

SCIENTIFIC AND TECHNOLOGICAL ACHIEVEMENTS OF RESEARCH INSTITUTE FOR AQUACULTURE No.1 SINCE 2000

Director
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1. INTRODUCTION

Research Institute for Aquaculture No.1 (RIA1) is an organization under the Ministry of Agriculture and Rural Development. The main function of RIA1 is to carry out scientific and technological research in aquaculture, including: Selective breeding and seed production; Aquaculture techniques; Environmental management and disease prevention; Resource protection and development for coastal and inland water areas; Post-harvesting technology; Innovation and applying technology. Over fifty years of development, RIA1 has achieved several goals in terms of science and technology, which have contributed significantly to the development of the aquaculture sector in Vietnam. This paper will present some of the outstanding achievements of RIA1 from 2000 to date.

2. SCIENTIFIC AND TECHNOLOGICAL ACHIEVEMENTS

2.1. Selective breeding and seed production in aquaculture

- *Brackish and marine species*

From 2000 and especially since 2005, National Broodstock Center for Marine Species in Northern Vietnam and Aquaculture Research Sub-Institute for North Central was established. RIA1 was successful in achieving breeding technology for 6 marine fish species and several molluscs as well as crustacean species of high economic value which could be a good candidate for commercial culture scale. For example: Orange-spotted grouper (*Epinephelus coioides*), humpback grouper (*Cromileptes altivelis*), cobia (*Rachycentron canadum*), Red drum (*Sciaenops ocellatus*), pompano (*Trachinotus blochii*), brown-marbled grouper (*Epinephelus fucogustatus*), greasyback shrimp (*Metapenaeus ensis*), Ben Tre hard clam (*Meretrix lyrata*), Asiatic hard clam (*Meretrix meretrix*), carpet clam (*Paphia undulata*), oysters (*Crassostrea rivularis*), Pacific oyster (*Crassostrea gigas*), otter shell (*Lutraria rhynchaena*), white leg shrimp (*Litopenaeus vannamei*). A number of companies and farmers have applied grow-out technologies of the species above in such provinces like Hai Phong, Quang Ninh, Phu Yen, Khanh Hoa for the marine fish and in Van Don- Quang Ninh, Cat Ba-Hai Phong the mollusc species (Otter clam and Pacific oyster). The Ben Tre hard clam seeds are now produced artificially in Nam Dinh, Thai Binh, Ninh Binh, Nghe An and cultured in several North Central provinces such as Thanh Hoa, Nghe An and Thua Thien - Hue.

Since late 2003, as a research outcome of RIA1, numerous aquatic species were pilot hatched/nursed such as post larvae (PL) of shrimp in Quang Ninh, Hai Phong, Nghe An, Phu Yen, juvenile marine fish were cultured in Khanh Hoa, Da Nang, Nam Dinh and Nghe An. The results were highly efficient, not only in these provinces, but also later in other provinces in Vietnam. For instance, from larvae to juvenile stage, survival rate of marine fish species in local hatcheries was high and ranged from 4% (grouper) up to 20% (pompano and red drum).

Currently, RIA1 is continuing to study and complete breeding technology of high economic value species such as humpback grouper (*Cromileptes altivelis* Valenciennes), coral trout (*P. leopardus*) and mangrove red snapper (*Lutjanus argentimaculatus*). RIA1 has recently been successful in artificial spawning and nursing techniques for the giant grouper (*Epinephelus lanceolatus*) from larvae to fingerling stage and is further developing nursing techniques for Giant grouper from fingerling to juvenile stage. Furthermore, RIA1 has produced 120 000 juveniles of fourfinger threadfin (*Eleutheronema tetradctylum*) with the size of 3 to 5 cm a fish in high demand in by Chinese customers.

According to RIA1, the level of reproduction technology for marine species of Vietnam is similar or higher than many other Southeast Asian countries and equal to 60% of the level of Taiwan. This achievement has contributed and promoted the rapid development of marine

aquaculture in coastal provinces, such as; Hai Phong, Quang Ninh, Nam Dinh, Nghe An, Phu Yen and Khanh Hoa.

In terms of molluscs, RIA1 completed studies on breeding technologies for Pacific oysters, Ben Tre hard clam and Otter clam. The most important achievement is high and stable survival rate (6-10%) from D-shape larvae to juvenile seed stage. Recently, Pacific oysters were reintroduced into Vietnam, and now several coastal provinces in North East Vietnam culture this species. As a result, there are more and more job opportunities for local people. Total production of Pacific oysters' seed in Vietnam can now supply not only domestic, but also international market. The hatchery production of Ben Tre hard clam seed is increasing day by day while natural seed resources are decreasing due to demand, thus the success in breeding technology for good quality seed of Ben Tre hard clam is important to farmers.

For crustacean species, RIA1 was successful in producing scientific pathogen free (SPF) broodstock of white leg shrimp (*Litopenaeus vannamei*). In 2009, a quarantine unit of RIA1's hatchery at Cat Ba Island - Hai Phong, produced the first generation of SPF white leg shrimp broodstock. The successful breeding technology for white leg shrimp was achieved by specifically being free of five diseases (TSV, WSSV, YHV, IHHNV, and MBV), and having a maturity rate >70%; hatching rate >75%; number of egg/female brooders/spawning > 150.000 eggs; and survival rate from nauplii to PL1: 20%.

RIA1 also focuses on genetics and selective breeding research, in particular, genomic sequencing for tiger shrimp; selective breeding for SPF white leg shrimp and selection for enhanced growth performance for tilapia in brackish water and cobia; and inducing polyploidy of oysters.

- Fresh water species

Up to date, RIA1 has achieved controlled breeding of a number of freshwater species, namely silver carp (*Hypophthalmichthys molitrix*), mud carp (*Cirrhinus molitorella*), grass carp (*Ctenopharyngodon idellus*) and common carp (*Cyprinus carpio*). RIA1 also focuses on high demand, valuable and native species such as freshwater catfish or ca lang (*Hemibagrus guttatus*), anh vu (*Semilabeo obscurus*), dam xanh (*Sinilabeo lemassoni*), and goonch catfish (*Bagarius rutilus*).

Tilapia is an important and very common species farmed in freshwater areas and ranks second in terms of total production and rearing after Tra and Basa catfish. In Vietnam, RIA1 is the first organization to conduct studies on genetic selection and seed production of tilapia. In 1998, the first selective breeding program for tilapia started, with a focus on growth and cold tolerance traits. Over several generations, the selected strain of tilapia of RIA1 (known as NOVIT4) shows many advantages, because of a very good genetic gain and selection response. Growth rate of NOVIT4 strain is 33% higher than the base (control) population. The NOVIT4 strain is reared in a wide range of culture areas and systems and it plays an important role in development of tilapia culture in Vietnam. Additionally, RIA1 has implemented a selective breeding program for tilapia in brackish water environments since 2006. Tilapia was spawning in water with salinity levels of 15‰. Growth performance and survival rate of tilapia were examined in different salinity levels from 15‰ to 20‰. The estimated heritability for growth traits was high (0.64). The result also indicated a significant difference in harvest weight between the selected stock and the base (control) stock ($P < 0.05$). Selection response for harvest weight was from 11.2-24.6% per generation.

RIA1 has also been successful in producing all male tilapia by applied sex reversal technology (17 α -Methyl testosterone). Some achievements are as follows: maturity rate >80%, hatching rate >75%; survival rate to 21 days post hatch (DPH) >75%; and all male rate >95%. The technology has been transferred to other hatcheries around Vietnam by RIA1 in order to provide good tilapia seed to farmers.

In recent years, the Institute has also been successful in producing all male tilapia by crossing different strains/species. The resulting percentage of males in the progeny population

is >95% and farmers have accepted the fingerlings produced through this cross breeding technique.

A study on seed production of native and vulnerable/endangered species, such as fresh water catfish or ca lang (*Hemibagrus guttatus*), anh vu (*Semilabeo obscurus*), dam xanh (*Sinilabeo lemassoni*), goonch catfish (*Bagarius rutilus*) and track eel (*Mastacembelus armatus*), was implemented with the purpose of preserving and introducing new valuable species for aquaculture. The RIA1 developed the complete technology for breeding and rearing of the species mentioned above. As for breeding techniques, an average maturity rate of >80%; spawning rate >80%; fertilization rate >65%, hatching rate >60%; survival rate from larvae to 15 DPH 80%; survival rate from 15 DPH to 30 DPH 80%; survival rate from fingerling or juvenile 80% has been achieved. The breeding technologies for vulnerable species have been transferred to numerous local hatcheries in Nam Dinh, Phu Tho, Vinh Phuc, Bac Giang, Thanh Hoa and Nghe An.

In terms of seed production for cold-water species, RIA1 was successful in transferring and introducing new commercial species, such as rainbow trout (*Oncorhynchus mykiss*), Siberian sturgeon (*Acipenser baerii*) and European whitefish (*Coregonus lavaretus*) into Vietnam. Hence, there are additional species for freshwater resources with high economic value available. The rainbow trout and sturgeon were imported in 2005 and the Institute conducted a pilot rearing program in the Centre for Cold water Aquaculture Research in Sapa - Lao Cai resulting in large improvements in selective breeding and grow out for rainbow trout. The first artificial spawning of rainbow trout was in 2008. By 2010, RIA1 developed a new technology to produce all female rainbow trout with a higher growth rate, higher production and better quality. The Institute also started a selective breeding program for rainbow trout with focus on growth performance and higher temperature tolerance under the natural conditions of Vietnam.. As a result, rainbow trout now is cultured in more than 15 provinces in Vietnam. As for sturgeon, a broodstock is cultured and used to study artificial breeding by RIA1. However, in order to fulfil farmer's demand, fertilized eggs still has to be imported, incubated and nursed to juvenile stage at RIA1.

2.2. Nutrition and culture technologies

This is a new field for RIA1, though in recent years, RIA1 have promoted training of young researchers in this area and focused on research for aquafeed production for key aquaculture species including marine fish, tilapia, salmon and sturgeon. Also RIA1 has invested in the processing technology chain for aquafeed research. Some achievements have been made such as identification of nutritional requirements of important aquaculture species and determination of the right diets for different stages of tilapia farming, spotted longbarbel catfish /giant catfish (*Hemibagrus guttatus*), some other marine fish (silver snapper, groupers) and cold-water fish (salmon, sturgeon) for industrial farming. Research has been done on finding plant protein alternatives to animal protein, improvement of efficiency of plant protein usage, rational use of lipid sources for energy supply, application of enzymes in feed production, nutritional requirements of broodstock and larvae of some farmed marine fish.

Along with the research on seed production and aquafeed, development of techniques for modern industrial farming was studied. RIA1 developed many effective technical procedures for commercial production of freshwater, brackish and marine farming regarding to food hygiene and safety as follows:

- Technical procedures for commercial production of high economic value freshwater species: common carp, spotted longbarbel catfish (giant catfish), anh vu fish (*Semilabeo notabilis*), barramundi, spinibarbus caldwebli, rainbow trout and tilapia, ...
- Technical procedures for commercial production of high economic value marine species: White legged shrimp, greasyback shrimp, kuruma shrimp, hard clams, oysters, otter clam, grouper, cobia, snapper, pompano ...
- Technical procedures for intensive farming of black tiger shrimp, white legged

shrimp.

- Technical procedures for fish farming in reservoirs.
- Investigation and application of techniques for cage farming of marine fish in Norwegian style cages in open sea have also been done and technical advice has been provided to aquaculture companies and investors willing to apply these techniques as seen in Quang Ninh, Ha Tinh, Quang Binh, Phu Yen provinces. Currently, RIA1 continues work on this project.

2.3. Environment and management of aquatic animal health

Environmental monitoring and early warning has been carried out at by RIA1 from 2000 to present. Sampling and sample analysis are done annually focusing in shrimp farming area, marine fish cages, evaluation of environmental changes and disease occurred in each sampling areas at each sampling time. In addition, unscheduled observations are also made in response to the environmental problems and diseases. The findings are analysed and timely informed farmers and local fishery agencies as well as fishery authorities for updating and to assist fast response. Findings are uploaded to a database which can easily be accessed at the internet.

RIA1 provided instructions on assessment of environmental impact from freshwater aquaculture as well as its gradual practical application according to the national standards for wastewater management from aquaculture. RIA1 has also established procedures for health management of freshwater fish cultured in cages, ponds and lakes.

Research in diseases has focused on identification of pathogens, environmental causes in order to find suitable measures for the environmental management. On the other hand, vaccines for some diseases that can cause massive mortality have been studied. Recently, RIA1 was actively involved in research on diseases of major important species such as black tiger shrimp, white shrimp, clams and otter clams with an encouraging achievement.

3. TECHNOLOGY TRANSFER

Since 2000, RIA1 has transferred 15 different techniques for seed production and growout culture to hatcheries and fish farms. The transferred techniques have been effectively adopted by the industry.

During the technology transfer, the projects have established models for hatcheries and growout production of high value species which fit the natural and social conditions in the coastal provinces and which will contribute to improve the production efficiency for household based farms. As an example hatchery production of Ben Tre clam seed production has been transferred to the provinces of Thanh Hoa, Nam Dinh, Ben Tre, Thai Binh and Nghe An. So far, present clam seed production has been estimated about 4-6 billion pieces per year.

The projects have contributed to strengthening awareness among stakeholders to comply with technical guidelines on protection of ecological environment thus assisting in reducing diseases during their farming.

Some major techniques, which have been transferred during recent years:

No	Techniques transferred
1	Techniques for hatchery and growout production of orange-spotted grouper (<i>Epinephelus coioides</i>)
2	Techniques for hatchery and growout production of mouse grouper (<i>Cromileptes altivelis</i>)
3	Techniques for hatchery and growout production of red drum (<i>Sciaenops ocellatus</i>)
4	Techniques for hatchery and growout production of pompano (<i>Trachinotus ssp.</i>)
5	Techniques for hatchery and growout production of cobia (<i>Rachycentron canadum</i>)
6	Techniques for hatchery and growout production of otter clam (<i>Lutraria rhynchaena</i>)
7	Techniques for hatchery and growout production of Ben Tre clam (<i>Meretrix lyrata</i>), and carpet clam (<i>Paphia undulata</i>)
8	Techniques for hatchery and growout production of Pacific oyster (<i>Crassostrea gigas</i>)

9	Techniques for production of SPF white legged shrimp broodstock (<i>Penaeus vannamei</i>)
10	Techniques for hatchery and growout production of spotted longbarbel catfish/giant catfish (<i>Hemibagrus guttatus</i>)
11	Techniques for hatchery and growout production of rainbow trout (<i>Oncorhynchus mykiss</i>)
12	Techniques for production of monosex tilapia by crossing species
13	Methyltestosterone techniques for production of monosex tilapia
14	Techniques for selected breeding of tilapia
15	Techniques for hatchery production of RIA1 common carp

4. CONCLUSION

The achievements in science and technology of RIA1 especially during recent years have helped promote the development of aquaculture in Vietnam by initiation of marine and brackish water farming into a new position with in-country seed production and the establishing of commercial industrial farming. RIA1 in recent years has worked closely with central and local agencies in order to develop new concepts and techniques, which then can be promoted to be applied in rural, mountainous and coastal areas. RIA1 is willing to cooperate with individuals, groups, business operators, national and international organizations in order to carry out technical transfer or technical training as required.

EFFECT OF SALINITY AND STOCKING DENSITY ON GROWTH AND SURVIVAL RATE OF SNUBNOSE POMPARO (*Trachinotus blochii* Lacepède, 1801) REARING FROM JUVERNILE TO FINGERLING

Chu Chi Thiet, Nguyen Thi Le Thuy and Le Xan

ABSTRACT

Study on effect of salinity and stocking density on 21 day-old Snubnose pompano (*Trachinotus blochii* Lacepède, 1801) was conducted in three experiments. Experiment 1: Fish were stocked at different salinity levels at 10, 15, 20, 25, 30 and 35‰ in 48 hours; experiment 2: Fish were stocked at different salinity levels at 10, 15, 20, 25, 30 and 35‰ in 28 days; and experiment 3: Fish were stocked at three different densities of 1.0 fish per liter, 1.5 fish per liter and 2.0 fish per liter in 28 days. The results indicate that Snubnose pompano were not affected by different salinity conditions, as the survival rate of fish after 48 hours varied from 97.67±0.58% to 99.67±0.76%, but with no significant difference among the treatments ($P>0.05$). The experiment on rearing fish in different salinity levels showed that at salinity range from 20 to 25‰ provided the best conditions for growth as they grew, significantly faster than the fish reared at salinities of 10, 15, 30 and 35‰ ($P<0.05$). Fish reared at stocking density of 1.0-fish/l had the highest growth rate (1.69±0.14 g), which was significantly different from those fish reared at stocking densities of 2.0-fish/l (1.23±0.03 g) There were no difference from those fish reared at 1.5-fish/l (1.49±0.09 g). Survival rate of fish after 28 days was not affected by salinity and stocking density in the above experiments. Thus, the results of the experiments indicated that the range of salinity between 20 and 25‰ and stocking density of 1.5-fish/l most suitable for rearing Snubnose pompano in hatcheries for rearing of the juvenile Snubnose pompano.

Keywords: *Snubnose pompano*, *Trachinotus blochii*, salinity, stocking density, survival rate.

APPLICATION OF THE MOM (*Modelling – Ongrowing fish farm – Monitoring system*) METHOD FOR ENVIRONMENT IMPACT ASSESSMENT OF MARINE FISH FARMS IN VIETNAM

Mai Van Tai, Nguyen Duc Binh, Nguyen Thi Minh Nguyet, Nguyen Quang Chuong

ABSTRACT

Modelling – Ongrowing fish farm – Monitoring system (MOM) is a method to assess environmental capacity and can be used to proposed environmental monitoring plans and to estimate the extent of environmental impact from marine cage fish farms in Norway. The same method was applied to estimate the environmental impact from marine cages in Ben Beo bay, Cat Ba, Hai Phong in 2010. Investigation type B and type C components of MOM monitoring was done, adding a number of environmental parameters such as water temperature, pH/Eh, salinity, NH₄-N, NO₂- N, PO₄-P, COD and H₂S. The results indicated that the water environment and Ben Beo bay sediments polluted by organic matter derived mainly from marine cage fish farming. Levels of organic carbon, nitrogen and phosphorus in the sediment were higher than those in the intermediate and control samples (P<0.01). The investigation type B and type C showed that environmental conditions in the bay around the marine fish cages have reached or exceeded the environmental carrying capacity. In the water column DO was often low and NH₄-N and COD exceeded the Vietnam standards for environment quality of aquatic animals. Initial trials of using the MOM method in Vietnam show that the investigation type B was suitable while investigation type C should be studied further in benthic diversity as it is influenced by a number of other activities such as tourism, transportation, fishing, domestic waste discharge and pollution. When MOM is applied, additional criteria for water and sediment quality standards of coastal area (QCVN 10: 2008/BTNMT) can be used Vietnam.

Keywords: MOM system, environmental carrying capacity, environment impact assessment, environmental monitoring, marine fish farm, coastal water and sediment.

SPECIES COMPOSITION AND DENSITIES OF TOXIC ALGAE AT IMPORTANT AQUACULTURE AREAS IN HA LONG BAY, VIETNAM

Nguyen Thi La, Bui Dac Thuyet, Nguyễn Thị Minh Nguyệt, Le Thi Anh Tuyet

ABSTRACT

Microalgae play an important role in aquatic ecosystems in terms of producing primary biological production in the food web and generating dissolved oxygen in the water column. However, some microalgae may release toxins or “bloom” with excessive density which can harm the aquatic ecosystem, human health as well as important economic activities (e.g. aquaculture, fisheries, tourism). In fact, a “red tide” occurred in the eastern part of Cat Ba Island, Ha Long bay, which had a serious negative impact on the marine farms in the area. This study therefore investigated species composition and the variation and density of toxic algae at some aquaculture areas in Ha Long bay, contributing to reduction of negative impacts on aquaculture caused from toxic algae. The results of this study found 26 toxic algal species in shellfish farming areas at Ban Sen, Quang Ninh Province and 20 toxic algal species in fish farming areas at Ben Beo, Hai Phong Province. The toxic algae were mainly in genera of *Dinophysis*, *Ceratium*, *Pseudo-Nitzschia* and *Prorocentrum*. The density of most toxic algae groups was generally lower than the warning level of toxic algae in the marine environment, except the *Dinophysis* genus (in May, August and October 2010). The results also showed that the highest density of genus *Prorocentrum* occurred in May, *Dinophysis* and *Pseudo-Nitzschia* in August and *Ceratium* in October 2010. The excess level of toxic algae in *Dinophysis* genus at several times within a year showed that such toxic algal species should be managed in aquatic products since their toxins may cause diarrhetic shellfish poisoning (DSP).

Key words: *Aquaculture, Ha Long, red tide, toxic algae.*

CAUSATIVE AGENT OF DARK BODY DISEASE IN CLIMBING PERCH (*Anabas testudineus*) IN INTENSIVE CULTURE

Dang Thi Lua, Phan Thi Van, Pham The Viet, Ngo Thi Ngoc Thuy

ABSTRACT

Climbing perch, a native fish species in Vietnam, has been taken into intensive farming in freshwater environments. The fish can be infected by dark body disease during the culture period and the diseased fish show clinical signs such as dark body, haemorrhagic or yellowish liver, no food or very little food in intestines. The disease usually occurs when the fish is 20-60 days old with mortality rates from 40-70%, and with unusual cases with mortality rates as high as 90-100%. By application of methods for isolation and identification of all pathogens, using electron microscopy and experimental artificial infections, the causative agent of the dark body disease was identified as viruses parasited in the cytoplasm of host cells. Viruses have symmetric shape structure with the size of about 150-160 nm and is surrounded by capsid layer. Liver and kidney of climbing perch are most suitable organs of the dark body disease.

Key words: Dark body disease, climbing perch, filtrate, electron microscopy, histopathology, pathogen of dark body disease, virus.

HISTOPATHOLOGICAL AND ULTRASTRUCTURAL FINDINGS OF OTTER CLAM (*Lutraria philippinarum* Reeve, 1854) IN DISEASE OUTBREAKS

Phan Thi Van, Dang Thi Lua, Truong Thi My Hanh, Tran Thi Ly

ABSTRACT

Outbreaks of disease in otter clam have occurred in most farming areas throughout the Viet Nam from the end of 2011, starting from Khanh Hoa province to Hai Phong and Quang Ninh provinces, causing serious damage to otter clam farming. High mortality in all otter clam farms both for the fingerlings and the commercial sizes clams. Clinical signs are swelling and flaking siphon. In this paper, histopathological and electron microscope techniques were used to determine changes in structures and ultrastructures of diseased otter clam from outbreaks and determine the presence of pathogens in diseased otter clam. This paper describe structural changes of gills, mantle, liver and hose muscle tissues as well as presence of microbial structures virus-like in the hose muscle of the diseased otter clam. This is the first time results related to diseased otter clam during the serious disease outbreaks have been presented and the results will enhance the scientific base for identifying the causative agent and for developing affective measures for control of disease outbreaks.

Key words: *Otter clam, swelling siphon, histopathology, electron microscopy, virus-like.*

EFFECTS OF REPLACING FISH MEAL WITH DRIED BREWER'S YEAST IN FEED ON THE GROWTH OF TILAPIA (*Oreochromis niloticus*)

Tong Hoai Nam, Hoang Van Dat, Pham Anh Tuan, Nguyen Bich Hue, Nguyen Quang Huy

ABSTRACT

Four diets at the same nutritional composition (DE 2287-2314 kcal/g, P 30%, L 6%), but different in the rate of dried brewers yeast at 0% (MB0), 5% (MB5), 10% (MB10) and 15% (MB15) corresponding to the rate of fish meal, respectively, at 15%, 10%, 5% and 0% were used in a trial with Tilapia (*Oreochromis niloticus*). Experimental fish with initial size at 40 ± 1.96 g/fish were fed using four different diets for 75 day with feeding 3 times per day at proper feeding rate. Results showed that fish fed with MB5 and MB15 formulations had highest growth performance, lowest feed conversion ratio, highest protein efficiency rate ($P < 0.05$) with a survival rate from 96.30-97.67%. There was no significant difference between different diets ($P < 0.05$). There was a correlation between substituted dried brewer's yeast to the average growth of the fish ($y = - 0.0046 x^2 + 0.00644 x + 1.7667$, $R^2 = 0.8192$). Therefore, the rate of dried brewers yeast at 5% and 10% in the diet showed the best results. Dried brewer's yeast can replace 33–66% of fish meal in Tilapia diets at the 40-200g phase.

Keywords: *Tilapia*, *Oreochromis niloticus*, dried brewer's yeast, growth.

**DESCRIPTION OF A NEW SPECIES OF THE GENUS *Channa hanna*
Scopoli, 1777 (PERCIFORMES, CHANNIDAE) DISCOVERED
IN HA NAM PROVINCE, VIETNAM**

Nguyễn Văn Hảo, Bùi Đình Đăng, Nguyễn Mạnh Tiến

ABSTRACT

The article talks about a new freshwater fish *Channa hanamensis* sp.n. of the Small snakehead, having no ventral fins, of the genus *Channa* (Channidae, Perciformes). The new species is described based on the sample taken from Tam Chuc lake, Ba Sao town, Kim Bang district, Ha Nam province, Viet Nam. This species differs from three other *Channa* species namely *C. asiatica* Linnaeus, 1758, *C.nox* Zhang (Musikasithorn & Watanabe, 2002) and *C. ninhbinhensis* (Nguyen V.H, 2011). The difference are that the mouth is arched, deep and narrow, and the length is greater than it is wide. There are 60 upper lateral-line scales (61-63). The body has between 55-57 vertebrae. There are 4-6 gill rakers on the first arch. This newly discovered fish is also distinguished from the species *C. hoaluensis* Nguyen V.H, 2011 by the combination of the following characters: The dorsal fin originates in front of or opposite to that of the pectoral fin. The anal fin originates between the snout tip and the caudal fin tip. The tongue is flat and thin, short and a little arched. The tip of the tongue is triangular, with a waist in the middle, wide at the back and occupies incomplete width of the oral cavity. The body has 10-12 crossed bracket strips.

Key words: *Perciformes, Channidae, genus Channa, new species, Ha Nam, Viet Nam.*

EVALUATION OF GROWTH PERFORMANCE AND SURVIVAL RATE OF 16 CROSSES FROM FOUR NILE TILAPIA STRAINS

Nguyen Thi Hoa, Ngo Phu Thoa, Nguyen Huu Ninh, Nguyen Hong Diep, Nguyen Hoai Nam

ABSTRACT

The complete diallele cross (4×4) have been used to evaluate growth performance and survival rate of four Nile tilapia strains, namely Thailand strain, Taiwan strain, Israel strain and Novit-4 strain. A total 6,735 fish from 16 crosses was reared at three different water temperature in water tank environments at 15- 20⁰C, 20-25⁰C and 15-30⁰C. Statistical analyses using a generalized linear model (GLM) was performed to test the the systematic effects associated with body strait measurements. The model was fitted using PROC MIXED in SAS and comprised an overall mean, three main effects (cross, environment and sex) and two-way interactions, linear regression on age at harvest and residual error term. This paper presents the growth performance and survival rate of the 16 crosses (4×4 complete diallele cross) from the four Nile tilapia strains in the three water temperature environments. Four crosses between Novit-4 strain and Taiwan strain (N×N, D×D, N×D and D×N) showed better gowth performance compared with the other crosses (P<0.05). However, the survival rate were not significantly differentbetween the 16 crosses (P>0.05).

Key words: *Nile tilapia, growth performance, survival rate, diallele cross.*

CRYOPRESERVATION OF PACIFIC OYSTER (*Crassostrea gigas*) IN LIQUID NITROGEN

Kim Thi Thoa, Pham Hong Nhat, Nguyen Van Dai, Vu Van Vien

ABSTRACT

This paper presents the process of sperm cryopreservation for Pacific Oyster in liquid nitrogen based on determined suitable cryoprotectants, these concentration and extender solutions. The two extender solutions (sterilized seawater, Hank's free canxi CF-HBSS 1000 mOsmol/kg) and two cryoprotectants which were permeating cryoprotectants (Dimethyl sulfoxide DMSO, methanol MeOH, ethylenglycol EG) and non-permeating or membrane protection cryoprotectant (Polyethylene glycol at formula weight of 200 - PEG 200) have been tested. The trial with 2% PEG / 10% DMSO cryoprotectant and CF-HBSS extender solution, the dilution ratio of 1:9 (semen:extender), the freezing program as reported by Yanksson and Moyse (1991) with freezing rate of $4,6^{\circ}\text{Cmin}^{-1}$ from 0°C to -70°C showed the highest fertilization and hatching rate of $66.38 \pm 0.72\%$ and $78.94 \pm 0.53\%$ with fresh sperm (81.04% , and 82.88%) ($P < 0.05$), respectively.

Keywords: *Cryopreservation, cryoprotectant, Crassostrea gigas, extender, Pacific oyster.*

RESEARCHING ON BROODSTOCK MATURATION AND SPAWNING STIMULATION OF CHANNEL CATFISH *Ictalurus punctatus* (Rafinesque, 1818)

Nguyen Anh Hieu, Dang Van Hoan, Vo Van Binh, Nguyen Huu Ninh

ABSTRACT

Success in reproduction of catfish *Ictalurus punctatus* (Rafinesque, 1818) will contribute to sustainable juvenile production of catfish and be part of ensuring continued growth for the catfish industry. This article presents the latest research in broodstock maturation, spawning stimulation and embryo hatching of channel catfish *Ictalurus punctatus*. Broodstock maturation in artificial conditions using industrial feed containing 35% protein had a maturation rate of 82.7% in female fish. Using stimulated reproductive dose 50 µg LRHa and 5 mg DOM per kg of female fish the spawning rate was 66.7%, fertilization rate 92.7% and the hatching rate 70.3%. The effective time of stimulated dose was from 20-28 hours and the hatching time was from 130-135 hours at water temperatures of 25.5-28.0°C.

Keywords: *Catfish, broodstock maturation, spawning stimulation.*

NURSING OF CHANNEL CATFISH *Ictalurus punctatus*

Nguyen Anh Hieu, Dang Van Hoan, Vo Van Binh, Nguyen Huu Ninh

ABSTRACT

Research on optimal rearing density and feed for channel catfish *Ictalurus punctatus* (Rafinesque, 1818) from fry to juvenile stages is needed to develop artificial seed production for aquaculture and thus to close the life cycle of this species. This article presents the latest results of the effect of rearing density and feed on growth and survival rates of channel catfish *Ictalurus punctatus* from fry to juvenile stages. The largest growth in length and weight, and survival rate were respectively 4.22 cm/fish; 0.88 g/fish and 88.6% from fry to fingerling stage, while from fingerling to juvenile stages they were 10.6 cm/fish; 11.5 g/fish and 93.1% respectively.

Keywords: *Catfish, nursing.*

COMPARISON OF GROWTH AND SURVIVAL RATE OF MONOSEX TILAPIA PRODUCED BY HORMONE TREATMENT AND HYBRIDIZATION

Nguyen Huu Ninh, Nguyen Anh Hieu, Le Ngoc Khanh

ABSTRACT

Three experimental, monosex tilapia stocks including 17 α -Methyltestosterone hormone reversed GIFT tilapia and NOVIT4 tilapia and an interspecific hybrid between ♂ *O. aureus* (Israel) and ♀ *O. niloticus* (Israel) were compared for growth and survival rates. Results showed that survival rates of all monosex tilapia were high and that there were no significant difference ($P>0.05$) between the stocks. However, there was a significant difference ($P<0.05$) between the stocks in growth rates from larvae to fry and fry to juvenile stages, of which the interspecific hybrid tilapia showed the fastest growth. Furthermore during the grow-out from juvenile to marketable size, GIFT tilapia had the poorest growth, while the interspecific hybrid tilapia again showed better growth performance. Daily growth rate of the fish less than 300 g was significantly better ($P<0.05$) for the hybrid than the hormone reversed monosex tilapia stocks.

Keywords: *Monosex tilapia, growth comparison.*

THE EFFECT OF DENSITY ON GROWTH AND SURVIVAL RATE OF BABUS (*Spinibarbus hollandi* Oshima, 1919) FROM FRY TO FINGERLING

Mai Van Nguyen, Vo Van Binh, Nguyen Huu Ninh

ABSTRACT

Success in artificial reproduction and rearing on the rare fish Babus (*Spinibarbus hollandi* Oshima, 1919) opened a new species for aquaculture because of its high economic value due to its rarity and demand, and the urgent need for conservation and restocking of the species. This article presents the results of rearing the fish from fry stage to fingerling size 6-8cm to determine the suitable density for nursery rearing. Three different densities were used: 200 individuals/m³, 400 individuals/m³ and 600 individuals/m³. A common industrial feed (powder - 42% crude protein) were used for the 3 density treatments. The fish were fed 10-12% of their body weight a day, feeding 2 times per day 8-9am and 4-5pm. The results show that the density of 200 individuals/m³ reached the best results when nursing from fry to fingerling stages. The growth in length and weight, and the survival rate reached 6.68±0.06 cm/individual, 2.62±0.038 g/individual and 74.33±0.60% respectively. The results showed that Babus can adapt fully to artificial conditions and that the life cycle has been fully closed.

Key words: *Babus*, *fry*, *fingerling*, *density*, *growth*, *survival rate*.

INITIAL RESEARCH ON BROODSTOCK MATURATION AND ARTIFICIAL INDUCTION OF SPAWNING OF BABUS (*Spinibarbus hollandi* Oshima, 1919)

Mai Van Nguyen, Vo Van Binh, Nguyen Anh Hieu

ABSTRACT

Babus (*Spinibarbus hollandi* Oshima, 1919) is a rare fish species, having high economic value in upstream regions of Northern of Vietnam. However, due to overfishing, habitat destructing and pollution, the population of Babus has decreased. The species is now classified as endangered with level V, i.e. urgent protection is needed. Success in the artificial induction of spawn this species will contribute to improve its natural population by restocking as well as it can provide juveniles for aquaculture. This article presents some results on artificial spawning induction of broodstock of Babus including domestication and broodstock maturation in the pond. Feeding formulated feed (40% crude protein) resulted in the highest maturation rate of 79.2%. Using a combination of 35 µg LRHa + 25 mg DOM resulted in 84.62% of the females spawning after 5-7 hours post injection at 26-28⁰C. Application of 'dry' insemination gave the highest fertilization rate, 89.2±4.6% and a hatching rate of 84.2±1.6% at controlled temperature 23-27⁰C.

Key words: *Barbus*, broostock management, artificial seed production.

EFFECT OF TEMPERATURE AND DIET ON REPRODUCTION AND NURSING OF *BAGARIUS RUTILUS* (NG & KOTTELAT, 2000)

Vo Van Binh, Pham Ngoc Tuyen, Nguyen Anh Hieu, Nguyen Huu Ninh

ABSTRACT

Broodstock of *Bargarius rutilus* (Ng & Kottelat, 2000) was cultured at the National Broodstocks Centre - North, Haiduong. Once fish matured, they were induced to spawn. There were significant differences in induction duration, ratio of hatched eggs, and larval survival at different temperatures. At normal spawning temperatures (28-32°C), spawning occurred 3 hours post injection, while at room temperature (24-25°C) spawning occurred after 5.5 hours. At the lower temperature, there was a higher percentage of hatched eggs and larval survival (58.7% and 84.1%, respectively) compared to those at 28-32°C (27.5% and 8.2%, respectively). Fish fed diets supplemented with astaxanthin and vitamin C had better survival (22.8% and 6.3%) in comparison to unsupplemented (2.6%). Growth performance of different diets conducted for fingerling on a formulated feed (46% protein, 14% lipid) resulted in better growth and survival rates than diets of earthworms and trash fish, suggesting a prospective for mass culture of the species.

Keywords: *Bargarius rutilus*, temperature, diet, hatching, survival rate.

**STUDY RESULT ON THE USE OF EXTENDER SOLUTION TO
IMPROVE FERTILIZATION EFFICIENCY OF NEO-MALE MILT IN
REPRODUCTION OF ALL-FEMALE RAINBOW TROUT
(*ONCORHYNCHUS MYKISS*)**

Nguyen Thanh Hai, Nguyen Huu Ninh, Tran Thi Kim Chi

ABSTRACT

Extender solution can be used to increase the effectiveness of fertilization in comparison with the traditional dry fertilization, especially in producing all female rainbow trout seed by using neo-male. The neo-male of rainbow trout have limited milt volume and this cannot be collected for fertilization using the normal method because the testes of neo-male are large and round and have no anterior genital pore. The results showed that using Extender solution reduced milt volume required for fertilization and it contributes to save number of neo-males needed in producing all female rainbow trout. The fertilization rate when using Extender solution was 96.0% which is higher than that of the traditional dry method 87.7%. In addition, the milt volume used was reduced to half the amounts normally used even though the fertilization rate remained very high.

Key words: *All female rainbow trout, Extender solution, neo-male milt.*

EFFECT OF STOCKING DENSITY ON SURVIVAL AND GROWTH OF JUVENILE WHITE SHRIMP (*Litopenaeus vannamei*) FROM PL10 TO PL45 REARED IN INDOOR COMPOSITE TANKS

Vu Van In, Tran The Muu, Vu Van Sang, Nguyen Phuong Toan, Cao Truong Giang

ABSTRACT

A study on survival and growth of white shrimp juvenile SPF (*Litopenaeus vannamei*) was carried out during nursing for 35 days from PL10 to PL 45 at three different stocking densities, i.e.: 600, 900, and 1.200 PL/m³. Each treatment was done in triplicate in 4 m³ indoor composite tanks under biosecurity control. Shrimps were fed 4 times a day with a feeding ratio of 50% body weight for week 1, 25% for week 2 and 10-15% for week 3 and onwards with CP pellets containing 38% crude protein. During the experiment, water temperature ranged from 28 to 31°C and salinity ranged from 18 to 20‰. Starting from week 3, 30% of the water was renewed weekly. Highest growth in body weight and length was found in the treatment of 600 PL/m³ (0.039 g/day; 1.23 mm/day¹), and this was significantly different from treatments of 900 PL/m³ (0.031 g/day; 1.00 mm/day) and 1.200 PL/m³ (0.029 g/day; 0.98 mm/day; P<0.05). Survival rate in 600 PL/m³ was highest (85.7 ± 2.6%), followed by 900 PL/m³ (78.7 ± 2.7%) and the lowest for 1.200 PL/m³ (67.8 ± 3.5%; P<0.05). Coefficient of variation values (CV %) at 900 PL/m³ (14.13 ± 2.32%) and 1.200 PL/m³ (15.12 ± 3.45%) were significantly higher than the treatment at 600 PL/m³ (9.48 ± 1.24%; P<0.05). However, there was no significant difference in FCR among the treatments (P>0.05). All shrimp sample tissues were found negative for WSSV, YHV, TSV, MBV and IHHNV.

Key words: *SPF white shrimp, Litopenaeus vannamei, stocking density, growth rate.*

STUDY ON SOLUTIONS TO INCREASE EFFICIENCY AND MAINTAIN BIOFLOC IN INTENSIVE POND CULTURE OF WHITE SHRIMP (*Litopenaeus vannamei*)

Nguyen Thi Thu Hien, Nguyen Van Huan, Tran Trong Luong

ABSTRACT

The application of biofloc technology in intensive pond culture of white shrimp (*Litopenaeus vannamei*) addresses the development of sustainable aquaculture at reduced production costs. Experimental studies were done in 3 m³ tanks and in 2000-2200m² ponds with no water exchange in both systems at stocking density of 100 individuals/m². Attempts to increase of efficiency and biofloc maintenance in these culture systems were done by controlling pH, alkalinity and Floc Volume Index (FVI). In order to control these parameters, the application of Ca(OH)₂, NaHCO₃ and CaCO₃ in the culture system was studied. Findings from the study showed that usage of these chemicals to stabilize alkalinity and pH is necessary. Maintaining pH value and alkalinity in a suitable range for biofloc development is essential for its efficiency and well maintenance in culture systems. The results showed that shrimp in these biofloc systems grew at 5.6- 6.2 g/month with a FCR (food conversion rate) of 0.74-0.79, resulting in a production of 13.5-15.5 tons/ha.

Key words: Alkanility, BFT, Biofloc technology, FVI, pH, white shrimp (*Litopenaeus vannamei*).

EFFECTS OF LIVE FOOD TYPE ON GROWTH AND SURVIVAL OF MOUSE GROUPER (*Cromileptes altivelis* Valenciennes, 1828) REARED IN THE STAGE 0-40 DAYS AFTER HATCHING

Nguyen Duc Tuan, Le Xan, Nguyen Huu Tich, Hoang Nhat Son

ABSTRACT

In order to find proper feeds for growth and survival of mouse grouper larvae (*Cromileptes altivelis*) during the stage 0-40 days after hatching (DAH), experiments were carried out with four types of feed, i.e. super small rotifer (*Brachionus rotundiformis*), 20 ind/mL (NT1); copepod nauplii (*Paracalanus sp.*), 10 ind/mL combined with rotifers (*Brachionus plicatilis*), 20 ind/mL (NT2); trochophores of Pacific oyster (*C. gigas*), 10 ind/mL combined with rotifers (*B. plicatilis*), 10 ind/mL (NT3); and a combination rotifer (*B. plicatilis*) (7 ind/mL), copepod nauplii (*Paracalanus sp.*) (10 ind/mL) and trochophores of Pacific oyster (*C. gigas*), (6 ind/mL), (NT4) and a control experiment (ĐC) (no feed). In these experiments, larvae of mouse grouper were fed by *Artemia* nauplii (Vinh Chau) and an artificial feed (NRD of INVE) from 15 and 20 DAH, respectively. The results showed that survival rate in NT2 (combination of copepod nauplii and rotifers (*B. plicatilis*)) was highest with the figure being $3.62 \pm 0.24\%$, followed by NT1 (using of super small rotifers (*B. rotundiformis*)) ($2.18 \pm 0.17\%$), and lowest in NT3 and NT4, i.e. $1.26 \pm 0.16\%$ and $1.57 \pm 0.22\%$, respectively. The growth rates of larvae in NT1 and NT2 were highest with the height being 18.1 ± 0.85 mm and 17.8 ± 0.92 mm, respectively, while NT3 saw the modest growth of 16.3 ± 1.02 mm. Hence, super small rotifer (*B. rotundiformis*), copepod nauplius (*Paracalanus sp.*), rotifers (*B. plicatilis*) should be used in combination with *Artemia* nauplii and artificial feed (INVE) to rear mouse grouper.

Key words: Mouse grouper, *Cromileptes altivelis*, larva, live food, rotifer, copepod, artemia.

NUTRITIONAL COMPOSITION OF PACIFIC OYSTER (*Crassostrea gigas*) CULTURED IN BAI TU LONG BAY

Cao Truong Giang, Vu Van Sang, Tran Thi Thu Ha, Vu Van In

ABSTRACT

A study on the nutritional composition of oysters cultured in Bai Tu Long Bay showed that oyster is a species of high nutritional value with 81.54% water, 55.23% protein, 8.10% lipid and 8.99% mineral. Especially, there are 17 amino acids in their flesh and 7 of these are indispensable. The investigation indicated that there was a variation in biochemistry of oysters cultured in Bai Tu Long bay during cultivation. The highest proportions of protein (58.75%) and mineral (10.37%) was found in July, while the largest percentage of water (85.64%) was found in February and lipid (8.20%) in April. In contrast, the lowest proportion of water (78.79%), protein (51.61%), mineral (8.15%) and lipid (8.00%) are detected during July, May, April and June respectively.

Keywords: *Pacific oyster; Crassostrea gigas, nutrition of oyster, amino acids.*

EFFECT OF WATER TEMPERATURE AND SALINITY ON EMBRYOGENESIS AND HATCHING RATE OF FOURFINGER THREADFIN EGGS (*ELEUTHERONEMA TETRADACTYLUM*)

Tran The Muu, Vu Van Sang, Nguyen Huu Tich, Vu Van In

ABSTRACT

This study on effects of water temperature and salinity on embryonic development and hatching rate of fertilized eggs was designed to identify optimal water temperature and salinity for incubation of Fourfinger Threadfin (*Eleutheronema tetradactylum*) eggs. The study was carried out in two separate experiments with 3 replicates each. Fertilized eggs were incubated in a series of 1L-glass beakers at 100 eggs/L. The first experiment was conducted at five different water temperatures, i.e. 20°C, 24°C, 28°C, 32°C and 36°C. In the second experiment fertilized eggs were incubated at $28.0 \pm 1.0^\circ\text{C}$ at salinities of 10‰, 15‰, 20‰, 25‰, 30‰ and 35‰. The data from the first experiment showed that the highest hatching rate ($90.0 \pm 4.2\%$) and the lowest deformity rate ($4.3 \pm 0.7\%$) was obtained when eggs were incubated at 28°C ($P < 0.05$). The second experiment showed that 90.3-91.0% of the fertilized eggs hatched when they were incubated in salinity between 30 and 35‰ and this salinity also resulted in the lowest deformity rate (1.87-2.40%) and both rates differed significantly from the other treatments ($P < 0.05$). In conclusion, among the range of water temperature and salinity studied, a water temperature of 28°C and salinity range from 30 to 35‰ are the most suitable for incubation of fertilized eggs of Fourfinger threadfin.

Key words: *Fourfinger threadfin*, *Eleutheronema tetradactylum*, water temperature, salinity.

ASSESSMENT OF IMPACT OF ICEFISH (*Neosalanx tangkahkeii*) ON FISH RESOURCES IN THAC BA RESERVOIR, YEN BAI PROVINCE, VIET NAM

Nguyen Hai Son, Vu Thi Hong Nguyen, Dang Xuan Ky, Nguyen Quang Thai

ABSTRACT

An assessment of the impact of Icefish introduction in Thac Ba reservoir, Yen Bai province was implemented in the period of 2009-2011. Results showed that the scientific name of this species is *Neosalanx tangkahkeii* (Wu, 1931) and it belongs to the *Salangidae* family. The spawning time of Icefish was found to be earlier than that of indigenous species in Thac Ba reservoir. Therefore, there was no competition with indigenous species in term of spawning ground as well as natural food resources during the spawning time. The feeding competition between Icefish and other indigenous species in Thac Ba was only assessed based on the type of natural food. Although, there was feeding competition between Icefish and some indigenous species, this did not result in great decline of the indigenous species in Thac Ba reservoir. The study showed that Icefish did not carry new diseases, but the species may be affected by some common diseases that also affect indigenous species. However, the prevalence of these diseases in Icefish was lower when compared with other exotic species which had been introduced in Thac Ba reservoir earlier. The fish fauna of Thac Ba reservoir was still diverse and this was expressed by diversifying of order, family and species that have existed in the reservoir and there was no impact of Icefish introduction on indigenous species. The icefish production recently occupied from 1.5% to 2% in total fish catch. An impact of Icefish development on the total fish production in Thac Ba reservoir was not observed. The introduction of Icefish with the main purpose of providing new species with a high value seemed to be justified and it contributed to the value and the production of total fish catch in Thac Ba reservoir.

Key words: *Icefish, introduction, impact, indigenous species, Thac Ba reservoir.*

ASSESSMENT OF FLUCTUATION IN FISH SPECIES COMPOSITION IN NINH BINH, THAI NGUYEN, BAC KAN PROVINCES

Ngo Sy Van, Bui The Anh, Vu Thi Hong Nguyen

ABSTRACT

Fish species composition assessment is important to know the biodiversity of the fish fauna, to conserve genetic resources and to develop hybrids with high production potential in aquaculture and also indirectly for management and monitoring of the resources of the country as well as of each province. This paper presents results from studies carried out in the period 2009-2012 in some provinces in the northern Vietnam by the Research Institute for Aquaculture No.1. In Ninh Binh in 2009, 152 species belonging to 45 families and 13 orders were found. In comparison with previous surveys some species endemic fish species were not found, and there is a danger of species such as *Pterocypitis cucphuongensis* and also the number of valuable rare fish species of Ninhbinh fish fauna is a few. In Thai Nguyen province, the fish fauna consisted of 87 species belonging to 53 genera, 18 families and 5 orders. In particular, 45 species belong to the carp order *Cypriniformes*, make up 51.7% of all species. The bass order, *Perciformes*, was represented by 20 species (23% of all species found) and then 14 species belong to the catfish order *Siluriformes* (16.1% of all species); 6 species (6.9% of all species) belong to the order *Synbranchiformes* and one species (1.1% of total) belong to the order *Clupeiformes*. A total of 8 species reported by Ngo & Pham (2005) were not found in this survey but this may be because of the low number of individual species difficult encounter. In Bac Kan, 112 species were found and they belonged to 66 genera and 6 orders. The highest number of species was found in the carp order 70 species belonging to 39 genera (62.50%). Then 26 species belong to the bass order *Perciformes* (23.21%). The fish fauna in Bac Kan province has 28 economically valuable fish species and 18 valuable rare fish species and some species are in danger of extinction. Comparison of these results with those reported by Ngo & Pham (2005) shows that 3 species have appeared included: *Siniperca chuatsi*, *Trichogaster trichopterus* and *Prochilopodus lineatus*. A total of 15 valuable rare fish species as *Elopichthys bambusa*; *Acrossochilus elongates*, *Onychostoma babeensis*, *Schistura chapaensis*, *Sinogastromyzon tonkinensis* and *Cyprinus multitaeniatus*, etc. may be extinct.

Key words: *Species composition, fluctuation, fish fauna, species, Bac Kan province, Ninh Binh province, Thai Nguyen province.*

APPLICATION OF BIOFLOC TECHNOLOGY IN INTENSIVE CULTURE OF NILE TILAPIA, *Oreochromis niloticus*, IN VIETNAM

Nguyen Van Tien, Vu Hong Su, Nguyen Thi Nien, Nguyen Xuan Kha, Nguyen Thi Bien Thuy, Nguyen Tien Hoa and Le Van Khoi

ABSTRACT

Intensive culture of Nile tilapia was conducted in biofloc pond system in Northern Viet Nam to investigate effectiveness of the biofloc technology for growth performance, feed efficiency, maintaining good water quality and economic aspects. Mono-sex all male tilapia were stocked at 5 fish/m² in two biofloc pond modules, namely medium and small scale with a pond size of 2,000 and 1,000 m², respectively. Each module included three ponds. No water exchange was applied during the experimental period, but water was added to compensate for losses due to evaporation and leakage. Extruded floating feed (P/L = 28-30/6) was fed daily to 90% in average satiation for 6 days/week and 1 day no feeding was applied so that fish could feed on biofloc biomass as natural feed. To avoid water quality deterioration, molasses was added to the ponds as a supplementary carbon source so as to stimulate the formation of biofloc at a C/N ratio of about 11.5. Fish survival levels were excellent, being 81.6-85.7, much higher than that in green water culture systems surrounding our experimental ponds. After 177 days of culture, the experimental fish had grown from 7.7 g/fish to 624.2 g in average. The overall FCR was 1.35. The protein efficiency (PER) was 2.65 g weight gain per gram protein in feed consumed. The percent protein deposited (PPD%) as fish biomass was 50.48%. The biofloc culture system could convert about 51% of the total nitrogen input in the culture system. Total investment for one ha of pond with biofloc system was 526.662 million VND, with a net profit of 100.938 million VND. Return to investment (ROI) was 19.17% for a culture cycle of 6 months. This study indicates that biofloc technology is applicable in tilapia culture, showing good growth performance of fish, higher feed efficiency and also reduce effluence to the environment. The biofloc technology thus could be applicable to modern farms with high investment capability and good infrastructure in Viet Nam.

Key words: *Biofloc*, *BFT*, *Nile tilapia*, *Oreochromis niloticus*, *intensive culture system*.