

5-3 経済評価（要約）

分析手法

本プロジェクトの基本的目標は、日本人専門家による教員への技術移転、研修員の日本での研修、必要機材の供与、教材・カリキュラムの整備によって、水産学部の研究・教育水準高めることにあり、経済的効果を直接意図したものではない。しかし、UPMの水産学部が果たすべき社会的使命は、同校の建学理念にも記されているように、「社会、国家に役立たない知識には価値がない」という前提のもとで、教育、研究、普及の3者を結合して、同国の農林水産業に近代的・科学的農業技術を普及させることにある。卒業生に対しては、技術面、知識面、文化面の能力を十分に開花させ、社会で指導的な役割を果たすことが期待されている。すなわち、本プロジェクトの評価にあたっては、研究・教育面での成果のみならず、同国水産業の発展、さらには国民経済に対する寄与の度合いも検討されなければならない。

本プロジェクトは技術協力であるが、プロ技協として、かなり多数の長期・短期専門家が加わり、供与機材もかなりの多額にのぼり、無償援助とはいえ、資本支出としての規模をそなえており、その援助効率を何らかの形で数量評価する必要がある。本プロジェクトの数量評価の手法としては、すでに確立されたプロジェクト評価の手法である費用・便益分析を用いる。

費用・便益分析の適用にあたっては、費用面では、機材購入費、マレーシア側のローカル・コスト部分、学部運営費（特定プロジェクト予算を含む）、学生の教育支出を計上し、日本人専門家派遣費用・研修生受入れ費のJICA負担分は無償であり、本プロジェクトの社会的プロジェクトとしての性格を考慮して、埋没コストとして処理し、経済計算には算入しない。同様の理由によって、諸外国がFFNSに援助するプロジェクト予算も費用に算入しない。機材購入費も無償であるが、マレーシア国内で他のプロジェクトに充当した場合、そこから得られる便益が犠牲になり、ある種の機会費用が生じることを考慮し、本プロジェクトの資本費用に計上した。学部運営費は本プロジェクト以外の支出分を含むが、学生の教育に果たす本プロジェクトの寄与分を純粹に分離することは不可能なので、一括して経済費用に算入した。すなわち、この費用計算を通じて、本プロジェクトを含むFFMSの人材養成費を明らかにする。

本プロジェクトの主要便益は、教師の頭脳に蓄積された知識・技能であり、その経済便益を直接数量化することはできない。すなわち、本プロジェクトの便益は学生が卒業後水産業の発展に寄与する度合いの推計を通じて間接的に評価するほかない。また、従来、水産業の高等教育を受けるにあたっては、外国に留学するほかなかったが、本プロジェクトの結果、多くの人材を国内で養成できるので、留学費用の節約が可能である。したがって、本プロジェクトの便益としては、大学卒業生が水産業に従事した場合に期待される生産性の社会的増加分と大学院生の高等教育を国内で実施することによる留学費用の節約効果を、間接的便益として推計する。なお、卒業生が水産業以外に就職した場合には、教育を受けたことによる個人所得の増加分を便益として計上する。

費用・便益分析の分析手法としては、費用・便益比率、内部経済収益率、純現在価値の3種類

あるが、本プロジェクトの主要便益は非貨幣的であり、企業的意思での効率の向上を目的としている訳ではないので、純現在価値を国民経済に対する寄与の指標として採用する。なお、純現在価値の算出には割引率をあらかじめ設定しておく必要があるが、本プロジェクトの社会的プロジェクトとしての性格を考慮して、5%に設定する。また、本プロジェクトのプロジェクト・ライフは、機材の耐用年数、水産開発計画の目標年次等を考慮して、1984/85/1999/2000年度の16年間に設定する。

経済評価

以上のような分析手法に基づいて経済計画を試みたところ、16年間のプロジェクト・ライフを通じて、経済費用の現在価値は7987万ドル、経済便益の現在価値1億1728万ドルで、後者から前者を差し引いた純現在価値は3742万ドルという計算結果が得られた。この数字は、本プロジェクトを実施することにより、教育・研究の質が高まり、卒業生の知識・技術水準の向上を通じて、漁業生産の生産性が向上し、国民経済の観点からみて、プラスの経済効果が生じることを示している。

しかし、ここで留意しなければならないことは、このような経済的便益が発生するためには、一定の前提条件を満たさなければならないということである。すなわち、経済費用、経済便益の中の所得増加分、留学費用の節約については、ある程度客観的数値が得られるが、漁業生産性の向上については、今後の卒業生の就職動向いかにかかっているのである。この試算においては、1987/88年度から1991/92年度にかけて、民間漁業分野の就職率が17%から60%に高まる一方、官庁へ就職率が33%から15%へ、失業率が40%から10%に下がることを前提としている。この前提条件が満たされるためには、漁業分野における生産の増大と労働市場の拡大が必要とされるのである。

この経済分析の結果から引き出される結論としては、本プロジェクトから十分な経済便益を引き出すためには、マレーシアの水産業の発展により、漁業労働市場が拡大し、他方、FFMSの卒業生が水産業に従事することにより漁業生産性が向上するような関係が形成されなければならないということである。このような関係が、自然発生的に形成されない場合、何らかの政策的奨励措置あるいは直接生産的な分野での新規プロジェクトが必要であろう。すなわち、本プロジェクトを取り巻く社会経済的条件の好転こそが、その社会的使命を達成する鍵なのである。

Table 5-1 Flows of economic costs and economic benefits

(Unit: 000)

	Economic costs				Economic benefits				Present value			
	Equipment cost	Budget of FFMS	Education cost	Total	Increase of prod.	Increase of income	Saving edu. cost	Total	Discount. factor(5%)	Economic costs	Economic benefits	NPV
1984/85	202.5	3,404.9	484.2	4,241.9	138.2	241.9	240.8	620.0	1.000	4,241.6	620.9	-3,620.7
1985/86	1,373.0	4,129.2	504.8	6,007.0	345.6	551.9	481.7	1,370.2	0.952	5,718.7	1,313.0	-4,405.7
1986/87	12,275.5	4,257.7	102.5	16,635.4	645.2	1,050.8	401.4	2,097.4	0.907	15,088.3	1,992.3	-13,186.0
1987/88	856.2	4,606.9	579.2	6,042.3	921.6	1,489.3	602.1	3,013.0	0.864	5,220.5	2,618.3	-2,602.2
1988/89	639.0	4,676.0	700.2	6,015.8	1,520.6	1,980.7	602.1	4,103.4	0.823	4,951.0	4,103.4	-847.6
1989/90		4,958.1	842.4	5,800.5	2,073.6	2,313.4	602.1	4,989.1	0.784	4,547.6	4,989.1	441.5
1990/91		5,034.1	1,063.0	6,097.1	3,410.0	2,857.7	602.1	6,860.9	0.746	4,548.4	5,124.9	576.5
1991/92		5,185.1	904.2	6,089.3	5,391.4	3,303.7	602.1	9,207.2	0.711	4,329.5	6,610.3	2,280.8
1992/93		5,340.7	904.2	6,245.0	7,312.8	3,749.8	602.1	11,664.7	0.677	4,227.9	7,807.0	3,689.1
1993/94		5,500.9	904.2	6,405.1	9,354.2	4,195.8	602.1	14,152.1	0.645	4,131.3	9,128.1	4,996.8
1994/95		5,666.0	904.2	6,570.2	11,335.0	4,641.8	602.1	16,579.5	0.614	4,034.1	19,170.8	6,145.7
1995/96		5,835.9	904.2	6,740.1	13,317.2	5,087.0	602.1	19,007.2	0.585	3,943.0	11,119.2	7,176.2
1996/97		6,011.0	904.2	6,915.2	15,298.6	5,533.0	602.1	21,434.6	0.557	3,851.8	11,939.1	8,087.3
1997/98		6,191.3	904.2	7,095.5	17,280.0	5,980.0	602.1	23,882.1	0.530	3,760.6	12,646.9	8,886.3
1998/99		6,377.3	904.2	7,281.5	19,261.4	6,430.0	602.1	26,289.5	0.505	3,677.2	13,276.2	9,599.0
1999/00		6,568.4	904.2	7,472.6	21,242.8	6,872.0	602.1	28,716.1	0.481	3,594.3	13,812.4	10,218.1
Total	15,406.5	83,833.5	12,414.1	111,654.2	103,128.4	56,266.6	8,951.2	169,348.2		79,865.8	117,280.9	37,415.1

6. 結 論

本調査団は今回の調査結果に基づき技術移転の達成度、今後の対応についてつぎのとおり結論づけた。

① プロジェクトの当初の目的は概ね達成され、未達成の部分についても協力期間内に修了することが可能である。

② R/Dによって定められたプロジェクトの協力期間を延長する必要性は認められない。

また、プロジェクト終了後の我が国の協力として先方の要請の中から妥当な事項をつぎのとおり策定した。

① マレーシア農科大学海洋水産学部と日本における学術交流の促進

② 大規模商業用種苗生産技術と保蔵加工及び漁具漁法の両分野での学位論文指導のための専門家派遣

また、以上の主旨を別添の団長書簡としてプロジェクトの最高責任者であるDr.Nayan Ariffin (マレーシア農科大学副学長) に提出した。

March 13, 1989

Professor Dr. Nayan Ariffin
Vice-chancellor
Universiti Pertanian Malaysia
Serdang, Selangor
Malaysia

Dear Sir,

On behalf of the members of the Japanese Evaluation Team for the Development of the Faculty Fisheries and Marine Science, Universiti Pertanian Malaysia, I would like to express our sincere gratitude for all the efforts and assistance you kindly rendered during our stay in Malaysia from March 2 to 13, 1989.

During our stay in Malaysia, we exchanged views and had a series of discussions with our Malaysian counterparts and Japanese experts for the purpose of evaluating the Project activities.

As a result of the evaluation, we agreed to recommend to both governments the following :

① Most of the original targets in the project have been accomplished , and it is possible that the remaining part will be completed at the termination of the cooperation period on September 30, 1989.

② We have no outstanding reasons for any extension of the project, and the project will be terminated as scheduled on R/D.

③ More efforts by both countries are necessary to complete the project by September 30, 1989. This includes the official documentation of the receipt of equipments by UPM and the completion of textbook publication.

Additional requests will be forwarded to the Government of Japan after the termination of the project.

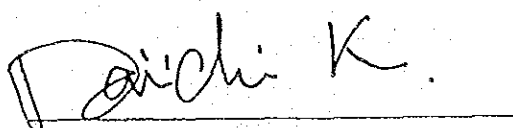
These requests include :

- ① Enhancement of an academic linkage between Japan and FPSS, UPM.
- ② Dispatch of an expert in the following fields:
 - (a) Aquaculture for a large scale seed production of local commercial fishes,
 - (b) Guidance of Ph.D. students in the fields of fish preservation/processing and fishing technology.

We recognize, that these requests are necessary for the counterparts to progress further or attain an even higher level of achievement. Additional cooperation based on these requests will effectively enhance the achievements of the project and promote further mutual benefits to both countries.

Your cooperation on this matter would be greatly appreciated.

Yours sincerely,



Dr. Daiichi Kakimoto
Leader
Japanese Evaluation Team
Japan International Cooperation Agency
Japan

7. 投入実績

7-1 調査団派遣

事前調査

昭和58年8月13日～8月28日

構成：柿本大壺（鹿児島大学）
尾上義夫（鹿児島大学）
川村軍蔵（鹿児島大学）
西村俊道（文部省学術国際局）
橋浦広志（JICA水産技術協力室）

補足調査

昭和59年4月21日～6月20日

構成：野沢沿治（鹿児島大学）
柿本大壺（鹿児島大学）
千田哲資（長崎大学）
北村幸久（文部省学術国際局）
高橋満之（JICA水産技術協力室）

計画打合せ

昭和60年6月25日～7月4日

構成：木村喬久（北海道大学）
田口一夫（鹿児島大学）
松本 進（文部省学術国際局）
小樋山覚（JICA水産技術協力室）

モデル・インフラ整備事業実施設計

昭和60年9月29日～10月19日

構成：竹林 勇（㈱パシフィック・コンサルタンツ・インターナショナル）
池ノ上宏（㈱国産水産技術開発）
大淵雄興（㈱パシフィック・コンサルタンツ・インターナショナル）

巡回指導

昭和61年7月10日～7月24日

構成：元広輝重（鹿児島大学）
中尾 繁（北海道大学）
大川晴美（JICA水産技術協力室）

巡回指導

昭和62年11月10日～11月21日

構成：小池 篤（東京水産大学）
野田 潔（文部省学術国際局）
吉田勝巳（JICA水産技術協力室）

エバリュエーション

平成元年3月2日～3月14日

構成：柿本大壺（鹿児島大学名誉教授、国内支援委員会委員長）

川村軍蔵（鹿児島大学）

大野正夫（高知大学）

渡辺政美（文部省）

三国成晃（JICA水産技術協力室）

森 久男（システム科学コンサルタンツ株式会社）

橋本尚司（ " " ）

7-2 ローカルコスト負担

・技術交換費

漁業航海

昭和61年9月11日～9月24日

交換先：TD/SEAFEC（タイ国）

構成：川村軍蔵、Mr. ZEINAL A. Shahardin, Mr. Kahlid Samo.

経費：838,000円

資源数理

昭和63年3月28日～4月12日

交換先：ICLARM（フィリピン国）

構成：早瀬茂雄、Dr. Azmi bin Ambak, Dr. A. K. M. Mohsin

経費：938,130円

・現地語教科書作成費

元年1月19日示達（1,000,000円）

元年7月31日示達（510,000円）

・プロジェクト基盤整備費（モデルインフラ）

実施設計調査 昭和60年9月29日～10月19日（11,282,000円）

施工管理 昭和61年2月16日～6月28日（10,488,000円）

建設費（6,577,002円）

・現地セミナー開催実施

昭和63年11月8日示達（500,000円）

7-3 専門家派遣

59 (長) 川村軍蔵

漁具漁法/リーダー

59・11・16-61/11・15

鹿児島大学水産学部

(長) 市川敏夫

水産海洋

59・11・16-61/11・15

鹿児島大学理学部

	(長) 河上楯男		
	航海運用	59・11・16-61・11・15	
	(長) 宇田川和夫		
	業務調整	59・12・7-63・6・6	
	(短) 平田八郎		
	ふ化場管理	59・12・28-60・1・22	鹿児島大学水産学部
60*	(長) 川村軍蔵		
	漁具漁法／リーダー	59・11・16-61/11・15	鹿児島大学水産学部
*	(長) 市川敏夫		
	水産海洋	59・11・16-61/11・15	鹿児島大学理学部
*	(長) 河上楯男		
	航海運用	59・11・16-61/11・15	
*	(長) 宇田川和夫		
	業務調整	59・12・7-63・6・6	
	(短) 平田八郎		
	ふ化場管理	60・5・27-60・6・10	鹿児島大学水産学部
	(短) 田口一夫		
	航海運用	60・8・9-60・9・9	鹿児島大学水産学部
	(短) 佐藤道雄		
	沿岸工学	60・10・7-60・11・5	鹿児島大学工学部
	(短) 川村章人		
	浮遊生物	61・2・4-61・3・30	鹿児島大学水産学部
	(短) 手島新一		
	魚類栄養	61・2・4-61・3・30	鹿児島大学水産学部
	(短) 竹林 勇		
	ふ化場建設	61・2・16-61・6・28	(株)P C I
61*	(長) 川村軍蔵		
	漁具漁法／リーダー	59・11・16-61・11・15	鹿児島大学水産学部
*	(長) 市川敏夫		
	水産海洋	59・11・16-61・11・15	鹿児島大学理学部
*	(長) 河上楯男		
	航海運用	59・11・16-61・11・15	

	(長) 中雄 繁		
	海面養殖	61・8・20-62・8・19	北海道大学水産学部
	(長) 山崎繁久		
	ふ化場管理	61・8・20-62・8・19	鹿児島大学水産学部
	(長) 早瀬茂雄		
	資源数理／リーダー	61・6・12-63・8・30 (61・11・15よりリーダー兼務)	
*	(長) 宇田川和夫		
	業務調整	59・12・7-63・6・6	
	(短) 平田八郎		
	ふ化場管理	61・5・1-61・5・12	鹿児島大学水産学部
	(短) 平田八郎		
	ふ化場管理	61・8・5-61・9・2	鹿児島大学水産学部
	(短) 大淵雄興		
	ふ化場管理	61・5・16-62・2・28	(休) P C I
*	(短) 竹林 勇		
	ふ化場管理	61・2・16-61・6・28	(休) P C I
	(短) 木村喬久		
	魚病	61・5・21-61・6・4 61・7・3-61・8・4	北海道大学水産学部
	(短) 元広輝重		
	漁獲物処理	61・8・6-61・9・2	鹿児島大学水産学部
	(短) 田口一夫		
	航海運用	61・8・6-60・9・6	鹿児島大学水産学部
	(短) 手島新一		
	魚類栄養	61・12・10-62・1・7	鹿児島大学水産学部
	(短) 木島明博		
	電気泳動	61・10・16-61・12・18	広島大学水畜産大学
62*	(長) 早瀬茂雄		
	資源数理／リーダー	61・6・12-63・8・30	
	(長) 中雄 繁		
	海面養殖	61・8・20-62・8・19	北海道大学水産学部
	(長) 山崎繁久		
	ふ化場管理	61・8・20-62・8・19	鹿児島大学水産学部

	(長) 飯沢正人 海面養殖	62・6・10-64・6・9	(株)国際水産技術開発
*	(長) 宇田川和夫 業務調整	59・12・7-63・6・6	
	(短) 千田哲資 海面養殖	62・7・1-62・8・17	長崎大学水産学部
	(短) 川村軍蔵 漁具漁法	62・7・16-62・9・2	鹿児島大学水産学部
	(短) 元広輝重 漁獲物処理	62・12・18-63・1・14	鹿児島大学水産学部
	(短) 田口一夫 航海運用	62・7・18-62・8・15	鹿児島大学水産学部
	(短) 佐藤道雄 沿岸工学	62・8・19-62・10・15	鹿児島大学工学部
	(短) 河村章人 浮遊生物	62・10・15-62・11・23	北海道大学水産学部
	(短) 尾上義久 海洋化学	62・9・3-62・9・30	鹿児島大学水産学部
63*	(長) 早瀬茂雄 資源数理／リーダー	61・6・12-63・8・30	
*	(長) 飯沢正人 海面養殖／リーダー	62・6・10-63・6・9 (63・8・30よりリーダー兼務)	(株)国際水産技術開発
*	(長) 宇田川和夫 業務調整	59・12・7-63・6・6	
	(長) 瀬尾重治 ふ化場管理／業務調整	63・4・18-64・9・30 (1・1・1よりふ化場管理兼務)	
	(短) 手島新一 魚類栄養	63・8・22-63・9・20	鹿児島大学水産学部
	(短) 木島明博 電気泳動	63・8・10-63・9・10	東北大学農学部
	(短) 木村喬久 魚病	63・6・2-63・6・30	北海道大学水産学部
	(短) 田島研一 魚病／電顕	63・7・16-63・8・4	北海道大学水産学部

	(短) 田口一夫			
	航海運用	63・7・18-63・8・15		鹿児島大学水産学部
	(短) 元広輝重			
	漁獲物処理	63・8・4-63・9・1		鹿児島大学水産学部
	(短) 川村軍蔵			
	漁具漁法	63・9・12-63・11・11		鹿児島大学水産学部
	(短) 尾上義夫			
	海洋化学	63・12・28-1・3・6		鹿児島大学水産学部
1 *	(長) 飯沢正人			
	海面養殖/リーダー	62・6・10-1・6・9		(株)国際水産技術開発
*	(長) 瀬尾重治			
	ふ化場管理/業務調整	63・4・18-1・9・30		
	(短) 市川敏夫			
	水産海洋	1・4・4-1・9・30		鹿児島大学理学部
	(短) 田中昌一			
	資源数理	1・7・24-1・8・25		東京水産大学水産学部
	(短) 元広輝重			
	海獲得処理	1・8・5-1・9・1		鹿児島大学水産学部
	(短) 川村軍蔵			
	漁具漁法	1・8・15-1・9・25		鹿児島大学水産学部

* 前年度からの継続

7-4 研修員受入れ

59	Mrs. Siti Shapor Hj. Siraj			
	電気泳動	59/11/5~59/12/19		東北大農学部
	Mr. Azmi Bin Yaacob			
	水族館管理	59/11/15~60/3/30		江ノ島水族館
	Mr. Mohammad Bin Embong			
	水産海洋学	59/11/15~60/3/30		鹿大水産学部
60	Mr. Chear Sin Hock			
	種苗生産	60/4/29~60/3/30		東大農学部
	Mr. Liew Hock Chark			
	海洋生物	60/4/29~60/12/3		東大海洋研
	Mr. Khalid Bin Samo			

		漁業機械	60/ 4/29~60/12/ 3	北大水産学部
	Mr. Shamsul Bahar Bin Ahmad			
		ふ化場管理	60/ 8/14~61/ 5/13	長大水産学部
61	Mr. Mohd. Saller Kamarudin			
		魚類栄養	61/ 5/12~61/ 8/15	鹿大水産学部
	Mr. Mohd. Lokman Husain			
		沿岸工学	61/ 6/24~62/ 3/31	鹿大理学部
	Mr. Ahmad Kimon Bin Sule Iman			
		漁業電気	61/ 6/11~61/12/20	鹿大水産学部
62	Ms. Mariana Nor Shamsudin			
		ウィルス学	62/ 5/19~62/ 8/ 3	北大水産学部
	Dr. Abdullah Abu Bakar			
		漁獲物処理	62/ 6/23~62/ 9/30	鹿大水産学部
	Mr. Mohamad Bin Muda			
		漁具漁法	62/10/ 8~63/ 2/25	鹿大水産学部
	Mr. Umar Bin Saleh			
		海面養殖	62/ 3/18~63/ 7/19	長大水産学部
63	Ms. Jamilah Bt Bakar			
		漁獲物処理	63/ 5/30~63/ 8/ 2	鹿大水産学部
	Mr. Khalid Bin Samo			
		航海・運用	63/10/24~63/ 3/24	鹿大水産学部
	Dr. Mohd. Ibrahim Bin Haji Mohd			
		漁具漁法	1/ 3/21~ 1/ 4/30	鹿大水産学部
	Dr. Locman Bin Shamsudin			
		浮遊生物学	1/ 3/13~ 1/ 6/ 3	三重大生物資源学部 東北大農学部
元	Mr. Yaakub Bin Rasip			
		ふ化場管理	1/ 4/18~ 1/ 7/22	長崎県増養殖研究所

7-5 機材供与

1) 供与機材購入金額

	59	60	61	62	63	元	総額
本部 (千円)	23,776	12,710	15,695	2,162	2,425	5,900	62,668
現地 (10M\$)	3,129	121,921	101,874	81,231	59,106	12,912	380,236

2) 供与した機材のリストはつぎのとおり

なお、利用、管理状況の評価基準は以下による

評価基準	利用状況	管理状況
A	充分活用	充分管理
B	活 用	普通に管理
C	時々活用	粗悪な管理
D	無活用	無管理
D1	部品不足	
D2	故障中	
D3	研究に未着手	
D4	その他	

セルダン キャンパス

供与 年度	機 材 名	数量	金額 (1000 ¥) (10M\$)	利用 管理 状況 状況
59	Hatchery Materials		404	消費済み
	Electric Zigzag Hand Saw Set, BOSCH	1	38	A A
	PVC Welding Machine, FUJI MFG	1	95	A A
	Polycarbonate Tank, Round SPS-200	3	377	A A
	Polycarbonate Tank, Round SPS-100	3	192	A A
	Polycarbonate Tank, Round SPS-50	3	132	A A
	Livefish Transportation Tank, 1000L	2	166	C B
	UV Ozon Hybrid Water Sterilizer, STK UZ-110MR	1	1,632	A A
	Polyethylene Water Tank, Round 100L White	60	564	A A
	Acrylic Tank, NISSO 100L	3	71	破損・廃棄
	Fish Pool, Round E-20B 2000L	7	520	D3 A
	Fish Pool, Rectangular K-3 3700L	3	374	C A
	Shading Mesh		23	消費済み
	Polyethylene Mesh, 200 mesh 2m x 5m		92	同上
	Polyethylene Mesh, 150 mesh 12cm x 50m		87	同上
	Polyethylene Mesh, 100 mesh 12cm x 50m		39	同上
	Polyethylene Mesh, 50 mesh 12cm x 50m x 2		54	同上
	Polyethylene Mesh, 18 mesh 12cm x 50m x 2		47	同上
	Magnetic Drive Pump, TANAKA MD-30R 32L/min	3	120	B A
	Direct Current Pump, NAKASU 10L/min	10	14	破損・廃棄
	Air Oxygen Diffuser, FUKUHASHI 180mm	7	123	D3 A
	Solar Cell, SHARP NT-111	4	456	D3 D2, A
	Charge Controller	2	56	D3 A
	Automatic Regulator, KAIYOU SANGYO	1	240	D3 A
	Cartridge Filter, TOYO ROSHI TCW/1/3/10		153	消費済み
	Portable Compressor, FUKUHASHI TF DC12V	2	160	C A
	Seawater Thermometer, TOHO DENTAN ET-5	2	464	破損・廃棄
	Blower, HITACHI Oil Baby Com RC-20S	1	67	D3 A
	Blower, HITACHI Baby Com 0.75K	1	225	A A
	Ring Blower, FUJI MH 7210	1	150	A A
	Electric Submersible Pump, EBARA 100ES	1	360	A A

供与 年度	機 材 名	数量	金額 (1000 ¥) (10M\$)	利用 状況	管理 状況
59	Microcomputer, NEC PC-9801 F2 with accessories	1	1,000	A	A
	Copier, CANON NP-155	1	620	A	A
	Calculator, CASIO FR-101	1	14	破損・廃棄	
	Cash Box, SEKISEI	1	45	A	A
	Electric Typewriter, BROTHER Electra 60 with transformer	1	173	B	A
	Underwater Strobo, NIKON SB-101	2	144	B	A
	Instant Camera, POLAROID 650	1	23	D	A
	Underwater Wire Communication System	2	310	水中使用不可	
	Transit, SOKKISHA TG-60 with tripod	1	319	C	A
	Transceiver, NATIONAL RJ-450	4	70	B	A
	Wagon, ISUZU FARGO 4WD	1	1,835	A	A
	Incubator, SANYO MIR 251	2	1,000	B	A
	Blender, YAMATO KAGAKU 7012-S with transformer	1	165	B	A
	Lux Meter, TOPKON 1M-2D	1	45	B	A
	Portable Digital DO Temp. Meter, CENTRAL SCIENCE UC-12	2	480	B	A
	Portable Digital pH/ORP Meter, CENTRAL SCI. UC-23	2	340	A	A
	Portable Digital Conductivity Meter, CENTRAL SCIENCE UC-33	3	675	A	A
	Circuit Tester, YEW 2412	1	6	A	A
	Submersible Pump, EBARA 50 DVF 50・75	1	80	B	A
	Alternating Current Constant, ACV21P2SI METRONICS F2A-1000	1	237	A	A
	Universal Alternating Current Constant Voltage,	1	843	B	A
	High Magmix Stirrer Constant, MSTH 140600	3	366	B	A
	Water Distillation Apparatus, SHIMAZU 111-080	2	329	B	A
	Portable NaCl Digital Meter, TOA DENTAN SA-10-KB	2	304	B	A
	Micrometer for Photomicroscope, NIKON	10	56	B	A
59年度計			14,841¥ 2,133M\$		

供与 年度	機 材 名	数量	金額 (1000 ¥) (10M\$)	利用 状况	管理 状况
60	Meat Mincer (Silent Cutter), YANAGIYA NHY-60	1	2,830	A	A
	Standard Mixer, YANAGIYA 30K	1	1,200	A	A
	Mashing Machine, YANAGIYA R-12-C	1	1,540	D3	A
	Pellet Mill, HIRAGA 22VR-1500	1	320	A	A
	Feed Grinder (Rotor Beater Mill), MITAMURA	1	1,200	修理中	
	Digital Nutrition Meter, CENTRAL KAGAKU HC-100 with transformer	1	420	A	A
	Sieve Shaker, NIHON KAGAKU MS-2, with 5 meshes	1	320	A	A
	Fibreglass Conical Tank, 1000L	15	1,243	B	A
	Fibreglass Conical Tank, 500L	10	533	B	A
	Fibreglass Conical Tank, 100L	11	209	B	A
	Fibreglass Conical Tank, 50L	10	168	A	A
	DO Temp. Meter, YSI-58	1	505	A	A
	Eye-piece Micrometer, NIKON	1	10	B	A
	Electric Typewriter, OLIVETTI ET-115	1	240	A	B
	Flash Light for Camera, METZ	1	11	C	A
	Fluorescent Lamp (Desk Type)	2	9	破損・廃棄	
	Motorcycle, YAMAHA Passola	1	147	A	B
	pH Meter, Digital Portable, YEW PH-51	1	83	修理中	
	pH Meter, METROHM 632	1	263	A	A
	Water Bath, AQUA CTA 452-1	1	379	A	A
	Vacuum Handy Pump, TOYO KAGAKU VP-20 with transformer	1	140	A	A
	Glass Microanalysis Holder, ADVANTEC	1	19	A	A
	Sterilizing Can for Pipetes	2	12	A	A
	Bell Jar with glass plate, VI-500	2	25	A	A
	Paddle Wheel, NRA 111	16	1,872	A	A
	Tractor, YANMAR YM 155DT with accessories	1	1,570	A	A
	Digestion System, TECATOR DS-20 with accessories	1	1,165	A	A
	Kjeltec Auto Analyser, TECATOR 1030	1	2,690	A	A
	Fibretec System, TECATOR with accessories	1	3,800	A	A
	Soxtec System, TECATOR HT 6 WITH ACCESSORIES	1	2,230	A	A
	Generator, YANMER 4T96LTE	1	3,675	A	A

供与 年度	機 材 名	数量	金額 (1000 ¥) (10M\$)	利用 状況	管理 状況
60	Gas Chromatography, SHIMAZU GC-8APF	1		D3	A
	Data Processor, SHIMAZU CR3A	1	3,251	D3	A
	Sample Injector, SHIMAZU SPL-G9	1		D3	A
	Walkie Talkie, TAIT	2	339	A	A
	DO Meter, YSI 57	1	691	A	A
	Bloodcell Counter, ELMA PC-604	1	2,667	D3	A
	High Speed Centrifuge, KUBOTA KH-180 with transformer	1	1,200	C	A
	Motorcycle, HONDA CS0 (中古品)	1	112	A	C
	Underwater Camera, CANON AS-6 with accessories	1	39	C	A
	Pocket pH Meter, YEW PH 51	1	97	A	A
	Electric Semimicro Balance, SARTORIUS 2004/MP6	1	1,030	B	A
	Electric Analytical Balance, SARTORIUS 1902/MP8	1	410	B	A
	Electric Toploader, SARTORIUS 1465/tp8 420g/001g	1	437	B	A
	Portable Pen Recorder, YEW 305722	2	649	B	A
	Multipoint Recorder, YEW	1	1,148	B	A
	Soldering Iron	1	5	A	A
	HPLC, SHIMAZU LC-4A	1	6,386	A	B
	Total Organic Carbon Analyser, SHIMAZU TOC-500	1	4,200	B	A
	Electrophoresis Apparatus, ATTO	1	797	B	A
	Refrigerator, HOSHIZAKI	1	310	B	A
	Sample Mill, TECATOR 1093-001	1	504	B	A
	High Pressure Sterilizer "Mediclave", HIRAYAMA HK 350E	1	8,770	B	A
	60年度 計		5,664¥ 56,206M\$		

供与 年度	機 材 名	数量	金額 (1000 ¥) (10M\$)	利用 状況	管理 状況
61	Analytical Balance, SARTORIUS 2842 0.1mg/160g	1	300	B	A
	Heating Modules	1	266	A	B
	Sieve, 250 um	2	29	B	A
	Sieve, 125 um	2	29	B	A
	Sieve, 100 um	4	58	B	A
	Sieve, 63 um	2	29	B	A
	S. C. T. Meter, YSI-33	3	304 517	B	A
	Mini Copier, CANON FC-5	1	235	A	A
	Electric Typewriter, BROTHER CX 60 with transformer	1	106	A	A
	Nitrate Nitrogen column	10	159	B	A
	Vacuum Dessicator, NOVUS	3	143	A	A
	Homogeniser	1	990	A	A
	Peristaltic Pump, SESAGA 131900	2	905	A	A
	Atomic Absorption Flame Spectrophotometer SHIMAZU AA670	1	7,847	A	A
	Graphite Furnace Atomizer, SHIMAZU GFA4T	1	2,890	B	A
	Auto Sample Changer, SHIMAZU ASC 60F	1	970	B	A
	Automatic Injector, SHIMAZU ALU-I	1	810	B	A
	Mercury Analyzer Attachment, SHIMAZU MVU-IA	1	890	B	A
	Auto Sample Changer for Flameless Analysis SHIMAZU ASC-60G	1	1,230	B	A
	Refrigerated Centrifuge Centricon, KONTRON H401	1	5,663	B	A
	Electrocardiograph, YAMAGUCHI YM102	1	270	C	A
	Meat Mincer, HOBART 4822	1	478	B	A
	Freeze Dryer, VIRTIS (Freezemobile-6)	1	2,971	B	A
	Ice Machine, ZIEGRA UBE 50-35	1	925	A	A
	Electronic Balance, SARTORIUS 1mg/424g	1	450	B	A
	Dispenser Perifill, JENCONS (UK)	1	475	A	A
	Profile Projector, NIKON V-10	1	1,290	B	A
	T. L. C. Scanner, BIOMED with Computer and Printer	1	5,220	B	A
	Low Temperature Incubator, MEMERT 408KE	1	823	A	A

供与 年度	機 材 名	数量	金額 (1000 ¥) (10M\$)	利用 狀況	管理 狀況
6 1	Ultrasonic Cell Disrupter, VIRSONIC	1	1,378	B	A
	Personal Computer, NEC 9801 VM2E	1	550	D	A
	Display, NEC APC-H I310	1	126	D	A
	Color Printer, NEC PC-PR20IE2	1	443	D	A
	Voltage Regulator, MATSUNAGA	1	350	D	A
	Cut Sheet Feeder, NEC PC-PR-20I HE	1	43	D	A
	Binocular Student Microscope, NIKON SE-D-B	15	2,932	A	A
	Microflex Photomicrography, NIKON UFX-35	1	815	A	A
	Stereoscopic Zoom Microscope, NIKON SMZ-2B	15	4,892	A	A
	Trinocular Research Microscope, NIKON XF-21N	3	3,128	A	A
	Phase Contrast N Plan Set, NIKON PH-21N	1	637	A	A
	Diaphot Inverted Microscope, NIKON TMD-2	1	1,705	A	A
	Inverted Microscope, NIKON TMS-PH-4	1	643	A	A
	TV System for Microscope, JVC KYM-280	1	3,843	A	A
	6 1年度 計		2,082¥ 56,675M\$		
6 2	Automatic Feeder, MEI Singapore	8	1,503	D3	A
	DO Meter, YSI 57	1	557	A	A
	Spectronic, B & L 21 DV	1	568	D3	A
	Spectronic 20, MILTON ROY	6	1,320	D3	A
	Hammer Mill, ELE EL523-140/03	1	798	C	A
	Pelletier, CMC CHINA SLP-75	1	2,480	A	C
	Autoclave (Top Loading), EXPRESS ST23	1	525	A	A
	Scuba Tank, Yellow, US DIVER	10	635	B	A
	Regulator, US DIVER	10	632	B	A
	Kam Pac, US DIVER	10	130	B	A
	Camera, NIKON FE-2 with zoom lens, 35/135mm	1	159	C	A
	Flash for Camera, CROWN T816	1	8	C	A
	Radio Casset Recorder, SHARP GT-88	1	32	A	A
	Portable Casset Recorder, SONY TCM-15V	1	91	C	A
	Microphone Mixer, SONY	1	24	C	A

供与 年度	機 材 名	数量	金額 (1000 ¥) (10M\$)	利用 狀況	管理 狀況
62	Uninterruptable Power Supply, PK ELECTRO. US 2060	1	175	A	A
	Copier, MINOLTA EP 410Z	1	965	B	B
	Typewriter, BROTHER EM-1000	1	609	A	B
	Uninterruptable Power Supply, PK ELECTRONICS US2040	2	290	A	A
	Universal Oven, MEMMERT 80UL	1	505	B	A
	Water Filtration System, GELMAN	1	331	A	B
	Laminar Flow Air Cabinet, ESCO	2	1,060	B	A
	Auto Analyser, CHEMLAB INSTRUMENTS				
	Auto analyser Sampler, CS40	1	979	B	A
	Auto analyser Peristaltic Pump	1	1,133	B	A
	Auto analyser Ammonia Cartridge	1	773	B	A
	Auto analyser Nitrate Cartridge	1	278	B	A
	Auto analyser Phosphate Cartridge	1	507	B	A
	Auto analyser Silicates Cartridge	1	507	B	A
	Auto analyser Multicolorimeter, MK III	1	1,854	B	A
	Auto analyser Recorder	1	1,030	B	A
	Auto analyser Voltage Regulator, IS 1000	1	99	B	A
	Warring Blender, WARRING 80I2S	2	199	A	A
	Computer ALR Access, ALR 386 with 14" Display	1	1,265	A	A
	Laser Printer, Laser Jet II HEWLETPACKARD	1	710	A	A
	Uninterruptable Power Supply, US 2060	1	185	A	A
	Liquid Nitrogen Tank, 34.8L, MVE	1	331	B	A
	Embedding Centre, THERMOLYNE HC 3320-2S	1	760	B	A
	Tissue Sonicator, SONIC & MATERIALS VC 250	1	1,003	B	A
	with accessories				
	pH Meter, WTW PH 96A with bag	1	132	A	A
	Ekman Dredge, EKMAN with messenger (2pc.)	1	144	B	A
	Vacuum/Pressure Pump, COLE PARMER J7061-22	1	145	A	A
	Portable Balance, SARTORIUS	2	180	B	A
	Portable Balance, SARTORIUS P600	2	179	A	A
	Spectronic 20, B & L with accessories	2	288	B	A
	Osmometer, CONOTEC OSMOMAT 030-D	1	1,111	B	A
	Quantum Meter, LI-COR LI 1858 with accessories	1	861	B	A

供与 年度	機 材 名	数量	金額 (1000 ¥) (10M\$)	利用 状況	管理 状況
62	Water Bath & Refrigerated Recirculator, LAUDA	1	1,132	B	A
	Flame Photometer, CORNING 410	1	499	B	A
	Air Compressor 850, CORNING	1	108	B	A
	Water Purification System with accessories	1	1,036	A	A
	Stomacher, SEAWARD MEDICAL BA6021	1	410	B	A
	DO Meter, YSI 57	1	606	B	A
	Desk Top Centrifuge, HERAEUS Biofuge B	1	484	B	A
	Angle Rotor, HERAEUS 1.5mL	1	68	B	A
	Haematocrit rotor, HERAEUS	1	50	B	A
	Plug-on Reader, HERAEUS	1	44	B	A
	Angle Rotor, ERAEUS 0.4mL	1	68	B	A
	Biological Safety Cabinet, HEPAIRE	1	2,313	B	A
	Electrophoresis Unit, LKB	1	473	B	A
	Macrodrive 5 Power Supply, LKB	1	920	B	A
	Ultracould Gel Casting, LKB	1	90	B	A
	Immunoelectrophoresis Kit, LKB	1	200	B	A
	Staining Kit, LKB	3	252	B	A
	Extraphor Electrophoretic Concentrator, LKB	2	260	B	A
	Electrophoresis Kit for SDS/Page, LKB	1	150	B	A
	Large Scale 2D & Gradient Gel Kit, LKB	1	260	B	A
	Freezer, (-20 ° C), 20-20, SCIENTENP	1	454	A	A
	Rotary Evaporator, TOKYO RIKAKIKI N-I	1	430	B	A
	Water Bath, TOKYO RIKAKIKAI SB-55	1	151	B	A
	Low Temperature Incubator, TOKYO RIK LTI 6000	5	3,161	A	A
	Fibre Glass Fume Hood, 60", HAMCO	1	2,190	A	A
	Fibre Glass Fume Hood, 48", HAMCO	1	1,428	A	A
	Optiphot Trinocular Microscope, NIKON XT 20N MS	1	1,206	A	A
	Microflex Photomicrography, NIKON UFX-35	1	875	A	A
	Trinocular Zoom Stereoscopic Microscope, NIKON SMZ 10 TD	1	623	A	A

62年度計

0¥ 47,991M\$

供与 年度	機 材 名	数量	金額 (1000 ¥) (10M\$)	利用 狀況	管理 狀況
63	Water Bath & Shaker, HOTPACK with accessories	1	1,419	C	A
	Freezer (-80° C), REVOO ULT 170	1	1,532	A	A
	Upright Freezer, SANYO MDF 0535	1	1,185	B	A
	Precision Incubator, MEMMERT B50	1	306	A	A
	Water Checker, CENTRAL SCIENCE	1	300	B	A
	Portable OHP, RICOH with transformer	1	113	B	A
	Fibre Optic Illuminator	1	193	A	A
	Automatic Photomicrography, NIKON HFX-35	1	672	A	A
	Peristaltic Pump 25 Channel	1	443		
	Va Dorn Water Sampler	2	376		
	Automatic Burette	2	880		
	Fraction Collector	1	1,324		
	pH Meter Deluxe Field	1	104		
	Rotary Micro Kjeldahl Distillation	1	1,003		
	Kjeldahl Distillation App.	1	1,211		
	Top Pan Balance	2	444		
	Field Model DO Meter	2	1,185		
	Spectronic 20	3	885		
	Hewlett-Packard 7475A Plot	1	474		
	Desk Top Publication Acc.	1	951		
	Microscopes	20	6,722		
	Four Wheel Drive Lorry	1	4,043		
	Water Pump with Tube Well	1	4,590		
	Pond Materials Bricks	1	1,735		
	Hatchery Equipment	1	393		
	FRP 1 Ton Tank	10	485		
	Rotary Evaporator	1	262		
	High-pressure Micropump	1	398		
	System Stand	1	77		
	Aspirator	1	72		
	Propeller for Water Testing	1	170		
	Hatchery Materials		293		
	Water Pump	1	29		
	Hatchery Materials		96		
	Plankton Net		59		
	Sewing Machine	1	46		

63年度 計

1,685¥ 32,785M¥

トレンガス キャンパス

供与 年度	機 材 名	数量	金額		利用 状況	管理 状況
			(1000円)	(10万円)		
59	Fish Pool, Round, EARTH SHOKAI E-20B	3	156		A	B
	Ultraviolet Rays Hybrid Water Sterilizer SENTOKUSHU KOGEN SS-10G	1	204		D3	B
	Multi tester, SANWA YX 360TR	1		7	B	A
	Lux Meter, TOPKON 1M-2D	1	45		C	A
	Portable Digital DO/O2 Temp. Meter, CENTRAL SCIENCE UC-12	1	240		A	B
	Portable Digital pH/ORP Meter, CENTRAL SCIENCE UC-23	1	170		破損・廃棄	
	Circuit Tester, YEW 2412	1	6		B	A
	Freezer, EBARA ESU-17, with transformer	1	590		A	B
	Current Constant Voltage, ACV 21P 2SI	1	237		A	A
	Universal Constant Voltage, METRONICS F2A-1000	1	843		A	A
	High Magmix Stirrer, MSTH 140600	1		122	A	A
	Water Distillation Apparatus, SHIMAZU 111-080	1	173		C	B
	Water Distillation Apparatus, SHIMAZU 111-100	1	156		D	B
	Oscilloscope, IWATSU SS 5702	1	268		B	A
	Digital Multimeter, IWATSU SC 7404	1	268		B	A
	Copier, CANON NP 155 with accessories	1		620	A	B
	Van Dorn Water Sampler, RIGOSHA 6L	3	339		A	C
	Van Dorn Water Sampler, RIGOSHA 20L	2	520		A	C
	Nansen Reversing Water Bottle, RIGOSHA 1300L	5	700		C	A
	Portable Fish Finder, KODEN SB-500 50kHz	1	91		B	A
	Pantagraph "Black 40"	1	49		C	A
	Satellite Navigator, KODEN SAN-185 with antenna	1	1,810		B	A
	Transit, SOKKISHA G-60 with tripods	2	639		C	A
	Protractors, TAMAYA No. 1724	2	248		C	A
	Transceiver, NATIONAL RJ-450	5	870		C	A
	Portable Computer for Navigation, SHARP PC1253H	2	124		C	A
	Portable Computer for Navigation, TAMAYA NC-88	2	189		C	A
	Underwater Wire Communication System	2	310			

59年度 計 9,245円 749万円

供与 年度	機 材 名	数量	金額 (1000¥) (10M\$)	利用 狀況	管理 狀況
60	Slide Projector, ELMO S-300	1	21	B	A
	Portable Pen Recorder, YEW 305722	1	325	B	A
	Soldering Gun, COPPER INDUSTRIES	1	6	C	A
	Test Sieve, ENDECOTTS	1	17	B	A
	Hook Balance, SALTER 100kg	1	17	B	A
	Hook Balance, SALTER 50kg	1	17	B	A
	Multisystem Colour TV, PHILIPS 16"	1	145	B	A
	Multisystem Video Cassette Recorder, HITACHI VT38EM	1	225	B	A
	Typewriter, BROTHER ELECTRA 60 with transformer	1	173	A	A
	Paper Cutter	1	8	A	A
	Temperature Measuring Apparatus 2036A	8	760	C	A
	Temperature Measuring Apparatus 2036B	8	600	C	A
	Bottom Sampler, RIGOSHA Type B	1	217	A	B
	Bathythermograph, TSURUMI SEIKKI 2045A	2	1,751	C	A
	Thermometer Reader, RIGOSHA No. 2041	10	90	C	A
	Inductive Salinometer, WATANABE KEIKI	1	2,100	B	A
	Winch (Sounding Machine), RIGOSHA 2000	2	1,000	D4	A
	Doublebeam Spectrophotometer, SHIMAZU	1	1,876	A	A
	Flash Light for Camera, METZ 30BCT4	1	11	破損・廃棄	
	Camera, NIKON FG20	1	48	B	A
	Microscope, NIKON SMZ 10-3 with recorder	3	1,290	A	A
	Binocular, NIKON FP-W/Scope	1	110	A	A
	Motorcycle, HONDA 70	1	195	A	A
	Mini-type Fish Finder, KODEN SB-6000 200kHz	2	190	B	A
	Fish Finder, KODEN CVS-8805	1	1,200	B	A
	Syncro Cheker, TS 001	2	152	B	A
	Echo Sounder, JRC NJA-550M11	1	450	B	A
	Precision Echo Sounder, KAIJO DENKI PS-10E	1	1,811	C	A
	Auto Level, NIKON AE-5 28X	1	152	B	A
	Radio Telephon, JRA JSB-56 with antenna	3	5,100	A	A
	Precision Marine Sextants, TAMAYA	1	108	C	A

供与 年度	機 材 名	数量	金額 (1000¥) (10M\$)	利用 状況	管理 状況
60	Survey Rod for Transit	5	10	A	A
	Two Face Reading Rod for Taransit Survey	5	13	B	A
	Fibron Measure	1	6	B	A
	Gyro Compass (Water Compass), TOKYO KEIKI	1	2,000	A	A
	Repeater Compass, TOKYO KEIKI TKC-BB	1	330	A	A
	Repeater Compass, Stand, TOKYO KEIKI TKC-BH	1	430	A	A
	Color Radar, KODEN MDC-430 AS with accessories	1	1,600	A	A
	Vessel, YANMAR with fishing gears and equipments	1	48,207	A	A
	60年度 計			7,046¥ 65,715\$	
61	Omega Receiver for Research, KODEN OR-160/167	3	8,100	寄贈品	A A
	Rubidium Frequency Standard, NEC RB-1007	1	2,250		A A
	Recorder, YOKOGAWA/HOKUSHIN ER-180	1	300		A A
	Automatic Voltage Regulator, MATSUNAGA AT-105	1	250		A A
	Glinometer for Sounding Wire, RIGOSHA 2005	3	169		A A
	Noninterruption Power Supply, FKB-US 152A	1			A A
	Automatic Squid Jigging Machine, TOWA DENKI	1	800	寄贈品	C A
	Minibus, MERCEDES BENZ 0309D/35	1	4,351		A A
	8mm Video Camera, SONY CCD-M8EK	1	245		
	Underwater Housing, SONY KRM-M8	1	135		
	Underwater Video Light, SONY HVL-80D	1	72		
	8mm Video Deck, SONY EV-S700	1	247		
	TV Set, SONY KV-21 VX-DMT	1	176		
	8mm Video Carrying Case, SONY	1	3		
	Filter Holder, TOYO ROSHI 47mm	2	49		A A
	Filtering Bottle, RIGOSHA IL	2	15		B A
	Plankton Sample Divider	2	16		B A
	Flowmeter for Plankton Net, RIGOSHA	4	150	142	A A
	Plankton Net, RIGOSHA NCG54	1	25		A A
	Plankton Net (CORPACK CG54), RIGOSHA	2	100		A A
Plankton Net NXX13, RIGOSHA	1	360		A A	
Plankton Net (CONCO Net), RIGOSHA 500 um	2	1,120		A B	

供与 年度	機 材 名	数量	金額 (1000¥) (10M\$)	利用 状況	管理 状況
61	Plankton Net (KITAHARA'S), RIGOSHA	2	100	A	A
	Release Mechanism for Plankton Net, RIGOSHA	1	20	D	A
	Forel Standard Water Colour Set, RIGOSHA	2	20	B	A
	Underway Bucket for Surface Water, RIGOSHA	1	18	海中粉失	
	Liquid Scintillation Counter, WALLAC RACBATE with accessories	1	9,359	C	A
	ATP Lumination System, TURNER with accessories	1	2,790	C	A
	Current Meter, RIGOSHA CC-1	2	1,741	A	B
	Electric Current Meter, CM-2	1	1,762	A	B
	Submarine Illuminometer, ISHIKAWA IU-2B	1	900	B	A
	Stainless Steel Pump, WALHATY 3 Hp	2	866	B	B
	Rectangular Fibreglass Tank, UNIVERSAL TRADING	24	876	A	A
	S.C.T. Meter, YSI	1	258	D2	B
	Nitrate Nitrogen Column	3	110	A	B
	Spectrophotometer, SPECTRA 20	1	296	A	A
	Ice Machine, UEE 50-35	1	925	A	A
	Strain Amplifier, YOKOGAWA 3134-01-9	2	442	B	A
	Underwater Tension Meter, PR-0520 KG	1	584	63年海中粉失	
	Underwater Tension Meter, PR-0550 KG	1	584	B	A
	Personal Computer, NEC PCS801-VM2E-2	1	550	B	A
	Display, NEC APC-H 1310	1	126	B	A
	Color Printer, NEC PC-PR201E2	1	443	B	A
	Voltage Regulator, MATSUNAGA	1	350	B	A
	Analogue-Digital Converter	1	160	B	A
	Digitizer with transformer	1	190	B	A
	Cut Sheet Feeder, NEC PC-PR-201 HE	1	43	B	A
	Trinocular Bright Field Research Microscope, NIKON XF-31	1	1,104	A	A
	Fibre Optic Illuminator, NIKON	1	193	A	A
	Binocular Student Microscope, NIKON SE-D-B	13	2,542	A	A
	Microflex Photomicrography, NIKON UFX-II	1	598	D2	B
	Stereoscopic Zoom Microscope, NIKON SMZ-2B	15	4,892	A	A
	Trinocular Reserach Microscope, NIKON XF-21N	2	2,085	A	A
	Optiphot Trinocular Differential Interference Microscope, NIKON XF-NT	1	2,187	A	A

供与 年度	機 材 名	数量	金額 (1000¥) (10M\$)	利用 状況	管理 状況
6 1	Diaphot Inverted Microscope, NIKON TMD-2	1	1,705	A	A
	Inverted Microscope, NIKON TMS-PH-4	1	643	A	A
	Mini Copier, CANON CP-10	1	175	A	A
	Messenger, RIGOSHA	5	47	A	B
	Copy Stand	1	53	B	A
6 1年度 計			13,613¥ 45,199M\$		
6 2	Wave Recorder, NAKAMURA 3-CHANNEL	2	1,200	C	A
	Pen Recorder Labograph, KANOMAX 5164	1	157	A	A
	Salinity Refractometer, TANAKA SANJIRO S-100	1	24	A	A
	Pocket pH Meter, YOKOGAWA PH-81	1	85	A	A
	Rotary Shaker, IKA KS-500	1	504	A	A
	XY Plotter, J. J. LIOY PL	1	450	B	A
	Rotary Evaporator, TOKYO RIKAKIKAI N-1	1	430	D2	A
	Water Bath, TOKYO RIKAKIKAI SB-55	1	151	B	A
	Rotary Microtome, LEITS 1512 with knives	1	1,420	B	A
	Scanning Electron Microscope, HITACHI S-2300	1	19,505	B	A
	Cool Wter Recirculator, NESLAB GFT 33	1	715	B	A
	Polaroid Camera, 107	1	429	B	A
	Uninterruptable Power Supply, CEI ELECTRONICS UPS 7040	1	2,300	B	A
	Ion Sputter Coater HITACHI IB-2	1	1,104	B	A
	Critical Point Dryer, HITACHI HCP-2	1	1,178	D2	C
	Electric Typewriter, BROTHER AX-20	1	110	A	A
	Table for Typewriter	1	8	A	A
	Table for Copymachine	1	8	A	A
	Portable Cassette Recorder, SONY TCM 12	1	24	B	A
	Handy Copy Machine, PLUS	1	80	A	B
	Word Processor, FUJITSU OASYS with accessories	1	492	B	A
	Camera, OLYMPUS OM-2	1	110	B	A
	Flash, OLYMPUS OM-2	1	14	B	A
	Micronikor Lens, NIKON 105 mm	1	102	B	A

供与 年度	機 材 名	数量	金額 (1000¥) (10M\$)	利用 狀況	管理 狀況
6 2	Slide Duplicator, REYDAWN	1	15	B	A
	4WD Pick Up, TOYOTA HILUX	1	3,396	B	A
	Kam pac, US DIVER	10	130	B	A
	Regulator, US DIVER	10	630	B	A
	Scuba Tank, US DIVER	10	635	B	A
		6 2年度 計	2,162¥ 33,240M\$		
6 3	Echo Sounder, JRC NJA-550M11	1	130	B	A
	Hydraulic steering gear system, MORAL	1	610	A	A
	Profile Projector, NIKON with accessories	1	11,405	A	A
	Rectangular Fibreglass Tank	6	330	A	A
	Projection Lens 50X, NIKON	1	135	A	A
	Projection Lens 100X, NIKON	1	147	A	A
	Diabooster Lens for 50X/100X	1	34	A	A
	Polarographic Analyser System, EE & G 174-13	1	4,185	A	A
	Submergible Pump, EBARA 50DYC S.4 CS	1	259	A	A
	Homogenizer System		495		
	Fume Hood	1	1,580		
	Microcomputer	2	685		
	Underwater Camera	1	489		
	Omega Receiver Cum. Sat. Nav.	1	4,058		
	Net Cages	1	496		
Underwater Communication	1	2,023			
		6 3年度 計	740¥ 26,321M\$		

平成元年度分本部調達

JAPAN INTERNATIONAL COOPERATION AGENCY

P.O.Box 216, Mitsui Bldg., Shinjuku-ku, Tokyo, Japan.

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Nos.	Description of Goods	Quantity	Unit Price	Amount
1.	MTD NET, MESH500micron	2	100,000	200,000
2.	NOLPACK NET, MESH200micron	2	43,000	86,000
3.	WATER SAMPLING BOTTLE	4	7,500	30,000
4.	INFRARED LAMP, 375N-110V	1		2,400
5.	SPOT LIGHT, 450W-110V	2	2,000	4,000
6.	INCANDESCENT BULB, PS, 500W-110V	24	1,200	28,800
7.	UNDERWATER LAMP, PS, 300W-110V	12	1,300	15,600
8.	RECORDING PAPER FOR J-6	30	1,800	54,000
9.	TRANSFORMER	2	55,000	110,000
10.	PIRANI GAUGE, R433004	1		9,600
11.	PHOTOMUCTIPLIER TUBE, R-268	1		78,000
12.	HOLDER FOR EVAPORATOR, 533-2277	1		10,000
13.	FIXED APERTUREIIST CONDENSER, 533-1101	1		6,400
14.	APERTURE, 531-4245	1		15,000
15.	FLLAMENT, 777-0179, 10PCS/CASE	4	22,000	88,000
16.	SCINTILLATOR, 533-0286	1		62,000
17.	DP OIL, 532-0292	1		8,300
18.	RP OIL, G469023	1		6,600
19.	O-RING, L456529, 5PCS/CASE	1		400
20.	O-RING, L456464, 5PCS/CASE	1		200
21.	O-RING, L456008	1		200
22.	O-RING, L456459, 5PCS/CASE	1		200
23.	O-RING, L456015, 5PCS/CASE	1		200
24.	O-RING, L456547, 5PCS/CASE	1		1,500
25.	O-RING, L456515, 5PCS/CASE	1		300
26.	O-RING, L456463, 5PCS/CASE	1		200

JAPAN INTERNATIONAL COOPERATION AGENCY
P.O.Box 216, Mitsui Bldg., Shinjuku-ku, Tokyo, Japan.

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Nos.	Description of Goods	Quantity	Unit Price	Amount
27.	O-RING, L456764, 5PCS/CASE	1		750
28.	O-RING, L456028, 5PCS/CASE	1		300
29.	O-RING, L456004, 5PCS/CASE	1		200
30.	DP HEATER, 531-1437	1		29,000
31.	HUSE, J821030, 5A, 5PCS/CASE	1		200
32.	HUSE, J821026, 1A, 5PCS/CASE	1		200
33.	HUSE, J821027, 2A, 5PCS/CASE	1		200
34.	HUSE, J821028, 3A, 5PCS/CASE	1		200
35.	HUSE, J821025, 0.5A, 5PCS/CASE	1		200
36.	HELISERT, 42 47E-1115	1		500
37.	HELISERT, 15 47E-1117	1		700
38.	APERTURE OBT, 531-0991	1		10,000
39.	HOLDER, 531-1501	1		5,200
40.	APERTURE PLATE, 533-1001	1		24,000
41.	WEHNELT, 531-4377	1		29,000
42.	FLASKS, 100ML	17	13,000	221,000
43.	MEMBRENE FILTER, D-3749	10	10,000	100,000
44.	CARTRIDGE, D-0835	3	18,000	54,000
45.	CARTRIDGE, D-0803	3	17,500	52,500
46.	CARTRIDGE, D-0809	6	18,000	108,000
47.	CADMIUM, 500G, 0.3-1.5M/M	2	35,000	70,200
48.	Catalysis for Total Carbon Analysis, 638-92069	1		10,000
49.	I.C Feeler, 638-92071	1		12,000
50.	Catalysis for High Sensitivity Total Carbon Analysis, 638-92070	1		40,000
51.	Soda Lime, 630-0056	1		1,200

JAPAN INTERNATIONAL COOPERATION AGENCY

P.O.Box 216, Mitsui Bldg., Shinjuku-ku, Tokyo, Japan.

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Nos.	Description of Goods	Quantity	Unit Price	Amount
52.	MICRO SYRINGE, 630-00561-02	3	13,000	39,000
53.	AIR CYLINDER, 630-00960	1		110,000
54.	TUBING, 200-54520	10	3,800	38,000
55.	HEAT PAPER, 200-91522-01	10	2,100	21,000
56.	GLASS REACTION CONTAINER, 200-93018	5	5,100	25,500
57.	RUBBER PLUG, 204-21989	2	1,900	3,800
58.	CATHOD LAMP Ca, K, Pb EACH 1	1		110,000
59.	HUSE, 6A, 001-42-361K	2	1,500	3,000
60.	SODIUM FILTER, 589.6NM, 989-05-137M	1		30,000
61.	KALIUM FILTER, 768NM, 989-05-138M	1		30,000
62.	CALCIUM FILTER, 620NM, 400-16-004N	1		45,000
63.	BARIUM FILTER, 520NM, 400-16-005P	1		45,000
64.	REAGENT, SODIUM, 001-56-1204	1		14,000
65.	REAGENT, KALIUM, 001-56-121J	1		14,000
66.	REAGENT, LITHIUM, 001-56-122K	1		15,000
67.	REAGENT, CALCIUM, 001-56-123L	1		14,000
68.	REAGENT, BARIUM, 001-56-124M	1		14,000
69.	PRINTER, HR20, WITH SHEET FEEDER, CF-150	1		200,000
70.	TUNGSTEN LAMP FOR NIKON MICROSCOPE	10	1,000	10,000
71.	REAGENT FOR ELECTROPHORESIS BNAD+NO. 139-21 B-NICOTINE-AMIDE ADENINE DINUCLEOTIDE 1g	5	4,500	22,500
72.	Phenazine Methosulfate 1g	5	2,400	12,000
73.	D-FRUCTOSE 6-PHOSphate 1g	5	5,100	25,500
74.	D-GLUCOSE 6-PHOSphate 1g	5	2,000	10,000
75.	NADP (TPN) 1g	5	12,000	60,000
76.	D-GLUCOSE 1-PHOSphate DISODIUM SALT 25g	5	15,000	75,000

JAPAN INTERNATIONAL COOPERATION AGENCY
P.O.Box 216, Mitsui Bldg., Shinjuku-ku, Tokyo, Japan.

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Nos.	Description of Goods	Quantity	Unit Price	Amount
77.	DL-ISOCITRIC ACID TRISODIUM SALT 5g	5	9,000	45,000
78.	L-LEDCYL B-NAPHTHYLAMIDE HYDROCHLORIDE 1g	5	4,810	24,050
79.	1-NAPHTHYLPH ACID 5g	25	3,400	85,000
80.	B-NAPHTHLAMIDE 25g	5	5,000	25,000
81.	KINRAN	50	1,980	99,000
82.	TEST TUBE, UNIVERSAL, FOR 21D	2	5,000	10,000
83.	TUNGSTEN LAMP, 340-1000NM, for 21D	2	12,000	24,000
84.	GLASS CELL FOR SPECTROPHOTOMETER 21D, 1a	4PCS/CASE	28,000	16,000
85.	TUNGSTEN LAMP FOR SPECTROPHOTOMETER, 340-1000NM	2	17,500	35,000
86.	BOD ELECTRODE, 230V, 50/60Hz	1		120,000
87.	OXYGEN ELECTRODE, NO.5739	1		68,000
88.	CALBE, 230V, 50/60Hz	1		48,000
89.	MEMBRANE, POTASSIUM CHLORIDE KIT	5	5,000	25,000
90.	REAGENT FOR NH ₄ -N, A-50ML, B-50ML	A 30 B 30	3,500 3,500	105,000 105,000
91.	REAGENT FOR NO ₂ -N, 100ML	32	7,500	240,000
92.	REAGENT FOR NO ₃ -N, 500ML	12	14,000	168,000
93.	REAGENT FOR PO ₄ -P	A 10 B 10	3,500 3,500	35,000 35,000
94.	SAMPLING CELL FOR HC-100, 10PCS.	12	1,000	12,000
95.	PIPET, SM-IN & AM-5M EACH 5PCS	10	19,500	195,000
96.	TIP, 5ML & 1ML EACH 5PCS, 10PCS/CASE	10	1,500	15,000
97.	TRANSFORMER FOR HC-1000, AC-240V	25	15,100	377,500
98.	PORTABLE COMPRESSOR, DC12V	1		75,000
99.	CADMIUM FOR NITRATE ANALYSIS GRAIN SIZE: 0.5-2.0m/m 100g	6	10,000	60,000
100.	OXYGEN ELECTRODE, NO.5739, FOR DO METER YS157	1		68,000

JAPAN INTERNATIONAL COOPERATION AGENCY
P.O.Box 216, Mitsui Bldg., Shinjuku-ku, Tokyo, Japan.

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Nos.	Description of Goods	Quantity	Unit Price	Amount
101.	PHOTOTUBE, INFRARED PHOTOTUBE SPECTROMETER SPECTRONIC 20, (340-600nm 2PCS. 600-900nm 2PCS	4	10,300	41,200
102.	RED FILTER for ABOVE	2	4,000	8,000
103.	TYGON TUBING for Pump ϕ 0.8m/m TYPEC 200m ϕ 1.59m/mTYPEE 200m	1		114,000
104.	STIRRER for FOOD, MS-40	1		520,000
105.	HANDY REFRIGERATOR CASE, MRFT-530	1		90,000
106.	INCUBATOR FOR LOW TEMPERATURE, IS-2200, WITH TRANSFORMER	1		360,000
107.	PH ELECTRODE, OUTLET-TYPE CG-280-BNC (1W-022)	1		6,500
108.	COLMN for CHROMATOGRAPHY 3.9x150m/m NOBAPACK, C-18	1		72,000
	Total			<u>¥5,900,000</u>

平成元年度分現地調達

EPSON PC J1 Computer	8 units	36,204 ^{8.0}
EPSON PC AX Computer	2 units	17,627 ^{2.0}
EPSON LX-800 Dot Matrix Printer	2 units	1,218 ^{1.0}
HP Laser Jet Sivies II 220/240 Printer		7,752 ^{6.0}
" 1 Mbyte Memory Board		1,412 ^{2.0}
Nikon Stereoscopic Microscope		5,433 ^{0.0}
Model SMZ-2T-b (220-290V)		
Nikon Fibet Optics Ring Illuminator		4,043 ^{0.0}
Auxialiary Len 0.5×c/w Extension Pillar		425 ^{0.0}
Nikon Profile Projector V-10		19,750 ^{0.0}
(with Micrometer stage and 6 Lens)		
Materials for Hachery		5,000 ^{0.0}
Canon Copier PC-7		3,495 ^{0.0}
books (40冊)		7,977 ^{8.8}
UNDERWATER ULTRAXONIC COMMUNICATION SISTEM		14,284 ^{1.0}
RICH FAY 20		4,500 ^{0.0}

129,123^{4.8}

8. 經濟評估報告書

Report
for
Evaluation Survey for the Project
for the Development of The Faculty of
Fisheries and Marine Science,
Universiti Pertanian Malaysia

1989, March

MAIN REPORT

- 5 - 2 Indirect Economic Benefits
- 7 - Socio-Economic Problems to be Solved

BACKGROUND OF THE PROJECT

- 1 National Development Plan and Fisheries Administration
 - (1) Fifth Malaysia Plan
 - (2) Fisheries development plan
 - (3) Fisheries administration
- 2 Fisheries Economy of Malaysia
 - (1) Role of fisheries in the national economy
 - (2) Fisheries production
 - (3) Foreign trade of fishery commodities
- 3 Research, Education and Training of Fisheries
 - (1) Fisheries research
 - (2) Fisheries education
 - (3) Fisheries training
- 4 Fisheries Labour Market

PRESENT SITUATION OF FACULTY OF FISHERIES & MARINE SCIENCE OF UPM

- 1 General Information on UPM
 - (1) History, philosophy and objectives
 - (2) Faculty and courses
- 2 Education System of FFMS
 - (1) History and objectives
 - (2) Location and organization
 - (3) Programmes/courses
- 3 Analysis of Questionnaire to Students
- 4 Placement of Graduates of FFMS
- 5 Budget of FFMS
- 6 International Corporation to FFMS

Methodology of analysis

The main target of the Project, without direct intension to attain the economic effects, is to improve the levels of research and education of FFMS through technical transfer of Japanese experts, training of counterparts in Japan, provision of equipment, making textbooks, and curriculum development. But as shown in 'Philosophy of UPM', the social mission of FFMS is committed to the trilogy of function, namely, instruction, research and extention as its contribution to disseminating modern and scientific agricultural practices to the agriculture, forestry and fisheries of Malaysia. The graduates are expected not only to be technically competent, but also intellectually and culturally developed and capable of assuming roles of leadership in the society. Therefore it is necessary to examine not only the results in the fields of research and education but also its contribution to the development of the fisheries and the national economy.

Being the technical corporation in its essence, the Project comprises despach of fairely many long- and short-term experts and a lot of equipment as a project type corporation. Although the form of the corporation is a grant, it has the scale as capital expenditure. The effects of the assistance must be evaluated using quantitative criterion. The cost-benefit analysis, which is the established method for analysing the efficiency of projects, is adopedet as a method to evaluate the Project. Methodology of the anlysis is as follows:

Cost of equipment provided by JICA, budget of FFMS including project funds and education cost paid by students is calculated as the economic costs. Considering the nature of the Project as a social project, expenditure of JICA for dispatching experts and training

counterparts in Japan are excluded as the sunk cost, since they were offered in the form of a grant. By the same reason, project funds offered by foreign countries are also excluded as the sunk cost. Although the form of assistance of providing equipment is also a grant, equipment cost is calculated as capital expenditure of the economic costs, because in case the sum of fund is expended to another project in Malaysia, it may cause a kind of opportunity cost by sacrificing the benefits derived from the Project. The formal budget of FFMS includes expenditures paid apart from the Project. However, the whole budget is calculated as the economic costs, since it is impossible to distinguish the pure contribution of the local cost paid for the Project to research and education of FFMS from the another part of the fund. Through this cost calculation the total costs for improving the levels of research and education including the cost of the Project are analysed.

The main benefits of the project are knowledge and technology embodied in the brain of the teaching staffs, so that the benefits cannot be measured using quantitative criteria in an economic sense. The economic benefits derived from the Project cannot but evaluate indirectly through estimating the contribution of the students to the development of the fisheries after their graduation. In the past Malaysian students had to go to a foreign country to have the higher level of education in the field of the fisheries. After implementing the Project many human resources can be developed locally and then education cost studying in a foreign country can be saved. Therefore the increase of the fisheries productivity, which is expected in case the graduates may be engaged in the fisheries, and the sum of saving education cost, which is expected in case the graduates students may be educated locally, are estimated as the indirect economic benefits of the Project. In case the graduates are engaged in industries other than

the fisheries, the increase of personal income as a result of the education in the university is accounted as a economic benefit.

There are three criteria for evaluating the result of the cost-benefit analysis, i.e. the Benefit-Cost ratio (B/C), the Economic Internal Rate of Return (EIRR) and the Net Present Value (NPV). The main benefits of the Project being non-monetary do not have a target in an entrepreneurial sense, so that NPV is used as the analysing criterion. A discounting factor must be set as a pre-requisite of calculating NPV. Because the nature of the Project can be classified as a social project, the discounting factor is set at a lower rate of 5%. The project life of the Project is set at 16 years, i.e. from 1984/85 to 1999/2000, considering the durable length of time of the equipment and the target year of the Fisheries Development Plan of DOF.

Economic evaluation of the Project

According to the methodology mentioned above the results of the economic calculation through the whole project life of 16 years are as below: NPV is $\$40.5$ million, while the present value of the economic costs is $\$79.9$ million and that of the economic benefits is \$117.3 million. These figures mean that the fisheries productivity will increase and there will be positive effects on the national economy through improving the quality of research & education, and improving the levels of knowledge & technology of the graduates by implementing the Project.

But it must be noted that the certain pre-requisites must be fulfilled to attain these economic benefits. Namely as to the economic costs, and among the economic benefits the increase of personal income & the saving of education cost in a foreign country, fairly objective data can be obtained, but creditability of the data on the increase of the fisheries productivity is mainly depends on the performance of the

graduates in the fisheries labour market. In this economic calculation it is supposed that during 1987/88-1991/92 the employment rate of them in the fisheries labour market will rise drastically from 17% to 60%, while the employment rate in the government offices will lower from 33% to 15% and the un-employment rate from 40% to 10%. Increase of the fisheries production and enlargement of the fisheries labour market are needed for fulfilling these pre-requisite.

The conclusion derived from this economic analysis is as below. For attaining sufficient economic benefits from the Project it is necessary that the fisheries labour market will enlarge through the development of the fishing industry, while the fishing productivity will increase through the graduates being engaged in the fisheries. In case these relations will not arise spontaneously, then it will be required to take policy measures for encouraging the fisheries or to form new projects in the directly productive fields in fisheries. In short improvement of socio-economic conditions around the Project is the key factor for attaining its mission.

Table 5 - I Flows of economic costs and economic benefits

(\$'000)

	Economic costs				Economic benefits				Present value			
	Equipment cost	Budget of FFNS	Education cost	Total	Increase of prod.	Increase of income	Saving edu. cost	Total	Discount factor(SX)	Economic costs	Economic benefits	N.P.V
	1984/85	262.5	3,498.0	484.2	4,344.7	138.2	241.9	240.8	620.9	1.000	4,344.7	620.9
1985/86	1,373.0	4,132.8	504.8	6,010.6	345.6	551.9	481.7	1,379.2	0.952	5,722.1	1,313.0	-4,409.1
1986/87	12,275.2	4,132.8	102.5	16,510.5	645.2	1,050.8	401.4	2,097.4	0.907	14,975.0	1,902.3	-13,072.7
1987/88	856.2	4,261.4	579.2	5,696.8	921.6	1,489.3	602.1	3,013.0	0.864	4,950.5	2,618.3	-2,332.2
1988/89	639.6	4,421.4	700.2	5,761.2	1,520.0	1,980.7	602.1	4,103.4	0.823	4,741.5	4,103.4	-638.1
1989/90		4,484.7	842.4	5,357.1	2,073.6	2,313.4	602.1	4,989.1	0.784	4,200.0	4,989.1	789.1
1990/91		4,765.0	1,063.0	5,828.0	3,410.0	2,857.7	602.1	6,869.9	0.746	4,347.7	5,124.9	777.2
1991/92		4,814.8	904.2	5,719.0	5,391.4	3,303.7	602.1	9,297.2	0.711	4,066.2	6,610.3	2,544.1
1992/93		4,952.7	904.2	5,856.9	7,312.8	3,749.8	602.1	11,664.7	0.677	3,965.1	7,837.0	3,931.9
1993/94		5,118.0	904.2	6,022.2	9,354.2	4,195.8	602.1	14,152.1	0.645	3,884.3	9,128.1	5,243.8
1994/95		5,276.7	904.2	6,180.9	11,335.6	4,641.8	602.1	16,579.5	0.614	3,795.1	10,179.8	6,384.7
1995/96		5,440.1	904.2	6,344.3	13,317.2	5,087.9	602.1	19,007.2	0.585	3,711.4	11,119.2	7,407.8
1996/97		5,608.9	904.2	6,512.1	15,298.0	5,533.9	602.1	21,434.6	0.557	3,627.2	11,939.1	8,311.9
1997/98		5,782.8	904.2	6,687.0	17,280.0	5,980.0	602.1	23,862.1	0.530	3,544.1	12,646.9	9,102.8
1998/99		5,962.0	904.2	6,866.2	19,261.4	6,426.0	602.1	26,289.5	0.505	3,467.7	13,276.2	9,808.5
1999/00		6,146.9	904.2	7,051.1	21,242.8	6,872.0	602.1	28,115.1	0.481	3,391.6	13,812.4	10,420.8
Total	4,405.5	78,739.0	13,336.8	106,749.4	103,128.4	56,266.6	8,951.2	168,346.2		76,734.2	117,280.9	40,546.7

Table 5 - 2 Cost of equipment provided by JICA

	Equipment purchased in Japan			Equip. Purchased in Malay	Total
	Yen '000	Ex. rate	\$ '000	\$ '000	\$ '000
- 1984/85	23,776	0.0097	230.6	31.9	262.5
1985/85	12,710	0.0121	153.8	1,219.2	1,373.0
1986/87	15,695	0.0163	255.8	1,018.4	1,274.2
1987/88	2,162	0.0203	43.9	812.3	856.2
1988/89	2,425	0.0200	48.5	591.1	639.6
1989/90					
1990/91					
1991/92					
1992/93					
1993/94					
1994/95					
1995/96					
1996/97					
1997/98					
1998/99					
1999/00					
Total	56,768		732.6	3,673.2	4,405.5

Table 5 - 3 Budget of FFMS of UPM
(Unit: S'000)

	Formal budget of FFMS	Project funds	Total
1984/85	3,047.0	451.0	3,498.0
1985/85	3,600.0	532.8	4,132.8
1986/87	3,600.0	532.8	4,132.8
1987/88	3,712.0	549.4	4,261.4
1988/89	3,827.0	594.4	4,421.4
1989/90	3,945.7	539.0	4,484.7
1990/91	4,068.0	697.0	4,765.0
1991/92	4,194.1	620.7	4,814.8
1992/93	4,314.2	638.5	4,952.7
1993/94	4,458.2	659.8	5,118.0
1994/95	4,596.4	680.3	5,276.7
1995/96	4,738.8	701.3	5,440.1
1996/97	4,885.8	723.1	5,608.9
1997/98	5,037.3	745.5	5,782.8
1998/99	5,193.4	768.6	5,962.0
1999/00	5,354.4	792.5	6,146.9
Total	68,572.3	10,215.7	78,799.0

Table 5-4 Education cost of students

(Unit: S'000)

	Diploma	Degree	Post-graduate	Total/semester	Total/year
1984/85	129.3	106.3	6.3	242.2	484.4
1985/86	137.6	102.3	12.5	252.4	504.8
1986/87	157.2	92.5	10.4	512.5	1025.0
1987/88	196.2	77.7	15.7	289.6	579.2
1988/89	240.9	93.5	15.7	350.1	700.2
1989/90	285.5	120.0	15.7	421.2	842.4
1990/91	279.0	136.8	15.7	531.5	1,063.0
1991/92	279.0	157.4	15.7	452.1	904.2
1992/93	279.0	157.4	15.7	452.1	904.2
1993/94	279.0	157.4	15.7	452.1	904.2
1994/95	279.0	157.4	15.7	452.1	904.2
1995/96	279.0	157.4	15.7	452.1	904.2
1996/97	279.0	157.4	15.7	452.1	904.2
1997/98	279.0	157.4	15.7	452.1	904.2
1998/99	279.0	157.4	15.7	452.1	904.2
1999/00	279.0	157.4	15.7	452.1	904.2
Total	4,146.7	2,145.7	233.3	6,668.4	13,336.8

Table 5 - 5 Increase of fisheries productivity and non-fisheriers income

	Fisheries			Non-fisheries		
	No. of graduate	Accumulation	Prod. \$'000	No. of Graduate	Accumulation	Income \$'000
1984/85	6	6	138.2	3 2	3 2	241.9
1985/85	9	1 5	345.6	4 1	7 3	551.9
1986/87	1 3	2 8	645.2	6 6	1 3 9	1,050.8
1987/88	1 2	4 0	921.6	5 8	1 9 7	1,489.3
1988/89	2 2	6 6	1,520.6	6 5	2 6 2	1,980.7
1989/90	2 4	9 0	2,073.6	4 4	3 0 6	2,313.4
1990/91	5 8	1 4 8	3,410.0	7 2	3 7 8	2,857.7
1991/92	8 6	2 3 4	5,391.4	5 9	4 3 7	3,303.7
1992/93	8 6	3 2 0	7,312.8	5 9	4 9 6	3,749.8
1993/94	8 6	4 0 6	9,354.2	5 9	5 5 5	4,195.8
1994/95	8 6	4 9 2	11,335.6	5 9	6 1 4	4,641.8
1995/96	8 6	5 7 8	13,317.2	5 9	6 7 3	5,087.9
1996/97	8 6	6 6 4	15,298.6	5 9	7 3 2	5,533.9
1997/98	8 6	7 5 0	17,280.0	5 9	7 9 1	5,980.0
1998/99	8 6	8 3 6	19,261.4	5 9	8 5 0	6,426.0
1999/00	8 6	9 2 2	21,242.8	5 9	9 0 9	6,872.0
Total	9 1 8	5 5 9 5	103128.4	9 0 7	7 4 4 4	56,266.6

Remark: Increase of per capita fisheries productivity

: \$1,920/month × 12 = \$23,040/year

Increase of per capita income

: \$630/month × 12 = \$7,560/year

Table 5 - 6 Saving of education cost
(Unit: \$'000)

	No. of post -graduate	Education cost
1984/85	6	240.8
1985/86	1 2	481.7
1986/87	1 0	401.4
1987/88	1 5	602.1
1988/89	1 5	602.1
1989/90	1 5	602.1
1990/91	1 5	602.1
1991/92	1 5	602.1
1992/93	1 5	602.1
1993/94	1 5	602.1
1994/95	1 5	602.1
1995/96	1 5	602.1
1996/97	1 5	602.1
1997/98	1 5	602.1
1998/99	1 5	602.1
1999/00	1 5	602.1
Total	2 2 3	8,951.2

Remark: School expences £4,840/year

Living cost £340/month × 12 = £4,080

Total cost £8,920 = \$40,140. (£1.00 = \$4.50)

7 - □ Socio-Economic Problems to be Solved

As a result of implementing the project-type corporation by JICA from 1984/85 to 1988/89, research and education system of FFMS has strengthened through technical transfer from experts, training of counter-parts in Japan, provision of equipment and development of curriculum & textbooks. Therefore higher level of education can be offered to students studying in FFMS and their worthiness as human resources was doubled. In this sense FFMS has already constructed efficient education system in a certain extent that can meet the social needs of for human resources in fisheries.

During 1980's fisheries has been stagnating, so that it could not exploit its vast potentials for development. The main reasons of its stagnation are as below: exhaustion of fish resources along the coastal area, lack of capital & technology, shortage of human resources, un-efficiency of fish marketing system, and disuse of vast area of water surface conducive for aquaculture. Among these reasons shortage of human resources with high levels of knowledge and technology on fisheries has been very serious. By the influence of lasting stagnation of the coastal fishing there has been a surplus of the number of fishermen engaged in traditional fisheries, while human resources that is needed for encouraging the modern and capital-intensive fishing industry such as deep-sea fishing and aquaculture are in shortage. Coping with decline of traditional coastal fishing, it is necessary to encourage deep-sea fishing and aquaculture for developing fisheries of Malaysia and the crucial factor for its development is securing human resources with high levels of knowledge and technology.

FFMS has already supplied several hundreds of graduates to the society as human resources needed for the development of fisheries. In short it can be concluded that FFMS has already attained its mission

of fostering human resources. However, Percentage of the employed among the graduates is only 60% and that of the un-employed is 40%. Among the employed about one half of them had gotten jobs in the government offices, mainly in DOF and LKIM, and about only 30% of them were engaged in private fishing companies. Because of decline of fisheries of Malaysia and narrowness of the fisheries labour market, educated human resources cannot be fully exploited, while the development of fisheries is restricted by shortage of capable human resources. As a result of the vicious circle, valuable human resources have been exhausted.

It is necessary to enlarge the fisheries labour market by vitalizing investment activities in private sector for cutting off the vicious circle. However, if new investment or additional investment in the fishing industry is not sufficient, this problem must be solved by taking policy measures. Although the government has already taken measures to encourage the fishing industry, the results is not satisfactory.

Achievement of the Project is restricted mainly by the socio-economic factors. The government endeavors to increase the fisheries production, but there are still many difficulties to overcome. As further steps of the Project, new project formation in the directly productive fields such as deep-fishing, aquaculture, fish marketing, processing of marine products etc., is required to create chances of employment for human resources fostered by the Project.

BACKGROUND OF THE PROJECT

1 National Development Plan and Fisheries Administration

(1) Fifth Malaysia Plan

The average growth target of GDP during the Fifth Plan period, 1986-1990, is set at lower rate of 5.0%, in spite of the performance of the average growth rate of GDP during the Fourth Plan period, 1981-1985, being 5.8%. As the background of this moderate growth target, there is a pessimistic prospect for a trend of international economy during the latter half of 1980's, while Malaysia is highly dependent on export of primary commodities. The average growth target of GDP by industrial sector is as follows: primary sector 2.8%, secondary sector 6.3% and tertiary sector 6.3%. Among primary sector the average growth target of agricultural sub-sector is set at especially lower rate of 2.6%.

Allocation of public development expenditure for agriculture and rural development programmes during the Fifth Plan period is \$11,799.95 million, higher by 49.6% compared to that of during the Fourth Plan period \$7,888.20 million. While development expenditure for fisheries during the Fifth Plan period is \$263.35 million, lower by 12.7% compared to that of during the Fourth Plan period \$301.48 million. The budgetary allocation for fisheries means its lower priority in the national development plan.

Table I - 1 Gross domestic product by industry of origin, 1985 and 1990
(In 1978 constant prices)

(Unit: S million)

Industry	1985	Share of GDP (%)	1990	Share of GDP (%)	Average annual growth rate(%)	
					1981-85	1986-90
Primary	18,052	30.4	20,702	27.4	4.2	2.8
Agriculture, forestry, livestock, and fishing	12,046	20.3	13,713	18.1	3.4	2.6
Mining and quarrying	6,006	10.1	6,989	9.2	6.0	3.1
Secondary	14,405	24.3	19,509	25.8	5.5	6.3
Manufacturing	11,357	19.1	15,509	20.5	4.9	6.4
Construction	3,048	5.1	4,000	5.3	8.1	5.6
Tertiary	26,138	44.0	34,982	46.3	7.9	6.0
Electricity, gas, and water	988	1.7	1,513	2.0	9.1	8.9
Transport, storage, and communications	3,805	6.4	5,494	7.3	8.4	7.6
Wholesale and retail trade, hotels and restaurants	7,551	12.7	10,252	13.6	7.0	6.3
Finance, insurance, real estate, and business services	5,212	8.8	7,230	9.6	7.2	6.8
Government services	7,270	12.3	8,842	11.7	9.8	4.0
Other services	1,312	2.2	1,651	2.2	5.1	4.7
Less: Imputed bank service charges	1,675	-	2,224	-	-	-
Plus: Import duties	2,424	-	2,630	-	-	-
Gross Domestic Product at purchasers' value	59,344	-	75,599	-	5.8	5.0

Source: Fifth Malaysia Plan

Table 1 - 2 Allocation of public development expenditure for
agriculture and rural development programmes

(Unit: \$ million)

	Fourth Plan 1981-1985	Fifth Plan 1986-1990
Land and regional development	3,148.84	4,418.97
New land development	2,218.61	2,878.24
Regional development	930.23	1,540.73
In situ development	2,859.44	5,094.44
Integrated agricultural development projects	505.62	1,560.11
Drainage and irrigation	1,451.26	337.44
Replanting	398.61	1,909.97
Rehabilitation	503.95	1,286.92
Forestry	20.96	264.22
Fisheries	301.48	263.35
Livestock	135.46	185.23
Support services	1,111.60	1,273.35
Input subsidy for paddy	430.16	505.95
Agricultural credit, processing and machinery	606.27	743.27
Extension and other services	75.17	24.13
Other programmes of MOA	310.42	300.39
Total	7,888.20	11,799.95

Source: Fifth Malaysia Plan 1986-1990.

(2) Fisheries development plan

Marine fishing

The Malaysian government introduced Exclusive Economic Zone (EEZ) ACT, 1984, the Fisheries Act, 1985, and the territorial water usage policy to encourage marine fishing. During Fifth Plan period, further expansion in output of fish is forecast in the light of greater emphasis given to deep-sea fishing, faced with the diminishing marine fish resources along the coastal area. DOF focuses its research on deep-sea fishing, particularly to assess the resource potential in the EEZ. Towards this end, a research vessel is used to facilitate research to be taken jointly by local and foreign consultants. According to the long-term projection during the period 1986-2000, target of total fish production is set at 658,000 tonnes in 1990 and 805,000 tonnes in 2000. Conservation of fisheries stocks in marine parks is also planned at various location, such as Pulau Babi and Pulau Rau in Johor, Pulau Paya in Kedah, and Pulau Redang, Pulau Kapas, and pulau Tengah in Terengganu.

Aquaculture

During the period 1986-2000, it is anticipated that total investment of \$940 million will be required, the bulk of which is expected to come from the private sector. By 2000 aquaculture is anticipated to contribute as annual production of 205,520 tonnes for the domestic market and for export as well. The strategies of the government for achieving the production target of aquaculture are as below:

- a. To identify water and land resources for aquaculture development;
- b. To undertake research into fish nutrition and feeds, seed production, fish diseases and post harvest handling and processing;
- c. To promote and develop local and export markets for all aquaculture products;

- d. To upgrade extension and training services in all aspects of aquaculture to promote growth of the industry;
- e. To establish quality and disease control centre to ensure wider acceptability and demand of all aquaculture products;
- f. To provide financial incentives and credit facilities to encourage the industry;
- g. To promote private sector involvement in all aspects of commercial aquaculture.

Table 1 - 3 Marine fisheries & aquaculture productions for 1985
and projection for 1990 and 2000

(Unit: tonnes)

	Actual	Projection	
	1985	1990	2000
Marine fishing			
Total	574,354	608,000	805,000
Aquaculture			
Tiger prawn		8,442	22,000
Sea bass		1,450	3,960
Mussel		2,100	8,160
Cockle		106,000	148,400
Fresh water fish		17,940	23,070
Total	51,710	135,932	205,520

Source: Department of fisheries.

(3) Fisheries administration

The Ministry of Agriculture (MOA)

MOA implements its fisheries policies through the Department of Fisheries and the Fisheries Development Authority of Malaysia. For developing fisheries MOA is in charge of below items:

- a. Development of fishing port.
- b. Education facilities for fishermen.
- c. Fisheries administration and development of marine & fresh water fisheries; Fisheries Research Institute; fisheries schools; and fisheries statistics.
- d. Marine and Fresh Water Aquarium.
- e. Navigation aids for fishermen.

The Department of Fisheries (DOF)

DOF is responsible for the overall development and management of the fisheries and matters related to them. The objectives of DOF are to manage and regulate the exploitation of, and to develop other fisheries resources to achieve optimum production of fish and fish products to meet the country's food demand; and to increase the productivity and income level of the fishermen and fish farmers.

DOF consists of five divisions: administration & Finance Division, Planning & Development Division, Extension Division, Training - Division, Fisheries Research Division, and Fisheries Management & Conservation & Technology Division.

The Fisheries Development Authority of Malaysia (LKIM)

LKIM was established on 1st November, 1971 under Act 49, Lembaga Kemajuan Ikan Malaysia Act 1971. The objectives of LKIM are to upgrade the socio-economic status of fishermen, and to develop and improve the

nation's fishing industry. LKIM consists of eight divisions: Technical Division, Marine Fishing Development Division, Aquaculture Division, Fishermen Community Development Division, Administration Division, Finance Division, Marketing Division and Planning Division.

2 Fisheries Economy of Malaysia

(1) Role of fisheries in the national economy

The agricultural sector which includes forestry and fisheries plays an important role in the national economy. The contribution of the agricultural sector to GDP in 1978 constant prices is estimated at \$13.3 billion or 21.9% in 1987 compared to \$10.2 billion or 22.9% in 1980. In terms of employment, the sector provided 1.9 million jobs or 31.9% of the nation's employment in 1987 compared with 2.1 million jobs or 40.6% in 1980.

Performance of agricultural sub-sectors is contrasting. The production value of agriculture & livestock has increased, \$9,101 million in 1986 compared to \$6,828 million in 1980, that of forestry is stagnant, \$2,025 million in 1986 compared to \$1,966 million in 1980, and that of fisheries has decreased, \$1,263 million in 1986 compared to \$1,395 million. As a result of reduction of the production value of fisheries during 1980 and 1986, its importance of in the national economy as a industry has been contracting.

Table I - 4 Gross domestic product by industrial origin, 1980-1987
(In 1978 constant prices)

(Unit: \$ million)

	1980	1981	1982	1983	1984	1985	1986	1987
Agricultural sector	10,189	10,684	11,375	11,302	11,623	11,914	12,389	13,311
Agriculture & livestock	6,828	7,112	7,733	7,410	8,060	8,493	9,101	
Forestry	1,966	2,127	2,262	2,438	2,139	2,104	2,025	
Fisheries	1,395	1,445	1,380	1,456	1,423	1,317	1,263	
Mining & quarrying	4,487	4,289	4,617	5,342	6,073	5,985	6,439	6,442
Manufacturing	8,742	9,155	9,668	10,429	11,711	11,263	12,111	13,663
Construction	2,066	2,367	2,598	2,667	2,988	2,738	2,355	2,077
Electricity, gas & water	640	689	721	798	890	948	1,027	1,109
Transport, storage & communications	2,542	2,847	2,984	3,138	3,464	3,630	3,851	4,055
Wholesale & retail trade								
hotel and restaurants	5,383	5,694	6,104	6,583	7,107	8,911	6,147	6,423
Finance, insurance, real estate & business services	3,087	3,953	4,231	4,570	4,892	5,093	5,073	5,355
Government services	4,563	5,649	6,027	6,328	6,817	6,957	7,253	7,543
Other services	1,021	1,065	1,141	1,193	12,249	1,300	1,352	1,393
Less: Imputed bank service								
vice	854	877	1,152	1,397	1,595	1,834	1,891	2,175
Add: Import duties	2,046	2,087	2,116	2,429	2,522	2,245	1,759	1,660
GDP at market prices	44,512	47,602	50,430	53,582	57,741	57,150	57,859	60,846

Source: 'Economic Report, 1988/89', Ministry of Finance.

'Statistical Handbook, Agriculture, 1986', Ministry of Agriculture.

(2) Fisheries production

Marine fishing

During 1980-1988 the total landings of marine fish in Malaysia have been decreasing from 733,668 tonnes to 561,967 tonnes. As a result of the fast increase of production in Peninsula Malaysia, the total landings in 1987 was 859,443 tonnes, i.e. 52.9% more than that of in 1986. The average fish price in 1986 and 1987 was \$2,280 and \$1,330 respectively. The wholesale value of the landings in Peninsular Malaysia in 1987 was \$989 million, i.e. lower by 3.2% compared to that of in 1986, while the wholesale value of the total landings was \$1,343 million, i.e. higher by only 0.3% compared that of in 1986.

The landings in Peninsular Malaysia in 1987 were 741,000 tonnes, i.e. 86.2% of the total landings. The composition of fish according to the main fisheries is as follows: trawlers 390,000 tonnes (52.8%), purse seiners 163,000 tonnes (22.0%), and traditional fisheries 188,00 tonnes (25.4%). The main edible fish caught in Peninsular Malaysia is as follows: Indian Mackerel (9.4%), Round Scad (7.3%), anchovy (3.7%), sardine (3.6%), and tuna (3.4%).

Aquaculture

The aquaculture industry in Malaysia is relatively small. In 1987 the total aquaculture production is 46,200 tonnes valued at \$48.8 million. Cockle culture constitutes the main bulk (88.2%) of the total production. The aquaculture production constitutes only 5.1% of the total fish production. However, Malaysia's extensive seas, rivers, lakes mud-flats and mangrove swamps are conducive for culture of fish, prawns, mussels, oysters, crabs, cockles and other edible under water plants. Up to today, this vast economic potential has hardly been tapped except for cockle culture which has expanded in the recent years.

Table 1 - 5 Landings of marine fish & prawns, 1982-1987

(Unit: tonnes)

	Peninsular Malaysia	Sabah	Sarawak	Total
1 9 8 0	623,898	32,700	77,070	733,668
1 9 8 1	649,315	38,000	68,043	755,358
1 9 8 2	567,324	39,800	69,340	676,464
1 9 8 3	609,055	45,500	70,438	724,993
1 9 8 4	481,641	50,200	68,633	600,474
1 9 8 5	462,861	48,600	62,893	574,354
1 9 8 6	446,376	47,620	67,971	561,967
1 9 8 7	741,000	49,000	69,443	859,443

Source: 'Statistical Handbook, Agriculture, 1986', Ministry of Agriculture.

'Annual Fisheries Statistics, 1987', Department of Fisheries.

Table 1 - 6 The number of ponds, cages, areas and number of culturists in Peninsular Malaysia, 1986-1987

	Number		Area (ha)		No. of culturist	
	1986	1987	1986	1987	1986	1987
Brackishwater						
- Ponds	563	636	475.8	558.3	168	190
Cages	8,740	13,071	82,257	111,257	457	602
On-bottom culture (cockle)			(sq. m)	(sq. m)		
	80	160	4,445.7	4,187.0	210	163
Freshwater						
Ponds	15,388	13,057	2,594.3	2,196.9	11,497	9,179
Cages	596	656	8,101	6,353	71	80
Ex-mining pools			(sq. m)	(sq. m)		
	841	747	1,296.2	1,072.9	625	519

Source: 'Annual Fisheries Statistics, 1987', Department of Fisheries.

Table 1 - 7 Estimated landing of fish, cockle and mussels by culture system in Peninsular Malaysia, 1987

(Unit: tonnes)

	Ponds & ex-mining pool	cages	Cockles	Mussels	Total
Brakishwater	798.16	1,260.15	40,794.40	604.60	43,457.31
Freshwater	2,734.05	8.81	-	-	2,742.86
total	3,532.21	1,268.96	40,794.40	604.60	46,200.17

Source: 'Annual Fisheries Statistics, 1987', Department of Fisheries.

(3) Foreign trade of fishery commodities

Malaysia imported 245,217 tonnes (\$353 million) of fishery commodities in 1987. The distribution is as follows: Peninsular Malaysia 237,872 tonnes (\$332.6 million), Sabah 3,838 tonnes (\$10.6 million) and Sarawak 3,507 tonnes (\$9.8 million). In terms of exports, the quantity (value) of fishery commodities was 166,513 tonnes (\$445 million). The distribution is as follows: Peninsular Malaysia 155,433 tonnes (\$320.5), Sabah 7,259 tonnes (\$80.9 million) and Sarawak 3,821 tonnes (\$43.6 million). The trade surplus was \$92 million.

Imports of Peninsular Malaysia mainly came from Thailand (184,315 tonnes or \$182.1 million), Indonesia (19,744 tonnes or \$59.5 million) and Japan (1,316 tonnes or \$25.7 million). The main destination of Malaysia's fishery commodities exports were Singapore (98,073 tonnes or \$68.6 million), Japan (3,751 tonnes or \$52.4 million) and Thailand (32,542 tonnes or \$16.7 million).

Table I - 8. Import and export of fishery commodities

	I m p o r t		E x p o r t		Balance
	tonnes	S million	tonnes	S million	S million
1 9 8 5	230,309	309.6	156,863	220.5	-89.1
1 9 8 6	238,989	328.2	184,350	353.7	25.2
1 9 8 7	245,217	353.0	166,513	445.0	92.0

Source: 'Annual Fisheries Statistics, 1987', Department of Fisheries.

3 Research, Education and Training of Fisheries

(1) Fisheries research

Fisheries Research Institute (FRI)

FRI began in 1957 as small research station at Glugor, Penang with only few fisheries officers assigned to carry out research on marine fisheries, freshwater fish culture and fish technology. It was only 1972 that research activities of the Institute were organized under three sections, with Aquaculture being one of these sections but then being confined to coastal aquaculture. However, with the transfer of the Fresh Water Fish Water Culture Station at Batu Berendam, Malacca to the DOF in 1984, FRI is now responsible for all fisheries research including aquaculture research in all sectors of the aquatic environment, i.e. fresh water, brackishwater and seawater. FRI focuses its research on identifying new species of fish and prawns in relation to aquaculture development. Research in deep-sea fishing was especially undertaken in late 1985 to access fishing resources. The results are expected to facilitate and guide the future development of off-shore fishing.

Freshwater Fish Breeding Station (WARDI)

WARDI is located in Malacca and the type of works are freshwater fisheries research on breeding, nutrition & culture, technical training centre, and centre for consultation work on freshwater aquaculture.

Brackishwater Research Station (BRS)

BRS is located in Selang Patah, Johor and the type of works are research on marine prawn and finfish.

Government seed production centre

name of organization	location	kind of fish
Fisheries Research Institute	Penang	giant freshwater prawn
Fish breeding Station	Engor, Perak	carp
Fish Breeding Station	Jitra, Kedah	carp
Fish Breeding Station	Machang, Kelantan	snake-skin gourami
Fish Breeding Station	Bukit Tinggi, Pahang	carp
Fish Breeding Station	Kong-kong, Johor	carp
Fish Culture Experimental Station	Cameron Highland, Pahang	carp
Prawn Hatchery Station	Port Dickson, Negeri Sembilan	giant freshwater prawn

Universities

See section (2).

Private bodies

Apart from government organizations and universities, there are several private bodies undertaking research projects such as Equasian Sdn. Bhd. (aquacultural & environmental research and development), and Wan Mohamad and Khoo (undertaking consultancy services in aquaculture).

(2) Fisheries education

Universities

There are two universities which can offer high level education in the fields of fisheries and marine science, i.e. UNIVERSITI PERTANIAN MALAYSIA (UPM), Serdang, and UNIVERSITI SAINS MALAYSIA (USM), Pulau Pinang. UPM has the Faculty of Fisheries and Marine Science, and USM has few courses as to these subjects.

Others

PUO (Politeknik Ungku Omar) and ALM (Academi Lant Malaysia) provide a course in Marine Engineering.

(3) Fisheries training

Training Division of DOF is implementing training for fish culturists, marine fisheries training, and extension training.

Training for culturists

This programme of courses on fish culture is conducted at the Inland Fisheries Training Centre, Bukit Tinggi, Pahang; and Fish Breeding Stations in Machang, Kelantan, Enggor, Perak and Jitra, Kedah.

Marine fisheries training

This training is held at the Marine Fisheries Training Centres in Gelugor, Pulau Pinang, and in Seberang Tikar, Kuala Terengganu. Training is aimed at upgrading the skills of traditional fishermen to enable them to progress with new innovations in the fishing industry. Courses of three months duration are held three times annually. The courses cover the fields of care & maintenance of marine engines, navigation and gear technology.

Extension training

This form of training is given to fishermen who are not able to attend courses at the Marine Fisheries Training Centres. These courses are given in order to extend and propagate knowledge throughout the country and to give services and know-how in care & maintenance aspects of marine engines.

Table 1 - 9 Type of courses and numbers trained by DOF and LKIM,
1981-85

Agency	Training/extension	Staffs/ students	Farmers/ fishermen
DOF	Boat operation, basic helmsmanship and maintenance	77	397
	Management and harvesting technique in aquaculture	120	3,600
LKIM	Small-scali industries	50	98

Source: The Department of Fisheries.

4 Fisheries Labour Market

Scenario of Fifth Malaysia Plan

In accordance with the decline of marine fishing, the number of fishermen have also decreased during 1980's. Confronted with difficulties around the fisheries, Fifth Malaysia Plan foresees a pessimistic scenario for fisheries labour market as follows: 'In view of the depleting fisheries resources and excess fishermen estimated at 30,000 in Peninsular Malaysia, LKIM and DOF, with the assistance of other supporting agencies, will carry out a fishermen resettlement programme, this programme will involve relocating, in phases, the excess fishermen to FELDA schemes, estates, and other agricultural and non-agricultural activities, subsequent to undergoing appropriate training. The remaining fishermen will be trained and encouraged to engage in modern fishing as well as downstream activities, through the provision of credit and other support services'.

Present situation of the fisheries labour market

In 1987 the fishing labour force of 91,319 persons constitutes about 1.6% of the total labour force in Malaysia (5.7 million). The fishing labour force has dropped by 1.7% in 1987 compared to 92,929 persons in 1986. However, there is a slight increase of 1.9% in the number of fishermen in Peninsular Malaysia, to 60,569 persons. The composition of fishermen according to ethnic groups is as follows: Malay (58.8%), Chinese (35.7%), Thais (6.4%) and others (2.1%). The Thais were given permission in order to make up for the lack of skilled and experienced crew especially in the deep-sea fishing. There are 18,060 and 12,690 fishermen in Sabah and Sarawak respectively, experiencing a decline of 13.5% and 13.7%.

Table 1 - 10 Number of fishermen, 1980-1987

	Peninsular Malaysia	Sabah	Sarawak	Total
1980	88,972	18,000	11,670	118,642
1981	86,925	18,000	12,529	117,454
1982	80,237	19,850	12,143	112,230
1983	75,590	19,900	11,783	107,273
1984	76,368	19,900	12,819	109,087
1985	69,530	20,500	12,878	102,908
1986	59,452	20,908	12,569	92,929
1987	60,569	18,060	12,690	91,319

Source: 'Statistical Handbook, Agriculture, 1986', Ministry of Agriculture.

'Annual Fisheries Statistics, 1987', Department of Fisheries.

PRESENT SITUATION OF FACULTY OF FISHERIES & MARINE SCIENCE of UPM

1 General Information on UPM

(1) History, philosophy and objectives

History

UNIVERSITI PERTANIAN MALAYSIA (UPM) was officially established on 4th October, 1971 by an Incorporation Order of His Majesty, the Yang Di-Pertuan Agong. Prior to establishment of UPM, the Authorities of Universities of Malaya were responsible for providing agricultural training at diploma (sub-professional) and degree level. The diploma courses were offered by the College of Agriculture, Malaya (from 1931) and degree courses by the Faculty of Agriculture, University of Malaya (from 1959). Owing to the post-war scientific and well as Malaysia's continuing dependence on an agricultural economy, it became apparent there was a need for a new education. Towards this end, a merger between the College of Agriculture and the Faculty of Agriculture was conceived, resulting in the birth of UPM. In the process, the Council of the College of Agriculture was dissolved and its function and properties transferred to the new university.

Philosophy

UPM is the highest agricultural training institution in the country. It upholds to the philosophy that the pursuit of knowledge is not for its own sake; knowledge is for the service of society. In other words, knowledge is of little value if it is not utilized for the benefit of the society and the nation. In this context, knowledge is agricultural knowledge in its wide sense and encompasses all aspects within the

eco-system comprising the environment, land, vegetation, animal, and man. Other aspects within the eco-system were added from time to time since the establishment of this institution.

UPM is committed to the trilogy of function, namely, instruction, research and extension as its basic contribution to the growth and development of the nation. While its main function is the provision of instruction, UPM strongly believes that to the students and the academicians alike, teaching will be more meaningful if the function is supplemented with intense research efforts. Since modern and scientific agricultural practices generated by research should be disseminated to the farming community, UPM is committed to the extension function.

UPM strives to produce graduates not only to be technically competent, but also intellectually and culturally developed and capable of assuming roles of leadership in an increasing complex society. In order to realize this, the UPM requires all curriculum to incorporate courses in social science and humanities to augment the technical content.

Objectives

Consistent with its philosophy, UPM has the objectives as follows:

- a. To prepare well-trained personnel for the county's needs in the field of agriculture defined in its broadest sense.
- b. To play a major role in basic and applied research in all aspects of agriculture for further development of agricultural activities in keeping with the aspirations of the country.
- c. To serve society through extension activities by disseminating new ideas and practices and to bring back problems faced by farmers to UPM for solutions so that agriculture attain its appropriate position in the structure of the national economy.

(2) Faculties and courses

Faculties

- a. Faculty of Agriculture
- b. Faculty of Agricultural Engineering
- c. Faculty of Educational Studies
- d. Faculty of Fisheries and Marine Science
- e. Faculty of Food science & Technology
- f. Faculty of Forestry
- g. Faculty of Resource Economics & Agri-business
- h. Faculty of Science and Environmental Studies
- i. Faculty of Veterinary Medicine & Animal Science

Centre

Center for Extension & Continuing Education Institute of Consultancy

Diploma courses

- a. Agriculture
- b. Agri-business
- c. Animal Health & Production
- d. Computer Science
- e. Engineering (Agricultural)
- f. Fisheries
- g. Forestry
- h. Human Development
- i. Science with Education

Degree courses

- a. B. Agric. Sc.
- b. B. Education (Agri. Sc)
- c. B. Education (Home Techn.)
- d. B. Education (Physical Ed.)
- e. B. Engineering (Agric.)
- f. B. Food Sc. & Technology
- g. B. Sc (Hons)
- h. B. Sc with Education (Hons)
- i. B. Sc (Agri-business)
- j. B. Sc (Computer)
- k. B. Sc (Environment)
- l. B. Sc (Fisheries)
- m. S. Sc (Forestry)
- n. B. Sc (Human Development)
- o. B. Sc (Resource Economics)

Post-graduate courses

The master's degree is offered through 33 departments and the doctoral degree through 29 departments of the University. The various degrees offered are as below:

- a. Master of Science
- b. Master of Business Administration
- c. Master of Agricultural Science
- d. Master of Veterinary Medicine
- f. Master of Engineering
- g. Doctor of Philosophy

Post-graduate courses

the master's degree is offered through 33 departments and the doctoral degree through 29 departments of the University. The various

2 Education System of FFMS

(1) History and objectives

History

The Faculty of Fisheries and Marine Science (FFMS) had its origin in 1974 when the Division of Fisheries and Marine Science was established under the Faculty of Veterinary Medicine and Animal Science. On May 1, 1979, the Division was officially raised to the status of a fully faculty thus making the Faculty of Fisheries and Marine Science, the eighth faculty established at UPM. With its establishment, the four major disciplines in the field of fisheries, namely fisheries biology, aquaculture, marine science and fishing technology were merged under one institution for a systematic and integrated approach in fisheries education.

Objectives

Besides training personnel in the field of fisheries, the Faculty carries out research and also provides extension services for government agencies, private firms, fishermen and fish farmers. These activities are in line with the three primary functions of UPM, namely teaching, research and extension to meet national needs and aspirations.

(2) Location and organization

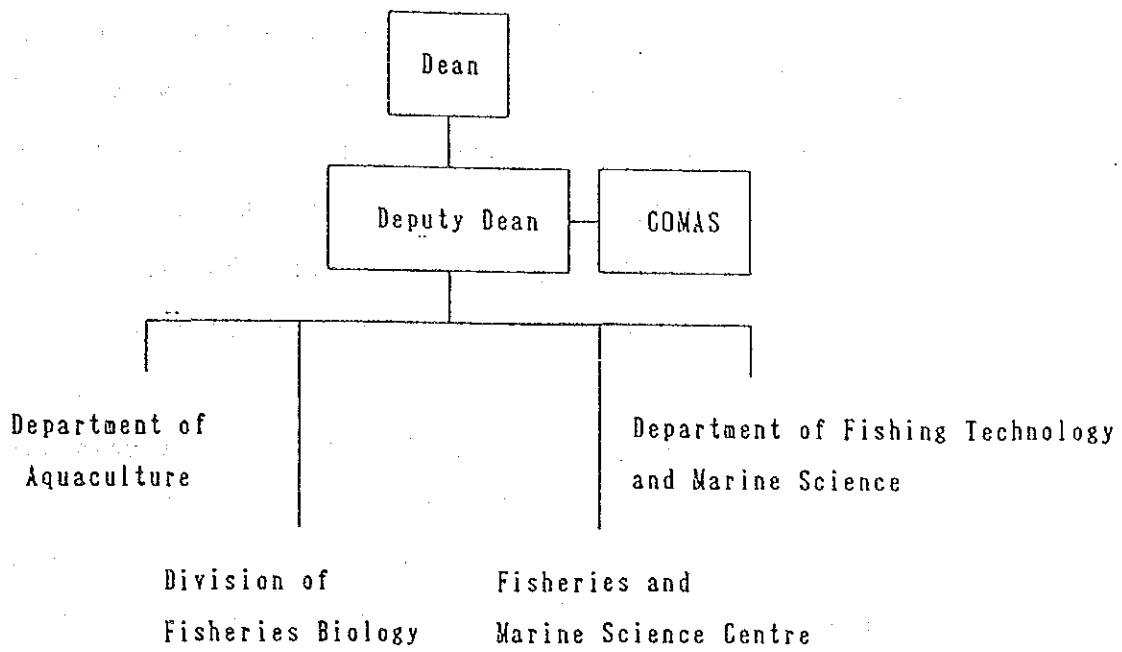
Location

FFMS is located at the main campus in Serdang, Selangor, which is approximately 23 km south of the capital city of Kuala Lumpur via the Kuala Lumpur - Seremban highway. The Faculty also has a branch campus on the east coast of Peninsular Malaysia. This is the Fisheries and Marine Science Centre at Mengabang Telipot, which is about 21 km north of Kuala Terengganu. To cater for research in the West Coast, the Centre for Oceanography and Mariculture Studies (COMAS) has been developed. The Centre is located at Port Dickson, Negeri Sembilan, specifically built to facilitate studies on marine pollution, marine sciences, various aspects of oceanography, mariculture and ocean ranching.

Organization

The Faculty consists of two departments, a division and Fisheries and Marine Science Centre. The structure is shown in Figure U - 1.

Table II - 1 Organization chart of FFMS



(3) Programmes/courses

The curriculum has been designed to give students an understanding of the theoretical and applied knowledge of aquatic organisms and their inter-relationship with the environment for the beneficial exploitation and perpetuation of these organisms. In line with the concept and in recognition of these programmes as professional, students are required to undergo practical training in related government departments and the private sectors. The Faculty offers four levels of programmes/courses, namely Diploma, Degree, Post-graduate and special courses.

Diploma in Fisheries

This is a three-year programme aimed at producing sub-professionals at middle management level capable of performing technical extension or administrative duties or serving as intermediaries between fish farmers and government agencies. Students are required to take up courses in basic sciences, social sciences and core courses in the fields of fisheries sciences and undergo practical training. Students spend one semester at the Fisheries and Marine Science Center at Kuala Terengganu

Bachelor of Science (Fisheries)

This is a four-year professional programme. At this level, the students will acquire knowledge to fit into a research, managerial or technical position. Students spend one year at the Fisheries and Marine Science Centre in Terengganu for advanced courses in marine studies, fishing technology and practical training at sea. The programme also offers specializations in aquaculture and marine fisheries.

Post-graduate studies (M.S. and Ph.D)

The programme is directed at those interested in pursuing further studies after completing their Bachelor of Science (B.S.). Besides attending courses, students would be required to conduct research and produce a thesis as part of the requirements of the programme. Presently, seven fields of studies are offered for post-graduate studies as follows:

- a. Fisheries Biology/Fisheries Management
- b. Oceanography
- c. Aquaculture/Integrated Aquaculture
- d. Water Pollution/Aquatic Chemistry
- e. Fishing Technology
- f. Fisheries System Model

Special courses

Special courses are conducted from time to time for government and semi-government agencies, private organizations, fishermen and fish farmers to upgrade their knowledge in specific areas. These short courses normally 1 to 4 weeks duration are tailored to meet the differing needs and educational backgrounds of the participants. Courses offered include general fisheries, fishing technology, fish disease and aquaculture.

3 Analysis of questionnaire to students

Recovery

The number of students who answered to this questionnaire is 68 persons.

Motive to enter FFMS

About one half of students answered as 'To learn about fishing technology and fisheries', 'To improve knowledge' or 'Just to learn'. But 10% of them answered as 'I don't know'. Some of the answers are as below: 'To obtain a degree', 'For my future' or 'Nothing'.

Reason to select the course

Those who answered as 'I am interested in the course' are only 25% and over one-half of the students answered negatively as 'I didn't select the course', 'There is no other choice' or 'I don't applied, but they gave it to me'. Many students are not satisfied with their courses.

Satisfaction with the curriculum

One-third of them satisfied with the curriculum but one-half of them don't satisfied with it and their answers are as below: 'More practical should do especially on aquaculture', 'Make more practical in the curriculum' or 'The faculty should press more on fisheries and drop the irrelevant subjects'.

Practical use of their knowledge

Relatively many students are interested in aquaculture but their answers are deversified as below: 'To develop the aquaculture in Malaysia', 'To help the fisheries industry of Malaysia', 'I will help the local people' or 'I'll open my own business, make a fish pond, etc'.

Kind of job in the future

Their hope is as follows: Self-employment (24 persons), Government officer such as DOF, LKIM (13 persons), Private fishing company (12 persons), Educator (1 person) and others (9 persons).

In-service student

There are only 3 persons who are in-service students among 68 persons.

School expenses (\$/year)

Below \$999	12 persons
\$1,000 ~ \$1,499	1 persons
\$1,500 ~ \$1,999	7 persons
\$2,000 ~ \$2,499	15 persons
Over \$2,500	6 persons
No answer	27 persons

Living cost (\$/month)

\$50 ~ \$99	6 persons
\$100 ~ \$149	9 persons
\$150 ~ \$199	11 persons
\$200 ~ \$249	9 persons
\$250 ~ \$299	3 persons
Over \$300	3 persons
No answer	27 persons

Source of fund

Main sources of fund are as below: loan (53 persons), scholarship (8 persons), family (4 persons) and no answer (3 persons). Typical type of loan is JPA Loan of \$2,500/year (45 persons).

Table II - 1 Number of students from 1974/75 to 1987/88

1974/75	Diploma				Bachelor					Post-graduate	
	1st	2nd	3rd	Total	1st	2nd	3rd	4th	Total	M.S.	Ph.D.
1974/75	30			30							
1975/76	34	18		52							
1976/77	31	25	20	76							
1977/78	32	24	25	81							
1978/79	28	18	22	68							
1979/80	25	16	17	58	30				30		
1980/81	29	17	14	60	18	26			44	1	
1981/82	35	18	17	70	26	48	25		69	3	
1982/83	51	22	18	91	39	24	17	25	105	4	1
1983/84	58	34	21	113	33	34	18	15	100	3	2
1984/85	57	48	34	139	32	30	32	14	108	4	2
1985/86	70	35	43	148	12	30	30	32	104	9	3
1986/87	68	55	40	163	26	16	27	25	94	5	5
1987/88	107	52	57	211	19	23	13	24	79	8	7

4 Placement of Graduates of FFMS

During 1984/85-1987/88 about 235 students, i.e. Diploma 140 persons, Bachelor 85 persons and Post-graduate 10 persons (M.S. 8 persons and Ph.D. 2 persons), have graduated from FFMS. Placement of 235 graduates is as follows: government offices (DOF and LKIM) 60 persons, government offices (except DOF and LKIM) 15 persons, private fishing companies 40 persons, private companies other than fishing companies 10 persons, the self-employed 15 persons and the unemployed 95 persons. Only 60% of the students could get jobs after graduation and 40 % of them were not employed. The share of the employed in the field of the fisheries including the government offices (DOF and LKIM) is 43% of the graduates, and the share of the employed in the directly productive field of the fisheries is only 17% of them.

Many graduates of FFMS have already gotten jobs in the government offices (DOF and LKIM), so that it will be difficult to get jobs in those offices from now on. Therefore new graduates must get jobs in private fishing companies, if they want to apply their knowledge studied in FFMS. Social needs for human resources is weighted in the field of aquaculture rather than in the field of marine marine fishing, reflecting the decline of fish resources along the coastal area. In case the potential of deep-sea fishing may be fully exploited in the future, then many graduates will be employed in private marine fishing companies. But the government must take proper measures encouraging deep-sea fishing to enlarge the fisheries labour market.

6 Budget of FFMS

The formal budget of UPM is assigned as follows: UPM Finance Committee accepts the budgetary draft prepared by each faculty, and submit it to the government. After the approval of the parliament the Finance Committee is informed the allocation of budgetary fund and then the formal budget is to be executed. Corresponding to the implementation of the technical corporation by JICA, a fixed amount of the local cost was allocated to FFMS. The concurrent expenditure is paid through the formal budget of UPM but certain amount of funds have been allocated independently to specified projects by the government. For example, the projet funds of FFMS during 1988 and 1989 is as below:

- a. Project name: 'The Development of an aproprate Fishing Gear Technology for Off-shore fisheries'.

Project code: MPKSN 1-07-05-040

Chief : Dr. Mohd. Ibrahim Bin Hj. Mohamed.

Project year

(Money) : 1988 (\$ 55,000.00)

1989 (\$ 60,000.00)

- b. Project name: 'Fisheries Management in Malaysian Water'.

Project code: MPKSN 1-07-05-011

Chief : Dr. A. K. Mohsin

Project year

(Money) : 1988 (\$ 73,000.00)

1989 (\$ 147,000.00)

- c. Project name: 'Development of an Appropriate Technology for Optimum Production of Aquaculture'.

Project code: MPKSN 1-07-05-012

Chief : Dr. Ang Kok Jee

Project year

(money) : 1988 (\$ 329,000.00)

1989 (\$ 400,000.00)

d. Project name: Coastal Oceanography Studies of South China Sea
and the Straits of Malacca'.

Project code: MPKSN 4-07-05-006

Chief : Dr. Law Ah Theem

Project year: 1988 (\$ 82,000.00)

1989 (\$ 90,000.00)

Table II - 2 Total budget of FFMS from 1985 to 1988

(Unit: \$ 1,000)

Item of Expenditure	1985	1986	1987	1988
1 Emorwen				
(1) Gaji dan Upahan	1,511.0	1,950.0	2,078.0	2,093.0
(2) Elaun Tetap	182.0	260.0	337.0	319.0
(3) Tambahan Kos Kakitangan	191.0	230.0	247.0	260.0
(4) Elaun Lubih Masa	64.0	40.0	50.0	46.0
(5) Lain-lain Faedah Kewangan				
(6) Sub-total	1,948.0	2,480.0	2,712.0	2,718.0
2 Perkhidmatan Bekalan				
(1) Pengangkutan Orang dan Perbelanjaan Sara Hidup	1117.0	60.0	84.0	90.4
(2) Pengangkutan Barag- barang	5.0	8.5	6.5	12.0
(3) Perhubungan	20.0	31.0	9.8	87.5
(4) Utiliti	138.0	166.0	11.0	6.5
(5) Sewaan	13.0	16.5	9.9	5.0
(6) Perkhidmatan Pereetakan	27.0	30.5	15.6	168.2
(7) Bekalan dan Bahan-bahan	229.0	250.0	230.2	111.3
(8) Penyelenggaraan dan Pembaikan Kecil Yang Dibeli	96.0	187.0	159.0	189.1
(9) Perkhidmatan Tkhtjsas dan Lain-lain Perkhidmatan Yang Dibeli & Hospitaliti	46.0	71.5	74.0	130.0
(10) Sub-total	691.0	820.0	600.0	800.0
3 Pemilikan Harta Modal				
(1) Lain-lain Harta Modal	408.0	300.0	200.0	400.0
(2) Sub-total	408.0	300.0	200.0	400.0
Grand total	3,047.0	3,600.0	3,712.0	4,016.5

Source: FFMS.

Table II - 3 Local cost budget for JICA experts, Nov. 1984-Oct. 1988

(Unit: \$)

	Duration	Cash	Housing	Living	Total
Expert A	16Nov.84 - 14Nov.86	1,100	12,925	11,750	25,775
Expert B	16Nov.84 - 14Nov.86	1,100	12,925	11,750	25,775
Expert C	16Nov.84 - 14Nov.86	1,900	15,275	17,625	34,800
Expert D	20Nov.86 - 19Nov.87	1,100	6,582	5,984	13,666
Expert E	20Nov.86 - 19Nov.87	1,500	7,779	7,779	17,058
Expert F	07Dec.84 - 31May.88	1,100	23,939	22,020	47,058
Expert G	12Jun.86 - 30Aug.88	780	16,273	14,888	31,941
Expert H	19Apr.88 -	1,100	3,814	3,468	9,382
Expert I	10Jun.88 -	1,100	9,185	8,350	18,635
Total		10,780	108,698	103,614	223,091

Source: FFMS.

Table II - 4 Local cost for operation and maintenance of equipment

Item	Duration	Value
<u>Terengganu</u>		
1. Honda C 70	20/10/1985	\$ 1,945.60
2. Mercedes Benz	21/08/1986	\$ 16,559.70
3. Toyota Hilux	29/02/1988	\$ 6,292.80
4. Boat Unipertama III	1986	\$ 27,595.00
5. For placing the scanning electron microscope (SEM)		\$ 13,170.00
6. Machine xerox Cannon NP-155		\$ 2,900.00
7. Hatchery organizer/preparation		\$ 14,000.00
	Total	<u>\$ 82,463.10</u>
<u>Serdang</u>		
1. Recirculating water system	1986	\$ 5,424.00
2. BPC building	1986	\$151,210.00
3. Food processing	1986	\$ 13,605.00
4. Automatic feeder and Paddle wheel NRA-III	1987	\$ 3,965.00
5. Tractor YM 155 DT Yanmar	09/02/1986	\$ 2,623.20
6. Four wheel drive lorry Hilux 4 x 4 pick-up	05/01/1989	\$ 4,447.00
	Total	<u>\$181,274.20</u>
	Grand total	<u>\$263,737.30</u>

Source: FFMS.

6 International Corporation to FFMS

Besides JICA, several foreign countries have given economic and technical assistances to FFMS, supplementing the deficiency of the formal budget of FFMS. Certain amount of the local cost must be raised for operation and maintenance of the equipment provided by JICA and some part of external funds are appropriated for it, forming effective teamwork among foreign assistances. On-going and committed projects assisted by foreign countries are shown as below:

- a. Project name: 'Development of an appropriate technology for the culture of *Macrobrachim Rosenbergii*'.
Donar : EEG
Purpose : Subsidy for research and fellowship of M.S. & Ph.D
Chief : Dr. Ang Kok Jee
Project year
(Money) : Phase 1 1985-1987 (\$ 124,000.00)
Phase 2 1989-1991 (\$ 412,000.00)
- b. Project name: 'The biology and culture of Ikan Baung'.
Donar : IFS (Sweden)
Purpose : Subsidy for research
Chief : Salim Khan
Project year
(Money) : 1989-1991 (\$ 30,725.00).
- c. Project name: 'Fish Parasire Studies'.
Donar : IDRC (Canada)
Purpose : Subsidy for research and two workshops
Chief : Dr. Mohd, Shariff Md. Din
Project year
(Money) : Phase 1 1984-1989 (\$ 337,000.00)
Phase 2 1989-1992 (\$ 440,000.00)

d. Project name: 'Asean-Australian Coastal Zone Research'.

Donar : Australia

Purpose : Coral reef research

Chief :

Project year

(Money) : On-going

e. Project name: 'International Corporation for Living and Aquaculture
Resources Management'

Donar : USAID

Purpose : Coastal Zone Resources Management

Chief :

Project year

(Money) : On-going

JICA