

III. MASTER PLAN

1 Future Projection

1.1 Per Capita Fish Consumption and Fish Demand in the Study Area

Per capita fish consumption and the fish demand in the study area for 10 years in future is projected based on the growth rate of population and projected per capita regional income.

1.1.1 Population projections

Annual average growth rate of population of the study area during 1990-99 (about 1.5%) was lower than the national average (about 2.0%) reflecting the relatively high rate of population outflow. This trend may not change unless otherwise the respective regional economic development is achieved. It is projected that national average growth of population would be 1.5 percent per annum by 2010. Accordingly, the projection of population in the study area was made assumed that growth rate would drop at same rate (0.5% lower than the past decade) (See Table below, and Table 1.1.1 for details).

Sub-area	Population (1,000 persons)		Growth Rate 1990/1999 (%/year)	Projected Population (1,000 persons)		Growth Rate 1999/2012 (%/year)
	1990	1999		2007	2012	
Lombok	2,403	2,751	1.52	2,987	3,146	1.02
Sumbawa	967	1,118	1.63	1,228	1,304	1.13
NTB Total	3,370	3,870	1.55	4,215	4,451	1.05
Sumba	445	521	1.78	577	615	1.28
Western Flores	697	814	1.74	899	957	1.24
Eastern Flores	731	768	0.55	772	775	0.05
Alor	145	158	1.00	165	169	0.50
Timor	1,249	1,444	1.62	1,580	1,629	1.12
NTT Total	3,267	3,706	1.41	3,993	4,145	0.91
Study Area Total	6,638	7,576	1.48	8,208	8,597	0.98

Source: Dalam Angka NTB and NTT 1990-99 and forecast made by the Study Team.

1.1.2 Projection of Gross Regional Domestic Products (GRDP) and Per Capita Regional Income

After the currency crisis of Indonesia in 1997, the GDP at 1993's constant price had decreased about 12 percent, but minor effect was caused to the study area. The economic indicators in target years were assumed as shown on tables below, based on the condition that the economic growth would be achieved at same pace of 1993-1999 (see Table 1.1.2 for details).

Areas	GRDP Constant Price (Million Rp)		Growth Rate (%/year)	GRDP Projection (Million Rp)	
	1993	1999		2007	2012
Lombok	1,637,916	2,125,812	4.49	3,033,232	3,796,929
Sumbawa	912,648	1,274,516	5.81	2,010,000	2,678,294
NTB Total	2,550,564	3,400,328	4.97	5,012,015	6,387,333
Sumba	274,047	335,456	3.46	440,539	522,535
Western Flores	374,172	468,255	3.85	634,016	766,774
Eastern Flores	415,830	555,314	5.00	817,934	1,048,490
Alor	88,595	112,151	4.05	154,049	187,854
Timor	2,113,500	1,320,983	5.52	2,045,228	2,697,908
NTT Total	2,113,500	2,792,159	4.81	4,064,873	5,140,304
Study Area Total	4,664,064	6,192,487	4.90	9,076,888	11,527,637

Source: Dalam Angka NTB & NTT 1990-99 NTB and forecast made by the Study Team.

Areas	Per Capita Regional Income (1,000 Rp)		Annual Growth Rate (%)	Projection of Per Capita Regional Income (1,000 Rp)	
	1993	1999		2007	2012
Lombok	624	734	2.77	913	1,047
Sumbawa	859	1,083	3.97	1,478	1,796
NTB Total	689	826	3.10	1,055	1,229
Sumba	562	593	0.89	636	665
Western Flores	493	555	2.01	650	718
Eastern Flores	531	666	3.87	902	1,090
Alor	569	662	2.57	811	920
Timor	698	833	3.00	1,054	1,222
NTT Total	587	704	3.08	897	1,044
Study Area Total	653	783	3.10	999	1,164

Source: Dalam Angka NTB and NTT 1990-99 NTB and forecast made by the Study Team.

1.1.3 Per capita fish consumption and fish demand

The local demand on fish at the target year of this study is expected to increase with the growth of population and the purchase ability to be increased according to the increase of per capita income (See Figure 1.1.1). There is the positive co-relation (relative on logarithm curve) between per capita fish consumption and the regional income in the study area, which can be divided into the following 3 models by trends of consumption (See Figure 1.1.2).

- 1) Lombok Model ($y = 23.192\text{Ln}(x) - 140.32$)
- 2) Sumbawa/Sumba/Flores Model ($y = 41.707\text{Ln}(x) - 244.62$)
- 3) Timor Model. ($y = 46.282\text{Ln}(x) - 279.97$, NTB/NTT Average Model¹)

Applying the respective model to each region, the expected per capita fish consumption and total demand for fish (maximum) for the target years are calculated (corresponding to Case 2 below).

¹ The average model of NTB/NTT is applied to the Timor Island due to the large difference between urban (Kupang) and rural areas among the data of four districts of Timor Island.

On the other hand, the PROTEKAN 2003 sets forth the average fish consumption of 26.5 kg/year as national target, and some districts of the study area had already achieved this target. Considering these matters, the following 3 cases of calculations were made, among which the best figures (on minimum level) reflecting the consumption pattern of each district are applied to the projections (See Table 1.1.3 and Table 1.1.4 for details).

Case 1: Based on the growth of population by keeping the present level of per capita fish consumption (to be applied to each district where per capita fish consumption has already been exceeding the target of PROTEKAN 2003)

Case 2: Based on the growth of population as well as the empowering of purchase ability (to be applied to each district where the purchase ability would not be expected enough to achieve the target of PROTEKAN)

Case 3: Based on the growth of population with keeping the target level of PROTEKAN 2003 (to be applied to each district where the purchase ability would be enough to achieve the target of PROTEKAN)

The per capita fish consumption and fish demand by each region are projected as given in the Table below.

Sub-area	Per Capita Fish Consumption ¹⁾ (kg/year)			Total Demand for Fish (tons/year)		
	1999	2007	2012	1999 ²⁾	2007 ³⁾	2012 ³⁾
Lombok	12.9	16.2	19.2	35,509	49,264	60,345
Sumbawa	50.6	50.2	49.9	56,573	61,618	65,102
NTB Total	23.8	26.1	28.2	92,081	109,882	125,446
Sumba	12.5	17.4	18.2	6,521	10,034	11,173
Western Flores	11.1	20.4	22.6	9,021	18,315	21,628
Eastern Flores	25.5	29.5	29.7	19,617	22,799	23,050
Alor	40.8	40.8	40.8	6,449	6,712	6,882
Timor	19.2	35.3	37.1	23,442	55,776	60,478
NTT Total	18.7	28.5	29.7	65,050	113,636	123,210
Study Area Total	21.4	27.2	28.9	157,131	223,517	248,657

Note: Estimated by the Study Team using the general and fisheries statistics data of NTB and NTT.

1) Details of fish consumption are explained in Table 1.1.3

2) Estimated fish consumption by area (1999 actual fish production + fish volume inflow – fish volume outflow)

3) Details of fish demand volume are explained in Table 1.1.3.

1.2 Supply and Demand of Fish in the Study Area

1.2.1 Demand of Fish

(1) Local market (local demand of fish)

The local demand of fish is projected in Section 1.1.3.

(2) Inter-island market

Considering the geographical condition and the scale of markets, the major markets outside of the study area are the provinces of East Java, Bali and South Sulawesi. The future demands of these provinces are calculated using the same methods used for local market as indicated below.

Province	Per Capita Fish Consumption (kg/year) ¹⁾			Total Fish Demand (tons/year)		
	1999	2007	2012	1999 ²⁾	2007 ³⁾	2012 ³⁾
Bali	47.5	47.5	47.5	145,084	151,555	155,799
East Java	6.0	12.8	17.0	212,705	463,806	627,693
South Sulawesi	44.3	44.3	44.3	358,457	392,780	415,929

Note: Estimated by the Study Team using the general and fisheries statistics data.

- 1) Details of fish consumption are explained in Table 1.1.3
- 2) Estimated fish consumption by area (1999 actual fish production + fish volume inflow – fish volume outflow)
- 3) Details of fish demand volume are explained in Table 1.1.3.

Among others, the province of East Java is expected as the main market outside the study area, and it has the highest future increasing demand (max. 250,000 – 400,000 tons/year). The provincial capital, Surabaya, has the close economic relations with the study area, not only as a supply base of general and fishing materials but also to as a consumption market of fresh shrimps and dried fish. On the other hand, South Sulawesi and Bali seems not to be highly expected as future potential markets since per capita fish consumption are high enough and the existing fishing capacities are large enough to meet the increasing demand.

(3) Export market

Demand of the fishery products at major export markets is estimated as follow, based on the current export activities from the study area.

Type of Products	Major Market	Current Export Volume At raw weight (ton/year)	Remarks
Frozen large pelagics	Japan, Korea	3,000 – 4,000	3 Fishing Companies
Alive demersal fish/lobster	Hong Kong, Taiwan	50 – 100	Via. Denpasar
Fresh demersal fish	Hong Kong, Taiwan	500 – 1,000	Via. Denpasar
Dried squid/sea cucumber	Taiwan, Korea	500 – 1,000	Via. Surabaya, Jakarta
Dried seaweed	China	3,000 – 4,000 (Dried seaweed)	Exported after processing and extracting into Caragenan at factory in Mataram (Lombok).

Out of the above commodities, the demand for demersal fish may largely be covered by aquaculture in the future, considering the current resources trends in the world. As long as examined based on the potential stock data, however, the study area seems to have sufficient exploitable demersal fish resources. It is expected that the study area have an advantage to export captured demersals to the export markets where the cultured fish would be the

majority. As for large pelagics/frozen fish, it will be one of the international market commodities. Large pelagics caught by hand line fishing in the coastal waters of the study area seem to have an advantageous position in terms of its marketability since the quality of fishes caught in the study area is highly reputed.

1.2.2 Supply of Fish

Considering the natural increase of fish catch only, the marine fishery productions in 2007 and 2012 are forecasted as shown on the Table below. The maximum productions, however, are limited to the level of the total allowable catch (TAC).

Region	Fish Catch (ton/year)		Increase Rate (1993/99)	Naturally Expected Fish Catch (ton/Year)		Exploitation Rate (based on TAC)	
	1993	1999		2007	2012	2007	2012
Lombok	22,414	29,854	1.33	31,797	31,797	100%	100%
Sumbawa	42,292	48,769	1.15	56,656	66,653	85%	100%
NTB Total	64,706	78,624	1.22	88,453	98,450	90%	100%
Sumba	5,012	6,321	1.26	7,851	9,431	15%	19%
Western Flores	9,987	9,807	0.98	9,689	9,588	17%	17%
Eastern Flores	18,167	26,213	1.44	37,534	48,841	53%	69%
Alor	3,585	6,794	1.90	13,767	19,795	34%	49%
Timor	23,476	30,463	1.30	41,449	50,760	82%	100%
NTT Total	60,227	79,598	1.32	110,290	138,416	41%	52%
Study Area Total	124,933	158,222	1.27	198,743	236,866	54%	65%

Note: The naturally expected fish catch at each region was calculated based on the increase rate of fish catch during 1993-1999.

Source: Actual Fish Catch Data: Fisheries statistics NTB and NTT 1993-99.

1.2.3 Expected Fish Flow

Based on the demand and supply of fish estimated in the above, the surplus or shortage of fish at each region would be anticipated as shown on the attached Figure 1.1.3. Thus, the fish distribution as shown on the same Figure would be necessary to balance the regional demand and supply.

- It is anticipated that Lombok would meet the shortage of about 22,900 tons in the year that should be covered by supply from Sumbawa as well as from the eastern part of Flores.
- As about 12,800 tons of fish would be shorted in the western part of Flores Island in 2012, and would be necessary to cover by the supply from the eastern part of Flores. As well, the eastern part of Flores Island would also supplement the shortage of fish in Sumba (about 1,200 tons).
- It is anticipated that about 15,500 tons of fish would be shorted even in Timor. This shortage would be necessary to cover by the supply from the neighbouring Alor or by the increase of own fish production through fishing operation in Flores/Alor waters.

On the other hand, to achieve the supply of fish to the prospective outside market "Java", it is necessary to expand the fishing capability in Flores, Alor and Sumba where would have much fish resources even in 2012. As described in the former chapter "Development Goals", the coastal fishery resources management is to be achieved as one of the main objectives of the Project. As tools to promote these objectives, the diversification of fishing grounds is planned through promotion of motorization of fishing boats, training of fishermen for offshore fishing, and so on. As the incidental results of these activities, the fish catch may be increased more than the natural increase as expected. Such incidental surplus of catch could be supplied to Java. Due to the late development of infrastructure, the long-distance fish marketing is not conducted except partly conducted by fishing companies / large-scale fish traders in the study area. Therefore, it is better to place the highest priority to keep the regional fish balance during the next 10 years, and thereafter to supply fish to Java using the experience in long-term.

2 Development Frame

2.1 Target Year

One of the major targets of PROPENA 2000~2004, national development plan, is early reduction of poverty class that was largely expanded by the economic crisis happened in 1997. On the other hand, as for the decentralization policy started its implementation from January, 2001, it is considered its implementation needs more transition time to solve problems such as lack of understanding on this policy concept by regional people, needs of capacity building of regional staff, etc. Furthermore, in the fisheries sector, PROTEKAN 1999~2003, national fisheries development plan, is under revisions as of the year 2001. Considering these circumstances, the target year of this master plan is set for about ten years with short term development leading to income increase of poverty class and strengthening capacity building of regional human resources and mid term development leading to establishment of sustainable utilization system of fishery resources and stable supply system of fish to the study area.

As this study is finished during the year 2002, the target year of this master plan is set up as 10 years in the period of 2003~2012.

2.2 Development Issues

2.2.1 Development Issues for Coastal Community Development

Issues on coastal communities development described in the present conditions are summarized as follows.

(1) Issues on fishermen household poverty

Per capita annual income of fishermen households in the study area is generally lower than that of the national average of small-scale agriculture farmers. The income level of fishermen in about half of major fishing villages is on the poverty line. Accordingly fishermen household poverty conditions needs to be alleviated.

- Because of poor fishing means, fishing activities are limited only to near shore waters, and the effective use of offshore resources has been delayed.
- Economic loss of landed fish during the stage of marketing and processing is quite large.
- Most of fishermen are economically isolated. Even fisheries cooperatives received the government credit; almost all of their activities are not along with original aims of setting up cooperatives. Consequently their activities do not lead to making current fisheries management healthy.

(2) Issues on future deficit of fish supply in the study area

By the year 2012, fish supply will become deficit in Lombok Is., the western areas of Flores Island, Sumba Island and West Timur Island. It is necessary to establish a fish supply system from other areas.

(3) Issues on vulnerable situation of fisheries resources in the study area

The coastal fisheries resources in the study area are under a vulnerable situation. It is necessary to establish a sustainable system of their utilization:

- Much volume of juveniles is being caught by some specific fishing activities concentrated near shores waters and inside bays.
- Dynamite fishing and poisoning fishing are prevailed that lead to destruction of the coastal environment.
- There is no recording system of daily fish catch in the study area. Accordingly it is unable to assess coastal resources trend precisely.

(4) Issues on delay of organizing fishermen

Taking measures of organizing fishermen and/or strengthening fisheries cooperatives that are one of major strategies of national fisheries development, are delayed

- Lack of government fund for supporting fisheries cooperatives.
- Low project management capacity of district government staff caused by insufficient practical training of project monitoring and evaluation.
- Fishermen try to organize themselves expecting to receive government support. But they only wait for government support and not take any self-help efforts.
- Even fisheries cooperatives received the government credit are not doing their activities along with original aims of setting up cooperatives.

(5) Issues on insufficiency of fisheries infrastructure

It is necessary for planning of fisheries infrastructure to reflect the fact that there exist large difference of development level of fisheries and regional roles of fishing community for fish marketing in the study area.

- Utilization rate of most of existing PPI is low.
- Most of fish landing places are lacking in functional facilities and equipment which therefore leads to economic loss of landed fish.
- Because of insufficiency of facilities, both basic and functional facilities, the quality of landed fish decreases quickly.

(6) Issues on inconvenient living conditions of fishing community

- Many coastal communities need some fundamental improvement on living environmental aspects such as water supply, sanitary condition, etc.

- Community women in most coastal communities are very busy in their daily living works, and do not have enough time to consider improvement of their living conditions and need capacity building to consider such improvement.

2.2.2 Development Goals

The above-mentioned development issues have strongly related with aforementioned short/mid term priorities of the national economic development policies and the national fisheries development policies. The development goals of this master plan have been set up based on the relation with these issues and national development policies as shown below.

Development Policies	Issues on Coastal Fisheries Community Development in the Study Area					
	Poverty of Fishermen	Delay of Organizing Fishers	Low Level of Living Conditions	Vulnerable Fisheries Resources	Future Deficit of Fish Supply	Insufficiency of Fisheries Infrastructure
1. Economic Development						
Alleviate poverty and provide basic needs	Δ		○		Δ	
Develop cooperatives and self reliant management potential, make society participate in national development		Δ	○			
Stabilize economy & finance						
Promote non petroleum / gas product export					○	
Promote investment on the basis of capital participation		○			○	
Provide facilities / infrastructure			○			Δ
Utilize natural resources considering environmental protection				Δ	○	
2. Regional Development						
Improve institutional / management capacity of regional government	○	Δ	○	Δ	○	Δ
Develop and activate regional potentials	○	○			Δ	○
Upgrade social and inhabitants living capacity		Δ	Δ	○		○
3. Fishery Development						
Increase fish protein supply					Δ	
Develop aquaculture business		○			○	
Upgrade fishery product quality and develop new products		○				
Develop fishermen potentials and techniques	○	○		○		
Develop and strengthen fisheries cooperatives	○	Δ		○		
Coastal management by local people	○	Δ		Δ		
Close cooperation between sectors		○		○	○	
Ease restrictions and provide permit system		○				
Development Goals of This Master Plan	Increase Fishermen Income through Achieving Self Reliant fisheries				Establish Stable Fish Supply System in the Study Area	

Note: Δ, strongly related, ○ Related

2.3 Development Strategy

The goals of this development plan are to raise the average income of fishermen in the target region by 1.6 times or Rp.2.08 million in the next decade by 2013 and to establish a systematized stable fish supply. The four strategic components that will be pursued to achieve these goals are given as follows.

- Establish a sustainable fisheries system.
- Adjust the balance in the supply and demand by establishing a widespread marketing network of fresh and processed fish products.
- Reduce marketing losses.
- Give value-added to fishery products through processing.

The role and function of facilities networking on the process of fisheries improvement in the target area was proposed in the Sector Plan to achieve the goals.

3. Basic Development Plan

The following approaches will be adopted to address these issues in the development plan.

3.1 Approach to Issues

(1) Poverty Level Fishermen Households

Some of the basic factors that contribute to the poverty of fishermen households are the lack of proper fishing equipment (boats, fishing gear, etc) that limits fish catch volume, the lack of ice which lowers fish price due to the inability to maintain fish freshness, undeveloped processing techniques for surplus fish during the peak fishing season that produces poor quality products and low prices. In order to suppress fishing pressure in the current fishing grounds intensive fish production increase by motorization and/or fishing gear expansion will not be planned except in some part of fishing grounds showing low resource exploitation rate. Offshore fishing activities will be fostered in order to diversify fishing grounds. Since the majority of the wives of fishermen are engaged in fish marketing and processing activities, measures to improve the fish price and subsequently, fishermen income through the use of ice to maintain fish quality and improve processing technology will be included in the study.

(2) Undeveloped Fishermen Organizations

The majority of the fishermen in the study area are not organized and they are economically isolated. In some areas, traditional fishing village cooperatives and fishermen kelompoks have been formed to receive government subsidies. In the case of the former, fishermen do not feel the merits of joining a cooperative because in many cases, the head of the cooperative does not represent fishermen. In the latter case, the kelompoks are not organized to engage in joint activities, and subsequently, they lack the possibility of future growth. In addition, although there are fishermen cooperatives that represent fishermen and are not fishing village cooperatives, the scope of their activities is small and their economic capabilities are very low.

In contrast, the capabilities of the district fisheries offices and village administrative bodies are generally familiar with organizational concepts and are capable. Therefore, the participation of existing fishermen cooperatives, the district fisheries offices, the village administrative bodies, and others will be included in the study to help establish new fishermen organizations that will operate and manage the planned facilities. Their participation in the project operations will help foster and strengthen the management fishermen organizations in the first five years of the project; and the latter five years will be focused on educational and training activities to enable the fishermen organizations to become self-reliant in future.

(3) Low Living Standards of Fishermen Communities

Many of the fishing communities were dependent on assistance from the central government, but in many cases, the assistance centered on very minor improvements to the village infrastructure. However, under the new regional decentralization policy, the community is gradually being forced to improve their living standards through self-help measures. But the motivation level of the residents to improve their living standards is low. Subsequently, measures to raise community awareness about improving the village infrastructure and the social environment of the community have been included in the development plan.

(4) Loss of Fishery Resources

Destructive fishing activities using dynamite and poisonous substances have destroyed fish and coral reefs in other areas. In addition, Bagan fishing and light fishing by purse seiners at night harvest the fry. Due to the national policy of open access to marine resources, the opposition against such fishing methods is minimal. Moreover, despite the advent of areas where resources have been adversely affected by these fishing methods, the situation remains uncontrolled due to the lack of specific means and countermeasures to control fishermen and fishing boats at the district level. In the development plan, measures have been included to draft regulations by the district government to establish a surveillance system of fishing grounds and countermeasures to provide guidance for fishermen and coastal residents about sustainable coastal resources.

(5) Future Shortage in Fish Supply

The estimated shortage in the fish supply in ten years time for Lombok Island is 28,500 tons, 12,000 tons for west Flores, 1,700 tons for Sumbawa Island, and 9,700 tons for Timor Island. The regions where fish supply will continue to grow are the East Flores region (25,800 tons) and Alor Island (12,900 tons). Geographically, the Alor Island will supply the markets in west and east Timor and the East Flores region will supply fish to the western Flores region and Lombok Island.

Since fish will be transported to Lombok Island by boat, it will be difficult unless the fish catch volume is significant. But in the case of west Flores, the fish catch volume can be transported overland for the time being. When the production system is strengthened, it is surmised that the fish supply will be shipped by private transport in future.

(6) Low Standards of the Fisheries Infrastructure

The usage ratio of the existing fisheries infrastructure in the study area is extremely low. This is due to the unattractive merits of the existing landing facilities for fishermen, the fish traders and retailers (the location of the landing facilities is too far, the crown height of the landing facility is too high, the lack of ice-making facilities, etc.). In view of these

circumstances, the needs of the fishermen and the distributors have been adequately reflected in the development plan.

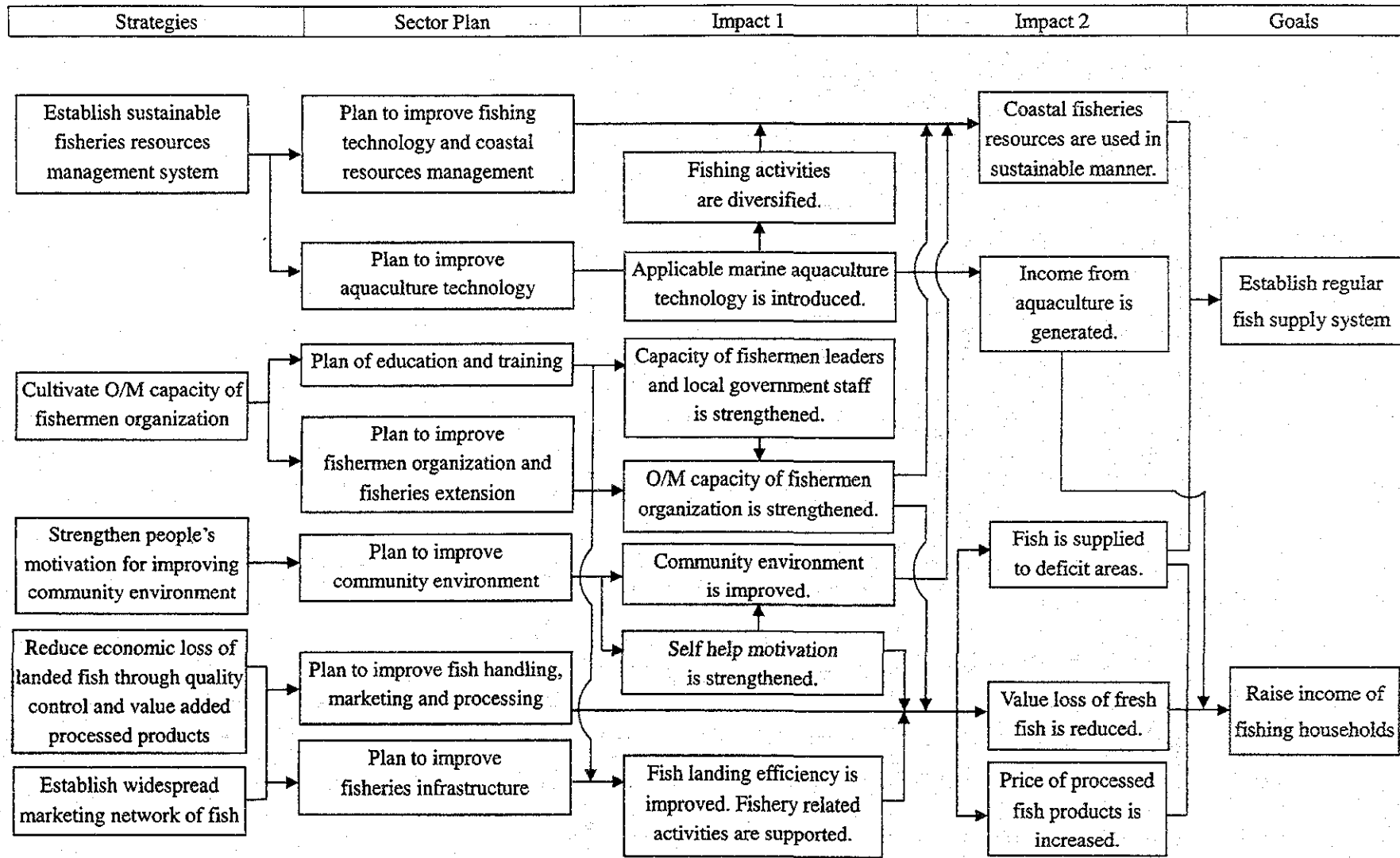
3.2 Viewpoint of Plan Formulation

The following factors were focused on in formulating the development plan.

- In principle, the management and operations of the planned facilities will not be focused on the fishermen association from the start, but will reflect the will of the fishermen. Therefore, with the participation of administrative parties, the project perspective will remain flexible.
- The planned programmes will eventually be implemented independently in future.
- During the initial implementation period of the project, the focus will be to strengthen the management skills of the staff through OJT; and a programme to strengthen the operational skills of the fishermen association that will manage the facilities will be formulated in the latter half of the project.
- Extension activities will be included from the start of the project since the new processing technology and measures to maintain fish freshness are anticipated to lead to increased income for fishermen due to the development of value added fishery products

3.3 Overall Plan of the Development Concept

The overall plan is comprised of several sector improvement plan accordingly to development strategies. The overall plan is shown in the following figure.



Overall Concept Flow Plan

4. Sector Plan

4.1 Plan for Improvement of Fishing Technology and Coastal Resources Management

4.1.1 Basic Design

The inability to effectively utilize unexploited fishery resources because fishing activities have concentrated in one area of the bay or coastal waters is a major issue that prevails in the coastal fisheries of the study area. Subsequently, the sustained use of resources has not been carried out, and a segment of the coastal resources has deteriorated. If this situation continues, the individual fish catch volume will drop and overfishing will increase, and there is concern that resources will deteriorate. The following two factors explained below will trigger such a potential scenario.

- Much of the fish catch is comprised of juvenile fish and fishing pressure on resources is high.
- Regulations governing the fisheries industry do not exist since fishery resources and ocean waters can be exploited freely by the population.

In addition, illegal fishing such as blast fishing that destroys a large volume of fish, which is not harvested, or fishing using poisonous substances in coral areas, which are the spawning and rearing grounds of coastal resources, has become a serious problem for both the environment and the fisheries industry.

In this development plan, a segment of the current fishery operations that use coastal resources will be extended to low usage, unexploited offshore water areas and a resources management system will be created to promote the sustainable use of coastal resources. To achieve these goals, the following measures have been proposed in the study to improve coastal resources management and fishing technology.

(1) Extend Fishing Activities to Unexploited Water Areas and Disperse the Fishing Pressure of Coastal Resources

The majority of the fishing boats in the study area are small non-motorized boats. This has restricted the scope of the fishing grounds and has caused the concentrated usage of specific coastal resources. Therefore, the motorization of fishing boats and the shift to larger boats will be promoted to enable fishermen to extend their fishing grounds. FADs will also be installed in unexploited coastal areas to create new fishing grounds and enable fishermen to shift their fishing operations to unexploited water areas. This will reduce the concentrated fishing effort of specific coastal waters.

The fishermen or village cooperative will collect uniform user fees and manage the

new fishing grounds where the FADs will be installed. In addition, trial fishing operations will be conducted in new water areas to develop new fishing grounds, which will also provide OJT for individual fishermen or fishermen groups and enable them to experience the merits of extending the fishing grounds. Therefore, a model fishing boat will be provided to conduct these trial fishing and training operations.

(2) Establish a Fisheries Loan System

The majority of the fishermen in the study area are small-scale fishermen who do not have the capital to begin new fishing methods. Moreover, the existing loan system for fishermen offers only small short-term credit that does not allow fishermen to purchase large fishing boats and modernized fishing equipment and materials. Therefore, the existing loan system for fisheries will be expanded in conjunction with financial assistance measures that will allow fishermen to purchase large fishing boats and modernized fishing equipment.

Ideally, the organization, operations, and finances of the fishermen cooperatives should be strengthened to enable their members to obtain credit from private and public financial institutions. Therefore, in this project, fishermen organizations will be created in each zone, which will be fostered and strengthened through planned activities in the project.

(3) Establish Community Based Coastal Resources System

Presently, coastal resources management is nonexistent in the study area due to the inadequate capital and manpower of the provincial and district governments that are the responsible management bodies. Each district fisheries office does not even have accurate basic information needed for resources management such as the number of boats and fish catch volume in each respective district. In addition, another factor that has impeded resources management are the fishermen, who are the users of these resources and do not understand about resources management since fisheries resources have been considered infinite.

Based on these circumstances, the following improvements are proposed to establish a coastal resources management system.

- Improve the data collection on the number of fishing boats, fish catch volume, etc.
- Establish a fishing boat registration and fisheries licensing system.
- Establish a fishery surveillance system based on fishermen participation.

4.1.2 Coastal Resources Management Plan

Based on the development policy explained above, the following development programmes are proposed.

(1) Extend and Appropriately Utilize Fishing Grounds

This programme is comprised of measures to motorize fishing boats, introduce FADs, diversify coastal fishing methods, and shift purse seine fishing to offshore waters.

1) Motorization of Fishing Boats

According to the 1999 survey, there were 32,459 fishing boats, of which 24,470 were non-motorized. Therefore, the motorization of fishing boats will be promoted in order to extend coastal fisheries. The targeted motorization ratio and engine size according to fishing boat size are shown in the table below.

Non-motorized Boat	Length	Targeted boat length	Targeted motorization ratio by 2012	Number of motorized boat by 2012	Boat engine (Hp)	Extended area of fishing ground
Canoe	2.5~7m	More than 5m	30%	5,490	5.5~12	Max. 12 miles
Wooden boat (small)	Less than 7m	More than 5m	50%	2,808	5.5~12	Max. 12 miles
Wooden boat (medium)	7~10m	All	100%	539	12~22	Max. 20- 30 miles
Wooden boat (large)	More than 10m	All	100%	16	22~28	Maxi. 50- 60 miles

During the project implementation period, 20 percent of the targeted motorization rate of fishing boats according to boat size will be targeted. The capital required for motorization will be provided by the existing credit system available for fishermen (the LEPPM 3 from the central government, district government credit, cooperative credit, NGO credit, etc.) The loans will be collected from the fishermen organization and will be extended again as a revolving fund.

In order to prevent fishing pressure on coastal resources from suddenly increasing, fishing gear that can be used by motorized fishing boats will be restricted to hand line fishing, gill nets, bottom long lines, and trolling.

2) Establish Offshore Fishing

FADs will be installed in water areas that are minimally used as fishing grounds and pelagic fisheries will be developed (purse seine, gill net, trolling, and hand line fishing). Fishing fees will be collected for these fishing grounds by the fishermen association, which will manage these waters. The FADs will be installed under the following conditions.

- It will be located within a range that is accessible and usable by local fishing boats (water areas within a 20-mile range where the impact of current flow and wind waves are minimal).
- The average lifespan of one FAD is one year and their number will be limited to the management and replacement costs that can be covered by user fees collected from local fishing boats.

- FADs will be installed in water areas that within the jurisdiction of the district and provincial governments.

There are presently water areas where FADs have been installed, and to prevent their uncontrolled installation and the creation of water areas dominated by specific individuals, the following measures will be pursued.

- A FAD registration system will be introduced and existing FADs will be registered and new installations and replacements will be reviewed to prevent uncontrolled installation.
- The FADs that will be installed under the project will be jointly managed by the fishermen association to extend fishing grounds and to function as a fishing ground surveillance base.

Although the location of the FAD according to type, the targeted fish species, and fishing methods will differ according to region, a summary of the installation standards for FADs is given in the table below.

FAD Type	Water Depth and Distance from Coast	Fish Species	Fishing Method
Shallow waters	Within a depth of 200m, and distance of 2 miles	Small pelagic fish	Existing fishing methods (purse seine, gill net, trolling, and hand line fishing by small fishermen; one line tuna fishing boats will be included in deep waters.
Off-shore	Within a depth of 200m ~1,000m, and distance of 4 miles	Small and large pelagic fish	
Deep-sea	Within a depth of 1,000m ~2,000m, and distance of 4 ~12 miles	Large pelagic fish	

3) Large Fishing Boats

The future direction of fisheries development is to disperse the fishing pressure that has concentrated on specific coastal resources and to develop fishing activities in unexploited water areas. To achieve this, the navigational and fishing capacity of fishing boats must be increased, and this will require large capital. To exploit new fishing grounds, the technical skills to collect data on fishing grounds and acquire knowledge and experience in new waters are essential. Therefore, at this stage, trial fishing operations will be conducted in new water areas to develop fishing grounds; and through these trial operations, fishermen will be given OJT to acquire new technical skills, experience, and to raise their awareness about the merits of extending their fishing grounds. In this project, a model fishing boat will be provided to conduct trial fishing operations, to develop fishing grounds, and to provide training for fishermen under safe conditions.

4) Develop Mariculture

Measures to extend the fishing grounds in inland water areas such as Saleh Bay will require fishermen to move to distantly located water areas that may not be economically

viable for fishing operations that are centered on the village. The potential resource volume in such enclosed water areas has already been exceeded and increasing the CPUE to raise fishermen income is not feasible. But in view of the extremely limited employment opportunities for inland fishing communities, if the current situation is allowed to continue, there is the danger of overfishing the resources. Therefore, for fishing communities that border such water areas, aquaculture will be developed as a source of supplementary income for fishermen, which will also alleviate the fishing pressure and enable the water area to be effectively utilized. The shallow areas of the inland bay are the rearing and spawning grounds for valuable fry and shellfish species. In particular, mangroves, coral reefs, and seaweed beds provide an important ecological environment for fry. Therefore, artificial ecological environments will be created, and fishermen will be given education, training, and management skills to conduct trial culture operations to propagate different fish species.

(2) Expand Coastal Resources Management System

The most essential element to improving fisheries and resources management is the collection of fisheries related data. Therefore, cooperative measures between the district fisheries office and fishermen associations to conduct fishing ground surveillance and management activities will be implemented to improve the existing system.

1) Improving the Data Collection System

The lack of an adequate data collection system has been one of the factors that have impeded resources management. Despite the existence of fisheries data, its accuracy is low, and the data of the district and provincial governments are not coordinated due to the inadequacy of the existing data collection system.

Although the inadequacy of this system has been blamed on the limited manpower and budget of each district fisheries office, the problem has been further compounded by the scattered fish landing and marketing activities at each site and the non-existence of any record keeping activities. If the cooperation of fishermen is solicited to record fish catch volume and other data, the data will greatly improve in accuracy. The project has focused on this factor, and has proposed measures to supervise fishermen to keep records of their daily fishing operations. The records will be used to improve and organize data on fish catch volume. The record keeping task will also enable fishermen to become aware of the conditions of their fishing operations and to raise their consciousness about implementing improvements.

2) Expanding the Fishery Licensing System

In addition, basic data on the number of fishermen, fishing boats, etc. are also important for resources management, but this data is also inadequate. Therefore, a system to record the number of fishermen according to district, type, size, and category of fishing

activity will be created in the project. Initially, the focus will be on registering the motorized fishing boats, establishing a mandatory licensing system, to provide boat markings for registered and licensed boats to enable fishing boats to be readily distinguished. In addition, only registered and licensed boats will be able to operate in managed fishing grounds, and will be a specific source of revenue.

3) Establishing a Fisheries Surveillance System Based on Fishermen Participation

Based on the aforementioned fisheries licensing system, the district fisheries office will control illegal fishing activities with the cooperation of fishermen associations. A surveillance system to control illegal fishing activities will be created for the fishing grounds with FADs.

Water Area	Managing Body	Improvement Plan
0-4 miles	District government	A system that will enable local fishermen associations to conduct surveillance and report illegal activities during their daily fishing operations in FAD fishing grounds will be established. The district fisheries office in cooperation with the local police will control fishing boats engaged in illegal fisheries.
4-12 miles	Provincial government	
12-200 miles	Central government	It is difficult for the local fishermen associations to conduct surveillance activities because the area is outside their fishing area. Surveillance activities of water areas where illegal fishing activities are prevalent will be conducted with the cooperation of the government and private companies. A vessel monitoring system (VMS) will be introduced for registered fishing boats of 30GT or higher and cargo boats.

Note: Boat markings will be distributed to register fishing boats to enable easy discrimination and the district fisheries office will maintain the data.

Presently, the coastal fishermen are unaware of the need to implement resources management. Therefore, the district fisheries office will explain the need for fishermen to participate in resources management activities through fishing ground management activities and the surveillance system that will be implemented. In addition, it will hold seminars to explain why blast fishing and the cyanide fishing activities should not be conducted and the current condition of the coastal fisheries resources.

4.1.3 Input Plan

(1) Facilities and Equipment

Objective	Management and Operations Organization	
	Fishermen association	District Fisheries Office
Extend fishing grounds, promote their appropriate use	Pelagic fish reefs, small boat engines	Model fishing boat, equipment and materials for trial propagation culture operations
Expand resources management system	Recording materials for fishermen, fishing boat markings, wireless VHF units	High-speed boat, wireless VHF units

(2) Activities

Objective	Activity	Implementing Body
Extend fishing grounds, promote their appropriate use	1) Training in data collection for fishermen households	District Fisheries Office
	2) Selection of credit applicants	District Fisheries Office
	3) Preparation to procure boat engines, fishing equipment and materials	Fishermen Organization
	4) Monitoring, audit of revolving funds	District Fisheries Office
	5) Operation of model purse seiner	Fishermen Organization
	6) OJT(on-job-training) for young fishermen	Fishermen Organization
Expand the resources management system	1) Develop fisheries licensing system and fishing boat markings	District Fisheries Office
	2) Install FADs	Fishermen Organization
	3) Manage and maintain pelagic fish reef areas	Fishermen Organization
	4) Monitor daily fishing activities of members	Fishermen Organization
	5) Control illegal fishing boats using community association reports	District Fisheries Office

4.1.4 Implementation Plan

(1) Division of Roles

Fishermen Association	District Government
1) Surveillance activities of the fishing ground will be conducted during daily fishing operations on a rotational basis (surveillance of near pelagic fish reefs).	1) Registration and boat markings will be distributed in conjunction with fishing licenses.
2) When illegal operations are spotted, fishermen will report immediately to the district fisheries office via wireless unit.	2) The district fisheries office will respond immediately to reports of illegal fishing operations by fishermen associations.
3) Fishing ground surveillance reports will be regularly submitted to the district fisheries office.	3) Information will be closely exchanged with other district fisheries office regarding illegal fishing operations
4) Operate the model fishing boat in offshore waters to provide OJT for the younger fishermen and to promote new fishing grounds and fishing technology.	4) Registered fishing boat data will be integrated and shared between the central, provincial, and district governments to ensure that consistent data is disseminated.
5) Manage and operate revolving funds (sales generated from fishing gear and boat engines will provide a source of capital for this project).	5) Individual fishermen associations at the district level will be strengthened.
6) Required purchases of fishing equipment and materials (boat engines, fishing gear, fuel) and inventory management will be carried out with the cooperation of the fisheries companies and fish collectors.	6) Financial assistance will be provided for fishermen associations (input of operating funds through credit activities).
7) Repair and maintenance of fishing gear and engines will be carried out with the cooperation of the fisheries companies and fish collectors or a mechanic from Java or south Sulawesi will be recruited.	7) Operating audit and guidance will be provided for each revolving fund that has been allocated to each fishermen association.
8) Credit handling activities will be reported regularly to the government.	

(2) Source of Capital for Boat Operations

Fishermen Association	District Government
1) User fees will be collected from local and other district fishing boats, which will be saved to cover the maintenance cost of the FADs.	1) Fishing license fees will be collected from fishermen from other districts and will be saved as fishery activity maintenance funds.
2) Sales revenue from fishing equipment and boat engines will be pooled to purchase fishing equipment.	2) Facility user fees will be collected and saved as fishery activity support funds.

4.2 Plan for Improvement of Aquaculture Technology

4.2.1 Basic Approach

(1) Role of Aquaculture

The two major objectives of aquaculture in this development project are to improve the income of fishermen and to provide a supply of protein in the region.

Fishermen incomes can be improved through aquaculture by culturing high priced fish species such as the sea bass, which is the most promising high-priced fish species in the market. Culture activities that utilize inexpensive trash fish landed by the fishing communities will generate employment opportunities and raise incomes. Presently, fishing operations aimed at harvesting live fish for export is carried out in the NTB and NTT provinces. However, poisonous substances such as cyanide are often utilized in live fish harvest operations, which also lead to the destruction of the marine environment. Culture of the grouper species is anticipated to serve as an alternative industry to this illegal form of fishing.

In addition, seaweed culture is also being promoted as an important means of generating profits within a short period of time and the initial investment costs are minimal. Although large growth cannot be expected due to the balanced supply and demand that prevails in the international market, selection of suitable seaweed varieties, disease countermeasures, improved culture methods, and other efforts are required to produce high quality seaweed.

Aquaculture, which is also a source of protein in the region, will target fish species that can be produced in large volumes at low cost. Presently, the fish species with the highest potential for aquaculture is the sea bass. Natural seedlings are harvested in both NTB and NTT and a stable supply of seedlings is available. Although sea bass is not viable for feed culture due to its low unit price, productivity can be raised with fertilization fish culture.

Aquaculture will be promoted according to the following five components.

1) Improve the method of calculating the area of water bodies suited for aquaculture

Data on the area of water bodies with development potential in the study region is essential in formulating aquaculture development plans and their administrative management. However, the calculation method currently utilized by each local government to estimate the area of potential aquaculture sites lacks accuracy.

The provincial governments of NTB and NTT must establish a uniform method of calculating the area of potential sites that can be developed for aquaculture; and the potential area should be recalculated using this method. However, since the fisheries officer of each

district Fisheries Office will be responsible for calculating the area of potential sites, a method that will not require the use of advanced technology or instruments will be proposed.

The cooperation of a Kelompok will be solicited in the collection of basic data on ocean conditions by establishing mandatory record keeping tasks on water temperature, salinity concentrations, etc. for aquaculture projects implemented by the district Fisheries Office. The district Fisheries Office will be responsible for overseeing this activity.

2) *Establish aquaculture related laws and regulations*

Currently, specific restrictions pertaining to aquaculture development do not exist, but marine feed culture and intensive brackish pond water culture has the potential to pollute marine waters. In addition, mariculture that signifies the control of a specific water area by individuals or organizations necessitates clearly defined legal parameters.

The district Fisheries Office must establish a uniform calculation method for potential mariculture development sites as well a system of laws and regulations. The provincial Fisheries Office will draft the basic system of laws and regulations and it will be appropriately revised to suit the environmental conditions of each ocean site. It will then be established as a district ordinance. However, the enactment of the basic system of laws and regulations will require the assistance of the DGA and the central government.

3) *Establish a technical training system for aquaculture*

Presently, the district Fisheries Office is not staffed with an aquaculture expert. Subsequently, private operators often have a higher knowledge about aquaculture than the government officer. Raising the technical expertise of the district Fisheries Office will be conducted through a separate project, "Organizing and Strengthening Fishermen Engaged in Aquaculture", where monitoring and evaluation activities will be implemented. However, for the short term, private aquaculture operators will provide technical supervision in the district.

For the short-term, the technology will be transferred to the private aquaculture operators, who will be placed under the direct supervision of the central government. In conjunction with the plan to improve the technical expertise of the district Fisheries Office, the role of the private aquaculture operators will then be transferred to the district Fisheries Office.

To raise fishermen income through aquaculture, concentrated development of high class, high profitability fish species must be implemented. Presently, the grouper species, which are mainly exported to Hong Kong and China as live fish, have been targeted for development. Since the market is limited, there is the risk that an over supply will rapidly lower profits.

However, since grouper seedling production on a commercial basis has not succeeded

in Indonesia yet, it is surmised that a prolonged period of time is required before Indonesian operators will be able to establish a monopoly of the market. Therefore, the development of the mariculture industry in Indonesia is synonymous with the culture of groupers. Once mariculture becomes established as an industry and a constant and consistent production system is achieved, businessmen engaged in large sale, large profit culture of the giant sea perch and streaked spinefoot or culture development of high-class fish such as the Napoleon fish will emerge in conjunction with market demands; and aquaculture will develop of its own accord.

4) Improve the fish disease prevention system

Some elements of aquaculture development cannot be controlled solely by the private sector. Fish disease prevention is one such element. Currently, prawn culture is carried out in NTB province, but an inspection body or institution or a fish disease prevention system has not been established. Moreover, countermeasures against fish diseases such as Ice-ice are vital in seaweed culture. In conjunction with the spread of grouper culture, fish disease countermeasures will become an increasingly important issue. However, in view of the current scope and capabilities of each district Fisheries Office, it is extremely difficult for the district office to implement fish disease testing activities.

Therefore, the fish disease testing and disease prevention activities of Lombok Aquaculture Station will be strengthened to enable it to conduct fish disease testing services for Lombok, Sumbawa, and the Flores islands. Each district Fisheries Office will help establish a disease prevention system at the Lombok Aquaculture Station and fish disease guidance will be provided for private aquaculture operators.

5) Organizing and strengthening fishermen engaged in aquaculture

As explained earlier, direct technical guidance for fishermen engaged in projects implemented by each district Fisheries Office will be provided at the aquaculture center. Presently, the technical guidance provided for fishermen organizations by the Fisheries Office is superficial and subsequently, the projects have not produced successful results. The district Fisheries Office should provide concentrated guidance in the operations, maintenance, and financial administration of fishermen organizations. In addition to this guidance, monitoring and evaluation of individual projects should be conducted, and the operations and maintenance capabilities of culture projects should be improved.

Continuous assistance for outstanding fishermen cooperatives should be provided until they are completely self-reliant.

(2) Division of Public and Private Sector Roles in Aquaculture Development

Both the public and private sectors will implement the five components explained

above. The roles of the public and private sectors will be divided to ensure that development is achieved efficiently.

Under this MP, the roles of the public and private sectors in the development of aquaculture are as follows.

- Public sector: Develop basic and practical technology, fish disease countermeasures, culture technology extension, and guidance for culture operations
- Private sector: Seedling production, general production activities such as the rearing of adult fish

However, during the initial stages, the public research institutions will be in charge of technical extension and production activities in regions where seedling production operations are nonexistent. The production activities will gradually be turned over to the private sector.

The role of the public sector will further be divided between the tasks that will be assumed by the district Fisheries Office and the activities that will be the responsibility of research institutions in the region. The Lombok Mariculture Station will be in charge of technical development and fish disease countermeasures and the district Fisheries Office will be responsible for providing extension and guidance for culture operations. The division of these roles are given in Table 4.2.1.

The long and short-term goals of each policy and the projects that need to be implemented in order to achieve these goals have been summarized below.

4.2.2 Area of Water Bodies with Aquaculture Development Potential

(1) Objectives

The long-term objective is to formulate an aquaculture development project based on the accurate area or scope of water bodies suited for aquaculture development. The short-term goal is to establish a practical method to calculate the area of water bodies with aquaculture development potential.

(2) Project

To achieve the above goals, the following projects are required.

- 1) Short-term project
 - (a) Establish a method to calculate the area of water bodies with aquaculture development potential in the model district

The provincial Fisheries Office in NTB and NTT will be the focus of this project and it will be responsible for formulating a draft method to calculate the area required to culture each fish species that has been targeted for aquaculture. Each provincial Fisheries Office will

select one district to serve as a model. The district Fisheries Office in the selected district will implement the calculation method and will corroborate its feasibility. Based on the findings of the district Fisheries office, the method will be revised as needed and the calculation method will be disseminated in the NTB and NTT provinces.

Currently, the natural environment is the only index that is utilized to calculate the potential area or scope required for aquaculture development. But in actuality, the following diverse indexes must be examined as well.

- Water quality (water temperature, saline concentration, COD, etc.)
- Sediment (soil quality, BOD, etc.)
- Water depth
- Ocean current
- Impact of monsoons
- Potential supply of stable feed
- Existence of marketing network
- State of infrastructure, etc.

2) Long-term project

(a) Introduce a method of calculating the area or scope needed to develop aquaculture

The provincial Fisheries Office will disseminate the calculation method for aquaculture development potential. This data is vital in formulating aquaculture development projects.

(b) Formulating aquaculture development goals

The targeted production volume/development area of culture activities is established at this stage. Each district Fisheries Office will formulate the development goals based on the potential development area or scope. For the culture of seaweed, grouper, or other fishery products with a limited market, it is important to formulate the value for development goals based on market supply and demand and not solely on the production potential based on the natural environment conditions.

4.2.3 Establish Aquaculture Related Laws and Regulations

(1) Objectives

The long-term objective is to achieve the organized development of aquaculture based on a system of laws and regulations. The objective during the initial stage will be to formulate a system of aquaculture related laws and regulations that can be implemented by the district Fisheries Office.

(2) Project

The following projects will be required to achieve the objective mentioned above.

1) Short-term project

(a) Establish a system of laws and regulations in the model district

The NTB and NTT provincial Fisheries Office will formulate a registration system of

aquaculture operators, establish the potential number of aquaculture facilities per area unit, and formulate a system of laws and regulations related to mariculture development. The system of laws and regulations (provisional) will be initially implemented in the model district and will be revised as needed. The following items pertaining to this legal system must be reviewed.

- Environmental conservation, cages per area unit, potential pond area for installation of cages, wastewater standard for culture ponds
- Use of water site, establish water site for culture activities, licensing system for cage installation
- Diversity of living organisms, protection of existing species and restrictions on introducing new species
- Fish disease countermeasures, fish disease prevention system, disposing of diseased fish, etc.

2) Long-term project

(a) Introduce the system of laws and regulations in each district

The system of laws and regulations that were established as explained above, will be disseminated within each district in the province. The restricted values will change according to the natural environment of each water site.

4.2.4 Establish Aquaculture Technical Training System

(1) Objectives

As explained above, once the scope of the cage culture industry is established, the fish species that is cultured is anticipated to change in conjunction with the supply and demand of the market. If the culture technology for groupers is acquired, the transition to other fish species will be easier as the grouper species is a relatively difficult species to culture.

In contrast, many aquaculture operators engaged in brackish pond water culture raise milkfish. However, a segment of these operators continue to rely on traditional non-fertilization feed or fertilizer culture and their productivity remains low.

The final objective is to achieve sustainable and self-reliant mariculture in the NTB and NTT provinces. Established culture production will help the development of the marketing and processing industry and the overall development of the region. For the short-term, focus will be placed on the culture of groupers and projects and programmes aimed at establishing mariculture technology will be implemented. In addition, fertilization fish culture will be promoted in brackish pond water culture activities in order to raise productivity.

(2) Projects

The following projects will be required to achieve the objectives. The development of aquaculture technology such as developing the culture of new fish species will be placed under the guidance of the private sector. The district Fisheries Office will concentrate on assisting the extension of existing technology.

1) Short-term project

(a) Technical transfer of grouper culture technology in NTB and NTT

The district Fisheries Office will set up demonstration cages and carry out technical transfer activities in intermediate rearing and stocking of groupers that is presently conducted in Labuan, to fish culture operators in NTB and NTT. The actual culture will be carried out by culture operators who have learned the technology in Labuan and Situbondo, where culture technology of groupers is advanced. The district Fisheries Office will also assist the culture operators with facilities and costs; and it will evaluate the project during the interim stage and after it is completed as will be explained in the section on "Strengthening the Organization of Fishermen Engaged in Aquaculture Activities".

The effectiveness of the Labuan culture technology for groupers will be corroborated by the trial culture activities conducted in the NTB and NTT provinces; and it will be revised according to the culture environment of these provinces.

(b) Establish grouper seedling production technology in NTB and NTT

The demand for grouper seedlings will rise as the intermediate rearing and stocking culture for groupers becomes established as an industry. Presently, grouper seedlings are raised by the Gondol Research Institute and neighbouring seedling production farms, the Labuan Aquaculture Center, and the Situbondo Aquaculture Center. The demand for grouper seedlings is high and the supply has been unable to meet this demand. The establishment of a seedling supply system is vital to developing grouper culture in NTB and NTT. However, seedling production of marine fish species in NTB and NTT is nearly nonexistent and natural seedlings are harvested for milkfish culture. Subsequently, it is difficult to establish a grouper seedling production system in the private sector under these existing conditions.

Therefore, the participation of government institutions is required during the initial stages. The Lombok Aquaculture Station will conduct seedling production with the assistance of the Gondol Research Institute and the Situbondo Aquaculture Center. When the seedling production technology becomes fully established at the Lombok Aquaculture Station, the technology will be transferred to the private operators. In addition, a training system at each aquaculture center for private operators will also be set up during the technical transfer period at Lombok Aquaculture Station to be utilized by private operators as needed.

(c) Developing fertilization fish culture for milk fish

Fertilization fish culture will be introduced to the brackish pond water culture farms that are dependent on non-fertilization culture, in order to improve productivity. Bima district has the highest productivity (2,000kg/ha) within the province. The targeted value will be set at 1,000kg/ha or half the productivity level of Bima district and the rearing methods of culture farms with low productivity will be improved.

In particular, the large brackish water ponds that have been developed in west Lombok and Sumbawa districts have been unable to increase their production volume; and immediate measures to improve the productivity of the culture ponds are needed. Specific measures aimed at disseminating fertilization fish culture include training activities supervised by the district Fisheries Office at fertilization fish culture farms in Bima district and preparing and disseminating a manual on fertilization fish culture.

2) Long-term project

(a) Extension activities of grouper culture technology in NTB and NTT provinces

The culture technology for groupers described above will be disseminated to other regions in the province. Culture operators who want to learn this technology will receive technical training at the demonstration cage rearing facility mentioned above.

In addition, the district Fisheries Office will conduct a project to culture groupers for small-scale fishermen. The technical transfer activities will utilize the demonstration cage rearing facility and the district Fisheries Office will supervise the operations and maintenance of the fishermen cooperatives.

4.2.5 Establish Fish Disease Prevention System

(1) Objectives

The final objective is to establish a fish disease testing and prevention system centred at the Lombok Aquaculture Station. Presently, the Lombok Aquaculture Station is not equipped with fish disease testing and prevention functions. Therefore, a project or programme aimed at strengthening these functions at the Lombok Aquaculture Station will be implemented during the initial stages.

(2) Projects

1) Short-term project

(a) Strengthening the fish disease testing and prevention functions of Lombok Aquaculture Station

The capabilities of the staff members of Lombok Aquaculture Station and its equipment and facilities will be strengthened to enable the station to conduct fish disease

tests of prawn and fish species. During the initial stage, a technical expert in diagnostic technology (PCR method) from the Gondol Mariculture Research Institute will be sent to the Lombok Aquaculture Station. The technical expert will be responsible for teaching fish disease prevention technology to the staff members of Lombok Aquaculture Station and will conduct fish disease testing activities at the center. In addition to the technology that is transferred through OJT, the staff members will also conduct a survey on the prevailing state of fish diseases in the region. When the staff members of the station acquire a uniform level of technology, a liaison system between the station and the Gondol Mariculture Research Institute will be set up and the station will solely conduct the actual testing activities.

- (b) Establish a fish disease testing and prevention network between Lombok, Sumbawa, and Flores islands

Each district Fisheries Office in Lombok, Sumbawa, and Flores islands will set up an information network with the culture farms within their respective districts to continuously provide information on fish diseases to the culture farms. In view of the existing conditions, establishing an information network on Lombok and Sumbawa islands will be prioritized.

Each district Fisheries Office will be staffed by one officer in charge of fish diseases who will undergo training at the Lombok Aquaculture Station. When there is an onset of fish disease at a culture farm, this officer will be responsible for contacting the Lombok Aquaculture Station and to ensure that appropriate countermeasures will be taken.

In addition, the district fisheries office will be responsible for collecting samples and a system of analysis will be set up. Therefore, a means of transporting these samples to the Lombok Aquaculture Station from each district will be established based on the local transportation conditions.

- 2) Long-term project

- (a) Strengthening the disease prevention functions of the district Fisheries Office

With the establishment of a fish disease testing and disease prevention network described above, the Lombok Aquaculture Station will be handle the initial needs of the region, but as the aquaculture industry grows, it will not be able to cope with all disease related problems. Therefore, in conjunction with the growth of the aquaculture industry, simple disease prevention and diagnostic functions at each district Fisheries Office will be strengthened. Each district office will be equipped with a culture testing facility for bacteria strains.

4.2.6 Organizing and Strengthening Fishermen Cooperatives

- (1) Objectives

The Fisheries Office or private companies assisted the majority of the culture

activities that are conducted in NTB and NTT provinces. Subsequently, fishermen cooperative members are engaged in culture activities on an individual basis.

Due to the lack of continuous guidance on assistance project operations by the provincial or district Fisheries Offices, many projects have failed. To improve this situation, the long-term objective is to promote the independent development of fishermen cooperatives to enable them to receive financing from public institutions such as banks.

To achieve this long-term objective, a model of an independent and self-reliant aquaculture cooperative must be initially established. Therefore, a project or programme aimed at improving the capabilities of the culture cooperatives will be implemented.

(2) Projects

1) Short-term project

(a) Create a model culture cooperative

Fisher assistance projects currently implemented by the district Fisheries Office will be improved by providing assistance focused on the operations and maintenance of the culture activities and their financial administration. The fishermen will receive training in aquaculture technology at the Lombok Aquaculture Station and at other culture centers. The district Fisheries Office will be responsible for providing guidance on culture operations, reinvestments, and other matters for the fishermen cooperatives. Specific guidance activities include compiling an activity plan, feed plan, monitoring, maintaining growth records on fish growth and rearing activities, compiling a list of financial matters, and others.

For fishermen cooperatives that are continuously engaged in culture activities, the project duration will be extended and efforts to strengthen the cooperative's operations capabilities will be carried out. Specifically, the district Fisheries Office will conduct interim and follow-up evaluations of each project with the aim of improving the knowledge and technical guidance of culture operations at each district Fisheries Office. In addition, the district Fisheries Office will be responsible for compiling a model on aquaculture operations according fish species based on the findings obtained from these individual projects.

2) Long-term projects

(a) Formulate a project to develop aquaculture among small-scale fishermen

Implementing such a project will strengthen the operations of fishermen cooperatives and the guidance capabilities of the district Fisheries Office. Each district Fisheries Office will formulate an aquaculture development project for the small-scale fishermen in their respective districts when they have adequately improved their knowledge and guidance skills in aquaculture.

The district Fisheries Office will study past project operations that were implemented

in Lombok and will introduce a model for culture operations that was mentioned above. New assistance projects will incorporate this model. In addition, the relations between aquaculture cooperatives will be strengthened, joint shipping and equipment purchases will be conducted, and guidance activities aimed at strengthening the cooperative structure will be implemented.

When aquaculture cooperatives are able to meet certain conditions, the district fisheries office will provide assistance that will enable the cooperatives to receive financial assistance from public financial institutions.

4.2.7 Aquaculture Development Implementation Plan

The projects needed to promote mariculture and brackish water pond culture in NTB and NTT provinces have been listed in Table 4.2.2. Of these projects, an implementation plan for the project with the highest priority ranking in the study area has been given below.

(1) Develop the Lombok Mariculture Station

Strengthening the functions of the Lombok Mariculture Station is essential in order to promote mariculture in the NTB and NTT provinces although they are outside the study area of this project. Since the district fisheries office in the study area does not possess knowledge or the technical skills in mariculture, an effective measure will be to have the Lombok Mariculture Station conduct technology transfer activities to the fishermen and each district fisheries office.

(2) Establish Aquaculture Related Regulations

Laws and regulations related to developing aquaculture are vital. As evidenced by the development process of prawn culture in other Southeast Asian countries, the productivity of aquaculture that was pursued without relevant laws and regulations not only dropped, but also was the cause of major environmental damages.

In the fisheries sector of Indonesia, notable input in mariculture cage culture of groupers has been made. As explained earlier, in areas where the culture of groupers has been implemented, the impact of the input has been large despite the fact that the project has not yet produced successful results. In the ocean areas where the Gondol Aquaculture Research Center has conducted trial cage culture activities, surplus development due to input by the private sector has occurred during the period of this study. However, since relevant laws and regulations governing aquaculture development do not exist, adequate measures have not been taken.

A vital prior condition to aquaculture development is the establishment of laws and regulations to prevent excessive development. The lack of such laws leads to not only rampant environmental destruction, but will hinder the opportunities of small-scale fishermen

to participate in the aquaculture sector due to excessive competition.

In particular, private prawn culture activities and the live fish exporters are active in the districts in NTB province. In addition, seaweed culture is also actively carried out and the infrastructure for aquaculture development exists. If the cage culture of groupers is introduced, rapid development by the private sector is anticipated. Therefore, laws and regulations related to aquaculture development must be established in NTB province and there is an urgent need to define the development potential area of each water body by the government.

(3) Promote Mariculture in Sumbawa and East Flores

One of the foremost priority projects in mariculture conducted in line with the development policy of the Indonesian government is the establishment of a technical training system for the culture of groupers (seedling production and propagation). This will enable seedling production technology to be established at the Lombok Aquaculture Station.

The major water bodies that are targeted for propagation culture activities are Saleh Bay in NTB province, Waworada Bay in NTT province, and Lembata and East Flores districts.

As explained above, a legal system for aquaculture development is urgently needed in NTB province in comparison to NTT province due to the input environment that currently exists. Following the enactment of a legal system, a grouper cage culture project will be implemented in several areas of Saleh Bay, which has the largest water area. Since the water quality and the concentration of salinity and other factors are unknown, the project will be initially started on a small-scale basis and will be expanded according to the prevailing conditions. Small areas of Sumbawa Island that are suited for culture activities also exist outside Saleh Bay and Waworada Bay. As in the case of the project that will be implemented in East Flores district, floating cage culture will be conducted in these water areas during the latter half of the development project. Thus the project in Saleh Bay will serve as a demonstration facility and will be utilized for technical training activities for local fishermen.

In contrast, although grouper cage culture activities have been implemented in several areas in NTT province, mariculture activities are undeveloped and the provincial government is in a position to establish laws and regulations in conjunction with culture activities. There are also small areas of water that are suited to aquaculture along the coast of Flores Island, in addition to Lembata and East Flores districts. The development of these water areas will center on individual villages. Subsequently, there is a need to develop aquaculture by collectively gathering several villages under one project, in order for the endeavour to be effective in terms of technology transfer activities and seedling and equipment provision.

Based on these circumstances, intensive cage culture activities will be introduced and East Flores and Lembata districts will be designated as an aquaculture development area.

The marketing system for culture equipment and materials and live fish shipments that aquaculture development will produce in these two districts, will enable the use of small culture projects that will be implemented throughout Flores Island, which is located in the center of this marketing route.

During the initial development stages, small culture projects will be implemented in several locations throughout East Flores and Lembata districts. During the latter half of the development period, the culture facilities will be used as demonstration and training facilities. Cage culture activities will be started near these facilities.

Although the culture of groupers generates high revenues, the harvest period is 1.5 years and long. Therefore, in order to shorten the input returns, there is a need to divide the interim rearing and training periods.

(4) Extension Technology of Fertilization Method of Milkfish Culture on Sumbawa Island

In the area of brackish water pond culture, a high priority project is the technology transfer of milkfish culture from Bima district, which has the most advanced fertilization method for production in the study area, to other districts. In 1999, a large culture pond encompassing 2,500ha was developed in Sumbawa district, which has the highest priority ranking for brackish water pond culture development. But due to its low productivity, it is currently unused. In future, Sumbawa district situated adjacent to Lombok Island, where a shortage of fresh fish supply is anticipated, and the increased production volume of cultured fish is an important issue.

The model project that will be operated by the culture association will combine the grouper and milkfish culture projects. A system to prevent fish diseases will be established between Sumbawa and Dompu districts, where prawn culture has developed, and the Lombok Aquaculture Station during the initial stage of the project. It will be extended to other districts during the later stages of the project.

4.3 Plan for Improvement of Fish Handling, Marketing and Processing

4.3.1 Basic Approach

The seasonal and daily fluctuations in fish catch volume are large in the study area, and due to inadequate storage and shipping functions, the flow of fresh fish is restricted despite there is high consumer demand. Subsequently, marketable fresh fish remains unsold or is sold at cheap prices as raw fish for processing or sold as fertilizer and livestock feed; and fishermen are forced to sustain economic losses. In the area of processed fish, the

development and extension of processing methods other than dried and salted products have lagged and much of the processed products are inferior in quality due to undeveloped processing technology and facilities. This has been another source of economic loss. As a result, the landing prices of fish are reflective of these conditions and fishermen incomes have stagnated and a stable supply of fish to the consumer has been impeded.

In contrast, as explained in section 1.2 of the Master Plan, the supply and demand of fish in the study area in 2012 will be balanced throughout the region without actively increasing fishing effort. The implementation of the coastal fisheries resources management project proposed in Section 4.1 will generate large secondary increases in the fish catch volume due to the development of fishing grounds, the training and education of fishermen, and the establishment of a community based management system of fishing grounds over the next decade. This has been designated as a preparation period to enable increased fish catch after 2012. Therefore, the following goals for fish handling, processing, and marketing have been targeted for 2012.

- The fish handling, processing, and marketing infrastructure will be developed and the regional disparity in fish supply and demand will be corrected, and economic losses will be eliminated.
- In order to market the surplus fish of the region estimated after 2012 to outside markets, measures to develop different processing methods, marketing routes, and to foster regional fish traders and retailers will be implemented (laying the groundwork).

The following basic approach will be pursued to achieve these goals.

(1) Measures to Meet Regional Consumption Demand

1) Fish Catch Destination

A large shortage of fish is estimated for Lombok Island, West Flores, and Timor Island in 2012. In contrast, a surplus fish volume is estimated for East Flores and Alor islands. In addition, a small surplus as well as shortage is estimated for Sumbawa Island. Due to the lagging transport network in the study area, transport costs are expensive and the purchasing power of the inland consumption areas is limited. Therefore, measures to improve fish shipments from the surplus zones to the shortage regions that are within close geographical proximity will be pursued (see Chapter 1.2, Fig. 1.1.3).

2) Fish Shipment

The surplus fish is treated either as fresh, frozen, or processed fish. Since much of the fish catch is comprised of pelagic fish and the basic marketing infrastructure for fresh fish lags in the destination areas, the ice-packed fish catch must be transported and sold within one day after landing. For more distantly located destinations, the fish must be frozen or

processed. However, presently, frozen fish is mainly earmarked for export and companies conduct it. Since the local fish traders and retailers who market the fish in the consumption areas are unable to adequately handle fresh fish, the fishermen cooperatives must be given training in the technical operating aspects of frozen fish shipments. It is recommended that frozen fish marketing activities are gradually introduced after the fishermen cooperatives have gained adequate experience in managing a fresh fish marketing infrastructure. In view of the above, this project has mainly focused on improving fresh fish marketing activities in the region and the marketing of processed fish products to Lombok Island that are suited to local preferences will be developed.

Marketing Route (surplus district→ shortage district)	Targeted Volume (2012)	Transport Means	Handling Method
East Flores→West Flores	12,800 tons	Truck (6-12 hours)	Fresh fish
East Flores→Lombok Island	6,500 tons	Boat (2-3 days)	Processed fish
Alor Island→Timor Island	12,600 tons	Boat (16-24 hours)	Fresh + processed fish
East Flores→Sumbawa Island	1,200 tons	Boat (16-24 hours)	Fresh + processed fish
Sumbawa Island→Lombok Island	9,400 tons	Truck (6-14 hours)	Processed fish

Based on the approach described above, the following measures must be taken throughout the study area to rectify the balance in the regional supply and demand of fish.

- Increase the production and supply of ice.
- Improve the storage methods of fresh fish.
- Expand the means of fresh fish shipments.
- Accelerate the quality improvements of existing processed fishery products.

(2) Measures to Develop the Groundwork for Marketing Fish outside the Region

1) Fish Shipment Destination

Potential fish markets outside the study area are Denpasar (Bali province), Makassar (south Sulawesi province), and Surabaya (east Java province) and other large urban consumption areas. Of these areas, Bali and south Sulawesi are estimated to be able to meet the regional demand by 2012. In contrast, a fish demand of about 630,000 tons annually is estimated for east Java, which is about a 400,000 tons increase from current production levels, and transporting fish from other regions is anticipated (see Table 1.1.4). The fish supply in east Java province can be raised by developing the unexploited resources or extending the fishing grounds of Flores district, which has surplus resources.

2) Fish Shipment Patterns

The fish that is supplied from Flores Island to east Java province are presently large pelagic fish (frozen fish) that is shipped by commercial operations. In addition to small pelagic fish (salted and dried) that is shipped by large fish traders, potential processed

products are vacuum packed fish meatball, semi-broiled products, and semi-salted products that can be sold directly to urban area supermarkets.

For fishery products that are already shipped on a commercial basis, increased shipments to markets outside the region due to increased company input can be anticipated following the development of a regional fisheries infrastructure and increased fish production levels due to extended fishing grounds. For newly developed processed products, the development of fishing villages that will serve as the base of operations for these products will be pursued in tandem and existing companies and fish collectors will be used to establish marketing routes and shipment and sales to outside markets.

The focus over the next decade will shift from the exportation of processed fishery products (development of export products will be left to private fishery companies) to the development and improvement of processed fish products for the domestic market. Furthermore, major fish species that have been focused on in the regional plan were the popular small pelagic fish. Specifically, the processing methods of small pelagic fish that are harvested during the peak fishing seasons were targeted. They are frigate tuna (Tongkol), round scad (Layang), and sardines (Tembang). In addition, the processing method will reflect the consumption preferences of the public; and salted/dried fish and fish paste products will be developed by small-scale processing activities conducted at the fishing villages.

4.3.2 Fresh Fish Marketing Improvement Plan

(1) Objectives

The objective is to establish a sanitary and stable, high quality fresh fish supply in the region by reducing marketing risks and economic losses through an improved marketing system of fresh fish.

(2) Content of the Project

1) Promote Ice Production and Establish a Supply System

The absolute shortages in the ice supply and the high price of ice in the study region have impeded the development of a high demand and stable supply of fresh fish for the consumption market. Therefore, ice production and supply system will be developed and the storage, shipment and sales of fresh fish that can be maintained for long hours will be established to expand the marketing scope for fresh fish. The conditions related to a production and supply base for ice is given below.

- (a) The base of operations for ice production and supply will have access to 24-hour electricity and access to an abundant water supply. Ice can be produced in remote areas with poor electricity access by installing a private generator, but the cost is twice that of

electricity supplied by the PLN and maintenance of the facility is problematic. In districts with poor electricity and water intake conditions, an ice-making facility will not be installed; however, ice will be supplied from the nearest ice supply base.

- (b) The ice-making facility will be located at the district's fish landing site or at sites where the fish landing volume is large.

The demand volume for ice is minimal in districts where the fish landing volume is small. If a block ice-making facility is installed in such areas, the facility cost would be expensive and it would not be viable in terms of profit. Therefore, for districts where the ice demand volume is less than 2 tons per day, a small refrigerator will be provided to stock plastic bagged ice or ice will be supplied on the return trip of fish shipments at the market where an ice-making facility will be installed.

2) Develop a Fresh Fish Storage System

Insulated fish boxes will be distributed and used at all stages from the handling stage on board the fishing boats, to the fish landing, handling, and marketing stages, in order to maintain fish freshness through the economic and effective use of ice.

(a) Fish storage on board the fishing boat

It is structurally difficult to install insulated fish holds in small fishing boats. In addition, since the majority of the boats engage in one-day fishing operations, fish freshness is relatively good when the fish is landed without the use of insulated boxes. Therefore, although there is a need to disseminate the use of insulated boxes on fishing boats, it will be gradually implemented in conjunction with measures to extend fishing grounds and promote large fishing boats. However, for fishing boats engaged in gill net and angling operations for demersal fish, irrespective of the one-day fishing operations, small insulated fish boxes will be introduced for use on board to store exported fish.

(b) Storage, shipping, and retail of fish after landing

The majority of the fish boxes used for marketing in the region are plastic boxes with very little insulation capacity even with the use of ice. Fish traders engaged in larger operations utilize insulated boxes (used refrigerators, home-made wooden ferrocement boxes), but their insulation capacity is low. Shifting to high insulation capacity polystyrene or FRP boxes in the transport, storage and marketing activities in the region, will enable fish freshness to be maintained for a longer period of time. The effective use of ice by traders and retailers will greatly reduce marketing costs. In addition, the opportunities to sell fresh fish will increase and economic losses will be reduced.

3) Disseminate Fresh Fish Handling Technology and Improve Awareness about Fish Freshness

Methods to effectively maintain fish freshness to reduce the economic losses of local

fish traders and retailers, and fishing village women involved in the region's fish marketing activities will be disseminated and measures to improve the usage ratio of ice and insulated boxes for fresh fish will be implemented. To improve the ice usage ratio, ice-making facilities will be installed as explained earlier to provide ice at inexpensive prices. This will enable traders and retailers to increase the volume of ice they presently use at the same ice price. In addition, if the usage volume of ice for fresh fish increases, the transport cost for fresh fish is estimated to rise. But the use of insulated boxes to transport the fish will allow the boxes to be stacked.

Although the adequate use of ice and insulated boxes will significantly improve the ability to maintain fish freshness, the purchasing costs will rise for small distributors (fishing village women and small traders and retailers). Therefore, the following will be disseminated.

- Provide hands-on guidance in reinforcement methods for insulated boxes.
- Provide comparative demonstrations with and without the use of insulated boxes.
- Implement priority measures to promote the sale of insulated boxes (interest free credit, free trial usage time, etc.)

4) Improve the Fish Marketing Facility

The market facilities will be improved to enable fresh fish that is transported from each fish-landing site to be sold and stored in a sanitary environment at the major consumption markets in the study area (district markets). There are two types of markets in the consumption areas—wholesale and retail markets. Presently, there are no specifically designated wholesale markets, but public retail markets have been set up in each district. However, due to their limited area, the fish is sold in aisles and outdoors in the sun. To secure a minimum level of sanitation for the handling and retail area for fresh fish (concrete floor slabs, with roof, and tap water facility), the market facility will be expanded and improved.

(a) Expand wholesale functions for fish

If the fish-landing site is located in the district capital, the wholesale functions will be placed within the fish landing facilities and the handling and auction functions will be combined. For district capitals located inland, the wholesale area will be set up adjacent to the retail market. For the inland market in the western Flores Island, an ice-making facility and insulated boxes will be provided. Fresh fish storage functions and ice supply will be provided for the remote fishing communities in the district.

(b) Expand and improve the retail market

The public markets located in the district capital are limited in space and the fresh fish retail space will be built next to the existing market. In addition, storage space for insulated boxes will be created to enable leftover, unsold fresh fish transported from the fish landing sites to be stored in the market.

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(3) Improvements

1) Onboard Handling of Fish

Fishing boat	Fishing days/hours	Present Conditions	Improvements	
			Phase 1	Phase 2
Bagan	Night (about 12 hours)	Bamboo cages, without ice, no space for fish hold or insulation box	Use of plastic fish boxes. Due to the difficulty of shifting to large fishing boats, insulated fish hold and use of ice is unfeasible.	
Purse seiner	Daytime or night (about 12 hours)	Plastic tubs, without ice, no space for fish hold or insulation box	Installation of insulated fish hold (model fishing boat).	Spread of ice usage and insulated fish hold with the use of large fishing boats.
Gill net, angling, trawlers (boat length 4-5m)	Daytime (6-12 hours)	Fish will be stored under the floor boards of the fishing boat (without ice).	Use of small insulated fish hold (30L) and use of ice (10kg) due to harvest of export demersal fish. No changes for local consumption fish.	
Gill net, angling, bottom long line (boat length more than 6m)	2-3 days	Fish is stored under the deck in insulated fish boxes with ice (ice: 150 to 250kg/operation)	Present conditions maintained (ice, insulated boxes proved by fish collector under contract). Promote sale of ice to fish collectors.	
Pole and line fishing	1 day (12-24 hours)	Fish is stored in insulated fish holds containing ice and water.	Present conditions maintained (ice is provided by the fisheries company according to contract)	

2) Handling after Fish Landing

Destination	Landing time	Distance to the market	Present Conditions	Improvements	
				Phase 1	Phase 2
Local market	Dawn	Within 2 hours	After landing fish is transferred to plastic fish boxes at the beach (20-30L). Ice ratio: 10-15% (Flores), 25-60% (Sumbawa)	<ul style="list-style-type: none"> Disseminate insulated boxes. Improve ice ratio: Same day sales 25%, for transport outside the district 75%, for overnight storage 75% Fish landing site, storage site for insulated boxes at major markets Improve fish handling shed (sales, washing, packing in ice) Install water storage facility 	Provide refrigerated truck for major cities and fish landing sites
		More than 2 hours	Shipped in plastic fish boxes stocked in ice		
	Evening	—	Stored overnight at home. [Ice ratio : 10-15% (insulated boxes), 40-60% (plastic fish boxes)], or processed as dried and salted, salted and boiled, salted and broiled		
Export market	—	12-24 hours	Stocked in ice and stored in insulated boxes. (Ice ratio: 100%), maximum storage period 3 days before shipment.	Maintain present conditions: Promote ice sales to fish collectors, transport inexpensive ice from Java, Bali, etc.	

4.3.3 Plan to Improve Fisheries Processing Technology

(1) Objectives

The objective is to improve and develop fish processing technology, to improve and diversify the quality of processed products, to eliminate economic losses, to effectively use raw fish and improve the income of the fishing village.

(2) Content of the Plan

1) Improve the Quality of Existing Processed Products and Disseminate

In addition to dried and salted fish, which is the major processed fish product in the

study area, improved technology to produce salted and boiled fish and salted and grilled fish, which are the specialties of Sumbawa and Lombok islands, will be disseminated to improve the income of fishermen households. In addition, improved processing facilities will be developed and disseminated to prevent the drop in quality during the wet season and to effectively utilize the space of processing areas. Extension activities will be conducted by the district fisheries office that will conduct demonstration workshops in processing technology using newly improved equipment for fishing village women engaged in processing activities at each landing site. Major reforms and the content of the extension activities are explained below.

(a) Disseminate technology to improve the quality of processed products.

- Countermeasures against oxidization of dried and salted fish (pass the raw fish through boiling water and recommended handling procedures, etc.)
- Prevent oxidization that occurs through sun exposure (introduce the practice of drying the fish in shaded, well-ventilated indoor areas, etc.)
- Diversify salted and dried products (trial operations of seasoned and dried products)
- Improve and disseminate packaging methods.

(b) Introduce improved processing facilities

- Space-saving sun drying areas (trial operations of improved drying tables and dissemination)
- Countermeasures against the rain (disseminate easy-to-put-away drying pallets)
- Efficient processing tasks (disseminate improved iron pots for salt grilling and salt boiling)

2) Promote Development and Sales of New Processed Products

Using diverse fish species landed in the study area, new processed products for outside city markets will be developed and marketed by each fishing village. The aim is to improve the value added product price (effective use of inexpensive pelagic fish) and improve fishing village income. The trial development of processed products will be conducted regularly by the fishing village women at each landing site under the guidance of the district fisheries office. In addition, the assistance of fisheries companies and fish collectors will be solicited to market these new products on a trial basis with the cooperation of fishermen cooperatives that have connections to outside markets. The products that will be developed are as follows.

- Tuna and half-dried frigate tuna
- Ground fish meat products made from sardines, round scads, and frigate tuna (fish balls, hamburgers, etc.)

(3) Improvements

1) Improving the Existing Processing Methods

Processed Product	Present Conditions	Improvements
Salted dried fish	Fresh fish is salted and dried for two days, sun-dried for 4-5 days during the wet season. A plastic sheet is laid out on the ground or fish is dried on a fixed table or net; product lasts 3 to 6 months. Due to lack of manual help and land space, adequate drying is not carried out. Subsequently, the product quality is poor.	A. Improved drying equipment 1) Save space using drying trays/racks 2) Simple roofed area (against the rain) 3) Install product storage facility B. Improve salted and drying method • Pass fish through boiling water and dry in the shade (countermeasure against oxidization) • Differentiate between salting fish and soaking in salt, soak salt time, adjust saline concentration • Salt removal, and introduce washing process
Salted boiled fish	Place fresh fish in bamboo container, followed by salt, banana leaves that is layered over the fish and placed in steaming water, product may be kept for 3 days.	Extend the shelf life by salting and vacuum packing (can be kept for 7 days at room temperature), develop products and promote marketing (diversify market)
Salted grilled fish	Wrap salted fish in palm leaf and grill for one hour (shelf life is 3 days at room temperature)	Same as above.
High pressure steamed fish	Steam seasoned milkfish in high pressure pot (shelf life 17 days at room temperature)	Shelf life of the product is extended through vacuum packing, develop and conduct trial operations of other fish species.

2) Develop New Processed Product

Processed Product	Fish Species	Processing Method
Dried (overnight drying)	Small pelagic fish	Season; pass through boiling water, overnight drying, vacuum pack.
Half-dried frigate tuna	Frigate tuna, tuna	After dressing the fish, dry for one hour, refrigerate and vacuum pack.
Fish balls	Sardines, round scads	Pass the fish meat through water, wipe dry (or cook whole fish under high pressure, mix with binder (starch) and kneed well, season, shape, and heat. Refrigerate immediately, then vacuum pack (dry in the case of fish crackers).
Fish crackers	Same as above	

4.3.4 Plan to Improve Fish Shipment and Information Network

(1) Objectives

The objectives are to expand the retail market through improvements in fish shipping, transport, and information system and correct the imbalance in the supply and demand of fish in the region.

(2) Content of the Plan

1) Improve the Means of Fresh Fish Shipment

Fresh fish shipments will be improved according to the following two methods.

(a) Supplying fish to the inland areas

A fish transport system from the fish landing sites to the inland regions that is managed and operated by the fishing village will be introduced for districts where fresh fish

shipments are extremely limited. A full-time driver will be hired by the village or the fishermen association to operate the transport truck. Initially, the local village women will utilize the truck to accompany their fish products, but the shipments of other groups will be gradually accepted according to a transport fare system. In particular, the inland regions have a high resident population and development will particularly focus on NTT province where the production of fresh water fish is nonexistent.

(b) Fish shipment and commodity supply to regional marketing centers

A multipurpose transport boat and fish transport truck will be provided to enable a stable supply of fish, ice, fuel, and fishing gear and equipment to the fishing bases in remote areas and the outlying islands where market access is difficult. The village or the fishermen association to operate the multipurpose boat and transport truck will hire a full-time driver and captain. Initially, the local village women will utilize the truck and boat to accompany their fish products, but the shipment of other groups will be gradually accepted according to a transport fare system. The procurement and supply of other commodities on the return trip will be directly sold by the fishermen associations. The focus of the multipurpose transport boat is to link the remote fishing villages in the western Flores Island with the district capital.

(c) Widespread shipment of fish products in the zones

The fish landing and marketing base in the East Flores island play an important role in marketing fresh fish over a widespread area (fresh fish supply to the western Flores district). With an increased capacity to maintain fresh fish for longer periods of time, a refrigerated truck will be provided to enable long-distance transport of fresh fish. A full-time driver will be hired to operate the refrigerated truck by the management association, and the truck will be chartered for trader groups.

2) Access to market information

A wireless unit (SSB) will be provided for each fish landing site and city market in the study site and information on market prices for that day, the daily trend in fish landing volume will be exchanged. This will give the local distributors a wider selection of destinations, and a more efficient fish marketing system with limited losses is anticipated.

(3) Improvements

Destination	Fish Species	Present Conditions	Improvements
Inland markets	Pelagic fish, demersal fish	Fresh fish transport using passenger bus and minibus (sometimes chartered) Fish shipment is impeded due to poor transport conditions to outlying islands. Transport fares are expensive, in the case of passenger vehicles; the wait for other passengers is time-consuming.	<p>Stage 1: Promote group shipments</p> <p>A. Develop fish shipping system from outlying islands.</p> <p>B. Develop a widespread model fish transport system for inland areas (shipment from major production sites)</p> <p>Stage 2: Develop shipping system by regional fisherman associations</p> <p>A. Implement long-distance, large volume fish shipments</p> <p>B. Develop communications network</p>
Outside markets	Demersal fish	Shipped by chartered vehicles of exporters or own boat.	Integrated fish collection activities by regional fishermen cooperatives
	Tuna, frigate tuna	Processed at freezing plant of fisheries company and shipped.	Same as above.

4.3.5 Input Plan

(1) Facilities and Equipment Plan

The facilities and equipment that will be needed to implement each of the projects explained above are shown in the table below.

Name	Fish Landing, Fish Marketing Center (7 sites)	Regional Fish Landing, Collection Center (14 sites)	Fishing Village Center (14 sites)	Major Fish Markets (14 sites)
Plan to Improve Fresh Fish Marketing	Fish landing facilities, fish handling shed (wholesale market), ice-making, ice storage facilities, insulated boxes, fish retail market	Landing facilities, handling shed, ice-making, ice storage facilities, insulated boxes	Multipurpose facility	Cold storage facility, market improvements (expansion and improved sanitary conditions)
Plan to Improve Fish Processing Technology	Diversification of fishery product, extension facility (processing, cooking area, food fish extension room, processing, cooking utensils (one set), model processing plant	Model processing plant	—	—
Plan to Improve fish Collection and Information Network	Refrigerated truck, communications unit	Fish transport vehicle, communications equipment	Multipurpose transport boat, fish transport vehicle, communications equipment	Communications equipment

Note: Please see Fig. 4.3.1, "Fisheries Marketing Plan 2012". Based on the fish landing volume, consumption volume, and conditions related to location, the model sites will be categorized into 1) fish landing and marketing center, 2) rural fish landing and shipping center, and 3) fishing village center. Development of processing will be categorized according to the same criteria.

- a) Core site to develop fish processing and promote fish consumption: Seven locations that have been designated as fish landing and marketing centers (diversification of fish products and extension facility + model processing plant)
- b) Core site to develop and improve fish processing at fishing villages: 14 locations that have been designated as rural fish landing and shipping centers (model processing plant)
- c) Core site to improve fish processing at fishing villages: 14 locations that have been designated as fishing village centers (multipurpose facilities)

(2) Activity Plan

Name of Plan	Activity	Implementation Body
Fresh Fish Marketing Improvement Plan	1) Supply polystyrene boxes with wooden reinforcement	Fishermen cooperative
	2) Ice-production, sales, and sales of insulated fish boxes	Same as above
	3) Outside fish transactions, handling controls	Same as above
	4) Record transacted volume and price	Same as above
	5) Technical management and guidance of landing facility, sanitation control	District Fisheries Office
	6) Linkage with fish traders, fish collectors (for equipment supply and to establish a fish marketing route)	Fishermen cooperative
Plan to Improve Fisheries Processing Technology	1) Supply, produce, install improved fish drying table	Fishermen cooperative
	2) Processed dried fish generates employment in neighboring fishing communities	Same as above
	3) Extension of improved processing technology to neighboring fishing villages	District Fisheries Office
	4) Trial operations, development, and dissemination of processed fish products	Same as above
	5) Guidance on quality control	Same as above
	6) Develop market, promote sales (cooperation with private businessmen)	Fishermen cooperative
Project to Improve Fish Shipments and Information Network	1) Promote joint fish shipments	Fishermen cooperative
	2) Management of fish transport operations	Same as above
	3) Collect information for marketing purposes and provide information to members	Same as above
	4) Develop fish marketing of fisherman cooperative	Same as above

4.3.6 Implementation Plan

(1) Organization and Division of Roles

Fishermen Cooperatives	District Government
1. Operations of a fish processing facility (management consigned by the government)	1. Foster and provide guidance for local fishermen cooperatives
2. Maintenance of related equipment (technical support with a private company, employ technician from other districts)	2. Maintenance of related facilities
3. OJT of local personnel	3. Trial operations, development and dissemination of fish processing
4. Promote widespread marketing of fish products (in cooperation with fishermen cooperative)	4. Monitor, coordinate, and provide guidance for cooperative activities.

(2) Operations Capital

Fishermen Cooperatives	District Government
Utilize revenue generated from ice sales and facility user fees (completely independent accounting system)	Revenue generated from facility user fees (to be saved to cover facility maintenance costs and as specific financial source)