artificial diets that does not impact reproduction productivity has not been resolved yet. Middle East has a privileged sanitary status when compared to other shrimp farming regions.

However, emerging pathogens such as EMS/AHPND, Enterotizooan hepatopenaei (EHP) or covert mortality nodavirus (CMNV) are a current threat that needs to be addressed in a proactive manner through restriction of importations of life shrimp and frozen products and active surveillance. Disease resistance is rarely included as a trait in shrimp breeding programs. These mostly focus on growth performance. This may be due to the lack of understanding

007

Ecology and environment

TITLE: PROSPECTS OF CAGE AQUACULTURE ALONG THE PERSIAN GULF COAST OF UNITED ARAB EMIRATES

Presenting author: Muhammad Naeem Khan
Institute: Department of Zoology, University of the Punjab, Lahore, Pakistan

Topic: Sustainable Development of Aquaculture

Abstract:

Most of the United Arab Emirates (UAE)'s coastline of about 1318 km lies along the Persian Gulf, with only a minor (6.82%) portion falling in the Gulf of Oman in the east. UAE / Dubai although surprised the world with its land mark marine projects like artificial islands of "Palm Jumeirah", "Palm Jebel Ali", "Deira Island" and "The World Islands" but far simpler marine and aquaculture projects like those in developed countries to raise fish in sea cages have yet to be fully developed here. UAE has yet to develop and exploit true potential of its aquaculture. The author recently surveyed a small portion of UAE west coast along the Persian Gulf and observed that the country is having many natural inlets and suitable sites for coastal & marine aquaculture. Considering the trade, business and investment boom witnessed by UAE during the last 2-3 decade and considering the ease, with which the new and modern technologies are imported, adopted and transferred to the country, the transfer of global aquaculture and marine aquaculture technologies can be very advantageous to the UAE fish production system. The prospects of culture of marine finfish in open pen-sea cage aquaculture in UAE are enormous as hydrographical and farming conditions are suitable /similar to other aquaculture rich regions of the world. It is recommended that a new state of art technical facility for fish seed production and aquaculture demonstration center for sea cages of a globally established and proven aquaculture fish species like Asian sea bass (Australian barramundi) (Lates calcarifer) be established in UAE. It is anticipated that cage aquaculture of this marine fish species and others can be promoted on a large commercial / industrial scale in Persian Gulf coast of UAE as these waters are known to have suitable natural productivity, water quality and rearing temperatures in the area. The booming tourism industry in UAE will get a further boost by this new type of marine food production and eco-tourism. Similarly sustainable aquaculture will help reduce pressure on traditional capture fishing operations and the coastal environment and its beauty will be least affected by these operations. The paper will discuss the prospects of transfer of globally established, sustainable, eco-friendly, modern aquaculture technologies from leaders like Norway, Chile, China and Europe to UAE.

008

TITLE: A CASE FOR COMMERCIAL SHRIMP FARMING IN THE NIGER DELTA OF NIGERIA

Presenting author: Adewumi Adejoke A.
Institute: Ekiti State University, Ado Ekiti, Nigeria

Topic: Sustainable Development of Aquaculture

Abstract:

The coastal shelf of the Niger Delta basin, rich in organic debris input due to its characteristic frequent rainfall, supports rich shrimp resources. Nigeria is involved in the shrimp business contributing significantly to wild–caught shrimps from the tropics, exporting about US$65million worth of shrimps to the European Union, the USA and other countries annually. Nigeria however, is yet to fully key into the lucrative culture trade. Shrimp farming will significantly reduce Nigeria's dependence on imported food grade aquatic products currently valued at US$270 million and increase employment of those engaged from 3,306 to 83,950 within 10 years. The challenges of production, as witnessed in some practising nations, are listed. Two of the family Penaidae, Penaeus vannamei and the P. monodon, account for roughly 80% of all farmed shrimp. Despite the numerous challenges of operation, for rapid agricultural development, for realization of vision 20-2020, commercial shrimp/prawn farming should be encouraged, putting in place, all the pre-cautionary measures, towards sustainable farming. This review serves the purpose of sensitizing aquaculturists/investors, from the middle east, to the rich potentials available in Nigeria, for profitable investment in shrimp farming.

016

TITLE: STRATEGIC DEVELOPMENT OF OPEN OCEAN MUSSEL & OYSTER FARMING; A CASE STUDY FROM THE BAY OF BISCAY

Presenting author: Diego Mendiola
Institute: AZTI, Spain

Topic: Sustainable Development of Aquaculture

Abstract:

The Basque Government has recently decided to promote open ocean aquaculture with the aim of creating a sustainable and complementary activity for both local fishing and seafood sectors. Particularly, open ocean mollusc farming offers a new perspective for the economic development of the marine economy, as no expansion of this food production activity has ever occurred. Mediterranean mussel M. galloprovincialis and the European flat oyster O. edulis represent some of the most popular occurring species; however, all shellfish products commercially exploited within the region are imported. Such considerations led to develop a series of project proposals on (i.) feasibility assessment of local key-aspects (technology, socioeconomics, market analysis, coastal dynamics, spatial planning, business models, etc.) and (ii.) development of pilot projects (biology, economics and product-quality) to solve the profitability details on the expected businesses. Results on project management, marine sites selection, mussel growth performance, coastal dynamics and marketability will be presented. Albeit, the region is showing extreme high energy and wave exposure conditions, the operational challenges have been correctly faced. Several substantial areas totaling 1.400Ha of available space to produce up to 119.520 T/mussel were identified. The probability of phytoblooms is very low (17-21%) and no eutrophication risks (0,01-10µgL-1/Chl.) are observed. Mussel growth rate and annual mortality range showed 0,40cm/month and 20-24%, respectively. Oyster growth rate and monthly mortality range showed 0,46cm/month and 3,9%, respectively. Offshore mussel products based on high fatty acid levels (EPA and DHA) and meat yield (>23%) were developed. The potential exists to create a multi-million euro sustainable industry involving local marine and seafood sectors.

035

TITLE: RESEARCH NEEDS IN IRAN AQUACULTURE

Presenting author: Mehdi Soltani
Institute: University of Tehran
Co-author(s): Mansoreh Ghaeni

Topic: Sustainable Development of Aquaculture

Abstract:

Aquaculture development in Iran commenced in the early 1970's for the artificial propagation of sturgeon fingerlings. Total sturgeon production via aquaculture activity mainly in concrete tanks has reached in ca 564 tons in 2014. The mass production of Chinese carp species in pond system was about 140000 tons in 2012 and has been reached in 168000 tons in 2014. For many years artificial propagation of some Caspian Sea species including Rutilus frisii kutum and Salmo trutta caspius is undertaken by Iran fisheries organization for the restocking purposes. Rainbow trout aquaculture however is now the most active industry in Iran with a production of 144000 tons per year. More recently other species including Sobaity sea bream (Sparidenten hasta), sea bream (Sparus aurata), grouper (Epinephelus coioides) barbus sharpeyi, Asian sea bass (Lates calcarifer) and cobia have been targeted for future culture in cage culture systems in the Persian Gulf. Development of shrimp culture in Sothern part of country is now growing rapidly especially since L. indicus was replaced with F.vannamei a few years ago. Iran has also initiated projects to evaluate the feasibility of culturing Artemia cyst, pearl oyster, freshwater crayfish (Astacus leptodactylus), giant river prawn (M. rosenbergii) and aquatic plants. Also, more recently for a sustainable development aquaculture some new species such as tilapia, some species of Indian carps, sterlet (Acipenser ruthenus), Siberian sturgeon (Acipenser baerii) have been imported inside the country. In addition, the sector of ornamental fish industry has been remarkably increased via both their importation and propagation inside the country. Despite the development of the industry during the recent years it is faced with following constraints:

1. Lack of new technology; the industry is suffering from insufficient aqua culture engineering e.g. cage culture technology and recirculation bio-filtra tion systems plus no integrated aquaculture
2. Insufficient financial resources
3. Negative impact of environmental pollution
4. Outbreaks of some economically important infectious diseases.
5. Poor environmental conditions,
6. Poor health managements
7. Lack of aquaculture diversity

One of critical element in Iran aquaculture is now the lack of aquaculture development of in brackish and seawater. This is because of some no interest by the private sector to invest in cage aquaculture. Also, trout farming has been encountered with a serious problem due to losses by some economically important infectious diseases e.g white spot viral disease, infectious hematopoietic necrosis, infectious pancreatic necrosis and streptococcosis/lactococcosis as well as contaminating of freshwater sources that are critical for other agricultural activities. Because of high potential in development of aquaculture activities in both coastal areas of north and southern parts of the country, a continuous research and development can rapidly increase the aquaculture production in Iran. This paper describes why Iran aquaculture is now need especial attention particularly its development in open seas.

037

TITLE: MIXOTROPHIC™ SYSTEM

Presenting author: Farshad Shishehchian

Institute: Blue Aqua International Pte. Ltd., President, World Aquaculture Society-Asia Pacific Chapter

Topic: Sustainable Development of Aquaculture

Abstract:

Since 2012, shrimp farmers in many countries in Asia and Mexico have suffered from EMS (Early Mortality Syndrome) crisis. Until now, the solution is still unclear. Many factors can affect and cause the problem. Farm management is one factor of concern for farmers that can be managed. Disease prevention with good water quality management can overcome this problem. Mixotrophic™ system is a culture system, patented in 144 countries, suitable for super-intensive shrimp/fish farming. The main concept of Mixotrophic™ system is divided into three phases. It starts by promoting natural food for super-intensive stocking. Next is to increase probiotic and nutrient balance in the middle phase. The last part of the culture is to boost up probiotic for healthier shrimp and maintain optimized water quality for highest profitability. This new approach of shrimp faming would help reduce disease outbreaks and increase productivity in super intensive culture.

039

TITLE: REGULATION, SCIENCE & INNOVATION, AND VOLUNTARY APPROACHES AS THREE KEY ELEMENTS OF SUSTAINABLE AQUACULTURE DEVELOPMENT

Presenting author: Neil Auchterlonie
Institute: Centre for Environment, Fisheries and Aquaculture Science
Topic: Sustainable Development of Aquaculture
Abstract:

Aquaculture is the global leader in protein supply and has been for more than 25 years. Although across the world aquaculture is an extremely diverse food production sector in terms of system types and species cultivated, in many instances that growth has occurred alongside criticisms of poor environmental sustainability. In this paper we consider three elements of importance in relation to the sustainable development of aquaculture, drawing from examples in Europe.

The first element is a regulatory framework which should be clear, effective and fit for purpose. That regulation needs to cover a broad spectrum of subject areas for aquaculture, including: environmental impact, animal health and welfare, consumer safety. The second element is the application of science and innovation to provide technological advances in production system efficiencies. That science and innovation is funded through both public and private sector, and is provided by a spectrum of research providers including universities, consultancies and government laboratories. The third element is the importance of voluntary approaches such as certification schemes, Codes of Practice and other ways of effective self-regulation by the sector, often at levels beyond the requirements of the regulatory framework. It is argued that the adoption of these three elements in the developing sector help to secure social, economic and environmental sustainability, providing confidence in the growth of the sector and, ultimately, the supply of high quality farmed seafood products into domestic and international markets. The approach has widespread application across the global developing sector, and is proposed as a way forward for the Middle East aquaculture sector at this stage of its development.

063

TITLE: ECOLOGICAL ASSESSMENT MODEL FOR CAGE CULTURE SITE SELECTION OF THE IRANIAN SOUTHERN SEAS (PERSIAN GULF AND OMAN SEA)

Presenting author: Fereidoon Owfi
Institute: Iranian Fisheries Research Organization, Iranian Ornamental Fish Society
Co-author(s): Mahnaz Rabbaniha, Shahram Dadgar, Somayeh Ordoo

Topic: Spatial Planning and Regulation

Abstract:

Promote the aquaculture industry, aquaculture cage can contain solvents and Muslim countries are aimed at the domestic market, while many non-edible species for export purposes can also have a place in this industry. The systematic and planned to produce a variety of industries, such methods can conserve marine cages, powder; packaged fillets well fed and return the industry to maximize. This method can work well in the fisheries sector, particularly in disadvantaged areas and undeveloped, the cornerstone of creating complex or cluster fisheries and traditional fishing methods be safe from the volatility in the currency. Base on studies of more than 400 thousand tons of potential for this project was recognized in the provinces of North and South. According to experts and studies the capacity and potential of marine fish whole country is 100 thousand tons. Series of studies on coastal zone geomorphology and hydro graph characteristics of the study area has identified the target areas, including the southern coastal area in the western part of Qeshm Island, and the area of offshore island is that the areas the appropriate and safety done on the induction cage system according to scientific management, will be successful. The above results and the previous groups, the data are consistent with the consulting engineers on site selection. Moreover this area despite being in a particular region for the interference of the incoming water and surface currents and deep currents of Oman through the Strait of Hormuz, the outlet from the region of Oman, as well as barrier natural barriers the islands of the he Ecology and hydrocarbons in the marine environment and graph are due to local disturbances. Based on the results of these studies, the location and geographical coordinates of the proposed sites for the development of marine cage aquaculture - Qeshm Island and the region is western, central and eastern site.

068

TITLE: HARMFUL ALGAL BLOOMS (HABS) AND RED TIDE PHENOMENON OF COCHLODINIUM POLYKRIKOIDES IN THE PERSIAN GULF - IRANIAN SIDE

Presenting author: Mahnaz Rabbaniha
Institute: Iranian Fisheries Research Organization, Iranian Ornamental Fish Society
Co-author(s): Fereidoon Owfi, Shahram Dadgar

Topic: Environment, Biodiversity and Climate Change

Abstract:
Harmful Algal Blooms (HABS) and Red Tide phenomenon started from 20.Sept.2008 in Hormouz Strait – Iranian side, which is the first record of Cochlodinium polykrikoides blooms as exotic and invasion species in region. The results of previous studies showed that identified species of Dinoflagellate blooms goes back to some report from South-East of Asia (Korean and Japanese waters) and Mexican waters which to created fish-killing. Passing way and movement pattern of C. polykrikoides blooms in studied area was from Hormouz Strait in Hormozgan province, to the North-West part of the Persian Gulf - Bushehr province waters, so that the blooms passed 500km from east to west during 5 months approximately. Distribution pattern of C. polykrikoides bloom is spreading in most part of Iranian side of the Persian Gulf (Hormozgan & Bushehr provinces waters). But now, it seems the speed of spreading and bloom patch movement decreased, which the reason of this event (decrease of maximum cell concentration of C. polykrikoides) is some of environment and physical-chemical parameters limitation and specific condition of local marine environment such as temperature, salinity, seasonally storms, waves, currents and maybe some of unknown environmental effects and parameters fluctuation. The results of field survey, marine and coastal cruise and laboratory analysis of bloom samples and dead fishes (floating and strands) was showed that this species of Dinoflagellate have not any toxic effects, and also confirmed by laboratory technical laboratory test by mouse bioaccumulation. But, the important point is negative effects by mucus excretion and OH / H202 reaction, which is the main cause of fish mortality / kills by blooms of this species. The total mortality of fishes by HABs and Red Tide phenomenon estimated 23 tones approximately which to including diverse fish species of coralline, benthic and pelagic groups.

077

TITLE: THE SOUND OF SHRIMP EATING – PASSIVE ACOUSTIC FEEDING CONTROL TECHNOLOGY IMPOVES GROWTH, FOOD CONVERSION AND WATER QUALITY IN SHRIMP AQUACULTURE

Presenting author: Ross Dodd
Institute: AQ1 Systems Pty Ltd

Topic: Sustainable Development of Aquaculture

Abstract:

In intensive terrestrial farming systems (chickens, pigs, cattle) and sea cage aquaculture (salmon, trout, bass, bream) feeding control systems are fundamental production technology.

These systems use micro tag readers, infra red sensors, video analysis and many other sensing methods to automatically deliver an optimum ration to the animals every day.

In shrimp farming however, there is a variety of unique challenges to implementing feeding control. Shrimp are small animals (<50gms), grown in large numbers (many million) in large enclosures (0.1 to 30ha) which have shallow turbid waters that are prone to significant environmental fluctuation.

Many species make sounds associated with feeding, spawning or other behavioural displays and research has shown that shrimp make distinct feeding sounds. Based on this knowledge AQ1 Systems (Australia) has developed a novel shrimp feeding control technology called the "Sound Feeding System" which measures the acoustic signal created by the act of feeding with an underwater microphone (hydrophone).

AQ1 has combined the sound of the eating shrimp with intelligent control algorithms to ensure feed delivery matches shrimp feed demand precisely and instantaneously. The system does not allow feed to build up on the pond bottom by ensuing each feed delivery is consumed prior to the delivery of more feed and the system adjusts feeding rate continuously to match shrimp demand.

Research and commercial production trials of the system in Australia, Oceania, Latin America and SE Asia, on several species of shrimp [P. monodon (black tiger), M. japonicus (kuruma), L. vannamei (white) & L. stylirostris (blue)] has demonstrated a clear benefit of using the "feeding sound" as a key indicator of feed intake. These trials showed increased growth (10-60%), lower food conversion (10-40%), improvements in key water quality parameters and a reduction in labor cost per kg over traditional manual feeding methods.

079

TITLE: LIFE CYCLE ANALYSIS FOR AN INTEGRATED SEAWATER AQUACULTURE/AGRICULTURE PROJECT FOR BIOENERGY PRODUCTION IN THE MIDDLE EAST

Presenting author: J. Jed Brown

Institute: Center for Sustainable Development, College of Arts and Sciences, Qatar University, Qatar

Co-author(s): Brian Warshay, Sgouris Sgouridis

Topic: Sustainable Development of Aquaculture

Abstract:

We evaluate the lifecycle impacts of aviation biofuel production in Abu Dhabi, UAE based on a production system that integrates marine aquaculture, seawater agriculture (halophytes) and mangrove silviculture, termed an Integrated Seawater Energy Agriculture System (ISEAS). We compare the hydroprocessed renewable jet fuel (HRJ) produced from the ISEAS against fossil jet fuel using a life cycle assessment (LCA) methodology. Based on a detailed compilation of the production process and informed assumptions based on a wide-ranging literature review, we find that an ISEAS can produce aviation biofuels, electricity, and food while afforesting coastal desert land, acting as a long-term sink for carbon, minimizing freshwater consumption, and having beneficial land use impacts when compared to fossil jet fuel production. Based on a sensitivity analysis, we show that ISEAS HRJ has the potential to emit 5 to 45% less greenhouse gases than fossil jet fuel, and yields an overall positive net energy balance. We show that achieving the more positive results, depends critically on minimizing freshwater use and maximizing biomass yield from the seawater agriculture component.

081

TITLE: APPLICATION OF MODIS SATELLITE IMAGERY TO INVESTIGATE GENERAL CIRCULATION PATTERNS IN THE OMAN SEA AS TO BE APPLIED IN SUSTAINABLE MARICULTURE DEVELOPMENT

Presenting author: S. Abbas Haghshenas

Institute: Institute of Geophysics, University of Tehran, Iran Fisheries Organization, Mc Master University, Parthia Water Wave Research Co., Hounam Sakhteman Pars Co.

Co-author(s): Ali Esmaeily, Seifollah Haghighi, Azadeh Razavi Arab

Topic: Sustainable Development of Aquaculture

Abstract:

Mariculture of finfish is an increasing critical contribution to a nation's food security, as well as providing an important measure to ensuring public health. Concurrently with the development of mariculture in coastal and marine areas, a need for understanding general circulation patterns increasingly arises. On the other hand, field measurement programs are not enough for studying a problem on an ocean scale framework. Adopting a remote sensing framework using satellite imagery is an effective method to trace general patterns of ocean circulations over an ocean scale domain. This research was performed in order to offer a sophisticated response for the arisen needs via providing a better understanding of ocean scale processes in the Oman Sea. We applied a two-dimensional hydrodynamic model to the Oman Sea and simulated the current field for a 1-year period. The results were applied for selecting a set of MODIS images in four years between 2011 and 2014. Analyzed images for determining spatial distribution of SST and Chlorophyll A variations were adopted to define general circulations pattern in the Oman Sea with a concentration on the Iranian side. The numerical model output data were compared to the results extracted from analyzed MODIS satellite images for model calibration. Large scale eddies in the Oman Sea were captured using the described method and is a big deal for setting up high reseloution numerical models.

088

TITLE: USE OF ENVIRONMENTAL MODELS TO INFORM DEVELOPMENT OF SUSTAINABLE FIN-FISH AQUACULTURE IN WESTERN AUSTRALIA

Presenting author: Glenn R. Shiell
Institute: BMT Oceanica, BMT WBM, The University of Western Australia
Co-author(s): Michael Barry, Matt Hipsey, John Eyres

Topic: Sustainable Development of Aquaculture

Abstract:
The Western Australian Government is supporting the development of two fin-fish aquaculture development zones: Cone Bay, in the state's north-west, and the Houtman Abrolhos Islands, in the state's mid-west. The proponent for the development, the Department of Fisheries, must demonstrate that the proposed aquaculture activities are environmentally sustainable and manageable. Technical studies required of the Environmental Impact Assessment (EIA) are numerous: geo-rectified benthic habitat mapping; development of location specific environmental thresholds and cause-effect pathways; extensive baseline water and sediment quality surveys, hydrodynamic and ecological modelling; and development of environmental management strategies, as per the state governments Environmental Quality Management Framework (EQMF). The process encompasses state of the art environmental modelling; coupled hydrodynamic, depositional, water quality and biogeochemical models are used to predict the likely 'footprint' of the proposed aquaculture operations, and the likely period of recovery following cessation of aquaculture activities. Modelling is used to assign levels of impact [Zone of High Impact; Zone of Moderate Impact and Zone of Influence] based on the time required for sediments and/or benthic biota to recover following fallowing: ZoHI (>5yrs); ZoMI (<5 yrs) and ZoI (changes to water quality but with no resulting changes to benthic ecology). This highly conservative approach to EIA, although resource intensive, has proven to be an equally practical tool for predicting the extent of the impacts, and to ensure that future operations are sustainable and acceptable to the environmental regulator and the (increasingly environmentally discerning) general public. We present options for the application of the approach in the Middle East.

Economics & Social Sciences

032

TITLE: THE ECONOMIC PERFORMANCE OF TILAPIA CULTURE IN EARTHEN PONDS IN EGYPT. COMPARISON OF THREE CULTURE SYSTEMS

Presenting author: Ahmed Mohamed Nasr-Allah
Institute: WorldFish, Egypt

Topic: Aquaculture Economics & Management (IAAEM)

Abstract:
The aim of this study is to understand the economic performance characteristics of different pond-culture systems for Nile tilapia (Oreochromis niloticus) in Egyptian fish farms. The study adopted a field survey approach covering sixty fish farms in the four main aquaculture governorates. Economic performance data were obtained for three culture systems; tilapia system; tilapia & mullet system; tilapia & mullet plus catfish and carp system. The current study discusses general characteristics and the financial performance of different tilapia culture strategies. Budget analysis and sensitivity analysis for the different culture systems are estimated in this article. A production function was employed to compare resource use efficiency between the systems. The study revealed that on average, tilapia system produced significantly higher yields (9.988 t/ha/yr) than tilapia and mullet system or tilapia mullet plus catfish and carp system (7.789 t/ha/yr and 7.481 t/ha/yr), respectively. In terms of financial performance, tilapia & mullet system showed significantly higher returns to investment and sensitivity analysis demonstrated that it was able to tolerate financial shocks more easily compared to the other two culture systems. Production function estimation showed that fish feed is a common input resource which has the most significant effect on increasing fish yields in the three culture systems. The study concludes that tilapia & mullet system is more financially sustainable than tilapia monoculture and tilapia & mullet plus catfish and carp system. Improved credit availability could enable farmers to increase fish yields through buying more fish feed to increase their annual yield per hectare.

094

TITLE: TOWARDS A ROADMAP FOR SUSTAINABLE AQUACULTURE IN THE MENA REGION

Presenting author: Ahmad R. Al-Ballaa
Institute: Saudi Aquaculture Society

Abstract:
The MENA region holds tremendous potential for development of aquaculture, with long coastlines bordering unspoiled seas, plentiful land for ponds, hatcheries and processing, and a growing middle class to drive consumption. Perhaps most importantly there is access to capital, in many cases driven by governmental decisions to drive growth in the aqua sector, as evidenced by recent initiatives like those of Saudi Arabia and Oman, where hundreds of millions of dollars have been earmarked for projects that will improve local and regional food security and generate much needed employment, in particular for women.

There is however an overarching need when promoting these valuable initiatives to consider the risks and threats alongside the opportunities. Recent experience has shown us that the development of aquaculture is capital-intensive and carries high risk due to issues ranging from diseases impacting production to cold chain support limiting market access across the region.

099

TITLE: THE PROSPECTS, STRATEGIC POTENTIALS AND INVESTMENT OPPORTUNITIES OF THE
AQUACULTURE AND ALGACULTURE INDUSTRIES IN THE GCC REGION

Presenting author: Haydar H. Al Sahtout
Institute: Arabian Shrimp Co.

Abstract:
Aquaculture industry in the GCC countries, with some notable exceptions, is still in its infancy stage and has been slow to develop; this is despite the availability of all the necessary and sustainable production resources, and in spite of that the GCC governments recognized the vital role that the Aquaculture industry can plays in providing social and economic development to their nations mainly as a source of foreign exchange in trades, source of affordable and reliable animal protein and income generation. According to the FAO, Aquaculture has been the fastest growing food production sector in the world, accounting to nearly 50 percent of the fishes used in the global consumption, but in order to maintain the current level of per capita consumption at the minimum, global aquaculture production should be increased by 30 million tonnes by 2030, and by 70 million tonnes by 2050, this constitute significant investment opportunities for the GCC region, especially in modern and advance technologies and systems. Special studies conducted regionally indicate that the GCC region poses huge potentials for promising Aquaculture and Algaculture industries in a way that can be significantly and uniquely competitive at the global level, particularly when taking into account the abundant natural and anthropogenic resources that are available within the region.

102

THE IMPLEMENTATION OF THE FAO PROJECT "STRENGTHENING AND SUPPORTING FURTHER DEVELOPMENT OF AQUACULTURE IN THE KINGDOM OF SAUDI ARABIA" (UTF SAU/048/SAU)

Presenting author: Francesco Cardia
Co-authors: F. Cardia*, M. S. Hazzaa**, M. I. Odaiby**

Abstract:
The Government of the Kingdom of Saudi Arabia has recently identified aquaculture development as a priority area second to the oil and gas sector. An ambitious target of up to 1M tonnes of production from aquaculture has been set for 2030 as reflected in the latest Sector Development Plan drafted within the 7th Initiative Programme under the Agriculture Development Fund.

Species diversification, development and introduction of new hatchery and production technologies, and the development of Aquatic Animal Health (AAH) management protocols are among the actions being implemented by the Saudi Ministry of Agriculture (MoA).

FAO is currently providing technical support to MoA through the implementation of a Unilateral Trust Fund (UTF) project entitled "Strengthening and supporting further development of aquaculture in the Kingdom of Saudi Arabia" (UTF SAU/048/SAU). The project became operational in February 2013 under the current 2012-2016 FAO-KSA programme.

The overall objective of the project is the sustainable and responsible development of marine aquaculture through the provision of technical assistance to the Aquaculture Department and the Jeddah Fisheries Research Center (JFRC). The project is working on the following four outputs: (i) development of marine cage culture; (ii) development and expansion of marine hatchery production; (iii) reinforcing national aquaculture research programmes and (iv) institutional capacity building.

Several activities have been implemented so far, achieving relevant results, among others the establishment of a working group on GIS for spatial analysis applied to aquaculture site selection; development of tools for planning and management of the cage aquaculture sector; trials on P. indicus culture using biofloc technology; collection of broodstock of native species for species diversification; increased capacity of MoA staff on technical and environmental issues for a better aquaculture governance.

Freshwater Fish Culture

074

TITLE: DEVELOPMENT OF TILAPIA AQUACULTURE INDUSTRY IN PAKISTAN (THE BLUE REVOLUTION)

Presenting author: R.S.N. Janjua
Institute: American Soybean Association/ WISHH/SoyPak/ Pakistan
Co-author(s): Kevin Fitzsimmons, Ahmed Shoaib, John G. Woiwode

Topic: Tilapia

Abstract:
In 2012 the FEEDing Pakistan project of World Initiative for Soy in Human Health (WISHH) funded by USDA, helped to import 200,000 Genetically Improved Farmed Tilapia (GIFT – Oreochromis niloticus) fry from Thailand. By 2014 farmers were stocking 3,000,000 fry from a mix of imports and local hatchery production. The FEEDing Pakistan project also provided U.S.-soy based floating feed for demonstrations reaching hundreds of tilapia farmers. The tilapia reared in this demonstration project ranged from 600 to 900 grams per fish. This was much larger than the few feral O. mossambicus that had been released in various water courses in Pakistan 30 years earlier. The farmed GIFT tilapia received a premium in the domestic market place. The market value of tilapia produced went from zero at the beginning of the project to an estimated $4.5 million in 2014.

The project also included training programs at the Asian Institute of Technology, Thailand, covering intensive hatchery techniques for tilapia, at the University of Arizona on intensive tilapia farming and best management practices, and at Kansas State University on feed manufacture. The project included a project trainee / intern program that provided a first professional position for 12 recent fisheries graduates. A private sector company, Oryza Organics Pvt. Ltd., imported Pakistan's first extruder, and built the first feed mill, dedicated to the production of floating fish feed supplying tilapia, carp and trout farmers. Another trainee/partner, Tawakkal Fish Farms, has made multiple investments creating the first private-sector tilapia hatchery in Pakistan. In coming few years approximately 10 million young tilapia will be stocked in Pakisan. FEEDing Pakistan also organized and hosted the first international aquaculture conference in Pakistan, with the collaboration of the World Aquaculture Society. The project also developed The Aquaculture Handbook—Fish Farming and Nutrition in Pakistan which contains 12 chapters on the entire farm-to-consumer aquaculture value chain.

026

Marine Fish Culture

TITLE: ENVIRONMENTAL TOLERANCES AND REQUIREMENTS OF SIGANIDS

Presenting author: Imad Saoud
Institute: American University of Beirut

Topic: Other Marine Fish

Abstract:

World population continues to increase and become more affluent, thus increasing demand for seafood.

Oceans are overfished and unable to meet increased demand. Accordingly, increased demand for edible seafood will be supplied by marine aquaculture. However, sustainability of marine aquaculture necessitates that we farm species that feed low on the food chain (herbivores or algaevores), and have better energy efficiency than piscivorous species. Siganids (rabbitfish) are a relatively small family of algaevorous fishes widely distributed in the Indo-West Pacific Region. They are economically important and supposedly easy to farm. Although the life cycle of siganids is known, aquaculture methodologies and requirements are not well established and the sparse information available is not always based on sequential research starting with basic culture requirements and moving to more complex issues such as exact dietary needs and health. This presentation will discuss research performed for the past 10 years at the American University of Beirut Aquaculture Laboratory that aimed to develop a set of protocols to aquaculture rabbitfish. We worked with a locally available species, Siganus rivulatus, but believe the information is applicable to most if not all siganids. Accordingly, the information required for a successful siganid aquaculture industry is now available. There is demand for inexpensive and environmentally sustainable marine protein production and the region is home to several siganid species with lots of potential. Some of the culture requirements of the fish are given in Table 1.

Table 1. Environmental tolerances of the rabbitfish Siganus rivulatus.

Parameter	Optimal	Range
Density (number per m3)	> 800	N/A
Salinity (ppt)	35	10 - 50
Temperature (oC)	27	17 - 32
Water movement speed (m / sec)	0	Unknown
Ammonia-N (ppm; 96 hr LC50)	16	
Nitrite-N (ppm at 35 ppt; 96 hr LC50)	90	
Sexual size dimorphism	Non	
Protein requirement (g / 100 g diet)	30-40	10 - 50
Lipid requirement (g / 100 g diet)	3 - 4	2 - 15
Optimal feed regimen (# per day)	3	1 - 4
Filet yield (%)	35	33 - 39

O11

Nutrition

TITLE: EVALUATION OF DIFFERENT COMMERCIAL FEEDS ON GROW-OUT SOBAITY, SPARIDENTEX HASTA FOR OPTIMUM GROWTH PERFORMANCE, MUSCLE QUALITY AND COST OF PRODUCTION

Presenting author: Mohammed Arshad Hossain

Institute: Aquaculture Program, Environment and Life sciences Research Centre, Kuwait Institute for Scientific Research

Co-author(s): Khaled M. Al-Abdul-Elah, Salim El-Dakour

Topic: Alternative Feedstuffs and Aquafeeds

Abstract:

The objective of the study was to find a cost-effective feed from three commercial feeds, namely, Arasco (Saudi Arabia), Skretting (Turkey), and Biomar (Greece) for commercially producing sobaity (Sparidentex hasta) in Kuwait. For confidentiality, these feeds were randomly given code names, diets 1, 2, and 3 which were known only to the investigating staff. The trash fish (diet 4) was used as the control. The experiment was conducted for 28 weeks with grow-out sobaity (210.0±0.51 g) using a flow-through system consisting of twelve 1-m3 tanks. Each Treatment had three replicates and fish were fed two times daily at satiation level. The results showed that fish fed diet 2 resulted in significantly better growth performance, feed utilizati-

on, and higher muscle eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA) content compared to other diets. There were no significant differences (P > 0.05) between the final weight, weight gain, and specific growth rates (SGR) of fish fed diets 1 and diet 4, but these values were significantly (P > 0.05) higher than those fed diet 3.

A comparison of muscle quality of cultured and wild sobaity showed no significant (P > 0.05) difference between sensory attributes, except that of 'flavor' in cooked muscles in wild sobaity. A simple economic analysis showed that the cost per kg of fish production was significantly the lowest in diet 2 (USD 4.13), followed by diet 1 (USD 5.70), diet 4 (USD 6.33), and diet 3 (USD 6.92). Thus, based on growth performance, feed utilization, cost of production and nutritional quality of fish muscle, diet 2 may be recommended for commercial culture of sobaity in Kuwait. Future research should focus on how to improve muscle quality of the cultured fish at par wild fish by manipulating the feed formulation.

012

TITLE: APPLICATION OF DIETARY SUPPLEMENTS (SYNBIOTICS AND PROBIOTICS IN COMBINATION WITH PLANT PRODUCTS AND Β-GLUCANS) IN AQUACULTURE

Presenting author: Einar Ringo
Institute: The Arctic University of Norway

Topic: Prebiotics and probiotics

Abstract:

This presentation addresses the dietary supplements; synbiotics and probiotics in combination with plant products and β-glucans in aquaculture. The potential application of the synbiotic concept, a mixture of probiotics and prebiotics has a relatively short history in aquaculture but has generated interest because of numerous benefits reported in endothermic animals. Since the first study was published by Rodriguez-Estrada et al. (2009) the concept has been used in aquaculture to reveal effects on growth performance, gut microbiota, gut histology, immune parameters, haematological and biochemical parameters as well as increased disease resistance. However, a limited number of probiotic bacteria (mainly Bacillus and Enterococcus) and prebiotics (mannanoligisaccharides, fructooligosaccharides, short chain fructo-oligosaccharides, galactooligosaccharides, arabinoxylan-oligosaccharides, isomaltooligosaccharide, chitosan oligosaccharide and inulin) have been used. Additionally, some studies have used plant products or β-glucans in combination with probiotics. Some of these studies strongly suggest that the dietary supplements promote growth performance and boost some immune parameters. The present review tries to cover the gaps of existing knowledge and suggest issues that merit further investigations.

013

TITLE: EVALUATION OF DATE PITS AS A REPLACEMENT FOR YELLOW CORN IN TILAPIA OREOCHROMIS NILOTICUS FINGERLING SEMI-PURIFIED DIET

Presenting author: Ibrahim El Shishtawy Hassan Belal
Institute: United Arab Emirates University

Topic: Feedstuffs and Feed additives

Abstract:
The United Arab Emirates (UAE) is one of the largest date-producing countries in the World (760 000 MT year) which is about 6% of the World date production) (FAO 2004). The Date pits are by-products of the date industry. A date pit comprises from 6-12 % of the total weight of the ripe date depending on variety and grade. Very limited scientific evaluation of date pits asa nutrient source has been undertaken. Three experiments were conducted to achieve the objective of study the using date pits as replacements of carbohydrate sources of tilapia feed. One experiment was done using date pits without treatment, second experiment was done using date pits after sprouting them, and the last experiment was done using degraded date pits. All diets in every experiment were isocaloric isonitrogenous with replacement level of 0, 15, 30 and 45 percent of the diet. Untreated date pits showed significant reduction of tilapia growth and their growth parameters namely; weight gain, feed conversion, specific growth rate and protein efficiency ratio as compared to the control group while sprouted date pits showed no significant differences as compared to the control group. Feeding tilapia degraded date pits up to 30% of the diet improved growth and growth parameters as compared to the control. Further increasing of degraded date pits affected growth and growth parameters significantly. Tilapia body composition was affected by increasing date pits level in the diets as body fat was decreased, while body moisture was increased.

015

TITLE: NEC VARIOUS LYSINE TO ARGININE RATIO AFFECT GROWTH OF LABEO ROHITA (ROHU) FED ON HIGH PLANT PROTEIN DIETS

Presenting author: Muhammad Ashraf
Institute: University of Veterinary and Animal Sciences, Lahore Pakistan

Topic: Feedstuffs and Feed Additives

Abstract:
Studies were designed to determine the P/E ratios and workable lysine and arginine ratios to obtain balanced growth of fingerlings of Labeo rohita. First 8-week feeding trial was conducted to determine the effect of high plant-protein-based diets with different E/P ratios and accordingly control group consisted conventional feed, T1 had 2% fish oil, T2 4% and T3 had 6% fish oil supplementation. Diet with best performance in first trial 1 served as control in second trial(different lysine to arginine ratios). There were 4 treatments in each trial. In trial 2 T1 has lysine/arginine ratio of 0.7:0.9, T2 has 0.78:1.20, T3 has 0.87:1.51 while control was free of lysine supplemenation. Fish were stocked in glass aquaria @ 126.0 mg/L. In trial 2 each diet was iso-nitrogenous and iso-caloric while in trial 1 each diet had different calorific values. The feed was dispensed to fish twice a day at 10.00 and 16.00 hours. Whole studies were continued for 120 days (60 days for each trial). Fish were sampled for weight and length measurements fortnightly and quantity of feed in relation to weight increments was adjusted accordingly. At the time of feed formulation crystalline amino acids were added to individual diet group in the ratios and weights given above. Dissolved oxygen, temperature, pH, TDS, EC and salinity were monitored daily. All the water quality parameters remained uniform because of daily exchange of water with similar properties.

Weight gain in trial 1 was 1.48±0.06c g in control group, 2.39±0.1a g in T1, 2.67±0.1aa g in T2 and 1.96±0.2b g in T3 respectively. In trial 1 FCR was 1.75±0.21d in control group, 1.37±0.08b in T1, 1.28±0.02a in T2 and 1.49±0.07cb in T3 respectively. FCE in trial 1 was found to be 57±0.64c % in control group, 72±1.33a % in T1, 78±0.62aa % in T2, 67±1.53bb % in T3. Similarly SGR in trial 1 was 7.0±0.52c % in control group, 13.0 ±0.03b % in T1, 16.0 ±0.15a % in T2, 12.1 ±0.6b % in T3. FCR was the lowest in T2 and the highest in T0 without fish oil. Similarly differences in FCR, FCE and SGR were prominent in all four treatments. Digestibility of protein in trial 1 in control group was 62.9%, in T1 69.5%, in T2 77.5%, and in T3 66.4%. Digestibility of fat in trial 1 in control group was 31.26%, in T1 22.9%, in T2 22.00%, and in T3 19.05%. P/E ratio in control group was 1/4.37, in T1 1/4.82, in T2 1/4.92, and in T3 1/4.77. Like trial 1 physicochemical parameters remained uniform in all the four treatments. Weight gain in trial 2 was 2.52 ±0.07ccg in control group, 3.39±0.09a g in T1, 2.86±0.24b g in T2 and 2.71± 0.02bbg in T3 respectively. The highest weight gain was observed in T1 (0.7/0.9 lysine/arginine), then T2, T3 and the lowest in control with no amino acid supplementation. Feed conversion ratio was the lowest in T1 then in T2, T3 and the highest was in T0. In trial 2 FCR was 1.71±0.21bb in control group, 1.43±0.15aa in T1, 1.52±0.12a in T2 and 1.64±0.16b in T3. FCE in trial 2 was 58±0.11b % in control group, 69±0.33a % in T1, 65±1.19b % in T2, and 60±2.24ab % in T3. In trial 2 SGR was 12.0±0.01c % in control, 15.1±0.11aa % in T1, 14.0±0.13b % in T2 and 13.0±0.05bb % in T3. Digestibility of protein in trial 2 in control group was 60.7%, in T1 73.8%, in T2 68.8%, and in T3 was 65.3%. Digestibility of fat in trial 2 in control group was 29.13%, in T1 54.88%, in T2 36.35%, and in T3 was 31.19%. P/E ratio in trial 2 in control group was 1/4.83, in T1 1/5.40, in T2 1/5.29, and in T3 was 1/5.04. Physico-chemical parameters (pH, DO and salinity) remained uniform among various treatments. TDS, however, differed significantly among all the experimental groups. The best final body weight, weight gain, feed conversion ratio were in the treatment T1 having 0.7:0.9(L/A) then in T2 having 0.78:1.20(L/A) then in T3 having 0.87:1.51 (L/A) and the lowest in in control group having no amino acid supplementation. Abstract is a summary of important studies on feed formulation with particular emphasis on P/E ratios and Lysine/Arginine two essential and highly important and limiting amino acids in fish diets.

027

TITLE: EXTRUSION COOKING: METHOD OF PRODUCTION FOR HIGH QUALITY AQUATIC FEEDS, BOTH FRESH AND SALTWATER SPECIES

Presenting author: Joseph P. Kearns

Institute: Wenger Manufacturing, Inc., Sabetha, Kansas, USA

Topic: Alternative Feedstuffs and Aquafeeds:

Aquaculture feeds produced by extrusion cooking offer many advantages over other methods including flexibility, wide ingredient selections, pasteurization, reduced formulation costs and even environmental sustainable qualities. The process is evolved into a scientific proven method to take cereals, proteins and other nutrients and combine them into specific product qualities for all the different farmed aquatic species. Floating, sinking, slow sinking, large diameter, micro diameter as well as various shapes and water stabilities can all be made in this production method. This presentation will cover as number of topics to convey the versatility of the extrusion process. Central to the environmental aspects is the system's ability to combine the ingredients together in a matrix form that binds the ingredients into pellet form. This reduces the leaching of phosphorus and nitrogen into the water which has shown to be detrimental to the environment.

It also allows for use of ingredients at levels not normally seen simply by pelleting methods. The minimal starch levels used hold the major ingredient together and allows expansion and or improved water quality as required. It should be noted that the lower starch levels used do require the use of functional proteins or proteins not highly denatured. After selection of the ingredients on a nutritional and extrudable basis and definition of the final product characteristics the system can be configured and operated in a fashion to achieve the final desired feeds. Extrusion is advancing with specific equipment for selected product styles or all of them can be made on the same machine with minimal equipment change overs between production runs of different styles of products. Once extruder the feeds are normally dried and some are coated before packaging or storage. Exacting feed parameters are assisted greatly by computerization of the process with on line product analysis systems, all to be briefly discussed.

031

TITLE: PROTEIN REQUIREMENTS FOR FINGERLINGS GILTHEDHEAD SEABREAM (SPARUS AURATA)

Presenting author: Abdelhamid Mohamed Slah Eid
Institute: Faculty of Agriculture- Suez Canal University - Egypt
Co-author(s): Asmaa Abdelnaby

Topic: Alternative Feedstuffs and Aquafeeds

The objective of this study is to investigate the effects of dietary protein levels on the growth performance, whole body composition and nutrient utilization of fingerlings gilthead seabream (Sparus aurata). Fish (initial weight 2.20±0.10 g) were fed to satiation four iso-energetic diets (397 Kcal/100g), containing 40, 45, 50 and 55%, crude protein during 60 days. Fish fed 50% and 55% protein attained better growth and feed utilization than the other groups ($P < 0.05$). Specific growth rate and feed conversion ratio were the poorest for fish fed 40% and 45% protein ($P < 0.05$). Protein retention increased significantly ($P < 0.05$) from 0.80 to 1.90 and Lipid retention increased 2.7% to 5.9%. The estimated protein requirement for fingerlings gilthead seabream (Sparus aurata), was 50%.

036

TITLE: PREBIOTICS RESEARCHES IN MIDDLE EASTERN AQUACULTURE: ADVANCES AND CHALLENGES

Presenting author: Seyed Hossein Hoseinifar
Institute: Department of Fisheries, Faculty of Fisheries and Environmental Sciences, Gorgan University of Agricultural Sciences and Natural Resources, Gorgan, Iran

Topic: Prebiotics and probiotics

Abstract:
There is increasing interests for administration of functional dietary supplement in aquaculture as an alternative to traditional administration of antibiotics. Prebiotics are non-digestible dietary ingredients that modulate fish and shellfish intestinal microbiota which per se beneficially affects growth performance, gut histology, immune parameters, haematological parameters as well as disease resistance.

In line with the other region of the world, there were a growing number of researches on evaluation of prebiotics effects on various cultured species. Inulin, oligofructose (fructiooligosaccharide), short chain fructiooligosaccharide (ScFOS), galactooligosacharide, xylooligosaccharide as well as commercial prebiotic (mainly yeast based) were within the most studied prebiotics in Middle Eastern aquaculture. Administration of prebiotics showed contradictory results on different species. The present review covers the advances, challenges as well as research gaps in the field of prebiotics application in Middle Eastern aquaculture.

043

TITLE: ALLTECH'S ALGAE AND ORGANIC MINERAL TECHNOLOGIES BOOST OMEGA 3 UPTAKE

Presenting author: John Sweetman
Institute: Alltech Bioscience Centre, Ireland

Topic: Feedstuffs and Feed Additives

Abstract:

In the last 10 years changes in diet formulation have seen the content of salmon feeds change from 70% marine raw materials to 70% vegetable and 30% marine raw materials in 2013. This trend continues with 4% LC n-3 HUFAs in the feed/fillet oil fraction (FHL 2013) and this shift has increased the complexity of feed formulation with more functional ingredients and additives being utilized to satisfy the nutrient requirement of the species being cultured.

Recent studies have shown that it is possible to replace fish oil in salmon feed using an algal meal (Alltech Inc.) rich in the marine omega-3 fatty acid DHA and obtain high n-3 fillet levels with improved DHA and total n-3 ADC while maintaining good fillet technical quality and without affecting the growth or having any negative effect on fish health.

In a study on the effect of fish oil replacement by algae at a dietary inclusion of 2.5 and 5.0% on growth, performance and on salmon fillet quality an organic mineral premix was added to one of the experimental diets to study any effects of these on fillet quality. The diets had 4.85% EPA+DHA (% in dietary oil) and contained equal amounts of crude protein, crude lipid, digestible energy, total saturated fatty acids, EPA+DHA and n-3/n-6 fatty acid ratio using different oil and plant protein mixes. The algae used in this study was SP1 (Alltech Inc) and the organic mineral mix was prepared using Bioplex minerals supplied by (Alltech Inc).

The salmon growth rates were high and the FCR low and similar in all the dietary treatments. The highest fillet levels of DHA were found in the fish fed the organic minerals. The Bioplex mineral supplementation in low fish meal diets resulted in lipid levels similar to that of the medium fish meal diets.

No differences in fillet quality was measured across the 5 dietary treatments when liquid loss, Lightness, SalmoFan Cscore or firmness were measured. However the gaping % was nearly eradicated by the supplementation of the Bioplex minerals indicating that Bioplex minerals played a positive role in fillet quality and may protect the polyunsaturated fatty acids in the diet from oxidative stress.

047

TITLE: EFFECT OF A NOVEL FEED ADDITIVE ON LIPID VACUOLIZATION OF THE HEPATOPANCREAS AND PRODUCTION PARAMETERS OF TWO SPECIES OF WHITE SHRIMP PENAEUS (FENNEROPENAEUS) INDICUS AND PENAEUS VANNAMEI IN SAUDI ARABIA

Presenting author: Nasser K. Ayaril
Institute: National Aquaculture Group, Kingdom of Saudi Arabia
Co-author(s): Peter Coutteau

Topic: Feedstuffs and Feed Additives

Abstract:

Feed is the major cost in the production of Penaeid shrimp. Increases of ingredient prices encourage nutritionists to explore novel strategies to improve the cost efficiency of nutrition, including the use of feed additives to enhance the efficiency of nutrient digestion. The aim of the present study was to evaluate the effect of a novel feed additive which enhances the hepatopancreas function on nutritional status and production parameters for two species of white shrimp, Penaeus (Fenneropenaeus) indicus and Penaeus vannamei.

Two sets of pond trials were executed to evaluate the effect of the feed additive on production parameters in ponds following standard production protocols at the farm till harvest (P. indicus: 1 ha; 12 replicate ponds per treatment; stocked at 30 pcs per m2; 122-129 DOC; P. vannamei: 10 ha; 8 replicate ponds per treatment; stocked at 34 pcs per m2; 144-164 DOC). The control feed consisted of the standard feed used at the farm, the treatment feed was supplemented with the feed additive. Histological analysis was performed on 30 to 40 shrimp per treatment to evaluate lipid vacuolisation in the hepatopancreas according to 3 grades (high, medium and low level). Final pond results for P. indicus indicated 2% higher average body weight (ABW), 3% higher survival, 6% higher biomass for the treatment compared to the control group. However removal of outliers for survival from control and treatment set showed 8% higher ABW, 12% higher survival, 23% higher biomass with treatment. The pond trials with P. vannamei yielded 7% higher ABW and 2% higher survival in treatment ponds. Lipid vacuolization by quantitative histology of the hepatopancreas indicated more shrimp showing a higher level of lipid vacuolization in the treatment group. The histological observations and production results confirmed the potential of the feed additive to improve the productivity under the local conditions for two different species of penaeid shrimp.

053

TITLE: FUTURE FEEDS FOR A GROWING AQUACULTURE SECTOR IN A HUNGRY WORLD **Presenting author: Albert G.J. Tacon**

Institute: Aquatic Farms Ltd, USA

Topic: NA

Abstract:

Sustaining the current and future food needs of 7.3 billion people in the face of a limited natural resource base and a changing climate is one of the major challenges facing the planet; global population increasing by about 75 million annually and expected to reach 8.4 billion by 2030. In particular, concerns exist about the ability of our traditional land-based agricultural food production systems to be able to produce sufficient food to meet our future food demands. Although aquaculture, the farming of aquatic plants and animals, is often touted as the next blue revolution in terms of agricultural food supply, aquatic food products (whether captured or cultured) currently contribute less than 3.6% of total global food supply, 6.7% of total global protein supply and 1.2% of total calorie supply. However, whilst the overall contribution of aquaculture to global food supply maybe appear to be small when viewed on a global basis, this is not the case at a regional or country level; over 91.2% of total global aquaculture production in 2012 being produced within the Asian region and China alone accounting for about 60% of total global aquaculture production, with total farmed aquatic meat production from aquaculture in China being greater than that of total farmed chicken, cattle and duck meat production combined, and only second to pork in terms of total meat production. As the worlds largest meat producer and manufacturer of compound animal feeds (including aquaculture feeds), China is also the worlds largest importer of plant and animal feed ingredients; the latter being necessary to sustain China's growing animal feed industry and the maintain the changing food habits and appetite of the worlds most populous and wealthy nation. A similar increasing dependency upon the importation of feed ingredients also exists for most other major aquaculture producing countries within the Asian and North African region, including most Middle Eastern countries. With feeds and feeding representing the highest operating cost item of most animal food production systems, there are also increasing pressure for aquaculture feed producers and aquaculturists alike to reduce feed costs per unit of fish or crustacean production and at the same time minimize any potential negative environmental impacts; to a large extent this is due to market forces outside the control of feed manufacturers and farmers, including steadily increasing feed ingredient prices of key commodities (including fishmeal and fish oil), increasing feed processing and labor costs, and the implementation of ever more stringent environmental and feed/food safety controls by producing and importing countries. The current paper discusses how the aquaculture feed sector has been able to address the above issues to ensure the continued growth and development of the sector, including through improvements in feed ingredient selection and feed formulation, improvements in feed manufacturing technology, improvements in on-farm feed management, and improvements in water management and fish/shrimp health and growth.

054

TITLE: USING SATELLITE IMAGES IN DELINEATION AND MAPPING THE EGYPTIAN LAKES

Presenting author: Mahmoud. H Ahmed

Institute: National Authority for Remote Sensing and Space Sciences, Marine Sciences Department, Egypt

Co-author(s): Kh. AbuTaleb, S.B. El Kafrawy

Topic: Alternative Feedstuffs and Aquafeeds

Abstract:

Lakes are one of the most important natural resource in Egypt. It save 30% of the fish production and food supply; which contribute to the national economy, as well it is important for the national food security. The Egyptian lakes complain a rapid and severe decreasing in the area and fish production; this is due to illegal anthropogenic activities, such as drying Lake Boundary to private fish farms. This continues decrease in some cases such as Manzala lake exceeded 45 % of its original area over the past decades (1935- 2008). Satellite images in this case play a crucial role providing historical archive of earth images which assist in monitoring and delineation of lakes boundary over past decades. This can help in developing a GIS based system that documents and authenticates these boundaries so that any illegal activity could be detected and traced. The National Authority for Remote Sensing and Space Sciences (NARSS), part of the Ministry of State for Scientific Research, in collaboration with General Authority of Fish Resources Development GAFRD, were developed the basis for an integrated information system for operational monitoring and management of the Fish Resources Sector and digital mapping of the Egyptian Lakes. The information system will assimilate and integrate satellite and in situ data, as well as information on lakes Ecosystems and lakes boundaries mapping. This information will then be transformed into digital maps of all lakes and surrounded land use, and distributed to public and private entities needing such information. In particular, the lakes boundaries digital maps and Information system are greatly assisting the sustainable management of Egyptian lakes as well fish resources sector in Egypt, the placement of aquaculture facilities, the conservation of important wetland systems, and facilitating the routine monitoring of anthropogenic activities.

078

TITLE: DEVELOPMENT OF FISHMEAL AND FISH OIL FOR AQUACULTURE FEEDS IN THE SULTANATE OF OMAN

Presenting author: Gafar al-Ajmi
Institute: Aquaculture Centre, Ministry of Agriculture and Fisheries Wealth, Oman
Co-author(s): Dave Robb, Aida al-Kharusi, Bader Hattali, Darwish al-Balushi, Esa al-Farsi, Fahad Ibrahim

Topic: Fish Meal and Oil Extension

Abstract:

The Sultanate of Oman has a long, rich coast line, where many species of fish are caught. Some of these species have a high price for human consumption, but other species are hardly utilised. In particular small pelagic species such as sardines, anchovies and scad are poorly utilised compared to their estimated biomass, as the market for them is relatively poor.

The Sultanate of Oman wishes to develop aquaculture of fish and Crustacea. This will require feed, which can be made domestically. The raw materials to make such feeds would have to be imported at present, but the under-utilised species of fish can be fished sustainably in order to produce fishmeal and oil.

Fishmeal and oil are excellent sources of protein and lipid respectively. Fishmeal provides a balanced supply of amino acids for healthy growth of fish and livestock. Fish oil supplies long chain n-3 HUFAs, which are essential in human nutrition. Production of these raw materials in Oman, from sustainably exploited fisheries, would support local production of aquaculture feeds and export sales of the lucrative commodities. This in turn will increase the quantity of aquaculture products which can be farmed, also taking the pressure off existing stocks of fish used for fishmeal and oil.

This project will investigate the opportunity to produce fishmeal and oil from different species of fish along the coastline of Sultanate of Oman, analysing changes in nutrients and contaminants over the seasons. The outcome will determine the potential quality and hence value of developing fishmeal and oil processing in the Sultanate of Oman, which can be used to make aquaculture feeds for the developing industry.

091

TITLE: EFFECTS OF REPLACING FISH MEAL AND OIL WITH PLANT SOURCES ON PERFORMANCE,, DIGESTIVE ENZYMES AND GUT MICROBIAL COMPOSITION OF ACIPENSER PERSICUS AND ONCORHYNCHUS MYKISS

Presenting author: Naser Agh

Institute: Department of Artemia and Aquaculture, Urmia Lake Research Institute, Urmia University- Urmia - Iran

Topic: Alternative Feedstuffs and Aquafeeds

Abstract:

The present study was performed to examine the effect of replacing fish meal and fish oil with plant sources on performance of juvenile rainbow trout and Beluga sturgeon. The fish were fed 6 different experimental diets for 60 days. The control diet contained only fish meal and fish oil as the primary sources of protein and lipid, while the 5 remaining diets either contained fish oil or 80% the canol a:linseed:sanflower:safflower oil blend (30:30:30:10, respectively) and 20% fish oil as the primary lipid source and 0, 40, 60, 80 and 100 percent replacement of fish meal with plant protein sources (wheat gluten, corn gluten and soybean meal). Results showed 100% fish meal and 80% fish oil replacement with plant sources in rainbow trout diet hadn't significant effects on growth indices, feed utilization and digestive enzyme activity. However replacement of fish meal with 60% plant protein in combination with 80% vegetable oils resulted in increased growth indices and food utilization ($P < 0.05$). Replacement of fish meal with 100% plant protein in combination with 80% vegetable oils in beluga sturgeon diet resulted in decreased growth indices and feed utilization ($P < 0.05$). In both groups of fish fed with 80% vegetable oil did not show any significant differences on growth indices, feed utilization and digestive enzyme activity ($P > 0.05$). The composition of fatty acid in body muscles were found directly related to the composition of the same in feed. No significant differences were detected in microbial counts of fish fed control diet and those fed on diet containing vegetable oil in both fish. But, replacing fish meal with plant protein resulted in significantly decreased microbial counts in rainbow trout and beluga sturgeon compared to control group ($P < 0.05$).

092

TITLE: COMBINING MARINE HYDROLYSATES ASSETS FOR BETTER FEED PERFORMANCES AND SUSTAINABLE FISH MEAL REPLACEMENT ALL ALONG THE PRODUCTION CYCLE

Presenting author: Philippe Sourd

Institute: Aquativ

Topic: Feedstuffs and Feed Additives

Abstract:

Marine ingredients are still recognized as the best sources of nutrients to meet fish and shrimp requirements. Yet fish meal availability and prices have proven to be very challenging at times. Substitution of fish meal does not come without hazards for fish and shrimp biological performances. Many metabolic functions, including growth or immunity, can be impaired with the use of alternative ingredients. Controlled hydrolysis allows turning marine co-products into a sustainable, standardized and highly bio-available source of essential and bioactive nutrients: marine functional hydrolysates which have well documented benefits for aquatic species. Marine hydrolysates palatability and nutritional benefits have been verified under controlled tests and farms conditions when applied in aquafeed. There is also growing interest in using functional hydrolysates to promote aquatic animal health. Their profile consistency, reliable availability and proven performance have made them become a natural solution for aquafeed formulators. We will shortly review the critical importance of the raw material sourcing and quality and describe briefly the hydrolysis process management and the analytical characterization tools required to produce highly performing and standardized products. Then, we will illustrate the functional benefits that have been obtained from hydrolysates when used in aquafeeds for shrimp and fish. This illustration will show, very practically, how these innovative ingredients can bring a whole range of assets to dietary formulation for all species and at all stages. Through fish and shrimp trials results, we intend to demonstrate how the variety of hydrolysates available today, the combination of their assets and the different application methods can allow the formulator to turn these products into concrete solutions. We will show how the formulator can use these innovative and sustainable ingredients to meet aquatic animals' needs at all stages while keeping good control of fish meal use and preserving or enhancing fish and shrimp health.

095

TITLE: EFFECT OF MORINGA OLEIFERA MEAL ON THE GROWTH, BODY COMPOSITION AND NUTRIENT DIGESTIBILITY OF LABEO ROHITA

Presenting author: Noor Khan and Hussain Mehdi

Institute: Department of Fisheries and Aquaculture, University of Veterinary and Animal Sciences (UVAS), Lahore-Pakistan

Abstract:

In the present study, various concentration of Moringa oleifera meal was explored as protein source on the growth, body composition and apparent digestibility on Labeo rohita fingerlings. The experimental fish (Labeo rohita) fingerlings with an average body weight of 5.7g were stocked in eight glass aquaria. Twenty two fingerlings were stocked in each aquarium. Four diets designated as treatments; T1, T2, T3, and T4 were prepared on basis of Moringa oleifera inclusion level as 0%, 10%, 20% and 30% by replacing fish meal and fed to fish at 4% body weight for eight weeks. The net weight gain recorded was 11.0 g,10.0 g, 13.0 g and 8.0 g inT1, T2, T3 and T4 respectively. Statistical analysis reveals significant difference ($P \leq 0.05$) among treatments. The FCR and SGR values for each treatment were recorded as 1.81. 2.28, 2.25, 3.1 and 2.15, 2.01, 1.90, 1.40 and exhibited significant differences ($P \leq 0.05$) among treatments. Smimlarly, the CP digestibility in T2 was found significantly higher (43.64) followed by T1 (38.66) and lowest in T3 (12.36) whereas the fat digestibility was significantly higher in T4 (98.78) followed by T3 (44.16), T2, and in T1. In conclusion, inclusion of Moringa oilefera upto 20% in fish feed implies significant effect on fish growth validating it as favourable feed.

097

TITLE: MICROALGAE AQUAFEEDS

Presenting author: John Benemann

Institute: MicroBio Engineering, Inc.

Topic: Fish Meal and Oil Extension

Abstract:

Algae are a potential future source of aquaculture feeds due to their high contents of proteins, unsaturated fatty acids, vitamins, pigments, immune stimulating factors and other nutritional and health promoting substances. Spirulina, a cyanobacterium produced commercially, has been used as a specialty aquafeed for several decades in modest amounts, a few hundred tons per year, and live microalgae feeds are produced and sold in small quantities by a number of commercial enterprises. Attention is now focusing on larger-scale microalgae production for low cost commodity feeds. Of particular attraction is the potential of marine microalgae to substitute for fish meal and fish oils high in long-chain omega-3 oils, for which demand is rapidly increasing, but supplies are not. Many research projects and private companies are now advancing the technology for low-cost large-scale commercial production of a variety of microalgae aquafeeds, as whole biomass or isolated components, from proteins to high value pigments and vitamins. Their challenge is to reduce current commercial microalgae biomass production costs by an order of magnitude. Examples of current developments in the U.S. and elsewhere in this field will be reviewed, and future prospects for microalgae feeds production technology discussed. If successful, the rapidly growing aquaculture industry will benefit from microalgae feed products through improved nutrition and reduced costs using environmentally sustainable resources.

025

Other species and topics

TITLE: EFFECTS OF THE DIETARY SYNBIOTIC 'BIOMINIMBO' ON GROWTH AND FEEDING INDICES IN GOLDFISH (CARASSIUS AURATUS)

Presenting author: Babak Moghaddasi

Institute: Islamic Azad University - Iranian Ornamental Fish Society (IOFS)

Topic: Ornamentals):

Abstract:

Dietary effects of the synbiotic "BiominImbo" on growth and feeding indices of the Goldfish (Carassius auratus), was studied. Increasing of the fish biomass in shorter time and less prime cost was the main aim of the recent research. For 2 months, 150 young Oranda Goldfish were fed with the symbiotic "BiominImbo" (0, 0.5, 1, 1.5 and 2 g/kg in dry food), Standard length and body weight were being meseared twice a mount (every 2weeks) and growth indices including Body Weight Growth (BWG), Daily Growth Rate (DGR), Condition Factor (CF) and Special Growth Rate (SGR) were calculated at the end of the 2nd mount. Results showed that the synbiotic "BiominImbo" increased the growth performance of the treatments and the best dosage of the symbiotic (BWG=53.76, DGR=0.12, CF=20.97, SGR=0.76, FCE=39.07 and FCR=2.61) was 2g/kg in the Oranda Goldfish dry food.

052

TITLE: PRE-COMMERCIAL SCALE PRODUCTION OF DUNALIELLA SALINA: INDUCTION AND EXTRACTION OF OF B-CAROTENE IN KUWAIT

Presenting author: Tawfiq Abu-Rezq

Institute: Kuwait institute for scientific research

Co-author(s): M. Al-Roumi, N. AHmed, M. Al-Shamali, A. Naseeb, S. Al-Hooti

Topic: Seaweeds and algae

Abstract:

D. salina grow significantly higher ($p<0.05$) at 45-psu salinity against 80-psu, at temperature and light intensity (21.5 to 24.0°C) and (1615 µ mole m-2 s-1 i.e., 87.4±7.19x103 lux) against at higher temperature and light intensity (31.0 to 44.0°C) and (1800 µ mole m-2 s-1, i.e., 97.4±9.82x103 lux, respectively). Results also confirmed that higher D. salina growth was obtained while using outdoor raceways during summer (high temperature and high light intensity) against during winter (low temperature and low light intensity). Results obtained indicated that the β-carotene induction in D. salina cells is faster when high salinity regimes at 175 psu (7 to 8 days) were used rather than at 80 psu (17 days), high temperatures (39 to 41°C) and high light intensities (1500 µ mole m-2s-1 to 1850 µ mole m-2s-1 , i.e., 80 to 100x103 lux, respectively). The β-carotene induction duration can be shortened from 38 to 7 days at summer (temperature, 27 to 37°C), outdoor (light intensity at 1800 µ mole m-2 s-1, i.e., 97.63x103 lux) and increasing the salinity within 4 days. Results also proved possibility of changing the D. salina color from brown to green with 95 to 100 pure culture. Using 1 to 5 % fresh water could be used to collect the D. salina cells aiming for cheap and practical β-carotene extraction. Good amount of β-carotene obtained during this study (19.13 to 180.0 pg/cell) compared with other scientists. Cifuentes et al., 1992 and 2003 reported (8.1 to 49.0 pg cell-1); Borowitzka and Siva, 2007 reported (42.0 to 836.0 pg cell-1).

071

TITLE: PRE CONCENTRATION OF ALGAE DUNALIELLA SALINA – USING SILICON CARBIDE MEMBRANE - A CASE STUDYe

Presenting author: Bondada. S. Rao
Institute: National Aquaculture Group, Al-Lith, Saudi Arabia
Co-author(s): Medimi Pradeep Kumar, David Griffith

Topic: Seaweeds and Alga

Abstract:
Dunaliella salina is a green algae, turn red on stress produce beta carotene, growing Dunaliella salina in earthen ponds and pre concentration with Silicon Carbide Membrane (SiC), Artemia feed on Dunaliella salina, grow into adult Artemia biomass & produce cyst / Nauplii for sustainable aquaculture.

082

TITLE: THE PERFORMANCE OF RED SEAWEED (RHODOPHYTES, KAPPAPHYCUS SPP.) CULTIVATED IN LAND-BASED CULTURE FACILITIES

Presenting author: Rossita Shapawi
Institute: Borneo Marine Research Institute, Universiti Malaysia Sabah, Kota Kinabalu Sabah Malaysia
Co-author(s): Wahidatul Husna Zuldin

Topic: Seaweeds and Algae

Abstract:
Little is known on the performance of seaweed cultivated in land-based facilities which is very beneficial for research purposes and expansion of the industry. The present study was conducted to determine the performance of Kappaphycus sp. (K.alvarezii variety Brown Tambalang, BT and K. striatum variety Green Flower, GF) cultivated in two different tank designs: round tank with flow-through water and raceway tank. In the first attempt using round tanks, four different treatment tanks (control treatment, C1: without sand and corals, without fertilizers, T1: without sand and corals with fertilizers, T2: with sand and corals, without fertilizers & T3: with sand and corals, with fertilizers) with different culture density (1.26gL^(-1), 1.01gL^(-1) and 0.51gL^(-1)) were applied. GF showed a better growth performance in T1 and T3 compared to the control, C1. The daily growth rate of GF in C1 was 0.28%, while in T1 and T3 were 0.43% and 0.33%, respectively. However, the BT variety showed a negative growth performance due to bleaching problem. In the second attempt using raceway tank, both red seaweed showed improved growth rate with the average daily growth rate of 2.14±0.17 %□ day□^(-1) for K. striatum var. GF and 2.67±0.37 %□ day□^(-1)for K. alvarezii var. BT. No fertilizers or enrichments were added during the cultivation period and less occurance of epiphyte infection was observed. It can be concluded that Kappaphycus sp. can be grown in land-based faciltities but a proper culture design must be applied. Apparently, the raceway culture system is able to support good growth of Kappaphycus sp. These findings are significant to provide a baseline data for research related to quality improvement of the seed and facilitate the land-based seaweed farming in the future.

030

Other Topics & Special Sessions

TITLE: MONITORING OF AQUAPONIC SYSTEM USING WIRELESS SENSOR NETWORK

Presenting author: Nahid Mohammadi
Institute: UAE university
Co-author(s): Nafisa Maaz, Noora Albalooshi, Shamma Aref, Mohammad Abdul Hafez

Topic: Education, Extension and Technology Transfer

Abstract:
Aquaponic is an indoor closed-loop system that allows a careful control for the fish environment, which will help in providing the plants with nutrient-rich waste water. Common problems for Aquaponic systems are the temperature variations, high ammonia concentration, difficulty in maintaining optimum pH level and water level. The undesired change in these parameters can affect the fish growth or even cause their death. As a consequence, the plant growth will be affected. Plants and fishes may also die because they are not getting enough oxygen due to high water flow or lack of oxygen in water. This project suggests the use of wireless sensor network (WSN) to monitor the various parameters. The system will consist of microprocessors, wireless transceivers, sensors, network gateway, power supplies, PCs, and user interface software. The sensor components will be connected to processors and Zigbee transceivers to transmit data to the gateway. The user will receive every sensor's data from the gateway and display it on application software such as LabVIEW. The other possibility of receiving data on the end user is to use cloud computing. So the data will be sent to the cloud from the gateway. Then the user can access that data by accessing their cloud account. This project will be designed and demonstrated either on small scale Aquaponic system or on one of Falaj Hazza campus Aquaponic greenhouse. This solution will lead to an increase in fishes and plants growth, in addition of having the advantage of reducing water consumption used in the cultivating process. Another Advantage of having this system in UAE is having the ability of growing plants easily in an arid land which is relatively not suitable for growing fruits and vegetables.

041

TITLE: AN ASSESSMENT OF KNOWLEDGE TRANSFER AMONG FISH FARMERS TO IMPROVE INTEGRATED AQUACULTURE-AGRICULTURE IN SOUTH AFRICA

Presenting author: Khalid Salie
Institute: Stellenbosch University. South Africa
Co-author(s): Krishen Rana

Topic: Education, Extension, and Technology Transfer

Abstract:
South Africa has a myriad of irrigation reservoirs that can be used for integrated aquaculture-agriculture practices. Much research has been conducted to provide information on optimising usage. However, it is not fully understood how much of the knowledge is correctly interpreted and successfully applied. To achieve sustainable technology transfer, the aspects were investigated in a research project funded by the Water Research Commission entitled "Knowledge transfer on water resource management for improved integrated aquaculture and agriculture systems":
a. What information is available to aquaculture and agriculture?
b. What modes are used by fish farmers to access information?
d. What are the constraints to information pathways amongst fish farmers?
e. What rationale drives priority for information use?
f. What level of success is based on existing or new knowledge?
g. What are the cost implications?
h. What benchmarks are used to rate performance?
j. How are fish farmers managing the daily influx of information?
Fish farmers were interviewed using structured questionnaires. Additional information was recorded during group discussions and informal talks. Data were analysed using software (SAS and SPSS) as well as descriptive statistics. Our preliminary results indicated that there is no ubiquitous approach to enhancing technology transfer - the suite of measures for addressing barriers, and facilitating successful technology transfer, is typically community specific and demand-driven. Fish farmers have access to ITC and regularly discussed issues with peers, local and abroad. Farmers share their experiences in addressing challenges or to enhance other farmers' knowledge, thereby improving their growth and sustainability of the aquaculture sector. However, a need was expressed to formalise communication and to establish a demonstration unit for training. The South African experience can provide useful approaches for sustainable aquaculture development in the Middle East and the rest of the world.

006

Post Harvest Technologies

TITLE: ADVANCES IN SEAFOOD PROCESSING TECHNOLOGY USING THERMAL AND NON THERMAL PROCESSING

Presenting author: T.K. Srinivasa Gopal
Institute: Central Institute of Fisheries Technology, India

Topic: Advances in Seafood Processing

Abstract:

Fish is a very perishable food and hence susceptible to high post harvest losses after landing, either in quantity or quality, due to post harvest handling during transport, storage, processing, on the way to markets or in markets waiting to be sold. About 27% of landed fish globally ends up being lost or wasted from landing to consumption. This can lead to substantial economic losses as the value of fish decreases with quality loss. Specific preservation techniques are needed in order to preserve fish's nutritional quality, extend shelf life, minimize the activity of spoilage bacteria. Fish processing occupies a position of major importance in the world food trade. At present and in future, studies on fish preservation are of more critical nature such as reducing post harvest losses and developing new processes that optimize cost, nutritional quality, utilization of resources and energy. To achieve food and nutrition security in middle east it is essential to adopt latest emerging technologies in seafood processing. Generally it is distributed as fresh, chilled, frozen, heat treated, fermented, dried, smoked, salted, fried, minced etc. Lot of advancements have taken place in the preservation of fish both thermal and non thermal techniques The aim of fish processing is to develop novel preservation methods to prevent undesirable changes in the nutritive value and sensory quality of the products. This is achieved by developing cost effective methods of preservation which controls the growth of microorganisms, reduce undesirable changes in physical, chemical and sensory parameters and prevent contamination. The present status of seafood industry with emphasis on need for special processing technologies like Modified atmosphere packaging, Active food packaging, High pressure processing, High pressure assisted freezing, Pulse electric field, Ohmic heating, Microwave heating, Irradiation, Extrusion, Retort pouch processing, and pulse light preservation techniques have been discussed.

028

Production Systems

TITLE: EXTRUDED FEED FOR WORM WATER FINFISH AND SHRIMP

Presenting author: Mohammad Y. Alsaiady
Institute: Arabian Agricultural Services Company (ARASCO), P.O. Box 53845 Riyadh, 11593, Kingdom of Saudi Arabia
Co-author(s): Radwan Al Ibrahim

Topic: Cage culture

Abstract:
Aquaculture feeds produced by extrusion cooking offer many advantages over other methods including flexibility, wide ingredient selections, pasteurization, reduced formulation costs and even environmental sustainable qualities. The process is evolved into a scientific proven method to take cereals, proteins and other nutrients and combine them into specific product qualities for all the different farmed aquatic species. Floating, sinking, slow sinking, large diameter, micro diameter as well as various shapes and water stabilities can all be made in this production method. This presentation will cover as number of topics to convey the versatility of the extrusion process. Central to the environmental aspects is the system's ability to combine the ingredients together in a matrix form that binds the ingredients into pellet form. This reduces the leaching of phosphorus and nitrogen into the water which has shown to be detrimental to the environment. It also allows for use of ingredients at levels not normally seen simply by pelleting methods. The minimal starch levels used hold the major ingredient together and allows expansion and or improved water quality as required. It should be noted that the lower starch levels used do require the use of functional proteins or proteins not highly denatured. After selection of the ingredients on a nutritional and extrudable basis and definition of the final product characteristics the system can be configured and operated in a fashion to achieve the final desired feeds. Extrusion is advancing with specific equipment for selected product styles or all of them can be made on the same machine with minimal equipment change overs between production runs of different styles of products. Once extruder the feeds are normally dried and some are coated before packaging or storage. Exacting feed parameters are assisted greatly by computerization of the process with on line product analysis systems, all to be briefly discussed.

029

TITLE: BIOFLOC SYSTEM FROM LAB TO FIELD: MORE PROS THAN CONS

Presenting author: Ashraf Suloma

Institute: Fish Nutrition Lab (FNL), Department of Animal Production, Faculty of Agriculture, Cairo University

Co-author(s): Abd El-Naem F.A Zida, Rania S Mabroke. Azab M. Tahoun

Topic: Bio-floc Systems

Abstract:

The Egyptian government strategy aims to increase the annual national fish production and ensure the low prices to meet the overpopulation. To accomplish this goal, aquaculture production should be increased five-fold during the next five decades in Egypt, which is not an impossible goal if intensive fish culture will be adopted as a national goal. The main obstacles to spread the intensive fish farming is water shortage, since intensive aquaculture require frequent total or partial water exchange to avoid accumulation of toxic metabolites, such as ammonia and nitrites which has been reported to negatively affect the performance of farmed fish. Techniques like the rotating biological contactors, trickling filters, bead filters and fluidized sand biofilters are conventionally used in intensive aquaculture systems to remove toxic nitrogen from water in production units. These techniques tend to be technically more complex with high investment costs thus discouraging prospective adopters especially for non-specialist farmer. Meanwhile a high feed cost is another problem facing intensive fish farming in Egypt. Biofloc technology (BFT) is the solution to the above problems. It is a bacteria based system which depends on heterotrophic bacteria that consume ammonia and nitrites during its growth, meanwhile bacterial flocs become a fish feed as a single cell protein (a double purpose technique). This technique can be also used as sustainable method for over-wintering of tilapia and could help in controlling bacterial infections within the aquaculture pond. This system is under development in several countries, and some countries consider it as a national project. The challenge is to further fine-tune this technology under our local conditions. This review attempts to summarize recent field and laboratories studies carried out by our group of investigation to test biofloc system under different conditions. This work was supported by Science & Technology Development Fund (STDF), Egypt under grant no 5671.

038

TITLE: AQUACULTURE PROJECT DEVELOPMENT – FROM PROJECT IDEA TO PRODUCTION FOR MARKET

Presenting author: Jacob Bregnballe
Institute: AKVA group Denmark

Topic: Recirculation Systems

Abstract:

Aquaculture is becoming increasingly important to meet the growing demand in world fish consumption. The sector is becoming industrialized and fish welfare, production standards, food health regulations and environmental issues must be addressed. New fish farming projects are growing in scale and complexity, which calls for the availability of high technology and project management. Thus a professional approach is required in all phases of building up a successful aquaculture enterprise whether it is cage farming or land based activities. Proper design work, project execution, start-up and farm management are all linked together for making a successful production of farmed fish to the market.

049

TITLE: A POWERFUL NEW TOOL FOR SUSTAINABLE FISH FARMING: LIGHT-EMITTING DIODE (LED) LIGHTING SYSTEMS

Presenting author: Juliette Delabbio
Institute: ONCE Innovations

Topic: Aquaculture and High Techs

Abstract:

Until now, comprehensive lighting systems for aquaculture facilities have not been available to aquaculturists. LED lighting technologies now provide lighting systems that not only offer variation in photoperiod, but also incorporate the spectral composition (color) and degree of illumination (intensity) into the lighting treatment given to cultured animals. LED lighting systems are very favorable to sustainable aquaculture. Energy costs from LED lighting systems are one-tenth the cost of operating traditional lighting systems (incandescent, fluorescent, high pressure sodium). Innovative application of LED lighting systems has also been shown to increase feed uptake, reduce feed waste and improve water quality.

This talk will examine the importance of spectral composition and intensity of lighting in an animal's rearing environment. Results of a recent study on crustacean culture and underwater lighting will be discussed. As well, the discussion will look at the many different applications of this new technology to enhance aquaculture production and support sustainable aquaculture operations.

058

TITLE: INTEGRATED AQUACULTURE-AGRICULTURE SYSTEMS IN ARID AREAS IN THE MIDDLE EAST

Presenting author: Sherif S. Sadek
Institute: Aquaculture Consultant Office, Cairo, Egypt
Co-author(s): Peter G.M. van der Heijden; Greet Blom-Zandstra

Topic: Aquaponics and Integrated Aquaculture-Agriculture Systems

Abstract:
The 16 Middle East (ME) 16 countries has showed that aquaculture production has increased 2.5 times in the last ten years (2003-2012) from 641 517 in 2003 to 1 59 224 tonnes in 2012. Among the eight Middle East (ME) countries that produce fish from Integrated Aquaculture Agriculture (IAA)systems located in reclaimed desert land, Egypt and Saudi Arabia are the pioneers, together producing 90.5% of the total production of 7,888 tons of fish from integrated systems in the ME. Aquaculture systems that are applicable in desert regions consist of tilapia raised in intensive systems with or without recirculation and varying levels of ground water replenishment. The effluent of such systems is enriched with nutrients (organic matter, nitrogen compounds, phosphate) and is used for irrigating crops such as tomato, fruit trees, wheat, corn and alfa-alfa (fodder). A special type of IAA is the aquaponic system that combines fish basins and horticulture crops grown in separate hydroponic basins in one recirculating system. Besides from using water efficiently, IAA systems reduce the need for fertilizer; the level of reduction depends on the design and the intensiveness of the aquaculture system. In an aquaponic system nearly 100% of the nutrients needed by the crops come from the fish. The part of the ME where agriculture can be applied can expand when IAA systems based on brackish and saline ground water are used to produce fish and salt-tolerant crops such as the field grown Date, Sugar beet, Barley, Oleander and Cotton or salt tolerant crops that can be grown in a hydroponic system, like Lavender, Asparagus or Petunia. One farm produced European seabass in ground water (26 ppt salinity) in combination with the growth of the animal fodder crops Saltbush and Sea-blite and the fresh vegetable Samphire (Salicornia) in the field, all halophyte crops. In another farm salt tolerant potatoes were grown successfully. Other examples of various integrated systems from Egypt and other ME's countries will be shown.

060

TITLE: AUTOMATION AND CONTROL SYSTEMS IN AQUACULTURE

Topic: Recirculation Systems

Presenting author: Fernando C. Malet Navarro

Institute: Innovaqua, SL, Spain

Abstract:

Automation systems in aquaculture has to assume the role of protagonist during the following years in the context of Sustainable Aquaculture. Automation will provide competitive advantage focused on optimization of resources. Among these resources there could be found: water, oxygen and power consumption, feed and growth rates or land extension by means of intensive culture. In addition to these it will provide security, in terms of alarms provided in real time, repeatability, to know what is going on and apply improvements, and a background of historic data which provide very valuable information to understand why things are happening in the way they are. General concept of automation, why it is necessary and several control systems and strategies will be explained in different situations, with practical examples. Particularly, Recirculation Aquaculture Systems (RAS) have a variety of variables that has to be controlled and will be analyzed as practical example. An intensive pond culture will also be explained as example of how automation can reduce the costs and optimize the use of land in the context of Sustainable Aquaculture.

061

TITLE: DISEASE DIAGNOSIS APPROACHES OF ON-GROWING MARINE FIN-FISH CAGES IN UAE

Presenting author: Ahmed Gharieb Abdulwahab
Institute: ANAF Aquaculture, UAE

Topic: Cage culture

Abstract:

Within the term of health hazard pathogens causing diseases in cultured fin-fish in UAE, two main fish cage farms were performing the on-growing practices in UAE, three species were cultured on commercial basis; the introduced gilthead seabream (Sparus aurata) and European seabass (Dicentrarchus labrax) beside native Sobaity seabream (Sparidentex hasta). Water quality parameters investigation protocol was done all over the on-growing season according to HACCP manual to monitor the environmental significance on fish health. Regular diseases monitoring regime was applied using (in-vivo) diagnostics kits (AQUARAPID-Pp, AQUARAPID –Va) in order to identify bacterial Pasteurellosis (Photobacterium damselae subsp.piscicida) infections among on-growing gilthead seabream (Sparus aurata) as well as Vibriosis (Vibrio anguillarum) among cultured European seabass (Dicentrarchus labrax). Diagnostic (in vitro/French accredited lab) immunohistochemistry technique was done to identify the Viral Encephalopathy and Retinopathy (VER) which was the cause of the massive mortalities among early stocked European seabass juveniles. Parasitic infestation was represented by two main external infestations, The external monogenetic infestation caused by Neobenedenia SPP. for cultured native Sobaity seabream (Sparidentex hasta) and gill monogenetic trematode (Micocotyle SPP.) which mainly infested seabream (Sparus aurata) beside the enteric nematode infestation (Camallanus SPP.) which was predominant among all cultured species.

070

TITLE: INTEGRATION OF AQUACULTURE WITH SEAWEED AND HALOPHYTE CROP PRODUCTION IN SAUDI ARABIA

Presenting author: Aftab Alam

Institute: Division of Biological and Environmental Sciences and Engineering, King Abdullah University of Science and Technology, Saudi Arabia

Co-author(s): Yousef Al-Hafedh; Michael Schwarz

Topic: Aquaponics and Integrated Aquaculture-Agriculture Systems

Abstract:

Aquaponics is a symbiotic integration of traditional agriculture with aquaculture for producing aquatic animals in recirculating systems with the hydroponic cultivation of plants. Freshwater aquaponics has been successfully optimized around the world, including Saudi Arabia, to produce fish and vegetables by virtue of water and nutrient recycling. Saudi Arabia has vast natural resources in both underutilized saline ground water as well as over 2,500 km of coastline which is preparing to implement significant aquaculture expansion in coming years. This will lead to a discharge of excess nutrients that can be utilized to cultivate seaweed and halophyte for food and fodder as effectively as in freshwater aquaponics to minimize coastal eutrophication and keep the aquaculture production sustainable. The importance and value of seaweeds and halophytes and the potential of Saudi Arabia's coastline for integrated cultivation needs to be studied. There are earlier studies on integrated mariculture of seaweeds on the Red Sea coast, as well as current studies on both pure and applied aspects of seaweed and halophyte production being carried out in Saudi Arabia. However, commercial integrated aquaculture systems have yet to be tested in this region. A proposal has been developed to optimize integrated aquaculture technology based on Asian sea bass (Lates calcarifer) and halophytes (Salicornia and Distichlis) on the coasts of the Red Sea and the Arabian Gulf as well as the landlocked desert in Riyadh. There is a need to evaluate the performance of selected halophytes in nutrient uptake, waste utilization efficiency and biomass production and to facilitate the operation and management of these integrated saline systems. This work will serve the promotion of food security in the coastal deserts, enhancing the environmental sustainability of aquaculture through excess nutrient bioremediation, and recycling these excess nutrients into food and fodder towards enhancing profit potential of aquaculture industry.

073

TITLE: INTENSIVE ZERO-WATER EXCHANGE TECHNOLOGY FOR FRESHWATER REDCLAW C. QUADRICARINATUS APPLIED IN DESERT CONDITIONS

Presenting author: José Naranjo-Páramo
Institute: Centro de Investigaciones Biológicas del Noroeste, S.C. (CIBNOR, S.C.), La Paz Baja California Sur México
Co-author(s): Humberto Villarreal

Topic: Arid land Aquaculture

Abstract:

Culture of redclaw crayfish Cherax quadricarinatus has been adopted by several countries with varying degrees of success. Several culture techniques are used depending on the region. In the desert northwest region of Mexico, water availability is limited, so the Northwest Biological Research Center (CIBNOR) developed a foto-heterotrophic technology that is environmentally sustainable, can be easily implemented, and is highly viable economically. The technology is based on more than 20 years of research and development. The technology eliminates water exchange, which is reutilized for several production cycles, or can be transferred for use in agriculture. This is achieved by a foto-heterotrophic system and an efficient feeding strategy, which maximize growth of redclaw and result in food conversion factors close to 1.

Redclaw de Mexico, a private company, has tested this technology commercially in La Paz, B.C.S., Mexico, using a two phase nursery/growout, system, with PVC lined 2,500 m2 ponds, 12 h aeration provided by a 2 hp AIRE-O2 unit, and zero water exchange. Nursery ponds are stocked at 25 j/m2, with 3-gram juveniles produced in outdoor ponds. After 90 days, the ponds are harvested and the preadults (21.2 + 2.2g) are sexed. Males or females are stocked in ponds at 10/m2 for monosex culture. A commercial pelleted ration with 35% CP is fed 3 times/day. Yields for the intensive production system consistently reach 5,000 kg/Ha/cycle with production costs of US$4.5/kg. For a sale price of US$12/kg IRR equals 54%. The relevance for potential commercial culture expansion in other desert areas is discussed.

Figure 1. Growth of males and females of redclaw during monosex culture in PVC lined 2,500 m2 ponds with aeration and zero water exchange.

080

TITLE: FEASIBILITY STUDY FOR DEVELOPING AN ENVIRONMENTALLY SUSTAINABLE INTEGRATED MULTI-TROPHIC MARICULTURE SYSTEM IN THE NORTHERN PERSIAN GULF AND GULF OF OMAN COASTLINES

Presenting author: S. Abbas Haghshenas

Institute: Institute of Geophysics, University of Tehran, Iran Fisheries Organization, Mc Master University, Parthia Water Wave Research Co., Hounam Sakhteman Pars Co.

Co-author(s): Seifollah Haghighi, S. Majid Shojaee Borhan, Michael John Risk, Arash Bakhtiari, Morteza Jedari Attari, Azadeh Razavi Arab

Topic: Cage culture

Abstract:

Large-scale and intensive mariculture of finfish is inevitable along the Iranian coastline in the Persian and Oman Gulfs. Finfish mariculture at the proposed sites poses a serious threat to the environmental integrity of over Iranian coastal and marine ecosystems. As a measure of Ecological Conservation and protection of coral reefs, sea turtles, and sea grass beds, we propose a feasibility study for the development of an Integrated Multi-Trophic Mariculture system (IMTM), as an alternative to intensive mariculture of only finfish. IMTM is the primary environmental conservation tool in not only mitigating, but preventing the environmental destruction brought on by eutrophic pollution from finfish mariculture operations. IMTM preserves biodiversity by alleviating fishing pressure of wild fisheries, reduces or eliminates the reliance of net-caught "trashfish" as mariculture fish food, reduces the need for destructive fishing practices, and reduces anthropogenic-usage loads for coral reefs. Furthermore, IMTM is a humanitarian effort that provides economic participation of traditional-fishing coastal communities by providing employment and co-localized services and industries. Successful IMTM operations will also allow the Iranian government to enact more stringent regulations for the extraction of wild fisheries and protection of coral reefs while having a positive effect on the industries that rely on these natural resources. The application of IMTM is considered the vanguard of environmental sustainability and commercial viability in mariculture, and its adoption by Iranian interests will put the Iranians in an elite membership of countries that can successfully balance commercial interests with ecological conservation. This paper summarizes the attempts which have done to achieve an Environmentally Sustainable Integrated Multi-Trophic Mariculture System in the Northern Persian Gulf and Gulf of Oman Coastlines.

083

TITLE: ADVANCES IN THE INTENSIVE CULTURE OF WHITE SHIMP LITOPENAEUS VANNAMEI IN DESERT CONDITIONS IN NORTHWEST MEXICO

Presenting author: Humberto Villarreal

Institute: Centro de Investigaciones Biológicas del Noroeste, S.C. (CIBNOR, S.C.), La Paz Baja California Sur México

Co-author(s): José Naranjo-Páramo, Pedro Cruz, Laurence Mercier, Violeta Gleaves, Diana Carreño, Mayra Vargas

Topic: Arid land Aquaculture

Abstract:

In Mexico, shrimp farms have been using semi-intensive systems based on water exchange over the last 15 years. The industry faces severe challenges due to the presence of diseases (WSSV, EMS), increases in production costs and lack of environmental sustainability. CIBNOR has been working with producers in Baja California Sur, a state located in the desert belt of Northwest Mexico, to introduce science-based technologies that innovate current practices. Over that last few years, it has been possible to obtain 2 cycles/year with yields of 20 tons/ha, using 30 hp/ha of aeration and 25% water exchange. Genome expression analyses showed a negative impact on shrimp condition. Using a photoheterotrophic technology and efficient feeding techniques, water exchange requirement was reduced significantly in PVC lined ponds, and yields up to 25 ton/ha/cycle were obtained (Figure 1A). A family selection genetic program for high growth at high salinities and temperatures allowed for culture in near zero water exchange systems to reach 17 ton/ha in 90 days (Figure 1B). Results represent an important advance towards sustainable systems. Implications for the consolidation of shrimp culture in desert areas are discussed.

084

TITLE: COMPARATIVE EVALUATION OF POLYPROPYLENE AND PALM KERNEL SHELL AS BIOFILTER MEDIA FOR DENITRIFICATION OF FISH CULTURE WASTE-WATER

Presenting author: Dauda Akeem Babatunde

Institute: Department of Fisheries and Aquacultural Technology,Faculty of Agriculture and Agricultural Technology, Federal University Dutsin-Ma, Katsina State, Nigeria

Co-author(s): Akiwole Ayoola Olusegun

Topic: Recirculation Systems

Abstract:

The needs to develop low cost and indigenous facilities for recirculating aquaculture systems (RAS) components cannot be over emphasized, especially in the developing countries where recirculating system has been contributing significantly to sustainable aquaculture development. Biofilter is an important component of RAS, which is majorly imported from Europe at a high price and contributes to the high cost of RAS.

086

TITLE: ACCUMULATION OF HEAVY METALS IN RECIRCULATING AND NON-RECIRCULATING AQUAPONIC SYSTEMS FOR GROWING NILE TILAPIA AND LETTUCE

Presenting author: Wenresti G. Gallardo
Institute: Department of Marine Sciences and Fisheries, College of Agricultural and Marine Sciences, Sultan Qaboos University, Sultanate of Oman
Co-author(s): Ahmed Al Jassasi

Topic: Aquaponics and Integrated Aquaculture-Agriculture Systems

Abstract:
Culturing fish in recirculating systems (RAS) is considered to be one of the most environment-friendly ways of producing fish but there are reports that heavy metals are accumulated in fish cultured in RAS. We conducted a 6-week experiment to determine if heavy metal accumulation in fish can be reduced if cultured in an aquaponic system and to assess if fish and lettuce are safe for human consumption. Nile tilapia and lettuce were grown in the three systems: recirculating aquaponic system, non-recirculating aquaponic system, and non-recirculating aquaculture system (without plants, control). Inductively Coupled Plasma Mass Spectrometry (ICP-MS) was used to analyse Pb, Al, Ni, Zn, Mn, Fe, Cu, Cr, As in water, lettuce and Nile tilapia. There was a high accumulation of Pb and As in the culture water but this decreased at the end of the 6-week culture period but the lettuce in all systems had high level of Pb and As, thus not good for human consumption based on WHO standards. Pb accumulated in the liver of fish grown in non-recirculating aquaponic and non-aquaponic systems but the level was below the WHO limit. Recirculating aquaponic system had lower concentrations of heavy metals particularly Pb, Zn and Al. It can be concluded that heavy metal accumulation in fish can be reduced if cultured in a recirculating aquaponic system.

091

TITLE: 2 YEARS OF AQUAPONICS RESEARCH IN UAEU, THE LESSONS

Presenting author: Jean-Yves Mevel

Topic: Aquaponics and Integrated Aquaculture-Agriculture Systems

Abstract:
Aquaponics is the integration of aquaculture and hydroponics. In recent years, aquaponics has experienced a tremendous increase in production and research interest. however, very few data about commercial aquaponics is available, and the few available have indicated that only 1/3 of operations are profitable and most of the operation remain today relatively small.

Within the Arid Land agriculture department, United Arab Emirates University, a new aquaponics facility was built to evaluate the potential and problems associated with local environmental conditions. After 2 years of trials and errors, numerous lessons have been learned and it is obvious that aquaponics, while showing great potential is not yet an easy option for the region. This presentation will outline a series of problems encountered over the past 2 years which demonstrate a lack of global expertise and identify the major technical constraint to the development of aquaponics in the arid land environment.

101

TITLE:DEVELOPMENT AND APPLICATION OF A TECHICAL AND ECONOMIC FEASIBILITY STUDY MODEL FOR SMALL-MEDIUM SIZE CAGE FARMS WITHIN THE ACTIVITIES OF THE FAO PROJECT "UTF SAU/048/SAU"

Presenting author: Alessandro Ciattaglia

Abstract:

One of the tasks within the activities of the FAO project: ""Strengthening and supporting further development of aquaculture in the Kingdom of Saudi Arabia" was to draft a model of a Feasibility Study for small and medium fish farming enterprises in the Red Sea. Furthermore the next step was to adapt the feasibility study and the related business plan to a selected fishermen community to support the development of cage aquaculture activity directly managed by local cooperatives. Results emphasized a floating cage farm for European Gilthead Sea Breams with an estimated production of approx 1000 tons over a 5 years period. N° 20 HDPE circular cages of 22 mt diameter were designed to be installed in an area of 800x450mt and a sea depth of 40m. Selected site is around 6 miles offshore the coast line of Thuwal, approximately 100km North to Jeddah. The proposed Feasibility Study Model should be considered as a basic guidelines for all the investors that are interested to be a part of the development of cage aquaculture in this region.

002

Animal Science Health and diseases

TITLE: EVALUATION OF THE ANTIFUNGAL ACTIVITY OF ZATARIA MULTIFLORA, AND EUCALYPTUS CAMALDOLENSIS ESSENTIAL OILS ON SAPROLEGNIA PARASITICA–INFECTED RAINBOW TROUT (ONCORHYNCHUS MYKISS) EGGS

Presenting author: Hosseinali Ebrahimzadeh Mousavi
Institute: University of Tehran
Co-author(s): Ali Reza khosravi, Mostafa Sharifrohani

Topic: Hatchery & Larvae Management

Abstract:
The purpose of the present study was to evaluate and assess the capability of Zataria multiflora, and Eucalyptus camaldolensis essential oils in treating Saprolegnia parasitica–infected rainbow trout Oncorhynchus mykiss) eggs. A total of 150 infected eggs were collected and plated on glucose-pepton agar at 24_C for 2 weeks. The antifungal assay of essential oils against S. parasitica was determined by a macrodilution broth technique. The eggs were treated with essential oils at concentrations of 1, 5, 10, 25, 50, and 100ppm daily with three repetitions until the eyed eggs stage. Of 150 eggs examined, S. parasitica (54.3%), Saprolegnia spp. (45%), and Fusarium solani (0.7%) were isolated. The minimum inhibitory concentrations of Z. multiflora and E. camaldolensis oils against S. parasitica were 0.9and 2.3, respectively. Zataria multiflora and E. camaldolensis at concentrations of 25, 50, and 100 ppm, had significant differences in comparison with negative control ($p < 0.05$). The results revealed that malachite green, followed by Z. multiflora and E. camaldolensis treated eggs had remained the most number of final eyed eggs after treatment. The highest final larvae rates belonged to malachite green, E. camaldolensis and Z. multiflora respectively. The most hatching rates were recorded with malachite green (22%), and then Z. multiflora (11%), E. camaldolensis (7) and negative control (1%). Zataria multiflora was more effective than E. camaldolensis for the treatment of S. parasitica-infected rainbow trout eggs in aquaculture environment.

003

TITLE: STUDY OF OOMYCETES CONTAMINATION IN RAINBOW TROUT EGGS IN WEST IRAN

Presenting author: Ali Taheri Mirghaed
Institute: University of Tehran
Co-author(s): Golfam Ebrahimzadeh Mousavi

Topic: Hatchery & Larvae Management

Abstract:
400 infected eggs of rainbow trout were collected from 2 hatchery in west of Iran. Fungus- contaminated eggs were collected by sterile forceps and transferred to screw capped bottle contained sterilized tap water (STW). In laboratory the sample were washed 3 times with sterile distilled water and then inoculated in culture media. In all of the media, before inoculating of sample cotten seeds were added.After removing the eggs, the remaining materials were maintained at 18-24 degree centigrade for 48 hours under natural light. After 7-10 days of hypha appearance, wet smears were prepared and microscopic study were done. Then some of each colony was cut off and placed in sterile petri plates containing STW and cotten seeds. In all of the media , 250 µg/ml penicillin and 200µg/ml chloramphenicole were added . The identification of grown fungi were fallowed by methods described by Cocker &Matthew (1937) and Khulbe (2001). In saprolegniacae family 5 species isolated were S.parasitica ,S.lapponica S.diclina,S. hypogyna and Saprolenia ferax.(table 1). In this study, like previous ones, highest rate of infestation was related to Saprolegnia genus with 36.6% frequency. Among different species isolated in eggs, S.parasitica was the most important one with 26.8% frequency. Saprolegnia ferax was reported from different places under various ecological condition in the world (R.D.Khulbe).In this study S.ferax, S.hypogyna and S.diclina were reported from Iran for the first time.

059

TITLE: PRESENCE OF PATHOGENS ON COMMERCIALLY IMPORTANT DEMERSAL FISHES AND ABALONE IN THE SULTANATE OF OMAN

Presenting author: Gilha Yoon
Institute: Sultan Qaboos University, Muscat, Oman
Co-author(s): Haitham Al-Gheilani; Bader Al-Bawiqi; Mohammed Al-Naaman; Andrew Shinn

Topic: Biosecurity

Abstract:
As aquaculture expands into the production of new species and locations, there is a requirement to identify potential threats that might otherwise threaten the health or sustainability of the industry; the necessary steps to minimize their impacts can then be taken. In Oman, there are a number of leading candidate species for aquaculture including: the sparids - the soldierbream, Argyrops filamentosus; king soldierbream, Argyrops spinifer; and, the silverbream, Rhabdosargus sabra; a grunt – the grey sweetlip, Plectorhinchus schotaf; and the endemic Omani abalone, Haliotis mariae. Full health assessments of these species are in progress and to date, a parasitological assessment of the polyopisthocotylean monogenean gill fluke infections on the fish has been conducted (i.e. prevalence, abundance, distribution, correlation to host size etc) and at least four discrete parasite species have been identified. These are undergoing a full taxonomic evaluation but include microcotylids and a plectancocotylid. The Omani abalone is the only species to occur in national waters and is a valuable source of income. The industry, however, is impacted by low abundance and consequentially small harvests and by toxic blooms of algae. For the sustainable production of abalone, hatchery production for commercial aquaculture and restocking purposes has already begun. A recent disease outbreak in hatchery reared stock of wild origin, however, resulted in a ~50% mortality. Infected individuals had swollen mouth tissue, fluid tinged with blood, air-filled intestines which released a foul odour, and, histologically, spongiosis of the foot muscle linked to an evident bacterial infection accounting for poor adhesive strength. A Gram positive bacterium identified as Staphylococcus sciuri was isolated. Such studies begin to catalogue the aquatic pathogens that may threaten the profitability and sustainability of national aquaculture activities. Strategies to mitigate against their impacts are now being taken. This study was supported through projects IG/AGR/FISH/13/02, Sultan Qaboos University, Oman.

075

TITLE: HISTOMORPHOMETRICAL AND HISTOCHEMICAL STUDIES OF CAUDAL STALK OF BARBUS GRYPUS SKIN BY LIGHT AND ELECTRON MICROSCOPIC

Presenting author: Hassan Morovvati
Institute: University of Tehran
Co-author(s): Zahra Basir; Mahmood khaksarimahabadi; Mehrzad Mesbah

Topic: Physiology, Morphology & Histology

Abstract:
Skin is primary defence system and in fish is realized, that it is the interface between the external and internal environment of the animal. Samples for this research were obtained from warm water fish hatchery in spring, near Ahwaz to Susangerd road. In this study, for histological study of skin of the 10 adult Barbus grypus, after biomery were removed. The sample were taken from caudal stalk. Samples with thickness of 0.5cm for fixation, for light microscopis and TEM were in bouen and glutaraldehyde solution. Then routine procedures of preparation of tissues were followed and the paraffin blocks were cut at 5 to 6 microns , stained with H&E, PAS and AB and studied under light microscope. The results showed that fish caudal stalk skin of Barbus grypus consisted of epidermis and dermis. In epidermis with non keratinized stratified squamous epithelium, containing goblet cells, club cells no taste buds. Goblet cells with PAS positive, were seen in all of this region.With AB staining, this cells were two acid, as maximum near the surface and neutral, as minimum secratory and under the first type. In ultrastructural study, this cells against the epidermis epithelial cells nucleus of thems were without wrinkle, with most fitting between fingered. About club cells ultrastructural study showed, cytoplasmic organelles in the near of nucleus, consists mainly of mitochondria, rough endoplasmic reticulum and many ribosomes. The dermis consisted of spongy layer with pigment cells and loose connective tissue under the basement membrane, and reticular layer with dense irregular connective tissue with blood vessels and fat that was on hypodermis. In conclution, this finding was the same of other researcher on other species but there was some difference in epidermis thickness, number and type of goblet cells, location of taste bud and club cells that reported.

021

Ecology and Environment

TITLE: INVESTIGATING ENVIRONMENTAL EFFECTS OF AQUACULTURE INDUSTRY THROUGHOUT SHAHROUD RIVER BY HILSENHOFF MACRO BENTHOS INDEX VIA RAPID FIELD ASSESSMENT METHOD

Presenting author: Shahram Dadgar
Institute: Iranian Fisheries Research Organization, Iranian Ornamental Fish Society
Co-author(s): Farbod Chehrzad; Komeil Razmi
Topic: Aquaculture Standards & Certification
Abstract:
The result of chemical examination on samples demonstrates that most of assessed parameters met the environmental standards. The trend of BOD5 changes showed a decrease due to recreation of the rivers in the both studied points (1-4 stations of Khochireh zone and 5-8 Hassanjun zone). Therefore, aquaculture activities did not play a significant role in enhancing the instant organic load ($p<0.05$). Investigating the amount of total phosphorous revealed that Khochireh zone owned less pollutant consists of phosphorous compounds in comparison to Hassanjun zone. Hilsenhoff was an applied to determining the amount of pollution of assessed rivers. Biological and chemical examination of the Hassanjun, Khochireh and the main branch of Shahrud River was organized and done in May, 2012 by fast sampling method. Also monitored levels of total phosphorous showed the both rivers experienced an increase in downstream compared to upstream. The trace of frequency variation of macro benthos showed that Chironomidae and Elmidae families which are from Diptera and Coeloptera orders considered as the most crowded populations of macro benthos in the study zone with the total frequency average of 11.6 and 10.0 per square meter. The result of studying on macro benthos based on Hilsenhoff biological index elaborated in Khochireh zone the activity of aquaculture industry (without any urban zone and other industries) led to deteriorate the water quality from average in station 1 to average –weak in station 2 whereas, fish farms couldn't affect the quality of main branch of Shahroud river due to higher volume, so didn't any significant change in third and fourth station. In the Hassanjun River at the upstream of the fish farm the water quality seems to be never appropriate, that be alleviated to average in downstream. The main branch of Shahroud River was affected due to admixture with hassanjun River; therefore turned the quality from very good in station 7 to bad in station 8, obviously due to the low quality of Hassanjun River.

022

TITLE: THE EFFECT OF MNEMIOPSIS LEIDYI ON THE CASPIAN SEA ECOSYSTEM

Presenting author: Shahram Dadgar
Institute: Iranian Fisheries Research Organization, Iranian Ornamental Fish Society
Co-author(s): Fereidoon Owfi

Topic: Environment, Biodiversity and Climate Change

Abstract:
The Caspian Sea is the largest lake on earth with area of 3,626,000 km². http://en.wikipedia.org/wiki/Square_meterIt is a landlocked body of water and lies between Iran, Russia, Azerbaijan, Kazakhstan and Turkmenistan. The maximum depth of the Caspian Sea is about 1025 meters. It is called a sea because when the Romans first arrived there, they tasted the water and found it to be salty. It has a salinity of approximately 1.2%, about a third the salinity of most seawater. In recent years, human considered the presence of an exotic species called Mnemiopsis leidyi in Caspian Sea, which caused changes in its ecosystem and indirectly had influence on reduction of the population of sturgeon fishes. Mnemiopsis leidyi is a bioluminescent comb jellyfish which in 1999 was introduced in the Caspian Sea as a invasive species. Previously, it was introduced in the Black Sea in the 1980's to deal with the eutrophication (phytoplankton and Aurelia aurita medusae) caused by ballast water of shipping and marine transportation. The result was showed that 75 % of the zooplankton was annihilated, thereby affecting the entire food chain of the lake. The comb jelly eats eggs and larvae of Anchovy fishes and competes for the same food sources. It caused a dramatic drop in pelagic fish populations. Now, it is a very big mistake in this area and since 10 years ago, Iranian scientists were tried to solve this problem via biological and non- biological control methods with emphasis on integrated management and the Caspian Sea countries cooperation.

050

TITLE: THE EVALUATION OF THE STAPHYLOCOCCUS AUREUS IN SHRIMP AND FISHES OF SUPPLIED IN IRAN FISHERY CENTER

Presenting author: Noushin Arfatahery
Institute: Tehran university medical
Co-author(s): Taranehpeimaneh Abedmohtasabi

Topic: Sustainable Development of Aquaculture

Abstract:

Staphylococcus aureus is the most important pathogen found in sea foods. Food poisoning in human may happen due to the consumption of aqua products contaminated with this bacteria and its enterotoxin. The procedures carried out to maintain and preserve the quality of these products, from the time they are fished and transported to stores until they are consumed, can play a major role in the generation and growth of pathogenic bacteria and toxins. A total of 600 samples were collected, including 300 shrimps and 300 fish (fresh and frozen, farm and marine). Consistent with the Iran National Standards, a number of phenotypical and molecular assays were utilized for screening S. aureus in order to detect Staphylococcus aureus. They study was conducted from September 2013 to September 2014. The outcomes of phenotypical methods were in conformity with those of the molecular procedures. A total of 206 samples (34.3%), including 84 shrimps (28%) and 122 fish (40.7%), were contaminated with Staphylococcus aureus. Due to the presence of Staphylococcus aureus in fish and shrimps, it is necessary to enforce quality control standards by the fisheries and carefully monitor fishing, farming, preparation, freezing, and transporting marine products, and ensure the health of workers.

051

TITLE: SUBTIDAL CRABS OF OMAN SEA: NEW COLLECTIONS AND BIOGEOGRAPHIC CONSIDERATIONS

Presenting author: Negar Ghotbeddin
Institute: Department of Fisheries, College of Agriculture and Natural Resources, Ahvaz Branch, Islamic Azad University, Ahvaz, Iran
Co-author(s): Seied Mohammad Reza Fatemi; Tooraj Valinassab

Topic: Environment, Biodiversity and Climate Change

Abstract:

The samplings were carried out at 8 stations (Govatr, Pasabandar, Beriss, Ramin, Chabahar, Pozm, Gordim and Meidani) in subtidal zones of Oman Sea during the year 2009-2010. The specimens were collected by trawl net and preserved in 70% alcohol. A total of 23 species belonged to 9 families and 15 genera were caught. The results of the present study revealed that families Portunidae had the highest species enriched with 9 species. Most of the species had high distribution in the west Indian Ocean (69.56%) and 8.69% of species were endemic. Almost species were similar to those found in the Persian Gulf.

064

TITLE: ECOLOGICAL CLASSIFICATION OF INTERTIDAL ZONES FOR AQUACULTURE DEVELOPMENT POTENTIAL, USING BY CMECS MODEL

Presenting author: Fereidoon Owfi
Institute: Iranian Fisheries Research Organization, Iranian Ornamental Fish Society
Co-author(s): Foziyeh Koveei;Mahbobeh Mehrdost; Javad Bahrami

Topic: Sustainable Development of Aquaculture

Abstract:
The "Coastal and Marine Ecological Classification Standard (CMECS)", a new approach to ecological classification, was applied to 122 km of the southern intertidal stretch of Qeshm Island, located in the Persian Gulf – Hormouz Strait. Surface Geology Component (SGC), Biotic Cover Component (BCC) and Geo-Form Component (GFC) components of Coastal and Marine Ecological Classification Standards (CMECS) model were used for this study and research. Considering the extent and geo-morphological structure of coastal habitats in covered area, totally 12 sites (sampling station zone) within 5 sub-regions were designated using by GPS. Base of the results, 60 habitats (biotopes) with 47 codes were determined which this variety of biotopes is directly related to the diverse surface geology (substrate) of the covered area. Most of the biotopes and codes were recorded in the mid-eastern coastal stretch, due to heterogeneity in substrate structure associated with numerous ecological niches in rocky shores. Crustacean species such as Eriphia smithi, Thalamita prymna, molluscan species such as Clypeomorous bifisciatus, Cerithium caeruleum and echinoderm species such as Echinometra mathaei and Ophiactis sp. were characteristic of rocky shores, while Ocypode rotundata, Dotilla sp. (Crustacea) and Umbonium vestiarium (Mollusca) was indicator of sandy shores dominant invertebrate groups. Although the highest number of codes was recorded in Zeitun Park site, it did not possess the expected specific species (such as Diadema setosum, Linckia multiflora, Ophiocoma scolopendrina) that were encountered in sites with similar surface geology. This could have been caused by tourist traffic at the southern coastal park site.

065

TITLE: BIODIVERSITY AND DISTRIBUTION PATTERN OF CORAL REEF HABITATS (PERSIAN GULF - IRANIAN WATERS)

Presenting author: Fereidoon Owfi

Institute: Iranian Fisheries Research Organization, Iranian Ornamental Fish Society

Co-author(s): Mohammad Reza Shokri; Mahnaz Rabbaniha; Nasim Zareei

Topic: Environment, Biodiversity and Climate Change

Abstract:

The Persian Gulf is northern part of the ROPME Sea Area (RSA), and is semi-enclosed shallow sea which located in subtropical climate. Measuring is 1000km in length, varying in width 60-340km, and average depth is about 35m and maximum depth is 105m. This research was carried out during 2005-2010 for reviewing the corals status and determination of coral reef habitats distribution in the Persian Gulf. Coral reef sites and patches were determined by field surveys and direct observations. Also, the violet-blue bands of Land Sat satellite images were used for seaward extent of coral reefs. Sampling sites covered by SCUBA, Manta Tow technique and Transect survey base on Reef Check and GCRMN standard method. Coral reefs habitats in Iranian coastal areas are found in two types and structures which observed around seventeen islands fringing coral reefs and two limited patches of coral reefs around Nayband Bay. Widest coral reef cover observed around Khark, Kharko and Larak Islands. Due to extremes of water temperature and salinity that are close to the physiological tolerance limits ,coral reefs diversity and coral species composition in this area is similar and close to Indo-Pacific eco-region coral communities. In comparison, species richness of hard corals in the Gulf of Oman; with about 70 species is more than the entire Persian Gulf. Totally, 36 species belonging to 9 family and 20 genera of hard coral has been reported and documented. Among identified coral species, Porites and Acropora were the dominant and Faviidae family was the most diverse.

066

TITLE: DIVERSITY AND DISTRIBUTION PATTERN OF MARINE MAMMALS IN THE ROPME SEA AREA (RSA)

Presenting author: Fereidoon Owfi
Institute: Iranian Fisheries Research Organization, Iranian Ornamental Fish Society
Co-author(s): Sheyda Dadashi; Nasim Zareei

Topic: Environment, Biodiversity and Climate Change

Abstract:

A total of 98 marine mammal records from Iranian coastal waters of the Persian Gulf and Oman Sea were compiled of which 66 are previously unpublished new records. Seventy-nine were from the Persian Gulf and 16 from the Oman Sea coast. The largest numbers of records were from Qeshm Island and Bushehr Provinces. Records of finless porpoise (Neophocaena phocaenoides), Indo-pacific humpback dolphin (Sousa chinensis) and Indo-pacific bottlenose dolphin (Tursiops aduncus) were by far the most numerous probably reflecting their inshore distribution and local abundance. Other species recorded are common dolphin (Delphinus capensis tropicalis), rough-toothed dolphin (Steno bredanensis), Risso's dolphin (Grampus griseus), false killer whale (Pseudorca crassidens), and dugong (Dugong dugon). Evidence of 22 Mysticetes were obtained eight of which were tentatively identified as Bryde's whales (Balaenoptera edeni), three as Fin whales (Balaenoptera physalus) and three as Humpback whales (Megaptera novaeangliae). The largest threat to marine mammals in Iran is likely to be incidental capture in fishing gear. Six by caught finless porpoises were recorded and this species may be particularly vulnerable to incidental mortality in gillnets. Recommended marine mammal research, conservation and management small projects in Iran are described.

067

TITLE: IMPACT ASSESSMENT OF TECTONIC ACTIVITY AND MUD VOLCANOES OF THE PERSIAN GULF AND OMAN SEA - IRANIAN COASTAL ZONE

Presenting author: Fereidoon Owfi

Institute: Iranian Fisheries Research Organization, Iranian Ornamental Fish Society

Co-author(s): Gholam Reza Izadpanahi; Mahnaz Rabbaniha

Topic: Environment, Biodiversity and Climate Change

Abstract:

Pakistan earthquake (7/7 Richter) of southern Baluchistan province,(24 September 2013) was the affected area by Makran Chaman fault, which appeared three muddy islands / islets of the Arabian Sea coastal waters - Gwadar and Ormara Bay, and some mud volcanoes in the Makran region. The appearance and disappearance of islands or hills, ridges, bumps and other forms morphologically are the normal phenomenon familiar in the wide area of the coast of the Arabian Sea and Pakistan (Baluchistan - Karachi - Gwadar - Makran). However, usually the islands after storms and heavy monsoon waves, severe winds or sea flooding leads to damage, destroy and disappear. Overlapping activity of tectonic plates, faults and Makran joint area mud volcano are the main disaster causes and consequences of marine coastal geology in southern of Iran, which will also be affected. The process and the outcome of the different views of land and sea, as well as economic - social and regional geopolitical importance and notable scientists and managers and political leaders - have been regional security. In this paper, the possible effects on the flow of resources, biological resources ,marine and coastal habitats and ecosystems, as well as structural changes in coastal morphology and expression has been evaluated, and turning the marine and coastal risk of such a phenomenon in the coastal waters of the Persian Gulf and Oman Sea far greater. The results of this research and study indicate that the hydro-geological and biological differences between the Persian Gulf and Oman Sea basin are the main reason for formation of mud volcano and appear of sudden and new islets and islands. On the other side ran out the possibility of rapid destruction of the region's geological stability and shelf-life and possibility will be minimized.

069

TITLE: SUSTAINABLE DEVELOPMENT OF AQUACULTURE, USING BY INTEGRATED COASTAL ZONE MANAGEMENT (ICZM), (PERSIAN GULF, OMAN SEA, CASPIAN SEA)

Presenting author: Mahnaz Rabbaniha

Institute: Iranian Fisheries Research Organization, Iranian Ornamental Fish Society

Co-author(s): Fereidoon Owfi; Afshin Danehkar

Topic: Sustainable Development of Aquaculture

Abstract:

A large part of the infrastructure in coastal countries is located in the coastal zone. This zone is, therefore, of prime importance from all socio-economical, political and military viewpoints. The huge potential of coastal zones in transportation, energy, food and water supply, tourism, etc is well recognized. A number of marine ecosystems are being destroyed due to human neglect of environment and pollution problems. Waters of the Persian Gulf and Sea of Oman are among such instances where their fragile ecosystems are vulnerable to irreversible damage. Various organizations have implemented policies in protecting coastal zone. The scope, objectives and defining features of Integrated Coastal Zone Management (ICZM) are briefly described and a conceptual framework for the effective operation and evolution of ICZM programs is presented. ICZM is a dynamic and continuous process by which progress towards sustainable use and development of coastal areas may be achieved. ICZM programs therefore have the dual goals of conserving the productivity and biodiversity of coastal ecosystems while improving and sustaining the quality of life of human communities. Selected case studies from a diversity of settings in developed and developing nations reveal striking commonalties in the interplay between science and ICZM and demonstrate that effective ICZM cannot occur in the absence of science. The natural sciences are vital to an understanding of the functioning of ecosystems and the social sciences are essential to comprehending patterns of human behavior that cause ecological damage and to finding effective solutions. Scientists and resource managers often have different perspectives and imperatives. Nevertheless, as the case studies clearly suggest, they must work together as a team through all stages of an ICZM program and reach agreement on the scientific work needed to address priorities and guide policy development.

023

Marine Fish Culture

TITLE: A GLANCE AT THE PERSIAN GULF AND OMAN SEA MARINE MAMMALS

Presenting author: Shahram Dadgar
Institute: Iranian Fisheries Research Organization, Iranian Ornamental Fish Society
Co-author(s): Fereidoon Owfi

Topic: Other marine fish

Abstract:
The Persian Gulf is semi-closed sea with area about 233,000 km², which is connected to the Oman Sea in the east by the Hormuz Strait. Its western end is marked by the major river delta of Arvand River, which carries the waters of the Euphrates and the Tigris. Its length is 989 kilometers, separating mainly Iran from Saudi Arabia with the shortest divide of about 56 kilometers in the Strait of Hormuz. The waters are overall very shallow and have a maximum depth of 100 meters and an average depth of 50 meters. Countries with a coastline on the Persian Gulf and the Oman Sea including: Iran, Iraq, Kuwait, Saudi Arabia, United Arab Emirates, Qatar, Bahrain, Oman, and Pakistan.
The natural environment of the Persian Gulf is very rich and different with good fishing grounds, extensive coral reefs, and abundant pearl oysters, also marine mammals. The reports have shown that there are 118 species of mammals, which are living in the oceans, and seas of the world (FAO, 1989). The dominant species in the Persian Gulf and Oman Sea are as bellows:
1- Stenella attenuate
2- Steno bredanensis
3- Delphinus capensis
4- Sousa chinensis
This paper wants to explain the variety of marine mammals species in the Persian Gulf and the Oman Sea, their distribution patterns, biological characteristics and present situation of them in that area from protection point of view.

062

Molluscs & Crustaceans

TITLE: EFFECT OF AMMONIUM SUPPLEMENTS ON EARLY STAGE DEVELOPMENT OF GIANT CLAM (TRIDACNA SPP.)

Presenting author: Mohammad Khaleel Al-Zibdah
Institute: The University of Jordan-Aqaba
Co-author(s): Mohammad Rasheed

Topic: Mussel

Abstract:
This study attempted to address the role of heterotrophic and autotrophic nutrition on the developmental growth and survival of Tridacna spp clams from larval, to post metamorphic to visible 2-3 month old juveniles. Two experiments were carried out on different levels of algae and dissolved inorganic nitrogen (DIN) to determine optimum rates to supplement the two modes of feeding of clam-symbiont association. In the first run, 4-day old larval clams were stocked at 3 veligers/ml and placed in 1.5L bins. There were 4 replicate bins per treatment. For each treatment, 2 replicate-bins were stocked with clams and the other 2 without clams as controls. Higher stocking density at 10 villagers/ml was also used to examine the effect of density on nitrogen assimilation. Water samples (20 ml) were taken at 4-hour intervals from feeding/spiking for both ammonium measurements. Marked difference in ammonium concentration was observed between the spiked treatments ranging from 2.37-6.27 □M and non-spiked treatments at 0.22-0.62 □M. There was a fast uptake in veligers and postmetamorphosis in the first 4 hours upon spiking for all spiked treatments. In the veligers, the spiked bins without clams showed relatively same ammonium concentration over time. In comparison to the bins with clams, the concentrations were lower and there was a continuous decrease of ammonium over time. These differences in ranges at both stages suggested that the stocking density influenced the uptake of ammonium. This study has practical importance in the culture rearing protocol of giant clams in the oligothrophic waters of Red Sea.

005

Nutrition

TITLE: FOOD AND FEEDING HABIT OF CLARIAS ANGUILLARIS IN TAGWAI RESERVOIR, MINNA. NIGER STATE. NIGERIA

Presenting author: Ibrahim Baba Usman
Institute: Ibrahim badamasi babangida university, lapai. niger state. nigeria
Co-author(s): Ada Okafor

Topic: Feedstuffs and Feed Additives

Abstract:
The seasonal variations in the physicochemical parameters were studied from January, 2013 to December, 2013, in Kontagora reservoir, Niger State, Nigeria. The physico-chemical parameters were determined bimonthly, using the following methods, temperature using mercury thermometer in degree centigrade, transparency using Secchi-disc, Pye Unicam model 292 meter used for pH and electrical conductivity. Dissolved oxygen by modified Winkler-azide method, water hardness and Phosphate – phosphorus by method of Lind (1979), total alkalinity by standard method described by Boyd (1979), Nitrate-Nitrogen by Phenoldisulphonic acid method. The rainy season mean values for water temperature, depth, pH, Nitrate-Nitrogen, were significantly ($P<0.05$) higher than those for the dry season. However, for transparency, conductivity, dissolved oxygen, hardness, alkalinity, phosphate-phosphorus and total dissolved solid, the dry season mean value were higher than the rainy season mean value. As in most other Africa inland water bodies, there was seasonality in the physicochemical parameters variables. The torrential rains of the dam environment, the characteristics trade winds of the dry season, effect of deforestation, fertilizer application, herbicides, insecticide and other chemical factors might have contributed to the fluctuations of some of the physicochemical parameters determined in the reservoir.

009

TITLE: EVALUATION OF GUAR MEAL AS A DIETARY PROTEIN SOURCE FOR NILE TILAPIA OREOCHROMIS NILOTICUS REARED IN HAPA-IN-POND SYSTEM

Presenting author: Hanan A.
Institute: National research centre, Abo- State
Co-author(s): Abdel-Fattah M., El-Sayed, Al-Azab Tahoun

Topic: Alternative Feedstuffs and Aquafeeds

Abstract:
This study was carried out to investigate the effect of Guar meal (GM) as a protein source for Nile tilapia (Oreochromis niloticus) fingerlings. Six isonitrogenous (283 g kg-1 crude protein), isoenergetic (18.34 MJ kg-1 GE) test diets were prepared. GM was incorporated into the diets at 0, 20, 40, 60, 80 and 100% of dietary soybean meal (SBM). The diets were fed to triplicate groups of all-male Nile tilapia juveniles (20 g) reared in hapa-in-pond system, at 2–3% of their body weight, twice a day, for 105days. The results indicated that fish performance was excellent at all GM substitution levels. However, growth rates significantly increased and feed conversion ratio (FCR) decreased with increasing GM levels. Protein efficiency ratio (PER) and protein productive value (PPV) were not significantly affected with GM inclusion up to 80% levels. The cost/benefit analysis including incidence cost (IC) and profit index (PI) of the test diets indicated that GM-based diets, even at 100% substitution, were economically better than the control, SBM-based diet. These results suggest that GM can totally replace SBM in Nile tilapia feeds.

017

TITLE: EFFECT OF FISH MEAL REPLACEMENT BY CANOLA MEAL ON GROWTH AND BODY COMPOSITION OF WHITE WESTERN SHRIMP (LITOPENAEUS VANNAMEI)

Presenting author: Shahram Dadgar
Institute: Iranian Fisheries Research Organization, Iranian Ornamental Fish Society
Co-author(s): Mahmoud Hafezieh

Topic: Alternative Feedstuffs and Aquafeeds

Abstract:
The possibility of 25, 50, 75 and 100% replacement of canola meal instead of fish meal in diet of cultured Litopenaeus vannamei shrimp were investigated. Shrimp with an average initial weight of 2.5 ± 0.5g were fed with different treatment diets in tank for 45 days under laboratory conditions and growth performance, survival rate and body composition were determined at the end of experiment. The experimental diets including control diet (no canola meal and 30% fish meal) and four treatment levels of 25, 50, 75 and 100 percent of canola plant protein replaced with fish meal were fed to the shrimp ad libitum which were randomly stocks in 15 plastic tanks, (300-liter-30 shrimp per tank) during the experimental period. The average water temperature and salinity were 29/5 ±0/6° C and 33±0/8 g.L-1, respectively. The results showed that canola meal can replaced completely instead of fish meal in this shrimp diets, without any diverse impact on growth performance and body composition(P>0.05) except for FCR and protein content (P>0.05) which was the least and highest in control diet, respectively (P<0.05).

019

TITLE: NUTRITIONAL VALUE OF THREE IRANIAN ARTEMIA STRAINS

Presenting author: Mahmoud Hafezieh
Institute: Iranian Fisheries Research Organization, Iranian Ornamental Fish Society
Co-author(s): Shahram Dadgar

Topic: Alternative Feedstuffs and Aquafeeds

Abstract:
Artemia biomasses were harvested from three Iranian regions: Urmia Lake (ULAM), culture earthen pond near Urmia Lake (EPAM) and Ghom Salt Lake (GSLAM). The biomass were rinsed, dried and ground into meal, analyzed for proximate analysis, mineral determination and compared with the Peruvian fish meal (FMP). Under in vitro condition. Protein digestibility of all meals (including fish meal) by pepsin enzyme and active lysine by dye binding method were determined. Results showed that nutritional value of artemia meal varied from source to source. Variety of species, artemia nutritional conditions; region and season of collection and impurity in collected biomass have a significant effect on the nutritional value of the meals. Artemia sources have significant effect on the pepsin digestibility of the meals ($P<0.05$). EPAM has the lowest protein digestibly (90.47%) which is significantly lower than the other meals ($P<0.05$). However, active lysine is not significantly affected with artemia sources ($P>0.05$).

089

TITLE: THE EFFECTS OF TOW SYNBIOTICS ON HEMATOLOGICAL PARAMETERS AND THEIR INHIBITORY ROLES AGAINST V.HARVEYI IN THE WHITE SHRIMP (L.VANNAMEI)

Presenting author: Saeed Ziaeinejad

Institute: Behbahan Khatam Alanbia University of Technology

Topic: Prebiotics and Probiotics

Abstract:

The solution that can also provide nutrients to support the growth of aquatic organisms, increased health, resistance to stress and pathogens are using dietary probiotics, prebiotics and Synbiotic is aquatic food. This study aimed to evaluate the performance of commercial and autoctonous Synbiotic on hematologic and biochemical parameters of western white shrimp hemolymph was done in 4 treatments including S1 (commercial synbiotic), S2 (autoctounus synbiotic), treatment S3 (combination of commercial and autoctounus synbiotic) and control (C) (witout synbiotic). For commercial Synbiotic, a mixture of a commercial Lactobacillus bacteria (at a concentration of 1.5× 106 per g) and mannan oligosaccharide (at a concentration of 0.1%), and for autochthonous synbiotic, a mixture of a autochthonous Lactobacillus and mannan oligosaccharide was used. After 2 months of feeding, growth and survival factors, some of hemolymph indexes such as the number of total haemocytes, and biochemical and immunological parameters such as glucose, total protein, Lysosim, phagocytosis, phenoloxidase, total antioxidant, superoxide dismutase, alanine aminotransferase, aspartate aminotransferase and gastrointestinal bacterial indicators were measured. Finally, challenge test of the shrimp with pathogenic Vibrio was done. The results showed that application of the synbiotics could enhances growth and survival of shrimp and increased the total number of haemocyte significantly ($P<0.05$). Immunological indicators in the shrimp fed with different synbiotics, were higher than the control group ($P<0.05$). The number of intestinal Lactobacillus bacteria in synbiotic treatments was significantly higher than the control treatment ($P<0.05$). The chaleng test showed that, feeding of western with the synbiotics, increase protection against bacterial infections. The average mortality rate in synbiotic treatments significantly decreased compared with the control ($P<0.05$).

042

TITLE: THE INFLUENCE OF PONTOGAMMARUS MAEOTICUS EXTRACT ON IMMUNE RESPONSE AND GROWTH PERFORMANCE OF CASPIAN ROACH RUTILUS RUTILUS FRY

Presenting author: Seyed Hossein Hoseinifar

Institute: Department of Fisheries, Faculty of Fisheries and Environmental Sciences, Gorgan University of Agricultural Sciences and Natural Resources, Gorgan, Iran

Co-author(s): Rudabeh Rufchaie;Daryosh Parvaneh Moghadam

Topic: Feedstuffs and Feed Additives

Abstract:

The Caspian roach is an important species in the Caspian Sea and is major food sources for sturgeons. The present study investigates the effects of Pontogammarus maeoticus extract on Rutilus rutilus fry innate immune response and growth performance. Caspian roach (4.39 ± 0.3 g) were randomly allocated in 9 fiber glass tanks at a density of 10 fish per tank and triplicates groups were fed with experimental diets contain 2% of gammarous extract. Gammarous extract was mixed with distilled water at a concentration (0, 1: 25, 1: 50). At the end of the feeding trial, growth factors (final weight, weight gain, SGR, FCR) as well as innate immune responses (Total immunoglobulin, lysozyme activity and ACH50) were determined. Our results confirmed that fry fed diet mixed with 1:50 extract had significantly higher final weight, weight gain, Specific growth rate (SGR) and lower food conversion ratio compared to control treatment ($P < 0.05$). However, there were no significant between growth performance of roach fry fed 1:25 and 1:50 levels of extract ($P > 0.05$). Evaluation of innate immune parameters (Total immunoglobulin, lysozyme activity and ACH50) revealed significant elevation in roaches fed 1:50 and 1:25 levels of extract ($P > 0.05$). Furthermore, resistance to salinity stress challenge was remarkably higher in gammarous extract fed fry compared with those fed control diet ($P < 0.05$). According to these results administration of Gammarous extract can be considered as an efficient feed additive in Caspian roach fry culture.

045

TITLE: EFFECT OF DIETARY NANO IRON OXIDES ON GROWTH PERFORMANCE AND HEMATOLOGICAL INDICES OF RAINBOW TROUT (ONCORHYNCHUS MYKISS)

Presenting author: Ahmad Tahmasebi-Kohyani
Institute: University of Tehran
Co-author(s): Ali Reza Mirvaghefi; Zahra Karimi

Topic: Feedstuffs and Feed Additives

Abstract:
This experiment was conducted to examine the effect of dietary nano iron oxides on growth performance and hematological indices of rainbow trout fingerlings. A basal diet supplemented with 0 (control), 0.5, 1 and 1.5 mg.kg-1 nano iron oxides to formulate four experimental diets.. Each diet was randomly allocated to triplicate groups of fish with initial average weight of approximately 1.94 g. After 8 weeks of feeding trial, fish fed diets with nano iron oxides the highest final weight and SGR, and lowest in fish fed the control diet. The feed conversion ratio (FCR) was better when the fish were fed diet with 1.5 mg.kg-1 nano iron oxides. There were significant difference in hematological parameters including RBC, WBC, HB, lymphocyte percentage, lysozyme activity, MCH and MCV in fish fed by dietary nano iron oxides compared with control treatment (P < 0.05). The results suggest that dietary nano iron oxides administration at 1.5 mg.kg-1 exerted positive effects on growth indices and hematological indices in rainbow trout.

046

TITLE: THE EFFECT OF DIETARY PROBIOTIC PEDIOCOCCUS ACIDILACTICI ON IMMUNE RESPONSES OF RAINBOW TROUT (ONCORHYNCHUS MYKISS)

Presenting author: Ahmad Tahmasebi-Kohyani
Institute: University of Tehran
Co-author(s): Hosein Moradian; Einollah Naderi; Ali Parseh

Topic: Prebiotics and probiotics

Abstract:
Probiotics are micro-organisms which by improving intestinal microbial balance and by stimulating growth and microbial activity in intestine effects the well being of the host. This experiment was conducted to examine the effect of dietary probiotic Pediococcus acidilactici on immune responses of rainbow trout fingerlings. A basal diet supplemented with 0 (control), 0.05, 0.1, 0.15 and 0.2 percent probiotic to formulate five experimental diets. Each diet was randomly allocated to triplicate groups of fish with initial average weight of approximately 8 g. After 12 weeks of feeding trial, fish fed diets with probiotic were significant difference in immunity parameters including lysozyme activity, ACH50 and IgM in fish fed by dietary probiotic compared with control treatment (P < 0.05). The results suggest that dietary probiotic Pediococcus acidilactici administration at 0.05, 0.1 percent exerted positive effects on immune responses in rainbow trout.

018

Other Species & Topics

TITLE: THE EFFECT OF USING PARSLEY (PETROSELINUM SATIVUM) ON GROWTH PERFORMANCE OF KOI FISH (CYPRINUS CARPIO)

Presenting author: Narges Moorakı

Institute: Islamic Azad University, North Tehran Branch Iranian Fisheries Research Organization, Iranian Ornamental Fish Society

Co-author(s): Shahram Dadgar

Topic: Ornamentals

Abstract:

Recently using growth stimulators in fish diets has been brought to attention. Among these supplements, using medicinal herbs as a growth and immune system stimulator has been paid more attention to, due to their lower damage rate to fish and environment. The aim of this study is to evaluate the effect of parsley (Petroselinum sativum) as a growth stimulating dietary supplement in diet of koi (Cyprinus carpio) on growth parameters, feed conversion ratio and survival rate. 180 specimens with the average weight of 0/93±0/22 g were fed diets supplemented with four concentrations (0/1, 0/25, 0/5 and 1 percent) of parsley and the control group were fed with a parsley-free diet for 60 days. During the study period, the fish were biologically surveyed every 15 days. Growth and feeding indices and survival rate were measured. Fishes that were fed with diets supplemented with parsley showed better growth, FCR and survival rate. The highest weight gain (2/36±0/16 g), length gain (2/83±0/76 cm), specific growth rate for weight (3/93±0/18) and Specific Growth Rate for length (4/72±0/79), the least feed conversion ratio (1/34±0/19)) and also the most daily growth rate (3/9±0/29) belonged to the treatment containing 0/5 percent parsley in the diet and these differences were significant in comparison to the control group (p<0/05). It can be concluded that 0/5 percent parsley can be used in koi dietary feed as a good growth stimulator.

020

TITLE: INTRODUCING IRANIAN CICHLID (IRANOCICHLA HORMUZENSIS): A SPECIAL ENDEMIC AQUARIUM SPECIES IN HORMOZGAN PROVINCE

Presenting author: Shahram Dadgar

Institute: Iranian Fisheries Research Organization, Iranian Ornamental Fish Society

Co-author(s): Mohsen Marjani, Alireza Khiabani, Mansoor Sharifian;Homayoon Hosseinzadeh

Topic: Ornamentals

Abstract:

This study was conducted to evaluate adaptation and maturity trend of Iranian cichlid (Iranocichla hormuzensis) fish in captivity. Sixty three fish were collected from their natural habitat, Shahoo River (between Bandar Abbas and Haji Abad) and were moved to High Tech Fisheries Research Station- Khojir- IFRO. The fish were then divided into 9 groups based on weight (5-7 fish per group), and were placed in aquariums (100×40×40 cm3) fixed on iron shelves. During the two month experiment, all the environmental parameters were monitored and maintained within the standard ranges. Feeding was performed manually based on 3% BW. At this stage, reproduction behavior and changes in secondary sex characteristics such darkening color pigmentation especially in the male fish were monitored weekly. The obtained results showed that this native ornamental fish can well adapt to the captivity condition and successfully pass through the sexual gland development and maturity stages during the two month experiment.

087

TITLE: INCIDENCE OF PINNOTHERID CRAB PARASITISM IN SANDFISH HOLOTHURIA SCABRA IN SABAH, MALAYSIA

Presenting author: Rafidah Othman
Institute: Borneo Marine Research Institute, Universiti Malaysia Sabah

Topic: Emerging Species in Aquaculture

Abstract:

The sea cuccumber Holothuria scabra mostly inhabited the shallow tropical water, which less than 20 meters depth, sheltered area with high nutrient levels and muddy and seagrass beds. The demands and prices for beche-de-mer (trepang) or processed dried body-wall is high in Asian markets. Sea cucumber highly consumed by Asian communities due to its medicinal properties and as the delicacies, therefore, the natural population of sea cucumber were overfished and resulted in declining of supply. Borneo Marine Research Institute has started to develop a hatchery technique for breeding and larval rearing of sea cucumber Holothuria scabra for seed and juvenile production to ensure the released of juvenile sea cucumber can be done through restocking or sea ranching program. The first batch of 80 sea cucumbers were brought into the hatchery consisted of several sizes between 2 to 5 inches purchased from local farmers from Banggi Island, Sabah (7°15'0"N and 117°10'0"E). All sea cucumbers were kept in separate tanks based on the body size. A layer of treated sand was provided for each tank with the flowing seawater system and continuous aeration. The sea cucumbers were feed twice a day with microalgae paste and ground prawn pellets. After one month of maintaining the sea cucumbers in the tanks, 25% mortalities were recorded within 5 days. All dead sea cucumbers were dissected to discover that 85% had pinnotherid crabs. While, 64% of the infested hosts were observed with a pair (a male and female) of this crab species. Most of the crabs were found in the posterior parts of the digestive tract (especially the cloaca) and in the respiratory trees. The pinnotherid crabs found were typically small, with a size not exceeding 15mm carapace width. Infestation of holothuroids by internal parasites takes place mainly through body openings (mouth and cloacal aperture). The pinnotherids (genus Holotheres) are categorized as obligate parasitic in holothurians. However, wound on the wall of respiratory trees or cloaca due to pinnotherid parasitism may give influence to some parameters in farming such as the growth rate of individual or the reproductive abilities of breeders. The incidence of severe infestation of parasitic pinnotherids in sea cucumber that caused death was uncommon for many of the farmers in Sabah. The preliminary findings of the pinnotherids parasitism in sea cucumber from Sabah are presented herein. Further study of the incidence of pinnotherids infestation on sea cucumber as well as the biology of this crab is necessary.

001

Post Harvest Technologies

TITLE: EFFECTS OF ZATARIA MULTIFLORA BOISS. ESSENTIAL OIL, NISIN, PH AND TEMPERATURE ON VIBRIO PARAHAEMOLYTICUS THERMOSTABLE DIRECT HEMOLYSIN PRODUCTION

Presenting author: Afshin Akhondzadeh Basti

Institute: Department of Food hygiene, Faculty of veterinary medicine, University of Tehran, Iran

Co-author(s): Ali khanjari, Nourdahr Rokni

Topic: Aquaculture Food Safety Programs, Inspections and Audits

Abstract:

Vibrio parahaemolyticus is often causes gastroenteritis because of consumption of raw or inadequately cooked seafood. Zataria multiflora Boiss. is extensively used as a flavor ingredient in a wide variety of food in Iran. Studies showed a strong association of thermostable direct hemolysin (TDH) produced by members of this species with its pathogenicity. Nisin (N) containing 2.5% active N was purchased from Sigma– Aldrich Inc. Z. multiflora Boiss. Essential oil (EO) were prepared by steam distillation of the air-dried aerial parts of the pant using Clevenger-type apparatus. TDH assessment was done by a reversed passive latex agglutination assay (KAP-RPLA kit) in tubes with the inoculation level of the organism 1× 105 that showed visible growth (OD = 0.86; with ca. 8.7 × 108/mL of the growth medium) after affected by different concentrations of EO and N at the defined temperatures (T) and pH.

Results showed, the TDH production was significantly affected by EO, pH, T and their interactions, but not by N used in this study. As a result, the TDH titration at the combinations of EO = 0.005%, N = 0 mg/mL, pH = 7.5 and T = 8°C; EO = 0.005%, N = 0 mg/mL, pH = 5.5 and T = 35°C; and EO = 0.005%, N = 0 mg/mL, pH = 6.5 and T = 8°C were 1/128, 1/64 and 1/64, respectively, which were two- to threefold less than TDH titration obtained at the optimum condition for the growth of the microorganism in this study (pH = 7.5 and T = 35°C). The inhibitory effect of EO was also enhanced by increasing its concentration at each pH and T combinations.

056

Production Systems

TITLE: EFFECT OF WATER TEMPERATURE ON BIOFLOC FORMATION

Presenting author: Abd El-naem F.A Zidan

Institute: Cairo University. Faculty of Agriculture, Department of Animal Production, Fish Nutrition Lab.

Co-author(s): Ashraf Suloma , Rania S Mabroke and Azab M. Tahoun

Topic: Bio-floc Systems

Abstract:

The nutritional values of the bioflocs, as well as their morphological characteristics, are dependent on a large set of operational parameters. There is lack of knowledge about the factors that influence the formation of biofloc, so several investigations are needed on the optimization of these factors for the formation of biofloc in order to control the biofloc system. Therefore, we studied the impact of water temperature on the formation of biofloc, water quality and propagation of heterotrophic bacteria. The experiments were carried out in 12 plastic tanks. Each tank was filled with 70 L of well water. The experiments were conducted in a controlled temperature room at 20± 1 □C. Tilapia juveniles. Fish with initial average body weight of 15.8 ± 0.11 g were randomly distributed in the tanks at a density of 15 fish/tank (215 fish/ m2). Four different temperatures (18, 24, 28, and 32□C) were maintained by heaters with a thermostat (NEWATT-NWP 150W Italy). Each temperature group consisted of three replicates. Fish fed 4% feeding level and starch was added to obtain a C:N ratio 10:1 in water. Sufficient mixing intensity and saturated DO were ensured in each tank by use of a bubbling diffusive air stone, which was connected to a air pump. This laboratory study was conducted on day 30. The biofloc volume recorded its highest values for fish reared under 18C° .Treatment exposed to both 18 and 24 C° lead to the highest total suspended solids (TSS) values. The lowest ammonium levels were recorded for fish reared under 28 and 32 C°. Same results noted for Nitrite as shown for all temperature above 18C°. Nitrate accumulation increased with increasing the cultured temperature above 18C°. This work was supported by Science & Technology Development Fund (STDF), Egypt under grant no 5671.

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TITLE: TILAPIA AT HIGH DENSITY GROW BETTER IN RECIRCULATING AQUAPONIC SYSTEM THAN IN NON-RECIRCULATING AQUAPONIC AND NON-AQUAPONIC SYSTEMS

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Topic: Aquaponics and Integrated Aquaculture-Agriculture Systems

Abstract:

Aquaponics is considered to have great potential for growing fish and plants in an environment-friendly way but there are still some research gaps that need to be addressed. We conducted an experiment to compare the growth and survival of tilapia and lettuce in recirculating and non-recirculating aquaponic systems at different fish densities (10, 15 and 20 per tank). The system consisted of 12 units of rectangular tanks (80x40x40cm, with 100-l water), 3 of which were stocked with fish only (control), another set of 3 tanks with fish and lettuce grown on top (to save space) with Styrofoam platform (non-recirculating aquaponic system), another set of 3 tanks with fish only but these tanks were connected to another set of 3 tanks serving as filtration tanks in which lettuce were grown on top with Styrofoam platform (recirculating aquaponic system). All tanks had gravel on the bottom and the 3 filtration tanks had a vertical layer of gravel filter. Submersible pumps were used to bring water back to the tanks containing fish only and the water from the fish tanks went to the filtration tanks by gravity. Experiment was conducted for 6 week and sampling for growth was done every 2 weeks. Growth of fish was highest at the highest density (20/tank) in a recirculating system and lowest in tanks without plants (control). Survival was highest at 10 and 15 fish/tank in recirculating system. Survival was lowest in non-recirculating aquaponic system. Growth of lettuce was highest in recirculating system at 10 fish/tank and lowest in non-recirculating system at 20 fish/tank. There was no mortality among lettuce. It can be concluded that tilapia grow much better in recirculating aquaponic system than in non-recirculating aquaponic and non-aquaponic systems. In terms of maximizing production of both tilapia and lettuce, fish density of 15/tank may be used.

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