ANNEX F. AGRONOMY

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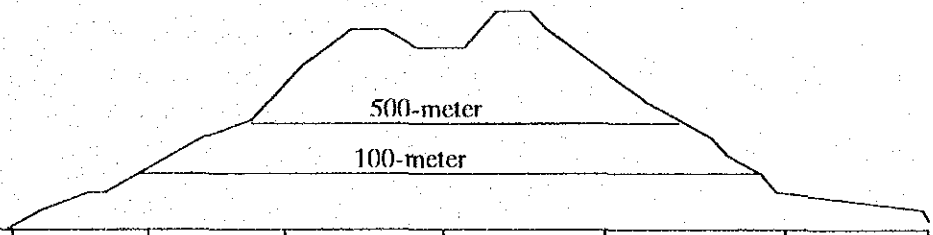
F-1. Cropping Patterns, Agro-Climatic Zones and Soil Moisture

Although the country is quite small it is highly diverse and it is very difficult to give a common cropping pattern even for isolated areas but it is not to difficult to give a general pattern based on elevation and rainfall with consideration given to what direction the slope is facing for the mountainous areas. Figure 1 is the best schematic version of East Timor for at least the western and central parts of the country with only Lautem in the far eastern part of the country being considerably different because of the rainfall pattern and also the lack of significant mountains to cause rain shadows. However, Lautem also shows the influence of the central divide in terms of soil moisture regime with a rough division down the center

Indicative North-South East Timor transects showing the major agro-climatic zones.



Agro climatic zones	Northern low lands	Northern lower slopes	Northern Highlands	Southern Highlands	Southern lower slopes	Southern lowlands
Average no of Wet months	4 -5	5 -6	6 -7	9	8	7 - 8
Average Annual *Rainfall* (mm)	< 1,000	1,000 to 1,500	> 1,500	> 2,000	1,500 to 2,000	< 1,500
Estimated area of East Timor (Ha)	147,056	336,627	290,553	215,020	304,981	166,700
Estimated percentage	10%	23%	20%	15%	21%	11%

Source : BARDAP 2000

The general features arising from the above diagram and field visits in the western, central and eastern areas of East Timor are:

- The northern lowlands and northern lower slopes have the least agricultural potential. They have large areas with poor soils and short/unreliable-wet season. Although there are pockets of alluvial soils with good agricultural potential, any rice crop grown in the lowland plains is subject to frequent flash floods that increase the risk of growing rice and in damage and siltation to the irrigation systems
- The southern lowlands and lower slopes generally have the best agricultural potential (large areas with soils of good agricultural potential on gently undulating plains and moderate slopes, although there are pockets with unsuitable soils and locations subject

to flood damage

- The northern upper slopes and mountainous slopes also have a lower agricultural potential than the south coast with large areas with poor soils but a more reliable wet season makes them safer in terms of yield stability than the dry northern coastal plain.
- The southern upper slopes and mountain slopes have generally better agricultural potential than the northern side of the mountains with soils of adequate agricultural potential on steep to more moderate slopes. The increased rainfall makes vegetation cover grow for a longer period each year and this tends to give these areas greater erosion resistance than the northern slopes.

Figure F-1 gives another way of looking at the potential for crop growth and the potentials for managing crops production in terms of soil moisture. The positive aspects of the soils moisture regime are however counteracted by the lack of roads and the prevalence of mosquito and water born diseases that have caused these productive areas to be under populated in relation to higher areas that are more disease free.

1.1 Cropping Patterns in the Lower Northern Slopes and Lowlands

Because of the very short duration and erratic distribution of rainfall on the northern coastal areas, dry land cropping systems tend to revolve around maize planting at the first opportunity following the first significant rainfall in November or December. The maize is most commonly planted with squash although interplanting with beans and cassava is also common. If squash is the companion crop, the farmers rarely plant beans. Cassava and beans are more commonly grown together with maize. The maize is harvested first followed by beans in one month and cassava after seven or eight months. The low lying squash plants continue to grow for as long as the rains continue and soil moisture are available for plant growth. Squash plants are almost as productive as maize in short wet seasons and more productive than maize in long wet seasons. The leaves, flowers and young fruit of the quash plant are a staple item in the diet of Timorese providing many vitamins not found elsewhere in the diet.

The variability of cropping patterns on the north coast is limited by the short wet season and the limited time available for crop growth. There is only one very short opportunity to plant upland crops each year. This limits the flexibility of any cropping pattern to short annuals with cassava as the only crop growing into the dry season although the squash do well in wetter years.

The shortness of the wet season is the primary factor together with the fear of flooding in determining the planting date of lowland rice. The normal pattern of planting rice is to delay planting after the fear of floods has decreased this usually means that most rice grown on the northern coast is planted too late in the wet season for reliable yields. The fear of drought on delayed plantings is not as great as the fear of flooding in the early part of the season.

1.2 Cropping Patterns of the Upper Northern Slopes and Mountains.

The higher northern slopes have somewhat more rainfall and farmers have a bit more flexibility in what they can grow. This area is generally planted to coffee, robust coffee at tithe lower elevations and Arabica coffee at the higher elevations, which provides the major part of the farmer's cash income. Under this coffee they farmers often plant bananas, taro or other root crops that can grow and produce in reduced sunlight. Squash is less common and beans are more frequently found together with cassava as the inter crop with maize. The staple food of these people is a mixture of maize, root crop, and beans on the lower areas and sweet potatoes, beans and vegetables on the higher locations. As the elevation increases and soil moisture is available, a varied number of vegetables are grown and maize is not grown at all being completely replaced by sweet potato.

Rice is grown in many areas along the northern slopes in the limestone areas especially in Baucau where there are many small spring fed irrigation systems. Some of these simple village irrigation systems can be over thirty hectares but a second crop of rice is rarely grown because of rat problems on the second crop. If there is spring water available, the farmers frequently plant vegetables as a cash crop after rice. In some isolated areas peanuts are also grown particularly in Baucau but rarely in the same field for two years running.

1.3 Cropping Patterns of the Upper Southern Slopes and Mountains

This is the most varied and potentially productive agro-climatic zone in East Timor. Irish potatoes are commonly grown along with sweet potatoes and other root crops. Again coffee dominates the highland areas with widespread plantings of root crops under the coffee. Wheat is also able to grow in the highlands although it does not appear to be especially productive. In common with the northern highlands and mountains, maize is not grown at the higher elevations with sweet potato taking over as the staple food. There is a large and varied production of cool weather vegetables grown that provides cash income in addition to Arabica coffee.

As one moves down the slopes there is an increase in maize plantings and also some traditional upland rice is grown. The upland rice is favored as a cash crop because of its good taste and high market price. In some wetter areas below springs, long duration paddy rice (seven months duration) is also grown for market most notably in Viqueque. Peanuts are also frequently interplanted with maize on the southern areas where the soil is light enough for peanuts to peg properly. Peanuts are also often grown as an intercrop with cassava in these lighter soils.

There is a large amount of unused land available for growing crops that has not been used in recent years because the population were moved down to the lowlands for security reasons during Indonesian times. If these people return to their point of origin in the southern parts of the country, the potentials for increasing cropping intensity and production in these southern highlands and lowlands would increase greatly.

1.4 Cropping Patterns in the Lower Southern Slopes and Lowlands

The wet southern slopes and lowlands have the greatest potential, but have been limited more by transportation and health considerations than by climatic or soil related constraints. The rainy season is long and the variability is great both in pattern and types of plants grown. Maize is still generally planted in early November as the rains start although upland rice is also commonly found. There are common patterns of maize followed by upland rice, or maize followed by beans and cassava.

In the lowlands there is a strong preference for rainfed paddy rice and there is also a great deal of irrigation that is in various states of disrepair but again rats are a continuing problem on the second crop. In some cases the first crop grown in November is intercropped maize in slightly higher elevations, followed by rice in the lowlands and beans following the rice crop. Rat problems tend to limit the farmers enthusiasm for planting a second rice crop and rat control is essential if increase rice plantings as a second crop are to be expected. At present there is extensive plantings of mung bean or soybeans after rice because the soil moisture is adequate to complete a crop after rice and because of decreased rat problems on bean crop

Beans, often soybeans, cow peas, red beans or mung beans can be planted in any month from November until May in slightly higher elevations. Interest in planting beans has increased because of the difficulties in selling the wet rice crop. Farmers will continue to grow at least one rice crop, mostly for self sufficiency, but will tend to plant more beans which are still wanted by the market place.

Cassava was formerly planted in large plantations in Manufahi, Ainaro, Cova Lima and Bobonaro for industrial purposes and exported to Atambua for sale as tapioca starch. This marketing of cassava has stopped because of the new international boarder and the farmers are not sure what to plant. It is likely that maize and beans will replace cassava in the future.

1.5 Lautem as a Special Case

As the furthest eastern district and on the predominant highland areas, it is neither northern nor southern slope or normal lowland area although it tends to follow the southern coast in having a long rainy season. The only dry months (>100mm/month) are August through October. In Lautem there is a mix of beans, maize and squash interplanted with cassava and lower down in the profile, wetland rice. Vegetable production is limited by the low elevation but there are large areas of coconuts grown. The great distance from the main markets in Dili make marketing a greater problem in Lautem than in other districts.

Very often it is possible to grow two crops of maize although maize is frequently followed by upland rice or even upland rice followed by maize depending on the rainfall. Land preparation for upland crops is rarely plowed and is usually burned first and then the maize or upland rice and cassava is planted directly into the burnt soil surface. The area planted to rice could increase significantly if the irrigation systems were repaired. The rice farmers are often planting mixed varieties of rice and have to harvest more than once in a single field because the crop does not mature at the same time. The introduction of purer seed lines could easily fix this

problem.

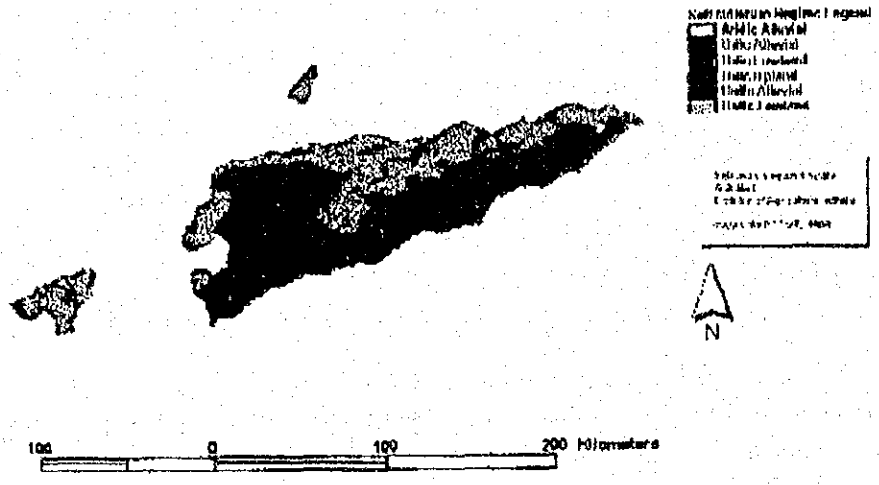
1.6 Agriculture Data Reliability

There has been a universal tendency amongst donor agencies and international Institutions to use the Indonesian agricultural statistics rather uncritically. The Inventory survey data has indicated an average of about 117 hectares of maize and squash interplanting per Suco (509 Sucos in East Timor) while the official 1997 Central Statistics Board data indicate only 55 hectares of squash in the whole province. The same underestimation problem is found in tuber crop production that only counts sweet potatoes and cassava with no attention paid to taro or other types of cocoyams and forest yams. Since squash and root crops are a staple food of many of the rural people, the official statistics do not give a true picture of the caloric size and stability of the diet since they only use rice and maize in caloric and nutrition computations.

A similar problem is found in the other direction with rice production. The rice crop yields were wildly increased and this data was taken seriously by many donors in calculating future production potentials and present production levels. This can only cause problems in the future. It is difficult to get more than 2.0 tons/ha or paddy rice without the use of fertilizer and the farmers do not presently use fertilizers. Some rationality is returning to this problem but great restraint has to be used in using Indonesian statistics.

The results of the household survey that will be coming in during the later part of this year should provide a much better indication of real production levels and plants grown. The general view is that carbohydrates are clearly sufficient but there is a significant need for increasing the protein and plant fat in the diet. Bean crops appear to be the major deficiency in the present cropping system and the group of plants that need the most attention in the future.

Figure F.1-1 Soil Moisture Regime



F-2. Crop Yields and Fertilizer Use

There is a constraint in the availability of reliable time series data in East Timor on agricultural production. This has resulted in an ongoing debate among donors and others about crop yields in East Timor. There is a lack of agreement in data sources including differences in reported yields on all major crops between provincial and central government. However, from the official data on fertilizer imports into East Timor it is unlikely that any of the higher estimates of crop yield from provincial sources are accurate. The central government data is also likely to be an over estimate. The low levels of fertilizer importation and use are responsible for this.

2.1 Fertilizer Import and Use in East Timor

The official Indonesian Central Statistical Bureau data on fertilizer inputs into East Timor from 1995 to 1999 are presented below;

Table F.2-1 Fertilizer Imports into East Timor

(unit: ton)

	1995/1996	1996/1997	1997/1998	1998/1999	Yearly Average
Urea	508	1,663	431	1,230	958
TSP	276	528	134	583	380

Source: Agricultural Statistics 2000 (pp 64 - 65)
Ministry of Agriculture, Republic of Indonesia Jakarta, April 2001

Since the yearly importation is quite uneven, an average of the data above gives the reported average yearly import of fertilizer to East Timor: Urea = 958 tons and TSP = 380 tons. The estimated harvested area of wetland paddy rice in East Timor from the above source is 14,198ha. If we assume that 3/4 of all the fertilizer imported into East Timor is put on wetland paddy rice, fertilizer use is: Urea 50.6 kg/ha and TSP 27.8 kg/ha.

Other official data in Rencana Induk Pengembangan Pertanian Terpadu 1995 pp 77. (Master Plan for Integrated Agriculture Development in East Timor Dili 1994) indicate that some distant districts like Viqueque had an average fertilizer use in 1992 of about 8kg/ha urea and 2.2 kg/ha TSP. This is quite low and very similar to the present situation.

More recent data compiled by the Colombia University and Norway ICRP group in 1999 indicate similar low levels of fertilizer use in East Timor as shown below. This group also mentioned the variability in the data depending on source and lack of statistical accuracy in the data. The fertilizer use data are especially questionable since it claims higher urea fertilizer use in the eastern part of the country rather than the more advanced western areas. However, it does indicate that some other fertilizer types were brought into the province.

Table F.2-2 Fertilizer Use in 1996

Fertilizer Type	Average	East	Middle	West
Urea	42.33	50.48	37.33	39.19
TSP/DAP	26.44	00	37.33	42.00
Others	10.67	00	32.01	00

Source : BPS Statistics (Quoted in ICRP Colombia University 1999)

From the available data, it is not clear how much fertilizer was brought into the Province of East Timor from West Timor but it was clearly a large amount. Unfortunately, the amount remains unknown, as does the amount of rice exported from East Timor to West Timor. Intra provincial statistics are difficult to obtain since no records of this type of trade are kept.

The available data is reasonably consistent in that it indicates a generally low level of fertilizer use and also an unbalanced use of fertilizer because of the lack of Potassium fertilizer supply. Furthermore, it is difficult to determine how much fertilizer was applied to rice or to competing crops like maize, beans or vegetable crops. A significant amount was applied to green vegetables and some to maize since there were officially at least 8,226 ha of special intensification for maize. This special intensification maize area had about 500 kg/ha yield increase over general non-intensified maize so it had to receive a significant amount of fertilizer to obtain this yield increase

If we use the official published data on fertilizer importation via the data above we can be quite sure that it is an over estimation of the fertilizer applied to rice. It is also apparent that there are areas of significant Potassium deficiencies on the calcareous soil type. Zinc is also deficient in the wetter more water logged rice growing soils usually found in limestone area below springs in Baucau, Bobonaro and Viqueque.

2.2 Rice Crop Yield and Response to Fertilizer

The yield of a rice crop grown without added fertilizer is limited by the inherent fertility of the soil and the length of time it is in the field. Traditional long duration rice crops grown for five to six months in historically fertile areas can yield up to 2.2 tons/ha and do so for hundreds of years. However most of the rice varieties grown in East Timor are only in the field for less than four months and usually for less than 110 days. This short growing period allows for second rice crops in irrigated areas or for upland crops following rice but the growing period is too short to allow for yields of more than 2.0 tons/ha. Given the poor land preparation, seedling handling for transplanting and lack of weeding commonly observed, the yields are usually in the 1.5-1.8 ton/ha range.

The published Indonesian Government data on fertilizer imports and the Colombia University ICRP data all indicate that the "official" rice yield data are quite suspect. The Colombia/ICRP report also mentions that most of the official statistics are difficult to reconcile. Indeed the official national statistics for East Timor gives rice yields at 2.8 tons/ha while the Provincial data in Timor Timur Dalam Angka 1997 gives 3.31 tons/ha. When official

government statistics differ by this much, a large degree of caution should apply to all of these numbers and statistics.

The Indonesian Government Central Bureau of Statistics rice production data refer to (Gabah Kering Giling) or dry rice (14 % moisture) ready to be milled while the provincial data does not make this distinction. Field rice in East Timor is invariably calculated by volume and not weight and the cropped area is often not known too well. Yields given by farmers often represent paddy rice at 22 percent moisture or more and these yield data also frequently include unfilled grain.

It is difficult to determine how rice yields of 2.8 tons/ha were obtained in light of the fertilizer data from official statistics. It is most probably that rice yields were never as high as official claims. It is possible, however, that areas planted to rice are significantly larger than official data would suggest although this is also not a provable statement. It is clear that rice yields are not as high as claimed. Planted area is difficult to determine precisely and if this is underestimated, it could explain some of the inconsistencies in the production data.

The actual fertilizer response of a rice crop to applied fertilizer depends on the amount applied, the timing and the application method amongst other factors. The response curve of rice to applied fertilizer also changes as the fertilizer dosage is increased so that the first ten kilograms of fertilizer applied usually gives a higher yield response than the last ten kilograms applied. However, as a general rule of thumb for low doses of fertilizer it is safe to assume about 10 kilograms of paddy rice yield increase for every kilogram of fertilizer nitrogen or phosphorous (as P2O5). This of course declines as additional fertilizer is applied. With the past and present levels of fertilizer use in East Timor it is unlikely that it would even be less than a five to one ratio. This makes the official national statistics of 2.8 tons/ha or rice yields very unlikely and the provincial estimate of 3.3 tons/ha even less likely.

If one assumes a five or ten to one conversion ratio of paddy rice to fertilizer applied, the average increase in rice yield from fertilizer use is about 400-600 kg/ha. Since unfertilized rice yields are about 1.5-1.8 tons/ha the increase in yield from fertilizer only brings the average yield to 1.9-2.4 tons/ha. Claims that East Timor has rice yields in excess of 3.0 tons/ha with no fertilizer applied are not supported by any data. If consistent paddy yields of over 4.5-5.0 tons/ha are desired, it will be necessary to apply fertilizer including potassium at over 300 kg/ha.

F-3. Rice and Maize Farming System

3.1 Rice Farming System

In East Timor. farmers still do not use animal drawn equipment widely. It is important to consider for farm mechanization in East Timor that rice farmers in the lowlands did not start transplanting rice until the 1970s about two thousand years after the Chinese Timorese will change practices but it will be never happened Even during Indonesian time, Indonesian Government tried to introduce animal draft equipment but failed to spread draft animal farming. Most popular seen in Asian countries, animal drawn carts can not be seen in anywhere field in East Timor but manual-push 2-wheel carts are used. Rice farming system in East Timor is as follows:-

a) Land preparation :The farmers do not use animal drawn plow but continue to use buffalo and cattle to trample the soil by walking in circles so called "rencah", or plow and puddle by means of trampling by human power group together with mutual help group members in the muddy field after watering sometimes with poles. However, the advanced rice farmers just started to operate hand tractors or 4-wheel tractor with attachment for land preparation skipping the animal-drawn plow stage.

b) Planting : In the rice lowlands, transplanting is most popular planting but not so correct in line. However spreading still there are in the upland. More than 50% farmers depend on community mutual help group or contracted laborers together with land preparation work..

c) Weeding : Manual weedings are widely done several times in every field. Mechanical weeders are also surveyed at some Districts.

d) Chemical Application : fertilizers and agro-chemicals are seldom applied due to difficult purchase and high price in rice production area..

e) Harvesting : All paddy stalks are cut by small (tudik) or large (katana) knife by men, women and children in every field in East Timor. Cutting depth is, however, from high 100 – 200 mm to low 60-70 mm stubble at different field.

f) Threshing : 3 kinds of threshing method can be surveyed, dancing or trampling on the paddy stalks on the mat under the shelter in the field by farmers, striking stalks to standing bar or plate and then mechanical threshing on the field by mobile engine-driven thresher. Rough estimates are 20% mechanical, 30% dancing and 50% striking threshing.

g) Drying : Harvested paddy stalks are commonly dried on the field and then threshed paddy on the mat at farm yard or alongside road, the same as in other Asian countries.

h) Milling : Due to slow introduction of rice milling unit, more than 90% are milled by manual pounding, which causes low milling rate and poor quality rice and may intervene market access. Karung (sack), Hoka (large storage sack), Tan (small handling basket) or tin can are traditionally used for weighing weight/volume of intake and milled rice volume, which varies depending on millers, from community to community or District to

District. Milling charge by machine (Kiskisan, cono and rubber roll type) is at the range of Rp.220-340/kg-intake paddy.

i) Storage : Usually stored inside house, "hoka", or "karung" but causing quantitarive and qualitative depreciation loss. Storage loss for paddy is quite low, usually less than 2%. Serious damage by rats and mice are reported on the field before harvesting in some Districts.

3.2 Maize Farming System

Maize farming system is surveyed as follows:-

a) Preparation of land : Manual cultivation in general and mechanical plowing can be seen at flat wetland.

b) Planting : Making holes and drilling seeds into them by hand.

c) Application of fertilizer :One month after planting in Indonesian time but seldom now.

d) Ditching : Also one month after planting.

e) Harvesting : Manual by family labor especially of women and children.

f) Drying : Solar drying on the mat, tin roof, concrete or drying platform whether ear maize or shelled maize.

g) Shelling and pounding : Manual and partially mechanical by women or children.

h) Storage : Storage loss for maize can reach 70-80% with an average 20% if the harvest is stored from harvest to the subsequent planting season. Maize is traditionally stored in bundles of unshelled ear hung from the roof beams over the kitchen fire so that the smoke and heat can protect it. This is appearently effective in some areas and considerably less so in others. Timorese maize varieties have been genetically selected over the years to protect against post harvest losses more than for yield. The ears of traditional varieties of maize are usually small with a very strong multi leafed husk with the tip of the corn ear covered by at least 4 cm of leaf sheath. This makes it more difficult for insects to enter. The destruction of housing during the disturbances of 1999 has made this traditional storage less possible and many modern maize varieties have been rejected by Timorese farmers more because of lack of proper husk properties than for any other reason. introduced varieties that have a thick husk with well-covered ears are generally well received. More modern methods include storage in 220 liter drums. Well-dried maize seeds can last up to 2 years in this type of storage with negligible losses and retain an acceptable percentage. Maize seeds are stored in the rice straw umbrella on the top of pole, what is called "fatin batal fini" to secure better ventilation in Manufahi and Ainaro District.

In addition to maize, bean crop losses are more difficult to estimate but appear to be closer to the maize average with storage weevils as the major pest. Beans are often stored in smaller closed containers with acceptable results. Long-term storage in closed containers is well

received but this type of container is difficult for many to obtain since it is not a normal commercial product. The Don Bosco Technical High School in Fatumaca,

Baucau District uses hundreds of 220 liter drums for successfully storing maize and bean crops.

Table F.3-1 Rice and Maize Farming System in East Timor (1)

I. Rice Farming System

Farming Category	Description of Works
1. Seedbed preparation	3 methods any by man-power, animal trampling rencah or tractor. In case by 1-3 times rencah, initial rencah after watering in 30 – 40 cm depth, 2nd after 2 – 3 weeks, 3rd in next day continuous to 2nd rencah, manual leveling evenly, draining and seeding. Leaving exposed seed field during 5– 7 days. In case by 1 – 2 times tractor cultivation, 1st after watering, 2nd after a week, and then 1 day later seeding and then watering 1 day later
2. Seeding	Soaking seeds into water in a day, then bagging/wrapping by leaves and then leaving during 3 days for sprouting. 2 – 5 cans (18 liter and 25 kg) per hectare. Direct seeding is also employed
3. Land preparation	Also 3 methods any by man-power, rencah or tractor. The farmers do not use animal drawn plow but continue to use buffalo, cattle horse or their combination to trample the soil by walking in circles so called "rencah", or plow and puddle by human power group together with mutual help group members in the muddy field after watering sometimes with poles. However, the advanced rice farmers just started to operate hand tractors or 4-wheel tractors with attachments for land preparation skipping the animal-drawn plow stage Contract land preparation fee by rencah : Land owner : a half of harvest or Rp.600,000/ha Tenant : each one third of harvest to landload, rencah and farmer Contract land preparation fee by hand tractor : Rp.1,000,000/ha In case by shifting : Cutting grass and bush, drying, firing, and then trailing spike tooth roller by 2 men. Then after seeding and 2 men roller covering. 4 – 5 days per hectare.
4. Planting	In lowland rice, transplanting is most popular planting but not so correct in line. However, spreading still there are in upland. More than 50% farmers depend on community mutual help group or contracted laborers together with land preparation works. Transplanting efficiency : 30 workers – 1 day per hectare Direct seeding as a traditional way while labor shortage.
5. Water management	Watering 2 days after transplanting. Keeping field more or less in 25 cm depth till flowering.
6. Weeding	1 – 2 times manual weeding after transplanting before harvesting. 4 – 5 workers and 2 weeks per hectare. Mechanical weeder of hand-push cage is also surveyed at some field.
7. Chemical application	Fertilizers and agro-chemicals are seldom applied due to difficult purchase and high price in rice production area.
8. Harvesting	All paddy stalks are cut by small (tudik) or large (katana) knife by men, women and children in every field. Cutting depth is, however, from high 100 – 200 mm to low 60 – 7– mm stubble at different field. Efficiency : a worker 3.5 are per day, 1 – 3 days drying on the field, a week required for interval from harvesting to threshing, 4 – 5 workers and 2– 3 weeks per hectare.
9. Threshing	3 kinds of threshing methods can be surveyed, namely dancing or trampling on the paddy stalks on the mat under the shelter in the

Table F.3-1 Rice and Maize Farming System in East Timor (2)

Farming Category	Description of Works
	field by farmers, striking stalks to standing bar or plate and then mechanical threshing on the field by mobile engine-driven thresher. Rough estimates are 20% mechanical, 30% dancing and 50% striking threshing. Efficiency : dancing : 20 workers and 4– 5 days per hectare, 40 – 50 workers and 2 days per hectare, 5 workers and a month per hectare. mechanical : 1.5 day per hectare Contract threshing fee : 12 cans (18 liter/can) of paddy
10. Drying	Harvested paddy stalks are commonly dried on the field and then threshed paddy on the mat at farm yard or alongside road, the same as in other Asian countries.
11. Milling	Due to slow introduction of rice miiling unit, more than 90% are milled by manual pounding, which causes low milling recovery rate and poor quality rice and may Intervene market access. Karung (sack), Hoka (large storage sack), Tan (small handling basket) or tin can are traditionally used for measuring weight/ volume of intake and milled rice, which varies depending on millers , from community to community or District to District. Milling charge by machine (kiskisan, cono and rubber roll type) is at the range of Rp.220 – 340/lg – Intake paddy. Efficiemcy : hand pounding : 10 – 15 minutes per kilogram mechanical : 500 – 800 kg per hour (rubber roll type)
12. Storage	Usually stored Inside house, "Hoka" or #Karung" but causing quantitative and qualitative depreciation loss. Storage loss for paddy is quite low, usually less than 2%. Serious damage by rats and mice are reported on the field before harvesting In some Districts. Household Survey reports 3% upland and 5% lowland rice losses during storage.

II. Maize Farming System

Farming Category	Description of Works
1. Land preparation	Manua; cultivation in general and mechanical plowing can be seen at flat wetland.
2. Planting	Making holes and drilling seeds into them by hand.
3. Fertilizer application	One month after planting In Indonesian time but seldom now.
4. Mulching	Also one month after planting.
5. Harvesting	Manual by family labor especiall of women and children.
6. Drying	Solar drying on the mat, tin roof, concrete or drying platform whether ear or shelled maize.
7. Shelling and pounding	Manual by women or children and mechanical In some area.
8. Storage	Storage loss for maize can reach 70 – 80% with an average 20% if the harvest stored from harvest to the subsequent planting season. Maize is traditionaliy stored in bundles of unshelled ear hung from the roof beams over the kitchen fire so that the smoke and heat can protect it. This is appearently effective in some areas and considerably less so In others. Timorese maize varieties have been behetically selected over the years to prtect against post harvest losses more than for yield. The ears of traditional varieties of maize are usually small with a very strong multi leafed husk with the tip of the maize ear covered by at least 4 cm of leaf sheath. This makes It more difficult for Insects to enter.

Table F.3-1 Rice and Maize Farming System in East Timor (3)

Farming Category	Description of Works
	The destruction of housing during the disturbances of 1999 has made this traditional storage less possible and many modern maize varieties have been rejected by Timorese farmers more becausee of lack of proper husk properties than for any other reason. Introduced varieties that have a thick husk with well-covered ears are generally well received. More modern methods includee storage in 220 liter drums. Well-dried maize seeds can last up to 2 years in this type of storage with negligible losses and retain an acceptable percentage. Maize seeds are stored In the rice straw umbrella on the top of pole or tree, what is called "fatin batal fini" to secure better ventilation In Manufahi and Ainaro District. In addition to maize, bean crop losses are more difficult to estimate but appear to be closer to the maize average with storage weevils as the major pest. Beans are often stored in smaller closed containers is well received but this type of container is difficult for many to obtain since It is not a normal commercial product. The Don Bosco Technical High Schooln In Fatumaca, Baucau District uses hundreds of 220 liter drums for successfully storing maize and bean crops.

III. Transportation of Agricultural Produce

Farming Category	Description of Works
Transportation	No transporting facilities belonging to farmers except anima; without any trail cart, and 2-wheel manual push cart, bucycle and motorcycle In addition to porter/walking for short distance are most popular In East Timor.

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Table G-1 Land Area and Forest Land Area

Unit: ha

District	Land Area (A)	Forest Land Area (B)	Ratio of Forest land (B) / (A) %
1 Covalima	122,553	94,195	77
2 Ainaro	79,887	56,773	71
3 Manufahi	132,491	103,511	78
4 Viqueque	178,050	137,028	77
5 Lautem	170,233	135,147	79
6 Baucau	149,380	114,952	77
7 Manatuto	170,545	146,311	86
8 Dili	37,160	28,593	77
9 Aileu	72,949	67,340	92
10 Liquica	54,812	35,910	66
11 Ermera	74,600	42,249	57
12 Bobonaro	136,812	92,183	67
13 Oecussi	81,466	59,083	73
Total	1,460,938	1,113,275	76

(Source):Timor Timur Dalam Angka 1997: BPS Timor Timur

Table G-2 Inside Forest Areas

Unit: ha

District	Inside Forest Area	Poduction Forest	Conservation Forest	**Protected Natural Area (PNA) No.19 / 2000**	Covertible Forest
1 Covalima	61,090	23,568	17,944	**12,800**	6,778
2 Ainaro	45,465	2,997	24,468	**18,000**	
3 Manufahi	67,654	14,979	22,675	**30,000**	
4 Viqueque	116,188	77,708	13,480	**25,000**	
5 Lautem	82,996	37,111	9,885	**36,000**	
6 Baucau	51,837	13,285	16,552	**22,000**	
7 Manatuto	133,007	27,543	90,464	**15,000**	
8 Dili	13,529	2,332	7,197	**4,000**	
9 Aileu	31,852	8,717	23,135	**0**	
10 Liquica	27,217	14,057	9,160	**4,000**	
11 Ermera	12,719	0	0	***20,000**	
12 Bobonaro	65,078	9,056	56,022	**0**	
13 Oecussi	36,543	2,639	33,904	**0**	
Total	745,175	227,214	324,886	**186,800**	6,778

(Source) : Estimated from;

1. East Timor Regional Forestry Office; Timor Timur Dalam Angka 1997
2. UNTAET/REG/2000/19, 30 June 2000

(Note) : "Protection Forest" is afraid of confusing with "Protection Area", so will be used "Conservation Forest".

* 20,000 ha (Mt.Tata Mailau Protection Area)

Table G-3 Production of Forest Products

Year	Timber (m^3)	Sawn Timber (m^3)	Ply wood	Fuel Wood (Stapel m)
1983/1984	460	1184	0	
1984/1985	-	-	0	
1985/1986	3,480	1,218	0	
1986/1987	746	276	0	
1987/1988	0	0	0	
1988/1989	0	0	0	
1989/1990	0	0	0	
1990/1991	1,995	249	0	
1991/1992	962	814	0	759
1992/1993	0	933	0	1,067
1993/1994	0	908	0	606
1994/1995	2,072	368	0	322
1995/1996	1,599	1,565	0	-
1996/1997	214	355	0	118
1997/1998	1,582	-	0	76
1998/1999	-	-	0	
1999/2000	-	-	0	

(Source) : 1. Statistik Kehutanan(1985/1986) : Kanwil Dephut. Prop. TimTim (Des. 1986)
2. Statistik Kehutanan (1995/1996) :Kanwil Dephut Prop. TimTim(Agust.1996)
3. Timor Timur Dlalam Angka 1997: BPS Prop.TimTim

Table G-4 Production of Non Timber Forest Products(NTFP)

Kind of NTFP	Unit	1991 / 1992	1992 / 1993	1993 / 1994	1994 / 1995	1995 / 1996	1996 / 1997	1997 / 1998
Sandale *wood(Cen* dana)	kg	73	175	118	109	76	146	63
Cendana Oil	ton	2	3	4	72	2	3	1.4
Cendana Sawdust	kg	0	0	0	0	0	0	0
Fuel Wood	Sm	759	1,067	606	322	0	118	76
Tamarind	Ton	0	0	0	1,580	0	0	0
Bamboo	Stick	0	1,385	0	0	500	640	0
Candle	Ton	0	0	0	0	0	0	0
Bebak	Sheet	0	127	427	467	0	0	1,900
Honey	1000 Liter	0	0	0	70	40	530	-
Candle nut	Ton	0	0	0	0	314	504	49

(Source) : 1. Timor Timur Dalam Angka 1997(Kanwil Kehutanan Propinsi Timor Timur)
2. Statistik Kehutanan Tahun1995/1996(sda:1996)

Table G-5 Distribution of Tree Species

District	Cendana (*Santalum album*)	Jati (*Tectona grandis*)	Kayu Merah (*Ptrocarpus indicus*)	Ekaliptus (*Eucalyptus alba,*)	Sengon (*Albizia falcataria*)	Cemara (*Casuarina spp.*)
1 Covalima	◎	△	◎	○	△	◎
2 Ainaro	△	△	△	◎	○	◎
3 Manufahi	△	◎	◎	◎	○	◎
4 Viqueque	○	◎	○	△	△	◎
5 Lautem	◎	○	◎	▲	▲	○
6 Baucau	○	△	○	△	▲	▲
7 Manatuto	△	▲	○	○	▲	◎
8 Dili	▲	▲	△	◎	○	△
9 Ailcu	▲	▲	▲	◎	◎	△
10 Liquica	◎	△	△	◎	○	△
11 Ermera	▲	○	○	◎	◎	△
12 Bobonaro	◎	△	△	○	○	◎
13 Oecussi	◎	○	○	◎	▲	△

(Notes) : ◎ : Rich ○:Moderate △: Few ▲:Non

Estimation by ETFOG(East Timor Forester's Grroup)

Table G-6 Critical Land Area(Biginning of PELITA VII)

Unit: ha

District	Forest Land (A)	Inside Forest Area (B)	Outside Forest Area (C) = (A) -(B)	**Critical Land (Inside Forest Area) (D)**	**Critical Land (Outside Forest Area) (E)**	**Total Critical land (F) = (D) + (E)**
1 Covalima	94,195	61,090	33,105	**13,484**	**25,042**	**38,526**
2 Ainaro	56,773	45,465	11,308	**3,347**	**7,809**	**11,156**
3 Manufahi	103,511	67,654	35,857	**22,945**	**53,539**	**76,484**
4 Viqueque	137,028	116,188	20,840	**17,235**	**47,101**	**64,336**
5 Lautem	135,147	82,996	52,151	**5,779**	**13,483**	**19,262**
6 Baucau	114,952	51,837	63,115	**6,794**	**15,852**	**22,646**
7 Manatuto	146,311	133,007	13,304	**21,716**	**50,671**	**72,387**
8 Dili	28,593	13,529	15,064	**16,465**	**10,872**	**27,337**
9 Aileu	67,340	31,852	35,488	**19,149**	**35,563**	**54,712**
10 Liquica	35,910	27,217	8,693	**6,931**	**9,030**	**15,961**
11 Ermera	42,249	12,719	29,530	**3,628**	**13,929**	**17,557**
12 Bobonaro	92,183	65,078	27,105	**7,582**	**17,565**	**25,149**
13 Oecussi	59,083	36,543	22,540	**32,052**	**5,1018**	**37,160**
Total	1,113,275	745,175	368,100	**177,107**	**305,564**	**482,671**
		Natibnal Forest	Private Forest	*D / B=24%*	*E / C = 85%*	*F / A = 43%*

(Source) : Estemated from;

1. Timor Tomur Dalam Angka 1997:BPS Timor Timur
2. Statistik Kehutanan(1995/1996): Kanwil Departemen Kehutanan Prop. Timor Timur(Agust. 1996)
3. Urutan DAS prioritas dan lahan kritis :DJRLPS (Direktrait Jenderal Rehabilitasi Lahan dan Perhutanan Sosial), Dephutbun RI;Feb.2000

1. Definition of Critical Land and Watershed

The characteristics of watershed which is managed appropriately are:

1) constitute a high productivity of land
2) able to achieve a sustainable high productivity of land, low level of soil erosion, high water yield, and equal water distribution along the year
3) easily adjust with respect to the climatological changes, and
4) able to create equity among farmers

(Reference): Arsyad, S. ; A. Priyanto; L. I. Nasoetion, 1985. Konsepsi Pengelolaan Das (Concept for Watershed Management). Workshop on Watershed Management Programme Study, Posts Graduate Faculty, IPB, Bogor, Indonesia

2. The Evaluation System of Critical Land and Watershed

Based on the definition of system, the following aspects must be considered in the establishment of critical land and watershed evaluation system, such as:

1) Limitations of the system must be clearly stated
2) Elements of the system must be clearly determined
3) Characteristics of the land and watershed that will be studied must be well known
4) Theoretical framework, assumptions, and simplifications must be made on the basis of academic works
5) Validation of the system should consider the quality and availability of the data

1. The critical land is determined by 2 factors
   a. Land coverage
   b. Soil erosion
2. The critical degree of land and watershed is determined by the value of its respective factors.
3. The historical data and field data are considerably right
4. The parameters use are assumed to be constant in a certain period of time

3. Evaluation System of Critical Land

The evaluation system of critical land consists of two elements i.e. land coverage and soil erosion. To operationalize the system, the elements are proportionally weighted. The weight of each element is derived from its weight in the evaluation system of critical watershed. The results and its calculation is shown as follows in following table;.

No.	Elements	Weight
1	Land Coverage	25 / 40 x 100 % = 62.5 %
2	Soil Erosion	15 / 40 x 100 % = 37.5 %

To determined the critical degree of land, the following principles are used:

1. The critical value of land coverage factor is formulated as follows:
   KL = { 62.5 (NKP) + 37.5 (NKE) } / 100
   Where:
   AKL = critical value of land
   NKP = critical value of land coverage factors
   NKE = critical value of soil erosion factors

2. The critical value of land is classified as shown below;

AKL	Degree	Class of Critical Land
> 50	Critical	I
< 50	Not critical	II

It should be noted that valuation on land coverage and soil erosion factors in the system of critical land evaluation is the same as that in the system of critical watershed evaluation.

4. Evaluation System of the Critical Land Based on the Land Coverage

Valuation on land coverage factors as one of the determined of critical land is done as follows:

1. The performance of land 67.5% s determined by land coverage factor.
2. The weight of each type of land use is set up as:
   a. Upland = 50%
   b. Plantation = 20%
   c. Forest = 15 %
   d. Rice-field = 10%
   e. Settlement = 5%
3. The critical value of land coverage factors is counted as follows:
   AKP = { 50 LT + 20 LK + 15 LH + 10 LS + 5 LP } / 100
   Where:
   AKP = critical value of land coverage factor
   LT = upland area (%)
   LK = plantation area (%)
   LH = forest area (%)
   LS = rice-field area (%)
   LP = settlement area (%)

4. The critical value of land based on the land coverage factor is classified as shown below;

No.	AKP	Degree	Value(NKP)
1	> 50	Heavy	75
2	25 – 50	Moderate	50
3	< 25	Light	25

5. Evaluation System of the Critical Land based on the Soil Erosion Factors

Valuation on soil erosion factor as one of determinants of critical land is done as follows:

1. The performance of land 37.5% is determined by soil erosion factor
3. The critical degree of land based on the soil erosion factor is determined by the criteria which is shown below;.

No.	Ratio of Aa / At	Degree	Value(NKE)
1	> 1.50	Heavy	75
2	0.50 – 1.50	Moderate	50
3	< 0.50	Light	25

Where:

Aa = actual erosion (ton / ha / year)

Aa = R.K. Ls.C.P

Where:

R = raifall erosivity (ton/ha/year)

K = erodibility index

Ls = length and slope index

C = cropping system index

P = soil and water conservation practice index

At = tolerabe erosion(ton / ha /year)

Tolerance Erosion Rate for Soils in Indonesia

No	Soil Properties	At (ton/ha/year)
1	Soil on the bed rock, low depth	0.0
2	Soil above Unconsolidated materials, low depth	4.8
3	Soil of degraded parent materials, low depth	9.6
4	Soil above degraded parent materials, average depth	14.4
5	Soil with water resistant layer under in, above degraded substratum, high depth	19.2
6	Soil with low permeability layer under in, above degraded substratum, high depth	24.0
7	Soil with high permeability layer under in, above degraded substratum	30.0

1. Tolerable soil erosion is determined by using the guidance lifted from Arsyad (1989).
2. Average volume weight for soil in Indonesia 1.2 g / cc

6. Application of the System of Critical Land Evaluation

The system is applied in each land. Land unit is used as the unit of evaluation.

No.	Land Unit CODE	Area (ha)	Critical Value		AKL	Degree Critical Not Critical
			Land Coverage(NKP)	Soil Erosion(NKE)		

Table G-7 Distribution of Non Timber Forest Products(NTFP)

District	Clove	Cinnamon	Tamarindo	Candle-nut	Cotton tree	Coffee	Cashew nut	Vanilla	Coco nut	Cacao	Betel Palm
1 Covalima	▲	△	○	◎	△	○	◎	▲	◎	▲	○
2 Ainaro	△	△	△	○	△	◎	○	▲	△	△	○
3 Manufahi	△	△	△	○	△	◎	◎	▲	◎	△	○
4 Viqueque	▲	▲	△	○	△	○	○	▲	◎	△	◎
5 Lautem	△	▲	◎	○	△	△	△	▲	◎	△	△
6 Baucau	△	▲	△	◎	△	○	△	▲	◎	△	△
7 Manatuto	▲	△	△	○	△	◎	◎	▲	○	△	◎
8 Dili	△	△	△	○	△	△	△	▲	△	△	△
9 Aileu	△	▲	△	△	▲	◎	△	▲	△	▲	△
10 Liquica	△	△	△	△	▲	◎	△	△	○	▲	△
11 Ermera	△	△	△	△	△	◎	△	△	△	○	△
12 Bobonaro	△	△	△	◎	△	○	△	▲	◎	△	○
13 Oecussi	△	▲	○	△	△	△	○	▲	○	▲	◎

(Notes) ◎: Rich(Over500ha) ○: Moderate(100-500ha) △: Few(under100ha) ▲: Non

(Source) Dalam Angka Timor Timur1997(BPS):Dinas Perkebunan Prop. Timor Timur
Dalam Angka TimorTimur1995(BPS):Dinas Perkebunan Prop. Timor Timur

Table G-8 Reforestation and Regreening Activities

Activity	1994/1995		1995/1996		1996/1997		1997/1998		1998/1999		Jumlah	
	Planed	Executed (%)	Planed	Executed (%)	Planed	Executed (%)	Planed	Executed (%)	Planed	Executed (%)	Planed	Executed (%)
Reforestation (ha) *Kab.Aileu, *Kab.Emam, *Kab.Baucau *Kab.Manatuto	400	340 (85)	590	590 (100)	570	570 (100)	455	455 (100)	100	100 (100)	2,115	2,055 (97.16)
Afforestation Development of Villagers Nursery(KBD) (Unit) 1unit=1ha= 400,000seedlings	8	8 (100)	11.5	11.5 (100)	15	15 (100)	95	95 (100)	425	425 (100)	48.25	48.25 (100)
Community Forest Development (ha)	1,196	1,196 (100)	1,250	1,250 (100)	1,330	1,330 (100)	660	660 (100)	725	625 (86.21)	5,161	5,061 (98.06)
Pilot Prject of Natural Resources Conseveration (UPSA) (unit)	16	16 (100)	14	14 (100)	19	19 (100)	11	11 (100)	14	14 (100)	74	74 (100)
Check dam Development (Unit)					6	6 (100)	7	7 (100)	4	4 (100)	17	17 (100)
Terrace Rehabilitation (ha)					80	80 (100)	40	40 (100)			120	120 (100)

Activity	1994/1995		1995/1996		1996/1997		1997/1998		1998/1999		Jumlah	
	Planed	Executed (%)	Planed	Executed (%)	Planed	Executed (%)	Planed	Executed (%)	Planed	Executed (%)	Planed	Executed (%)
Community Forest Plantation (ha)	2,000	1,871 (93.55)	2,000	2,000 (100)	2,000	2,000 (100)	2,000	2,000 (100)	1,000	1,000 (100)	9,000	8,871 (98.57)

(Source) Statistik Pembangunan Direktorat Jenderal Rehabilitasi Lahan dan Perhutanan Sossial Tahun 1998/1999: SETJEN RLPS, Jakarta, Desember1999

Table G-9 Demand of Forest Products

Year	Population	a.Estimation for Assumption (m^3)		Potential of Wood Product (m^3)		Supply and Demand (m^3) (-) Shortage	
		Timber	Fuel Wood	b. Timber	c.Feul Wood	Timber	Fuel Wood
1980	555,350*	55,535	277,675	48,632*	336,991*	-6,903	59,316
1985	634,172*	63,417	317,086	48,632*	336,991*	-14,785	19,905
1990	724,182*	72,418	362,091	48,632*	336,991*	-23,786	-25,100
1995	842,696**	84,270	421,348	48,632*	336,991*	-35,638	-84,357
1996	857,028**	85,703	428,514	48,632*	336,991*	-37,071	-91,523
1997	881,600**	88,160	440,800	48,632*	336,991*	-39,528	-103,809
1998	887,686***	88,769	443,843	48,632*	336,991*	-49,137	-106,852
1999	695,325***	69,533	347,663	48,632*	336,991*	-20,901	-10,672
2000	753,189***	75,319	376,595	48,632*	472,170*	-26,687	95,574

(Note) a. Domestic demand of Forest Products is estimated roughly as follows;

Timber : 0.1 m^3 / capita / year

Fuel Wood : 0.5 m^3 / capita / year

b. Timber will be harvested 1 m 3 / ha per year from Production Forest area;

From Production Forest:45,211 ha X 1 m 3 / ha = 45,211 m 3

From Lautem District by Forest Industry 52,016 m 3

(45,211 + 52,016) / 2 = 48,614 m^3 / year

c. Fuel Wood will be got 1 m 3 / ha from insde forest area and 0.5 m 3 / ha from outside forest area(Pantation,Farmland and Home-garden) per year;

Inside forest: 215,695 m 3

Outside forest: 121,296 m 3

Total : 336,991 m 3 / year

(Source) : *Rencana Umum Kehutanan Prop. Timor Timur, Kanwil Kehutanan TimTim:Dili, 31 Mar. 1987

** Timor Timur Dalam Angka 1997: BPS, Dili, Desember,1998

*** Special Rport FAO/WFP(Crop and Food Supply Assesment Mission to East Timor,April 2000)

Table G-10 Another estimation for Demand of Fuel Wood in East Timor

1. Result of Suco Survey (executed by JICA Study Team on April 2001).
   Number of Sucos reporting production : 91 Sucos
   Production per reportng Suco : 62,903 bunch / year
   Note : 1 bunch = 0.04 m^3

2. Estimation for all Sucos/ Timor Lorosae
   Total number of Sucos : 498 Sucos
   Total demand of Fuel Wood : 62,903 bunch X 489 Sucos = 31,640,209 bunches
   31,640,209 bunches X 0.04 m^3 / bunch = 1,265,608 m^3

3. Demand of Fuel Wood per Kapita/ man
   1,265,608 m^3 / 737,811 person = **1.698cu.m / capita**

ANNEX H. FISHERIES

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Table H-1 Fishermen and Fishing Canoes in 1997

(1) Fishermen

Districts	Full-time	Part-time (Major)	Part-time (Minor)	Total
Lautem	207	219	193	619
Baucau	175	130	115	420
Viqueque	163	190	25	378
Manatuto	168	81	46	295
Manufahi	20	81	37	138
Dili	2,454	2,718	52	5,224
Ainaro	0	0	0	0
Liquica	387	255	117	759
Bobonaro	217	143	176	536
Covalima	68	71	118	257
Ambeno (Oecussi)	185	137	118	440
Total	4,044	4,025	997	9,066

Source: East Timor in Figures, 1997

(2) Fishing Canoes

Districts	Dugout	Plank-built	Equipped with OBM	Total
Lautem	100	36	64	200
Baucau	122	11	29	162
Viqueque	86	22	17	125
Manatuto	64	3	38	105
Manufahi	30	6	15	51
Dili	207	104	349	660
Ainaro	0	0	0	0
Liquica	135	148	76	359
Bobonaro	82	5	20	107
Covalima	45	3	6	54
Ambeno (Oecussi)	124	64	16	204
Total	995	402	630	2027

Source: East Timor in Figures, 1997

Table H-2 Coastal Sucos Sampled in the Inventory Survey in Village Level in 2001

Districts		Coastal Sucos	Sampled Sucos in (A)	Sucos Reporting Fishermen
		(A)	(B)	(C)
Lautem		15	4	4
Baucau		15	6	4
Viqueque		13	10	6
Manatuto		6	1	1
Manufahi		6	2	1
Dili	Main Island	14	10	2
	Atauro	5	1	1
Ainaro		2	0	-
Liquica		10	4	4
Bobonaro		3	0	-
Covalima		11	5	5
Ambino (Oecussi)		9	3	3
Total		109	46	31

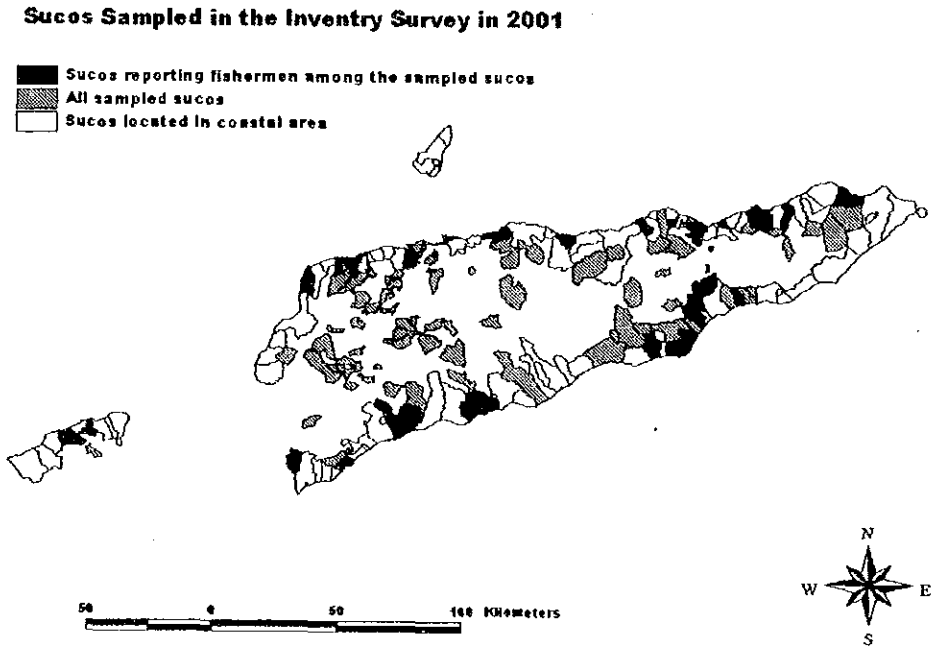


Table H-3 *Fisheries and Aquaculture Supporting Facilities in 106 Sampled Sucos*

Code	District	Suco	Facilities	Conditions	Scale
090202	Lautem	Com	Jetty/wharf	good	L=80m
030202	Baucau	Bahu	Jetty/wharf	good *)	L=5m
030402		Soba	Jetty/wharf	good *)	L=50m
060403	Dili	Benunuk	Fish handling building	good	72sq.m
060403		Benunuk	Net loft/Storage	good	45sq.m
080108	Liquica	Tibar	Jetty/wharf	good	L=50m
040307	Bobonaro	Maliubu	Freshwater pond	good	775sq.m
060301	Dili	Loscabubu	Freshwater pond	good	36sq.m
090207	Lautem	Serelau	Freshwater pond	good	10sq.m
070102	Ermera	Baboe Leten	Freshwater pond	good	224sq.m
070208		Estado	Freshwater pond	good	250sq.m
010112	Aileu	Hohullo	Freshwater pond	good	6,000sq.m
060403	Dili	Benunuk	Brackish water pond	good	5,000sq.m
080108	Liquica	Tibar	Brackish water pond	good	250sq.m
120304	Oecusse	Taiboco I	Brackish water pond	fair	10,000sq.m
120304		Taiboco I	Freshwater pond	fair	10,000sq.m
080307	Liquica	Vatuboro	Brackish water pond	poor	4,000sq.m

Remark: In our site survey, jetty in Bahu and Soba could not be confirmed. Remained concrete structure and a bollard were observed at beach in Soba. These reported jetties seem to have been lost.

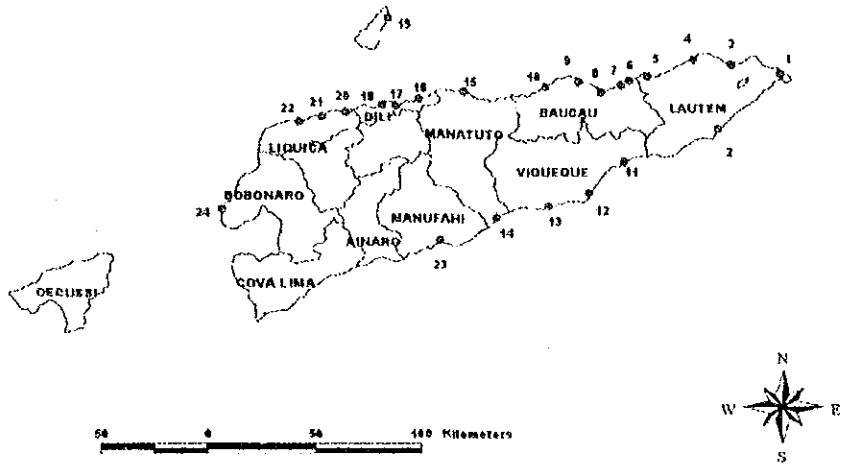
Table II-4 Number of Fishermen and Fishing Vessels in 31 Sampled Sucos

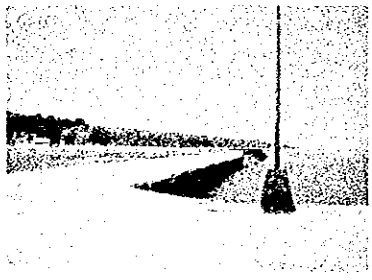
(unit: person, vessel)

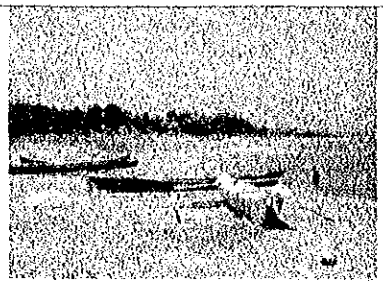
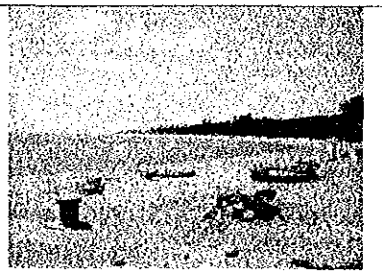
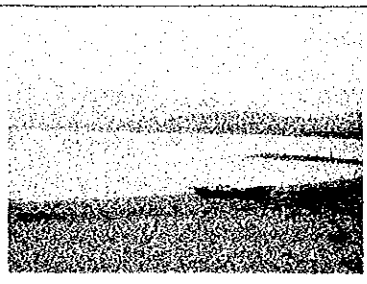
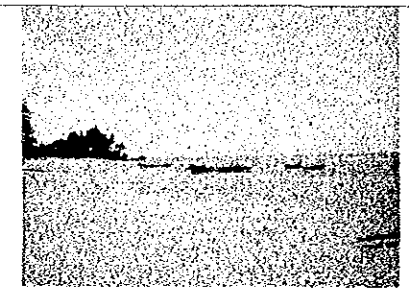
Code of Suco	District	Name of Suco	Household	Full-time Fisherman	Part-time Fisherman	Total Fisherman	Full-time /Household (%)	Total /Household (%)	Canoe w/o Engine	Canoe with Engine	Boat with Engine
1. North Coast											
090202	Lautem	Kon (Com)	546	50	17	67	9	12	7	4	0
090207		Serelau	488	4	0	4	1	1	1	0	0
090209		Ililai	265	25	10	35	9	13	0	0	0
090210		Euquisi	256	40	7	47	16	18	5	0	0
030202	Baucau	Bahu	1,445	0	25	25	0	2	15	10	0
030205		Seical	510	0	120	120	0	24	110	1	0
030207		Bucoli	461	0	110	110	0	24	90	0	0
030402		Soba	508	20	20	40	4	8	15	0	0
110504	Manatuto	Maabat	156	2	5	7	1	4	6	2	0
060101	Dili	Maumeta (Ataruro)	235	39	6	45	17	19	31	4	2
060209		Metiaut	193	22	66	88	11	46	30	1	0
060403		Benunuk	282	85	15	100	30	35	10	2	0
080108	Liquica	Tibar	500	25	15	40	5	8	6	3	0
080201		Dato	709	100	70	170	14	24	99	1	0
080305		Vatuvou	669	0	20	20	0	3	10	0	0
080307		Vatuboro	263	55	20	75	21	29	40	0	0
120304	Oecusse	Taiboco I	543	36	6	42	7	8	3	0	0
120307		Tibal Pah	662	12	4	16	2	2	30	1	0
120401		Lalisuk	626	2	1	3	0	0	8	0	0
Sub Total 19 Sucos			9,317	517	537	1054	6	11	516	29	2
2. South Coast											
130304	Viqueque	Uma Uma	308	0	50	50	0	16	0	0	0
130403		Afaloikai	816	50	100	150	6	18	0	0	0
130406		Mata Ohi	792	20	50	70	3	9	0	0	0
130508		Uma Kiik	377	0	72	72	0	19	0	0	0
130509		Uma Uain Leten	430	20	50	70	5	16	10	3	0
130510		Fatudere	107	-	-	-	-	-	8	0	0
100308	Manufahi	Betano	808	55	250	305	7	38	30	0	0
050401	Covalima	Raimea	44	5	10	15	11	34	1	0	0
050408		Beco II	423	4	4	8	1	2	1	0	0
050411		Beilaco	187	0	30	30	0	16	2	0	0
050503		Suailoro	608	180	0	180	30	30	100	0	0
050602		Raihun	424	20	8	28	5	7	5	1	0
Sub Total 12 Sucos			5324	354	624	978	7	18	57	4	0
Total 31 Sucos			14,641	871	1,161	2,032	6	14	673	33	2

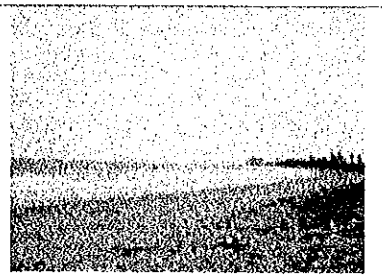
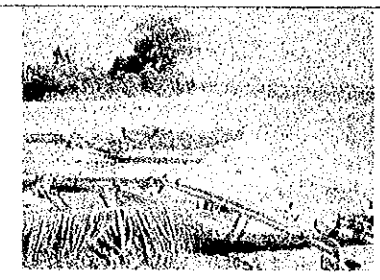
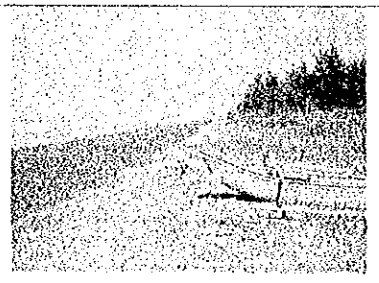
Remark: *) Reported number of fishermen in Fatudere was 210. As it appears to be over estimates when comparing with number of the household, the reported number of fishermen in this suco is omitted from this table.

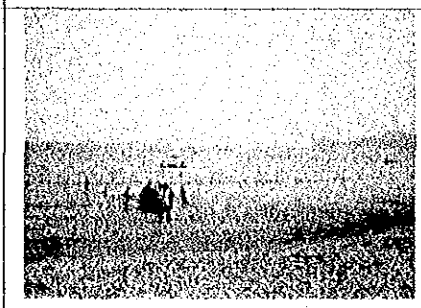
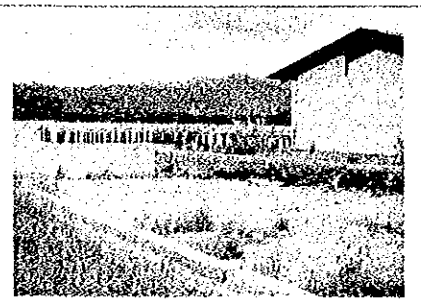
Table H-5: Fish Landing Spots and Beaches



No.	Landing Spot	Landscape
1	Cape Cutcha, Lautem Tutuala, unpaved one lane road, around 10 km, with several very steep spots that may obstruct transports by 2 WD or larger vehicles. 8 to 9 canoes, mostly whole dugout, one old open boat	
2	Lore, Lautem Los Palos, unpaved mountainous road, one lane, around 20km 3 canoes, donated by a church in the Indonesian times.	
3	Com, Lautem Los Palos, paved road, two lanes, around 25 km 12 canoes, berthed on beach, not moored at the concrete jetty.	

4	Lautem (Parlamento), Lautem Los Palos, paved road, two lanes, around 25 km A small roofed market near the landing spot 5 to 6 canoes	
5	Laivoi (Hilai), Lautem Baucau or Los Palos, paved road, two lanes, around 30 km or more. 2 canoes with outboard motor, anchored in front of the beach.	
6	Vuigira (Samalari?), Baucau Between Laivoi and Soba. Near to Baucau. 6 canoes or more. A few canoes from Bahu, Baucau were observed (October 2001).	
7	Soba, Baucau Baucau, two lanes paved road 32 canoes Remains of concrete structure of a jetty	
8	Makerek (Seical), Baucau Baucau, connected to the main road through a branch road, unpaved, one lane Only a few canoes at this beach, though Suco Seical is said to have much more.	
9	Bahu, Baucau Near to Baucau Several open boats with outboard motor	

10	Vemasse, Baucau Near to Baucau In the north of a jetty for ro-ro ships (photo), there is a landing spot of canoes.	
11	Ailembata (Babulo?), Viqueque 4 whole dugout canoes River Bebar obstructs transports to Viqueque in the rainy season.	
12	Beacu, Viqueque Viqueque, paved road 19 canoes, whole dugout and planked Remains of dinas perikanan that is said to have had an ice plant.	
13	Bibileo, Viqueque Viqueque or adjacent communities, paved and unpaved road in mountainous area, around an hour by car from Viqueque 8 whole dugout canoes	
14	Natabora, Manatuto No fishing canoes were observed.	
15	Komando, Ailili, Manatuto Adjacent to open-air market in the town of Manatuto. Around 20 canoes, mostly planked	

16	Metinaro (Benunuk), Dili Dili, paved and two lanes road, less than an hour by car. 10 canoes in Aldeia Borohun	
17	Hera, Dili Dili, paved and two lanes road, around a half an hour by car. Decked boats in the harbor, canoes in the adjacent beach	
18	Santana (Metiaut), Dili Beach in the urban area of Dili 18 canoes and one open boat were counted. Fish traders open stalls to retail and wholesale fish on the beach.	
19	Biquele (Atauro), Dili Dili, 5 to 10 hours by canoe, 4 hours by Bonito class. Numbers of canoes are unknown, though the numbers in total of Atauro Island should be considerable and possibly make the largest fishing fleets in East Timor.	
20	Tibar, Liquica Dili, less than an hour by car, two lanes paved road. A small harbor of the inlet of Tibar was once under the administration of the port authority. At present it is not used by cargo or fishing vessels. It is said shallow reefs scattered in the inlet obstructs access of larger vessels to the harbor.	

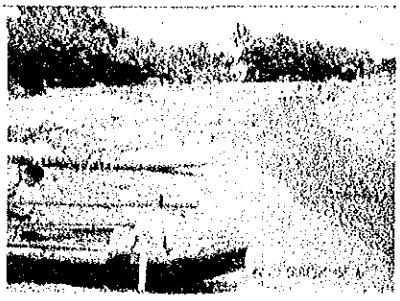
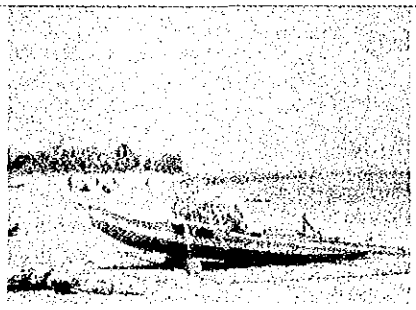
21	Leopa, Dato, Liquica Dili, less than an hour by car, two lanes paved road. It is said Aldeia Leopa (A and B) has 10 fisher's groups and each group operate 2 canoes.	
22	Dualara, Viviquinia, Liquica Dili, around an hour by car One whole dugout canoe was observed.	
23	Betano, Manufahi Same, around a half an hour by car 60 canoes, mostly whole dugout	
24	Batugade, Bobonaro Mariana, around two hours by car More than 10 canoes in the landing spot observed. Mostly whole dugout canoes.	

Table H-6: Development Demands Analysis on the Fishery Sector in East Timor
Sea Conditions, Fishery Resources, Fishing

No. 1

Areas	Present Situation			Problems and Measures to Solve		
	General	Regional		Midterm (2003 to 2007)	Long term (2008 to 2017)	Future (2018 -)
Sea Conditions	Seasonal changes of the sea conditions by monsoon considerably affects canoe fishing in aspects of fishing seasons, trip days and/or selection of fishing grounds, mostly due to low seaworthiness of the canoes. CIVIPOL or other government bodies do not record *marine accident of the canoes at present.*	Seasonal affects of the sea conditions seem to be different between north-west coast (fishing is difficult by strong wind from July to September) and north-east and south coast (good fishing season due to calm sea from July to October).		AusAID (Phase I, completed) and ICEIDA (Phase II) have assisted a boat building project to introduce more seaworthy open (un-decked) boats. The boats built by Phase I has not come into wide use so far. Phase II adopted Indonesian type that was used in East Timor, some being still used now, and has a possibility to become widespread in the sector. Though Phase II terminated in September 2001, appropriate types of boat of low building costs appear not have been attained. This project should be continued.	To fish in the open sea, it will be needed to build boats with watertight deck and navigational and safety equipment. Once three classes of such boats with FRP hull were built and publicly operated. Some of these still remain and are idled or operated. It will be required to develop decked boats of the similar scale and of a building cost that can be born by the private sector.	The administration for marine safety, which covers meteorological observation and prediction, sea rescue, and safety rules for small boats, should be established.
Marine Fishery Resources	Canoes are operated mainly in the coastal waters, a few kilometers from shore in the furthest. Demersal fish in the outer reef slope and pelagic fish in the near shore to offshore waters are not utilized. It was told that a fishery resource survey was once conducted by FAO or UNDP in 1980s, but the details are not available. Some officers in the DGP in Indonesia observe that the fishery resources in East Timor may be less abundant than in the waters of NTT because of the different bottom topography.	Coastal Waters	Bottom topography in the north coast is generally steep and the shallow waters are limited. The south coast has similar condition but the shallow waters are wider. Coral reefs seem to be limited through the whole coast. As shown in a case of the River Lacio in Manatuto, good fishing grounds are occasionally formed in front of river mouths. These conditions however are not always reflected on the canoe distribution.	Because of the limited sailing capability, fishing efforts of canoes are being concentrated in the coastal waters. To try to diversify these, FADs are planned to install at several points in the deeper waters in the north coast. Success of this trial will depend on whether the expected life of FAD can be attained, as the current velocity in the Strait of Wetar is rather high. The current plan has well arranged anchors and floating structure to avoid wind pressure, and hence the substantial results are expected. As other trial to diversify the fishing effort, the near shore fishery for the pelagic resource of small and middle size and others should be developed.	Concentrated fishing efforts in the coastal fishery resulted in a few recent cases of fishing ground conflicts among sucos or aldeias. Several cases of explosives fishing are also reported in the north coast. Division of Fishery (DOF) intends to let communities to tackle these problems. When the CBFM regime needs to be applied on these cases, relevant law and regulations and law enforcement should be prepared.	Measures to reform coastal fishing grounds that meet local conditions should be identified. When considering a present scale of the fishery sector in East Timor, cultivating fishery is questionable as it may cost too much.
		Near and Offshore	In the Strait of Wetar in the north coast, the Indonesian waters would be reached to by a trip of around 15 nautical miles. In contrast to this, Timor Sea in the south coast extends over, through Timor Gap, to the Australian continental shelf. Sahul Bank is well known to have abundant demersal resource. Drop line or other fishing has high development potential.	The EEZ waters are not demarcated yet with neighboring countries. By the assistance from ADB, a plan to define the boundaries is going to undertake. By the current strategy of DOF, offshore fishery development will totally depend on investment by the private sector and foreign companies. Offshore fishing, as well as coastal fishing with engine more than 15PS, will not be licensed until the fishery resources are assessed. As the resource survey in the near and off shore waters is necessary anyhow, it is suggested to ask the assistance from NORAD that operates R/V "F. Nansen" or other competent aid organizations in this field.	Sooner or later foreign fishing boats will start licensed fishery in the waters of East Timor. For controlling of these larger fishing boats, a surveillance system possible under the current DOF institutional conditions should be designed and established.	While it is needed to build a continuous fishery survey system, acquisition of a state's own research vessel is questionable because of its operation costs. Statistic methods may be applicable, obtaining data by obliging fishing boats of a certain size or more to submit catch reports.
Fishing	Operation: Canoe fishing is practiced generally in one-day trip basis, sailed on early morning and returned before noon. *Mostly canoes sail until where they can be seen* from shore. Though some operates fishing in nighttime with kerosene lumps, these are few. Collection of fish and lobster on foot is also made mainly in nighttime.	Daily operation pattern mentioned in the left has no regional difference. Fishing seasons are *different by the regions.* North-west coast and north-east/south coast have seasonally different sea conditions, and thus limitation of fishing terms shows regional difference.		Daily or annual operation pattern is basically passive factor. If open boat mentioned above can be developed and come into wide use, limitation of fishing seasons will decrease.	If decked boat mentioned above can be developed and come into wide use, choice of fishing grounds will increase.	
	Fishing Gears and Methods: Most common fishing gears are gillnets and hand lines. Gillnets are generally of monofilament, not dyed, and of various mesh sizes. Many of gillnets are purchased in complete (pre-assembled) form. A gillnet is used for various fishing methods like surface gillnet and surrounding gillnet. Likewise, hand lines are also used for trolling. Maybe for this reason, hand lines are not attached with sinker. A few shops in Dili sale fishing gears. These appear to be imported from Surabaya. Fishing gears donated by China, in total of 3 millions US$ including outboard motors and insulated boxes, will give the state impact to an extent that supply and demand of fishing gears may change in next a few years or more.	It appears specifications of gillnet and hand line have no regional difference. Though it is said that the gillnets in the south coast have larger mesh sizes, it has not been confirmed yet. Some firemen in Atauro Island operate fish trap, "bubu" or "bubur", of around 2m length which is not practiced by fishermen in other places. Beach seines can be observed occasionally at coastal aldeias where fishermen are many.		A reason why fishing gear is being used for various fishing methods may be explained by shortage and high prices of fishing gears. While a new canoe can be purchased for 2,500,000Rp, a complete set of gillnet costs 800,000Rp. 1,500 rolls of gillnets donated by China are expected to decrease the current prices. Generally, fishing gears are expendables. It is possible to try to assemble fishing gears of appropriate specifications by using locally available materials even partly. Especially for less effective fishing gears like trolling should be developed in such a manner.	It is desirable to decrease import tax on fishing gear materials. While some fishermen can repair monofilament fishing nets with net needle and some others can assemble traps only with locally available bamboo and hemp-like ropes, many completed gillnets are purchased. This situation may be called technically unbalanced. It might be necessary to prepare for training for buoyancy, shrinkage and other basics on fishing nets.	It seems not to be necessary to develop yarning and webbing industries in the future as the sector scale is not large enough. It might be needed to introduce production of lead sinkers.

Fishing (continued), Fishing Vessels

No.2

Area		Present Situation: General	Present Situation: Regional	Problems and Measures to Solve: Midterm (2003 to 2007)	Problems and Measures to Solve: Long term (2008 to 2017)	Problems and Measures to Solve: Future (2018~)
Fishing (continued)	Production Level	Any information, like catch per canoe and trip days, to estimate fish production level is quite limited or not available at all. Fishery statistics in East Timor are available until 1997, but the production volume seems to be unreliable.	11 districts face the sea. For an example, Atauro in Dili and Bahu in Baucau have active coastal fisheries with higher production level. To the contrary, ones at Betano in Manufahi show less active operation, possibly due to less consumption population. Regional difference in the production level should be noted.	Presently catch volume, both in districts and East Timor, are totally unknown. Because of the current institutional and budgetary limitation in DOF, collection of the primary data is not included in immediate or foreseeable administrative actions. It should be tried, even under such limited conditions, to identify measures to enable the data collection.	In addition to catch volume, statistics on fishermen, fishing boats, aquaculture, fish market and others will be required. Practical measures enabling to establish the data collection system for these should be tried to find.	
	Onboard Fish Preservation	The canoes in East Timor have 4m to 5m overall length and around 50cm width. There remains no enough space when manning two fishers and loading nets. Generally catch is put in the bow space and covered with palm leaves to avoid direct sunshine.	In any landing points surveyed so far, ice is not loaded on fishing canoes to preserve the catch onboard.	It may be difficult to improve the conditions of onboard fish preservation for the canoes, the majority of the present fishing fleet. The open boat mentioned above should be enabled to load a removal insulated box.	The decked boat above mentioned should have insulated fish holds that enable ice preservation.	Depending on boat size or trip days, refrigerated fish holds may be required. Introduction of the refrigerated hold depends on the management decision by owner companies.
Fishing Vessels	Type of Boat and Fleet Scale	In 1997, the canoes totaled 2,027 vessels over in East Timor. Destructed by the post referendum violence in 1999, the number decreased remarkably. From results of the suco inventory survey, it is estimated around a half of the fleet has been remained. Other than canoes, 14 decked FRP boats are told to be operated and 10 or some are idled with engine trouble. There are several open boats of Indonesian type at Bahu and other places.	By results of the suco inventory survey, almost similar numbers of the fishermen were reported from 19 sucos in the north coast and 12 sucos in the south coast. However, the number of canoes in these sucos in the north is 6 times more than in the south. This difference may be reasoned by the south's less dependency on the fishery and more difficult access to markets. To deliver the fishery equipment and materials donated by China, DOF conducted the survey on numbers of fishermen and canoes in the districts. The data is being processed at present. From the results, it is expected to be able to know the fleet scales in each of the districts.	Undoubtedly recovery of the fleet is an urgent issue. However, free delivery of the canoes and open boats by the new government or aid agencies would be difficult to justify, because of the policy to develop self-reliance economics and also a scale (around 1,000 vessels) of the project demands. Accordingly, it is suggested to develop an open boat of appropriate design and building cost, and to give a micro credit fund that provides the fishers with necessary financial assistance. It is desirable to ensure even chances of loan application by allocating budgets by districts, like a case of SEP assisted by IBRD.	In case of Phase II, building capability for open boats of the Hera boatyard is said to be one boat per week. If a 30% of the recovery demands is assumed to go to open boats, it will take 6 years to meet it under the present manning and facility conditions. If cost reduction is succeeded, the demand will be considerably higher. Privatization of the boatyard should be considered in a wider view extending from the midterm to long term.	Because of lower building costs, canoes will survive in the future. Canoes, open boats and decked boats will increase or decrease by financial capabilities, and thus form the fishing fleet with shares different year to year. To keep fishing efforts in an appropriate level, DOF will need to administer adjustment of numbers of these fishing vessels.
	Engines	Most of the canoes are driven by paddling and sailing. Some are equipped with outboard motor, made of Johnson, Yamaha and others, as well as ketinting (long-tail outboard motors). Before 1999, such OBMs totaled 630 units. By the violence in the year, these were largely decreased. In Dili, a few OBM dealers have started or resumed their business already. OBMs are imported mostly from Surabaya. In the Chinese grant aid, 300 units of OBM are included and these will accelerate the mobilization of canoes at once. Price of gasoline is 0.55 US$/lit at usual gas stations in Dili, and 35,000Rp/lit at open-markets, contained in plastic tanks, that are suspected to sale smuggled oils.	By results of the suco inventory survey, among the coastal sucos surveyed, 33 units of outboard motors were reported from 12 sucos. 10 sucos holding 29 units are situated in the north coast and 2 sucos holding 4 units in the south coast.	It is supposed many fishermen have experiences to operate OBM. Some fishermen seem to be able to repair most troubles if spare parts are available and already have knowledge on how much fuel oil costs them for a fishing trip, based on experiences. It appears that the fishermen do not so much need guidance or training accompanied with motorization of canoes. The administration will need to check utilization of and follow up the OBMs from China to avoid obstacles on repairs and purchase of spare parts.	Although stock volumes of the spare parts of the OBMs from China is unknown, in a long term view, it will be needed, when requested, to release the information on shipper, parts list and repair manual for the OBM, so that the private sector can deal with repairs and sales of the spare parts.	
	Boat Building and Repairing	Canoes are built by fishermen themselves or by asking others. In case of the latter, it appears many ask the fishermen in Atauro. It is said the life of canoes is around 5 years. Many unused canoes are observed left at beach with holes on bottom.	The open boats under the ICEIDA project have been built at the boatyard in Hera Fishing Port. The FRP boats above mentioned were built here as well. The equipment for boat building is mainly hand and electric tools and a compressor. These facilities are rather simple but there are no similar facilities in East Timor other than Hera.	To build the planned open boats in testing basis, facility components of the boatyard in Hera seems to be enough. To mass-produce boats in a certain level of production, it will be necessary to repair exiting buildings and install electric and machinery facilities. The ICEIDA project aims to transfer boat building technology to trainees as one of the project objectives. The followed project should also have technical transfer in the scope. After completing to develop the planned open boat, the project should be privatized.	To build and repair decked boats, the existing facilities should be totally restored and new buildings should be constructed. Adjacent to Hera Fishing Port, there is a slipway. Structure and loading facilities should be checked and repaired. After completing to develop the decked boat that meets local conditions and is of lower building cost, the project should be privatized.	While spreading decked boats locally, management capability should be raised for price competition so that the boats can be exported to the neighboring countries.

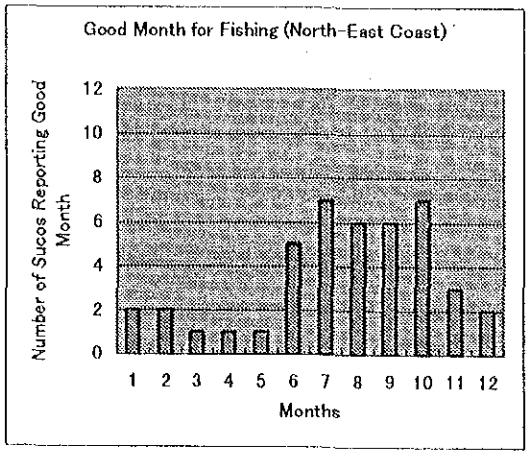
Areas		Present Situation: General	Present Situation: Regional	Problems and Measures to Solve: Midterm (2003 to 2007)	Problems and Measures to Solve: Long term (2008 to 2017)	Future (2018~)
Fishing Harbors	Outer Constructions	There are presently two harbors in Hera and Com that have water breakers and/or wharves other than a commercial port at Dili. As mentioned in the right column, some facilities exist in other local *places in addition to these. Excepting Hera, all these were not* designed for fishing harbor but for local sea transport terminal for passengers and cargos. Once Hera Fishing Port had full equipped shore-based facilities, and served for the FRP boats (above) as a mother port and local canoes as fish landing port. Rehabilitation of the water breakers and wharves are planned under the assistance by ADB.	It is said a jetty of the Com harbor has enough water depth and international containers can be handled. In Bahu and Sob, jetties were reported but these are lost without traces. In the inlet of Tibar, there are port facilities that have a jetty, wharf and storage. However this inlet has many reefs and access by a larger boat is said to be difficult. The jetty and loading facilities in Vamasse is for ro-ro ships and difficult for other use.	The canoes in East Timor have generally double outrigger and are berthed on beach after returning from fishing trip. In case of Bahu, outriggers are attached on open boats, too. Some of these are berthed on beach and some are anchored in front of beach. Because most, nearly 100%, of the fishing fleet in East Timor comprises the canoes, the necessity to construct jetties or wharves is little. Some of the active FRP boats are owned by the Atauro fishermen as a matter of fact, *and are being operated as transport vessels to connect with* Dili other than fishing seasons. In Dili, these are berthed at rusted remains of a barge and use it as a jetty. The administration says these boats will be transferred to Hera Fishing Port.	Decked boats need jetty or wharf for effective operation. As in Atauro, anchoring is possible if calm waters like inlet exists, but fish landing and supply of fuel need jetty or wharf. Depending on development of decked boats, it will be necessary for the administration to prepare these outer constructions. By that such demands for harbors are generated, and by that the administration well responds these demands, there will be developed the chances to advance into fisheries in the offshore waters like Sahul Bank.	It will be needed to categorize fishing harbors, with vessel type and scale of fleets, into some groups such as paved berthing slipways for canoes and open boats, and harbors with outer construction for decked boats. By such service standards, a fishing harbors system should be established.
	Shore-based Facilities	At present there is no standard fishery supporting facilities for refueling, ice supply and fish refrigeration. In the private sector, some produce and sell ice. In Hera Fishing Port, rehabilitation and expansion of the existing ice plant is planned by the administration, and this will be operated by the private sector. The necessity of preservation for fresh fish is generally well *known (in the late afternoon, it becomes difficult to sell fresh* fish). Demand of ice exists. Some fishermen in Betano told that, once when the electricity was available, after making ice by home refrigerator, the catch was iced and brought to market.	In Dili and Baucau, some private firms or groups produce and sell ice. In case of Dili, by using floor-top type freezers, ice in a small plastic bag is made. Because of probably insufficient temperature and time to make ice, the ice looks like crusted snow and seems not to keep so long time. The price is 1,000Rp/bag (weighing around one kg). By putting a few unusable home refrigerators on beach and using these as insulated boxes, a fish trader in Santana buys the ice and keeps fresh fish. *Setting the issue of ice quality aside, making of ice by* means of plastic bags should have been one of the feasible actions to cope with the local conditions of electricity and financial capability.	Due regards should be paid to following points when designing any plans for ice demands: 1) The fishery strategy says all profitable projects should be managed by the private sector. 2) As proposed by the Joint Donors Mission, it is possible that the government will take a policy that the beneficiary should pay for a project, especially in case of project that yields financial gain. 3) Operation and management of the subject facilities seem to deeply depend on operator's individual capability of cost management as well as his/her efforts for business activities. To pursue these conditions and develop ice plants in local sites, it is appropriate to install a fund that aims to accelerate incorporation of small-scale enterprises for this sub-sector. In case that the support is made by providing operators with necessary facilities, it is needed to plan a unit of building and equipment within such a cost that an individual operators can repay. *The outer constructions of Hera Fishing Port is planned to* rehabilitate by assistance of ADB. Accompanied with this plan, the fishery administration presently seeks an assistance to renovate shore-based facilities such as fish handling building and others.	Most probably, it will be general that fish traders also work as ice suppliers. At a stage to complete the mid-term plan, such *status and forms of the business activities* should be analyzed. The finance project should be proceeded after review of loan conditions *1) and modification of the project, as required, which may include addition of the site and renovation or expansion *2) of the facilities. *1) For an example, joining of representatives of local fisher's groups to board of directors can be considered as such loan conditions. *2) After transaction volume of fish, its seasonal change, foreseeable demands, cost and profit are well known, there should be firms that start to manage cold stores.	
Fishery Households		Presently there is no case that fishing operations are managed by enterprises in East Timor. In all cases fisheries seem to be managed by individuals. The full-time and part-time fishermen totaled to 9,000 in 1997. By results of the suco inventory survey, *around 5,000 to 5,500 fishermen are estimated at present.* Irrelevantly to full or part-time, canoe fishing is practiced to catch fish not for self-consumption but as source of cash income.	After data of the household inventory survey is made available, fishery management in households and its regionality will be analyzed.	It is said that there are fisher's households that cannot take meals sufficiently three times per day. A case of full-time fisherman is also reported that a monthly expense of his household is 800,000Rp. It should not be deemed that local economics allow them to live with this amount of money, but that they can expend only that amount. It should be tried to increase cash income by increasing fishing trip days and fishing efficiency.	Fishery management statistics should be prepared to know economic conditions of fishery management of households.	

Area		Present Situation: General	Present Situation: Regional	Problems and Measures to Solve: Midterm (2003 to 2007)	Problems and Measures to Solve: Long term (2008 to 2017)	Problems and Measures to Solve: Future (2018 -)
Aquaculture	Freshwater	A DFO told about demands of carp that, as live carps can be distributed (in the previous time these were being put in plastic bag filled with water), we do not need to worry about freshness and can eat them on other days, which is quite different from marine fish, and that carps are served for traditional ceremonies. Before 1997, carp farming was done in ponds of 109ha and in rice paddies of 119ha in total of East Timor.	Once 6 carp hatcheries were operated. Among these, Gleno station has resumed operation by a technical cooperation from Japan and two stations in Same and Viqueque are panned to rehabilitate. Carp farming was actively practiced in Aileu and Ermera of inland district, as well as Bobonaro, Baucau and Lautem. It is said that some farmers in Aileu operate mini-hatcheries for carps.	IBRD support that includes freshwater aquaculture is scheduled to start for 6 districts from September 2001. The Japanese technical cooperation is requested to continue as well. It seems that the present objectives are reduction of costs for production of fries and rehabilitation of Same station. Continued support by means of the technical cooperation is desirable. For repairs of water leak in concrete tanks in the stations and other renovation works, some pre-coordination will be needed, as these are difficult to undertake in a usual scope of the technical cooperation. It appears that the current production system for fries is not clearly given a position as an official or semi-official institute. To continue the project further more, it is desirable to provide the institution with a regulation that covers a position in the administration, staffs and accounts.	Operation of the hatcheries should be commissioned to the private sector. Repairs or construction of ponds by local farmers should be supported by means of tax reduction, finance or others.	
	Brackish Water	Once brackish aquaculture for milkfish was operated in ponds of 23ha in total. There is a record that shows, through inter-islands trade, the fries were shipped from East Timor. A remarkably large size of milkfish was observed in open-air markets. It seems to be highly possible that milkfish resource is abundant.	Several idling brackish ponds are observed in the northern coast districts such as Baucau, Dili and others. Some fisher' groups in Metinaro started the milkfish aquaculture under the support from a NGO. Once the operation was tried in Tibar, but failed.	Though not confirmed yet, it is said that idling brackish ponds cannot be handled with because of land tenure issues. The fishery strategy limits capture of natural fries. Though there are request for operation of brackish ponds from fisher's groups (Tibar), administrative action and decision should precede beforehand.	Many small inlets can be observed that dry up in low tide. Some of these are used for saltpans. These sites give good conditions for extensive aquaculture, taking advantage of tidal range. Repairs or construction of ponds by local fishers should be supported by means of tax reduction, finance or others.	
	Sea Water	So far, the team has not observed any case of marine aquaculture such as cage or tank culture.	Same as the left.	Cage or pond culture for grouper or sea bass is technically possible in either of intensive or extensive way. It might be suggested to ask experts for the above technical cooperation to undertake a trial survey on site conditions and availability of fries to prepare for further studies.	Because there have been few cases of shrimp culture so far and East Timor is geographically isolated, there appears no incidence of white spots and other disease at present. It is said that, by taking such advantage of the clean environment, shrimp larvae might be able to export to Southeast Asian countries by managing intensive hatcheries.	
Producer's Organization		In the Indonesian times, fisher's groups were organized and these are still functioning when they share canoes of limited numbers and receive supports from aid agencies. By the results of the suco inventory survey, such 164 groups for fishery were reported in 24 sucos, including 12 groups for freshwater aquaculture in 2 inland sucos.	In marine fishery, among 22 sucos, 11 sucos in the north coast reported 104 groups and 11 sucos in the south coast reported 48 groups. Number of the group in the north is two times more than in the south. It is said that, in the course to implement some fishery supports under UNTAET/ETTA, the groups was reorganized in some districts for convenience to supply fishing materials.	Many projects will be necessary through the mid and long term. These may include improvement of fishing gears, fish landing survey, credit for small-scale enterprise for fishery, survey for fishery management of households, baseline survey for CBFM, follow-up for the fishing equipment supplied and others. These projects will need involvement of the fisher's groups directly or indirectly. That is, it will be difficult to undertake these projects without the groups. By their participation to these projects, the groups should be affirmatively tried to raise.	Accompanied with growth of the fisher's groups, it will be required to enact law and/or regulations for the institution and system that regulates right and obligation of the producer's organization and the administration. The groups should be reorganized to legal bodies such as fishermen's cooperatives, and then entrusted with right to undertake fishery management. The administration should prepare for law enforcement system to control illegal fishing and for arbitration for fishing conflicts.	Planning on economic activities, including joint purchase and fish marketing, by the legal bodies (see the left) and its implementation should be undertaken.
Transport Infrastructure		In the Indonesian times, construction of motor vehicle road was progressed. It was said that at that time coastal roads and roads to connect the north and south coast were opened between cities such as Dili and Same, and Baucau and Viqueque. As north-south routes are generally narrow and run through mountainous areas with many sharp curves, a tip takes a long time. Repair works are being proceeded with for these roads. Finance by the SEP has accelerated to spread private minibuses. Their charges seem to be high especially in case of a long distance. It may give some suggestions on the necessity to reflect management achievements on loan conditions.	Generally the north coast roads are in good conditions. From Baucau or Bobonaro, a day is enough for a round trip to Dili. On the contrary, from Viqueque, Covalima or Lautem, two days are needed. From Manufahi or the south coast of Manatuto, a day trip is possible but two days will be needed when taking opening hours of markets and time to handle cargos into account. Present north-south gap seems to be partly generated by different accessibility to Dili and high transport charges.	Solutions of the present problems depend entirely on the development of the transport infrastructure. In the sector however, it can be one of the measures to cover small vehicles, including second-handed ones, in the items to finance for small-scale enterprises for fishery.		

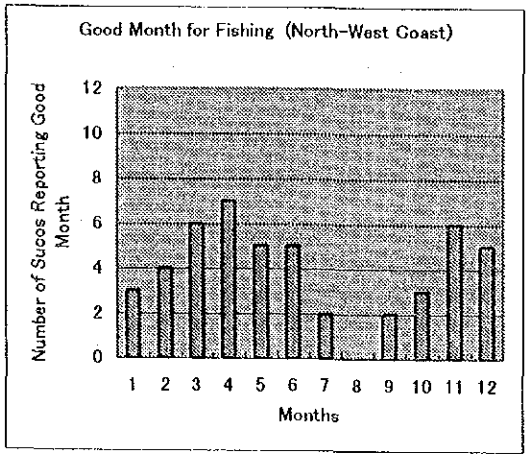
Areas	Present Situation		Problems and Measures to Solve		
	General	Regional	Midterm (2003 to 2007)	Long term (2008 to 2017)	Future (2018~)
Marketing	By observation in Dili that holds a large population of consumers, mostly fish is distributed in form of fresh fish. A limited portion of fish is distributed after dried. Fish distribution to the uplands is unknown. Marketing by fish traders has become general already. They are mostly individuals. In Dili, some groups sell iced fishes and lobsters to hotel and restaurants by transporting these on pick-ups. Apart from an issue whether these groups are juridical corporations or not, these may be managed by enterprise bodies. Some traders use ice to keep fresh fish and it seems little remained fish is abandoned. By seasons, a difference between producer's and retailer's price varies but it is considerably large. For an example in bad seasons, the price of large flying fish is 10,000Rp/2 pieces in a beach of Liquica and is 20,000Rp/1 piece in markets of Dili.	Where fresh foods markets of its own scale are Dili (3 places), Manatuto (1), Baucau (2) and others. The market of Liquica is said to open twice in week. By interview at several aldeias between Liquica and Baucau, in general, landing sites from Liquica to Manatuto are visited by traders from Dili, and those from Manatuto to Baucau are by traders from Baucau. Those in Manatuto are visited by the both. Fishers sell the catch whoever visits the beach first. There was no case observed that fishers are obliged to sell specific traders due to debts.	By results of observations have been made so far, fish traders show different scales of business. In some cases, traders carry a plastic bucket and use minibus to trip to landing sites and then retail fish at markets in Dili. In others cases in Santana, Dili, traders put stalls at the beach and buy fish landed, and then retail these directly or wholesale these to other traders or peddlers (carrier with a pole). Remains are kept iced. The administration will need to register or license these traders sooner or later for the control of fish markets and foods hygiene. A similar finance project for small-scale enterprise to develop ice plant should be considered for fish trading enterprise of a small-scale.	Registration or license system should not obstruct free marketing of fish. By monitoring of fish prices or other measures, the system should be reviewed to adjust total numbers of and conditions for renewal.	For a scale of fish distribution in East Timor, it may not be necessary to establish a central wholesale market system in the urban areas.
Process	It is said that, in Seical small fishes are stringed through gill with palm leaves, and then sun-dried for selling. In Atauro, remained fishes are opened and sun-dried after salted. These are traditional ways to preserve fish and observed in various places.	In Atauro and Oecussi, a way of fish processing by salting and drying was trained for women's groups by aid agencies recently.	Processing of fish seems to be made entirely for preservation, and not for tastes. In view of the past and present scale of fish production in East Timor, it is questionable that fish processing can develop to one of the major industries in the fishery sector. At this stage, the fish processing may be placed in a position of measures to preserve remained fish.		
Consumpt'n	At the moment a considerable demand for marine fish exists, as the prices are generally high. Demand for carp also exists as mentioned above, though price tendency is unknown, as marketing is not resumed yet. By the result of the suco inventory survey, many sucos reported tunas, sardine and bottom fishes as major fish species.	Although it is considered that level of fish consumption is different between coastal areas and uplands, present situation is unknown.	Basically, in the field of fish consumption, the administration may need to take a responsibility to control fish quality including food hygiene inspection. Preparatory works will be needed to regulate hygiene standards for fresh fish. Some measures may be needed to seek for a survey in contract bases to know local consumption of fish, like difference between coastal areas and uplands.		
Import and Export	Once, fresh sea cucumber, live lobster, shark fins and others were shipped to inter-islands market. There was no receipt of marine products in statistics of the previous time. Presently the export seems to be negligible. Canned and frozen fish are imported. Prices of frozen fish in supermarkets appear not to be affordable to the local people and hence to be sold mainly to foreigners like the UN resident staffs and others. There seems to be marine products brought in by overland transport from NTT. Canned fish of 960 tons is included in EMOP6177 by WFP.		Unlike the sustenance fishery, the fishery for overseas market aims significant surplus, though there are exceptional cases in the world as always. Involvement of the administration may therefore be limited to a case that foreign capitals obstruct development of the domestic export industries for the marine products.	When domestic fish marketing firms are developed, their business efforts will be directed to export in course of time. For the quality control, application of HACCP or other measures should be considered.	
Fishery Administration	**Basic strategy:** "Fish for the Future" that is expected to give development and fishery management policies puts its most emphasis on ecologically sustainable development of the marine resource. **Fishery management:** In this strategy, fishing vessels of engine more than 15PS or fishery in the waters more than 3 nautical miles from shore will be licensed, and rest of the marine fishery will be the free fishery, requiring no license, and be entrusted to the CBFM. **Institution:** The Division of Fishery, Ministry of Agriculture and Fishery, administers the fishery sector. The division had been called FMES and was renamed after the election for the Constitutional Assembly in 2001. It holds 18 own officers. Among them, 8 officers are assigned to district fishery administration as DFO. There are 5 districts without DFO at present. Based on this institutional condition, the division will need to find measures or system to undertake tasks given to the fishery administration. Since 1999 and 2000, a UN chief advisor and 4 to 5 volunteers work for capacity building for the division officers. Portugal provided 10 officers with a short term training in 2001. AUSAid is making a new proposal for the capacity building.		Fishing vessels without engine or with engine of 15PS or less are the very thing of the present fishing fleet in East Timor. It may be risky to handle these like the free fishery without overall limitation of fishing gears and methods. Even if these are put in hands of the CBFM regime, the responsibility and involvement of the administration will remain after all, so far as fishing grounds exist in the public waters. For an example, law enforcement for illegal fishing and arbitration for fishing ground conflicts among communities should be the issues administered by the government. Prior to the institutionalization of the CBFM, it will be needed to study on details of the traditional customs for fishing management. Some officers say such customs have become ineffective after continued political confusions. By results of the suco inventory survey however, around 50% of the surveyed coastal sucos reported to keep various customs to manage their fishing.	Institutionalization of the CBFM, after its pilot trials in the communities where coordination is required.	
Research and Education	In the previous time, there were 5 superior educational institutions of 3 or 4-year term in East Timor. Among these, UNTIL and another resumed recently. There were also two special schools for agriculture and livestock. Among these, SPP Fuiloro resumed. All of them had no course for fisheries. It is said that those who hoped to get fishery education after high school went to colleges in Surabaya or Semarang.		In the above, when outlining the present situation and problems in the fishery sector, it was indicated that following studies or laboratory works would be needed: fishery resource survey, fishery statistics, aquaculture research and fish quality control. Training or education for young successors in the sector will be needed likewise. It will be not possible for DOF to undertake all these works with its rather limited number of officers. Apart from establishing a special school for fisheries, it is desirable an appropriate institution like UNTIL will open a fishery course and be facilitated to able to work for research and study in the fishery sector.		

Figure H-1 Fishing Seasons Reported by 31 Sucos

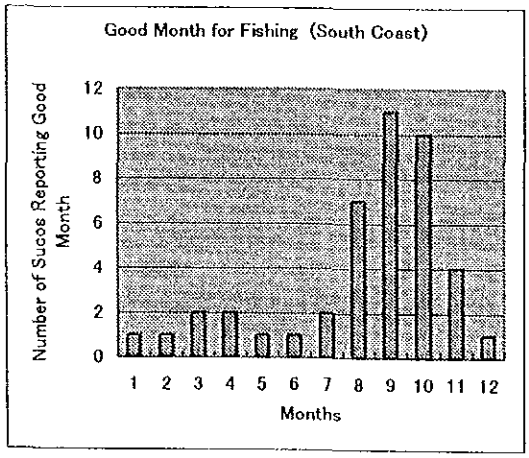
1. Good Months for Fishing



Reported by Lautem, Baucau, Manatuto

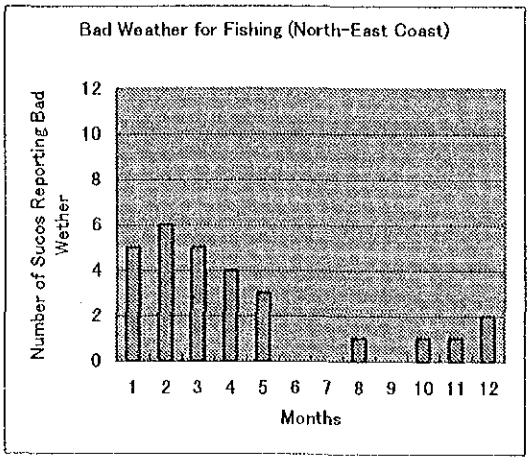


Reported by Dili, Liquica, Oecusse

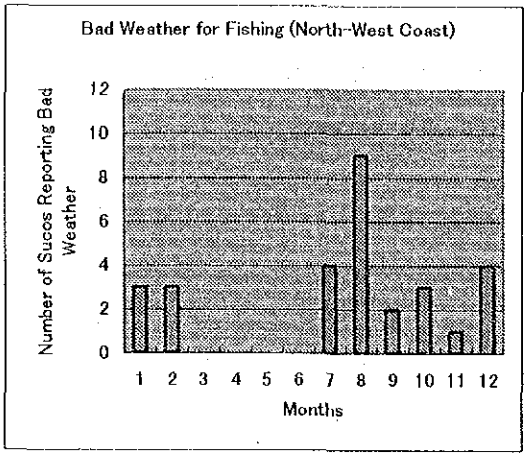


Reported by Viqueque, Manufahi, Covalima

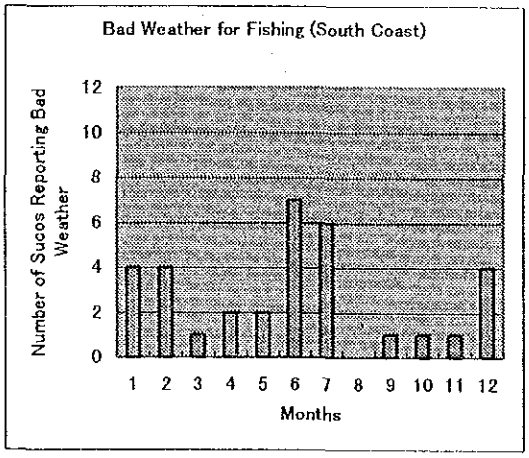
2. Bad Weather for Fishing



Reported by Lautem, Baucau, Manatuto



Reported by Dili, Liquica, Oecusse



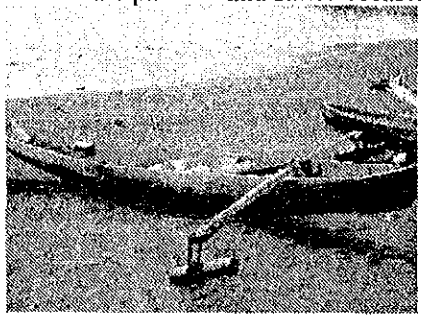
Reported by Viqueque, Manufahi, Covalima

Figure H-2 Fishing Vessels

(1) Dugout canoes

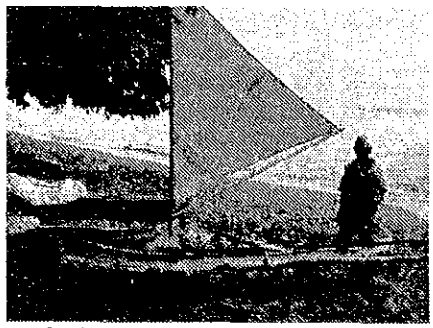
The majority of fishing fleets in East Timor is dugout canoes at present. All dugout canoes have double outriggers that are hung with double or single beams. Some of the canoes have plank-constructed gunwale with dugout hull bottom. These canoes are paddled and sailed occasionally.

Double beams, Liquica



Single beam, Liquica

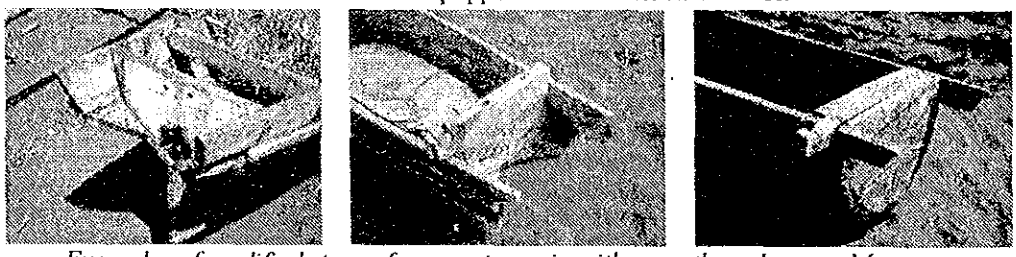
Plank-built gunwale and dugout bottom



Sail and poles with flexible joint

(2) To equip an outboard motor

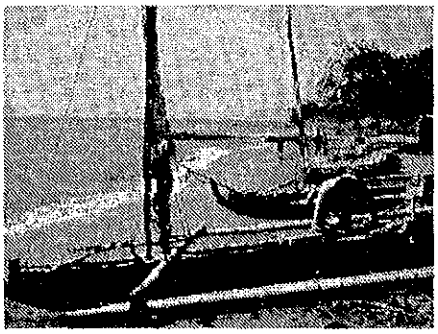
Some limited numbers of the canoes are equipped with an outboard motor.



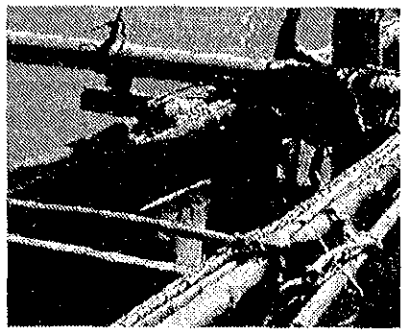
Examples of modified stern of canoes to equip with an outboard motor, Manatuto

(3) Canoes of More Rigid Construction

Some of the canoes, especially in Atauro Island, have more rigid construction to increase seaworthiness. To increase a height of gunwale, various methods are being applied.



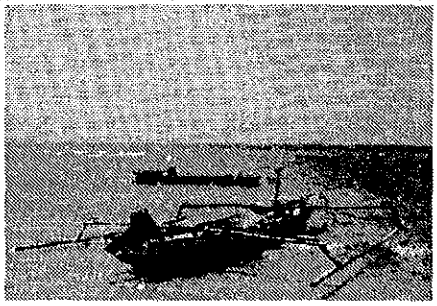
Canoes from Atauro, Dili



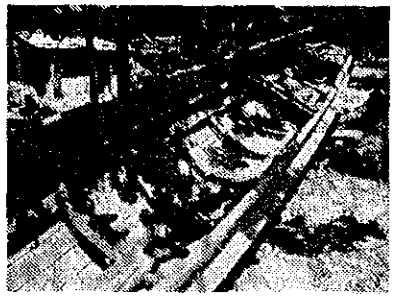
View from bow side (same canoe)

(4) Open Boats

At a beach in Baucau, several open boats of keel structure are observed. These seem to be built by Sulawesi fishermen before the conflict in 1999.



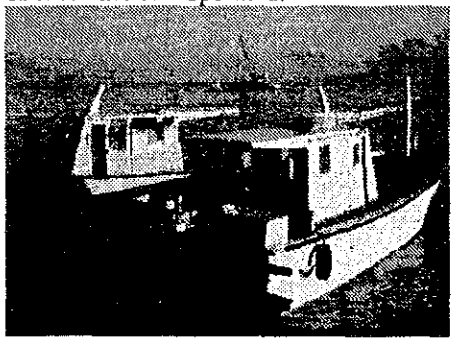
Bahu, Baucau



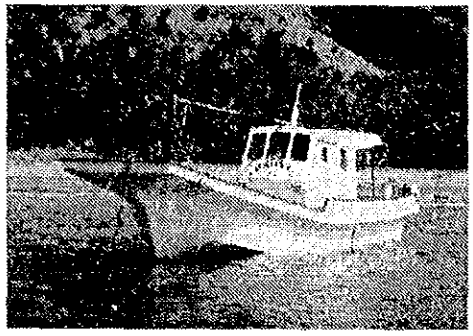
-Ditto-

(5) FRP Decked Boats

In Indonesian times, some 24 FRP fishing boats were built in a boatyard of Hera fishing port. Some of these are still operated.



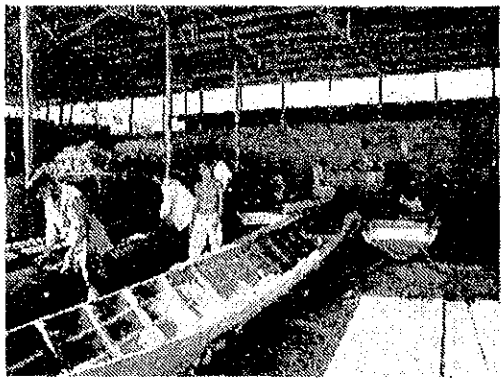
"Bonito class" from Atauro, Dili



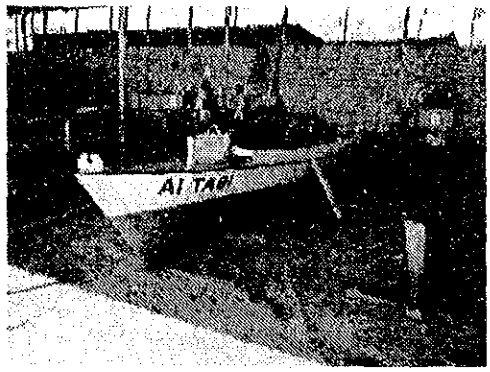
"Timor Lolo Sa'e" class, Atauro

(6) Boat Building Project (Phase II) by ICEIDA

Boat building project (Phase II) was started in end of June 2001. An Indonesian instructor was invited from Atambua, NTT, Indonesia and 11 boats were planned to build for training. As of mid of August 2001, building of 5 boats of the similar construction as the open boats in Bahu was on the way or mostly completed. The Phase II was terminated in end of September 2001.



Boat building yard, Hera



Mostly completed