factory to form a new kelompok.

(2) Relationship between the Tauke and the fishermen

As in Desa Pelantai, there is no Tauke in this village whose occupation is fishing.

(3) The problems of the village

1) Unorganized part-time fishermen

As in Desa Pelantai, there are villagers who in the statistics are classified as fishermen, but in reality many of them are part-time fishermen who are engaged in the other work such as wage labor. However, in this village, these people have already been receiving the benefits of the APBD II and PKT projects, which have promoted organizing the fishermen. It is necessary to promote the organization of these part-time fishermen and establish a new industry that promotes a fishing business by these fishermen and increase their chances of employment.

2) The inadequacy of financial institutions engaged in financing for activities

As previously stated, the members of the kelompok are obligated to make a 5,000 rupiahs donation each month. On Merbau island where the village is located, there is no bank. Thus, depositing and withdrawing money is very inconvenient. It appears that it is necessary to take effective measures for handling the cooperatives money.

3) The inadequacy of means of funds procurement for fishing

As with Desa Pelantai, there is no Tauke in this village and, therefore, no means of obtaining funds to finance fishing. Most of the fishermen who have benefited by being provided with Gombang nets because of the financial support of the APBD II and the PKT projects, had been gill-net fishing using sampans until then or had been engaged in felling work of mangroves. They are typical examples of people who would convert to fishing, which brings in cash, if only they could obtain the initial investment required to purchase fishing equipment.

4.4.5 Current Condition of Model Mangrove Area

(1) Characteristics of mangrove forest

This area is located in the southwest part of the Merbau Island. The area faces the Pelantai forest area beyond the Asam Channel. *Rhizophora* spp. dominant mangrove forests range along the Channel (Inland-sea type mangrove forests). There are large mangrove forests along the rivers in the north inland part. The range of the mangrove forests to the south of Teluk Ketapang is narrow in width (about 200m). There range mangrove forests where partially high and medium *Rhizophora* spp. is dominant, from the Terus village in the south to the coast of the S. Rengit Channel.

There is one HPHH on the north coast of the Asam Channel, and 2 along the Rengit Channel. There are also 3 sites of charcoal kilns.

Near the residential area in the hinterland, there range coconut trees and rubber trees. Between mangrove forests and inland high forests, the development of sago palm trees in under way. Land conversion to coconuts, rubbers and sago is considered to be one of the reasons of secular changes of mangrove coverage (especially rear mangrove).

(2) Function of mangrove forest

The general conditions are the same as those of the Pelantai model mangrove area and the use of mangrove forests as forestry resources is hoped for. The large and frequent waves caused by speedboats erode the substratum at the edge of forests. The increased maritime traffic through the S. Rengit Channel in this area in recent years has been eroding the substratum of the edges of mangrove forests there. Restrictions on the navigation speed appears necessary to prevent such erosion. The increased maritime traffic in this area has also made it desirable for mangrove forests to provide a pleasant landscape as well as sites for health resort and ecoturism.

(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 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 mangrove area. While there are some dwarf sparse stands and marshland with low vegetation, their total area is negligible.

(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. Four HPHH are established within the model mangrove area of 1.413 ha and four kilns are installed in Tlk.Ketapang Model Mangrove Area. Applying the restriction of green belt area, the area of supplying charcoal woods is 622 ha, and calculated annual total growth volume of the mangrove trees is 933 m^3, thus a maximum number of charcoal kilns is 2.1 and a maximum total annual yield of the products is 101 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.

4.4.6 Environmental Matters

The village of Desa Tlk. Ketapang is located on the northern part of Merbau island, opposite Desa Pelantai across the Asam channel. Near the jetty of Dusun Terus is a ferry boat departure point where many other boats also arrive and depart frequently. Around the jetty, there is a cluster of houses of people living on the water, and many wastes from daily life are floating around.

(1) Sediment outflow

To the south of this village is the Rengit channel running between Merbau island and Tebing Tenggi island. This channel is a ship's route connecting Pekan Baru and Slatpanjang and has heavy ship traffic. The Rengit channel is so small, with a breadth of only about 100 m, that waves produced by ships coming and going through the channel have a great impact on the erosion of shoreline. In the forests along the shoreline, many mangroves were observed toppled by soil erosion around their roots.

(2) Felling mangroves

Similar to Desa Pelantai, felling mangroves is a popular means of making a living. Although the shores of Asam channel and Rengit channel are covered by mangroves, many clearances are seen on the Asam channel side, which is rather densely populated. The forest bed of densely grown mangroves on the shore looks gray or light brown. The shore consists of a mixture of stepped and sloped hills and forms an uneven shoreline with irregularities of three to seven meters.

(3) Water pollution by mineral oil

Crude oil drilling is in operation in north Bletung to the north. The drilling station completed facility construction and started operation in the middle of the 1980's. No oil spills have been reported yet. However, drifting oil films and tar balls are continually seen all the year around.

(4) Industrial effluent

There is a sago palm processing plant operating under KUD on the shore of Asam channel at RW II. The plant started its operation in 1991, processing three tons of materials a day. At present, the effluent is not treated but simply drained to the shore. The brown effluent gives off a strange odor around the plant.

(5) Other considerations

In the Rengit channel, it is difficult to conduct fishing operation or build any structures on the water because of small channel breadth and heavy ship traffic. In the Asam channel, the influence of a tidal current must be taken into consideration, as in the case of Desa Pelantai. When building a structure in the Asam channel, where Gombang fishing is very active, it is necessary to devise some means to allow both the structure and Gombang fishing coexist successfully.

5. Formulation of Policies for Coastal Resources Inventory Management and Enhancement

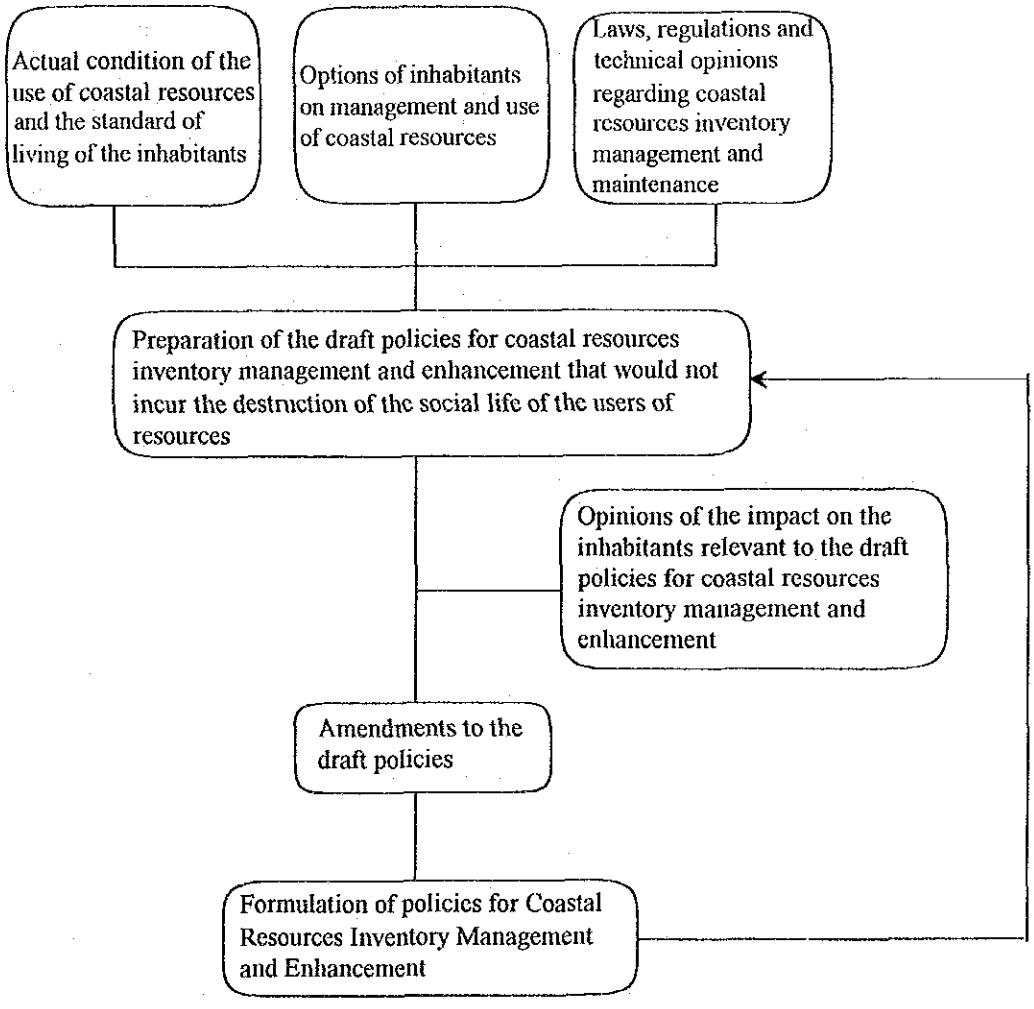
5. Formulation of Policies for Coastal Resources Inventory Management and Enhancement

5.1 Process of Policy Formulation

Policies for coastal resources inventory management and enhancement have been formulated through the process shown in the figure below.

At the first stage, the draft policies concerned were prepared, taking into account three points: 1) laws, regulations and academic opinions regarding coastal resources inventory management and conservation, 2) the actual condition of utilization of coastal resources and the living standard of the inhabitants, and 3) opinions of inhabitants on management and utilization of coastal resources. Another matter of consideration was to avoid the destruction of the social life of the users of the resources.

At the last stage, the policies have been formulated after the draft policies were amended in such a way that the opinions of and the impact on the inhabitants relevant to the proposed policies was taken into consideration, that the policies might be acceptable to the local inhabitants, and that the management and enhancement of coastal resource could be achieved.



If we try to explain the process of policy formulation in detail, each of the above-mentioned stages needs to be described. However, the difference between the draft and the final policies is relatively small, so we shall not give a full description of the policy formulation process but only give the following summaries in the next section:

1) Considerations relating to formulation of draft policies concerned
2) Contents of formulated policies

Major modifications made to the draft policies according to the opinions of and the impact on the inhabitants will be mentioned in 2) whenever appropriate. Coastal resources were classified into fishery resources and mangrove forest resources, each of which is summarized as above.

5.2 Formulation of Policy for Fishery Resources Inventory Management and Enhancement

5.2.1 Considerations upon Formulation of Draft Policy

(1) Basic structure of fishery resources in the Study Areas

Numerous rivers flow into the Malacca Straits, sandwiched between the Malaysian peninsula and Sumatra Island. The area is mostly surrounded by mangrove forests on both sides. As a result, the Malacca Straits is rich in nutrient salts and decomposed organic substances. The water environment is suitable for the reproduction of fishery resources belonging to the lower position of the food chain system (mysids, shrimp, anchovies, etc.). Fishes on the higher position of the food chain (wolf herring, narrow barred king mackerel, etc.) which feed on the said lowered positioned fishes are also found in these waters, and are harvested as useful fishery resources.

Although the flow of the current in the Malacca Straits shifts at ebb and flow, it basically flows north-westward. As the waters of the Study Area are located at a particularly narrow part of the Straits, the current is strong and the water mass is sufficiently stirred, forming excellent fishing grounds.

(2) Opinions of inhabitants on problems relating to fishing activities and fishery resources

An example of the measures taken in fishery resources management on the Indonesian side of the Malacca Straits is the ban on trawling implemented in 1981 as the Presidential Decree (Pelaksanaan Kredit Keppres No 39/1980).

In 1980, the fish production of Kab. Bengkalis was 114,274 tons, of which the production by marine fisheries accounted for 97 percent. Forty percent of the total production by marine fishing was achieved by 216 trawlers in 1980, the last year before the trawling was banned. The yield by trawlers consisted of 77 percent various fishes and 23 percent shrimps. But the trawling that harvests regardless of species or size of the fish has oppressed the coastal fishery resources, causing discord with the local fishermen who earn their daily bread through coastal fishing.

Under these circumstances, prohibition of trawling throughout Indonesia, except for an area in eastern Indonesia, came into force by the said Presidential Decree. As a result, fish catch volume by marine fishing in Kab. Bengkalis dropped to 83,781 tons in 1981. Its marine fish catch volume thereafter ranged between 80,000 - 90,000 tons; 84,581 tons in 1990, and 84,568 tons in 1991.

The Malacca Straits is the major marine fishing grounds for Kab. Bengkalis, and the potential fish catch volume has been estimated at 84,928 tons (Evaluasi Perkembangan Perikanan Riau Pada Repelita V S/D Tahun 1991/1992 dan Usulan Program/Proyek 1992/1993). In 1980, the year preceding the ban on trawling, 135 percent of said potential fish catch volume had been actually harvested, and the 100-percent level has been maintained ever since. Therefore, no further increase in catch volume could be anticipated under the current fishing methods. Nevertheless, the number of fishermen households in the area rose from 4,339 in 1981 (3,936 owning a fishing boat) to 6,846 in 1991 (5,130 owning a fishing boat). With the stagnant harvest from the fishing grounds within the Straits since the ban on trawling, the harvest per household has actually been on the decline.

The findings from the "Opinion Poll on Development and Conservation of Coastal Resources," which has been carried out as a part of this Study, show that 73.7 percent of the fishermen claim that the catch volume has dropped, and 86.5 percent of them think that the reason for this decline is the increasing number of fishermen.

Under these circumstances, some fishermen have moved their fishing grounds due to the decline in fish catch resulting from the increase in competition. However, the fishing grounds within the Straits are limited in area, and it is practically impossible to develop new fishing grounds under the current methods. Therefore the fishermen can only move from one existing fishing ground to another seeking for fish.

Although the fishermen in the Study Area recognize that the fishery resources are limited, and that the number of fishermen is on the rise, they are unable to come up with an effective solution. However, it is clear that they are aware of the existence of a problem, and 77.1 percent of them admit the necessity of some means of conservation of the fishery resources.

5.2.2 Policy Concerned in the Study Area

Taking into account the discussions in 1) and 2) above, the draft policy on fishery resources inventory management and enhancement has been compiled. It consists of the following three sub-policies:

a. olicy on management and enhancement of the fishing activities targeted to the fishery resources ranked at the higher position of the food chain (wolf herring, narrow barred king mackerel, etc.)
   1) Enhancement of fishery licensing and monitoring systems
   2) Establishment of monitoring and analysis systems for the movement of fishery resources
b. Policy on management and enhancement of the fishing activities targeted at the fishery resources ranked in the lower position of the food chain (mysids, shrimps, anchovies, etc.) which are supported by the nutrient salts and decomposed organic substances supplied by the coastal mangrove forests and rivers flowing into the straits
   1) Establishment, conservation and management of coastal green belt areas
   2) Restrictions on bag-net fishing : Establishment of appropriate intervals for setting up the Gombang net
   3) Establishment of monitoring and analysis systems for the movement of fishery resources
c. Policy on management and enhancement through increasing the income of fishermen by organizing them, and the effective and value added use of existing resources
   1) Organization of fishermen
   2) Increasing the income of fishermen through an effective use of existing resources

Details of these three sub-policies are outlined below:

(1) Policy on management and enhancement of the fishing activities targeted at the fishery resources ranked at the higher position of the food chain system (wolf herring, narrow barred king mackerel, etc.)

The Malacca Straits is the major marine fishing grounds for Kab. Bengkalis, and it is highly possible that the fish catch volume under the current methods has already reached the potential fish catch volume. In order to maintain the current catch level within the area, it is necessary to restrict the increase in the number of fishermen, fishing boats and fishing gear.

1) Enhancement of fishery licensing and monitoring systems
   ① Enhancement of registration of fishing boats (except non-powered boats) and fishermen based on the existing fishing regulation
   ② Restrictions on the size and number of fishing gear according to the size of the fishing boat; especially, restriction on the mesh size of the fishing nets

③ Obligation to display the registration sign on the side of the boat in order to enhance the registration of the boats

④ Prevention of operation by unregistered boats by establishing the fishery supervising system using a small rapid boat (penalties such as removal and confiscation of the fishing gear)

⑤ Ban on specific fishing methods or establishment of the fishing grounds specified by fishing methods

The following are the modifications made to the draft policy:

- Restrictions on the mesh size of the fishing nets:

  This point was not mentioned in the draft policy, but ② has been developed as follows. In some villages, it has been observed that some fishermen replaced their fishing nets with those of smaller mesh. Harvested fish, including those for export such as wolf herring and narrow barred king mackerel, are mainly smaller in size, and the price has dropped sharply. Therefore, making the fish nets of smaller mesh size will be restricted in order to prevent overfishing of younger fish.

- Prevention of operation by unregistered boats:

  Many claim that ④ will not be effective unless there are punitive measures, so penalties such as removal and confiscation of the fishing gear shall be included in the monitoring for the prevention of operation by unregistered boats.

- Ban on specific fishing methods:

  This point has been added as ⑤. Many mishaps, such as the drift gill-nets getting entangled with the bottom gill-nets, have been reported. It is therefore necessary to take preventive measures such as a ban on specific fishing methods (Jaring Kurau, etc.) or establishment of the specific fishing grounds by fishing methods.

2) Establishment of monitoring and analysis systems for the movement of fishery resources

① Establishment of long-term monitoring and analysis systems for the movement of resources regarding the target species, including their ecology

② Development of an appropriate fishery management method

③ Conduct of an educational activity aimed at fishermen on the importance of management of fishery resources as a part of fishermen organization's activities.

Results of a survey on the opinions of and the impact on the inhabitants show that over 70 percent of fishermen in both model areas of Muntai and Sei

Cingam think it is necessary to establish monitoring and analysis systems for the movement of resources. However, most of those who do not agree say that they do not understand in what way the establishment of monitoring and analysis systems for the movement of resources concerns their own life. Some of those who recognized the necessity of monitoring and analysis systems may not have fully understood what kind of measures would be involved. It is therefore necessary to conduct a sufficient educational activity on the maintenance of fishery resources and fishing prior to establishing monitoring and analysis systems for the movement of fishery resources.

Such are the reasons for the inclusion of ③ in this policy.

(2) Policy on management and enhancement of the fishing activities targeted at the fishery resources ranked in the lower position of the food chain (mysids, shrimp, anchovies, etc.)

As mentioned in section 5.2.1 (1), the Malacca Straits forms a marine environment suitable for the propagation of the fishery resources ranked at the lower water area of position of the food chain (mysids, shrimp, anchovies, etc.). Bag-net fishing within a green belt zone may lead to overfishing of the said resources. Therefore it is necessary to restrict the bag net fishing in small- and medium-sized rivers within the coastal green belt.

1) Establishment, conservation and management of the coastal green belt areas

Refer to section 5.3.2 (2) 4).

2) Restrictions on bag-net fishing : Establishment of appropriate intervals for setting up the Gombang nets

Concrete means of restriction were not mentioned in the draft policy. The following have been decided based on the results of the field study.

- Establishment of appropriate intervals for setting up the Gombang:

The fishing law in Riau Province restricts the intervals for setting up the Gombang to 1,500 m to the front and back, and 100 m to each side. In Kab. Bengkalis, they are restricted to 500 m to the front and back. However, it has been observed that some fishing gear was set up at about 50m intervals to the front and back. It is necessary to determine appropriate intervals for setting up the fishing gear through the monitoring and analysis of the movement of resources explained below.

3) Establishment of monitoring and analysis systems for the movement of fishery resources

① Establishment of monitoring and analysis systems for the movement of resources regarding the target species of the bag-net fishing within the channels

② Development of an appropriate fishery management method

③ Conduct of an educational activity aimed at fishermen on the importance of management of fishery resources as a part of fishermen organization's activities.

As mentioned in section 5.2.2 (1) 2), many fishermen did not understand in what way the establishment of monitoring and analysis systems for the movement of resources would concern their own life. Therefore ③will be included to help them understand the systems.

(3) Policy on management and enhancement through increasing the income of fishermen by organizing them and the effective and value added use of existing resources

1) Organization of fishermen (refer to Fig. 19)

① Obligation for recording the volume of the fish catch sold from fishermen to the Tauke

② Establishment and improvement of the fishermen organization to conduct the following activities:

- Setting up of a guideline by the fishermen organization for the Tauke's purchase prices of the fish catch
- Selling of fish catch by individual fishermen to Tauke through the fishermen organization and collection of its handling fee
- Handling by the fishermen organization of the administrative procedures for issuing of an export permit
- Employment of the invested funds to each fisherman by the fishermen organization
- Upgrading the fishermen's managerial capacity and raising their awareness of the resource management through the technical guidance by external personnel

The following points have been modified in consideration of results of our field study and interview survey on the opinions of and the impact on the inhabitants.

- The draft policy stated that the fishermen organizations would receive from the Tauke the reserve fund for the improvement of the fishery resources according to the volume of transaction. However, as the relations between the Tauke and fishermen go beyond the village, it will be difficult to determine which Tauke will pay the said reserve fund if such payment will become an obligation. This Study proposes that the fishermen organizations will sell fish catch by individual fishermen to the Tauke and collect the handling fee accordingly. The collected money will be allotted as the fund for fishermen's support and management activities of fishery resources.
- Fishermen organizations set the minimum selling price which might be acceptable the Tauke and impose strict observance. In order to realize this, it is necessary to establish a system in which the fishermen organizations have their own means of transporting the fish catch, and that they can export the fish if required.
- Results of the said interview survey showed that many fishermen think that they can easily get investment fund in fishing activities if they are organized. However, few of them actually deposit money. Income surplus is often used for Alisan. Leaving the control of the Tauke means no more granting of fishing loans from them. In order for the fishermen to be able to manage their own operation fund, the fishermen organizations have to provide an education. During the first stage following the establishment of the fishermen organizations, members will have to deposit money. The organizations will use the money to lend the operation fund to the members.

2) Increasing the income of fishermen through an effective use of existing resources

① Upgrading quality of fish catch (raising fish price) through the supply of cheap ice, insulated fish boxes, etc.

② Increasing fishery-related income by an effective use of existing resources:
- Development of high value added products through utilization of fish catch by the Gombang fishing
- Introduction of aquaculture

③ Study of potential target species other than the existing ones under the current fishing methods, and promotion of their catching methods
- Introduction of trap fishing in the shallow water area

④ Effective use of the undeveloped shallow-water areas:

- Propagation of shellfish

Results of the said interview showed that more than 80% of fishermen in all areas think it is necessary to increase the fishermen's income through the effective use of the existing resources. Their expectations are high. A half of those who did not think it is necessary gave as their reason the lack of funds to take up new fishing activities, reflecting their concern over finances.

Fishermen's expectations are high despite their concern over finances.

5.2.3 Policy Concerned in the Model Areas

Following the "5.2.2 Policy on fishery resources inventory management and enhancement," the policy concerned in the model areas was established, based on the fishery characteristics in each area. The policy is given in Table 63.

5.3 Formulation of Policy of Mangrove Resources Inventory Management and Enhancement

5.3.1 Consideration upon Formulation of a Draft Policy

(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 green belts in local areas, based on the Presidential Decree on the conservation area (Keppres No32,1990). 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 KLH, the LIPI and the Mangrove Forest Research and Development Association (LPP-Mangrove).

This draft paper concretely deals with the mangrove forest management based on the Action Plan by BAPPENAS and/or the DEPHUT 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 : Formulation of implementation guideline for conservation of mangrove forest and development of social forestry participated by local people
- Research and Development :Application of research results to policy making and provision of research system
- Utilization and Sylviculture : Establishment of conference system by provincial level for mangrove utilization and promotion of silviculture

(2) Problems in the mangrove forest management in the study area

Problems in the mangrove forest management in the study area are summarized as follows :

a. Insufficient coastal management plan and system

- Actual conditions:

  It is supposed that mangrove forests have been diminished the most by a variety of land conversion for oil development, agricultural development, formation of communities and so forth.

- Causes:

  The regional spatial general plan (Tata Ruang Daerah) and the forest land use categories (TGHK) are not concrete to control each development.

- Countermeasures (draft):

  It is desirable to formulate a coastal management plan in Riau Province and make up definitive land use categories and future plans of mangrove lands mainly by a provincial government and so on.

  It is desirable for the central and provincial governments to enhance the communication and cooperation system among the administrative agencies concerned and appropriately arrange facilities, equipment and materials needed for the coastal management.

b. Insufficient in mangrove forest management plan and management system

- Actual conditions:

  Large size trees have diminished, and in some forests there are many standing trees of which diameter is too small to legally be allowed to fell. Therefore in some places there is a tendency of shortage of wooden material to make charcoal and illegal cutting of small trees is seen. there is a fear of deterioration of forest condition to diminish the forest in the future at places where the felling volume and the regeneration and growth volume are not balanced.

- Causes:

  There is no mangrove forest management plan to control the balance between the felling volume and the regeneration and growth volume. Felling is not appropriately controlled.

- Countermeasures (draft):

  It is desirable to formulate a national mangrove forest management plan mainly by the DEPHUT and make up the Riau Province mangrove forest management plan mainly by Provincial Forestry service in Riau Province.

It is desirable for the DEPHUT and the Provincial Forestry Service in Riau Province to take the lead in staff training and preparing facilities, equipment and materials for guidance and supervision at site.

c. Non-participation of local inhabitants into the mangrove forest management

- Actual conditions:

Most felling for land conversion, charcoal making and smuggling of wood sell to Malaysia and Singapore are directly done by inhabitants.

(3) Results of interview survey on local inhabitant's intention

- Most inhabitants recognize that mangrove forest area has been decreased and its main cause is over felling.
- They also recognize such decrease has negatively affected various village lives.
- Most inhabitants recognize mangrove forest contributes to prevent from erosion and providing nursery function for fishery resources, and have an opinion of the necessity of its
- As the method of forest conservation, planting, restriction of felling amount, setting limitation of the minimum size of trees
- Few inhabitants know mangrove related laws and regulations

5.3.2 Policy Concerned in the Study Area

(1) Purpose

1) To propose proper management procedures on mangrove forests that their functions for public benefits are declined and their resources volume are diminished.
2) To contribute toward the development planning in order to decrease stresses to mangrove forests and increase chances of inhabitants' income.

(2) Planning principles

1) The preparation of a regional mangrove forest management plan and the establishment of a plan monitoring system will be facilitated.

The findings of the interview survey suggest the existence of many large diameter trees in the past. At present, however, many forests are characterized by the lack of trees which are large enough to be legally felled. The lack of a mangrove forest management plan to balance the felling volume and the regeneration and growth volume taking the local conditions into proper consideration and also the absence of a monitoring system for such a plan have presumably contributed to the present poor state of mangrove forests.

2) In order to either conserve or sustainable utilize the existing mangrove forests, conversion to other types of land use to improve the land productivity shall not be conducted.

a. The areas have a fairly active charcoal industry using mangrove trees, providing cash income for immigrants from Java and other islands and for locals. The status of the charcoal industry in the local economy in relatively high as it is an important export industry in the Riau province.

b. While the conversion of mangrove forests is relatively easy, a long period of time and a large social cost will be required to restore them to their original state.

3) Social forestry will be introduced to facilitate mangrove forest management by local inhabitants.

a. A positive participation of local inhabitants to forest management can result in proper management of mangrove forests.

b. Measures other than the felling of mangrove trees must be implemented to support the livelihood of local inhabitants if restrictions on the felling volume are to succeed vise-a-versa those local inhabitants whose livelihood depends on the felling of mangrove trees.

4) A provisional plan on Mangrove Green belts will be formulated.

Under the Plan, mangrove green belts will be designated based on relevant laws and regulations in which a Presidential Decree plays a central role. The use of mangrove forests in mangrove green belts will be restricted and mangrove forests will be conserved to maintain their function of serving public interests. The established mangrove green belts will be treated as being provisional until a concrete decision has been made by the provincial and district authorities.

This mangrove green belts are composed of the Coastal Protection Zone and the Mangrove Ecosystem Protection Zone.

a. Coastal protection zone

The main purpose of this zone is to maintain the soil erosion prevention function of mangrove forests to protect the coastline and river banks and its status is similar to that of a coastal protection area (Sempadan Pantai) or river bank protection area (Sempadan Sungai) under the category of a definite protection area (Kawasan Perlindungan Setempat) introduced by the Presidential Decree in 1990 (Keppres No.32,1990).

- Width of belt : See Fig. 20.
- Any projects except collecting of trees for personal consumption by local inhabitants will be prohibited

- Since the mangrove forests of open sea type exist on severe condition, the all existing mangrove forests must be protected. The minimum requirement for protecting the mangrove forests is to conserve the dominant species which have prop roots and are *Rizophora* spp flourishing along the coast about 100 m in width. The finding of the Study shows most *Bruguiera* spp having no prop roots flourish further 100 inland from the shoreline.

4) Mangrove ecosystem protection zone

The main purpose of this zone is the conservation of the ecosystem along the coast and river banks to maintain the function of mangrove forests as nursery grounds of fishery resources, and its status is similar to that of a mangrove forest coastal area (Kawasan Pantai Berhutan Bakau) under the category of a nature conservation area (Kawasan Suaka Alam dan Cagar Budaya) introduced by the said Presidential Decree in 1990.

- Width of Belt : See Fig. 20.
- Any project involving clear felling in a mangrove ecosystem protection zone, such as the construction of a tambak, which may seriously disturb the coastal environment will be prohibited. However, selective felling under sustainable production management (such as selective felling for the commercial production of charcoal) will be permitted.
- It is necessary to keep a certain level of litters until the relationship between the aquatic production and the mangrove forest production per square meter will become clear. The finding of the Study shows the dominant species of *Rizophora* spp. produced some 9 t/ha/year immediately after intensively selective felling. Selective felling under the maximum limit is thought to yield more litter production, thus the function of mangrove forests as nursery grounds for the coastal fishery resources will be remained.

5) Base for improved management

A Mangrove Management Field Office will be established together with a fishery base in each model development areas to promote the following activities in each model mangrove area. The office will be responsible for conducting the nursery practice and planting as well as the examination under the operation of the institutions concerned with forestry such as Cabang Dinas Kehutanan.

- Extension and education work to organize local inhabitant groups, KUD and charcoal production cooperatives, and to improve their conservation awareness.
- Supervision to plant mangrove trees and produce nursery stocks to promote mangrove reforestation and establishment of multipurpose forests.
- Dissemination and guidance of techniques and extension to promote social forestry.

- Experimental work of apiculture and soil improvement using unmarketable charcoal.

To implement the Plan, multi-faceted cooperation will be essential among not only forestry-related organizations but also those in the agricultural, industrial and commercial fields.

6. Formulation of Regional Development Plan

6. Formulation of Regional Development Plan

6.1 Small-Scale Fishery Development Plan

Regarding fishing in the Malacca Straits, the means of gathering such basic data as the fish catch volume and fishing effort is limited. It is therefore difficult to make an accurate evaluation of fishery resources. Although the past fishing statistics show no decline in the total catch volume, CPUE clearly has a declining tendency. This leads to a supposition that the fishery resources of this water area are almost used up to the upper limit. The results of interviews with fishermen in this Study also show that a majority of them feel that the catch per individual has decreased. Based on these facts, it is considered that an increase in individual profit of fishermen is not likely to be achieved even by intensifying the fishing effort; it is not only difficult to increase the fish catch much from the current level, but CPUE will also be on the decline. Therefore, the important issue will be to study how to achieve sustainable use of resources through restriction of the number of fishing boats and fishing equipment.

On the other hand, the fishing activities in the Study Area are under the influence of the financial business of the Tauke who acts as a broker throughout all activities, from fishing to collection of fish catch and its export. In practice, the purchase price of the fish by the Tauke is fixed at a low level; thus, the low income of the fishermen households. The objectives of this plan are improvement of the fishermen's social status and the increase in their income, by relieving them from the fishing practices under the control of the Tauke and by establishing an fishery structure in which fishermen can be independent. Another aim of this plan is sustainable use of the resources through coastal resource management by the fishermen organization.

Small-scale bag-net fishing has been developed in the channels linking the islands of the Study Area. The main catch consists of smaller fish, mysids, etc.. There will be a possibility to increase the fishermen's income by adding value to the catch other than the consumption as fresh fish.

This leads to the following three development policies of the small-scale fisheries of this plan.

i) Transition from Tauke-dependent fishing activities to independent ones by fishermen themselves
ii) Building up of a basic data-gathering system required for coastal resources management through strengthening fishermen organizations
iii) Establishment of new industries to give additional value to the catch of the bag-net fishing : fish processing and aquaculture

6.1.1 Powered-Boat Fishing Development Project in the Malacca Straits

The model areas for this project are Desa Muntai and Desa Sei Cingam.

In the areas concerned, the basic infrastructure (such as the landing facility) is still incomplete, despite the fact that the Tauke carries out the entire procedures from the collection and icing of fish catch to the export to neighboring countries. The Tauke's financial control over the fishermen is one of the elements that hinder the organization of fishermen.

The following are the basic strategies of development of the model fishing village area in this project:

1) Establishment of infrastructure facilities such as landing facilities and ice plant, etc., and operation of these facilities by the fishermen organization
2) Motorization of fishing boats
3) Conversion of the relationship between the individual fishermen and the Tauke into the one between the fishermen organization and the Tauke, on the basis of strengthening the fishermen organization through the establishment of an infrastructure and motorization of fishing boats (establishment of fish catch transactions at the price agreed between the fishermen organization and the Tauke)
4) Prohibition of specific fishing methods and restriction on the mesh size of the fishing nets through the fishermen organization, and prevention of catching the small, low-priced fish, encouraging the selective fishing of large, high-priced fish as the result of said prohibition and restrictions.
5) Fishing organization acts as an agent for customs clearance procedures for exported fishery products
6) Fishing organization, records fishing efforts and volumes landed, and gathers basic information required for the resource management of the Malacca Straits

The followings are the main points of the development project of each model area.

(1) Small-scale fishing development project in Desa Muntai

1) Establishment of fishery infrastructure facilities and equipment

- Fishery base: Excavate the west bank of the Muntai river to provide the anchorage and the site for the base. The base will be equipped with a landing wharf, mooring wharf, marketing hall, shipyard, management office (which will also serve as the customs office), solar system ice plant, insulated storage, water supply tanks, oil tank yard, meeting place, shops, warehouses, fishing equipment repair yard, etc.

- Wooden breakwater: To be installed where the water is sufficiently deep so that a boat can be moored when it cannot return to the anchorage during low the tide (approx. 900 m off the coast, as the beach is shallow). Fishing boats can be moored inside the breakwater even in rough weather during the north wind.
- Wooden jetty: Ensures access between the shore and the breakwater.
- Powered boats: Powered boats will be at the disposition of sampan fishermen in order to ensure a certain quantity of the fish catch handled by the fishermen organization.
- Fish transportation: This boat should have a loading capacity of approximately five tons so that it can be used for the export of the fish catch to neighboring countries. It should be designed even for fishing operation when necessary, considering its net working rate.
- Insulated box: For icing and stocking the fish immediately after catching to keep them fresh.
- Other: Carts, scales, office equipment, vehicles, etc.

2) Setting up the fishermen organization

A fishermen organization composed of fishermen operating with powered boats or sampans will be set up (the existing kelompok will be reorganized). The qualifications for membership are as follows:

- To be a fishermen
- To owe little or no debt to the Tauke (to have no obligation to sell his catch to the Tauke).
- To be literate.

The specific activities of the fishermen organization shall be:

i) Production aspect

- Conversion from sampans to powered boats : Sampan fishermen can rent powered boats. The motorization will allow the fishermen to reach further fishing grounds, where they can catch larger, exportable fish. Powered boats have enough space to carry install insulated boxes, enabling maintenance of the freshness of the fish.
- Supply of ice at a lower price through the management and operation of an ice plant : Create an ice plant using solar power generation at a low production cost; the fishermen organization will be responsible for management and operation of the plant. Try to improve the quality of the fish catch by supplying lower-priced ice to the members of the organization. The ice produced at the plant will also be sold to the Tauke and their subordinate fishermen at a price lower than the market price, the profit of which will be allotted to the running expenses of the organization.

ii) Marketing aspect

Install a fish marketing system via the fishermen organization by providing a fish transportation boat that also serves as a fishing boat. The fish catch by the burden-free fishermen are either sold to the Tauke via the fishermen organization or directly exported by the organization at a certain amount of handling fee. In this case, the organization purchases the fish from fishermen at the standard price fixed in consideration of the wholesale price in the importing country (the price can be fixed at 20 - 30% higher than the current purchase price by the Tauke). When an agreement on the purchase price cannot be reached with the Tauke, the fishermen organization will take the catch to export by its own transportation boat.

iii) Resources management, extension works and other aspects

- Sales at a lower price of the fishing equipment adapted to the fishing regulations

  The fishermen organization will purchase the fishing equipment in bulk and sell it to fishermen at a lower price. By the preelection and the sales of the equipment that corresponds to the fishing regulation (such as the mesh-size of the net), the restriction of the equipment can be carried out naturally.

- Recording of fishing activities and the volumes landed

  All fishermen and Tauke who use the landing facilities and benefit from the cheap ice supply must submit to the fishermen organization a record of all operations and catch volume, whether or not they belong to the organization. This record will then be forwarded to DPK as a reference for evaluation and management of fishery resources in the Malacca Straits.

- Export permit procedures

  Since Desa Muntai is quite remote from the town of Bengkalis, in which the DPK is located, the fishermen organization will carry out the export permit procedures for the marine products to collect relevant charge. The organization will also receive an agent's commission from the DPK.

- Members' obligation to deposit money

  Member fishermen will have an obligation to deposit money in an installment saving account every month. This is to initiate savings among the fishermen, the notion with which they are not familiar.

- Aid to the fishermen's independence through the operation fund credit

  The fishermen organization will provide financial assistance to fishermen regarding the expenses to purchase fishing boats and equipment and for their operation in general. The aim of this assistance is to restrain the debt of the fishermen to the Tauke, and to eventually make them independent, free from all control by the Tauke.

- Education and extension work for member fishermen
  Educational activities for fishermen will be carried out on the themes of the importance of coastal resources management and fishermen's activities for financial independence.

(2) Small-scale fishing development project in Desa Sei Cingam

1) Establishment of fishery infrastructure facilities and equipment

- Fishery base: Build up the site as a fishery base by excavating and collect soil from the land behind the mangrove forest at about 500 m inward from Suri Jaya Jetty in the Marong channel, and by reclaim the part where there Suri Jaya jetty now is. The base will be equipped with a landing jetty, mooring jetty, marketing hall, shipyard, management office (which will also serve as the customs office), solar system ice plant, insulated storage, researcher's room, water supply tanks, oil tank yards, meeting place, shops, warehouses, fishing equipment repair yard, etc.
- Site for residences of the fishermen moving in: The land next to the soil excavation site will be reclaimed for the site.
- Powered boats: Powered boats will be at the disposition of sampan fishermen in order to ensure a certain quantity of the catch handled by the fishermen organization.
- Fish transportation: This boat should have a loading capacity of approximately five tons so that it can be used for the export of the fish catch to neighboring countries. It should be designed even for fishing operation when necessary, considering its net working rate.
- Insulated box: For icing and stocking the fish immediately after catching to keep them fresh.
- Other: Carts, scales, office equipment, vehicles, etc.

2) Setting up of the fishermen organization

This will be the same as the small-scale fishing development project in Muntai.

6.1.2 Fisheries Development Project in the Channels between the Islands

The model areas for this project are Desa Pelantai and Desa Tlk. Ketapang.

The popular methods of fishing operated in the channels between the islands are bag-net fishing such as Gombang fishing using the currents generated by the change of the tide level, and small gill-net fishing. The fish catch by the former method are mostly anchovies, mysids and other trash fish that are dried in the sun for a short time and processed into dried products. Such fishing activities are operated on a very small scale, mostly as a side business to mangrove felling or day labor in plantations.

This project promotes the following measures to increase the fishermen's income by giving additional value to the catch and to manage the resources within the channels.

1) Use the fish catch by Gombang fishing to feed the cultured giant sea perch and mud crabs, in order to transform the catch to the high-priced product.
2) Produce high-quality dried fish which could be exported by standardizing the drying method of the catch and by providing a processing plant in which the fish can be dried even during the rainy season.
3) Reduce felling pressure of mangrove trees by transferring of part-time fishermen whose main income source is felling mangrove trees, to full-time fishermen engaging in the above jobs.
4) Establish a resources management system, sustainable production system, and marketing system through organizing fishermen.

The main points of this project for each model area are as follows:

(1) Small-scale fisheries development project in Desa Pelantai

This area has been selected as a model area for aquaculture development because it faces the Asam Channel, and the land behind the coastal mangrove forests is spotted with unexploited marshlands with low vegetative cover. The people whose main source of income is mangrove felling and who operate fishing as a side business, will be converted to full time fish farmers. It will be necessary to build separately a fry production center in order to ensure the stable supply of fry for aquaculture (refer to (3) below).

1) Installation of aquaculture facilities and equipment

The species to be cultured will be mud crab and giant sea perch, whose aquaculture has already started on an experimental basis in the Study Area. The following facilities and equipment will be required for the aquaculture of these species.

- Aquaculture for mud crabs : earth ponds (3000 m^2/unit), water canal, for water intake and drainage management office, solar system refrigerator for feed stock, Gombang nets, powered sampans, carts, scale, scoop nets, etc.
- Aquaculture for giant sea perch : Floating cages (framework 4 x 4 m, net 2 x 2 x 1.5 m per unit), Gombang nets, powered sampans, management office, solar system refrigerator for feed stock, carts, scale, scoop nets, etc.

2) Setting up the fishermen organization

To organize the part-time fishermen living on mangrove felling into a kelompok and to convert them to full-time fish farmers.

The following are the specific activities of the fishermen organization:

i) Production aspect

- Aquaculture of mud crabs and giant sea perch
  - Mud crabs: Farming from fry to the marketable size in the earth pond to be built in Dusun Pelantai.
  - Giant sea perch: Farming the fry up to 3 inch-long in the floating cages to be installed within the Asam Channel facing Dusun Kengkam. Some of the fish are farmed up to marketable size.
- Catching the feed fish for aquaculture by Gombang fishing

  Fish farmers will catch their own feed by installing Gombang nets at appropriate spots near the aquaculture site.

ii) Marketing aspect

- Mud crabs: Sold to the domestic market through the fishermen organization.
- Giant sea perch: 3 inches-long fry is to be sold to the existing sea perch fish farmers in the Study Area at a price lower than its import price through the fishermen organization. The marketable size are sold to the domestic market.

iii) Operation and management aspect

Farming fry of giant sea perch up to 3 inches will make possible to get income on a two-month basis; if they are to be grown up to the marketable size, however, fish farmers will have to wait for five to eight months before harvest. Therefore, the fishermen organization will save the income obtained from the former farming and appropriate it as the running expense required for the rearing of giant sea perch and mud crabs.

The fishermen organization will pay the proceeds of the cultivated products to its member fishermen after deducting the running cost, facility fees and installed saving deposit. Unsuccessful members will have their own right to rent the facilities revoked and new members will join the operation.

iv) Resources management, extension works, etc.

- Record of Gombang fishing and aquaculture production

  The fishermen organization will record all activities relevant to the catch of Gombang fishing and aquaculture production. The record will be submitted to DPK as a reference for evaluation and management of the fishery resources within the channels, or for the promotion of aquaculture in similar areas.
- Education and extension works for member fishermen

  Educational activities for fishermen will be carried out on the themes of the necessity of coastal resources management, measures for financial independence, etc.

(2) Small-scale fisheries development project in Tlk. Ketapang

This area is located on the opposite bank of Pelantai across the Asam channel. It is an appropriate ground for Gombang fishing. Therefore, the area has been selected in this project as a model area for the development of fish products with added value. Gombang nets have already been supplied to the part-time fishermen through government aid, and the catches are now being dried and processed. The aim of this project is to significantly improve the quality of these products in order to increase the fishermen's income.

1) Installation of the processing facilities and equipment

All-weather facilities necessary for the processing of the standardized dried products will be installed at the coastal area of Dusun Tlk. Ketapang, a center of Gombang fishing.

Landing jetty, management office (meeting place included), roofed drying space, pre-treatment place for fish catch, solar systems refrigeration storage for dried products, water supply tank, oil tank yard, shops, warehouses, workshop, cooker, tunnel-type drier, tentacle-removal device for mysids, carts, balance, drying trays, etc.

2) Strengthening functions of the fishermen organization

Since the operation of Gombang fishing in a limited water body within the channel is considered to have a great impact on fishery resources, this project aims at proper management of the resources by fishermen themselves through strengthening the functions of the existing kelompoks consisting of the fishermen devoted to Gombang fishing under the government's aid.

The following are the specific activities of the fishermen organization:

i) Production aspect

- Anchovies: The total volume of anchovies catch through the current Gombang fishing will be dried and processed into the standardized products in this processing plant.
- Mysids: Mysids will be caught through the new Gombang fishing to be introduced by the PKT project. Half of the catch volume will undergo non-thermal drying treatment to be processed into the standardized dried products.

ii) Marketing aspect

- Dried anchovies: By processing the standardized dried products, it will be possible to ensure stable production of the dried fish with higher value than the current market price regardless of the weather. These products will be stored in the refrigerated storage and shipped when the market price is high. They will also be exported to such countries as Japan.
- Dried mysids: These are currently traded in the domestic market as the raw material for fish meal or terasi (pickled guts) at a low price. In the Japanese

market, the products dried by the non-thermal treatment are used as shrimp-flavored seasoning for various food products. The demand is considerable, and the price is as high as that of dried anchovies. This project will therefore encourage exports to Japan.

iii) Resource management, extension works and other aspects

This will be the same as in the case of the Pelantai model area.

(3) Fry production center construction project

One of the problems related to the aquaculture activities in the Study Area is that there is no fry production center to ensure a stable supply of low-priced fry. This project will promote the construction of a fry production center for mud crabs and giant sea perch with the capacity to satisfy the demand of the existing aquaculture farms. Since the fry production center has the role of a public facility, it will not be constructed in the model areas, but as a part of the shrimp aquaculture demonstration facility of the Riau province, in Desa Banglas near Slatpanjang.

1) Installation of the fry production facilities and equipment
   - Fry production building (management office, dry-laboratory, wet laboratory, fry breeding tanks, refrigerators, etc.)
   - Elevated water tank
   - Feed cultivation tanks
   - Nursery ponds/fish cages
   - Bloodstock ponds/fish cage
   - Various other equipment

2) Operational structure

It is ideal that this center be operated under direct control of DPK with the assistance of DPP. However, there are not enough engineers at present. For the first three to five years following the establishment of this center, technical assistance shall be provided by engineers from the central government (including technical assistance through foreign aid).

6.2 Mangrove Forest Conservation and Management Improvement Plan

6.2.1 Procedures for Mangrove Forest Resources Management and Enhancement in the Study Area

The improvement plan for conservation and management of mangrove forests which has been prepared toward the model mangrove areas envisages the improvement of mangrove forest resources management and enhancement toward the Study Area in the following manner.

(1) Establishment of mangrove forest management plan

1) Plan preparation

a. A detailed mangrove forest management criteria which are applicable to the actual conditions in the entire Study Area will be prepared using the management criteria prepared for the model mangrove areas.

b. It is desirable that more site surveys, research and experiment to set up management method by selective cutting based on the designated felling area method or clear cutting based on the designated small-area felling area in order that local economy are activated by the charcoal industry.

2) Formulation of management plan

a. The actual components of the management plan formulation process will be aerial photography (approximate scale of 1/10,000 in the case of selective felling based on the designated felling area method), preparation of a forest type map forest, inventory and plan compilation, etc.

b. The mangrove green belts will be designated at the plan compilation stage.

3) Popularization of and Coordination for Management Plan

Effective resources control will not be feasible without the positive understanding and support of local inhabitants. Therefore, it will be necessary for the management plan to reflect the opinions of local inhabitants and to secure their support for the plan.

4) Marking of green belt Boundaries

The site boundaries are to be clearly marked for such basic components of the plan as green belts and forest areas once local support for the plan has been secured.

(2) Establishment of mangrove resources management system

As part of the mangrove forest resources management, it is necessary to establish a system which is capable of promoting appropriate felling practices in accordance with the management plan. Three different management system types are proposed here as the administration-led, the inhabitants' participated and the private business participated system. A close cooperation system among authorities, inhabitants and private business should be established and each responsibility to mangrove forest management should be clearly determined.

1) Administration-led management system

For the implementation of this type of management system, it will be necessary to introduce on-site felling monitoring by administrative staff. The Riau Dinas Kehutanan appears to have approximately 3 staff members per KBKPH who can supervise the felling of mangrove trees. It is necessary for the Dinas Kehutanan to increase the staff if this system applied and to facilitate patrol system for the efficient on-site felling monitoring, making the establishment of a patrol system desirable. It will be necessary to procure patrol boats (average of one boat per

CDK) and other equipment, and a budget for operation to effectively patrol the designated areas 3 times a month for 3 days each time.

2) Inhabitants' participated management system

For the implementation of this type of management system, the relevant education and extension system must firstly be established to spread awareness of the need for resources conservation and to stimulate voluntary efforts. It is desirable to establish a support system whereby a small business loan is provided for local inhabitants for apiculture, soil improvement on tree crops lands and agriculture lands, etc. in order to consolidate their livelihood.

a. Coastal land use improvement survey

This survey is designed to identify the optimal coastal land use to stabilize the livelihood of local inhabitants and consists of a soil survey and a crop productivity survey. The aim is to improve the productivity of tree crops lands (Rubbers, Coconuts and so on) by identifying the optimal sites for the permanent crops and also by improving cultivation methods.

b. Extension work

The extension work of the system will consist of the following.

- Recruitment and training of extension workers (approximately one extension worker per Desa) by a forestry-led organization.
- Establishment of extension offices (approximately one office per island).
- Implementation of a resources conservation and management program.
- Financial assistance for the necessary small investment.

3) Private business participated management system

As mangrove forests are national assets, the HPHH concessionaires lack a forest management policy based on appropriate management system, and tend to tolerate illegal sale of timber produced inside their concessions to Malaysia and Singapore.

Willingness of HPHH concessionaires and charcoal kiln owners to conserve forests will be inclined by the following incentives:

a. Reduction of or exemption from royalty (IHH) or reforestation fee (DR)

HPHH concessionaires are required to pay the IHH (royalty) and DR (reforestation fee). Since the recycling of such payments to reforestation and conservation projects has not been clearly established in Riau Province, the willingness of HPHH concessionaires to conserve forests has been declining. The reduction of or exemption from the royalty or reforestation fee for a specific period is designed as a supportive measure to encourage such willingness. And also it is important to establish an reforestation and management system by HPHH concessionaires through a measure of reduction or exemption of system IHH and DR.

b. Extension of HPHH permit period

An appropriate forest management requires the establishment of a long-term management strategy. An extended HPHH permit will be given if an appropriate forest management plan is submitted. The desirable period is longer than 15 years as this length of time will be required for the regenerated seedlings to grow to allowable size.

c. Financial assistance

The forestry authority will provide financial assistance by means of securing lower interest on bank loans or providing a debt repayment guarantee to help charcoal producers secure the necessary working capital to improve forest management of HPHH concessionaires and / or charcoal kiln owners.

6.2.2 Outline of Mangrove Forest Conservation and Management Improvement Plan

The present Mangrove Forest Conservation and Management Improvement Plan consists of the following 2 plans :

a. Mangrove forest management plan

This Plan provides the foundations for mangrove resources management and enhancement and is a model mangrove forest management plan in the Study Area.

b. Mangrove forest management support plan

This Plan intends to promote the implementation of the Mangrove Forest Management Plan. A model project of social forestry are planned for inhabitants to participate forest management and in order that excessive cutting of mangrove forest against allowable cut can be reduced.

6.2.3 Mangrove Forest Management Plan

(1) Management criteria

1) Status of the Plan

The Plan is a model forest management plan of the mangrove forests in the Study Area which is characterized by the existence of open sea-type or inland sea-type mangrove forests in the islands along the Malacca Strait. The Plan aims at achieving the sustainable production of mangrove logs for charcoal production for commercial purposes and logs for household use while maintaining the functions of the mangrove forests which serve public interests. The following preconditions have been adopted in the preparation of the Plan.

- The existing mangrove forests will not be converted to other types of land use.
- Structure of charcoal kilns and charcoal making process will not be changed because those things have been accepted by local manufacturers since long- time ago.

- Only selective felling will be conducted in the case of trees with a diameter of 10cm or more in accordance with the current felling practice for charcoal production.
- Improvement of forest conditions by introducing a periods of adjustment (period to prohibit or strictly restrict cutting until it's purpose will be achieved) will not be proposed because of few income opportunity of local inhabitants.
- Felling in excess of the estimated increment will not be conducted to ensure sustainable production and sure regeneration.
- Actual projects will address each forest type, indicating on the basis of th principle of sustained yield the approximate locational conditions.
- All mangrove green belts will be considered to be limited production forests where the conservation function is featured equally with the production function. Consequently, coastal protection zone where the conservation function is particularly emphasized will not be included in the areas subject to felling under the Plan. Selective felling will be introduced in mangrove ecosystem protection zone.
- Early reforestation will be attempted in the case of treeless land, such as cut- over areas and bare land.

2) Compartmentation of forests

The compartmentation of forests for management purposes is usually based on natural boundaries (watershed boundaries) or administrative boundaries. Under the present Plan, however, the boundaries of the model mangrove areas will be used as the boundaries of subject areas.

a. Forest categories

Forest categories are introduced here to classify the mangrove forests subject to the Mangrove Forest Management Plan based on the main management purposes. The forest categories are given in Table 64. The sites earmarked as mangrove forests are classified as forest land, including existing mangrove forests and brackish marsh lands. The areas to be conserved in view of the maintenance of the desirable functions of mangrove forests are designated as green belts. Green belts (mangrove forest green belts) are coastal protection forests where the conservation function is emphasized and the restrictions on felling activities as described in Table 64 are introduced to mangrove forests and marshlands that mangrove forests can be restored.

• Width of green belts

- Coastal protection zone: 100m towards land from datum tide level along coasts, 50m towards land from datum tide level along the rivers.
- Mangrove ecosystem protection zone: Mangrove forest area towards land

outside of the coastal protection zone, with the range of 130m from datum tidal level x maximum tide range (m).

- Datum tide level : Projection of coastal water line at high tide (as shown on the existing topographical map, scale: 1/50,000) has been adopted as the datum line.

• Maximum intertidal variation : An average maximum tide range of 3m has been adopted based on the tide table for 1993 at Port Bengkalis.

• Rivers : Those with a width of 10m or more are considered to be river (those with a width of less than 10m are considered to be creeks (tributaries))

• Coast means an area facing the ocean or land zones along a channel of which both ends open to the ocean; a river mouth area affected by ebb and flow is treated as a river.

• Any coastal protection zone with housing or other types of land use has been omitted from the Plan. Those included in the Plan are mainly currently mangrove or other types of forests, swamps and grassland.

• Any mangrove ecosystem protection zone are designated within mangrove forests and brackish marshlands.

b. Compartmentation

Compartmentation is necessary to accurately indicate the location of each forest land area to facilitate forest management. Three compartment levels have been adopted, i.e. working unit, compartment and sub-compartment.

The KBPHs of the Dinas Kehutanan Riau are divided as the following.

- Working units :In principle, each working unit converges with each Kecamatan. The entire island is considered to be a single working unit when such a wide area working unit is deemed appropriate. Under the Plan, each model mangrove area constitutes a separate working unit.
- Compartments : The boundaries of each compartment have decided based on the administrative boundaries, water channels and rivers, etc. The standard compartment size has been set at between 500 ha and 2,000 ha (a HPHH to be considered as a compartment).
- Sub-compartments : The boundaries of each sub-compartment have been decided based on the forest type.

3) Management by regeneration

Both artificial regeneration and natural regeneration (by natural seeding) are adopted for regeneration of the existing mangrove forest lands.

a. Artificial regeneration

The candidate species for regeneration have been selected based on the forest types and the expected use of the target forests and the final decision on the species earmarked for regeneration has been made in view of the frequency of local flooding and the surface soil properties (see Table 65).

b. Natural regeneration

Basically he "Guidelines for Reforestation Systems in Brackish water Areas[1]" prepared by the DEPHUT has been applied for this plan.

As far as results of forest inventory plots, many plots of number of existing seedlings reach the standard number of seedlings (2,500 seedling/ha) of the above mentioned guideline. It can be said that there is few problems on the standard number of seedlings to be regenerated.

But 10,000 seedlings/ha is expected to be the value of the number of seedings to be existed in order that stand regeneration can sustain, taking into safety factors considerations. A few problems on the regulation of *Rizophoracea* by natural seedings are as follows :

- Because most of the saplings and seedlings exist under the lack of dense covers of trees, natural seeding is appeared patchy.
- There are fewer fruits on tall trees (seed tree) to be conserved according to the above mentioned guideline.
- Disperses of the fallen seeds require the water movement such as the flood tide.

The "Guidelines for Silviculture Systems in Brackish water Areas" is based on the selective cutting system of felling area that circulates 1 felling per 30 years. However most of the mangrove forests in the Study Area belong to small-scale concessions' area (HPHH) that are renewed annually and maximum allowed area is 100 ha a concession. It can be said that because the above mentioned guidelines can be adaptable only for large-scale concessions (HPHI, it is difficult to adapt the guidelines to the mangrove forests in the Study Area.

Natural regeneration management for the Study Area to yield every year crops must be based on individual-tree selective cutting with the allowable diameter (10 cm and over) and within the limit of an estimated annual increment.

As the tree diameter growth rate is estimated to be approximately 0.5 - 1.0cm/year, it requires more than 15 years for a tree to reach the allowable diameter for felling.

1: Surat Keputusan Direktorat Jenderal Kehutanan No. 60/Kpts/DJ/I/1987, tentang Pedoman Sistem Silvikultur Hutan Payau, Direktur Jenderal Kehutanan, 1978 (Indonesian)

(2) Mangrove green belt plan

Forest classification of the model mangrove areas has resulted in the coastal protective forest land shown in Table 66 and attached map "Layout on Mangrove Forest Green belts".

- Coastal Protection Zone (G-I) : No felling will be permitted except for personal consumption by local inhabitants.
- Mangrove Ecosystem Protection Zone (G-II) : The present level of felling for commercial charcoal production will be permitted in accordance with the standard felling volume. Felling based on the sub-compartment clear felling method (felling area method) will be prohibited.
- Productive Forest Land (P) : Sub-compartment clear felling will be permitted.

(3) Mangrove felling plan

The allowable cut for charcoal production and annual allowable charcoal production by the standard felling volume were specified on the prerequisite as follows

- As the mangrove wood cut by local inhabitants is not sold to specific charcoal manufacturers, it is difficult under existing laws and regulations to formulate felling plan by HPHH and charcoal production plan by charcoal kiln.
- As the work details (concession renewal data and planned felling volume, etc.) of the HPHHs in the model mangrove areas differ, the introduction of an annual felling plan which commences the same year for all concessions is difficult.
- Should the competent agency of the government of Indonesia decide to withdraw concessionary rights, it is highly desirable that such a decision should be made only after measures have been introduced to ensure new employment for work ers in the charcoal production industry and cash income opportunities for full- time mangrove cutters. And it is necessary to be consented with cooperative attitude by a HPHH concessionaire and/or a owner of the site of charcoal kilns.

1) Mangrove felling plan

a. Standard felling volume

The annual allowable cut has been within the limits of an annual volume increment because felling for charcoal production purposes shall be conducted not by clear cutting designated felling area but by selective cutting of allowable trees.

The mean annual volume increment has been estimated to be 1.5 m^3/ha based on the Study's observation results and also on the study results on man-made forests in Indonesia. This value includes a safety margin.

The annual allowable cut was decided regardless of the diameter class and the forest type. Because stand growths may be differ each stand density in the same forest type and individual increments in 9 months haven't been clearly differed depend on diameter class according to this survey results.

The Study has identified the 3 main mangrove species (*Rhizophora* spp. *Brugniera* spp. *Ceriops* spp.) which are used for commercial charcoal production.

b. Timing of felling

Felling only before and after the spring tide is desirable as already practiced by some local inhabitants in order to facilitate the inland transportation of logs. Felling during the dry season is to be done after new seeds have dropped onto the forest floor.

c. Felling method : Felling must be conducted by manpower, and logs will be extracted by Sampan as currently practiced from the viewpoint of forest conservation.

2) Allowable cut for charcoal production in the Study Area

a. Study Area

The average charcoal kiln in the Study Area is either the traditional or Malaysian-type kiln. The charcoal production volume per each operation is approximately 12 tons (some 45% of carbonized products) from some 110 m^3 of logs. Estimated amount of each carbonized product per 1 kiln. 1 burning is shown on Table 67.

One operation takes approximately 50 days and 4 operations are conducted each year on average. On this production basis, the required log volume is some 440 m^3/kiln/year, indicating that the minimum mangrove forest area required to produce this log level is 293 ha.

Table 68 shows the number of charcoal kilns with the appropriate production level in the Study Area.

Allowable number of kilns of the jurisdiction of CDK Dumai, CDK Bengkalis, CDK Selatpanjang are 25, 12, 23 respectively. It can be judged that present charcoal production exceed 3 times potential for sustainable utilization in number of kilns.

b. Model Mangrove Area

Table 69 shows the appropriate felling volume for commercial charcoal production and the feasible charcoal production volume.

Present charcoal production can result in the deterioration of mangrove forests because of over cutting, although it can not result in the diminishment of mangrove forests. It is necessary to reduce the number of existing charcoal kilns to the appropriate ones as soon as possible.

In the future it is necessary to improve charcoal productivity in order that charcoal can be produced as much as possible while limited mangrove forest resources can sustain.

- Non-carbonized woods can be decreased by the improvement of charcoal making techniques such as drying felled woods before loading in a kiln.
- It is important to improve structure of kilns and process of charcoal makings in order to increase productivity of charcoal. Therefore it is necessary to establish and support a subsidy system to charcoal manufactures and research and experiments to improve the kilns and the process.

(4) Mangrove forest regeneration plan

In principle, artificial regeneration and natural regeneration will be employed for brackish marsh lands (M1 and M2) and existing forests respectively.

The artificial regeneration of Rhizophoraceae species (*Rhizophora* spp, *Bruguiera* spp. and *Ceriops* spp.) will, in principle, be conducted in accordance with the "Technical Guidelines for the Regeneration of Rhizophoraceae[2]" issued by the Dinas Kehutanan Riau. In the case of natural regeneration, the Guidelines for Silviculture Systems in Brackish water Areas issued by the DEPHUT will be referred to.

Details of implementation methods will be study on trial and error while implementing because growths and survivals of planted trees will be depend on micro-site conditions. The planned planning area and number of seedlings, etc. are given in Table 70, Fig. 21 shows a tentative schedule of artificial regeneration.

1) Regeneration method

a. Natural regeneration

The "Guidlines for Silviculture Systems in Brackish Water Areas" will be referred to for the forest type except LRh-s.

b. Artificial Regeneration

Candidate species for artificial regeneration are as follows based on Table 65.

- M1 : Marshlands (Non-low vegetation covers)

Avicennia spp. will be planted in those areas with a thick deposit of such coarse materials as sand on the surface. Given the oceanic condiitons of the candidate locations, the high density planting method will be employed to ensure a high

2: Petunjuk Teknis Pembuatan Permudaan Bakau[Rhizophoraceae] Dinas Kehutanan Riau, 1986 (Indonesian)

survival rate and to alleviate strain on the micro-environment. The planting distance for *R. mucronata* will, in principle, be 1m by 1m while the planting of *Avicennia* spp. will be conducted in groups of 5 in spacing of planting pit of 1m by 1m.

- M2: Marshlands with low vegetation covers

  R. apiculture or *Bruguiera* spp. will be planted to establish the respective forests which will take a belt shape of some 20m wide. The planting distance will be 1m by 1m because the vigorous growth of *Acrostichum aureum* is observed. In regard to the fish culture ponds planned in the Pelantai model mangrove area in Kec. Merbau, *R. apiculture*, *Lumnitzera* spp. and *Bruguiera* spp. etc. will be planted. The actual species to be planted will be decided based on the specific character of the planting sites and structure of aquaculture pond sites in question. of site.

- Sparse low *Rhizophora* spp. dominant stands (LRh-S).

  Many bent trees of *R. apiculture* result in a small number of regeneration of seedling. Therefore, felling will be conducted in a belt shape and *Brugiera* spp., and roots of such ground covers as *Acrostitum* spp. will be removed. *Bruguiera*spp. and *Ceriops* spp., etc. will be planted in the felled areas to induce the establishment of mixed forests with land ward-type species on trial. The spacing will be decided based on 1m by 1m. The width of the felling belt will be some 20m which is the standard seed tree distance suggested by the guidelines.

2) Nursing

A fixed nursery will be established at an appropriate site near by the Mangrove Forest Management Field Office for pot culture to produce nursery stocks. Seeds for direct seeding and potted seedlings will be collected in mangrove forests around the Study Area and/or the estuary of Indragili River. The nursing of Rhizophoraceae will be based on the guidelines issues by the Dinas Kehutanan Riau and also the "Reforestation Guidelines for Social Mangrove Forests[3]" issued by the DEPHUT. The nursing practices for other species will be decided based on the progress of "Development of Sustainable Mangrove Management Project in Bali and Lombok. (DEPHUT and JICA).

3) Work

a. Site preparation

As part of the artificial regeneration work at M2 sites, the site preparation of the planned belt-shaped areas will be manually conducted.

3: Pedoman Penyelenggaraan Pengembangan Hutan Baku Rakyat, Departemen Kehutanan, 1992 (Indonesian)

b. Planting

The planting of Rhizophoraceae will be based on the guidelines issued by the DEPHUT and so on. The planting of other species will be decided based on the progress of "Development of Sustainable Mangrove Management Project in Bali and Lombok (DEPHUT and JICA). Supplementary planting will be conducted if the mortality rate exceeds 20%. A schematic drawing on planting concept of mangrove tree is shown in Fig. 22.

c. Tending

In principle, weeding and thinning will not be conducted.

(5) Mangrove forest protection plan

No serious damage due to natural disasters, disease or harmful insects/animals has been observed in mangrove forests in the Study Area. It is desirable to carefully study the following forest protection measures in view of possible damage in the future.

1) Measures vise-a-versa disease and harmful insects/animals

a. Fungi

When a large number of mushrooms propagate on *R. apiculture*, tree vigor deteriorates, resulting in tree death. No large outbreak of fungi (species unknown) is currently reported in any forest. However, in the case of a large outbreak, the damaged trees will be felled and removed for burning outside the forest.

b. Crabs

The newly planted trees will likely suffer from damage caused by crabs (Cradisoma carnifex and others).

Marshlands (non-low vegetation cover) (M1) :

Given the present situation of natural seeding, no specific measures will be introduced.

Marsh lands with low vegetation cover (M2) :

Cut leaves of *Acrostichum* spp. will be planted around the site.

Sparse low *Rhizophora* spp. Stands (LRh-S) :

Crab mounds and holes will be buried at the time of planting.

2) Measures Vis-a-Vis Waves

It is believed that the substratum is subject to erosion by natural waves in the Muntai model mangrove area in Kec. Bengkalis (particularly in the rainy season) or waves caused by large speedboats in the Tlk. Ketapang model mangrove area in Kec. Merbau. If the over-turning of standing trees or newly planted trees due to erosion of the substratum is observed, wooden stakes will be driven in zigzag in

front of the eroding area in a crisis-cross pattern.

3) Measures to protect green belts

Given the present felling sites of local inhabitants, it will be important to urge them to conduct felling on the inland side of the designated greenbelts. A sign-board showing greenbelts boundaries will be installed as a protection measure of the greenbelts area set by the Plan. In order to evaluate its effect, periodical inspection against illegal cutting will be executed in the permanent plots in transects to be established in the implementation of the plan.

6.2.4 Mangrove Forest Management Support Plan

The Mangrove Forest Management Support Plan intends to assist the smooth implementation of the Mangrove Forest Management Plan facilitating inhabitants' participation to forest management.

(1) Inhabitants' participation plan

1) Establishment of inhabitants' participation system

Attempts will be made to organize the local inhabitants of a Desa to create a core system to assist official guidance and assistance efforts and to be responsible for the management of local mangrove forests. The active participation of local inhabitants in various activities will help to achieve a consensus on the conservation of the common resources of a Desa and will also stimulate their awareness of the need for proper management on their own initiative. To promote the inhabitants' participation, a Kelompok among inhabitants to be created through the implementation of the coastal social forestry plan will become inhabitants' group having the same purpose of production.

Unjoined manufacturers to the charcoal manufacturers' cooperative will be encouraged to join the cooperative or organize a new cooperative.

2) Extension plan

a. Diffusion of plan and coordination with local communities

The contents of the Improvement Plan for Conservation and Management of Mangrove Forest will be explained at the following meetings to facilitate the understanding and to enlist the cooperation of local inhabitants.

- Meetings with the head of a village
- Meetings with official village organizations, such as the LKMD (Lembaga Ketahanan Masyarakat Desa) and LSD (Lembaga Sosial Desa) led by the head of a village
- Meetings with such official organizations as the KUD, LSM (Lembaga Swadaya Masyarakat) and PKK (Pembinaan Kesejaheteraan Keluarga)
- Open discussions in villages

b. Organization

Efforts will be made to organize local groups (Kelompok) consisting of farmers and fishermen with a view to lending or giving initial investment materials and equipments for such small businesses as apiculture and the utilization of unmarketable charcoal.

c. Leader training

Training relating to the implementation of the small businesses will be provided for local leaders, such as group leaders and the head of a village, and HPHH owners.

d. Support service

Technical guidance and marketing information publicity by extension workers' round of visits are considered to be important to smooth implementation.

3) Extension facility

The Mangrove Forest Management Field Office will mainly act as the extension facility where the programs will be conducted. Demonstration plots for apiculture and the utilization of unmarketable charcoal will be created at the Office to inform inhabitants and to serve trainees.

(2) Coastal social forestry plan

The Coastal Social Forestry Plan aims at promoting forestry which is harmonious with the local socioeconomic conditions, including the livelihood basis of local inhabitants.

As "the Communal Forest Planning Criteria", etc., this plan intends also to provide incentives for greening efforts as well as to conserve reforestation sites for public interests.

It will be necessary to secure the full understanding and cooperation of local inhabitants for the successful implementation of the Coastal Social Forestry Plan.

1) Local apiculture support plan

A few farmers in the Study area have been doing apiculture installing more or less 10 beehive around their residence and using fruit trees around the home gardens (pekarangan) such as durian coffee, star fruit, mango, coconut trees, rubber trees, and etc. in nearby area as nectar source.

The Local Apiculture Support Plan is a model apiculture aiming at not only supporting the existing local apiculturists but also at encouraging small-scale extensive apiculture to create new opportunities for local inhabitants to earn side income.

a. Increased honey production through increase of nectar-producing plants and

reduction of honey consumption during non-flowering season by reforestation and conservation of forest

Bees collect nectar during the flowering season and consume the honey stored in the beehive during the non-flowering season. An increase of the nectar-producing plants and the availability of nectar sources during the non-flowering season are required to increase the honey production volume.

Mangrove trees standing at the edge of a forest or in a gap inside a forest tend to flower all year round. Reforestation of mangrove trees will increase the availability of nectar sources during the non-flowering season. In Bangladesh, honey is collected from many mangrove forests (*Avicennia* spp.). There is the opinion that the honey produced from nectar collected solely from mangrove flowers is sour. However, mangrove flowers are still viable as a supplementary nectar source.

b. Provision of breeding bees and apiculture equipment and technical extension

Local inhabitants will be encouraged to establish groups (Kelompok) to improve apiculture techniques and to consolidate the product distribution system and the leaders of these groups will be provided with technical advice (apiculture techniques: e.q. hiving off, countermeasures against harmful insects). At the same time, breeding bees and apiculture equipment will be leased or donated to these groups through the Plan.

c. Subject areas

Tlk. Ketapang model mangrove area will be the subject area because apiculture practice can be found and nectar sources as the above mentioned are distributed around this place.

2) Silvofishery Support Plan (Silvofishery: Combined management between fisheries and forestry)

The main target of silvofishery in areas is the prevention of mangrove forest conversion. Sei Cingam and Pelantai model mangrove areas will be the subject areas because brackish marsh widely spread in these area. A schematic drawing of planting under silvofishery is given in Fig. 23.

3) Unmarketable charcoal utilization plan

Inferior portion which has failed to meet the quality standards of importing countries of charcoal, is piled up at the place of production(some 10 of the carbonized products of mangrove trees). Only very limited amount of unmarketable charcoal is purchased by horticulturists in Singapore. Therefore, aiming at improving efficiency of mangrove utilization and creating chance of side incomes (selling the unmarketable charcoals processed by inhabitants, tree crop plantation in the unutilized grasslands and improving productivity of tree crops

such as rubbers), such unmarketable charcoals had better be used as soil improvement materials as follows :

- Unmarketable charcoals will be used as soil dressing to improve permeability at the experimental planting aiming at establishing multi-purpose forests in the unutilized grasslands (G) to produce minor forest products (rubbers) and to increase nectar sources (fruit trees). Experimental application of the unmarketable charcoals to the existing agriculture lands (A) and tree crops (C,R) will be conducted to get information on increase of soil pH and improvement of permeability.
- Annual unmarketable charcoal born from mangrove supplied outside from the greenbelts area set by the Plan, are estimated to be 26 ton in the Sei Cingam Model Mangrove Area and 23 ton in the Tlk. Ketapang Model Mangrove Area. By use a portion of these waste, soil improvement test to be executed at the mixing rate of 1kg of unmarketable charcoals per $1m^3$ of soils. The subject areas are Sei Cingam and Tlk. Ketapang model mangrove areas because charcoal kilns exist in these areas.
- If it is confirmed that the yield goes up after soil improvement practice by using unmarketable charcoal, it will also be used in existing tree crop such as rubber forests in order to improve their productivity aiming at increasing inhabitants' income.

6.3 Regional Development Plan by Each Model Area

This regional development plan consists of the small-scale fishery development plan in model areas, described in 6.1 combined with the mangrove forest conservation and management improvement plan described in 6.2, together with road repair works considered necessary for regional economic activities.

6.3.1 Regional Development Plan of the Muntai Model Area

(1) Development objectives

- Sustainable use of the coastal resources of the Malacca Straits (fishery resources and mangrove forests)
- Financial independence and increased income for fishermen
- Prevention of erosion caused by waves, and land conservation

(2) Development strategies

- Build up a fishery system that will promote the financial independence of fishermen by providing the fishery basic infrastructure and by establishing a fishermen organi zation to operate this infrastructure.

- Seek the way to raise the price of the fishery products in order to increase the fishermen's income, through the improvement of the quality management of the fish catch.
- Carry out, through the fishermen organization, educational activities relevant to resources management and restrictions on fishing boats and fishing gear.
- Rehabilitate the coastal mangrove forests through reforestation of brackish marsh land (M1 and M2) and prevent erosion in the coastal areas.

(3) Project components

i)	Construction of a fishery base (at the mouth of the Muntai River)	....	refer to 6.1.1 (1)
ii)	Establishment of a fishermen organization that operates the base	....	refer to 6.1.1 (1)
iii)	Establishment of the mangrove forest management field office (Head office: in the base, Nursery station : Bantang Tengah)	....	refer to 6.2
iv)	Nursery practice and reforestation project based at this office	....	refer to 6.2
v)	Repair work on the weak foundation of the road between Muntai and Bantan Tengah (approx. 2 km)		

The fishery development plan and the mangrove forest conservation and management improvement plan have an independent nature at implementation in this plan. The rehabilitation of coastal mangrove forests, however, will eventually upgrade the nursery function for fishery resources.

The facilities layout for the fishery development plan is shown in Fig. 25, and the plan scale of the facilities and equipment in Table 71.

The facilities layout of the nursery station at Bantanain are shown in Figure

The plan scale of the mangrove forest construction and management is shown in Table 72. Fig. 26 shows the facility layout for the nursery in Bantantengah.

6.3.2 Regional Development Plan of the Sei Cingam Model Area

(1) Development objectives

- Sustainable use of the coastal resources of the Malacca Straits (fishery resources and mangrove forests)
- Financial independence and increased income for fishermen
- Improvement of the fishery resources nursery function through mangrove forest recovery

(2) Development strategies

- Build up a fishery system that will promote the financial independence of fishermen by providing the fishery basic infrastructure and by establishing a fishermen organization to operate this infrastructure.
- Seek the way to raise the price of the fishery products in order to increase the fishermen's income through the improvement of the quality management of the fish catch.
- Carry out, through the fishermen organization, educational activities relevant to resource management and restrictions on fishing boats and fishing gear.
- Reforest the coastal marshlands with low vegetation cover (M2) and sparse low stands (LRh-S) dominated by *Rhizophora* spp., and upgrade nursery function for fishery resources. A Silvofishery method will be used for reforestation and operated executed mainly by fishermen in the M2.
- Carry out experimentations of soil improvement by the use of unmarketable charcoal

(3) Project components

i)	Construction of a fishery base (at the Suri Jaya jetty within the Marong Channel)	....	refer to 6.1.1 (2)
ii)	Establishment of a fishermen organization that operates the base	....	refer to 6.1.1 (2)
iii)	Establishment of the mangrove forest management field office (attached to the fishing base)	....	refer to 6.2
iv)	Nursery practice and reforestation project, and experimentation of soil improvement, based at this office	....	refer to 6.2
v)	Repair work on the main part of the road on the northern bank of the Marong Channel in the model area (approx. 9 km)		

In this plan, fishermen will conduct fishing in the Malacca Straits and participate in the reforestation of a part of the marshlands with low vegetative cover (M2). Tilapia will be stocked and fertilized in the cannel of reforestation area, and fishermen will be responsible for reforestation and management of the forest, in return for the harvest of tilapia.

The facilities layout for the fishery development plan is shown in Figure 27, and the plan scale of the facilities and equipment in Table 73.

The plan scale of the mangrove forest conservation and management improvement plan is shown in Table 72.

6.3.3 Regional Development Plan of the Pelantai Model Area

(1) Development objectives

- Sustainable use, with high added value, of the fishery resources within the channels
- Convert part-time fishermen whose main income sources are from mangrove felling, to full-time fishermen, and upgrade their living standard (restriction of mangrove felling)
- Improvement of the mangrove forests function as fishery resources nursery ground.

(2) Development Strategies

- Promotion of aquaculture using the trash fish caught within the channel as the feed
- Convert part-time fishermen whose main sources of income have been mangrove felling to full-time fish farmers
- Establishment of a fishermen organization and conducting educational activities on coastal resources management through the organization
- Reforestation of mangroves on marshlands with low vegetative cover (M2) by fish farmers

(3) Project components

i)	Construction of aquaculture bases - Earth ponds for mud crabs: Dusun Pelantai - Floating cage for giant sea perch: Dusun Kengkam	....	refer to 6.2.1 (1)
ii)	Establishment of a fishermen organization that operates the base	....	refer to 6.2.1 (1)
iii)	Establishment of the mangrove forest management field office (attached to the aquaculture base)	....	refer to 6.2
iv)	Nursery practice and reforestation projects based at the office	....	refer to 6.2

This plan aims at encouraging the part-time fishermen whose main source of income is mangrove felling to convert their activities to aquaculture using the trash fish caught by Gombang fishing within the channel as the feed. By ensuring them of a higher income than from mangrove felling, deforestation will eventually slow down. At the same time, these fish farmers will have the main responsibility for planting mangroves on a part of M2 in the area.

The facilities layout of the aquaculture plan are shown in Fig. 28 and 29, and the plan scale of the facilities and equipment in Table 74. The plan scale of fry pro duction center is shown in Table 75. The plan scale of mangrove forest conservation and management improvement plan is shown in Table 72. There will be no road repair work in this area.

6.3.4 Regional Development Plan of Tlk. Ketapang Model Area

(1) Development objectives

- Sustainable use, with high added value, of the fishery resources within the channels between the islands
- Conversion of part-time fishermen whose main sources of income have been mangrove felling to full-time fishermen, and upgrade their living standard (restriction of mangrove felling)
- Increasing the income of forestry-related workers

(2) Development Strategies

- Production and sales of the dried products with high value added given by drying and processing the low-price fish using a standardized method
- Conversion of part-time fishermen whose main sources of income have been mangrove felling to full-time fishermen engaging in fish processing
- Strengthening the fishermen organization and conducting educational activities on coastal resources management through the organization
- Carrying out experimentation projects aiming at increasing the forestry-related profits, based at the mangrove forest management field office.

(3) Project components

i)	Construction of a fishery processing base (at the site of the former sawmill in Dusun Ketapang Hilir)	....	refer to 6.2.1 (2)
ii)	Strengthening the functions of the fishermen organization that operates the base	....	refer to 6.2.1 (2)
iii)	Establishment of the mangrove forest management field office (attached to the fishery processing base)	....	refer to 6.2
iv)	Experimentation of apiculture and soil improvement, and monitoring work of illegal mangrove felling in the greenbelts based at the office	....	refer to 6.2

The local government has supplied Gombang nets to the part-time fishermen, whose main source of income have been mangrove felling, to encourage them to produce dried anchovies. However, the price of the products is stagnating because of poor processing technology. This project aims at improving the processing method in order to raise the product price and eventually to increase the fishermen's income. It also aims at slowing down mangrove felling by encouraging the fishermen to concentrate on fishery activities. At the same time, experimentation will focus on other forestry-related side businesses such as apiculture, which could lead to an increase in profit.

The facilities layout of the fishery processing base is shown in Figure 30, and the plan size of facilities and equipment in Table 76.

The plan scale of experimentation within the framework of mangrove forest conservation and management improvement plan is shown in Table 72. There will be no road repair work in this area.

6.4 Project Cost Estimation

The project cost was estimated under the following assumption.

1) Constant price as of October 1993 will be utilized.
2) Imported facilities and equipment will be tax exempted.
3) The currency exchange rate will be set at Yen 1.00 to Rp.19.8 and US$1.00 to Rp.2080.
4) The cost of imported construction facilities and equipment is estimated at CIF price at Jakarta and the domestic transportation cost is added.
5) Physical contingency is assumed to be 10 percents of the total construction cost.

Total project cost is as follows. The breakdowns of project cost by model area are shown in Table 77 to 82.

Total Project Cost

Unit : Rp.1000

Model area	Small-scale fishery development plan	Mangrove forest conversionand management improvement plan	Total
Headquaters	10,940	-	10,940
Muntai	4,192,508	2,247,797	6,440,365
Sei Cingam	2,745,414	1,297,575	4,042,989
Pelantai	2,050,872	552,601	2,603,473
Hatchery	1,115,455	-	1,115,455
Tlk. Ketapang	1,025,535	45,672	1,071,207
Total	11,140,724	4,143,645	15,284,369

6.5 Conditions for Implementation of the Plan and Management and Operation System

6.5.1 Conditions for Implementation of the Plan

(1) Conditions of the implementation system

The significance of this plan is to carry out measures for sustainable and effective use of the fishery resources and mangrove forests in the selected model areas. In order to improve the standard of living of the population of the coastal region, who now suffer from the poor economic situation in Indonesia. However, it has been discovered that in the areas concerned, most of those involved in mangrove felling are not fishermen. This makes it essentially difficult to integrate the fishery development plan with the mangrove forest conservation and management plan. For the former, it is easy to identify the effect, often quantitatively, and results can be obtained after a short period. For the latter, on the other hand, it is often impossible to identify the effect other than qualitatively. Even in the case of reforestation for charcoal production, in which the results can be estimated quantitatively, it will take at least 15 years before any result is achieved. Therefore, the only imaginable regional plan that can integrate fishery and forestry would be silvofishery in which fishermen will plant mangrove and manage it by themselves in order to culture fish in the reforested areas.

This overall plan adopted the regional plan with elements similar to social forestry for two of the four model areas: Sei Cingam and Pelantai. As for Muntai and Teluk Ketapang, the fishery plan and forestry plan are two separate plans in the same areas.

Prior to implementing this overall plan, it is at least necessary to cooperate with the DGF of the Ministry of Agriculture and Ministry of Forestry. It is also possible that relations with Ministry of Population and Environment, and National Science Institute, etc., will be required. The plan involves issues with which coastal residents are not familiar, such as operation of a fishery base, organization of fishermen, introduction of aquaculture and processing, reforestation, etc. It will be difficult to implement each project without a support system. Therefore, the following conditions are needed to be fulfilled when implementing the plan:

i) It is essential to establish in BAPPEDA a "Project implementation coordination committee" that unifies the projects of each model area, to coordinate the opinions of relevant agencies.

ii) Effective and continued instruction on organization, technology, management and marketing are necessary when implementing this plan. However, the local administration does not have adequate personnel with the qualifications and fund source to provide such instruction. It will therefore be necessary to call for outside instruction for the first three to five years of the plan.

iii) Fishermen or local residents who will be the direct beneficiaries of the plan have not received sufficient education. They need to be reorganized, and the instructors should try to get to know the fishermen and local residents better through the creation of the "Advisory committee for operation and management," which should include not only staff from public sectors but also locally respected educators and religious leaders.

(2) Conditions of the project fund

On the assumption that the catchable fishery resources in this area has almost reached the upper limit, this fishery development plan in this overall plan contents only the improvement of the added value of the fishery products as its benefits. Therefore, no significant increase in the fishermen's income can be expected. Even less direct benefit to the local residents is expected in the mangrove forest conservation and management improvement plan. This leads to the conclusion that the project will not be accomplished unless some portion of the project fund is subsidized by the government. The following methods are required to procure funds:

i) Recoverable investment: low-interest loans

ii) Unrecoverable investment: government subsidiaries or foreign cooperation grants

iii) All or part of technical assistance for management and operation of the projects: technical cooperation grants

6.5.2 Management and Operation Systems

The management and operation systems for the fishery and forestry sectors may be integrated or separated depending on conditions in each model area of this overall plan.

Systems will vary according to the model area are shown in the table below.

	Integrated operation	Partial integrated operation	Separate operation
Muntai	-	-	X (Fishermen operate fishery project, other residents operate reforestation project)
Sei Cingam	-	X (Fishermen and other residents operate reforestation project, other residents operate experimentation project)	-
Pelantai	X (Fish farmers operate reforestation project)	-	-
Tlk. Ketapang	-	-	X (Fishermen operate fishery product processing, other residents operate experimentation projects)

When the fishermen organization (or forestry related agencies, in the case of the forestry project) manage and operate the facilities and equipment of the plan, the following precautions must be observed:

i) External instruction is necessary at an early stage of the project because the fishermen (or local residents) are not used to running an organization.

ii) It is important to appoint well-qualified people and to establish an auditing system, considering the amount of money involved in the management of an organization.

All points considered, the management and operation systems of this overall plan are shown in Fig. 31. The period requiring external instruction on management and technology will be three to five years following the implementation of the projects.

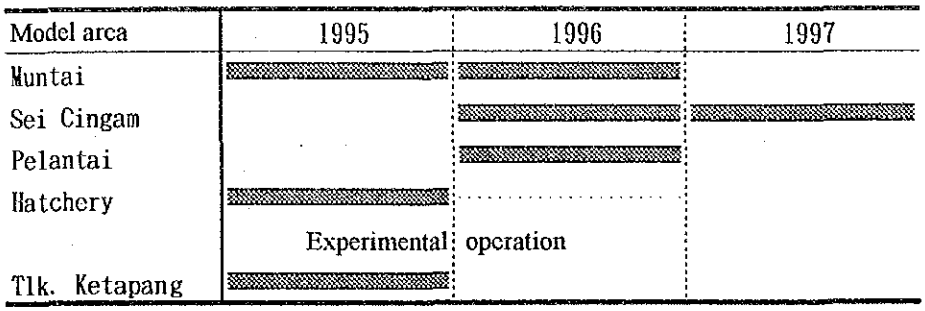
6.6 Project Evaluation

(1) Preconditions for evaluation

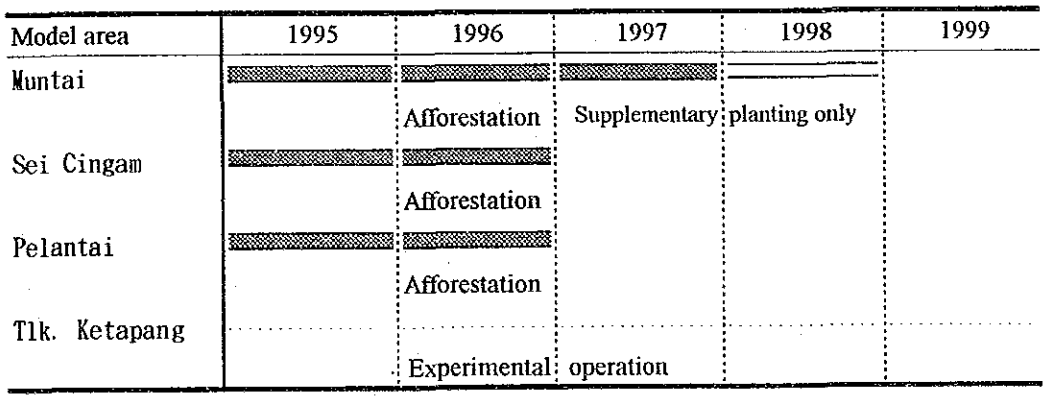
1) Construction schedule

Construction will begin in 1995, and proceed according to the following schedule.

a. Small-scale fishery development plan



b. Mangrove forest conservation and management improvement plan



All expenses and profits are based on prices as of October 1993.

3) Depreciation

The physical life of the facilities are given in Table 83. Depreciation was calculated by straight line method.

4) Fund procurement

The construction would be financed by temporary government credit without interests and subsidies, and the following low-interest loans :

- Annual interest: 3%
- Grace period for repayment of the capital: 10 years
- Repayment period: 30 years (including the grace period)

5) Revenue and expenditures

The revenue and expenditure of the small-scale fishery development project consist of the following:

Model area	Revenue	Expenditure
Muntai	Fresh fish export, ice sales, fishing boat charterage	Personnel expenses, fresh fish purchases, carrier vessel operation cost, maintenance cost
Sei CIngam	Fresh fish export, ice sales, fishing boat charterage	Personnel expenses, fresh fish purchases, carrier vessel operation cost, maintenance cost
Pelantai	Sales of giant sea perch, crabs, and anchovy	Personnel expenses, fry purchases, payment to fishermen, fishing boat operation cost, maintenance cost
Hatchery	Sales of giant sea perch fry, and crabs fry	Personnel expenses, feed cost, electric cost, fuel cost for boats, maintenance cost
Tlk. Ketapang	Sales of dried ancchovy, dried mysids and fresh shrimp	Personnel expenses, paymant to fishermen, fuel cost, maintenance cost

Participation of residents is considered for the operation of mangrove forest conservation and management improvement plan. After the completion of reforestation, no regular expenditures will be necessary. In Sei Cingam and Pelantai, the planted mangroves will be felled after 15 years or more. The wood will be used and sold as timber, and thus produce income. In Sei Cingam, tilapia are stocked by fertilized culture method and sylvofishery system, and the sales profit of the tilapia in Desa will be included in the income.

(2) Results of the evaluation

Income and expenditures of the small-scale fishery development plan (before payment of interest) are given in Tables 84 to 88. The fact that the profits before payment of the interest and depreciation is in the surplus in all model areas shows that normal operations will not incur any difficulty. In Muntai, Sei Cingam and Tlk. Ketapang, the profits after depreciation for the first two or three years are in the deficit, but it turns to the surplus in the following years, offering the villages the possibility to renovate the facilities.

Tables 89 to 94 were compiled to study the capital recovery. The following results were obtained:

- The project will not stand financially without an overall subsidy of approx. 30%.

- The Muntai project requires a large amount of money for the construction of breakwaters, jetties and solar systems. The profit raised from the annual landing of about 103 tons can hardly cover the repayment of the interest and the capital. A subsidy of approximately 50% will be needed.
- The Sei Cingam project requires a large amount of money for the construction of roads and solar systems. The profit raised from the annual landing of about 61 tons (in year 2002) can hardly cover the repayment of the interest and the capital. A subsidy of approximately 40% will be needed to implement this project.
- With regard to the fish farming and hatchery projects in Pelantai, the entire amount can be repaid if a low-interest loan as indicated in (1)-4) has been provided.
- A subsidy of approximately 10% will be needed to develop a processing industry in Tlk. Ketapang project. This is due to the large proportion of money appropriated for the construction of the all-weather drying place for mysids.

Power generation by solar systems requires a significant amount of money for the initial investment and procurement, but little is needed for daily operation. Thanks to the low-cost solar system, this project aims at maintaining the price of the ice supplied to fishermen in Muntai at a low level, in order to improve the quality of the fish catch, and eventually to raise the price of the fish sold to Malaysia or Singapore. This is the fundamental condition for the realization of this project in Muntai model area. Considering the fact that the improvement of the marketing system for marine products increase the fishermen's income, the solar system including the ice machine should be entitled a subsidy. The access road construction should not be treated as a single project but as a part of the government project, and therefore it should also be entitled a subsidy. With all the above subsidies, the subsidy rate of the Muntai area will be about 50%, allowing the project to stand financially.

For a similar reason, the project in the Sei Cingam model area will stand financially if the solar system including the ice machine is entitled to a subsidy.

The Tlk. Ketapang area uses a solar system to supply the power to refrigerators installed to maintain the quality of the dried products. The project will stand financially if this system is subsidized.

With all the above subsidies, the small-scale fishery development plan will become a profitable project.

The profit of the mangrove forest conservation and management improvement plan consists of the following:

- Sales of mangrove timber: Sei Cingam, Pelantai
- Sales of tilapia: Sei Cingam

Sales of mangrove timber cannot be financially expected to form a part of the project profit, as the sales profit from timber will be generated 15 years after reforestation, and mangrove felling involves considerable personnel expenses. Only an indirect benefit can be expected, such as home consumption by the local residents and minimal proceeds.

The annual sales of tilapia is about one million rupiah, less than 0.1% of the total project cost. Even if the sales is totally considered as a project profit, it will reach only 3% of the total project cost in 30 years. The tilapia sales involves considerable personnel expenses, and the volume of fish caught each time must be limited to maintain sustainable fish catch. Taking these facts into account, this cannot be included in the project profit, as it will be no more than pocket money raised by self-consumption of the local residents and other sales.

Once the reforestation and experimentation projects are over, maintenance and management fees will not be required. Thereafter, there will be only a little expense for mangrove forest inspection by the officials.

Therefore, the operation cost and profit can be considered as nil.

Only in Pelantai model area, the mangrove forest conservation and management improvement project will be integrated in the small-scale fishery development project in the Pelantai area. Although the small-scale fishery development plan in Pelantai will stand financially without subsidies, there are not enough funds to cover mangrove reforestation. Therefore, when the integrated operation system is launched, subsidies for mangrove reforestation will be still necessary.

The mangrove forest conservation and management improvement plan in the model areas other than Pelantai will also require total subsidy (100%).

As stated above, sufficient revenue which enable the project financially feasible, cannot be expected from the mangrove reforestation project. Most of the expenditure in the reforestation project is the personal expenses. The employment opportunity and income of inhabitants in each model area will be increased as shown below:

Model area	Increased income by the project	Period
Muntai	588 M Rp./year (Yearly Income of about 300 persons)	1995-1997
Sei Cingam	544 M Rp./year (Yearly Income of about 270 persons)	1995-1996
Pelantai	233 M Rp./year (Yearly Income of about 120 persons)	1995-1996

It is expected that apiculture on which the project will implement its experimentation will bring inhabitants the increase of side income in future, and soil improvement by the use of unmarketable charcoal will also bring the increase of income through improvement of productivity.

Considering indirect benefit such as the nursery function of mangrove forest to fisheries resources and the increase of inhabitants' income, etc., it is clear that the mangrove conservation and management will lead to the sustainable utilization of the coastal fishery resources, even though it requires total subsidy for project cost.

7. Conclusions and Recommendations

7. Conclusions and Recommendations

7.1 Conclusions

The objective of this Study is to increase the income of the residents of the coastal area under unfavorable economic conditions, while at the same time setting up measures for sustainable use of fishery resources and mangrove forests as coastal resources by the model area level.

In this Study, we grasped the overall situation of fisheries activities and ecology/management and utilization of the mangrove forests along the coast of Kab. Bengkalis in Riau province, the Study Area. Based on this understanding, the coastal resources management enhancement policy and the economic vitalization measures for the model areas were concluded as follows:

(1) Policies for coastal resources management and enhancement

1) Fishery resources management

- The area concerned in the Malacca Straits is rich in shrimps, mysids and anchovies, and forms a favorable fishing ground for human being as well as for larger fish that prey on them. Although the fishing effort in the Malacca Straits has been increasing in recent years, the total catch volume is stagnating, and the CPUE is clearly on the decline. For reasons of resources management, any further increase in fishing effort should be avoided.
- Fishery resources management requires an information-gathering system with high accuracy regarding fishing activities. In order to establish such a system, it is necessary to seek for the financial independence of fishermen and to establish a sound fishermen organization.
- Due to the social and technical restrictions imposed on fishermen, the sales price of the fish catch in the area concerned is too low compared with the market price. The most effective way to achieve the financial independence of the fishermen in the Study Area should be based on the added value gained by improvement of product quality and promotion of fish-farming, etc., and not an increase in the fishing effort.

2) Mangrove forest conservation and management

- It is necessary to adopt a regional mangrove forest management plan from long-term view points, based on scientific grounds relative to the regeneration and growth volume of the mangrove forests (no such management project exists at this stage). It is also necessary to institute a monitoring system for related information and data. However, it is expected that long-term preparation within the government will be required to institute such system. In this plan, a "mangrove forest management field office "tentative name) will be attached to the fishery development base, and projects of reforestation and experimentation will be implemented. For the operation of these projects, cooperation of various relevant agencies led by forestry related institutions such as Cabang Dinas Kehutanan, is required.
- Protection of the fishery resources nursery function of the coastal mangrove forests is extremely important from the viewpoint of sustainable use of the coastal resources. A green belt should be established in the coastal mangrove forest zone.
- The mangrove forests in the Study Area are estimated to have been reduced by 25% within the past 15 years (present covering area: approx. 70,000 ha). The main reason for this is considered to be conversion of the forests to farmland, cash-crop plantation, etc. Over cutting of mangroves for charcoal production has also been significant. In case a green belt is set up in the model mangrove forest area, the production capacity of the existing charcoal kilns is estimated to be twice the total allowable cut of the mangrove forest outside the green belt. It will be necessary to reduce the number of existing charcoal kilns by half. It is necessary to improve charcoal making techniques, structure of kilns and process of charcoal making and to conduct experiments and subsidies for the above improvement.
- The study area includes the marshlands (with and without low vegetative cover) that have the potential to become mangrove forests through reforestation. Reforestation of these lands will contribute to increase in the nursery function for the fishery resources and to prevention of coastal erosion. However, these results will hardly be visible to the coastal residents and will take more than 15 years until the residents enjoy the returns. Therefore a social forestry method with the participation of fishermen has been adopted for the mangrove reforestation in this plan, so that the results will be felt directly by the local people.

In this Study plan, reforestation projects with the participation of fishermen have been planned in two model areas (Sei Cingam and Pelantai).

(2) Effects on the coastal resources of the regional development plan in the model fishing areas

For the four selected model areas, a regional development plan combining a fishery development plan with a mangrove forest conservation and management improvement plan has been adopted, respectively. This is not exactly the same as incorporating the two projects. It is clear, however, that the mangrove forest conservation and management will lead to the sustainable use of the fishery resources in the long run.

	Muntai	Sei Cingam	Pelantai	Tlk. Ketapang
Contents of Development	• Installation of Fishery base • Establishment of fishermen organization • Resources management by the fishermen organization • Mangrove afforestation of the coastal bare land under the initiative of local residents • Road repair work	• Same as left • Same as left • Same as left • Mangrove afforestation of the marsh lands with low vegetation cover under the initiative of fishermen • Same as left	• Installation of aquaculture base • Job conversion to fish-farming of the side-business fishermen whose main sources of income is mangrove felling • Mangrove afforestation of the marshlands with low vegetative cover by the converted fish-farmers	• Instalation of Dried product processing base • Same as left (conversion to processing industry) • Experimentation project, such as apiculture, soil improvement, etc.
Effects on the coastal resources	• Realization of fishery resource management by the fishermen themselves, encouraged by the achievement of financial independence throught the increased • Prevention on erosion, and expansion of the nursery area through the recovery of mangrove forest over the coastal bare land	• Same as left • Increase the fishery resources nursery function through the recovery of mangrove forest over marsh lands with low vegetation • Increase in the forestry-related supplementary income • Improvement of the fishermen's awareness of coastal resopurce management through social forestry	• Job conversion to fish-farming that assures a large income of the fishermen dependent on mangrove felling to restrain mangrove felling • Realization of resource management within the channel by the fishermen themselves	• Same as left (conversion to processing industry) • Increase in the forestry-related supplementary incom

(3) Significance of project implementation

Financial evaluations of the fishery development plan and the mangrove forest conservation and management improvement plan gave different results.

- Fishery development plan:

  Fish-farming development in Pelantai can recover the invested fund, but the fishing development in Muntai and Sei Cingam and the fish product processing development in Tlk. Ketapang will require public subsidies of 50%, 40% and 10% of the total project cost, respectively.

- Mangrove forest conservation and management improvement plan:

  Reforestation in Sei Cingam and Pelantai will produce accountable results 15 years after planting but will require nearly 100% public subsidies. Reforestation of the marsh land on the coast of Muntai has the objective of national land conservation, through the prevention of erosion. It has a secondary effect of improving the nursery function of the fishery resources. Therefore, it should be entitled to a 100% public subsidy.

  The results of the experimentation projects, such as apiculture, soil improvement, etc., planned in Tlk. Ketapang and Sei Cingam more area, are expected to be obtained in the near future. It is however impossible to calculate the benefit at this stage.

The above-mentioned facts lead us to believe that the fishery development plan will achieve planned effects if a certain proportion of public subsidy is provided. On the other hand, the mangrove forest conservation and management improvement plan is not expected to give any results that can be evaluated financially. Since sufficient data can not be collected at this stage to make a scientific and quantitative evaluation in this field, we should aim at a qualitative evaluation from long term view points. Results of the existing scientific studies suggest that the vast coastal mangrove forests of Indonesia play an important role in the nursery area of the country's fishery resources.

It is therefore considered significant to implement this overall plan as a model development including the mangrove conservation and management improvement plan from the standpoint of national interest.

7.2 Recommendations

For a country like Indonesia, which has a long shoreline and a vast mangrove forest zone along the coast, it is extremely important in forming a national development policy to consider fishery resources and mangrove forests as the coastal resources and to seek the sustainable use of such resources.

The regional development project in each model fishing areas adopted by this plan is small in scale, but it will offer valuable information for examination of the future policy of coastal resource management. By realizing these projects and by evaluating the results obtained, they can be applied to other regions to contribute to improvement of the standard of living of the coastal population.

The following suggestions are made in relation to the conclusions of this Study.

(1) Fishery development field

1) Government response to the implementation of the model regional development plan

Based on the recognition that the fishing is reaching the limit of fishery resources in the Malacca Straits, this project already maintains a policy of not increasing the number of boats or fishermen. It also tries to restrict the mesh size of nets. If such measures are only applied in the model areas, they will not be effective but increase the sense of partiality. Therefore, the government should fix a new fishing regulation to prevent the catch of the fish smaller than the present size and apply it to the entire Study Area.

2) Assistance to the fishermen organization

The most noteworthy of the facts revealed in the opinion poll given to fishermen is that they are highly willing to invest in their fishing activities. One problem is that they do not know how to use the investment fund. Therefore, what the government should do is not only to prepare the investment fund but also to build an effective support system for fishermen, one that takes into account the "software" - management of fishermen households and their organization (e.g. introduction of a long-term instruction system by experts).

3) Improvement of marketing system of fishery product

The Study Area is close to Malaysia and Singapore, and it is able to export such products as fresh fish, cultured fish and processed fish at a higher price than selling in the domestic market. However, insufficient understanding of the existing marketing system (especially the price structure) dominated by the brokers obstructs the settlement of measures to improve the marketing system, which will eventually increase the fishermen's income. This study has clarified the problem to a certain extent, but the government should continue to gather and analyze information and build up a marketing system that will increase the fishermen's income (and limit the brokers' margin).

(2) Mangrove forest management field

1) Formulation of the mangrove forest management plan

The central government is currently preparing natural strategies for

mangrove forest management. Present conditions of mangrove forest management and utilization should be reflected when adopting the strategies. As a temporary solution, Riau province should compile its own mangrove management plan as soon as possible.

2) Mangrove resources management system

Three types of the mangrove management system ; administration-led system, inhabitants' participated system and private business participated system, have been proposed in this plan. Prior to implementing the plan adopting any of these systems, following points are to be examined ;

- A purchased method by charcoal manufacturers that can clearly specify the mangrove felling area in order to prevent the current situation of excessive felling caused by purchasing raw material regardless of the HPHH area
- A monitoring system of mangrove trees which are not marketed through charcoal manufacturers

3) Improvement of production method of mangrove charcoal

The occurrence rate of unmarketable charcoal by the traditional method is very high, estimated at about 25% out of raw material wood volume. The effective use of mangrove raw material is to be pursued by reducing the unmarketable volume through improvement of the structure of charcoal kilns, production procedure, etc. Such research works are to be led by the government.

4) Strengthening technical support to the mangrove forest management

Continuous technical support by the government is required to the following items which need long study period :

- Growth speed of mangrove trees by region
- Counter measures of illegal felling in a green-belt zone
- Project evaluation of apiculture, soil improvement using unmarketable charcoal, etc.

(3) Environmental considerations

Illegal dumping of waste oil from tankers that transit the area often has a harmful influence on the coastal areas. The government should enhance the administrative guidance and restrain such violations through the relevant agency.

Tables and Figures

Table 1 Outline of Fishery Development Project in Riau Province

Project Type	No. of Project	Total Fund (Rp. 1000,000)	Fund Source
1. Production Increase	17	689.2	APBN
1) Administration	1	85.0	
2) Fishing	7	239.5	
3) Aquaculture	8	293.5	
4) Processing	1	71.7	
2. Batam Station Sea Farming	4	391.0	APBN
1) Administration	1	306.6	
2) Aquaculture	3	84.4	
3. Tarempa Fishery Harbour	3	1,986.0	APBN
1) Administration	1	20.1	
2) Facilities	2	1,965.9	
4. Natua Is. Development	2	135.0	APBN
1) Administration	1	35.0	
2) Fishing	1	100.0	
Sub total	26	3,201.2	APBN
5. Administration	2	32.5	APBD
6. Fishing	3	105.0	APBD
7. Aquaculture	20	66.5	APBD
8. Processing	2	45.0	APBD
9. Marketing	1	7.5	APBD
10. Female	1	18.0	APBD
Sub total	29	674.5	APBD
Grand total	55	3,875.7	

Sources : Evaluasi Perkembangan Riau Pada Repelita V S/D Tahun 1991/1992 dan Usulan Program/Proyek 1992/1993

Table 2 Population by Province and Its Growth Rate

Province	Population (x 1000)			Growth Rate	
	1971	1980	1990	1971-80	1980-90
1 DI Aceh	2,009	2,611	3,416	3.0%	2.7%
2 Sumatera Uatara	6,622	8,361	10,256	2.6%	2.1%
3 Sumatera Barat	2,793	3,407	4,000	2.2%	1.6%
4 Riau	1,642	2,169	3,304	3.1%	4.3%
5 Jambi	1,006	1,446	2,021	4.1%	3.4%
6 Sumatera Selatan	3,441	4,630	6,313	3.4%	3.1%
7 Bengkulu	519	768	1,179	4.5%	4.4%
8 Lampung	2,777	4,625	6,018	5.8%	2.7%
9 DKI Jakarta	4,579	6,503	8,254	4.0%	2.4%
10 Jawa Barat	21,624	27,454	35,381	2.7%	2.6%
11 Jawa Tengah	21,877	25,373	28,522	1.7%	1.2%
12 DI Yogyakarta	2,489	2,751	2,913	1.1%	0.6%
13 Jawa Timur	25,517	29,189	32,504	1.5%	1.1%
14 Bali	2,120	2,470	2,778	1.7%	1.2%
15 Nusa Tenggara Barat	2,204	2,725	3,370	2.4%	2.1%
16 Nusa Tenggara Timur	2,295	2,737	3,269	2.0%	1.8%
17 Timor-timur	-	555	748	-	3.0%
18 Kalimantan Barat	2,020	2,486	3,239	2.3%	2.7%
19 Kalimantan Tengah	702	954	1,396	3.5%	3.9%
20 Kalimantan Selatan	1,699	2,065	2,598	2.2%	2.3%
21 Kalimantan Timur	734	1,218	1,877	5.8%	4.4%
22 Sulawesi Utara	1,719	2,115	2,479	2.3%	1.6%
23 Sulawesi Tengah	914	1,289	1,711	3.9%	2.9%
24 Sulawesi Selatan	5,181	6,062	6,982	1.8%	1.4%
25 Sulawesi Tenggara	714	942	1,350	3.1%	3.7%
26 Maluku	1,090	1,411	1,856	2.9%	2.8%
27 Irian Jaya	923	1,174	1,641	2.7%	3.4%
Grand total	119,210	147,490	179,375	2.4%	2.0%

Sources : Central Bureau of Statistics.

Table 3 Population Density in Sumatera

Province	Density (persons/km2)		
	1971	1980	1990
1 DI Aceh	36	47	62
2 Sumatera Uatara	94	118	145
3 Sumatera Barat	56	68	80
4 Riau	17	23	35
5 Jambi	22	32	45
6 Sumatera Selatan	33	45	59
7 Bengkulu	24	36	55
8 Lampung	83	139	180
Sumatera	44	59	77
Indonesia	62	77	93

Sources : Central Bureau of Statistics.

Table 4 GRDP at Current Price by Province, Including Oil, Gas and Their Products

Province	GRDP (x Billion Rupiah)						Growth
	1984	1985	1986	1987	1988	1989	Rate
1 DI Aceh	4,224	4,251	5,208	5,201	6,067	7,232	11.3%
2 Sumatera Uatara	4,362	4,702	5,182	6,440	7,907	9,476	17.5%
3 Sumatera Barat	1,442	1,616	1,847	2,205	2,556	2,899	15.5%
4 Riau	7,616	7,433	7,539	9,393	9,225	11,635	8.9%
5 Jambi	624	704	771	944	1,140	1,352	17.1%
6 Sumatera Selatan	4,112	4,557	4,614	5,531	6,175	7,180	11.7%
7 Bengkulu	301	360	448	535	623	682	18.4%
8 Lampung	1,236	1,354	1,805	2,177	2,566	2,839	19.6%
9 DKI Jakarta	9,611	10,519	11,745	13,730	16,001	18,771	14.6%
10 Jawa Barat	13,144	14,635	15,716	18,618	22,357	26,032	14.9%
11 Jawa Tengah	8,829	10,124	11,492	13,594	16,423	18,782	16.7%
12 DI Yogyakarta	894	994	1,162	1,300	1,487	1,651	13.4%
13 Jawa Timur	12,695	14,017	15,842	18,086	20,921	24,661	14.2%
14 Kalimantan Barat	982	1,091	1,302	1,575	2,032	2,287	19.7%
15 Kalimantan Tengah	552	636	742	880	1,057	1,272	18.3%
16 Kalimantan Selatan	1,048	1,143	1,238	1,475	1,732	1,975	14.0%
17 Kalimantan Timur	5,575	5,962	5,502	7,218	7,927	8,884	10.4%
18 Sulawesi Utara	745	811	875	1,018	1,141	1,287	11.8%
19 Sulawesi Tengah	426	480	535	617	718	863	15.0%
20 Sulawesi Selatan	2,012	2,323	2,609	2,871	3,299	3,736	12.9%
21 Sulawesi Tenggara	361	373	419	482	630	723	16.0%
22 Bali	1,092	1,440	1,693	1,954	2,234	2,593	18.0%
23 Nusa Tenggara Barat	635	709	771	853	951	1,098	11.2%
24 Nusa Tenggara Timur	594	659	737	849	938	1,040	12.1%
25 Maluku	581	637	728	940	1,130	1,332	19.1%
26 Irian Jaya	887	933	1,079	1,143	1,300	1,624	12.4%
27 Timor-timur	97	112	133	167	200	231	19.7%
Total of 27 Provinces	84,677	92,575	101,734	119,796	138,737	162,137	14.1%
Indonesia *)	89,885	96,997	102,683	124,817	142,020	166,330	13.4%

*) National Income of Indonesia/1984-1989

Remarks : The difference between the total and National Income of Indonesia is due to the statistical discrepancies.

Sources : Central Bureau of Statistics.

Table 5 Per Capita GRDP at Current Price by Province, Excluding Oil, Gas and Their Products at current prices

Province	Per Capita GRDP (x Rp. 1,000)						Growth
	1984	1985	1986	1987	1988	1989	Rate
1 DI Aceh	465	523	567	635	722	785	11.1%
2 Sumatera Uatara	446	475	520	634	766	899	15.8%
3 Sumatera Barat	398	439	494	580	662	740	13.7%
4 Riau	479	523	568	650	735	834	11.9%
5 Jambi	339	370	394	446	503	561	10.7%
6 Sumatera Selatan	544	585	634	738	836	927	11.7%
7 Bengkulu	338	388	464	532	596	626	13.7%
8 Lampung	224	234	297	340	382	402	13.8%
9 DKI Jakarta	1,286	1,355	1,456	1,639	1,840	2,098	10.5%
10 Jawa Barat	358	406	456	527	626	654	13.6%
11 Jawa Tengah	308	345	387	442	532	603	14.7%
12 DI Yogyakarta	310	340	393	434	491	539	12.0%
13 Jawa Timur	413	449	501	565	645	751	12.7%
14 Kalimantan Barat	362	392	456	538	673	736	16.5%
15 Kalimantan Tengah	516	576	651	749	872	1,018	14.6%
16 Kalimantan Selatan	444	478	523	608	714	799	13.0%
17 Kalimantan Timur	973	1,044	1,183	1,495	1,776	2,114	17.7%
18 Sulawesi Utara	326	347	369	422	464	515	9.9%
19 Sulawesi Tengah	295	321	348	389	438	511	11.4%
20 Sulawesi Selatan	298	342	382	418	478	538	12.3%
21 Sulawesi Tenggara	338	337	366	408	515	572	12.1%
22 Bali	419	546	633	721	813	932	16.4%
23 Nusa Tenggara Barat	214	233	248	269	294	332	8.9%
24 Nusa Tenggara Timur	200	217	237	268	289	314	9.7%
25 Maluku	370	394	443	556	691	748	16.8%
26 Irian Jaya	407	445	533	594	632	866	15.1%
27 Timor-timur	159	180	207	255	297	335	16.8%
Indonesia *)	441	492	531	618	701	799	12.7%

*) National Income of Indonesia/1984-1989

Remarks: Oil, gas, and their products consist of crude petroleum, natural gas, LNG and refined petroleum

Sources: Central Bureau of Statistics

Table 6 GRDP in Riau at Current Price by Industrial Origin, Excluding Oil

Industrial Origin	GRDP (x Rp. 1,000,000,000)					Growth	Share (%)				
	1985	1986	1987	1988	1989	Rate	1985	1986	1987	1988	1989
1 Agriculture	350	375	439	504	595	14.5%	27.7	26.8	26.9	26.2	26.2
2 Mining and quarrying	78	84	102	117	137	15.7%	6.2	6.0	6.3	6.1	6.0
3 Manufacture	97	107	134	164	215	22.3%	7.7	7.7	8.2	8.5	9.5
4 Electricity and water	10	12	17	25	33	36.8%	0.8	0.8	1.0	1.3	1.4
5 Construction	26	29	33	37	45	14.2%	2.1	2.1	2.0	1.9	2.0
6 Trade, hotel and restaurants	336	369	409	478	537	12.7%	26.6	26.4	25.1	24.9	23.6
7 Transportation and communications	148	163	193	224	260	15.5%	11.7	11.7	11.8	11.7	11.4
8 Banking & Other financial intermediaries	25	35	47	60	75	31.4%	2.0	2.5	2.9	3.1	3.3
9 Ownership of dwellings	87	100	108	117	126	9.4%	6.9	7.1	6.6	6.1	5.6
10 Government and Defence	89	102	120	166	212	25.0%	7.0	7.3	7.4	8.6	9.3
11 Services	20	23	27	32	37	16.6%	1.6	1.7	1.7	1.7	1.6
Gross Regional Domestic Products	1,266	1,399	1,628	1,924	2,272	16.0%	100.0	100.0	100.0	100.0	100.0

Remarks : Preliminary figures

Sources : Statistical Office, Riau Province

Table 7 Export by Country of Destination, 1990

Country of Destination	Weight (1,000ton)	Value F.O.B(million US$)
1 Singapore	10,690	366
2 Taiwan	1,086	133
3 China	982	211
4 South Korea	863	158
5 Japan	21,513	3,352
6 USA	4,075	569
7 Australia	650	129
8 Others	772	266
Total	40,631	5,186

Sources : Statistical Office, Riau Province

Table 8 Population by Kabupaten in Riau Province

Kabpaten	Population(X 1000)			Growth Rate		Density (person/km2)		
	1971	1980	1990	1971-80	1980-90	1971	1980	1990
1 Pekanbaru	145	186	399	2.8%	7.9%	2,314	2,958	893
2 Kampar	259	363	570	3.8%	4.6%	9	11	20
3 Induragiri Hulu	197	229	368	1.7%	4.9%	12	14	23
4 Induragiri Hilir	286	398	478	3.7%	1.8%	25	34	41
5 Bengkalis	424	567	904	3.3%	4.8%	14	18	30
6 Kep. Riau	331	386	479	1.7%	2.2%	44	52	64
7 Batam	-	39	108	-	10.7%	-	64	176
Total	1,642	2,169	3,306	3.1%	4.3%	17	23	35

Sources : Statistical Office,Pekanbaru

Table 9 Per Capita GRDP by Kabupaten in Riau at 1983 Constant Price

Kabupaten	Per Capita GRDP (x 1000)			Growth Rate	
	1983	1986	1989	1983-86	1986-89
1 Pekanbaru	483	701	775	13.2%	3.4%
2 Kampar	358	374	422	1.5%	4.1%
3 Indragiri Hulu	262	277	331	1.8%	6.1%
4 Indragiri Hilir	292	326	378	3.7%	5.1%
5 Bengkalis	485	493	565	0.5%	4.7%
6 Kep. Riau	439	493	570	4.0%	4.9%
7 Batam	602	649	647	2.5%	-0.1%

Sources : Satistical Office, Province Riau, 1989

Table 10 Share of Industry in GRDP by Kabupaten in Riau at 1983 Constant Price

Industry	PBR	KMR	INHU	INHIL	BKLS	KEPRI	BTM
1 Agriculture	0.97	53.73	42.49	39.31	25.88	18.74	0.81
2 Mining and quarrying	0.01	0.93	5.27	0.07	10.89	14.31	7.86
3 Manufacture	9.79	7.68	4.92	4.60	13.32	8.57	34.41
4 Electricity, gas and water	6.07	0.12	0.70	0.32	0.56	1.75	0.78
5 Construction	1.67	2.54	2.51	2.21	1.32	1.97	1.87
6 Trade, hotel and restaurant	36.68	13.38	14.57	25.41	28.10	27.36	19.05
7 Transportation and comminucation	20.20	6.95	7.51	11.15	8.83	11.84	16.33
8 Banking & other financial intermediari	11.29	0.37	3.89	2.10	1.42	1.50	7.27
9 Ownership of dwellings	6.38	5.28	6.17	6.78	4.55	6.30	4.88
10 Government and defence	4.29	7.13	9.60	6.28	4.55	5.84	5.61
11 Services	2.66	1.88	2.38	1.77	1.18	1.82	1.14
Total	100.00	100.00	100.00	100.00	100.00	100.00	100.00

Sources : Satistic Office, Province Riau, 1989

Table11 Socio-Economic Index of Villages in Kab. Bengkalis (1991) (1/6)

Kecamatan / Desa	Popu-lation	Number of house-holds	Inhbt Density (p/km2)	Ratio of 10 - 55	Work Force by Industry Total	Paddy	Farm-ing	Estate	Live-stock	Fish-ery	Small Indus.	Large Indus.	Trade	Desa Type	Net Production Total amount (x Rp. 1000)	Per capita (Rp.)	
1 Bengkalis																	
1 Bengkalis Kota	6,569	1,196	3,285	76.9%	1,237	-	-	-	10	-	6	-	1,221	Trade	3,429,320	522,046	
2 Demon	5,193	969	2,597	68.1%	1,482	-	-	-	-	12	5	-	1,465	Trade	2,829,480	544,864	
3 Rimba Sekampung	3,918	729	1,567	73.5%	884	-	-	-	-	20	-	-	864	Trade	1,995,638	509,351	
4 Senggoro	2,398	448	218	68.9%	632	-	-	30	-	-	-	-	602	Trade	1,226,400	511,426	
5 Kelapa pati	4,114	765	411	76.0%	916	-	55	75	5	15	9	-	757	Trade	2,094,188	509,039	
6 Pedekik	1,642	314	82	71.1%	718	-	258	322	18	4	3	-	113	Estate	830,923	506,043	
7 Pangkalan Batang	2,412	409	73	64.2%	518	-	170	225	-	11	2	-	110	Estate	1,007,674	417,775	
8 Wonosari	3,129	605	156	77.1%	1,391	-	450	525	-	-	-	-	416	Estate	1,435,363	458,729	
9 Penebal	1,187	211	54	72.2%	427	-	115	220	21	27	7	-	37	Estate	365,821	308,190	(#)
10 Air Putih	1,284	240	86	65.9%	447	-	-	300	-	-	-	-	147	Estate	481,800	375,234	
11 Ketam Putih	1,931	340	84	68.0%	711	-	-	600	15	50	-	-	46	Estate	682,550	353,470	(*)
12 Sebauk	1,544	254	62	76.3%	416	-	-	280	-	30	30	-	76	Estate	472,821	306,231	(*) (#)
13 Teluk Latak	2,070	378	129	66.4%	661	-	74	349	49	71	11	-	107	Estate	758,835	366,587	(*)
14 Penampi	1,486	291	106	65.8%	424	-	-	240	-	86	-	-	98	Estate	531,075	357,386	(*)
15 Pematang Duku	2,433	471	61	66.3%	861	283	-	458	7	-	3	-	110	Estate	1,031,490	423,958	
16 Bentan Air	4,689	890	120	71.2%	1,358	321	-	556	-	150	47	-	284	Estate	1,949,100	415,675	(*)
17 Tameran	2,076	362	173	70.7%	450	-	75	222	29	26	5	-	93	Estate	528,520	254,586	(#)
18 Jangkang	2,151	391	80	72.4%	731	-	100	300	67	160	30	-	74	Estate	570,860	265,393	(*) (#)
19 Teluk Pambang	4,548	958	49	72.4%	2,059	-	-	1,834	-	100	2	-	123	Estate	2,098,020	461,306	(*)
20 Muntai	1,686	305	80	65.0%	311	-	-	218	-	57	-	-	36	Estate	500,962	297,130	(*) (#)
21 Meskom	2,871	514	106	73.2%	683	-	-	150	-	460	13	-	60	Fishery	844,245	294,060	(*) (#)
22 Bantan Tua	2,105	355	105	77.2%	583	-	75	349	22	20	10	-	107	Estate	647,875	307,779	(#)
23 Sungari Alam	2,791	483	164	69.7%	522	-	30	330	-	40	12	-	110	Estate	969,622	347,410	(*)
24 Kelemantan	1,384	267	58	69.9%	433	-	140	250	20	7	-	-	16	Estate	389,820	281,662	(#)
25 Sekodi	1,856	335	93	68.1%	365	-	20	298	-	-	30	-	17	Estate	550,238	296,464	(#)
26 Selat Baru	5,314	1,080	133	73.3%	1,698	-	200	961	-	98	65	-	374	Estate	2,759,400	519,270	(*)
27 Kembung Luar	2,908	521	145	69.9%	824	-	-	685	45	-	30	-	64	Estate	760,660	261,575	(#)
28 Teluk Lancar	1,382	242	69	64.4%	614	-	43	479	-	45	-	-	47	Estate	353,320	255,658	(*) (#)
29 Bantan Tengah	4,249	867	104	74.2%	1,010	-	125	723	42	15	19	-	86	Estate	1,898,730	446,865	

Remarks : (*) Fishermen in the Desa were 30 and over. (#) Per Capita Net Production of desa was lower than the poverty line (US$ 160).
Sources : Desa Reconstruction Office of Kabupaten Bengkalis

Table11 Socio-Economic Index of Villages in Kab. Bengkalis (1991) (2/6)

Kecamatan / Desa	Popu-lation	Number of house-holds	Inhbt. Density (p/km2)	Ratio of Age 10 - 55	Work Force by Industry: Total	Paddy	Farming	Estate	Live-stock	Fish-ery	Small Indus.	Large Indus.	Trade	Desa Type	Net Production: Total amount (x Rp. 1000)	Per capita (Rp.)	
2 Tebing Tinggi																	
1 Slt.Panjang Kota	11,490	2,203	2,873	74.5%	2,674	-	-	-	1	-	10	-	2,663	Trade	7,236,855	629,839	
2 Slt.Panjang Barat	8,992	1,591	8,992	71.5%	2,495	-	-	-	61	87	33	3	2,311	Trade	5,226,435	581,232	(*)
3 Slt.Panjang Timur	11,683	2,214	2,124	80.8%	2,316	-	120	1	23	5	219	6	1,942	Trade	7,272,990	622,528	
4 Slt.Panjang Sltn	7,370	1,427	4,913	75.5%	2,713	-	-	-	-	-	-	-	2,713	Trade	4,687,695	636,051	
5 Sokop	841	180	42	67.7%	238	-	-	168	-	-	-	-	70	Estate	262,800	312,485	(#)
6 Kedabu Rapat	3,979	743	111	69.7%	538	80	54	358	-	-	-	-	46	Estate	1,423,774	357,822	
7 Tanjung	2,031	370	23	71.0%	831	-	331	361	46	19	16	-	58	Estate	709,013	349,096	
8 Insit	3,080	596	308	71.4%	875	-	85	636	52	8	18	-	76	Estate	1,142,085	370,807	
9 Bungur	3,302	654	94	64.9%	1,920	-	-	1,220	30	400	93	-	177	Estate	1,253,228	379,536	(*)
10 Tlk.Buntal	1,652	300	75	65.7%	562	-	225	235	-	27	-	-	75	Estate	574,875	347,987	
11 Lemang	3,936	759	123	74.3%	675	-	-	506	-	-	-	-	169	Estate	1,454,434	369,521	
12 Repan	1,906	371	159	66.5%	470	-	-	378	-	25	-	-	67	Estate	541,660	284,187	(#)
13 Sungai Cina	2,603	494	186	70.6%	1,125	583	-	415	40	-	-	-	87	Paddy	946,628	363,668	
14 Tenan	682	136	85	62.2%	283	-	-	180	25	15	-	-	63	Estate	198,560	291,144	(#)
15 Tg.Medang	2,308	425	96	66.3%	574	-	-	235	30	180	7	-	122	Estate	814,406	352,862	(*)
16 Melai	3,204	625	169	71.0%	1,470	747	-	604	-	26	5	-	88	Paddy	1,197,656	373,800	
17 Tg.Gadai	1,285	246	214	68.1%	255	-	-	224	-	12	-	-	19	Estate	471,398	366,847	
18 Sonde	1,712	321	90	63.7%	504	-	-	315	-	115	-	-	74	Estate	468,660	273,750	(*) (#)
19 Lukun	1,944	391	108	73.2%	490	-	-	450	-	25	-	-	15	Estate	606,539	312,006	(#)
20 Sungai Tohor	2,916	559	81	68.5%	1,106	-	275	650	25	20	50	-	86	Estate	1,081,386	370,846	
21 Anak Setatah	1,070	220	129	65.0%	559	245	45	106	25	60	15	-	63	Paddy	321,200	300,187	(*) (#)
22 Alai	4,480	881	118	75.6%	1,554	-	250	1,085	-	20	-	-	199	Estate	1,768,608	394,779	
23 Penyagun	1,465	301	133	66.4%	325	-	-	298	-	-	-	-	27	Estate	494,393	337,470	
24 Kayu Ara	864	188	51	69.8%	297	-	68	120	-	64	30	-	15	Estate	274,480	317,685	(*) (#)
25 Tg.Sari	762	139	191	70.7%	306	-	92	201	-	-	3	-	10	Estate	202,940	266,325	(#)
26 Banglas	6,067	1,136	202	75.4%	2,782	-	-	1,625	80	262	12	-	803	Estate	2,487,840	410,061	(*)
27 Bokor	2,629	558	263	72.3%	1,220	-	48	648	-	6	78	-	440	Estate	1,120,185	426,088	
28 Sesap	350	66	88	63.7%	107	-	-	95	-	-	-	-	12	Estate	84,315	240,900	(#)
29 Segomeng	1,037	213	130	72.3%	369	75	-	219	-	-	-	-	75	Estate	330,416	318,627	(#)
30 Topang	2,486	455	166	65.3%	508	-	-	422	-	-	-	-	86	Estate	871,894	350,722	
31 Alah Air	5,520	998	690	72.2%	999	-	69	220	30	60	-	-	620	Trade	2,003,485	362,950	(*)
32 Bantar	2,569	479	257	67.5%	563	-	30	360	-	78	-	-	95	Estate	961,593	374,306	(*)
33 Tg.Peranap	1,408	277	64	66.5%	356	25	-	250	-	28	-	-	53	Estate	556,078	394,942	
34 Tg.Samak	6,405	1,181	97	64.9%	1,380	-	-	975	-	50	30	-	325	Estate	2,694,156	420,633	(*)
35 Beting	990	202	124	75.4%	514	-	161	227	27	40	2	-	57	Estate	221,190	223,424	(*) (#)
36 Tg.Kedabu	3,402	538	43	67.8%	717	-	60	355	50	70	115	-	67	Estate	1,030,943	303,040	(*) (#)

Remarks : (*) Fishermen in the Desa were 30 and over. (#) Per Capita Net Production of desa was lower than the poverty line (US$ 160).
Sources : Desa Reconstruction Office of Kabupaten Bengkalis

Table11 Socio-Economic Index of Villages in Kab. Bengkalis (1991) (3/6)

Kecamatan / Desa	Popu-lation	Number of house-holds	Inhbt. Density (p/km2)	Ratio of Age 10 - 55	Work Force by Industry									Desa Type	Net Production		
					Total	Paddy	Farm-ing	Estate	Live-stock	Fish-ery	Small Indus.	Large Indus.	Trade		Total amount (x Rp. 1000)	Per capita (Rp.)	
3 Merbau																	
1 Teluk Belitung	3,808	784	190	69.0%	822	-	-	281	15	51	37	-	438	Trade	1,638,120	430,179	(*)
2 Mengkirau	1,624	298	62	72.7%	536	-	-	334	23	43	23	1	112	Estate	598,235	368,371	(*)
3 Mengkopot	1,589	336	41	65.9%	440	-	185	215	-	13	-	-	27	Estate	521,220	328,018	
4 Bandul	2,795	526	233	67.5%	759	-	125	455	43	28	30	1	77	Estate	1,439,925	515,179	
5 Kudap	2,380	398	190	78.6%	707	-	-	416	84	92	15	4	96	Estate	871,620	366,227	(*)
6 Dedap	2,011	442	201	73.7%	645	-	-	613	-	15	-	-	17	Estate	806,650	401,119	
7 Tanjung Padang	1,829	259	61	83.5%	578	-	150	398	-	6	-	-	24	Estate	458,623	250,751	(#)
8 Baran Melintang	1,881	341	188	65.7%	445	-	112	272	34	14	-	-	13	Estate	622,325	330,848	
9 Semukut	2,255	409	282	71.6%	655	-	65	527	-	25	5	-	33	Estate	746,425	331,009	
10 Centai	2,342	437	260	73.3%	1,076	45	66	783	98	36	-	-	48	Estate	638,020	272,425	(*) (#)
11 Lukit	1,341	249	42	64.4%	333	47	-	191	15	10	11	-	59	Estate	363,540	271,096	(#)
12 Pelantai	2,540	438	254	79.3%	555	-	-	378	26	50	-	-	101	Estate	719,415	283,234	(*) (#)
13 Bagan Melibur	1,940	392	41	62.5%	376	-	-	250	-	101	-	-	25	Estate	500,780	258,134	(*) (#)
14 Renak Dungun	1,341	253	84	79.0%	393	-	125	160	55	-	-	-	53	Estate	332,442	247,906	(#)
15 Kuala Merbau	2,520	438	140	73.4%	525	-	-	376	-	118	-	-	31	Estate	959,220	380,643	(*)
16 Meranti Bunting	1,512	303	126	61.6%	566	-	-	510	-	33	-	-	23	Estate	497,678	329,152	(*)
17 Selat Akar	1,965	319	58	67.4%	694	-	-	381	63	187	37	11	15	Estate	465,740	237,018	(*) (#)
18 Teluk Ketapang	1,443	295	80	66.9%	819	-	358	243	79	40	22	-	77	Farming	430,700	298,475	(*) (#)

Remarks : (*) Fishermen in the Desa were 30 and over. (#) Per Capita Net Production of desa was lower than the poverty line (US$ 160).
Sources : Desa Reconstruction Office of Kabupaten Bengkalis

Table11 Socio-Economic Index of Villages in Kab. Bengkalis (1991) (4/6)

Kecamatan / Desa	Popu-lation	Number of house-holds	Inhbt. Density (p/km2)	Ratio of Age 10 - 55	Work Force by Industry: Total	Paddy	Farming	Estate	Live-stock	Fish-ery	Small Indus.	Large Indus.	Trade	Desa Type	Net Production: Total amount (x Rp. 1000)	Per capita (Rp.)	
4 Bukit Batu																	
1 Sungai Pakning	5,529	1,097	369	70.7%	1,208	-	-	-	-	35	175	-	998	Trade	3,603,385	651,725	(*)
2 Lubuk Muda	3,041	581	127	70.8%	744	-	227	321	-	25	15	-	156	Estate	1,366,358	449,312	
3 Bukit Batu	909	163	45	71.1%	305	-	59	164	-	-	38	-	44	Estate	258,233	284,085	(#)
4 Buruk Bakul	791	135	99	67.3%	207	-	-	140	-	30	8	-	29	Estate	247,100	312,389	(*) (#)
5 Tenggayun	1,525	291	76	69.6%	372	-	19	287	-	12	-	-	54	Estate	477,768	313,290	(#)
6 Dompas	762	148	127	68.1%	188	-	-	148	-	11	-	-	29	Estate	243,090	319,016	(#)
7 Sukajadi	502	107	20	69.1%	188	61	-	96	-	-	-	-	31	Estate	124,693	248,392	(#)
8 Sepahat	874	164	146	67.2%	202	-	-	135	-	27	15	-	25	Estate	188,559	215,743	(#)
9 Langkat	1,645	347	46	69.2%	600	425	67	30	-	-	-	-	78	Paddy	469,948	285,683	(#)
10 Sungai Selari	2,909	498	145	71.3%	621	-	88	295	-	-	18	-	220	Estate	1,508,850	518,683	
11 Tanjung Belit	1,712	311	68	73.4%	437	280	40	75	-	-	-	-	42	Paddy	597,575	349,051	
12 Temiang	922	175	115	69.1%	302	-	56	186	-	-	-	-	60	Estate	223,563	242,476	(#)
13 Sepotong	1,921	388	192	73.5%	608	-	148	365	-	-	20	-	75	Estate	609,241	317,148	(#)
14 Pangkalan Jambi	777	149	97	72.2%	228	-	55	145	-	-	-	-	28	Estate	247,114	318,036	(#)
15 Sungai Siput	546	105	30	66.8%	245	107	81	40	-	-	-	-	17	Paddy	133,719	244,907	(#)
16 Sejangat	3,449	652	172	70.8%	833	85	498	120	-	-	-	-	130	Farming	1,070,910	310,499	(#)
17 Lubuk Gaung	2,729	620	61	71.6%	929	582	120	145	-	-	-	-	82	Paddy	892,925	327,199	
18 Api-Api	1,049	207	105	72.1%	313	-	72	198	-	15	7	-	21	Estate	283,331	270,096	(#)
19 Parit I Api-Api	260	51	65	68.5%	79	-	50	17	-	-	-	-	12	Farming	58,637	225,527	(#)

Remarks : (*) Fishermen in the Desa were 30 and over. (#) Per Capita Net Production of desa was lower than the poverty line (US$ 160).
Sources : Desa Reconstruction Office of Kabupaten Bengkalis

Table11 Socio-Economic Index of Villages in Kab. Bengkalis (1991) (5/6)

Kecamatan / Desa	Popu-lation	Number of house-holds	Inhbt. Density (p/km2)	Ratio of Age 10 - 55	Work Force by Industry: Total	Paddy	Farming	Estate	Live-stock	Fish-ery	Small Indus.	Large Indus.	Trade	Desa Type	Net Production: Total amount (x Rp. 1000)	Per capita (Rp.)	
5 Sungai Apit																	
1 Sungai Apit	4,475	936	172	76.4%	1,847	61	484	296	10	20	172	-	804	Trade	2,220,660	496,237	
2 Sungai Kayu Ara	2,211	403	221	77.1%	551	-	-	451	-	40	-	-	60	Estate	882,570	399,172	(*)
3 Tanjung Kuras	2,096	426	116	70.8%	433	20	-	225	-	52	-	-	136	Estate	870,744	415,431	(*)
4 Rempak	3,131	622	78	71.5%	1,166	844	-	172	-	13	-	-	137	Paddy	1,396,235	445,939	
5 Parit I/II	1,018	177	170	67.2%	531	-	217	268	-	-	-	-	46	Estate	355,328	349,045	
6 Pebadaran	275	34	46	63.6%	223	75	45	94	-	-	-	-	9	Estate	62,050	225,636	(#)
7 Sungai Berbari	566	90	103	64.5%	245	109	-	120	-	-	-	-	16	Estate	139,613	246,666	(#)
8 Perincit	680	147	57	70.7%	411	75	50	175	-	48	-	-	63	Estate	201,206	295,891	(*) (#)
9 Benayah	982	218	98	72.3%	416	150	-	210	-	30	-	-	26	Estate	278,495	283,600	(*) (#)
10 Teluk Lanus	309	66	39	67.6%	89	-	75	-	-	6	-	-	8	Farming	72,270	233,883	(#)
11 Bandar Sungai	2,680	532	61	75.1%	1,023	334	-	525	-	-	14	-	150	Estate	1,067,990	398,504	
12 Sungai Limau	479	97	68	67.0%	163	-	70	80	-	-	-	-	13	Estate	123,917	258,699	(#)
13 Sungai Rawa	1,068	214	107	70.0%	260	-	-	157	-	17	-	-	86	Estate	312,440	292,547	(#)
14 Penyengat	689	128	172	73.9%	250	-	-	160	-	-	-	-	90	Estate	140,160	203,425	(#)
15 Mengkapan	894	184	56	67.0%	563	-	73	430	-	-	-	-	60	Estate	302,220	338,054	
16 Teluk Mesjid	3,566	677	137	79.5%	930	465	-	240	-	53	36	-	136	Paddy	1,111,993	311,832	(*) (#)
17 Dosan	450	113	75	66.7%	109	-	-	92	-	-	-	-	17	Estate	113,424	252,053	(#)
18 Lalang	2,211	436	92	77.8%	484	15	-	338	-	-	-	-	131	Estate	755,915	341,888	
19 Dusun Pusaka	304	58	61	69.4%	204	30	10	150	-	7	-	-	7	Estate	68,803	226,326	(#)
20 Bunga Raya	2,900	595	207	64.6%	1,150	665	67	-	18	10	15	-	375	Paddy	1,085,875	374,440	
21 Jaya Pura	2,826	659	202	76.4%	836	685	8	-	-	-	25	-	118	Paddy	1,082,407	383,017	
22 Jati Baru	2,678	551	191	68.5%	810	527	65	-	-	131	-	-	87	Paddy	1,005,575	375,495	(*)

Remarks : (*) Fishermen in the Desa were 30 and over. (#) Per Capita Net Production of desa was lower than the poverty line (US$ 160).
Sources : Desa Reconstruction Office of Kabupaten Bengkalis

Table11 Socio-Economic Index of Villages in Kab. Bengkalis (1991) (6/6)

Kecamatan / Desa	Popu-lation	Number of house-holds	Inhbt. Density (p/km2)	Ratio of Age 10 - 55	Work Force by Industry: Total	Paddy	Farming	Estate	Live-stock	Fish-ery	Small Indus.	Large Indus.	Trade	Desa Type	Net Production: Total amount (x Rp. 1000)	Per capita (Rp.)	
6 Rupat																	
1 Batu Panjang	2,803	540	280	68.7%	678	25	333	50	-	31	4	-	235	Farming	886,950	316,429	(*) (#)
2 Tanjung Kapal	3,283	570	109	68.1%	505	-	175	256	-	-	15	-	59	Estate	936,225	285,174	(#)
3 Terkul	2,655	483	156	73.1%	585	75	-	389	-	56	-	-	65	Estate	793,328	298,805	(*) (#)
4 Pergam	1,821	305	152	70.7%	846	-	291	373	-	61	15	-	106	Estate	500,963	275,103	(*) (#)
5 Teluk Lecah	2,998	507	73	68.8%	700	32	-	395	40	75	76	-	82	Estate	832,748	277,768	(*) (#)
6 Hutan Panjang	1,790	281	149	65.6%	291	-	240	-	-	25	-	-	26	Farming	358,978	200,546	(#)
7 Teluk Rhu	1,391	230	139	67.9%	289	-	-	-	18	220	10	-	41	Fishery	335,800	241,409	(*) (#)
8 Tanjung Medang	1,579	237	197	70.0%	332	-	49	-	-	212	9	-	62	Fishery	405,062	256,531	(*) (#)
9 Pkl.Nyirih	3,078	520	154	73.6%	846	-	495	160	-	31	-	-	160	Farming	949,000	308,317	(*) (#)
10 Sungai Cingam	1,948	355	162	67.0%	675	-	348	-	86	135	32	-	74	Farming	534,497	274,382	(*) (#)
11 Makeruh	1,453	224	85	67.7%	300	-	88	-	-	186	-	-	26	Fishery	327,040	225,079	(*) (#)
12 Tanjung Punak	491	85	82	67.4%	146	-	-	75	-	48	12	-	11	Estate	108,588	221,157	(*) (#)
13 Kador	2,075	313	130	65.3%	431	75	-	119	-	190	-	-	47	Fishery	514,103	247,760	(*) (#)
14 Titi Akar	3,781	611	56	70.0%	648	-	-	267	-	325	-	-	56	Fishery	1,003,568	265,424	(*) (#)
7 Dumai Barat																	
1 Laksamana	3,178	596	2,119	69.3%	638	-	-	-	-	-	-	-	638	Trade	2,175,400	684,519	
2 Bukit Timah	4,807	836	240	73.6%	1,360	-	942	-	-	-	-	-	418	Farming	3,051,400	634,783	
3 Purnama	5,445	1,106	170	80.8%	2,247	-	2,019	-	4	116	-	4	104	Farming	3,229,520	593,335	(*)
4 Rimba Sekampung	10,233	1,664	2,274	81.3%	2,623	-	-	-	-	-	74	-	2,549	Trade	6,377,280	623,207	
5 Bukit Datuk	13,237	2,559	509	78.5%	5,105	-	10	-	-	-	-	-	5,095	Trade	10,274,385	776,187	
6 Pangkalan Sesai	14,234	2,586	791	68.6%	2,411	-	912	-	-	-	-	-	1,499	Trade	9,910,845	696,280	
8 Dumai Timur																	
1 Dumai Kota	8,294	1,734	1,885	75.7%	1,167	-	-	-	-	-	15	-	1,152	Trade	6,329,100	763,094	
2 Sukajadi	14,589	2,830	5,611	75.9%	6,994	-	-	-	-	-	10	10	6,974	Trade	10,845,955	743,434	
3 Tanjung Palas	3,165	599	144	72.8%	685	-	196	-	-	74	63	-	352	Trade	1,749,086	552,634	(*)
4 Buluh Kasab	8,363	1,687	1,858	73.2%	2,747	-	-	-	-	-	55	8	2,684	Trade	6,157,550	736,285	
5 Teluk Binjai	10,436	2,062	745	69.2%	2,327	-	-	-	-	-	-	10	2,317	Trade	7,526,300	721,186	
6 Jaya Mukti	8,989	1,789	1,798	74.3%	3,960	-	736	-	89	-	5	-	3,130	Trade	6,529,850	726,427	
9 Bukit Kapur																	
1 Bagan Besar	4,761	961	298	69.0%	1,247	-	263	199	-	-	30	-	755	Trade	2,455,355	515,723	
2 Bukit Kapur	5,670	1,110	95	68.1%	1,149	-	929	-	4	-	1	-	215	Farming	2,633,475	464,458	
3 Teluk Makmur	1,446	287	72	76.9%	449	-	305	75	-	30	-	-	39	Farming	477,398	330,151	(*)
4 Guntung	577	104	58	70.0%	303	-	210	69	-	-	-	-	24	Farming	132,860	230,260	(#)
5 Mundam	837	154	105	73.1%	304	-	222	51	-	5	-	-	26	Farming	196,735	235,048	(#)
9 Pelintung	1,768	341	111	68.0%	819	-	235	455	-	-	-	-	129	Estate	520,673	294,498	(#)

Remarks : (*) Fishermen in the Desa were 30 and over. (#) Per Capita Net Production of desa was lower than the poverty line (US$ 160).
Sources : Desa Reconstruction Office of Kabupaten Bengkalis

Table12 Annual Landings and CPUE of Demarsal Fish in Malacca Strait (1969~1975)

		1969	1970	1971	1972	1973	1974	1975
Total demarsal landings	(ton)	56,651	63,243	60,259	74,138	88,059	89,405	82,623
Total fishing effort	(days)	307,585	438,240	535,311	581,061	502,044	527,948	562,256
CPUE	(kg/day)	184	144	113	128	175	169	147

Sources : Report of the Workshop on the Fishery Resources of the Malacca Strait, South China Sea Fisheries Development and Coordinating Programme, 1976

Table13 Fishery Resources and Fish Catch Potential in the Malacca Strait

Unit : ton/year

	Resources	Potential
Demarsal fish	235,800	116,900
Pelagic fish*1	216,000	108,000
Coral Fish	13,053	6,526
Penaeid Shrimps	45,800	22,900
Lobster	856	428
Squid	16,500	8,250

Remarks : *1 ; Figure of pelagic fish doesn't include Tuna.
Sources : Potensi dan Penyebaran Sumberdaya Ikan Laut di Perairan Indonesia, DGF 1989

Table14 CPUE of Pelagic Fish in Malacca Strait (1969~1990)

Year	Total catch (ton)	Fishing effort (days)	CPUE (kg/day)
1969 *1	40,102	151,248	265
1970 *1	44,831	163,153	275
1971 *1	49,632	174,001	285
1972 *1	57,473	203,005	283
1973 *1	59,750	213,371	280
1974 *1	66,027	317,804	208
1975 *1	32,597	(285,868)	(114)
1976 *2	47,671	116,000	411
1977 *2	47,758	153,900	310
1978 *2	42,193	166,400	254
1979 *2	41,343	212,700	194
1980 *2	47,277	485,000	98
1981 *2	38,598	585,200	66
1982 *2	45,521	873,400	52
1983 *2	-	-	-
1984 *2	42,466	309,900	137
1985 *2	67,875	407,000	162
1986 *2	79,993	416,900	192
1987 *2	88,668	672,700	132
1988 *2	78,227	932,400	84
1989 *2	87,315	636,000	137
1990 *2	97,274	543,700	179

Remarks : Figures in brackets are estimates
Sources : *1; Report of the Workshop on the Fishery Resources of the Malacca Strait, SCS, 1976
*2; Studi Penyeunan dan Penataan Zona Penangkapan Ikan di Perairan Selat Malaka, DGF, 1993

Table15 Trend of Marine Fisheries Production in Keb. Bengkalis (1987~1991)

Unit : Ton

	1987	1988	1989	1990	1991	Growth ratio
Kubu						
Fishing	51,563.6	53,573.4	48,837.0	48,516.0	48,448.0	-2.2%
Aquaculture	-	-	-	-	-	
Bangko						
Fishing	16,630.8	15,192.1	20,766.2	21,242.6	21,964.8	9.3%
Aquaculture	-	-	-	-	-	
Dumai/Rupat						
Fishing	1,558.6	1,164.4	1,772.7	1,825.2	1,715.4	6.6%
Aquaculture	-	0.8	10.0	20.6	1.5	
Bengkalis/B.Batu						
Fishing	1,765.8	1,597.6	1,941.6	1,526.4	1,528.4	-3.3%
Aquaculture	1.4	3.9	5.8	3.5	4.9	27.1%
T.Tinggi/Merbau						
Fishing	10,737.6	11,701.9	11,142.8	11,470.5	10,796.1	-0.1%
Aquaculture	-	0.6	20.0	7.5	2.3	
Mandau/T. Puteh						
Fishing	-	-	-	-	-	
Aquaculture	-	-	-	-	-	
Siak/Sei Apit						
Fishing	-	-	-	-	114.8	
Aquaculture	-	-	-	-	-	
Fishing sub total	82,256.4	83,229.4	84,460.3	84,580.7	84,567.5	0.7%
Aq. sub total	1.4	5.3	35.8	31.6	8.7	72.3%
Total	82,257.8	83,234.7	84,496.1	84,612.3	84,576.2	0.7%

Sources : Laporan Tahunan 1987 - 1991, Cabang Dinas Perikanan, Kabupaten Bengkalis

Table16 List of Fish Names (1/2)

Local name	Scientific name	English name
Ikan		Fishes
Ikan Sebelah	*Psettodidae*	Indian halibuts
Ikan Lidah	*Cynoglossus spp.*	Flat fishes
Ikan Nomei	*Harpodon nehereus*	Bombay duck
Ikan Peperek	*Leiognathidae*	Pony fishes/Slip mouth
Manyung	*Tachyurus spp.*	Sea catfishes
Beloso	*Saurida spp.*	Lizard fishes
Biji nangka	*Upeneus spp.*	Goat fishes
Ikan Gerot-gerot	*Pomadasys spp.*	Grunters/Sweetlips
Ikan Merah/Bambangan	*Lutjanus spp.*	Red snappers
Kerapu	*Epinepheius spp.*	Groupers
Lencam	*Lethrinus spp.*	Emperors
Kakap	*Lates calcarifer*	Giant sea perch/Baramundi
Kurisi	*Nemipterus spp.*	Threadfin breams
Swanggi	*Priacanthus spp.*	Big eyes
Ekor kuning/Pisang-pisang	*Caesio spp.*	Yellow tail/Fusiliers
Gulamah/Tigs waja	*Sciaenidae*	Croakers, drums
Cucut	*Carcharhinidae, Sphyrinidae*	Shark
Pari	*Trigonidae*	Rays
Bawal hitam	*Formio niger*	Black pomfret
Bawal putih	*Pampus argenteus*	Silver pomfret
Alu-alu	*Sphyraena spp.*	Baracudas
Ikan Layang	*Decapterus spp.*	Scads
Selar	*Selar spp., Selaroides spp.*	Trevallies
Kuwe	*Caranx spp.*	Jack crevallies
Tetengkek	*Megalaspis cordyla*	Hardtail scads
Daun bambu/Talang-talang	*Chorinemus spp.*	Queen fishes
Sunglir	*Elagatis bipinnulatus*	Rainbow runner
Ikan terbang	*Cypselurus spp.*	Flying fishes
Belanak	*Mugil spp.*	Mullets
Kuro/Senangin	*Polynemus spp.*	Threadfins
Julung-julung	*Tyiosurus spp., Hemirhamphus spp.*	Needle fishes
Teri	*Stolephorus spp.*	Anchovies
Japuh	*Dussumieria spp.*	Rainbow sardine
Tembang	*Sardinella fimbriata*	Fringescale sardinella
Lemuru	*Sardinella longiceps*	Indian oil sardinella
Golok-golok/Parang-parang	*Chirocentrus spp.*	Wolf herrings
Terubuk	*Clupea(Alosa) toli*	Tolishad(Chinese herring)
Kembung	*Rastrelliger spp.*	Indian mackerels
Tenggiri papan	*Scomberomorus guttatus*	Indo pacific king mackerels
Tenggiri	*Scomberomorus commersoni*	Narrow bared king mackerels
Layur	*Trichiurus spp.*	Hairhails, cuttlass fishes
Cakalang	*Katsuwonus pelamis*	Skipjack tuna
Tongkol	*Euthynnus spp.*	Eastern little tunas
Bandeng	*Chanos chanos*	Milk fish
Biang biang	*Setipinna breviceps*	(Setipinna breviceps)
Kelampai	*Otolithoides biauritus*	Bronze croaker
Puput	*Pellona sp*	(Pellona sp)
Ikan ikan lain	-	-

Table16 List of Fish Names (2/2)

Local name	Scientific name	English name
Bintan Berkulit Kerau		Crustacean
Rajungan	*Portunus spp.*	Swim crab
Kepiting	*Scylla serrata*	Mud crab
Udang barong	*Panulirus spp.*	Panulirid spiny lobsters
Udang windu	*Penaeus monodon, P. semisulcatus*	Giant tiger prawn
Udang putih/Irebung	*Penaeus merguiensis, P. indicus*	Banana prawn
Udang dogol	*Metapenaeus spp.*	Metapenaeus shirimps
Udang lainnya	-	Other shrimps
Udang Rebon	-	Mysid
Lainnya	-	Others
Binatang Lunak		Molluscs
Tiram	*Crassostrea spp.*	Cupped oyster
Simping	*Amusium spp.*	Scalops
Remis	*Meretrix spp.*	Hard clams
Kerang darah	*Anadara spp.*	Blood cockles
Cumi-cumi	*Loligo spp.*	Common squids
Sotong	*Sepia spp.*	Cuttle fishes
Gurita	*Octopus spp.*	Octopuses
Lainnya	-	Others
Binatang Air Lainnya		Others
Penyu	*Chelonia mydas*	Marine turtles
Teripang	*Stichoous spp.*	Sea cucumbers
Ubur-ubur	*Rhopilema spp.*	Jelly fishes
Lainnya	-	Others
Rumput laut	*Euchema spp., Gracillaria spp.*	Sea weeds

Table17 Trend of Fisheries Production in Riau Province (1980~1991)

Unit : Ton

	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991
Fishery Sector	159,119	144,499	128,549	153,032	156,099	160,761	163,114	170,026	172,198	176,592	181,445	188,282
Aquaculture	210	174	213	211	271	385	439	546	577	675	876	945
Brackish Water	64	35	49	64	58	47	33	90	93	139	188	221
Fresh Water	145	139	165	147	213	338	405	456	484	536	688	723

Sources : Buku Tahunan Statisik Perikanan Tingkat Propinsi 1980-1991

Table18 Supply/Demand Balance of Fishery Products by Province (1990)

Unit : Ton

Province	Fish Supply			Fish Demand			Balance
	Sub-total	Production	Import	Sub-total	Consumpti	Export	
Whole Country	3,235,754	3,162,469	73,285	3,235,754	2,915,514	320,240	0
a. Sumatera	862,451	855,849	6,602	907,230	823,929	83,301	-44,779
1 DI Aceh	111,476	111,290	186	110,575	110,497	78	901
2 Sumatera Uatara	231,695	226,481	5,214	303,613	273,444	30,169	-71,918
3 Sumatera Barat	69,169	69,169	0	68,662	68,592	70	507
4 Riau	182,055	181,418	637	143,299	92,614	50,685	38,756
5 Jambi	22,490	22,490	0	49,664	49,006	658	-27,174
6 Sumatera Selatan	132,994	132,994	0	130,993	129,643	1,350	2,001
7 Bengkulu	14,890	14,890	0	19,698	19,698	0	-4,808
8 Lampung	97,682	97,117	565	80,726	80,435	291	16,956
b. Jawa	967,621	901,186	66,435	1,353,940	1,239,101	114,839	-386,319
9 DKI Jakarta	64,893	30,196	34,697	157,024	110,129	46,895	-92,131
10 Jawa Barat	300,648	300,648	0	550,066	550,066	0	-249,418
11 Jawa Tengah	257,339	254,404	2,935	224,231	221,053	3,178	33,108
12 DI Yogyakarta	3,216	3,216	0	9,396	9,396	0	-6,180
13 Jawa Timur	341,525	312,722	28,803	413,223	348,457	64,766	-71,698
c. Nusa Tenggara	264,188	264,167	21	141,136	133,226	7,910	123,052
14 Bali	143,455	143,452	3	43,181	36,292	6,889	100,274
15 Nusa Tenggara Barat	65,736	65,719	17	56,381	56,381	0	9,355
16 Nusa Tenggara Timur	54,180	54,180	0	37,355	36,335	1,020	16,825
17 Timor-timur	817	816	1	4,219	4,218	1	-3,402
d. Kalimantan	384,804	384,798	6	257,806	248,877	8,929	126,998
18 Kalimantan Barat	87,614	87,613	1	75,147	72,754	2,393	12,467
19 Kalimantan Tengah	85,426	85,426	0	38,409	38,095	314	47,017
20 Kalimantan Selatan	124,999	124,994	5	84,345	82,410	1,935	40,654
21 Kalimantan Timur	86,765	86,765	0	59,906	55,619	4,287	26,859
e. Surawesi	533,343	533,339	4	395,814	358,851	36,963	137,529
22 Sulawesi Utara	81,658	81,657	1	78,995	68,051	10,944	2,663
23 Sulawesi Tengah	38,718	38,718	0	43,753	43,633	120	-5,035
24 Sulawesi Selatan	318,263	318,260	3	223,688	203,812	19,876	94,575
25 Sulawesi Tenggara	94,704	94,704	0	49,378	43,355	6,023	45,326
f. Maluku & Irian Jaya	223,347	223,130	217	179,827	111,529	68,298	43,520
26 Maluku	154,494	154,291	203	113,532	75,583	37,949	40,962
27 Irian Jaya	68,853	68,839	14	66,295	35,946	30,349	2,558

Sources:1) Population : Central Bureau of Statistics.
2) Consumption of Calorie & Protein of Indonesia and Province, 1990
Central Bureau of Statistics
3) International Trade Statistics of Fishery Commodities, 1990, DGF
4) Fish Production : Fishery Statistics of Indonesia, 1990, DGF

Table19 Export Volume of Fishery Products by Province

Unit : ton

Province	1986	1987	1988	1989	1990	1991
Whole Country	107,445	140,378	181,217	228,594	320,240	411,586
a. Sumatera	24,755	31,471	37,400	43,307	83,301	114,641
1 DI Aceh	283	667	519	274	78	58
2 Sumatera Uatara	13,043	17,269	23,522	27,493	30,169	39,569
3 Sumatera Barat	63	34	58	74	70	58
4 Riau	9,407	11,566	11,203	13,694	50,685	70,950
5 Jambi	0	5	205	2	658	1,002
6 Sumatera Selatan	1,950	1,929	1,877	1,719	1,350	1,828
7 Bengkulu	3	1	0	0	0	0
8 Lampung	6	0	16	51	291	1,176
b. Jawa	35,904	47,136	72,705	104,073	114,839	153,669
9 DKI Jakarta	13,021	18,292	33,398	43,398	46,895	48,436
10 Jawa Barat	10	24	1,001	7	0	0
11 Jawa Tengah	3,109	3,092	3,807	6,343	3,178	2,663
12 DI Yogyakarta	0	0	0	0	0	175
13 Jawa Timur	19,764	25,728	34,499	54,325	64,766	102,395
c. Nusa Tenggara	340	1,644	3,253	7,837	7,910	8,752
14 Bali	189	1,464	2,936	7,590	6,889	7,985
15 Nusa Tenggara Barat	128	80	175	88	0	0
16 Nusa Tenggara Timur	23	100	142	159	1,020	767
17 Timor-timur	0	0	0	0	1	0
d. Kalimantan	5,206	7,847	8,714	8,411	8,929	9,288
18 Kalimantan Barat	962	2,181	2,421	1,974	2,393	1,892
19 Kalimantan Tengah	330	320	387	256	314	300
20 Kalimantan Selatan	1,213	2,115	2,134	2,225	1,935	1,855
21 Kalimantan Timur	2,701	3,231	3,772	3,956	4,287	5,241
e. Surawesi	15,076	20,548	23,038	21,281	36,963	25,326
22 Sulawesi Utara	655	3,188	3,720	3,848	10,944	13,026
23 Sulawesi Tengah	394	187	120	98	120	202
24 Sulawesi Selatan	10,432	12,391	13,655	14,027	19,876	7,852
25 Sulawesi Tenggara	3,595	4,782	5,543	3,308	6,023	4,246
f. Maluku & Irian Jaya	26,164	31,732	36,107	43,685	68,298	99,910
26 Maluku	6,688	12,166	12,330	24,372	37,949	40,339
27 Irian Jaya	19,476	19,566	23,777	19,313	30,349	59,571

Sources : International Trade Statistics of Fishery Commodities, 1990, DGF

Table20 Export Amount of Fishery Products by Province

Unit : FOB US$ 1,000

Province	1986	1987	1988	1989	1990	1991
Whole Country	374,116	475,526	712,205	822,747	1,039,681	3,765
a. Sumatera	71,818	96,356	144,166	161,898	209,893	700
1 DI Aceh	3,041	8,054	6,401	520	545	0
2 Sumatera Uatara	48,597	66,038	116,637	138,659	152,784	38
3 Sumatera Barat	124	82	92	114	105	0
4 Riau	4,240	5,754	5,954	10,098	43,509	662
5 Jambi	0	3	210	92	1,385	0
6 Sumatera Selatan	15,811	16,423	14,868	12,356	9,748	0
7 Bengkulu	5	2	0	0	0	0
8 Lampung	0	0	4	59	1,817	0
b. Jawa	157,401	186,661	332,631	446,228	582,120	2,531
9 DKI Jakarta	54,007	65,251	142,929	201,278	236,385	838
10 Jawa Barat	1	4	848	3	0	0
11 Jawa Tengah	25,895	24,728	29,597	30,572	21,839	1,109
12 DI Yogyakarta	0	0	0	0	0	0
13 Jawa Timur	77,498	96,678	159,257	214,375	323,896	584
c. Nusa Tenggara	2,680	5,484	13,702	21,411	25,463	7
14 Bali	2,027	5,028	12,651	20,533	24,401	7
15 Nusa Tenggara Barat	646	434	813	413	0	0
16 Nusa Tenggara Timur	7	22	234	406	1,050	0
17 Timor-timur	0	0	4	59	12	0
d. Kalimantan	28,768	44,173	53,466	44,723	43,787	3
18 Kalimantan Barat	3,653	10,506	13,449	10,031	10,287	3
19 Kalimantan Tengah	2,742	2,335	3,090	1,584	2,187	0
20 Kalimantan Selatan	6,090	11,591	12,870	12,361	9,026	0
21 Kalimantan Timur	16,283	19,741	24,057	20,747	22,287	0
e. Surawesi	49,673	65,436	88,147	84,019	91,224	6
22 Sulawesi Utara	416	2,326	4,456	4,454	13,280	0
23 Sulawesi Tengah	293	495	332	308	480	0
24 Sulawesi Selatan	45,660	58,287	77,880	76,263	71,510	6
25 Sulawesi Tenggara	3,304	4,328	5,479	2,994	5,954	0
f. Maluku & Irian Jaya	63,776	77,416	80,093	64,468	87,194	518
26 Maluku	33,388	42,912	38,823	34,991	47,608	293
27 Irian Jaya	30,388	34,504	41,270	29,477	39,586	225

Sources : International Trade Statistics of Fishery Commodities, 1990, DGF

Table21 Export Volume of Fishery Products in Kab. Bengkalis

Unit : Ton

Kecamatan	1987	1988	1989	1990	1991
1 Kubu	215	1,838	1,369	443	226
2 Bangko	1,893	813	1,240	549	486
3 Dumai/Rupat/Bukit Kapur	63	54	101	73	237
4 Bengkalis/Bukit Batu	-	38	276	89	193
5 Tebing Tinggi/Merbau	-	-	-	-	23
6 Mandau/Tanah Putih	-	-	31	3	-
7 Siak/Sungai Apit	-	-	-	-	-
Total	1,956	906	1,648	714	938

Remarks : Export consist of fresh fish and dried/salted fish.
Dried/salted fish volume converted into weight of fresh fish.
Sources : Laporan Tahunan 1987-1991, Cabang Dinas Perikanan, Kabupaten Bengkalis

Table22 Export Amount of Fishery Products in Kabupaten Bengkalis

Unit : US$

	Kecamatan	1987	1988	1989	1990	1991
1	Kubu	124,115	666,725	532,054	633,646	428,450
2	Bangko	1,970,485	1,814,565	1,935,908	1,034,297	923,909
3	Dumai/Rupat/Bukit Kapur	28,830	17,550	167,992	138,243	449,730
4	Bengkalis/Bukit Batu	-	15,238	458,567	167,712	365,750
5	Tebing Tinggi/Merbau	-	-	-	-	28,927
6	Mandau/Tanah Putih	-	-	50,811	4,752	228
7	Siak/Sungai Apit	-	-	-	-	-
	Total	2,123,430	2,514,078	3,145,332	1,978,650	2,196,994

Sources : Laporan Tahunan 1987-1991, Cabang Dinas Perikanan, Kabpaten Bengkalis

Table23 Export of Fishery Products in Riau Province (1990)

	Fishery Commodities	Net Weight (ton)	Value of FOB (US$)
1	Other marine ornamental fish	3.6	9,128
2	Fresh water ornamental fish, bettas	7.4	88,121
3	Fresh water ornamental fish, gurami	12.6	51,942
4	Other fresh water ornamental fish	3.4	11,008
5	Other live fish	112.5	307,525
6	Trout other than fry	0.3	813
7	Other fish, fresh or chilled	1,377.7	516,161
8	Other flat fish, fresh or frozen	295.3	177,138
9	Marine fish, fresh or chilled	42,146.3	36,052,962
10	Other marine fish, fresh or chilled	5.7	2,671
11	Other salmonidae, frozen	1,477.4	1,032,205
12	Teri fish, dried	248.9	238,407
13	Shark fins, dried	13.7	72,515
14	Other than marine fish, dried	14.0	6,836
15	Teri fish, salted	9.5	2,862
16	Other fish, salted but not dried or smoked	7.1	2,529
17	Shrimps and prawns, frozen	620.9	2,556,023
18	Other than cray fish, frozen	190.7	639,265
19	Rock lobster & other sea craw fish other than in airtight container	139.5	445,879
20	Lobster, other than in airtight container	0.5	400
21	Shrimps and prawns, other than in airtight container	2,133.3	694,894
22	Crabs, other than in airtight container	135.8	93,163
23	Cuttlefish, other than frozen	3.2	2,464
24	Cray Fish, in airtight container	334.2	272,864
25	Other cray fish	1.9	7,221
26	Other crustaceous, other than in airtight container	195.4	32,554
27	Jellyfish, live, fresh, chilled	14.5	9,975
28	Jellyfish, frozen	107.6	16,142
	Total	49,612.8	43,343,667

Remarks : Volume was converted into weight of fresh whole fish.
Sources : Statistical Office in Riau Province