

**PEREZ-GUERRERO TRUST FUND FOR ECONOMIC AND TECHNICAL COOPERATION AMONG
DEVELOPING COUNTRIES, MEMBERS OF THE GROUP OF 77**

GOVERNMENT OF PEOPLE'S REPUBLIC OF CHINA

Final Report

On

**The Project “Improvement of Recirculating Aquaculture
System Performance in Vietnam and Sri Lanka”**



**FRESHWATER FISHERIES RESEARCH CENTER OF CHINESE ACADEMY OF FISHERY
SCIENCES**

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I. Project Description

1. Project Title

Improvement of Recirculating Aquaculture System Performance in Vietnam and Sri Lanka

2. Abstract

Focusing on making a valuable contribution to capacity building of technicians and farmers engaged in RAS industry under the Directorate of Fisheries, Ministry of Agriculture and Rural Development, Vietnam, and the National Aquaculture Development Authority, the Ministry of Fisheries and Ocean Resources, Sri Lanka, with the support from Chinese government and Perez-Guerrero Trust Fund (PGTF), Freshwater Fisheries Research Center (FFRC) of Chinese Academy of Fishery Sciences, Ministry of Agriculture and Rural Affairs, P.R.China, successfully implemented the project "Improvement of Recirculating Aquaculture System Performance in Vietnam and Sri Lanka" during July 13, 2018 to July 26, 2018. For the implementation, three parts including room lectures, field practices and technical instruction in RAS were combined to help technicians and farmers to acquire the basic theory of RAS system technology, practical technique and management pattern. The whole project was generally divided into three phases: first, second and third phase, respectively focusing on preparation, implementation and follow-up & evaluation. With the project, six aquaculture experts from FFRC were assigned to carry out on-site technical extension, training and consultation in Sri Lanka and Vietnam, which, with expected outcome fully met, was highly appraised by both the beneficiaries and authorities for their devoted work, professional level and contributions to local aquaculture development as well as to poverty alleviation in the long run.

3. Background and Rationale

The fisheries sector (including aquaculture) has played an important role in the economy of Vietnam and Sri Lanka. That's why government of both countries have given high priority for development of fisheries, culture based fisheries and aquaculture. However, a rapid expansion of the area being utilised for aquaculture has been difficult to regulate, this has in some cases resulted in the limitation of water resources for aquaculture, which presents the requirement for change the developmental model of fishery to achieve the reduction of water resources. In Vietnam and Sri Lanka, some of fish species aquaculture was practiced using closed and semi-closed production systems as well as fully recirculated systems of operation. But the recirculation of water is not highly intensive. The governments of Vietnam and Sri Lanka attached great significances to developing the recirculating aquaculture system (RAS) to achieve high

reduction of water supply by employing a water treatment unit, which besides employing re-aeration and mechanical filtration, at least one biological treatment is used. However, the development of recirculating aquaculture systems in both countries has been stagnant in recent years. The major constraints for the development of recirculating aquaculture system can be attributed to numerous factors as follows:

- Limited knowledge about RAS component interactions (bio-filters, mechanical filters, energy flows);
- Poorly understanding of interaction of pathogens and benign microbes in bio-filters;
- Very few studies on biofilms, biomats, etc.;
- Needing more modified processes when using new feeds;
- Lack of predictive modeling to assess multifactor interactions in recirculation system design and testing.
- Very few qualified technicians on recirculating system;
- Lack of fund for scaling up and other research projects.

In terms of global aquaculture production, China is the world leader in aquaculture involved in farming of large variety of fish species, under different farming systems. Since the reform and opening up, its aquaculture has developed very fast due to the techniques improvement on seed production. Regarding sustainable aquaculture development, China has matured important experience and successful stories on recirculating systems to be shared with experts and technicians from Vietnam and Sri Lanka. Freshwater Fisheries Research Center, Chinese Academy of Fisheries Sciences (FFRC/CAFS) is a national research institution in China. It is of great strength on fishery research and is having several decades of experience in providing international training in aquaculture. So far, it has trained above 90 technicians and officers for Vietnam and over 170 for Sri Lanka. It's capable of helping both countries to solve the constraints mentioned above.

II. Project Implementation

1. Efforts for forwarding the implementation of the project

Upon the granting of the project, *"Improve recirculating aquaculture system performance in Vietnam through technical staff's training and study tour"*, Freshwater Fisheries Research Center (FFRC), Chinese Academy of Fishery Science (FFRC/CAFS) has been keeping close communication with the Directorate of Fisheries, Ministry of

Agriculture and Rural Development, Vietnam, and the National Aquaculture Development Authority, the Ministry of Fisheries and Ocean Resources, Sri Lanka for the implementation of this project. Firstly FFRC has selected the proper mission group members, led by Prof. Yuan Xinhua, Deputy Director of FFRC after rounds of selection and discussion. Reference books on RAS were compiled to facilitate the technical consultation and training. To guarantee a fruitful project, FFRC has invited 10 fishery officers from Vietnam in 2016, and 36 fishery officers from Sri Lanka in 2017 to attend the technical training courses and seminars.

In 2017, a detailed and reasonable schedule came into being after several rounds of coordinating and opinion exchanges. According to the schedule, the project would be implemented in November, 2017. In October, 2017, FFRC started the process for visa application. Sri Lanka authority sent scanned invitation letter to us. However, Vietnam authority did not feedback after FFRC requested for the invitation letter. Therefore, FFRC failed to complete the project in 2017.

Through indefatigable communication, FFRC has bridged with responsible authorities in Vietnam and Sri Lanka in early March, 2018. All parties agreed to complete the PGTF project in July, 2018.

2. Preparation for the implementation of the project

Mission group designation: Upon the granting of the project, FFRC set out to select the proper mission group members. After rounds of selection and discussion, a mission group composed of five experts was formed, led by Prof. Hu Haiyan, FFRC Director Assistant. The expertise fields of the group covered aquaponics application in aquaculture, recycling system engineering, water purification system in RAS, farming model in RAS and farming management in RAS etc.. All the members had experiences in international training, teaching and technical consultation.

Reference book compilation: To facilitate the technical consultation and training, reference book was compiled on aquaponics application in aquaculture, recycling system engineering, water purification system in RAS, farming model in RAS and farming management in RAS. The compilation of the series was based on China's most advanced technologies and experiences, as well as the demand analysis accumulated during over 30-year's international training and communication with the target counterparts of Sri Lanka and Vietnam.

Schedule discussion and refinement: After several rounds of coordinating and opinion exchanges, a detailed and reasonable schedule came into being which was later proved to be a feasible guideline and reference for fruitful daily work in both countries.

Others: Other preparing work included equipment purchasing, communication with counterparts for the settlement of training, meeting, travelling, accommodation, etc., and a kick-off meeting, among others.

	
<p>Kick-off meeting</p>	<p>Reference book series</p>

3. Implementation, July 13-26, 2018

As the core part of the whole project, this phase began on **July 13** when the mission group set out to travel to Sri Lanka. Spending 2 weeks in Sri Lanka and Vietnam, the group carried out a series of activities according to the schedule to help the local people with aquaculture development through improved practices and management.

3.1 Baseline survey

Even though lots of background information on the current recycling aquaculture development of Sri Lanka and Vietnam was collected during the preparing stage, efforts were made to learn more about what was currently most needed in local aquaculture development and fish market demand. With the help of the counterparts, the group visited many local farms, hatcheries, experiment stations, etc. to get more authentic firsthand information on one side, and on the other side, to give more practical and feasible suggestions and guidance to the farmers and managerial personnel based on the real situation. The mission group had survey meetings with related officials, especially extension officials for more information on managerial level and extension aspect.

In Sri Lanka, accompanied by Mr. Herath, Director (Freshwater Development) of National Aquaculture Development Authority (NAQDA), the experts group first visited the wholesale markets for seafood in Colombo to investigate the local aquatic products trading conditions, and has mastered the related basic data of the Sri Lanka fishery. In recent years, the output value of fisheries production was about 70 billion rupees, which accounts for 1.5 percent of gross domestic product. And aquaculture production

was 15 thousand tons. It is estimated that more than 300,000 people directly engaged in the fisheries and aquaculture, which accounted for about 2 percent of total employment. Fishery products are exported with foreign exchange earning of nearly \$ 200 million, which is more than 2 percent of the total exports.

	
<p>Investigation in fish market of Sri Lanka</p>	<p>Survey in aquaculture farms of Sri Lanka</p>
	
<p>Meeting with fishery officers in Vietnam</p>	<p>Survey in aquaculture farm of Vietnam</p>

3.2 Technical consultation

In Sri Lanka, the experts group visited a private farms to investigate culture of Genetic Improvement of Farmed Tilapia (GIFT), and to provide farmers with direct guidance and advice. The experts group learnt that the farms focused on larvae rearing and adult fish cultural of GIFT. In view of the shortage of continuous local freshwater resources, the limitation of fecal waste collection and oxygen supply system in high-density culture, etc. the experts group advanced a tilapia culture mode based on Bio-floc aquaculture System (BAS), by adding organic carbon sources such as glucose, and it can not only purify the aquaculture environment, but also realize the food recycling use and reduce the sewage discharge greatly. They also suggested that GIFT should be feed to apparent satiation 4-5 times daily to increase feed conversion efficiency and growth rate. During the interview, the farmer has put forward the major current requirement, which include (1) construct, install and run oxygen equipment of solar panels; (2) install small-size fodder processing unit to improve the feed mixing efficiency, and (3)



would like to serve as the demonstration base of industrial recirculating aquaculture, and looking forward to spot-watching guidance and staff training by the relevant technicians.

In *Penaeus monodon* recirculation aquaculture base, the experts group found out that although the *Penaeus monodon* culture profit is high, it need very skilled breeding technology and developed system for water quality control. Therefore, according to the actual conditions, the experts group suggested that *Penaeus vannamei* should be cultured to reduce the aquaculture risk and ensure the breeding profit. During the interview, the farmer stated the main problems at present, which include (1) white spot syndrome virus (WSSV) was the most destructive shrimp virus, Therefore, breeding specific pathogen free(SPF) shrimp is one of the effective ways to prevent WSSV epidemic; (2) severe climate changes can easily cause stress disorders, such as gastrointestinal disorders of prawn.

	
<p>Technical consultancy in Tilapia farm in Sri Lanka</p>	<p>Technical consultancy in RAS farm in Sri Lanka</p>

In Vietnam, technical consultation was carried out in recirculating aquaculture bases of the First Fishery Research Institute and the Second Fishery Research Institute, respectively. These two bases have rich experience in conducting tilapia breeding and grow-out culture in recirculating system. The major challenges for it include disease prevention and treatment, lack of skilled technicians and facility upgrading, etc.. The experts group recommended the popular RAS facilities with higher farming efficiency and low energy consumption. They presented some conducive suggestions for disease prevention and treatment with bio-technology and equipment. Meanwhile, experts shared some experiences and knowledge on breeding technologies of tilapia, *Rosenboggii*, catfish and carps, etc.. Moreover, the experts group visited stated-owned fish breeding farm of Trung Tam Giong Thuy San in Hanoi and provided detailed instruction on how to improve the performance of seeding production of common carp, tilapia and grass

carp, etc.

	
<p>Technical consultancy in the First Fishery Research Institute, Vietnam</p>	<p>Technical consultancy in fish breeding farm of Trung Tam Giong Thuy San</p>

3.3 Technical training and academic exchanges

To help the transfer of Chinese advanced techniques on recirculating aquaculture systems, 3 technical trainings for the technicians and farmers engaged in RAS industry in Sri Lanka and Vietnam were organized. One was conducted in the National Aquaculture Development Authority, the Ministry of Fisheries and Ocean Resources (NAQDA/MFOR); another one was conducted in the Ngoc Dong Fishery Cooperative of the People's in Hanoi and one was conducted in Fishery Department of Phu Tho Province. Mr. Nuwan Prasantha, Chairman of NAQDA, Mr. Hoang Tien Minh, Director of Fishery Department of Hanoi Province and Mr. Don, Director of Fishery Department of Phu Tho Province attended the opening ceremonies of trainings, respectively. There were 30 fishery officers and technicians from NAQDA and 40 fishery officers and technicians from Ngoc Dong Fishery Cooperative of the People's in Hanoi and Fishery Department of Phu Tho Province participated in trainings.

4 technical presentations about RAS technology have been done by Prof. Min Kuanghong, Dr. Meng Shunlong, Dr. Zhang Chengfeng and Dr. Xu Gangchun respectively. The report on "Status and trend of Chinese RAS industry Development" was made by Prof. Min Kuanghong; the report on "Fish and vegetable co-existing in pond and recirculating aquaculture technology" was made by Dr. Meng Shunlong; the report on "the design of RAS" was made by Dr. Zhang Chengfeng and the report on "Industrial in-pond raceway recirculating aquaculture technology" was made by Dr. Xu Gangchun. The technological innovation and results of fish and vegetable co-existing and ecological-engineering recirculating aquaculture in China were introduced. The technical training integrated in-door lectures together with case study, simple lab works,

demonstrations and outdoor practices, which were more effective and much easier for the trainees to understand and to apply, and gained high praise and positive feedbacks from both the participants and the local authorities in both countries.

During the trainings, the development issues and needs of aquaculture, indoor industrialized culture technology (RAS), in-pond raceway recirculating culture technology (IPRS), and the prospect of the industrial recirculating aquaculture were introduced. In the part on fish and vegetable co-existing technology, the basic composition, purification mechanism, evolution process, water plant selection of fish and vegetable co-existing system were introduced, and carried out the detailed analyses of eco-culture model. In the part on recirculating aquaculture technology, the basic types, purification mechanism, advantages and disadvantages, construction method, wetland plants selection of artificial wetland were introduced. In the report of "Industrial Recirculating Aquaculture Technology", RAS involves a number of technologies, such as aeration, filtration, disinfection, temperature control, and the regulation of ammonia nitrogen and nitrite were transferred to participants.

To enhance the effect of training, group share were conducted. And the characteristics and key technologies of RAS were accurately summarized by participants: (1) there is no need to add coagulants, flocculants, alienating agents and other chemicals that cause chemical pollution, nor need to change much water, in order to make water form a virtuous cycle. (2) The dissolved oxygen of treated water is more than 7.5mg/L, so it is fresh and activated. (3) It can effective remove organic matter in water to maintain good water quality. (4) The backwash time of the equipment is short, the backwashing intensity is large, and the backwash quantity is less. (5) The quality of treated water reaches national standard, and some indexes are better than national standard. (6) Small land area and low cost. The IPRS is a new culturing technique, which includes culture in a small area (High-density) and regulate water quality in a big area. The basic principles of IPRS is to make use 2%~5% of pond area as culture areas, equipped with airlift, pushing water and aeration equipment, aimed to achieve higher density and super-intensive culture, and to make use 95%~98% of pond area, mainly used for biological purification of wastewater in pond culture. This new culture model aim to reduce production costs by intensifying production, and achieve no discharge or standard discharge of waste water in culture cycle. In this report, the structure and material of the in-pond Raceway, the increasing oxygen method, the purification method, the construction and regulation of ecosystem in purification area, and the key points of IPRS are summarized. In addition, the main farmed species, stocking mode, daily management, automatic feeding, and pollutants disposal methods were also introduce. The ultimate aim is to achieve no discharge or standard discharge of waste

water in culture cycle.



Technical training in Sri Lanka



Technical training in Vietnam

3.4 Workshop on future cooperation

During the implementation of the project, the experts group visited the economic and commercial counselor's office of Chinese Embassy in Sri Lanka, and reported a series of achievements of FFRC in international education training in recent years, short-term training. They exchanged more on the plan for future fishery cooperation, like technical training, high-value species exchange, academic exchange and staff exchange, etc.

To further strengthen and broaden the cooperation between FFRC and Sri Lanka, FFRC and Vietnam, based on what has been learnt through the technical consultation and training activities, workshops on future cooperation were held respectively in NQADA and Fishery Administration, Vietnam. These two workshop aimed at discussing and exchanging on how to establish a partnership of sustainable long-term cooperation.

In NQADA, Sri Lanka, Mr. Nuwan Prasantha, chairman of NQADA and Mr. Nimal, director of NQADA appreciated China's valuable support and assistance over these years, especially helping improve *Cyprinid* fish variety, controlling parasite outbreaks in black carp culture and so on. And then the two parties have had an extensive exchange on cooperation in the fields of capacity building, the genetic improvement of fish and academic exchange and other areas. The advices on how to solve the problems

they were facing and to improve their aquaculture practices were highly appreciated. And a memorandum of cooperation intent will be signed between FFRC and Sri Lanka during their visit to China.

In Fishery Administration, Vietnam, Dr. Pham Anh Tuan, DDG of Fishery Administration, expressed the willingness of conducting tilapia exchange, strengthening cooperation in the fields like aquaculture, aquaculture environment protection, disease prevention, etc.. Other priority areas like fish nutrition and feed development, disease prevention and control, aquaculture model, water quality control, market information, etc. were also discussed. The two parties proposed to form an annual mechanism for academic exchange.

The mission group also donated fishery appliances brought from China such as portable dissolved oxygen meter; microscope to NQADA and Fishery Administration, Vietnam, and taught the researchers in both agencies how to use them.



Meeting with ECC Officer in Sri Lanka



Workshop in NQADA



Workshop in Vietnam Fishery Administration



Donating apparatus to beneficiaries

III. Conclusion

After the activity was successfully implemented, the general and specific objectives were achieved and the overall outcomes were as the following:

- 1) Participants were able to enhance knowledge on the principles, and further understood technical context of Recirculating Aquaculture Systems, as well as socioeconomic and ecological benefits, political reflections as well.
- 2) Information of Recirculating Aquaculture Systems was exchanged between China and Laos. Success and experiences of China were shared through lectures, discussions and country reports.
- 3) Draft business plans and policy pitches were formulated through joint efforts to take actions to support the Recirculating Aquaculture Systems development.
- 4) Understanding of participants to farmer and community experiences relevant to Recirculating Aquaculture Systems especially the innovative culture model through the lectures.
- 5) Understanding of the China's Modern Aquaculture development and Industrialized Fisheries. Through the lecture "High stocking density recirculating aquaculture system" presented by Dr. XU Gangchun, participants got the opportunity to know the policy and strategy of China's aquaculture development.
- 6) Through the technical support of FFRC Mission team, it helped the capacity building for the local fishery officials and the farmers in the pilot demonstration farm. Also the ideas and suggestions of the Mission Team were much useful for the future plan of RAS in both countries.
- 7) The Workshops organized in NQADA provided a platform where the ideas from both sides were exchanged and shared. Both sides reached consensus on the priority fields for future cooperation.

IV. Advice for future cooperation

With all sides recognizing the necessity and possibility for further cooperation, a

Memorandum of Understanding (MOU) was signed between FFRC and NQADA with the following fields as cooperation priorities:

- Training of fish farming communities: seed production, feed production, safety and quality control, disease prevention and treatment, and Mariculture (fish and mollusks culture), etc.;
- Collaborative research: management of brood stock and feed production, etc.;
- Technical assistance: extension strategies, aquaculture information technology, etc..

Priority fields between FFRC and Vietnam are listed in the following field for mutual cooperation in the near future:

- Training on fish farming: seed production and hatchery management, feed development, pond management, disease prevention and treatment, technical extension and demonstration, freshwater prawn culture, etc.
- Collaborative research: selective breeding and sex reversal control of tilapia, aqua-feed development and beneficiary bacterial development, etc.
- Technical assistance and cooperation: design of new fish farming system, establishment of fishery technical demonstration bases and capacity building of research fellows, etc.
- Fish species exchange: tilapia, catfish and *Rosenbergii*, etc.

V. Appendix

1. Financial Costs and Expenses

2. Schedule of the project

3. Scanned copy of Agreement of Cooperation

4. Name list of mission group members

1. Financial Costs and Expenses

The uses and allocation of the project fund was strictly based on the financial budget, with a few adjustments according to the actual number of mission group members and that of participants of the training sessions. Each sum of money was spent in place, and all the process was under the monitor of the project leaders; FFRC financial staff have also evaluated and reviewed the project expenses.

Project fund expenditure

No.	Items	PGTF Fund	FFRC Fund	Total
1	Reference book compilation	US\$2,000	0	US\$2,000
2	International Travel fees of Chinese experts	US\$5,900	0	US\$5,900
3	Lodging for Chinese experts	US\$10,800	0	US\$10,800
4	Meal for Chinese experts	US\$3,200	0	US\$3,200
5	Transportation for Chinese experts in Vietnam and Sri Lanka	US\$3,600	0	US\$3,600
6	Allowance for Chinese experts	0	US\$12,000	US\$12,000
7	Travel tickets for technicians and farmers of Vietnam and Sri Lanka	0	US\$5,600	US\$5,600
8	Lodging for technicians and farmers of Vietnam and Sri Lanka	0	US\$7,400	US\$7,400
9	Pocket money for technicians and farmers of Vietnam and Sri Lanka	0	US\$7,000	US\$7,000
10	Training & meeting of Chinese experts	US\$1,000	US\$2,500	US\$3,500
11	Training equipment purchase	US\$1,500	US\$4,500	US\$6,000
12	Workshop and training (arrangement, venue and facility lease, etc.)	US\$5,500	US\$2,500	US\$8,000
13	Materials translating, editing, copying, printing, internet etc.	US\$500	US\$2,500	US\$3,000
14	Wrap-up and report	US\$1,000	0	US\$1,000
15	Miscellaneous Component Total	0	US\$2,000	US\$2,000
Total		US\$35,000	US\$46,000	US\$81,000

2. Provisional Schedule

PGTF Program--Improvement of Recirculating Aquaculture System (RAS) Performance in Vietnam and Sri Lanka

Date	Time	Activity
13 July	09:00-19:00	Departure for Colombo, Sri Lanka
14 July	08:30-11:30	Meeting with Chairman and senior officers of National Aquaculture Development Authority (NAQDA), Sri Lanka; and discussing the detailed activities for program implementation
	14:00-16:30	Meeting with officers of Economic and Commercial Counselor's Office of the Chinese Embassy
15 July	08:00-10:30	Driving to Rambodagalla Fish Breeding and Training Center (FBTC)
	10:30-12:00	Exchange with FBTC staff and local farmers on situation and technical needs for application of Recirculating Aquaculture System (RAS) in Rambodagalla
	12:30-14:30	Technical consultancy in tilapia farm for application of bio-floc technology in RAS
	15:00-17:00	Technical consultancy in <i>Monodon</i> RAS farm for disease control
	17:00-19:00	Driving back to Colombo
16 July	08:30-11:30	Presentation: <ul style="list-style-type: none"> ● Status and trend of Chinese RAS industry Development ● Fish and vegetable co-existing in pond and recirculating aquaculture technology
	14:00-17:00	Presentation: <ul style="list-style-type: none"> ● Design and facility use of RAS ● Industrial in-pond raceway recirculating aquaculture technology
17 July	08:30-11:30	Tour to fish market in Colombo
	14:00-17:00	Seminar on future plan for improving performance of RAS in Sri Lanka
18 July	08:00-11:30	Seminar on future cooperation in aquaculture between NQADA and FFRC and drafting MOI
	12:00-17:00	Wrapping-up
19 July	08:00-19:00	Departure for Hanoi, Vietnam
20 July	08:30-11:30	Meeting with senior officers of Fisheries Department,

		Vietnam; and discussing the detailed activities for program implementation and priority fields for future cooperation
	14:00-17:00	Technical visit and consultancy in the First RIA
21 July	08:30-11:30	<p>Presentation:</p> <ul style="list-style-type: none"> ● Status and trend of Chinese RAS industry Development ● Fish and vegetable co-existing in pond and recirculating aquaculture technology
	14:00-17:00	<p>Presentation:</p> <ul style="list-style-type: none"> ● Design and facility use of RAS ● Industrial in-pond raceway recirculating aquaculture technology
22 July	08:30-11:30	Travel to Phu Tho Province
	14:00-17:00	Technical consultancy on improvement of fish seed production in Trugung Tam Giong Thuy San Farm
23 July	08:30-11:30	<p>Presentation:</p> <ul style="list-style-type: none"> ● Status and trend of Chinese RAS industry Development ● Fish and vegetable co-existing in pond and recirculating aquaculture technology
	14:00-17:00	<p>Presentation:</p> <ul style="list-style-type: none"> ● Design and facility use of RAS ● Industrial in-pond raceway recirculating aquaculture technology
24	08:30-11:30	Flight to HCM city
	14:00-16:00	Technical consultancy to 2 prawn breeding stations of the Second RIA
25	08:30-11:30	Visit the Second RIA and seminar on future cooperation in aquaculture between Vietnam and FFRC
	14:00-16:00	Wrapping-up
26 July	08:30-17:30	Back to China

3. Scanned copy of Agreement of Cooperation

MOI between NQADA and FFRC

Memorandum of Intent

Between

**The Freshwater Fisheries Research Centre, of the Chinese Academy of Fisheries Sciences (FFRC/CAFS),
China**

And

The National Aquaculture Development Authority (NAQDA), Sri Lanka

For the Program

“Strengthening Capacity of Technology in farming techniques of Aquaculture

Inter- regional Cooperation & capacity improvement of Human Resources between the two parties.”

This Memorandum of Intent (MoI) is between Freshwater Fisheries Research Centre, of the Chinese Academy of Fisheries Sciences (here in after referred to as FFRC/CAFS), China and National Aquaculture Development Authority Sri Lanka coming under the Ministry of Fisheries & Aquatic Resources Development and Rural Economy (here in after referred to as NAQDA)

1. Background

Freshwater Fisheries Research Center of Chinese Academy of Fishery Sciences (FFRC/CAFS), affiliated to Ministry of Agriculture Rural Affairs, China, is a comprehensive institution for fishery research and development, combining together scientific research, training and education, technology extension and information exchange. Since its establishment, FFRC has been awarded with 186 prizes, among which 9 are of national level (5 of second-grade and 4 of third-grade) and 65 of provincial or ministerial level. Moreover, FFRC has been consecutively conducting international training programs for fishery officials and technicians since 1981. Up to now, around 3700 senior aquaculturists and managerial personnel from about 129 countries/regions have been trained.

With the responsibility for the development and promotion of inland fisheries, freshwater and coastal aquaculture in Sri Lanka, National Aquaculture Development Authority (NAQDA) which is an institute coming under the Ministry of Fisheries & Aquatic Resources Development and Rural Economy plays a major role in implementing the strategies formulated in its Corporate Plan by promoting, facilitating and exercising monitoring and regulatory activities to ensure sustainable development and enhanced production from inland fisheries, culture based fisheries and aquaculture in Sri Lanka.

FFRC and NAQDA has been in active cooperation for more than 35 years in various fields of freshwater aquaculture development. The cooperation resulted in numerous joint R&D projects, exchanges of experts and fish seeds. The cooperation proved to mutually beneficial both for FFRC and

1

NAQDA and also contributed to the development of freshwater aquaculture in China and Sri Lanka. Leaders of FFRC and NAQDA expressed their interest in the renewal of cooperation and decided to sign a Memorandum of Intent.

2. Main themes of the cooperation:

- Intensive fish farming techniques
- Technology of pearl culture
- Technology on crab breeding and farming
- Recirculation aquaculture system
- Aquaculture engineering
- Market information (potentials, demands and requirements, etc.)
- Capacity building of the staff through MSc./PhD. Degree programmes and technical training(aquaculture, culture-based fisheries, fish feed processing, selective breeding of Tilapia and Carp varieties and others)
- Fish seed exchange

Additional areas of cooperation may be added by mutual agreement.

3. Forms of R&D cooperation

- Implementation of joint research programs;
- Exchange of R&D information;
- Exchange of scientists (short term);
- Joint publication;
- Technical training programs;
- Parties make efforts to contribute jointly to the strengthening of inter-regional cooperation (in cooperation with FAO, NACA and other international organisations);
- Joint participation in national and international scientific workshops, symposia and conferences;

Cooperation in forms other than those mentioned in the preceding section shall be determined through mutual consultation and agreement.

4. Financing of cooperation

For financing the cooperation, parties are using their own financial resources, however they do their best to explore additional financing opportunities from external resources either from Chinese or Sri Lanka development institutions, international organisations, or also from innovative companies for development programs.

5. Procedures

Parties are carrying out the joint activities in the frame of annual workplans, that include the specific activities, the persons responsible for the implementation, conditions required for the implementation (including financial conditions), reporting and deadline.

Competent leaders of FFRC and NAQDA review and evaluate the results and experiences of the cooperation once a year and suggest follow up activities that form the base of an annual work plan. Then the workplan is finalized and signed by representatives of both FFRC and NAQDA.

The Parties shall strive to make research results publicly known to the scientific community and society at large primarily through publications, seminars, lectures, and conferences. Procedures for disclosing research results shall be determined through mutual consultation and agreement by the Parties.

This Agreement may be amended by written consent of the Parties.

Matters not provided for in this Agreement shall be determined through mutual consultation and agreement.

Parties assign a competent person in their institutions who are following and supervising the activities of the cooperation, assisting the work and report to the leadership if any corrective measure is required.

6. General provisions

Cooperation will be in concert with each organization's national and local regulations, procedures and policies.

Treatment of intellectual property rights will be determined between the Parties through mutual consultation and agreement on a case-by-case basis, consistent with principles of existent laws of Sri Lanka and China.

This Agreement shall become effective on the date it is signed by both Parties and be valid for five (5) years. Written notice of intent to terminate shall be given by one Party to the other Party at least six (6) months prior to the date of the termination.

In witness whereof, the Parties have executed this Agreement and represent that they approve, accept and agree to the terms contained herein.

SIGNED AND DELIVERED by the authorized representatives of both Parties


.....

Prof. Hu Haiyan

On behalf of

FFRC/CAFS

Date: 18/7/2018


.....

Mr. N. P Madawan Arachchi

On behalf of

NAQDA

Date: 18/7/2018

4. Name list of mission group members

Name	Gender	Occupation	Expertise field
Hu Haiyan	Male	Assistant to Director General Freshwater Fisheries Research Center, Chinese Academy of Fishery Sciences	Management on fishery science & management
Min Kuanhong	Male	Professor Freshwater Fisheries Research Center, Chinese Academy of Fishery Sciences	Aquaculture technology extension
Xu Gangchun	Male	Associate Professor Freshwater Fisheries Research Center, Chinese Academy of Fishery Sciences	Breeding and culture farming management in RAS
Zhang Chengfeng	Male	Associate professor Freshwater Fisheries Research Center, Chinese Academy of Fishery Sciences	Design and facility use in RAS
Meng Shunlong	Male	Associate professor Freshwater Fisheries Research Center, Chinese Academy of Fishery Sciences	Water improvement technology
Xu Sheng	Male	Associate professor Freshwater Fisheries Research Center, Chinese Academy of Fishery Sciences	Engineering of pond and RAS system