5. Soft Component (Technical Assistance) Plan

Marine Aquaculture Development Centre (MADeC) is the first research and technical development institute for marine aquaculture in Cambodia. It will contribute for the development of marine aquaculture in Cambodia by carrying out basic research for marine aquaculture technical development as well as production and distribution of aquaculture seeds.

The core staffs expected to be stationed to the Centre are equipped with basic knowledge and techniques on marine aquaculture technology as they have been trained trough participation in marine aquaculture training courses at Southeast Asian Fisheries Development Center (SEAFDEC) in Philippines or other similar institutions in Vietnam and Thailand. Although the fingerling production of marine species is somewhat more complicated, its fundamental procedural flow does not differ from that for freshwater species which are widespread in Cambodia. Therefore, it is considered that those core staffs become capable to operate the facility in the long and medium terms. However, none of them has actual working experience in fingerling production of marine species at a practical scale. Consequently, there are some uncertainties remaining on operation of the Centre in the period right after the hand-over of the facility. Especially for the fingerling production of *Lates calicarifer*, MADeC has to start virtually from scratch from collection and management of brood fish and culture of live feed organisms. Technical assistance through an On-The-Job form to be provided during the initial phase of facility operation is expected to minimize the operational uncertainty.

Despite that it is confirmed in the Minute that Fisheries Administration will strengthen the institutional capacity of MADeC by providing the necessary budget and human resources in stages, it has yet to formulate the work programs including research contents, annual fingerling production and distribution targets, and extension activities. Preparation of an inventory for the supplied equipment is also an important work for proper operation and maintenance of the facility.

In consideration of the situations explained above, provision of technical assistance by Japanese consultants who understand well the background of the Project

Soft Component (Technical Assistance) will be planned as On-The-Job technical assistance by Japanese consultants and starting from the time around the facility hand-over is considered effective in realization of the objectives of this Grant Aid project. The category of the Soft Component (Technical Assistance) are Operation and maintenance of facility and Fingerling Production Technic of *Lates calicarifer* , its activity are as follows.

(1) Operation and maintenance of facility (1.5MM)

1) Preparation of MADeC work plan (draft) for the first year

The consultant will assist the counterpart staffs to prepare the work plan for the first year for MADeC.

2) Preparation of inventory of the facility and equipment

The consultant will prepare an installation plan for the supplied equipment and also an inventory for the equipment. The consultant will also train the counterpart staffs on registration and management system of the equipment using the inventory to develop a appropriate operation and maintenance system for the facility.

3) Workshop on operation and maintenance of the facility

Workshops will be held with participants including the MADeC staffs who are planned to be increased step by step, officers from Aquaculture Division of Fisheries Administration, and innovative aquaculture producers to discuss on various operational issues of MADeC such as human resources requirement, research and technical development activities, and schedule for fingerling production. Holding such workshops several times repeatedly is expected to facilitate the sharing of information among stakeholders, and therefore, to improve the operation of MADeC to be more practical with appointments of appropriate personnel and allotting proper budgets.

4) Survey on the possible buyers of the produced fingerlings

The produced fingerlings will be sold to fingerling distributors at the Centre as well as to small-scale aquaculture producers by delivering them using the supplied equipment (pick-up truck etc.). Although the general situation of coastal aquaculture operators were studies in the Basic Design Study of this project, it is necessary to carry out another detail survey for assessing the demand on the aquaculture seedlings for formulation of a strategic distribution plan of the produced aquaculture seeds. The consultant will assist the Cambodian staffs for conducting a survey to produce a list of aquaculture producers in order to assess their fingerling demands.

(2) Fingerling Production Techniques on *Lates calicarifer* (total 1.5MM)

1) Survey on the possible sources of brood fish collection and support for the procurement

The consultant will conduct a survey on the possible sources where brood fish of *Lates calicarifer* are available and support the actual procurement activity by MADeC. There are two types of potential sources for the brood fish collection; cage culture producers in

Cambodia and fingerling suppliers in Thailand. The consultant will prepare a procurement plan after comparing quality of brood fish, availability, means for transportation, and the cost between these two types of potential sources. Although the actual procurement must be carried out by MADeC, the consultant will assist their activities for the live fish transportation though technical advices. The consultant will also assist them for checking infectious diseases like viral nervous necrosis (VNN) using the supplied equipment.

2) Review on reproduction biology of *Lates calicarifer* and study on existing fingerling production manuals of similar species

To review existing literatures on basic biology of *Lates calicarifer* in particular on the reproduction biology including process of sexual maturation, spawning behaviour, spawning period, spawning pattern, fecundity, food and feeding habit of hatchlings and fingerlings, and to explain systematically the reproduction biology of the species to the Cambodian staffs.

There are several fingerling production manuals of *Lates calicarifer* that were already published by SEAFDEC Aquaculture Department and other institutions. The consultant will collect these manuals and other latest information on the fingerling production techniques of similar species and evaluate the techniques in order for assessing the possibility of applying them at MADeC.

3) Preparation of fingerling production manual for MADeC

Based on the review and study explained above, the consultant will prepare a draft version of fingerling production manual of *Lates calicarifer* specially adjusted for the MADeC facilities. The manual should be practical and user-friendly with plenty of illustrations and charts for ease of understanding by the Cambodian staffs who will try full-scale fingerling production first time at the Centre.

The prepared draft manual will be evaluated through the demonstration process explained below and finalized as an output of the ProJect, Fingerling Production Manual of *Lates calicarifer* of MADeC (ver. 1).

This first version of manual which will be prepared for the first year operation by inexperienced staffs should be revised within one to two years with practical issues raised and improvements made during the initial phase of operation of the Centre.

6. Equipment List

REQUESTED EQUIPMENT EVALUATION AND SELECTED EQUIPMENT

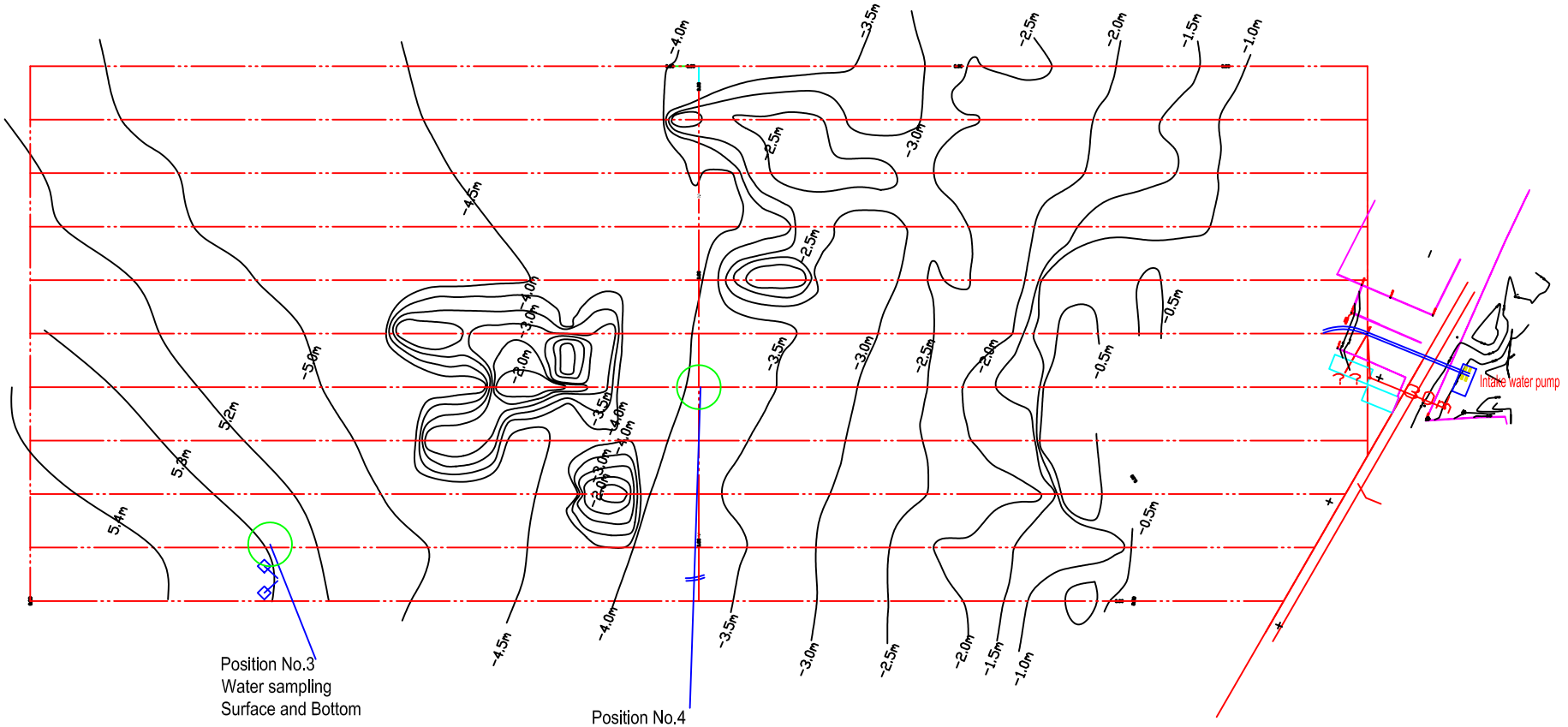
REQUEST			PTIORITY	PURPOSE	NECESITY	TECHNIC	OPERATION	COST	OVERALL EVALUATION	NUMBER
	NUMBER	EQUIPMENT								
A. EDUCATION										
	A1	OHP	A	○	×	○	○	○	×	
	A2	LCD PROJECTOR	A	○	○	○	○	○	○	1
	A3	GPS	A	○	×	○	○	○	×	
	A4	BINOCULAR	A	○	×	○	○	○	×	
	A5	MINI BUS	A	○	○	○	○	○	×	
B. R&D										
FEED & NUTRITION	B1	Feed mill/machine	A	○	×	○	○	○	×	
	B2	8- 20 place Kjeldahl digester/still	A	○	×	×	×	×	×	
	B3	Heater block	A	○	×	○	○	○	×	
	B4	Draft system	A	○	×	○	○	○	×	
	B5	Support rack and 20 tubes	A	○	○	○	○	○	○	1
	B6	Scrubber	A	○	×	○	○	○	×	
	B7	Recirculating water vacuum pump	A	○	×	×	×	×	×	
	B8	Auto fat extraction system	A	○	×	○	○	×	×	
	B9	Fiber analysis system (Extractor for	A	○	×	○	○	×	×	
	B10	Soxhlet extraction glassware units	A	○	×	○	○	○	×	
	B11	Vaccum oven >120 oC (Drying	A	○	×	○	○	○	×	
	B12	Ezoperiball iso pobol	A	○	×	○	○	○	×	
	B13	Analytical Balance 0 .1 mg	A	○	○	○	○	○	○	1
	B14	Technical balance	A	○	○	○	○	○	○	1
	B15	Muffle furnace >1000 oC	A	○	×	○	○	○	×	
	B16	Freezer -20oC	A	○	×	○	○	○	×	
	B17	Vortex mixer	A	○	×	○	○	○	×	
	B18	Spectrophotometer	A	○	×	○	○	○	×	
	B19	Basic Infrared moisture analyzer	A	○	×	○	○	○	×	
	B20	Kjeldahl distillation unit	A	○	×	○	○	○	×	
	B21	Laboratory fume hood	A	○	○	○	○	○	○	1
	B22	Vacuum pump	A	×	×	○	○	○	×	
	B23	Single water distiller	A	○	○	○	○	○	○	1
	B24	Refrigerator	A	○	○	○	○	○	○	1
	B25	Desiccators	A	○	○	○	○	○	○	1
	B26	Size reduction cutting mill	A	○	○	○	○	○	×	
	B27	Ultra centrifugal mill	A	○	×	○	○	○	×	
	B28	Knife mill	A	○	×	○	○	○	×	
	B29	Size reduction with rotor mill	A	○	×	○	○	○	×	
	B30	Dispenser (1-30ml)	A	○	×	○	○	○	×	
	B31	Micro pipettes	A	○	×	○	○	○	×	
	B32	Pipette mate pipet controller	A	○	×	○	○	○	×	
	B33	Water bath	A	○	×	○	○	○	×	
	B34	Spectrophotometer UV-Vis	A	○	×	○	○	○	×	
	B35	Ventilation oven	A	○	×	○	○	○	×	
	B36	Sieve shaker	A	○	×	○	○	○	×	
	B37	Feed formulation software	A	○	×	○	○	○	×	
	B38	Glass wares	A	○	○	○	○	○	○	1
	B39	Chemicals, reagents, solvents	A	×	○	○	○	○	×	
	**	Small pellet maschine	A	○	○	○	○	○	○	1
	**	Cutter	A	○	○	○	○	○	○	1
	**	Measure	A	○	○	○	○	○	○	1
	**	Mixier	A	○	○	○	○	○	○	1
AQUATIC ANIMAL HEALTH	**1. Bacteria**									
	B40	Incubator (-10 to + 500C)	A	○	○	○	○	○	○	1

REQUEST			PTIORITY	PURPOSE	NECESITY	TECHNIC	OPERATION	COST	OVERALL EVALUATION	NUMBER
	NUMBER	EQUIPMENT								
	B41	Freezer -20oC	A	○	○	○	○	○	○	1
	B42	Freezer -80oC	A	○	○	○	○	○	○	1
	B43	Shaker	A	○	×	○	○	○	×	
	B44	Liquid N2 freezer	A	○	×	○	○	○	×	
	B45	Laminar flow cabinet	A	○	○	○	○	○	○	1
	B46	Stirrer hot plate	A	○	×	○	○	○	×	
	B47	ELISA (complex)	A	○	×	×	○	○	×	
	B48	Fluorescence microscope	A	○	×	×	○	○	×	
	B49	Invert microscope with digital	A	○	×	○	○	○	×	
	B50	Microscope (dissecting and	A	○	×	○	○	○	×	
	B51	Autoclave	A	○	○	○	○	○	○	1
	B52	Oven	A	○	○	○	○	○	○	1
	B53	Chemicals, reagents, solvents	A	×	○	○	○	○	×	
	2. Histopathology									
	B54	Paraffin oven	A	○	×	○	○	○	×	
	B55	Automatic processor (Paraffin	A	○	×	○	○	○	×	
	B56	Automatic slide stainer	A	○	×	○	○	○	×	
	B57	Rotary Microtome	A	○	×	○	○	○	×	
	B58	Slide warmer	A	○	×	○	○	○	×	
	B59	Algid refrigerator	A	×	×	○	○	○	×	
	B60	Paraffin dispenser wax	A	○	×	○	○	○	×	
	B61	Thermostat water bath	A	○	×	○	○	○	×	
	B62	Cold plate	A	×	×	○	○	○	×	
	B63	Hot plate	A	×	×	○	○	○	×	
	B64	Thermostat	A	○	×	○	○	○	×	
	B65	Microscope	A	○	○	○	○	○	○	1
	B66	Microscope-camera	A	○	○	○	○	○	○	1
	B67	Micropipette	A	×	×	○	○	○	×	
	B68	Slide moat	A	○	×	○	○	○	×	
	B69	Oven	A	×	×	○	○	○	×	
	B70	Cryo-microtome	A	×	×	○	○	○	×	
	B71	Absorbent-tap box	A	○	○	○	○	○	○	1
	B72	Fluorescence-microscope	A	×	×	×	○	○	×	
	B73	Chemicals, reagents, solvents	A	×	○	○	○	○	×	
	3. Virology									
	B74	Centrifuge	A	○	○	○	○	○	○	1
	B75	Freeze Centrifuge	A	○	○	○	○	○	○	1
	B76	Vortex mixer	A	○	○	○	○	○	○	1
	B77	Sanyo medicool	A	○	○	○	○	○	○	1
	B78	DNA sequencer	A	○	×	○	○	○	×	
	B79	PCR Thermal cycler	A	○	○	○	○	○	○	1
	B80	Real time PCR machine	A	○	×	○	○	○	×	
	B81	64-well shark-teeth combs	A	○	○	○	○	○	×	
	B82	microplates	A	○	○	○	○	○	○	5
	B83	Microwave	A	○	○	○	○	○	○	1
	B84	Micro pipette	A	○	○	○	○	○	○	1
	B85	Electrophoresis apparatus	A	○	○	○	○	○	○	2
	B86	UV trans-illuminator	A	○	○	○	○	○	○	1
	B87	UV-face shield	A	○	○	○	○	○	○	1
	B88	Sphetrophoto meter	A	○	○	○	○	○	×	
	B89	Gel Doc	A	○	○	○	○	○	○	1
	B90	Laminar flow cabinet	A	○	○	○	○	○	○	1
	B91	Polaroid camera or digital photo	A	○	×	○	○	○	×	

REQUEST			PTIORITY	PURPOSE	NECESITY	TECHNIC	OPERATION	COST	OVERALL EVALUATION	NUMBER
	NUMBER	EQUIPMENT								
	B92	Electronic scale	A	○	×	○	○	○	×	
	B93	Heating block	A	○	○	○	○	○	×	
	B94	Refrigerator	A	○	○	×	○	○	×	
	B95	pH meter	A	○	○	○	○	○	○	1
	B96	Microscope (dissecting and	A	○	×	×	×	×	×	
	B97	Eppendorf tubes	A	○	○	○	○	○	○	6
	B98	scissors	A	○	○	○	○	○	○	10
	B99	Scalpels	A	○	○	○	○	○	○	10
	B100	forcepsPpinset)	A	○	○	○	○	○	○	10
	B101	tips	A	○	×	○	○	○	×	
	B102	Blades	A	○	×	○	○	○	×	
	B103	Chemicals, reagents, solvents	A	×	○	○	○	○	×	
WATER ANALYSIS										
	B104	Incubator, Cooled incubators	A	○	×	○	○	○	×	
	B105	Drying Ovens, Vacuum Drying	A	○	×	×	×	×	×	
	B106	Laminar Flow Safety Cabinets	A	○	×	○	○	○	×	
	B107	C02 incubators	A	○	×	○	○	○	×	
	B108	Plant Growth Chambers	A	○	○	○	○	○	○	1
	B109	Climatic Chambers	A	○	×	○	○	○	×	
	B110	Hybridization Ovens	A	○	×	○	○	○	×	
	B111	Furnaces (Muffle oven)	A	○	×	○	○	○	×	
	B112	Analytical Balances	A	○	○	○	○	○	○	1
	B113	Dissolved Oxygen Meter	A	○	○	○	○	○	○	1
	B114	Conductivity Meter	A	○	○	○	○	○	○	1
	B115	VIS and UV - VIS	A	○	×	○	○	○	×	
	B116	Single, Double Water Distiller	A	○	×	○	○	○	×	
	B117	Gas Detector, Sound Level Meters, Vibration Meters, Heat Stress	A	○	×	×	×	×	×	
	B118	Portable Water Analysis	A	○	×	○	○	○	×	
	B119	Automatic Water Sampler	A	○	○	○	○	○	○	1
	B120	Portable Water Multi – Parameter	A	○	○	○	○	○	○	1
	B121	Flow meters	A	○	○	○	○	○	○	1
	B122	Turbidy meters	A	○	○	○	○	○	○	1
	B123	Thin Layer Chromatography, High	A	○	×	×	×	○	×	
	B124	Digital Refractor meter	A	○	○	○	○	○	○	1
	B125	Micro Balance - up to 0.1microgram	A	○	×	×	○	○	×	
	B126	Mass Comparators - Volume	A	○	×	○	○	○	×	
	B127	Gas Chromatograph (GC)	A	○	×	×	×	×	×	
	B128	Gas Chromatograph - Mass	A	○	×	×	×	×	×	
	B129	High - Performance Liquid	A	○	×	×	×	×	×	
	B130	Luminescence Spectrometer (LS)	A	○	×	×	○	○	×	
	B131	Atomic Absorption Spectrometer	A	○	×	×	×	×	×	
	B132	Microscopes: Binocular,	A	○	○	○	○	○	○	1
	B133	Dark field, Phase Contrast	A	○	×	○	○	○	×	
	B134	Inverted Microscope With	A	○	×	○	○	○	×	
	B135	Epi – Fluorescent Microscopes	A	○	×	×	○	○	×	
	B136	DIC Microscopes	A	○	×	○	○	○	×	
	B137	Polarizing Microscopes	A	○	×	○	○	○	×	
	B138	Metallurgical Microscopes	A	○	×	×	○	○	×	
	B139	Confocal Laser Microscopes	A	○	×	×	○	○	×	
	B140	Profile Projectors	A	○	×	○	○	○	×	
	B141	Digital Cameras	A	○	○	○	○	○	×	
	B142	Plankton nets	A	○	○	○	○	○	○	1
	B143	Benthos sampler	A	○	○	○	○	○	×	
	B144	Plankton chamber	A	○	×	○	○	○	×	
	B145	Chemicals, reagents, solvents	A	×	○	○	○	○	×	

REQUEST			PTIORITY	PURPOSE	NECESITY	TECHNIC	OPERATION	COST	OVERALL EVALUATION	NUMBER
	NUMBER	EQUIPMENT								
		COD meter	A	○	○	○	○	○	○	1
		H2S meter	A	○	○	○	○	○	○	1
		Salinity meter	A	○	○	○	○	○	○	1
		Nitric acid meter	A	○	○	○	○	○	○	1
		Ammonium meter	A	○	○	○	○	○	○	1
C.FISH CULTURE										
	C1	3t Boat	A	○	○	○	○	○	○	1
	C2	2t Small truck	A	○	○	○	○	○	○	1
	C3	Fork lift	A	○	×	○	○	○	×	
	C4	Wheel barrow	A	○	×	×	○	○	×	
	C5	High pressure washer	A	○	○	○	○	○	○	1
	C6	Submerge pump	A	○	○	○	○	○	○	3
	C7	Scal	A	○	○	○	○	○	○	1
	C8	Hose	A	○	○	○	○	○	○	1
	C9	Scuba	A	○	○	○	○	○	○	3
	C10	Fish net	A	○	○	○	○	○	○	40
	C11	Portable generator	A	○	○	○	○	○	○	1
	C12	Artemia tunk 1t	A	○	○	○	○	○	○	4
	C13	Artemia tank O. 1t	A	○	○	○	○	○	○	10
	C14	Tank for fingerlings 4t	A	○	○	○	○	○	○	20
	C15	Tank for brood stock prawn1.3t	A	○	○	○	○	○	○	4
	C16	Tank for prawn larva	A	○	×	○	○	○	○	
		Scuba tank compressor	A	○	○	○	○	○	○	1

7. Other Relevant Data



Position No.3
Water sampling
Surface and Bottom

/Sand Thickness
If you could make sand thickness on only this point by stick.

Position No.4
/Water sampling
Surface and Bottom

/Sand Thickness
If you could make sand thickness on only this point by stick.

Notice:
Bottom sampling have to taken from 1m above the sea bottom.
i.e : depth was -3m, the sampling depth will be -2m.

(2) Cost estimation for MADeC operation

Revenue

1) Sale of sea bass fingerlings

Price per piece: 0.25USD × 119.47%= 0.30, same price for 5 year

Production (pieces): 2011: 0, 2012: 10,000, 2013: 50,000, 2014: 20,000, 2015: 40,000

Sales revenue: 2011: -

2012: 10,000×0.25×119.47% = 2,986USD

2013: 50,000×0.25×119.47% = 14.993USD

2014: 200,000×0.25×119.47% =59,735USD

2015: 400,000×0.25×119.47%=119,470USD

2) Sale of black tiger seeds

The black tiger prawn production is a research program in an experimental scale and therefore no revenue is expected from the production.

3) Training fee

The expected annual revenue from training implementation is USD3200 in 2008. Considering the annual inflations, the future values of the training related revenue in 2008 is calculated as follow. The revenues after 2011 to 2015 are assumed to remain at the same value.

Training revenue for 2011～2015: 3200×119.47%=3,823USD

Expenses

1) Procurement of sea bas brood fish (importation from overseas in the 2011 operation only)

Price per piece: Brood fish price in 2008 × CPI in 2011 (2008=100)

20USD×119.47%= 23.9 USD

Number of brood fish procured: 20 fish

Amount: 20 fish×23.9USD= 478USD

2) Procurement of sea bas brood fish (domestic procurement)

Price per piece: Brood fish price in 2008 × CPI in respective years (2008=100)

2011: 20USD×119.47%=23.9 USD

2012: 20USD×124.59%=24.9USD

2013: 20USD×129.92%=26.0USD

2014: 20USD×135.48%=27.0USD

2015: 20USD×141.28%=28.3USD

Number of procured brood fish: 2011:20, 2012:20, 2013:20, 2014:10, 2015:10,

Procurement cost: Number of fish procured × price per piece

2011: 20×23.9USD = 478USD

2012: 20×24.9USD = 498USD

2013: 20×26.0USD = 520USD

2014: 10×27.0USD = 270USD

2015: 10×28.3USD = 283USD

3) Procurement of black tiger prawn brood stock

Price of brood stock per piece: Price in 2008×CPI in respective years (2008=100)

2011: 10USD×119.47%= 11.9USD

2012: 10USD×124.59%= 12.5USD

2013: 10USD×129.92%= 13.0USD

2014: 10USD×135.48%= 13.5USD

2015: 10USD×141.28%= 14.1USD

Number of procured prawn: 2011:20, 2012:10, 2013:5, 2014:5, 2015:5

Procurement cost: Number of prawn procured × price per piece

2011: 20×11.9USD= 238.0USD

2012: 10×12.5USD=125.0USD

2013: 5×13.0USD= 65.0USD

2014: 5×13.5USD= 67.5USD

2015: 5×14.1USD= 70.5USD

4) Feed procurement for sea bass rearing

Total quantity of trash fish fed to sea bass per fish: 180 kg

Trash fish price per kg Price in 2008 × CPI in respective years (2008=100)

2011: 0.25USD/kg×119.47%=0.30USD

2012: 0.25USD/kg×124.59%= 0.31USD

2013: 0.25USD/kg×129.92%= 0.32USD

2014: 0.25USD/kg×135.48%= 0.34USD

2015: 0.25USD/kg×141.28%= 0.35USD

Trash fish procurement cost: Number of fish × Quantity required (kg) × Price per kg

2011:40×180kg×0.30USD/kg=2,160USD/yr (final survival: 40×50%→20)

2012:(20+20)×180kg×0.31USD/kg=2,232USD/yr (final survival: 40×80%→32)

2013:(32+20)×180kg×0.32USD/kg=2,995USD/yr (final survival: 52×80%→41)

2014:(41+10)×180kg×0.34USD/kg= 3,121USD/yr (final survival: 51×99%→50)

2015:(50+10)×180kg×0.35USD/kg= 3,780USD/yr (final survival: 60)

5) Public electricity bill

In the Project facility, the electricity charge for operating the aquaculture facility (sea water intake pump, blowers, etc.) occupies the largest share in the total expenditure. The estimated annual electricity expenses for the Project facility is as shown in following table . The electricity consumption for the operation of seawater intake pump is 132 kWh per day including the weekend days. Similarly, the electricity consumption for the aeration blower is 180 kWh per day including the weekend days. The total consumption for lighting, air-conditioning, and operation of refrigerators etc. is estimated to be 597.2 kwh/day for weekdays or 407.7 kwh/day for weekend days. Total weekdays and total weekend days are assumed to be 300 days and 65 days in a year in the calculation of electricity consumption in the table below.

Electricity consumption estimated for the Project facility (unit: kWh)

	Seawater intake pump	Air blower	Lighting	Air-conditioning	Others	Total consumption/day
Daytime (operating hours)	5.5/hr (12hr: 66.0)	7.5/hr (12hr: 90.0)	15.3/hr (8hr: 122.4)	28.8/hr (8hr: 230.4) 30%→69.1	5.0/hr (8hr: 40.0)	387.5 kWh
Nighttime (operating hours)	5.5/hr (12hr: 66.0)	7.5/hr (12hr: 90.0)	2.3/hr (8hr: 18.4)	0.41/hr (8hr: 3.3)	2.0/hr (16hr: 32.0)	209.7 kWh
Total/day in weekdays Total/day in weekend days	132.0 132.0	180.0 180.0	140.8 18.4	72.4 3.3	72.0 72.0	597.2 kWh 405.7 kWh

The total electricity expenses for the Project facilities in 2008 are estimated as follow.

- Total annual electricity expenditure per day in weekdays (2008):

597.2 kWh×0.177USD/ kWh=105.7USD

- Total annual electricity expenditure per day in weekend days (2008):

405.7 kWh×0.177USD/ kWh=71.8USD

• Total annual electricity expenditure (2008):

105.7×300 days + 71.8×65days = 36,377 USD

The annual electricity expenditures for the Project facility from 2011 to 2015 are 2008 are obtained by multiplying the 2008 value by CPIs of the respective years as follows.

2011: 36,377USD×119.47%= 43,459USD

2012: 36,377USD×124.59%= 45,322USD

2013: 36,377USD×129.92%= 47,260USD

2014: 36,377USD×135.48%= 49,283USD

2015: 36,377USD×141.28%= 51,393USD

6) Public water bill

Quantity of water used in Administration & Research Building:

Number staff 41person × 50 liter/day =2,050 liters

→ Annual quantity: 2,050 litres×300days = 615,000 liters

Quantity of water used in accommodation building:

Training participants 2,480 persons/day × 100 liters/day = 248,000 liters

Annual total quantity: 615,000 litres + 248,000 litres = 863 kilo litres/yr

Annual water bill (2008): 863 × 0.384 USD/m^3 = 331.4USD

2011: 331.4USD×119.47%=395.9USD

2012: 331.4USD/kg×124.59%= 412.9USD

2013: 331.4USD/kg×129.92%= 430.5USD

2014: 331.4USD/kg×135.48%= 449.0USD

2015: 331.4USD/kg×141.28%= 468.2USD

7) Fuel expenses

Annual total duration of blackout time: Monthly average×12 = 6hr×12months = 72 hr/yr

Fuel consumption: 60 litres /hr

Annual total fuel consumption: 60×72 hr/yr = 4,320 litres

Fuel expenses (2008): 4,320 litres × 0.61USD/litre = 2,635USD

2011: 2,635USD×119.47%= 3,148 USD

2012: 2,635USD×124.59%= 3,282 USD

2013: 2,635USD×129.92%= 3,423 USD

2014: 2,635USD×135.48%= 3,569 USD

2015: 2,635USD×141.28%= 3,722 USD

8) Consumables

Total annual amount of 2500USD in 2008 is supposed to be accounted for the expenses in procurement of artemia cysts as a consumable item for the Project operation. The expenses in 2011 to 2015 are obtained by multiplying the 2008 expenditure and CPI for the respective years.

2011: 2,500USD×119.47%= 2,986.8USD

2012: 2,500USD×124.59%= 3,114.8USD

2013: 2,500USD×129.92%= 3,248.0USD

2014: 2,500USD×135.48%= 3,387.0USD

2015: 2,500USD×141.28%= 3,532.0USD

9) Expenses related to training operation

The expenditure for implementing the training courses is assumed to be a total of 1000USD in 2008 for activities like food procurement, employment for cooking and others. Multiplying the 2008 value by appropriate CPI rates, the annual expenditures in 2001 to 2015 are calculated.

2011: 1,000USD×119.47%= 1,194 USD

2012: 1,000USD×124.59%= 1,245 USD

2013: 1,000USD×129.92%= 1,299 USD

2014: 1,000USD×135.48%= 1,354 USD

2015: 1,000USD×141.28%= 1,412 USD

10) Payroll cost (public servants)

Director (1 person): 100USD×12 months×1person= 1,200USD

Deputy Director (3 persons) 80USD×12 months×3persons=2,880USD

Regular staffs (25persons), 2011: 50USD×12 months×25persons= 15,000USD

Regular staffs (30persons), 2012: 50USD×12 months×30persons= 18,000USD

Regular staffs (37persons), after 2013: 50USD×12 months×37persons=22,200USD

Total payroll

2011: 1,200+2,880+15,000 =19,080 USD

2012: 1,200+2,880+18,000 =22,080 USD

2013: 1,200+2,880+22,200 =26,280 USD

2014: 1,200+2,880+22,200 =26,280 USD

2015: 1,200+2,880+22,200 =26,280 USD

(*no increase in payroll accompanying the rise in CPI is assumed)

11) Labour cost (casual worker)

Expected casual labor employment (4perosn, common for the period from 2011to 2015):

20USD×12months×4persons= 960USD

(*no increase in payroll accompanying the rise in CPI is assumed)

8. References

1 Sub-decree on Construction Permits

2 Proclamation on the Organization and Function of the Fisheries Administration

3 Temperature Data Wind data And Rainfall data 1997-2008 by Sihanoukvill Meteorology Station