

PPA:SRI 16025

**ASIAN DEVELOPMENT BANK**

**PROJECT PERFORMANCE AUDIT REPORT**

**ON THE**

**AQUACULTURE DEVELOPMENT PROJECT  
(Loan No. 648-SRI[SF])**

**IN**

**SRI LANKA**

**August 1995**

## CURRENCY EQUIVALENTS

Currency Unit - Sri Lankan Rupee (SLRs)

		At Appraisal	At Project Completion	At Postevaluation
SLRs1.00	=	\$0.0413	\$0.0233	\$0.0202
\$1.00	=	SLRs24.21	SLRs43.00	SLRs49.50

## ABBREVIATIONS

BME	-	Benefit Monitoring and Evaluation
BOC	-	Bank of Ceylon
EA	-	Executing Agency
EIRR	-	Economic Internal Rate of Return
FAO	-	Food and Agriculture Organization
FIRR	-	Financial Internal Rate of Return
FSC	-	Fisheries Sub-Committees
IFD	-	Inland Fisheries Division
IFFS	-	Inland Freshwater Fisheries Stations
MOFARD	-	Ministry of Fisheries and Aquatic Resources Development
NARA	-	National Aquatic Resources Agency
NIFDEC	-	National Inland Fisheries Development Center
PB	-	People's Bank
PCC	-	Project Coordinating Committee
PCR	-	Project Completion Report
PEM	-	Postevaluation Mission
PIU	-	Project Implementation Unit
PPAR	-	Project Performance Audit Report
PPTA	-	Project Preparatory Technical Assistance
SDR	-	Special Drawing Rights
SHC	-	Shrimp Hatchery Complex

## WEIGHTS AND MEASURES

t	-	metric ton
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## NOTES

- (i) The fiscal year (FY) of the Government ends 31 December.
- (ii) In this Report, "\$" refers to US dollars.

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**BASIC PROJECT DATA**  
**Aquaculture Development Project (Loan No. 648-SRI[SF])**

**PROJECT PREPARATION:**

T.A. No.	TA Project Name	Type	Estimated Person-months	Approved Amount	Approval Date
412-SRI	Aquaculture Development Project	PPTA	16 person-months	\$105,000	2 September 1981

KEY PROJECT DATA (\$ million):	As per Bank Loan Documents	Actual
Total Project Cost	21.62	7.45
Foreign Currency Cost	9.20	3.52
Bank Loan Amount/Utilization	17.27 (loan approval)*	6.41
Bank Loan Cancellation		2.84

KEY DATES:	Expected	Actual
Fact-Finding		16 November-01 December 1982
Appraisal		15 February-02 March 1983
Loan Negotiations		04-08 July 1983
Board Approval		03 November 1983
Loan Agreement		23 November 1983
Loan Effectivity	23 February 1984	21 March 1984
First Disbursement		06 April 1984
Project Completion	22 February 1990	31 December 1991
Loan Closing	31 December 1990	12 August 1993
Months (Effectivity to Completion)	72	93

KEY PERFORMANCE INDICATORS (%):	Appraisal	PCR	PPAR
Economic Internal Rate of Return:			
- Whole Project	20	not calculated	5.7
- IFFS	27	not calculated	-1.5
- SHC	15	not calculated	13.4
Financial Internal Rate of Return			
- Whole Project	19	not calculated	1.8
- IFFS	25	not calculated	-4.7
- SHC	14	not calculated	9.7

**BORROWER:** Democratic Socialist Republic of Sri Lanka

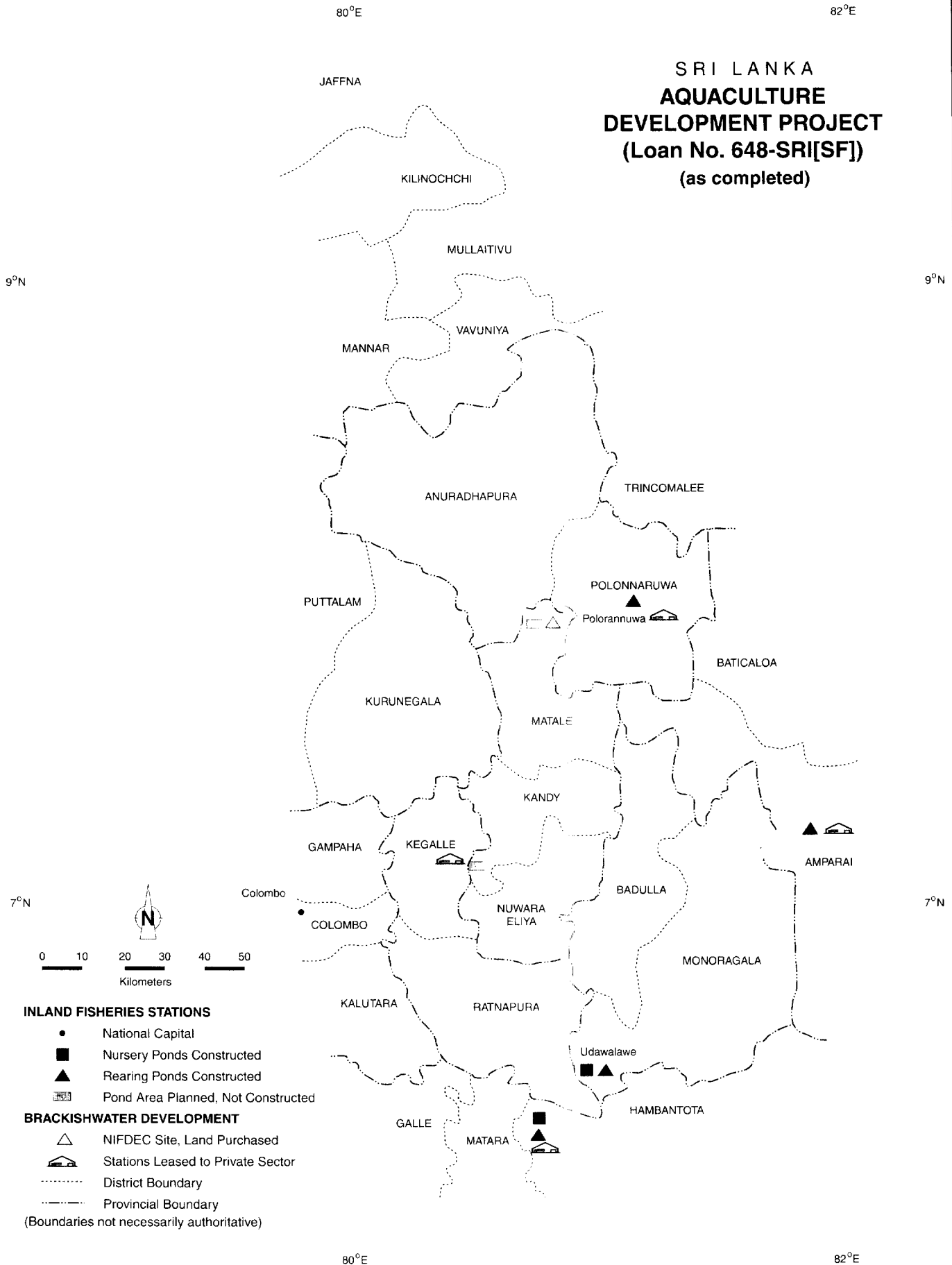
**EXECUTING AGENCY:** Ministry of Fisheries and Aquatic Resources Development  
Bank of Ceylon  
People's Bank

**MISSION DATA:**

Type of Mission	No. of Missions	Person-days
Fact-Finding	1	8
Appraisal/Loan Negotiations	1	57
Project Administration		
- Inception	1	8
- Review	8	147
- Technical Review	1	11
- Special Project Administration	4	40
- Project Completion	1	43
Postevaluation	1	36

\* The original loan amount approved was SDR16.58 million, which was equivalent to \$17.27 million. At the time of loan closing, the dollar equivalent was \$21.99 because of the downward depreciation of dollar against the SDR. The Bank approved the reallocation of the loan amount of \$12.74 million in 1991 to the Gulf Crisis Special Assistance Program to Sri Lanka.

SRI LANKA  
**AQUACULTURE  
 DEVELOPMENT PROJECT**  
 (Loan No. 648-SRI[SF])  
 (as completed)



## I. HIGHLIGHTS

1. **Objectives and Scope.** The Project sought to increase inland fish production from aquaculture; to establish the basis for shrimp culture to earn foreign exchange; and to strengthen the institutional infrastructure for the future development of aquaculture in Sri Lanka. This was to be achieved through provision of supporting services and facilities for freshwater and brackish water fisheries development; provision of training and fellowships, extension support, and consulting services; and benefit monitoring and evaluation. Credit was to be provided through the Bank of Ceylon and People's Bank to the private sector for commercial brackish water shrimp culture.
2. **Cost, Financing, and Schedule.** The total cost of the Project was estimated at \$21.62 million, of which the Bank's loan was Special Drawing Rights (SDR) 16.581 million, equivalent to \$17.27 million at appraisal. But, with the strengthening of the SDR in relation to dollar, the loan appreciated to \$21.99 million at loan closing. The actual cost of the Project was \$7.45 million. Disbursements under the Bank's loan amounted to \$6.41 million or about 37 percent of the approved amount. The Project was completed in December 1991, after a delay of about 21 months from the original schedule.
3. **Implementation.** The Project was completed with substantial reduction in scope. Three of the proposed six freshwater hatcheries were upgraded as the major seed production centers. Nursery and rearing ponds were constructed in four sites but the pond area was reduced from 24 hectares (ha) to 7 ha. Only 5.7 percent (571 ha) of the targeted seasonal tanks were upgraded and repaired. The National Inland Fisheries Development Center (NIFDEC) and the credit components were canceled. Buildings and offices as well as equipment for extension services were provided. Civil disturbances coupled with weak management resulted in implementation delays. A major change in Government policy in July 1990, withdrawing state patronage from inland freshwater fishery activities, resulted in termination of most Project activities and reduction in the Project scope (see para. 25). Except for two hatchery centers, all Project facilities were privatized after Project completion.
4. **Institutional Aspects.** The Project strengthened the Ministry of Fisheries and Aquatic Resources Development (MOFARD) by upgrading its skills in planning, management, and extension in aquaculture related fields. The bulk of the trained staff in the Inland Fisheries Division (IFD) were retrenched after the change in Government's policy and they were mostly employed by the private sector, which subsequently contributed to the upsurge of shrimp culture activities.
5. **Environmental Impact.** No adverse effects on the environment resulting from pond construction, rehabilitation, and operation were detected. However, the shrimp culture industry is facing potential environmental problems in the brackish water because of unregulated discharge of shrimp-pond water to the common canal by the small-scale shrimp farmers.
6. **Cost/Benefit Assessment.** The financial internal rate of return (FIRR) for the Project as a whole was reestimated at about 1.8 percent and the economic internal rate of return (EIRR) at 5.7 percent. At appraisal, the FIRR and EIRR estimates were about 19 percent and 20 percent, respectively. The lower-than-expected FIRR and EIRR resulted from the significant cost overrun of the shrimp hatchery complex (SHC), substantial delay in realizing SHC benefits, and termination of inland freshwater fish production, which was replaced by small-scale ornamental

fish production. The SHC was privatized and accounted for most of the Project benefits. The FIRR for the SHC was reestimated at about 9.7 percent compared to 13.4 percent at appraisal. Intended benefits to seasonal tank farmers were not realized because state patronage was terminated, but the shrimp culture development did provide the demonstration effects to small-scale farmers in the Project areas. Ornamental fish and shrimp production are contributing to substantial foreign exchange earnings.

7. **Overall Performance and Sustainability.** The Project stimulated significant development in the aquaculture industry through improved extensions, skill training, and privatization of Project investments. Although the state patronage for inland fisheries was terminated, it provided the model and foundation on which the future program could be based. The shrimp culture component has taken off rapidly and contributed to foreign exchange earnings. The extension and training component has provided the private sector a pool of expertise in the development of aquaculture industry. Indirect socioeconomic benefits were generated through private sector smallholder shrimp development, and with full privatization of the Project facilities, these components are expected to be sustainable. However, Project achievements were lower than envisaged mainly because of the withdrawal of support from inland freshwater fisheries activities, as well as other factors such as design deficiencies, weak management, poor consultancy services, and intermittent civil disturbances. The Project is considered partly successful.

8. **Feedback.** The Project experience illustrates the need for detailed preparatory work in order to minimize delay, avoid unnecessary investment costs, and recruit consultants and key management staff on time. It also highlighted the need to examine the sociocultural aspects of beneficiaries and to place a greater emphasis on benefit monitoring and evaluation (BME). Project supervision should review regularly the appropriateness of Project design and approach to determine the need for design modifications in response to changing circumstances. The Project also illustrates that the Government role should be to facilitate private sector-led development, rather than to participate actively in production process.

## II. BACKGROUND

### A. Rationale

9. Sri Lanka is endowed with large areas of freshwater and brackish water where the potential for aquaculture development is significant. Under the Government's second Five-Year National Fisheries Development Plan (1980-1984) emphasis was given to improving the socioeconomic status of the rural population and to encouraging the domestic consumption of fish. The Project was formulated to exploit the abundant inland freshwater resources and promote shrimp culture to develop the brackish water potentials in order to increase domestic fish production and to produce shrimp for foreign exchange earnings.

### B. Formulation

10. The Project was preceded by a feasibility study prepared by the Food and Agriculture (FAO) Investment Center, during March to November 1982 under Bank Project

Preparatory Technical Assistance (PPTA).<sup>1</sup> The feasibility study, which amounted to \$197,000, was conducted under a cost-sharing agreement between the Bank and FAO (see para. 28).

### **C. Objectives and Scope at Appraisal**

11. The Project was formulated to develop a viable aquaculture industry. The main objectives of the Project were to (i) increase fish production from aquaculture for domestic consumption, (ii) establish the basis for shrimp culture to earn foreign exchange, and (iii) strengthen the institutional infrastructure for the future development of aquaculture in Sri Lanka.

12. The scope of the Project consisted of two parts. Part A included provision of supporting services and facilities for freshwater and brackish water development, training and fellowships, extension support, consulting services, and BME. Included in the freshwater fisheries component were the development and upgrading of carp hatcheries, carp rearing stations, and a seasonal tanks program. Part B included provision of credit for brackish water pond culture by the private sector.

### **D. Financing Arrangements**

13. The total cost of the Project as estimated at appraisal was \$21.62 million, comprising \$9.20 million in foreign exchange cost and \$12.42 million in local currency cost equivalent. A Bank loan from the Asian Development Fund resources was approved on 3 November 1983 to finance \$17.27 million of the Project costs (equivalent to SDR16.581 million), covering the entire foreign exchange cost of \$9.20 million and \$8.07 million equivalent of the local currency cost. The balance, equivalent to 20 percent of the total cost, was to be financed by the Government (\$1.37 million) and sub-borrowers under the credit component (\$2.98 million). The borrower was the Democratic Socialist Republic of Sri Lanka, and the main Executing Agencies (EAs) were MOFARD, Bank of Ceylon (BOC), and People's Bank (PB).

### **E. Completion**

14. The Project was completed in December 1991 but the Bank loan was closed only on 12 August 1993 to accommodate late submission of withdrawal applications for civil works and equipment purchases contracted prior to Project completion. The Project Completion Report<sup>2</sup> (PCR) was prepared by the Bank's Agriculture Department in December 1992 and circulated to the Board on 4 January 1993. The PCR is a comprehensive document providing detailed Project information on scope, costing, implementation, and operational aspects. However, no financial and economic reevaluations of the Project were conducted.

### **F. Ex-Postevaluation**

15. The Project Performance Audit Report (PPAR) focuses on pertinent aspects of the Project and assesses the effectiveness of the Project in terms of achieving its objectives and generating benefits, and of the sustainability of the Project's operations. It also deals with

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<sup>1</sup> TA No. 412-SRI: Aquaculture Development Project for \$105,000, approved on 2 September 1981.

<sup>2</sup> PCR No. SRI16025: Project Completion Report of the Aquaculture Development Project.



important issues such as Project design, implementation constraints, and the Government's policy change that terminated all inland freshwater fish production activities.

16. The PPAR is based on a review of the PCR, the Appraisal Report, material in Bank files, and the findings of the Postevaluation Mission (PEM) that visited Sri Lanka from 20 February to 10 March 1995. The PEM inspected Project sites and held discussions with officials of MOFARD and other agencies of the Borrower, beneficiaries of the Project, and the private sector. Copies of the draft PPAR were provided to the Borrower, MOFARD, and Bank staff for review and comments. Comments received have been taken into consideration and incorporated in the final Report.

### III. IMPLEMENTATION PERFORMANCE

#### A. Design

17. The prevailing abundance of inland seasonal tanks as well as the existing inland freshwater fisheries stations (IFFS) for aquaculture development provided the basis for the formulation and adoption of the Project design. However, when the Project was appraised, there was no assessment of the institutional capability and Government bureaucratic procedures that resulted in prolonged delay in recruiting key Project management staff (particularly the Project Director) and awarding the consultant contract for the SHC during implementation. More importantly, the sites targeted for freshwater hatcheries, fry rearing ponds, and NIFDEC were selected without proper site selection criteria (such as water and land availability, soil suitability, etc.) and anticipation of potential land acquisition problems at the sites. The target for the development of 10,000 ha under the seasonal tanks program was overly optimistic. The design of the Project also did not take into account the sociocultural sensitivity of Project area inhabitants. Some of the seasonal tank sites were located near sensitive places such as places of worship. These factors, coupled with the abrupt and unexpected change in Government policy in July 1990 (see para. 25), necessitated a substantial reduction in the Project scope. The reduction eliminated three of the originally intended six hatchery sites. Of the three original sites selected as rearing ponds, only one was implemented. The other two were substituted with other sites (see Appendix 2). The NIFDEC site at Kalawewa was found not suitable and later the site was planned at Dambulla, but it was eventually canceled.

18. The Project suffered from a number of design deficiencies. The introduction of new technologies such as the use of pens and plastic pools for carp rearing and polyculture for SHC proved to be impractical, expensive, and not viable under local conditions. In promoting freshwater fisheries production, the Project design focused exclusively on stimulating production from seasonal tanks. This focus was found overly optimistic because fish production from seasonal tanks was, by and large, a new activity, whereas fishing in reservoirs was well established. Building on the existing activity should have been the primary focus, with a more realistic and slower build-up planned for the new seasonal tanks activity.

19. The BME component, provided for under the Project, was not implemented because of lack of local expertise in developing and conducting the BME system. This problem could have been overcome if MOFARD's capability to plan and implement the BME component had been assessed during appraisal.

## **B. Contracting, Construction, and Commissioning**

20. Lack of knowledge regarding the Bank's procurement guidelines coupled with cumbersome Government procedures in tendering and the award of contracts were the major causes of slow Project implementation. The delays were compounded by a combination of factors, including weak management and land acquisition problems. The work carried out by contractors for pond construction and related civil works in some IFFS were substandard. In some cases, supervision during construction was difficult as a result of civil disturbances. In addition, most works were completed by the time the Government decided to change its policy (see para. 25). This allowed no opportunity for commissioning and testing of the structures. The facilities were consequently left idle for about two years until the private sector lessees took over. In the interim the facilities were not maintained and significant deterioration occurred. The lessees are currently rehabilitating the stations, including the ponds constructed under the Project.

21. A turnkey contract was entered with an international consulting group for the establishment of the SHC; from site selection, planning and design, preparation of tenders, supervision of construction, and initial operation. In the event, the construction incurred significant cost overruns and delays in implementation, requiring extensions of the consultant's contract (from 37 person-months and \$890,000 at appraisal to 60.5 person-months and \$1.6 million upon completion). Although the Bank provided the Government initial assistance in drawing up the original contract, the final agreement reached between the consultants and the Government was more favorable to the consultants than to the Government. For example, the contract lacked specific performance criteria for the ponds and contained no penalty in the event of poor construction and weak structures. Based on the evidence available, the PEM concurs with the PCR that the group of SHC consultants performed less than satisfactorily, because of (i) the significant delays in constructing the SHC, (ii) the pond dikes and canal erosion problems that emerged during commissioning caused by construction and design flaws, (iii) the shortfall in hatchery production of post larvae, and (iv) inadequate transfer of technology to local counterparts.

## **C. Organization and Management**

22. Project organization and management was to be provided by a Project Implementation Unit (PIU) headed by a Project Director. The implementation of the Project was to be guided by an interagency Project Coordinating Committee (PCC). The MOFARD was given overall responsibility for Project implementation. The initial stage of Project implementation was plagued with administrative and organizational problems. Key management staff were not appointed in a timely manner. Less than half of the envisaged technical staff (223 out of 468) were appointed, and most of them were recruited from within MOFARD but they continued with many of their regular functions in MOFARD. The PCC, which was headed by the Secretary of MOFARD, met once during the first year of implementation but has not been active since then.

23. Weak Project management, compounded by cumbersome Government procedures, was the major reason for the delay in implementation and low level of achievement of Project targets. Because of the failure to appoint a full-time Project Director until about five years after loan effectivity and the insufficient number of staff assigned to the PIU, the Project lacked direction and impetus in the critical early years. The inability to recruit a Project Director was reportedly due to insufficient financial incentives to attract a suitably qualified and

experienced candidate to the post. This problem should have been resolved at a relatively early stage of Project implementation, through cooperation between the Bank and the Government. Delays in the recruitment of consultants and the decision not to recruit a number of the proposed consultants,<sup>1</sup> together with the generally unsatisfactory performance of the SHC consultants (see para. 21), also contributed to poor Project performance.

24. During Project implementation, Bank fielded 15 Review and Special Project Administration Missions with a staff input of about 249 person-days. In terms of number of missions, this was considered adequate. However, the missions fielded during the first three years were mostly of short duration (less than a week) and accomplished little in resolving implementation problems. For example, the problem of recruiting a full-time Project Director was identified as early as 1985 but was not resolved until 1989. Despite various implementation problems, earlier missions did not examine the need for Project design/scope modifications to overcome design flaws and relied solely on MOFARD's capability to resolve major problems such as staff recruitment, site selection, and consultant recruitment. Only in the later implementation years (from 1988 onwards) did the Bank provide effective assistance and take firm action in assisting MOFARD to resolve both technical and management problems.

25. On 24 July 1990, the Government made an unexpected policy change to withdraw state patronage from all inland fisheries activities. No specific reason was given for the policy change. The policy change resulted in (i) termination of all Project activities in the inland freshwater fisheries stations for which planning and preliminary work had started (Ginigathena and Polonnaruwa sites), (ii) reduction in scope of SHC, (iii) all IFFSs and SHC were to be privatized, and (iv) closure of IFD and the retrenchment of its staff, resulting in virtual termination of all inland freshwater fish production activities. The Bank reacted promptly by fielding a Special Project Administration Mission in September 1990 followed by a Project Reformulation Mission in December 1990. The Project was subsequently reformulated with significant reduction in its scope, including the canceling of NIFDEC, two IFFS, and the credit component, and reduction in size of SHC (see para. 34). The Bank's attempt to convince the Government to reverse its decision was unsuccessful; however, the Bank was able to have the Project reformulated to sustain Project activities and support the Government's decision to privatize all IFFS as well as the SHC facilities. This led to an upsurge of private sector activities soon after privatization in 1994, especially in the brackish water culture and ornamental fish production for the export markets.

#### **D. Actual Cost and Financing**

26. The actual Project cost was \$7.45 million or about 35 percent of the appraisal estimates. About \$6.41 million or 37 percent of the Bank loan was utilized. The Bank approved the reallocation of \$12.74 million on 5 June 1991 to the Gulf Crisis Special Assistance Program to Sri Lanka and canceled the remaining \$2.84 million in 1993. The substantial cost underrun was attributed to the major reduction in scope of the Project (see para. 25) and the relatively large contingencies (\$8.05 million or about 37 percent of total Project cost at appraisal). The

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<sup>1</sup> The appraisal envisaged the engagement of four individual consultants (for brackish water aquaculture, pen culture, training, and carp breeding and rearing) to assist the Project management, but only one (for carp breeding and rearing) was recruited.

establishment of the SHC and the cost of its consulting services were among the few items that had an overrun, exceeding the appraisal estimate by about 51 percent and 80 percent, respectively. A comparison of appraisal and actual costs by category is given in Appendix 3.

#### **E. Implementation Schedule**

27. The Project was completed on 31 December 1991 compared with the scheduled date of 22 February 1990. There was a delay of about 21 months or about 29 percent over the envisaged implementation period of 72 months, despite the reduction in scope. The Government took an unnecessarily long time to appoint a full-time Project Director and the late recruitment of consultants resulted in sluggish progress and poor performance of some contractors in the hatchery and rearing ponds construction. The commissioning of SHC was delayed by about two years. Civil disturbances, difficulties in pond site selection, problems in land acquisition, and MOFARD's initial lack of familiarity with the Bank's procurement policies and procedures all contributed to the delay.

#### **F. Effectiveness of Technical Assistance**

28. The Bank provided a PPTA (see para. 10) for \$105,000 in a cost-sharing agreement with FAO, which provided \$92,000 to prepare a report on the feasibility of the Aquaculture Development Project. The study was carried out by the FAO Investment Center, and the report was submitted on 9 July 1982. Although the terms of reference for the PPTA included a detailed study on institutional capability and sociocultural aspects of target groups to ensure that Project objectives, scope, and implementation arrangements were compatible with social customs, cultural practices, needs, and preferences among the target groups, this was inadequately covered. Upon review of PPTA documents and discussion with concerned Bank staff responsible for appraisal, it was concluded that the PPTA report was poorly prepared and was a weak document for the appraisal. While the rationale and objectives as well as the main components proposed were appropriate, detailed analysis of site selection, land acquisition, socioeconomic and engineering aspects, and costs of the SHC and of private sector commercialization aspects was inadequate.

#### **G. Compliance with Loan Covenants**

29. In general, MOFARD's overall compliance with loan covenants was less than satisfactory. There were also minor areas of incomplete compliance (see Appendix 4) and delayed compliance. A particular case was the appointment of a full-time Project Director after about five years of implementation. This is particularly of concern because partial or late compliance had an adverse impact on Project implementation. Similarly, late compliance pertaining to SHC consultant recruitment, site selections, and land acquisition also adversely affected the Project performance. Appendix 4 provides the PEM's comments on compliance with major loan covenants.

## IV. PROJECT RESULTS

### A. Operational Performance

#### 1. Hatcheries and IFFS Pond Rearing Facilities

30. Total pond area to be constructed by the Project was about 24 ha. Actual construction was about 7 ha, or about 29 percent of the appraisal target. Total fingerling production declined steadily from a peak of 10 million in 1984 to just over 3 million in 1989 and 4 million in 1990 (see Appendix 1). This was due mainly to the effect of civil disturbances on IFFS operations. Currently, the Project does not contribute to increasing freshwater fish production for domestic consumption. This situation was the consequence of the 1990 policy reversal that stopped all Government-sponsored inland fisheries activities.

31. As a consequence of the Government policy change, a program of privatization of all IFFS was initiated in 1990. Of the five stations where loan funds were expended on infrastructure works (Udawalawe, Inginiyagala, Muruthawela, Polonnaruwa, and Dambulla), four were leased to the private sector. The annual lease fee ranged from SLRs25,000 for the Muruthawela station to SLRs120,000 for the Inginiyagala station. The fifth station, Udawalawe, was initially handed over to the National Aquatic Resources Agency (NARA) for research, but MOFARD took it back in September 1994 to initiate a program for seed (fingerling) production to reactivate the inland freshwater fish production program.

32. All the IFFS that have been leased are being used for ornamental fish production, exclusively for export markets. Each lease agreement specifies that an annual quantity of carp and tilapia fingerlings are to be produced by the private sector operator. The private sector has made significant improvements to the IFFS including rehabilitation of nursery and rearing ponds, as well as buildings and equipment. Thus, the inland freshwater fish production component has, by virtue of privatization, been used for producing highly profitable ornamental fish for the export market rather than growing fingerlings for local fish production.

#### 2. Seasonal Tank Program

33. Of the target of 1,000 seasonal tanks, the Project rehabilitated and upgraded about 204 that came into production. The total area in production peaked at 1,135 ha in 1984/85, compared with the target of 10,000 ha. Maximum production of 432 metric tons (t), or 6 percent of the target annual production of 7,500 t, was reached in 1985/86 (see Appendix 1). A proportion of production is believed not to have been reported due to civil disturbances. The program was terminated after the 1990 Government policy change because the supply of fingerlings from IFFS was stopped and there was no other private supplier of fingerlings to these tanks.

#### 3. Shrimp Hatchery Complex

34. The SHC was commissioned in 1991, with a delay of two years from the appraisal schedule despite significant reduction in scope and consultancy cost overrun. The scope of SHC was revised and reduced in the following manner: a reduction of demonstration ponds from 25 ha to 14 ha, deletion of 25 ha of demonstration pens, simplification of SHC's polyculture to

monoculture, and cutback in roads and buildings. The complex was expected to produce around 10 million post-larvae (newly hatched shrimp) per year. Trial operation in 1992 resulted in the production of 8.69 million post-larvae and 41 t of shrimp (see Appendix 1). Subsequently, the SHC was laid idle while awaiting privatization. In 1994, the SHC was leased to a private company (99-year lease) for an annual fee of SLRs1.256 million. The equipment at the SHC was sold for SLRs66 million. The first harvest was made in October 1994 when 70.9 t of shrimps were exported, giving foreign exchange earnings of SLRs32 million. About 4.5 million post-larvae were sold to private shrimp farmers in 1994. On full production from 1995 onwards, the company is expected to produce about 142 t per annum from the Project-funded ponds. The shrimp hatchery has now been upgraded to produce 20 million post-larvae per year from 1995. There are 25 ponds covering 11.9 ha currently in production and a further 15.5 ha will be developed for shrimp production in 1996. All shrimps produced are for export markets. At the same time, the private sector has established numerous small and medium size shrimp farms around the Project site. It appears that the SHC component has provided demonstration effects and generated substantial benefits to the aquaculture industry.

#### **4. Support Services**

35. The upgrading of extension and technical services to promote and develop seasonal tanks program and the brackish water aquaculture program was substantially realized as envisaged at appraisal. Extension and training equipment were provided and the incremental extension staff (19 new members) were recruited and trained. Extension programs through mass media were effective in disseminating information on the seasonal tanks program and shrimp culture development. About 31 MOFARD staff were trained abroad and about 2,900 farmers, extension staff, and fishermen were provided with short-term training on various aspects of aquaculture and inland fisheries production. Most trained staff from IFD were retrenched after the 1990 Government policy change, but these technicians are now employed by the private sector and contribute to the development of the industry.

#### **B. Institutional Development**

36. The principal achievement of the Project in institutional development was the significant strengthening of the private sector through the dispersal of trained personnel from MOFARD. The Project staff acquired the skills needed to prepare aquaculture projects and to manage and implement Project activities. They also acquired experience in the prequalification of contractors, preparation of contract packages and documents, evaluation of bids, and administration of contracts. MOFARD's engineering supervision, accounting, management information systems, and problem solving skills were strengthened because of the Project. Although not currently operational, up to 204 Fisheries Sub-Committees (FSC) were supported by the Project's extension program and the members trained to carry out fish production from seasonal tanks. FSC members gained knowledge and practical experience in aquaculture, albeit at a very basic level. All representatives of FSC that PEM met expressed interest in resuming the seasonal tanks program. Further, most FSC members expressed a willingness to pay market price for the fingerlings.

37. The transfer of technology to counterparts would appear to have been effective as many of these personnel have found jobs in the private sector aquaculture industry where their skills are being put to good use. A consulting company formed by former MOFARD staff is providing expertise to the company operating the SHC and is providing the manager for the country's largest shrimp farm.

## C. Financial Performance

38. The FIRR was reestimated using a methodology similar to that used in appraisal (see Appendix 5). The overall financial return from the Project was significantly lower than the appraisal target. The FIRR for the Project was reestimated at about 1.8 percent compared with appraisal estimate of 19 percent. The FIRR for the inland freshwater fisheries component was about -4.7 percent as against the appraisal estimate of 25 percent.

39. The development and subsequent privatization of the SHC is a profitable venture. From the Project point of view, even with the initial significant cost overrun and lack of commercial production after commissioning (for two and a half years), the FIRR reestimated for the SHC incorporating further rehabilitation costs in year 9 is about 9.7 percent as against the appraisal estimate of 14 percent. Assuming that there is no outbreak of shrimp diseases, the private company expects to recoup all their investment in two years.<sup>1</sup>

## D. Economic Reevaluation

40. Economic reevaluation for the Project was carried out by PEM using the same general methodology as used at appraisal (see Appendix 5) and the EIRR is reestimated at about 5.7 percent compared with the appraisal estimate of about 20 percent. The reestimated EIRR was based on major direct benefits that accrued to the Project viz.: (i) inland freshwater fish production from seasonal tanks during 1985 to 1989, (ii) the production of ornamental fish from IFFS rearing ponds from 1994 onwards, and (iii) the production of shrimps and post-larvae from the SHC commencing 1992. The EIRRs for the inland freshwater fisheries and the SHC components were reestimated at -1.5 percent and 13.4 percent, respectively. The appraisal estimates for inland freshwater fisheries and SHC components were 27 percent and 15 percent respectively. The overall EIRR decreased because the seasonal tanks program was canceled (see para. 25) and shrimp production was delayed by more than four years. Because the benefits flow effectively only commenced 11 years after Project commencement, the results are not sensitive to changes in the major assumptions used.

## E. Socioeconomic and Sociocultural Results

41. The Project has generated significant socioeconomic benefits to the beneficiaries, although the number of beneficiaries falls far short of the appraisal target. These benefits were mostly in the form of increased income. While the seasonal tanks program was operating (1984-1989), the net income of the participants increased by about 10 percent (Wijithapura Miridiya FSC) to almost 50 percent (Mahawewe FSC). The increased income was achieved over a short period of time, thus facilitating its expenditure on large items such as house improvements, purchase of bicycles, radios, etc., which the beneficiaries could not have afforded otherwise. The Project had some impact on employment generation. The inland freshwater fisheries component (including the seasonal tanks program) generated some 530 person-years of incremental employment opportunities during 1984-1990. Currently, ornamental fish production by private operators at the IFFS has created full-time employment for about 60 people. The SHC created substantial employment opportunities for the villagers living near the site at Kusala. About 85

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<sup>1</sup> Based on the private company's income statement, the first harvest from the SHC in October 1994 gave a net profit of SLRs15 million. The company expects to harvest 200 t in 1995 seasons, which would give a gross return of about SLRs90 million, of which about 45 percent constitutes the operating costs. Total contribution from Project-funded ponds is expected to be about 142 t per annum.

people are currently employed at the SHC. The number is expected to increase to 300 when the company sets up a shrimp processing plant in 1996.

#### **F. Women in Development**

42. Women in development was not a major issue at the time of appraisal. About 25 percent of the workers employed in the SHC are women. Women have minimal involvement in inland fisheries, generally restricted to net repair in fishing households. The SHC has provided job and training opportunities to about 29 women in shrimp production and brackish water culture.

#### **G. Environmental Impacts and Control**

43. The impact of the Project on the environment has been minimal. No adverse environmental impacts were detected in the construction of ponds and other Project facilities. The main Project-related environmental issue was the failure of the SHC design to include sedimentation tanks to filter the used water before discharge to the canal. This is now being rectified by the private sector lessee. In general, the shrimp culture industry is facing a potential environmental problem in the brackish water area because a rapidly increasing number of small-scale shrimp farmers are discharging shrimp-pond water into the common canal. Gaining control of this situation is a high priority for the recently established Aquaculture Development Division and other concerned sections of MOFARD.

#### **H. Gestation and Sustainability**

44. Despite the very slow build-up of benefits towards target levels caused by delays in Project implementation, the Project was starting to show some momentum in 1989. However, the 1990 policy change brought about a cessation of most Project activities and hence its benefits. Under the present situation, the seasonal tanks that were upgraded by Project funding have mostly reverted to the original degraded conditions. The seasonal tank program is considered unsustainable and no future benefits can be derived from it unless fresh funding is provided to rehabilitate and upgrade the tanks. Because the new Aquatic Development Division has been established within MOFARD (see para. 47) and an operating model had been tested under the seasonal tanks program of the Project, the PEM concurs with MOFARD that relatively rapid progress towards achieving about 10,000 ha of seasonal tanks is now possible during the next six years under the new Fisheries Development Plan, taking into account the lessons learned from the Project and in light of the new Government's policy and determination to promote aquaculture and inland fisheries development. Fresh funding is required to attain this objective. To ensure the revival and sustainability of the seasonal tanks program, MOFARD is well aware of the need to create a market for fingerlings where the private sector can participate in producing fingerlings using facilities at the IFFS.

45. The prospect of sustaining the Project benefits for shrimp culture is favorable. The technology adopted for shrimp production, fingerling production, and the seasonal tank program was appropriate and provided the basis for future sustainable development. The sustainability of the aquaculture industry also depends upon regulatory controls being enforced to prevent environmental degradation of the brackish water canals and outbreak of diseases. The Government accords high priority to devising regulatory and conservative measures to reduce the risks of diseases and to protect the environment.



## V. KEY ISSUES FOR THE FUTURE

### A. The Government's Role in Future Aquaculture Development

46. As discussed in para. 25, the 1990 change of Government policy had resulted in termination of all inland freshwater fisheries activities and all IFFS, with the exception of Dambulla and Udawalawe stations, were leased to the private sector. Because of the policy change, the momentum was lost for establishing and developing a national aquaculture industry,<sup>1</sup> except for the private sector's continuation of the brackish water culture, which grew rapidly during the last few years. As a result of termination of state patronage for inland fisheries, most of the inland fisheries stations were privatized for ornamental fish production. This had a negative impact on inland fish production because the private companies are not keen to invest in freshwater fish seed production. Shrimp farming and ornamental fish culture were, however, firmly in the hands of the private sector, which provides the engine of growth in the sector.

47. The current Government (elected in 1994) has reversed the policy change and is firmly behind the promotion of aquaculture and inland fisheries development. A new Aquatic Development Division was created in September 1994 and a fisheries development strategy that includes aquaculture development has been formulated. Currently, a six-year Fisheries Development Plan is being prepared for implementation in late 1995. The PEM reviewed the new aquaculture development strategy and agrees with its emphasis that the most appropriate role for the Government is to facilitate and monitor private sector-led development. Three important justifications for strengthening the inland fisheries development are that (i) food security for the rural poor would be enhanced, (ii) employment for the fishing households would be sustained, and (iii) abundant natural resources (seasonal tanks and reservoirs) would be utilized to yield significant economic returns to the rural economy. A 1992 study by FAO indicated that inland fisheries could generate at least \$24 million per annum (1992 prices) for the rural economy. Thus, the Government should embark on its planned program to develop the inland fisheries sector through commercialization of all IFFS to promote fish production in inland reservoirs and seasonal tanks. The Government should also encourage the development of high-value shrimp culture (in which private sector investment is increasing), and regulate the industry to ensure its sustainability, and to conserve and protect the environment. The Bank could assist the Government in reviving the inland freshwater fisheries production based on experience and lessons learned from this Project. The Government is expected to have an important role to play in research and extension and in providing a suitable regulatory framework to promote private sector participation in the development of the sector.

### B. Regulation and Monitoring of the Shrimp Farming Industry

48. As a result of the pioneering efforts by the Project, the shrimp industry has developed rapidly in recent years. In addition to a number of intermediate to large farms (pond area of 5 ha and over), hundreds of small shrimp farms were established in an ad hoc manner.<sup>2</sup> There is no control over the number of small-scale operators and no enforcement of regulatory measures on the use of common canals for water supply. The unregulated growth of the industry

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<sup>1</sup> In terms of forming and strengthening a pool of technical expertise in aquaculture extension, promotion, and development, efforts extended in developing and upgrading all IFFS, and efforts made in developing a system of organizing seasonal tanks committees and its operations.

<sup>2</sup> The Government has no detailed information on the number and size of shrimp farms in the country as the Aquatic Development Division was formed only in September 1994.

could have disastrous consequences, as an outbreak of shrimp disease will affect or wipe out all the farms. Regulation and monitoring of shrimp farm operations are urgently needed. There is need for MOFARD to strengthen its Coastal Conservation Department and to enact laws to regulate the aquaculture industry to protect the environment. The first requirement is a data collection exercise in order to describe, *inter alia*, the current state of the industry in terms of number of units, size, production levels, and expansion plans. In the future, statistics must be disaggregated to differentiate between culture and capture production. A management plan for the industry needs to be jointly developed by the Government and industry. Finally, Government and industry need to agree and put in place a monitoring and regulatory system. Given the profitability of the sector, there is no reason why the costs of monitoring should not be borne by industry. This could be done through a cess on all shrimp and ornamental fish exported from the country. The cess collected could be used to fund the monitoring and regulatory agency for the services provided.

### **C. Enhancing Benefit Monitoring and Evaluation Capability**

49. In light of the lack of BME information in this and many other postevaluated projects, the task of monitoring project progress, initiating mitigating measures during implementation, and conducting postevaluation incorporating social and other cross-cutting issues has been difficult. In most cases, both the PPTA feasibility studies and appraisal reports or report and recommendations of the President contained only a passing statement on the need for the Government (meaning the EA) to design and carry out the BME. No other specific indicators and guidance were given to assist the EA in conducting BME. Most EAs have little or no expertise in BME and they generally conduct minimal BME activities or avoid doing it altogether. For the purpose of postevaluation, especially the need to determine social impact, Bank resorts to providing impact evaluation technical assistance to collect social impact data. But this may not be effective as in many cases baseline information was not available as a benchmark survey was not done. Hence, there is need for the Bank to consider strengthening its BME capability and to ensure that EAs are provided all the assistance they need during design and implementation. To ensure effective BME implementation, institutional arrangements within the Bank for promoting BME activities need to be reviewed.

## **VI. CONCLUSIONS**

### **A. Overall Assessment**

50. The Project laid the foundation for the development of an aquaculture industry in Sri Lanka. The institutional strengthening component contributed substantially to an awareness about and the development of the sector. Despite these achievements, the Project's goal of assisting in the development of an aquaculture industry through development of existing natural resources and providing the pioneering efforts to establish brackish water culture was not fully achieved. During implementation, the Project succeeded in providing facilities for hatcheries and rearing ponds of IFFS, organized seasonal tanks committees, established the SHC, and strengthened institutions related to aquaculture development. Privatization of IFFS and the SHC has enabled the Project to sustain its activities and to derive benefits from Project facilities. The direct impact of the Project is significantly less than expected. Nevertheless, the Project has provided a demonstration effect and highlighted the market niche towards commercialization of aquaculture industry through private sector participation. While the Project suffered from a change of Government policy in 1990, the situation in 1995 has a number of positive aspects that

bode well for the future of the aquaculture industry. Specifically, the shrimp farming industry is now firmly in the hands of the private sector, which has a substantial number of skilled aquaculturists (mostly former MOFARD staff) to guide its development. Export-oriented ornamental fish production received a boost from the privatization of IFFS, shrimp production from brackish water culture has become the dominant fishery sector export, and the body of knowledge on how to realize the potential for freshwater fish production has grown considerably. With the impetus provided by the Project and liberalization of the economy, the private sector, including fisheries cooperatives, is playing an active role in the development and expansion of the aquaculture industry.

51. The delay in Project completion, the slow tendering process for privatization of IFFS and the SHC, and the adverse effects of the 1990 policy change have reduced substantially the Project's benefits. The overall EIRR is reestimated at about 5.7 percent after making allowances for the delays in Project implementation and reduction in Project scope. Considering the nonquantifiable benefits, including those from improved extension services, institutional strengthening, and other support services, the Project is rated partly successful.

## **B. Lessons Learned**

### **1. Greater Supervisory Input during Project Formulation and Initial Implementation Phase**

52. In light of poor preparatory work by the PPTA consulting team, it is vital that the Bank give greater emphasis on providing advisory input and guidance to the PPTA team to ensure that the Project design is formulated in line with the Bank's and the Government's strategy frameworks, and that all detailed information is adequately presented for further analysis. This is especially important in projects involving the introduction of new technologies. The Project highlights the need for frequent monitoring and supervisory missions. During the initial critical years of Project implementation, Bank supervision needs to identify emerging problems at a much earlier stage and to react with appropriate assistance in a more timely fashion. Another important aspect is that review missions should carefully identify implementation constraints and review the appropriateness of Project design and approach to ensure maximum flexibility to meet changing circumstances during implementation.

### **2. Need for More BME Details in Project Design**

53. In light of weak BME expertise both in EA and local consultant capability, Project design should give greater emphasis on designing a detailed BME program to enable the EA to execute the program. The BME program should specify key indicators by which the achievement of project objectives and the generation of outputs and provision of inputs are to be monitored.

### **3. Need for Site Selection Criteria and Detailed Socioeconomic Analysis**

54. The Project was considerably delayed because some sites identified for hatcheries, rearing ponds, the SHC, and NIFDEC were not suitable because of water, land and/or soil constraints. Much time was lost in finding alternative sites. Project preparatory teams should pay greater attention to devising appropriate site selection criteria and selecting suitable sites. In devising site selection criteria and subsequent site selection, detailed information pertaining to such factors as land availability and acquisition issues, soil suitability, beneficiary

participation, and socioeconomic analysis of beneficiaries living around the proposed Project sites should be collected as a basis for appraisal. Land availability and acquisition issues should be fully resolved prior to loan effectivity.

#### **4. Need to Strengthen Project Management and Coordination**

55. That weak Project management was not identified as a key issue in Project preparation and appraisal contributed to the delay in staff and consultants recruitment. This and the cumbersome Government procedures were the major reasons for the inefficient Project implementation. Ineffective Bank supervision and failure to take firmer action to overcome the weak management during the early years of implementation also contributed to the major delay in implementation. The failure to appoint a full-time Project Director until about five years after loan effectivity and insufficient staff assigned to the PIU resulted in the Project lacking direction and impetus in the critical early years. Where weaknesses are identified in the EA, consideration should be given to the inclusion of advisory technical assistance to address these needs.

#### **5. Timely Compliance With Loan Covenants**

56. Loan covenants should identify key milestones and ways to ensure that covenants are complied with in a timely manner. In this regard, implementation activities that can adversely affect the operational performance should not be allowed to proceed unless mitigating measures have been adopted in consultation with loan consultants and Bank supervisory staff.

### **C. Follow-Up Actions**

57. MOFARD should institute regulatory and conservational measures to monitor and control the growth of small brackish water shrimp farmers to control the discharge of polluted water into brackish water sites and to prevent outbreak of shrimp diseases. Effective regulatory and conservational measures should extend to inland fisheries, to help protect the environment and the aquaculture industry. To this end, MOFARD should embark on an awareness campaign to educate inland freshwater fishermen and brackish water shrimp farmers on the need for hygienic cultural practices.

58. MOFARD should recruit more technical staff for the hatchery stations at Dambulla and Udawalawe to commence tilapia and carp seed production to supply to the private sector operators of the IFFS for fingerlings production. This will be the first step to reviving the seasonal tanks program and replenishing stocks at the reservoirs.

59. To follow-up on the current Government's policy to revive the inland freshwater fisheries development after almost five years of inactivity, MOFARD needs to strengthen the newly created Aquatic Development Division (currently with only five staff including the Director), provide funding to rehabilitate and commence carp and tilapia breeding programs, and recruit and train extension staff to service the aquaculture industry.

60. To strengthen the longer term sustainability of shrimp farming and to regulate proliferation of brackish water shrimp cultivation, there is urgent need to formulate coastal zone masterplanning and management to guide the shrimp farmers in controlling the pollution of the common canals in order to prevent the outbreak of shrimp diseases.

# APPENDIXES

<b>Number</b>	<b>Title</b>	<b>Page</b>	<b>Cited On (page,para.)</b>
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2	Framework Analysis of Project Achievement	19	4,17
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4	PEM Findings on Compliance with Loan Covenants	24	7,29
5	Financial and Economic Reevaluation	31	10,38

## PROJECT PHYSICAL ACHIEVEMENTS

		Appraisal Target	Actual Achievement
<b>A.</b>	<b>Freshwater Hatcheries <sup>a</sup></b>		
	Broodstock ponds <sup>a</sup>	29.93 ha	2.60 ha
<b>B.</b>	<b>Freshwater Rearing Stations <sup>a</sup></b>		
1.	Buildings	not available	9
2.	Rearing Ponds	24 ha <sup>b</sup>	5.70 ha
3.	Nursery Ponds	not available	1.30 ha
4.	Fingerlings	120 million	59.8 million
<b>C.</b>	<b>Seasonal Tanks</b>		
1.	No. of Tanks Surveyed	10,000	8,033
2.	No. of Tanks Suitable for Fish Culture	-	2,100
3.	No. of Tanks Repaired (area in ha)	-	141 (571.7 ha)
4.	No. of Tanks Stocked and Equivalent Area (at peak in 1985/86)	-	204 in 118 ha
5.	Fish Harvested at Peak Period (85/86)	7,500 t	432 t
<b>D.</b>	<b>Brackishwater Culture <sup>a</sup></b>		
1.	Hatchery Building	1	1
2.	Demonstration Ponds	25 ha	14 ha
3.	Post-larvae Produced	10 million	about 9 million
4.	Marketable Shrimps Harvested	160 t	41 t
<b>E.</b>	<b>National Inland Fisheries Development Center</b>		

Not implemented because of delays and change of Government policy.

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<sup>a</sup> Includes various equipment, supplies and/or transport vehicles.  
<sup>b</sup> Includes nursery ponds.

		<b>Appraisal Target</b>	<b>Actual Achievement</b>
<b>F.</b>	<b>Development of Extension Services <sup>a</sup></b>		
	No. of Incremental Extension Staff Recruited and Trained	19	19
<b>G.</b>	<b>Training and Fellowship</b>		
1.	No. of Project Staff Trained Abroad	39	31
2.	No. of Participants in Local Training (MOFARD staff, farmers, and students)	not available	2,900
<b>H.</b>	<b>Project Management</b>		
1.	No. of Skilled Workers Hired	not available	38
2.	No. of Unskilled Workers Hired	not available	228
<b>I.</b>	<b>Consulting Services Provided</b>		
1.	Brackish Water Foreign Consulting Firm	37 person-months	60.5 person-months
2.	Carp Expert	36 person-months	36 person-months
3.	Brackish Water Aquaculturist	24 person-months	0 person-month
4.	Pen Culture Expert	12 person-months	0 person-month
5.	Training Expert	12 person-months	0 person-month
<b>J.</b>	<b>Benefit Monitoring and Evaluation</b>		
	Not implemented due to lack of local expertise and civil disturbances. To be undertaken by Fisheries Sector Project approved by the Board on 1 December 1992 (Loan No. 1201-SRI[SF]).		
<b>K.</b>	<b>Provision of Funds/Subloans for the Construction of 200 ha of Commercial Brackish Water Ponds</b>		
	Not implemented because of the Government's policy change.		

<sup>a</sup> Includes various equipment, supplies and/or transport vehicles.

# FRAMEWORK ANALYSIS OF PROJECT ACHIEVEMENT

Project Component	Original and Revised Scope	Achievement
<p><b>A (i) Freshwater Hatcheries</b> Upgrading of facilities for Seed (fingerling) production in – Inginiyagala</p>	The broodstock pond area was reduced from 4.22 ha to 0.8 ha.	0.8 ha of broodstock pond area constructed. <b>Benefit:</b> Leased to private sector in September 1993. Rearing ornamental fish for export. Benefits to the country are foreign exchange and employment generation. Government received SLRs 150,000 for sale of equipment and SLRs 120,000 annual lease.
	The pond area was reduced from 5.32 ha to 0.6 ha.	0.6 ha of broodstock pond area constructed. <b>Benefit:</b> Leased to private sector (former Ministry of Fisheries and Aquatic Resources Development [MOFARD] staff). Producing ornamental fish for export. Benefits to country are foreign exchange and employment generation (17 partners employed). Government receives annual lease of SLRs 25,000.
	The pond area was reduced from 7.92 ha to 1.20 ha with concurrence of the Bank.	1.2 ha of broodstock pond area constructed. <b>Benefit:</b> Unit 1 of station retained by MOFARD. Unit 2 (Bank – constructed ponds) utilized by private sector without lease for ornamental fish production. Benefits to country are foreign exchange and employment generation.
	No suitable site for brood stock ponds; activity shifted to other hatcheries.	Not applicable.
<p>– Polonnaruwa</p> <p>– National Inland Fisheries Development Center (NIFDEC) Dambulla</p> <p>– Ginigathena</p>	The pond area was reduced from 8.32 ha to 8.00 ha.	NIFDEC was subsequently canceled after the design stage in view of the policy decision of the Government.
	Activity shifted to Dambulla with Bank concurrence.	Not applicable.
	The list of stations was expanded from 3 to 7 and pond area increased from 24 ha to 34 ha.	Only 7 ha of pond area was constructed. The other constructions were canceled due to policy decision after the awards of contract.
<b>(ii) Rearing Station</b>		



# FRAMEWORK ANALYSIS OF PROJECT ACHIEVEMENT

Project Component	Original and Revised Scope	Achievement
– Udawalawe	3 ha included in this site	Constructed 3 ha. <b>Benefit:</b> Most ponds have been rehabilitated and are currently being utilized without a lease by a private sector operator for ornamental fish production. MOFARD is taking legal action to regain control of these ponds from the private sector in order to start carp breeding.
– Inginiyagala	4.66 ha of land was available for pond construction.	Constructed 2.0 ha of pond area. The next phase stopped after award of contract. <b>Benefit:</b> Currently leased to the private sector for fish seed production and related activities.
– Muruthawela	1.0 ha included in this site.	Constructed 1.0 ha of pond area. <b>Benefit:</b> Currently leased to the private sector for fish seed and related activities. Many ponds constructed under the Project are still in degraded condition and require substantial investment to rehabilitate.
– Dambulla	Revised from 5 ha to 4.06 ha.	Stopped after the award of contract.
– Kalawewa	6.3 ha included in this site.	Stopped after the award of contract.
– NIFDEC	14 ha to be constructed.	Stopped after the award of contract.
– Polonnaruwa	1.0 ha included in this site	Constructed 1 ha <b>Benefit:</b> Currently leased to the private sector. Producing ornamental fish for export. Benefits to country are foreign exchange and employment. Government receives annual lease payment of SLRs120,000.
– Plastic Pens	Not implemented (with concurrence of the Bank) because the desired water depth along periphery of tanks was limited to a short period, breeding cycles of carp not synchronized with water availability, and problems with predators (birds).	Ponds were used for rearing activities.

## FRAMEWORK ANALYSIS OF PROJECT ACHIEVEMENT

Project Component	Original and Revised Scope	Achievement
<p>(iii) <b>Seasonal Tanks</b> Project envisaged improvement to 10,000 ha of seasonal tanks to produce 7,500 t of freshwater fish.</p>	<p>10,000 ha of seasonal tanks to be prepared. This target was reduced to 1,200 ha in 1989 when the Project scope was reduced.</p>	<p>The Project funded the improvement and minor repair of 141 seasonal tanks with an aggregate area of 571.7 ha.</p> <p><b>Benefit:</b> Formation of 204 fisheries tank committees; peak stocked area reached 1,135 ha, with production of 422 not in 1985 season; provided an affordable source of freshwater fish at half the price of marine fish to inland rural population; created a seed (fingerling) market where the private sector can participate; provided an opportunity for income generation. The July 1990 Government decision to close all inland fisheries stations resulted in termination of the seasonal tank program due to shortage of carp fingerlings from the stations.</p>
<p>(iv) <b>Brackish Water Culture</b> Project envisaged providing a shrimp hatchery complex (SHC) with 25 ha of brackish water demonstration ponds. 25 ha of pens were to be constructed for pen culture shrimp production.</p>	<p>SHC was completed at a reduced scale. Reduction of demonstration ponds to 14 ha. Deletion of 25 ha of shrimp production pens. Cutback in roads buildings. Objective was refocus from commercial orientation to research, training, and extension.</p>	<p>SHC completed in 1992.</p> <p><b>Benefit:</b> Within Project period, around 9 million post-larvae produced and 41 t of prawn for export. Station now leased to private sector. First cycle production 71 t. Developing a further 15 ha of ponds. Currently employment is 85 but will rise to 300 with establishment of a processing facility. Government received SLRs61 million for sale of plant and equipment together with an annual lease of SLRs1.25 million.</p>

## FRAMEWORK ANALYSIS OF PROJECT ACHIEVEMENT

Project Component	Original and Revised Scope	Achievement
(v) NIFDEC Construction of NIFDEC	Site selected at Dambulla. Initial planning proceeded. Because of 1990 policy decision, work on this component stopped.	No progress made.
Extension Services	Extension equipment including two mobile audiovisual vans and video equipment were provided.	<ul style="list-style-type: none"> <li>– trained 19 extension workers</li> <li>– organized 204 fisheries tank committees</li> </ul> <b>Benefit:</b> Initiated a freshwater aquaculture industry. Farmers gained knowledge and information on freshwater fish rearing in seasonal tanks. Incremental fish production.
<b>Training</b> Project envisaged sending 43 staff overseas for short-term training. Local Training Programs.	31 MOFARD staff was sent for short-term courses overseas. 2,900 extension staff and farmers were trained locally.	<b>Benefit:</b> <ul style="list-style-type: none"> <li>– Institutional strengthening</li> <li>– Transfer of technology</li> <li>– Seasonal tanks farmers increase fish production</li> </ul>
(vi) <b>Benefit Monitoring and Evaluation</b> Benchmark survey in 1987	Submitted brief report on planning Benefit Monitoring and Evaluation.	No further progress made. Planned for implementation under the Fisheries Sector Loan.
<b>B. Bank of Ceylon and People's Bank</b> Provide credit to private sector to develop up to 200 ha of commercial brackishwater ponds	Planned to introduce cluster concept in which small farmers can participate. No further progress made.	Credit component was not implemented because of initial delay and was later canceled because of the change of Government policy.

## PROJECT COST SUMMARY (\$'000)

	APPRAISAL						ACTUAL								
	Foreign Exchange		Local Currency			Sub-Borrower <sup>a</sup>	Total Local Currency	Total	Foreign Exchange		Local Currency			Total Local Currency	Total
	Bank		Bank	MOFARD	BOC/PB				Bank		Bank	MOFARD MOF	BOC/PB		
A. Part A															
1. Freshwater Hatcheries	821	995	61				1,056	1,877	304	277			1,012	1,316	
2. Rearing Stations	1,007	806	48				854	1,861	139	122			450	589	
3. Preparation of Seasonal Tanks	248	189	0				189	437	0	0			50	50	
4. Brackish Water Culture	517	562	42				704	1,221	1,001	158			845	1,846	
5. NIFDC	1,111	1,207	87				1,294	2,405	0	0			0	0	
6. Extension	213	26	108				134	347	0	0			45	45	
7. Training and Fellowships	372	23	0				23	395	201	0			0	201	
8. Project Management	110	171	11				182	292	0	134			784	784	
9. Consulting Services	1,669	314	78				392	2,061	1,601	341			680	2,281	
10. BME	0	96	0				96	96	0	0			50	50	
11. Import Duties and Handling	0	0	384				384	384	0	14			14	14	
12. Service Charge During Construction	570	0	0				0	570	276	0			0	276	
Base Cost	6,638	4,489	819		0	0	5,308	11,946	3,522	1,046		0	3,930	7,452	
Physical Contingency	1,110	673	123				796	1,906	0	0			0	0	
Price Contingency	1,452	2,908	428				3,336	4,788	0	0			0	0	
Subtotal A	9,200	8,070	1,370		0	0	9,440	18,640	3,522	1,046		0	3,930	7,452	
B. Part B															
1. Brackish Water Ponds (credit)	0	0	0		1,456	162	1,618	1,618	0	0			0	0	
2. Import Duties and Handling	0	0	0		11	0	11	11	0	0			0	0	
Base Cost	0	0	0		1,467	162	1,629	1,629	0	0		0	0	0	
Physical Contingency	0	0	0		220	24	244	244	0	0			0	0	
Price Contingency	0	0	0		967	140	1,107	1,107	0	0					
Subtotal B	0	0	0		2,654	326	2,980	2,980	0	0		0	0	0	
C. TOTAL PROJECT COST (A+B)	9,200	8,070	1,370		2,654	326	12,420	21,620	3,522	1,046		0	3,930	7,452	
D. Gulf Crisis Assistance									12,741	632		0	632	13,373	
TOTAL EXPENDITURE	9,200	8,070	1,370		2,654	326	12,420	21,620	16,263	1,678		0	4,562	20,825	

BME – Benefit Monitoring and Evaluation; NIFDC – National Inland Fisheries Development Center

a Sub-borrower farmer.

Source: PCR and Project files.

## PEM FINDINGS ON COMPLIANCE WITH LOAN COVENANTS

Covenant	No.	Status Reported by PCR	PEM Findings
<p>1. <b>Loan Effectiveness</b></p> <p>The Borrower will, as a condition for loan effectiveness, establish a Project Coordinating Committee (PCC), chaired by the Secretary of the Ministry of Fisheries and Aquatic Resources Development (MOFARD) and including representatives of all agencies concerned.</p>	L.A. Schedule 6 para. 4	Complied with. However, due to the Government policy decision to withdraw state patronage for inland fisheries in July 1990, use of PCC discontinued. Since then, Secretary MOFARD provided directly guidance to the Project Implementation Unit (PIU).	In reality, only partially complied with. PCC met infrequently and appeared to not accept responsibility for solving problems besetting the Project.
<p>2. <b>Management and Coordination</b></p> <p>Ministry of Finance (MOF) will establish a PIU and appoint a full-time Project Director.</p> <p>The Borrower will ensure that Bank of Ceylon (BOC) and People's Bank (PB) will each establish a Project Unit and appoint a Project Manager.</p>	<p>L.A. Schedule 6 para. 5</p> <p>L.A. Schedule 6 para. 6</p>	<p>Complied with. Full-time Project Director appointed in 1989.</p> <p>Not applicable: component deleted due to July 1990 policy decision.</p>	<p>Effectively not complied with. Project Director only appointed about five years after loan effectiveness. PIU never fully staffed.</p>

Covenant	No.	Status Reported by PCR	PEM Findings
<p>3. Acquisition of Land and Water Rights</p> <p>The Government will ensure that all land and water rights are acquired or otherwise made available promptly when required, so as to ensure timely implementation of the Project.</p>	L.A. Schedule 6 para. 7	Complied with.	Delays in obtaining land significantly affected Project implementation.
<p>4. Selection of Site</p> <p>The sites for the Project's shrimp hatchery and the National Inland Fisheries Development Center (NIFDEC) will be selected with the Bank's concurrence.</p>	L.A. Schedule 6 paras. 10 and 11	Complied with. However, NIFDEC was canceled due to July 1990 policy decision.	As in PCR, significant delays in site selection.
<p>5. Plants, Designs, Specifications</p> <p>Borrower will furnish to the Bank promptly after their preparation, the plans, design standards, specification, and work schedules for consultants.</p>	L.A. Section 4.03(b)	Complied with.	Significant delays in submission due to late finalization of these documents.
<p>6. Financial Statements</p> <p>Borrower will prepare and submit to the Bank not later than 6 months after the end of each related fiscal year certified copies of the unaudited financial statements; 9 months after the end of each related fiscal year, certified copies of externally audited financial statements and the report of the auditors in the English language.</p>	L.A. Section 4.06(b)	Partly complied with. Audited accounts for 1990 and unaudited accounts for 1991 submitted. Auditing of 1991 accounts and preparation of 1992 final accounts in progress.	As in PCR.

Covenant	No.	Status Reported by PCR	PEM Findings
<p>7. Quarterly Progress Reports</p> <p>The Borrower will furnish to the Bank quarterly progress report on the carrying out of the Project.</p>	L.A. Section 4.07(b)	Complied with.	
<p>8. Project Completion Report</p> <p>Not later than 6 months after closing date for withdrawals from the loan account, the Borrower will prepare a Project Completion Report.</p>	L.A. Section 4.07(c)	Complied with. Submitted on 31 July 1992.	
<p>9. Management and Coordination</p> <p>MOF will establish a PIU in IFD in Colombo, prior to effective date. Borrower will ensure that the PIU is at all time headed by a full-time Project Director who will be appointed in consultation with the Bank.</p>	L.A. Schedule 6 para. 3(c)	Complied with. However, permanent Project Director posted only in May 1988 after six earlier part-time Project Directors.	Permanent Project Director only appointed in July 1989, five years after effectivity and then from January 1990 he was concurrently appointed as Chairman of the Ceylon Harbours Corporation. Failure to effectively comply with this loan covenant was the single most important cause of poor Project performance.
<p>10. Implementation</p> <p>MOF will consult with the Bank and obtain its prior concurrence to the 8 sites to be selected for the rearing pools and pen enclosures to be provided under Part A(ii)(b).</p>	L.A. Schedule 6 para. 2(a)	Complied with. This component eventually deleted due to implementation problems. In place of pools and pens, additional pond space was expanded in existing Inland Freshwater Fisheries Stations (IFFS).	As in PCR.

Covenant	No.	Status Reported by PCR	PEM Findings
<p>11. <b>Schedule of Charges for Fingerlings</b></p> <p>MOFARD will, in consultation with the Bank, develop a program to implement collection of appropriate charges for the provision of fingerlings to the users of the seasonal tanks, in order to ensure full cost recovery.</p>	L.A. Schedule 6 para. 5(a)	<p>Partly complied with. Phased charges over three years implemented from nil in 1983 to SLRs0.25 to SLRs50/fingerling in 1986-1989.</p> <p>However, charges were stopped following the July 1990 policy decision.</p>	As in PCR.
<p>12. <b>Promotional Campaign for Carp Consumption</b></p> <p>MOFARD will utilize the audiovisual facilities to be provided at NIFDEC under Part A(v) of the Project, undertake a promotional campaign to popularize carps as table fish, and undertake programs to teach villagers methods of processing carps for off-season consumption.</p>	L.A. Schedule 6 para. 5(b)	<p>Complied with. One-year promotional campaign until July 1989 conducted, then stopped in 1990 due to policy decision. Facilities, e.g., audiovisual vans, being used for marine fisheries extension Information Unit of MOFARD.</p>	As in PCR.
<p>13. <b>Overseas Training Program</b></p> <p>MOF will establish and administer an overseas training program and consult with and seek the approval of the Bank with respect to:</p> <p>(i) institutions to be used for training purposes;</p> <p>(ii) proposed level and type of training;</p>	L.A. Schedule 6 para. 16	Complied with.	As in PCR



Covenant	No.	Status Reported by PCR	PEM Findings
(iii) timetable for the implementation of such training;			
(iv) financial arrangements to be made; and			
(v) criteria for selection of staff to participate.			
The Borrower will ensure that after completing training, the recipients will be reassigned to the Project and will serve MOFARD, BOC, or PB, as appropriate for a reasonable period of time.		Complied with except for one trainee who was not reassigned to the Project/MOFARD.	As in PCR.
14. <b>Staffing</b>			
The Borrower will ensure that MOF meets all requirements for the engagement and assignments of all additional appropriately qualified staff required to implement the Project.	L.A. Schedule 6	Partly complied with. Difficulty experienced in recruiting qualified staff because of lack of incentives.	As in PCR.
15. <b>Guidelines for Selection of Subborrowers</b>			
The Borrower will cause BOC and PB within six months of effective date, to furnish to the Bank for its review and concurrence, a comprehensive single implementation plan for disbursing subloans.	L.A. Schedule 6 para. 19	Not applicable. Credit portion did not proceed because of the July 1990 policy decision.	As in PCR.

Covenant	No.	Status Reported by PCR	PEM Findings
MOFARD will within six months of effective date submit to the Bank for its review and comments detailed work plan for the organization and functioning of committees to be responsible for the operation and maintenance of the seasonal tanks.	L.A. Schedule 6	Complied with.	Late compliance.
<b>16. Benefit Monitoring and Evaluation</b>	L.A. Schedule 6 para. 23	Not complied with. Preliminary report of consultant and detailed benefit monitoring and evaluation (BME) plan not submitted as work was discontinued largely because of the peace and order situation in Project area. This will be done under the proposed Fisheries Sector Project currently under consideration by the Bank.	Still awaiting completion.
<b>17. Onlending to Subborrowers</b>	L.A. Schedule 6 para. 20	Not applicable. Credit component not carried out because of the July 1990 policy decision.	As in PCR.
Onlending terms for the subloans from BOC and PB to subborrowers to include (i) interest rate of 14 percent per annum; and (ii) a repayment period not exceeding four years.			

Covenant	No.	Status Reported by PCR	PEM Findings
<p>18. Provision of Local Funds to BOC/PB</p> <p>The Central Bank will provide to BOC and PB local currency funds for onlending to subborrowers on terms (i) interest rate at 10 percent per annum; and (ii) a repayment period(s) used for the subloans.</p>	<p>L.A. Schedule 6 para. 21</p>	<p>Not applicable. Credit component not carried out because of the July 1990 policy decision.</p>	<p>As in PCR.</p>

## FINANCIAL AND ECONOMIC REEVALUATION

### A. Methodology and Assumptions

1. The methodology used in the financial and economic reevaluation follows the Bank's *General Guidelines for Economic Analysis of Projects*. The financial internal rate of return (FIRR) and the economic internal rate of return (EIRR) are reestimated for the inland freshwater fisheries production, the shrimp hatchery complex (SHC), and the Project as a whole. Major assumptions underlying the reestimation are given below.

- (i) With respect to the Project component aimed at stimulating production from seasonal tanks, a total change of direction was caused by the 1990 policy decision to withdraw state patronage from inland fisheries development. The three inland freshwater fisheries stations (IFFS) were leased to private sector parties who are using them for ornamental fish production. In the reestimation, the benefits have been calculated in terms of incremental ornamental fish production. Prior to 1990, 141 seasonal tanks were upgraded by the Project. Production from seasonal tanks is given below. Incremental benefits from seasonal tanks resulting from Project funding have been calculated and reflected in both EIRR and FIRR estimates.

Year	Production (t)
1985	422
1986	432
1987	28
1988	340
1989	50

- (ii) The SHC was also privatized as a result of the 1990 policy decision, however it continues to be used as a shrimp hatchery and production unit. The input/output figures actually achieved by the private sector lessee were used as the basis for the calculation of operating costs and benefits. The actual and expected production of shrimp are presented in Table 1.
- (iii) Foreign exchange expenditure was only available in SLRs. This expenditure was converted to dollar values using the appropriate annual exchange rate as given in the 1993 Annual Report of the Central Bank. Constant 1992 prices were converted back to SLRs using the 1992 exchange rate of SLRs46.00 to a dollar.
- (iv) Foreign and local costs are expressed in constant 1992 prices (the year the Project was completed) using a dollar deflator for costs expressed in foreign exchange and a domestic deflator for local costs. Foreign costs were converted to 1992 prices using the World Bank Manufacturing Unit Value Index (MUV) as of November 1994 for recent past and future values (earlier values for the MUV were taken from a schedule dated 26 October 1992). Local costs were converted to 1992 prices using the Colombo Consumer Price Index as detailed in the Central Bank of Sri Lanka Bulletin of October 1994.

- (v) The local costs of nontradeable items were converted to border prices using standard conversion factors (SCFs) as specified in the 1991 Report on Shadow Prices for Sri Lanka (Curry, S., Lucking, R. and Adhikari, R. 1991. *Report on Shadow Prices for Sri Lanka*. Development and Planning Centre, Bradford University, United Kingdom, 1991). Taxes and duties were estimated and deducted from financial prices. The following SCFs were used:

Civil Works	0.906
Unskilled Rural Labor	0.722
Other Nontradeables	0.723

- (vi) The economic prices for shrimp and ornamental fish were assumed to be the same as their farmgate financial prices, as there are no tariffs or duties involved. Future price movements of shrimp were based on the World Bank Commodity Price Projections as of November 1994.
- (vii) The economic life of the Project is assumed to be 20 years (as was assumed at appraisal).
- (viii) Production of shrimp from SHC has been calculated from the 11.33 ha of ponds constructed by the Project. A stocking rate of 20.5 post-larvae per square meter have been assumed, 70 percent survival, and an average weight of 44 grams per harvested shrimp. Two production cycles per year have been allowed for. Costs of production were taken from those achieved by Indiwary Aqua (Pvt) Ltd in 1994.
- (ix) Production of ornamental fish from IFFS commenced from 1994 and is estimated based on data supplied from the private operators. Returns and operating costs for the mixed production of guppies and other varieties are estimated from information provided by Ujay Aqua Enterprises.
- (x) The Project investment costs for IFFS are given in Table 2 and those for the SHC are in Table 3.

## **B. Results of EIRR and FIRR Reestimation**

### **1. Inland Freshwater Fisheries Production**

2. On the basis of the directly quantified costs and incremental benefits derived from the inland freshwater fisheries production from seasonal tanks and ornamental fish production from IFFS, the EIRR and FIRR are reestimated at -1.5 percent and -4.7 percent, respectively (see Tables 4 and 7). The appraisal estimates of EIRR and FIRR were 27 percent and 25 percent, respectively.

### **2. Shrimp Hatchery Complex**

3. On the basis of the directly quantified costs and benefits, the EIRR and FIRR for the SHC are reestimated at 13.4 percent and 9.7 percent, respectively compared with the appraisal estimates of 15 percent and 14 percent respectively. The lower FIRR results from

delays in realizing benefits and cost overruns in the turnkey consultancy input (see Tables 5 and 8).

### **3. Whole Project**

4. The EIRR and FIRR for the whole Project were reestimated at 5.7 percent and 1.8 percent, respectively (see Tables 6 and 9) compared with the appraisal estimates of 20 percent and 19 percent, respectively. Since the benefit flow effectively only started 11 years after Project commencement, the results are not sensitive to changes in the assumptions used.

**Table 1: Shrimp Production and Prices for SHC**  
(Constant 1992 Prices)

	Shrimp <sup>a</sup> Production (t)	Shrimp <sup>a</sup> Price (SLR/t)	Surplus Post-Larvae Sales	Post-Larvae Price (SLR/piece)
1992	41	346,779	0	—
1993	0	0	0	—
1994	71 <sup>b</sup>	449,670	4,524,000	0.6
1995	142	461,092	7,681,000	0.6
1996	142	464,504	12,681,000	0.6
1997	142	464,504	17,681,000	0.6
1998	142	464,504	17,681,000	0.6
1999	142	464,504	17,681,000	0.6
2000	142	464,504	17,681,000	0.6
2001	142	464,504	17,681,000	0.6
2002	142	464,504	17,681,000	0.6
2003	142	464,504	17,681,000	0.6

<sup>a</sup> Production and price figures used for reestimation of cost and benefits were derived from the private operator (Indiary Aqua Pvt. Ltd.) of SHC.

<sup>b</sup> Actual first year production from Project-funded ponds.

<sup>c</sup> Expected full production from Project-funded ponds.

**Table 2: Total Investment Costs for Inland Fisheries Component**  
(SLRs '000)

Year	Civil Works <sup>a</sup>	Equipment <sup>b</sup>	Vehicles <sup>c</sup>	Consultancy <sup>d</sup>	Total
1984	0	0	0	0	0
1985	315	0	3,905	1,349	5,569
1986	5,176	0	3,905	1,349	10,430
1987	11,631	0	0	1,349	12,980
1988	4,401	4,739	0	0	9,140
1989	2,168	1,529	0	0	3,697
1990	1,046	3,259	0	0	4,305
1991	654	1,530	0	0	2,184
1992	0	0	0	0	0

<sup>a</sup> About 60 percent of civil works are local costs.

<sup>b</sup> About 25 percent of equipment costs are local.

<sup>c</sup> About 35 percent of vehicle costs are local.

<sup>d</sup> About 10 percent of consultancy costs are local.



**Table 3: Total Investment Costs for SHC Component**  
(SLRs '000)

Year	Civil Works <sup>a</sup>	Equipment <sup>b</sup>	Vehicles <sup>c</sup>	Consultancy <sup>d</sup>	Total
1984	0	0	0	0	0
1985	0	0	0	0	0
1986	0	0	0	6,660	6,660
1987	0	0	0	2,232	2,232
1988	1,056	0	0	4,893	5,949
1989	11,004	0	0	7,241	18,245
1990	12,346	16,245	839	10,688	40,119
1991	5,431	2,154	321	15,517	23,422
1992	4,630	142	0	13,768	18,540

<sup>a</sup> About 60 percent of civil works are local costs.

<sup>b</sup> About 25 percent of equipment costs are local.

<sup>c</sup> About 35 percent of vehicle costs are local.

<sup>d</sup> About 10 percent of consultancy costs are local.

**Table 4: Estimation of FIRR for Inland Freshwater Fisheries Production**  
(Constant 1992 Prices, SLRs '000)

Year	Benefit <sup>a</sup>	Investment Cost	Operating Cost	Net Benefit
1984	0	0	20,735	(20,735)
1985	5,620	13,916	20,424	(28,720)
1986	4,964	21,962	18,911	(35,909)
1987	504	24,268	17,561	(41,325)
1988	2,669	14,760	15,403	(27,494)
1989	845	5,166	13,809	(18,130)
1990	0	5,293	11,366	(16,659)
1991	0	2,451	10,131	(12,582)
1992	0	0	0	0
1993	0	0	0	0
1994	11,377	0	9,414	1,963
1995	22,414	0	12,608	9,806
1996	22,026	0	7,512	14,514
1997	21,476	0	7,476	14,000
1998	20,940	0	7,441	13,499
1999	20,418	0	7,406	13,012
2000	19,909	0	7,373	12,536
2001	19,458	0	7,343	12,115
2002	19,016	0	7,313	11,703
2003	18,585	0	7,285	11,300
FIRR				-4.7%

<sup>a</sup> Benefits were calculated based on:

1985–1989: Benefits were derived from fish production under the seasonal tank program.

In 1987 and 1988, the inland fish production were adversely affected by drought and civil disturbances.

1990–1993: No benefits because the Government's 1990 policy change terminated all inland fisheries activities.

1994–2003: Benefits derived from ornamental fish production.

**Table 5: Estimation of FIRR for SHC Component**  
(Constant 1992 Prices: SLRs '000)

Year	Benefit <sup>a</sup>	Investment Cost	Operating Cost	Net Benefit
1984	0	0	0	0
1985	0	0	0	0
1986	0	14,131	0	(14,131)
1987	0	4,037	0	(4,037)
1988	0	9,421	0	(9,421)
1989	0	25,272	0	(25,272)
1990	0	49,302	0	(49,302)
1991	0	26,325	0	(26,325)
1992	14,218	18,540	2,842	(7,164)
1993	0	0	0	0
1994	34,396	0	20,557	13,839
1995	68,598	0	35,219	33,378
1996	70,761	0	36,432	34,329
1997	70,761	0	37,599	33,163
1998	70,761	0	37,498	33,263
1999	70,761	0	37,405	33,356
2000	70,761	0	37,322	33,440
2001	70,761	0	37,259	33,502
2002	70,761	0	37,206	33,556
2003	70,761	0	37,161	33,600
FIRR				9.7%

<sup>a</sup> Benefits for the SHC commenced from 1992 with the commissioning of the complex. No production occurred in 1993 as SHC was awaiting privatization. Private sector took over SHC from 1994 and normal production commenced from 1995 onwards.

**Table 6: Estimation of FIRR for Whole Project**  
 (Constant 1992 Prices: SLRs '000)

Year	Total Benefit	Total Cost	Net Benefit
1984	0	20,735	(20,735)
1985	5,620	34,340	(28,720)
1986	4,964	55,004	(50,040)
1987	504	45,866	(45,362)
1988	2,669	39,584	(36,915)
1989	845	44,247	(43,402)
1990	0	65,961	(65,961)
1991	0	38,907	(38,907)
1992	14,218	21,382	(7,164)
1993	0	0	0
1994	45,773	29,971	15,802
1995	91,012	47,826	43,186
1996	92,787	43,944	48,843
1997	93,285	45,075	48,210
1998	90,957	44,940	46,017
1999	88,686	44,812	43,874
2000	86,477	44,695	41,782
2001	85,189	44,602	40,587
2002	83,922	44,520	39,402
2003	82,077	44,446	37,631
		FIRR	1.75%

**Table 7: Estimation of EIRR for Inland Freshwater Fisheries Production**  
(Constant 1992 Prices: SLRs '000)

Year	Benefit <sup>a</sup>	Investment Cost	Operating Cost	Net Benefit
1984	0	0	14,991	(14,991)
1985	5,620	10,806	14,766	(19,952)
1986	4,964	18,512	13,673	(27,221)
1987	504	23,001	12,697	(35,194)
1988	2,669	14,339	11,136	(22,806)
1989	845	4,980	9,984	(14,119)
1990	0	5,218	8,217	(13,435)
1991	0	2,410	7,325	(9,735)
1992	0	0	0	0
1993	0	0	0	0
1994	11,377	0	7,406	3,971
1995	22,414	0	9,896	12,518
1996	22,026	0	5,933	16,093
1997	21,476	0	5,797	15,679
1998	20,940	0	5,761	15,179
1999	20,418	0	5,727	14,691
2000	19,909	0	5,693	14,216
2001	19,458	0	5,663	13,795
2002	19,016	0	5,634	13,382
2003	18,585	0	5,606	12,979
FIRR				-1.5%

<sup>a</sup> Benefits were calculated based on:

- 1985 – 1989: Benefits were derived from fish production under the seasonal tank programs.  
In 1987 and 1988, the inland fish production were adversely affected by drought and civil disturbances.
- 1990 – 1993: No benefits because the Government's 1990 policy change terminated all inland fisheries activities.
- 1994 – 2003: Benefits derived from ornamental fish production.

**Table 8: Estimation of EIRR for Shrimp Hatchery Complex**  
(Constant 1992 Prices: SLRs '000)

Year	Benefit <sup>a</sup>	Investment Cost	Operating Cost	Net Benefit
1984	0	0	0	0
1985	0	0	0	0
1986	0	14,131	0	(14,131)
1987	0	4,037	0	(4,037)
1988	0	9,320	0	(9,320)
1989	0	24,330	0	(24,330)
1990	0	42,988	0	(42,988)
1991	0	25,258	0	(25,258)
1992	14,218	18,243	2,182	(6,208)
1993	0	0	0	0
1994	34,396	0	15,860	18,537
1995	68,598	0	27,033	41,564
1996	70,761	0	27,943	42,819
1997	71,809	0	28,803	43,005
1998	70,016	0	28,690	41,326
1999	70,016	0	28,583	41,433
2000	70,016	0	28,484	41,532
2001	70,016	0	28,405	41,611
2002	70,016	0	28,333	41,683
2003	70,016	0	28,268	41,748
EIRR				13.4%

<sup>a</sup> Benefits for SHC commenced from 1992 with the commissioning of the complex. No production occurred in 1993 as SHC was awaiting privatization. Private sector took over SHC from 1994 and normal production commenced from 1995 onwards.

**Table 9: Estimation of EIRR for Whole Project**  
(SLRs '000)

Year	Benefit	Investment Cost	Operating Cost	Net Benefit
1984	0	0	14,991	(14,991)
1985	5,620	10,807	14,766	(19,953)
1986	4,964	32,644	13,673	(41,352)
1987	504	27,038	12,697	(39,231)
1988	2,669	23,660	11,136	(32,127)
1989	845	29,310	9,984	(38,449)
1990	0	48,207	8,217	(56,424)
1991	0	27,669	7,325	(34,994)
1992	14,218	18,243	2,182	(6,207)
1993	0	0	0	0
1994	45,774	0	23,266	22,508
1995	91,012	0	36,929	54,083
1996	92,787	0	33,776	59,012
1997	93,285	0	34,600	58,685
1998	90,956	0	34,451	56,505
1999	88,686	0	34,310	54,376
2000	86,477	0	34,178	52,299
2001	85,189	0	34,068	51,120
2002	83,922	0	33,967	49,955
2003	82,677	0	33,874	48,803
EIRR				5.73%