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ASIAN FISHERIES SOCIETY

e-Newsletter

MESSAGE FROM EDITOR

Arrangements are in full swing for the organisation of 11th Asian Fisheries and Aquaculture Forum (11AFAF) and the ASEAN Fisheries and Aquaculture Conference and Exposition 2016, being organised jointly by the Asian Fisheries Society in collaboration with the Department of Fisheries, Thailand and Network of Aquaculture Centers in Asia-Pacific (NACA) during 3-7 August 2016 in Bangkok.

Asia-Pacific FishWatch has made considerable progress in completing and publishing the profile of Long Tail Tuna (*Thunnus tonggol*) and is in the process of compiling profile of Pacific Blue Fin Tuna (*Thunnus orientalis*) and a freshwater aquaculture species *Pangasius hypophthalmus*.

Gender in Aquaculture and Fisheries group has been quite active and is busy preparing for the 6th Gender in Aquaculture and Fisheries conference (GAF 6) which will be held in Bangkok in conjunction with 11AFAF. The Society has agreed for the Gender in Aquaculture and Fisheries to be a Section of AFS (GAFS

M. V. Gupta

Inside this issue:

AFS PRESIDENT MESSAGE

The 11th Asian Fisheries and Aquaculture Forum(11AFAF) and the ASEAN Fisheries and Aquaculture Conference and Exposition 2016, jointly organized by Asian Fisheries Society (AFS), the Department of Fisheries, Thailand and the Network of Aquaculture Centers in the Asia-Pacific(NACA), will be convened at the Bangkok International Trade and Exhibition Center in Bangkok, Thailand from 3 to 7 August 2016. The Forum provides an international platform for distinguished scientists, researchers, traders, producers from all over the world to discuss the issues pertaining to sustainable fisheries and aquaculture in the Asia-Pacific Region. I am sure that the forum will promote sustainable development of fisheries and aquaculture in the Asia and in the world.

I would like to take this opportunity to acknowledge my sincere gratitude to the conveners and supporters of 11AFAF as well as friends of AFS, and special thank-you goes to the combined efforts of the Department of Fisheries, Thailand, NACA and AFS Councillors. They have been delivering excellent performance on the onerous task of the 11AFAF preparation, and I am confident that the forum will bring together many active experts, enterprises and students from across the aquaculture and fisheries institutions, industries and regulatory agencies together who will have a great discussion and achievement in many critical issues.

Once again, we would like to welcome all of you to 11AFAF and to the beautiful tropical city of Bangkok. See you in August. For your information, please link to the forum website (http://www.enaca.org/modules/afaf/themes.php).

Professor Shuolin HUANG

President AFS

Since the last Newsletter, AsiaPacific-FishWatch has published the species profile for *Thunnus tonggol* (longtail tuna) and a news post summarizing the material. Please view the post on our home page, and the species profile on our website http://www.asiapacfish.org/ under the Species menu.

We are now commencing to compile the species profile for Pacific Bluefin tuna (*Thunnus orientalis*). In addition, we will be commencing shortly to develop our first profile for an aquaculture species, namely the striped catfish (*Pangasius hypophthalmus*). Profiles for aquaculture species will have a different structure to that of fisheries species. All species profiles so far have been fisheries species.

Pacific Bluefin Tuna (*Thunnuus orientalis*). Image: International Scientific Committee (http://isc.fra.go.jp/working_groups/pacific_bluefin_tuna.html).

At the 47th AFS Council meeting in April 2016, the Council nominated Drs J.K. Jena, A. Ferrer and N. Loneragan to work with the AsiaPacific-FishWatch team to develop collaborations with AFS members in specific countries to further the development of this important information system.

In addition to information on the AsiaPacific-FishWatch website, AFS members can keep abreast of Asia-Pacific fisheries and aquaculture news by liking our Facebook page (https://www.facebook.com/asiapacificfishwatch), and following us on Twitter (@Asiapacfish, https://twitter.com/Asiapacfish).

We welcome suggestions and contributions for AsiaPacific-FishWatch.

Please contact:asiapacific.fishwatch@gmail.com.

Contributed by Meryl J Williams

GENDER IN AQUACULTURE AND FISHERIES (GAF) UPDATE

The period since the last Newsletter has been very productive. The GAF team has been focusing on three activities: formalizing its character, completing the publication of papers arising from the 5th Global Symposium on Gender in Aquaculture and Fisheries (GAF5 – November 2014, Lucknow, India), and preparing for GAF6 at the 11th Asian Fisheries and Aquaculture Forum in Bangkok.

***Formalizing the Gender in Aquaculture and Fisheries group in AFS*:** A large group of people have come together for the triennial AFS women or gender in aquaculture and fisheries (GAF) events since the first one in 1998. The Society has been very supportive of these events and they have grown in strength and depth over the years. Thus, when this interest group met in November 2014 at GAF5 in Lucknow, India, we decided to consider requesting the Asian Fisheries Society Council to establish a formal group on GAF. A small working group was established to develop the purpose and procedures of the group further, resulting in a proposal to form a GAF Section of AFS being put to the 47th Council meeting in April 2016.

We are very pleased to report that the AFS Council has agreed to the formation of the GAF Section (GAFS), and further work will now go into developing the operating arrangements for GAFS as an active part of AFS.

We note that the Asian Fisheries Society will be the first professional fisheries or aquaculture society to have created a gender section.

GAF5 Proceedings to be Published as a Special Issue of Asian Fisheries Science Journal: Selected papers from GAF5 are now in the final stages of preparation for publication in a Special Issue of Asian Fisheries Science Journal, due for release at the 11th Asian Fisheries and Aquaculture Forum (11AFAF).

GAF6 Attracts a Record Number of Abstracts: Over 70 abstracts were received for presentation at GAF6 in Bangkok, as part of the 11AFAF. This is a record number for a GAF event, and a record percentage in an AFAF event (over 17%). The GAF6 Organizing Committee is developing the program so as to give the best opportunity for presenting high quality work on the theme (*Engendering Security in Fisheries and Aquaculture*), allowing time for discussion and exposure of all work underway, including the important poster presentations. Our website (**http://genderaquafish.org/**) and other social media outlets give regular updates on the program.

LINKS

Website: http://genderaquafish.org/

Facebook: https://www.facebook.com/pages/AFS-Gender-in-Aquaculture-and-Fisheries/181176555231544

Twitter: @Genderaquafish https://twitter.com/Genderaquafish

Paper.li: Genderaquafish http://paper.li/f-1343620155

Google Group: https://groups.google.com/forum/#!forum/genderaquafish

Contributed by Meryl J Williams

NEWS FROM AFS SECRETARIAT

1. PAYPAL

Please be informed that the Paypal System is not functioning. Whoever want to make membership payment, please pay through Telegraphic Transfer (TT) or bank in to our account. We will announce the status of Paypal system once the errors have been rectified.

2. 11AFAF

The upcoming event 11AFAF will be held on 3rd - 7th August 2016 in BITECH, Bangkok. We would like to invite all to join the Forum.

3. Kanazawa Research Grant Award

The successful candidates for Kanazawa Research Grant are Aslizah Mohd Aris from Malaysia and Rajesh M from India. Our congratulations to both of them.

4. AquaFish Innovation Lab Yang Yi Young Scientist Travel Grant

The successful candidates for this travel grant are **Laila M. Gallego** and **Isagani P.Angeles, Jr.** Congratulations to them.

5. 48th Council meeting will be held on 3rd August 2016 in Bangkok, Thailand.

6. AFS General Assembly will be held on 5th August 2016 at BITECH, Bangkok, Thailand.
All members are invited.

Regular Journal Series: The journal is attracting manuscripts from many more countries than in the past. We are seeing increasingly more submissions from Vietnam, the Philippines, Japan, Thailand and Indonesia, unlike in the past when the journal attracted manuscripts mainly from South Asia. During January – 3 March 2016, 16 manuscripts were received of which 9 are under processing and 7 rejected as they did not meet journal standards.

Use of ScholarOne: Agreement for the use of UPM's ScholarOne for processing manuscripts, as suggested by the Chief Editor has been signed in February 2016. Arrangements are underway to implement the use of ScholarOne in stages to enable everyone involved to familiarise with the system. The use of ScholarOne will certainly improve the journal's standing internationally as most of the international journals use ScholarOne or its equivalent for processing manuscripts.

Editorial Board Members: With resignation of Dr Kenneth Ruddle from the Editorial Board, there are now 15 members on the Editorial Board consisting of Dr. Upali S. Amarasinghe (Sri Lanka), Dr. Richard Arthur (Canada), Dr. John Benzie (Ireland), Dr. Dominique Bureau (Canada), Dr. Yong-MengGoh (Malaysia), Dr. M. Vijay Gupta (India), Dr. Mick Haywood (Australia), Dr. Malcolm Jobling (Norway), Dr. Iddya Karunasagar (India), Dr. Peter Mather (Australia), Dr. Nguyen Hong Nguyen (Australia), Dr. Shi- Yen Shiau (ex editor) (Chinese Taipei), Dr. Hisatsugu Wakabayashi (Japan), Dr. Meryl Williams (Australia) and Dr. Fatimah Md. Yusoff (Malaysia).

Selection for new Editorial Board Members will take place shortly based on their area of expertise and experience as well as Scopus H-Index Factor.

NEWS FROM INDIAN BRANCH (AFSIB)

During the year, the Asian Fisheries Society Indian Branch (AFSIB) has been active in organising the National Seminar on "Fisheries and Aquaculture: Livelihood Security, Sustainability and Conservation" during 21-22 January, 2016 and2nd International Symposium on Genomics in Aquaculture (ISGA-II) during 28-30 January 2016, the details of which are as follows.

A National Seminar on *"Fisheries and Aquaculture: Livelihood Security, Sustainability and Conservation"* was organized at the College of Fisheries, Lembucherra, Tripura, India during 21-22 January, 2016. The event was organized by the North East Society for Fisheries and Aquaculture (India) and Asian Fisheries Society Indian Branch (AFSIB), in collaboration with Central Agricultural University (Imphal).

The Seminar brought different stakeholders including academicians, researchers, line department officials, research scholars, graduate students and farmers from the country in general and NE region of India in particular on one platform and enabled them to share the recent research findings encompassing seven technical sessions namely: (1) aquaculture production systems including climate resilient aquaculture, (2) aquatic resources and their conservation, (3) harvest and post-harvest technology, (4) fish genetics and biotechnology, (5) fish nutrition, biochemistry and feed technology, (6) aquatic animal health management and environment and (7) emerging social issues in aquaculture and fisheries.

The seminar was attended by more than 170 delegates from 20 states and Union Territories of India.

Major recommendations from the Seminar were as follows:

- Need for periodical up gradation of the database of fish diversity, especially that of biodiversity hot-spots like Northeast region using combination of recent classical and molecular tools;
- Undertake inter-disciplinary comprehensive research and development efforts for sustainable aquaculture species diversification (food and ornamental fishes), through development of protocols for commercial seed production, feed development utilizing locally available ingredients and package of practices for grow-out for region-specific prioritized species;
- Development of organic aquaculture certification to establish, promote and popularize organic aquaculture;
- Develop and enforce a regulatory mechanism and surveillance to check introduction of exotic species along with trans-boundary movements of pathogens;
- Undertake efficacy testing of new drugs and immunostumulants under field conditions;
- Need to formulate suitable adaptive measures for climate resilient fisheries and aquaculture through appropriate species selection, selective breeding, feed additives;
- Efforts be made to mechanise the production processes of traditional fish products of Northeast India for shortening of the fermentation period and improvement of hygiene of the product.
- Undertake live gene banking and scientific ranching of region specific prioritized species;
- Study anthropogenic as well as other pollutants and their impact on aquatic ecosystem health as there is growing concerns about their impact not only on aquatic biota but also on human.

Organisation of The 2nd International Symposium on Genomics In Aquaculture

The 2nd International Symposium on Genomics in Aquaculture (ISGA-II) was held at the ICAR-Central Institute of Freshwater Aquaculture (CIFA), Bhubaneswar, India during 28-30 January 2016. The event was organized by ICAR-CIFA in association with Association of Aquaculturists (AoA), Bhubaneswar and Asian Fisheries Society Indian Branch (AFSIB).

A compendium of 'Lead Lecturers and Abstracts' was published for the occasion.

The Technical Sessions consisted of Molecular Breeding, Genomics in Fish Health, Reproduction and Nutrition, Population Genomics as well as Genome Informatics. There were 9 Lead Lecturers, 23 Oral Presentation and 36 Poster Presentations.

The Symposium came up with the following recommendations:

- Prioritize objective, trait and species before starting a whole genome sequencing project;
- Ensure that the classical selective breeding program is supported by genetic markers to increase the accuracy of selection and thrust upon the Phenomics research program to assist genomic selection;
- Need to enhance the pool of bioinformaticians and conducting advance training program on bioinformatics at institute level;
- Need for infrastructure development for computational biology work & validation of *in-silico* work;
- Plan for Best Early career Researcher competition for the innovative and novel ideas in the next edition of Symposium;
- Develop on-farm assay (biochemical) system for identification of improved varieties from non-improved one;
- Work with zebra fish as model fish along with farm food fish simultaneously to solve the research problems;
- Develop designer fish for production of drug or vitamin through transgenesis in collaboration with industry (PPP approach);
- Need for Network building in collaboration with international and national institutes to develop core group in the area of genomics.

UPCOMING CONFERENCES ORGANISED BY AFS & BRANCHES/NETWORKS

11th Asian Fisheries and Aquaculture Forum

With the theme *ASIAN Food Security for the World,* the 11AFAF will be held from 3 to 7 August 2016, at the Bangkok International Trade and Exhibition Centre in Bangkok, Thailand. The Asian Fisheries Society collaborates with the Department of Fisheries, Thailand, the Network of Aquaculture Centres in the Asia-Pacific, and partners in organizing the 11AFAF. The Forum provides an international platform for distinguished scientists from all over the world to discuss the issues pertaining to sustainable fisheries and aquaculture in the Asia-Pacific Region.

The 11AFAF will be a mixture of keynote speeches, participant presentations, poster presentations (and competition), plenary discussions, and exhibits. There will be four keynote speakers, about 240 oral presentations and 120 posters under six themes that include Governance, Education and Training, Sustainable Aquaculture, Climate Change, Sustainable Fisheries, Post-Harvest and Safety, and the 6th Global Symposium on Gender and Aquaculture and Fisheries (GAF6). Special sessions are also being organized by the Too Big To Ignore (TBTI) and the Economy and Environment Program for Southeast Asia (EEPSEA).

More Big Retailers Say 'No' to GMO Salmon

On the heels of Canada's approval of GMO salmon, Friends of the Earth U.S. and a coalition of more than 30 consumer, health, food safety and fishing groups released updated numbers showing that nearly 80 major food retailers have committed to not sell genetically engineered salmon, despite FDA's approval in November 2015.

"The growing number of commitments from retailers not to sell, demonstrates there is no market for GMO salmon," Dana Perls, senior food and technology campaigner with Friends of the Earth, said. "Retailers and restaurants are wisely listening to their customers and rejecting GMO salmon."

Walmart, the world's largest retailer, and Publix are among the last remaining large retail grocers in the U.S. that have not said publicly whether or not they will sell GMO salmon.

In the wake of controversy over the U.S. approval, the U.S. has put in place an import ban on GMO salmon until labeling standards are established. The day after Canada's announcement, Provincial Fisheries Minister of Nova Scotia announced the province will ban the farming of GMO fish.

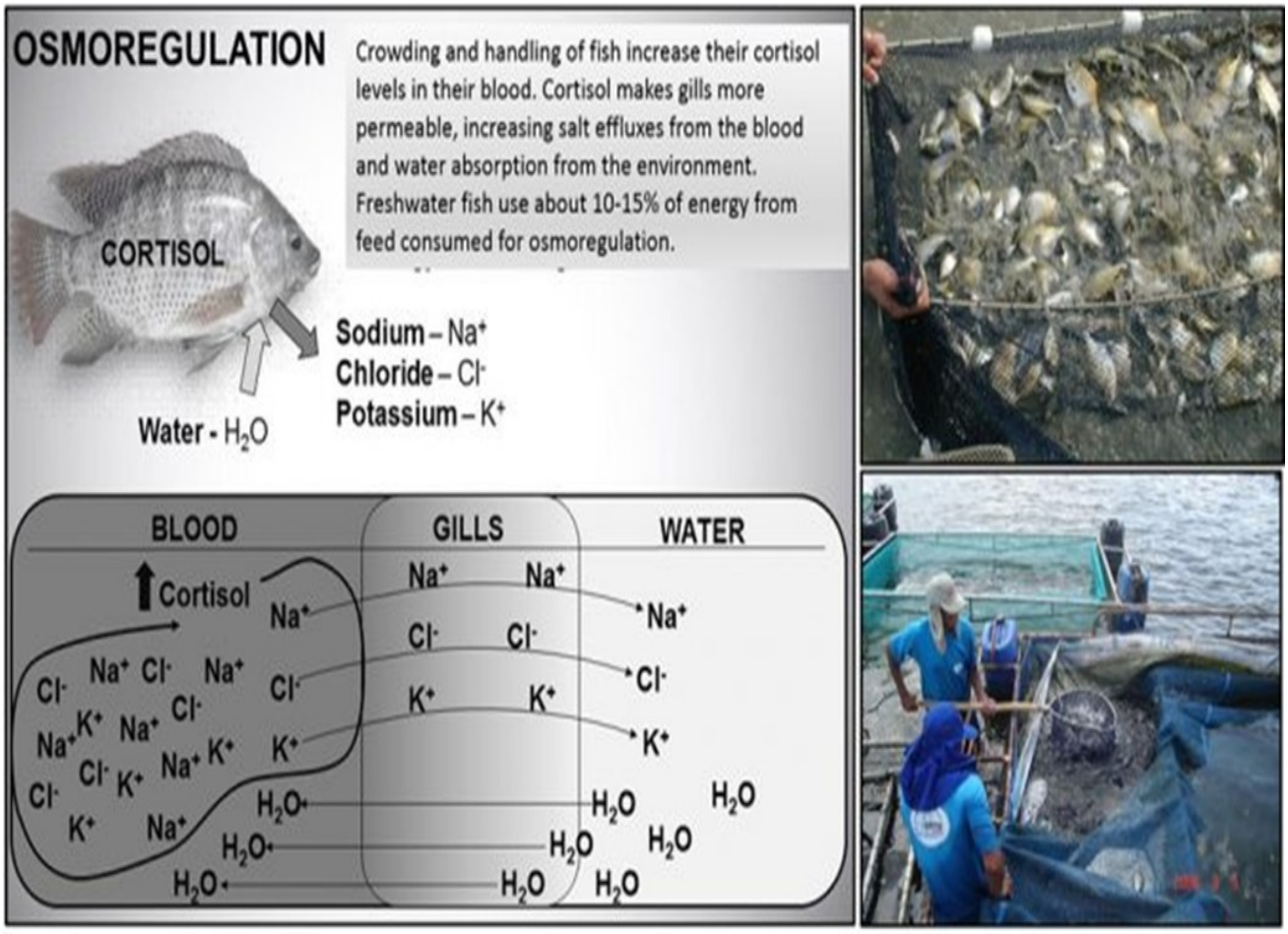
Source: http://ecowatch.com/2016/05/25/retailers-no-gmo-salmon/

Common salt a useful tool in aquaculture

Fish farmers know that stress and infections after excessive manipulation or mishandling of their fishes during routine work activities can cause significant losses of fish. These losses could be minimized by improving handling and preventively using common salt. This article provides some practical information on the routine, preventive use of salt in fish farms.

Why is salt so useful to aquaculturists? Common salt helps to counteract handling stress, restore osmoregulation, prevent and control diseases, improve overall condition and survival of fish prior to and after transportation, helps to alleviate adverse environmental conditions, and supports the well-being of breeder fish during and after spawning activities, among other practical applications and benefits.

Osmoregulation in freshwater fish: The salt balance of fish can be adversely affected by physical injuries. Extended crowding in nets and tanks triggers hormonal and physiological responses that provoke excessive losses of salts (Figure 1). Gill injuries and inflammation caused by parasites and bacterial infections, suspended solids (clay or organics), and irritating chemicals (such as formalin and potassium permanganate), as well as the frequent exposure to low oxygen, can also make osmoregulation more difficult. Under these adverse situations fish may lose salt to a point of no return. Some species are more tolerant to osmoregulation stress than others. For this reason, farmers should adjust their handling procedures and preventive practices according to the species cultured.



Many uses of salt in fish farming: Most fish farmers are unaware of all the possible applications of salt to reduce fish losses. In fact, salt is often misused or applied too late, and often at very low and ineffective doses and for too short a time. In addition, fish farms commonly lack adequate facilities to handle and treat fish properly when needed. Salt helps to reduce the risk of bacterial and fungi infections after handling, and is an effective and safe product to control some external parasites. Salt treatments may be short in duration and highly concentrated (20 to 50 ppt), or longer and at lower concentrations (12 to 15 ppt). Fish can be normally kept for an indefinite time at physiological salt concentrations (8 to 10 ppt). The addition of salt to water during handling and transport improves fish condition and minimizes mortalities after crowding and handling stress. Adding salt plus gypsum to water is an effective way to prevent the death of breeders in some fish species more susceptible to osmoregulation imbalance after handling and spawning. Salt baths are often used to prevent fungal infections in fish eggs. Salt can also be added to fish feeds, to help fish recover blood salts after handling stress.

Recommendations for the use of sea salt in freshwater fish production.

Salt in water where fish is being conditioned (fasting) for live transport: Fish farmers routinely experience mortality of fry and fingerlings after handling stress and transport. Fish invariably suffer physical injuries (such as loss of mucus and scales, bruises, punctures, etc.) and lose salt in excess, making it difficult to balance osmoregulation. In addition, the crowding stress and the high-density confinement of fish for depuration (fasting) trigger a sequence of physiological reactions that culminate with the rise of cortisol in the blood. Keeping post-larvae, fry, fingerling and even adult fish in water salted at 3 to 6 ppt will help fish balance osmoregulation. Fish will also produce more mucus in response to salt, which will cover damaged body surfaces, preventing skin and fin lesions from getting worse. Furthermore, concentrations of 3 to 6 ppt of salt inhibit the onset of opportunistic fungi (*Saprolegnia*) and bacteria (*Flavobacterium*) infections.

Salt helps to counteract handling stress, restore osmoregulation, prevent and control diseases, improve overall condition and survival of fish prior to and after transportation:

When transporting freshwater fish, adding salt to the water at 5 to 8 ppt helps minimize the difference in salt concentration between water and fish blood. When fingerlings are transported in plastic bags under optimized fish loads, the total ammonia concentration in transport water normally exceed 40 mg/L. If the fish are not properly fastened, total ammonia may go even beyond 120 mg/L. Fish do not die as the pH of water inside the plastic bags is generally acid, due to the increase in carbon dioxide levels in the transport water. However, high ammonia concentration in water will prevent fish from excreting ammonia by simple diffusion from blood to water. The presence of sodium ions (Na^+) in the water favours the active transport of ammonium ion (NH_4^+) from blood to water, even under the negative ammonium gradient between blood and water commonly observed when transporting fish in plastic bags.

Salt to control fungi and external bacteria: Keeping fish in water with 5 to 6 ppt of salt is effective in preventing infections by fungi and external bacterial. However, when the fish are already infected, salt baths of 20 to 30 ppt for 10-30 minutes may be necessary. When farming fish in small volume cages, salt baths can be applied by surrounding the cages with a vinyl enclosure (Figure 4). Aeration is necessary to maintain adequate oxygen levels inside the enclosure during the treatment. Short salt baths (20 to 30 ppt of salt for 10 to 30 minutes) or long baths (10 to 15 ppt for 6 to 12 hours) are the choices.

Applying salt to pond water to treat *Saprolegnia* or *Flavobacterium* infection in fish is not as easy and economical compared to the treatment of low volume cages. Other treatment options may be considered for pond fish. For treating a small biomass of high-value fishes (such as ornamental, sportfish and breeders), it is possible to carefully harvest the fish and transfer them to hauling tanks for short treatments. In very small ponds it may be feasible to concentrate the fish with a seine at a pond's end and delimit a treatment zone of about 10 percent of the pond area by placing a vinyl curtain just behind the seine. The volume of the treatment zone should be estimated and salt applied accordingly to reach at least 10 ppt that should be maintained for 8 to 12 hours. Mechanical aeration is required and dissolved oxygen levels should be monitored frequently for the duration of the treatment.

See more at: http://advocate.gaalliance.org/common-salt-a-useful-tool-in-aquaculture-part-1/#sthash.6xNvuVDT.dpuf

Probiotics benefit Pacific white shrimp challenged with AHPND

Researchers note higher survival and histological signs of hepatopancreas regeneration in Vietnam trials with INVE. The study showed that commercial probiotics treatments had beneficial effects for Pacific white shrimp, including higher survival and histological signs of hepatopancreas regeneration.

A combination of adverse factors in nutrition, biosecurity, host physiology, and especially microbial management leads to a situation in which opportunistic pathogens such as *Vibrio parahaemolyticus* can bloom and dominate the microbiota around and inside the shrimp. When additional virulence factors such as colonization of the stomach and toxin production are added to this setting, diseases such as acute hepato-pancreas necrosis (AHNPD) will cause severe losses.

INVE Aquaculture has been working on this issue for more than a decade, in the context of "traditional" vibriosis. Hence it was a logical step to extrapolate our established pro- and metaphylactic treatments to this new variant of *Vibrio*. When applying our probiotics in the field, as part of a holistic intervention protocol, a significant amount of empirical data of the beneficial action of *Bacillus* probiotics during shrimp culture has been collected. In this study our objective was to measure the effects of Sanolife probiotics in a standardized AHPND challenge model under controlled laboratory conditions.

Test shrimp: Shrimp of PL20-25 stage, with an average body weight of around 1 g were used, the age and size which is most affected by EMS/AHPND under culture conditions. Natural seawater was used throughout the experiments, sterilized and diluted to 25 g/L, a typical salinity for *P. vannamei* grow-out. This study was originally published in Aquaculture Asia Pacific 11(6):14-17.

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Bacteria: We designated the bacterial strain used in this study as LTS14. It was originally isolated from shrimp diagnosed with AHPND (histo)pathology in Vietnam in May 2014 and stored at -80°C in TSB supplemented with 1.5 percent NaCl and 25 percent glycerol. The bacteria were identified as *V. parahaemolyticus*, by green colonies on TCBS, conventional API 20E biochemical tests and PCR with LTH primers. Additionally, the isolate was positive on PCR with AP3 primers.

Challenge: Bacterial cultures were grown 24 hours in TSB supplemented with 1.5 percent NaCl at 28°C. Based on the standard curve determined for the strain, the bacterial suspension was diluted in sea water to an OD corresponding to 10^8 cells ml^{-1}. Shrimp were immersed for 15 minutes in this bacterial culture with continuous aeration and then both bacterial solution and shrimp were transferred to aquaria containing sea water, reducing the bacterial concentration to 10^5, 2×10^5, 10^6, 2×10^6 cells/mL. No water was exchanged until two days after the challenge, from which point 20 percent of water was renewed daily.

Experimental design: Experimental shrimp were stocked at a density of 30 individuals per aquarium with 30 liters of water, continuous aeration and water parameters held constant at 29±1°C, pH 7.7±2, NH_3 <0.1 mg/L and DO 4 mg/L by daily water exchange.
Feed applications were top-coated with every ration and the Sanolife PRO-W water application was added to the water of the aquarium once per day. The dose of Sanolife PRO-2 was 2×10^8 CFU *Bacillus* per g feed and the dose of Sanolife PRO-W was 2.5×10^5 CFU *Bacillus* per ml water. Apart from the NC, all shrimp were challenged with 2×10^5 CFU/mL of LTS14, and clinical follow-up was performed for 15 days after challenge.

Severity of clinical signs AHPND: Clinical signs such as anorexia, lethargy and pale coloration of the body and hepatopancreas were observed in 75 percent of the animals in the positive control group as early as 24 hours after the challenge. Shrimp in the AB and Sanolife PRO-W groups also demonstrated AHPND symptoms, but with less pronounced anorexia, and in a reduced group of animals (50 percent). Less than 20 percent of shrimp receiving Sanolife PRO-2 were recorded with AHPND symptoms, and with a significant delay of 72h after challenge.

Reduced mortality: Mortality started in the PC group 1 dpi (days post-inoculation) and reached a cumulative mortality of 52±10 percent after 10 days (Figure 3). In AB and Sanolife PRO-W groups, mortality also started at 1 dpi and cumulative mortality attained 32±12 percent and 34±5 percent respectively. A delay in mortality of 4 days was noted for the Sanolife PRO-2 group, with cumulative mortality stopping at 17±3 percent after 9 days. The Sanolife PRO-2 result was statistically significantly lower than the PC, but also still higher than the NC 3±3 percent.

Perspectives: The AHPND challenge model developed and standardized for this study resulted in a mortality curve of the positive control which reaches its maximum after several days, and does not wipe out all the inoculated shrimp. This is more in line with AHPND outbreaks in shrimp farms and also offers a better chance for evaluating possible therapeutic interventions than many reported challenge models employing impossibly high bacterial concentrations and resulting in hyper-acute mortality.

The results of the study show that Sanolife PRO-2 and Sanolife PRO-W probiotics treatments by themselves have beneficial effects, such as higher survival and histological signs of hepatopancreas regeneration. However, similar to antibiotic treatments, probiotic treatments are not sufficient to completely protect shrimp from disease. For this, a holistic approach is needed, supporting and correcting the rearing system and the shrimp's health status on all levels.

- See more at: http://advocate.gaalliance.org/probiotics-benefit-pacific-white-shrimp-challenged-with-ahpnd/#sthash.lmne6C4V.dpuf

Dartmouth team makes breakthrough toward fish-free aquaculture feed

HANOVER, N.H., USA - Dartmouth College scientists have discovered that marine microalgae can completely replace the wild fish oil currently used to feed tilapia, the second most farmed fish in the world and the most widely farmed in the United States.

The findings, which appear in the open-access journal *PLOS ONE*, are a major breakthrough in the quest to develop sustainable, fish-free feeds for aquaculture, the world's fastest growing food sector. The authors claim that the Dartmouth study is the first report of a marine microalgae species being successfully used as a complete replacement of fish oil in feed for Nile tilapia.

Aquaculture currently uses more than 80 percent of the world's fish oil and fishmeal. Pallab Sarker, the new study's lead author, previously found that salmon aquaculture consumes more wild fish in the form of protein and oil from open-ocean fishes like mackerel, herring, anchovies and menhaden -- than it produces in the form of edible meat from farmed fish, resulting in a net removal of fish on a global basis.
Scientists have reported success in partially or totally replacing fish oil with vegetable oil in many farmed-fish species, but studies show that vegetable oil reduces the nutritional quality of the fish flesh. In contrast to vegetable oil, microalgae are much higher in essential omega-3 fatty acids, which are important for maintaining fish health and imparting neurological, cardiovascular and anti-cancer benefits to humans.
In their new study, the Dartmouth researchers looked at juvenile *Nile tilapia*. The team conducted a feeding experiment with dried Schizochytrium, a species of marine microalgae rich in health-promoting omega-3 fatty acids. Their goal was to determine the optimum level of fish-oil substitution (partial or complete) for good growth of tilapia.When the researchers fully replaced fish oil with the microalgae, they found significantly higher weight gain and better food conversion compared to a control diet containing fish oil, and no significant change in survival and growth rates among all diets. The fish-oil-free microalgae diet also had the highest content of omega-3 fatty acids in tilapia fillets.

"Our study shows that Schizochytrium is a high quality candidate for complete substitution of fish oil in juvenile Nile tilapia feeds, providing an innovative means to formulate and optimize the composition of feed while simultaneously raising feed efficiency of tilapia aquaculture," says Sarker.
Co-author Anne Kapuscinski, says the results also point to the possibility of formulating ecologically and socially sustainable aquafeeds, with greatly reduced or no fish oil from marine fisheries and without having to switch to vegetable oils from industrially farmed crops. Commercial realization of this potential will require advances in strategies to reduce non-renewable inputs, such as inorganic fertilizers and fossil fuels, and monetary costs of large-scale production of marine microalgae, she says.

"Researchers have to find the ways to cut the high production cost of microalgae in order for such nutritionally enhanced tilapia to succeed in the market" says Anne Kapuscinski. Towards this end, we are exploring ways to reduce production costs and the environmental footprint of microalgae production by using organic waste streams as a partial replacement for expensive inputs of inorganic fertilizer normally used to grow microalgae. Now that we've been able to fully replace fish oil in tilapia feed, our next step towards a fish-free diet is to replace fishmeal. We are now investigating combinations of different marine microalgae to achieve this goal in tilapia."
The Dartmouth researchers are conducting similar studies in rainbow trout, which they are using as a model species for salmon farming.

Source: http://www.eurekalert.org/pub_releases/2016-06/dc-dtm060216.php

The Aquarium: As An Educational Tool

Aquarium fish keeping hobby is coming under increased scrutiny from those who question the value and ethical soundness. As researcher and professional educators, it is our firm belief that there is no greater good served by maintaining living creatures in captive systems i.e. Aquariums; than the opportunity to expose people of all ages to the variety of life found in aquatic environments. Through this exposure, many lessons can be learned about the creatures themselves, the environments in which they live and the fragile balance of the ecosystems that support them.

We are well aware that aquariums are sometimes found in the classrooms of schools, but it is not clear as to what systematic use is made of them in education. ? how are they integrated into the curriculum?, what lessons are built around them and how teachers can be made aware of the educational potential that the classroom aquarium contains? What we propose here is that there are many a ways in which these wonderful aquatic resources can be used for specific teaching goals at all levels of educational systems.

AQUARIUM: SCIENCE CENTER

Almost everyone is attracted to the looks of well-run aquaria, and children especially love them. This innate curiosity of people and their spontaneous interest can be utilized for both formal and informal education because there's so much that can be learned from these little artificial ecosystems. A well-planned and run aquarium can be an extraordinarily valuable aid for science education. It can be used to teach the fundamentals of the scientific method as well as more specific topics in biology, chemistry, ecology, the behavioral sciences and even technology and physics, and it can teach these from basic to advanced levels. Equally important, it can teach children valuable lessons about responsibility toward their living charges and the natural environments from which they come.

One of the most basic necessities in the learning process is the need to create motivation in the learners. The aquarium can provide this kind of motivation to learn in a natural and spontaneous way. It is critical to find opportunities for this kind of educational motivation especially in the sciences, subject's children often resist or find difficult

Primary Level

Of course there are specific issues to be dealt with when it comes to science education. Some of the educationalist point out that there are two basic approaches in the field. One, the *process* approach, emphasizes the development of skills such as observation, description, classification, measurement, inference and prediction. The other educational approach emphasizes *content* of large blocks of knowledge such as the traditional fields of biology and chemistry as well as newer integrations like ecology. These approaches are not mutually exclusive, of course. It is clear that both can utilize the aquarium productively. Primary level school children can be introduced, informally, to the basic techniques of the process approach and can start to build a "knowledge-base" of concepts as suggested by the content approach. They can certainly be encouraged to develop the fundamental processes of observation and description and they can learn to communicate their observations and start to make generalizations. They can begin to take and record measurements. They can make drawings and be encouraged to read. Basic content about nutrients, the nitrogen cycle and photosynthesis can be introduced. Students can be introduced to thermometers and other simple equipment. Those children lucky enough to live near bodies of water can be introduced to the ecologies and organisms that are nearby. They can use some of the things they've learned to explore their local environments and perhaps to see the effects of environmental degradation or pollution, and hopefully to observe some of the attempts to improve conditions.

High School and College Level

By the High School and College level years, departmental education takes place and the science education tank will probably be in the Biology classroom. From this point, science education will be more formal. Aquaria with plants and animals can be used to demonstrate and discuss all of the fundamental process of energy utilization, growth, reproduction, adaptation, photosynthesis - there is almost no limit to the material that can be presented by an imaginative teacher. Biochemical processes can also be explored through studies of water chemistry and its measurement, as well the interaction between water chemistry and metabolic processes. Biophysical processes can also be explored through studies such as the relationship between parameters of light and the process of photosynthesis. It is also possible to introduce behavioral studies – learning, perception, territoriality, parental behavior, aggression, social behavior and communication – all of these can be illustrated in "real life" situations. It is worth mentioning here that aquarium possess values beyond those of narrowly defined science education. They can motivate students in many unpredictable ways and deserve a place beyond the classroom, in the general use._The Aquarium touches people's hearts in many ways through its unique combination of entertaining, educational and scientific resources.

Contributed by Prakash E Shingare and Ravindra D. Bondre

UPCOMING CONFERENCES

FishAdapt: Global Conference on Climate Change Adaptation for Fisheries and Aquaculture

Scheduled for 8-10 August 2016 in Bangkok, Thailand. For more info visit: www.fishadapt.com/modules/conference/

2nd Global Summit on Aquaculture and Fisheries

Scheduled for 11-13 July 2016 in Kuala Lumpur, Malaysia.

For additional info visit: http://aquaculture.global-summit.com

11th Asian Fisheries and Aquaculture Forum 2016

The Forum is scheduled for 3-7 August 2016 in Bangkok, Thailand.

For more details visit: www.asianfisheriessociety.org

11th International Conference on Recirculating Aquaculture

Scheduled for 19-21 August 2016 in Roaanoke, USA.

For additional info visit: www.recircaqua.com

2nd Fisheries and Aquaculture Conference.

Scheduled for 24-26 August 2016 in Xian, China.

For additional info visit: www.engil.org/ws2016/Home.aspx?ID-792

3rd International Conference on Fisheries and Aquaculture 2016

Scheduled for 24-25 August 2016 in Negombo, Sri Lanka.

For additional info visit: http://aquaconference.com

VIV China 2016

Scheduled for 6-8 September 2016 in Beijing, China.

For additional info visit: vivchina.nl/en/Bezoeker.aspx

AquaEpi 1-2016

First global conference on aquatic animal epidemiology scheduled for 20-22 September 2016 in Oslo, Norway.

For info log on to: http://www.berg-hansen.no/eventportal/?E=1453&A=55839&Att=0&Web NO-1&Sec=cbblpkckkZKtcxiK

International Fisheries Synposium 2016

Scheduled for 31 Oct-2 Nov 2016 in Quoc Island, Vietnam.

For more details visit: www.ifs2016.ctu.edu.vn

4th International Conference on Fisheries and Aquaculture

Scheduled for 28-30 November 2016 in San Antonio, USA.

For more info visit: www.fisheries.conferences.com

AFS MEMBERSHIP RENEWAL NOTICE

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Thank you all AFS Members for your ongoing commitment and support towards the Society!

The Secretariat has started to update the Members details in database.

Therefore, the Secretariat requests all AFS members to up-date their membership dues and contact information, to the Secretariat via email at info@asianfisheriessociety.org

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Please apply your membership at http://www.asianfisheriessociety.org/join.php.

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SYNOPSIS OF PAPERS VOLUME 29 (ISSUE 1) : ASIAN FISHERIES SCIENCE JOURNAL

Gendered Spaces in Abalone Fisheries in the Philippines

ALICE PRIETO-CAROLINO, HANNY JOHN MEDIODIA, CHERRY ANASCO,

ROWENA PAZ GELVEZON and FE GABUNADA

This paper analysed the social, economic and ecosystem conditions of abalone fishing in seven abalone-producing provinces in the Philippines. In the province of Iloilo, a closer examination of how these factors shaped patterns of resource access, control and benefits by women and men vis-à-vis their roles in production, reproduction and in the community was done. Gleaning in tidal flats was usually undertaken by women while skin diving in deeper parts of the sea was performed only by men. On average, abalone fishing contributed 56% to the total household income. Men had greater access and control over abalone fisheries. Women's access and control were constrained by the location of the resource and access to it, religion and household responsibilities. There is a need, however, to recognise the complementation of the roles of men and women in abalone fisheries, in the home and in the community as starting point towards more judicious management of abalone fisheries.

Population Dynamics and Fishery of Roughear Scad *Decapterus tabl* Berry 1968 (Perciformes: Carangidae) in Camotes Sea, Central Philippines

CHARINA I. NARIDO, HERMINIE P. PALLA, FRANCIS ALBERT T. ARGENTEand PAUL JOHN L. GERALDINO

Population dynamics and fishery status of the roughear scad, *Decapteru stabl* Berry 1968 caught from Camotes Sea, Central Philippines were investigated. Asymptotic length ($L\infty$) was 32.55 cm while growth coefficient (K) was 0.97 year^{-1}. Total mortality (Z) was 5.57 year^{-1} while natural mortality (M) and fishing mortality (F) were 1.71 year^{-1}and 3.86 year^{-1} respectively. Exploitation level (E) was 0.69. The length at which 50% of the fish were retained by the gear (L_{50}) was 17.48 cm. The recruitment pattern was continuous with one major peak in the months of February-March. The coefficient "b" of the length-weight relationship (LWR) was 2.986 ($\pm$0.178) indicating isometric growth while results of the length-length relationships(LLRs) were highly correlated (r^2 =0.99, p<0.01).The fishery of roughear scad revealed mean monthly catch per unit effort (CPUE) and income per unit effort (IPUE) ranging from 0.83-11.48 kg·man^{-1}·h^{-1} and 73.10-1247.80 peso·man·h^{-1}(1.72-29.39 USD) while total catch was estimated at 144,856 tonnes during the study period. High Z and Fsuggest that the roughear scad is facing high level of exploitation in the Camotes Sea. It is recommended that the reproductive biologyshould be studied to properly address the fishing pressure confronting this species.

Age, Growth and Mortality of Brown Stripe Snapper *Lutjanus vitta* (Quoy and Gaimard 1824) from West Sulu Sea, Philippines

HERMINIE P. PALLA, BENJAMIN J. GONZALES, FILIPINA B. SOTTO, ANTHONY S. ILANO and KATSUNORI TACHIHARA

The age, growth and mortality parameters of brown stripe snapper *Lutjanus vitta* (Quoy and Gaimard 1824) from west Sulu Sea were investigated. Brown stripe snappers were sampled from small-scale bottom set longline landings from October 2012 until December 2013. The oldest recorded male was 11.71 years and female was 10.71 years, and measured 33.5 and 26.5 cm, respectively. Examination of sectioned otolith margins (n= 490) indicated annuli deposition in December and January which was closely related to the lowest water temperature in Sulu Sea. The von Bertalanffy growth parameters (male L_∞ = 32.5 cm, K= 0.34 year^{-1}, t_0 = -1.68 year; female L_∞= 27.1 cm, K = 0.53 year^{-1}, t_0 = -1.30 year) differed significantly between sexes (ARSS F= 6.33, d.f. =22, p< 0.05). The estimated total mortality rates were, 0.53 year^{-1} (male) and 0.50 year^{-1} (female). Linear relations between otolith weight and age implies continuous growth proportional to age and otolith weight and therefore, otolith weight may be used as proxy to predict age in future stock assessment.

Biomedical Potential and Preliminary Phytochemistry of the Brown Seaweed *Sargassum wightii* Greville ex J. Agardh 1848

RAVI, C.*, MUTHAMIL, R. and KARTHIGA A.

The brown seaweed *Sargassum wightii* Greville ex J. Agardh 1848was collected from Pamban (south east coast of Tamilnadu, India) and extracted with different solvents such as acetone, ethanol, benzene and chloroform in a soxhlet apparatus. The antibacterial activity of the extracts were tested against natural pathogens isolated from housefly (*Musca domestica* Linnaeus 1758), such as *Staphylococcus aureus, Enterococcus faecalis, Bacillus cereus, Micrococcus luteus, Pseudomonas aeruginosa* and *Escherichia coli* respectively. The extracts were also subjected to alpha amylase inhibitory, anti-inflammatory and antioxidant activities following standard protocols. Ethanol extract exerted high inhibitory effect on all the microbes and was assertive against *B. cereus* (14. 2 mm). Potential and significant ($p<0.05$) alpha amylase inhibition was observed in the chloroform extract (81.24±8.063%). The benzene extract had significantly ($p<0.05$) higher antioxidant activity (74.44±3.27%) and the anti-inflammatory activity was comparatively higher in the acetone extract (65.5±1.21%). However, the control drugs exhibited better activity than all the tested extracts. The qualitative phytochemistry showed the presence of flavonoids, pholobatannins, phenolic compounds, aromatic acids and xanthoproteins. The Fourier transform infra-red (FT-IR) spectrum contained eight major peaks which confirmed the presence of amino, keto, fluoro alkane group and aromatic compounds in the extracts which could be responsible for the bioactivity.

Early Feeding by Cultured Paralarvae of *Octopus sinensis* d' Orbigny1841: Comparison of Survival, and Fatty Acid and Amino Acid Profiles, Using Two Species of *Artemia*

KEIJI MATSUBARA, SHUNZO MORII, MASAMI ABE, GOH NISHITANI, MASAZUMI NISHIKAWA, NOBUHIKO AKIYAMA and IAN G. GLEADALL

Experiments were performed to compare the effect on survival patterns of early paralarvae of the East Asian common octopus, *Octopus sinensis* d'Orbigny 1841, fed with one of two species of *Artemia*. Comparison of predator and prey nutritional content (amino acids and fatty acids) revealed that *O. sinensis* paralarvae raised on *Artemia* are relatively deficient in b-alanine, cysteine, carnitine and 20:01 unsaturated fatty acid. Using *Artemia tibetiana* Abatzopoulos, Zhang & Sorgeloos 1998 as sole prey resulted in better survival than with *Artemia franciscana* Kellog 1906 but the latter has better supply and pricing reliability and consistency in hatching. Feeding paralarvae on *A. franciscana* supplemented with a microalgal culture resulted in a survival pattern similar to that when paralarvae were fed with unsupplemented *A. tibetiana*. Therefore, future feed development will be based around amino acid supplementation of *A. franciscana* grown with microalgae.

SYNOPSIS OF PAPERS VOLUME 29 (ISSUE 2) : ASIAN FISHERIES SCIENCE JOURNAL

Growth Performance and Immune Response of Snakehead, *Channa striata* (Bloch 1793) Fed Soy Diets with Supplementation of Mannan Oligosaccharides

HIEN, TRAN THI THANH, DUC, PHAM MINH, TU, TRAN LE CAM, PHU, TRAN MINH, THY, DANG THUY MAI and BENGTSON, DAVID A.

This study evaluated the effectiveness of mannan oligosaccharides (MO) supplementation in fish meal (FM), soybean meal (SBM) and soy protein concentrate (SPC) formulated feeds for snakehead, *Channa striata* in a two-way factorial experiment. Factors were diet (FM, 40% FM replacement by SBM, and 40% FM replacement by SPC) and MO supplementation (0%, 0.2%, or 0.4% MO). Growth was significantly affected ($p<0.05$) by diet and MO, as well as their interaction. Feed conversion ratio, protein efficiency ratio and survival were significantly affected ($p<0.05$) by diet, but only survival was significantly affected ($p<0.05$) by MO supplementation, and interactions were insignificant ($p>0.05$). Red blood cell counts were not significantly affected ($p>0.05$) by diet, MO supplementation, or the interaction, but white blood cell counts were significantly affected ($p<0.05$) by diet and MO supplementation, not the interaction. Immunoglobulin (Ig) levels were significantly increased ($p<0.05$) by MO supplementation and the MO x diet interaction, but diet did not affect Ig levels ($p>0.05$). Following a 15-d bacterial challenge with *Aeromonas hydrophila*, lysozyme levels were significantly increased ($p<0.05$) by MO supplementation and the MO x diet interaction, but not by the diets themselves. Cumulative mortality did not differ among fish fed different diets ($p>0.05$).

Isolation and Identification of Protease-Producing *Pseudomonas* sp. PD14 in the Gut of Rabbitfish *Siganus guttatus* (Bloch 1787)

CINDY D. ARMADA and RHODA MAE C. SIMORA

Bacterial enzymes associated with the gut of fish are known to aid in digestion and nutrition of the host. Isolation, identification and characterisation of protease-producing bacteria from the gut of rabbitfish *Siganus guttatus* were carried out in the present study. Protease-producing bacteria were isolated in peptone gelatin agar (PGA) plates and the isolated strains were qualitatively and quantitatively screened for enzyme production. Highest protease activity, 25.32 ± 1.06 U·mg^{-1} protein, was observed in bacterial isolate PD14. Biochemical and molecular analysis revealed that the isolate is 99% homologous to *Pseudomonas* sp. Qualitative tests on enzyme production through measurement of the zone of hydrolysis further suggest that optimum protease production was 36 h at 40 °C, pH 7-8 in a peptone gelatin agar with 2% NaCl.

Linkages between Social-learning Networks and Farm Sustainability for Smallholder Shrimp Farmers in Sri Lanka

JESSICA P. WU, THERESA BURNS, KAWADUGAMA PRASANNA KUMARA, TIM DJAGER, TRISHA WESTERS, SYLVIA CHECKLEY, CARL RIBBLE, SAM DANIEL and CRAIG STEPHEN

In Sri Lanka, shrimp farmers' perceptions about access to knowledge and their knowledge-exchange social networks were examined. A cross-sectional survey of 225 farmers was completed in two separate shrimp farming regions. The questionnaire assessed social learning networks, farm-level sustainability, demographics, and wealth of farmers. Associations between the number of connections in social learning networks (degrees) and the other factors from the questionnaire were examined using Poisson regression analysis. Overall, social learning networks were not highly connected (median farmer degree =2) and network structure varied by geographic location and farmer ethnicity. Higher social learning network degrees were associated with increased wealth and decreased ecological sustainability; however, this varied by ethnicity. Significant differences in networks between geographic areas and ethnicities point to the need for contextually adapted knowledge mobilisation activities. Leveraging existing farmer-to-farmer peer networks by providing accurate knowledge through the existing networks, as well as strengthening the farmer-to-expert network, may provide the most relevant and effective route to disseminate information to affect practices to improve farm management and increase the likelihood of improved productivity and income.

Growth and Spawning Period of Ridged-eye Flounder *Pleuronichthys lighti* Wu 1929 in the Central Seto Inland Sea, Japan

MASAYUKI YAMAMOTO and SATOSHI KATAYAMA

Ridged-eye flounder *Pleuronichthys lighti* is a commercially important flatfish in East Asia. Its growth and spawning period in the central Seto Inland Sea, western Japan were examined. The gonadosomatic index increased from September to November, with a peak in November, and decreased from December. Females ≥1 year had mature eggs in November. The results suggest that the main spawning period was November. Using otolith sectioning and etching methods, the opaque zone in sectioned sagittal otoliths was found to be formed annually, during the spawning period. The maximum ages were 5 years old for both sexes. The parameters for the von Bertalanffy growth equation of both sexes were TL_∞= 262 mm, k = 1.18·year^{-1}, t_0 = 0.10 year, indicating that ridged-eye flounder grows rapidly until they are 1 year old.

Book Review

Checklist of the Parasites of Fishes of Malaysia, by J.R Arthur and M. Shariff.Universiti Putra Malaysia Press, Serdang, Malaysia. 2015. 374 pp. ISBN No 978-967-344-395-6.Soft cover

The 2015 *Checklist of the Parasites of Fishes of Malaysia* by Richard Arthur and Mohamed Shariff is a welcomed addition to fisheries libraries everywhere, and follows similar publications on fish parasites of the Philippines, Bangladesh and Vietnam. Incentive for producing these regional lists arises from the basic needs of an expanding aquaculture industry and the increasing intra- and interregional movement of cultured and wild fishes and invertebrates, and potential pathogens, throughout the Asia-Pacific region and beyond.

The parasite-host list uses a standard layout that includes official scientific name, mention of junior synonyms, location on or in the host, geographical distribution (by Malaysian state), habitat type (freshwater, brackish or marine), mention of useful taxonomic trip-ups that one should be aware of if following up a specific identification, and relevant notes on life cycles and zoonotic potential. The host-parasite lists provide a summary of all reports of parasites by host species, which includes both endemic and introduced species to the region. The literature cited is meticulous in accuracy and includes all reports from 1902 to 2013.

As summarized by the authors, the parasites listed include 425 nominal species: Protista – 18, Myxozoa – 22, Digenea – 39, Monogenoidea – 207, Cestoda – 72, Nematoda – 24, Acanthacephala – 4, Hirudinida – 1, Brachiura – 4, Copepoda – 26, Isopoda – 6 and Pentastomida – 2. Additional records of unidentified parasites are included. The host fishes include representatives of major lineages within the Elasmobranchii and the commercially important Actinopterygii in fresh and marine waters.

Regional parasite checklists like this one are typically the first resource reached for when one is faced with a parasite that needs identifying, and as such are invaluable tools for taxonomists, fish health diagnosticians and government regulators, all brands of fish parasite ecologists, and for theoreticians who digitize the data to test hypotheses on the evolution and biogeography of parasites and their hosts. Proof of the sustained usefulness of such check-lists is reflected in the physical state of copies in bookshelves in front of me, ones opened and closed and fingered through so much over the past 40 years they are giving up – tattered and torn with bent corners, round stains throughout, and dislodged pages on the verge of being mistakenly lost. This new *Checklist of the Parasites of Fishes of Malaysia* should be prepared for lots of use, given that only a small proportion of the fishes of Malaysia (196 of more than 1900 fish species) have been examined so far for parasites.

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Canada B4V 5R7

*The book can be ordered from M. Shariff (pshariff@gmail.com) at Malaysian Ringgit 70/copy excluding postage.

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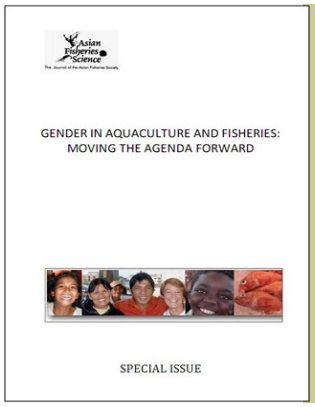

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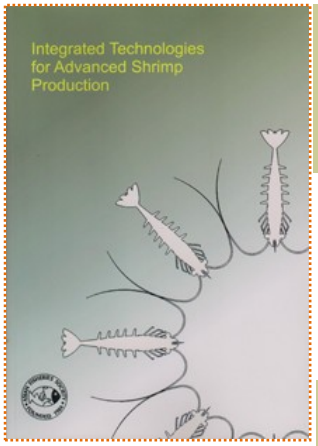
Gender in Aquaculture and Fisheries: Moving the Agenda Forward

MERYL J WILLIAMS, MARILYN PORTER, POH SZE CHOO, KYOKO KUSAKABE, VEIKILA VUKI, NIKITA GOPAL AND MELBA BONDAD-REANTASO

Gender in aquaculture and fisheries is still under-researched but interest is increasing. This volume shows progress in visualizing women's contribution to fisheries and aquaculture and also in structural analysis on value chains and institutions. Faced, however, with additional challenges such as climate change and economic integration, more nuanced analysis is now needed on ecological, economical, political and cultural systems. Factors such as class, age, ethnicity, race, caste, religion etc all come into play to define/condition gender relations.



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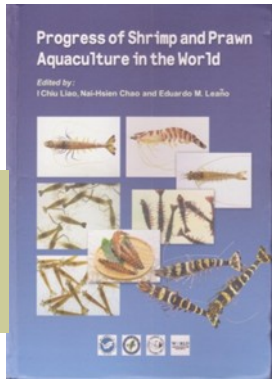
Integrated Technologies for Advanced Shrimp Production



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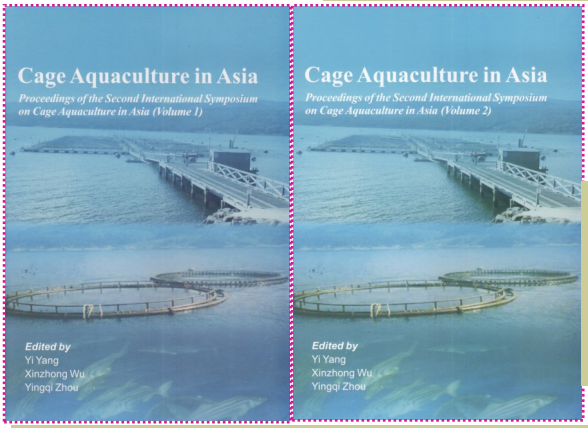

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Cage Aquaculture in Asia: Proceedings of the Second International Symposium on Cage Aquaculture in Asia (Volume 1 and Volume 2)

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