

July 1993

No. 2	I Phase: Fundamental study										II Phase: Application									
	1988		1989		1990		1991		1992		1993		1992		1993					
	Apr.	Mar.	Apr.	Mar.	Apr.	Mar.	Apr.	Mar.	Apr.	Mar.	Apr.	Mar.	Apr.	Mar.	Apr.	Mar.				
term of cooperation : 5 years	FISCAL YEAR:		1989		1990		1991		1992		1993		1992		1993					
	MONTH : Oct.																			
2. REARING TECHNOLOGY OF LARVAE																				
2-1 Refinement of Rearing Techniques																				
2-1-1 Fundamental techniques of larval rearing			C B A		A		A													
2-1-2 Rearing management (handling, feeding, harvesting, cleaning, etc.)			C B A		A		A													
2-1-3 Studies for the application of micro diets			3. C		B		C		B		C		A		B					
2-1-4 Intermediate (nursery) culture techniques			4. C		C		C		B		A									
2-1-5 Technical manual for larval rearing			5. C		C		C		B		A									
2-2 Natural Feed																				
2-2-a phytoplankton (algal organisms)			C B		A		A		A		A									
2-2-1 Investigation of suitable local species			C B		A		A		A		A									
2-2-2 Isolation techniques (micro-pipetting, dilution method, agar plate)			C B		A		A		A		A									
2-2-3 Stock culture techniques (preservation, management)			4. C		B		A		A		A									
2-2-4 Studies of the optimum environment conditions and culture media			5. C		B		B		A		A									
2-2-5 Studies of mass culture techniques			6. C		B		A		A		A									
2-2-6 Systematic culture management			7. C		B		A		A		A									
2-2-b. Feeding experiments			8. C		B		A		A		A									
2-2-7 Experiments on the nutritional value of algal organisms			9. C		B		A		A		A									
2-2-8 Experiments on the nutritional value of animal organisms																				
2-2-9 Experiments on the feeding ecology																				
2-3 Environmental Conditions																				
2-3-1 Studies on the optimum environment conditions of larval rearing (physico-chemical factors)			1. C		B		A		B		A		B		A					
2-3-2 Maintenance of sterile environment																				
2-3-3 Improvements due to modified hatchery																				

Result of MET Confirmed by CST Confirmed by FET

July 1993

No. 3	I Phase: Fundamental study					II Phase: Application						
	1988	1989	1990	1991	1992	1993	1988	1989	1990	1991	1992	1993
term of cooperation: 5 years	Apr.	Mar.	Apr.	Mar.	Apr.	Mar.	Apr.	Mar.	Apr.	Mar.	Apr.	Mar.
FISCAL YEAR:	1988		1989		1990		1991		1992		1993	
MONTH: Oct.	Apr.	Mar.	Apr.	Mar.	Apr.	Mar.	Apr.	Mar.	Apr.	Mar.	Apr.	Mar.
3. FEED DEVELOPMENT												
3-1 Studies on Nutrient Requirement for shrimp												
3-1-1 Theory												
3-1-2 Rearing techniques of larvae employed compounding feed and examination of its effect	1.											
3-1-3 Making refined experimental feed for larvae												
3-1-4 Experiments on nutrient requirements for larvae												
3-1-5 Experiments on nutrient requirements for broodstock												
3-2 Studies on feed formulation for shrimp												
3-2-1 Investigations of nutrient value in prospective raw materials for larval feed												
3-2-2 Investigations of nutrient value in prospective raw materials for broodstock feed												
3-2-3 Compounding feed for larvae												
3-2-4 Compounding feed for broodstock												
3-3 Evaluation of compounding feed												
3-3-1 Production methods												
3-3-2 Examinations for efficiency												
3-4 Technical manual												

* For Larvae : B, For Broodstock : C
 ** For Larvae : B, For Broodstock : C

Result of MET Confirmed by CST Confirmed by FET

No. 4	I Phase: Fundamental study — II Phase: Application												
	fiscal year :		1988	1989	1990	1991	1992	1993					
term of cooperation: 5 years	month :	Oct.	Apr.	Mar.	Apr.	Aug.	Mar.	Apr.	Sep.	Mar.	Apr.	Jul.	Oct.
4. DISEASES PROBLEM													
4-1	Preparation/installation of Equipment/apparatus and learning how to use												
4-2	Techniques for diagnosis (Symptoms, Isolation/culture of pathogens, rapid diagnosis, histopathology)												
4-2-1	Viral diseases												
4-2-2	Bacterial diseases												
4-2-3	Fungal diseases												
4-2-4	Parasitic diseases												
4-2-5	Diseases caused by environmental factors												
4-2-6	Nutritional deficiency												
4-3	Epidemiological field surveys for shrimp diseases												
4-3-1	Investigations of the outbreak & damage (questionnaire, interview and taking the history and examination)												
4-3-2	Making an Atlas for shrimp diseases (Identification of causative factors)												
4-4	Studies on the prevention of epidemics												
4-4-1	Methods of preserving the isolates												
4-4-2	Drug sensitivity tests of the isolates												
4-4-3	Experiments on the prevention of infectious diseases (investigations of pathogenicity and prevention/treatment)												
4-4-4	Therapeutic examinations in the field												
4-4-5	Regular sampling from the rearing tanks & ponds (water quality, flora of the micro organisms etc.)												
4-4-6	Studies on precautions of epidemics (examinations for factors/conditions of outbreak)												
4-5	Making a manual for diagnosis												

* : Not including VIRUS Result of MET Confirmed by CST Confirmed by

Annex 5

Journal of Coastal Aquaculture Research Vol.7 No.1, 1991

In spawner production

- Effect of photoperiod on the gonadal maturation of tiger prawn
- Study on the environmental condition of the fishing ground of tiger prawn broodstock in Jembrana, Bali

In feed development

- Survey on the utilization of artificial feed for tiger prawn at hatcheries in Bali and East Java
- Substitution of fish meal with shrimp head meal as protein source on feed formulation for tiger prawn
- Evaluation on the utilization of some local feedstuffs as nutrient sources in feed formulation for growth of tiger prawn
- Effect of several commercial feeds on the growth of tiger prawn larvae

In larvae rearing technology

- The utilization of living food for mass culture of tiger prawn larvae
- Effect of natural feeds to the growth of tiger prawn larvae
- Development of larvae stage, growth and survival rate of tiger prawn larvae fed with different natural feeds
- Comparative study of the larvae growth and survival rate of tiger prawn fed with three species of diatoms
- Effect of light intensity on the growth of cell population of *Skeletonema* sp collected from Tanjung Perak, Surabaya
- Effect of different water exchange percentages on the survival rate of tiger prawn postlarvae

In disease problem

- *Vibrio* sp as opportunistic pathogen for tiger prawn

Journal of Coastal Aquaculture Research Vol.8 No.3, 1992

In spawner production

- Study on morphometric variability of broodstock for genetic improvement in tiger prawn, *Penaeus monodon*
- Induced ovarian maturation of *Penaeus monodon* by injection with lobster, *Panulirus homarus* thoracic ganglion extraction
- Effect of ultraviolet irradiation on the spawning rate and egg quality of tiger prawn, *Penaeus monodon*
- Survey on the utilization of tiger prawn, *Penaeus monodon* spawners resources in Nusa Tenggara

In larvae rearing technology

- The isolation technique forward-stock *Skeletonema* sp preservation in laboratory
- Influence of initial diatoms feeding delay on the growth and survival rate of *Penaeus monodon* larvae
- Effect of green macroalgae, *Ulva* sp added into the larval rearing tank of tiger prawn, *Penaeus monodon*
- The influence of different artemia initial feeding delay on the growth and survival rate of tiger prawn, *Penaeus monodon* larvae
- Effect of photoperiods on the growth and survival rate of tiger prawn, *Penaeus monodon* larvae

In feed development

- Effect of different levels of vitamin L-Ascorbyl 2-Phosphate Magnesium in feed on development and survival rate of tiger prawn, *Penaeus monodon* larvae
- Preliminary study on the effect of some protein sources on the development and survival rate of tiger prawn, *Penaeus monodon* larvae
- Response of tiger prawn, *Penaeus monodon* larvae toward experimental and commercial feeds
- Evaluation the utilization of local feedstuffs as protein sources on growth and survival rate of tiger prawn, *Penaeus monodon* juveniles

In disease problem

- Characteristics of several luminescent bacteria isolated from tiger prawn, *Penaeus monodon* larvae
- *Haliphthoros* sp, a parasitic fungus on the larvae of tiger prawn, *Penaeus monodon*

Asian Fisheries Forum October 26-30, 1992 Singapore

In disease problem

- Histological study of luminescent vibriosis diseases in hatchery reared larvae of *Penaeus monodon*

In feed development

- Effect of L-Ascorbyl 2-Phosphate Magnesium in feed on the growth of *Penaeus monodon* juveniles

In larvae rearing technology

- Survival and development of *Penaeus monodon* larvae reared on different species of phytoplankton

In spawner production

- Induced maturation, spawning and rematuration of pond reared *Penaeus monodon* under different female size

Annex 6

NUMBER OF STUDENT FROM VARIOUS UNIVERSITIES
Carried out an experiment for graduation and short training

NAME OF UNIVERSITIES	NUMBER OF STUDENT			
	YEAR			
	1990	1991	1992	1993
1. Bogor Agriculture University	6	35	29	13
2. Gajah Mada University	3	2	2	-
3. Diponogoro University	1	1	6	-
4. Brawijaya University	1	8	6	3
5. Udayana University	-	1	1	-
6. Warmadewa University	3	1	3	-
7. Budi Utomo University	-	3	-	-
Total	14	51	47	19

NUMBER OF PRIVATE HATCHERY PERSON TOOK TRAINING IN
LARVA REARING AND DISEASES

YEAR	LARVAL REARING	SHRIMP DISEASES
1991	7	11
1992	10	8
1993 (May 1993)	2	13
TOTAL	19	32

Annex 7

**NAME OF PRIVATE HATCHERIES TOOK PURE & MASS CULTURE
OF PHYTOPLANKTON IN GONDOL**

N A M E	1991	1992	1993
1. PT. Mutiara Blambangan	5	1	1
2. PT. Ndaru Laut	2	2	3
3. PT. Benur Sakti	-	1	1
4. PT. Windu Agung	-	1	1
5. PT. Windu Laut	-	1	1
6. PT. Windu Kéncono	1	1	-
7. PT. Benur Indah Jaya	-	1	1
8. PT. Surya Adikumala Abadi	-	1	-
9. PT. Benur Putri	3	1	2
10. PT. Mutiar Biru	-	1	-
11. PT. Windu Basuki	-	1	-
12. PT. Tirta Mutiara Makmur	-	1	-
13. PT. Summa Benur	4	2	1
14. PT. Dewi Windu	-	1	1
15. PT. President Benur	-	1	1
16. PT. Tiko Windu Kusuma	-	1	1
17. PT. Delta Windu Purnama	-	1	1
18. PT. Taman Benur Nusantara	-	1	1
19. PT. Kurnia Agrograha	-	1	1
20. PT. Sanitara	-	3	1
21. PT. Sarana Boga	-	3	1
22. PT. Tri Windu (TWM)	-	1	1
23. PT. Dipa Sena	-	1	1
24. PT. Bonecom	-	2	1
25. PT. Bali Nusa Windu Mas	-	1	1
26. PT. Bama	-	4	1
27. PT. Lingga Laut Wisena	-	5	6
28. PT. Urang Ayu	-	1	2
29. PT. Windu Jaya	-	1	2
30. PT. Putra Cendana	-	1	1
31. PT. Samaya Sapta Setya Sejati	10	15	10
32. PT. Duta Benur	2	-	-
33. PT. Lagoon	-	-	1
34. PT. Mahkota Benur	-	1	1
35. PT. Delta Benur	-	1	1
36. PT. Benur Unggul	-	-	1
37. PT. Mutiara Biru	-	1	1
38. PT. Benih Agung	-	-	1
39. CV. Laut Mas	-	1	-
40. Sub Center DGF	-	1	1
Total	27	60	57

4 プロジェクト方式技術協力に関するR/D

THE RECORD OF DISCUSSIONS
BETWEEN THE JAPANESE IMPLEMENTATION SURVEY TEAM
AND THE AUTHORITIES CONCERNED OF
THE GOVERNMENT OF THE REPUBLIC OF INDONESIA
ON JAPANESE TECHNICAL COOPERATION FOR
STRENGTHENING THE RESEARCH AND DEVELOPMENT OF COASTAL AQUACULTURE PROJECT

The Japanese Implementation Survey Team (hereinafter referred to as "the Team") organized by the Japan International Cooperation Agency (hereinafter referred to as "JICA") and headed by Mr. Syunichi Hozumi, visited the Republic of Indonesia from October 16 to October 27, 1988 for the purpose of working out the details of the technical cooperation program concerning Strengthening the Research and Development of Coastal Aquaculture Project (hereinafter referred to as "the Project") in the Republic of Indonesia.


During its stay in the Republic of Indonesia, the Team exchanged views and had a series of discussions with the Indonesian authorities concerned in respect of the desirable measures to be taken by both Governments for the successful implementation of the above mentioned project.

As a result of the discussions, both parties agreed to recommend to their respective Governments the matters referred to in the document attached hereto.

Jakarta, October 26, 1988



Mr. Syunichi Hozumi
Leader, Implementation Survey
Team, Japan International
Cooperation Agency



Dr. Soetatwo Hadiwigeno
Director General,
Agency for Agricultural Research
and Development

THE ATTACHED DOCUMENT

I. COOPERATION BETWEEN BOTH GOVERNMENTS

1. The Government of Japan and the Government of the Republic of Indonesia will cooperate with each other in implementing Strengthening the Research and Development of Coastal Aquaculture Project for the purpose of strengthening the study and research activities on shrimp seed production and related items, and thus contributing to development of shrimp culture in the Republic of Indonesia.

2. The Project will be carried out at Gondol Research Station and Negara Installation of Gondol Research Station of Research Institute for Coastal Aquaculture (hereinafter referred to as "RICA"), Agency for Agricultural Research and Development (hereinafter referred to as "AARD").

3. The Project will be implemented in accordance with the Master Plan which is given in Annex I.

II. DISPATCH OF JAPANESE EXPERTS

1. In accordance with laws and regulations in force in Japan, the Government of Japan will take necessary measures through JICA to provide, at its own expense, services of the Japanese experts as listed in Annex II through the normal procedures under the Colombo Plan Technical Cooperation Scheme.

2. Privileges, exemptions and benefits to be granted by the Government of the Republic of Indonesia to the Japanese experts and their families in the Republic of Indonesia will be no less favorable than those granted to experts of third countries or of international organization such as the United Nations who are performing similar missions, and will include the following :

- (1) Exemption from income taxes and charges of any kind imposed on or in connection with the living allowances remitted from abroad in relation to the implementation of the Project;
- (2) Exemption from import and export duties and any other charges imposed in respect of personal and household effects which may be brought in from abroad or taken out of the Republic of Indonesia ;
- (3) Exemption from import taxes, import sales taxes, sales taxes and other taxes and charges of any kind imposed on or in connection with the purchase in the Republic of Indonesia by the Japanese experts of one motor vehicle per expert;
- (4) Free local medical services and facilities for the Japanese experts and their families.

III. PROVISION OF EQUIPMENT

1. In accordance with laws and regulations in force in Japan, the Government of Japan will take necessary measures through JICA to provide, at its own expense, such as equipment, machinery and other materials (hereinafter referred to as "the Equipment") necessary for the implementation of the Project as listed in Annex III through the normal procedures under the Colombo Plan Technical Cooperation Scheme.
2. The Equipment will become the property of the Government of the Republic of Indonesia upon being delivered CIF to the Indonesian authorities concerned at the ports and/or airports of disembarkation, and will be utilized exclusively for the implementation of the Project in consultation with the Japanese experts referred to in Annex II.

IV. SPECIAL MEASURES TO BE TAKEN BY THE GOVERNMENT OF JAPAN

In order to assure the smooth implementation of the Project, in accordance with laws and regulations in force in Japan, the Government of Japan will take necessary measures through JICA to supplement a part of the local expenditures involved in execution of the physical infrastructure of the Project, such as construction work on the experimental hatchery.

V. TRAINING OF INDONESIAN PERSONNEL IN JAPAN

1. In accordance with laws and regulations in force in Japan, the Government of Japan will take necessary measures through JICA to accept, at its own expense, the Indonesian personnel connected with the Project for technical training in Japan through the normal procedures under the Colombo Plan Technical Cooperation Scheme.
2. The Government of the Republic of Indonesia will take necessary measures to ensure that the knowledge and experience acquired by the Indonesian personnel who have received technical training in Japan will be utilized effectively for the implementation of the Project.

VI. SERVICES OF INDONESIAN COUNTERPART AND ADMINISTRATIVE PERSONNEL

1. In accordance with laws and regulations in force in the Republic of Indonesia, the Government of the Republic of Indonesia will take necessary measures to secure, at its own expense, the necessary services of Indonesian counterpart and administrative personnel as listed in Annex IV.
2. The Government of the Republic of Indonesia will allocate the necessary number of suitably qualified personnel, corresponding to each Japanese experts to be dispatched by the Government of Japan as listed in Annex II, for the effective and successful transfer of technology under the Project.

VII. MEASURES TO BE TAKEN BY THE GOVERNMENT OF THE REPUBLIC OF INDONESIA

1. In accordance with laws and regulations in force in the Republic of Indonesia, the Government of the Republic of Indonesia will take necessary measures to provide at its own expense :

- (1) Land and facilities as listed in Annex V;
- (2) Supply or replacement of equipment, machinery, vehicles, instruments, tools, spare parts thereof and any other materials necessary for the implementation of the Project other than those provided through JICA under III above;
- (3) Transportation facilities and travel allowances for the official travel of the Japanese experts within the Republic of Indonesia;
- (4) Suitably furnished accommodations for the Japanese experts and their families.

2. In accordance with laws and regulations in force in the Republic of Indonesia, the Government of the Republic of Indonesia will take necessary measures to meet:

(1) Expenses necessary for the transportations of the Equipment within the Republic of Indonesia, as well as for the installation, operation and maintenance thereof:

(2) Customs duties, internal taxes and any other charges imposed on the Equipment in the Republic of Indonesia:

(3) All running expenses necessary for the implementation of the Project.

VIII. ADMINISTRATION OF THE PROJECT

1. The Director of Central Research Institute for Fisheries will bear overall responsibility for the implementation of the Project.

2. The director of RICA, as the Head of the Project, will be responsible for the administrative and managerial matters of the Project.

3. The Japanese Team Leader will provide necessary recommendations and advise on technical and administrative matters concerning the implementation of the Project to the Head of the Project.

4. The Japanese experts will give necessary technical guidance and advice, through joint research, to the Indonesian counterpart personnel on matters pertaining to the implementation of the Project.

5. For the effective and successful implementation of the Project, a Joint Committee will be established with the functions and composition as referred to in Annex VI.

IX. CLAIMS AGAINST JAPANESE EXPERTS

The Government of the Republic of Indonesia undertakes to bear all claims, if any should arise, against the Japanese experts engaged in the Project, resulting from, occurring in the course of, or otherwise connected with the discharge of their official functions in the Republic of Indonesia except for those arising from the willful misconduct or gross negligence of the Japanese experts.

X. MUTUAL CONSULTATION

There will be mutual consultation between the two Governments on any major issues arising from, or in connection with this Attached Document.

XI. TERM OF COOPERATION

The duration of the Technical Cooperation for the Project under this Attached Document will be five (5) years from October 26, 1988.

However, there will be a general review on the progress of the implementation of the Project during the third year of the cooperation in order to decide as to whether the cooperation should be modified for the rest of the period.

ANNEX I MASTER PLAN

1. The Project is to be implemented at Gondol Research Station of RICA, Bali Province.

2. The purpose of the Project is to strengthen the study and research activities on shrimp seed production and related items at Gondol Research Station and Negara Installation of Gondol Research Station of RICA, expecting to contribute to the development of shrimp culture in the Republic of Indonesia through the following activities.
 - (1) Research program
 - a. Spawner production
 - b. Rearing technology of larvae
 - c. Feed development
 - d. Disease problem
 - e. Other items closely related to seed production

 - (2) Dissemination of research result (training, seminars, workshop, publications) in consultation with other related organizations

ANNEX II JAPANESE EXPERTS

1. Team Leader
2. Coordinator
3. Long-term Experts in the field of :
 - (1) Shrimp Breeding
 - (2) Larvae Rearing
 - (3) Feed Development

Note : 1. Total number of the Japanese Long-term experts listed 1,2 and 3 above will be about five (5).

2. Short-term experts will be dispatched when necessity arises for the smooth implementation of the project.

ANNEX III LIST OF THE EQUIPMENT

1. Equipment, machinery and materials necessary for research of shrimp culture
2. Books and other necessary printed matters
3. Vehicles
4. Other equipment, machinery, materials and spare parts thereof necessary for the implementation of the Project.

ANNEX IV LIST OF INDONESIAN COUNTERPART AND ADMINISTRATIVE PERSONNEL

1. Head of the Project (Director of RICA)
2. Head of the project site (Director of Gondol Research Station of RICA)
3. Counterpart personnel for the Japanese experts in ANNEX II.
4. Administrative personnel including secretary, typists and clerks
5. Car drivers, watchmen, workers, etc.

ANNEX V LIST OF LAND AND FACILITIES

1. Land

Land of Gondol Research Station of RICA and Negara Sub Station of Gondol Research Station

2. Facilities

- (1) Office room for each Japanese Expert
- (2) Laboratories
- (3) Library
- (4) Storage house and workshop
- (5) Dormitory
- (6) Other facilities necessary for the implementation of the Project

ANNEX VI THE JOINT COMMITTEE

1. Functions

The Joint Committee will be held at least once a year and whenever necessity arises, and work:

- (1) To formulate the annual working plan of the Project in line with the framework of the Record of Discussions;
- (2) To review the overall progress of the technical cooperation program as well as the achievements of the above mentioned annual working plan;
- (3) To review and exchange views on major issues arising from or in connection with the Project.

2. Composition

(1) Chairman : Director of CRIFI

(2) Members :

a. Indonesian side :

- Representative of Ministry of Agriculture
- Representative of AARD
- Representative of BAPPENAS
- Representative of SETKAB
- Director of RICA
- Head of provincial fisheries office, Bali
- Counterpart personnel assigned to the Project
- Representative(s) of other related organization(s) if necessary

b. Japanese side :

- Team Leader
- Coordinator
- Experts assigned to the Project
- Resident Representative of JICA in the Republic of Indonesia
- Other personnel concerned to be dispatched by JICA, if necessary

Note : Official(s) of the Embassy of Japan may attend the meeting of the Joint Committee as observer.

THE MINUTES OF MEETING ON THE RECORD OF DISCUSSIONS
ON THE JAPANESE TECHNICAL COOPERATION FOR
STRENGTHENING THE RESEARCH AND DEVELOPMENT OF COASTAL AQUACULTURE PROJECT
IN THE REPUBLIC OF INDONESIA

The Japanese Implementation Survey Team, JICA of Japan and the Indonesian authorities concerned, signed the Record of Discussions (hereinafter referred to as "the R/D") on the Japanese Technical Cooperation for the Project.

Understandings reached between both sides are recorded in the following in order to clarify some specific matters concerning the provisions in the R/D.

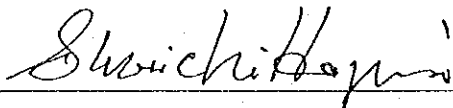
1. As for the replacement of the equipment referred to in VII.1.(2) of the Attached Document of the R/D, the communications network necessary for the implementation of the Project would be prepared continuously.
2. As for the housing accommodations referred to in VII.1.(4) of the Attached Document of the R/D, the accommodations as follows would be provided for Japanese experts.

(1) 1 Guest house at Gondol Research Station

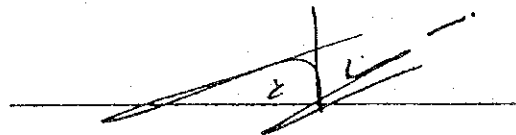
(2) 1 Staff house at Gondol Research Station

3. As for the budgetary allocation referred to in VII.2.(3) of the Attached Document of the R/D, the budget necessary for the smooth implementation of the Project would be allocated.

Jakarta, October 26, 1988



Mr. Syunichi Hozumi
Leader, Implementation Survey
Team, Japan International
Cooperation Agency



Ir. Sofyan Ilyas
Director,
Central Research Institute for
Fisheries

MINISTRY OF AGRICULTURE
AGENCY FOR AGRICULTURAL RESEARCH AND DEVELOPMENT

Jalan Ragunan 29
Pasar Minggu
Jakarta 12520
INDONESIA

Phone : 782202
Cable : LITTANI JAKARTA
Telex : 48369 AARD IA

Nr. KL 510.810.4053

October 26, 1988

Mr. Syunichi Hozumi
Leader, Implementation Survey
Team, Japan International
Cooperation Agency

Dear Mr. Hozumi :

In the occasions of the discussion between your Team and the Indonesian Team in the preparation of the Japanese Technical Cooperation for Strengthening the Research and Development of Coastal Aquaculture Project (ATA 379), there are two pending matters that need to be added on the minutes of meeting on the Record of Discussion, those are :

1. The scientific results may be published jointly or separately by mutual agreement. Either party publishing any research findings will give credit to other party's contribution but shall at the same time be entirely responsible for the conclusions and interpretations reported.
2. The words "any others charges" mentioned on point III.2.(2) and point VII.2.(2) should be meant "public charges"

I hope you would consider the inclusion of the two above mentioned matters in the minutes of discussion.

Thank you for your kind consideration.

Sincerely yours,



Dr. Soetatwo Hadiwigeno
Director General.

/mk

インドネシアエビ養殖計画平成4年度巡回指導調査団

資料

1. プロジェクト活動計画の進捗状況

a) 親エビ養成

本プロジェクトの一つの成果として、その実現を目指していた池産エビの親エビ化に関し、環境の要因の組み合わせ、飼料の調整及び眼柄切除の組み合わせで可能となっており、現在平成4年度現地業務費地域実証普及費によりネガラステーションに隣接した民間のエビ養殖場にて池での親エビの養成を実施中であり、それらのエビを使用した催熟、産卵のデモンストレーションを計画中である。但し、まだ池産親エビの産卵率やふ化幼生の生残率は低く、これらの改善のため実験を繰り返し行う必要がある。またホルモン注射、成熟用飼料及び環境要因等の組み合わせによる池産エビの親エビ化についてはその緒についた段階であり、これらについては残る一年間の協力期間での進捗が期待される。

b) 幼生飼育

実験室における幼生飼育技術及び幼生の天然飼料の人工培養保存技術については、ほぼ完全にC/Pにより実施が可能となっている。最近環境の悪化により天然海域が汚染されてきているため近隣の養殖業者から、ゴンドールで人工培養した天然飼料を入手にくるケースが増えており既に60件近い要請があった。また、人工培養技術の伝習を請う業者も多くC/Pによる教育訓練も行われている。

但し、本分野では人工初期飼料、水管理、種苗育成タンクの管理及び養殖業者の老朽化した池においても導入した種苗の生残率が高くなるよう種苗の中間育成技術の実験研究にかかる技術移転については、残る一年の協力期間に実施する必要がある。

c) 飼料開発

飼料については、インドネシア産の原料により作成された人工飼料は輸入品と同様の効果を持ちかつコストが格段に安価な組み合わせが得られている。今後も同様な実験を繰り返すことと共に、成熟促進のための飼料開発を行いその結果を親エビ養成のホルモン処理、飼料、環境調節及び眼柄切除のコンビネーションの実験に反映させる必要がある。この部分にかかる技術移転が今後の一年間の課題である。

d) 魚病

本分野は、長期専門家を欠いていることもあり「イ」側のC/Pの配置、魚病研究のための施設機材の整備設置の遅れがあり、本格的な技術移転が開始されたのは1991年1月からである。かかる状況の中で現在インドネシアを始め東南アジア各国のエビ養殖場で猛威を振っている発光性細菌の分離培養、種の同定、人為感染等が可能となり、同細菌の特徴が明らかにされつつある状況にまで技術移転が進んでいる。また、このほかにも真菌性疾病が幼生に発生しており、これについても分離培養が試みられている。

しかしながら魚病については、広範囲に渡る学問的基盤の習得が必要であり、残す一年間の技術協力期間内に当初の目標として設定された最低限の技術移転項目を達成させることは困難であると危惧される。

e) その他

R/Dでは上記4分野での研究開発にかかる技術移転以外に、「イ」国内関係機関と協議の上開発された技術の普及を行うことがマスタープランに記載されているが、現在この部分にかかる活動としてはセミナーや上述の地域実証普及活動があるが全て日本側主導であり、「イ」国本来の普及実施主体である農業省水産総局や地方州政府との間で実施されておらず充分とは言い難い。しかしこの点については、水産総局のジェバラ研究所と本ゴンドール研究所が研究テーマの調整を行うようになってきていること、地方政府との間で

Research & Extension Linkage Project を行う計画があり、望ましい状況に向かっている。

また、上記4分野での研究開発にかかる技術移転の結果、幼生飼育や飼料開発の分野では基礎的な実験、研究開発についてはC/Pのみにも対応可能な部分が出てきている。しかしながら、実際の養殖の現場ではこれら4分野の技術がリンケージした結果が求められておりこの部分にかかる技術移転も手つかずの状況である。

2. 各分野ごとの目標達成のみこみ

別添指導調査団派遣時の技術移転のレベル参照（1992年8月派遣の短期専門家及び本調査団員による評価）

3. 「イ」側プロジェクト実施予算の確保執行状況

1992/93年度予算執行状況

開発予算：		293, 222	(千R p.)
(内訳) エビ種苗生産研究：	親エビ養成	34, 836	
	幼生飼育/魚病	34, 075	
	飼料開発	26, 412	
	(小計)	95, 323	
その他：	親エビ代	19, 477	
	電力代	30, 100	
	機材運搬費	13, 000	
	管理費等	11, 534	
	(小計)	74, 111	
		169, 434	

ゴンドール研究所開発予算の58%に当る。

1993/94年度予算要求

開発予算：		
(内訳) エビ養殖研究 (種苗生産研究+親エビ代)	175, 000	
ミルクフィッシュ研究	150, 000	
マングローブガニ研究	30, 000	
アルテミア研究	60, 000	
ナマコ研究	30, 000	
	(計) 445, 000	

4. ローカルコスト負担事業

平成4年度	地域実証普及費	2, 504千円
	シンガポールでのアジア水産学会参加	約1, 000千円
平成5年度	現地セミナー開催：プロジェクト終了時にこれまでの集大成として、プロジェクトの実験研究結果にかかるセミナーを開催する。	
	技術広報普及：普及用マニュアルの印刷製本	
	実験研究レポート集の印刷製本	

5. 平成5年度活動計画

短期専門家派遣計画：魚病
飼料開発
親エビ養成
機材保守メンテ

尚、機材保守メンテを除く上記3名については現地セミナーに講師として参加できるように、派遣時期について検討を要する。

カウンターパート受け入れ事業：幼生飼育、親エビ養成、飼料開発 計4名
機材供与事業：既供与機材の付属品を中心に通常予算枠の50%程度

6. 問題点

- a) 実験器具等を洗浄するための淡水が入手困難であり、研究所近郊の村(約5～7 Km)よりパイプにより入手する必要がある。
- b) 自動車電話システムを導入して電話連絡がとれるようにしているが、故障が多くいまだに問題が多い。
- c) 機材の使用に必要な試薬等がサイト近くでは入手できない、または困難である。
- d) 機材の修理のための業者がサイト近くに存在しないため、修理に時間を要する。

7. その他

プロジェクトの協力期間の終了を一年後にひかえ、上記の通り魚病及びその他の部分で述べた問題はあるものの技術移転は順調に推移していると思われる。ついでには残る一年において各分野共に当初の目標を達成するように更に技術移転が進むことが望まれる。

しかしながらその一方で魚病の分野、魚病も含む各分野のリンケージ及びその結果の養殖業の現場への普及については残す一年の間にこれを充分に行うことは困難と思われるため、平成5年度に予定している本プロジェクト終了時評価までに充分進捗状況をモニタリングし、必要に応じてなんらかの措置をとることがこれまでの4年間の技術協力をより効果的なものとし、プロジェクトの持続性のためにも重要と思われる。

本協力のおかげでプロジェクトサイトであるゴンドール研究所は、施設、機材及び人材共にインドネシアの水産関連では最良の機関となっており、「イ」国内のみならず日本を含む海外からも注目を集めている。本プロジェクト終了後他国の援助機関がここでのプロジェクト実施を検討しているとの未確認の情報もあり、対応に注意を要する。

「イ」側からも本プロジェクトの延長、または本プロジェクトの協力期間内に達成が困難な部分への技術移転の継続と既に本プロジェクト及び浅海養殖計画において移転した技術を普及にまでつなぐ新規プロジェクトの実施要請があった。これについては本調査団の検討事項ではないため来年派遣する終了時評価調査団と協議するようにとコメントすると共に、合同委員会においてJICA事務所長からも残す一年間の協力期間に最善を尽くして欲しい旨のコメントがあり「イ」側も了承した。

以上

ANNEX 2

		I Phase: Fundamental study				II Phase: Application			
		1988	1989	1990	1991	1992	1993		
Term of cooperation: 5 years		Apr.	Mar. Apr.	Mar. Apr.	Apr. Aug. Mar.	Apr. Aug. Mar.	Apr. Oct.		
FISCAL YEAR: MONTH : Oct.									
1. SPAWNER PRODUCTION									
1-1 Ecological Survey									
1-1-1 Meteorological observation				B		A			
1-1-2 Environmental survey for fishing ground of spawner (a specific point at sea)		1. C		B		A			
1-1-3 Biological survey		2. C		B		A			
1-1-3 Biological survey		3. C		B		A			
1-2 Gonadal Maturation		C		B		A			
1-2-1 Theory of gonadal maturation		1.							
1-2-2 Application of eyestalk ablation to pond-reared prawn		2. C		B		A			
1-2-3 Studies on hormon injection		3. C		C		C		(A)	
1-2-4 Tests of prospective feed (comparative study)		4. C		C		B		(A)	
1-2-5 Studies on environmental factors		5. C		C		B		(A)	
1-2-6 Experiments for hastening maturation by hormon, feed and environment		6. C		6.		C		(A)	
1-2-7 Experiments of raising spawner in pond		7. C		C		B		(A)	
1-2-8 Technical manual						C 8.		(A)	
1-3 Handling Technique									
1-3-1 Improvement of spawning rate		1. C		C		B		(A)	
1-3-2 Improvement of hatching rate		2. C		C		B		(A)	

Note: A = Counterparts are able to conduct experiment by themselves
 B = Still need some suggestion for expert
 C = Still on the initial stage
 (...) = hopefully

Result of MTE (Mid Term Evaluation)

term of cooperation : 5 years	I Phase: Fundamental study				II Phase: Application							
	1988	1989	1990	1991	1992	1993						
	Apr.	Mar.	Apr.	Mar.	Apr.	Mar.	Apr.	Mar.				
FISCAL YEAR:	1988		1989		1990		1991		1992		1993	
MONTH : Oct.												
2. REARING TECHNOLOGY OF LARVAE 2-1 Refinement of Rearing Techniques 2-1-1 Fundamental techniques of larval rearing 2-1-2 Rearing management (handling, feeding, harvesting, cleaning, etc.) 2-1-3 Studies for the application of micro diets 2-1-4 Intermediate (nursery) culture techniques 2-1-5 Technical manual for larval rearing 2-2 Natural Feed 2-2-a. phytoplankton (algal organisms) 2-2-1 Investigation of suitable local species 2-2-2 Isolator techniques (micro-pipetting, dilution method, agar plate) 2-2-3 Stock culture techniques (preservation, management) 2-2-4 Studies of the optimum environment conditions and culture media 2-2-5 Studies of mass culture techniques 2-2-6 Systematic culture management 2-2-b. Feeding experiments 2-2-7 Experiments on the nutritional value of algal organisms 2-2-8 Experiments on the nutritional value of animal organisms 2-2-9 Experiments on the feeding ecology 2-3 Environmental Conditions 2-3-1 Studies on the optimum environment conditions of larval rearing (physico-chemical factors) 2-3-2 Maintenance of sterile environment 2-3-3 Improvements due to modified hatchery												
	1.	C	C	C	A							
	2.	C	B	A	A							
	3.	C	B	A	A							
	4.	C	B	A	A							
	5.	C	B	A	A							
	6.	C	B	A	A							
	7.	C	B	A	A							
	8.	C	B	A	A							
	9.	C	B	A	A							
	10.	C	B	A	A							
	11.	C	B	A	A							
	12.	C	B	A	A							
	13.	C	B	A	A							
	14.	C	B	A	A							
	15.	C	B	A	A							
	16.	C	B	A	A							
	17.	C	B	A	A							
	18.	C	B	A	A							
	19.	C	B	A	A							
20.	C	B	A	A								

Result of MTE

		I Phase: Fundamental study					II Phase: Application				
		1988	1989	1990	1991	1992	1993				
		Apr.	Mar.	Apr.	Mar.	Apr.	Mar.	Apr.	Mar.	Apr.	Oct.
FISCAL YEAR:		1988		1989		1990		1991		1992	
MONTH: Oct.		Apr.		Mar.		Apr.		Mar.		Apr.	
3. FEED DEVELOPMENT											
3-1 Studies on Nutrient Requirement for shrimp											
3-1-1 Theory											
3-1-2 Rearing techniques of larvae employed compounding feed and examination of its effect											
3-1-3 Making refined experimental feed for larvae											
3-1-4 Experiments on nutrient requirements for larvae											
3-1-5 Experiments on nutrient requirements for broodstock											
3-2 Studies on feed formulation for shrimp											
3-2-1 Investigations of nutrient value in prospective raw materials for larval feed											
3-2-2 Investigations of nutrient value in prospective raw materials for broodstock feed											
3-2-3 Compounding feed for larvae											
3-2-4 Compounding feed for broodstock											
3-3 Evaluation of compounding feed											
3-3-1 Production methods											
3-3-2 Examinations for efficiency											
3-4 Technical manual											

* For Larvae : B, For Broodstock : C Result of MTE

** For Larvae : B, For Broodstock : C

term of cooperation: 5 years	fiscal year:		1988		1989		1990		1991		1992		1993		
	month:	Oct.	Apr.	Mar.	Apr.	Mar.	Apr.	Mar.	Apr.	Aug.	Mar.	Apr.	Aug.	Mar.	Apr.
<p>4. DISEASES PROBLEM</p> <p>4-1 Preparation/installation of Equipment/apparatus and learning how to use</p> <p>4-2 Techniques for diagnosis (Symptoms, isolation/culture of pathogens, rapid diagnosis, histopathology)</p> <p>4-2-1 Viral diseases</p> <p>4-2-2 Bacterial diseases</p> <p>4-2-3 Fungal diseases</p> <p>4-2-4 Parasitic diseases</p> <p>4-2-5 Diseases caused by environmental factors</p> <p>4-2-6 Nutritional deficiency</p> <p>4-3 Epidemiological field surveys for shrimp diseases</p> <p>4-3-1 Investigations of the outbreak & damage (questionnaire, interview and taking the history and examination)</p> <p>4-3-2 Making an Atlas for shrimp diseases (Identification of causative factors)</p> <p>4-4 Studies on the prevention of epidemics</p> <p>4-4-1 Methods of preserving the isolates</p> <p>4-4-2 Drug sensitivity tests of the isolates</p> <p>4-4-3 Experiments on the prevention of infectious diseases (investigations of pathogenicity and prevention/treatment)</p> <p>4-4-4 Therapeutic examinations in the field</p> <p>4-4-5 Regular sampling from the rearing tanks & ponds (water quality, flora of the micro organisms etc.)</p> <p>4-4-6 Studies on precautions of epidemics (examinations for factors/conditions of outbreak)</p> <p>4-5 Making a manual for diagnosis</p>															
1.	C								B			(A)			
1.	C								B			(B)			(B)
2.	C								B			(B)			(A)
3.	C								B			(B)			(B)
4.	C								C			(C)			(A)
5.	C								C			(C)			(B)
6.	C								C			(C)			(C)
1.	C								C			(C)			(B)
2.	C								C			(B)			(B)
1.	C								B			(A)			*
2.	C								B			(A)			(A)
3.	C								C			(C)			(B)
4.	C								C			(C)			(C)
5.	C								B			(B)			(A)
6.	C								C			(B)			(B)
1.	C								C			(C)			(B)

Result of MTG

* Not Including Virus

魚病分野

ウシエビ (*P. monodon*) の疾病に関する研究はこの1年間精力的になされており、以下のような成果が得られている。ただし、これまでに実施されている研究は細菌性疾病に関する微生物学的、病理組織学的研究（特に発光性を有する *Vibrio harveyi* に起因する“コナン・コナン”と呼ばれる疾病）が中心であり、他の研究に関しては着手されたばかりであるか、またはこれからの状態にある。

全般的に眺めると、魚病の技術援助が開始されたのは1991年の1月からであり、長期の魚病専門家がない状態で、ゼロから研究が開始されたことを考えると、細菌病の研究を独自に研究できるようになったことは大きな収穫である。

ウシエビの細菌性疾病に関する研究：

1. コナン・コナンと呼ばれる発光性細菌に起因する疾病の野外調査を実施した
2. 多くの症例について原因菌の分離・培養を試みた
3. 代表菌株について生物学的・生化学的性状試験を実施し、原因菌が *Vibrio harveyi* であることを究明した
4. 異常エビを顕微鏡で観察すること、および病理組織像から、疾病の進行を3段階に類別することができた
5. 分離菌のウシエビ幼生に対する病原性試験を人為的に実施し、病原性試験法を確立するとともに、分離菌がウシエビに病原性を有することを立証した
6. 当初、*V. harveyi* は日和見的な病原性の弱い細菌であると考えられたが、最近の研究により強い病原性を有することが実験的に確認された
7. 人為感染試験により、分離菌の病原性は Zoea , Mysis, Postlarvae の順に強く示されることが証明された

ウシエビの真菌性疾病に関する研究：

1. 幼生に真菌病が発生し、分離・培養を試みた結果、*Haliphthoros*属に分類されると思われる菌の培養に成功した
2. 真菌病の発生は散見されるが、その研究はこれからの課題である

ウシエビ以外の魚介類の疾病に関する研究：ウシエビ以外の魚介類についても疾病検査依頼があり、それらにも積極的に取り組んでいる。これまでに取り扱った主なものは下記の通りである。

1. マングローブクラブに発生したコナン・コナン
2. マングローブクラブに発生した *Haliphthoros* 症
3. 魚類の一種、*Siganus virgatus* (Siganid) に発生した体表に潰瘍形成をともなうピブリオ病
4. ナマコの体表に潰瘍病変が形成されるピブリオ病

以上の結果は極めて多くの知見が得られたばかりではなく、カウンターパート自身が細菌性疾病に関しては自信をもって取り組めるところまで成長したことを示していると判断される。

これらの成果のうち、コナン・コナン原因菌の同定結果、および自然発生エビの病理組織学的検索結果については、1992年10月開催予定の第3回アジア水産学会でカウンターパートの一人、Zafraan によって口頭発表される。

研究を遂行する上での現在の問題点：

1. 実験を行なう上での器具・機材は大分整えられたが、購入された機材が細部の不備によりまだ使用されていなものがある。例えば、クリーンベンチ、蛍光顕微鏡など。早急に使用可能にし、また保守点検ができるような配慮もなされるべきである。
2. 水道水に塩分が含まれているために、器具の洗浄、実験の遂行に支障を来している。また蒸留水の作成に時間がかかり、このため実験が出来なかったり、開始が遅れことがある。
3. 試薬などがまだまだ不足している。このため、研究が先に進めないことが少なくない。これらの補充をしない限り、今後の研究に支障をきたすものと思われる。
4. 幅広い魚病の知識を有する人材の養成が今後も必要である。現在の状況では細菌病にどうか対応出来る段階であり、今回のプロジェクトの項目に掲げた他の項目に移行し、研究を進めていくには、さらに多くの年月を要することは確実である。
5. ゴンドールにこれだけ整備された魚病研究室が出来、確実に各カンターパートが実力を付けてきている現状から、もし、来年の10月でこのプロジェクトが終了したならばもとのもくあみになることは目に見えている。私見ではあるが、新たなプロジェクトをゴンドールで再スタートさせるか、またはこのプロジェクトを延長させ、これまでに不足している器具・機材を充実させ、このプロジェクトで検討困難な項目についてある程度着手できるだけの技術を獲得させることが賢明である。そうすれば、今後、インドネシアの魚病研究の中心としてこの研究所が発展することは間違いないと考えている。
6. 魚病診断マニュアルおよび魚病アトラスの作成にはまだまだ時間がかかりそうであり、これらもプロジェクトが延長されればよりよいものが作成可能かと思われる。
7. インドネシアの魚病研究の核となり、国の内外から評価されるためには学位をもつ研究者の養成が必要である。そのためにはこれまでこの研究所で魚病研究の核として頑張っている Mr. Zafran にその機会を与える配慮が必要であると考えます。
8. 当初計画した項目を眺めてみると、現段階でA段階に到達できたのはわずかに3項目だけであり、他の13項目はまだBまたはCの段階である。これらのうち、来年の10月までにA段階に到達できそうなものは4項目に過ぎない。従って、本プロジェクトの魚病部門の延長は少なくとも2年間、できれば3～4年間の間必要なのではないかと思われた。

今後の研究の進め方：

発光性細菌 *Vibrio harveyi* に関する検討

1. 異なる病原性を有する *Vibrio harveyi* を用い、発病要因を検討する
2. 天然における *Vibrio harveyi* の生息場所を検討する
3. 親エビの消化管内菌叢を検索する
4. 簡易診断法の開発（抗血清による凝集反応など）
5. 選択培地の開発

その他：

1. *Vibrio harveyi* 以外のウシエビ幼生の細菌病の検索
2. 種々の環境中から抗菌活性を有する細菌を探索する
3. 抗生物質に依存しない微生物フロッグを用いた細菌病発生の抑制
4. ウシエビなどの真菌病の研究法
5. 真菌病の防除法に関する研究
6. 疾病発生に影響する水質の検討
7. マニュアル・アトラス作成の資料およびデータ収集

**THE MINUTES OF DISCUSSIONS
CONCERNING
THE TECHNICAL COOPERATION**

**For
THE STRENGTHENING THE RESEARCH AND DEVELOPMENT
OF COASTAL AQUACULTURE (ATA-379)**

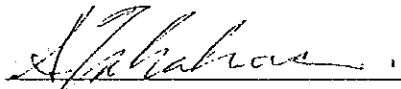
**at
THE 4th JOINT COMMITTEE HELD ON SEPTEMBER 25, 1992**

The 4th Joint Committee for the Strengthening the Research and Development of Coastal Aquaculture Project (ATA-379) in the Republic of Indonesia (hereinafter referred to as "the Project"), was held at the Central Research Institute for Fisheries, Jakarta in accordance with Article VIII (Administration of the Project) of the Record of Discussion signed on October 26, 1988 (hereinafter referred to as "the R/D") for the purpose of proceeding the project activities successfully and dealing with specific matters connected with the implementation of the project.

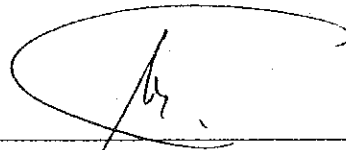
The Japanese Advisory Team (hereinafter referred to as "the Team") organized by Japan International Cooperation Agency (hereinafter referred to as "JICA") and headed by Dr. Takeshi Nose, also attended the meeting.

As a result of the discussion at the 4th Joint Committee the Japanese and Indonesian sides, composed of such members (including those of the "Team") as a participants list attached hereto, made the following minutes of discussion which is attached hereto as Appendix.

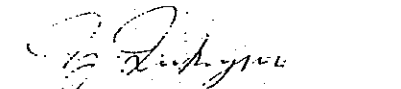
September 25, 1992



Akira Takahashi
Resident Representative
JICA Indonesia Office



Dr. Fuad Cholik
Chairman of the 4th Joint Committee
Director,
Central Research Institute for Fisheries



Yoshitetsu Nukiyama
Team Leader, ATA-379



Dr. Achmad Sudradjat
Project Manager ATA-379

**4th JOINT COMMITTEE MEETING ATA -379
JAKARTA, SEPTEMBER 25, 1992**

List of Participants

I. Indonesian side

1.	Dr. Fuad Cholik	Director of CRIFI
2.	Dr. Ahmad Sudradjat	Chief of RICA, Maros
3.	Mr. Wardana Ismail	CRIFI
4.	Dr. Taufik Ahmad	RICA, Gondol Station
5.	Dr. Ketut Sugama	RICA, Gondol Station
6.	Mr. Hasan Mubarak	CRIFI
7.	Dr. E.Danakusumah	RICA, Maros
8.	Mr. Didin Burhanudin	Setkab
9.	Mr. Nasrudin	
10.	Mr. Rusnadi R.	Bappenas
11.	Dr. Budiman Notoatmojo	AARD
12.	Mr. A.A. Gede Harmony	Fish, Services of Bali
13.	Mr. Hartoyo	DGF

II. Japanese side

1.	Mr. A. Takahashi	Res. Representative JICA Indonesia
2.	Dr. T. Nose	JICA Advisory Team
3.	Mr. Y. Nukiyama	Team Leader ATA-379
4.	Mr. H. Tomobe	JICA Tokyo
5.	Mr. T. Hirai	JICA, Jakarta
6.	Mr. E. Saito	Coordinator ATA-379

**STRENGTHENING THE RESEARCH AND
DEVELOPMENT OF COASTAL AQUACULTURE
(ATA-379)**

**Progress Report & Implementation Plan
Presented at
4th Joint Committee Meeting
Jakarta, 25 September 1992**



**CENTRAL RESEARCH INSTITUTE FOR FISHERIES
AGENCY FOR AGRICULTURAL RESEARCH AND DEVELOPMENT
in cooperation with
JAPAN INTERNATIONAL COOPERATION AGENCY**



PROGRESS REPORT
STRENGTHENING RESEARCH AND DEVELOPMENT
OF COASTAL AQUACULTURE (ATA-379)

Aug. 1991 to Aug. 1992

1. INTRODUCTION

1.1 Objective

- to strengthen the study and research activities on shrimp seed production and related items
- to contribute the development of shrimp culture technology in the Republic of Indonesia

1.2 Location : Research Institute for Coastal Aquaculture (hereinafter referred to as "Gondol Station")

1.3 Duration : October 1988 to October 1993 (5 years)

1.4 Master Plan

- 1.4.1 Spawner production
- 1.4.2 Rearing technology of larvae
- 1.4.3 Feed development
- 1.4.4 Disease problem
- 1.4.5 Other items closely related to seed production
- 1.4.6 Dissemination of research result (training, seminar, workshop, publication) and consultation with other related organizations

1.5 Organization of the Project:

See annex 1.

2. DISPATCH OF EXPERT MISSION

2.1 Long-term Experts

- 1) Team Leader
Mr. Yoshitetsu NUKIYAMA January 31, 1989
- 2) Coordinator
Mr. Etsuo SAITO July 22, 1991
- 3) Spawner production
Mr. Sadaharu MAKINOUCHI April 7, 1991
- 4) Rearing technology of larvae
Mr. Masakazu TAKANO August 22, 1991
- 5) Feed development
Mr. Chiaki KUMA April 24, 1989

2.2 Short-term Experts

- 1) Rearing technology of larvae
Dr. Shusaku KADOWAKI October 14, 1991 -
November 13, 1991
- 2) Spawner production
Dr. Isao YANO October 20, 1991 -
November 17, 1991
August 4, 1992 -
September 1, 1992
- 3) Disease problem
Dr. Shinpei WADA August 8, 1991 -
September 20, 1991
May 18, 1992 -
July 17, 1992
- 4) Feed development
Dr. Akio KANAZAWA August 4, 1992 -
August 28, 1992

2.3 Survey Mission

- Mid-term Evaluation September 1, 1991 -
September 12, 1991

Consultation Personnels:

Dr. Keiji HIROSE
Dr. Akio KANAZAWA
Dr. Kishio HATAI
Mr. Hideki TOMOBE

3. PROVISION OF MACHINERY AND EQUIPMENTS

Machinery and equipments provided in the fourth year of the Project (1991/1992) installed at Gondol Station:

- 1) Equipments purchased in Japan amounted to around 22.1 (C.I.F.) million yen. The equipments are laboratory equipments and apparatus, tanks, pumps and so forth.
- 2) Local-purchased equipments amounted to about 4.0 million yen: laboratory equipment is mainly for the pathology section, hand tractors for Negara, radio communication system, FRP tanks, one set of copy machine, a pick up truck, a motorcycle and mechanic tools and so forth. All of those equipments have been utilized.

4. COUNTERPARTS TRAINING

4.1 Fiscal year 1991-1992

- | | |
|--|----------------------------------|
| 1) Miss Suko Ismi
(Larval rearing) | August 25 - November 2, 1991 |
| 2) Mr. Tridjoko
(Spawner production) | September 9 - October 19, 1991 |
| 3) Mr. Nyoman Adiasmara Giri
(Feed development) | September 17 - November 23, 1991 |
| 4) Miss Des Roza
(Disease problem) | February 19 - June 7, 1992 |

4.2 Fiscal year 1992-1993

- | | |
|---|--|
| 1) Mr. Wardana Ismail
(Project management) | May 26 - ^{June} October 20, 1992 |
| 2) Mr. Abdul Malik ^{H.}
(Larval rearing) | July 16 - October 20, 1992 |

4.3 Transfer of technology

Some technologies of broodstock maturation, feed production, larval rearing and disease prevention have been transferred from Japanese experts to the Indonesian counterparts. However, some are not completely transferred.

5. RESEARCH ACTIVITIES

5.1. Spawner production

5.1.1 Ecology survey

Ecological survey on broodstock of shrimp in the coastal waters of Sumbawa Island (West Nusa Tenggara Province) had been conducted.

We learned that Cempi bay is the main fishing ground for shrimp spawner. This resource has not exploited. Fishermen have just started to supply private hatcheries in Bali Island and East Jawa with broodstock caught in that area.

5.1.2 Gonadal maturation

a. Maturation, spawning and rematuration of pond reared spawner

In order to investigation the minimum size and age of pond reared spawner without eyestalk ablation, series of experiment had been conducted. The results showed that shrimp of 88.0 g BW (1-year old) was matured and spawned three times (on the 3rd, 9th and 15th days after the experiment started). This suggest that it is possible to make precious pond-reared spawner.

b. Induction of ovarian maturation by injection of thoracic ganglion extract

We found that extract of thoracic ganglion (prepared from matured female lobster) can be used as stimulating agent for maturation of tiger prawn.

c. Induction ovarian maturation using formulated feed

We tested seven kinds of maturation pellets to induce gonade maturation of pond cultured shrimp. A pellet containing carotene or DHA (collected from eyes of tuna) could induce ovarian maturation of shrimp. This experiment, however, needs further confirmation to clarify the optimum dosage of carotene or DHA.

d. Combination of hormon, feed and environmental condition

We have carried out an experiment to know how we could induce ovarian maturation of pond-cultured prawn by combination treatments of hormon, feed and environmental condition. We will repeat this experiment several times more to find out the best condition for inducing ovarian maturation of pond cultured shrimp.

5.1.3 Production of pond-reared spawner

We had established new techniques of shrimp spawner production in a pond. The average size of the shrimp is more than 100 g. in weight. This technique is quite useful to provide spawner in case of lack of wild spawner.

5.2. Larval Rearing technology

5.2.1 Refinement of rearing techniques

We conducted several rearing trials with various size of tanks. One of trials was to gain acquaintance with water quality control applying *Ulva* sp We obtained basic knowledge and techniques of larval rearing through Indonesian counterparts and technicians. However, in order to refine rearing techniques, studies on tank management, intermediate culture techniques and application of micro diet on mass culture intermittent trial basis should be investigated.

5.2.2 Natural feed

We acquired techniques and knowledge of algae culture from Indonesian counterparts and technicians. We successfully established algae culture systems. However, we still need to study the systematic culture techniques, nutritional value of animal organism and feeding ecology.

A number of private hatcheries came in for some diatoms as a source of their diatoms culture. In addition, some technicians of the private hatcheries took the individual training with us on the algae culture techniques. In other words, examination work in this field has been already started.

5.2.3 Environmental condition

In order to determine the optimum environmental conditions we investigate the effects of photoperiod and light intensity on the growth of larvae. We also applied several different treatments to rearing water for larvae to prevent larval disease.

The results showed that maintaining sterile environment condition is the most important factor to prevent disease out-break. Our staff are always making effort to maintain the good environment, however, but it is very hard because there is no pure fresh water supply.

5.3 Feed development

5.3.1 Nutrient requirement

We have conducted two experiments to find out the requirement of vitamin C-PMg for larvae and juveniles of *P.monodon*. The temporary results showed that vitamin C-PMg requirement for juveniles is about 20 mg/100 g diet. The results still need further confirmation.

We also studied lipid and fatty requirement for larvae using a 30 L polycarbonate tank. We obtained a good result when used a combination of 50% soybean oil with 50% cod liver oil or 25% soybean oil with 75% cod liver oil, each weighing 8% of diet.

5.3.2 Feed formulation

We studied some local feeding stuffs such as squid meal, sardine meal, small shrimp meal, etc. and used in shrimp formulation for larvae and juveniles of *P.monodon*. We found that squid meal and small shrimp meal were potential protein sources for larvae diet.

5.3.3 Feeding schedule

We conducted a experiment of feeding schedule for *P.monodon* larvae to find out the best feeding time using artificial diet (microparticulate diet). The larvae was much better fed with diatoms at the zoea-1 stage but at the zoea-2 stage artificial diet had better result.

5.4 Disease problem

5.4.1 Field

We conducted field surveys several times in hatcheries located at East Jawa and Bali. Ten samples of luminescent bacteria were isolated. These samples showed that the bacteria are negative, positive oxidase and catalase reaction. There also occurred bacterial growth on TCBS agar with green colour. These samples were identified as *Vibrio harveyi* ("kunang-kunang"). One sample of fungus was identified as *Haliphthoros* sp. *Vibrio harveyi* may cause total mortality in private hatcheries and occurs throughout the year.

5.4.2 Source of *Vibrio harveyi*

Luminous *Vibrio* is one species of normal flora of natural sea water and an intestinal bacteria of penaeid shrimp. Contamination of luminous bacteria are mainly induced from the fecal materials of spawner and somehow, from rearing sea water. This disease tends to occur in a hatchery of intensive culture system.

We investigated artificial infection of luminous bacteria to different stages of larvae and found that the experimental animals did not have severe pathogenicity. *Vibrio harveyi* may act as opportunistic pathogen.

It seems that *Vibrio harveyi* may be induced by some kinds of stresses such as high density, high water temperature, organic matter or other kind of micro organism, etc.

Zoea stage is the most susceptible to the bacterial strain. Once the bacteria gets into intestine of larvae, it is difficult to attack the bacteria by any kinds of chemicals.

The most important point to prevent luminous bacteria is the use of sterile sea water. We made small scale experiments on the use sterilized sea water for rearing of larvae and there most of larvae survived until PL-12. We still have some technical problems in producing large volume of sea water with free bacteria and need further trials.

5.4.3 Prevention bacteria using antibiotic

We conducted experiments on the use of OTC to prevent bacteria. We found that small amount of OTC could eliminate the bacteria on body surface of animals but that could not be effective to the bacteria inside the guts. This means that prevention should be done in nauplius stage. We still need further study on prevention of luminous bacteria.

6. PUBLICATION

Until September 1992, we had finished 31 scientific papers.

7. CONTRIBUTION

- 7.1 Consulting service for the prawn hatcheries and prawn farmers.
- 7.2 Helping the univeristy students to conduct their research program.
- 7.3 Training for prawn hatcheries operators and prawn farmers.
- 7.4 Water quality and disease analysis service.
- 7.5 Food organism supply to prawn hatcheries.

8. BUDGET

Budget allocation for Gondol Research Station:

1) Development budget	APBN	Rp	293,222,000 ,-
	ARMP	Rp	70,000,000 ,-

		Rp	363,222,000 ,-
To support ATA-379			
Research activiteis		Rp	174,278,000 ,-
Handling cost		Rp	13,000,000 ,-

		Rp	187,278,000 ,-
2) Routine budget including salary		Rp	150.000.000 ,-
(To support ATA-379)		(Rp	25.200.000 ,-

9. PROBLEM

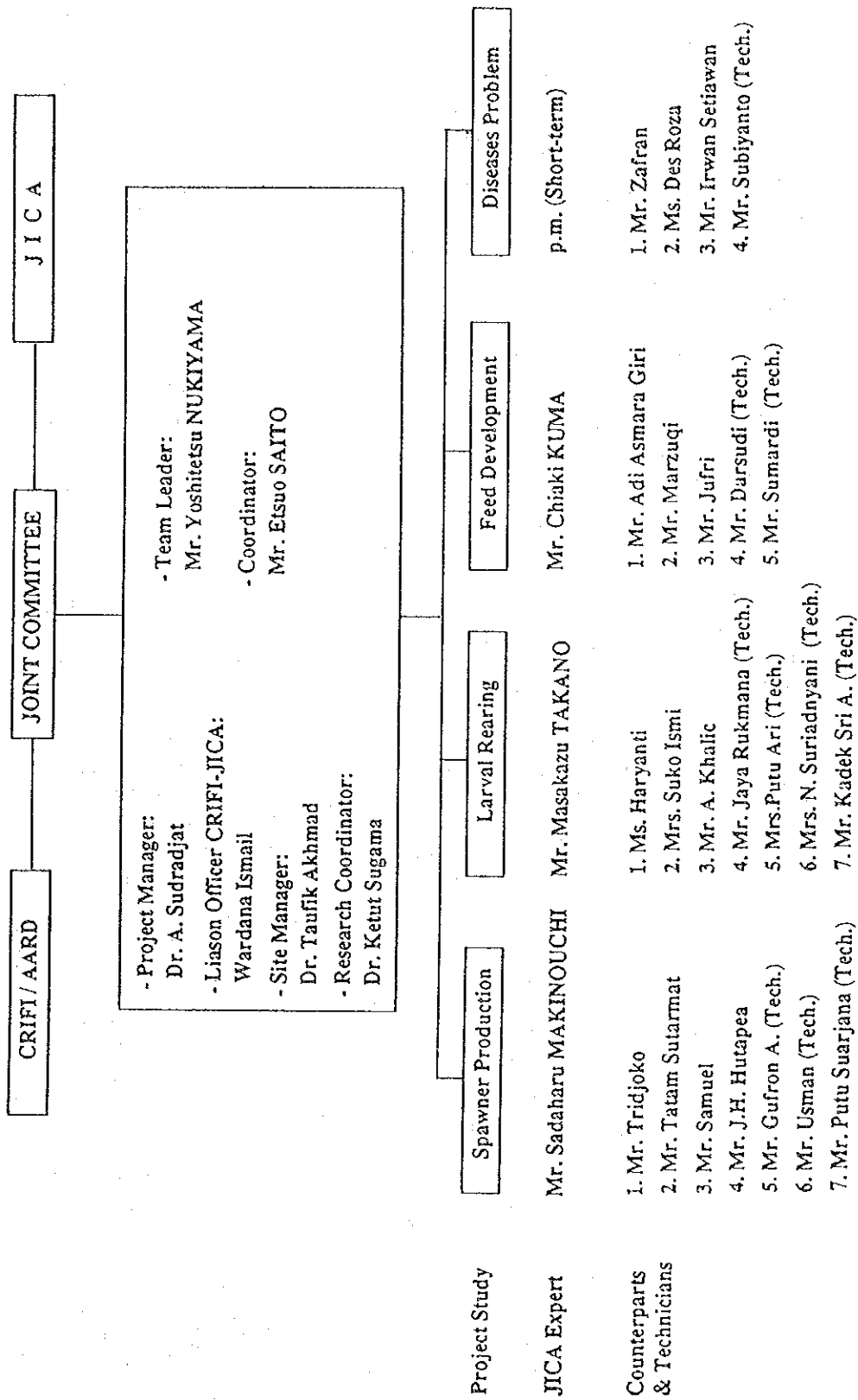
At present the Project has problem as below:

- 1) No pure fresh water for cleaning and washing equipments available
- 2) Only one telephone line available using telemobile system. Some times we can not use it when weather condition is very bad.
- 3) Some materials are difficult to obtain in Bali, especially chemicals for analyzing water quality and nutrient content of feed.
- 4) It is very difficult to repair equipments in Bali due to lack of preparing shops.

10. SUGGESTIONS

- 1) To construct and extend a fresh water pipe from Grogak to Gondol.
- 2) To install a new telephone line using TELKOM facilities which have been built near Gondol Research Station.
- 3) To improve the maintenance and repairing equipment systems, including budgeting.

ORGANIZATION OF THE ATA-379



PROGRESS REPORT OF THE PROJECT

No. 1

	1988		1989			1990			1991			
	Nov.	Jan.	Apr.	July	Oct.	Jan.	Apr.	July	Oct.	Jan.	Apr.	Jun.
JAPANESE CONTRIBUTION												
1. Experts												
(1) Long-term Experts												
1) Team leader : Mr. Yoshitetsu NUKIYAMA												
2) Coordinator : Mr. Nobuhiro SUGA												
3) Spawner production :												
Mr. Atsushi ISHIKAWA			Apr. 12								Apr. 11	Aug. 30
Mr. Sadaharu MAKINOUCHI											Apr. 7	
4) Rearing technology of larvae :			Apr. 24									
Mr. Hideki EDA												
5) Feed development :			Apr. 24									Apr. 23
Mr. Chiaki KUMA												
(2) Dispatch of Short-term Experts												
1) Shrimp ecology : Mr. Hiroshi KITANI												
2) Natural feed : Mr. Yuji OTSUKA												
3) Spawner production : Dr. Issamu YANO												
4) Shrimp pathology : Dr. Kishio HATAI												
5) Feed development : Dr. Akio KANAZAWA												
2. Counterpart training in Japan												
(1) Dr. Fuad Cholik : Observation tour												
(2) Mr. Toni Richinet : Spawner production												
(3) Mr. Zafril Imran : Hatchery management												
(4) Ms. Harianti : Larval rearing												
(5) Mr. Jatan Sutarnat : Spawner production												
(6) Mr. Haruzaki : Feed development												
(7) Mr. Zafran : Disease problem												
3. Provision of machinery and equipment												
(1) Fiscal year of 1988 : Total ¥71.8 Mill.												
(2) Fiscal year of 1989 : Total ¥70.1 Mill.												
(3) Fiscal year of 1990 : Total ¥50.2 Mill.												
4. Others												
(1) Model infrastructure work												
(2) Consultation survey team												
(3) Field trip(overseas) for counterparts												
INDONESIAN CONTRIBUTION												
1. Assignment of counterparts												
2. Administrative personnel												
3. Land and facilities												
4. Expenses of implementation of the Project												

	1991			1992			1993			
	Jun.	Oct.	Jan.	Apr.	Jul.	Oct.	Jan.	Apr.	Jul.	Oct.25
JAPANESE CONTRIBUTION										
1. Experts										
(1) Long term Experts										
1) Team leader : Mr. Yoshitetsu NUKIYAMA										
2) Coordinator : Mr. Etsuo SAITO										
3) Spawner production :										
Mr. Sadaharu MAKINOCHI										
4) Rearing technology of larvae :										
Mr. Masakazu TAKANO										
5) Feed development :										
Mr. Chiaki KUNA										
(2) Dispatch of short term Experts										
1) Spawner production : Dr. Isao YANO		Oct20 - Nov17								
2) Shrimp pathology : Dr. Sinpei WADA		Aug. 8 - Sep20								
3) Feed development : Dr. Akio KAWAZAWA										
4) Larval rearing : Dr. Shusaku KADOWAKI										
2. Counterpart training in Japan										
(1) Vs. Suko Ismi : Larval rearing										
(2) Mr. Iridjoko : Spawner production										
(3) Mr. N. Adiasmara Giri : Feed development										
(4) Vs. Des Rosa : Disease problem										
(5) Mr. Marwata Ismail : Project management										
(6) Mr. Abdul Khalik : Larval rearing										
3. Provision of machinery and equipment										
(1) Fiscal year of 1991 : Total 26.1 Mil. Yen										
(2) Fiscal year of 1992 : Total 25.0 Mil. Yen (Unfixed)										
4. Other activities										
(1) Consultation survey team										
(2) Publication of research paper & Pamphlet										
(3) Trial and extension work										
(4) Publication of research paper										
(5) Holding seminar										
(6) Participation in the Asian Fish. Forum										
INDONESIAN CONTRIBUTION										
1. Assignment of counterparts										
2. Administrative personnel										
3. Land and facilities										
4. Expense of implementation of the Project										

IMPLEMENTATION PLAN FOR FISCAL YEAR 1993-1994
(ATA-379)

The project goal is composed of the 2 points (Annex 1) as below,

- 1) Existing shrimp seed production is to be improved and to be more fitted for aquaculture surroundings in Indonesia.
- 2) The quality and ability of Gondol Research Station regarding its staff and facilities should be upgraded in order to carry out further research and development to give effective advices to people and companies facing problems.

We have made various researches and experiments proposed by Indonesian counterparts and JICA experts in each fiscal year and related activities to achieve the Project goal as above mentioned.

We are also planning several activities in the Implementation Plan in the next fiscal year of 1993/1994 that is the final year of JICA's 5-year cooperation on the Project. We expect that these activities together with the results through the past activities contribute much to attain output of each field.

In addition to the Implementation Plan, we also appended the Itemized Action Plan that shows a current level of technical transfer in each field and a prospective attainment level at the end of the Project (Annex 2).

1. RESEARCH PROPOSAL FOR THE FISCAL YEAR OF 1993-1994

A. Spawner Production

- 1) To induce ovarian maturation of pond-reared shrimp by injection of various hormones including HCG, thoracic ganglion extract and etc.
- 2) To induce ovarian maturation of pond-reared shrimp using high quality feed and hormone in combination with adjustment of environmental factors.
- 3) To improve techniques for production of pond-reared spawners.

B. Rearing Technology of Larvae

- 1) To apply microcapsulated diet to shrimp larvae.
- 2) To evaluate growth performance of larvae produced from pond reared spawner.
- 3) To start mass production of fingerling shrimp for semi-intensive or traditional pond culture.

C. Feed Development

- 1) Effect of unsaturated fatty acid W-3 PUFA and HUFA on survival and growth of shrimp larvae.
- 2) Use of stable-form of vitamin-C at larvae and juvenile food additives.
- 3) Substitute for casein by local materials as a protein source for diet of larvae.
- 4) Effect of various nutrients on the ovarian development of pond-reared shrimp spawners.

D. Disease Problem

- 1) To study occurrence of bacterial disease due to some stress factors.
- 2) To study larval culture management by controlling water quality and feeding without antibiotics.
- 3) To study seasonal changes of bacterial flora in guts of spawner collected from various sites.

E. Other Items Related to Seed Production

- 1) Genetic variation of shrimp collected from various sites using electrophoretic data.
- 2) Reduction of genetic variability in hatchery stock of shrimp.
- 3) Relationship between individual growth and heterozygosity of certain locus.

2. PROJECT ACTIVITIES
(Including Fiscal Year of 1992/1993)

In order to help both the accomplishment of the Project goal and the future research activities after the end of the Project, we are planning various activities and have already started some of them.

1) Fiscal Year 1992-1993

a. Trial and Extension Work

We have almost attained one of the outputs of the Project in the logical framework at Gondol Station, that is, "Gonadal maturation techniques using pond-reared shrimp". We started the Trial and Extension Work at Negara in June 1992 aiming to transfer the maturation techniques for cultured shrimp to the local private sector. The activities is funded by JICA.

b. Publication of Research Papers

We are preparing the second research papers.

c. Holding Seminar at Bali

The seminar will be sponsored by JICA and CRIFI. Participants from Directorate General of Fisheries, local researchers, private sectors, and teachers from universities are expected.

d. Participation in the 3rd Asian Fisheries Forum in Singapore
(October 1992)

Four counterparts and three experts will joint the meeting for oral presentation.

2) Fiscal Year of 1993-1994

a. Publication of Final Report

It will cover the research results from the latter part of the Project.

Future research plan

b. Publication of Technical Manual

The research results will be published as scientific report and will be written as technical manual.

c. Last Seminar

The results will be presented in a seminar and papers will be published in a proceedings.

d. Reinforcement of the Library of Gondol Station

We will bookbound research papers and their copies accumulated so far to reinforce the reference materials in the library. The bookbinding machine will be provided this fiscal year.

Annex 1

THE STRENGTHENING THE RESEARCH AND DEVELOPMENT OF COASTAL AQUACULTURE
(ATA-379)

Objectives/Activities	VERIFIABLE INDICATORS	MEANS OF VERIFICATION	IMPORTANT ASSUMPTIONS
Overall goal (national level) Achievement industry of cultured shrimp which has strong competence in the international market	Indicators of goal achievement: Increased foreign reserve by the increment and stable shrimp export	-Fisheries Statistics by Directorate General of Fisheries (DGF) -Export Statistics by Ministry of Trade -Information from international market	For sustainability of overall goal -Stable demand for shrimp in the international market -Present level of shrimp supply by the other countries
Overall goal (sector level) Technical improvement to increase shrimp culture productivity	Indicators which shows the achievement -Increment of productivity -Increment of profit	-Comparative study between existing techniques and improved ones	For achievement of the OG -Extension activities for progress techniques -A good coordination and linkage among related institutions
If the project goal is achieved, then a contribution is made towards above mentioned overall goals (both national & sector level). If these results mentioned below are obtained, the the project goal is achieved.			
Project goal 1) Existing shrimp seed production method is improved to be more fitted for aquaculture surroundings in Indonesia 2) The quality and ability of pond research station regarding staff and facilities are upgraded in order to carry out the further research & development and give effective advices to the persons & companies facing problems	-High quality seed -Higher survival rate -High productivity -Cost effectiveness (not only seed production but also pond culture) -Ability to continue research activities based on the research outcomes	-Results of the research and development -Research paper by the counterparts -Dissemination of the results of research & development by seminars & workshops -Publication & distribution of annuals for persons & companies	-Newly developed method is better than existing ones in cost saving, quality of products and stability of production -Enough budget for seminars & workshops -Enough budget for manual distribution -Win confidence from persons & companies

<p>Output</p> <ul style="list-style-type: none"> -Conadal saturation techniques using cultured shrimp -Mass production techniques for higher quality seed (cost effective and good vigour) 	<p>Results which are obtained through activities:</p> <ol style="list-style-type: none"> 1) Spawner production using cultured shrimp <ul style="list-style-type: none"> -Fast modal saturation (3-7 days) -Higher fecundity (more than 300,000 eggs/spawner/line, minimum 3 times/spawner) -Better hatching (average 30%) 2) Larvae rearing <ul style="list-style-type: none"> -Fast growth of larvae, post larvae and vimorous (28-30 days to PL-20) -High productivity (average 35%) -Low cost and simple procedure 3) Feed development <ul style="list-style-type: none"> -Feed formulation technology for larvae, PL and maturation -List of recommendable local feed materials for food production 4) Disease problem <ul style="list-style-type: none"> -Preventive measures of various larvae and post larvae diseases -Indicator for establishment of effective monitoring control system of disease 	<ul style="list-style-type: none"> -Seminars and workshops -Quantity and quality of papers -Publication and distribution of manuals 	<ul style="list-style-type: none"> -Limited and high price of wild spawners -Dissemination of the research results should be increased
<ul style="list-style-type: none"> -Improve the ability of researchers at Gondol Station -Providing sufficient facilities for seed production study at Gondol Station <p>Input</p> <ul style="list-style-type: none"> -Dispatch of experts -Counterpart training -Provision of equipment -Reinforcement of facilities 	<ul style="list-style-type: none"> -Researchers are capable of participating in the National and international societies -Complete equipment and facilities for research -Capable of using and maintaining equipment especially sophisticated ones <p>Experts</p> <ul style="list-style-type: none"> 1 expert 5 persons short-term 3 man month Counterpart training in Japan 3 man month <p>-Equipment total 250 million yen</p> <p>-Model hatchery construction 50 million yen</p>	<ul style="list-style-type: none"> -Comparison between before and after project regarding staffs and equipments <p>R/D</p> <ul style="list-style-type: none"> -Tentative schedule of implementation (T/S) -Annual joint committee 	<ul style="list-style-type: none"> -Maintain capability of the researchers at Gondol Station <p>Necessary inputs are carried out according to the initial time schedule</p> <ul style="list-style-type: none"> -G/I provides adequate level of staff, local cost and land/building to the project

ANNEX 2

		I Phase: Fundamental study				II Phase: Application			
		1988	1989	1990	1991	1992	1993		
Term of cooperation: 5 years	FISCAL YEAR:	Apr.	Mar.	Apr.	Mar.	Apr.	Mar.	Apr.	Oct.
	MONTH : Oct.								
1. SPAWNER PRODUCTION									
1-1 Ecological Survey									
1-1-1 Meteorological observation									
1-1-2 Environmental survey for fishing ground of spawner (a specific point at sea)									
1-1-3 Biological survey									
1-2 Gonadal Maturation									
1-2-1 Theory of gonadal maturation									
1-2-2 Application of eyestalk ablation to pond-reared grass									
1-2-3 Studies on hormon injection									
1-2-4 Tests of prospective feed (comparative study)									
1-2-5 Studies on environmental factors									
1-2-6 Experiments for hastening maturation by hormon, feed and environment									
1-2-7 Experiments of raising spawner in pond									
1-2-8 Technical manual									
1-3 Handling Technique									
1-3-1 Improvement of spawning rate									
1-3-2 Improvement of hatching rate									

Note: A = Counterparts are able to conduct experiment by themselves
 B = Still need some suggestion for expert
 C = Still on the initial stage
 (..) = hopefully

Result of MTE (Mid Term Evaluation)

Sept. 1992

term of cooperation : 5 years	I Phase: Fundamental study		II Phase: Application			
	1988	1989	1990	1991	1992	1993
FISCAL YEAR:	Apr.	Mar.	Apr.	Mar.	Apr.	Mar.
MONTH : Oct.						Apr. Oct.
2. REARING TECHNOLOGY OF LARVAE						
2-1 Refinement of Rearing Techniques						
2-1-1 Fundamental techniques of larval rearing				A		
2-1-2 Rearing management (handling, feeding, harvesting, cleaning, etc.)	C	B	A	A		
2-1-3 Studies for the application of micro diets	C	B	A	B	(B)	(A)
2-1-4 Intermediate(nursery)culture techniques			3.	C	(C)	(B)
2-1-5 Technical manual for larval rearing				4.	(B)	(A)
2-2 Natural Feed						
2-2-a. phytoplankton (algal organisms)	C		B	A		
2-2-1 Investigation of suitable local species				A		
2-2-2 Isolator techniques (micro-pipeting, dilution method, agar plate)				A		
2-2-3 Stock culture techniques (preservation, management)	C		B	B	(A)	
2-2-4 Studies of the optimum environment conditions and culture media				B	(A)	
2-2-5 Studies of mass culture techniques				B	(A)	
2-2-6 Systematic culture management				B	(A)	
2-2-b. Feeding experiments				B	(B)	(A)
2-2-7 Experiments on the nutritional value of algal organisms				B	(B)	(A)
2-2-8 Experiments on the nutritional value of animal organisms				B	(B)	(A)
2-2-9 Experiments on the feeding ecology				B	(B)	(A)
2-3 Environmental Conditions						
2-3-1 Studies on the optimum environment conditions of larval rearing (physico-chemical factors)				B	(B)	(A)
2-3-2 Maintenance of sterile environment	C		B	A		
2-3-3 Improvements due to modified hatchery				C 3.	(B)	(A)

Result of MTE

term of cooperation: 5 years	I Phase: Fundamental study					II Phase: Application				
	FISCAL YEAR:	1988	1989	1990	1991	1992	1993			
	MONTH : Oct.	Apr.	Mar.	Apr.	Mar.	Apr.	Mar.	Apr.	Mar.	Apr.
3. FEED DEVELOPMENT 3-1 Studies on Nutrient Requirement for shrimp 3-1-1 Theory 3-1-2 Rearing techniques of larvae employed compounding feed and examination of its effect 3-1-3 Making refined experimental feed for larvae 3-1-4 Experiments on nutrient requirements for larvae 3-1-5 Experiments on nutrient requirements for broodstock 3-2 Studies on feed formulation for shrimp 3-2-1 Investigations of nutrient value in prospective raw materials for larval feed 3-2-2 Investigations of nutrient value in prospective raw materials for broodstock feed 3-2-3 Compounding feed for larvae 3-2-4 Compounding feed for broodstock 3-3 Evaluation of compounding feed 3-3-1 Production methods 3-3-2 Examinations for efficiency 3-4 Technical manual	1.	C								
			2.	B		A				
				C		A				
			3.	C	B	A	(A)			
					4.	C	(B)			
					5.	C	(A)			
				1.	C	B	(B)	(A)		
				2.	C	B	(B)	(A)		
				3.	C	B	(B)	(A)		
				4.	C	C	(B)	(A)		
				1.	C	* B.C.	(B)	(A)		
			2.		** B.C.	(B)	(A)			
					C	(C)	(B) (A)			

* For Larvae : B, For Broodstock : C Result of MTE

** For Larvae : B, For Broodstock : C

I Phase: Fundamental study — II Phase: Application —

Sept. 1992

term of cooperation: 5 years	fiscal year: 1988		1989		1990		1991		1992		1993	
	month	: Oct.	Apr.	Mar.	Apr.	Mar.	Apr.	Mar.	Apr.	Aug.	Mar.	Apr.
4. DISEASES PROBLEM												
4-1-1 Preparation/installation of Equipment/apparatus and learning how to use						C		B			(A)	
4-2-2 Techniques for diagnosis (Symptoms, Isolation/culture of pathogens, rapid diagnosis, histopathology)						C		B			(B)	(B)
4-2-1 Viral diseases						C		B			(B)	(A)
4-2-2 Bacterial diseases						C		B			(B)	(A)
4-2-3 Fungal diseases						C		B			(B)	(B)
4-2-4 Parasitic diseases						C		B			(B)	(A)
4-2-5 Diseases caused by environmental factors						C		C			(C)	(B)
4-2-6 Nutritional deficiency						C		C			(C)	(C)
4-3 Epidemiological field surveys for shrimp diseases						C		C			(C)	(B)
4-3-1 Investigations of the outbreak & damage (questionnaire, interview and taking the history and examination)						C		C			(B)	(B)
4-3-2 Making an Atlas for shrimp diseases (identification of causative factors)						C		C			(B)	(B)
4-4 Studies on the prevention of epidemics						C		B			*	(A)
4-4-1 Methods of preserving the isolates						C		B			(A)	(A)
4-4-2 Drug sensitivity tests of the isolates						C		C			(B)	(B)
4-4-3 Experiments on the prevention of infectious diseases (investigations of pathogenicity and prevention/treatment)						C		C			(C)	(C)
4-4-4 Therapeutic examinations in the field						C		C			(C)	(C)
4-4-5 Regular sampling from the rearing tanks & ponds (water quality, flora of the micro organisms etc.)						C		B			(B)	(A)
4-4-6 Studies on precautions of epidemics (examinations for factors/conditions of outbreak)						C		C			(B)	(B)
4-5 Making a manual for diagnosis						C		C			(C)	(B)

JICA