10) There are no regulations or laws on quality standards of fresh and dried/salted fish that are consumed locally; and there is no monitoring agency for fish quality. Frozen prawns and tunas earmarked for exportation, are inspected by the Lembaga Peneritian Pengusian Mutu Hasil Perikanan in Tg. Pinang. However, since there are no legal inspection obligations for exported fresh and dried/salted fish, they are not inspected.

11) According to the usual marketing pattern for domestically consumed fish products, the fish catch is sold to the fish trader when it is landed at the local TPI, who in turn, sells it to the retailers and consumers at the local fish market. Fish trading is rarely carried out at auctions, but is commonly based on negotiation or consignment.

12) There are four fish auction facilities (TPI) in the Study Area, located in Tg. Medan, Dumai, Bengkalis, and Selatpanjang. Only the TPI of Dumai is keeping the originally aimed auction function. There are all in eight fish retail market in the Study Area, but main ones are located in Dumai (two locations), Bengkalis (one location) and Selatpanjang (one location). There are presently a total of nine ice plants in the Study Area. Total production capacity for the nine plants is 27 tons/day. There are small cold storage rooms in fish markets where unsold fish or export one are stored. There are no freezing facilities in the study area.

2.4.3 Constrains of Fish Marketing and Processing

The constraints of fish marketing and processing in the Study Area are described below:

- Insufficient or luck of fish transportation infrastructure, even the export of fish is very popular in the Study area
- Lack of effective utilization of by-products (trash fish)
- Lack of production technology of high quality processed products
- Lack of technical, managerial, and financial capability for fish processing development

2.4.4 Development Policy of Fish Marketing and Processing

- Pursuit of possibility of price upgrading of fresh fish by thorough quality control

  In large markets of neighboring countries such as Malacca, Singapore, etc., fresh fishes imported from the Study Area are not appreciated much. Therefore the possibility of upgrading fish price is to be examined by improving quality of fresh fish through the measures of enough supply of cheap and qualified ice to fishermen.

- Pursuit increase in value added of processed fish products

  Processing high valued traditional fishery products such as Terasi and cincaro under the quality control. Improve the quality of the products which already have some market share in overseas, such as dried shrimps and anchovies, through standardizing processing methods.

2.5 Fishermen Organizations and Institutions

2.5.1 Relationship Between Government and Fishermen Organizations

1) Government assistance measures to subsistence fishermen and fish farmers was established under the auspices of a fishing act (known as Law of the Republic of Indonesia Number 9 of the Year 1985 on Fisheries) enacted in 1985.
2) There are two types of fishermen organizations known as KUD (multipurpose village cooperative) and the Kelompok.
3) KUD is an economic cooperative by Desa level in which the Ministry of Cooperatives officially grants assistance and guidance. Its members are engaged in the primary industry such as agriculture, fisheries, etc. and economic activities. The government provides financial assistance and other services for those activities. The Ministry of Cooperatives is responsible for organizing and operating KUD for fishermen; and DGF is responsible for all technical matters on fisheries.
4) Unlike the KUD, the Kelompok is not a legally established organizational system, but is an organization which implements learning, production, and cooperative activities. It is a farmer and fishermen's group which is part of the regional agricultural guidance program. In 1992 the government separated the agriculture and fisheries sector and created a separate and autonomous fisheries division. The Kelompoks are to be formed for all the fishermen in all the Desa and the future goal is to incorporate them into KUD.
5) Although the government has set up various types of financing programs for KUD, it has not established a loan system specifically for fishermen. In 1980 financing was provided for fishermen engaged in trawling, to help them make the transition to other forms of fishing when trawling was banned, and for subsistence fishermen, to help them modernize their fishing methods (Kredit Kepres). However, due to a poor repayment ratio of 14 percent, loans to fishermen have not been aggressively implemented. Although many reasons for the default on loans by fishermen have been given, the major cause appears to be the long established credit ties between the fishermen and the Tauke, which have made repayment to the government difficult, because fisherman put priority to repay their credit to the Tauke..

2.5.2 KUD activities in Kab. Bengkalis

1) There are 417 KUD organizations in Riau province, of which 105 are in Kab. Bengkalis (18,136 members). Among the KUD in Kab. Bengkalis, there are 13 KUD for fishermen of which 10 are still active (1,564 members). They comprise only 9 percent of the total number of KUD members in the kabupaten (see Fig 26). There are only 34 (2 percent) fish farmers in the KUD membership.
2) A major cause underlying the low membership ratio of fishermen KUD is the financial ties between the fishermen and the fish traders (Tauke). The KUD is attempting to sever these ties by offering financial assistance in the form of operating loans, to the fishermen.
3) KUD Bengkalis has 172 members who are fishing boat owners and crew members. There are a total of 100 powered fishing boats engaged in gill net fishing (about 70 boats) and bottom long line fishing (about 30 boats). In addition, there are approximately 200 to 300 sampans affiliated to the KUD. The executive committee members are composed of seven the Tauke who own 16 fish carrier boats which are independent of KUD. They export the fish catch they receive in return for the credit extended to fishermen for their operations and living expenses. The duties of the KUD entail processing and issuing the export permit. It receives 25,000 rupiahs per voyage after the permit have been issued. This type of system does not change the personal ties between the fishermen and the Tauke; and KUD activities have simply rationalized export operations by the Tauke.
4) The same type of situation exists in KUD Rupat. In the case of KUD Rupat, PT. Kepal Jala Guna, a fish export company owned by the naval cooperative, provides the KUD with operating capital; and in return, the company receives and exports the fish catch from KUD members.

2.5.3 Kelompok activities in Kab. Bengkalis

1) As of 1991 the number of fishermen Kelompok in Kab. Bengkalis was 82 (3,507 members) and there were 38 aquaculture Kelompoks (511 members) (see Figure 27). The Kelompoks were established under a separate fishing act from KUD and they have been created exclusively for fishermen.
2) The activities of the Kelompok have been categorized according to fishing methods, fish processing by fishermen wives, aquaculture, etc. The DPK has been providing technical and financial assistance to the Kelompok as part of their development program, since the banks will not provide loans to the Kelompok.
3) The issues confronting the kelompok are:
   - Desired activities cannot be implemented due to a lack of capital.

• Production according to the plan endorsed by DPP or DPK cannot be achieved, and therefore the Kelompok is unable to receive financial assistance from the government.

• These issues signify technical and operational problems that must be resolved.

2.5.4 Constraints of Fishermen Organization in the Study Area

The constraints of fishermen organization are below :

- Because of so many fishermen are under the financial control of the Tauke, it is very difficult to established an independent fishermen organization in the Study Area.
- There are no independence organization due to the financial matter

2.5.5 Ideal Role of Fishermen Organizations in Fishery Development

The influence of the Tauke is strong in the area encompassing Rupat and Bengkalis islands; and rather than attempt to sever the relationship between the subsistence fishermen and the Tauke, it would be wiser to include them in the project of to co-exsit with them, and thereby lessen the economic risk to the subsistence fishermen. Or sampan fishermen who are not strongly influenced by the Tauke, will be organized in the first step, and then this organization tries to liberate powered boat fishermen who owe the Tauke not much through shouldering a part or all of their debt by using the organization's fund. And by and by all the fishermen might be able to be freed from the control of the Tauke. In contrast, puribumi organizations are active in the area of Selatpanjang and a project which will promote accumulate their capital might be feasible here.

2.6 Current Condition and Function of Mangrove Forest

Riau Province had a forest area of approximately 9.4 million ha in 1986, accounting for slightly less than 5% of Indonesia's total forest area. The forest area of the Study Area controlled by the 3 branch Offices (CDK), i.e. Dumai, Bengkalis and Selatpanjang, is approximately 3.7 million ha, accounting for slightly less than 40% of the forest area in Riau Province. The area of mangrove forests in Riau Province was estimated to be 276,000ha in 1982, accounting for some 3% of the provincial forest area and some 6% of the national mangrove forest area.

2.6.1 General Condition of Mangrove Forest

(1) Forest land use categories

The DEPHUT has adopted a land zoning system called Agreed Forest Land Use Categories (Tata Guna Hutan Kesepakataan: TGHK) based on forest functions. The zoning in each province has been agreed with the governor or other provincial authorities with particular emphasis on the conservation of water and Soils. The characteristics of each forest land use category are described below.

Protection Forest (Hutan Lindung) : no felling is permitted

Reserve Forest (Hutan Suaka Alam dan Hutan Wisata) : forest serving for the biological diversity of fauna and flora where no felling and hunting is permitted.

Production Forest (Hutan Produksi) : forest serving for the production of timber accordance with concession agreements. It is composed of limited production forest (Hutan Produksi Terbata) and ordinary production forest (Hutan Produksi Tetap).

Conversion Forest (Hutan Konversi) : forest which can be converted to farmland

Forest land areas by TGKH in Indonesia are shown in Table 28. Most mangrove forests in Riau Province are designated to the limited production forests. There appears to be neither protection forests nor reserve forests in the coastal area of the Study Area except P.Payung island and P. Kembang Luar island.

(2) Distribution of mangrove forests

General distribution of the mangrove forests in the Study Area and those temporal changes during the past 15 years were studied by using satellite images and existing information. The distribution and changes are shown in Fig. 10 and those areas are tabulated in Table 29. It is estimated that some 95,000ha of mangrove forests distributed in the Study Area as of 1976 and some 25,000ha (some 26%) of them have been diminished during some 15 years up to 1991.

1) Characteristics of distribution of mangrove forests

The mangrove coverage is generally very thin and the width of forests is narrow along the coastline of the Strait of Malacca. The width of mangrove forests is also narrow around end of major channels.

In contrast, the large mangrove coverage was found along large river and minor channels. The mangrove coverage along the coast of Sumatra Island in the Study Area is rather limited.

2) Secular changes of mangrove coverage

The characteristics of the secular changes are summarized as follows:

a. Sites of conspicuous reduction

- Bengkalis Island : land ward of the Selatbaru River and the Bantang Tengah River
- Padang Island :near the S. Akar River and the S. Raya River
- Merbau Island : near the S. Merbau River
- Rangsang Island : northwest coast
- Tebingtinggi Island : near the S. Tohor River

b. Distribution of coverage reduction sites

- Many sites of large secular changes are found on Merbau Island and its surrounding areas.
- Many sites of large secular changes are found in the case of conversion forests (HPK) or other utilizations (APL) and their surrounding areas among the various forest land use categories (TGHK).
- The scale of reduction is larger at the landward area along rivers.
- Many reduction sites are found along the coast facing the Strait of Malacca on Rangsing Island.

3) Classification of mangrove forests in the study area

There is a correlation between a long-scale deterioration and diminishment of mangrove forests and TGHK. Mangrove forests in the Study Area can be classified into as follows in order to extract the high stressed area by human activities (see Table 29) :

Class 1: An area with large secular changes within a narrow mangrove forests.

Impacts including the current human activity is considered to result in pronouncedly serious damage to the mangrove ecosystem because of poor condition for the establishment and maintaining of mangrove forests and much reduction of mangrove forests.

Class 2: An area with large secular changes within an extensive mangrove forest

Impacts including the human activity may be causing serious damage to the mangrove ecosystem because this zone has much reduction and is believed to be suitable for the growth of mangrove.

Class 3: An area with small secular changes within an extensive mangrove forest

Impacts including the human activity is not expected to cause much damage to the mangrove ecosystem because this zone has little reduction and is believed to be suitable for mangrove growth.

Class 4: An area with small secular changes within a narrow mangrove forest

Coasts with no past or present mangrove growth or with no mangrove forest of which the width is narrower than the minimum effective width will be classified as this zone. Because this zone is unsuitable for establishment and maintaining of mangrove forests, the possibility of existing forests maintaining their ecosystem appears to be low.

Most of mangrove forests in the Study Area belong to Class 3 and have some 40,000ha in area in 1991. Mangrove forests that have been diminishing are ones of Class 1 and some 70% of the existed forests have diminished.

(3) Stand conditions of mangrove forests

Characteristics of the forest structure of mangrove forests in the Study Area are as follows based on the field investigation :

a. There is usually a concentration of charcoal kiln sites in areas of extensive mangrove coverage. No clear difference in crown density was found in relation to the distance from the nearest kiln site.

b. The existing regulation provides that about 40 trees/ha seed trees with diameters of 210cm and over must be preserved. Except high trees (average height: 20m), the average tree height of most forests is 10m or less and the average diameter of most forests is around 10cm. Seed trees are not found except in areas of major mangrove coverage.

c. The values of average stem diameter on Rupat Island tend to be smaller than on other islands.

(4) Site environment of mangrove forest

1) Distributing factors of mangrove forests

Environments where mangrove forests grow are categorized into three types in Indonesia:

a. The Study Area is located in small islands on the coast of the Malacca Strait, and there isn't any large rivers. Therefore any mangrove forests of the Study Area belong to either open-sea type or the inland-sea type. The width of the mangrove forest-belts is not very wide compared with standard width of mangrove forest belts in Riau Province (KLH, 540m)

- Open Sea Type (Terbuka): coasts directly faced to the open sea
- Inland Sea Type (Terlindung): coasts affected a little by waves or currents because of gulfs or islands.
- River Type (Tepian sungai): shores in brackish water areas along river system around estuaries of the large rivers.

b. Most of the mangrove forests in the Study Area grow better because they exist on muddy matrix.

c. The mangrove forests grow poorly and also geographical distributions of the mangrove forest are limited along the Malacca Strait or ends of water channels in the Study Area where affects of erosion- sedimentation or waves are very severe. (open sea type)

d. The yearly precipitation of Kab. Bengkalis is 1,800mm, and this is relatively little compared with the data of other tropical areas. There is no significant difference of temperature and precipitation in the study areas. It is presumed that strong winds and waves would affect during rainy season in the vicinities of Malacca Strait and eastward shores. (open sea type)

2) Zonation by site condition

The structure of mangrove forests is called a zonation. That is because forest composing tree species changes on after another along the environmental gradient (the change of environmental factors such as degree of tidal inundation) from the seaside to the inland area. Usually each composing species ranges in parallel with the seashore. The tree species can be classified into the pioneer species type in the seaward zone - the meso type zone - the landward species zone - the pioneer species type in the brackish - water zone (rear mangrove).

The characteristics of the species composition type of mangrove forests in the Study Area identified by the field investigation are summarized below.

a. *Avicennia* spp. - *Sonneratia* spp. Type (pioneer type in the seaward zone)

These species belong to the dominant species on sites inundated by medium high tides. This type is dominant mainly in places where the mangrove coverage width is narrow, and is narrowly distributed on the water edge in other places. *Sonneratia* spp. tends to be more dominant than *Avicennia* spp. in the southeastern part. This type is often absent of mixed with *Xylocarpus* spp. and/or *Rhizophora. mucronata* in areas with extensive mangrove coverage.

b. *Rhizophora* spp. Type (the meso type)

These species belong to the dominant species on sites inundated by normal high tides. Most mangrove forests found in the Study Area belong to this type. *R. apiculata* is the dominant species and *R. mucronata* is also found in the lower places. *Xylocarpus* spp. is mixed with *Rhizophora* spp. on the landwards.

c. *Bruguiera* spp. Type (the mixed-type of the meso-type and the landward type)

These species belong to the dominant species on sites inundated by spring tides. This type has no distinctive distribution pattern some species that often found in landward areas, exists on the water edges. This type isn't said to exist on Bengkalis Island. Forests along the S. Suir River tend to show a dominance of this type. *Xylocarpus* spp. is often mixed on the landwards areas. This type mixed with R. mucronata is found along the Selat Padang channel and the Selat Asam channel. Generally mangrove forests in the Study Area have zonation similar to one in Malaysia in terms of species composition. Site conditions in the mangrove forests in these areas are expected to be almost the same as ones in Malaysia.

2.6.2 Stand Condition of Mangrove Forest

The forest type was fixed on the basis of dominant species and tree high by taking the zonation into consideration. Data on stand conditions were collected through the forest survey and forest management was examined using forest type.

The growth and litter production of mangrove forests were presumed by the results of the follow up survey using permanent plots and litter traps installed in 1992. Table 30 shows summary of forest inventory plots and summary of quantitative characteristics by forest type is shown in Table 31.

(1) Volume of mangrove forest biomass

The utilizable volume for charcoal production and above ground biomass (in weight) were estimated in the case of standing trees (minimum stem diameter of 4cm). The subject species for estimation of the utilizable volume were *Rhizophora* spp., *Bruguiera* spp. and *Ceriops* spp. Using the existing volume table[4], the standing tree volume was firstly estimated and converted to the volume per ha.

Estimation of the existing above ground biomass (in weight) was conducted for all species. The existing estimation formula[5] was used to estimate the biomass for each standing tree and converted to the biomass per ha.

4: K. Soemarha (1974). Table Volume Bakau-bakau (*Rhizophora* spp.) di Daerah Bengkalis Riau

5: C. Kusama, S. Sabiham, K. Abe, H. Watanabe (1992). An Estimation of Above Ground Tree Biomass of a Mangrove Forest in East Sumatra. Indonesia

The mangrove forest resources per ha is shown in Table 32.

The standard sample plot method was used for the present study in view of the short field survey period.

1) Utilizable volume

The Utilizable volume for charcoal production per ha is approximately 7 - 27 m^3 for the standing trees and approximately 3 - 19 m^3 for trees with a allowable diameter (10cm and above).

In the case of low *Rhizophora* spp dominant stands, the volume on Rupat Island was estimated to be approximately half the volume of other islands.

2) Above ground biomass

The above ground biomass per ha is approximately 9 - 60 tons for the standing trees and 5 - 54 tons for trees with a allowable diameter (10cm and above).

C. Kusama, S. Sabiham, K. Abe, H. Watanabe (1992). An Estimation of Above Ground Tree Biomass of a Mangrove Forest in East Sumatra. Indonesia

(2) Mangrove forest growth and litter production Volume

For the present Study, fixed plots and litter traps were introduced for continuous observation to determine individual tree growth (in about 9 months) and the litter production volume (in about 1 year).

1) Mangrove forest growth

a. Growth of diameter and height of individual trees

While the actual observation values widely differ, the average values are estimated to be a tree diameter growth of 0.5 - 1.0cm in 9 months and tree height growth of 0.5 - 1.0m in the same period regardless of the plot or initial tree diameter.

b. Individual tree growth

- Utilizable volume

While growth of the Utilizable volume also differs from tree to tree (*R. apiculata*), the average value is estimated to be 0.003 - 0.005 m^3/tree in the 9 month period regardless of the tree diameter. The actual utilized volume of *Rhizophora* spp. for charcoal production was found to be approximately 0.01 m^3/tree for trees with a diameter of some 7cm and 0.05 m^3/tree for trees with a diameter of some 14cm. The actual utilized volume of *Xylocarpus* spp. for fuel at charcoal making was found to be approximately 0.02 m^3/tree for trees with a diameter of some 10cm.

- Above ground biomass (in weight)

For estimation of the total stand growth, the total growth of individual trees and that of the stem are assumed to be 6.7 kg/ha and 4 kg/ha respectively.

The total growth of the above ground biomass (*R. apiculata*) largely varies from one tree to another. This variation becomes smaller when only the stem volume is considered. The leaf weight is approximately 1Kg/tree-regatd-less of the stem diameter.

In the case of standing trees (*Rhizophora* spp.) with a diameter of some 6cm, no predominant tendency was observed in regard to the relationship between the measured value of the stem section and root section and the estimated one. The approximate stem and leaf weight of which were 12 kg/tree and 3 kg/tree respectively is similar to the estimated one. In the case of standing trees (*Xylocarpus* spp.) with 2 branches of some 8cm in diameter and 3 branches of some 5cm in diameter, the total stem weight was some 46kg while the branch weight and leaf weight were some 25kg and some 5kg respectively, all of which were lower than prior estimates.

c. Stand growth estimate

Table 33 shows the estimated annual increment of mangrove forest biomass. The annual growth of the Utilizable volume per ha is approximately 2 - 7 m^3 for the standing trees and approximately 0.2 - 0.6 m^3 for trees with a allowable diameter.

2) Volume of litter production

a. Litter production

Fig. 9 shows the oven-dried litter production per ha by forest conditions.

The monthly total volume of litter production is approximately 0.5 - 1.0 tons/ha except in January when the litter production hits a peak. Stands along the shoreline produce the most litter at a rate of some 15 tons/ha/year, followed by (mixed stands of *R. apiculata* and *Xylocarpus* spp. (some 13 tons/ha/year) and dense stands of *R. apiculata* (some 11 tons/ha/year). Space stands in cut- over areas produce some 9 tons/ha/year.

The litter predominantly consists of leaves (90% of the total litter volume), followed by others (mainly petioles), seeds and branches in this order.

b. Litter ingredients

The average volumes of the ingredients of leaf-based litter in the 6 samplings collected between February and May are given in Table 34. There is little fluctuation of the Na, P and ash at approximately 10 mg/g, 23 mg/g and 10 m/g respectively. However, large fluctuations occur in the case of K and N with respective ranges of 6 - 12 mg/g and 0.6 - 7.0%.

2.6.3 Functions of Mangrove Forests

(1) Functions of mangrove forest

Stems of mangrove trees are mainly used for charcoal making or firewood in the Study Area, and are important forest resources. In addition to such value as forest resources, mangrove forests have particular functions for erosion prevention and for nursery ground for fishery resources. A certain dimension of mangrove forests need to be protected for maintaining of the function.

(2) Causes of functional deterioration

It is considered that mangrove forests in the Study Area have been macroscopically under such stress as interaction of soil deposition and erosion, felling pressure resulting from socio-economic structure changes, etc. It seems that the deterioration of functions as mangrove forests is caused by such stress.

Main stress caused by human activities is the conversion of mangrove forests to other types of land use such as development of oil, agriculture, village, etc. as well as mangrove felling to get woods for living such as firewood. Furthermore, the large-scale developments involving oil, etc. have transformed the socio-economic structure of the local community from self-sufficient style or non-cash economy to cash economy. As a result, the increased necessity for cash may explain increased number of local people who cut mangrove trees and sell them to brokers.

2.6.4 Policy on Forests and Forestry

(1) Forestry policies

REPELITA V has 2 basic agendas in the forestry. One is reforestation and revegetations to conserve forest soil and water source and to prevent flood and the other is incidental service felling concessions to which are that concession holder must construct centralized timber processing centers and conduct tree planting, tending and yielding in its own concession area. The main forestry issues incorporated in the REPELITA V are described next.

1) Survey on and evaluation of forest resources and environment

The importance of conducting of preparing forest vegetation and ecology maps and of establishing the boundaries for planned conversion forests are emphasized to provide appropriate data on conversion forests and prepare reliable forest data on conversion forests and to prepare reliable forest data through improved data in terms of both quantity and quality and the development of better survey methods.

2) Forestry production

- In terms of log production, REPELITA V anticipates an increase of some 19% for timber and some 38% for plywood on the Fourth Plan results.
- REPELITA V forecasts a pulp and paper production volume of 2,539,000 tons, a five-fold increase on the REPELITA IV result of 551,000 tons. Administrative emphasis is also given to encouraging the particle board industry and furniture industry as related industries to the wood industry.
- High production of fuelwood also is prospected in the Fifth Plan.

In addition, the Fifth Plan refers to surveys on the resources prospect of cut-over areas (4 million ha), forest patrols (2.3 million ha) and the development of reforestation technologies.

3) Forest and water resources conservation

Reforestation (some 1,800,000 ha) establishment of social forests (some 240,000 ha), natural forest work (some 230,000 ha) establishment of and industrial plantation forest (some 70,000 ha) are major components of actual achievements under the 4th Plan. Under the 5th Plan, distribution of seedlings (some 210,000 ha) is planned and planning areas for the industrial plantation forest are enlarged to some 1,500,000 ha. These values point out that forestation with participating of local inhabitants and reforestation for commercial forests are the main objectives recently.

Riau Province belongs to the Indragiri-Kampar.Rokan(DAS)(15th priority).

(2) Fuelwood production policy

The fuelwood consumption volume and fuelwood sources for domestic consumption for 1987, forecast by the Government of Indonesia, are shown in Table 35 and 36 respectively.

The fuelwood production policy of the Government of Indonesia appears to have the following characteristics.

- Energy plantations will be developed using fast-growing species in Jawa and also in the semi-arid areas of NTT and other priority areas. Research and development for promotion of charcoal production, gasification and energy-saving fuelwood/charcoal stoves will be undertaken.
- Utilization of biomass waste products in forestry and agriculture will be promoted as energy resources. There will be an expansion of multipurpose tree planting activities under the existing Reforestation/Rehabilitation and Regreening programmes. Income-generating activities such as beekeeping, sericulture and growing fodder plants and grasses are suitable pursuits for integration with the establishment of community fuelwood forests.
- Demonstration and extension of fuelwood production and improved utilization will be carried out. The policy of exemption of royalty payment on logging residues for non-commercial uses will be maintained. Support services (supply of quality seeds, establishment of nurseries, supply of planting material, etc.) will be provided to ensure successful implementation of the Reforestation/Rehabilitation and Regreening programmes as prescribed in REPELITA V. Research and extension related to fuelwood species for planting will also be undertaken. Improved technologies such as charcoal and briquette manufacture will be developed to promote the efficient conversion of wood into energy.

The charcoal consumption level in Indonesia is not high. The manufacture of mangrove charcoal in Riau Province is not based on a coherent national policy but is understood as being a local export industry based on the unique local conditions.

2.6.5 Mangrove Forest Management

(1) Indonesia's policy for mangrove forest management

In recent years the Indonesian government has carried out its policy to positively deal with the management of coastal resources including mangrove forests. The Ministry of Home Affairs is preparing establishment of mangrove forest greenbelts in local areas. In February 1993, a paper called "National Strategy For Mangrove Forest Management in Indonesia (Draft)" was prepared by a governmental team mainly composed of the Ministry for Population and the Environment (KLH), LIPI and the Mangrove Forest Research and Development Association (LPP-Mangrove).

This paper concretely deals with the mangrove forest management based on the Action Plan by BAPPENAS and/or the Ministry of Forestry and so forth. For the mangrove forest management, it proposes basic principles.

In addition to the above, a variety of strategies are proposed however, the pressing subjects can be summarized as follows:

- Preservation and protection
  a. Develop guidelines for the implementation of security in the protective mangrove forest areas.
  b. Prepare both local people and the developed villages to become the nucleus that will develop public perception and participation to the mangrove forests.
- Research and development
  a. Follow-up the developed research outcomes for further uses as the basis for policy making and necessary actions.
  b. Prepare facilities, infrastructures and skilled researchers to conduct mangrove forests researches and development.
- Utilization and silviculture
  a. Encourage Regional government to establish a coordinating Team with the task to discuss each proposal dealing with mangrove forest use at Provincial level of which the coordination falls on the hand of the respective governor.
  b. Define areas of mangrove forests to be managed using various silviculture systems for various types of soil.
  c. Evaluate the existing silviculture systems.
  d. Develop volume table regarding the stemmed types of mangrove plants.

(2) Management plan and actual conditions of management in Indonesia

The management of mangrove forests is under the jurisdiction of the DEPHUT, Ministry of Agriculture, Ministry of Home Affairs and KLH. The final authority. however, rests with the DEPHUT.

It is said that a mangrove forest management master plan hasn't yet been prepared by the DEPHUT although several regional conservation plans have been prepared.

1) Actual conditions of protection

"Mangrove Forest Greenbelt" is very important regulations for utilization of mangrove forests resources, as described in the paper prepared by a governmental team mainly composed of the KLH. The mangrove forest greenbelt is defined as protection areas on the coasts around unreserved mangrove forests.

a. Presidential decree about protection areas in 1990 (Keppres No. 32, 1990)

This decree appears to be taken the first priority of a series of decrees about the mangrove forest greenbelts. There are various kinds of specifications for protection areas, and the specifications for the mangrove forests are as follows:

- Definite protection area (Kawasan perlindungan setempat)
    - Coastal protection area (Sempadan pantai) : Minimum 100m toward the land from the shoreline at the highest tide level
    - Riverbank protection area (Sempadan sungai) :
      Areas with no inhabitancies ; 100m on both sides of the main stream
      50m on both sides of the branch
      Areas with inhabitancies ; 10 - 15m
      Any business which interferes the conservation functions is prohibited.
- Nature Conservation areas (Kawasan suaka alam dan cagar budaya)
    - Coastal/area of mangrove forest : The area at widths of minimum 130 times the maximum inter-tidal variation in a year toward the land from the shore-line at the lowest tide level
      Any business which disturbs relating functions, nature, utilization of the land or the natural ecosystem is prohibited.

2) Major regulations by relating governmental offices before official announcement of presidential decree the relating major regulations are as follows:
- Felling prohibition zones of mangrove forests (proposed by the DEPHUT: felling restrictions)
    - along coasts: up to 50m from the shoreline
    - along rivers: up to 10m from the shoreline

  (Surat Keputusan Direktur Jenderal Kehutanan Nomor: 60/Kpts/DJ/I/1978)
- Width of coastal greenbelt: 200m (mutual agreement between the Ministry of Agriculture and the DEPHUT: restrictions of agricultural development)

  (KB 550/246/Kpts/4/1984,082/Kpts-/1984)
- Minimum Width of Greenbelt (m): 130 x TAPT x 1m
  (proposed by the KLH: environmental protection of mangrove forests)
  130 : factor (calculated on the basis of average width of mangrove forests and average of annual maximum intertidal variation in Indonesia)
  TAPT: annual maximum inter-tidal variation (m)

This minimum width was proposed to conserve marine and coastal environment. Therefore the above described formula is applied only to following items:
- mangrove forest areas which are either destroyed or untouched
- muddy coastal areas
- coastal area which are not utilized for ports, tourism or other purposes

- coastal area with 0 - 8% slope (B2178/Men, KLH/10/1989)

2) Actual conditions of development

- Development system

  Forestry development must be based on the acquisition of a concession from the DEPHUT or a Dinas Kebutanan.

  - large concession (Hak Pengusahaan Hutan: HPH)
  - small concession (Hak Pemungutan Hasil Hutan: HPHH)

- Felling control

  According to the "Brackish Water Silviculture System Guidelines"[6] prepared by Director General of Forestry in the Ministry of Agriculture (now DEPHUT), the following regulations apply to the felling of a mangrove forest.

  - felling cycle: 30 years
  - felling diameter: over 10cm (at a point of 20cm above prop root height or highest point of aerial roots)
  - speed tree: 40 trees/ha (minimum diameter of 20cm above prop root height or highest level of aerial roots) or approximately 17m intervals
  - secondary forest after cut-over (without management): no preservation of seed trees is required if seedlings exist at intervals of less than 2m (2,500 seedling/ha)

(3) Management of mangrove forests in Riau Province

1) Permit system of HPHH

One HPHH concession is allowed up to 500m^3/year up to an area of 100ha. The continuation of felling in HPHH beyond one year forces the obligation of regeneration.

"Minor Forest Products (not timber) Gathering (Mengambil hasil hutan lainnya - (bukan kayu))" permit of HPHH is obtained by most concessionaires for felling in the study areas.

As of March, 1991, there are some 170 HPHHs and the planned felling volume of 55,650m^3 in the Study Area, mainly in areas controlled by the CDK Dumai or CDK Selatpanjang (Total permitted area is some 17,000ha, see Table 37 and Fig. 10).

Felling at a rate of approximately 360m^3/HPHH and approximately 320m^3/HPHH are planned for the entire Riau Province and for the Study Area

6: Surat Keputusan Direktorat Jenderal Kehutanan No.60/Kpts/DJ/I/1978, tentang Pedoman Sistem Silvikultur Hutan Payau. Direktur Jenderal Kehutanan, 1978 (Indonesian)

respectively.

Incidentally the DEPHUT guides to freeze the issuing of HPHH permit except for yielding of non-wood products since 1989 based on the ministerial decree[7].

2) Acquisition system of charcoal business license

Most of the charcoal manufacturers must have a HPHH permit for purchasing woods for charcoal making before "the small industry registration (Pendaftaran Industri kecil). New application of the small industry registration become impossible since 1992 because of the Presidential Decree[8].

(4) Utilization of mangrove woods

The utilization of mangrove wood in Riau Province is mostly limited to the production of charcoal or pulp chips although a minor quantity is used for construction timber and fishing gear. Of the main forest products in Riau Province, the production volume of charcoal substantially declined from some 45,000 tons in fiscal 1989 to some 21,000 tons in fiscal 1990. Firewood production also declined from some 68,000 SM (48,960m^3) to some 27,000 SM (19,440m^3) in the same period.

The felling volume of mangrove trees for charcoal production is given in Table 38. A felled volume during Apr. 1991 until Mar. 1992 of some is 29,000m^3. The whole amount is assumed as half of planned volume.

2.6.6 Actual conditions of reforestation technics in Indonesia

The DEPHUT has been trying to standardize technics concerned throughout Indonesia using the "Brackish Water Silviculture System Guidelines" issued in 1978. In Riau Province, the "Technical Guidelines on Regeneration"[9] were issued by the Dinas in 1986 to raise the technical standards dealing with the reforestation of Rhizophoraceae.

At Cilacap in Central Java Province, the Forestry State Enterprise (Perum Perhutani) has been conducting reforestation of mangrove tree-species and has accumulated technical know-how on nursing and planting.

7: Larangan Pemberian Ijin HPHH (No.328/Menhut-II 1989) (Indonesian)
8: Keputusan Presiden Republik Indonesia Nomor 32 Tahun 1992 tentang Daftar Bidang Usaha Yang Tertutup Bagi Penanaman Model 1992 (Indonesian)
9: Petunjuk Teknis Pembuatan Permudaan Bakau [Rhizophoraceae] Dinas Kehutanan Riau, 1986 (Indonesian)

The regeneration of *Rhizophora* spp. in most areas in Indonesia is conducted by the regeneration method by natural seeding pursuant to the 1978's Guidelines with felling leaving seed trees intact. The Guidelines recommend the suspension of felling for 15-20 years after the final felling, followed by selective felling (thinning) to achieve a tree density of 1,100 trees/ha with 3m intervals. Final cutting is next conducted when the regenerated site reaches an age of 30 years. The Guidelines permit the felling of seed trees provided that there are plentiful seedlings. In this case, no felling should be conducted for 30 years except for selective felling (thinning) between the twentieth and thirtieth year after the final felling.

2.6.7 Cutting of mangrove forest in the Study Area

The felling of mangrove forests in the Study Area is conducted by various types of local inhabitants, who do not posses any farmland (many are people called as "orang asli" who are descendants of aboriginal tribes) and those engaged in fishing in mangrove areas using simple fishing gear. Most wood is sold to charcoal manufacturers although some proportions is also sold to brokers engaged in the sales of wood to Malaysia and Singapore.

According to interviews conducted locally,, it appears that full-time local fishermen are not generally involved in the felling of mangrove although some appear to do so during the season when the north wind prevails meaning off-season of fishery.

- Felling for selling to charcoal manufacturers

  The price of charcoal wood is an average of Rp 200/tree. Inhabitants seldom have a direct contract with charcoal manufacturer(s) but freely choose the buyers.

- Felling for sale of trees to brokers

  The price of mangrove timber in Malaysia is RP 500/tree with a minimum butt end diameter of 7cm. In the case of Singapore, the price is approximately RP 800/tree with a minimum butt end diameter of 8cm.

It is presumed that a difference on the price and minimum diameter of buying trees between charcoal manufacturers and brokers has resulted in more in more inhabitants' selling to brokers than to charcoal manufacturers.

2.6.8 Production and Distribution of Mangrove Charcoal in the Study Area

(1) Charcoal kilns

The number of charcoal kilns in the Study Area is shown in Table 38.

On average, 3-4 kilns operate 4 production cycles each year at a single kiln compound. The daily wage of the workers is said to be some Rp 5,000. Additional workers commute to the site form nearby settlements.

Kilns operated in the Study Area can be classified into traditional, Malaysian and Japanese models.

As of either traditional or Malaysian, a kiln has a capacity of 80-150m^3 (majority: 150 m^3), producing 60-110m^3 of black charcoal (5-20t) the capacity of 150m^3 tends to be dominant. Some 2 months are required to complete the following cycle as shown in Table 40.

(2) Distribution of mangrove charcoal

1) Distribution channels

Most charcoals produced in the Study Area is believed to distribute to importers through brokers. Most manufacturers in the southeastern part of the Study Area are members of a cooperative which also acts as an exporter while manufacturers in the northwestern part tend to have a direct business connection with dealers mainly operating out of Dumai.

Singapore is the major importer of mangrove charcoal produced in Indonesia and some of the mangrove charcoal exported to Malaysia is said to be re-exported to Singapore.

2) Selling price

The price of charcoal is based on the grade which is determined by the diameter and length and quality (in terms of cracks and sheen: hardness). The grades are basically decided in accordance with the purpose of use in the importing country and the price is mainly determined by the preference of importers. On average, the charcoal price ranges from US$70 to 90/t although it largely depends on the grade and market situation.

3) Production of mangrove charcoal

The production and export volumes of mangrove charcoal in Riau Province showed a sudden increase in 1986 as shown in Table 42 have been declining since 1990 on average, Riau province exports 10,000-20,000t of mangrove charcoal each year. According to mangrove manufacturers, regional struggles affects such declining of export to Saudi Arabia, etc. However, it is expected the production will be increased soon because many manufacturers are increasing the number of kiln.

The production of mangrove charcoal in the Study Area is shown in Table 43. Some 14,000t of mangrove charcoal was exported from the Study Area in 1991. Half of the production takes place in areas under the jurisdiction of the CDK Selatpanjang, exactly reflecting the mangrove felled volume in these areas.

2.7 Environmental Considerations

(1) Environmental policies and legal restrictions

The objectives of REPELITA V is to achieve economic equilibrium between the agricultural and industrial sectors. In order to attain economic growth, natural resource management and sustainable resource utilization have been emphasized. In Chapter 8 of "Natural Resources and Environmental Conservation", sustainable development was established as the basic policy of environmental conservation. In conjunction with this policy, development plans for the coastal area emphasized measures to prevent ocean contamination and preserve the environment of coastal fishing communities, to protect coral reefs, mangrove forests, and the ocean ecosystem, etc.

(2) Environmental laws

a. Basic environmental law

The basic environmental law was established in 1982 under the authority of Law No. 4, Clause 24 and covers all areas pertaining to environment such as general regulations, objectives, rights, obligations, authority, environmental protection, system, compensation, penalties, etc. In particular, all industries which are anticipated to have an impact on the environment are required to submit reports on environmental impact, environmental impact assessment, environmental management, and environmental monitoring.

b. Environmental impact assessment methods

A system of environmental assessment was created in 1987. Under this system, all development plans are required to clarify its potential impact on the environment, and operating permits are granted only upon completion of an investigation of the proposed activities.

c. Law on natural resources protection

The law on protection of natural resources was created in 1990 under the authority of DEPHUT and pertains to conservation of animal resources and its ecosystems, specifically, conservation of animal habitat, protection of animal and plant life, sustainable utilization of animal/plant resources and their ecosystems, creating designated protection zones and banned zones for development, encouraging participation of local inhabitants, implementing administrative duties, enforcing penalties, etc.

(3) Implementation of environmental restrictions

The Ministry of Population and Environment, the Department of National Development Planning, and the Department of Environmental Impact Management are the foremost institutions addressing environmental issues at the national level. The implementing agencies of development activities are the ministries of the Interior, Justice, Industry, Forestry, Agriculture, Public Works, Mining and Energy, Construction, etc. under whose cooperation policies are formulated, implemented, evaluated for environmental impact, etc. Management and implementation of development plans, natural resources conservation, and other environmental issues surrounding the coastal areas, including the mangrove forests will be left to the responsibility of the Ministry of Agriculture, Departments of Fisheries and Fisheries Resource Management, and DEPHUT, Department of Natural Resource Protection. The Provincial Development Planning Agency and the Provincial Population and Environmental Agency will act as the local agency in collaboration with the aforementioned ministries in managing the Environmental Research Center and regional activities of private organizations. Assistance by international organizations, foreign institutions, and NGO technical cooperation are being implemented to resolve environmental issues in Indonesia.

(4) Environmental conditions of the Study Area

a. Sedimentation from river flow

A satellite image of the coastal waters surrounding the islands of Ransan, Tebing Tinggi, and Merbau, show accumulated sedimentation from Kanpar River. The sedimentation is affected by the Malacca Current and has formed a trail of accumulated sediment stretching northwest toward Bengkalis island.

b. Felling of mangrove forests

- Erosion

Erosion has been observed in several locations along the coast of the study area. It has been reported that every year approximately ten meters of land near the western tip of Bengkalis island is disappearing. The underlying causes are due to the wave effects, transformations in topography due to accumulated sediment, and other causes. Unfortunately, in this study sufficient data could not be obtained to investigate the cause and effect.

- Inland aquaculture ponds

The marsh lands of the mangrove forests in the study area are ideally suited for aquaculture ponds. In the past the government implemented policies promoting aquaculture, and constructed culture ponds by opening mangrove forest areas in complete disregard of the impact on the coastal ecosystem, as seen in the culture ponds on Tebing Tinggi island. However, presently government guidance measures on mangrove forest conservation is being implemented; and many of the culture ponds built recently have been constructed at selected sites that will allow coexistence with the mangrove forests.

c. Oil pollution

The presence of the petroleum industry is extensive in the study area and in comparison to other environmental impact factors, the potential damage from oil pollution is great.

According to data obtained from the Bengkalis regional office of the Provincial Development Agency and the field survey, damage due to pollution was not discovered. However, according to an interview survey of fishermen, oil contamination has been discovered more than once every year in the Study Area encompassing the four islands of Rupat, Bengkalis, Merbau, and Padan. It is surmised that the Study Area is affected to a greater or lesser extent by oil pollution, due to its close proximity to the international line and to the active oil development activities in the area.

d. Red tide

According to interview survey findings conducted in the Study Area, the red tide was reported on the open sea side of Bengkalis, Rangsang, Padang, and Rupat islands. However, there have been no recorded observations of the red tide based on scientific data. When there is a large inflow of river waters, large expanses of discolored water appears and it is surmised that this phenomenon is misinterpreted as the red tide. This is an issue which needs to be resolved according to scientific analysis.

e. Domestic discharge

Waste water treatment is nonexistent and sewage water is simply allowed to run off into the rivers and coastal waters. In cities or villages with a high population density, there is danger of infectious diseases, food poisoning, underground water pollution, etc.

f. Factory wastes

Approximately 100km downstream of Siak river from Pekanbaru, there is a concentration of processing plants for pulp, rubber, palm oil, sago starch, etc. The disposal of their organic wastes is unknown, but generally crude waste discharged from such plants are high in concentrations of nitrogen and phosphorus. If waste water treatment is inadequate, the discharged wastes will be highly concentrated at the disposal point and gradually become diluted as it flows downstream.

Although actual damages and concentrations of discharged wastes in certain areas have been reported to the provincial governor's office and the Provincial KLH, the data remains confidential and therefore the impact of discharged wastes could not be ascertained.

g. Declining fish landings of specific fish species

In the Study Area Chinese herring (Ilisha elongata or terebuk), specifically the eggs of the female adults, are sold at high prices which spurred efforts to harvest them in the past time.

Fish landings of Chinese herring peaked in 1950 to 1960 and gradually declined until the mid 1960s. Since that time, past production levels have not been surpassed.

5) Environmental conditions of the Study Area

a. Improving the efficiency of the relevant legal system and its implementation

A system of assessing the environmental impact of development projects before their commencement, was instituted; and data pertaining to the type of activity, location, number of operations, duration of operations (number of years), etc. is submitted to the relevant government authority. However, after the projects have started their operations, environmental assessment based on follow up surveys and monitoring has not been pursued and information on the existence of an independent monitoring system, actual enforcement of restrictions, evaluation of implementation conditions, etc. is not known. For example, survey findings on the degree of plant waste discharge, diffusion velocity, etc., the reported degree of damages incurred, etc. exists as confidential information, and has not been applied in assessments of development projects taking place in downstream areas.

The study area is likely to have waste discharge from the community of processing plants located mid-stream on Siak River as environmental impact on an area outside the study area, but the findings from water quality tests have not been made public. The Siak River flows into the Panjang channel bordering central Bengkalis island and the northwest area of Padan island. Rupat island located in the lower reaches of the Malacca Straits, is in danger of being exposed to contamination from those factory wastes. It is impossible to evaluate environmental impact using relevant data under the current system.

b. Factors to be considered in project planning

The environment of the Study Area is affected by both natural and human factors which are explained in the following. These factors must be taken into consideration in project planning.

i) Natural factors

- Accumulated sediment from the river

In selecting the site for coastal constructions such as port facilities, embankments, bridges, etc., it is essential to consider the flow of the river and the drift of the sand, in order to prevent erosion and further changes in the coastline.

- River inflow

The Study Area is subject to an inflow of fresh river water over a wide expanse and therefore experiences sudden decreases in salinity concentration. As a result, this factor must be seriously considered in selecting fish species for aquaculture.

- Acidic soil

The coastal areas of the Study Area may contain pyrites, and such areas should be avoided as aquaculture sites.

ii) Human factors

- Felling of mangroves

Excessive felling of mangrove forests will not only destroy the ecological source of the nutrition cycle, but will contribute to the disappearance of spawning grounds through erosion.

- Petroleum pollution

The Study Area contains the most extensive oil industry developments in the nation and subsequently, the potential for oil spills and accidents is high.

- Factory waste discharge

  Expansion of the existing community of processing plants located midstream of the Siak rivers and construction of new plant facilities along the coast are anticipated. Therefore, it is necessary to establish waste discharge standards on product and processing methods, irrespective of industry sector and on the discharge source. In addition to clarifying the need for waste treatment during the investigation process, it is necessary to provide financial assistance in the area of technology transfer and facility investments.

- Underground water

  Modern water supply facilities do not exist and drinking water is supplied by underground or rain water. As a result, there is a high risk of infectious diseases and food poisoning.

  The most vital factor to consider in introducing food processing activities is to secure an appropriate water supply.

2.8 Classification of the Coastal Fishing Villages

Based on the result of field survey in the Study Area, coastal fishing villages are classified into following types, and summarized constraints of each type as follows :

Type of Fishing Village	Constraints
A : Fishing village mainly using gill net and/or bottom long line (mainly exporting fresh fish)	
A1 : A fishing village with funcion of fish marketing center	- Long term stagnation of fish catch - Insufficiency of proper marketing facilities and equipment - Disadvantaged situation of fishermen controlled by middlemen ;Tauke (low income level, lack of economic self-reliance of full-time fishermen) - Lack of fishermen organization with capability of self-reliance
A2 : A fishing village without of marketing center fishfunction	- Long-term stagnation of fish catch - Lack of marketing facilities and equipment - Low income level ; supplementation of income by other jobs - Lack of marketing system to add more value to fish catch - Lack of fishermen organization with capability of self-reliance
B : Fishing village mainly using fishing methods utilizing tidal current such as Gombang, etc. (with potentiality enabling development of aquaculture or fish processing using by-product of fish catch)	
B1 : A fishing village with function of shrimp marketing center	- Long-term stagnation of shrimp catch - Insufficiency of proper marketing facilities and equipment - Disadvantage of fishermen controlled by Tauke - Lack of effective utilization of by-product (trash fish)
B2 : A fishing village without function of fish marketing center and mainly catching shrimps	- Long term stagnation of shrimp catch - Lack of effective utilization of by-product (trash fish)
B3 : A fishing village without function of fish marketing center and mainly catching fishes	- Long-term stagnation of fish catch - Low income level ; supplementation of income by other jobs such as mangrove cutting, etc. - Lack of effective utilization of by-product such as; for feed of aquaculture for raw material of value added processed products - Lack of technical, managerial and financial capability for development of aquaculture and processing

3. Selection of Model Areas of Fishing Village Development

3. Selection of Model Areas of Fishing Village Development

3.1 Precondition of Selection

The objective of this Study is to formulate a rural development plan composed of a fishing village development plan and mangrove forest management and conservation plan, aiming at effective and sustainable use of coastal resources in each of selected model areas of fishing village development (herein after referred to as "the model area").

According to results of the field survey, it was clarified most coastal parts in the Study Area are covered with mangrove forests. It may be theoretically reasonable that aerial difference of existing ecological and socio-economic conditions of mangrove forests are to be taken into account for setting up types of the model area. However, compared with fishing village development plan, mangrove forest management and conservation plan should be studied from view points of longer time span and wider land area. Accordingly, in this Study, types of the model area will be set up only based on types of fishing village and their socio-economic conditions.

Then the conservation and management improvement plan of coastal mangroves in the Study Area will be proposed based on existing ecological and socio- economic conditions of coastal mangroves including the model area.

3.2 Selection of the Model Area

3.2.1 First Step selection

The model areas will be selected in principle by unit of administrative village (Desa) and by type of fishing village, since fishing villages in the Study Area are categorized into five types as described in section 2.8 Classification of the Coastal Fishing Villages.

In the Study Area, the number of fishermen in some villages is too small to be selected as the model area, and there exists large gap among villages in terms of per capita net production value. Therefore as the 1st step selection, following criteria were applied to all the existing villages in the Study Area:

- The number of fishermen in one village is to be not less than 30.
- The priority is given to the village of which per capita net production value is less than the poverty line of Indonesia (US$160=Rp.320,000) which has been guidelined by UNDP.

The distribution of village with more than 30 fishermen is shown in Fig 11. These villages were again filtered by the said criteria of per capita net production value with less than US$160. The result is shown in Table 43. The number of selected villages by Kecamatan and by type of fishing village is shown in the following table.

Kecamatan	A1	A2	B1	B2	B3	Total
Bengkalis	1	3	-	-	-	4
Tebing Tinggi	-	1	1	-	3	5
Merbau	-	-	-	-	5	5
Bukit Batu	-	-	-	-	0	0
Rupat	1	10	-	-	1	12
Total	2	14	1	-	10	28

3.2.2 Second Step Selection

The plural candidate villages were selected in the 1st step selection by type of fishing village. In the second step, the following view points have been taken into consideration in order to select one village out of said candidate villages, which can induce maximum development effect.

(1) Fishing Village of A1 Type

Muntai in Kec. Bengkalis and Tg. Medang in Kec. Rupat have been selected in this category. The comparison between them is shown in the table below:

		Muntai	Tg. Medang
(i)	Distance to the destination of export	76km to Malacca and 133km to Port Dickson	70km to Malacca and 48km to Port Dickson
(ii)	Unloading facility	None	Existig
(iii)	Influence of the seasonal north east wind	Strong (Directly facing	Weak (Protected by an island)
(iv)	Fishermen's organization Kelompok	Kelompok	KUD
(v)	Necessary undertakings to be a marketing center	-to provide sufficient facilities and equipment -to foster fishermen to be self-sustained	-to foster fishermen to be self-sustained

Compared with the case of Tg. Medang, conditions of Muntai is worse in terms of level of marketing services. When this weak point is reinforced, Muntai is expected to have large development effect. Therefore Muntai has been selected as the model area.

(2) Fishing Village of A2 Type

There are 15 candidate villages of this type. In principal these villages need provision both of the functions of a proper marketing system and facilities in order to add higher value to fish catch by fishermen in these villages. However some villages locate comparatively near to the A1 type villages which has the function of a marketing center, and have chances to sell their fish to the center. In this study, the model area of this type is selected from such villages that are isolated from the A1 type villages. Following table shows accessibility of each candidate village to the A1 type villages.

Name of Village	Accessibility to A1 Type Village
Kec. Bengkalis	
- Sebauk	near to Bengkalis
- Jangkang	near to Slat Baru
- Tlk. Lancar	isolated
Kec. Tebing Tinggi	
- Sonde	isolated
Kec. Bukit Batu	
- Buruk Bakul	near to Bengkalis
Kec. Rupat	
- Batu Panjang	near to Dumai
- Terkul	near to Dumai
- Pergam	near to Dumai
- Tlk. Lecah	isolated
- Tlk. Rhu	near to Tg. Medang
- Sei Cingam	isolated
- Makeruh	isolated
- Tg. Punak	near to Tg. Medang
- Kador	near to Tg. Medang
- Titi Akar	near to Tg. Medang

Among these 15 villages, 5 villages are isolated from A1 type village, and has disadvantages from view point of price competition of fish.

Sei Cingam is located between other two A2 type village, Makeruh and Teluk Lecah. When it is developed, as a new marketing center it has potential to handle fish from these 2 villages evenly. On the contrary, as for there is no A2 type candidate villages near Telak Lancar or Sonde. Then the development effect will be smaller than that of Sei Cingam. Therefore in this Study, Sei Cingam has been selected as the model area.

(3) Fishing Village of B1 Type

Only Tg. Kedabu in Kec. T. Tinggi is this type. Even though it is categorized into a village below poverty line according to the statistical figures, enough facilities in landing site have been provided as a marketing center of shrimp by Gombang fishing according to the result of our reconnaissance survey. This village has large area and the per capita net production value including farmers is below the poverty line. But taking the above matters into account, inhabitants in fishery area can be guessed to live above the poverty line. Therefore it is considered that this village needs not to be selected as a model area for shrimp marketing center.

The constraint of this village is lack of technology for effective use of the by product (trash fish) of the Gombang fishing. At present this by-product is sold for raw material of fish meal at very cheap price. On the other hand, there exists same constraint in the fishing village of B3 type which is mainly catching fish instead of shrimp by the Gombang fishing.

In order to solve such constraint, it is not necessary to set up the model area in both of B1 and B3 type village but to set up either of them. In this Study, it is judged the model area is to be set up in B3 type village as its income level is assumed to be lower than that of B1 type village.

(4) Fishing Village of B2 Type

Bunger and Tg. Medang are of this type. They are located along the north coast of the Rangsang Island facing to the Malacca Straits. In this Study, they have not been selected as the model area because they are above poverty line.

(5) Fishing Village of B3 type

Following 10 village are B3 type:

Kec. Bengkalis :	Meskom
Ket. T. Tinggi :	Anak Setatah, Kayu Area, Beting
Kec. Merbau :	Centai, Pelantai, Bagan Melibur, Selat Akar, Teluk Ketapang
Kec. Rupat :	Pkl. Nyirih

The main target of the Gombang fishing of B3 type village is fish, and its by-product contains various kinds of small fishes and mysids. In order to upgrade income level of fishermen, it is considered this by-product should be utilized inside a village for more value added purposes such as for aquaculture and/or processed products instead of selling outside the village at cheap price.

In this Study, following two types of the model area are set up in the B3 type village.

(i) The model area for aquaculture development

Following two kinds of criteria were applied for selection of this model area.

Criteria 1: Factor of soil conditions

The fish pond is to be constructed where clay soil exists and the effect of acid sulfate soil is minimal. Soil conditions of above mentioned 10 villages were compared as follows:

Village	Distribution of clay soil	Excavation cost of Acid soil	Appropriateness of pond development
Kec. Bengkalis			
- Meskom	–	large	not appropriate
Kec. Tibing Tinggi			
- Anak Setatah	+	small	appropriate
- Kayu Ara	+	small	appropriate
- Beting	+	small	appropriate
Kec. Merbau			
- Centai	–	small	not appropriate
- Pelantai	+	small	appropriate
- Bagan Melibur	+	small	appropriate
- Selat Akar	+	small	appropriate
- Tlk. Ketapang	–	small	not appropriate
Kec. Rupat			
- Pkl. Nyirih	+	small	appropriate

As the result, following 7 villages remained for further selection:

- Anak Setatah - Kayu Ara - Beting - Pelantai
- Bagan Melibur - Selat Akar - Pkl. Nyirih

Criteria 2: Factor of land availability

The fish pond is to be developed without disturbing existing coastal mangroves. Accordingly land availability for pond development was compared among above mentioned 7 villages as shown in the table below, based on the land use map in Kab. Bengkalis (1989):

Name of Village		Availability
Kec. T.Tinggi	Anak Setatah	Very limited
	Kayu Ara	limited
	Beting	very limited
Kec. Merbau	Pelantai	Avilable
	Bagan Melibur	limited
	Selat Akar	limited
Kec. Rupat	Pkl. Nyirih	limited

As the result, Desa Pelantai, in which land availability is easier than in others, has been selected as the model area for aquaculture development.

(ii) The model area for fish processing development

This model area is to be selected from candidate villages of which potentiality of aquaculture development are low caused by natural conditions such as soil conditions. As shown in the table of the former section (i), appropriateness of pond development of following three village is low:

- Kec. Bengkalis: Meskom
- Kec. Merbau : Centai, Teluk Ketapang.

Among these village, at Meskom, a fish processing Kelompok has been recently organized under the guidance of DPk, Bengkalis, and getting technical supports. It can be said Meskom has more advantages than Centai and T. Ketapang in Kec. Merbau. Therefore, the model area is to be selected from these two villages.

In this study, Teluk Ketapang has been selected as the model area, because it locates at the opposite side of Pelantai, the model area of aquaculture development, along the Asam Channel, and therefore it will be convenient to monitor the activities of these two types of the model area when the project is implemented.

3.2.3 Conclusions of Selection of the Model Areas

Following four(4) villages have been selected as the model areas of fishing village development:

	Type of Model Area	Name of Vilage
(1)	A1 type village which needs provision of new marketing facilities / equipment and strengthening fishermen organization in order to co-exist with the Tauke	Muntai in Kec. Bengkalis
(2)	A2 type village which needs development of a new marketing system, provision of marketing facilities / equipment and strengthening fishermen organization	Sei Cingam in Kec. Rupat
(3)	B3 type of village which needs development of aquaculture through utilization of by-product (trash fish) of the Gombang fishing and transference of part-time fishermen to fish farmer, whose main income source is felling mangrove trees	Pelantai in Kec. Merbau
(4)	B3 type of village which needs development of high value added products through utilization of fish catch of the Gombang fishing	Tlk. Ketapang in Kec. Merbau

3.3 Establishment of Model Mangrove Forest Areas including Model Areas

As described in "3.1 Precondition of Selection", it is necessary to study the conservation and management improvement plan of mangrove forests from a long-term and wide-ranged point of view. Mangrove forests in the Study Area have the following characteristics.

1) Of all fishermen, the rate of full-time fishermen who take part in the felling of mangroves is low.
2) The felling area of mangroves by the residents is not usually limited to the neighborhood of their villages.
3) Much effect on coast conservation or fishery resource enhancement cannot be expected if the study area of mangrove forests is limited to the coasts of the model areas of fishing village development.
4) The major cause for the decrease of mangrove forests, is the felling of mangroves for land conversion. The major cause for the deterioration of the stand condition, is the felling not based on sustainable management of mangroves to make charcoal. It is, therefore, necessary to manage mangrove forests in a wider range than the Desa level.

It was, therefore, decided that an area larger than a model area of fishing village development is established as "a model mangrove forest area" with the following conditions:

1) The coasts covering the model areas of fishing village development and the neighboring fishing villages
2) The mangrove forests in the model areas of fishing village development; and the coasts where there are the mangrove forests which are adjacent to the mangroves in the model areas
3) The coasts which cover all small-sized concessions (HPHH) set on the coasts of a. and b..
4) The coasts which must be managed to establish mangrove areas up to adjacent large scale mangrove forests, of which is considered necessary for the conservation of coasts and the enhancement of fishery resources.

The agricultural land and the woodland in the hinterland will also be covered in the study because they are expected to be conserved by the management of mangrove forests.

The location of the model areas and model mangrove areas is indicated in Fig. 12.

Area by forest type and land use-vegetation type in the model mangrove areas is shown in Table 44.

The whole model mangrove areas (4 areas)covering some 12,000ha, mainly comprise of some 3,1000ha of mangrove forests,some 400ha of lands with no forest cover where were covered with mangrove forests in the past. The major part is covered with some 4,300ha of tree crops lands consisting of rubber, coconut palm, etc.

4. Present Conditions and Future Prospects in the Model Areas

4. Present Conditions and Future Prospects in the Model Areas

4.1 Desa Muntai

The map of Desa Muntai is shown in Fig. 13.

4.1.1 Socio-Economic Conditions

(1) Population

Muntai was the smallest village in Kec. Bengkalis in terms of its 1992 population of 1,685 people and 285 households. The annual population growth rate from 1986 to 1992 was approximately 2 percent, slightly higher than the growth rate for the entire Kec. Bengkalis.

The population of both Dusun Kelapasari and Pusaka in 1992 was 708 people and 148 households and 977 people with 137 households, respectively. The number of people per household was higher in Pusaka.

There were no great differences in the ratio of the working population (ages 10 to 55) in 1992 which was 76.7 percent in Kelapasari and 72.3 percent in Pusaka. There were 36 Chinese Indonesian households of which the majority or 30 households were living in Dusun Pusaka, RW01, and RT01 near the Sei Muntai river mouth.

(2) Distribution of fishermen households

The number of fishermen is based on the interview survey to the village master although discrepancies were found between the interview survey and BANDES data. The number of fishermen increased greatly from 130 to 220 in the period from 1986 to 1990, but has leveled off since that period.

Many fishing boats are moored around the Muntai river mouth in Dusun Pusaka and the majority of fishermen live in Pusaka (88 percent in 1992). However, very few fishermen live near their boat moorings and the majority commute to their mooring sites from homes distantly located from the shore in Pusaka. Although Pusaka is divided between the RW04 bordering the shore and the inland RW05, the fishermen population is nearly equal in both areas (102 and 91 fishermen, respectively in 1992).

The Penurun river mouth is located in Dusun Kelapasari in Muntai where fishing boats are also moored. However, the floating peat ("Gambut") is discharged and accumulated in this river mouth during the rainy season and impede the navigation of fishing boats.

(3) Number of employed workers and production value by major industry

In 1992 the number of employed workers in plantations, handicrafts and fisheries were 335, 312 and 220, respectively. Production value generated by the plantations, handicrafts and fisheries were Rp.218,000,000, Rp.62,000,000 and Rp.176,000,000, respectively. The major industries in Muntai are the plantations and fisheries. Handicrafts are mainly comprised of women making rugs and matting and their earnings are basically supplementary income for their families. However, production value generated by plantations and fisheries has leveled off since 1990, while that of handicrafts have grown, contributing to an increase in income for families. There are many employed workers in handicrafts and it is significant in providing employment opportunities for women and as a source of supplementary income.

(4) Life of the villagers

The following activities are performed as Gotong Royong (mutual aid):

- Village roads are repaired and cleaned by the voluntary service of all the families. Usually, this is done once a week or sometimes once or twice a month.
- Weddings or other ceremonies are helped by neighbors lending tableware or providing cooking labor.

Heads of families meet at least once a year. In addition, meetings are held from time to time whenever consultation becomes necessary on such subjects as the construction of bridges or the repair of roads in the village. Most of the meetings are presided over by the village master. If a meeting cannot reach an agreement after discussion for more than a half day, a decision is reached by majority vote.

There are a plural number of Arisan (mutual financing associations) by women members in RW5 and RT3. The members gather once a week and collect 10,000 rupias in each meeting.

(5) Financial capacity of the villagers

There are no banks in Muntai. A visit to the nearest bank in Selat Baru takes about two hours by a powered fishing boat, so villagers seldom use bank facilities. If they have money to spare, they will usually buy gold or hold it in cash. In our survey of residents' intentions and impact, about one half of the respondents replied that they had money to spare every month or once in a while. The interviews disclosed that most such spare money was spent for children's education, medical care, entertainment, Idulfitri (grand festivals after fasting) or contingencies, but was not saved for the future.

According to the residents' intention survey, their annual income averaged 1,575,000 rupias per family or 258,000 rupias per capita. This amount is far lower than the poverty line of US$ 160/year.

The above suggests that it is beyond the capacity of the villagers at large to bear a new financial burden, and that any projects must be planned on the basis of financing the project expenses through the projects' own income or government aid.

4.1.2 Fishery Production and Fishing Grounds

Located halfway between Malacca, a major marine product marketing point, and Tg. Barai Kalimun a major marketing point to Singapore, Desa Muntai is one of the main fishery bases of Kec. Bengkalis. It is composed of two Dusun, Dusun Kelapa Sari and Dusun Pusaka, with the Penurun river and the Muntai river flowing through each Dusun. Most of the fishermen of the village live in the basin of the Muntai river, which is used for mooring fishing boats.

(1) Present condition of the fishing village

1) Number of fishermen and fishing boats

Desa Muntai has 220 fishermen, of whom 193 (or 88%) now live in Dusun Pusaka (see Table 45). The interview survey at the site found the presence of 49 fishing boats, i.e. 5 outboard-engine boats and 44 inboard-engine fishing boats. The distribution of fishing boats in the village is similar to that of the fishermen.

2) Landing facilities

Desa Muntai functions as one of the landing points for fishing boats operating in the Malacca Straits. There are no landing jetties or port facilities on the shore, however. The reason is probably that the shore frontage has a rather even terrain, vulnerable to the wind and waves. Another reason may be that the beach is so shallow that a tidal dry land appears at low tide over an area about 700 to 800 meters from the shore, making it difficult for ships to approach the front shore.

Under the existing condition, powered fishing boats cannot approach the shore even at high tide except through channels. At low tide, the sea recedes to produce dry land extending far into the offing, making it hard even for small boats like sampans to approach. Under these circumstances, the construction of a jetty, if small in size, is meaningless. At the same time, it is financially and technically impossible for local people to construct a jetty big enough to withstand the wind and waves prevailing in this area.

3) Felling of mangroves by fishermen

The growth of mangroves in this area is quite limited. This survey could not ascertain the existence of any fishermen who were also engaged in mangrove

felling.

(2) Fishing methods and fishing grounds

1) Fishing seasons

The peak fishing season in Desa Muntai is normally from September to November. The northerly wind season of January through March is the lean fishing season; fishing operation during that period is not so active as in the other seasons due to rough sea. Many fishermen do not fish during the lean season and engage in other jobs. Those who fish year-round are mostly part time farmer fishermen.

2) Main fishing methods and the type of fishing operation

The most popular fishing method employed in Desa Muntai is gill net fishing. A small group of fishermen employ bottom long line fishing in addition to gill net fishing. The fishermen concentrate their fishing operation in the period of spring tide when the tide is running fast, operating 15 to 20 days per month.

The average was between 25 and 70 nets. The mesh size was varied from 1.25 to 5.5 inches, mostly in the range between 1.25 and 2.5 inches. The use of mesh sizes more than 3 inches was limited. Night operation was a usual practice, with fishermen departing in the evening, operating through the night, and returning the next morning.

For both gill net and bottom long line fishing, the main fishing grounds are in the offing of the Bengkalis island in the Malacca Straits. The fishing grounds are slightly changeable depending on the direction of wind. Powered fishing boats operate mainly in inshore areas, about one to four kilometers off the village coastlines around Muntai, Bantan Tengah and in the intermediate area between the Bengkalis island and the Ransang island. Gill net fishing is operated mainly near the shore and bottom long line fishing in the offing. Non-powered fishing boats operate near the shoreline in the frontage of the villages.

The target fish for both gill net and bottom long line fishing are primarily high-class fish such as wolf herring and narrow-barred king mackerel. Also, red snapper and threadfin are the preferred catch of bottom long line fishing.

3) Sale of the catch and profit sharing

Fishermen in Desa Muntai are classified roughly into three categories; boat owners, hired fishermen and family based sampan fishermen.

The profit of the catch is shared in the following two manners:

① Between the boat owner as captain and hired fishermen:

Profit after deducting operating expenses from sales is divided into four equal parts. Three parts of the profit go to the boat owner in compensation of the cost of the fishing boat and fishing equipment and as profit due to the boat owner, and the remaining one part is given to the fishermen.

② Between the boat owner, hired captain and hired fishermen:

Profit after deducting operating expenses from sales is divided into two equal halves. One-half goes to the boat owner, and the remainder is equally divided by the hired men. Further, the boat owner in this case happened to be a Tauke.

(3) Estimation of fish catch

According to the on-site interview, fishing efforts and the average daily catch in Desa Muntai are as shown in Tables 46 and 47. In the peak fishing season (September through November), the fish catch of 49 powered fishing boats in the village totaled about 642 kg/day (13.1 kg/day/boat) and the fish catch by 20 sampans was 100.0 kg/day (5.0kg/day/sampan) (see Table 48). The interview observed that the majority of fishermen did not go out for fishing during the lean fishing season of January through March.

Thus, the total annual fish catch by all the fishing boats and sampans in Desa Muntai is established at approximately 77.5 tons (excluding the catch in the lean fishing season).

(4) Problems encountered by the village fishermen

Two main problems are encountered by the village fishermen:

1) Lack of landing facilities

At present, the village has no landing facilities such as a jetty. Because the sea off the coast of Desa Muntai is shallow, the sea dries up over an area of 750-800m from the shoreline during the spring tide. Fishing boats come to moor in the rivers only high tide. Thus, fishing boats are forced to wait for an opportune time to come for landing fish, watching for the turn of high and low tide.

In addition, during the lean fishing season of the northerly wind, the "Gambut" will accumulate in the mouth of river to disable the traffic of fishing boats.

2) Use of small-meshed gill nets

Gill nets used by the fishermen of this village have a mesh size range of 1.25 to 2.5 inches, which is smaller than that used in other villages such as Sei Cingam.

4.1.3 Fish Marketing/Processing

(1) The present state of fish marketing /processing

Desa Muntai is regarded as one of the export bases in this island for harvested fish to Malaysia. All exported goods are iced fish. The fish catch are not processed, except for dried fish for home consumption.

1) Condition of fisheries infrastructure

Despite its role as a fish collection base, the village has no landing facilities such as jetties.

2) Ice plant facilities

The village has an ice plant run by KUD Putra Karya; capacity is two tons per day. The selling price of the ice which is low quality is Rp.150 /kg, 3 times higher than Rp.50 - 60 /Kg in Slatpanjang.

3) Marketing structure

The marketing channels for fish catch in this village are divided into two major categories: export to Malaysia and local consumption. Export is carried out by several Taukes and KUD Putra Karya.

The main purchasers of fish in the village are the two Taukes (the old Tauke and the new Tauke) and KUD Putra Karya. However, KUD Putra Karya entrusts the sales and export entirely to a Tauke who lives in the neighboring village. Therefore, only takes substantially handle the sole exporters of fish.

Powered boat fishermen, whose target is fish for export with high commercial value, such as narrow-barred king mackerel and wolf herring, sell their entire catch to the Taukes or KUD Putra Karya. The reason is that many powered boat fishermen have borrowed money from the Taukes to pay for their boats and operation fees, and they must sell the fish to the Tauke in return. Other fishermen who are free from such obligations can choose their own customer among the Tauke (see Fig. 14). The fish collected by the Taukes are exported mainly to Malaysia, but some of them may be exported to Singapore via Tg. Balai Karimun.

4) Price of the fish

KUD Bengkalis consists of fishery-related people within the Kec., including the Tauke, who time to time sets up purchase price guidelines for fish per species for when Taukes buy fish from the fishermen. However, the results of our interview survey to fishermen show that each Tauke sets up a different purchase price.

The new Tauke of the village purchases the catch at a price that is 22 - 60 percent lower than the purchase price guidelines set up by KUD Bengkalis (see Table 49). There are Taukes who fix a price higher than this purchase price when they buy from obligation-free fishermen. The old and the neighboring Taukes fix their purchase price at Rp.500 - 1,000 higher than the new Tauke, in an attempt to

expand their shares, as they are the latecomers in fish collection business.

5) Supply and demand for ice

As the majority of the fish catch are kept in ice, its demand is high. If fish/ice ratio is fixed at 1:1, the quantity of ice required to preserve the total of the catch by the 49 power boats of the village during the peak season will be about 642 kg (average catch: 13.1 kg/day/boat). As the same amount of ice is required for the storage of the fish after landing, a total of 1,284 kg of ice per day will be necessary for the entire village during the peak season. The fish catch by sampans do not require ice for storage, as they are consumed within the village in a short period of time.

The results of our interview survey to fishermen shows that the actual fish/ice ratio used to preserve them was 1:0.8, meaning that there is a shortage of supply in ice compared to the ideal ratio of 1:1.

(2) Problems of fish marketing and processing of the catch

1) Absence of the export permit office

There is no export permit office on the Malacca Straits side, the main fishing ground of Kec. Bengkalis. In order to obtain an export permit, one has to transport the fish to Kota Bengkalis, located in the opposite direction of the destination of the products. This means that more than 16 hours will be lost just to make a return trip to Kota Bengkalis. In most cases, therefore, the fresh fish are actually exported through temporary measures, and the export permit is obtained by the Tauke afterwards in Kota Bengkalis.

It is extremely difficult to obtain accurate figures regarding the export quantity, as the fresh fish are exported without undergoing inspection by the Fishery Department. Such a situation interferes the establishment of accurate data on the fish catch in the Malacca Straits and makes it difficult to control the fishery resources.

2) Lower purchase price proposed by Taukes

Although KUD Bengkalis has set up guidelines for the purchase price, the Taukes set their own prices that are often lower than the guidelines. Obligation-free fishermen who own their powered boats can choose their customers by comparing the different purchase prices proposed by the Taukes from neighboring villages, but the sampan fishermen who do not have means of transportation cannot choose among the Taukes. Therefore they end up selling their fish at a lower price than the guidelines, even if they are not in debt to Taukes.

3) Ice with low quality and high price

Ice produced in the ice plant of the village is sold at Rp. 150/kg. This price is

three times that of Slatpanjang, which is Rp. 50 - 60/kg. Also, the acidity of the water makes the quality of the ice produced in the plant inappropriate for the preservation of fish. Considering the necessity of high quality ice at a low price for the improvement of the quality of fish, the current situation regarding the supply of ice is hindering the development of the local fishing industry.

4.1.4 Fishermen Organizations

(1) The current state of the fishermen organizations

The KUD and the kelompok are the two types of organizations that can be given as fishermen organizations in the pertinent villages.

1) KUD Putra Karya

The KUD Putra Karya started up in December of 1991, encompassing the entire Desa Muntai. The number of members has increased from 22 when it started up to 81 as of August, 1993. KUD Putra Karya has plans to increase membership further in the future.

In the KUD Putra Karya articles of association, the following five items are given as the business operations of the cooperative:

① Financing by the cooperative.

② Sales of the items required for the livelihood of members of the cooperative at low cost.

③ The processing and sales of products produced by members of the cooperative.

④ Agriculture, forestry, livestock, fishery and handicrafts, such as industrial handicrafts.

⑤ The education, guidance and betterment of members of the cooperative.

Upon joining the cooperative, members are obligated to have a deposit of 10,000 rupiahs and add 200 rupiahs to that each month. This will become the source of finance for the cooperative. An activity of the cooperative that is currently taking place is the joint purchase of fertilizer for members that are rice producers.

Among the 81 current members, about 30 members engaged in fishing. At present, none of the activities of the cooperative are geared toward the fishermen.

2) The Kelompok

The kelompok was established at the same time that the KUD Putra Karya was established. The activities of the kelompok are to provide two meetings for the members each year, where things such as the current state of the fishing business and the future of fishermen organizations are considered. However, due to inadequate funding, there are no real activities. Neither are there any signs of administrative guidance by the government. The kelompok is formed of about 60

fishermen in RW04 and RW05. These fishermen are mainly sampan fishermen, with only a few members using powered fishing boats. Among them, some are members of the KUD mentioned above, while others are not.

Different from the KUD, to become a member of the kelompok does not require providing a deposit, and there are no articles of association.

(2) The relationship between the Tauke and the fishermen

Because the village concerned is an export base for fish bound for Malaysia, there are activities by several Taukes within the village and among the neighboring villages. The fishermen's activities are controlled by the financing from the Tauke. Moreover, the fisherman's total catch is solely sold to the Tauke, because individually they have no sales routes for export fish.

The following three people can be given as representative Tauke in the villages concerned:

① An old Tauke who was active until four years ago. Recently, this Tauke has began collecting fish in Desa Muntai.

② A new Tauke that is operating in place of the old Tauke. This Tauke receives financial support from a Malaysian Tauke in Malacca.

③ A Tauke in a neighboring village called Desa Teluk Pambang. This Tauke started collecting fish two years earlier. This is the only Tauke who is not of Chinese ancestry.

Many of the fishermen receive financing support from the Tauke for the purchase of things such as fishing boats and for operating expenses. They then sell their catch to the Tauke in order to pay back the financing. After repayment of the debt, they sometimes receive financing from the Tauke for operating expenses. However, in general, such fishermen are free to operate as they please, having little dependency on the Tauke. But there are fishermen who are continually being refinanced by the Tauke and are not able to repay their entire debt, thus, remaining under the control of the Tauke.

In the country of Indonesia, it is extremely difficult for fishermen whose income is dependent upon the fish catch and is unstable, to get financing from the banks. However, in the village concerned, there are fishermen who receive regular financing from the banks. To get the financing, they have to provide their houses and palm gardens as collateral.

(3) Problems in the village

1) Low level of fishermen organization activities

There are two fishermen organizations in the village concerned, but both are

organizations in name only. In actuality, neither conducts any activities for the fishermen. One reason for this is that funds are inadequate for conducting activities.

2) The vertical relationship between the Tauke and the fishermen

In general, the relationship between the Tauke and the fishermen is that a number of fishermen enter into a one-to-one relationship with the Tauke through debt. For the fishermen who have received financing from the Tauke, many are dependent on the Tauke for a significant part of their livelihood, from their fishing expenses to their living expenses. This puts them totally under the control of the Tauke. Therefore, in order to organize the fishermen anew will require the establishment of a financing system that replaces the Tauke and provides the same type of financing that exists now.

4.1.5 Current Conditions and Functions of Model Mangrove Areas

(1) Characteristics of the Model Mangrove Area

Facing the Strait of Malacca on the north, this area is directly affected by the waves of the open sea. The coast is about 30km long and the seashore is 700 - 800m wide where a large tidal flat appear at low tide. Mud (mainly sandy silt) accumulates along coasts at river mouths while limitedly there are some sites where Gambut (woody humus in peat) tends to accumulate. In the water about 100m seaward from the shore line, some 90ha of mangrove sparse stands are distributed. *Avicennia* spp. are dominant there (Open-sea type mangrove forests). There are found a lot of stumps between the shore line and thin stands and in themselves. It is, therefore, presumed that there used to be a wide range of mangrove forests. Brackish-water marsh, where considered to be such deteriorated area of mangrove forests, cover some 200ha. The hinterland is considered to have been terrestrial forests. At present, however, the land is dotted with houses and there are coconut (some 1,100ha) and rubber trees (some 400ha). Most other part of the hinterland is grassland (some 900ha) with low trees here and there. Some part is used as agricultural land.

In this forest area, there is no *Rhizophora* spp. dominant forest, except for the areas along the Sei. Bantan Tengah river and the Sei. Kembung river. There are, however, some small areas a long small rivers where the *Rhizophora* spp. can grow.

(2) Functions of mangrove forests

The area is subject to strong sedimentation and erosion as it faces the ocean. Once mangrove forests were formed a narrow zone, these have mostly been felled. The coastal area is affected by strong winds and waves in the rainy season. The eastern part of Bengkalis Island is rapidly eroding with coconut stands retreating several tens of metres every year according to the interviewed local inhabitants. As many marshlands have deteriorated in terms of their land creation and erosion prevention functions, the urgent creation of mangrove belts is required.

(3) Mangrove forest utilization and management

a. Impacts of forestry policies

At present, there is no mangrove stand being capable of producing mangrove timber in this model area. We can't evaluate the impact of current forestry policies.

b. Mangrove forest management

As implied by the situation described the above (a),there appears to be a shortage of manpower to effectively control or manage the mangrove forests in the model mangrove area. One feasible improvement measures for all the model mangrove area is an increase of the staff level (CDK staff members) to tighten control and to provide proper guidance for local inhabitants.

c. Reforestation of mangrove forests

A mangrove forest belt must have once been seen along the coastline in this model area as many stumps can still be found. While it is conceivable that any effort to restore mangrove forests may be hampered by strong waves due to the location which directly faces the Indian Ocean, current reforestation techniques should be able to overcome the problems. Reforestation efforts should be conducted by selecting suitable species.

(4) Felling of mangrove forests

The currently observed and Marsh land (M1) are assumed to be the result of intensive felling. Apart from areas around Parit Cape, a cut-over area of more than 100m in width is observed along almost the entire coastline. While there are some left-over stands, standing trees exist sparsely.

(5) Production and marketing for mangrove charcoal

Mangrove charcoals have not been manufactured due to lacks of HPHH and manufacturers in this mangrove area.

4.1.6 Environmental Matters

The village of Desa Muntai is located in the eastern end of Bengkalis island. Looking out on the Malacca Straits, the village is directly exposed to ocean waves. Black-brown water runs from rivers into the sea to a length of 1 km when the tide is low, and about 100 m when the tide is high. Gambut accumulates on the shores and settles in the mouths of rivers in such a quantity that it blocks the river mouths in the northerly wind season of December through February. In January in particular, the sedimentation of gambut is observed almost every day. Because the gambut sedimentation extends into the sea covering an expanse of about 200 m from the shore three or four days a month during this period, powered fishing boats cannot come to the land. They must stay in the offing, with sampans shuttling between the boats and the land.

(1) Sediment outflow

The color of the water near the shore turns to gray or brown due to sediment outflow after a rain. Also, a considerable amount of brown water bleeds from gambut, dyeing the sea a black brown color over an expanse of about 1 km from the shore.

(2) Felling mangroves

Wide development of plantations is seen around the village, leaving scarcely any mangroves on the shore due to excessive felling. Erosion by the ocean waves appears to have had a heavy impact on the terrain of some shores.

(3) Water pollution by mineral oil

Oil films and tar balls from tanker sludge are observed to drift to shore once or twice during the northerly wind season of January through April. Fishing operation is not affected, however.

(4) Other considerations

The shore is an unstable and shallow beach consisting of a mixture of sand and gambut sedimentation. Facing the ocean, it is also exposed not only to the north wind but also to a tidal current off the shore. Under this condition, if any structure is built directly on the shore, it may cause sand drift or erosion in the surroundings. Accordingly, special consideration should be paid in the planning of marine structures to prevent such sand drift and erosion.

4.2 Desa Sei Cingam

The map of Desa Sei Cingam in Fig. 15.

4.2.1 Socio-Economy

(1) Population

In 1992 the population of Sei Cingam was 1,982 people with 347 households. The annual population growth rate was approximately 2.6 percent from 1990 to 1992 which was nearly equivalent to the annual growth rate of the entire Kec. Rupat (2.5 percent).

The population of Srimenanti, Srimakmur, Pkl. Buah in 1992 was 826, 787, and 369 people, with 134, 132, and 81 households, respectively.

The ratio of its working population (ages 10 to 55) in 1992 was 68 percent for Srimenanti and 60 percent for Srimakmur and Pkl. Buah, with a slightly higher ratio in Srimenanti.

The majority of the 386 Chinese Indonesians lived in RW02 in Dusun Srimenanti (282 people) and RW04 in Dusun Srimakumur (73 people). In particular, the entire population of RT04 and RT05 of RW02 and RT10 of RW04 was Chinese Indonesians.

(2) Distribution of fishermen households

The number of fishermen is based on the interview survey to the village master although discrepancies were found between the interview survey and BANDES data. Although the number of fishermen in the working population is not large, there was an increase from 41 to 76 fishermen in 1990 to 1992.

The eastern part of RW04 borders the sea and sampans are easily access to the land for fish landing, although there is no jetty. The landed fish is automatically sold to a Tauke. Due to this factor, the fishermen population is the largest here at 35. On the northern side of Marong channel, there are 15 fishermen in RW02 who operate there and in the eastern waters outside of the channel. On the southern side of Marong channel, the majority of the 15 fishermen in RW05 and 7 fishermen in RW06 operate in powered boats whose base is Tg. Medang on northern Rupat island.

(3) Number of employed workers and production value by major industry

The majority or 55 percent (325 people) of the entire working population of Sei Cingam in 1992 were engaged in paddy cultivation. This was followed by 76 fishermen (13 percent), 61 dry field farmers (10 percent), 56 plantation workers (9 percent), 33 workers in livestock (6 percent), 29 workers in services/commerce (5 percent), and 11 workers in other fields (2 percent). Based on these findings, the majority of the working population (80 percent) were engaged in agriculture/livestock.

The ratio of fishermen comprising the total working population of RT09, RT10, and RT11 was comparatively high at 34 percent, 59 percent and 24 percent, respectively, and under 16 percent in the other RT.

Agriculture/livestock comprised the highest ratio at 70 percent (Rp.342,000,000) of the total production value in 1992. Although fisheries was only 20 percent of the entire ratio at Rp.96,000,000, the ratio was high in comparison to the number of employed workers; and it is believed that the earnings of fishermen are higher than farmers.

(4) Life of the villagers

As in other villages, village roads are repaired and cleaned by Gotong Royong (mutual aid). When the Sri Jaya Jetty was constructed in 1989 to serve as (1) a place for the departure and arrival of ferry boats, (2) a shelter for fishing boats and (3) a place for loading and selling fishes for food, money for the construction materials and labor for the construction were procured by Gotong Royong.

(5) Financial capacity of the villagers

There are no banks in Sei Cingam. To use a bank, villagers must go a long way to Dumai or Bengkalis on a ferry boat, so they rarely use bank facilities. If they have any money to spare, they usually will buy gold or hold the money in cash. In our survey of residents' intentions and impact, about one half of the respondents replied that they had money to spare every month or once in a while. The interviews disclosed, however, that most of such spare money was spent for children's education, medical care, entertainment, Idulfitri (grand festivals after fasting) and contingencies, but was not saved for the future.

According to the residents' intention survey, their annual income averaged 1,801,000 rupias family or 257,000 rupias per capita. This is far lower than the poverty line of US$ 160/year.

The above suggests that it is beyond the capacity of the villagers at large to bear a new financial burden, and that any projects must be planned on the basis of financing the project expenses through the projects' own income or government aid.

4.2.2 Fishery Production and Fishing Grounds

(1) Present condition of the fishing village

1) Number of fishermen and fishing boats

Desa Sei Cingam has a fisherman population of 76, of whom 54 fishermen (or 71%) live in Dusun Serimenanti and Serimakmur in the northern part of the village (see Table 50). Many fishermen gather in the northern part of the village, because of only sole Tauke in this village living in Alohong of Dusun Serimakmur and engaging in fishing.

The distribution of fishing boats in the village showed that 19 out of 20 non-powered boats were present in the northern part. For powered fishing boats, 3 outboard-engine boats and 8 out of 16 inboard-engine fishing boats were owned in the northern part. Of these, 3 outboard-engine and 7 inboard-engine boats were moored in Alohong.

In Dusun Pangkalah Buah of southern Desa Sei Cingam, where 1 non-powered and 8 powered fishing boats are in operation. Fishing in this place is being done mainly log powered boats.

2) Condition of fisheries infrastructure

In the northern part of the village, there is a wooden jetty (Sri Jaya Jetty) on the Maron channel. This jetty was constructed by the Gotong Royong in 1989. The objectives of the construction were (1) convenience for ferry transportation, (2)fish landing and sale for consumption by villagers and (3) shelter for fishing boats. This jetty, however, does not handle any fish of exportable quality with high commercial value.

Fish catches for export are landed only in Alohong in the north part of the Simpang) outside the village. In Alohong, there is no landing facility and fish catches are unloaded on the sand beach from fishing boats. Landed fishes are solely purchased by the Tauke in Alohong. The purchased fishes are stored in a cold storage facility and shipped to Malacca when the storage has reached a certain level.

In the southern part of the village, a jetty is installed near charcoal kilns in RT13 located along the Marong channel. This jetty is used not only for the purchase and delivery of charcoal; incoming and outgoing fishing boats, also use this jetty for mooring in the lean fishing season but not for landings.

3) Felling of mangroves by fishermen

Charcoal kilns located along the Marong channel purchase mangroves felled by villagers living nearby. Fishermen fell mangroves mainly as fuel for their own consumption. Only a few sell their mangrove to the charcoal kilns.

(2) Fishing methods and fishing grounds

1) Fishing seasons

For this village fishermen, the fishing grounds spread widely from the area surrounding Rupat island up to the offing of Sinaboi. The fishing seasons are slightly variable among the fishermen and the best fishing season starts from November to February. It is to be mentioned here that most of the fishermen in the village continue their fishing operation even during the lean fishing season.

2) Main fishing methods and the type of fishing operation

The main fishing method employed in Desa Sei Cingam is gill net fishing for both powered and non-powered fishing boats. The fishermen concentrate their fishing operation in the period of spring tide when the tide is running fast, operating 15 to 20 days a month.

The gill net fishing by the northern fishermen is based in Alohong primarily for one-day operation. The gill net fishing by the southern fishermen is based in the KUD Rupat landing facilities in Tg. Medang and Desa Kuala Simpang in the northern part of Rupat island; this is conducted on the scale of about one-week continuous operation in the offing of north of Rapat island, Sinaboi, etc. The fishing boats in this case visit the said fishing bases every day to land their catches and load ice.

The number of gill net used are 20 to 90 units with mesh size ranging from 2.5 to 3.5 inches.

Sampans in the northern part of the village do not use ice and are engaged in one-day gill net operation, 15 to 20 days a month mainly during the period of spring tide.

For both powered and non-powered fishing boats, the main fishing targets are wolf herring and narrow-barred king mackerel. In addition, *Pellona* sp. and sea catfish are also included in their target.

3) Sale of catches and profit sharing

While there are many fishermen getting income from sources other than fishery, through the ownership of coconut palm or rubber plantations or rice fields, fishermen living in Alohong and its vicinity are mostly dedicated fishermen who have no sources of income other than fishery.

The employment status of fishermen is quite similar to that in Desa Muntai. An exceptional case coming to our notice in this village was one sampan which hired a fisherman.

The profit of catches was shared in the following manner:

① Between the boat owner as captain and hired fishermen:

Profit after deducting operating expenses from sales is divided into four equal parts. Three-quarters of the profit go to the boat owner for the cost of the boat and fishing equipment and as profit due to the owner, and the remaining one-quarter goes to the hired fishermen. Alternatively, there was a case in which the sales were divided into four equal parts, one part going to the hired fishermen and three parts to the boat owner who pays the operation expenses from the income.

② Between the ship owner, hired captain and hired fishermen:

Profit after deducting operating expenses from sales is divided into four equal parts. Two-quarters of the profit go to the Tauke, one- quarter to the hired captain and one-quarter to the hired fishermen. It is common that the boat owner in this case is the Tauke.

③ Between the sampan owner as captain and one hired fisherman:

Profit after deducting operating expenses from sales is divided into three equal parts. Two-thirds of the profit go to the captain for the cost of the sampan and fishing equipment and the remaining one- third to the fisherman. The only difference from the case of powered fishing boats is the division of profit into three parts.

In case ① above, we were told that the income of the boat owner went to the Tauke in payment of his debt to the Tauke. Whenever the boat owner needed money, he borrowed it from the Tauke. This system keeps the boat owner permanently in debt to the Tauke.

(3) Estimation of fish catch

According to the on-site interview, fishing efforts and the average daily fish catch in Desa Sei Cingam are as shown in Tables 51 and 52. In the prime fishing season (November through February), the catch of 19 powered fishing boats (including outboard-engine boats) in the village totaled about 309.7 kg/day (16.3 kg/day/boat) and the catch by 20 sampans was 192.0 kg/day (9.6 kg/day/sampan, see Table 53).

Thus, the total annual fish catch by all the fishing boats and sampans in this village was approximately 56 tons.

(4) Problems encountered by the village fishermen

Three problems are encountered by the fishermen of Desa Sei Cingam:

1) Lack of a landing facility

The fishery base in the northern part of Desa Sei Cingam is Alohong. Alohong is not an adequate construction site for a landing facility, however,

because of the vulnerability of its shore to erosion and the accumulations of sand in the mouth of rivers where fishing boats are moored. It is therefore necessary to select a site suitable for this purpose and to equip it with a new landing facility where powered fishing boats may have access at any time.

2) Limitation of fishing grounds for powered fishing boats due to one-day operation

The fishing grounds of powered fishing boats cover an area extending to the offing of Sinaboi. Because these fishing grounds are out of reach by one-day operation from the village, they are inaccessible by fishermen other than those operating under KUD Rupat based in Tg. Medang. In order to promote the fishery industry of the village, it is important to take steps such as the introduction of mother ship fishery system, so that the fishermen based in the village can participate in fishing in these grounds.

3) Remote fishing grounds for sampans

Currently, sampans of the village are fishing in the area off the coast of RT9 and RT10. To arrive at this fishing area, it takes about 30 minutes one way from RT9 and RT10, and it may take more than three hours from a point in the Marong channel. To solve this problem, it is suggested that sampans be equipped with engines for improved fishing productivity.

(5) Aquaculture potential

Desa Sei Cingam is not a place where feeding-type aquaculture is feasible, because hardly any feed stuff is available in the village. However, it may be possible for fertilized aquaculture, utilizing marsh lands with low vegetation cover in the hinterland of mangrove forests.

1) Land availability for earth pond development

In the north of Desa Sei Cingam Model Mangrove Area, there are saltmarsh lands with low vegetation cover extending over an area of 70 hectares. These marshes are located on two areas ; around the mouth of the Marong Channel, and along the Marong Channel. The shore on the Malacca Straits consists of sandy beach, and drifting sand often blocks the mouths of streams in the area. This makes the area unsuitable for the location of culture ponds because of the risk that water inlet channels can be blocked by drifting sand.

On the other hand, marshlands along the shoreline of the Marong channel are located in the hinterland of mangrove.

2) Selection of fish species for aquaculture

The species of fish must be selected to suit the type of aquaculture, which will be the fertilized culture type in this village.

The species for selection must meet the following conditions:

- To grow in brackish water.
- To be omnivorous.
- To be highly reproductive and capable of reproducing within a pond.
- Fish fry to be easily available.

The species that meets all of the above conditions and is presently being bred in Indonesia is tilapia. In Indonesia, the average yield of tilapia by the fertilized culture type is 350 kg per hectare.

(6) Key points for the promotion of aquaculture

1) Introduction of sylvofishery

In Desa Sei Cingam, fertilized culture is a prerequisite for aquaculture development because there are no sources of cheap feed stuff in this village. The yield of aquaculture in this case is dependent on the inflow of organic substances and nutrient salts into the culturing water areas. Consequently, it is necessary to examine the possibility of a sustained supply of organic substances by means of the introduction of sylvofishery.

2) Clarification of the purpose and role of fertilized culture

Fertilized culture requires less money to operate, but it produces less yield per unit area. In addition, the price of tilapia, a species applicable to this culture method, is relatively low (Rp. 1,500/kg).

It should be mentioned here, however, that the purpose of our project is not to sell its products to outside markets. Rather the purpose is to fill the need of villagers and replace inshore fish catch now consumed by the villagers.

4.2.3 Fish Marketing / Processing

(1) Present state of distribution and processing of fish catch

1) Conditions of fisheries infrastructure

The village used to be a part of the official registered region of KUD Rupat, but it is now excluded from the region because of its remoteness. However, some fishermen in the village continue to work directly under KUD Rupat, and they use the base of KUD Rupat (outside the village of Sei Cingam) including its fisheries infrastructure.

The village centers upon the export of iced fresh fish, as in the case of Desa Muntai, and does not process the fish.

Fishermen in the village are largely classified into those who sell for the Tauke the only one of the village and those who sell for KUD Rupat.

The Tauke of the village uses Alohong of Dusun Srimakmur as his base. Since Alohong is a sandy beach, powered boats cannot come alongside the quay. Therefore, the boats moor near the shore, and the fish are reloaded onto sampans

for landing.

As fishermen working directly under KUD Rupat have their fishing base outside the village, they do not bring the fish to the village.

An ice plant with a capacity of two tons per day was operating from 1975 - 80, but it closed down after having been beaten in the price competition with the newly built large scale ice plant in Tg. Medang, which has a capacity of 40 tons per day. The village no longer has its own ice producing facilities.

2) Marketing Structure

The export channels of the village are classified into the following two: through KUD Rupat and through the Tauke of the village (see Fig. 16).

KUD Rupat collects fish from the fishermen in its zone of activities, including the four villages in the north of Rupat Island, and ships them to its main base of Tg. Medang towards Malacca. Some of the powered boats of the village use Tg. Medang and Desa Kuala Simpang, where KUD's fish collecting site is located, as their fishing bases. KUD Rupat is a legal form of fishermen's organization, but there are a number of Taukes among its members. The export of fish catch is financially controlled by one Tauke living in Malacca.

The Tauke of the village collects the fish at Alohong and exports them to Malacca by himself. He also buys fish from the sampan fishermen of the village, but handles only the exportable fish. Sampan fishermen sell other small fish within the village.

There is no fish market in the village, so consumers buy fish directly from the fishermen.

3) Price of the fish

The fish catch of the village with high commercial value are usually exported to Malaysia, and commercial transactions are settled in Ringgit (the Malaysian currency unit).

According to our interview survey, the purchase prices of KUD Rupat and the Tauke of the village were almost identical(see Table 54). The price of the small fish for local consumption, such as biang biang and lomek, was around Rp.1,000/kg.

4) Supply and demand for ice

If the fish/ice ratio was 1:1, the quantity of ice required for the preservation of the catch by the 19 powered boats of the village during the peak season will be about 310 kg (average catch: 16.3 kg/day/boat). As the same amount of ice is required to store the fish after landing, a total of 620 kg of ice per day will be necessary for the entire village during the peak season.

At present, fishermen under the control of KUD Rupat are supplied with ice

produced in the ice plant in Tg. Medang. The price of the ice is Rp.75/kg. The Tauke in the village also buys ice at Tg.Medang and supplies it to fishermen at the cost price (Rp.75/kg). The Tauke in the village buys the ice produced in Malacca at Rp.100/kg when he exports fresh fish there and sells the ice within the village. This ice costs Rp.25/kg more than the locally produced ice, but it is of better quality and can be used for a longer period of time.

According to our interview survey, the fish/ice ratio used in powered boats was 1:1.25, showing that a sufficient quantity of ice was used. However, as the quality of the ice is poor and therefore not appropriate for the preservation of fish for a longer period of time, it is unknown how much ice is actually used in an effective way.

(2) Problems of fish marketing/processing

The village faces the following three main problems.

1) Absence of an export authorization office

There is no export authorization office on Rupat Island except for Tg. Medang. Upon development of the fisheries infrastructure in Desa Sei Cingam, it will be necessary to establish an export authorization office or its agency on the east coast of Rupat Island to be able to accurately record the quantity of exported fish.

2) Absence of landing facilities

Currently, there are no landing facilities in the village. Therefore, sampans are used to land the harvested fish and to transport the ice to the boats. It is necessary to create landing facilities alongside which the powered boats can be stationed in order to improve the efficiency of those processes.

3) Absence of an ice plant

Many fishermen on boats purchase a sufficient amount of ice when leaving the port. But they are entirely dependent on resources outside of the village for the supply of ice. It is indispensable for the development of the local fishing industry to develop a stable ice supply system within the village. Therefore it is necessary to either create the ice plant facilities or ice storage facilities when transporting ice from outside.

4.2.4 Fishermen Organization

(1) Current state of the fishermen organizations

Desa Sei Cingam is located in the center of the eastern part of Rupat island. The KUD Rupat has been organized in Desa Tg. Medang, which is located in the northern part of this island. It covers four villages in the northern part of the island. Until 1991, KUD Rupat handled eight villages on Rupat island, including Desa Sei Cingam. From the time it was no longer part of KUD Rupat until the present, no KUD has been organized in Desa Sei Cingam. However, there are some fishermen who continue to operate under the influence of KUD Rupat as before.

There is one fishing organization in this village, a kelompok. However, currently, it is inactive.

1) The kelompok

This kelompok was organized in November of 1991 as the receiving organization for implementing a comprehensive regional development project sponsored by the government (Proyek Pengembangan Kawasan Terpadu: PKT). Under the PKT project, for the 38 fishing families within the village, one sampan and 20 gill net units were provided to each two families. Under the PKT project, the fishermen are obligated to set aside a portion of their fishing profits. However, there were accidents at sea in the PKT-provided sampans and some fishermen subsequently abandoned these government-supplied sampans. As a result, the kelompok is currently inactive and the repayment of the debt has been forgiven as a form of reparation for the accidents.

The activities of the kelompok organizations at the time that fishing took place using the sampans are as indicated below:

① A meeting of the kelompok members took place once a month. There, they did things such as exchange fish catch information and solicit donations for fishermen who lost equipment or whose equipment was destroyed.

② Fishermen with powered boats would tow sampans to the Marong channel estuary. Since there was no remuneration for the towing, for the powered boat owners it was purely service free of charge.

2) Fishermen under the umbrella of KUD Rupat

Desa Sei Cingam was once within the activity sphere of KUD Rupat. At the present time, there are some fishermen in this village who purchased powered boats and equipment through financing by the KUD and still continue to repay the debt. These KUD umbrella fishermen use Desa Tg. Medang, the base of the KUD Rupat, as a base and use Desa Kuala Simpang, which is where the catch of the KUD fishermen is gathered, as a base. They are supported by subsidies, such as those for fishing equipment, ice and fuel. In the KUD Rupat, many members are Tauke. The

fishermen often receive financing from these Taukes. The condition of the fishermen under this KUD in actuality is the same as if they were under the control of the Tauke.

The number of fishermen by Dusun are as shown below. The number of fishermen under the KUD umbrella are concentrated in Dusun Pangkalan Buah.

(2) The relationship between the Tauke and the fishermen

The Tauke that is active in the village concerned amounts to one Tauke who lives in Alohong, which is along the coast of Dusun Srimakmur. This person has been operating as a Tauke since 1990. At present, he owns six powered fishing boats (2 in Desa Sei Cingam and 4 in other villages). Under his control are 10 to 16 powered fishing boats and about 10 sampans (some of them have outboard engines). However, the fishermen are only financed operating expenses. Thus, there are only a few cases of them being heavily in debt to the Tauke.

The Tauke of this village was the treasurer for the kelompok mentioned earlier. In addition, his relationship with the fishermen is a smooth one.

(3) Problems of the villages

1) Repayment of debts to the KUD Rupat

Currently, for the fishermen under the KUD Rupat umbrella, there are many cases in which all of the profit from their catch goes toward repaying their debt. In such cases, when the fishermen need cash, including living expenses, they receive lump-sum financing from the KUD Tauke once again. The result is that they are continually in debt to the KUD, which makes it difficult for them to become economically independent.

2) Cease of the kelompok activities

The activities of the kelompok are ceased in this village. During the time when fishing took place using sampans under the financial assistance PKT, the types of activities previously mentioned also took place. Since the groundwork has been sufficiently laid for the activities of a fishing organization, the reestablishment of such an organization is desirable.

4.2.5 Current Condition and Function of Model Mangrove Area

(1) Characteristics of the distribution of the Model Mangrove Area

This area is located in the northeast part of the Rupat Island.

It is at the east end of the S. Morong Channel flowing in northwest. The *Rhizophora* spp. dominant mangrove forests grow along the Channel (some 1,100ha).

There are mangrove forests along the open sea to the south coast around the end of the Channel, extending about 1km inland from the shore line (Open-sea type mangrove forests). Near the land ward side, there range forests with mangroves of about 20m height. Most of the mangroves in the forests on both coasts of the Channel are lower than 15m in tree height (Inland sea type mangrove forests). There are sparse stand areas (some 130ha) on the north coast of the channel. Four HPHHs exist in this area and some parts of this model mangrove area is designated as a HPH.

Near the end of the S. Morong Channel in the northeast part of this area faces the Strait of Malacca, there exist small forests where the *Rhizophora* spp. and the *Avicennia* spp. are dominant. In most other part, marsh with grasses touches the shore line. There are about 10 private houses at the north end of the area, namely Alohong village. Only grasslands (some 690ha) and terrestrial high forests are found there.

In the hinterland of the mangrove forests on both coasts of the Channel, a considerably large residential area lies in parallel with the channel. Adjacent to the residential area, there are rubber trees (some 670ha). Terrestrial forests range behind the rubber trees.

(2) Functions of mangrove forests for public interests

The seaward eastern coast has a narrow mangrove belt and is probably subject to sedimentation and erosion as well as wind and waves in the rainy season. Those mangrove forests along the S. Morong Channel are used for charcoal production but their resources have been seriously depleted due to felling over a long period of time.

The establishment of mangrove belts along the eastern coast is required for the same reason as the Muntai Model Mangrove Area. As the degree of dependence on mangrove timber for the livelihood of local inhabitants is relatively low in Desa S. Cingam, the improvement of the forest function of providing good fishing grounds is strongly hoped for.

(3) Mangrove forest utilization and management

a. Impacts of forestry policies

While some positive effects of the regulative measures are observed along the coastal belt, stand conditions at the inland are presumed to be worse. Tightening the control appears necessary to improve the situation.

b. Mangrove forest management

As implied by the situation described in the above "a", there appears to be a shortage of manpower to effectively control or manage the mangrove forests in the model mangrove area. One feasible improvement measures for all the model mangrove area is an increase of the staff level (CDK staff members) to tighten

control and to provide proper guidance for local inhabitants.

c. Reforestation of mangrove forests

Although dwarf sparse stands are seen in some parts of this model mangrove area, the existing commercial species should be able to maintain proper growth with reasonable care. Reforestation using those species should to produce charcoal is feasible by firstly preparing the ground.

(4) Felling of mangrove forests

The felling intensity intends to decline in case of mangrove forests located further inland because of the dependence on sampans to transport the wood.

Swampy grassland and dwarf sparse stands are observed at the back of the current mangrove forest zone. As no stumps are found to be any causes other than intensively selective cutting have made the dwarf sparse stands and the grasslands probably.

(5) Production and distribution of mangrove charcoal

Manufacturing forms of mangrove charcoals are almost the same as the study area. Four HPHH are established within the model mangrove area of 1.143 ha and four kilns are installed in Sei Cingam. Applying the restriction of green belt area, the area of supplying charcoal woods is 721 ha, and calculated annual total growth volume of the mangrove trees is 1.081 m^3, thus a maximum number of charcoal kilns is 2.4 and a maximum total annual yield of the products is 115 tons. The current number of kilns (4) which is more than double of the maximum number is judged to be over manufacturing.

Charcoal manufacturers operating in this site export their products to Singapore or Malaysia through dealers operating in Dumai.

4.2.6 Environmental Considerations

The village of Desa Sei Cingam is located on the eastern gate of the Marong channel, separating Rupat island into two parts. Heavy tanker traffic is seen in the offing because it is situated to the west of the line connecting the oil shipping port of Dumai and the ocean.

(1) Sediment outflow

The color of water in the Marong channel turns to brown, gray and bluish green by the season. This change of color has become especially remarkable in the past several years although it was not noticeable more than 10 years ago.

In the Alohong zone facing the Malacca straits, the sea water is blue during the season of northerly wind and alternately changes between gray and brown during the other seasons. It is reported that, when the color changes from gray to brown in October through December, the fish catch becomes poor, but that a large catch can be expected in June through August when the sea turns from gray to bluish green.

(2) Felling mangroves

Mangroves have been felled over a long period of time and their stands has become scarce in many places. There is no mangrove in the Alohong zone, where other trees are being felled.

In the seasons of easterly or northerly wind, the land can be eroded by sea waves around the gate of the Marong channel.

(3) Water pollution by mineral oil

Oil smelling fish catches are not experienced now, although they were frequent about 20 to 30 years ago. Because of the nearby oil shipping port of Dumai, oil films and tar balls drift to the shore more than once a year in the time of easterly or northerly wind. It is reported that fishing operation is continued regardless of such drifts.

(4) Other considerations

In the Marong channel, the development of tidal flats as well as peculiar water change caused by tidal currents are observed near the channel gate. These conditions must be taken into consideration in the planning of structures for any development projects.

It should be remembered that the erosion of the shore in the Alohong zone has forced 14 fishermen's families to move to other places during the past four years. It is highly likely that more families will move in the future. Thus, in the planning of development projects, special attention should be paid to the possibility of fishermen moving to other places.

4.3 Desa Pelantai

The map of Desa Pelantai is shown in Fig. 17.

4.3.1 Socio-Economy

(1) Population

In 1991 there was a population of 2,333 people and 412 households in Desa Pelantai. The annual population growth was approximately 1.3 percent from 1986 to 1991, much lower than the entire population growth of Kec. Merbau (2.3 percent per year).

In 1991 the population of Dusun Pelantai, Sei Kamal, Wonosari, and Kengkam was 772, 808, 349, and 404 people, respectively, with 141, 152, 46, and 73 households, respectively. The working population (ages 10 to 55) ratio of those four Dusun of Pelantai, Sei Kamai, Wonosari, and Kengkam was 69 percent, 73 percent, 73 percent, and 75 percent, respectively.

There are 68 Chinese Indonesians, comprising a very small percentage (3 percent) of the entire population . They are all living in Dusun Wonosari, RW03, and RT03.

(2) Distribution of fishermen households

According to the data of BANDES, the number of fishermen was reported as 50 in 1991. Our local survey through an interview with the village master (Kepala Desa), however, confirmed the number of 130. Asked about the discrepancy, the village master could not give us any ground to support the number reported to BANDES. On the other hand, the number given in the interview was that of fishermen recorded on the residents' registration by the type of occupation. In this study, we will use the number given by the interview as the number of fishermen, including those who are simultaneously engaged in another occupation. In actuality, the figure includes many mangrove-felling workers who go out for fishing only a few times a year. The number of fishermen whose main source of income is fishing is 4 in Dusun Pelantai and 14 in Dusun Kengkam.

(3) Number of employed workers and production value by major industry

Pelantai's major industry is plantation, mainly consisting of 600 ha. of rubber plantations and 400 ha. of palm plantations. In addition, there are sago palm plantations over an area of 50 ha. as well as orchards where rambutans are grown.

During the period from 1986 to 1992, the number of persons at work in the plantation sector declined from 341 to 286, while those in the fishery sector sharply increased from 50 to 149. Most of these fishermen, however, were seldom engaged in fishing and primarily worked at mangrove felling and other simple labor, which essentially were their main sources of income. It is probable that, in consideration of the PKT assistance requirements that persons eligible for the grant of assistance are only those who are statistically classified as fishermen, many may have changed their occupation on the statistical record from plantation worker to fisherman in order to meet the PKT eligibility requirements.

(4) Life of the villagers

The following activities are conducted as gotong royong (mutual aid):

- Village roads are repaired and cleaned by the voluntary service of each family. This is done usually once a week and sometimes once or twice a month.
- Weddings and other ceremonies are helped by neighbors who lend tableware or provide cooking labor.

Heads of families meet at least once a year. In addition, meetings are held from time to time whenever consultation becomes necessary on such subjects as the construction of bridges or the repair of roads in the village. Most of such meetings are presided over by the village master. If a meeting cannot reach an agreement after discussion lasting more than a half day, a decision is reached by majority vote.

There are a plural number of Arisan (mutual financing associations) by women members in RW5 and RT3. They gather once a week and collect 10,000 rupias in each meeting.

(5) Financial capacity of the villagers

There are no banks in Pelantai. To use a bank, villagers must go a long way to Selat Panjang or Tlk. Belitung on a ferry boat, so they rarely take advantage of bank facilities. If they have any money to spare, they will usually buy gold or hold the money in cash. In our survey of residents' intentions and impact, about one third of the respondents replied that they had money to spare every month or once in a while. The interviews disclosed, however, that most of such spare money was spent for children's education, medical care, entertainment, Idulfitri (grand festivals after fasting) and contingencies, but was not saved for the future.

According to the residents' intention survey, their annual income averaged 1,582,000 rupiahs per family or 259,000 rupias per capita.

This is far lower than the poverty line of US$ 160/year.

The above suggests that it is beyond the capacity of the villagers at large to bear a new financial burden, and that any projects must be planned on the basis of financing the project expenses through the projects' own income or government aid.

4.3.2 Fishery Production

(1) Present Condition of the Fishing Village

1) Number of fishermen and fishing boats

Desa Pelantai has a fisherman population of 149; 87 live in Dusun Pelantai, 62 in Dusun Kengkam, and none at all in the other two Dusun (see Table 55). These are mostly part-time fishermen who occasionally catch fish for their own consumption and get cash income from other sources including the felling of

mangroves daily employment of the plantation, etc. Only 4 families in Dusun Pelantai and 14 families in Dusun Kengkam are dedicated fishermen who market their catch.

The fishing boat comprises 2 powered boats and 148 non-powered boats. The 2 powered boats are based in Dusun Kengkam. Of the 148 non-powered boats, 86 are based in Dusun Pelantai and 62 in Dusun Kengkam.

2) Condition of fisheries infrastructure

The village has two jetties, one in Dusun Pelantai and the other in Dusun Kengkam. These serve for fishery and for the felling of mangroves.

There are neither ice plant, cold storage nor freezing facilities in the village. When going out for fishing, fishermen buy ice for fish in Slatpanjang.

3) Felling of mangroves by fishermen

Many people in this village are engaged in felling mangroves for a living. These people fell and sell mangroves using sampans, occasionally catching fish for their own consumption using gill net fishing.

(2) Major Fishing Methods and Fishing Grounds

1) Fishing seasons

As for fishing seasons by Sampan in the Asam channel, the best season is between Sep. and Nov. Gill net fishing by sampans in the Asam channel is limited to the period of neap tide. This is to avoid the risk of gill nets placed in the spring tide adhering to Gombang installed in the straits.

2) Fishing methods and fishing grounds

The main fishing methods employed in Desa Pelantai are gill net fishing, bottom long line fishing and Pengeirih. Pengeirih has declined of late, and is done every day whether during a spring tide or a neap tide.

Gill net fishing and bottom long line fishing by non-powered boats are done in the channel for a total of 12 to 14 days per month on the basis of one-day operation. Many fishermen give up fishing during the lean fishing season. For gill net fishing, a powered boat use 25 to 50 net units of 1.25- to 2.25-inch mesh size. A sampan uses 4 to 12 units of such mesh size.

Gill net fishing and bottom long line fishing by sampans cover mainly the village shore frontage and the area along the coast of Asam channel extending from Desa Teluk Belitung to Desa Teluk Ketapang. Pengirih fishing also covers the Asam channel.

Some Chinese Indonesians employed Gombang fishing in Dusun Kengkam until three years ago with relatively good results. But now there is no Gombang fishing in that place.

Gill net fishing by sampan targets small fishes such as biang-biang, lomek and etc. Their exportable fishes, such as wolf herring and narrow-barred king mackerel, are relatively small in size compared with those fished in other regions.

3) Sale of the catches and profit sharing

A sampan is usually operated by two persons, who are normally members of the same family and others are not employed as fishermen. All fish catch is sold within the village. Only when the fish catch exceed the selling volume in the village, the excess is sold in Desa Tlk. Ketapang which is located in the opposite side of channel and in the fish market at Slatpanjang. A few fishermen have income sources other than fishing, such as the ownership of rubber or coconut palm plantations. Many fishermen earn extra income as wage workers in sago or mangrove felling, rubber plantations, etc.

4) Use of ice

Both Sampan fishermen and Pengerih fishermen does not use ice, because it is also operated in the village shore frontage.

(3) Estimation of Fish Catch

According to the on-site interview, the fishing effort and the average daily fish catch of gill net fishing by non powered boat in Desa Pelantai are as shown in Tables 56 and 57, respectively. Fishermen in the village rarely go out for fishing in that season.

(4) Problems Encountered by the Village Fishermen

The following three problems are encountered by the fishermen of Desa Pelantai:

1) Insufficient of fishery products supply to the demand of the village

As stated above, fishing in this village is primarily intended to fill the need of the villagers. Fishermen who resort to fishing for cash income are few. Consequently, fish supply to the villagers is not sufficient even though all the fish catch is consumed of in the village.

2) Small catch of high priced fish

The fish catch in the Asam channel, however, is mostly composed of small fish such as biang biang and lomek. This makes it difficult for fishing in the Asam channel to raise plenty of money and consequently makes fishing in this village a side business only.

3) Part-time fishermen dependence on the felling of mangroves for major income

A majority of the fishermen described above get cash income from the felling of mangroves. In order to increase their income from fishing and to increase the supply of fish to the villagers, it is important to improve their fishing boats,

fishing equipment and fishing methods.

(5) Aquaculture Potential in Desa Pelantai

1) Examination of feed stuff supply sources for aquaculture

It was reported that the Gombang fish catch in Kec.Tebing Tenggi/Kec. Merbau is at a level of 10 to 20 kg/net/day all the year around.

In the Asam channel, Gombang fishing is operated in Desa Tlk. Ketapang, at a level of 6 to 23 kg/net/day (daytime operation). The catch is mainly anchovies. Night gombang fishing is done in Desa Tlk. Belitung in order to obtain livestock feed stuff. The fish catch is relatively constant all the year around, at a level of 10 kg/net/night. A night test-fishing conducted in the site survey at Desa Tlk. Ketapang yielded a 12.7 kg/net/night catch on the average, mainly composed of mysids. Because 0.5 kg of the catch was shrimps of high commercial value, fish suitable for feed stuff use yielded 12 kg (including 10 kg of mysids) (see Table 58).

As stated above, the gombang fish catch in the Asam channel excluded shrimps is estimated that both night and day operation will yield an average feed stuff catch of 17 kg/net/day throughout the year. If anchovies boiled and dried for sale are included in feed stuff use, the yield will reach an average of 26 kg/net/day throughout the year.

2) Possible water area for Gombang net installation and the possible number of net installations

Possible gombang fishing grounds in Desa Pelantai are an area offshore about 4 km to the south of the mouth of the Kengkam river in the north of the village and an area offshore extending about 0.8 km at the mouth of Pelantai river in the south of the village.

In this project, the separation distance between Gombang nets will be 80 m lengthwise and 60 m crosswise, about the same size with the fishing equipment itself. Accordingly, a water area of about 0.02 km^2 will be necessary for installing one set of nets.

In consequence, about 110 Gombang fishing nets can be installed in the 2.2 km area in the south of the mouth of the Kengkam river, and about 25 Gombang fishing nets in the 0.5 km area off the mouth of the Pelantai river.

3) Suitability in terms of water quality

Suitable species to aquaculture in the Study Area will include giant sea perch, giant tiger prawn and mud crab. These fishes were also selected for a brackish water fish culture development study by the local fishery authority. Table

59 shows both the breeding conditions of these three species and the findings from a study on the natural conditions of the Asam channel.

The study of installing a sea-surface fish farm in the Asam channel indicated no particular problems except for a rapid tidal current. Although a current flow of 0.5 m/sec. or less is generally considered desirable for a fish farm to breed giant sea perch, the study of the natural conditions of the Asam channel measured a maximum tidal current speed of 0.77m/sec. Consequently, some means must be devised to moderate the speed of the tidal current when a floating cage farm is installed.

The culture of giant tiger prawn and mud crabs is not a subject to a tidal current because they are grown in earth ponds. However, the water condition in this area was determined to be appropriate for aquaculture although the salinity concentration was found somewhat high (30 ppt).

4) Land availability for earth pond development

From the nature of this study, earth fish ponds should be constructed in unexploited areas not covered by mangrove forests. The shore of this village along the channel is mostly covered by mangroves. Thus, marsh lands with low vegetation cover in the hinterland of mangrove forests will be utilized as the site for earth ponds relatively easy to get water from the water supply system construction.

The area of such marsh lands which can be suited for aquacultural land is about 46 hectares in this village.

5) Establishment of Fry Supply System

A major problem that could bar the promotion of aquaculture in the study area is the lack of a fry supply system. Therefore, in addition to the target of promoting aquaculture in the model area, this plan should envisions the establishment of fry supply system to fulfill the need of the Study Area.

- Selection of Fry Species

This project will concentrate on giant sea perch and mud crabs in the effort to establish the supply system. Tilapia, a species now planned to be introduced in Desa Sei Cingam, will be excluded from our project because its fry are now being produced in Kec. Bengkalis. Once the fry are introduced, it will not be difficult to reproduce them in aquaculture ponds, making it unnecessary to introduce additional fry.

- Selection of Site for Possible Fry Production Facility

CHP of Kec. Tebing Tenggi, which administrates both Kec. Merbau and Kec. Tebing Tenggi, was selecting possible sites for the construction of a fry production facility from its own point of view. The site in Desa Banglas is located only about 5 km to the south of Slatpanjang and has power service already available within 2 km. It is certain that the power service can be made available to the site quite easily. Therefore, it is considered Desa Banglas is the first priority as the site of new fry production facility.

The new facility in Desa Banglas will be constructed in the existing shrimps aquaculture demonstration facility located along the Suwir river and now managed by the fishery department of Riau Province.

(6) Key Points for the Promotion of Aquaculture

1) Desa Pelantai

- Fish species for aquaculture

Two types of aquaculture are considered in this village; marine cage culture and terrestrial pond breeding. A species suitable for marine cage culture is giant sea perch. Species suitable for terrestrial aquaculture pond are giant sea perch, giant tiger prawn and mud crab.

At present, all the marine cage culture in the study area are located in the mouth of rivers. Though suitable for breeding, the area within the mouth of rivers fit for this application is too small in size. Consequently, it is desired to exploit a wider area in an expanse of the channel.

The aquaculture of giant tiger prawn is technically established now and can be developed at the initiative of the private sector. In contrast, the aquaculture of mud crab is a technology that is quite new and still in an initial experimental stage. The fishery authority is trying hard to make their attempt successful. With growing markets like Singapore at hand, this area has a promise of good business in aquaculture of mud crabs and shipping them alive. Further support and assistance are needed to make its development successful.

All in all, the species most suitable for fish culture in this area are giant sea perch for marine cage culture and mud crabs for terrestrial pond aquaculture.

- Introduction of cold storage for feed stuff preservation

Because Gombang fishing in the area is limited to the period of spring tide, feed stuff is not supplied for two weeks a month. To deal with this problem, the existing breeding farms dry and preserve fishes taken in the period of spring tide. This situation, however, causes the deficiency of vitamins and essential fatty acids.

In this project, it is essential to provide a cold storage facility capable of preserving one week's stock of foodstuff against the period of neap tide.

- Introduction of sylvofishery

In the pond breeding of mud crab, platforms will be provided in the pond to serve as nests. It may be also necessary to study the introduction of sylvofishery, in which mangroves are planted as platforms. Mangroves can be planted in the low-vegetation marshlands where aquaculture ponds will be constructed.

2) Fry Production Facility in Desa Banglas

- Objectives of activity

One of the objectives of this facility is to provide a stable supply of fries at low cost to the breeding farms and ponds now existing in the area. Accordingly, the species chosen for production will be giant sea perch and mud crabs, which are presently being cultured in the farms and ponds but the supply system of which is still inadequate.

On the other hand, large quantities of giant sea perch are being grown in neighboring countries, such as Thailand and Malaysia. In view of this, it will be necessary in the future to introduce new species for aquaculturing. This facility will be responsible for the research and development of new species for aquaculture in addition to the production of fries of the above two species.

- Determination of production scale

Fries produced in this facility will be supplied to the existing breeding farms and ponds in this area. Therefore, the scale of this facility will be set at a level to match the demand of this area.

4.3.3 Fish Marketing / Processing

(1) Present state of fish marketing / processing

1) Condition of fisheries infrastructure

Fishermen in the village mainly work with sampans, and most of them catch fish for home consumption and are also involved in another job. The number of fishermen who sell the fish catch is extremely limited. All fish are consumed fresh within the village, but they are not of quantity to meet the demand. Processing of the fish does not take place in the village.

- Landing facilities

There are two jetties at Dusun Pelantai and Dusun Kengkam. At Desun Kengkam, the existing jetty is wearing out and a new jetty is being constructed by Gotong Loyong in this Dusun.

- Ice plant facilities

There are no ice plant facilities in this village.

2) Marketing structure

Fishery in the village is mainly focused on small-scale fishing for home consumption; the fish are not landed outside the village. The fish supply by current fishing does not even cover the demand of the village, so the village is dependent of the fish supply from outside.

3) Price of the fish

Fish are sold directly to consumers in the village. Therefore, the prices indicated here are the consumer prices (see Table 60). Fish coming in from outside are small in size or low quality fish that are not for sale in the markets of Slatpanjang.

(2) Problems of fish marketing / processing

Fish supply by current fishing is low; they are entirely sold and consumed as soon as they are landed, thus creating no particular problem regarding the condition of fish marketing within the village. The problems for the village are on the supply side. Currently the village depends on the fish coming in from outside to complement the inadequate supply of fish to be consumed within the village. The first step to be taken to improve the situation will be to increase the local production and to facilitate the acquisition of fish.

4.3.4 Fishermen Organization

(1) Current state of the fishermen's organizations

In Desa Pelantai, there has been no financial support from the government to date, and neither have there been any attempts to organize a KUD or a kelompok by the fishermen. Fishing activities are limited to those of individual family units, with virtually no horizontal connections among the fishermen.

(2) Relationship between the Tauke and the fishermen

In Desa Pelantai, there is neither a Tauke whose occupation is fishing nor the control of fishermen by a Tauke. In the village, there are two fishermen who operate powered boats, but these fishermen are not indebted to any Tauke, including those of other villages. They operate from their own funds.

(3) Problems in the Village

1) Unorganized part-time fishermen

Much of the fishing is for the purpose of personal consumption. Although statistically they are classified as fishermen, as a means of gaining cash, most of the villagers are engaged in wage labor, such as felling work of sago forests and mangroves. For this reason, there are no connections among fishermen and, under the current circumstances, organizing them would be very difficult.

In this village, which has few sources of cash income, it is necessary to organize the fishermen who are statistically considered fishermen but are currently engaged in wage labor. This will increase their opportunities for employment through the promotion of a new fishery industry such as aquaculture by these fishermen.

2) Lack of means of procuring financing for fishing

Because their is no Tauke in the village, it is not possible to receive the financing to purchase fishing boats and equipment and for operations from a Tauke. Although the fishermen are not restrained by a Tauke through debt, it is difficult to carry out the fishing that requires some initial investment, such as for a Gombang nets. Therefore, the fishing of this village will take place through gill-net. For Pengirih, it will take place through small sampans, which require only a small initial investment. Yet, because the fishing will be for a variety of trash fish, this will not lead to cash income.

3) Necessity for market development

Currently, in the village there is no fish catch that has a high cash conversion characteristic, just as there is no Tauke involved in catch collection operations. In order to establish a new fishery industry such as aquaculture, its marketing routes and customers must be developed. However, since there has been almost no contact with a Tauke, a sufficient amount of caution will be required in the relationship with the Tauke when developing its new markets.

4.3.5 Current Condition of Model Mangrove Area

(1) Characteristics of distribution of mangrove forests

This area is located at the southeastern end of the Padang Island. The area faces the Merbau Island beyond the Asam Channel. There range *Rhizophora* spp. dominant mangrove forests along the Asam Channel (Inland-sea type mangrove forest). Most part, except for the area near Tg. Merantibunting, is low forest. The range of forests is narrow in width (about 300m) except along rivers.

Two HPHHs are set in this area. Many coconut, sago palm, and rubber trees are distributed in the hinterland of mangrove forests observed, where secular changes of mangrove coverage are recognized. In the north end, there are petroleum related facilities such as wells, and petroleum development is under way.

(2) Functions of Mangrove Forests

The mangrove forests in this area are inland sea-type forests. With the supply of fresh water from inland peat swamps, the brackish area is rather small. Tall mangrove trees are still observed in the south as the felling intensity is low. However, the stand conditions have deteriorated in the north except in areas along rivers. The local inhabitants of Desa Pelantai largely depend on the sale of mangrove timber for cash income, making the maintenance of mangrove trees as forestry resources necessary.

(3) Mangrove Forest Management

a. Impacts of Forestry Policies

While some positive effects of the regulative measures are observed along the coastal belt, stand conditions at the inland may be worse. Tightening the control appears necessary to improve the situation.

b. Mangrove Forest Management

As implied by the situation described in a. above, there appears to be a shortage of manpower to effectively control or manage the mangrove forests in the model mangrove areas. One feasible improvement measures for all the model mangrove areas is an increase of the staff level (CDK staff members) to tighten control and to provide proper guidance for local inhabitants.

c. Reforestation of Mangrove Forests

Compared to Muntai and Sei Cingam model areas, mangrove forest areas have been better sustained in this model area. While there are some dwarf sparse stands and marsh lands with low vegetation, their total area is negligible. Reforestation should be conducted using the same method to be employed for the S. Cingam Model Mangrove Area.

(4) Felling of Mangrove Forests

The currently observed low *Rhizolhere* species stands (LR-s) are assumed to be the result of intensive felling. The felling intensity intends to decline in case of mangrove forests located further inland because of the dependence on sampans to transport the wood.

This model area has the least number of cut-over areas compared to the other two model areas.

(5) Production and Distribution of Mangrove Charcoal

Manufacturing forms of mangrove charcoals are almost the same as the study area. Two HPHH a re established within the model mangrove area of 454 ha and one kilns are installed in Pelantai Model Mangrove Area. Applying the restriction of green belt area, the area of supplying charcoal woods is 175 ha, and calculated annual total growth volume of the mangrove trees is 263 m^3, thus a maximum number of charcoal kilns is 0.6 and a maximum total annual yield of the products is 29 tons. The current number of kilns (1) which is more than double of the maximum number is judged to be over manufacturing.

Charcoal manufacturers operating in this site export their products to Singapore or Malaysia through dealers operating in Dumai.

4.3.6 Environmental Matters

The village of Desa Pelantai is located in the eastern region of Padan island and to the south of the Asam channel. The direction of tidal flow in the channel is changeable; from north to south at high tide, and from south to north at low tide. The depth of water is a few meters near the shore and reaches about 25 m in the middle of channel. Sea water in the channel intermingles with the change of tide, and current rips are conspicuous.

(1) Sediment outflow

The sea water drastically changes in the Asam channel. The ocean water flows into the middle of the channel at high tide to turn the water bluish green. In the rainy season, land water flowing from the Panjang channel spreads into the sea and turns the entire channel water light brown.

Erosion by the action of waves is seen in many places along the shore. Near the Dusun Kengkam jetty, the shoreline is gradually moving inland.

(2) Felling mangroves

Felling mangroves is one of the main sources of income in this village. Mangrove forests suitable for felling have diminished within this village, and some villagers go to other villages to fell mangroves.

(3) Water pollution by mineral oil

The occurrence of oil films has been observed in the Asam channel at a frequency of one to three times a month for the part 10 years. Oil smelling fish are caught, infrequently though.

In 1991, exploratory crude oil drilling was done at RW III of the Asam channel. The site is still off-limits. Nearby drilling stations include those at north Bletung 30 km to the north, Lalang and Sungaiklau. These facilities started operation in the middle of 1980's. No oil spills or other damages have been reported to date.

Drifting tar balls are observed almost every day. They drift to the shore at a frequency of more than once a month and stick to the roots of mangroves. The drifting of oil films from ballast dumped by tankers prior to their entry into the north Bletung port is noticeable in the season of northerly wind.

(4) Other considerations

The Asam channel is a route for ferry boats cruising around nearby villages. Therefore, when set net fishing is introduced in any development plan, in addition to bagnet fishing such as gombang now popular in the channel, it is essential that ship navigation routes should be secured in the plan.

In view of the speed of current reaching as high as 0.77 m /sec. in the channel, any marine structures built under this project must be designed to withstand water pressure from the current.

4.4 Desa Tlk. Ketapang

The map of Desa Tlk. Ketapang is shown in Fig. 18.

4.4.1 Socio-economy

(1) Population

The population of Tlk. Ketapan in 1992 was 1,674 people and 310 households. The annual population growth rate was about 2.9 percent from 1986 to 1992 which was higher than the entire Kec. Merbau (2.3 percent per year).

In 1992 the population of Dusun Terus, Ketapan Hulu, Ketapan Hilir, and Peskul was 520, 304, 676, and 174 people, respectively, with 83, 60, 141, and 26 households, respectively. The working population (ages 10 to 55) ratio for the aforementioned four Dusun was 77 percent, 68 percent, 69 percent, and 70 percent, respectively.

There are 200 Chinese Indonesians, comprising approximately 12 percent of the population and residing in the Dusun of Terus, RW01, and RT01. There is a wooden jetty here which can be used for loading and unloading cargo. In addition, there are five to six stores selling oil and fuel. Although they are small in scope, they form the center of the adjacent village.

(2) Distribution of fishermen households

As for the number of fishermen, the number in the data of BANDES and the number from the interview are not same. However, the number of fishermen obtained from the interview will be used as the number of fishermen.

The fishermen population of Tlk. Ketapang in 1986 and 1992 was 225 and 256 fishermen, respectively. The annual population growth rate for this period was 2.2 percent, which was lower than the annual population growth rate of 2.9 percent.

The Dusun of Terus, Ketapan Hulu, and Ketapan Hilir border the Asam channel and contain rivers flowing into it. In addition to the jetty in Dusun Terus, there is a wooden jetty in front of the sago processing plant and simple wooden jetties used in loading and unloading gombang. Fishing boats are moored in the river flowing into the channel or near these jetties. Generally, fishermen own homes that are slightly inland from the Asam channel and the majority live in the Dusun bordering the channel. Many reside in the north where there are 104, 80, and 57 fishermen living in Dusun Ketapan Hilir, Ketapang Hulu, and Terus, respectively. There are only 15 fishermen living in the inland Dusun Peskul.

(3) Number of employed workers and production value by major industry

Jobs in Tlk. Ketapang in 1992 were, in the order of number of workers, other (i.e. not specifically categorized)(410), fishery (256), plantation (207) and stock farming (164). Additional categories included vegetable farmers (37), industrial workers (25) and service industry workers/ merchants (58). In terms of the yield of production, the top was agriculture/stock farming (294 million rupias) followed by fishery (276 million rupias), other (221 million rupias), service/commerce (73 million rupias) and industry (54 million rupias). The yield of "Other" was small because the item included simple laborers such as those engaged in the felling of mangroves. Cultivated land was 203 ha. for rubber trees, 115 ha. for sago palm trees and 75 ha. for palm trees. These trees were mostly grown in plantations.

(4) Life of the villagers

As in other villages, village roads are repaired and cleaned by gotong royong (mutual aid).

(5) Financial capacity of the villagers

There are no banks in Pelantai. To use a bank, villagers must go a long way to Selat Panjang or Tlk. Belitung on a ferry boat, so they rarely take advantage of bank facilities. If they have money to spare, they will usually buy gold or hold the money in cash. In our survey of residents' intentions and impact, about one half of the respondents replied that they had money to spare every month or once in a while. The interviews disclosed, however, that most of such spare money was spent for children's education, medical care, entertainment, Idulfitri (grand festivals after fasting) and contingencies, but was not saved for the future.

According to the residents' intention survey, their annual income averaged 1,778,000 rupiahs per family or 306,000 rupiahs per capita. This is far lower than the poverty line of US$ 160/year.

The above suggests that it is beyond the capacity of the villagers at large to bear a new financial burden, and that any projects must be planned on the basis of financing the project expenses through the projects' own income or government aid.

4.4.2 Fish Production

(1) Present Condition of the Fishing Village

1) Number of fishermen and fishing boats

Desa Teluk Ketapang has a fisherman population of 256 distributed over the entire Dusun. The fishing boat comprises 256 non-powered boats and 2 powered boats(see Table 61).

In 1992/93, the government implemented two financial aid projects for this village. One project was made under the APBD II program and furnished two Gombang net sets for each fishing family, totaling of 60 sets for 30 families. These Gombang nets were intended to fish for anchovies. The other aid project was made by PKT for 40 fishing families, who were given 40 Gombang net sets in total (i.e., one set for each family), 20 sampans and 20 drying yards (i.e., one sampan and one drying yard for every two families), to fish mysids. At the time of our survey, the PKT aid was in the stage of delivering the materials and was not put into operation yet. Aside from the above aid projects, 9 fishermen were engaged in Gombang fishing. It was estimated all in all 87 Gombang sets (not counting the nets supplied under the PKT aid) were being used at the time of this survey.

In addition, gill-net fishing and Pengerih fishing are practiced by 2 powered fishing boats.

2) Condition of fisheries infrastructure

As stated above, Desa Teluk Ketapang is one of the major channel traffic bases in this area, and fuels for such traffic boats are sold here. There are two jetties

in Dusun Terus, the center of the village. In addition, small makeshift jetties are attached to fish drying yards (locally named Banliau scattered along the coast of Asam channel to dry anchovies caught by the Gombang fishing.

Fishing equipment and tools such as gill nets can be purchased at Slatpanjang.

3) Felling of mangroves by fishermen

Many fishermen in Desa Teluk Ketapang are engaged in the felling of mangroves for a living. Mangroves are used as fuel to boil Gombang catches before drying them in the sun. In some cases, besides used as fuel, mangroves are sold to charcoal manufacture.

(2) Main Fishing Methods and Fishing Grounds

1) Fishing seasons

The best fishing seasons of Gombang in the Asam channel in front of Desa Teluk Ketapang are September - December.

2) Main fishing methods and the types of fishing operation

The main fishing method employed in this village is the Gombang fishing method. Like gill net fishing and other fishing methods, Gombang fishing is operated during the spring tide. The nets are removed during the neap tide and again installed at the next spring tide. There are two types of gombang netting, i.e., the intermediate level netting and the bottom level netting. The gombang method employed by this village is the intermediate level netting designed to catch anchovies. Although the Pengirih method belongs to the same type of bag net fishing as Gombang, the target fish of Pengirih is different from that of Gombang because the Pengirih fishing nets are placed on the bottom level of the sea (to catch shrimps and small fish). Because of this, a recent increase in Gombang fishing operations under the government support has not affected the catch of Pengirih fishing at all.

The fishing grounds for all the fishing methods is an area in the Asam channel in the shore frontage of the village. The target of Gombang fishing in the daytime is mainly anchovies. Mysids are also fished, but they are small in volume. The Target fish of Pengirih is mainly shrimps and small fishes. Gill net fishing and bottom long line fishing in this village target fishes mainly comprising small fish as in the case of Desa Pelantai. Wolf herring and narrow-barred king mackerel in are also fished, but they are mostly small size.

3) Sale of the catches and profit sharing

Fishery in Desa Teluk Ketapang is primarily family operations with scarcely

any hired fishermen.

All the anchovies hauled by Gombang are boiled and dried, and then shipped to Slatpanjang for sale. Fish caught by gill net fishing are sold to grocers handling fresh fish in Dusun Terus or directly marketed to consumers.

Although someone own rubber or coconut palm plantations and get money from sources other than fishery, most of the fishermen earn cash as wage workers working for the felling of sago or mangroves, or for rubber plantations, etc.

4) Use of ice

Sampan fishermen in this village do not use ice as in Desa Pelantai because their fishing grounds are in the Asam channel. Since fish caught by gombang are boiled immediately after hauling, it is not necessary to use ice. This means that practically no ice is used for fishery in this village.

(3) Estimation of fish catch

According to the on-site interview, there was no difference between the lean and prime fishing seasons in the Gombang fishing activity, with fishermen operating 14.5 days per month all year round. Calculated from the average daily fish catch per net of Gombang fishing, the average daily fish catch of all the 87 Gombang fishing sets will total about 1,600 kg/day (see Table 62).

At the time of the field survey, the 40 Gombang sets supplied under the PKT aid were not operating. A test operation by this survey resulted in a catch of 5.2 kg of mysids per night. Based on this result, the total catch of all the 40 Gombang sets is estimated at 208 kg.

(4) Problems of the fishery in this village

Two problems are encountered by the fishermen of this village:

1) Catches by gill net fishing are mostly small fish

As in the case of Desa Pelantai, the village's gill net fishing in the Asam channel cannot expect a large catch of such high commercial valued fish as wolf herring or narrow barred king mackerel. The catch is limited to small fishes of those of lower commercial valued. Thus, the present gill net fishing cannot earn much money.

2) Unexploited Gombang fishing grounds

In this village, the shore on the north of RW 03 is not inhabited by fishermen. The fishermen in RW 01 and RW 02 have no access to the RW 03 because they are all sampan fishermen and their sampans are not fit to cover such a distance.

Thus, the good gombang fishing grounds in RW 03 are left unexploited.

4.4.3 Fish Marketing / Processing

(1) Present state of fish marketing/processing

1) Condition of fisheries infrastructure

There are two jetties at Dusun Trus and one at Dusun Ketapang Hilir in the village. These jetties are used not only for landing fish catch but also for landing general daily supplies. The jetties at Dusun Terus in particular are landing spots for ferryboats; in other words, there are the gateways to Desa Tlk. Ketapang.

Other than public jetties, there are many drying-yards for anchovies along the Asam channel. Anchovies are the products of Gombang fishing. The drying-yards serve as landing spots for sampans. Drying-yards for twenty fishing households are under construction with the aid of PKT.

There are no ice plant facilities in the village.

2) Marketing structure

The fishery in the village is centered on Gombang fishing. That for anchovies is now operated, and the catch are shipped to Slatpanjang in the dried form.

Gombang fishermen of the village form a kelompok (groups). The kelompok is divided into three sub-kelompoks according to the district. Dried anchovies are shipped through sub-kelompoks. The catch of Gombang are boiled and dried. Then they are collected at sub-kelompoks and shipped to the wholesale Taukes.

Mysids are harvested as by-products of gombang fishing, and are also boiled and dried to be shipped as the dried product.

3) Price of the fish

The price at which dried anchovies are sold to the wholesale Taukes of Slatpanjang varies according to the quality of the products and the seasons; it is generally between Rp.1,700 and 3,500/kg. Dried mysids are sold at Rp.300 - 1,000/kg. The size of the market in Slatpanjang is small, however, and some shops refuse to buy them.

(2) Problems of fish marketing / processing

1) Lack of means of drying anchovies during the rainy season

Boiled anchovies are spread onto the drying-yards to be dried in the sun. However, the peak season for anchovies is between September and November and falls into the rainy season. Sometimes the fish cannot be dried and become spoiled.

2) Lack of dried anchovy processing technology and quality control

Dried anchovies as products vary its water contents and include different sizes of fish or chipped ones. Other small fish or mysids are often found. These elements affect the quality and eventually the selling price of the products.

It is necessary to raise the quality of the dried anchovies by improving the production process.

4.4.4 Fishermen Organization

(1) Current state of the fishermen organizations

In 1992/93 in Desa Tlk. Ketapang, there were two government projects, the APBD II and the PKT. Kelompoks were formed along with these projects.

1) The APBD II kelompok

This kelompok was formed in February of 1993 as an organization to receive the two Gombang nets for each family. This kelompok has a large number of members, 30. They are divided into three sub-kelompoks.

The kelompok is involved in the following activities:

① Sponsorship of an annual general meeting.

② Joint shipment of dried anchovy products in sub-kelompok units.

③ Coordinating the talks between those involved when the location of the Gombang net installations change.

④ Joint handling of operations that are impossible for one individual, such as the work of driving stakes for the Gombang nets.

⑤ Assistance in purchasing new equipment when a member's equipment is stolen or washed away by the water.

The members are obligated to donate 5,000 rupiahs each month. This money is used to purchase fishing equipment for the members mentioned above.

2) PKT

This project involves providing Gombang nets to villagers in June of 1993 and providing sampans to them in September of 1993 using financial assistance from the PKT. When we surveyed this area, the materials that were being provided had just arrived and had not actually been put into operation. The kelompok had not even been formed yet. However, a decision already had been made to organize the 20 fishing families who would benefit from the project and organize a kelompok by the end of September.

The product of this project (various types of mysids) is scheduled to be processed for terasi. The construction of a processing facility also is part of the project. The plan is for the 20 villagers who will participate in the terasi processing