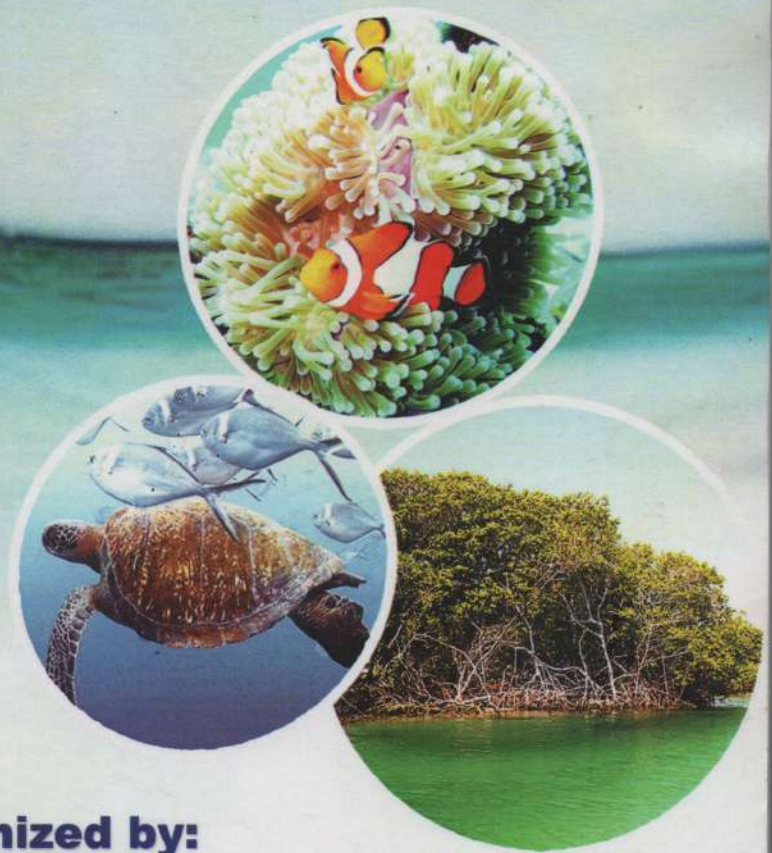


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and Environment”*

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**at Airlangga University
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PREFACE

In the name of Allaah the Most Gracious and Merciful. We would like to express our deep gratitude to our colleagues for their contribution to the Proceedings of International Seminar. This proceedings was set of articles or papers that has been presented at International Seminar on *From Ocean for Food Security, Energy, and Sustainable Resources and Environment*. This seminar is organized by cooperation between Fisheries and Marine Faculty, Airlangga University, Surabaya and Research Center for Marine and Fisheries Socio Economics, Agency for Marine and Fisheries Research, Ministry of Marine Affairs and Fisheries, Jakarta, and Agrotechnology and Food Science Faculty, Universiti Malaysia Terengganu, Malaysia. The seminar is attended by researchers, lecturers, students of undergraduate, master and doctoral degrees, and also by government official. The papers cover broad topics such as aquaculture production technology, product value improvement, resources and environment biophysics, alternative energy and environment biophysics, and socio-economic.

We would like to express our sincere thanks to Rector and Vice Rector of Airlangga University, Vice Rector and Dean of Agrotechnology and Food Science Faculty of Universiti Malaysia Terengganu, Head of Research Center for Marine and Fisheries Socio Economics, Dean of Fisheries and Marine Faculty, Airlangga University, keynote speakers: Prof. Dr. Gunawan Sumodiningrat from Gadjah Mada University, Prof. Dr. Sakri from Universiti Malaysia Terengganu, and Prof. Hassan Hj. Mohd Daud, DVM., Ph.D. from Universiti Putra Malaysia, moderators, presenters, participants, and colleague for supporting and kind help in the seminar. We also wish to thank to all sponsorships: Vice President of PT. CP Prima, Director of PT. Sufie Bahari Lines, Head of Fisheries and Marine Office, Regency of Tuban, Head of Fisheries and Marine Office, Regency of Pasuruan, General Manager of PT. Sanbe Farma, Director of PT. Petrokimia Gresik, Director of CV. Antika, Coordinator of Education Fish Pond, Fisheries and Marine Faculty, Airlangga University, and Director of PT. SIER for good contributions and partnership in the seminar. Finally, we would like to express our sincere thanks to the Steering Committee and Organizing Committee either staff and students from Faculty of Fisheries and Marine, University of Airlangga or staff from Research Center for Marine and Fisheries Socio Economics, Agency for Marine and Fisheries Research, Ministry of Marine Affairs and Fisheries, Reviewer: Prof. Ir. Sukoso, M.Sc., Ph.D from Fisheries and Marine Science Faculty, Brawijaya University, Ir. Murwantoko, M.Sc., Ph.D. and Ir. Triyanto, M.Si., Ph.D. from Department of Fisheries, Agriculture Faculty, Gadjah Mada University, Ir. Agung Sudaryanto, M.Sc., Ph.D. from Department of Marine and Marine Science Faculty, Diponegoro University, Mohammad Yunus, DVM., M.Kes., Ph.D. from Department of Parasitology, Veterinary Medicine Faculty, Airlangga University, Ir. H. M. Pujoyuwono, M.Sc. from Research Center for Marine and Fisheries Socio Economics, Agency for Marine and Fisheries Research, Ministry of Marine Affairs and Fisheries, and Prof. Sayed Mohd Zain Hasan, Ph.D. from Agrotechnology and Food Science Faculty, Universiti Malaysia Terengganu.

Surabaya, 1 December 2009

Editors

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ABSTRACT

Objectives of this program were to socialize of the catfish hatchery and culture and the induced spawning technology, to improve quality and productivity of efforts and accomplishment availability of food source and water stocks, to create effort opportunity potential, and to improve society economic by increase household income at food gristle and poorness areas, such as Pacitan Regency, East Java. Method of program that used were discussion, training of the hatchery and culture managements and the induced spawning technology of water, technical supervise, monitoring, evaluation and follow up the program continued in future. The result of this program were the induced spawning technology with use ovaprime can improve gonad maturation and spawning of catfish broodstock, the artificial spawning and production times of catfish fry with use induced spawning technology are more fast, efficient and effective than the natural spawning, good response, actively and well knowledged of participants on the technology and management of fish culture, good response and support of institution related, i.e. Service of Fisheries and Marine Affairs, Pacitan Regency on this program, the induced spawning technology is very must to developed and socialized to fish farmers at other region, the induced spawning technology is very must to developed and socialized to fish farmers at other region and support of local and province governments on application and socialization of technology and this program is the fish farmers were need, and synergic and continue cooperations between university and partners and local government to other program in the future were need.

Keywords: catfish, induced spawning, development, hatchery, culture

INTRODUCTION

Wongso (2004) mentioned that there are food crisis in East Java as food gristle area, one of them is Pacitan. Food crisis can be assessed from several factors, for example: food availability, access to food production, utilization or food absorption and food accessibility. Food resilience in an area can be measured from food availability, amenity accesses and food consumption, low food availability, poorness, and low nutrition (Anonym, 2009). Food security that can be developed for need nutrition management and public consumption besides food as animal protein source (fishery commodity). Pacitan Regency have big enough potency (wide of water pond is around 105.652 m²) to develop freshwater farm area, to accomplishment food security nutrition and to open opportunity of effort for local society through program of society socialization.

Catfish, *Clarias gariepinus* is one of quite important commodity of freshwater fishery and have potential for developed. This fish price is relative higher than others and its taste can be accepted by wide society (Hemowo and Suyanto, 2004), so at Pacitan has been developed up intensive aquaculture (Wongso, 2005). Catfish easy spawned and cultured, but up to scratch limited farm. Fish spawning can be conducted artificial through hormonal stimulation. Natural spawning of catfish is relative long, however, induced spawning of catfish can be quickened through hormonal treatment. Hormonal treatment is conducted to induce final maturation and spawning (de Graaf and Janssen, 1996). Egg

development is influenced by internal and external factors, i.e. environment and feed (Bromage, 1992; Lieberman, 1995; Mittlemark and Kapuscinski, 2000).

Artificial hormonal stimulation to manipulate of fish reproduction can be conduct through some methods. Generally, in broodstock management, hormonal stimulation is used to speed up development level and gonad or gamet maturity and spawning of fish, so its reproduction cycle can be arranged in such a manner outside its reproduction season. Hormonal stimulation very useful later in produce and provide of egg and seed in mass, overflow and continuous and can improve the egg quality produced (Mukti, 2002; Mukti and Rustidja, 2002). Hormonal manipulation is hormone utilization to improve efficiency of fish reproduction and expected can fast egg maturation (gonad), to improve percentage of ovulated-egg and to improve frequency of fish spawn (Stackey, 1986).

Fish culture, especially hatchery is potency and start liked by wide society. Factor of production that very determine in fish culture effort is seed availability. Seed availability is one of determinant of culture effort success (Mukti, 2002; Mukti and Rustidja, 2002). Seed availability are depend the broodstock availability, either male or female. Induced spawning technology uses hormone has been proven fast process of gonad maturity and spawning improvements of some fish species. Broodstock availability that ready spawn and catfish hatchery needs precise technology to that can speed up and increase production and easy adopted and developed at wide society, specially the catfish farmers at rural. In consequence, science and technology applied program through effort development of catfish hatchery and culture use

induced spawning technology are very useful and advantageous if applied and socialized furthermore, specially for area of food gristle and poorness at rural in order to improve society utilization, entered its economy utilization.

Objectives of this program were to socialize the catfish hatchery and culture for society at area of food gristle and poorness, specially at Pacitan Regency, East Java, to socialize the induced spawning technology in efforts the catfish hatchery and culture to speed up production process and improve catfish seed stok for easy and simple culture, furthermore and can be adopted by society, specially at Pacitan Regency, East Java, to improve quality and productivity of catfish hatchery and culture efforts and stock availability accomplishment of food materials and nutrition sources at area of food gristle and poorness, specially at Pacitan Regency, East Java, to create potential effort opportunity (employment) for society at area of food gristle and poorness, as in Pacitan Regency, East Java, and to improve society economic through increase household income from effort of catfish hatchery and culture with simple technology.

Benefits of this program were to develop the programs of apply, construction, and society utilization, specially at area of food gristle and poorness in rural, to develop the programs of food and nutrition stocks availability for society and also main program to improve income of local area through main fish commodity commerce (for relates services and local government), to repair and improve productivity of fish hatchery and culture and increase household income (for society target, specially farmer), to make profitable alternative of job field (for other society), and to concern and continual program in research development and construction of society through programs of society service and science and technology development for lecturers and also students (for institution/university).

MATERIALS AND METHODS

Strategic target of this program are Head of Minosari Fish Farmers and farmer group of other freshwater fish, elite figure, government officer village or district, district Field Education Officer, local Non Government Organization and relates service like Service of Fisheries and Marine Affairs, Pacitan Regency and Service of Fisheries and Marine Affairs, East Java Province. Targets of this program are freshwater farmers, society fisheries units, young man and other public that have big enthusiasm in the fishery field, specially the catfish hatchery and culture efforts.

Place of this program is Nogosari Village, Ngadirojo District, Pacitan Regency, East Java Province. Program method that used were local survey and coordination with relates institution. Strategic targets, discussion about: ^{a)} the catfish hatchery and culture, ^{b)} catfish excellence and induced spawning technology, ^{c)} need nutrition accomplishment animal food materials stock, ^{d)} economic value of the catfish hatchery and culture efforts, management training of the hatchery culture and induced spawning technology of the technical supervise of the induced spawning technology and the catfish hatchery and culture efforts, monitoring and evaluation, and follow program in the future.

RESULTS AND DISCUSSION

Education

First discussion conducted to identify about general problems of catfish farmers at Ngadirojo District, Pacitan Regency, East Java Province. Discussion result can be obtained input from local survey and identification of some main problems and faced by fish farmer group and also other farmers generally. General problems that faced in fish farming, specially catfish is produce broodstock, stimulate broodstock gonad maturity, broodstock spawning that relative long, natural and artificial feed in the area, high mortality of seed, seed availability and high price of seed. In other hand, disease and water quality management problems to catfish also is constraint by fish farmers (Figure 1).

Education is conducted through discussion and communication directly. Participant that attended are head and member of Minosari Fish Farmers and member of fish farmers and also other farmers at ten countrysides that exist in Ngadirojo District, Pacitan Regency, local government Field Education Officer at Ngadirojo District, Pacitan Regency, Head of Fisheries and Marine Affairs, Pacitan Regency and Head and Staff of Aquaculture and Society Service Section, Service of Fisheries and Marine Affairs, Pacitan Regency, East Java Province (Figure 2).

Discussion matter covers: broodstock management, gonad maturity process of broodstock, gonad stimulation of broodstock, factor that influence maturity level of fish, introduction of fish spawning technology, specially catfish and materials that applicable to induced spawning. On other hand, discussion matter also about natural types for larva and seed of catfish, available production of natural feed, nutrition for fish (especially for catfish), and management of water quality and culture as well as environmentally friendly.

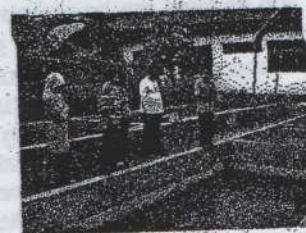
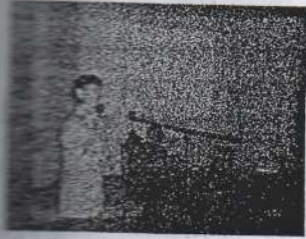


Figure 1. Discussion between team and fish farmer group as partner (a) and direct survey to field about broodstock management and culture ponds of catfish, *C. gariepinus* (b)



Discussion by team (a), input and comments by Head of Fisheries and Marine Affairs Service, Pacitan Regency (b), input and comments by Head of Fish Farmers Group as partner (c), and discussion of matter (d)

...matter during education not only ... matter above, specially related ... during discussion also related to ... in contrast in other culture of other ... which during the time often faced ... around Ngadirojo District, Pacitan ... Province.

Ngadirojo District, Pacitan Regency, East Java Province (Figure 3), whereas practical or demonstration is conducted at field pond (hatchery pond of catfish) property member of Minosari Fish Farmer Group, Nogosari Village, Ngadirojo District, Pacitan Regency, East Java Province (Figure 4). Some materials and equipments for training and demonstration that used are materials and equipments that relative easy and cheap obtained by society, specially fish farmers in rural (Figure 4).

Practical Field Demonstration

... is conducted at meeting room of ... Farmer Group, Nogosari Village,



... about training matter by program team (a), discussion about training matter (c), and place of ... (d)



... of practical and selection of catfish, *C. gariepinus* broodstock (a), preparation practical of ... hatchery and culture ponds (b), demonstration measurement of catfish broodstock by ... (c), and practical induced spawning of catfish broodstock by participant (d)

Response of participants during training and direct field demonstration showed very positive and show very big knowledge of participants. This condition are shown with active its participant in discussion during education and training and direct field demonstration about application of induced spawning technology and culture of natural feed in field (Figures 3 and 4).

Result of Training and Practical

Training result, especially demonstration about induced spawning of catfish, *C. gariepinus* that use ovaprime synthetic hormone shows good result. This condition is proved through process of gonad maturity and spawning of catfish broodstock that quickly than natural spawning of catfish. In general that experienced by catfish farmers around Ngadirojo District, Pacitan Regency, East Java Province is longer spawning of catfish, i.e usually take place around 7-10 d since paired. Not to mention failure that experienced under done consequence and has not yet ready to spawn of catfish broodstock paired. Richter and Rustidja (1985) suggested that in general, fish conducts reproduction activity in temporal and most spawn in seasonal, include catfish was that spawn rainy season. Rustidja (2004) state, success spawning is very determined by some factors. Fish spawn habit is determined by age, sex maturity level, seasonal and spawning place.

Result of induced spawning of catfish broodstock that use ovaprime synthetic hormone was indicated that catfish broodstock conduct spawn less than 24 h since injection. de Graaf and Janssen (1996) explain, fish spawning can be conducted artificial through hormonal stimulation. Natural spawn of catfish is relative long, however, maturity and spawning of catfish can be quickly through hormone treatment. Hormone treatment is conducted to induce final maturation and egg ovulation. Effendi (1981) mentioned that one of hormone function is morphogenesis or forming arrangement and maturation of gonad and secondary sex characteristics. Hoar (1978) stated that most fish species, sex character forming is dependent to sex steroid hormones. Steroid hormone is hormone that can influence reproduction, stimulate growth, difference sex, and influence fish behaviour (Donaldson *et al.*, 1978).

Monitoring and Technical Supervise

Monitoring is conducted relate to benefit the induced spawning technology of catfish, especially training result and demonstration directly in field by participants (fish farmers) at Minosari Fish Farmer Group, Nogosari Village, Ngadirojo District, Pacitan Regency, East Java Province and socialize the induced spawning technology in other fish farmer at around location Ngadirojo District, Pacitan Regency, East Java Province. Technical supervise about science and technology applied program is continued and constructed by Field Education Officers of District Fisheries and Marine and relate services (Service of Fisheries and Marine Affairs, Pacitan Regency). This condition is needed to support good and synergic cooperation program between fish farmers and Field Education Officers or relate services as well as role and function from relate services, i.e. education and

construction at fish farmers. Society are encourage to share in active to get the technology and manage information such as good and advantageous continuity program and quality and productivity improvement of fish culture can be quick reached.

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INTRODUCTION

One of the major constraints to the development of aquaculture is the availability of quality feed. In the beginning of 1967, the first fish farm was established in Sarabaya, where fishes often get caught in the net because of the

... changes to the increasing ... of the first nursery at two months old, ... such as physoclistous, rubber, ... and *Haemulon* spp., while at ... of four months old, given by ... and a shell, spring, transfer. These ... the feed given at growing phase

... influences the energy ... fish. Carnivore fish digests protein more ... and herbivore one (Zornowicki et al.) ... of energy and protein in the food ...

MATERIALS AND METHODS

The research has been conducted on 20 November 2007 until 6 January 2008 in Fishery Education Laboratory of Veterinary Medicine Faculty, Airlangga University. The only juveniles come from Yogyakarta with 1 cm height and 0.1 g weight.

The research used a completely randomized design with eight treatments and three replicates. The treatments were P1 (100% pellet), P2 (100% *Haemulon* spp.), P3 (100% *Haemulon* spp.), P4 (50% *A. granulosus* and 50% *Haemulon* spp.), P5 (50% pellet and 50% *Channa* spp.), P6 (50% pellet and 50% *Haemulon* spp.), P7 (50% *A. granulosus* and 50% *Haemulon* spp.), and P8 (50% *A. granulosus* and 50% *Haemulon* spp.).

The juveniles keeping of grey was held in 24 plastic basin with diameter 30 cm and filled with clean water 1/3 of total water volume. They also being aerated with the density four fishes per basin and being adapted a week using that feed. The feeding frequency was two times a day, 10% of biomass per day. The observation was held every day before feeding the feed.

Chemical composition of the treatment feed

Treatment	Carbohydrate (%)	Gross Protein (%)	Gross Fat (%)	Gross Fiber (%)	Feed Effectiveness (%)
P1	7.953	29.41	2.6	2.33	20.14
P2	7.573	42.88	9.03	4.08	30.25
P3	7.928	48.53	22.28	0.78	28.15
P4	7.9572	53.98	2.09	0.37	29.75
P5	7.798	36.145	5.315	24.706	12.141
P6	7.9725	35.97	12.49	1.553	28.045
P7	7.7703	48.43	8.55	23.725	28.045
P8	7.9575	51.253	15.735	0.575	28.045

Source: Data of Chemical Feed Laboratory, Veterinary Medicine Faculty, Airlangga University, 2008

... of weight includes the growth ... and the growth rate every ... from the beginning until the end of the

... as a supporting feed, water quality was analyzed, include temperature, pH, dissolved oxygen and ammonia levels. The result of research

ANALYSIS OF VOLUME AND ERYTHROCYTE CELL NUMBER OF TETRAPLOIDIZATION-TREATED NILE (*Oreochromis niloticus*)

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ABSTRACT

Purpose of this research was to analyze the volume and erythrocyte cell number of tetraploidization-treated Nile. Tetraploidization treatment of Nile were use heat shock 40, 41, and 42°C on eggs in 80, 85, and 90 min after fertilization during 2.5 min. Volume of erythrocyte cell was significantly difference ($p < 0.05$) in each treatment. The volume of erythrocyte cell was appeared at temperatures 42°C in 90 min after fertilization, i.e. $24.66 \pm 0.01 \mu\text{m}^3$. Erythrocyte cell number was not significantly difference ($p > 0.05$) in each treatment. The smallest number of erythrocyte cell was appeared at temperatures 42°C in 90 min after fertilization, i.e. $2.17 \times 10^6 \pm 0.0004$ cells/mL. Therefore, volume of erythrocyte cell was significantly difference ($p < 0.05$) in each treatment with the biggest at heat shock 42°C in 90 min after fertilization, i.e. $1.42 \mu\text{m}^3$.

Keywords: volume, erythrocyte cell, tetraploidization, Nile, heat shock

INTRODUCTION

Current interest in polyploidy induction is almost entirely due to its potential application in fish farming, for the production of triploid and tetraploid fish (Ward, 1985). Induced triploidy is used to produce sterile or completely sterile fish. Triploidy can be induced in fish by inhibiting the second meiotic division and extrusion of the second polar body by cooling eggs shortly after fertilization (Churruarín, 1981). Triploid fish can also be produced by crossing tetraploid with diploid breeders (Rougeot *et al.*, 2003). Tetraploidy can be induced by application of shocks into different phases of the cell cycle leading first to tetraploidy. Heat shocks are effective at inducing tetraploidy in fish including zebrafish and tilapia, and relatively simple (Herbst, 2002).

Tetraploid organisms have an increased DNA content, nuclear size, number of chromosomes and cell size compared to diploid. Ploidy level can be determined by several methods that allow for the comparison of these characteristics between polyploid and diploid. The variable of erythrocyte size of diploid and tetraploid is frequently used as an index to estimate ploidy level (Gao *et al.*, 2007). However, in virtue of having an extra chromosome set, tetraploidy causes an increase in cell size with concomitant reduction in cell numbers in variety of cell types, including erythrocytes (Cal *et al.*, 2005). The purpose of this research was to analyze the volume and erythrocyte cell number of tetraploidization-treated Nile.

MATERIALS AND METHODS

Stock Management

Reproductively mature Nile (*O. niloticus*) was raised in Freshwater Aquaculture Development Centre at Semburan, Pasuruan. Breeders were held in 1000 m³ tanks. Temperature was 28-30°C and breeders had given food 10-15% of weight.

Fertilization, Heat Shocks and Incubation

After mature each breeder was stripping for collected semen and egg. Semen was collected by stripping mature males and kept on syringe. Thus, egg was collected by stripping mature females and put it into bacches for mixing with semen. Mixing between semen and egg just during 1 min, after that preparing for heat shocks were 80, 85, and 90 min after fertilization (a.f.). Before shock treatment, egg has been counted, i.e. 150 cells to each treatment. Heat shocks were applied by immersing eggs into styrofoam as water bath maintained at the experimental temperature (40, 41, and 42°C) during 2.5 min. After shock treatment, eggs were transferred into hatchery, with water temperature range 27-29°C. Hatching rate assessed on embryos at 4 d a.f.. The fry fed three times a day with *Artemia* spp. until a week. After one week fry fed *Tubifex* spp. three times a day until two weeks before fry were transferred into net cage 40x60 m². The fry was reared in net cage until 90 d a.f. and fed three times a day with commercial fish food. Water temperatures were daily measured and dissolved oxygen and pH was measured three times every week.

Blood Sampling

Blood samples were taken from the caudal vessels using a 1 mL disposal plastic syringe fitted with a 23 gauge-needle. The blood smears were fixed in 95% methanol for three minutes, left to air dry and stained with 20% Giemsa solution for 15 min. The length and width of cells and nuclei were measured with 25 cells each per slide smears. The cells and nuclei volume were calculated as follows $V = 4/3 \pi a^2 b$, which a is the major and b is minor axes of the cell and nucleus. In particular, erythrocyte counts were performed on diluted blood samples (1:200 dilution NaCl fluid) using a Neubauer haemocytometer.

Statistical Analysis

The data was expressed as mean \pm deviation standard and compared with Analysis of Variance (ANOVA) followed by Least Significant Difference.

RESULTS AND DISCUSSION

Erythrocyte Measurements

Heat shocks treatment has significantly influenced ($p < 0.05$) to increased volume cells and measured nuclei in erythrocytes. The increase cell and nuclei sizes were larger than control (no shock) (Table 1). The largest cell volume was increase with shocks 42°C at 90 min a.f., i.e. $24.66 \mu\text{m}^3$ (45%), followed 42°C at 85 min a.f. was $24.38 \mu\text{m}^3$ (43%), 41°C at 90 min a.f. was $22.51 \mu\text{m}^3$ (32%), 42°C at 80 min a.f. was $21.73 \mu\text{m}^3$ (28%), 41°C at 85 min a.f. was $20.54 \mu\text{m}^3$ (21%), 40°C at 90 min a.f. was $20.40 \mu\text{m}^3$ (20%), 40°C at 85 min a.f. was $19.27 \mu\text{m}^3$

(13%), 41°C at 80 min a.f. was $17.97 \mu\text{m}^3$ (5%), at 80 min a.f. was $17.80 \mu\text{m}^3$ (4%), and no shock was $17.00 \mu\text{m}^3$ (Figure 1).

The largest nuclei volume was increase with shocks 42°C at 90 min a.f., i.e. $1.42 \mu\text{m}^3$ (83%), followed by 41°C at 90 min a.f. was $1.37 \mu\text{m}^3$ (83%), 42°C at 85 min a.f. was $1.31 \mu\text{m}^3$ (75%), 40°C at 90 min a.f. was $1.21 \mu\text{m}^3$ (61%), at 85 min a.f. was $1.20 \mu\text{m}^3$ (60%), 42°C at 80 min a.f. was $1.19 \mu\text{m}^3$ (59%), 41°C at 80 min a.f. was $1.13 \mu\text{m}^3$ (51%), 40°C at 85 min a.f. was $1.11 \mu\text{m}^3$ (48%), 40°C at 80 min a.f. was $1.02 \mu\text{m}^3$ (36%), shocks was $0.75 \mu\text{m}^3$ (Figure 2).

Table 1. Erythrocyte cells volume measurements

Temperature shocks treatment	After fertilization		
	80 min	85 min	90 min
Control	$17.00 \pm 0.27 \mu\text{m}^3$	$17.00 \pm 0.27 \mu\text{m}^3$	$17.00 \pm 0.27 \mu\text{m}^3$
40 °C	$17.80 \pm 0.07 \mu\text{m}^3$	$19.27 \pm 0.13 \mu\text{m}^3$	$20.40 \pm 0.02 \mu\text{m}^3$
41 °C	$17.97 \pm 0.10 \mu\text{m}^3$	$20.54 \pm 0.11 \mu\text{m}^3$	$22.51 \pm 0.13 \mu\text{m}^3$
42 °C	$21.73 \pm 0.14 \mu\text{m}^3$	$24.38 \pm 0.12 \mu\text{m}^3$	$24.66 \pm 0.01 \mu\text{m}^3$

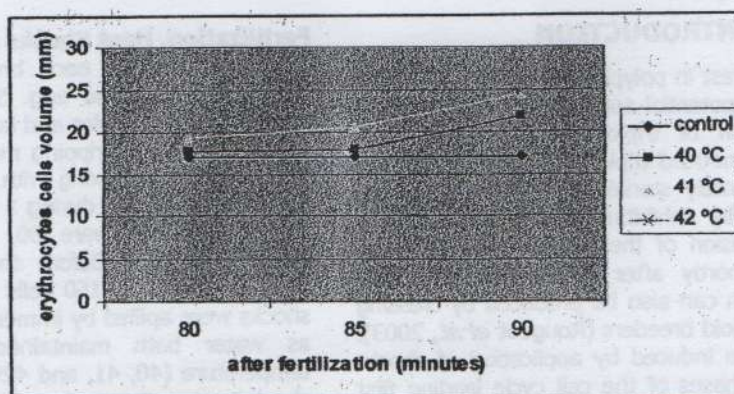


Figure 1. Comparison volume cells erythrocyte each treatment

Table 2. Erythrocytes nuclei volume measurements

Temperature shock treatment	After fertilization		
	80 min	85 min	90 min
Control	$0.75 \pm 0.03 \mu\text{m}^3$	$0.75 \pm 0.03 \mu\text{m}^3$	$0.75 \pm 0.03 \mu\text{m}^3$
40 °C	$1.02 \pm 0.03 \mu\text{m}^3$	$1.11 \pm 0.01 \mu\text{m}^3$	$1.21 \pm 0.01 \mu\text{m}^3$
41 °C	$1.13 \pm 0.01 \mu\text{m}^3$	$1.20 \pm 0.03 \mu\text{m}^3$	$1.37 \pm 0.01 \mu\text{m}^3$
42 °C	$1.19 \pm 0.04 \mu\text{m}^3$	$1.31 \pm 0.03 \mu\text{m}^3$	$1.42 \pm 0.01 \mu\text{m}^3$

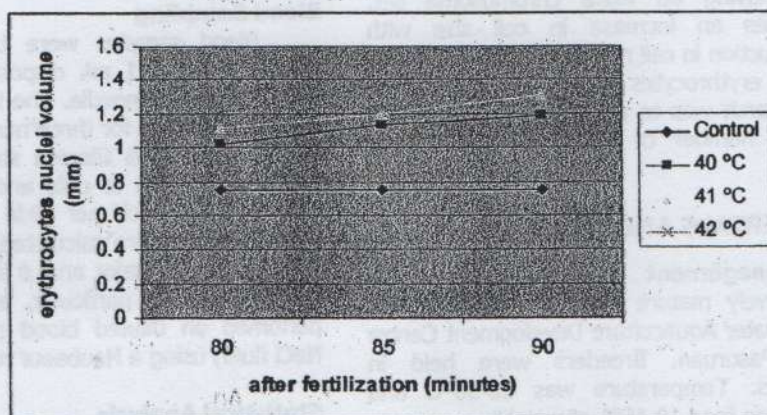


Figure 2. Comparison volume nuclei erythrocytes each treatment

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PRELIMINARY STUDY OF NATURAL HABITAT AND WATER QUALITY AS LIVING GROUND OF SPINY EEL (*Macrogathus aculeatus*) AT BENGAWAN SOLO RIVER BASIN, LAMONGAN

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ABSTRACT

The aim of this research was to know natural habitat and water quality as living ground of spiny eel. This research was done on ten areas at Bengawan Solo River Basin, Lamongan, i.e Cincim Bridge, Rowo Semandu, Babat Barage, Waduk Gondang, Brangsi, Maduran, Deket, Karang Binangun, and Glagah. The survey and descriptive methods were used. The natural habitat characteristics of ten areas were a large part of muddy and sandy land and vegetation grown. Water qualities that measured were NO (0.0-10.0 mg/L), NH₃/NH₄ (0.0-0.5 mg/L), O₂ (0.5-6.0 mg/L), PO₄ (1.0-2.0 mg/L), gH (5.0-21.0°dgh), NO₂ (0.1-0.9 mg/L), pH (6.0-7.0), temperature (29.0-35.0°C), salinity (0-3 ‰), depth (0.39-1.25 m), and brightness (0.85-46 cm).

Keywords: natural habitat, water quality, spiny eel, Bengawan Solo River Basin

INTRODUCTION

Climate change or global warming in the world today have caused changes on diversity an ecosystem, include population stock of water resource (fish species). Damages of environmental, habitat change and totally disappeared of distribution pattern and reproduction of vary fish species in the natural nature were very influence by environmental changes or climate change (global warming), include silih or spiny eel (*Macrogathus aculeatus*). CBD (2007) mentioned that climate change can pressure natural ecosystem, decrease species capacity to adaptation, decrease population number (mortality) and change distribution and reproduction performance of species.

Silih or spiny eel (*M. aculeatus*) are wild fish at Java and Indonesian original. This fish was very distribution in areas or island, include province of Kalimantan and Java. In Java Island, spiny eel found at river basin that flow until Province of East Java, include Bengawan Solo River Basin at Lamongan. Spiny eel was recognized at Lamongan since 1980s and still distribution on society, so this fish as priority commodity of fisheries at Lamongan. In the fisherman, price of this fish is very expensive, range USD 8.00 until USD 10.00/kg.

Not clear data and information about population stock of spiny eel in nature (river or lake) and reproduction pattern were cause non recognized benefit and advantages of this freshwater fish. Spiny eel can tolerant on salinity range 0-15 ppt and low dissolved oxygen conditions, so fish have potential to culture on freshwater and brackishwater ponds, though traditionally. However, research on population distribution of silih to development effort domestication and culture of their was need.

Vary species of genus *Macrogathus* in some area or country are *M. maculatus* (common name of silih, in Singapore), *M. aculeatus* (different name at province or district, in Indonesia), *M. perakensis* (in Perak, Malaysia and Singapore) (Kelvin *et al.*, 2000), *M. circumcinctus*, *M. zebrinus*, *M. keithi* (Fishbase

2003) and *M. siamensis*, *M. aral*, and *M. mekongensis* (at Mekong River, Kambodia) (Rainboth, 1996; Baird *et al.*, 1999). *M. aculeatus* discovered in Sumatera, Java, Kalimantan, and Maluku (O-Fish, 2002). In Kambodia discovered so species *Macrogathus* sp. (Amilhat *et al.*, 2005). Spiny eel as Indonesian original fish was difference with same species in other country. Especially, species name of *M. aculeatus* in Indonesia is silih, whereas same species name in other country is sili.

Yustina (2001) resulted that *M. aculeatus* discovered at Rangau River, Riau, Sumatera Island with common name is black tilan. This species have distributed in Southeast Asia region, include Indonesia and Thailand. In Borneo, this species can live and develop at brackishwater (Anonym, 2006).

MATERIALS AND METHODS

This research used explorative method by survey and field perceived to identification, determination, and study of ecosystem and spiny eel distribution, include live habitat of spiny eel and water qualities at river basin or lake in Lamongan, Province of East Java. This research conducted on ten areas at river basin or lake in Lamongan and Fisheries Education Laboratory, Fisheries and Marine Faculty, Airlangga University. Ten areas at Bengawan Solo River Basin that studied are Cincim Bridge, Rowo Semandu, Gilir, Babat Barage, Gondang Lake, Brangsi, Maduran, Deket, Karang Binangun, and Glagah. Measurement of Water qualities used water quality kits. Data analysis used descriptive method.

RESULTS AND DISCUSSION

This research was general know that live habitat of spiny eel at Bengawan Solo River Basin, Lamongan have characteristic muddy and sandy of soil and vegetation grown (Table 1), whereas water qualities are like Table 2 (measurement at morning) and on Table 3 (measurement at evening).

Table 1. Data of spiny eel *M. Aculeatus* habitat in ten areas at Bengawan Solo River Basin, Lamongan P

Areas	Habitat
Cimcim Bridge	- soil characteristic: muddy and sand - vegetation grown
Rowo Semandu	- soil characteristic: clay - many vegetation grown, especially grass
Gilir	- soil characteristic: clay and sand - few vegetation grown
Babat Barage	- soil characteristic: muddy - few vegetation grown
Gondang Lake	- soil characteristic: clay and sand - many vegetation grown
Brangsi	- soil characteristic: clay and sand - many stoney - few vegetation grown
Maduran	- soil characteristic: clay and sand - few vegetation grown
Deket	- soil characteristic: sand - many vegetation grown
Karang Binangun	- soil characteristic: clay and sand - many vegetation grown
Glagah	- soil characteristic: clay and sand - many vegetation grown

Table 2. Data of water qualities in ten areas at Bengawan Solo River Basin, Lamongan Regency (meas morning)

Areas	NO ₃ mg/L	NH ₃ /NH ₄ mg/L	O ₂ mg/L	PO ₄ mg/L	gH °dgh	NO ₂ mg/L	pH	T °C	Salinity ‰	Depth m
Cimcim Bradge	10	4.0	0.5	1.0	10	0.3	6	32.0	0	1.0
Rowo Semandu	10	0.5	4.0	2.0	11	0.3	6	31.0	0	0.41
Gilir	0	0.0	4.0	1.0	8	0.3	6	31.0	0	1.06
Babat Barage	0	5.0	4.0	1.0	7	0.3	6	32.0	0	0.84
Gondang Lake	10	5.0	4.0	1.0	10	0.3	6	29.0	0	1.25
Brangsi	10	0.5	4.0	2.0	10	0.3	6	29.5	1	0.39
Maduran	10	0.5	4.0	2.0	11	0.9	6	29.0	0	0.85
Deket	0	0.5	6.0	2.0	11	0.0	7	31.0	3	1.0
Karang Binangun	0	1.0	4.0	2.0	21	0.1	8	31.0	2,5	1.0
Glagah	0	0.5	4.0	2.0	14	0.1	8	31.0	3	1.0

Table 3. Data of water qualities in ten areas at Bengawan Solo River Basin, Lamongan Regency (meas evening)

Areas	NO ₃ mg/L	NH ₃ /NH ₄ mg/L	O ₂ mg/L	PO ₄ mg/L	gH °dgh	NO ₂ mg/L	pH	T °C	Salinity ‰	Depth m
Cimcim Bradge	0	0.5	4.0	2.0	5	0.3	6	32.0	0	1.0
Rowo Semandu	0	0.5	4.0	1.0	7	0.3	7	33.0	0	0.40
Gilir	0	0.5	6.0	2.0	5	0.3	6	34.0	0	1.0
Babat Barage	0	1.0	4.0	2.0	14	0.3	7	32.0	0	0.42
Gondang Lake	10	1.0	4.0	2.0	11	0.9	6	30.0	0	1.25
Brangsi	0	0.5	4.0	1.0	10	0.3	6	29.0	0	0.39
Maduran	0	0.5	4.0	1.0	9	0.3	6	29.5	0	0.85
Deket	0	0.5	6.0	2.0	20	0.1	7	35.0	0	1.0
Karang Binangun	0	1.0	4.0	2.0	26	0.1	7	33.0	0	0.9
Glagah	0	1.0	6.0	1.0	21	0.1	7	33.0	0	0.9

The live habitat of spiny eel (*M. aculeatus*) at river basin is sand soil and vary grown of natural vegetation. Generally, measure-resulted water qualities are suitable for life of spiny eel (*M. aculeatus*). Shuresh (2006) suggested that spiny eel can tolerant on salinity range 0-15 ppt and low dissolved oxygen conditions, so fish have potential to culture on freshwater and brackishwater ponds, though traditionally. Their habitat was river with deep and slow current and muddy sand. Yustina (2001) suggested that spiny eel *M. aculeatus* have discover

at Rangau River, Riau, Sumatera and their fish is black tilan.

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... such as the traditional (long, extending, monotonous) nature culture ... and mangrove forest conservation. On the other hand, the small islands ... and modern culture. The result of the diversity analysis from ... 21 class, which grouped the large area is location for agriculture culture ... is the precise location for the structure of marine tourism of ...

DISCUSSION

Indonesia is an island country in the world with 17,500 islands and ... the largest in the world ... (Hidayat and Hidayat, 1998) ... and tertiary market area ... Indonesian territory (total ... 2.7 km ... and marine ... which is very large and ... the small islands ... resources for economic ... The small islands ... which is ... (Hidayat et al., 2001). An ... has extensive types ... National Park areas, ...

The island of Karimunjawa Island ... a variety of ... conditions ... and other ... problem occurs ... the management ... has ... land usage in a ... for utilization or ... the use of some ... analysis is intended ... be suitable for the ... utilization become ... and initial ... resources are ... activities of ... islands which is

currently granted is for marine cultural education, nature tourism, and mangrove forest conservation. Therefore a research of the analysis of fish suitability for the three utilization is really necessary. Purpose of the research is to analyze and suitability management of Karimunjawa National Park area as the alternative (utility) of marine culture (grouped fish, sea cucumber, clamshell, marine turtle (duga, scorpion) and beach recreation tourism), and mangrove conservation which is suitable to be developed in the next future based on biogeographic criteria of least suitability for each usage.

MATERIALS AND METHODS

Location and Research Time
The research conducted in Karimunjawa National Park area which consists of 32 islands. The area administratively included in Sragen Regency, Central Java Province, and geographically it located in the peaks of 300°-310° of south latitude, and 110°-110°40' of East longitude (Figure 1). The research was conducted for 12 months which is started in April to November 2009. The research divided into three stages, the 1st stage: understanding, data analysis and data collection.

Method of Collecting Data
The research data method was secondary data collection. Primary data is obtained by direct observation in the field with some field record resources condition (biogeographic and environment), and the resource position by using GPS (Global Positioning System). Whereas secondary data collection used in this research was the data of related institution according to the assigned institution.

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