トンガ水産増養殖研究開発計画
実施協議調査団報告書

平成３年９月

国際協力事業団

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序　　文

日本国政府は、トンガ王国政府の要請に基づき、同国の水産増養殖研究開発計画にかかる実施協議調査を行うことを決定し、国際協力事業団がこの調査を実施した。

当事業団は、平成３年７月29日より８月13日まで、国際協力事業団水産業協力室　田所康穂室長を団長とする調査団を現地に派遣した。

調査団は、トンガ王国政府関係者と協議を行うとともに、プロジェクト・サイト調査を実施し、帰国後の国内作業を経て、ここに本報告書完成の運びとなった。

本報告書が、本プロジェクトの推進に寄与するとともに、両国の友好・親善の一層の発展に役立つことを願うものである。

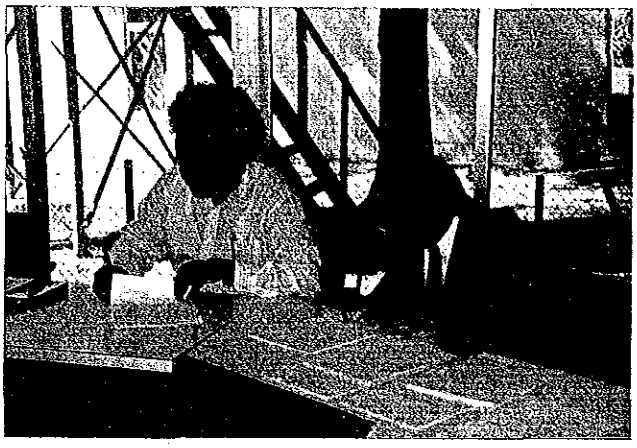
終わりに、本件調査にご協力とご支援をいただいた関係者各位に対し、心より感謝の意を表するものである。

平成３年９月

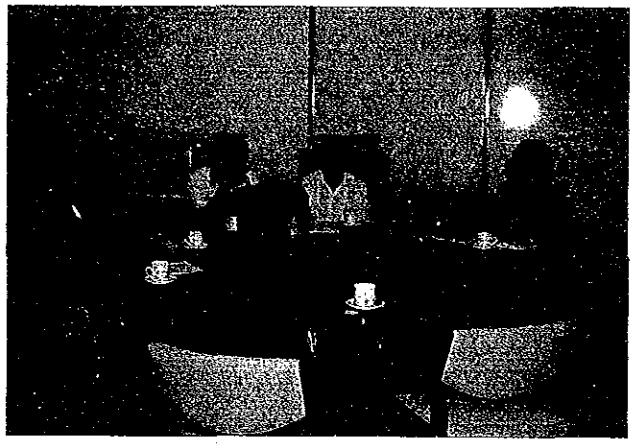
国際協力事業団

理事　田口俊郎

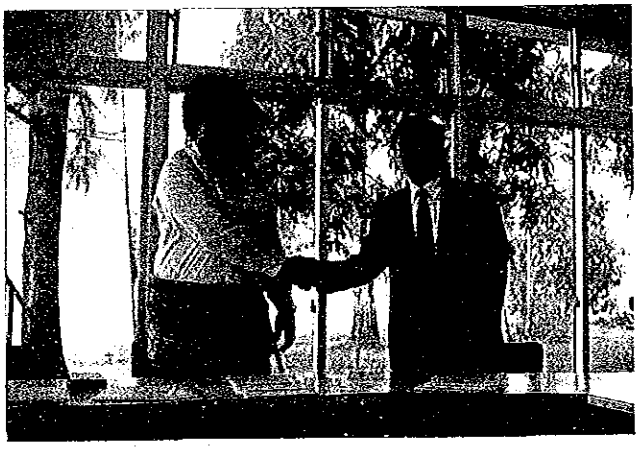
目　　次



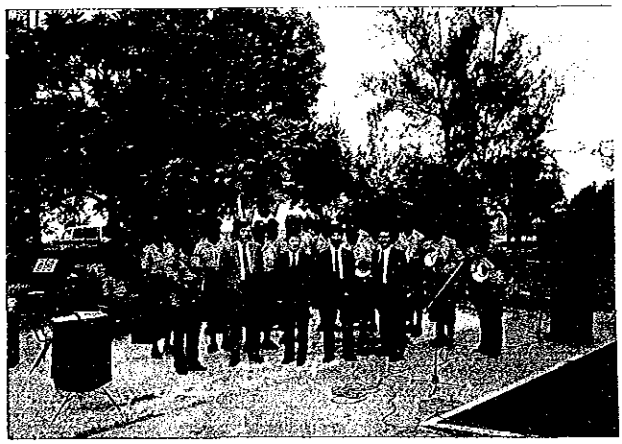
討 議 議 事 録 署 名
コロア水産局長代行　　田 所 団 長



外 務 省 で の 協 議
古谷団員 川口団員 ﾌｧｱﾀｸﾀ水産行政官 ｱｺｼｸﾀ外務事官補
田所団長

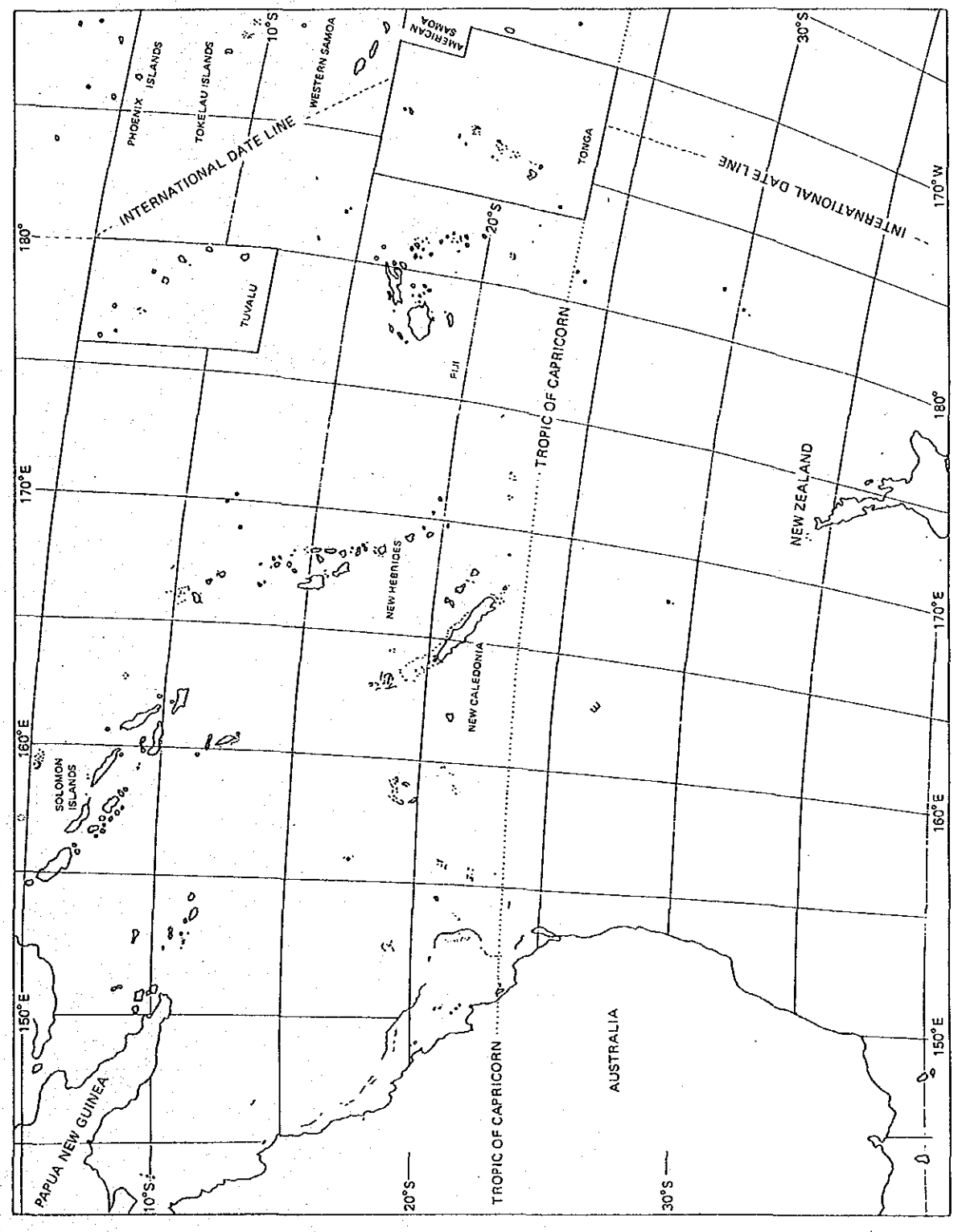


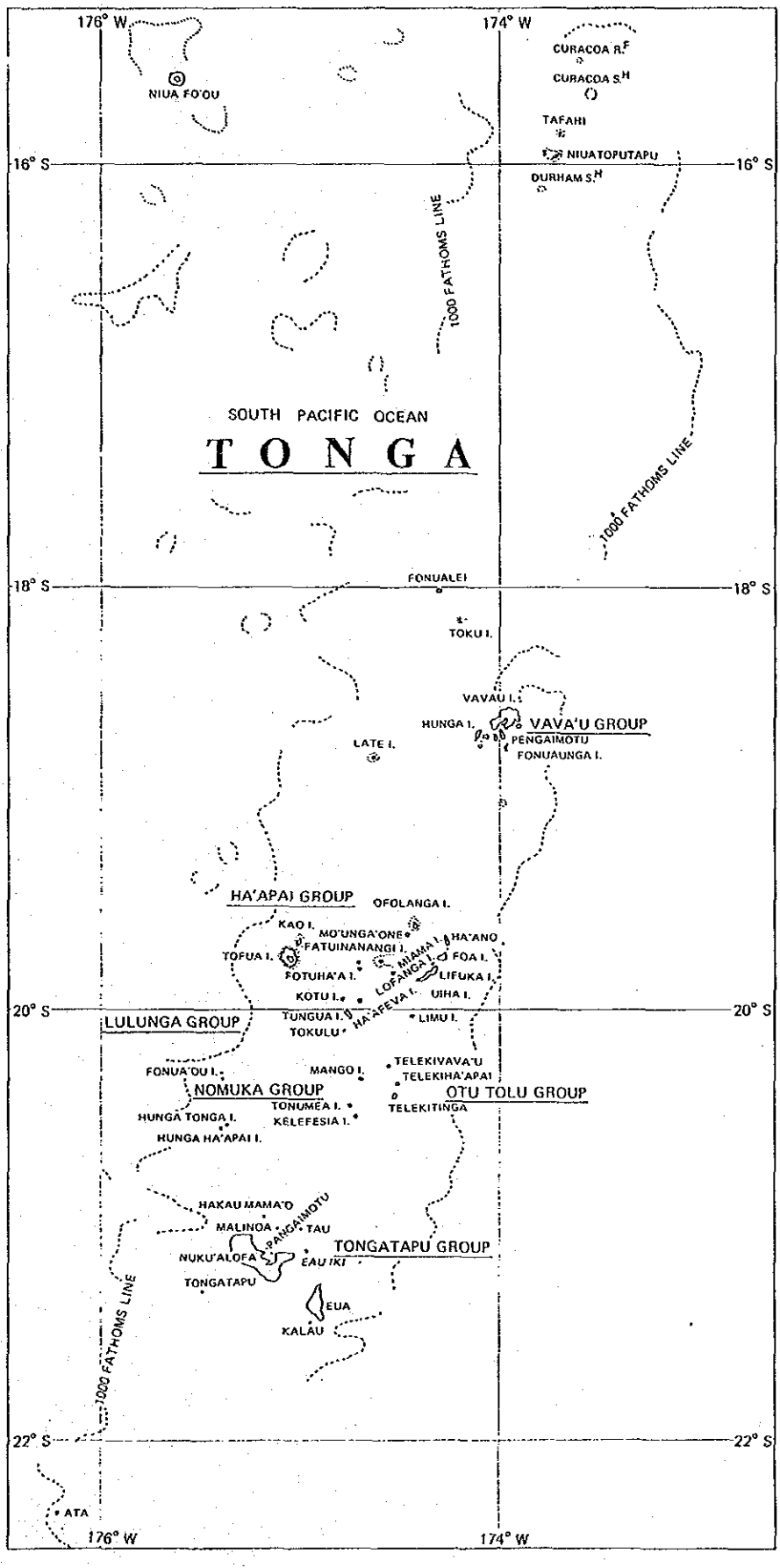
討議議事録署名を終えて
コロア水産局長代行　　田 所 団 長



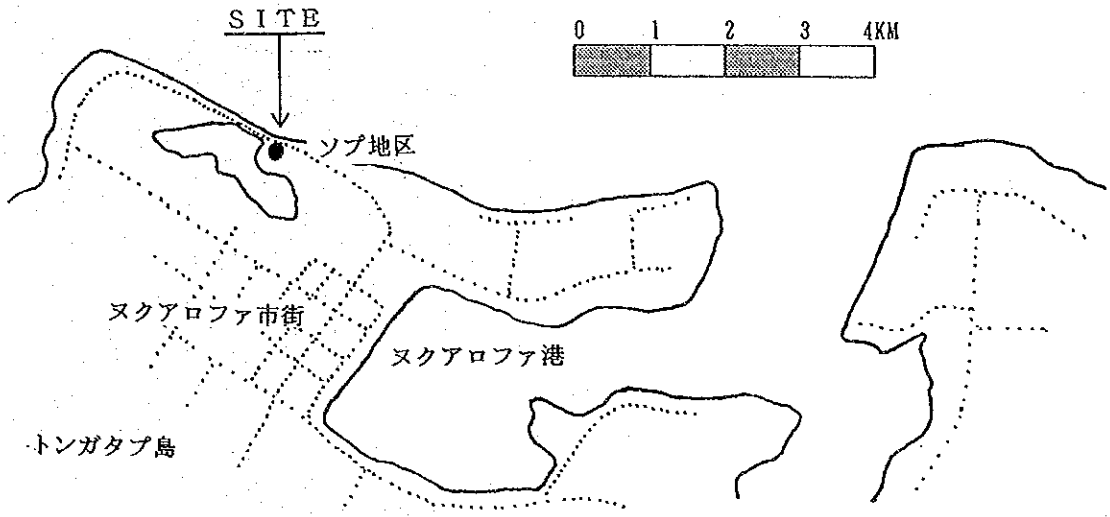
調査団歓迎式典でのポリスバンドと団員

MAP OF TONGA　　地　　図

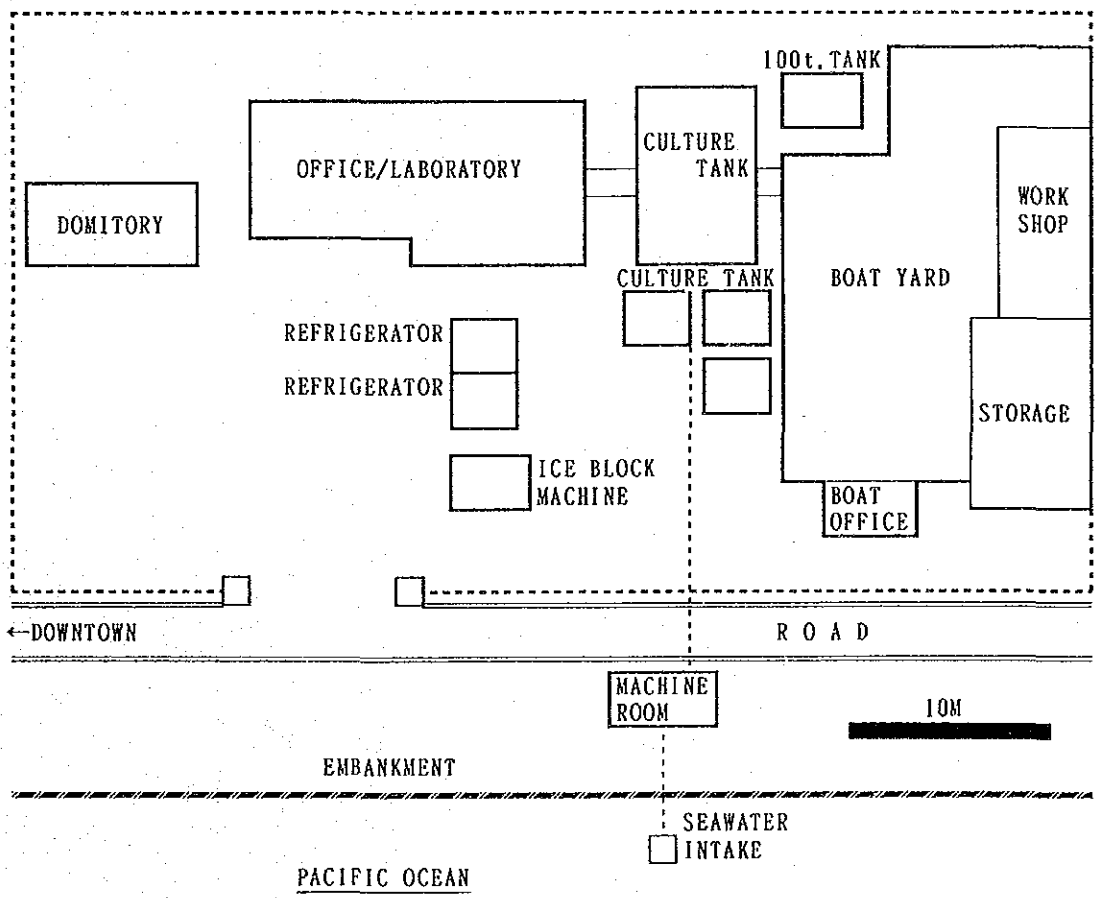



176° W
174° W
16° S
18° S
20° S
22° S
CURACOA R.F
CURACOA S.H
NIUA FO'OU
TAFAHI
NIUATOPUTAPU
DURHAM S.H
1000 FATHOMS LINE
SOUTH PACIFIC OCEAN
TONGA
FONUALEI
TOKU I.
VAVAU I.
HUNGA I.
VAVA'U GROUP
PENGAIMOTU
FONUAUNGA I.
LATE I.
HA'APAI GROUP
OFOLANGA I.
KAO I.
MO'UNGA'ONE
HA'ANO
FATUINANANGI I.
TOFUA I.
NIAMA I.
FOA I.
FOTUHA'A I.
LOFANGA I.
LIFUKA I.
KOTU I.
UIHA I.
TUNGUA I.
HA'AFEVA I.
LIMU I.
TOKULU
LULUNGA GROUP
FONUA'OU I.
MANGO I.
TELEKIVAVA'U
TELEKIHA'APAI
NOMUKA GROUP
OTU TOLU GROUP
TONUMEA I.
TELEKITINGA
KELEFESIA I.
HUNGA TONGA I.
HUNGA HA'APAI I.
HAKAU MAMA'O
MALINOA
PANGAIMOTU
TAU
TONGATAPU GROUP
NUKU'ALOFA
EAU IKI
TONGATAPU
EUA
KALAU
ATA

I. PROJECT SITE



II. MARICULTURE CENTRE



Ⅰ　プロジェクトの経緯

Ⅰ－1　要請の背景

(1) トンガ王国は、70万㎢におよぶ広大な漁業専管水域を有し漁業開発の大きな可能性を有している。同国の水産業はマグロ延縄漁、底釣り漁及びリーフ内小規模漁業の3種に大別される。

(2) トンガ政府は、水産開発の重要性を認識し第3次開発計画（1975～1980）より国家開発の手段の一つとして水産振興をうたっている。しかしこれまでの5ヶ年計画の中ではマグロ・カツオ資源の漁業振興が中心であった。

(3) 一方国民の重要な動物蛋白の供給源となっているリーフ内漁業は乱獲による資源の減少傾向がみられる。これに対応してリーフ内漁業資源の有効かつ持続的な利用を目指し、資源管理及び維持増大を目的として1978年に日本政府の無償資金協力により水産研究センターを設立した。

(4) 1982年3月トンガを襲ったハリケーンによりセンターの施設が被害を受け、特に養殖施設のポンプ関連設備（給水ポンプ、ブロワー、50KV発電機）が使用不能となっており、このためウェットラボラトリー、20トンタンクが使用できなくなった。

(5) 80年代になって第5次開発5ヶ年計画（1986～1990）の中でリーフ資源の調査が行われ、その結果トンガ人にとって一番重要な魚種であるボラ（Mugil cephalus）の漁獲減少が著しいことが分かった。現在このボラはニュージーランド、アメリカから輸入されているほどである。そのため第6次5ヶ年開発計画（1991～1995）の中で、放流試験や養殖可能性調査を実施する予定である。

(6) 1989年にオーストラリアのＡＣＩＡＲの援助により養殖施設の一部についてはシャコガイ種苗生産のため最小限の利用を行っている。しかしながら他の貝類の種苗生産の実験はとても出来る状態ではなく実験機器、養殖機材、消耗品等が不足している。

(7) トンガ政府は、1991年から1995年までの増養殖研究の5ヶ年計画を作成しており、その中心を、A．ボラの生簀養殖及びアノ湖への種苗放流、B．貝類種苗生産及び増殖、C．リーフ内漁業資源研究及び管理に置いており、この実施にかかる技術協力を平成2年2月に正式要請してきたものである。

(8) 上記トンガ政府の要請に対し、国際協力事業団は平成2年7月に長期調査員、平成3年3月に事前調査団を派遣し、わが国が技術協力として実施するプロジェクトの枠組みについてトンガ側と基本的な合意を得た。

Ⅰ－2　派遣の目的

上記調査団の報告を基に、本プロジェクト実施に関する討議議事録（R／D）、暫定実施計画（T．S．I）について、日本側の原案に基づきトンガ側と協議しR／D、T．S．Iの署名交換を行う。

Ⅱ　調査団の編成

1. 団長	総括	田所康穂 国際協力事業団　水産業技術協力室長
2. 団員	水産技術協力	古谷信雄 水産庁　海洋漁業部　国際課　海外漁業協力室
3. 〃	魚貝類養殖	川口正徳 株式会社　国際水産技術協力
4. 〃	業務調整	高橋和久 国際協力事業団　水産業技術協力室　ジュニア専門員

Ⅲ　主要面談者

— トンガ側 —

1.	Acting Principal Fisheries Officer Ministry of Fisheries	Mr. Taniela Koloa
2.	Fisheries Officer Ministry of Fisheries	Mr. 'Ulunga Fa'anunu
3.	Head of Marine Engineer Division Ministry of Fisheries	Mr. Siotame Vaipuna
4.	Boatyard Manager Ministry of Fisheries	Mr. Aisea Tupou
5.	Deputy Secretary of Foreign Affairs Ministry of Foreign Affairs	Mrs.'Akosita Fineanganofo
6.	Assistant Secretary of Foreign Affairs Ministry of Foreign Affairs	Mr.Tevita Kolokihakanfisi
7.	Secretary of Finance Ministry of Finance	Mr. Uhila Liava'a
8.	Assistant Industrial Ministry of Labour and Commerce	Mr. Maliepo Joma

— 在トンガ関係者 —

9.	青年海外協力隊トンガ調整員	倉　又　雅　広

— 在フィジー関係者 —

10.	在フィジー日本国大使館特命全権大使	堀　　靖　夫
11.	在フィジー日本国大使館二等書記官	中　島　　聡
12.	在フィジー日本国大使館二等書記官	仁　田　知　樹
13.	ＪＩＣＡフィジー事務所長	伊　藤　英　明
14.	ＪＩＣＡフィジー事務所職員	荒　金　恵　一
15.	ＦＡＯ南太平洋養殖開発プロジェクトマネージャー	田　中　秀　幸
16.	Deputy Permanent Secretary of Fisheries Ministry of Primary Industries	Mr. S.T.Cavuilati
17.	Scientific Laiason Officer ACIAR	Mr. Viliami Langi

Ⅳ　調査日程概要

Ⅳ－1　期　　間

平成3年7月29日～8月12日（15日間）

Ⅳ－2　日　　程

7月29日（月）	20：30	成田発（ＦＪ－303）
30日（火）	08：00	Nadi着
	09：30	Nadi発（ＦＪ－401）
	10：00	Suva（Nausori）着
	11：00	ＪＩＣＡフィジー事務所と打ち合わせ
	14：30	大使館表敬及びＲ／Ｄ（案）について打合わせ （堀大使、仁田二等書記官、中島二等書記官）
31日（水）	11：00	ＦＡＯ南太平洋養殖開発プロジェクトマネージャー田中秀幸氏に面会し、本計画におけるＦＡＯとの協力に関する意見交換
	15：00	フィジー水産局にてV. LANGI氏（ＡＣＩＡＲ）に面会し、本計画におけるＡＣＩＡＲとの協力に関する意見交換
	15：30	フィジー水産局の糸井信男ＪＩＣＡ専門家に面会し、フィジーの水産物流通に関する情報を収集
	16：00	S.T. CAVUILATI水産次官補に面会し、今後のフィジーにおける水産分野での協力に関する意見交換
8月1日（木）	08：15	Suva(Nausori）発（ＦＪ－400）
	11：05	Tongatapu着
	13：00	水産省（水産研究センター）にて歓迎式典参列
	14：00	水産省と打ち合わせ 調査団の目的、Ｒ／Ｄ手交及び概要説明、スケジュール打ち合わせ
2日（金）	09：00	Ｒ／Ｄ案について水産省と協議
	11：00	協力隊事務所にて倉又調整員に面会し、本計画における協力隊との協力に関する意見交換
	12：00	倉又調整員を招待し昼食会
	13：00 ～ 17：00	水産省にて「ト」側関係省庁を交えてＲ／Ｄ案全項目について協議

8月3日（土）		Fish Market及びTongatapu漁港視察
4日（日）		休日
5日（月）	09：00	外務省にてA.Fineanganofo外務次官補に面会し、本計画に関する手交打ち合わせ
	10：00 〜 17：00	水産省にて施設のリハビリ及びＴＳＩについて協議
	18：30	Dateline Hotelにて「ト」外務省主催のレセプションに出席
6日（火）	09：00 〜 17：00	水産省にてＲ／Ｄ案協議、合意を見る Ｒ／Ｄ合意文作成
7日（水）	09：00	水産省にてT. Koloa水産省長官代行、田所団長Ｒ／Ｄに署名
	18：30	Dateline Hotelにて団長主催のカクテルパーティー
8日（木）	11：05	Tongatapu発（ＦＪ－407）
	13：20	Nadi着
	15：15	Nadi発
	15：45	Suva(Nausori）着
9日（金）	09：00	ＪＩＣＡフィジー事務所にて伊藤所長に調査結果を報告
	15：00	大使館にて堀大使に調査結果を報告
10日（土）	10：00	Nanduruloulou Freshwater Culture StationをSatya Nand Lal技師及び森本ＪＩＣＡ専門家の案内で視察
11日（日）		休日
12日（月）	06：00	Suva発　陸路Nadi国際空港へ移動
	11：00	Nadi着
	12：05	Nadi発（ＮＺ－023）
	17：45	成田着

Ⅴ　実施協議

Ⅴ－1　討議議事録の交渉経緯

平成3年3月にトンガへ派遣された事前調査団がトンガ政府と討議の末、交換したミニッツをベースとして作成したR／D草案を相手側に提出して検討を願った。

交渉相手は主に水産省であったが、ジョイントコミッティーの構成メンバーである外務省、大蔵省、労働商工省の担当者とも協議を行った。

R／Dの最終案はほぼ日本案どおりの内容で合意され、8月7日に水産省で水産長官代行のT. Koloa水産長官補との間で署名が行われた。

以下、R／D協議を通じて問題となった内容、日本案の変更点等の討議経過をR／Dの各項に従って記述する。

(1)　R／Dカバー文書について

1)　「ト」側より、水産省長官が海外出張中であるため、長官代行であるT. Koloa主席水産行政官代行がR／Dに署名するとの説明があり、「ト」側署名者を同氏に変更した。

2)　タイトルに関し、ＪＩＣＡ本部からの訓令電に従い変更し、「ト」側と合意した。

(2)　THE ATTACHED DOCUMENTについて

1)　Ⅳ－1について、ＪＩＣＡ本部からの訓令電に従い、研修員の第三国派遣の部分の削除を協議し、「ト」側の同意を得て同部分を削除した。

しかしながら、「ト」側はボラ養殖で高い技術を有するOceanic Institute(ハワイ)でのカウンターパートの技術研修を強く希望しているため、技術交換費での技術研修を検討する旨返答し、「ト」側の合意を得た。

2)　Ⅳ－2－(3)について、「ト」側より予算難であることの理由からこの項目の削除が求められたが、相手国に自助努力を求める観点から本項目は削除できない旨返答した。しかしながら事前調査においてミニッツ署名に際し、本項目に係わるサイドレターを取り交わしている事から、同様の内容で再度サイドレターを取り交わしたい旨、強い要望がありサイドレターを取り交わした。

(3)　THE ATTACHED DOCUMENTのANNEXについて

1)　MASTER PLANの全文に関し、ＪＩＣＡ本部からの訓令電に従い変更し、「ト」側と合意した。

2)　ANNEX Ⅱ及びATTACHED DOCUMENT該当箇所について、ＪＩＣＡ本部からの訓令電に従い「Team Leader」を「Chief Advisor」と変更し、「ト」側と合意した。

3)　ANNEX Ⅶ-2について、「ト」側より合同委員会のメンバーに大蔵省を加え、その他のメンバーも昇格したい旨提案があり、協議した結果合同委員会の強化につながることと

判断し、これに同意し変更した。

(4) その他

1) 水産センターのリハビリについて

無償資金フォローアップによる水産センター（Mariculture Centre）のリハビリについて、事前調査では日本側の全額負担としたが、自助努力を求める観点から「ト」側に建設作業員及び一部工事用機材の提供を要求し協議した結果、工事用機材の提供については同意を得た。

建設作業員の提供に関しては予算難であることの理由から実施は困難であるとの返答があり、更に、協議を行った結果、「ト」側がリハビリ工事のスーパーバイズ及び工事監督を行うことで日本側の負担軽減を行うことで合意を得た。（必要な工事内容、優先順位については、付属資料参照）

Ｖ－２　計画実施に関する留意事項

１．第三国、国際機関による水産分野の協力実施状況

1) ＡＩＤＡＢ（Austrarian International Development Aid Bureau）による協力

1990年３月から1992年３月にかけてＡＣＩＡＲが、トンガ、フィジー、ツバル、キリバス、クック諸島の５か国を対象に、シャコ貝種苗生産プロジェクトを実施している。

ＡＣＩＡＲの協力終了後は引き続きＡＩＤＡＢが協力することになっているが予算の都合上、当初５か国、５年間の予定が、トンガ、フィジー、クック諸島の３か国、３年間に変更され、援助額は１か国あたり年間30,000オーストラリア・ドルとなっている。

この資金は水産局に提供され、日本人専門家の使用に関しては特に問題がない。

2) ＦＡＯによる協力

ババウ島アノ湖へのボラ稚魚の放流試験

1990年４月、ハワイよりボラ稚魚一万尾を取り寄せ放流試験を行い、今後も継続して行く予定であったが、近年、グアム、ミクロネシア等でボラの需要が高くなり稚魚不足となったため、当面ＦＡＯの協力は中止となった。

マベ貝の母貝養成

南太平洋プロジェクトの一環としてトンガ水産局事業のサポートという形で始まった。1987年から1988年にかけてのＦＡＯの調査により、マベ貝が再生産しているのが確認され、1989年から1990年にかけてSpat Collectingを実施した。現在は青年海外協力隊隊員とともに母貝の養成試験を重点に協力、順調に進行しており、将来的には輸出産業としての期待がかかっているが、南太平洋プロジェクトが1991年で終了するため、このサポートは打ち切りとなる。

3) ＵＳＡＩＤによる協力

Project Grant Agreement Between Tonga United States of America for Small Scale Tuna Longlining Component of the Pacific Islands Marine Resources（小規模マグロ延縄漁業計画）は、1990年初頭より開始される予定であったが、アメリカ側の予算の都合上により延期されている。

2．青年海外協力隊隊員の活動

現在、養殖（ババウ島でのマベ貝養成）、機関（トンガタプ）、冷凍（トンガタプ）、船外機（ハアパイ島）の４名の隊員が派遣されている。いずれも水産局のもとで活動しているが、本プロジェクトとの関わりは特にないと思われる。

3．トンガ王国第６次５か年国家開発計画（水産開発計画）について

トンガ政府は、漁業活動は経済的に最も高い成長の可能性（1991～1995年にかけて年平均4.5%の伸び率を予想）を実証しうる部門と考えており、本計画に関し次の目的を挙げている。

(1) 民間漁業会社の発展に資する環境作り
(2) 国内外への高品質魚及び他の海産物の商業的生産の促進
(3) 伝統的漁場の乱開発防止に適した漁法の推進
(4) 漁業の生産性及び利益を増加させるための技術移転の促進
(5) 国内外への水産物の流通発展、及び現在の流通システムの改善
(6) 品質管理措置下での水産物の運搬及び加工の改善
(7) 養殖技術の発展
(8) 漁業の発展に寄与するための、水産局の科学的・技術的支援

上記目的に関し、次のとおり計画されている。

1) マン・パワーの強化計画

これは主に、水産局職員の質的レベルアップを図ることを目的としている。内容は以下のとおりである。

- マン・パワー開発プランの準備
- 継続的な訓練計画の作成
- 統計データシステムの作成
- マン・パワー強化の一環としての、ＦＦＡやＳＰＣへの継続的な参加

2) 開発プラン計画

これは、開発計画の方針策定を目的としており、前述マン・パワーの強化計画に関連している。内容は以下のとおりである。

Project	Status	Funding
・統計データベース	新規	
・マン・パワー強化訓練	進行中	British Council, USAID, FFA, BEC
・市場調査	新規	
・漁業センサス	新規	

3) 政策管理計画

これは、漁業に関する法律（ライセンス制度、品質管理法、海洋制限等）の制定推進を目的とする。内容は以下のとおりである。

Project	Status	Funding
・漁業規制	進行中	FFA
・漁業監督	進行中	FFA

4) 漁業振興計画

これは、メディアの利用、漁業データの反映、女性の水産業への進出、漁業者団体へのサポートを目的とする。内容は以下のとおりである。

Project	Status	Funding
・女性の進出	進行中	CFTC
・漁業振興センター	進行中	USAID, Austraria
・漁業者団体	進行中	Local

5) 調査計画

これは、新しい漁法及び漁業の機会をつくることを目的としている。内容は以下のとおりである。

Project	Status	Funding
・資源評価	進行中	USAID
・沖合水域調査	新規	SPC
・イセエビ漁場調査	進行中	SPC
・ナマコ漁場調査	進行中	SPC

6) 養殖計画

これは、漁民の収入増加、就業の機会を目的とした養殖の可能性を調査、または養殖を行うことで、コスト面を考慮した養殖技術、商業的に生残出来るような養殖システムの確立を目指す。内容は以下のとおりである。

Project	Status	Funding
・ボラ養殖	進行中	USAID, FAO, JICA, Local
・真珠貝養殖	進行中	Local
・海草養殖	進行中	Local
・シャコ貝養殖	進行中	ACIAR, Local

7) 漁業の民営化及び商業化計画

これは、漁業開発の様々な分野に対する民間人の参加を奨励することを目的としている。

Project	Status	Funding
・漁業会社	進行中	ADB, Local
・水産加工	新規	ADB
・造船（工場）	進行中	UNCDF
・小規模マグロ延縄漁業	新規	USAID

Ⅵ. 協議議事録

THE RECORD OF DISCUSSIONS
BETWEEN THE JAPANESE IMPLEMENTATION SURVEY TEAM
AND
THE AUTHORITIES CONCERNED OF
HIS MAJESTY'S GOVERNMENT OF THE KINGDOM OF TONGA
ON
JAPANESE TECHNICAL COOPERATION
FOR
AQUACULTURE RESEARCH AND DEVELOPMENT PROJECT IN TONGA

The Japanese Implementation Survey Team (hereinafter referred to as "the Team") organised by the Japan International Cooperation Agency (hereinafter referred to as "JICA"), headed by Mr. Yasuho Tadokoro, visited the Kingdom of Tonga from August 1 to August 8, 1991 for the purpose of working out the details of the technical cooperation for Aquaculture Research and Development in Tonga.

During its stay in the Kingdom of Tonga, the Team exchanged views and had a series of discussion with the authorities concerned of His Majesty's Government of Tonga in respect of the desirable measures to be taken by both governments for the successful implementation of the above-mentioned project.

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

Tongatapu, August 7, 1991.

田所康穂

.....	.....
MR. YASUHO TADOKORO	MR. TANIELA KOLOA
Team Leader	Acting Director of Fisheries
Implementation Survey Team,	Ministry of Fisheries
Japan International Cooperation Agency	His Majesty's Government of Tonga

THE ATTACHED DOCUMENT

I. COOPERATION BETWEEN BOTH GOVERNMENTS

1. The Government of Japan and His Majesty's Government of Tonga will cooperate with each other in implementing the Aquaculture Research and Development Project in Tonga (hereinafter referred to as "the Project") for the purpose of strengthening aquaculture and resource assessment capabilities at the Mariculture Centre, Sopu in Tongatapu Island of the Kingdom of Tonga.

2. The Project will be implemented in accordance with the Master Plan which is given in ANNEX 1.

II. DISPATCH OF JAPANESE EXPERTS

1. In accordance with the laws and regulations in force in Japan, the Government of Japan will take necessary measures through JICA to provide, at its own expense, services of the Japanese experts as listed in ANNEX II through the normal procedures under the technical cooperation scheme of Japan.

2. The Japanese experts referred to in 1 above and their families will be granted in the Kingdom of Tonga the privileges, exemptions and benefits as listed in ANNEX III and will be granted privileges, exemptions and benefits no less favourable than those granted to experts of third countries or international organizations performing similar missions.

III. PROVISION OF MACHINERY AND EQUIPMENT

1. In accordance with the laws and regulations in force in Japan, the Government of Japan will take necessary measure through JICA to provide at its own expense such machinery, equipment and other materials necessary for the implementation of the Project as listed in ANNEX IV, through the normal procedure under the technical cooperation scheme of Japan.

2. The articles referred to in 1 above will become the property of the His Majesty's Government of Tonga upon being delivered c.i.f. to the Tongan authorities concerned at the ports and/or airports of disembarkation, and will be utilized exclusively for the implementation of the Project in consultation with the Japanese experts referred to in ANNEX II.

IV. TRAINING OF TONGAN PERSONNEL

1. In accordance with the laws and regulations in force in Japan, the Government of Japan will take necessary measures through JICA toward technical training in Japan through the normal procedures under the technical cooperation scheme of Japan.

2. His Majesty's Government of Tonga will take necessary measures to ensure that the knowledge and experience acquired by the Tongan personnel from technical training overseas will be utilized effectively for the implementation of the Project.

V. SERVICES OF TONGAN COUNTERPART AND ADMINISTRATIVE PERSONNEL

1. In accordance with the laws and regulations in force in the Kingdom of Tonga, His Majesty's Government of Tonga will take necessary measures to secure at its own expense the necessary services of Tongan counterpart and administrative personnel as listed ANNEX V.

2. As to the Tongan counterpart personnel, His Majesty's Government of Tonga will allocate the necessary number of suitably qualified personnel corresponding to each Japanese expert to be dispatched by the government of Japan as specified in ANNEX II to fulfil the effective and successful transfer of technology under the Project.

VI. MEASURES TO BE TAKEN BY HIS MAJESTY'S GOVERNMENT OF TONGA

1. In accordance with the laws and regulations in force in the Kingdom of Tonga, His Majesty's Government of Tonga will take necessary measures to provide at its own expense:

   (1) Land, building and facilities as listed in ANNEX VI;

   (2) Supply or replacement of machinery, equipment, instruments, vehicles, boats, tools, spare parts and any other materials necessary for the implementation of the Project other than those provided through JICA under III-1 above;

   (3) Transportation facilities and travel allowance for the Japanese experts for the official travel within the Kingdom of Tonga;

   (4) Suitably furnished accommodations for the Japanese experts and their families.

2. In accordance with the laws and regulations in force in the Kingdom of Tonga, His Majesty's of Government of Tonga will take necessary of measures to meet;

(1) Expenses necessary for the transportation within the Kingdom of Tonga of the articles referred to in III-I above as well as for the installation, operation and maintenance thereof;

(2) Customs duties, internal taxes and any other charges, imposed in the Kingdom of Tonga on the articles referred to in III-1 above;

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

VII. ADMINISTRATION OF THE PROJECT

1. The Director of Fisheries, Ministry of Fisheries will bear overall responsibility for the administration and implementation of the Project.

2. The Japanese chief advisor will provide necessary recommendations and advice on technical and administrative matters concerning the implementation of the Project to the Director of Fisheries, Ministry of Fisheries.

3. The Japanese expert will give necessary technical guidance and advice to the Tongan counterparts on matters pertaining to the implementation of the Project.

4. In order to ensure smooth and successful implementation of the Project, the Tongan authorities will establish a coordinating office properly staffed to ensure timely delivery of Tongan inputs to the Project and liaise with Japanese Project Coordinator.

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

VIII. CLAIMS AGAINST JAPANESE EXPERTS

His Majesty's Government of Tonga undertakes to bear claims, if any arises, against the Japanese experts engaged in the Project resulting from, occurring in the course of, or otherwise connected with the discharge of their official functions in the Kingdom of Tonga except for those arising from the willful misconduct or gross negligence of the Japanese experts.

IX. MUTUAL CONSULTATION

There will be mutual consultation between the two Government on major issues arising from, or in connection with this ATTACHED DOCUMENT.

X. TERM OF COOPERATION

The during action of the technical cooperation for the Project under this ATTACHED DOCUMENT will be five (5) years from October,1991.

ANNEX I. MASTER PLAN

1. The Project will be implemented for the purpose of strengthening aquaculture and resource assessment capabilities at the existing Mariculture Centre, Sopu in Tongatapu Island.

2. The technical cooperation will be implemented through technical guidance and advice to the Tongan counterpart personnel in the following fields:

A. Aquaculture Research and Development for Finfish
Mullet, rabbit fish and milkfish are targeted. Among the three, mullet has the first priority, rabbit fish the second and milkfish the third.

A-1. Biological and ecological research on natural stocks to identify distributions, spawning season, seasonal occurrence, growth rate, etc.

A-2. Identification and development of proper methods of natural seed collection.

A-3. Experiment of finfish culture by using tanks (nursery) and pen-culture system (grow-out).

A-4. Examination of economic feasibility of mullet culture in tanks (nursery) and pen-culture system (grow-out).

B. Aquaculture Research and Development for Shellfish
Aquaculture research and development are conducted by transplantation of valuable species and stock-enhancement of depleted species.

B-1. Transplantation experiment of trochus and red-lipped stromb.

B-2. Stock-enhancement experiment of giant clams, mainly Tridacna squamosa an Tridacna derasa by planting seed clams produced in the hatchery.

C. Basic Fisheries and Biological Research in Coral Reef and Lagoon for shellfish
Basic fisheries and biological research on shellfish resources in coral reef and lagoon are conducted for rational fisheries management.

C-1. Surveys to obtain reliable fisheries statistics of giant clams and other important shellfish in the Kingdom, especially in Tongatapu Island.

C-2. Research on status of shellfish stocks and their living environment before releasing seed-shell of giant clams.

C-3. Research on ecological and environmental conditions for transplantation of trochus and red-lipped stromb.

C-4 Follow-up surveys after releasing seed-shells of giant clams and transplanting trochus and red-lipped stromb in order to establish appropriate stock-enhancement techniques.

C-5 Resource assessment study for stock management of important shellfishes, mainly Anadara spp., Tectus pyramis.

ANNEX II. JAPANESE EXPERTS.

1. Chief advisor

2. Project Coordinator

3. Experts in the field of:

(1) Fish Culture
(2) Seed Production
(3) Shellfish Culture
(4) Stock Survey

Note:

(1) Chief advisor may serve as an expert in one of the field mentioned above.
(2) Short-term experts in the fields of technical cooperation as listed in ANNEX I will be dispatched when necessity arises for the smooth implementation of the Project.

ANNEX III. PRIVILEGES, EXEMPTIONS AND BENEFITS

1. Exemption from income tax and charges of any kind imposed on or in connection with the living allowances remitted from abroad.

2. Exemption from import and export duties and any other charges imposed in respect of personal and household effects (including one vehicle) which may be brought into the Kingdom of Tonga.

3. Free medical and dental services and facilities at Governmental hospital and health centres.

7

ANNEX IV. SUMMARY LIST OF EQUIPMENT AND MATERIAL

1. Machinery, equipment and material for seed production, seed collection and pen culture.

2. Machinery, equipment and material for stock survey.

3. Work boats with outboard motor and vehicles.

4. Other equipment, material and spare parts necessary for the implementation of the Project.

8

ANNEX V. LIST OF TONGAN COUNTERPART AND ADMINISTRATIVE PERSONNEL

1. **The Head of the Project**

   Director of Fisheries, Ministry of Fisheries.

2. **Counterpart**

   Suitably qualified personnel on full time basis to each Japanese expert as specified in ANNEX II.

3. **Administrative personnel**

   Typists, clerks, drivers, watchmen, etc.

9

ANNEX VI. LIST OF LAND, BUILDING AND FACILITIES

1. **Land**

   Mariculture Centre, Sopu, Tongatapu.

2. **Building and Facilities**

   (1) Office space for Japanese experts

   (2) Pen culture sites

   (3) Experimental tanks and water supply system

   (4) Storage house and workshop

   (5) Other facilities necessary for smooth implementation

ANNEX VII. THE JOINT COMMITTEE

1. Functions

The Joint Committee at policy level will meet at least once a year :

(1) To formulate annual work plan of the Project ;
(2) To review annual activities of the Project;
(3) To review all problems arising from the implementation of the Project and recommend corrective measures;
(4) To examine the local draft budget necessary for the implementation of the Project;
(5) Staffing of the Project and ;
(6) Others.

2. Composition

The Joint Committee will be set up consisting of:

(1) Chairman : Secretary of Ministry of Foreign Affairs
(2) Members :

a. Tongan side :
- Chief Secretary to Government, Prime Minister's Office.
- Director of Fisheries, Ministry of Fisheries
- Secretary, Ministry of Labour, Commerce and Industries.
- Secretary, Ministry of Finance.

b. Japanese side :
- Chief advisor
- Project Coordinator
- Experts assigned to the Project as needed
- Deputy Resident Representative of JICA in the Republic of Fiji
- Other personnel concerned to be dispatched by JICA, as appropriate

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

11

ANNEX VIII. THE STEERING COMMITTEE

1. Functions

The Steering Committee at working level will meet every two months:

(1) To review the progress of the Project;
(2) To formulate on a detailed work plan; and
(3) To settle any issues that might arises.

2. Composition

The Steering Committee will be set up consisting of :

(1) Chairman : Director of Fisheries, Ministry of Fisheries
(2) Members :

- Principal Fisheries Officer, Taniela Koloa
- Chief advisor
- Project Coordinator
- Experts assigned to the Project
- Other personnel concerned as needed.

All correspondence to be addressed to:
The Director of Fisheries,
P.O.Box 871,
Nuku'alofa,
Kingdom of Tonga.

MINISTRY OF FISHERIES
Telephone: (676) 21399
Telex : 66 369 PRIMO TS
Fax : (676) 23091

Our Reference : F2/9/1/248 **Date :** 7 August, 1991

Mr Yasuho TADOKORO
Team Leader
Implementing Survey Team
Japan International Cooperation Agency
JAPAN

Dear Sir

Hereby request additional funds to meet labour cost for the rehabilitation of Mariculture Centre under the Aquaculture Research and Development Project in Tonga. Breakdown of funds are as follows :

Estimated Labour Costs

T$600.00 / person/month
For 5 persons for 3 months = 9,000.00

Estimated Supervisor Costs

- Carpenter supervisor - T$500.00 per month.
- Engineering supervisor - T$500.00 per month.
  For 3 months = 3,000.00

Total = T$12,000.00

Grateful for your kind cooperation, and look forward to a most successful of this project.

.....
Taniela Koloa
Acting Director of Fisheries

Ⅶ. 暫定実施計画

TENTATIVE SCHEDULE OF IMPLEMENTATION OF THE TECHNICAL COOPERATION FOR AQUACULTURE RESEARCH AND DEVELOPMENT PROJECT IN TONGA

The Japanese Implementation Survey Team and the authorities concerned of His Majesty's Government of Tonga have jointly formulated the Tentative Schedule of Implementation and staffing schedule of the Project as annexed hereto.

This has been formulated in connection with the Attachment of the Record of Discussions signed between the Japanese Implementation Survey Team and the authorities concerned of His Majesty's Government of Tonga for the Project on the condition that necessary budget will be allocated for the implementation of the Project by both sides, and the schedule is subject to change within the framework of the Record of the Discussions when necessity arises in the course of the implementation of the project.

Tongatapu, August 7, 1991

田所康穂

Mr. YASUHO TADOKORO
Team Leader
Implementation Survey Team,
Japan International Cooperation Agency

Mr. TANIELA KOLOA
Acting Director of Fisheries
Ministry of Fisheries,
His Majesty's Government of Tonga

STAFFING SCHADULE

	1st	2nd	3rd	4th	5th
1. Japanese Side:					
(1) Dispatch of Long-term Experts					
a. Team Leader/Seed Production	———	———	———	———	———
b. Project Coordinator	———	———	———	———	———
c. Finfish Culture	———	———	———	———	———
d. Shellfish Culture	———	———	———	———	———
e. Stock Survey	———	———	———	———	———
(2) Dispatch of Short-term Experts	----------	(When necessity arises)			----------
(3) Provision of Machinery and Equipment	———	———	———	———	———
(4) Counterpart Overseas Training	——	(Two or three personnel every year)			—
2. Tongan Side					
(1) Staffing of Tongan Counterpart	———	———	———	———	———
(2) Expenses for The Implementation of The Project	———	———	———	———	———
3. Joint Committee	—	—	—	—	—
4. Steering Commitee	----------	(When necessity arises)			----------

NOTE: Short-term Experts in the fields of technical cooperation as listed in 1. above will be dispatched when necessity arises for the smooth implementation of the Project.

Programs	Sub Programs	Subject	I				II				III				IV				V			
			1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
1.Aquaculture Research and Development for Finfish	(1)Research on Biology and Ecology(by species)	A.Species Distributions B.Spawning Season C.Natural Seed Occurrence D.Other Biology and Ecology																				
	(2)Culture Experiment	A.Natural Seed Collection B.Tank C.Pen-culture(Grow-out) D.Local Feed Development																				
	(3)Study on Economic Feasibility	A.Production-Cost B.Economic Feasibility																				
	(4)Experiment on Seed Production	A.Breeding Experiment with Available spp.(Rabbit fish etc.)																				
2.Aquaculture Research and Development for Shellfish	(1)Seeds Releasing of Giant Clam	A.Survey on Necessary Condition for Seed Releasing B.Mass Production Technics C.Seed Releasing Methods																				
	(2)Experiment on Transplantation of Exotic Species (Trochus,Red-lipped stromb)	A.Survey on Necessary Condition for Transplantation B.Releasing Methods																				
	(3)Experiment on Seed Production	A.Biology and Ecology B.Artificial Breeding																				
3.Basic fisheries and Biological Research in Coral Reef and Lagoon Shellfish Resources	(1)Stock survey of Giant Clam	A.Survey of Coral Reef Ecology B.Survey of Seed releasing Results																				
	(2)Stock survey of Economically Important Species	A.Survey of Coral Reef Ecology B.Marketing Research																				
	(3)Resources Management	A.Study on Planning of Resources Management System B.Economic Study of Resource Management																				
4.Training Program	(1)Overseas Training and Study Tour	A.Fields of Aquaculture B.Fisheries Resource Management																				

付　属　資　料

1．第6次国家開発計画（抜すい）

2．水産センター・リハビリ工事の細目について

1．第６次国家開発計画（抜すい）

CHAPTER 1

NATIONAL DEVELOPMENT OBJECTIVES AND STRATEGIES

1.0 INTRODUCTION

The objectives and strategies of the Sixth National Development Plan (DPVI) reflect the economic and social objectives that the Government of the Kingdom of Tonga has approved as being attainable within a five-year period. It is recognized that other priorities may emerge during the plan period and would also need to be addressed.

1.1 *NATIONAL DEVELOPMENT OBJECTIVES*

The national economic and social objectives for DPVI are to:

- achieve sustainable economic growth conducive to a higher per capita income;
- achieve a more equitable distribution of incomes and a more equitable access to goods and services between regional community groups and between income groups;
- generate more employment opportunities;
- restore and control external financial balances;
- enhance the quality of life by raising health standards, maintaining national security and continuing to promote the cultural heritage of the Kingdom;
- develop beneficial relations with other nations; and
- ensure the continued protection and management of natural resources for sustainable development.

These national economic and social development objectives provide the framework within which the Government's strategies and policies are formulated.

1.1.1 Achieve sustainable economic growth conducive to a higher per capita income

This is the predominant objective of DPVI. Unless there is real and sustainable economic growth, it would be difficult to achieve other objectives such as a higher standard of living, a more equitable distribution of income and increased employment. It is noted that the objective of higher economic growth may conflict with certain other objectives (e.g. protection of natural resources). However, it is conceded that economic growth a precondition for the other economic *objectives. The objective of higher economic growth implies that Government will* seek through an appropriate framework of incentives and regulations to ensure the efficient distribution of resources, the expansion of the market economy (while

limiting the growth of the public sector) and a diversification of the economic base, and will implement dynamic export-oriented policies in view of the open nature of the economy.

1.1.2 Achieve a more equitable distribution of incomes and a more equitable access to goods and services between regional community groups and between income groups.

There are noticeable disparities in the distribution of incomes among the different island groups in the kingdom. There are still some communities where a substantial part of the economic activities are of a subsistence nature. In addition to this, the distribution of public goods and services also follows an uneven pattern. This is a reflection of the scattered nature of the island regions, which, in the presence of diseconomies of scale, makes the equitable provision of goods and services prohibitively high. Regional integrated development programmes have already been established for Vava'u and Ha'apai to address these specific issues and strengthen the public infrastructure and utilities, and the provision of public services. The needs of isolated island communities which do not yet have integrated development programmes ('Eua, Niuas) will be given special attention.

1.1.3 Generate more employment opportunities

The demographic structure of the kingdom is a matter of concern, given that over 40 percent of the population are under the age of 21 years. The number of school leavers joining the economically active age category has been increasing over the years. Many are seeking employment and employment opportunities will need to be increased to cater for them. It is intended that the higher economic growth should enable the absorption of a substantial number of this group into the work force. In the past, migration overseas has been an outlet for this group. However, recent events in the recipient countries have led to a slowing down of this trend. Unless more employment opportunities are generated as a matter of urgency, this may lead to the growth of urban poverty with severe social consequences. The ability of the Government and the public enterprises to employ school leavers has been severely constrained and it is hoped that the private sector will contribute significantly to the creation of employment opportunities.

1.1.4 Restore and control external financial balances

As the Kingdom is a small island open economy, the balance of payments is one of the most critical criteria of economic viability. It is therefore important that the management of the balance of payments be given high priority. Policy measures will be devised allowing for their impact on the external accounts. Failure to ensure this would eventually cause increased external financial dependence which could reverse the hard-earned gains in economic growth made in recent years. The Government will also implement policy measures to strengthen the structure of the balance of payments through expansion of the export and tourism sectors, the generation of domestic savings, the curtailment of Government budget deficits, and the rationalization of Government overseas borrowing. The Government will also use appropriate policy measures to maintain low inflation and a purchasing power parity with its main trade partners.

1.1.5 Enhance the quality of life by raising health standards, maintaining national security and continuing to promote the cultural heritage of the Kingdom

This objective first seeks to improve the quality of life of the people. Measures will be taken through public health education programmes to improve public

responsiveness to the dangers of AIDS, smoking, alcoholism, unbalanced diets, obesity and other illnesses. There is evidence of a trend towards increasing illnesses related to poor nutritional habits and a static lifestyle, and greater reliance on curative medical treatment than on prevention. Unless there is a healthy and generally fit workforce, losses in productivity could inhibit the achievement of higher economic growth. The Government will therefore place greater emphasis on preventive measures so that the people can enjoy a healthier lifestyle.

In the past, the South Pacific has been regarded as a haven of calm and peace. Recent political upheavals in the region, with their associated civil disturbances, suggest that it will be prudent for the Government to ensure continued vigilance with regard to national security. Disturbances could easily upset the pace of economic development.

The people of the Kingdom are justifiably proud of their cultural heritage. However, in a rapidly changing environment, lack of attention to the impact of outside influences can lead to the loss of important component elements of culture by default. The Government will therefore continue its efforts to promote the Kingdom's cultural heritage as a matter of priority.

1.1.6 Develop beneficial relations with other nations

The Government will continue its policies of maintaining cordial and mutually beneficial relations with other nations. This will be of crucial importance in developing the Kingdom's trade links with the outside world.

1.1.7 Ensure the continued protection and management of natural resources for sustainable development

The Government will implement policies to prevent depletion of the Kingdom's natural resources. A prime area of concern is with overfishing in coastal areas. There is also concern that such resources as black coral or rare birds are becoming scarce or endangered. Furthermore, another major area of concern is the need to regenerate the stock of trees available as these are widely used as a primary source of energy. The Government will implement appropriate measures to manage the use of forests.

1.2 NATIONAL DEVELOPMENT STRATEGIES

1.2.1 Economic development strategy

The economic development strategy of DPVI aims at generating economic growth and employment opportunities. Special emphasis will be placed on the export and tourism sectors, where certain competitive advantages are perceived. The Government will introduce measures to support private entrepreneurs in these and other sectors. The Government's role will be that of a growth catalyst. In particular, one will not adopt policies that could indirectly or unintentionally discriminate against or undermine the growth of the private sector. Furthermore, the Government will review its existing policies to ensure that the latter do not unduly constrain economic growth.

The Government will ensure that fiscal and monetary policies are conducive to non-inflationary growth. It will avoid frequent budget deficits, maintain non-inflationary growth in domestic liquidity, and seek to provide positive real interests to financial savers. In the presence of foreign competition, domestic producers must maintain efficiency in production. The Government will ensure that

allocations of resources through prices and taxes are favourable to competitive domestic production.

1.2.2 Social development strategy

The Government will maintain special emphasis on the development of health services and access to education. Both of these sectors will continue to offer subsidized services to the public. The Government will consider the development of disadvantaged or swampy areas as a matter of priority as well as the provision of affordable housing to low income-earning groups. The Government will also direct more assistance to women's development groups, particularly in isolated island communities, and enhance the provision of law and order and the protection of the environment. Finally, the Government will seek to develop public transport services because of the scattered pattern of people's settlements throughout the Kingdom.

CHAPTER 8

FISHERIES

8.1 OBJECTIVES

Objectives of development for the fisheries sector during the DPVI period are considered as follows:

- create an environment conducive to the development of private sector involvement in fisheries;
- encourage commercial production of quality fish and marine products for both domestic consumption and exportation;
- encourage alternative fishing habits to prevent over-exploitation of traditional fishing grounds;
- encourage technology transfers to increase the productivity and profitability of fishing activities;
- encourage the development of market outlets, both locally and overseas, for fish and other marine products; improve the existing marketing systems;
- improve fish handling techniques and encourage fish processing under quality control measures;
- develop aquaculture;
- develop the Fisheries Department's scientific and technical services to support the development of the sector.

8.2 BACKGROUND

8.2.1 *Fisheries in the economy*

Fishing activities are among sectors of the economy demonstrating the highest growth potential (4.5% annual average anticipated between 1991 and 1995). A large proportion of the outer islands population is dependent on fisheries as its main source of livelihood. Fish also accounts for a large part of the Tongan diet in rural areas.

8.2.2 Resources base

Tonga is still to declare its Exclusive Economic Zone, which could place approximately 700,000 sq. kilometres of ocean space under the national jurisdiction. This large ocean area harbours a great diversity of living marine resources.

The Kingdom's fisheries resources are classified into:

- shallow-water fisheries over shallow reefs, lagoons and inshore pelagic zones with a maximum 50-75 metres depth;

- deep-water demersal fisheries over reef slopes and offshore seamounts, extending to depths of 1000 metres;

- deep-water fisheries over the offshore pelagic zone where depths exceed 1000 metres.

8.2.2.1 Shallow reefs, lagoons and inshore pelagic zones

This resources zone encompasses the lagoons, inter-tidal zones and adjacent areas of sea with a maximum depth of about 75 metres. The width of this zone varies from less than 100 metres to more than 20 kilometres around islands and island groups. It includes areas within the barrier reefs, offshore shallow reefs and inshore pelagic zones.

It is estimated that some 65% of all fish landings, including shellfish and crustaceans, are caught in this zone. Many of the resources in shallow reef areas adjacent to towns and villages have been overfished, and current landings are close to maximum sustainable yields. There is a particular concern about rock spiny lobster and tridacnid clam stocks, which are now protected under resources management legislation (Fisheries Act 1989). This zone requires careful monitoring to avoid further overfishing in the future.

An inshore pelagic zone is delineated as a fishing area for a fleet that also fishes in shallow reef zones, seamount zones, and over reef slopes, but not for boats that fish in the offshore pelagic zone. The depth of an inshore pelagic zone varies from 75 m to more than 600 m, and the distance from land usually does not exceed 30 kilometres.

This resources zone is rich with small pelagic species of tuna, dolphin fish, mackerel and sardines. These are caught with troll lines, poles and lines using pearl shell lures and nets. Most species found in this zone are seasonal.

8.2.2.2 Reef slopes and offshore seamount zones

This resources zone comprises the deep-bottom fishing grounds at the outer fringes of the main plateaus, offshore islands, offshore banks and seamounts, in depths from 75 metres to not more than 1000 metres.

A scientific assessment of fishing resources in this zone estimated a total maximum sustainable yield of 222-761 metric tonnes. The capture method used is bottom handlining (to 500 m) although it is known that species live at depths that may reach 1000 metres.

A deep water snapper species called Alfonsino (of the Bericidae family) is known to exist in this zone at depths of 600-1000 m. This species is valued by the Japanese market.

8.2.2.3 Offshore pelagic zone

The offshore pelagic zone (mostly open ocean) is found beyond the 6000 m contour. Resources in this zone comprise the large tuna species of albacore, yellowfin, bigeye and skipjack. Other species common in this zone are the marlin and sailfish. Tongan catches in this zone amount to an average 300 metric tonnes annually. The estimated potential yield however is in thousands of tonnes.

Albacore tuna (Thunnus alalunga) is the most highly valued and most abundant species in this zone. Stocks in the whole South Pacific region are now threatened by the excessive use of drift gillnets by Asian fishermen. The accepted capture method for albacore is surface longlining and trolling.

Table 8.1 shows the estimated potential of Tonga's fish resources zones.

TABLE 8.1

SUMMARY OF ESTIMATED FISHERIES POTENTIAL

		PRESENT ANNUAL CATCH		POTENTIAL ANNUAL CATCH	
Fishing zones	Area (km^2)	Quantities (tonnes)	Landed value (T$'000)	Quantities (tonnes)	Landed value (T$'000)
Shallow reefs & lagoons zone	5,352	1,757	5,271	2,000	6,000
Inshore pelagic zone	41,010	150	450	200	560
Reef slopes & seamounts zone	1,420	100	1,000		
Offshore pelagic zone	313,820	425	8,920	1,460	30,660

8.2.3 Institutional structure

The Fisheries Department in the Ministry of Agriculture, Forests and Fisheries was established in early 1973 with a staff of four and an annual operating budget of T$1,000. At the end of 1989, the Department staff had risen to 44, and the operating budget for the current year was T$4,208,000.

The Fisheries Department is divided into six functional sections (Extension, Planning, Aquaculture, Administration, Support Services, Management). It is responsible for supporting the development of fisheries and managing the exploitation of fish resources within Tonga's jurisdiction while allowing the long-term sustainability of these resources and securing maximum economic and social benefits for Tongans.

8.3 PERFORMANCE DURING THE DPV PERIOD

8.3.1 Production and exports of fish

Table 8.2 indicates the volumes of fisheries production for the export and local markets during the DPV period.

TABLE 8.2

FISH LANDED FOR EXPORT AND LOCAL MARKETS
(in metric tonnes)

Type of market	1985	1986	1987	1988	1989	Total
Export	325	276	341	271	256	1962
Local	45	27	14	48	44	481
Total	370	303	355	319	300	2443

The fishing fleet employs some 180 fishermen. The volume of landed fish for exportation has demonstrated a decreasing trend over the DPV period: About 50% of total landings are eventually exported to the Hawaii fresh fish market. Tables 8.3 and 8.4 present the detailed volumes and values of fish exports during the 1985-1989 period.

TABLE 8.3

VOLUMES OF FISH EXPORTS, 1985-1989
(in '000 metric tonnes)

Type of export	1985	1986	1987	1988	1989
Fresh, chilled or frozen fish	320.3	331	1,144.1	452.4	373.7
Lobster	0.9	2.9	3.4	3.8	0.6
Vasuva	0.03	0.3	1.3	0.8	0.1
Octopus	0.1	0.1	0.2	0.05	0.4
Fish preserves	0.1	0.3	3.1	5.6	2.2
Crustaceans & molluscs	0	4.8	0.7	0.2	0.4
Total	321.4	339.4	1,152.8	462.85	377.4
of which:					
Government	86	238.2	888	299.5	205.1
Private	235.4	101.2	264.8	163.4	172.3

Other types of exported marine products include coral, shells and exotic local food for the tourist market or Tongan communities abroad.

TABLE 8.4

VALUES OF FISH EXPORTS, 1985-1989
(T$'000)

Type of export	1985	1986	1987	1988	1989
Fresh, chilled or frozen fish	727.2	750	1,193.1	2,295.0	1,100.4
Lobster	6.9	13.1	30.4	38.5	3.8
Vasuva	0.1	1	5.1	3	0.2
Octopus	0.6	0.7	0.5	0.2	1.4
Fish preserves	0.2	0.4	14.6	20.9	8.8
Crustaceans & molluscs	0	18.8	4.5	0.2	2
Total	735	784	1,248.2	2,357.8	1,116.6
of which:					
Government	193.5	571.1	761	779.1	507.5
Private	541.5	212.9	487.2	1,578.7	609.1

8.3.2 Imports of fish products

Fish and marine products have always been a major component of the Tongan diet. Recent trends, however, have indicated a shift to cheaper protein sources as local supplies are barely sufficient to meet the domestic demand at prices within the buying power of average Tongans. Table 8.5 shows volumes and values of fish products imports during the 1985-1989 period.

TABLE 8.5

IMPORTS OF FISH PRODUCTS, 1985-1989

	CANNED FISH		OTHER FISH PRODUCTS		
Year	Quantities (tonnes)	Values (T$'000)	Quantities (tonnes)	Values (T$'000)	Total value (T$'000)
1985	197	442	241	543	985
1986	133	318	161	402	720
1987	159	252	261	448	700
1988	124	227	173	320	547
1989	196	367	237	460	827

8.3.3 Operations of M.V. Lofa

Tuna longline fishing vessel Lofa was launched in 1982. Between 1985 and 1989, export sales realized by the government-owned vessel accounted for an average 62% of the country's total exports of fish and marine products. Though operated within commercial guidelines, M.V. Lofa is administered by the Fisheries Department.

In nine years, the vessel has developed proven efficiency in albacore tuna fishing in Tongan waters. During this development period, Government has been able to identify options for a successful commercial operation of M.V. Lofa. The latter is to become a public company with Government as a minority share-holder. Access to the exclusive economic zones of other South Pacific countries would greatly enhance the commercial performance of the fishing vessel. Table 8.6 summarizes the operations of M.V. Lofa.

TABLE 8.6

SUMMARIZED OPERATIONS OF M.V. LOFA (1985-1989)

in T$	1985	1986	1987	1988	1989	TOTAL
REVENUE						
export sales	637,140	531,304	751,224	746,231	698,713	3,364,612
local sales	31,864	19,957	25,830	40,608	35,967	154,226
total sales	669,004	551,261	777,054	786,839	734,680	3,518,838
EXPENDITURE						
crew costs	176,082	148,612	195,483	407,036	219,472	1,146,685
others	327,911	292,651	272,204	269,113	275,270	1,437,149
Total expend.	503,993	441,263	467,687	676,149	494,742	2,583,835
Net cash profit	165,011	109,998	309,367	110,690	239,937	935,003
Depreciation exp.	150,000	150,000	150,000	150,000	150,000	750,000
Net profit (loss)	15,011	(40,002)	159,367	(39,310)	89,937	185,003

8.3.4 Boat building

A programme of boat construction with external assistance has allowed the development of a small-scale commercial fishing sector. Through this programme, a number of fishermen have been provided with medium-sized vessels equipped to operate in offshore, deep-water fishing grounds for exportable snapper and grouper species. Table 8.7 shows the number of vessels constructed under the programme, and Table 8.8 outlines their distribution by island group.

8.3.5 Fisheries credit

The Tonga Development Bank provides loans to individual fishermen for income-generating projects. A record of loans granted during the DPV period is given in Table 8.9.

TABLE 8.7

NUMBER OF BOATS CONSTRUCTED
(by boat size and boat-yard)

Boat size	Sopu	Ha'apai	Vava'u	Total
20'	2	4	-	6
21'	-	3	-	3
28'	14	2	7	23
30'	4	2	2	8
32'	1	-	-	1
Total	21	11	9	41

TABLE 8.8

DISTRIBUTION OF BOATS BY ISLAND GROUP
(1984-1989)

Island group	20'	21'	28'	30'	32'	Total
Tongatapu	1	-	10	3	1	15
'Eua	2	1	-	-	-	3
Ha'apai	1	2	3	5	-	11
Vava'u	1	-	10	-	-	11
Niuatoputapu	1	-	-	-	-	1
Total	6	3	23	8	1	41

TABLE 8.9

TONGA DEVELOPMENT BANK LOANS TO FISHERIES, 1985-1989
(in T$'000)

Types of projects	1985-86	1986-87	1987-88	1988-89	1989-90	Total
Boats & motors	205.4	365.3	247.1	313.5	213.4	1,344.7
Fishing gear	8.9	7.6	3.6	6.9	2.1	29.1
Nets & traps	55.9	67.5	77.5	87.9	68.0	356.8
Marketing & processing	-	-	19.4	2.7	-	22.1
Others	6.3	0.4	10.7	5.6	4.4	27.4
Total	276.5	440.8	358.3	416.6	287.9	1,780.1

8.3.6 Assistance under the rural development programme

Assistance has been provided to the small-scale fishing sector under the Small Projects Fund and Rural Development Fund (see Table 8.10). This grant programme assists fishermen in establishing themselves in the fisheries industry.

TABLE 8.10

ASSISTANCE TO FISHERIES UNDER THE SPF/RDF PROGRAMME
(July 1985-June 1990)

	1985-86		1986-87		1987-88		1988-89		1989-90		Total	
	No.	T$'000	No.	T$'000	No.	T$'000	No.	T$'000	No.	T$'000	No.	T$'000
Boat & engine	12	23.6	5	26.1	7	15.1	35	66.2	9	19.4	68	150.4
Engine only	10	14.0	4	4.3	8	16.2	3	4.9	2	3.1	27	42.5
Total	22	37.6	9	30.4	15	31.3	38	71.1	11	22.5	95	192.9

8.3.7 Extension and training activities

The Fisheries Extension Section seeks to allow the successful transfer and adoption of new technologies among fishermen. During the DPV period, the following services were provided.

Fishermen's training

A two-week training course for fishermen has been organized every year with assistance from the United Nations Capital Development Fund (UNCDF). The course is divided between classroom and ocean-going sessions. Fisheries Extension officers have acted as instructors. Training subjects included: navigation, echo-sounder use, VHF radio use, first aid and sea safety, diesel engine maintenance, boat maintenance and fishing methods. The course has been attended by prospective owners of UNCDF project vessels, as well as crew members. Aboard each vessel with students was a Fisheries Extension staff member who monitored the students' ability to operate the vessel. At the end of the course, each fisherman received a certificate from the Fisheries Department and a VHF radio operator licence from Telegraph and Telephone Communications (TTC).

Village level programmes

Extension officers have been assisting fishermen, at the village level, to improve fishing techniques as well as fishing gear making and maintenance.

Training subjects include fishing net making and mending, outboard motor repair, knot tying and fish preservation methods (icing and freezing, fish handling).

8.3.8 Research

Research undertaken during the DPV period involved the following areas of activities:

1.	Rock Lobster Survey	- Abundance and size distribution survey
2.	Inshore Reef Fisheries Assessment	- Statistical information on: - Routine lunar monthly fishing - Inventory of fishing gear and materials - Catch assessment survey - Inventory and survey of fishing grounds
3.	Purse Seine Bait Fishing	- Series of bait trials for albacore fishing was completed
4.	Fishing Aggregation Devices (FAD)	- FADs were placed off the island of Tongatapu
5.	Seaweed Farming	- Trials of seaweed farming at Nukuleka and Vava'u
6.	Mullet Culture	- Feasibility study on mullet culture in Vava'u
7.	Demersal Species on Seamounts	- Full stock assessment programme to estimate maximum sustainable yield, mortality rate, age, growth
8.	Pelagic Species	- Data collection for tuna and billfish stocks assessment (fork length frequency, albacore guts). Part of South Pacific Albacore Research programme (SPAR)
9.	Trochus	- Survey on species and abundance
10.	Giant Clams (Tridacnidae)	- Abundance and size distribution survey Assessment of fishing pressure on the clams stock
11.	Beche-de-mer	- Abundance and size distribution survey, biological study, processing
12.	Oyster	- Pilot project study for culture of local oyster in Vava'u

8.4 KEY ISSUES AND CONSTRAINTS

8.4.1 Unequal distribution of the fishing effort

Fishing grounds around the larger islands appear to be nearing or exceeding the limits of sustainable exploitation. Meanwhile, much of the outer islands fisheries remains under-exploited. The unequal distribution of the fishing effort is primarily a function of the poor transport facilities and the lack of ice plants and supporting infrastructure for fishermen.

There is no immediate solution to the outer islands problem. The Fisheries Department is gradually establishing offices and improving facilities in the islands, but the main problem remains the transportation of fish to the markets. Fish collection by special vessels has been tried but no venture proved economically viable in the long run. The introduction of a fast and frequent cargo and passenger service could alleviate this problem. Such service was offered for 5 months in 1990 by an inter-islands ferry (M.V. Lulu Tahi).

8.4.2 Over-exploitation of resources

The over-exploitation of fish resources could be tackled at two levels: at the point of catch, and at the point of export.

Through public awareness programmes and a strengthened role of the Tonga Fishermen Association, the Department hopes to highlight the vulnerability of most marine resources to prolonged fishing pressures.

A more responsible attitude in regard to husbanding marine resources should also be encouraged among exporters.

8.4.3 Regulation of fisheries

The old Fisheries Act did not allow proper monitoring of fishing activities. New regulations under the Fisheries Act 1989 are apt to respond to the constraints of industrial, deep-sea and resources-limited fisheries. The problem of enforcing the law yet remains, and the Fisheries Department needs a greater law-enforcement capacity. There are plans to devolve a large part of the responsibility for regulating inshore fisheries on the Tonga Fishermen Association.

8.4.4 Lack of infrastructure

The major components of infrastructural support to fishermen (e.g., jetties, slipways, repair facilities), like spare parts for vessels and engines, are in short supply.

The recent growth of small-scale commercial fisheries has highlighted the lack of berthing, unloading and resupplying facilities at major ports. The emplacement and maintenance of infrastructure is a priority of the Fisheries Department, which seeks the assistance of various aid donors. The present infrastructure is inadequate to support commercial fishing activities, particularly in the context of diversification and growth of deep-sea fishing. Further training of Department staff in engineering, maintenance and equipment management will be necessary.

8.4.5 Fish processing

There has been little effort to develop fish processing in Tonga. In view of the general lack of awareness of fish processing methods, the Fisheries Department needs to organize fishermen's training and to support desirable investment proposals. The private sector should be encouraged into fish processing, particularly for the export market. The tourism industry also provides a demand for high-quality processed fish from local fishermen.

8.4.6 Need for a data base

There is a small fisheries data base, which is hardly adequate to allow meaningful analysis on any sector of fisheries. For effective management of Tonga's marine resources, there is an urgent need to develop a comprehensive data base and upgrade the Department's capability to collect and analyse data, and monitor developments in the fisheries sector.

8.4.7 Fishermen's organization

Early efforts to organize fishermen into a cohesive force had failed because of a lack of effective management and the part-time nature of most fishermen's activities.

Increasing numbers of full-time fishermen and the development of a deep-sea, export-oriented fishing profession are now creating a climate that is conducive to cooperative efforts among fishermen. The formation of the Tonga Fishermen Association in 1988 provided the necessary forum for fishermen's participation in the development of the sector. Existence of the Association should allow certain economies of scale in purchases of fishing gear and equipment, and for insurance premiums on fishing vessels. It should also strengthen the fishermen's bargaining power to export. Finally, the Tonga Fishermen Association should play a major role in the regulation of fisheries.

8.5 DEVELOPMENT STRATEGY

8.5.1 Prospects for growth

Tonga's marine resources, in particular, pelagic resources are large enough to sustain accelerated development. Tonga's numerous seamounts harbour a variety of deep-bottom snappers, for which lucrative markets exist overseas. The abundance of yellowfin tuna within Tonga's EEZ could be a basis for access to the attractive sashimi market. Reef-based fisheries, though showing signs of over-exploitation in many areas, could also be oriented towards export markets within sustainable limits.

Processing methods could be introduced in the outer islands as an export industry. The low prices of current fresh fish supplies should be an incentive for such diversification.

Aquaculture has shown promising signs, and if current marketing constraints are alleviated, it could provide income-earning opportunities and generate employment.

Finally, the waters of neighbouring states host substantial tuna resources which are currently being exploited, to a large extent, by distant foreign fishing operators. Tonga has, over the last 20 years, developed and perfected its tuna longline fishing technique. A desirable development would therefore be to seek access to the proven fishing grounds of neighbouring countries.

8.5.2 Project and development planning

The Fisheries Department will pursue the following strategy with regard to project planning and development coordination:

- formulate, evaluate and monitor development projects;
- carry out financial analysis of Government's commercial ventures and recommend measures allowing economic viability;
- conduct periodic evaluation of sectoral performance;
- conduct analysis of access fee levels;
- seek foreign market outlets through contacts with regional organizations;
- set out a manpower development programme;
- administer aid programmes;
- develop a system of fisheries data collection and analysis.

8.5.3 Policy management

The Fisheries Department is responsible for the enforcement of the Fisheries Act, conservation and surveillance measures and other regulations, as well as the administration of fishing licences and quotas, and export licences.

In order to regulate and control fisheries under the principle of optimum utilization and long-term sustainability of resources, the following strategy will be pursued:

- establish an appropriate licencing scheme for fishermen, domestic vessels and foreign vessels;
- authorize village elders to assist as "wardens" in resources management;
- devolve authority and responsibilities in inshore fisheries management on the Tonga Fishermen Association;
- organize a surveillance programme for Tonga's Exclusive Economic Zone.

8.5.4 Fisheries extension

The Department's programme of technical assistance to fisheries will concentrate on fishermen with a proven performance. During the DPV period, assistance focussed on the provision of vessels, loans or grants and training. Future assistance will benefit fishermen who have made the best use of these facilities to increase the fish supply.

A priority will be to promote self-sufficiency among fishermen who have been accorded development assistance, through the provision of spare parts and appropriate fishing gear. The Fisheries Department will also develop its capacity to assist fishermen in business management and marketing.

The following extension policy will be pursued in order to encourage production of fish and other marine products for the domestic and export markets:

- establish closer links between Extension and Research services on gear development and alternative fisheries;
- expand and improve fishermen's training in gear technology and fish business management;
- allow interaction between fishermen and the Extension Section through frequent exchanges of information and consultations, particularly through the Tonga Fishermen Association;
- develop a fisheries information service through the use of leaflets, radio programmes and existing newspapers;
- strengthen the Women's Development in Small-Scale Fisheries Unit.

8.5.5 Administrative support

Staff expansion has taken place in certain sections of the Department, particularly for market surveys, resource assessment, resource development and the operation of extension offices.

Devolution of certain functions on the private sector through the Tonga Fishermen Association or similar institutions is envisaged. These functions concern boat building, fishing gear sales, management of fish markets and ice plants.

8.5.6 Infrastructure

Expansion and renovation of ice plants will be made possible through external assistance. Fisheries Extension offices, particularly in Ha'apai and 'Eua, need to be upgraded to common standards with an ice plant, a jetty, a slipway and an engineering workshop.

8.5.7 Support services

The Support Services Section is responsible for all technical functions (electrical, electronic, mechanical) affecting the fishing fleet, vehicles, infrastructure and boat-yard.

The following strategy will be pursued:

- offer vessel maintenance and repair support to fishermen;
- develop preventive maintenance on vessels and in ice plants;
- provide training for local boat builders.

8.5.8 Research

The Research Section is responsible for resources surveys within Tonga's EEZ, and provides technical advice on related aspects.

The following strategy will be pursued during the DPVI period:

- implement resources surveys in liaison with regional organizations;
- study alternative fishing modes;
- develop links between Research and Management services;
- develop data forms for research purposes (markets, local and foreign vessels);
- train local observers to accompany foreign research vessel teams.

8.5.9 Resources assessment

An immediate priority for resources assessment is the establishment of a comprehensive data base on the various resources available in Tonga's waters.

Assessment of stocks in view of the danger of over-exploitation is another area of priority concerning inshore species within traditional fishing grounds. Such species include reef and deep-water snappers, and sedentary crustaceans that are currently being depleted.

Further assessment work will consist in the identification of resources with commercial potential, in particular, new offshore resources.

Resources assessments on an area basis will allow mapping of traditional fishing grounds and better management of inshore fisheries.

8.5.10 Resources development

A major thrust of resources development is expected in connection with small-scale offshore fishing. Emphasis will also be placed on the development of aquaculture as tested aquacultural techniques will be transferred to the private sector.

The deployment of fish aggregation devices anchored in deep waters has been of significant assistance in increasing fish catches and has helped to divert fishing efforts from over-exploited lagoon and reef resources. This programme is to be extended to other areas.

8.5.11 Aquaculture

The Aquaculture Section is responsible for the development of culture-based fisheries and re-seeding of reefs for stocks replenishment.

During the plan period, the following strategy will be pursued to develop aquaculture:

- experiment species that have commercial potential;
- liaise with the Planning Section on market outlets;
- liaise with the Research Section on technical aspects of the culture systems;
- implement reef re-seeding programmes;
- strengthen the manpower's capacity in regard to the various culture systems;
- exchange information on aquaculture with other South Pacific countries.

8.5.12 Fish processing and quality control

With the growth of fishing activities, one expects an increasing interest in fish processing and handling, particularly for exportation. Initial priority is on greater public awareness of the importance of proper handling of fish.

As the fisheries sector expands commercially, there are greater prospects for large-scale cooperative marketing and purchasing of handling gear and other equipment.

As retail sales tend to diversify from traditional local markets, it will be necessary to enforce recent regulations on fish quality control.

8.5.13 Fisheries trade

Tuna has been the major component of Tonga's fisheries export trade and is likely to have the greatest potential for improving the fisheries trade balance, subject to an increase in the local tuna fleet capacity. The privatization of M.V. Lofa as a local company should facilitate the purchase of two other vessels for the company.

Exports of specialty products such as trochus buttons, lobster, beche-de-mer and crab are based on limited resources. Re-seeding programmes through aquaculture for increasing resources are likely to be faced with competition from other South Pacific islands and Southeast Asia. Efforts accordingly will be directed toward increasing quality more than quantities.

8.6 DEVELOPMENT PROGRAMME

8.6.1 Strengthening the manpower capacity

This programme mainly concerns manpower training and development, and involves among other targets the fisheries data base. Its components will be:

- the preparation of a manpower development plan;
- the organization of a continuous training programme;
- the creation of a statistical data system;
- continued participation of the Forum Fisheries Agency and South Pacific Commission in manpower-related programmes.

8.6.2 Development planning

This programme will mainly involve manpower development planning for the sector, and strengthening of the Department's capacity for policy formulation and analysis of development options.

Projects	Status	Funding
1. Statistical Data Base	new	-
2. Manpower Training	ongoing	British Council, USAID, FFA EEC $300,000
3. Market Research	new	-
4. Fisheries Census	new	-
5. Storage Facilities	new	-

8.6.3 Policy management

This programme will concentrate on increasing legislation awareness, allowing coordination with New Zealand and Australian surveillance units, training community elders and members of the Tonga Fishermen Association to assume certain responsibilities for management and enforcement, and liaising with the Forum Fisheries Agency on the management of distant waters fishing fleets. Among components of the programme are:

- the development of an effective management unit;
- the establishment of a licencing scheme for fishermen, domestic vessels and foreign vessels;
- the conduct of training on quality control methods;
- the creation of marine reserves.

Projects	Status	Funding
1. Fisheries Regulation	ongoing	FFA
2. Surveillance	ongoing	FFA

8.6.4 Fisheries extension

This programme mainly concerns extension media, transfers of research findings to fishermen, women's involvement in fisheries enterprises, support to the Tonga

Fishermen Association and development of the fisheries extension centres.

It will involve the organization of training programmes for extension staff (statistics, resources assessment, fish handling and processing, business management), testing of new gear types and fishing methods, and upgrading of the advisory and support service capacity of the fisheries extension centres.

Projects	Status	Funding
1. Women's Involvement	ongoing	CFTC
2. Fisheries Extension Centres	ongoing	USAID ... ... $6,000 Australia ... $40,000
3. Fishermen Association	ongoing	Local $4,000

8.6.5 Research

This programme aims at highlighting new fisheries modes and opportunities. Activities will involve deep-water snappers, inshore and offshore pelagic resources, sedentary resources, lobster and beche-de-mer, and fish aggregation devices.

Projects	Status	Funding
1. Stock Assessment	ongoing	USAID
2. Fishing Aggregation Devices	ongoing	USAID
3. Offshore Pelagic Survey	ongoing	SPC
4. Lobster Survey	ongoing	SPC
5. Beche-de-mer Survey	ongoing	SPC

8.6.6 Aquaculture

This programme will explore the possibilities of aquaculture as an income earner and a source of employment. Its activities will involve mullet, pearl oyster, seaweeds and giant clams.

Components of the programme will consist of developing cost-effective culture techniques (particularly among rural communities) and encouraging the production of commercially viable culture systems. This will imply the creation of small aquaculture farms and reef ranches, as well as the development of locally produced feed.

Projects	Status	Funding
1. Mullet Farming	ongoing	USAID, FAO, JICA, Local
2. Pearl Oyster Farming	ongoing	Local
3. Seaweed Farming	ongoing	Local
4. Giant Clam Hatchery	ongoing	ACIAR, Local

8.6.7 Fisheries privatization and commercialization programme

This programme will promote the participation of the private sector in various areas of fisheries development.

Programme activities involve privatization of M.V. Lofa and research vessels, as well as boat-building operations, fish markets and marine engineering. These

activities will imply carrying out financial analysis of commercial projects, and developing subsidy schemes as incentives for entrepreneurs.

Privatization of M.V. Lofa will take place through a transfer of ownership of the vessel to the newly formed Sea Star Fishing Company Ltd. (1990), of which Government and the private sector will be shareholders. In addition to M.V. Lofa, the Company's assets will include two longline fishing vessels (23.5 m) to be built with ADB funds.

Projects	Status	Funding
1. Fishing Company	ongoing	ADB, Local
2. Fishing Industry (Processing)	new	ADB
3. Boat-building (Boat-yard)	ongoing	UNCDF
4. Small Scale Tuna Longline Fishing	new	USAID

TABLE 8.11

SUMMARY OF FISHERIES INVESTMENT PROGRAMME
(T$'000)

Programmes	1991	1992	1993	1994	1995
1. Development Planning	16	20	40	60	60
2. Policy Management	6	6	5	8	8
3. Fisheries Extension	48	8	6	20	10
4. Research	80	60	50	50	60
5. Aquaculture	105	80	90	90	100
6. Fisheries Privatization & Commercialization	30	625	560	480	500
Total	287	799	751	708	738

2．水産センター・リハビリ工事の細目について

		数量	単位	合　計	優先度
1	Laboratory Bldg.				
1-(1)	Conversion from Cold Storage to Office Room			50,800	
1-(1)-1	Clearing of Existing Cold Storage				
a)	Labor Cost(Unskilled labour)	15	MD	33,000	**
b)	Rent for Gus Cutter	2	day	17,600	**
1-(1)-2)	Construction of New Office			4,122,210	**
a)	Labour (for floor chopping)	15	MD	33,000	*
b)	Floor Concrete	6	cu.m	79,200	*
c)	Cement Mortar				
1)	Floor	40	sq.m	79,200	*
2)	Skitting H=150	23	m	12,650	*
3)	Wall	70	sq.m	138,600	*
d)	Carpentary Work				
1)	Plywood Veneer of Ceiling incl. Wood Furring	40	sq.m	176,000	*
2)	Wooden Jambs for Door and Window	21	m	34,650	*
3)	Wall Trim incl. Wood Furring	17	m	18,700	*
e)	Finishing Work (Vinyl Tile t=2.7mm)	40	sq.m	132,000	*
f)	Painting Work				
1)	Oil Paint for Plywood Veneer	40	sq.m	22,000	*
2)	Oil Paint for Wall Trim	77	m	12,705	*
3)	Emulsion paint for Mortar	70	sq.m	46,200	*
g)	Electrical Work				
1)	Lighting Fitting incl. Wiring and Piping(Type (A) FL 40 W x 2	4	No	75,200	*
2)	Socket-outlet incl. Wiring and Piping 1P 10A	4	No	22,000	*
3)	Socket outlet for Air Conditioner incl. Wiring and Piping	1	No	11,000	*
h)	Air Conditioner incl. Fitting	1	No	1,168,000	*
1-(2)	Replacemnet of Doors and Windows			731,020	
1-(2)-1	Laboratory's Alumium Doors incl. Hardware and Fitting 1600W x 20	1	No	103,960	
1-(2)-2	Glass incl. Fitting Plate Wire Glass t=6.5mm				
a)	1400W x 2100H	2	No	77,000	
b)	800W x 2000H	6	No	123,360	
c)	Fitting and Material	1	lot	77,800	
1-(2)-3)	Blind Curtain incl. Fitting				
a)	500W x 1900H	2	No	7,600	
b)	4000W x 2650H	3	No	127,200	
c)	7000W x 2650H	1	No	74,200	
d)	2900W x 1650H	2	No	38,280	
e)	1700W x 1650H	13	No	87,100	
f)	1700W x 1200H	5	No	40,800	
g)	1700W x 900H	1	No	6,120	
h)	Fitting	1	lot	17,600	
1-(3)	Toilet			321,680	
1-(3)-1)	Replacement of Toilet Partition				
1)	For Men				
a)	2200W x 2000H	1	No	44,000	
b)	1300W x 2000H	1	No	26,000	
c)	Hardware and Fixed Material	1	lot	35,000	
2)	For Women				
a)	2800W x 2000H	1	No	56,000	
b)	1300W x 2000H	1	No	26,000	
c)	Hardware and Fixed Material	1	lot	40,000	
3)	Fitting	1	lot	26,400	
1-(3)-2)	Replacement of Urinal				
1)	Uninal	1	No	53,960	
2)	Ditto Fitting	1	lot	8,800	
3)	Repairing Tile	1	lot	5,500	
1-(4)	Removing Wall Mounted Exhaust Fan and fix the Wall			14,300	
1-(4)-1)	Lobour for Removing Wall Mounted Exhaust Fan	2	MD	4,400	
1-(4)-2)	Repairing of Wall	6	No	9,900	
1-(5)	Replacement of Lighting Fixture,Switches and Socket Outlet's Pla			2,332,794	
1-(5)-1)	Lobour for Remove of Lighting Fixture, Switchws and Socket outle	26	No	80,080	
1-(5)-2)	Lighting Fixture				
1)	TYPE A	52	No	691,600	
2)	TYPE B	21	No	312,900	
3)	TYPE C	15	No	141,000	
4)	TYPE D	2	No	38,000	
5)	TYPE E	2	No	10,200	
6)	TYPE F	2	No	14,200	
7)	TYPE G	10	No	80,000	
8)	TYPE H	4	No	102,400	
9)	TYPE I	4	No	100,800	
10	TYPE J	21	No	183,750	
11	Consumption	1	lot	200,982	
12	Electrician for Fitting	90	MD	277,200	
1-(5)-3)	Switches				
1)	1 & 2 Device Plate	25	No	8,750	
2)	4 Device Plate	2	No	2,100	
3)	15A 1P Switch	45	No	12,375	
4)	15A 3W Switch	2	No	700	
5)	Flam	31	No	2,852	
6)	Consumption	1	lot	4,410	
7)	Electrician for Replacement	19	MD	58,520	
1-(5)-4)	Socket outlet (Plate)	57	No	9,975	
1-(6)	Spare Parts for Piping at Wet Lab			78,304	
1-(6)-1)	PVC Pipe				
1)	2 inch dia. 4m	3	No	5,640	*
2)	1 inch dia.	3	No	2,346	*
3)	3/4 inch dia.	3	No	1,623	*
1-(6)-2)	PVC Valve				
1)	1 inch dia.	10	No	34,200	*
2)	3/4 inch dia.	5	No	14,175	*
1-(6)-3)	Air Cock (1/4 inch dia.)	5	No	5,445	*
1-(6)-4)	PVC Socket				
1)	2 inch dia.	5	No	1,080	*
2)	1 inch dia.	10	No	630	*
3)	3/4 inch dia.	5	No	205	*
1-(6)-5)	PVC Elbow				
1)	1 inch dia.	10	No	790	*
2)	3/4 inh dia.	5	No	270	*
1-(6)-8)	PVC Faucet Elbow (3/4 inch dia.)	5	No	2,430	*

優先順位欄　＊は日本側，**はトンガ側の負担を求めた項目。無印はペンディング項目。

1-(6)-7)		PVC Fee				
	1)	2 x 2 inch dia.	5	No	2.235	*
	2)	3/4 x 3/4 inch dia.	5	No	385	*
1-(6)-8)		PVC Reducer 2 x 1 inch dia.)	10	No	2.080	*
1-(6)-9)		Solvent Cement (500g)	5	No	2.970	*
1-(7)		Rain Water Catchment Tank			934.534	
1-(7)-1)		Foundation of Tank				
	1)	Floor Concrete	0.8	cu.m	10.560	
	2)	Filling with Hardcore	0.8	cu.m	5.280	
	3)	Steel Bar	1	lot	6.600	
	4)	Form Work	1	lot	11.000	
	5)	Backfilling and Ram of Existing Rain Water Catchment	5	cu.m	33.000	
	6)	Unskilled Labour	3	MD	6.600	
1-(7)-2)		FRP Tank				
	1)	FRP Tank 1 ton incl. Steel Rack	1	lot	673.000	
	2)	Labour Cost for Plumber	5	MD	22.000	
1-(7)-3)		Rehabilitation of PVC Down Spout				
	1)	PVC Pipe 4 inch dia. incl. pipe fitting supports solvent cement	78	m	128.554	
	2)	Labour Cost for Plumber	20	No	88.000	
1-(8)		Replacement of Air Conditioner of Cultivation Room			281.600	
1-(8)-1)		Air Conditioner	1	No	273.000	*
1-(8)-2)		Labour Cost for Plumber	2	No	8.800	**
1-(9)		Equipment for Meeting Room			1.389.560	
1-(9)-1)		Replacement of Floor Carpet				
	a)	Floor Carpet	40	sq.m	120.000	
	b)	Carpenter	2	MD	10.560	
	c)	Unskilled Labour	3	MD	6.600	
1-(9)-2)		Folding Chair	10	No	104.000	
1-(9)-3)		Meeting Table	2	No	69.600	
1-(9)-4)		Air Conditioner				
	a)	Air Conditioner	1	No	1.080.000	*
	b)	Plumber	2	MD	8.800	**
2		Machine Room				
2-(1)		Removing of Existing Machine Room			131.560	
2-(1)-1)		Foreman	3	MD	15.840	**
2-(1)-2)		Unskilled Labour	15	MD	33.000	**
2-(1)-3)		Plumber	6	MD	23.760	**
2-(1)-4)		Electrician	6	MD	6.160	**
2-(1)-5)		Rent for Gas Cutter	2	day	17.600	**
2-(1)-6)		Rent for Crane	4	hrs	35.200	*
2-(2)		Construction of New Machine Room			1.447.800	
2-(2)-1)		Foundation of Concrete	2	cu.m	26.400	*
2-(2)-2)		Form Work	10	sq.m	38.500	*
2-(2)-3)		Anchor Bolt	8	No	24.000	*
2-(2)-4)		Structural Steel Work	1300	kg	429.000	*
2-(2)-5)		Roof Work				
	a)	Roof Deck t=0.8	62	sq.m	223.200	*
	b)	Ridge Covering	27	m	17.820	*
	c)	Gabel Covering	15	m	20.250	*
	d)	Steel Angle L-50x50x3	17	m	30.600	*
2-(2)-6)		Wall Work				
	a)	Siding t=0.4	72	sq.m	194.400	*
	b)	Corner Covering	31	m	54.250	*
	c)	Flashing of Wall	61	m	80.520	*
	d)	Flashing of Opening	24	m	28.800	*
2-(2)-7)		Painting Work				
	a)	Rust-preventive paint	99	sq.m	54.450	*
	b)	Oil paint	77	sq.m	42.350	*
2-(2)-8)		Glass (0.8 x 0.6)	6	No	9.900	*
2-(2)-9)		Labour Cost				
	a)	Foreman	7	No	36.960	**
	b)	Welder	21	No	92.400	**
2-(2)-10)		Rent for Gas Cutter	5	day	44.000	**
2-(3)		Electrical Work			7.787.554	
2-(3)-1)		Generator 50 KVA 415/240	1	No	3.600.000	*
2-(3)-2)		Distribution Panel	1	No	2.860.000	*
2-(3)-3)		Control Panel	1	No	330.000	*
2-(3)-4)		Wire Work incl. insulation tapes and connectors				
	a)	IV 38	36	m	9.936	*
	b)	IV 14	18	m	2.052	*
	c)	IV 5.5	104	m	4.888	*
	d)	IV 2.0	140	m	3.500	*
	e)	CV 3C-14	8	m	3.512	*
	f)	CV 2C-5.5	8	m	1.360	*
	g)	VVF 3C-1.6	6	m	252	*
2-(3)-5)		Steel Conduit with Fitting Supports and Pipe Clamps				
	a)	39	24	m	5.520	*
	b)	25	56	m	8.120	*
	c)	19	30	m	3.090	*
	d)	Flexible Joint 24	20	m	12.000	*
2-(3)-6)		Lighting Fitting FL 40x1	4	No	59.600	*
2-(3)-7)		Switch with Cover Plate	1	No	1.206	*
2-(3)-8)		Socket Outlet	1	No	1.368	*
2-(3)-9)		Reinforceing Material	1	No	16.610	*
2-(3)-10)		Consumption	1	lot	696.700	**
2-(3)-11)		Labour Cost (Electrician)	48	MD	147.840	**
2-(4)		Mechanical Work			5.880.812	
2-(4)-1)		Seawater Intake Pump	3	No	2.610.000	*
2-(4)-2)		Blower Pump	2	No	1.440.000	*
2-(4)-3)		Relief Silencer	1	No	65.200	*
2-(4)-4)		PVC Seawater Supply Pipe incl. Pipe Fitting Supports solvent Cem				
	a)	5 inch dia.	13	No	38.727	*
	b)	4 inch dia.	37	No	85.803	*
	c)	3 inch dia.	35	No	54.915	*
	d)	2 inch dia.	29	No	23.287	*
	e)	3/4 inch dia.	3	No	687	*
2-(4)-5)		Stop Valve				
	a)	5 inch dia.	3	No	166.779	*
	b)	4 inch dia.	4	No	159.300	*
	c)	3 inch dia.	3	No	79.137	*
	d)	2 inch dia.	3	No	52.704	*
	e)	1-1/2 inch dia.	1	No	17.235	*
2-(4)-6)		Check Valve				
	a)	4 inch dia.	3	No	95.850	*

	b)	3 inch dia.	2	No	43.380	*
2-(4)-7)		Pressure Switch	1	No	38.070	*
2-(4)-8)		Floor Drain(2 inch dia.)	2	No	6.408	*
2-(4)-9)		Faucet (1/2 inch dia.)	1	No	2.340	*
2-(4)-10)		Consumption	1	lot	248.990	*
2-(4)-11)		Labour Cost (Plumber)	150	MD	462.000	**
3		Culture Tank				
3-(1)		Removing of Existing Purline and Corrugated FRP Sheet			70.400	
3-(1)-1)		Labour Cost (Welder)	12	MD	52.800	**
3-(1)-2)		Rent for Gas Cutter	2	day	17.600	**
3-(2)		Construction of New Purline and Corrugated FRP Sheet			2,529,350	
3-(2)-1)		Structural Steel Work				
	a)	Structural Steel	3000	kg	990.000	*
	b)	Welder for Fitting	15	MD	66.000	**
3-(2)-2)		Roof Work				
	a)	Corrugated FRP Sheet	376	sq.m	1,090,400	*
	b)	Ridge Covering	29	m	91.350	*
	c)	Welder for Fitting	45	MD	198.000	**
3-(2)-3)		Painting Work				
	a)	Rust-preventive Paint	180	sq.m	99.000	*
	b)	Oil Paint	132	sq.m	72.600	*
	c)	Repaint for Tank	1	lot	22.000	*
3-(3)		Spare parts for Piping of Concrete Tank			420.084	
3-(3)-1)		PVC Drain Pipe H=1000mm 2-1/2 inch dia.	6	No	176.580	*
3-(3)-2)		PVC Level Control Pipe H=1000mm 2-1/2 inch dia.	6	No	252.504	*
3-(4)		Waterproofing (Labour)	8	MD	35.200	
4						
4-(1)		Removing of Existing Roof			11.000	**
4-(1)-1)		Labour Cost	5	MD		
4-(2)		Construction of New Roof			1,394,450	
4-(2)-1)		Structure Stell Work				
	a)	Structure Steel	2000	kg	660.000	*
	b)	Anchor Bolt	16	No	48.000	*
4-(2)-2)		Roof Work (Corrugated FRP Sheet)	114	sq.m	330.600	*
4-(2)-3)		Painting Work				
	a)	Rust-preventive paint	144	sq.m	79.200	*
	b)	Oil Paint	103	sq.m	56.650	*
4-(2)-4)		Labour Cost				
	a)	Foreman	5	MD	26.400	**
	b)	Welder	10	MD	44.000	**
	c)	Roof Worker	14	MD	61.600	**
4-(2)-5)		Rent for Gas Cutter	2	day	17.600	**
4-(2)-6)		Rent for Crane	1	day	70.400	*
4-(3)		Installing Sensor of Seawater			301.271	
4-(3)-1)		Wire Work				
	a)	CVV MAZV 5C-2	150	m	62.400	*
	b)	Connecting Material	1	lot	8.320	*
4-(3)-2)		Float Switch	1	No	15.900	*
4-(3)-3)		Consumption	1	lot	4.331	**
4-(3)-4)		Labour Cost (Electrician)	4	MD	12.320	**
4-(3)-5)		Excavation and Backfilling	45	cu.m	198.000	**
4-(4)		Seawater Piping Connection			93.318	
4-(4)-1)		PVC Pipe (4 inch dia.)	6	m	13.914	*
4-(4)-2)		Stop Valve				
	a)	4 inch dia.	1	No	39.825	*
	b)	3 inch dia.	1	No	26.379	*
4-(4)-3)		Labour Cost (Plumber)	2	MD	8.800	**
4-(4)-4)		Excavation and Backfilling	1	cu.m	4.400	**
5		Elevated Seawater Tank				
5-(1)		Removing of Existing Elevated Tank			212.980	
5-(1)-1)		Labour Cost				
	a)	Foreman	2	MD	10.560	**
	b)	Welder	6	MD	26.400	**
	c)	Plumber	4	MD	17.600	**
5-(1)-2)		Rent for Gas Cutter	2	day	17.600	**
5-(1)-3)		Rent for Crane	2	day	140.800	*
5-(2)		Construction of New Elevated Tank			4,693,550	
5-(2)-1)		Structure Steel Work				
	a)	Structure Steel	3700	kg	1,221,000	*
	b)	Anchor Bolt	16	No	48.000	*
5-(2)-2)		Painting Work				
	a)	Rust-preventive Paint	277	sq.m	152.350	*
	b)	Oil Paint	149	sq.m	81.950	*
5-(2)-3)		Labour Cost				
	a)	Foreman	2	MD	10.560	**
	b)	Welder	6	MD	26.400	**
5-(2)-4)		Rent for Gas Cutter	2	day	17.600	**
5-(2)-5)		Rent for Crane	2	day	140.800	*
5-(3)		FRP Seawater Tank			1,249,200	
5-(3)-1)		FRP Seawater Tank (5 ton)	1	No	1,214,000	*
5-(3)-2)		Labour Cost (Plumber)	8	MD	35.200	**
5-(4)		Replacement of Seawater Piping			425.282	
5-(4)-1)		PVC Pipe				
	a)	5 inch dia.	14	m	36.218	*
	b)	4 inch dia.	16	m	32.224	*
	c)	3 inch dia.	16	m	21.792	*
	d)	2 inch dia.	4	m	2.788	*
5-(4)-2)		Stop Valve				
	a)	5 inch dia.	1	No	55.593	*
	b)	2 inch dia.	1	No	17.568	*
5-(4)-3)		Consumption	1	lot	8.309	**
5-(4)-4)		Labour Cost	57	MD	250.800	**
5-(5)		Installing Sensor of Seawater			238.143	
5-(5)-1)		Wire Work				
	a)	CVV MAZV 5C-2	150	m	62.400	*
	b)	Connection Material	1	lot	8.320	*
5-(5)-2)		Electric Rod 5P	1	No	60.540	*
5-(5)-3)		Consumption	1	lot	6.563	**
5-(5)-4)		Labour Cost (Electrician)	4	MD	12.320	**
5-(5)-5)		Excavation and Backfilling	20	cu.m	88.000	**
6		Drainage				
6-(1)		Construction of Catch Basin			235.950	
6-(1)-1)		Excavation	12	cu.m	39.600	**
6-(1)-2)		Backfillinh	8	cu.m	8.800	**

6-(1)-3)		Hardcore	0.5	cu.m	3,300	**
6-(1)-4)		Plain Concrete	0.25	cu.m	2,750	**
6-(1)-5)		Reinforced Concrete	2.25	cu.m	29,700	**
6-(1)-6)		Steel Bar	225	kg	29,700	**
6-(1)-7)		Form Work	24	sq.m	92,400	**
6-(1)-8)		Cement Mortar	15	sq.m	13,200	**
6-(1)-9)		Cover of Concrete	3	No	16,500	**
6-(2)		Connecting Drainage Piping			389,080	
6-(2)-1)		PVC Pipe (5 inch dia.)	30	m	63,480	*
6-(2)-2)		Labour Cost (Plumber)	44	MD	193,600	**
6-(2)-3)		Excavation and Backfilling	30	cu.m	132,000	**
6-(3)		Removing and Replacement of the Water Mound			184,800	
6-(3)-1)		Hardcore	3	cu.m	19,800	**
6-(3)-2)		Cement Mortar	3	cu.m	39,600	**
6-(3)-3)		Labour Cost				
	a)	Foreman	3	MD	15,840	**
	b)	Unskilled Labour	15	MD	33,000	**
6-(3)-4)		Tent for Backhoe	3	day	76,560	**
7		Potable Culture Tank				
7-(1)		Rough Grading of Site			111,780	
7-(1)-1)		Labour Cost				
	a)	Foreman	2	MD	10,560	
	b)	Labour	10	MD	22,000	
7-(1)-2)		Rent for Bulldozer	1	day	79,200	
7-(2)		Construction of Roof			3,509,365	
7-(2)-1)		Foundation				
	a)	Excavation	28	cu.m	92,400	
	b)	Backfilling	28	cu.m	30,800	
	c)	Gravel	1.2	cu.m	3,960	
	d)	Plain Concrete	1.2	cu.m	13,200	
	e)	Reinforced Concrete	2	cu.m	26,400	
	f)	Steel Bar	100	kg	13,200	
	g)	Form Work	8.4	sq.m	32,340	
7-(2)-2)		Retaing Wall				
	a)	Excavation	36	cu.m	118,800	
	b)	Backfilling	36	cu.m	39,600	
	c)	Gravel	2.2	cu.m	14,520	
	d)	Reinforced Concrete	3.5	cu.m	46,200	
	e)	Steel Bar	360	kg	47,520	
	f)	Form Work	22	sq.m	84,700	
	g)	Block	45	sq.m	247,500	
	h)	Sand	57.5	cu.m	189,750	
7-(2)-3)		Drainage Canal				
	a)	Excavation	4	cu.m	13,200	
	b)	Backfilling	4	cu.m	4,400	
	c)	Hardcore	2	cu.m	13,200	
	d)	Reinforced Concrete	2	cu.m	26,400	
	e)	Steel Bar	120	kg	15,840	
	f)	Cement Mortar	12	sq.m	10,560	
7-(2)-4)		Structure Steel Work				
	a)	Structure Steel	4000	kg	1,320,000	*
	b)	Labour Cost				
	1)	Foreman	2	day	10,560	
	2)	Welder	6	day	26,400	
7-(2)-5)		Roof Work				
	a)	Corrugated FRP Sheet	200	sq.m	580,000	
	b)	Ridge Covering	14.5	m	45,675	
	c)	Labour Cost				
	1)	Foreman	3	day	15,840	
	2)	Roof Worker	24	day	105,600	
7-(2)-6)		Painting Work				
	a)	Rust-preventive Paint	300	sq.m	165,000	
	b)	Oil Paint	160	sq.m	88,000	
7-(2)-7)		Rent for Gas Cutter	2	day	17,600	
7-(2)-8)		Rent for Crane	2	day	140,800	
7-(3)		Electrical Work			185,750	
7-(3)-1)		Wire Work				
	a)	CVV MAZV 3C-2.2	50	m	20,750	
	b)	IV 2.0	120	m	3,000	
7-(3)-2)		Steel Conduit 19	40	m	4,120	
7-(3)-3)		Lighting Fitting FL-40W x 2	8	No	106,400	
7-(3)-4)		Switch with Cover Plate	2	No	11,000	
7-(3)-5)		Socket Outlet	2	No	22,000	
7-(3)-6)		Labour Cost (Electrician)	6	MD	18,480	
7-(4)		Mechanical Work			844,226	
7-(4)-1)		Seawater Supply PVC Pipe			56,400	*
	a)	2 inch dia. 4M	30	No		
	b)	Connection Material	1	lot	35,000	*
7-(4)-2)		Stop Valve (2 inch dia.)	8	No	140,544	*
7-(4)-3)		PVC Drainage Pipe				
	a)	4 inch dia.	15	m	31,740	*
	b)	Drain Pipe 2-1/2 inch H=100	4	No	74,000	*
	c)	Level Control Pipe 2*1/2 inch H=100	4	No	168,336	*
	d)	Catch Basin	1	No	78,650	*
7-(4)-4)		Air Cock (1/4 inch dia.)	4	No	4,356	*
7-(4)-5)		Labour Cost (Plumber)	43	MD	189,200	**
7-(4)-6)		Excavation and Backfilling	15	cu.m	66,000	**
8		Installing Sensor at Intake Pit			71,880	
8-(1)-1)		Wire Work				
	a)	CVV MAZV 5C-2	100	m	41,600	*
	b)	Connecting Material	1	lot	8,000	*
8-(1)-2)		Float Switch	1	No	15,900	*
8-(1)-3)		Labour Cost (Electrician)	2	MD	6,160	**
9		Rehabilitation of Domitory Bldg.			646,400	
10		Common Temporary Work			514,000	*
Total					39,020,465