JAPAN INTERNATIONAL COOPERATION AGENCIES

(JICA)

BASELINE STUDY (EXTENSION EVALUATION SURVEY)
FOR
FRESHWATER AQUACULTURE DEVELOPMENT PROJECT IN INDONESIA

FINAL REPORT

Cooperation
with

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Preface

Baseline Study (Evaluation Extension Survey) on Freshwater Aquaculture Development Project in Indonesia is carried out based on the contract agreement between the Japan International Cooperation Agency (JICA) and PLARENCO, PT.

By the end of execution of work PLARENCO, PT. submits Final Report. This Final Report comprised about the result from "Baseline Study (Evaluation Extension Survey) on Freshwater Aquaculture Development Project in Indonesia", covered both of five districts of model extension areas and seven provinces of target areas.

Hopefully, this report could be one of necessary supplements for implementation of the freshwater aquaculture development in Indonesia.

Thank you,

December 1st, 2004

PLARENCO, PT

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1. Background

The freshwater aquaculture development project of JICA, aiming at improving a sustainability of freshwater aquaculture of small-scale fish farmer has been implemented since August, 2000. At the beginning of the project, the first baseline survey was conducted on the project target areas consist of seven provinces i.e. six provinces in Sumatra and one province in Jawa, in order to collect a variety of information for determining indicators to evaluate and monitor achievements of the project purpose and the outputs.

In September 2004, a second baseline survey was conducted as an extension evaluation survey that was planned in beginning of the project in order to investigate the achievement levels of the project for the four years implementation and to draw out recommendations for the future implementation. The survey was carried out mainly on five districts in four provinces, where the extension model areas are in, also the related secondary data were collected in order to know change of socioeconomic and aquaculture situation of the project target areas.

2. Purpose

The baseline survey was subject to implement in order to analyze the impact of the project, especially in term of extension activities in the extension model areas selected based on the results of the first baseline survey that carried out in March 2001 and socioeconomic survey in August to November in the same year. The results of this survey shall be fed back and utilized in the foregoing project activities and for planning future strategy.

3. Methods

Based on the terms of reference, the survey has to be conducted not only in the extension model areas to collect both primary and secondary data, but also in the target area for collecting secondary data. The extension model areas are the selected areas, where the project's extension programs have been implemented

intensively in. The areas consist of five districts i.e. Bungo and Batanghari District in Jambi, North Bengkulu District in Bengkulu, Kuantan Singingi District in Riau, and Sawahlunto Sijunjung in West Sumatera. On the other hand, target area is defined as area including six provinces in Sumatera (West Sumatera, Riau, Jambi, Bengkulu, South Sumatera, and Lampung) and one province in Jawa (West Jawa).

Based on questionnaires prepared, the primary data have been collected directly in the field of survey through observations and interviews to pre-selected fish farmers who are mainly monitored fish farmers of the project.

The secondary data were collected at the Ministry of Marine Affairs and Fisheries and by visiting offices of local fishery administration in the survey areas and also by interviewing the representative staffs. The offices visited were central, provincial, and district's fishery relevant office as well as Bappeda, BPS, etc.

The collected data and analysis methods are presented in detail in Table 3-1.

Table 3-1. Item and Kind of Data and Analysis Methods

No.	Item	Kind of Data	Analysis Method
GENERAL SOCIO-ECONOMIC SITUATION IN THE TARGET AREAS OF THE PROJECT			
1	GDP per capita in each province and district	Secondary	Quantitative and descriptive
2	Yearly change of population classified by age-group and industry (type of occupation) in each province and district	Secondary	Quantitative and descriptive
3	Others	Secondary/Primary	Quantitative and descriptive
ADMINISTRATION SITUATION OF FISHERIES SECTOR IN THE TARGET AREAS OF THE PROJECT			
1	Yearly change of budgetary allocation in fishery administration in each province and district including subsidy from the central government if any	Secondary	Quantitative and descriptive
2	Operational condition of BBIS and BBIL in each province and district	Secondary/Primary	Quantitative and descriptive
3	Others	Secondary/Primary	Quantitative and descriptive
SOCIO-ECONOMIC AND AQUACULTURE DEVELOPMENT SITUATION IN EACH PROVINCE			
1	Yearly change of total population and labor population classified by type of occupation in each district and county	Secondary	Quantitative and descriptive
2	Economic indicator such as yearly income per capita in average. GDP by industrial classification wise in each district an county	Secondary	Quantitative and descriptive
3	Organization structure of fishery administration in each province and district	Secondary	Quantitative and descriptive
4	Organization structure of fishery extension service in each province and district	Secondary	Quantitative and descriptive

Table 3-1. (continued)

No.	Item	Kind of Data	Analysis Method
5	Number and specialty of staff relevant to the fishery administration and aquaculture development services including extension officers in each province and district	Secondary	Quantitative and descriptive
6	Yearly change of aquaculture areas and number of aquaculture households by type of aquaculture methods in each province and district	Secondary	Quantitative and descriptive
7	Yearly change of number of seed produced by fish species wise in each different provincial, district and private hatchery	Secondary	Quantitative and descriptive
8	Market price of cultured fish by fish species wise	Secondary/Primary	Quantitative and descriptive
9	Influence and existing situation of Carp Herpes Virus	Secondary/Primary	Quantitative and descriptive
10	Information exchange on aquaculture extension among autonomous bodies	Secondary/Primary	Quantitative and descriptive
HOUSEHOLD ECONOMY AND AQUACULTURE CONDITIONS OF FISH FARMERS IN THE MODEL AREAS			
1	General information	Primary	Quantitative and descriptive
2	Aquaculture production system	Primary	Quantitative and descriptive
3	Aquaculture technique assessment	Primary	Quantitative and descriptive
4	Socio-economy assessment	Primary	Quantitative and descriptive

4. Composition of the Study Team

Member of the survey team consist of 4 aquaculturists and 2 socio-economists, they were divided into two groups that have responsibility for collecting both primary and secondary data from each fixed location of the survey. The Survey Team and its coverage survey location as shown in the following table.

Table 4-1. List of Study Team and its Coverage Survey Location

No.	Name	Position	Group	Location*)
1	Ir. Haridiyatno S. MM	Responsible Person	-	-
2	Dr. Ir. Odang Carman	Aquaculturist 1 (Team Leader)	A	JR
3	Ir. Dadang Shafrudin, MSi	Aquaculturist 2	B	BWS
4	Ir. Nur Bambang PU, MSi	Aquaculturist 3	B	BWS
5	Dr. Ir. Luky Adrianto	Socio-economist 1	B	BWS
6	Ir. Suryono	Socio-economist 2	A	JR
7	Imron Hamsyah, SPi	Aquaculturist 4	A	JR

JR: Jambi and Riau, BWS: Bengkulu and West Sumatera.

5. Map of the Project Target and Model Extension Areas

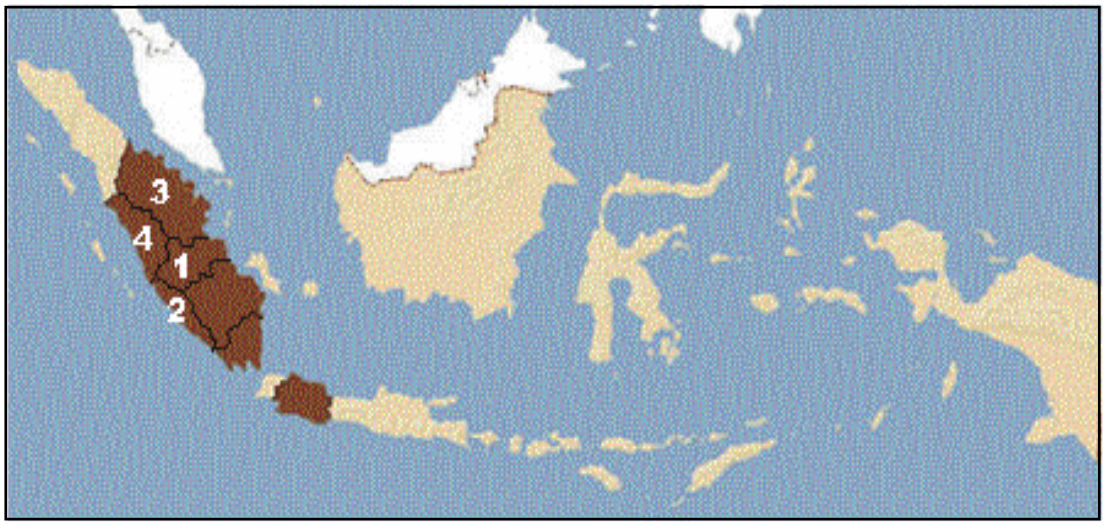


Figure 5-1. Map of The Target Areas (brown shadow) and Model Extension Areas (1,2,3,4)

6. Summary

6.1. Trend of Aquaculture Development in Target Area

6.1.1. Introduction

Development of freshwater aquaculture in certain region depends on three main factors: 1) natural resources, 2) market of freshwater fisheries products, and 3) human resources and institutional capability. Natural resources mean freshwater resources, land characteristics, climate, and geographical position. The market factors mean the quota of fish demand in local, regional and/or international trading (in volume, kind of fish, and prices). While human resources and institutional capability means the capability of operators in applying technologies and utilizing knowledge and skill, as well as capability of policy makers in providing suitable of programs, information and communication to all stakeholders.

As a consequence of limiting and supporting factor in development of freshwater aquaculture, in fact, various technologies or systems of freshwater aquaculture have been established, for instance stagnant pond system, running water pond system, cage culture such as karamba system (wooden or steel cage in river or irrigation

channel) and floating cage net system (its call KJA, Karamba Jaring Apung), and paddy field system. The karamba and KJA systems are basically same, the differences is only where those systems are practiced. Karamba is usually practiced in river or irrigation canal, while KJA is usually practiced in lake and/or dam.

Availability conditions of the above three factors are different among the project extension target areas, namely West Java, Lampung, South Sumatera, West Sumatra, Bengkulu, Jambi, and Riau Provinces. For example, West Java, has long success stories in freshwater aquaculture development in compare to the other provinces in the target areas. The success of West Sumatra derives from proper programs and capability to implement the programs. The three factors can be explained as follows:

1. Natural resources of West Java; plenty rainfall in most districts, especially Bogor, Sukabumi, Cianjur and Bandung. It is an ideal conditions to develop freshwater aquaculture in the pond (stagnant water or running water system), paddy field (mina padi), bamboo cage culture (karamba system). There are several large dam such as lake of Cirata, Saguling, Jatiluhur, and small lake as Lido (Bogor). In those waters, people has been developing floating cage net culture system.
2. Marketing potential and fish consumption: A great number of West Java people including Jakarta people (approximately 40 million people in 2003) and those people has characteristic of culture to eat more freshwater fishes than marine fishes.
3. Bogor plays role as a center of agricultural education and research (including fisheries science and technological practice) in Indonesia. It makes public or people easy to get information about skill and practice of freshwater aquaculture.

6.1.2. Institution and Policy

Administratively Indonesian government introduces five criteria from national level (iPemerintah Pusat, led by President), provincial level (Pemerintah Propinsi, led by Governor), district/municipal level (Pemerintah Kabupaten/Kota, led by Bupati/Walikota); sub district level (Kecamatan, a led by Camat), up to village level (Desa/Kelurahan, a led by Kepala Desa or Lurah).

The above each administrative body are called Ministry/Departemen in national level, Dinas Propinsi and Kabupaten/Kota (office or agency) in Provincial and District level, and Cabang Dinas (branch office) in sub district level. As fisheries affairs, the name of organization of provincial fisheries service varies among province. It depends on provincial governmental policy.

Since decentralization program has been implemented, each district has been introduced their own policy to arrange and manage their agencies. Some districts have merged Dinas Perikanan (Fisheries Services) with Dinas Peternakan (Livestock Service) or even Dinas Tanaman Pangan dan Hortikultura (Food Corps and Horticulture Service). For example in Bogor District, the name of agency in charge of fishery is *Dinas Peternakan dan Perikanan Kabupaten Bogor* and in Bungo District, it is *Dinas Pertanian, Peternakan dan Perikanan Kabupaten Bungo*. In the five model extension areas, fisheries office in the four districts has been merged with other offices. In Kuantan Singingi District, Dinas Perikanan is also planned to be merged with food crops and horticulture office in 2005.

There are two types of organizational structure criteria in provincial level. The first one is based on the function (i.e. Planning division, Production division, etc in Bogor District), while the second one is based on the affairs (i.e. Fisheries Sub Office, Livestock Sub Office, etc as in Batanghari District). Some of the organization structure of fisheries office are shown in the next pages.

Fisheries policies in provincial level basically sustain national policies. In general, the governmental master program for fisheries is stated as PROTEKAN 2003, and it has been implemented in detail as PROPENAS 2000-2004 (the National Development Program, 2000 – 2004). This means to increase the national income from fisheries export commodity. The Government of Indonesia aims at earning 10 billion US$ in 2003 (exaggerated program). This program clearly states that the government will control the catching activities and increase aquaculture activities. Commodity expected in most is black tiger shrimp. The government expects to earn around 7 billion US$ from black tiger shrimp. As for freshwater fisheries, the government is aiming at increasing cheap protein supply for the people. It means that freshwater fishes produced are dedicated for local market.

At present, in a draft of Government Working Plan 2005 of Indonesian Government

(Published by DPR-RI), the main activities relevant to aquaculture are 1) expansion of aquaculture area in marine, brackish water, and freshwater culture, 2) empowerment of fish farmer by aquaculture intensification, and 3) improvement of open waters resources. In Transition Strategic Plan 2005 of the Ministry of Marine Affairs and Fisheries, 5 issues to be coped with in aquaculture services are described, i.e. 1) spacing plan and space utilization regulation, 2) capital aid for fish farmer, 3) market globalization of aquaculture products, 4) technological improvement especially in quality improvement of seed production, and 5) aquaculture infrastructure.

6.1.3. Aquaculture Aspect

Fish Species

Since past 10 years ago fish farmers have been succeeding in breeding and growing up some fish species. At least 10 species have been recorded as domesticated fishes for human consumption: common carp (*Cyprinus carpio*), tilapia fishes: (*Oreochromis niloticus and O. mossambicus*), nilem (*Osteochilus hasselti*), kissing gouramy (*Helostoma temincki*), giant gouramy (*Osphronemous gouramy*), sepat siam (*Trichogaster pectoralis*), tawes (*Puntius javanicus*) and catfishes (*Clarias* sp and *Pangasius* sp). Among those species, common carp is the most popular species cultured in most districts of the project target area, followed by tilapia and giant gouramy. There are several strains of common carp have been registered such as majalaya strain, taiwan strain, sinyonya strain, mirror carp strain and punten strain. The strain liked best is majalaya and taiwan due to their rapid growth rate and practical easy handling..

Oreochromis mossambicus (local name: mujair) is a very easy species to be cultured in pond. But since the fish matures easily in small size (some time less than 100 gr.), it is difficult to grow them until becoming larger size. This species is easily spread out to the other area and becomes competitor for another cultured species. This is why the species is then getting less popular. In the last 5 years, two new species of tilapia namely red tilapia strain and GIFT strain (Genetically Improved of Farmed Tilapias) had been introduced, which are more popular due to their fast growth rate. Especially, red tilapia has been cultured intensively by an international company in Central Jawa and exported to European countries and United States.

GIFT strain is the newest species introduced. The broodstock is still imported from Philippines. This species is relatively easier to handle and grows faster in compare to the other species.

As for fish price in market, the most expensive species is giant gouramy followed by common carp and then tilapia. Giant gouramy is always one of the important menus for almost all cerablation occasions (especially wedding parties)

Aquaculture Technique and Production

Seed Production

Seed production has been done by farmer and government. Farmer seed production unit is usually called as *Unit Pembenihan Rakyat (UPR)* and the government-owned one is called as *Balai Benih Ikan Sentral (BBIS)* and *Balai Benih Ikan Lokal (BBIL).* The differences between BBIS and BBIL are the owner, duty, mission, and responsibility. BBIS, seed production unit is a property of provincial government, under control and management of provincial fisheries office; and BBIL is property of district government, under control and management of district fisheries office.

Number of BBIL and BBIS in the target area is 28 units in West Java (total area :18.35 ha, capacity of production : 9.2 million fish larvae per year), 11 units in Lampung (14.81ha,13.0 million fish larvae per year), 14 units in South Sumatra (29.45 ha, 22.1 million fish larvae per year), 9 units in Jambi (21.60 ha, 8.3 million fish larvae per year), 4 units in Riau (20.50 ha, 6.1 million fish larvae per year), 15 units in West Sumatra (21.16 ha, 11.2 million fish larvae per year), and 16 units in Bengkulu (9.95 ha, 7.8 million fish larvae per year) (Directorate General of Fisheries Culture, 2004).

In West Java as a leading province in freshwater aquaculture development, fish farmers can produce seeds either for their local demands satisfaction or even for export market requirement from other provinces. Hatcheries operated by the farmers are well developed in West Java. Common carp, tilapia, and pangasius catfish are the most successful species concerning to the breeding technology. The fish breeder can easily reach the survival rate of 40–60% from larval stage to fingerling. Seed production technology of pangasius catfish is more complicated and seed producers usually use indoor hatchery system.

The major problem in the nursery stage is feeding management. Most of fish breeders feed larvae simple rice brand or chicken eggs for several days and then release them in earthen pond. This causes higher mortality. Intensive care of larvae is still uncommon among fish breeders.

Grow Up Practice

There are several techniques/methods for growing up fish to reach consumption size. They are 1) stagnant water pond system, 2) running water pond system, 3) bamboo cage (karamba) system, 4) floating net cage system, and 5) rice filed system.

Stagnant water system is the most popular and traditional system. This system is used to grow all fish species mentioned above. The size of earthen ponds is usually small (500–2,000 m^2) and the water depth is around 50–90 cm. Unit area per farmer is usually also small (usually less than 1 ha per farmer). Some farmers use applied commercial feed, but most of farmers are still using traditional feed such as simple rice brand, leaves (*sente* leave), domestic waste (like rice and vegetables), etc. Fertilization is common treatment using organic fertilizer (chicken manure, cow dung) or un-organic fertilizer (urea and TSP), especially in seed production. Water exchange in this system is usually very limited with1–2% daily exchange rate, or just enough to replenish water loss due to evaporation. Earthen pond is used as a nursery pond or grow-out fish pond, where fish is grown from fingerling (or 50–100 g/fish) to consumption size (250–500 g/fish).

Running water system is modernized system in compare to stagnant water systems. This system could be more productive (2.5 tons/pond from the total area of 3x8 m^2) in compared to the stagnant water system. The common fish reared in this system is common carp. Average weights of seeds used for this system are about 100 g/fish and the seeds are reared until they become 500–1000 g/fish. Bogor is the most advanced district in producing common carp using this system, but in recent years (2002 – 2004) most of farmers have not practiced this method because of high cost of feed and pest control. In 1999 there were 1,524 units operated running water pond, but in 2003 only 597 units do it. West Sumatera is the newest developed area of running water pond.

Karamba is a cage made of wood or steel to grow up fish in. In West Java Province, this system is getting less popular, because it prevents water flow in river (small rivers) or drainage in canals and causes flood, and also river water quality tends to be decline because some pollution occurs from many sources. Karamba system recently has become popular in Sumatra target areas such as in Bungo and Batanghari. However, in Batanghari district there was a flood in February 2004. Due to this disaster outbreak, some of the farmers in extension model areas (Simpang Karmeo and Ampelu village), who operated karamba suffered from damages. They haven't restarted the same until now.

Floating net cage system is especially popular in man-made lakes such as Lake of Cirata (Cianjur), Saguling (Bandung) and Jatiluhur (Purwakarta) in West Java; Maninjau (Agam) and Singkarak (Solok) in West Sumatera. The size of the net is usually 7x7x7 m^3. Common species cultured in this system are common carp and tilapia (GIFT strain). This system is also considered as modern system since farmers feed fish commercial feed. As of 2002, number of floating net cage in West Java was 23,826 units with 7,150 ton production. When you compare the situation of the year 2000 with 21,365 units and 41,528 ton production, you may realize a decline in production but increase in number of units of cage in 2002. Floating net cage aquaculture in West Sumatra is increased both in production and number of facilities. The production increased from 339.10 tons in 2000 to 4,401.30 tons in 2002.

The intensive development of growing fish in paddy field (mina padi) had started in 1980s. There are two types in mina padi system depending on target fish size. The first one is to produce fingerling size. The other one is to produce fish consumption size. In the first type, farmers culture fish fry after they prepare land before rice culture season coming. Usually this practice needs a month in time. For the latter type, farmers make small channel at around and diagonal of paddy field as fish culture facilities.

Statistical data of 2002 shows that freshwater fish production in province is mostly produced from stagnant water ponds (87,557 tons), followed by MINAPADI system (49,357 tons) and floating nets cage system (26,400 tons). Meanwhile, capture fishery, running water system, and karamba culture system contributed 11,802 tons, 4,359 tons, and 204 tons per year, respectively.

As mentioned earlier, stagnant water is the most traditional system in freshwater aquaculture in the provinces. Seven provinces in the project target area produce freshwater fishes by this culture method. Among the seven provinces, West Java contributed the highest production (369,392 tons) in 2002. The production in the same year in Lampung, South Sumatra, West Sumatra, Jambi, Bengkulu, and Riau is 8,934 tons, 11,369 tons, 13,309 tons, 2,265 tons, 1,933 tons, and 11,369 tons, respectively.

6.1.4. Aquaculture Technology Condition in Model Extension Areas

Respondents in Batanghari and Kuantan Singingi show better capability in broodstock management than that of respondents in the other extension model areas, while respondents in Sawahlunto Sijunjung show lowest capability in managing broodstock. However, based on the highest average score (around 60%), capability showed by respondents in Batanghari and Kuantan Singingi indicated that although they can keep breeder in proper pond and fed regularly, but the possibility of cross breeding with any unclear breeders is might be occurred. Hence, their knowledge to keep good quality of breeders by avoiding the possibility of cross breeding is better to be considered in the next extension program.

Respondents in Batanghari and Kuantan Singingi also can manage feeding better than that of respondents in the other extension model areas, although generally they have not recorded feeding activities and growth of fish yet. The lowest management level is presented by most of respondent in Sawahlunto Sijunjung that never fed the fish appropriately based on the biomass.

In term of fish nutrition, respondents in Batanghari have better skill and knowledge than that of respondents in the other extension model areas. They also have knowledge on what are important nutritional elements according to fish species and growth stages. However, they still have no ability to consider necessary characteristics of feed according to species and special usage (breeders, nursery and grow-out), as well as to make an original feed composition by themselves. The lowest score on fish nutrition category is found in Sawahlunto-Sijunjung.

Most of respondent can identify their fish that infected by diseases and try to prevent spreading the infection; however, they don't know the causative agent

clearly. Respondents in Bungo have lower ability in controlling fish diseases compared with that of respondents in the other model extension areas.

In case of water management, the knowledge and skill of respondent in all model extension area have a similar scores, the average score is less than 30%. Respondents in Bungo and Batanghari represent the highest (26%) and lowest (19%) scores respectively.

General culture management indicator showed that most of the respondent scores are more than 40%, except respondents in Bungo (34%). It means that most of the respondents operate aquaculture with regular maintenance of facilities and equipment and kept it in safe condition.

Although respondents in Batanghari can manage broodstock better than that of the other extension model areas, but in average, they do not manage seed production as good as they manage the broodstock. The highest seed production score achieved by respondents in Kuantan Singingi, followed by Bungo and North Bengkulu.

Whole production management scores for all model extension areas relatively low, especially because of book record. Generally, the respondent does not record their culture activities; they cannot calculate production cost, benefit and plan future culture activities well. In this point respondents in Bungo reach higher score, while respondent in Sawahlunto Sijunjung reach the lowest score.

6.1.5. Socio Economic Aspect in Model Extension Areas

Aquaculture activities are not the main job of the farmer respondents answered, their main job is mostly agriculture varying from paddy field to natural rubber plantation. Agriculture as the main job in the model areas is from 56.52% in Kuantan Singingi District to 96.55% in Sawahlunto-Sijunjung District. This fact shown that freshwater aquaculture is still as supplementary job.

Fish farmers gross income in the three districts of Batanghari, Bungo and North Bengkulu, group of fish farmers who have gross income less than Rp. 500,000 per month are dominating the respondents. The other dominant group in the three districts is the fish farmers who have gross income in the range of Rp. 500,000 – Rp. 1,000,000 per month. This matches the per capita regional income calculated to be Rp. 4,383,521 per capita/year or Rp. 365,293 per capita/month in the same district.

The same situation is also seen in North Bengkulu of Rp.214,079 per capita/month and Bungo of Rp. 306,088, respectively. In the district of Sawahlunto-Sijunjung and Kuantan Sengingi, however, the fish farmers who have gross income of Rp. 500,000 – Rp. 1,000,000 monthly dominate the respondents. According to Statistical Office of Kuantan Singingi, per capita regional income of this district is Rp. 412,231 per capita/month.

In average, 29.20% of the total respondent fish farmers in the model area answered that the freshwater aquaculture contribution to the household income is only 10-30% of total gross income per month. Furthermore, only 22.12% of respondent fish farmers have 30-50% contribution of income from freshwater aquaculture and 12.39% answered that from the contribution of aquaculture is more than 70%.

In general, it can be revealed that most of the respondent fish farmers (48.21%) said that their production has been increasing during the last 2-3 years especially that of increasing less than doubled. This is the positive sign of farmer productivity that is able to increase their production even though not more than doubled. Another fact was found also that 26.79% of the fish farmers said that there is no change of their production during the last 2-3 years.

Talking about the production capability of fish farmers in the each district, it can be also revealed that the condition varies among districts. In Batanghari and Bungo, there are no farmers that have a decreasing production in the same period of years. However, in the other three districts there are a number of fish farmer who have decreasing production.

Of the 115 total respondent fish farmers, 76 fish farmers indicated that they have at least 1 to 3 items of assets. Bicycle and television are the most common assets of the fish farmers. In the Districts of Kuantan Singingi, Bungo and North Bengkulu are relatively wealthier than the other two districts of Sawahlunto-Sijunjung and Batanghari. The fact is shown in the number of fish farmers who have more than three items and some of them have seven items (all of items which reflect high level of family wealth). In Kuantan Singingi, there are 9 of the 23 fish farmers who have more than five items of the assets, while in Bungo 5 of the 20 fish farmers and in North Bengkulu 3 of the 28 fish farmers.

In terms of flow of assets, it is important to assess the capacity of family assets in order to coping with the liquid capital for initiating freshwater aquaculture. That most of fish farmers in Batanghari, Bungo and Nort Bengkulu had to borrow initial capital for starting aquaculture activities. The different situation is found in the case of Sawahlunto-Sijunjung and Kuantan Singingi that fish farmers in these districts mostly using their own capital for initiating aquaculture activities

6.2. Freshwater Aquaculture Extension Services in the Model Extension Area

Extension service is the important part of aquaculture and fisheries development in general. It is not only needed for introducing such new technology as given in the most conventional of extension service, but it also has important role for establishing comprehensive management toward sustainable development of fisheries.

In general according to new organization structure of fisheries services, there are two boards or sections under head office responsibility that carry out fisheries extension programs, namely structural board and functional board. The structural board have responsibility in planning and budgeting of extension program and the functional board have responsibility in implementing of the extension activities. The structural board usually has less staffs in compare to that of the functional board. And, in general, fisheries extension officer in most district is limited not only in term of number but also in term of technical back ground.

As a rule, fisheries extension programs are proposed annually for next year fiscal by the staff member of structural board which approved by the head office. The proposed programs will be then evaluated by local government and/or Fisheries Office at province level. Finalizations of readable programs involve revision and modification of detail activities based on available budget. In the coming year the programs will be implemented by the functional board.

The topics of those extension activities are relatively same among each district such as how to improve quality control management for fisheries, farmers groups development, fisheries marketing technique, fish culture technique and so on. In order to ease the activities, the institution has also prepared the guidance books, such as “guidance how to create and manage the training programs”. The simplified of the fisheries office organization structure at district level is shown in Figures 6-1.

Several meeting with the farmers routinely conducted to improve their ability of grow up fish. Besides, fisheries service held also some kind of public services through technical implementation unit (UPT). This UPT has task as a place for experimental technology and training. Another activity by this UPT were by showing technological demonstration pilot, guidance for groups, cooperation with other institutions in holding training, and also by holding or following incidental fisheries exhibition.

Bungo District

Fisheries Officer in District of Bungo is under the structure of Agriculture, Livestock, and Fisheries Office, which recently established as official nomenclature in the mid of 2004. In this office, the planning and budgeting of extension program is under responsible of Technology Information and Extension Section, understructure of Agribusiness and Human Resources Development Sub Office. The implementation programs in the field are conducted by Field Extension Officer (PPL) under coordination and responsibility of Sub District Head Office (Kepala Cabang Dinas/KCD) in each sub district area.

Based on the annual report of this office in 2002, however, there is no established schedule and action reported for extension program except some aquaculture practices.

As addition for extension program implementation in this district, there is a special institution called Agricultural Extension Office (Balai Penyuluhan Pertanian; BPP) with number of Extension Officer is 101 persons. All of administration and personal control is under responsibility of Agriculture, Livestock and Fisheries Office. Table 6-1., shown the number of BPP, PPS, PPL, and Farmer Group at Bungo District in 2002.

Base on information a Sub Head Office of Fisheries Affairs at Bungo District, from the 101 persons of PPL in Bungo District, there are 12 fishery specialists placed at 9 sub district.

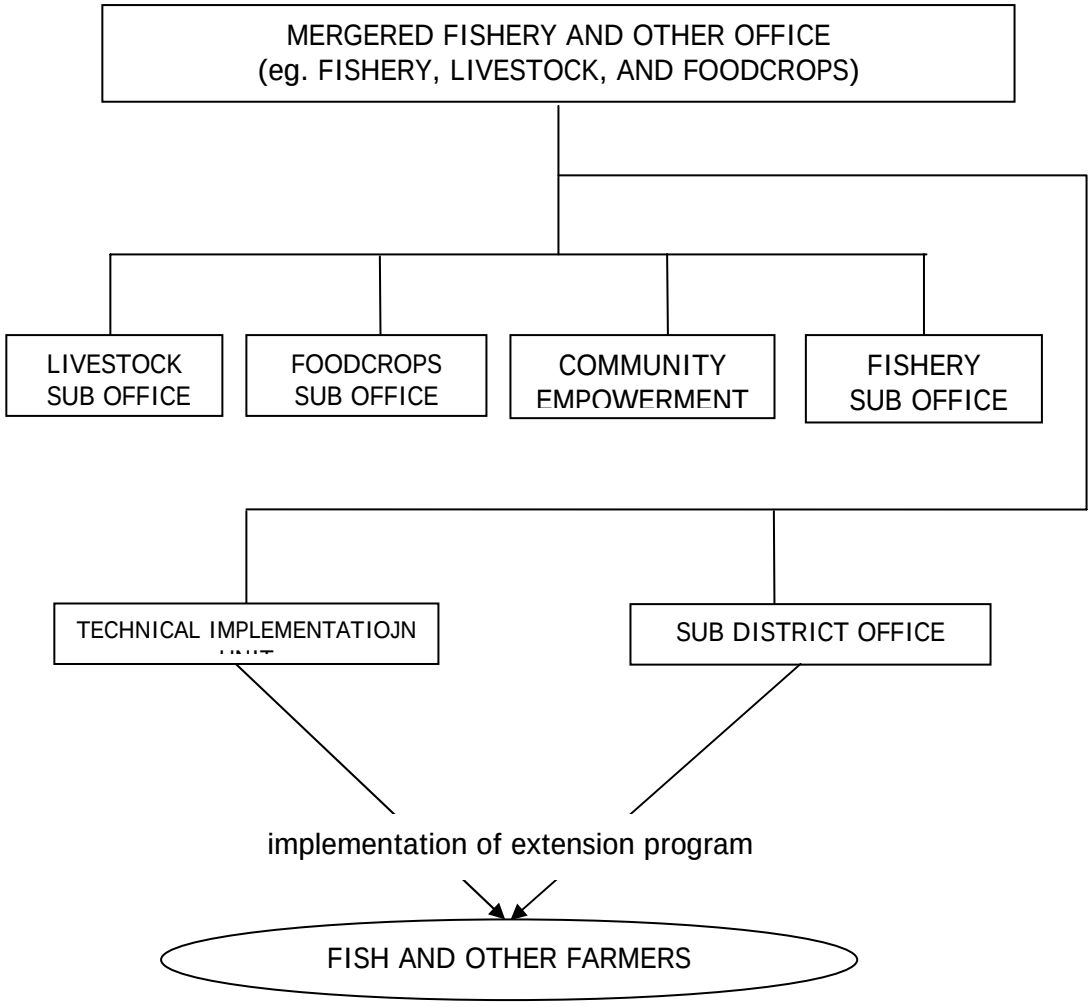


Figure 6-1. Simplified of Organization Structure of Fisheries Office in Model Extension Areas in relation toimplementation of Extension Program

Tabel 6-1. Number and Location of Extension Institution in Bongo District, 2002

No.	Sub District	BPP	PPS	PPL	Farmer
1.	Muara Bungo	1	1	27	109
2.	Pelepat	0	0	9	62
3.	Tanah Tumbuh	1	0	7	28
4.	Tanah Sepenggal	1	0	13	90
5.	Rantau Pandan	0	0	9	63
6.	Jujuhan	1	0	10	85
7.	Pelepat Ilir	1	0	15	120
8.	Limbur Lubuk Mengkuang	0	0	4	70
9.	Muko-muko Batin VII	1	0	7	31
	Total	6	1	101	658

Source : Annual Report of Agriculture Office , District of Bungo (2002)

There are several fisheries training conducted in the year 2003. In Bajubang County, fish culture training has been conducted on July 2003 with the main target

was the initial farmers in the village. As reported by the Agricultural Agency of Batanghari District, the Bajubang County is the area that having good potentials in fish culture both in terms of land, water as well as human resources.

The other training conducted in this district was training of Fish Culture using Karamba which was conducted in Sub-district of Batin XXIV, Karmeo Village on April 2003 and in Pemayung Sub-District, Senaning Village on August 2003. Total number of fish farmers joined to these two training programs was about 60 persons.

In the field of seed production, a special training with the total participants of 20 farmers had been conducted in Bajubang County. The training programs compos of 80 % practical contents which conducted in BBAT Sungai Gelam and the 20 % of theoretical contents in the class. From this training, the local government predicted that all of fish fry demand in Batanghari District can be supplied from the local fish farmer (UPR).

North Bengkulu District

In general, situation of extension program in North Bengkulu is relatively same with those conducted in Sawahlunto-Sijunjung. However, in terms of human resources North Bengkulu District has relatively better condition than Sawahlunto-Sijunjung. Table 6-2 shows number of fisheries extension officers in North Bengkulu District.

From Table 6-2. there are five aquaculture supervisors who conducting extension service in this district. However, if we compare the number of aquaculture supervisor with the areas must be coped, it can be argued that the efficiency of extension service program still must be developed. With total area of aquaculture as of 1,741.62 ha, ratio of extension officer-aquaculture area would be one person for 348.24 ha, higher than the ratio of extension officer-area of Sawahlunto-Sijunjung District.

Kuantan Singingi District

Different with two districts above, fisheries agency or office of Kuantan Singingi District is still independent without any merger with other offices. Administratively, Kuantan Singingi District covers 11 sub-districts with in terms of extension program it has to be done by 12 extension officers (PPL). They are divided into two type of responsible area. Some of them are allocated to 8 sub-districts and directly

responsible to fisheries agency in the district level, while in the case of other 3 sub-districts the extension activities must be responsible to the Head of Fisheries Sub-District Office (Kepala Cabang Dinas Perikanan).

Table 6-2. Number of Extension Officer under Marine and Fisheries Agency of North Bengkulu

No	Formation	Number of officer (person)		Total
		Expert	Skilled	
1	Seed supervisor	2	4	6
2	Fish disease supervisor	2	3	5
3	Aquaculture supervisor	2	3	5
4	Capture fisheries supervisor	2	4	6
5	Quality control supervisor	0	2	2
	Total			24

Source : Marine and Fisheries Agency, District of North Bengkulu (2004)

In terms of facilities, the extension program in this district has being supported with infrastructures as shown in Table 6-3. These infrastructures have been built under several national projects facilities such as through National Fisheries Improvement and Development Project (Proyek Pembangunan dan Pengembangan Usaha Perikanan; PPUP), Food and Nutrition Diversification Project (Proyek Diversifikasi Pangan dan Gizi), and Fisheries Production Raising Project (Proyek Peningkatan Produksi Perikanan). All of these projects are implemented during 2003/2004 fiscal year.

Table 6-3. Infrastructures/Facilities of Extension in Kuantan Singingi District, 2003

No.	Type of Infrastructure/Facilities	Number of Unit	Note
1	Training Equipment at BBI Teso	1	Multi Purpose Room and Training Center Equipment
2	Mini Hatchery at KPIR Kari	1	Technology Dissemination Center
3	Aquaculture Demonstration Pond	8	Every Sub District

Source: Marine and Fisheries Agency, District of Kuantan Singingi (2003)

Extension activities in this district have been standardized through the implementation of LAKU (Latihan dan Kunjungan) system or Practicing and Visiting which is based on the ultimate goal to improve the capability of fish farmers. Every

first week of respective month, there is a meeting between Extension Officers and the Head of Fisheries Sub District Office as well as people from the District Fisheries Office to evaluate all about extension activities including the success story, lesson learned, as well as problems of the implemented extension program activities.

According to official data, number of fisheries households (FHH) in Kuantan Singingi is 4,022 with total aquaculture area is about 175.87 ha including number of karamba as of 120 unit. From this data, it can be revealed that the ratio of extension service officer and fisheries household is 1: 365 FHH or one officer has to serve 365 FHH in extension program. In terms of aquaculture area, the ratio is calculated to be 1:15.99 ha. Unfortunately up to now there is no standard value of the optimal ratio between the number of extension officer and the number of FHH as well as aquaculture area.

Sawahlunto-Sijunjung District

In the case of model areas, some different situations are found in terms that not all of model area actually included in the JICA Extension Services Program. Some of them such as Sawahlunto-Sijunjung of West Sumatera Province still only been surveyed in order to determine the model areas. In this district, aquaculture extension program is conducted by the local government (district government) which is in the same time lag of human resources having strong background on aquaculture.

Freshwater aquaculture services are under the structure of Fisheries and Livestock Agency of the District of Sawahlunto-Sijunjung. In this case, extension service officer is categorized into the group of functionality officer, same with statisticians, librarians, etc. In this district, there are only 4 persons in charge for conducting extension program (overall for both fisheries and livestock). Among these persons, only one person actually has strong background on fisheries, including aquaculture. There is no established schedule for extension program except some special events such as training on fish disease which is usually conducted jointly with other organization or institution. In terms of ratio extension service officer and aquaculture areas, it can be said that with total area of aquaculture of 814.18 ha, one person extension officer have to be responsible for 203.55 ha.

7. Results and Discussion

7.1. Freshwater Aquaculture Production in the Target Areas

Target areas in this study refer to seven provinces where freshwater aquaculture development project are located. These target areas consist of West Sumatera, Riau, Jambi, Bengkulu, Lampung, South Sumatera, and West Java Province. From statistical data provided by the fisheries agency as well as statistical office of each province, it can be said that freshwater aquaculture production among these target areas varies depends on their level of fisheries development program. As presented in Table 7-1, West Java Province comprising the highest production of freshwater aquaculture which produced about 157,609 tons in 2003 or increasing about 20,027 tons from the previous year.

Table 7-1. Freshwater aquaculture production in the target areas (ton)

Province	1999	2000	2001	2002	2003
Riau	6,239	6,435	13,407	18,336	19,950
Jambi	2,329	2,792	3,887	4,730	5,929
West Sumatera	19,021	17,962	19,343	26,124	30,460
Bengkulu	2,585	2,892	2,892	2,154	5,975
Lampung	3,945	4,052	6,578	9,466	12,544
South Sumatera	3,231	13,059	15,596	17,137	25,546
West Java	127,521	140,810	135,167	137,582	157,609

Source : Statistical Office of Each Province (2003)

From the production growth point of view, however, production of freshwater aquaculture in West Java tends to be stagnant from the year 1999 to 2003 in compare to the other provinces (target areas). Production growth rate in West Java is calculated to be 6% during the period of 1999-2003. Situation in the other provinces (target areas) shows different level of production growth, meaning that production growth in the other provinces is higher than that of West Java Province. It reveals 15% of production growth of West Sumatera, 173% in South Sumatera, 55% in Riau, 54% in Lampung, 33% in Bengkulu, and 39% in Jambi, respectively during the same period.

As can be seen from Table 7-1, decreasing freshwater aquaculture production in West Java (2000-2001), West Sumatera, South Sumatera, Riau, Lampung, Bengkulu, and Jambi during 2002-2003 was affected mainly by fish diseases especially from the type of Koi Herves Virus (KHV) which growing common carps. Meanwhile, the

production increase in each province in the each year is predicted to be related to the changes of fish cultured. Most of fish farmer change from common carp to Tilapia and Patin (*Pangasius* sp). Production of aquaculture by type of technology is presented in Table 7-2.

Table 7-2. Freshwater Aquaculture Production in the Model Extension Areas

Model Extension Area	Stagnant Water Pond (ton)	Paddy Field (ton)	Bamboo Cage (ton)	Floating Net Cage & Open Water (ton)	Running Water Pond (ton)	Total (ton)
Jambi Province						
Regency/municipality						
Batanghari 1999	140		332			472
Batanghari 2003	259		1560			1819
Bungo 1999	108		181			126
Bungo 2003	92	1	14			107
Riau Province						
Regency/municipality						
Kuantan Singingi 1999	182		161			198
Kuantan Singingi 2003	859		116			975
West Sumatera Province						
Regency/municipality						
Sawahlunto-Sijunjung 1999	nad	nad	nad			nad
Sawahlunto-Sijunjung 2003	771	498	490			1759
Bengkulu Province						
Regency/municipality						
North Bengkulu 1999	1171	108				1279
North Bengkulu 2003	1500	45	2			1547

Source : Fisheries Agency Statistical Data (2003), nad: no available data

7.2. Population and Freshwater Aquaculture Household

Fisheries household is an important part of fisheries system, including in this study, freshwater aquaculture system. As mentioned by Charles (2001), the structure of fisheries system comprising natural system, human system and management system. Human system in this case consists of fisheries households, fish traders, fish processors and other stakeholders involving in the system investigated.

Among seven target areas, West Java province is the most populous fisheries household area due to the number of fisheries households of 327,855, the highest

among others. It is followed by West Sumatera with the number of fisheries household of 66,861, Lampung 22,625, and Riau 17,795 (Table 7-3).

Table 7-3. Freshwater Aquaculture Household in the Target Areas

Province	1999	2000	2001	2002	2003
Riau	11,844	11,351	17,943	15,571	17,795
Jambi	12,291	12,850	14,182	14,665	13,766
West Sumatera	46,507	49,145	54,216	52,110	66,861
Bengkulu	2,199	3,337	3,336	755	2,633
Lampung	15,166	14,569	15,835	16,788	22,625
South Sumatera	11,337	13,056	11,020	13,996	nad
West Java	334,405	333,241	302,717	298,437	327,855

Source : Fisheries Agency of Each Province (2003), nad: no available data

Similar with the condition of freshwater aquaculture production, in terms of growth rate, West Java Province, however, has a stagnant trend of the number of freshwater aquaculture household in the period of 1999-2003. In Compare to the other target areas, West Java Province has only 0.5% growth of fisheries households, smaller than West Sumatera (11%), South Sumatera (6%), Riau (13%), Lampung (12%), Bengkulu (5%), and Jambi (3%). The condition of fisheries household in model extension areas can be seen in Table 7-4.

Table 7-4. Freshwater Aquaculture Household in the Model Extension Areas

Model Extension Area	Freshwater Aquaculture Household
Batanghari	2,765
Bungo	601
Kuantan Singingi	1,615
North Bengkulu	2,251
Sawahlunto-Sijunjung	2,250

Source : Fisheries Agency of Each Province (2003)

7.3. Regional Economy and Fisheries Contribution

In this chapter, we describe briefly the condition of regional economy as well as the fisheries contribution to regional economy in both the target and the model extension areas. As previously explained, the target areas in this study refers to provinces where the Project covers, while the model extension areas refers to the district where JICA extension program will be as well as being implemented intensively. In the context of the target areas, there are seven provinces including

Bengkulu, West Sumatera, Riau, Jambi, Lampung, West Java, and West Sumatera. In the context of the model extension areas, it consists of North Bengkulu, Sawahlunto-Sijunjung, Kuantan Singingi, Bungo and Batanghari.

7.3.1. Regional Economy of the Target Areas

General Regional Economy

An important indicator for recognizing economic performance of a region is the regional gross domestic products (GRDP), which is defined as total value added created by all of economic sectors in the area. In terms of its typology, GRDP is divided into two types i.e. GRDP in the (current) actual prices and GRDP in the constant prices. The first type refers to the total value added calculated using current prices, which reflects the capability of region to produce goods and services. Meanwhile, the second type of GRDP refers to total value added calculated using their prices of a base year which in many cases using the year of 1993 as the base year. This type of GRDP shows the real growth both for the economy as a whole and a respective sector periodically.

In the context of target areas, the highest GRDP was obtained in the West Sumatera with Rp. 214,302,246.92 million and then followed by Riau Province with Rp. 67,664,109.70 million and South Sumatera Province with Rp. 49,494,903 million. All of those figures are based on GRDP current price. Table 7-5 presents the value of total GRDP of the seven target areas (provincial-based).

Table 7-5. GRDP of the Seven Regional Areas (million Rupiahs)

No	Districts	GRDP-Market Price*)	GRDP-Constant Price**)
1	Bengkulu	5,915,649.00	1,892,935.00
2	West Sumatera	29,117,557.01	8,503,927.51
3	Riau	67,664,108.70	23,544,879.98
4	Jambi	13,182,276.00	3,636,903.00
5	South Sumatera	49,494,903.00	12,785,793.00
6	Lampung	28,235,382.00	nad
7	West Java	214,302,246.92	60,594,235.36

Note : *) based on the current market prices; **) based on the constant market prices of 1993.
Source : Statistical Office of Each Province (2003), nad: no available data

From Table 7-5 we can say that in terms of the total capability of regional economy to produce goods and services, Bengkulu could be considered as the least developed regions in compared to the other target areas due to its small value of

GRDP. In the other hand, West Java and Riau are relatively wealthier-region among the target areas.

In terms of economic sector, agricultural sector still dominates the economic structure of the target areas. Among seven target areas, four areas comprise that agriculture as the leading sector i.e. Bengkulu, West Sumatera, Jambi, and South Sumatera. In other target areas such as Riau, non-agricultural sector i.e. mining dominates the regional economy. Meanwhile, manufacturing sector is the most dominant sector in West Java. Table 7-6 shows the contribution of economic sectors in the seven target areas of the Project.

Table 7-6. Leading Economic Sectors of Regional Economy in the Target Areas

No	Province	Dominating sector*)	Percentage to total GRDP
1	Bengkulu	Agriculture	40.55
2	West Sumatera	Agriculture	22.87
3	Riau	Mining	16.45
4	Jambi	Agriculture	28.65
5	South Sumatera	Agriculture	24.91
6	Lampung	nad	nad
7	West Java	Manufacturing	29.28

Note : *) based on the current market prices.
Source : Statistical Office of Each Province (2003), nad: no available data

Income per capita which is usually based on the per capita GRDP and per capita regional income is the other important indicator for the description of regional economy. According to the structure of regional income, per capita GRDP refers to the total GRDP per individual population of the region. Meanwhile, per capita regional income refers to the net regional income per individual population of the region. The net regional income is the lag between total GRDP and depreciation of capital goods and net indirect taxes. Table 7-7 shows the per capita GRDP as well as per capita regional income in the seven target areas.

From the Table 7-7, we can reveal that the lowest per capita income is the individual population of Bengkulu (Rp. 3,663,848 per capital/year), followed by the individual population of Jambi (Rp. 5,289,566 per capita/year. In the other hand, individual population of Riau has the highest regional income per capita comparing with other regions. This is interesting due to the fact that in terms of GRDP, West Java has higher value of GRDP than that of Riau. However, in terms of regional

income, as we can see from Table 7-7, West Java has lower GRDP per capita than Riau and even South Sumatera.

Table 7-7. Regional Income Per Capita in the Target Areas

No	Province	Per capita GRDP	Per capita regional income
1	Bengkulu	3,663,848.00	3,408,484.00
2	West Sumatera	6,655,350.33	6,171,621.73
3	Riau	13,236,066.48	12,296,305.76
4	Jambi	5,280,566.00	4,743,132.00
5	South Sumatera	7,697,271.00	6,535,879.00
6	Lampung	nad	nad
7	West Java	5,707,335.21	nad

Note : based on the current market prices.
Source : Statistical Office of Each Province (2003), nad: no available data

Fisheries Contribution

In general, fisheries contribution to regional economy of the target areas is considerably small which ranges from 1.28% to 4.41%. The contribution in Jambi and West Java Province is less than 2% each, and in the other target areas more than 2%. Comparing among target areas, the highest contribution is found in Bengkulu Province, while the smallest is found in West Java. Table 7-8 presents the contribution of fishery sector in the target areas.

Table 7-8. Percentage of Economic Sector to the Economy of Target Areas *)

No	Economic sector	South Sumatera	West Sumatera	Jambi	Riau	Bengkulu	West Java
1	Agriculture	16.92	22.80	30.73	11.49	40.55	15.59
	a. Food crops	4.74	11.90	11.37	-	21.02	11.73
	b. Estate crops	5.90	4.45	13.61	-	10.24	0.74
	c. Livestock	1.48	2.27	2.11	-	2.98	1.69
	d. Forestry	0.00	1.74	2.00	-	1.90	0.15
	e. Fishery	3.05	2.44	1.63	-	4.41	1.28
2	Mining and Quarrying	20.35	3.80	16.28	52.01	3.33	10.35
3	Manufacturing industries	23.26	12.83	15.24	16.45	5.12	37.29
4	Electricity, gas and water supply	0.70	1.88	0.07	0.38	0.62	2.66
5	Construction	5.30	4.42	0.10	2.41	2.60	2.98
6	Trade, restaurants and hotels	20.78	17.81	17.15	7.92	17.90	14.41

Table 7-8. (continued)

No	Economic sector	South Sumatera	West Sumatera	Jambi	Riau	Bengkulu	West Java
7	Transportations and communications	4.43	14.69	7.81	2.81	12.58	4.64
8	Ownership	3.60	4.85	2.44	1.85	4.52	3.30
9	Services	6.39	16.93	10.17	4.68	12.78	8.78
	Total	100	100	100	100	100	100

Note : *) Calculated based on the GRDP of current market prices.
Source : Statistical Office of Each Province (2003)

7.3.2. Regional Economy of the Model Extension Areas

General Regional Economy

As previously mentioned, the model extension areas of the Project consist of five districts i.e. North Bengkulu (Bengkulu Province), Sawahlunto-Sijunjung (West Sumatera Province), Kuantan Singingi (Riau Province), Bungo and Batanghari (Jambi Province).

Total domestic products in the five regional areas range from Rp. 915,075 million to 1,817,553.89 million based on the current prices in 2002, while if it based on the constant prices, the GRDP of the four regional area ranges from Rp. 274,767.75 million to Rp. 588,873.53 million. Table 7-9 presents the GRDP of the five regional areas in million rupiahs.

Table 7-9. GRDP of the Five Regional Areas (million Rupiahs)

No	District	GRDP-Market Price*)	GRDP-Constant Price**)
1	North Bengkulu	915,075.00	310,436.00
2	Sawahlunto-Sijunjung	1,817,553.89	588,873.53
3	Kuantan Singingi	1,202,637.84	335,999.19
4	Bungo	914,916.99	274,767.75
5	Batanghari	971,659.00	275,535.52

Note : *) based on the current market prices; **) based on the constant market prices of 1993.
Source : Statistical Office of Each District (2003)

From Table 7-9 we can reveal that in terms of the total capability of regional economy to produce goods and services, Bungo and North Bengkulu are categorized into the less developed regions in compare to Kuantan Singingi and Sawahlunto-Sijunjung which can be categorized into the relatively developed regions.

Furthermore, it can be revealed that in the five regional areas (North Bengkulu, Sawahlunto-Sijunjung, Kuantan Singingi, Batanghari and Bungo) where the model extension areas are located in, agricultural sector still dominates the economic structure of the region. The range of its percentage to the total value is calculated to be 32.08 – 58.18 percent. The highest contribution of agricultural sector is in the case of Kuantan Singingi District, Riau Province with 58.18%, and the lowest contribution is Sawahlunto-Sijunjung District with 32.08%. Table 7-10 shows the contribution of economic sectors in the five regional areas of aquaculture development projects.

Table7-10. Distribution of Economic Sectors in the Districts where the Model Extension Area Located in

No	Economic sector	Contribution (%) of Economic Sectors in the districts*)				
		North Bengkulu	Sawahlunto-Sijunjung	Kuantan Singingi	Batanghari	Bungo
1	Agriculture	37.67	32.08	58.18	30.82	45.07
2	Mining	10.78	11.85	2.06	11.56	1.54
3	Manufacturing	3.48	5.85	5.55	17.12	5.58
4	Electricity, gas	0.41	1.54	0.35	0.09	0.45
5	Construction	13.09	8.53	6.45	3.27	3.98
6	Trade	7.12	12.24	9.57	21.47	17.34
7	Transportation	8.01	4.08	2.29	2.63	8.16
8	Finance	3.26	17.39	2.95	2.60	4.90
9	Services	16.19	4.12	12.60	10.44	12.97

Note : *) based on the current market prices
Source : Statistical Office of Each District (2003)

Another important indicator of regional economy is per capita income based on the per capita GRDP and per capita regional income. The first indicator refers to the total GRDP per individual population of the region. The second indicator, meanwhile, refers to the net regional income per individual population of the region. The net regional income is the lag between total GRDP and depreciation of capital goods and net indirect taxes. Table 7-11 shows the per capita GRDP as well as per capita regional income for the respective regions.

From the Table 7-11, we can reveal that the lowest per capita income is the individual population of North Bengkulu followed by the individual population of Bungo. In the other hand, individual population of Sawahlunto-Sijunjung has the highest regional income per capita comparing with the other regions.

Table 7-11. GRDP and Regional Income per Capita in the Regional Area (Rp./year)*)

No	District	per capita GRDP	per capita regional income
1	North Bengkulu	2,641,589.00	2,568,951.00
2	Sawahlunto-Sijunjung	5,682,093.23	5,383,800.87
3	Kuantan Singingi	5,324,846.32	4,946,782.23
4	Bungo	4,023,116.29	3,673,065.10
5	Batanghari	4,885,237.00	4,383,521.00

Note : *) based on the current market prices
Source : Statistical Office of Each District (2003)

As previously mentioned above, the most suitable indicator for measuring the regional economic growth is the GRDP which calculated using constant prices. In this context, the highest rate of economic growth is revealed in Batanghari District of Jambi with 5.48% per year followed by Kuantan Singingi (4.44%) and North Bengkulu (4.52%). Detailed economic growth for each regional area is presented in Table 7-12.

Table 7-12. Economic Growth of the Regional Areas

No	District	Economic Growth (% per year)
1	North Bengkulu	4.52
2	Sawahlunto-Sijunjung	4.12
3	Kuantan Singingi	5.43
4	Bungo	4.44
5	Batanghari	5.48

Source : Statistical Office of Each District (2003)

Fisheries Contribution

In general, fisheries contribution to regional economy of the model extension areas ranges from 0.35% to 2.71%. This is related to the total GRDP and as we can see that contribution of this sector to total added value can be considered to be relatively small, especially for the case of District Bungo, Jambi and Kuantan Singingi of Riau with fishery contribution less than 1%. In the other hand, it can be said that fishery contribution in the other districts such as Sawahlunto-Sijunjung of West Sumatera and Batanghari of Jambi is relatively high, more than 1%. Table 7-13 presents the contribution of fishery sector in the four districts cover model extension areas (there is no data available on District of North Bengkulu).

Table 7-13. Fisheries Contribution to Regional Economy in the Districts where the Model Extension Areas Located in

No	District/Regency	% contribution to agricultural sector	% contribution to regional gross domestic products
1	Sawahlunto-Sijunjung	8.42	2.70
2	Batanghari	4.63	1.43
3	Bungo	0.77	0.35
4	Kuantan Singingi	1.21	0.71

Source : Data analysis

In terms of time series condition, fisheries contribution to both agricultural sector and total GRDP is relatively unchanged (stagnant) in terms of current market prices. Table 7-14 presents the time series data of fisheries contribution to agricultural sector in the model extension areas. From this table it can be said that fishery sector seems to be developed using business as usual scenario, meaning that there is not yet development scenario that able to accelerate the gross domestic products from fisheries sector.

Table 7-14. Fisheries Contribution to Agricultural Sector in GRDP 1998-2002*)

District	Year				
	1998	1999	2000	2001	2002
Sawahlunto-Sijunjung	8.56	7.89	7.39	8.03	8.42
Batanghari	nad	nad	4.76	4.71	4.63
Bungo	0.78	0.71	0.69	0.73	0.77
Kuantan Singingi	1.19	1.20	1.17	1.20	nad

Note : n.a = not avaliable; *) based on current market prices, nad: no available data
Source : Data Analysis

Going to each district level, we can reveal that according to economic data, fisheries contribution to total regional economic in the study area is relatively small. For example, it is about 2.70% in 2002 in the case of Sawahlunto-Sijunjung. The total value of fisheries in the same year is recorded to be Rp. 49,137.03 million which is based on the current market price calculation, smallest among the agricultural sectors and even smaller than livestock industry which contributes about Rp. 63,880.17 million or 10.95% of the total agricultural added values. Table 7-15 shows the detailed contribution of fishery activities to the total agricultural income in Sawahlunto-Sijunjung based on current market prices in 2002.

Table 7-15. Fishery Contribution to Total Agricultural Added Value in Sawahlunto-Sijunjung in 2002

No	Economic sector	Contribution based on current prices (Rp. million)	Percentage
1	Food crops and horticulture	121,636.22	20.86
2	Non-food crops	188,128.17	32.26
3	Livestock	63,880.17	10.95
4	Forestry	160,349.58	27.50
5	Fishery	49,137.03	8.43
Total Agriculture		583,131.17	

Note : *) number in the brackets refers to contribution of respective sectors to total GRDP (%)

Similar condition was obtained in the other districts, where fisheries activity is considerably the smallest contributor for agricultural sector. Table 7-16, Table 17, and Table 7-18 show the value of fisheries and its percentage to agricultural sector for Batanghari, Bungo and Kuantan Singingi respectively.

Table 7-16. Fisheries Values and its Percentage in the GRDP of Batanghari, Jambi*)

Economic sector	Year				
	1993	2000	2001	2002	%**)
Food crops and horticulture	15,202.56	61,163.96	68,176.50	73,828.16	24.66
Non food crops	18,310.49	105,248.97	117,042.23	127,196.44	42.48
Livestock	7,851.11	25,085.52	28,727.79	30,734.82	10.26
Forestry	9,876.65	38,652.81	48,879.99	53,800.98	17.97
Fisheries	2,618.42	11,502.78	13,012.74	13,876.50	4.63
Total Agricultural	53,859.24	241,654.04	275,839.25	299,436.90	

Note : *) based on current market prices in million IDR (Indonesian Rupiahs); **) in 2002

Table 7-17. Fisheries Values and its Percentage in the GRDP of Bungo, Jambi*)

Economic sector	Year				%**)
	1999	2000	2001	2002	
Food crops and horticulture	42,361.75	41,645.84	41,166.91	42,263.47	37.20
Non food crops	27,122.68	33,541.80	35,349.70	37,725.42	33.20
Livestock	13,254.07	13,824.04	14,242.71	14,563.39	12.82
Forestry	16,798.00	17,278.00	18,048.91	18,429.56	16.22
Fisheries	580.96	599.50	618.13	637.22	0.56
Total Agricultural	100,118.22	106,889.23	109,426.36	113,619.06	

Note : *) based on current market prices in million IDR (Indonesian Rupiahs); **) in 2002

Table 7-18. Fisheries Values and its Percentage in the GRDP of Kuantan Singingi, Riau*)

Economic sector	Year			%**)
	1999	2000	2001	
Food crops and horticulture	141,053.71	166,785.07	194,187.44	29.83
Non food crops	218,419.63	270,714.55	323,828.57	49.74
Livestock	24,188.72	27,434.82	32,719.60	5.03
Forestry	61,913.05	74,953.92	92,434.07	14.20
Fisheries	5,421.74	6,407.95	7,859.18	1.21
Total Agricultural	450,996.85	546,296.31	651,028.86	

Note : *) based on current market prices in million IDR (Indonesian Rupiahs); **) in 2002

7.4. Characteristics of Freshwater Aquaculture Target Species and The Distribution by Region

The fishes cultured by the farmers in 7-target area were identified to be more than 12 species. During the year of 2003, the highest production in the target areas is common carp, except in Riau and Jambi, those are, respectively, Pangasius catfish and Nile tilapia. Production of common carp in Bengkulu, West Sumatera, South Sumatera, Lampung and West Java, respectively, is 68,3%, 48,6%, 34,5%, 37,5% and 22,4% of the total production of fish in each province.

In 5 provinces, the second position of the fish production level following common carp, is Nile tilapia. Production of Nile tilapia in Bengkulu, West Sumatera, South Sumatera, Lampung and West Java, respectively, are 20,6%, 19,2%, 29,8%, 20,6% and 17,6% of the total production of fish in the each province.

The third position of fish production level in Jambi, Riau and Bengkulu is tilapia, in West Sumatera and West Java is Nilem carp, while in South Sumatera and Lampung is walking catfish. Production of fishes cultured in 7 target areas by species is shown in Table 7-19.

Table 7-19. Production of the Fishes Cultured in 7 Target Areas by Species

Riau	Jambi	Bengkulu	West Sumatera	South Sumatera	Lampung	West Java
Pangasius catfish (7,546)	Nile tilapia (2,146)	Common carp (4,173)	Common carp (21,134)	Common carp (9,256)	Common carp (4,758)	Common carp (102,098)
Common carp (4,337)	Common carp (619)	Nile tilapia (1,378)	Nile tilapia (6,476)	Nile tilapia (7,035)	Nile tilapia (2,765)	Nile tilapia (13,786)
Nile tilapia (3,819)	Mozambique tilapia (105)	Mozambique tilapia (215)	Nilem carp (1,725)	Walking catfish (1,269)	Walking catfish (2,204)	Nilem carp (10,965)

Table 7-19. (continued)

Riau	Jambi	Bengkulu	West Sumatera	South Sumatera	Lampung	West Java
Walking catfish (1,169)	Giant gouramy (71)	Java barb (120)	Giant gouramy (1,518)	Giant gouramy (1,254)	Pangasius Catfish (1,233)	Walking catfish (7,879)
Sleeper gobies (365)	Walking catfish (48)	Snake skin gouramy (28)	Mozambique tilapia (787)	Mozambique tilapia (587)	Mozambique tilapia (490)	Pangasius catfish (7,876)
Giant gouramy (341)	Snake skin gouramy (30)	Catfish (14)	Java barb (770)	Kissing gouramy (106)	Java barb (363)	Java barb (4,857)
Snake head (200)	Kissing Gouramy (25)	Nilem carp (8)	Walking catfish (646)	Java barb (94)	Giant gouramy (326)	Mozambique tilapia (4,212)
Kissing gouramy (2)	Java barb (21)	Giant gouramy (3)	Snake skin gouramy (123)	Snake skin gouramy (41)	Kissing Gouramy (221)	Kissing Gouramy (2,414)
Java barb (0)	Nilem carp (2)	Kissing gouramy (0)	Kissing gouramy (0)	Nilem carp (0)	Nilem carp (57)	Giant gouramy (2,187)
Mozambique tilapia (0)	Catfish (0)	Catfish (0)	Pangasius catfish (0)	Pangasius catfish (0)	Snake skin gouramy (3)	Snake skin gouramy (1,733)
Nilem carp (0)	Snake head (0)	Snake head (0)	Snake head (0)	Snake head (0)	Snake head (0)	Snake head (0)
Snake skin gouramy (0)	Sleeper gobies (0)	Sleeper gobies (0)	Sleeper gobies (0)	Sleeper gobies (0)	Sleeper gobies (0)	Sleeper gobies (0)
Others (1,987)	Others (2,794)	Others (36)	Others (1,656)	Others (6,270)	Others (124)	Others (4,747)
Total (19,766)	Total (5,861)	Total (5,975)	Total (34,835)	Total (25,912)	Total (12,544)	Total (162,754)

Source : Ministry of Marine Affairs and Fisheries (2004)

Common carp can digest carbohydrate better, while Nile tilapia can utilize detritus and phytoplankton as its diet. In pond and rice field, the farmers culture those fishes with various type of feed; natural food, rice bran-added feed cereal-added feed, complete feed. Traditional fish farmers have a long time experience to culture common carp and Nile Tilapia in pond. Although in present time other types of fish culture, such as floating net cage or cage are developed, production of those fish in pond in the target areas still is higher than the other type of culture, except in west Java, in which production of common carp cultured in floating net cage is higher than that of in pond.

Gurame (Giant gouramy) is herbivorous. Fish farmer cultures this fish relying on natural feed, crop leaves and complete feed. In consequence, this fish is mostly

cultured in pond or in paddy field in all targets area, especially in West Java, South Sumatera and West Sumatera.

Tawes (Java barb) and nilem (Nilem carp) are also herbivorous. Although culturing those fishes can be intensified by application high stocking density of fish and artificial feed, most of fish farmers prefer to culture the fishes relying on natural feed and crop leaves, because the price of those fish is lower than that of common carp. So farmer cultures those fishes also in pond or in paddy field. This culture method spreads widely in West Java, South Sumatera and West Sumatera.

Catfish is carnivorous. Early culture stage of the fish needs natural feed. Feed changes to artificial-complete feed after growing. In consequence this fish is generally grown in water pond or in paddy field, even some farmers in South Sumatera also culture it in cage pond and paddy field. Productions by species of cultured fishes are shown in Table 7-20 and Table 7-21.

Table 7-20. Pond Culture Production in the Target Areas by Species of Fish (In Tons)

Species	Riau	Jambi	Bengkulu	West Sumatera	South Sumatera	Lampung	West Java
Common carp	2,852	427	2,543	9,808	5,648	4,136	16,965
Nile tilapia	3,209	1,020	768	3,881	4,884	2,296	13,339
Nilem carp	0	2	8	1,644	0	57	10,446
Walking catfish	1,169	48	14	646	769	2,167	7,876
Pangasius catfish	7,546	0	0	0	0	1,216	7,876
Java barb	0	18	120	280	58	299	4,406
Mozambique tilapia	0	105	215	762	487	436	4,071
Kissing gouramy	2	25	0	0	106	213	2,411
Giant gouramy	341	56	3	1,496	1,254	319	2,171
Snake skin gouramy	0	30	28	123	41	0	1,719
Others	1,854	960	24	1,538	3,145	0	4,418
Total	16,973	2,691	3,723	20,178	16,392	11,139	75,698

Source : Ministry of Marine Affairs and Fisheries(2004)

Table 7-21. Paddy field culture production in the target areas by species of fish (In Tons)

Species	Riau	Jambi	Bengkulu	West Sumatera	South Sumatera	Lampung	West Java
Common carp	7	10	1,266	1,426	2,514	469	41,969
Nile tilapia	2	16	533	1,457	1,305	225	445
Java barb	0		0	487	36	62	448
Mozambique tilapia	0	0	0	23	100	51	138

Table 7-21. (continued)

Species	Riau	Jambi	Bengkulu	West Sumatera	South Sumatera	Lampung	West Java
Walking catfish	0	0	0	0	0	37	0
Pangasius catfish	0	0	0	0	0	17	0
Kissing gouramy	0	0	0	0	0	8	0
Giant gouramy	0		0	22	0	7	16
Nilem carp	0	0	0	78	0	0	511
Snake head	0	0	0	0	0	0	0
S. Gobies	0	0	0	0	0	0	0
Snake skin gouramy	0	0	0	0	0	0	14
Others		0	12	118	41	0	329
Total	9	26	1,811	3,611	3,996	876	43,870

Source : Ministry of Marine Affairs and Fisheries (2004)

Culturing fish in running water pond, bamboo cage or floating net cage needs relatively high capital to construct the facility, whereas the life span of the facility is limited. To compensate the investment, the production system must be intensified to achieve high profit. In this system the fish is cultured in high density and fed on artificial-complete feed. Only 2 species are cultured in floating net cage and wooden cage, namely common carp and Nile tilapia as shown in Table 7-22. and 7-23.

Table 7-22. Floating Net Cage Culture Production in the target Areas by Species of Fish (In Tons)

Species	Riau	Jambi	Bengkulu	West Sumatera	South Sumatera	Lampung	West Java
Common carp	0	46	0	4,374	131	131	42,814
Nile tilapia	0	236	0	0	233	233	0
Total	0	282	0	4,374	364	364	42,814

Source : Ministry of Marine Affairs and Fisheries (2004)

Table 7-23. Cage Culture Production in the Target Areas by Species of Fish (In Tons)

Species	Riau	Jambi	Bengkulu	West Sumatera	South Sumatera	Lampung	West Java
Common carp	1,478	136	364	5,526	963	22	350
Nile tilapia	608	874	77	1,138	613	11	2
Java barb	0	3	0	3	0	2	3
Nilem carp	0	0	0	3	0	0	8
Mozambique tilapia	0	0	0	2	0	3	3
Snake skin gouramy	0	0	0	0	0	3	0
Kissing gouramy	0	0	0	0	0	0	3

Table 7-23. (continued)

Species	Riau	Jambi	Bengkulu	West Sumatera	South Sumatera	Lampung	West Java
Walking catfish	0	0	0	0	500	0	3
Snake head	200	0	0	0	0	0	0
Sleeper gobies	365	0	0	0	0	0	0
Others	133	1,834	0	0	3,084	124	0
Total	2,784	2,862	441	6,672	5,160	165	372

Source : Ministry of Marine Affairs and Fisheries (2004)

During year 2001-2003, average growth of fish production varies among fish species and location. Production of common carp, Nile tilapia, and walking catfish has been increasing in the all target areas. Highest growth rate of common carp took place in Riau (350.75%), while that of Nile tilapia, and walking catfish, occurred in South Sumatera (respectively 752.52% and 58.55%). The other fishes that have high economic value and show good future perspective are Giant Gouramy in West Sumatera and Pangasius catfish in West Java. Production of gouramy and Pangasius catfish in the target areas has been increasing up to 233.57% and 702% respectively. On the contrary, production of Mozambique tilapia has been decreasing in the all target areas. This fish is substituted by Nile tilapia, which shows better performance, such as faster growth and bigger size. Fish culture production in the 7 target areas by species 2001-2003 is shown in Table 7-24.

Table 7-24. Fish Culture Production in 7 Target Areas by Species 2001-2003 (In Tons)

Species	Year	Province						
		Riau	Jambi	Bengkulu	West Sumatera	South Sumatera	Lampung	West Java
Common carp	2001	554	451	3,248	14,696	7,458	2,217	109,931
	2002	4,455	1,732	2,297	17,602	8,692	4,433	98,536
	2003	4,337	619	4,173	21,134	9,256	4,758	102,098
Average growth (%)		350.75	109.89	26.20	19.92	11.52	53.64	19.32
Java barb	2001	9	13	68	690	250	1124	8,805
	2002	0	16	19	545	130	521	5,270
	2003	0	21	120	770	94	363	4,857
Average growth (%)		-	27.16	229.76	10.13	-37.85	-41.99	-16.07
Mozambique tilapia	2001	855	155	667	1,111	1,269	871	6,653
	2002	870	89	28	1,012	1,683	608	5,957
	2003	0	105	215	787	587	490	4,212
Average growth (%)		-49.12	-12.30	286.03	-15.57	-16.25	-24.80	-26.28

Table 7-24. (continued)

Species	Year	Province						
		Riau	Jambi	Bengkulu	West Sumatera	South Sumatera	Lampung	West Java
Nilem carp	2001	21	1	3	594	15	127	13,561
	2002	17	2	2	698	0	0	12,790
	2003	0	2	8	1,725	0	57	10,965
Average growth (%)		-59.52	50.00	133.33	82.32	-	-	75.22
Nile tilapia	2001	2,380	1,013	108	3,332	163	538	24,481
	2002	2,874	1,234	645	3,841	504	1,716	23,045
	2003	3,819	2,146	1,378	6,476	7,035	2,765	13,786
Average growth (%)		26.82	47.86	305.43	41.94	752.52	140.04	112.60
Giant gouramy	2001	2,084	46	46	1,182	58	137	4,246
	2002	571	47	20	1,726	223	233	3,088
	2003	341	71	3	1,518	1,254	326	2,187
Average growth (%)		-56.44	26.62	-70.76	17.01	373.41	54.99	47.81
Snake skin gouramy	2001	9	56	95	50	14	0	1,940
	2002	0	31	9	314	63	0	1,912
	2003	0	30	28	123	41	3	1,733
Average growth (%)		-	-23.93	60.29	233.59	157.54	-	46.64
Kissing gouramy	2001	7	24	9	0	1	256	3,862
	2002	2	21	1	0	51	203	3,076
	2003	2	25	0	0	106	221	2,414
Average growth (%)		-35.71	3.27	-94.44	-	2553.92	-5.92	12.05
Walking catfish	2001	6,369	44	21	313	505	974	6,415
	2002	555	41	6	364	815	1,716	4,842
	2003	1,169	48	14	646	1,269	2,204	7,879
Average growth (%)		9.67	5.13	30.95	46.88	58.55	52.31	51.24
Pangasius Catfish	2001	0	0	0	0	39	0	6,246
	2002	7,498	0	0	0	0	536	6,941
	2003	7,546	0	0	0	0	1,233	7,876
Average growth (%)		32.88	-	-	-	-	32.88	702.20
Snake head	2001	0	0	0	0	0	0	0
	2002	584	0	0	0	0	0	0
	2003	200	0	0	0	0	0	0
Average growth (%)		-32.88	-	-	-	-	-	-
Sleeper gobies	2001	0	0	0	0	0	0	0
	2002	243	0	0	0	0	0	0
	2003	365	0	0	0	0	0	0
Average growth (%)		25.10	-	-	-	-	-	-
Others	2001	835	1,029	309	426	8,255	874	5,597
	2002	211	1,543	6	1,815	7,256	58	15,074
	2003	1,987	2,794	36	1,656	6,270	124	4,747
Total		50,769	13,449	13,582	85,145.6	63,356	29,686	154,878

Source : Ministry of Marine Affairs and Fisheries (2004).

7.5. Situation of Freshwater Aquaculture in the Each Model Extension Area

In this sub-chapter, the condition of the level or attitude of farmers in model extension areas are described in relation with aquaculture technology skill and socio-economic condition, based on survey data. The data are collected from the farmers using prepared questionnaires like attached in Annex 16. From that questionnaire answered, the data is tabulated and computed to expression the score of aquaculture technology and socio-economic rating.

The result of each farmer condition both of aquaculture technology and socio-economic condition in each district of model extension areas are shown in kite diagram like attached in Annex 1 – 10.

Besides those topics, this sub-chapter describe too the general condition of each location and general information of fish farmers for each model extension areas. The general conditions of location are obtained from secondary data, and for the general condition of fish farmers are obtained for the primary data. The general condition of locations explain the geographic position of location, latitudes and altitudes, population and climatic condition. In general fish farmer's condition the number of fish farmer respondent, the occupation, educational background, aquaculture skill background, and kind of cultured species are described. In the map location of each district in model extension areas, we plot each fish farmer respondent (number inside circles) same as the code number in list of the farmers.

The rating both of general aquaculture technology and socio-economic conditions are described in graphic and tabulation mode. There are eight categories of aquaculture technology rating, namely 1) broodstock management, 2) feeding management, 3) Fish Nutrition, 4) Fish diseases, 5) Water management, 6) General culture control, 7) Seed production, and 8) Whole production management. In socio-economic rating, there are nine categories i.e. 1) Income, 2) Income from fish culture, 3) Fish production, 4) Saving/debt, 5) Working hours, 6) Equipment, 7) Real estate, 8) Health care, and 9) Family education.

Those informations for each model extension area are described in detail below.

7.5.1. Bungo District, Jambi Province

7.5.1.1. General Condition of Location

Bungo District located in southern part of Jambi City, the capital city of Jambi Province. The distance from Jambi to Bungo is 250 km, its takes approximately 5 hours by car. The Western trans-Sumatera Road, a main road that connecting Southern and Northern part of Sumatera island. passes through the area of Bungo district. Muaro Bungo is the capital city of Bungo District and the district consists of 6 sub districts. The location of Bungo as a transit area for surrounded cities makes this area possibly develop rapidly during next five years. Based on the 2002 statistical data, population of Bungo was 230,323 persons consist of 116,108 males and 114,215 females.

Geographically Bungo District lies between 1° 08' to 1° 55' South Latitude and between 101° 27' to 102° 30' East Longitude, with its covered area of 4,659 km2 and altitude of 9-57 m above sea level. The climate in this area is tropical wet with average air temperature is 28 °C and average rainfall is 213.67 mm/month. There is four big rivers vary from 14.5 to 64.0 km in length.

7.5.1.2. General Information of Fish Farmer

The model extension area in Bungo covers 9 villages in 4 sub districts (Kecamatan), i.e. Tanah Sepenggal, Tanah Tumbuh, Muaro Bungo and Rantau Pandan. There is 31 respondents have been interviewed in Bungo, consist of farmers as seed producer (hatchery) and grower. Of the 31 respondents, 14 respondents (45%) doing aquaculture as their main occupation, while the rest doing aquaculture as their secondary (23%) or tertiary one (32%).

Educational background of the respondents in this area varies from the elementary school to university graduates. Composition of the respondent's educational background is 65% elementary school, 29% junior high school, 16% senior high school, 10% university graduates and 10% other informal education including religious education graduates. In term of skills in aquaculture background, most respondents learned the aquaculture technique from other farmers (39%),self-learning(32%), learned from their parents (16%) and learned from the extension officer (13%). The names, specialty and address of the each respondent are listed in Table 7-25., while each position of the respondents on the map is depicted in Figure 7-1.

Table 7-25. List of the Fish Farmer Respondents in the Model Extension Area in Bungo

No	Code	Name	Specialty of farmer	Address	
				Name of village	Name of sub-district
1	KBG01	Roji	G:GIFTnile	Ps. Rantau Embacang	Tanah Sepenggal
2	KBG02	Sainusi	G:GIFTnile	Ps. Rantau Embacang	Tanah Sepenggal
3	KBG03	Zulkifli	H/N:C.carp. G: GIFT nile	Ps. Rantau Embacang	Tanah Sepenggal
4	KBG04	Muhammad Y.	G:GIFTnile	Ps. Rantau Embacang	Tanah Sepenggal
5	KBG05	Syaiful Anas	H/G:C.carp	Ps. Rantau Embacang	Tanah Sepenggal
6	KBG06	Dalim	G:GIFTnile	Ps. Rantau Embacang	Tanah Sepenggal
7	KBG07	Abdullah	G:C.carp	Lubuk Landai	Tanah Sepenggal
8	KBG08	Yusuf umar	G:GIFTnile	Lubuk Landai	Tanah Sepenggal
9	KBG09	M. Zen Abas	G:GIFTnile	Lubuk Landai	Tanah Sepenggal
10	KBG10	Hasan Hajid	G:GIFTnile, Colosoma, C.carp and tawes	Tanah Periuk	Tanah Sepenggal
11	KBG11	Yahya Yunus	G:GIFTnile, gouramy	Tanah Periuk	Tanah Sepenggal
12	KBG12	Hasan Idris	H:nile, Colosoma, patin, C.carp, gouramy	Tanah Periuk	Tanah Sepenggal
13	KBG13	Muhammad N.	G:GIFTnile, Colosoma, C.carp, gouramy	Tanah Periuk	Tanah Sepenggal
14	KBG14	Abas	G:GIFTnile, Colosoma	Tanah Periuk	Tanah Sepenggal
15	KBG15	Aksori	H:nile	Embacang Gedang	Tanah Sepenggal
16	KBG16	Endang	H:C.carp	Embacang Gedang	Tanah Sepenggal
17	KBG17	M. Jaiz	H:nile, C.carp. N: com. carp, nile, catfish	Embacang Gedang	Tanah Sepenggal
18	KBG18	Abasri	G:GIFT nile, C.carp	Embacang Gedang	Tanah Sepenggal
19	KBG19	Idham Khalid	G:GIFT nile, C.carp	Tanah Bekali	Tanah Sepenggal
20	KBG20	Muhammad AK	G:GIFT nile	Tanah Bekali	Tanah Sepenggal
21	KBG21	Herniwati	H:nile, C.carp, goldfish. G:patin, Colosoma	Rantau Pandan	Rantau Pandan
22	KBG22	Supriyanto	H: nile	Sungai Binjai	Muaro Bungo
23	KBG23	Darussalam	H/N: com. carp	Tebing Tinggi Uleh	Tanah Tumbuh
24	KBG24	Abdul Ghani	H/N: nile	Bukit Kemang	Tanah Tumbuh
25	KBG25	Ihsan	G:C.carp, Colosoma	Tanah Periuk	Tanah Sepenggal
26	KBG26	A. Majid	G:GIFT nile, Colosoma	Tanah Periuk	Tanah Sepenggal
27	KBG27	Maimunah	G:C.carp	Tebing Tinggi Uleh	Tanah Tumbuh
28	KBG28	M. Rasyit	G:GIFT nile, C.carp	Embacang Gedang	Tanah Sepenggal
29	KBG29	Lasmana	H:nile	Embacang Gedang	Tanah Sepenggal
30	KBG30	Aknal	H/G:GIFT nile	Embacang Gedang	Tanah Sepenggal
31	KBG31	Satum	H:nile	Embacang Gedang	Tanah Sepenggal

Note : G: Grower, N: Nursery, H: Hatchery
Source : Field Survey September-October 2004

As presented in Table 7-25, most of fish farmers are growers and handling Nile tilapia as cultured species. The secondary cultured species that often handled by fish farmers in this area is common carp, while the other species such as Colosoma (Bawal), giant gouramy, catfish and patin (pangasius catfish) are relatively rare to be handled by the farmers.

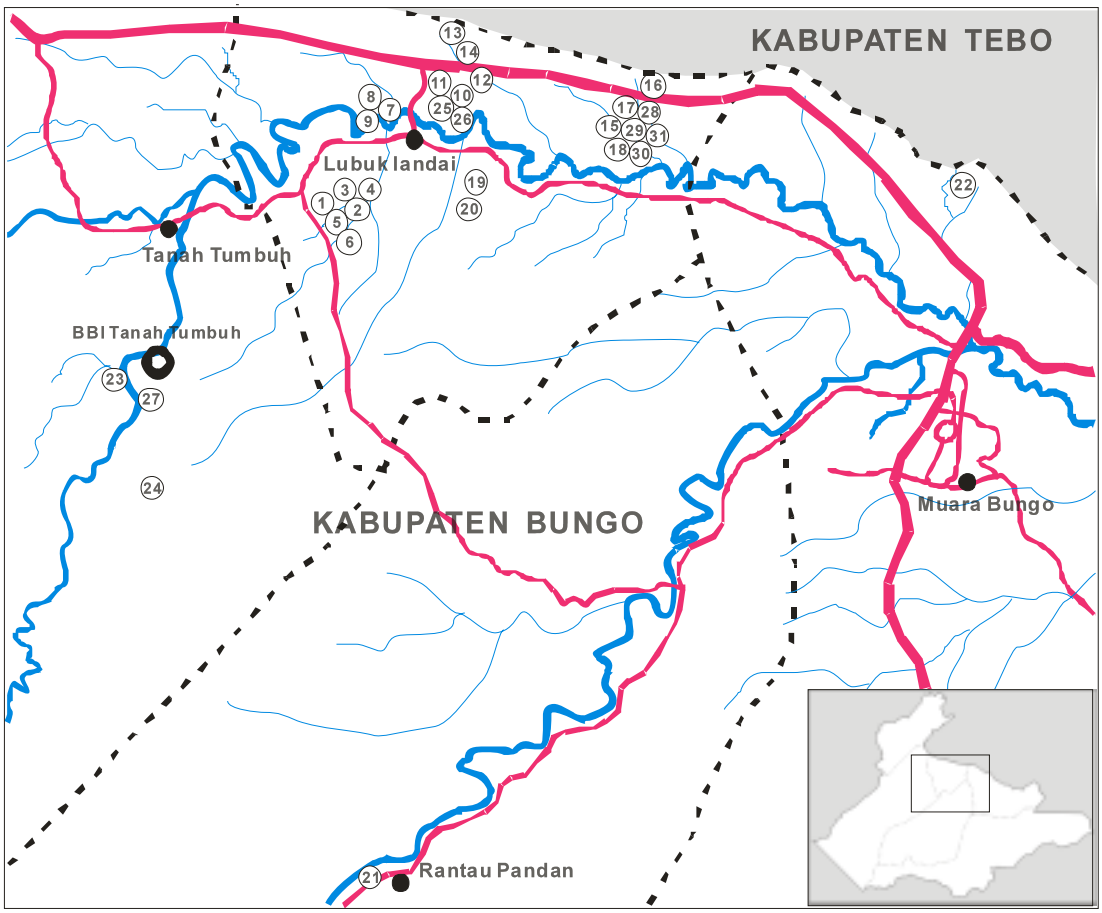


Figure 7-1. Location map of Fish Farmers Surveyed in Bungo District. Jambi Province

7.5.1.3. Aquaculture Technology

Freshwater Aquaculture in Bungo District is mainly classified into two types, namely stagnant water ponds and karamba. Farmers can be classified into three main types in terms of aquaculture production type : seed producers, nursery, and grow-out.

Seed production

Breeding of fish is conducted in ponds, the size of pond used in seed production between 1,420 – 7,000 m^2. Breeding Nile tilapia doesn't need special pond. All activities starting from spawning up to rearing the larvae are carried out in one type pond with the size more than 100 m^2.

According to the survey, water is filled in ponds and drained from ponds without using pumps. The ponds located in sloping area drains completely by gravitation power, even if the pond depth is shallower than 1 m.

Porosity of the earth pond is not porous. Source of water is irrigation channel, swamp, and reservoir; the water flow rate is enough to fulfill of the pond.

Size of female broodstock used is 0.3 – 0.5 kg/fish (Nile tilapia) and 1.5 – 3.0 kg/fish (common carp). The size of spawning pond is 300 – 1,420 m² (Nile tilapia) and 500 – 10,000 m^2 (common carp). In this pond, hatched larvae are reared for 3 - 5 days, then the larvae are harvested and moved to nursery pond.

Some farmer fertilized and/or manured the nursery pond before larvae stocked to stimulate growth of fingerlings. The manure used is cow dung, while inorganic fertilizer used is urea and TSP.

After pond is inundated with water during 3-10 days 3-7 days-old larvae are stocked. During fish rearing, some farmer spread rice bran over the pond to maintain natural food in abundance

A period of rearing fish is 30 - 90 days per cycle of the nursing. The number of fish harvested is 2,000 – 20,000 fish larvae per cycle.

Nursery

Total pond area in stagnant ponds farmer uses is between 48 – 2 000 m^2. Water is filled in ponds and drained from the ponds without using pump. The ponds located in sloping area drains completely by gravitation power, even if the pond depth is shallower than 1 m. Porosity of earth ponds is not porous. Source of water is irrigation channel. Water flow rate is enough to fulfill need of the pond, though some farmers feel lacking of water in dry season. In point of view water quality, the water is fertile.

Production cycle per year is 3 - 5 times, pond area used in each cycle of the production 438 – 1,844 m^2. The production per year is 2,400 – 12,500 fishes.

Grow-out

Total pond area in stagnant ponds farmer uses between 48 - 2000 m^2. Water is filled in ponds and drained from the ponds without using pump. The ponds located in sloping area drains completely by gravitation power, even if the pond depth is shallower than 1 m. Porosity of earth ponds is not porous. Source of water is irrigation channel. Water flow rate is enough to fulfill need of the pond, though

some farmers feel lacking of water in dry season. In point of view water quality, the water is fertile.

Production cycle per year is 2 – 12 times, pond area used in each cycle of the production 438 – 1,844 m^2. The production per cycle is 70 – 200 kg in average.

7.5.1.4. Rating of Aquaculture Technology

Broodstock Management and Seed Production Categories

There are 10 farmers of the 31 respondents has been engaging activity as fish seed producers. We analyzed broodstock management of the nine farmers and seed production of the 10 farmers by rating, respectively

In broodstock management category, there are 5 farmers with 20% of achievement level, a farmer with 40%, and 3 farmers with 80%. There is no fish farmer with 100% of the achievement. In seed production category, there is a farmer with 40% of achievement level, and a farmer with 60%, 5 farmers with 80%, and 3 farmers with 100% of the achievement. Table 7-26 shows the Rating Achievement of Broodstock Management and Seed Production from the Farmers Respondents in Bungo District.

Table 7-26. Rating on Achievement of Broodstock Management and Seed Production of the Farmers Respondent answered in Bungo District

	Rating Achievement					
	20%	40%	60%	80%	100%	Total Answered
Broodstock Management Category						
Persons	5	1	0	3	0	9
Percentage	55.5	11.2	0	33.3	0	
Seed Production Category						
Persons	0	1	1	5	3	10
Percentage	0	10,0	10.0	50.0	30.0	

Source: Field Survey September-October 2004

Feeding Management and Fish Nutrition Categories

There are 24 farmer respondents has answered the question about feeding management category, and as for the question about fish nutrition category, there are 17 farmers. From those respondent answered, we analyzed to know the achievement of farmers rating for each category.

The result shows that most of fish farmer respondents in District of Bungo reached to 40% of achievement level on feeding management category (It means fish

farmers can calculate feeding rate according to stocking quantity of cultured fish, and fish farmers understand daily feeding rate correctly to practice appropriate feeding quantity everyday); and most of farmers reached to 40% of achievement level on fish nutrition category (It means fish farmers have a way to keep standard quality of feed without feed storage). The rating achievement of feeding management and fish nutrition category of the farmer respondents in Bungo shown at Table 7-27.

Table 7-27. Rating Achievement of Feeding Management and Fish Nutrition Categories of the Farmer Respondents answered in Bungo District

	Rating Achievement					
	20%	40%	60%	80%	100%	Total Answered
Feeding Management Category						
Persons	6	12	0	2	4	24
Percentage	25.0	50.0	0	8.4	16.6	
Fish Nutrition Category						
Persons	1	10	5	0	1	17
Percentage	5.9	58.8	29.4	0	5.9	

Source: Field Survey September-October 2004

Fish Disease and Water Management Categories

Rating achievement on fish disease category is to know the degree (in%) of the fish farmers knowledge and skill to prevent fish disease. The same on water management category is to know what water quality factors (such as DO, pH, water temperature etc.) fish farmers understand about and how they can practice water monitoring with paying attention to fish culture circumstance.

As a result, of the 12 fish farmer respondents answered on disease category, that most of fish farmers in District of Bungo are at position of 60% achievement level.It means the fish farmers can identify some kinds of fish diseases, and take necessary measures to prevent fish diseases, such as bacteria, fungi and parasites.

The farmer respondents answered on water management category are 29 farmers. Most of the fish farmers are at position of 20% of the achievement level. It means most of the farmers have understood the basic water quality factors. The rating

achievement of fish disease and water management categories of the farmer respondents answered in Bungo shown at Table 7-28.

Table 7-28. Rating Achievement of Fish Disease and Water Management Categories of the Farmer Respondents answered in Bungo District

	Rating Achievement					
	20%	40%	60%	80%	100%	Total Answered
Fish Disease Category						
Persons	1	1	6	2	2	12
Percentage	8,3	8,3	50,0	16,7	16,7	
Water Management Category						
Persons	20	9	0	0	0	29
Percentage	69,0	31,0	0	0	0	

Source: Field Survey September-October 2004

General Culture Control and Total Fish Culture Management Categories

Rating achievement level on general culture control is to know if fish farmers can maintain their facilities properly according to the environmental condition, and attain sustainable and efficient fish culture production. In total fish culture management, final achievement level is the farmer can keep record of fish culture activities and calculate production cost; and fish farmer can make their fish culture production plan considering harvest time, and can practice fish production as planned.

The survey result shows most of fish farmers of the 14 fish farmers answered the questionnaire are at position of 80% of the achievement level on general culture control (it means most of fish farmers can understand kinds and characteristics of their facilities suitable for surrounding environments and fish species. and build their facilities by correct designs for fish culture. As for total fish culture management, the number of fish farmers in this district with 20% achievement level and with 100% level is same in number. 20% achievement level means fish farmer in this district have known rough figures of management condition, such as production harvest; however, they don't know their accurate profit from fish culture because they don't practice exact planned production. Hundred percent achievement level means farmers can make a plan for purchasing fish seeds and preparing feed taking their harvest time into account, and can practice fish production as planned.

The rating achievement of general culture and management category of the farmer respondents in Bungo is shown in Table 7-29.

Table 7-29. Rating Achievement of General Culture Control and Total Fish Culture Management Categories of the Farmer Respondents answered in Bungo District

	Rating Achievement					
	20%	40%	60%	80%	100%	Total Answered
General Culture Control Category						
Persons	4	1	0	9	0	14
Percentage	28.6	7.14	0	64,0	0	
Total Fish Culture Management Category						
Persons	7	0	0	2	7	16
Percentage	43.7	0	0	13.6	43.7	

Source : Field Survey September-October 2004

Total rating of aquaculture technique assessment is presented in Figure 7-2 below.

7.5.1.5. Socio-Economic Assessment

Main Job and Gross Income

According to the results of the field survey, it is revealed that aquaculture activities are the main job of the population. From the data we can see that the percentage of fish farmers whose main job is fisheries is 14 persons (45%) in Bungo District. Furthermore there are 7 persons or 23% of the total sample population whose main job is rubber farmers, 5 persons (16%) as other agriculture farmers, 2 persons (6%) traders, 2 persons (6%) government employee and 1 person (3%) other job, respectively. Detailed composition of the sample population according to their main job is presented in Table 7-30.

In terms of their gross income, most of the respondents have income range of Rp. 500,000-Rp. 1,000,000 per month. This is revealed from the results of baseline survey that 13 persons of the total 26 respondents (50%) have the same range when they asked about their gross income per month. However, it has been also found that more than 40% of the total sample population reveals that their gross income is less than Rp. 500,000 per month. Only 2 persons (8%) of the total sample population, who have gross income in the range of Rp. 1,000,000 – Rp. 5,000,000 per month. Detailed number of fish farmers according to their gross income per month can be seen in Table 7-31 below.

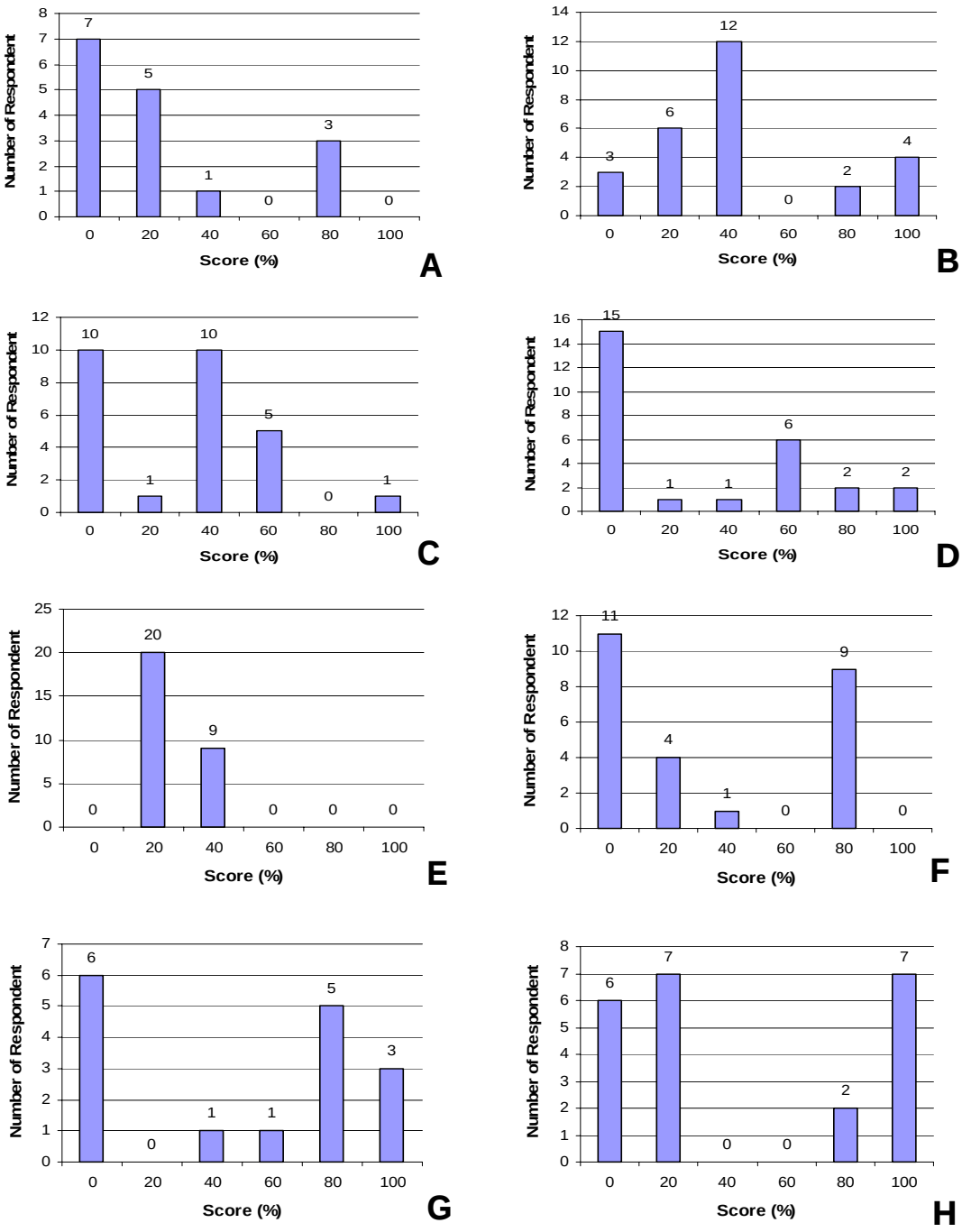


Figure 7-2. Aquaculture Technology Rating of Respondents in Bungo District

Note:
A. Brood stock management
B. Feeding management
C. Fish nutrition
D. Fish diseases
E. Water management
F. General culture control
G. Seed production
H. Total fish culture management

Table 7-30. Main, 2nd, and 3rd Job of the respondents in the Bungo Model Extension Area (person)

	Type of Job						
	Fish Farm	Rubber Farm	Agriculture	Trader	Govern. Employee	Others	Total Answered
Main Job	14 (45)	7 (23)	5 (16)	2 (6)	2 (6)	1 (3)	31
2nd Job	7 (23)	7 (23)	4 (13)	3 (10)	0	10 (32)	31
3rd Job	10 (32)	0	4 (13)	1 (3)	0	16 (52)	31

Source : Field Survey September-October 2004
Note : Number in the bracket refers to the percentage (%).

Table 7-31. Number of Surveyed Fish Farmers According to Gross Income in the Bungo Model Extension Areas

	Gross Income per Month				
	< 500,000	500,000-1,000,000	1,000,000-5,000,000	> 5,000,000	Total Answered
Persons	11	13	2	0	26
Percentage	42	50	8	0	100

Source : Field Survey September-October 2004

From the survey results we can see that situation of gross income among respondents is relatively stagnant to increasing. It can be revealed from the survey that about 42% of the total answered respondents (11 persons) mentioned stagnant total income during the last 2-3 years, but there are also about 38% of the total respondents (10 persons) who indicating a total income increase during the same years. Furthermore, there are about 19% of answered respondents also indicated a total income increase more than double in the same period. Situation of gross income indicator during the last 2-3 years in the Bungo model extension area is presented in Table 7-32.

Table 7-32. Improvement Situation of Gross Income Indicators in the Bungo Model Extension Area

Situation of Gross Income during the last 2-3 years	Person	Percentage (%)
Increased more than double	5	19
Increased less than double	10	38
Stable/Stagnant	11	42
Decreased	0	0
Total	26	100

Source : Field survey September-October 2004

Contribution of Income from Aquaculture and Fish Production in the Last 2-3 Years

Unlike the case of Batanghari model extension area, average contribution of aquaculture to respondents' total income in Bungo model extension area is about 10-30%. From Table 7-33, we can see that of the 19 respondents, 8 persons (42.2%) answered 10-30% of their total income is from aquaculture, followed by 7 persons (36.8%) with contribution of less than 10%. Only 4 persons (21,0%) answered more than 30% of their total income is from aquaculture consisting of 2 persons with 30-50% and the same number (2 persons or 10.5%) with 50-70% contribution to the total income, respectively.

Table 7-33. Number of Respondents Classified by Freshwater Aquaculture Contribution to their Income in the Bungo Model Extension Area

	Range of Contribution of Income From Freshwater Aquaculture					
	< 10%	10-30%	30-50%	50-70%	> 70%	Total Answered
Persons	7	8	2	2	0	19
Percentage	36.8	42.2	10.5	10.5	0	100

Source : Field Survey September-October 2004

The result reveals that the contribution situation of aquaculture to total income of the respondents is relatively stagnant to increasing. It can be revealed from the survey that about 46% of the total answered respondents (11 persons) mentioned increasing aquaculture income contribution during the last 2-3 years. There are 8 persons or 33% who indicating a stable contribution of aquaculture to total income. Situation of gross income indicator during the last 2-3 years in the Bungo model extension area is presented in Table 7-34.

Meanwhile, in terms of fish production during the least 2-3 years, fish farmers in the district Bungo has been performing a stable production, meaning that there is no significant changes of the production. As can be seen in Table 7-35, more than 40%

of the total sample population said that their production during 2-3 years shows a stable condition (stagnant), but some of them i.e. about 32% of total sample population mentioned that their production has been increasing less than double during the last 2-3 years. Furthermore, there are only 6 persons (24%) of the total respondents have increasing production more than double.

Table 7-34. Situation of Contribution Income from Aquaculture in the Bungo Model Extension Area

Situation of Contribution of Aquaculture Income to Total Income during the last 2-3 years	Person	Percentage (%)
Increased more than double	4	17
Increased less than double	11	46
Stable/Stagnant	8	33
Decreased	0	0
Total	26	100

Source : Field survey September-October 2004

Table 7-35. Number of Respondent Classified by Their Production of Freshwater Aquaculture in the Bungo Model Extension Area

	Condition of Fish Production During the last 2-3 years					
	Increase Double	Increase less than Double	Stagnant	Decrease less than Double	Double Decrease	Total Answered
Persons	6	8	11	0	0	25
Percentage	24	32	44	0	0	100

Source : Field Survey September-October 2004

Family assets and initial capital for aquaculture

As has been mentioned above, family assets can be used as an indicator to measuring fisheries household welfare. By investigating the condition of family assets in terms of a set of physical assets such as motorbike, television, video, etc, we can assess the welfare condition of the surveyed respondents.

From the results of the survey, we found that most of fish farmer households in Bungo model extension area have 1-3 items of goods as listed above. It can be seen in table 7-36 that 44% of the total sample population (25 respondents) has three items, the maximum number items that surveyed respondents have. From other respondents we found that 8 persons (32%) of the total sample population have only two items and 6 persons (24%) have 1 item of goods.

Table 7-36. Number of Respondents According to Their Assets in Bungo Model Extension Area

	Condition of household goods of fish farmer household					
	Have only one Items	Have two Items	Have Three Items	Have four Items	Have more than four Items	Total Answered
Persons	6	8	11	0	0	25
Percentage	24	32	44	0	0	100

Source : Field survey September-October 2004

In terms of initial capital, the condition of fish farmers in Bungo model extension area is more and less the same as those in the other model extension areas. From the results, we found that 57% of the total sample population mentioned that they used outsourcing capital in order to conduct fish aquaculture (Table 7-37), while the rest of them (43%) used their own capital. This situation is considerably rational if we look at the situation of income that more than 40% of the total sample population have less than Rp. 500,000 per month, indicating that all of their income is disposable income, less opportunity to save.

Table 7-37. Number of Respondent Classified by the Source of Initial Capital for Aquaculture in the Bungo Model Extension Areas

	Source of initial capital for aquaculture activities		
	Debt	Own Capital	Total Answered
Persons	12	9	21
Percentage	57	43	100

Source : Field survey September-October 2004

From the survey results we can see that situation of aquaculture assets is relatively stagnant. It can be revealed that about 56% of the total answered respondents (14 persons) mentioned stagnant situation of aquaculture assets during the last 2-3 years, but there are also about 36% of total respondents (9 persons) who indicating an increasing total income during the same period. Furthermore, there are about 8% of the answered respondents also indicated decreasing aquaculture assets in the same period. Situation of gross income indicator during the last 2-3 years in the Bungo model extension area is presented in Table 7-38.

7.5.1.6. Rating of Socio-Economics Assessment

From the results we can reveal that most of indicators showed low score such as that of gross income per capita, contribution of aquaculture income, and

saving/debt condition, as the main indicator of socio-economic situation. From this finding, these indicators have relatively low score compared to the other indicators. However, for the case of supporting indicators such as working hours and family equipments, the score of these indicators can be considerably high. In this context we can say that in general level of socio-economic situation of fish farmers in this district can be said to be moderate. Figure 7-3 shows overall score of socio-economic indicators for fish farmers in Bungo District, Province of Jambi.

Table 7-38. Improvement Situation of Aquaculture Assets Indicators in the Bungo Model Extension Area

Situation of Aquaculture Assets during the last 2-3 years	Person	Percentage (%)
Increased	9	36
Stable/Stagnant	14	56
Decreased	2	8
Total	25	100

Source : Field survey September-October 2004

7.5.2. Batanghari District, Jambi Province

7.5.2.1. General Condition of Location

Batanghari District is located at southern part of Jambi City, capital of Jambi Province. Geographic location of this district is 1°15' SL-2°2'SL and 102°30' EL to 104°30' EL. In terms of distance, Batanghari District is located approximately 90 km from Jambi City and it can be taken by car for about 1.5 hours. In this study, survey area covers 5 subdistricts (Kecamatan) namely Batin XXIV, Tembesi, Pemayung, Muara Bulian, and Bajubang Sub-Districts.

7.5.2.2. General Information of Fish Farmers

In Batanghari model extension area, from the 29 farmer respondents only 3 farmers whose main job is freshwater aquaculture. Freshwater aquaculture is second or third job of the rest of the respondents. The main job of the most of fish farmer respondents in Batanghari is rubber farming. In the segment of education, around half of the respondents is elementary school graduation (55%). The other half is shared by junior high school or senior high school graduation. No one has bachelor degree as their educational background.

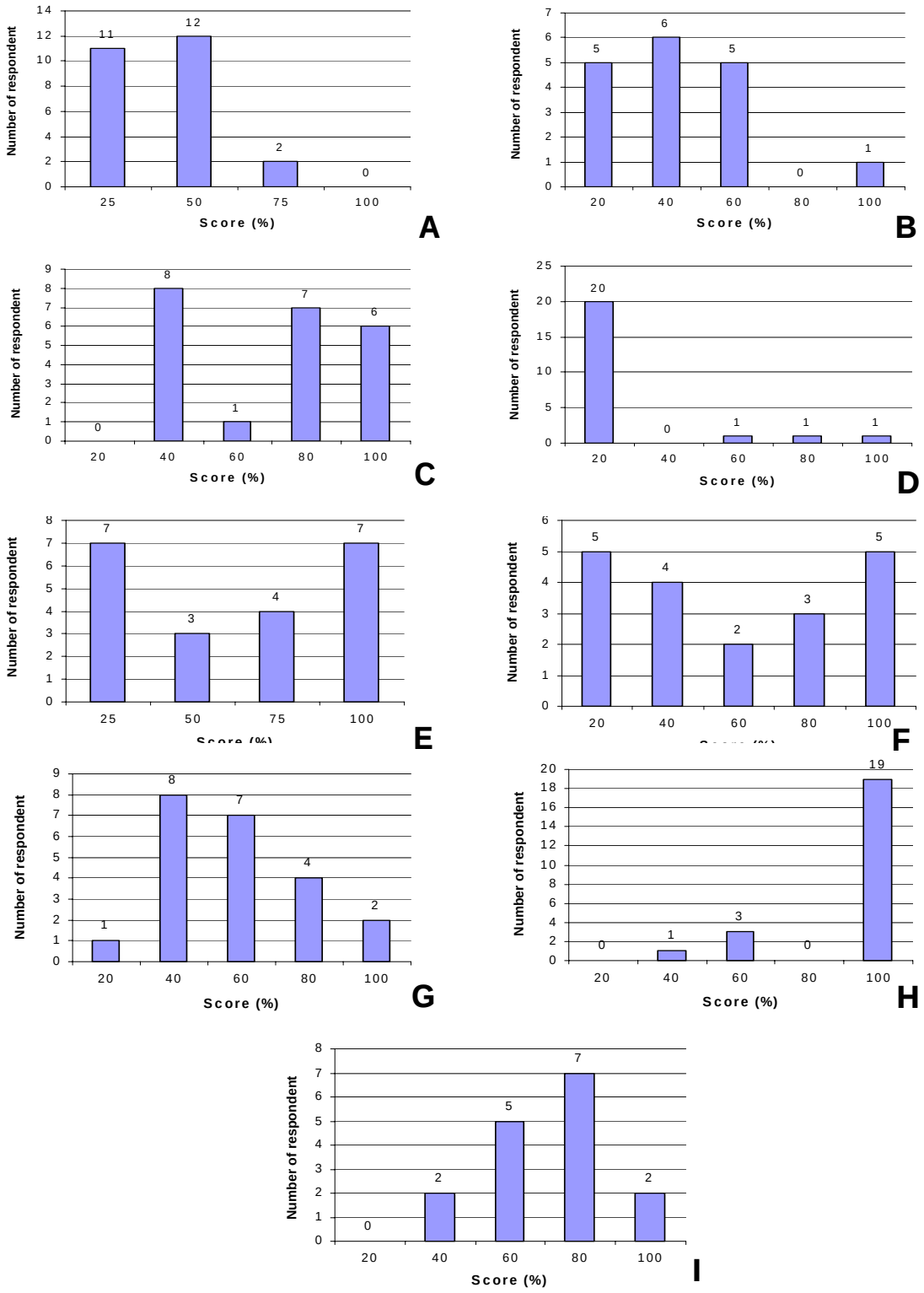


Figure 7-3. Total Rating of Socio-Economics Assessment in Bungo District

Note : A. Income B. Income from fish culture C. Fish productio
D. Saving/debt E. Working hours F. Equipment
G. Real estate H. Health care I. Family education

Table 7-39. List of the Fish Farmer Respondents in the Extension Model Extension Area in Batanghari.

No	Code	Name	Specialty of farmer	Address	
				Name of village	Name of sub-district
1	KBH01	Sablianto	G: GIFT nile	Simpang Karmeo	Batin XXIV
2	KBH02	Kasnadi	G: GIFT nile	Simpang Karmeo	Batin XXIV
3	KBH03	Santoso	H/G: Colosoma	Simpang Karmeo	Batin XXIV
4	KBH04	Sahril	G: GIFT nile	Ampelu	Tembesi
5	KBH05	Muhamad	G: GIFT nile	Ampelu	Tembesi
6	KBH06	Hasan	G: GIFT nile	Ampelu	Tembesi
7	KBH07	Ahmad Latfi	G: GIFT nile	Karmeo	Batin XXIV
8	KBH08	Muhamad Ali	G: Com.carp, nile, patin	Karmeo	Batin XXIV
9	KBH09	Yaman	G: Com.carp, nile	Karmeo	Batin XXIV
10	KBH10	Zaini	G: Com.carp, nile, patin	Karmeo	Batin XXIV
11	KBH11	Marjuk	G: GIFT nile	Karmeo	Batin XXIV
12	KBH12	Temon M. Nur	G: GIFT nile	Simpang Karmeo	Batin XXIV
13	KBH13	Tugirin	G: GIFT nile	Simpang Karmeo	Batin XXIV
14	KBH14	M. Liyas	G: GIFT nile	Simpang Karmeo	Batin XXIV
15	KBH15	Iham	G: GIFT nile	Simpang Karmeo	Batin XXIV
16	KBH16	Supandi	G: GIFT nile	Simpang Karmeo	Batin XXIV
17	KBH17	Suparman	G: GIFT nile	Simpang Karmeo	Batin XXIV
18	KBH18	M. Saman	G: GIFT nile, patin	Lubuk Ruso	Pemayung
19	KBH19	Asmuni	G: GIFT nile, patin	Lubuk Ruso	Pemayung
20	KBH20	Armen	G: GIFT nile, patin	Lubuk Ruso	Pemayung
21	KBH21	Rudi	G: GIFT nile	Bajubang	Bajubang
22	KBH22	Suheli	H/N: nile. G: GIFT nile, patin	Bajubang	Bajubang
23	KBH23	Sabidi	H/N: nile. G: GIFT nile, patin	Bajubang	Bajubang
24	KBH24	Margono	G: GIFT nile	Rengas Condong	Muara Bulian
25	KBH25	Dahlan	G: GIFT nile, patin	Senaning	Pemayung
26	KBH26	Hasbi	G: GIFT nile, patin	Senaning	Pemayung
27	KBH27	Helmi	G: GIFT nile, patin	Senaning	Pemayung
28	KBH28	Pungut Siyono	H/N: nile	Senaning	Pemayung
29	KBH29	Suip	G: GIFT nile, patin	Ampelu	Tembesi

Note : G: Grower, N: Nursery, H: Hatchery
Source : Field Survey September-October 2004

Fish culture technology applied by the respondents is mostly obtained from people who live in the vicinity where their parents or neighbours live as well as from Fishery Agency in the region. This situation related with the fact that fish culture has been long time carried out by the fish pond farmers, especially in Ampelu. Detailed information on the number of fish farmers in the model extension area is listed in Table 7-39 and spatially depicted in Figure 7-4.

7.5.2.3. Aquaculture Technology

The data collected in the model extension area of Batanghari District give information that the fish species cultured are common carp, Nile tilapia, Colosoma, and Pangasius catfish. These fish have been reared in stagnant water ponds and karamba. Farmers who involved in freshwater aquaculture can be divided into three main types: seed producers, nursery, and grow-out.

Seed production

The size of pond area that each seed production farmer owns is between 60 m^2 – 150 m^2. Breeding of fish is conducted in ponds. Breeding of Nile tilapia does not need special pond. All activities, starting from spawning the breeder up to rearing the larva, are carried out in one type pond, with the size more than 100 m^2 areas.

They don't use pumps to fill in ponds and drain water from ponds. The ponds built in sloping area use gravitation power to drain water. Usually the depth of water is shallower than 1 m. Porosity of ponds is not porous. Source of water is swamp, river, and rainfall.

0.5 - 1 kg/fish size of female breeder (Nile tilapia) is used in each cycle. Breeder spawning and egg incubation are carried out in one pond of the size of 60 – 100 m^2. In this pond, hatched larvae are reared for 3-5 days. After that the larvae are harvested and moved to nursery pond. Area of pond used for nursery ranges between 100-500 m^2 per cycle of the nursing.

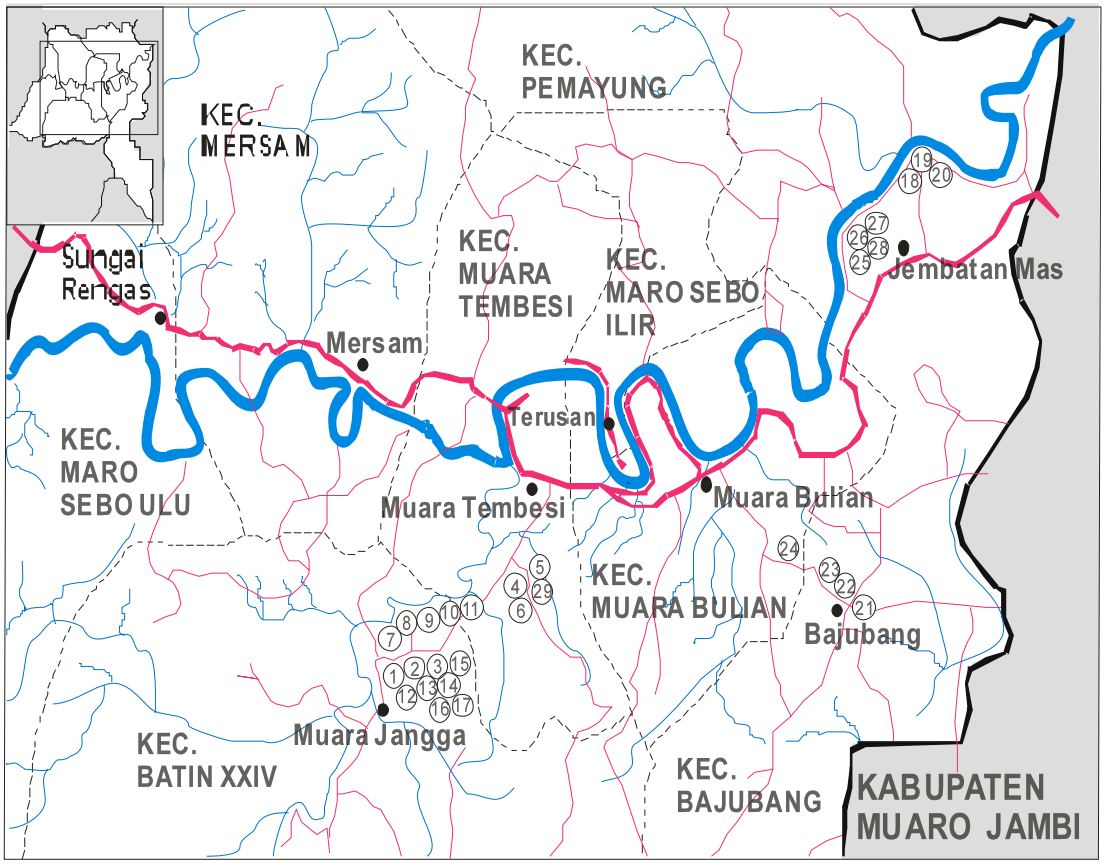


Figure 7-4. Location map of Fish Farmers Surveyed in Batanghari District, Jambi Province

The rearing pond is prepared before stocking larvae. The activities include drying and rehabilitating the pond, fertilizing and inundating. Some farmer fertilize and/or manure nursery pond before larvae stocked to stimulate growth of natural food. The manure used is cow dung , while inorganic fertilizer used is urea and TSP.

After pond is inundated by water within 5-10 days, 5-7 days old larvae are stocked in. During fish rearing, some farmer spread rice bran over the pond to maintain natural food in a proper abundance

A period of rearing fish is 15–40 days per cycle for nursing, with 2–3 times cycles production per year. The number of larvae harvested is 1,500 – 10,000 per cycle.

Nursery

Pond areas used by stagnant ponds farmer for nursery production vary between 48–2,000 m^2. Fish farmers fill and drain water without using pump. Ponds located in sloping area use completely gravitation power to drain water, even the depth is shallower than 1 m. Porosity of the earth ponds is not porous. Source of water is

irrigation channel. Water flow rate is enough to fulfill need of the pond, although some farmers feel lack of water at dry season. In point of view water quality, the water is fertile.

Production cycle is 3-5 times per year, pond areas used in each cycle production 438- 1,844 m^2. The production quantity per cycle is 2,400–12,500 fishes.

Grow-out

Pond areas used by stagnant ponds farmer for grow-out production vary between 60– 1,800 m^2. Fish farmers fill and drain water without using pump. Water flow rate is enough to fulfill need of the pond, although some farmers feel lack of water in dry season. In water quality point of view, water is fertile. Rearing periods is 90 - 250 days, depending on fish species cultured. The production cycle is 2 - 4 times per year and the production quantity is 250 kg per cycle.

7.5.2.4. Rating of Aquaculture Technology

Broodstock Management and Seed Production Categories

There are 4 farmers of the 29 farmer respondents are activity working as fish seed producers. We analyzed broodstock management of the 4 farmers in order to make rating on the technology. As for the seed production, we analyzed and made rating only on 2 farmers based on the number of respondents answered (Table 7-40)

In broodstock management category rating all the farmers reached 80% achievement level. There is no fish farmer in position of achievement 100%. The result of rating for seed production category is that only a farmer attained 20% of achievement level, and the other farmer attained 80%.

Table 7-40. Rating on Achievement of Broodstock Management and Seed Production of the Farmers Respondent in Batanghari District

	Rating Achievement					
	20%	40%	60%	80%	100%	Total Answered
Broodstock Management Category						
Persons	0	0	0	4	0	4
Percentage	0	0	0	100	0	
Seed Production Category						
Persons	1	0	0	1	0	2
Percentage	50	0	0	50	0	

Source: Field Survey September-October 2004

Feeding Management and Fish Nutrition Categories

Only 11 farmer respondents in Batanghari have answered the question about both of feeding management and fish nutrition categories (Table 7-41).

The result shows that most of respondents in District of Batanghari reached 60% of the achievement on feeding management category (It means fish farmers can calculate feeding rate based on stocking quantity of cultured fish, and also understand daily feeding rate correctly to practice appropriate feeding quantity); Also the result shows most of the farmers attained 40% on fish nutrition category (It means fish farmers have a way to keep standard quality of feed without feed storage).

Table 7-41. Rating Achievement of Feeding Management and Fish Nutrition Category of Fish Farmer Respondents in Batanghari District

	Rating Achievement					
	20%	40%	60%	80%	100%	Total Answered
	Feeding Management Category					
Persons	0	4	0	1	6	11
Percentage	0	36	0	9	55	
	Fish Nutrition Category					
Persons	0	3	4	2	2	11
Percentage	0	27	36	18	18	

Source : Field Survey September-October 2004

Fish Disease and Water Management Categories

Rating of fish disease and water management categories achievement is evaluated a degree (in%) of fish farmers knowledge and skill. The evaluation on water management category is to know what the farmers understand about the water quality factors (such as DO, pH, water temperature) and how farmers can practice water monitoring with paying attention to fish culture circumstance (Table 7-42).

On the basis of the survey results, of the 16 fish farmer respondents answered on disease category, that most of the fish farmers in District of Kuantan Singingi attained 60% of the achievement level. It means fish farmers can identify some kinds of fish diseases and take necessary measures to prevent fish diseases such as bacteria, fungi and parasites.

The number of farmer respondents answered to water management category is 23. Most of the fish farmers are still in 20% achievement level. It means most of the farmers have understood basic water quality factors.

Table 7-42. Rating Achievement of Fish Disease and Water Management Category of Fish Farmer Respondents in Batanghari District

	Rating Achievement					
	20%	40%	60%	80%	100%	Total Answered
	Fish Disease Category					
Persons	0	0	10	3	0	13
Percentage	0	0	77	23	0	
	Water Management Category					
Persons	12	1	0	0	0	13
Percentage	92	8	0	0	0	

Source : Field Survey September-October 2004

General Culture Control and Total Fish Culture Management Categories

Final achievement level of the general culture control is that fish farmer can maintain their facilities properly meet the environmental condition, and attain sustainable and efficient fish culture production. In total fish culture management, final achievement level is that fish farmer keeps record of fish culture activities and calculates production cost, and also fish farmer can make a plan for their fish culture production considering harvest time, and can practice fish production as planned.

The survey results show that most of the fish farmers of the 22 fish farmers answered the questionnaire attained 80% of the achievement level in general culture control (It means most of the fish farmers understand fish culture types and characteristics of their facilities suitable for surrounding environments and fish species. Also they can build their facilities with correct designs for fish culture.) In total fish culture management, most of the farmers in this district are still in 20% level. It means the most of the fish farmers in this district have known rough figures of management condition such as quantity of harvest, however they don't know their accurate profit from fish culture because they don't practice planned production exactly. The rating achievement of general culture and total fish culture management categories of the farmer respondents answered in Batanghari is shown in Table 7-43. Figure 7-5. shows the Rating Aquaculture Technique Assessment in Batanghari District.

Table 7-43. Rating Achievement of General Culture and Management Category of the Farmer Respondents in Batanghari District

	Rating Achievement					
	20%	40%	60%	80%	100%	Total Answered
	General Culture Management Category					
Persons	6	0	0	7	0	13
Percentage	46	0	0	54	0	
	Total Fish Culture Management Category					
Persons	11	0	0	0	2	13
Percentage	85	0	0	0	15	

Source : Field Survey September-October 2004

7.5.2.5. Socio-Economic Assessment

Main Job and Gross Income

According to the survey results, most of the respondents have the main job on agricultural activities such as rubber farming (41%) and other agricultural farming (24%). In this model extension area, there are only 3 persons whose main job is fish farmer (aquaculture). Table 7-44 presents type of jobs according to the survey conducted during September-October 2004.

Table 7-44. Main, 2nd, and 3rd Job of the Respondents in the Batanghari Model Extension Area

	Type of Job						
	Fish Farm	Rubber Farm	Agriculture	Trader	Govern. Employee	Others	Total Answered
Main Job	3 (10)	12 (41)	7 (24)	2 (7)	1 (3)	4 (14)	29
2nd Job	9 (53)	1 (6)	6 (35)	1 (6)	0	0	17
3rd Job	1 (25)	0	2 (50)	1 (25)	0	0	4

Source : Field Survey September-October 2004
Note : Number in the bracket refers to its percentage

In terms of gross income, group of fish farmers whose gross income is less than Rp. 500,000 per month are dominating the surveyed population (11 persons of the total 26 respondents). Furthermore, there are 8 fish farmers or 36% have gross income in the range of Rp. 500,000 – Rp. 1,000,000 per month, and 2 fish farmers whose gross income is more than Rp. 1,000,000. Detailed number of the surveyed fish farmers according to their gross income per month can be seen in Table 7-45.

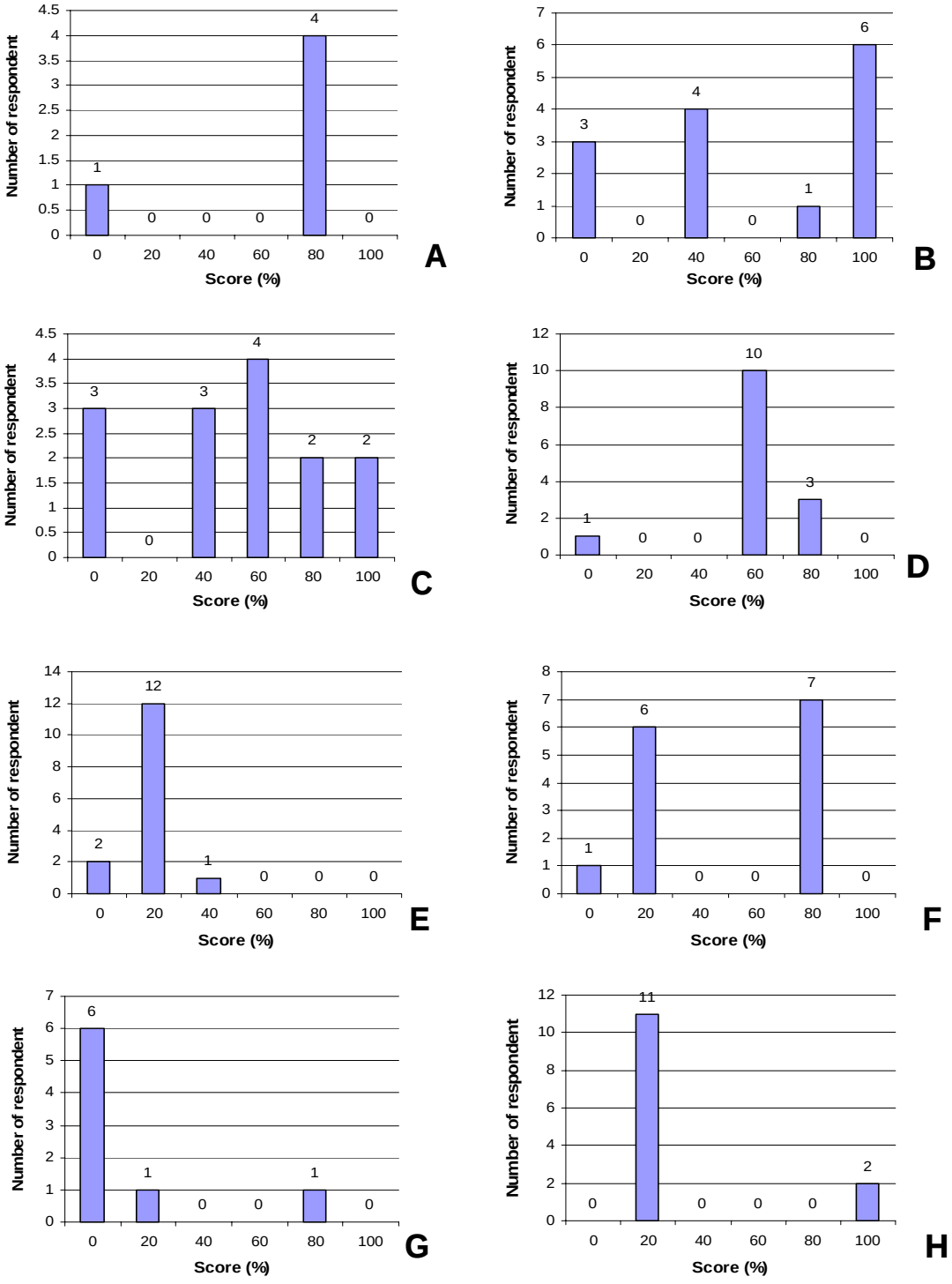


Figure 7-5. Aquaculture Technology Rating of Respondents in Batanghari District

Note:
A. Brood stock management
B. Feeding management
C. Fish nutrition
D. Fish diseases
E. Water management
F. General culture control
G. Seed production
H. Total fish culture management

In rural area, the main indicator of public welfare is that of income per capita. Using the benchmarking data that minimum regional wage of Batanghari District is around Rp. 500,000 per month, it can be said that welfare level of the surveyed fish farmers is categorized to be low to normal because the gross income is less than Rp. 500,000 per month.

Table 7-45. Number of the Surveyed Fish Farmers According to Gross Income in the Batanghari Model Extension Area

	Gross Income per Month				
	< 500,000	500,000-1,000,000	1,000,000-5,000,000	> 5,000,000	Total Answered
Persons	11	8	1	2	22
Percentage	50	36	5	9	

Source : Field Survey September-October 2004

In terms of improvement of this indicator during the last 2-3 years, survey results found that more than 50% of the respondents indicate a stable/stagnant total income during the last 2-3 years (64%). Of the 14 respondents who answered the question, only 4 persons who have increased their total income (29%). Table 7-46 below shows the improvement situation of gross income among the respondents in the Batanghari model extension area.

Table 7-46. Improvement Situation of Gross Income Indicators in the Batanghari Model Extension Area

Situation of Gross Income during the last 2-3 years	Person	Percentage (%)
Increased more than double	4	29
Increased less than double	1	7
Stable/Stagnant	9	64
Decreased	0	0
Total	14	100

Source : Field survey September-October 2004

Contribution of Income from Aquaculture and Fish Production in the Last 2-3 Years

As previously mentioned, freshwater aquaculture could be considered as the main sources of income in terms of fish farmer household point of view. This fact could be seen from the contribution of fish aquaculture income to total family income and improvement of fish production in last 2-3 years in the model extension area.

In terms of aquaculture income, average contribution to total income is estimated to be 20-50% (Table 7-47). It is shown that of the 14 answered-respondents, there are only 7 persons or 50,0% who have more than 30% contribution of fish aquaculture and 7 persons who have less than 30%. From this data, we can say that aquaculture activities could not be used yet as the main sources of income for at least 50% of the total respondents.

Table 7-47. Number of Respondent Classified by Freshwater Aquaculture Contribution to their Income in the Batanghari Model Extension Area

	Range of Contribution of Income From Freshwater Aquaculture					
	< 10%	10-30%	30-50%	50-70%	> 70%	Total Answered
Persons	4	3	4	1	2	14
Percentage	29	21	29	7	14	100

Source : Field Survey September-October 2004

In terms of improvement of this indicator during the last 2-3 years, a prospective result was found during the survey that about 43% of the total answered respondents (6 person) mentioned increasing contribution of aquaculture income to total income more than double during the last 2-3 years. Furthermore, there are about 29% of the answered respondents also indicated an increasing contribution, but less than doubled. There is no indication that during the last 2-3 years contribution of aquaculture income decreased. Table 7-48 below shows the improvement situation of contribution of aquaculture income among the respondents in the Batanghari model extension area.

Generally, production of fish aquaculture in the District of Batanghari has been decreased about double during the past 2-3 years. As can be seen in Table 7-49, there are only 6 persons (21%) of the total 29 respondents who successfully increased their production more than double, but other respondents' production are stagnant or increasing but not more than double (8 persons). In this case, it can be described that some farmers especially karamba did not operate their aquaculture activities because of flood disaster.

Table 7-48. Improvement Situation of Contribution of Aquaculture Income in the Batanghari Model Extension Area

Contribution of Aquaculture Income to Total Income during the last 2-3 years	Person	Percentage
Increased more than double	6	43
Increased less than double	4	29
Stable/Stagnant	4	29
Decreased	0	0
Total	14	100

Source : Field survey September-October 2004

Table 7-49. Number of Respondents Classified by Their Production of Freshwater Aquaculture in the Batanghari Model Extension Area

	Condition of Fish Production During the last 2-3 years					
	Increase Double	Increase less than Double	Stagnant	Decrease less than Double	Double Decrease	Total Respondent
Persons	6	3	5	0	15	29
Percentage	21	11	17	0	51	

Source : Field Survey September-October 2004

Family assets and initial capital for aquaculture

In this study, family assets refer to a set of goods which usually can be used in assessing family welfare. A set of goods in this case is defined to be a set of 7 (seven) items of assets i.e. bicycle, motorbike, refrigerator, washing machine, television, generator set, mobile phone, play station and VCD/DVD player. Main assumption used in this context is that more items fish farmers have wealthier the fish farmers are.

From the survey results, it can be revealed that of the 22 respondents, there are 7 fish farmers or 32% who have four items of goods as their family assets. There are only 2 persons of the 22 respondents who have more than four items as their family assets. Nevertheless, it has been shown also that the number of fish farmers who have less than four items is 13 persons consisting of 2 persons (9%) only have one item of goods, 6 persons (28%) have two items, and 5 persons (22%) have three items. Table 7-50 presents the number of the surveyed fish farmers according to their assets (number of items) in the Batanghari model extension area.

Table 7-50. Number of Respondents Classified by Their Household goods and Assets in the Batanghari Model Extension Area

	Condition of household goods of the fish farmer household					
	Have only one Items	Have two Items	Have Three Items	Have four Items	Have more than four Items	Total Answered
Persons	2	6	5	7	2	22
Percentage	9	28	22	32	9	

Source : Field survey September-October 2004

In terms of initial capital for engaging aquaculture activities, it is revealed that most of the fish farmers in Batanghari had to borrow initial capital for starting aquaculture activities. Of the 22 respondents, there are 12 persons or 57% using outsourcing capital for their activities and only 9 persons or 43% using their own capital for initiating the aquaculture activities (Table 7-51).

Table 7-51. Number of Respondents Classified by the Source of Initial Capital for Aquaculture in the Batanghari Model Extension Areas

	Source of initial capital for aquaculture activities		
	Debt	Own Capital	Total Answered
Persons	12	9	21
Percentage	57	43	

Source : Field survey September-October 2004

In Batanghari District, the situation of aquaculture assets is relatively unchanged during the last 2-3 years. This is indicated from the survey results that about 67% of the total answered respondents (8 persons) indicated a stable/unchanged situation of aquaculture assets, while only 3 persons or 25% mentioned increasing improvement of aquaculture assets. From the survey it is found also that there is one respondent who has decreasing situation of aquaculture assets. Table 7-52 below shows the improvement situation of aquaculture assets among the respondents in the Batanghari model extension area.

7.5.2.6. Rating of Socio-Economic Indicators

In the case of Batanghari District, it can be seen that the level of welfare of fish farmers can be categorized into the low level due to for example their gross income per capita, contribution of aquaculture income, and saving/debt condition. From the survey results, we can reveal that these indicators have relatively low score compared to the other indicators. In this context we can say that in general socio-economic situation of fish farmers in this district can be said to be low. Figure 7-6 shows overall score of socio-economic indicators for fish farmers in Batanghari District, Province of Jambi.

Table 7-52. Improvement Situation of Aquaculture Asset in the Batanghari Model Extension Area

Aquaculture Asset during the last 2-3 years	Person	Percentage
Increased	3	25
Stable/Stagnant	8	67
Decreased	1	8
Total	12	100

Source : Field survey September-October 2004

7.5.3. North Bengkulu District, Bengkulu Province

7.5.3.1. General Condition of Location

North Bengkulu District is one of the four Districts/Municipals in Bengkulu Province. The capital city, is Arga Makmur. The distance from Arga Makmur to Bengkulu City as the capital city of Bengkulu Province is approximately 120 km. This site is lies on geographic location of 2°15' SL-4°00' SL & 101°32' EL to 102°8' EL. Most of the land in the west part is low flat area with height less than 150 m above the sea level, but in the east part, the land is hilly with average 541 m above the sea level.

Total monthly rainfall in this district in 2002 is between 38 mm to 351 mm, in average 148 mm. Rainy days in a month are around between 1 to 11 days, with average 5.67 days.

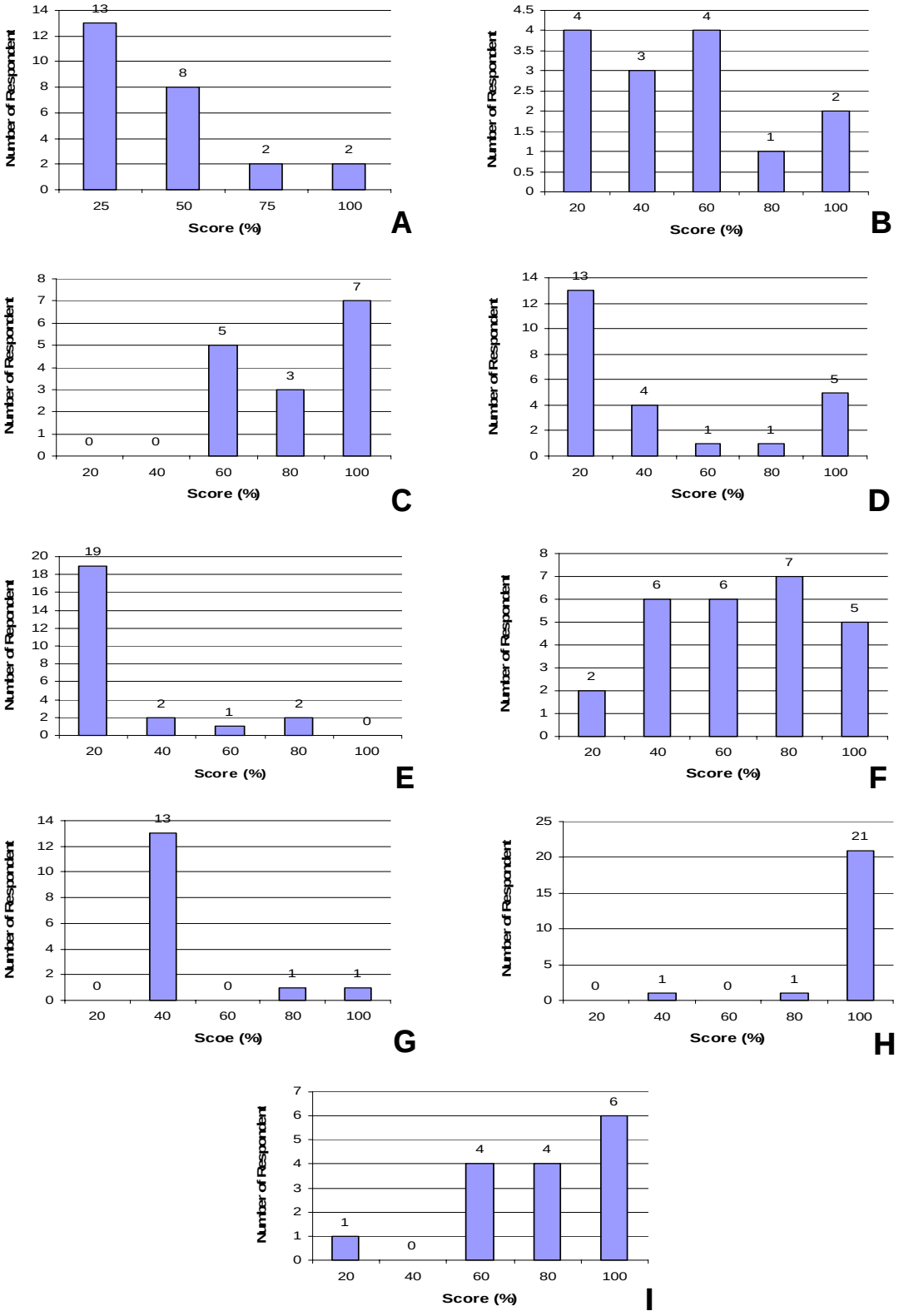


Figure 7-6. Total Rating of Socio Economic Assesment in Batanghari District

Note : A. Income B. Income from fish culture C. Fish production
D. Saving/debt E. Working hours F. Equipment
G. Real estate H. Health care I. Family education

The model extension area in this district is located at Padang Jaya Sub District. Padang Jaya is the one of sub districts in North Bengkulu consists of 9 sub district. The number of the respondent in this area is 33 fish farmers. All of them are members of three different farmer groups. Most of the respondents live in Desa Tanjung Harapan and the rest live in Desa Marga Sakti. Table 7-53 shows the list of the respondents in North Bengkulu District and their location can be seen in Figure 7-7.

7.5.3.2. General Information of Fish Farmers

Sub district of Padang Jaya represents one of freshwater aquaculture center in District of North Bengkulu, Bengkulu Province even though majority of the residents in this sub district are paddy farmers. Generally, location of freshwater aquaculture activity in this sub district lies on the area where has adequate irrigation canal as source of water.

The common species cultured in Padang Jaya sub district are common carp and Nile tilapia. Based on the result of interviews to 33 fish farmers, it is known that 51% of the respondents doing aquaculture as secondary job, 39% as main job, and 3% as tertiary job. At the moment, there is a tendency that paddy farmers are interested to start doing aquaculture as they believe that this activity is more profitable in compare to paddy culture.

Majority of the respondent's educational background is elementary school (54,5%) and only a few numbers of the respondents (3%) have college educational background. In order to make extension programs fruitful, it is better to select a level of technologies in line with the majority of respondent's educational background, such as appropriate-simple technologies.

Most of the respondents in this area have learned aquaculture techniques from his neighbor (61%), only a few numbers (1%) have learned from Fisheries Service Agency (Dinas).

In extension point of view, collected data show that 42% of the respondents have attended training program that carried out mostly by the JICA (37%) or other institutions such as Dinas, BBI, or BBAT (Table 7-54). The role and function of

extension services are transfer of technology and as mediator between local government and farmer society.

Table 7-53. List of the respondents in North Bengkulu District

No	Code	Name	Specialty of farmer	Address	
				Name of Village	Name of Sub-District
1	BKL01	Subadi	H/N: nile, C.carp. G: nile	Tanjung Harapan	Padang Jaya
2	BKL02	Dewa Gede Ari	G: GIFT nile	Tanjung Harapan	Padang Jaya
3	BKL03	Karyono	H: C.carp, nile. N:C.carp. G: GIFT nile	Tanjung Harapan	Padang Jaya
4	BKL04	Sadik	H: nile	Tanjung Harapan	Padang Jaya
5	BKL05	Sajimantoro	G: C.carp	Tanjung Harapan	Padang Jaya
6	BKL06	Sarmin	H: nile	Tanjung Harapan	Padang Jaya
7	BKL07	Dedi Seriono	H/G: C.carp, nile	Tanjung Harapan	Padang Jaya
8	BKL08	Nurkibat	G: C.carp, nile	Tanjung Harapan	Padang Jaya
9	BKL09	Samsul	N/G: C.carp	Tanjung Harapan	Padang Jaya
10	BKL10	Sa'un	H/N/G: C.carp	Tanjung Harapan	Padang Jaya
11	BKL11	Supandi	N: G: C.carp, nile	Tanjung Harapan	Padang Jaya
12	BKL12	Supono	H/N, G: C.carp	Tanjung Harapan	Padang Jaya
13	BKL13	Wawan Setiawan	N/ G: C.carp, nile	Tanjung Harapan	Padang Jaya
14	BKL14	Milanta	N/ G: C.carp, nile	Tanjung Harapan	Padang Jaya
15	BKL15	Wikarna	G: C.carp, nile	Tanjung Harapan	Padang Jaya
16	BKL16	Parjiono	H/N: nile	Marga Sakti	Padang Jaya
17	BKL17	Bambang	H: nile	Tanjung Harapan	Padang Jaya
18	BKL18	Ma'in	H: C.carp	Tanjung Harapan	Padang Jaya
19	BKL19	Samiran	H: nile	Tanjung Harapan	Padang Jaya
20	BKL20	Shomad	H: nile	Tanjung Harapan	Padang Jaya
21	BKL21	Sukardi	H: C.carp	Tanjung Harapan	Padang Jaya
22	BKL22	Yumarno	H/N: C.carp	Tanjung Harapan	Padang Jaya
23	BKL23	Sutarji	H: C.carp	Tanjung Harapan	Padang Jaya
24	BKL24	Toha	N: C.carp	Tanjung Harapan	Padang Jaya
25	BKL25	Umar Said	H/G: C.carp, nile	Tanjung Harapan	Padang Jaya
26	BKL26	Yusuf	H/N: nile	Tanjung Harapan	Padang Jaya
27	BKL27	Parjono	H: nile. G: C.carp	Marga Sakti	Padang Jaya
28	BKL28	Sugeng Hariyanto	G: GIFT nile	Marga Sakti	Padang Jaya
29	BKL29	Sukadi	H/G: GIFT nile	Marga Sakti	Padang Jaya
30	BKL30	Susanto	G: GIFT nile	Marga Sakti	Padang Jaya
31	BKL31	Sutopo	G: C.carp	Marga Sakti	Padang Jaya
32	BKL32	Tri Sumiyanto	G: C.carp	Marga Sakti	Padang Jaya
33	BKL33	Wawan Wahyudi	G: GIFT nile	Marga Sakti	Padang Jaya

Note: H : Hatching; N : Nursering; G : Grow Up

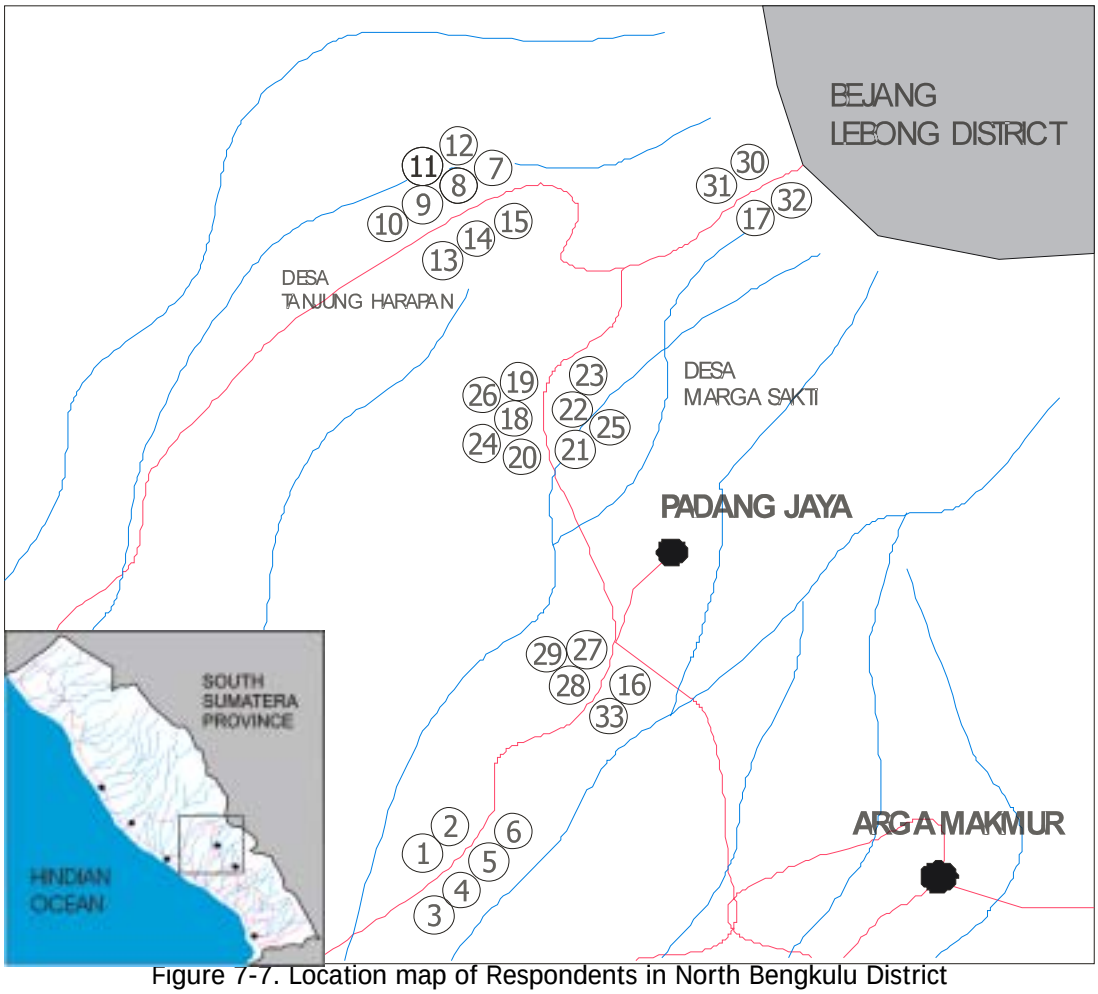


Figure 7-7. Location map of Respondents in North Bengkulu District

Table 7-54. Number of respondents attending training conducted by different institutions in North Bengkulu District

Training organizer	Number of respondent
JICA	11
Dinas	8
BBI	4
BBAT	2
Others	5

Source : Field Survey (2004)

Farmers who involved in freshwater aquaculture can be divided into 3 main types such as seed producers (UPRs), nursery farmer, and grow-out farmer (Table 7-55). All respondents in this area have experience in culturing fish at least 1 year. According to the activity of the respondents, most of the farmers who produce the seed have experience at the range of 1 to 5 years (39%). This percentage is almost same as that of the farmers who have experience at the range of 6 to 10 years. While the respondents who have experience more than 15 years is only 2

persons (11%). In case of nursery activity, composition of the respondents in term of their experience is similar with that of seed producer. While in grow-out activity, most of the respondents (72%) have experience at the range of 1-5 years.

Table 7-55. Number of the Respondent's Experience on Each Aquaculture Activities in North Bengkulu District

Experience (years)	Seed producer	Nursery	Grow-Out
<1	0	0	0
1-5	7	6	13
6-10	6	5	2
11-15	3	2	2
>15	2	2	1

Source : Field Survey (2004)

According to the activity conducted by the respondents, there are farmers who engage in single activity of grow-out, seed producer or nursery, while the others have multiple activities as presented in Table 7-56.

Table 7-56. Classification of Activities of the Respondents in North Bengkulu District

Activity	Number of respondent
Grow-out	5
Seed – nursery – grow-out	8
Seed - grow-out	1
Seed	3
Nursery – grow-out	9
Nursery	3

Source : Field Survey (2004)

As mentioned above, the respondents in this area are member of three farmer's groups. Generally, each farmer's group has own scheduled meeting to share each other in term of their experience, problems and technical procedures of aquaculture. In accordance with this aspect, most of the respondents (58%) has attended meeting more than 10 times per month, but there are also farmers who have never attended the meeting.

During the implementation of extension program, JICA has introduced the record book to the farmer in order to make easy in evaluating the performance of their aquaculture management. Generally, farmer in this area have no record book, while the others have a simple record book (48%).

7.5.3.3. Aquaculture Technology

The cultured species in Padang Jaya are common carp and Nile tilapia. Seed production and nursery of both species are usually carried out in stagnant water pond or paddy field, while grow-out activity is conducted in all type of ponds and paddy field. According to the interview and site visit, farmers fill water in their ponds and drain water from their ponds without using pumps. The ponds located in sloping area where water can be drained completely using gravitation power, even depth of the water shallower than 1 m. Porosity of the earth ponds is not porous. Source of water, to supply the ponds, is irrigation channel. Water flow rate is enough to fulfill the pond, although some farmers feel lacking of water in dry season. From water quality point of view, water is fertile.

In general, before starting of aquaculture activities, farmers usually prepare pond including rehabilitating, drying, fertilizing and liming. Drying the pond is proposed to clean toxic substances, harmful aquatic organisms and prevent from the diseases. To stimulate growth of natural food some farmers fertilize and/or manure nursery pond before stocking fish. Manures used are chicken or cow manure, while inorganic fertilizer used are urea and triple super phosphate.

Seed production

According to the interview and site visit, total pond areas that each seed producer own vary between 0.25-2.0 Ha. Breeding of fish is conducted in ponds. Pond type used depends on breeding habit of fish. In case of common carp, spawning is carried out in special pond with the size of 40-75 m^2 and attributed with a material consists of dry grass which play a role as egg collector like kakaban. The eggs attached in the grass are then transferred to other pond for hatching the eggs and nursing the larvae. Alternatively, the farmers use the same pond not only for spawning fish but also for hatching and nursing larvae for 5 days, after then the fries are transferred to other nursery ponds of the size at least 100m^2. Besides stagnant water ponds, some of farmers use paddy field as rearing pond.

Breeding of Nile tilapia uses the same pond of the size more than 100m^2 for all activities starting from spawning breeder up to rearing larvae. Some farmers also prefer to spawn breeders and rearing larvae in paddy field.

Number of common carp female used in each seed production cycle is 1-3 fish (2-4 kg/fish) and male 5-10 fish (0,5-2 kg/fish), while that of Nile tilapia female is 15-200 fish (0,5 kg/fish) and male 5-60 fish (0,5 kg/fish). Fish rearing period ranges from 15 to 75 days per cycle with production of 15,000 – 30,000 seeds of Nile tilapia and 15,000 – 100,000 seeds of common carp depending on the farmer's skill and condition of the ponds.

Nursery

As mentioned before, three respondents in Padang Jaya sub district are focused in the nursery activity only. In this activity, nursery farmer uses earth pond or paddy field with the total area of 500-2,500 m^2. The dimension of the pond ranges from 10x20x1 m to 30x30x0.75 m, while for paddy field ranges from 15x20x1 m to 10x 30x0.75 m.

Stocking density for rearing common carp is from 5,000 to 40,000 seeds per pond, while that of Nile tilapia is from 500 to 7,000 seeds per pond. Fish farmers feed fish mainly commercial pellet, sometimes they also feed fish rice bran and/or corn meal even though they don't calculate adequate feeding rate based on existing fish biomass in pond. Most of the farmers feed fish every day during rearing period which is from 20 to 60 days depending on the stocking size and expected harvesting size. In other words, the farmer can operate the nursery activity 4-10 cycles in a year. There are two categories of expected harvesting size in this activity i.e. 5-7 cm and 8-12 cm in total length. Based on these sizes, number of fish produced per cycle both common carp and Nile tilapia is 15,000 – 40,000 fish.

Grow-out

Grow-out activity in Padang Jaya is commonly carried out in whether stagnant water pond or running water pond. There is no farmer in this area use cage and floating net cage as found in other model extension areas like Jambi or West Sumatera. Total stagnant water pond area each grower owns varies between 300 to 2,500 m2 with the dimension of pond 10x20x1 m – 40x25x1 m for earth pond type and 5x20 x1 m – 20x20x1 m for paddy field type. On the other hand, dimension of running water pond type is basically same among farmers i.e. 8x4x0.75 m.

Stocking density for growing common carp using stagnant water pond and paddy field is from 2,000 to 5,000 fish per pond, while for Nile tilapia is from 4,000 to

5,000 fish per pond. Fish farmers feed fish mainly commercial pellet, sometimes they also feed fish rice bran and/or corn meal even though they don't calculate adequate feeding rate based on the existing fish biomass in pond. Most of the farmers feed fish every day during growing period that varies from 40 to 90 days to reach 200 gr. per fish for Nile tilapia or 400 gr. per fish for common carp with total biomass of 400 – 900 kg. Farmer can operate 3-5 cycles growing activity in a year.

In case of growing in running water pond, stocking density varies from 2,500 to 5,000 fish per pond both of common carp and Nile tilapia. All running water pond farmer use only commercial pellet to feed fish both for common carp and Nile tilapia. Generally, they use 1,500 – 4,000 kg of pellet per pond for 60 – 90 days of growing period to produce 1,000 – 2,000 kg of 200 gr. per fish of Nile tilapia or 400 gr. per fish of common carp. Number of production cycle per year in running water varies between 3-4 times.

7.5.3.4. Rating of Aquaculture Technology

Broodstock Management and Seed production

Based on the analysis of the respondents who doing seed production, most of them in the District of North Bengkulu (61% from all number of fish farmer respondents) don't sort broodstock, and mix up the broodstock with several species' broodstock in a same pond. Furthermore, fish farmers don't feed broodstock sufficiently. Around 18% of seed producers sort broodstocks by fish species, without separating the fish by size and generation and feed the broodstocks sufficiently. There is only 3% of seed producers can practice broodstock management according to sex and generation and manage broodstock to spawn on their planned schedule.

The goal of seed production is that fish farmers can practice spawning and hatching by effective and appropriate methods. Fish farmers can make effective and sustainable fish culture production on their planned schedule. On the basis of the survey results, most of the respondents (52%) can practice spawning and hatching, but practice them irregularly without any planned schedule. Around 3% of the respondents can produce high quality seeds with standardized size, and obtain 60% or higher survival rate of fish seeds from larval stage to harvest size. Table 7-57 show the rating achievement of fish farmer respondents answered on broodstock management and seed production categories in North Bengkulu District.

Table 7-57. Rating on Achievement of Broodstock Management and Seed Production of the Farmers Respondent answered in North Bengkulu Disctrict

	Rating Achievement					
	20%	40%	60%	80%	100%	Total Answered
Broodstock Management Category						
Persons	6	4	1	2	0	13
Percentage	46	31	8	15	0	
Seed Production Category						
Persons	6	4	1	2	0	13
Percentage	46	31	8	15	0	

Source: Field Survey September-October 2004

Feeding Management and Fish Nutrition

The goal of feeding management is that fish farmer can understand proper feeding rate, and practice regular feeding activities in proper feeding method. In North Bengkulu District, most of the respondents (45%) can calculate feeding rate based on stocking density of cultured fish. Fish farmer understand daily feeding rate correctly to practice appropriate feeding quantity everyday. 6% of the respondents have good knowledge in feeding management as they can calculate feed conversion rate and production cost on the basis of feeding quantity and body weight upon harvesting on the basis of their records, and make production plan for fish culture by themselves.

As for their knowledge on fish nutrition, analysis results reveal that most of the respondents (86%) with score level 20% (know how to keep standard quality feed in stable and store the feed in proper method). Table 7-58 show the rating achievement of fish farmer respondents answered on feeding management and fish nutrition categories in North Bengkulu District.

Table 7-58. Rating Achievement of Feeding Management and Fish Nutrition Categories of Fish Farmer Respondents answered in North Bengkulu District

	Rating Achievement					
	20%	40%	60%	80%	100%	Total Answered
	Feeding Management Category					
Persons	1	10	14	0	2	27
Percentage	4	45	64	0	9	
	Fish Nutrition Category					
Persons	1	24	3	0	0	28
Percentage	4	86	11	0	0	

Source : Field Survey September-October 2004

Fish Disease and Water management

On the basis of the survey results, most of the respondents (38%) can identify some kinds of fish diseases, and take necessary measures to prevent fish diseases, such as bacteria, fungi and parasites. Around 2% of the respondents can practice simple diagnosis and proper treatment to infected fish when some symptoms of fish diseases appear

The goal of water management is that fish farmer can understand water quality factors, such as DO, pH and water temperature. Fish farmer can practice water monitoring with paying attention to fish culture circumstances. In accordance with this aspect, most of the respondents (65%) have understood basic water quality factors (DO, pH, water temperature). Around 29% of the respondents can measure basic water-quality factor, and 6% of the respondents don't understand about the water quality factors and can not practice any water quality measurement. Table 7-59 show the rating achievement of fish farmer respondents answered on broodstock fish disease and water management categories in North Bengkulu District.

Table 7-59. Rating Achievement of Fish Disease and Water Management Categories of Fish Farmer Respondents answered in North Bengkulu District

	Rating Achievement					
	20%	40%	60%	80%	100%	Total Answered
	Fish Disease Category					
Persons	4	5	12	5	2	28
Percentage	14	18	43	18	7	
	Water Management Category					
Persons	26	6	0	0	0	32
Percentage	81	19	0	0	0	

Source : Field Survey September-October 2004

General culture control and Total fish culture management

On the basis of the survey results, most of the respondents (41%) can select appropriate fish species in accordance with surrounding environment, and keep minimum level of water quality required for fish culture.

Around 22% of the respondents can understand fish culture types and characteristics of their facilities and equipment suitable for surrounding environments and fish species, and build their facilities in correct designs for fish culture.

Based on the answers of the respondents who doing total fish culture management, most of the respondents (58%) have known rough figures of management condition, such as production at harvest; however, they do not know their accurate profit from fish culture because they do not practice exact planned production.

Around 21% of the respondents do not know their management condition of fish culture business. Table 7-60 shows the rating achievement of fish farmer respondents answered on general culture and total fish culture management categories in North Bengkulu District. Total rating of aquaculture assessment is presented in Figure 7-9.

Table 7-60. Rating Achievement of General Culture and Total Fish Culture Management Categories of the Farmer Respondents answered in North Bengkulu District

	Rating Achievement					
	20%	40%	60%	80%	100%	Total Answered
	General Culture Management Category					
Persons	3	13	5	7	0	28
Percentage	11	46	18	25	0	
	Total Fish Culture Management Category					
Persons	19	4	3	0	0	26
Percentage	73	15	12	0	0	

Source : Field Survey September-October 2004

7.5.3.5. Socio-Economic Assessment

Main Job and Gross Income

Similar to other model extension areas mentioned above, agricultural farming is the main job of the most of fish farmers in the North Bengkulu model extension area. According to results from the field survey, 58% of the total 33 respondents (sample population) have agricultural farming as their main job. This is followed by the group of fish farmers who have fisheries (aquaculture) as the main job as revealed from 13 person (39%) of the total. Table 7-61 shows the detailed structure of fish farmers classified by type of main job.

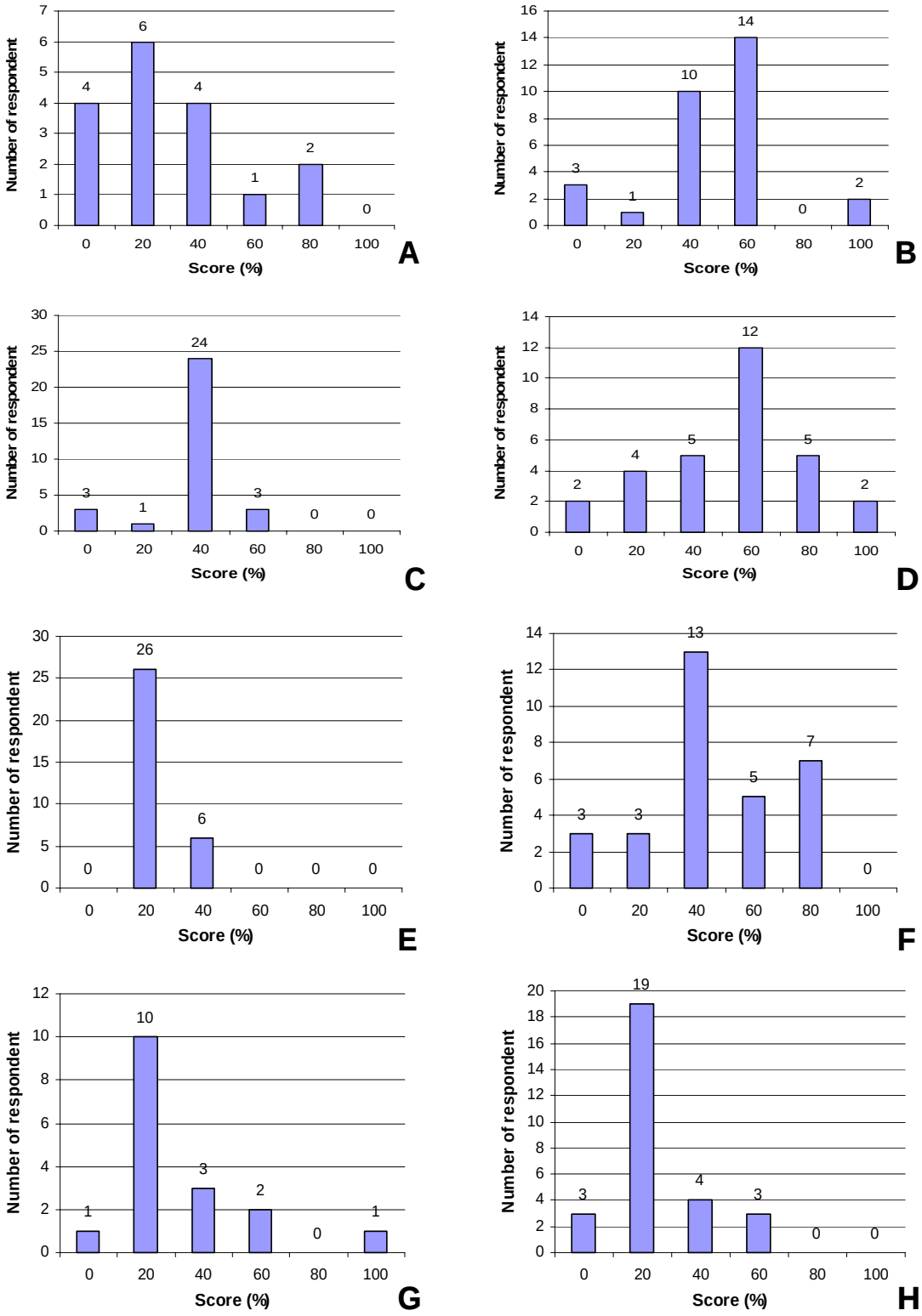


Figure 7-8. Aquaculture Technology Rating of Respondents in North Bengkulu

Note:
A. Brood stock management
B. Feeding management
C. Fish nutrition
D. Fish diseases
E. Water management
F. General culture control
G. Seed production
H. Total fish culture management

Table 7-61. Main, 2nd, and 3rd Job of the Respondents in the North Bengkulu Model Extension Area

	Type of Job						
	Fish Farm	Rubber Farm	Agriculture	Trader	Govern. Employee	Others	Total Answered
Main Job	13 (39)	0	19 (58)	1 (3)	0	0	33
2nd Job	17 (52)	0	7 (21)	5 (15)	0	4 (12)	33
3rd Job	1 (8)	0	7 (58)	4 (33)	0	0	12

Source : Field Survey September-October 2004
Note : Number in the bracket refers to its percentage

In terms of indicator of gross income, the group of fish farmers whose gross income is less than Rp. 500,000 per month is dominating the total sample population in North Bengkulu model extension area. It can be seen from the results of the survey that there are 12 persons of the 29 respondents (42%) whose gross income less than Rp. 500,000 per month. In this district, the other groups of farmers whose gross income in the range of Rp. 500,000 – Rp. 1,000,000 per month (8 persons or 27%), and more than Rp. 1,000,000 per month (9 persons or 31%) are also seen. Detailed number of surveyed fish farmers classified by their gross income per month can be seen in Table 7-62.

Table 7-62. Number of Respondents by their Gross Income in the North Bengkulu Model Extension Area

	Gross Income per Month				
	< 500,000	500,000-1,000,000	1,000,000-5,000,000	> 5,000,000	Total Answered
Persons	12	8	7	2	29
Percentage	42	27	24	7	

Source : Field Survey September-October 2004

It was found that the situation of total income of the respondents is relatively stagnant to increasing. It can be revealed from the survey that about 63% of the total answered respondents (17 persons) mentioned increasing contribution of aquaculture income during the last 2-3 years. There are 10 persons or 37%, however, who indicating stagnant total income. Situation of gross income indicator during the last 2-3 years in the North Bengkulu model extension area is presented in Table 7-63.

Table 7-63. Situation of Contribution Income from Aquaculture in the North Bengkulu Model Extension Area

Situation of Contribution of Aquaculture Income to Total Income during the last 2-3 years	Person	Percentage
Increased more than double	0	0
Increased less than double	17	63
Stable/Stagnant	10	37
Decreased	0	0
Total	27	100

Source : Field survey September-October 2004

Contribution of Income from Aquaculture and Fish Production During the Last 2-3 Years

From Table 7-22 we can see that of the 30 respondents (sample population), there are 11 persons (36%) whose income is from aquaculture occupies 30% or higher in their gross income. In the case of the other 19 respondents (64%), income from aquaculture in their gross income is less than 30%. Table 7-64 presents the detailed structure of fish farmers in North Bengkulu model extension area.

Table 7-64. Number of Respondents Classified by Freshwater Aquaculture Contribution to their Income in the North Bengkulu Model Extension Area

	Range of Contribution of Income From Freshwater Aquaculture					
	< 10%	10-30%	30-50%	50-70%	> 70%	Total Answered
Persons	2	9	5	9	5	30
Percentage	6	30	17	30	17	

Source : Field Survey September-October 2004

The survey results reveal that the situation of contribution of aquaculture to total income of the respondents is relatively stagnant to increasing. It also reveals that about 67% of the total answered respondents (18 persons) mentioned increasing contribution of aquaculture income during the past 2-3 years. There are 9 persons or 33% who indicating a stable contribution of aquaculture to total income. Situation of gross income indicator during the last 2-3 years in the North Bengkulu model extension area is presented in Table 7-65.

In terms of production trend during the last 2-3 years, it can be indicated that most of fish farmers in this model extension area have been able to increase their production even though less than double.

Table 7-65. Situation of Contribution Income from Aquaculture in the North Bengkulu Model Extension Area

Situation of Contribution of Aquaculture Income to Total Income during the last 2-3 years	Person	Percentage
Increased more than double	0	0
Increased less than double	18	67
Stable/Stagnant	9	33
Decreased	0	0
Total	26	100

Source : Field survey September-October 2004

Table 7-66 shows that there are 4 persons (13%) of the total 30 respondents have been able to increase the production more than double, but most of them (60% of the total sample population) increase the production by less than double. From the result we also found that there are 3 persons or 11% who have negative tend of production, meaning that their production has been decreasing in the past 2-3 years.

Table 7-66. Number of Respondents Classified by Their Production of Freshwater Aquaculture in the North Bengkulu Model Extension Area

	Condition of Fish Production During the last 2-3 years					
	Increase Double	Increase less than Double	Stagnant	Decrease less than Double	Double Decrease	Total Answered
Persons	4	18	5	1	2	30
Percentage	13	60	16	4	7	

Source: Field Survey September-October 2004

Family Goods and Initial capital for aquaculture

As mentioned in the beginning of this part, family assets which refer to a set of goods can be used in assessing family welfare. In this study, a set of goods refers to 7 (seven) items of assets i.e. bicycle, motorbike, refrigerator, washing machine, television, generator set, hand phone, play station and VCD/DVD player. It is assumed that more items fish farmers have wealthier the fish farmers are.

The survey results show that most of fish farmer households in North Bengkulu model extension area have 3-4 items listed above. As presented in Table 7-67, there are 16 persons or 56% of the total sample population have 3-4 items of the items, while the other fish farmers have 1-2 items (9 persons or 32%). It is also found that there are only 3 persons (11%) who have more than 4 items of goods in the case if the North Bengkulu model extension area.

Table 7-67. Number of Respondents Classified by Their Household goods and Assets in the North Bengkulu Model Extension Area

	Condition of household goods of fish farmer household					
	Have only one Items	Have two Items	Have Three Items	Have four Items	Have more than four Items	Total Answered
Persons	4	5	10	6	3	28
Percentage	14	18	36	21	11	

Source : Field survey September-October 2004

As well as the cases of Bungo and Batanghari model extension areas, most of the fish farmers in North Bengkulu model extension area use outsourcing initial capital for starting aquaculture activities. According to the survey results there are 25 respondents (89%) who using outsourcing initial capital, while only 3 respondents (11%) using their own capital (Table 7-68).

Table 7-68. Number of Respondents Classified by the Source of Initial Capital for Aquaculture in the Bengkulu Model Extension Area

	Source of initial capital for aquaculture activities		
	Debt	Own Capital	Total Answered
Persons	25	3	28
Percentage	89	11	

Source : Field survey September-October 2004

7.5.3.6. Rating of Socio-Economics Assessment

In this district, socio-economics situation of fish farmers can be categorized into moderate level due to the variation of score among indicators. There are some indicators which have low score, and also some indicators have high score. Judging from indicator of gross income per capita, contribution of aquaculture income, and saving/debt condition, for example, we can see that score of these indicators is relatively in middle value in compare to the same indicators in North Bengkulu. The distribution of score on these indicators ranges from 20-40. From this situation we can say that overall socio-economic situation of fish farmers in North Bengkulu District can be considered as moderate level. Overall score of socio-economic indicators for fish farmers in North Bengkulu District, Province of Bengkulu is presented in Figure 7-9 below.

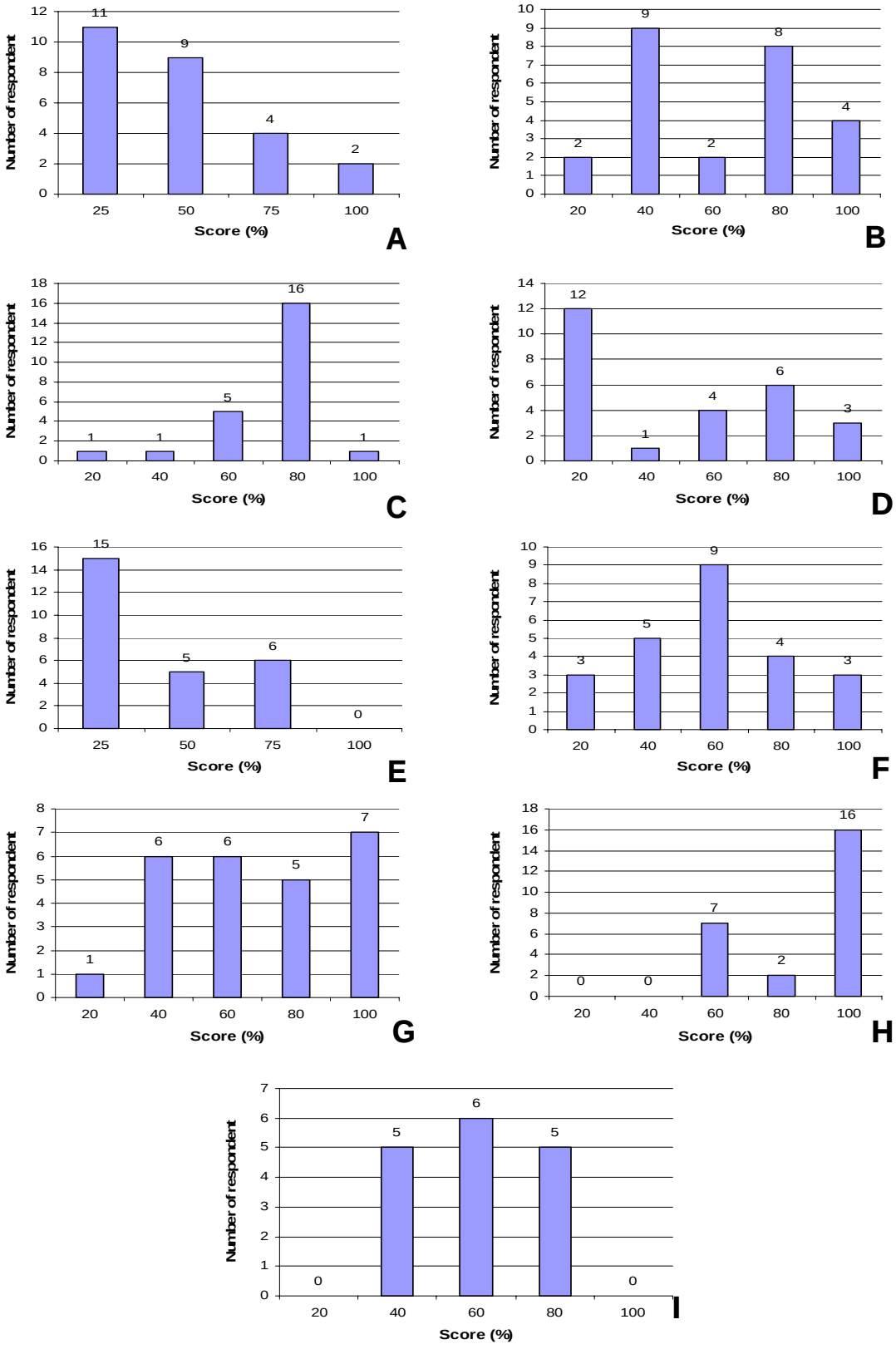


Figure 7-9. Total Rating of Socio-Economic Assessment in North Bengkulu District

Note : A. Income B. Income from fish culture C. Fish production

D. Saving/debt	E. Working hours	F. Equipment
G. Real estate	H. Health care	I. Family education

7.5.4. Kuantan Singingi District, Riau Province

7.5.4.1. General Condition of Location

Kuantan Singingi District located in southern part of Pekanbaru City, the capital city of Riau Province. The distance from Pekanbaru to Kuantan Singingi is approximately 150 km, its takes approximately 3 hours by car. The area of Kuantan Singingi district is passed by the Western trans-Sumatera Road, main road that connecting Southern and Northern part of Sumatera island. Taluk Kuantan is the capital city of Kuantan Singingi District and one among six Sub Districts belonging to the Kuantan Singingi District. The position of Kuantan Singingi as a transit area for surrounded cities makes this area possibly will develop rapidly during next five years. Based on the 2002 statistic data, the number of Kuantan Singingi population was 226,665 persons consist of 114,334 males and 112,220 females.

Geographically Kuantan Singingi District lies between 0° 00' to 1° 00' North Latitude and between 101° 02' to 101° 55' East Longitude, covered area of 7,656 km^2 with altitude of 3 - 75 m from sea level mean point of view. The climate in this area is tropical wet with the maximum temperature is 32.6 – 36.5 °C and the minimum is 19.2 – 22.0 °C. Rainfall between 43.17 – 376.50 mm/month.

Surveyed location in this district covered 3 subdistricts (Kecamatan) i.e. Pangean, Benai and Kuantan Tengah. Number, name, aquaculture practice, fish species cultured, and address, are listed in Table 7.69. The Location of each fish farmer in those areas is shown in Figure 7-10.

7.5.4.2. General Information of Fish Farmers

Number of respondents surveyed in this district was 30 persons, including breeders and raisers. Among these farmers, 14 respondents or 45 % mentioned that fish farming is their main job, while the others respondents indicated that fish farming is their second-job or hobby. For the case of fish farming is not the main job, agricultural farming is the main job for respective fish farmers.

From education point of view, most of fish farmers have high school level of education (40 %), followed by junior high school level (30 %), elementary school

(20 %) and only 10 % have higher education level such college or university. Their experiences to engage freshwater aquaculture are mostly taken from communication among community as well as from local fishery agency (Dinas Perikanan). The result of interviews indicated that 12 respondents or 40 % of total respondents mentioned that motivation to conduct freshwater aquaculture was coming from local fishery agency.

Tabel 7-69. Fish Farmers Respondent in Number, Name, Aquaculture Practice, Fish Species Cultured, and Address; in Kuantan Singingi Extension Model Area

No	Code	Name	Speciality of farmer	Address	
				Desa	Kecamatan
1	KSN01	Darwin	H/N/G: nile	Pasar Baru	Pangean
2	KSN02	Asmar	G: GIFT nile	Pasar Baru	Pangean
3	KSN03	Yuhardi	G: GIFT nile	Pasar Baru	Pangean
4	KSN04	Ilham	G: GIFT nile	Pasar Baru	Pangean
5	KSN05	Ihsan	G: GIFT nile	Pasar Baru	Pangean
6	KSN06	Islah	H/N/G: GIFT nile	Koto	Pangean
7	KSN07	Abdul Khadir	H: nile. G: GIFT nile, Com.carp	Koto	Pangean
8	KSN08	Sudirman	H/G: GIFT nile	Koto	Pangean
9	KSN09	Almiza	H/G: GIFT nile	Koto	Pangean
10	KSN10	Yasmin	H/N, G: GIFT nile	Koto	Pangean
11	KSN11	Hamdan	G: GIFT nile	Koto	Pangean
12	KSN12	Usmeri	H: nile. G: GIFT nile, Com.carp	Koto	Pangean
13	KSN13	Sarlis	H: nile. G: GIFT nile, Com.carp	Koto	Pangean
14	KSN14	Nur Hasan	G: GIFT nile	Penghijauan	Pangean
15	KSN15	Muis	G: GIFT nile	Pasar Baru	Pangean
16	KSN16	Rabana	H/G: GIFT nile	Pasar Baru	Pangean
17	KSN17	Bahmar	G: GIFT nile	Pasar Baru	Pangean
18	KSN18	Ahmad	G: GIFT nile	Pasar Baru	Pangean
19	KSN19	Yanto	G: GIFT nile	Tebing Tinggi	Benai
20	KSN20	Mulisman	G: GIFT nile	Tebing Tinggi	Benai
21	KSN21	Marlius	G: GIFT nile	Tebing Tinggi	Benai
22	KSN22	Paleri (Hery)	H/N/G: GIFT nile	Tebing Tinggi	Benai
23	KSN23	Hanafi	G: GIFT nile, catfish	Tebing Tinggi	Benai
24	KSN24	Kanadis	G: GIFT nile, patin	Munsalo	Kuantan Tengah
25	KSN25	Yarlis	G: GIFT nile, Com.carp	Pasar Baru	Pangean
26	KSN26	Radiah	G: GIFT nile	Pasar Baru	Pangean
27	KSN27	Osamsari	G: GIFT nile	Munsalo	Kuantan Tengah
28	KSN28	Rajuski	G: GIFT nile	Munsalo	Kuantan Tengah
29	KSN29	Daruwisi	G: GIFT nile	Munsalo	Kuantan Tengah
30	KSN30	A. Haris	G: GIFT nile	Munsalo	Kuantan Tengah

Note : H : Hatching; N : Nursering; G : Grow Up
Source : Field Survey (October 2004)

General information is the training experience. From survey, we can reveal that

57 % of respondents got special training from local fishery agency, JICA or other institution related to aquaculture. Some topics of training are including fish disease, raising fish, etc. Furthermore, 17 respondents or 57 % are fish breeders and growers, the other respondents are whether only breeding activities or mixed aquaculture activities (breeding, raising and growing).

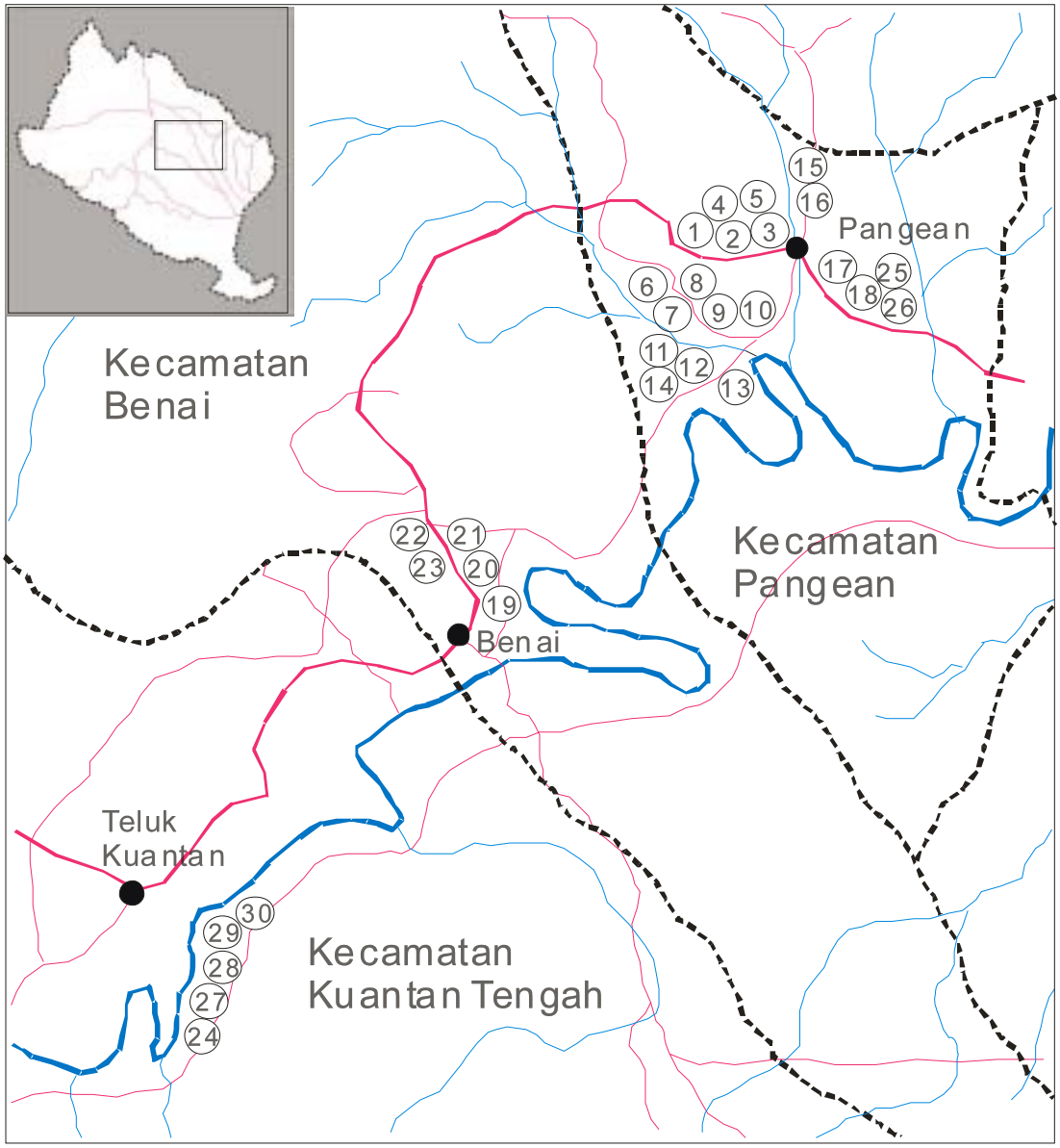


Figure 7-10. Location map of Respondents in Kuantan Singingi District, Riau Province

7.5.4.3. Aquaculture Technology

The data survey in extension model area of Kuantan Singingi District give the information are the fish species has cultured is only Nile tilapia. These fish have

reared in stagnant water ponds, the farmers who involved in freshwater aquaculture can be divided into three main types : seed producers, nursery, and grow-out.

Seed production

The sizes of pond area belong to each seed production farmer between 482 m^2 – 1,000 m^2. Breeding of fish is conducted in ponds. Breeding of Nile tilapia did not need special pond. All activities, starting from spawning the breeder up to rearing the larva, are carried out in one type pond, with the size more than 100 m² areas.

According to the interview and site visit, the ponds fill without using pumps and drainage the ponds without using pumps, too. The ponds located in sloping area which cause water pond can be drained completely using gravitation power, even depth of the water up to 1 m. Porosity of the earth ponds is not porous. Source of water is irrigation channel, water debit is enough to fulfill of the pond.

Number of female breeder is used in each cycle 0,5 - 1 kg/fish. Spawning of the breeders and incubating of the egg are carried out in one pond at the size of 482 – 1,000 m². In this pond, hatched larvae are reared as long 3-5 days. After that the larva are harvested and moved to nursery pond. Area of used nursery pond ranged between 100-500 m² per cycle of the nursing.

The rearing pond is prepared before stocking of the larva. The activities include drying and rehabilitating the pond, fertilizing and inundating. Drying pond is proposed to clean toxic substance, harmful aquatic organism and prevent diseases. During the drying, pond structures, such as embankment and harvesting ditch are repaired. To stimulate growth of natural food some farmers fertilize and/or manure the nursery pond before larvae stocked. The manure used is cow dung; while inorganic fertilizer is used is urea and TSP.

After pond is inundated with water during 1-15 days, then, 3-7 days-old larva are stocked. During fish rearing, some farmer spread rice bran over the pond to maintain natural food in a proper abundance. A period of rearing fish is 21 - 80 days per cycle of the nursing. Harvested fish is estimated to be 1,000 – 20,000 per cycle of production.

Nursery

Total pond area belongs to each production grow-out in stagnant ponds farmer between 48 – 2,000 m^2. The ponds fill the water without using pump and drainage the ponds without using pump, too. The ponds located in sloping area which cause water pond can be drained completely using gravitation power, even depth of the water up to 1 m. Porosity of the earth ponds is not porous. Source of water, to supply the ponds, is irrigation channel. Water debit is enough to fulfill need of the pond, although some farmers feel lacking of the water at dry season. In point of view water quality, the water is fertile.

Number of production cycle per year 3 - 5 times, pond area used in each cycle production 438 – 1,844 m^2. Production per cycle is 2,400 – 12,500 fishes.

Grow-out

Total pond areas belong to each production grow-out in stagnant ponds farmer between 48 – 2,000 m^2. The ponds fill the water without using pump and drainage the ponds without using pump, too. The ponds located in sloping area which cause water pond can be drained completely using gravitation power, even depth of the water up to 1 m. Porosity of the earth ponds not porous. Source of water, to supply the ponds, is irrigation channel. Water flow rate is enough to fulfill need of the pond, although some farmers feel lacking of the water at dry season. In point of view water quality, the water is fertile.

Number of production cycle per year 2 - 12 times, pond area used in each cycle production 438 – 1,844 m^2. Productions per cycle are 70 – 200 kg.

7.5.4.4. Farmers Rating of Aquaculture Technology

Broodstock Management and Seed Production Categories

There was 8 farmers from 30 farmers respondent has activity as the fish seed producer. From the eight farmers we analyzed the rating in broodstock management, but for the seed production rating only 7 farmers we analyzed, based on the number of respondent answered (Table 7-70)

In broodstock management category rating there was 2 farmers be at position of achievement 20 %, 2 farmers at 40 %, a farmer at 60 %, and 3 farmers the achievement position at 80 %. There is no fish farmer in position achievement

100 %. Rating for seed production category the result is a farmer at position of achievement is 20 %, and 6 farmers at 80 %.

Table 7-70. Rating on Achievement of Broodstock Management and Seed Production of the Farmers Respondent answered in Kuantan Singingi District

	Rating Achievement					
	20%	40%	60%	80%	100%	Total Answered
Broodstock Management Category						
Persons	2	2	1	3	0	8
Percentage	25,0	25,0	12,5	37,5	0	
Seed Production Category						
Persons	1	0	0	6	0	7
Percentage	14,3	0	0	85,7	0	

Source: Field Survey September-October 2004

Feeding Management and Fish Nutrition Categories

There was 22 farmers respondent has answered the question about feeding management category, and for the question about fish nutrition category there was 19 farmers. From both that respondent answered, we analyzed to known the achievement of farmers rating for each category (Table 7-71).

The analyze results is most of fish farmers respondent in District of Kuantan Singingi be at position of achievement 60 % for feeding management category (its mean the condition of fish farmers is can calculate feeding rate according to stocking quantity of cultured fish, and fish farmers understand daily feeding rate correctly to practice appropriate feeding quantity everyday); and most farmers at position of 40 % in fish nutrition category (Fish farmers have a way to keep standard quality of feed without feed storage).

Table 7-71. Rating Achievement of Feeding Management and Fish Nutrition Categories of Fish Farmer Respondents answered in Kuantan Singingi District

	Rating Achievement					
	20%	40%	60%	80%	100%	Total Answered
	Feeding Management Category					
Persons	4	3	7	3	5	22
Percentage	18,2	13,6	31,7	13,6	22,7	
	Fish Nutrition Category					
Persons	2	12	3	1	1	19
Percentage	10,5	63,1	15,8	5,3	5,3	

Source : Field Survey September-October 2004

Fish Disease and Water Management Categories

Fish disease category rating achievement be analyze to known the degrees (in %) of the fish farmers knowledgement and skill to prevent of fish disease. Analyzed of water management category is to known what are the farmers understand about the water quality factors (as DO, pH, Water Temperature) and how are the farmers can practice water monitoring with paying attention to fish culture circumstance (Table 7-72).

On the basis of the survey results, from the 16 fish farmers respondent answered on disease category, that most of fish farmers in District of Kuantan Singingi be at position of achievement 60 %, is it mean the condition of fish can identify some kinds of fish diseases, and take necessary measures to prevent fish diseases, such as bacteria, mold and parasites.

The farmers respondent answered for water management category is 23 farmers, that most of fish farmers be at position of achievement are 20 %, its mean most the farmers have understood the basic water quality factors.

Table 7-72. Rating Achievement of Fish Disease and Water Management Categories of Fish Farmer Respondents answered in Kuantan Singingi District

	Rating Achievement					
	20%	40%	60%	80%	100%	Total Answered
	Fish Disease Category					
Persons	3	1	6	6	0	16
Percentage	8,75	6,25	37,50	37,50	0	
	Water Management Category					
Persons	17	6	0	0	0	23
Percentage	73,9	15,1	0	0	0	

Source : Field Survey September-October 2004

General Culture Control and Total Fish Culture Management Categories

Final achievement level of general culture control is the fish farmer can maintain their facilities properly according to the environmental condition, and attain sustainable and efficient fish culture production. In total fish culture management, final achievement level is the farmer can keep record of fish culture activities and calculate production cost; and fish farmer can make their fish culture production plan considered of harvest time, and can practice fish production as planned.

The survey results (Table 7-73), that most of fish farmers from the 22 fish farmers

answered the questioner are at position of achievement 80 % in general culture control (its mean the condition of most fish farmers can understand kinds and characteristics of their facilities suitable for surrounding environments and fish species. And build their facilities by correct designs for fish culture. In total fish culture management, most of the farmers in this district are at 20 % level, it is mean the most fish farmer in this district have known rough figures of management condition, such as production harvest; however, they don't know their accurate profit from fish culture because they don't practice exact planned production. The Rating Achievement of General Culture and Management Categories from the Farmers Respondents answered in Kuantan Singingi, completed as shown in Figure 7-11.

Table 7-73. Rating Achievement of General Culture and Management Categories of the Farmer Respondents answered in Kuantan Singingi District

	Rating Achievement					
	20%	40%	60%	80%	100%	Total Answered
	General Culture Management Category					
Persons	2	1	1	18	0	22
Percentage	9,1	4,5	4,5	81,9	0	
	Total Fish Culture Management Category					
Persons	14	5	1	0	0	20
Percentage	70,0	25,0	5,0	0	0	

Source : Field Survey September-October 2004

7.5.4.5. Socio Economic Condition of The Farmers Respondent

Main Job and Gross Income

According to results from the field survey, it is revealed that aquaculture or fish farming is not the main job of the fish farmer surveyed. From results of survey we can see that percentage of fish farmers who have fish farming as their main job is only 17 % (5 persons) of total sample population. Most of them have agricultural farming such as rubber farming (40 % or 12 persons) and paddy or palm oil farming (13 % or 4 person) as their main job. The other type of main job is trader (3 % or 1 person), government employee (13 % or 4 persons), and other job as of 13 % or 4 person. Detailed type of the main, second and third job of the surveyed respondents in District of Kuantan Singingi is presented in Table 7-74.

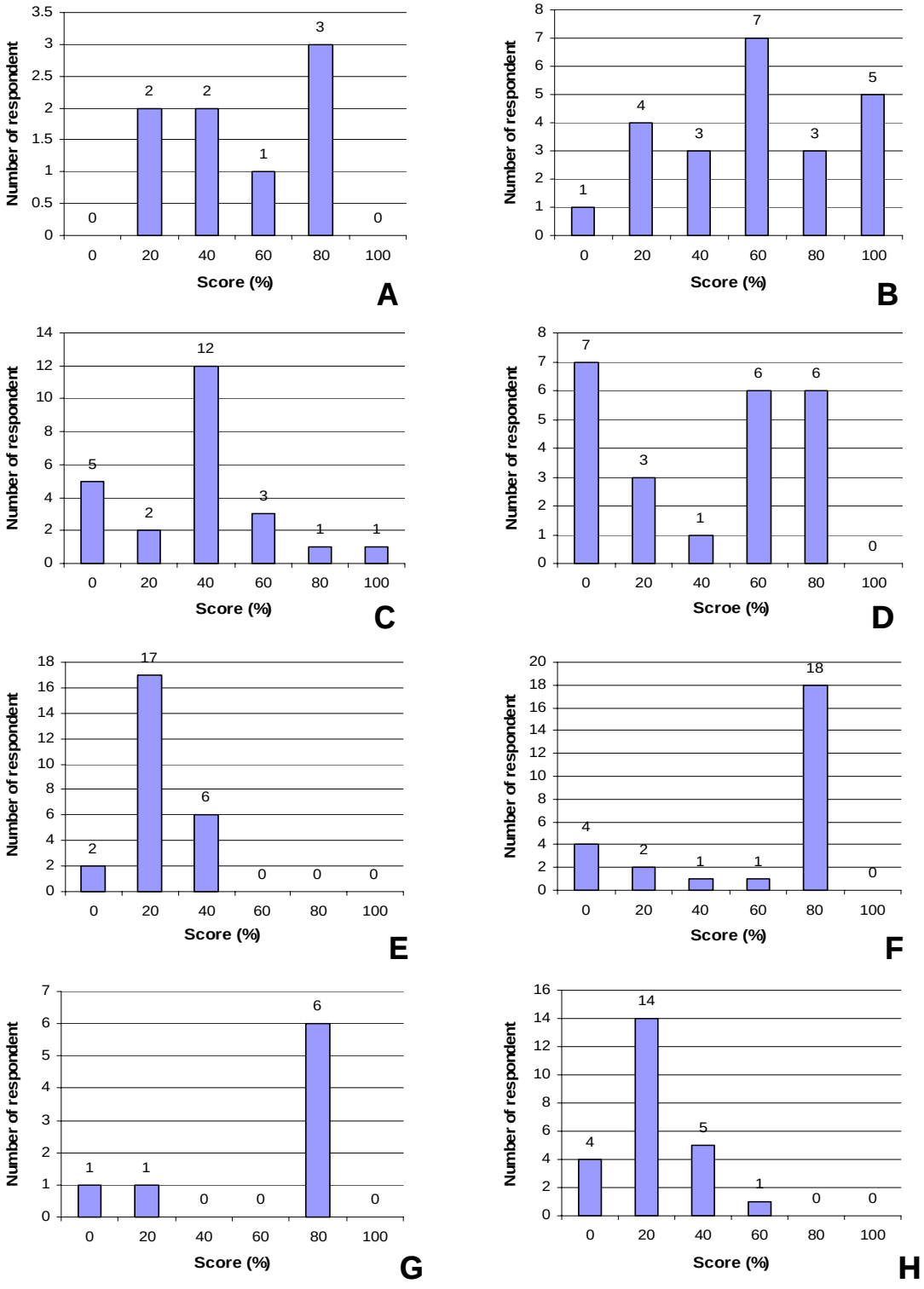


Figure 7-11. Aquaculture Technology Rating of Respondents in Kuantan Singingi District

Note : A. Brood stock management
B. Feeding management
C. Fish nutrition
D. Fish diseases
E. Water management
F. General culture control
G. Seed production
H. Total fish culture management

Table 7-74. Number of Respondent In Their Main, 2nd, and 3rd Job in the Kuantan Singingi Model Area

	Type of Job						
	Fish Farm	Rubber Farm	Other Farm	Trader	Govern. Employ	Others	Total Answered
Main Job	5 (17)	12 (40)	4(13)	1(3)	4(13)	4(13)	30
2nd Job	21(78)	1(4)	1(4)	3(11)	0	1(4)	27
3rd Job	3(33)	0	3(33)	0	0	3(33)	9

Source : Field Survey August-October 2004
Note : Number in the bracket refers to its percentage

Different with the case of fish farmers in Bungo model area, fish farmers in Kuantan Singingi district could be said having higher monthly gross income. This can be seen from the baseline survey that about 68 % of total sample population has the range of gross income of Rp. 500,000 – Rp. 5,000,000 per month. There are only 8 persons of 29 respondents (28 %) have gross income less than Rp. 500,000 per month. The other respondents have gross income within the range of Rp. 500,000-Rp. 1,000,000 (10 persons or 34 %) and the range of Rp. 1,000,000-Rp. 5,000,000 per month (10 persons or 34 %). Detailed number of surveyed fish farmers according to their gross income per month is presented in Table 7-75 below.

Table 7-75. Number of Respondent by their Gross Income in the Kuantan Singingi Model Area

	Gross Income per Month				
	< 500,000	500,000-1.000.000	1.000.000-5.000.000	> 5.000.000	Total Answered
Persons	8	10	10	1	29
Percentage	28	34	34	3	

Source: Field Survey August-October 2004

From survey results it was revealed also that the situation of total income is relatively increasing during the last 2-3 years. It can be revealed from the survey that about 74 % of total answered respondents (20 persons) mentioned increasing total income, while 5 persons or 19 % indicating a stable total income in the same period. Situation of gross income indicator during the last 2-3 years in the Kuantan Singingi model extension area is presented in Table 7-76.

Table 7-76. Situation of Gross Income in the Kuantan Singingi Model Extension Area

Situation of Gross Income during the last 2-3 years	Person	Percentage
Increased more than double	1	4
Increased less than double	20	74
Stable/Stagnant	5	19
Decreased	1	4
Total	26	100

Source: Field survey August-October 2004

Contribution of Income from Aquaculture and Fish Production During the Last 2-3 Years

In the case contribution of aquaculture to total household income, we found that most of the fish farmers in Kuantan Singingi have a range of 10-50 % of income contribution generated from aquaculture activities. From total 26 sample population, 54 % of total sample mentioned that contribution of aquaculture income to total household income is 10-50 %. This group of fish farmers consists of 27 % or 7 persons with 10-30 % contribution and 27 % or 7 persons with 30-50 % contribution. There are only 5 persons (19 %) who have 50-70 % contribution and 1 persons more than 70%. Table 7-77 presents detailed number of fish farmers according to their contribution of aquaculture income to their total gross income.

Table 7-77. Number of Respondent Classified by Freshwater Aquaculture Contribution to their Income in the Kuantan Singingi Model Extension Area

	Range of Contribution of Income From Freshwater Aquaculture					
	< 10%	10-30%	30-50%	50-70 %	> 70%	Total Answered
Persons	6	7	7	5	1	26
%-age	23	27	27	19	4	

Source: Field Survey August-October 2004

It can be revealed from survey results that the situation of contribution of aquaculture to total income of respondents is relatively stagnant to increasing. It can be revealed from the survey that about 84 % of total answered respondents (21persons) mentioned increasing contribution of aquaculture income during the last 2-3 years. There are 3 persons or 12 % who indicating a stable contribution of aquaculture to total income. Situation of gross income indicator during the last 2-3 years in the Kuantan Singingi model extension area is presented in Table 7-78.

Table 7-78. Situation of Contribution Income from Aquaculture in the Kuantan Singingi Model Extension Area

Situation of Contribution of Aquaculture Income to Total Income during the last 2-3 years	Person	Percentage
Increased more than double	1	4
Increased less than double	21	84
Stable/Stagnant	3	12
Decreased	0	0
Total	26	100

Source: Field survey August-October 2004

Another socio-economic indicator of fisheries households is their capability to produce fish as the main goods to be sold to contribute to their total income. From the fish production point of view, it can be revealed most of the fish farmers are performing positive trend of production meaning that their production tends to be increasing. Of total 25 respondents surveyed, 60 % said that they have been able to increase fish production less than double in the last 2-3 years (Table 7-79). There are 3 persons (24 %) of total sample population who have been able to increase their production more than double, 6 persons (24 %) stagnant, and there is one person (4 %) who has a decreasing production.

Table 7-79. Number of Respondent Classified by Their Production of Freshwater Aquaculture in Kuantan Singingi Model Extension Area

	Condition of Fish Production During the last 2-3 years					
	Increase	Increase	Stagnant	Decrease	Double	Total
Persons	3	15	6	1	0	25
%-age	12	60	24	4	0	

Source : Field Survey August-October 2004

Family Goods and Initial capital for aquaculture

From the survey, we found that most of fish farmer households in Kuantan Singingi model area have more than 2 items as listed above. As can be seen from Table 7-80, of 23 persons surveyed, there are 6 persons (27 %) mentioned that they have two items of goods indicated above. Furthermore, it is also found that 22 % of total sample population or 5 persons have more than 4 items of good. From the number of fish farmers who have only one item of good (3 persons of 23 respondents or 13 %), we can conclude that in general the fish farmers in this model area have relatively good welfare compared to fish farmers in the other two model extension

areas above.

Table 7-80. Number of Respondent Classified by to Their Household goods and Assets in the Kuantan Singingi Model Extension Area

	Condition of household goods of the fish farmer household					
	Have only one Items	Have two Items	Have Three Items	Have four Items	Have more than four Items	Total Answered
Persons	3	6	2	4	5	23
%-age	13	27	10	18	22	

Source: Field survey August-October 2004

An interesting finding can be presented in terms of initial capital for engaging aquaculture activities. In Kuantan Singingi model area, most of fish farmers using their own capital when they started the aquaculture activities. This is different with the situation in other two model areas above. From the 25 persons of sample population, it is revealed that 17 persons (68 %) using their own capital while 8 persons or 32 % using outsourcing of capital such as from banks, fish farmer groups, etc. (Table 7-81). If we overlay this situation with their gross income, it can be said that fish farmers in Kuantan Singingi have relatively better financial access in terms of that they can provide their own capital to engage aquaculture activities.

Table 7-81. Number of Respondent Classified by the Source of Initial Capital for Aquaculture in the Kuantan Singingi Model Extension Area

	Source of initial capital for aquaculture activities		
	Debt	Own Capital	Total Answered
Persons	8	17	25
%-age	32	68	

Source: Field survey August-October 2004

From survey results it was revealed also that the situation of aquaculture assets of respondents is relatively stagnant to increasing. It can be revealed from the survey that about 62 % of total answered respondents (16 persons) mentioned increasing contribution of aquaculture income during the last 2-3 years. There are 9 persons or 35 % who indicating increasing aquaculture assets more than double. Situation of gross income indicator during the last 2-3 years in the Kuantan Singingi model extension area is presented in Table 7-82.

Table 7-82. Situation of Contribution Income from Aquaculture in the Kuantan Singingi Model Extension Area

Situation of Aquaculture Assets to during the last 2-3 years	Person	Percentage
Increased more than double	9	35
Increased less than double	16	62
Stable/Stagnant	1	4
Decreased	0	0
Total	26	100

Source : Field survey August-October 2004

7.5.4.6. Rating of Socio-Economic Assessment

Situation of socio-economics of fish farmers in this district is completely different with other situation in two districts described above. From the main indicators such as indicator of gross income per capita, contribution of aquaculture income, and saving/debt condition, we can see that score of these indicators is relatively higher than the same indicators in two districts above. The distribution of score ranges from 20-50 reveal that fish farmers in Kuantan Singingi District have relatively higher socio economic situation. Overall score of socio-economic indicators for fish farmers in Kuantan Singingi District, Province of Riau is presented in Figure 7-12.

7.5.5. Sawahlunto-Sijunjung District, West Sumatera Province

7.5.5.1. General Condition of Location

Sawahlunto/Sijunjujung district located in eastern of West Sumatera Province. It is extended on geographic location of 0°18'43" SL-1°41'46" SL&101°30'52" EL to 100°37'40 EL. Distance between Padang, a native town of West Sumatera Province, to Muaro Sijunjung (native town of Sawahlunto-Sijunjung District) is 111 km, Sawahlunto-Sijunjung can be gone by car as long 2 hours.

Locations surveyed in Sawahlunto-Sijunjung District include 2 Subdistricts i.e. Sumpur Kudus and Tanjung Gadang. There is 28 the respondents have been interviewed, 25 respondents are located in Sumpur Kudus and 3 respondents are located in Tanjung Gadang Sub-district.

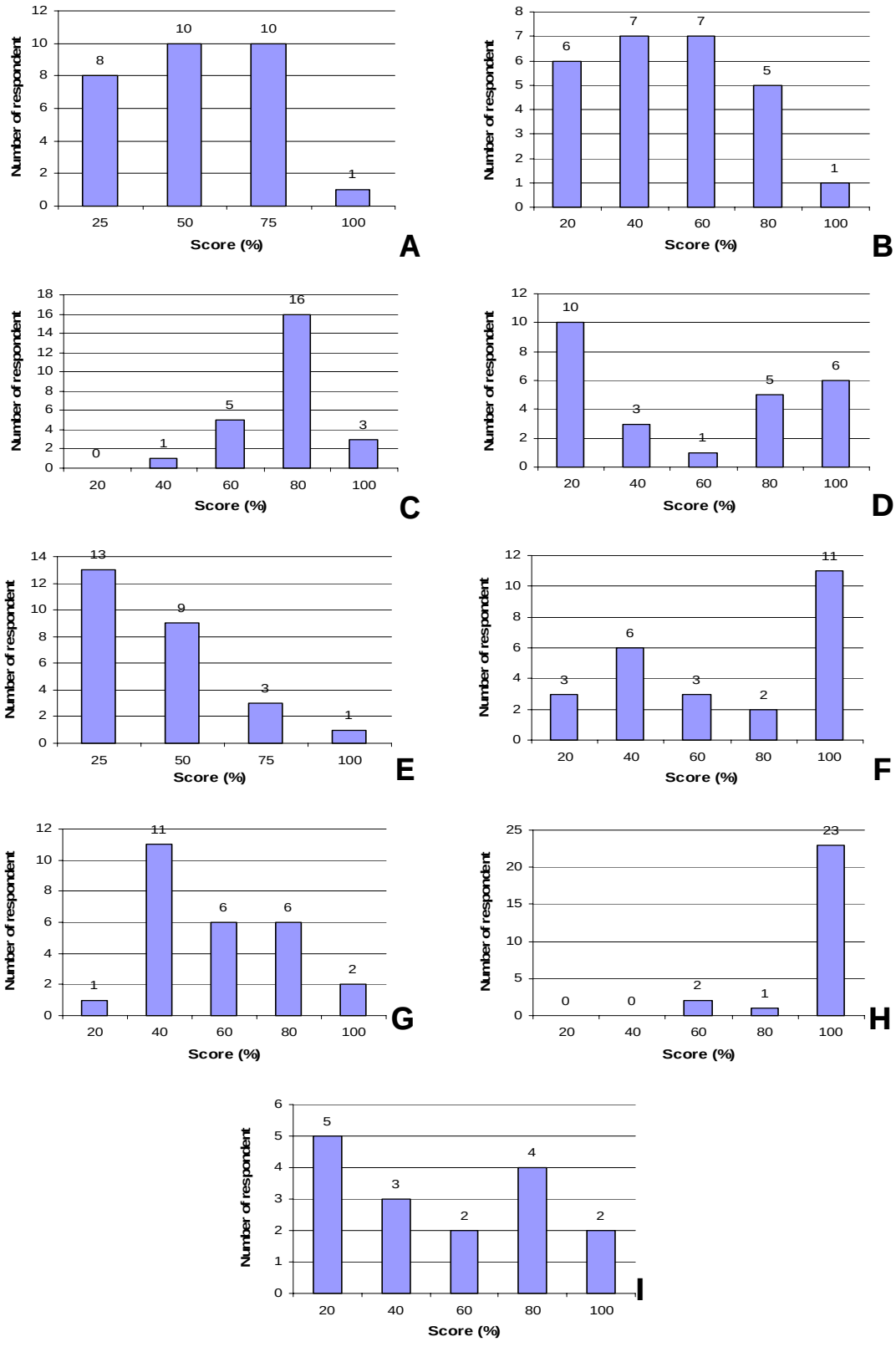


Figure 7-12. Total Rating of Socio-Economics Assessment in Kuantan Singingi

Note : A. Income B. Income from fish culture C. Fish production
D. Saving/debt E. Working hours F. Equipment
G. Real estate H. Health care I. Family education

7.5.5.2. General Information of Fish Farmer

Main job of the respondent is agricultural farming, especially paddy (61 %), followed by fish farmer (21 %). The respondents who consider culturing fish as second job are 54 % of the total respondent. This condition shows that the role of fish culture as income generates and job creating for some people in Sumpur Kudus has been established. The role fish culture as a main job in Sumpur Kudus has potency to be increased.

In the segment of education, almost half of respondent have basic education, elementary school (46%), equal with that have junior high school and senior high school degree (total 46 %). Only one respondent has bachelor degree certificate.

Fish culture technology applied by the respondent is mostly obtained from people who live in vicinity, that are parent and neighbor (42 %), and then followed from Fishery Agency (21 %). This situation related with the fact that fish culture has been along time carried out by the fish pond farmers, especially in Sumpur Kudus, and extension activity which should be done by fishery Agency seldom be done. Table 7-74 shows the list of fish farmers in Sawahlunto-Sijunjung District, while spatial location of the respondents is presented in Figure 7-13.

All respondent have experience in culturing fish. Most of respondent who breed fish mostly have experience 1 to 5 years (46 %), and then followed by responder who has experience 6-10 years. Also respondent who rear seed, to get a bigger size, and who grow out fish are dominated by the people that has experience 1 to 5 years. Some responder ever attend training program, carried out by JICA, Fishery Agency or BBAT They are 38 % of total respondent who has position as key farmers in Sumpur Kudus and Tanjung Gadang Sub-district.

Most of the respondents are joining farmers groups such as Sepakat Mandiri which recently established on May17th, 2004. Group meeting attended by some respondent vary in intensity, mostly less than 5 times (44 %), even 25 % never. However, 25 % of the respondents attend the meeting more than 10 times. 18 respondents have communicated with Fishery Agency Worker and/or Field Extension Officer related with their fish culture activity.

Table 7-81. List of the interviewed farmers in Sawahlunto Sijunjung District, West Sumatra Province

No	Code	Name	Speciality of farmer	Address	
				Name of village	Name of Sub-district
1	SBR01	Amirudin	H: Com.carp	Silantai	Sumpur Kudus
2	SBR02	Jamal	H: nile, Com.carp, tawes. N/	Silantai	Sumpur Kudus
3	SBR03	Adridal	H: Com.carp. G: tawes	Sumpur Kudus	Sumpur Kudus
4	SBR04	Amir Monti Sutan	H: Com.carp	Sumpur Kudus	Sumpur Kudus
5	SBR05	Jasril	H: Com.carp	Sumpur Kudus	Sumpur Kudus
6	SBR06	Jasrun	H: Com.carp. N: Com.carp,	Sumpur Kudus	Sumpur Kudus
7	SBR07	Pulan	H: Com.carp	Sumpur Kudus	Sumpur Kudus
8	SBR08	Patriatul	H/N: nile, Com.carp, tawes. G: Com.carp, nile	Sumpur Kudus	Sumpur Kudus
9	SBR09	Puti Dasni	H/G:Com.carp, gouramy. G:	Sumpur Kudus	Sumpur Kudus
10	SBR10	St. Suwirlan R	H/N: Com.carp. G: gouramy	Sumpur Kudus	Sumpur Kudus
11	SBR11	Suwardi	H: Com.carp, gouramy	Sumpur Kudus	Sumpur Kudus
12	SBR12	Syahrul	H: Com.carp, nile, tawes	Sumpur Kudus	Sumpur Kudus
13	SBR13	Tarmizi B	H: Com.carp. N: Com.carp, nile, tawes, catfish	Sumpur Kudus	Sumpur Kudus
14	SBR14	Enrizal	G: GIFT nile	Tampa Rungo	Sumpur Kudus
15	SBR15	Alpisriandy	H: Com.carp	Tanjung Bonai Aur	Sumpur Kudus
16	SBR16	Abdul Majid M.L	N/G: Com.carp	Tanjung Bonai Aur	Sumpur Kudus
17	SBR17	Ali Hanafiah	N/G: Com.carp	Tanjung Bonai Aur	Sumpur Kudus
18	SBR18	Handri	H/G: Com.carp	Tanjung Bonai Aur	Sumpur Kudus
19	SBR19	Helmipen	G: Com.carp	Tanjung Bonai Aur	Sumpur Kudus
20	SBR20	Jaminin	H/N, G: Com.carp	Tanjung Bonai Aur	Sumpur Kudus
21	SBR21	Nurjazali	G: Com.carp	Tanjung Bonai Aur	Sumpur Kudus
22	SBR22	Syahrial	G: Com.carp	Tanjung Bonai Aur	Sumpur Kudus
23	SBR23	Zakirman	G: Com.carp	Tanjung Bonai Aur	Sumpur Kudus
24	SBR24	Arifin	G: Com.carp	Taratak Baru	Tanjung Gadang
25	SBR25	Djisman	G: Com.carp	Taratak Baru	Tanjung Gadang
26	SBR26	Naip	G: Com.carp	Taratak Baru	Tanjung Gadang
27	SBR27	Rajo Hasan	H/N: GIFT nile	Unggan	Sumpur Kudus
28	SBR28	Simon	H/N: nile, Com.carp	Unggan	Sumpur Kudus

Note : H : Hatching; N : Nursering; G : Grow Up

Some respondent record some activity in a note book, they are cage farmers. The others, dominant (65 %), never record their activity. In view of extension, 70 % respondents are involved in extension activity. The extension carried out by Fishery Agency participated by 70 of respondent, while that carried out by JICA 4 %. Most of the respondents participate at the frequency of less than 2 times a month. All the respondents feel the useful of the extension.

7.5.5.3. Aquaculture Technology

Seed Production

Breeding of fish is conducted in ponds. Used pond type depends on breeding habit of the fish. In the case of common carp, spawning of the fish is carried out in special pond with the size of 10-50 m² and attributed with *kakaban*, a material consisted of palm fibers, whose function as egg collector. This pond is also used to incubate egg until hatch and to rear the larva as long 5 days. Another type of the pond is rearing pond which the size wider than the later, that is at least 100 m². Some times some farmer use paddy field as rearing pond.

Breeding of tilapia and java carp does not need special pond. All activities, starting from spawning the breeder up to rearing the larva, are carried out in one type pond, with the size more than 100m² areas. Some farmers also prefer to spawn the breeders and rearing the larva in paddy field.

Most of the broodstocks are not managed in a special pond. Some species of breeders are reared in one pond or the breeder mixed with smaller size fish that is reared in grow out pond.

The ponds located in sloping area which cause water pond can be drained completely using gravitation power, even depth of the water up to 1 m. Generally seepage of the ponds is low, but the soil texture rich in silt. So that to keep water in relatively narrow embankment (30-50 cm), the farmers build the dike of the pond relatively shallow (30-75 cm). Source of water, to supply the ponds, is irrigation channel. Water flow rate is enough to fulfill need of the pond, although some farmers feel lacking of the water at dry season. In point of view water quality, the water is not polluted, but the color indicated that to increase fertility of the water need fertilizer.

Some people in Nagari (sub district) Sumpur Kudus carry out breeding of fish to fulfill the need of seed for their own grow out fish or to earn money. In one cycle breeding of common carp in Sumpur Kudus, fish farmer spawn 2-3 fish breeder at the total weight of 2-10 kg. Spawning of the breeders and incubating of the egg are carried out in one pond at the size of 16 m². In this pond, hatched larvae are reared as long 3-5 days. After that the larva are harvested and moved to nursery

pond. Area of used nursery pond ranged between 600-3,200 m² per cycle of the nursing.

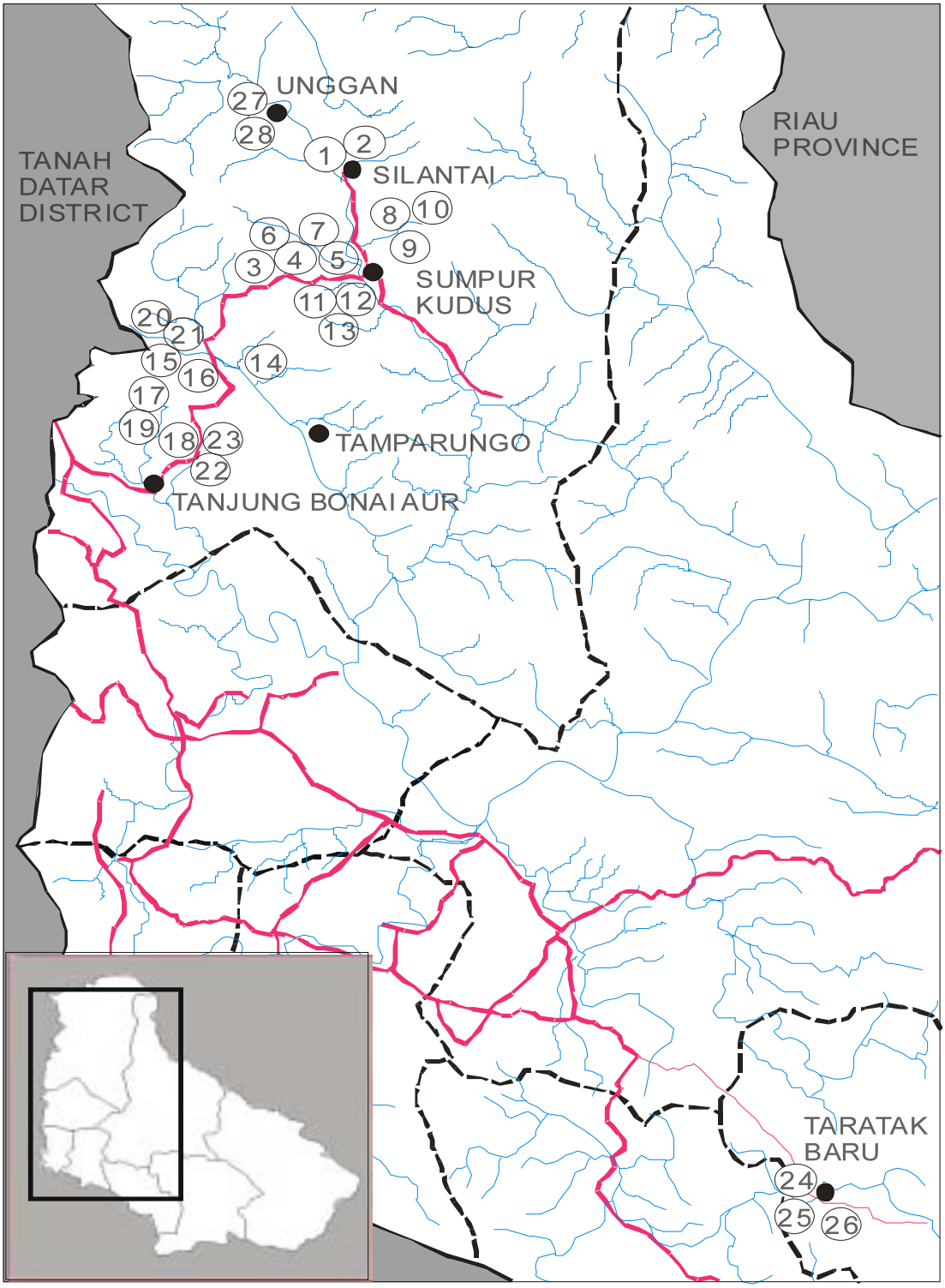


Figure 7-13. Location map of Respondents in Sawahlunto-Sijunjung District, West Sumatera Province

The rearing pond is prepared before stocking of the larva. The activities include drying and rehabilitating the pond, fertilizing and inundating. Drying pond is proposed to clean toxic substance, harmful aquatic organism and prevent diseases. During the drying, pond structures, such as dike and harvesting ditch are repaired. To stimulate growth of natural food some farmers fertilize and/or manure the nursery pond before larvae stocked. The manure used is chicken manure or cow dung, while inorganic fertilizer used is urea.

After the pond inundated for three day, then 3-5 days old larvae are stocked. During fish rearing, some farmer spread rice bran over the pond to maintain natural food in a proper abundance. Larger fry can also feeding directly with the rice bran.

A period of rearing fish is 30 days per cycle of the nursing, harvested fish are 500 to 30,000 per cycle. In the term of yield, the productivity is low. The problems related to the low productivity are:

Marketing. The product is sold to consumer close to the farmer area, while the quantities of the consumer are limited and the consumer prefer to buy seed at a bigger size. It make the farmer suspend selling the product which lead to decreasing production cycle per annum.

Production process. Production process is still traditional, which mean that the fish culture method applied without standard operation and it is obtained from older farmers or neighbors by oral. Preparing the ponds, stocking the larva and routine managing of the culture which are not applied in proper quantity and quality often because low productivity, even failure.

Nursery

In Sumpur Kudus, in the case the fish farmer has problem to sell harvested fish from nursery pond, he usually continue to rear seed in second rearing pond. The preparation of pond different as that carried out in nursery pond, namely without proper effort to grow natural food. The farmer also does not regulate stocking density. As the result growth of fish slowly and the population become decrease. Harvesting fish depend on demand of consumer (grow-out farmer), often partially harvest is done and the remainder fish are grown up to consuming size (100-300 grams). In this case the farmers have not record even the production input or the

yield.

In Bona Aur, some farmers carry out second rearing of fish to produce fish at the size of 10-12 cm in paddy field as alternate commodity. The area of paddy field ranged between 800 to 10,000 m². Generally the farmers get the seed from fish seller that bring the seed from Solok. The farmers have been prepared the paddy field before stocked. These activities include strengthening dike, building harvesting ditch in paddy field compartment and fertilization. The seed is stocked at the range of 4,000-15,000 fish per cycle. A farmer use artificial-complete feed to fed fish reared in high density, while the others maintain abundance of natural food in wider area (low density). After the fish reared as long 60-75 days, the fish are harvested.

Grow-out

Grow out of fish run commercially in cage or in ditch (running water pond). In Nagari Sumpur Kudus cage culture was expanded in year 2003, but after that most of the cage has been destroyed by flood which cause the culture activity desisted. In Nagari Riak Sinamar cage culture expand up to now. The cage building is made of wood material. The dimension of length, width and height respectively are 4 meter, 2 meter and 1,5 meter. This cage is floated in a part of water surface of the river. Each farmer has cage 3 to 10 compartment.

In Taratak Baru, situation of the river look like with in Sumpur Kudus, namely in rainy season, sometimes water flow of the river become rapid and high which can sweep away cage. To solve the problem the fish farmer change materials of early type of cage, which made of wood, become form of running water pond, which the structure consisted of concrete. The size of cage is 2m length, 1,5-m width and 1m dept.

Farmer needs seed at the weight of 75-1,000 kg per cycle of grow out depend on number and size of cage unit he has. In Riak Sinamar stocking density of fish is 8.3 to 12.5 kg per m² of cage, while that in Taratak Baru 8.3 per m². During growing, fish is fed artificial-complete feed 3 times a day. After 90 days grow out periods, the fish is harvested. The yield is 450-10,000 kg out depend on the number and size of cage unit.

7.5.5.4. Rating of Aquaculture Technology

Broodstock Management and Seed Production Categories

Most of the respondents in District Sumpur Kudus don't culture broodstock in special ponds. Some of them culture it mix up with several broodstock species, such as java barb and/or tilapia. The others stock it in grow out pond mixed with younger fish. These farmers don't feed broodstock sufficiently. The need of food for the broodstock is fulfilled by natural food or household wastes. Better management is carried out by farmers that sort broodstock by species but not by fish size and generation. The farmers feed the fish sufficiently through growing up natural food population and rice bran.

In broodstock management category, there are 6 farmers with 20% of achievement level, and 2 farmers with 80%. There is no fish farmer with 100% of the achievement. In seed production category, there are 2 farmers with 20%, 3 farmers with 40% level, and 3 farmers with 60%, no farmer with 80%, and 100% of the achievement. Table 7-84 shows the Rating Achievement of Broodstock Management and Seed Production from the Farmers Respondents in Sawahlunto-Sijunjung District.

Table 7-84. Rating on Achievement of Broodstock Management and Seed Production of the Farmers Respondent answered in Sawahlunto-Sijunjung District

	Rating Achievement					
	20%	40%	60%	80%	100%	Total Answered
Broodstock Management Category						
Persons	6	0	2	0	0	8
Percentage	75	0	25	0	0	
Seed Production Category						
Persons	2	3	3	0	0	8
Percentage	25	38	38	0	0	

Source: Field Survey September-October 2004

Feeding management and Fish Nutrition Categories

Some breeding farmers stimulate natural food to fulfill the need of fish, and practice to fed fish with simple feed, as like rice bran, irregularly. The respondents who grow fish in cage conduct feeding every day. The farmers can regulate amount feed to be fed, based on feeding behavior of the fish. Amount of feed is decreased, as attractiveness to the feed decrease. The ability of the farmers to calculate

feeding rate according to stocking quantity of cultured fish, to keep their records of fish culture, to make a production plan for fish culture by their selves is limited.

The farmers who feed fish, can always stock sufficient quantity of feed without feed shortage, but only some farmers have understood necessary element for fish culture according to species and growth stage. All the farmers are not able to compose originally fish feed and produce fish feed cheaply and good quality. Table 7-85 shows the Rating Achievement of feeding management and fish nutrition categories from the farmer respondents answered in Sawahlunto-Sijunjung District.

Table 7-85. Rating Achievement of Feeding Management and Fish Nutrition Categories of Fish Farmer Respondents answered in Sawahlunto-Sijunjung District

	Rating Achievement					
	20%	40%	60%	80%	100%	Total Answered
	Feeding Management Category					
Persons	3	8	3	2	1	17
Percentage	18	47	18	12	6	
	Fish Nutrition Category					
Persons	4	8	2	0	0	14
Percentage	29	57	14	0	0	

Source : Field Survey September-October 2004

Fish diseases and Water management Categories

Some the respondent have no ability to identify infected fish. Most of the respondent can identified infected fish and try to control it. Some the respondents, especially who grow fish in cage have ability to practice a prevention and treatment fish infected by KHV, although effectiveness is still questionable.

Quantity of respondent who do not know anything about water quality is still high (36%), The instruments to measure parameters of water quality are not available in the village, however most of responder know quality of water by symptoms, such as fish gasp in the water surface if dissolved oxygen in the waters is low, fish toward shadow area if water temperature is high. Even some farmer can solve some water quality problem, such as low oxygen content or high ammonia content, through increasing water flow rate. Table 7-86 shows the Rating Achievement of fish disease and water management categories from the farmer respondents answered in Sawahlunto-Sijunjung District.

Table 7-86. Rating Achievement of Fish Disease and Water Management Categories of Fish Farmer Respondents answered in Sawahlunto-Sijunjung District

	Rating Achievement					
	20%	40%	60%	80%	100%	Total Answered
	Fish Disease Category					
Persons	2	1	5	5	1	14
Percentage	14	7	36	36	7	
	Water Management Category					
Persons	15	3	0	0	0	18
Percentage	83	17	0	0	0	

Source : Field Survey September-October 2004

General Culture Control and Total Fish Culture Management Categories

Final achievement level of general culture control is the fish farmer can maintain their facilities properly according to the environmental condition, and attain sustainable and efficient fish culture production. In total fish culture management, final achievement level is the farmer can keep record of fish culture activities and calculate production cost; and fish farmer can make their fish culture production plan considered of harvest time, and can practice fish production as planned (Table 7-87). Total rating of aquaculture technical assessment is presented in Figure 7-15.

Table 7-87. Rating Achievement of General Culture and Total Fish Culture Management Categories of the Farmer Respondents answered in Sawahlunto-Sijunjung District

	Rating Achievement					
	20%	40%	60%	80%	100%	Total Answered
	General Culture Management Category					
Persons	3	6	0	6	0	15
Percentage	20	40	0	40	0	
	Total Fish Culture Management Category					
Persons	7	1	2	0	0	10
Percentage	70	10	20	0	0	

Source : Field Survey September-October 2004

The survey results, that most of fish farmers from the 15 fish farmers answered the questioner are at position of achievement 20-40% in general culture control (its mean the condition of most fish farmers can understand kinds and characteristics of their facilities suitable for surrounding environments and fish species. And build their facilities by correct designs for fish culture. In total fish culture management, most of the farmers in this district are at 20% level, it is mean the most fish farmer in this district have known rough figures of management condition, such as

production harvest; however, they don't know their accurate profit from fish culture because they don't practice exact planned production

7.5.5.5. Socio-Economic Assessment

Main Job and Gross Income

Structure of fish farmers in the Sawahlunto Sijunjung model area according to their main job is more or less same with the other model extension areas mentioned above. Most of them have the main job in agricultural farming as calculated to be 17 persons of total 28 respondents. Moreover, it is found also that there are 6 persons (21 %) who have fisheries (aquaculture) farming as their main job. Table 7-88 presents the detailed of type of main job of fish farmers in the case of Sawalunto Sijunjung model extension area.

Table 7-88. Number of Respondent in Their Main, 2nd, and 3rd Job in the Sawahlunto-Sijunjung Model Extension Area

	Type of Job						
	Fish Farm	Rubber Farm	Other Farm	Trader	Govern. Employ	Others	Total Answered
Main Job	6 (21)	0	17 (61)	0	4	14	28
2nd Job	15 (54)	1 (4)	2 (7)	1 (4)	0	9 (32)	28
3rd Job	1 (10)	0	6 (60)	2 (20)	0	1 (10)	10

Source : Field Survey September-October 2004
Note : Number in the bracket refers to its percentage

The numbers of fish farmers in this model area, who have gross income less than Rp. 500,000 per month are 7 persons of 26 respondents (27 %). However, the dominating group of farmers is that of farmers who have gross income in the range of Rp. 500,000 – Rp. 1,000,000 per month which is identified to be 16 persons or 63%. There are only 3 persons or 10 % of total sample population who have gross income in the range of Rp. 1,000,000-Rp. 5,000,000 per month. Detailed number of surveyed fish farmers according to their gross income per month is presented in Table 7-89 below.

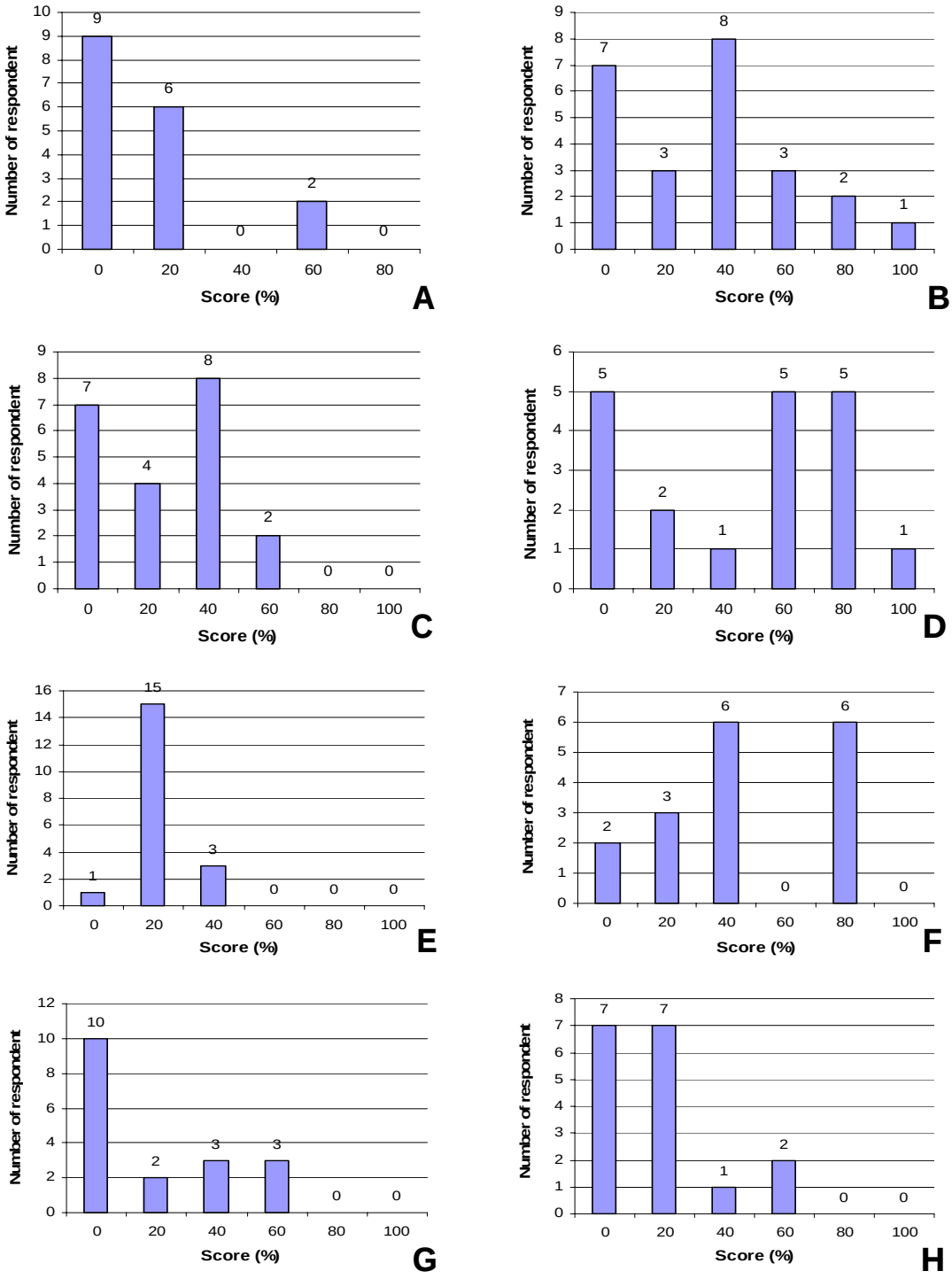


Figure 7-14. Aquaculture Technology Rating of Respondents in Sawahlunto-Sijunjung District

Note : A. Brood stock management
B. Feeding management
C. Fish nutrition
D. Fish diseases
E. Water management
F. General culture control
G. Seed production
H. Total fish culture management

It can be revealed from survey results that gross income of respondents is relatively stagnant to increasing situation. We found that about 54 % of total answered respondents (7 persons) mentioned stable total income during the last 2-3 years. There are 5 persons or 38 % who indicating an increasing total income. Situation of gross income indicator during the last 2-3 years in the Bungo model extension area is presented in Table 7-90.

Table 7-89. Number of Respondent by their Gross Income in the Sawahlunto-Sijunjung Model Extension Area

	Gross Income per Month				
	< 500.000	500.000-1.000.000	1.000.000-5.000.000	> 5.000.000	Total Answered
Persons	7	16	3	0	26
%-age	27	63	10	0	

Source: Field Survey September -October 2004

Table 7-90. Situation of Gross Income in the Sawahlunto-Sijunjung Model Extension Area

Situation of Income Indicator during the last 2-3 years	Person	Percentage
Increased more than double	1	8
Increased less than double	5	38
Stable/Stagnant	7	54
Decreased	0	0
Total	13	100

Source : Field survey September-October 2004

Contribution of Income from Aquaculture and Fish Production During the Last 2-3 Years

As presented in Table 7-91 below, it can be seen that of 24 respondents, there are only 7 persons (29,0%) who have less than 30% contribution of aquaculture activities to their total income. However, the other 17 respondents (71%) have more than 30% contribution of aquaculture activities.

In terms of production, most of fish farmers in Sawahlunto Sijunjung model extension area have been able to increase their production in the last 2-3 years. As presented in Table 7-90 there are 10 persons or 55% of total sample population (respondents answered) have been able to increase the production by less than double and 2 persons who have been able to increase production by double in the

last 2-3 years. It can be seen also that there are 3 persons (17%) who showed a stagnant production (there is no significant changes of production in the last 2-3 years, and 3 persons (17%) indicated a negative trend of production.

Table 7-91. Number of Respondent Classified by Freshwater Aquaculture Contribution to their Income in Sawahlunto-Sijunjung Model Extension Area

	Range of Contribution of Income From Freshwater Aquaculture					
	< 10%	10-30%	30-50%	50-70 %	> 70%	Total Answered
Persons	1	6	7	4	6	24
%-age	4	25	30	16	25	

Source : Field Survey September-October 2004

Table 7-92. Number of Respondent Classified by Their Production of Freshwater Aquaculture in the Sawahlunto Sijunjung Model Area

	Condition of Fish Production During the last 2-3 years					
	Increase Double	Increase less than Double	Stagnant	Decrease less than Double	Double Decrease	Total Answered
Persons	2	10	3	2	1	18
Percentage	11	55	17	11	6	

Source : Field Survey August-October 2004

Family Goods and Initial capital for aquaculture

As has been mentioned above, family assets can be used as an indicator to measuring fisheries household welfare. By investigating the condition of family assets in terms of a set of physical assets such as motorbike, television, video, etc, we can assess the welfare condition of the surveyed respondents.

From the results of baseline survey, we found that most of fish farmer households in Sawahulunto Sijunjung model area only have 1 item of goods as listed above. It is revealed from Table 7-93 that 41% of total sample populations (22 respondents) have one item of goods. From other respondents we found that 5 persons (23%) of total sample population have only two items and 6 persons (27%) have 3 items of goods.

From survey results it also was revealed also that aquaculture asset of respondents is relatively stagnant to increasing situation. It can be revealed from the survey that about 50% of total answered respondents (9 persons) mentioned stable situation of aquaculture assets during the last 2-3 years. There are 7 persons or

39% who indicating an increasing situation of aquaculture assets. Situation of gross income indicator during the last 2-3 years in the Sawahlunto Sijunjung model extension area is presented in Table 7-94.

Table 7-93. Number of Respondent Classified in Their Household goods and Asset in the Sawahlunto Sijunjung Model Extension Area

	Condition of household goods of the fish farmer household					
	Have only one Items	Have two Items	Have Three Items	Have four Items	Have more than four Items	Total Answered
Persons	9	5	6	0	2	22
Percentage	41	23	27	0	9	

Source : Field survey September-October 2004

Table 7-94. Situation of Aquaculture Assets in the Sawahlunto Sijunjung Model Extension Area

Situation of Aquaculture Assets to during the last 2-3 years	Person	Percentage
Increased	7	39
Stable/Stagnant	9	50
Decreased	2	11
Total	26	100

Source: Field survey September-October 2004

7.5.5.6. Rating of Socio-Economics Assessment

Similar to North Bengkulu District, from survey results we can reveal that most of indicators lay on the moderate score such as indicator of gross income per capita, contribution of aquaculture income, and saving/debt condition, as the main indicator of socio-economic situation. In the case of indicator of income from aquaculture, for example, we found that score for this indicator is relatively high (ranges from 40-100) meaning that dependency level of aquaculture income to total gross income is high. However, for the case of supporting indicators such as family equipments, the score of these indicators can be considerably low. In this context we can say that in general level of socio-economic situation of fish farmers in this district can be said to be moderate. Figure 7-16 shows overall score of socio-economic indicators for fish farmers in Sawahlunto-Sijunjung, West Sumatera Province.

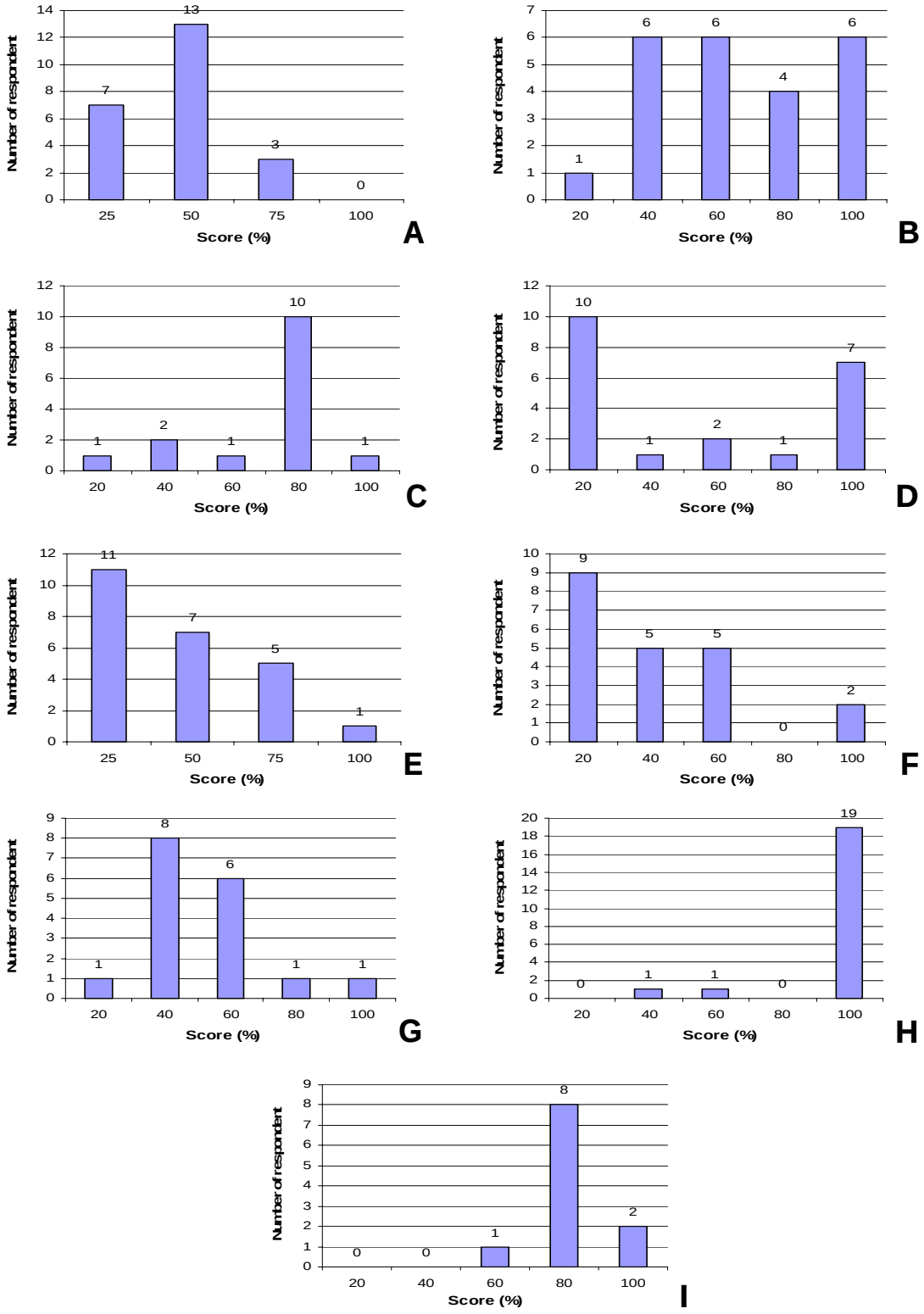


Figure 7-16. Total Rating of Socio Economics Assessment in Sawahlunto Sijunjung District

Note : A. Income B. Income from fish culture C. Fish production
D. Saving/debt E. Working hours F. Equipment
G. Real estate H. Health care I. Family education

7.6. Analysis of Situation of Freshwater Aquaculture in Model Extension Areas.

7.6.1. Aquaculture Technology Indicators

Aquaculture Technology Assessment

Based on the score of aquaculture technology as presented in chapter 7.5, to figure out the average score of each aquaculture technology categories in the extension model area can be calculated using following formula:

$$AS = \frac{0.n_0 + 20.n_{20} + 40.n_{40} + 60.n_{60} + 80.n_{80} + 100n._{100}}{N}$$

where:
AS : average score of certain aquaculture technology category
$n_0, n_{20}, \ldots n_{100}$: number respondent for each certain category score
N : total number respondent of certain aquaculture technology category

And result of the calculation can be seen in Table 7-95. From Table 7-95, the expression of aquaculture technology assessment in graphic mode shown in Figures 7-16; 7-17; and 7-18.

Table 7-95. Average Score of Aquaculture Technology Categories in the Extension Model Extension Areas

Category *)	Bungo	Batanghari	North Bengkulu	Kuantan Singingi	Sawahlunto Sijunjung	Average
A	24	64	38	53	14	39
B	43	60	54	59	34	50
C	30	51	41	37	25	37
D	29	60	57	41	46	47
E	26	19	24	23	22	23
F	34	49	51	61	46	48
G	50	13	34	63	19	36
H	45	32	28	23	18	29
Average	35	43	41	45	28	

*) A: Broodstock management, B: Feeding management, C: Fish Nutrition, D: Fish diseases, E: Water management, F: General culture control, G: Seed production, and H: Whole production management.

The table and figures shows that the aquaculture technology scores varied in each extension model extension areas. In general, respondents in Batanghari and

Kuantan Singingi show better capability in broodstock management than that of respondents in the other extension model areas, while respondents in Sawahlunto Sijunjung show lowest capability in managing broodstock. However, based on the highest average score (around 60%), capability showed by respondents in Batanghari and Kuantan Singingi indicated that although they can keep breeder in proper pond and fed regularly, but the possibility of cross breeding with any unclear breeders is might be occurred. Hence, their knowledge to keep good quality of breeders by avoiding the possibility of cross breeding is better to be considered in the next extension program.

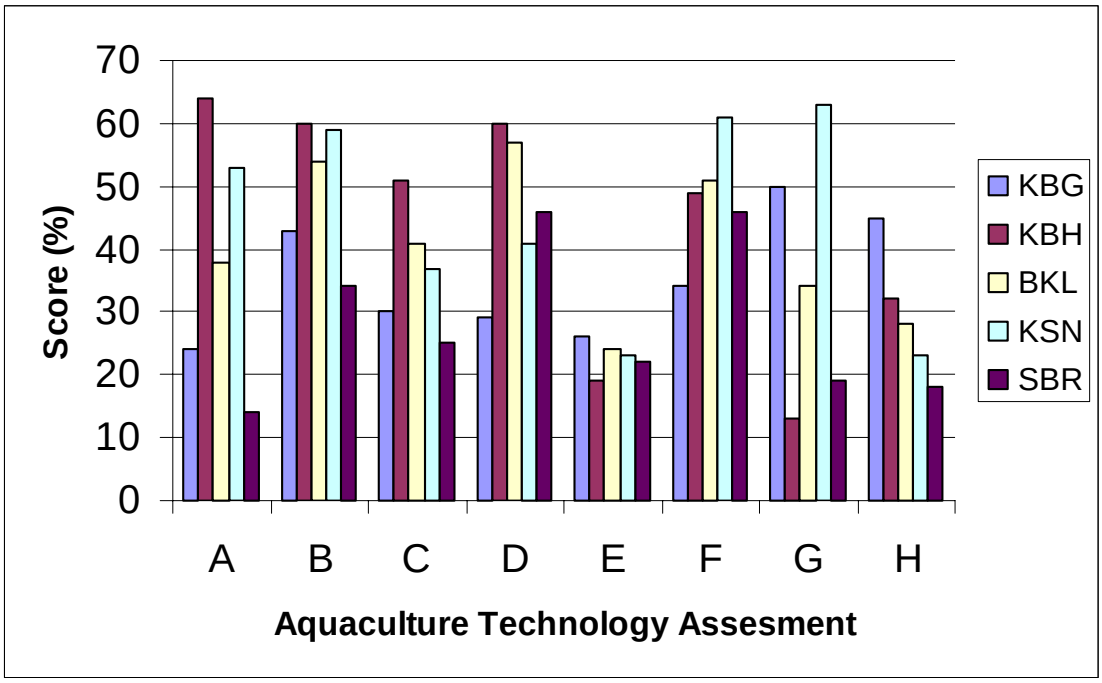


Figure 7-16. Average Rating of Aquaculture Technology Categories in the Model Extension Areas (based on score)

Notes: A: Broodstock management, B: Feeding management, C: Fish Nutrition, D: Fish diseases, E: Water management, F: General culture control, G: Seed production, and H: Whole production management.

KBH= Batanghari; KBG=Bungo; KSN=Kuantan Singingi; BKL=North Bengkulu; SBR=Sawahlunto-Sijunjung

Respondents in Batanghari and Kuantan Singingi also can manage feeding better than that of respondents in the other extension model areas, although generally they have not recorded feeding activities and growth of fish yet. The lowest management level is presented by most of respondent in Sawahlunto Sijunjung that never fed the fish appropriately based on the biomass.

In term of fish nutrition, respondents in Batanghari have better skill and knowledge than that of respondents in the other model extension areas. They stock feed regularly, keep standard-quality feed stably, and store the feed in proper method. They also have knowledge on what are important nutritional elements according to fish species and growth stages. However, they still have no ability to consider necessary characteristics of feed according to species and special usage (breeders, nursery and grow-out), as well as to make an original feed composition by themselves. As shown in the table, the lowest score on fish nutrition category is found in Sawahlunto Sijunjung.

Most of respondent can identify their fish that infected by diseases and try to prevent spreading the infection, however, they don't know the causative agent clearly. Respondents in Bungo have lower ability in controlling fish diseases compared with that of respondents in the other model extension areas.

In case of water management, the knowledge and skill of respondent in all model extension areas have similar scores, the average score is less than 30%. This means that most of respondent in all model extension areas never measures, monitors, and records the water quality parameters. Respondents in Bungo and Batanghari represent the highest (26%) and lowest (19%) scores respectively.

General culture management indicator showed that most of the respondent scores are more than 40%, except respondents in Bungo (34%). It means that most of the respondents operate aquaculture with regular maintenance of facilities and equipment and kept it in safe condition.

Although respondents in Batanghari can manage broodstock better than that of the other extension model areas, but in average, they do not manage seed production as good as they manage the broodstock, Moreover, in term of seed production management, their average score is lowest compared with that of respondents in the other extension model areas. Meanwhile, the highest seed production score achieved by respondents in Kuantan Singingi, followed by Bungo and North Bengkulu.

Whole production management scores for all extension model areas relatively low, especially because of book record. Generally, the respondent does not record their culture activities, they cannot calculate production cost, benefit and plan future

culture activities well. In this point respondents in Bungo reach higher score, while respondent in Sawahlunto Sijunjung reach the lowest score.

From overall rating of districts on aquaculture technology indicators (Table 7-96), we can see that Kuantan Singingi has relatively more indicators that contain good score compared to other, 2 indicators and in the same time have no indicator that contain the lowest score. Batanghari District actually has the same level of highest score with Kuantan Singingi, but this district has about 2 indicators with the lowest score. From trade-off between highest and lowest score, it can be concluded that Batanghari and Kuantan Singingi Farmers has relatively better aquaculture skill and knowledge with compared to other districts. This situation is expressed too in Figure 7-18.

Table 7-96. Overall Rating of Districts on Aquaculture Technology Indicators

No	District	Number of Indicators that Contains Highest Score	Number of Indicators that Contains Lowest Score
1	Batanghari	4	2
2	Bungo	2	2
3	Kuantan Singingi	2	0
4	North Bengkulu	0	0
5	Sawahlunto Sijunjung	0	4

Source : Analyzed from Figure 7-16

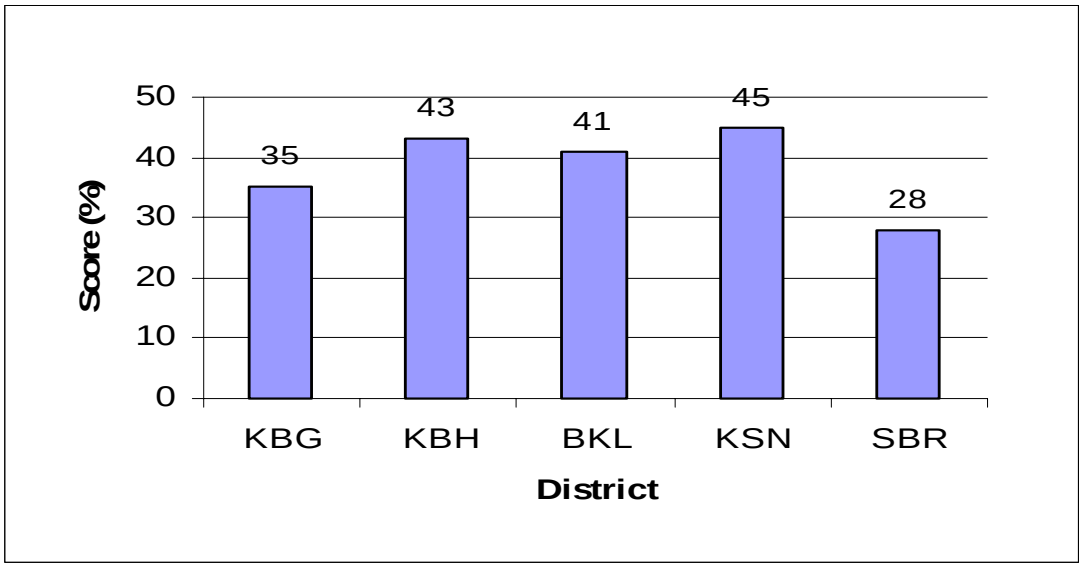


Figure 7-17. Average Score of Overall Aquaculture Technology Rating in Each District of Model Extension Areas

Notes : KBH= Batanghari; KBG=Bungo; KSN=Kuantan Singingi; BKL=North Bengkulu;SBR=Sawahlunto-Sijunjung

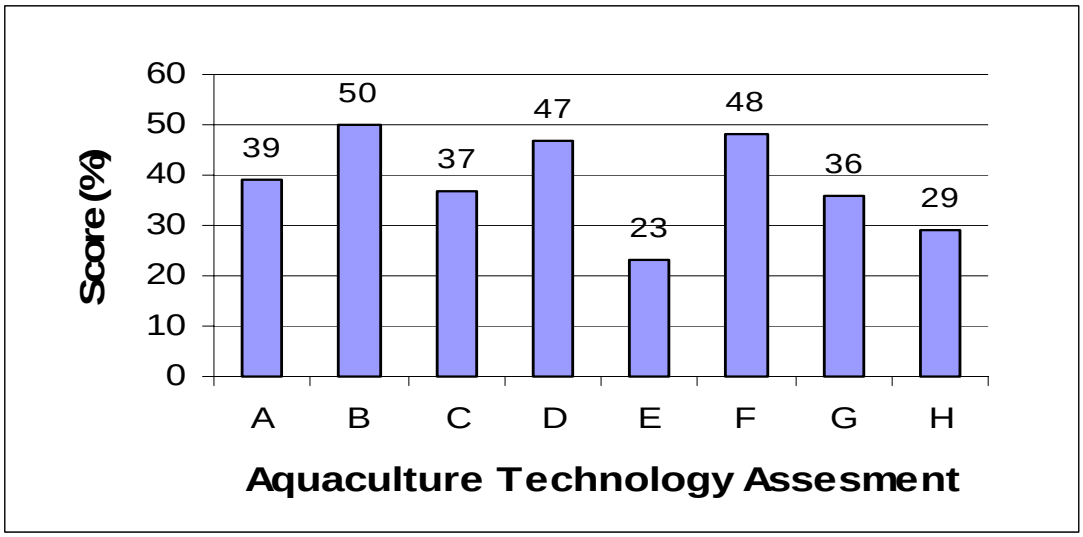


Figure 7-18. Average Score of Each Categories Aquaculture Technology Rating on Overall Model Extension Areas

Notes: A: Broodstock management, B: Feeding management, C: Fish Nutrition, D: Fish diseases, E: Water management, F: General culture control, G: Seed production, and H: Whole production management.

From Figure 7-19, we can see that maximum achievement of Fish Farmers skill and knowledgement on aquaculture technology is 50% (category B) and minimum is 23% on category E.

In point of view all aquaculture and all model extension area, it can summarize that:

1. Kuantan Singingi achieves the highest rating of aquaculture technology, this achievement is not significantly different from that did by Batanghari and North Bengkulu. It related with the fact that extension activities in those extension model areas are more intense compared that in Sawahlunto Sijunjung which achieves the lowest score.
2. Capability of respondents in feeding management, diseases control and general culture control is higher than that in the other categories. The lower is water management and whole production management.

7.6.2. Socio-Economic Indicators

Comparison among Model Extension Areas

In this part, rating of socio economic indicators is presented and discussed. This is undertaken by first comparing the scores of all of socio-economic indicators

between districts and then will be followed by description of rating among respondent fish farmers in the each district.

Generally it can be revealed that comparison between districts varies among indicators (Figure 7-19). From Figure 7-19 we can see that relatively better performance compared with other indicator is that of health-care indicator (indicator no. 5). It means that most of respondent fish farmers have good perception on the importance of health-care for their family. This indicator does not have relationship with level of income since that even that their income is low, most of them bring their family to medical services. Household income and saving-debts indicators, in the other hand, seem to be the worst performance due it their low score in overall (less than 50). It can be said from this condition that most of the fish farmers have relatively low-moderate level of economy.

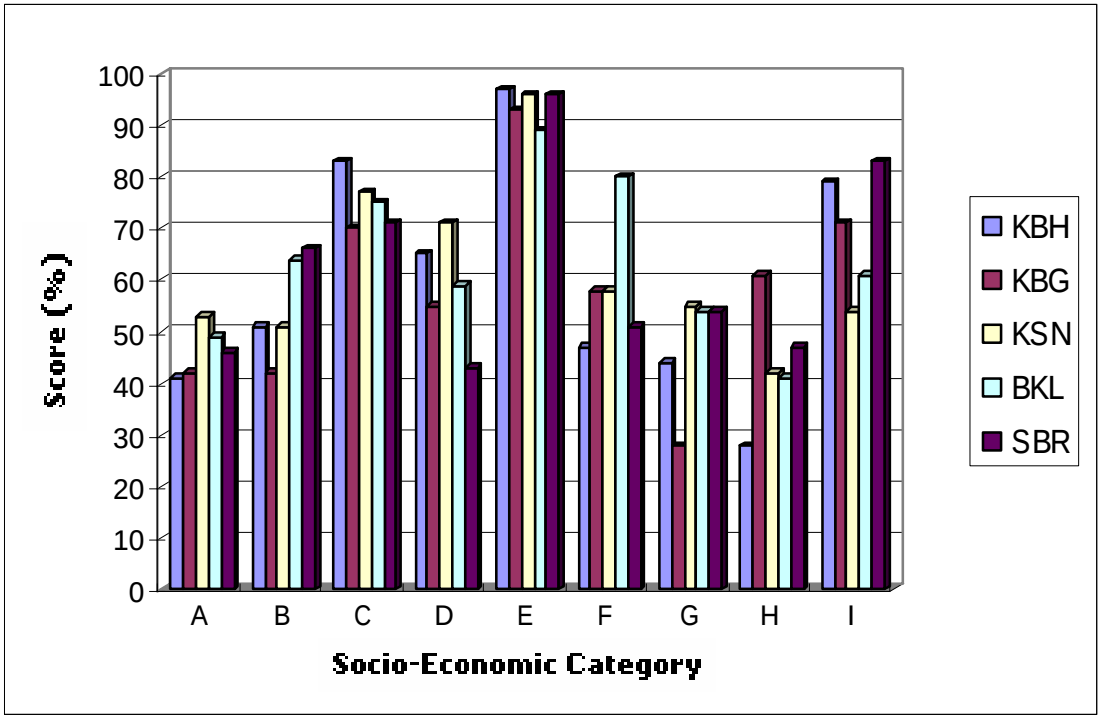


Figure 7-19. Rating of socio-economic indicators among districts (based on score)

Note : A= Income; B= Income from aquaculture; C= Production; D= Household goods etc.; E= Health care; F= Real estate; G= Saving and debts; H= Working hours; I= Family education; KBH= Batanghari; KBG=Bungo; KSN=Kuantan Singingi; BKL=North Bengkulu; SBR=Sawahlunto-Sijunjung

In the case of income indicator (indicator no.1), fish farmers in Kuantan Singingi in overall have relatively better income than fish farmers in the other districts, while

fish farmers in North Bengkulu is considered to be the lowest rate of income population according to its score. However, if we talk about aquaculture contribution to income (indicator no. 2), the survey results show that Sawahlunto-Sijunjung has relatively highest contribution compared to the other districts. In terms of production ability (indicator no. 3), Batanghari District has the highest score compared to the other districts, while Bungo can be considered as the lowest production-region because of its lowest score on this indicator. Comparison between districts for the other socio-economic indicators can be seen in Figure 7-20.

In order to assess the overall results of this comparison, Table 7-97 summarize the rating of each district on socio-economic indicators. From Table 7-97 we can see that Kuantan Singingi has relatively more indicators that contain highest score compared to other (3 indicators) and in the same time have one indicator that contain the lowest score. Batanghari District actually has the same level of highest score with Kuantan Singingi, but this district has about 3 indicators with the lowest score. From trade-off between highest and lowest score, it can be concluded that Kuantan Singingi has relatively better socio-economic condition compared to other districts.

Table 7-97. Overall rating of districts on socio-economic indicators

No	District	Number of Indicators that Contains Highest Score	Number of Indicators that Contains Lowest Score
1	Batanghari	2	3
2	Bungo	1	3
3	Kuantan Singingi	3	1
4	North Bengkulu	1	1
5	Sawahlunto Sijunjung	2	1

Source : Analyzed from Figure 7-19

In terms of individual fish farmers (surveyed) in the each district, we can also reveal some different characteristics among indicators. Using assumption that all of the indicators have same importance among others, we can say that an individual fish farmer is relatively better-off in terms of socio-economic if the farmer has more than 3 (three) moderate-high-scored indicators.

In the case of Batanghari District for example, of the 29 respondent fish farmers there are 10 individual fish farmers (34,48%) who have more than three indicators contains moderate-high scores. Table 7-98 presents the overall condition of socio-economic performance based on individual fish farmer in the model areas.

From Table 7-96 we can see that again Kuantan Singingi has relatively more good-socio-economic-performance fish farmers due to its highest percentage of total respondent fish farmer (75,75%), then followed by North Bengkulu (73,33%), Sawahlunto-Sijunjung (67,85%), Bungo (58,06%), and Batanghari (34,48%).

Table 7-98. Number of Fish Farmers with Good Socio-Economic Condition in the Model Extension Areas

No	District	Number of fish farmer who have relatively good socio-economic condition	Total surveyed fish farmers	Percentage
1	Batanghari	10	29	34.48
2	Bungo	18	31	58.06
3	Kuantan Singingi	25	33	75.75
4	North Bengkulu	22	30	73.33
5	Sawahlunto Sijunjung	19	28	67.85

Source : Data analysis; Figure 7-19

8. Conclusions and Recommendations

8.1. Conclusions

1. In the context of individual fish farmers, both of aquaculture technology skill and socio-economic conditions are differ between activity of aquaculture such as between fish breeders and fish growers.
2. From model extension areas point of view, both of aquaculture technology skill and socio-economic condition of fish farmers in Kuantan Singingi District is relatively better than fish farmers in other model extension areas. It is concluded from the total score both of aquaculture technology and socio-economic parameters of each model extension areas which is resulted from field survey.
3. Feed cost is a common problem faced by fish farmers in all model extension area. The farmers feel that feed price tend to increase, while fish price parallel, some cases, even, decrease.
4. Outbreak of Koi Herpes Virus results in suffers a financial loss. At first, the loss is felt by grow out farmers; since the diseases straightly attack the fish at grow out size (10 gram up). In Sub-district Padang Jaya (Bengkulu), it cause grow

out carp in running water is finished and some turn to grow nile tilapia. The later loss is felt by UPR (hatchery farmers), which supply seed to grow out farmers. Marketing of fry become retard. As the result some farmer decrease carp fry production intensity and the others turn their activities to breed Nile tilapia.

5. Generally speaking, most of fish farmers in model extension areas has main of income from agricultural activities such as paddy farming and rubber plantation. However, it could be argued that contribution of aquaculture to total income of fish farmers is considerably high and tend to be increasing over time.

6. In model extension area, except Kuantan Singingi District; intensive fish culture in cage (karamba) culture has been developed. This condition because of the government program in community empowerment by fish culture in karamba. To overcome this reality, the project should encourage the farmers turn their activity by utilization their stagnant water pond for fry rearing, especially to produce fingerling (at size of 10 gram each). The project should also provide better fry rearing technology, since the existing technology results in lower benefit compared with seed farming and grow out farming.

7. Generally, the extension activity of government agencies is too weak both of the program and implementation; however, institutionally those aspect has been prepared. This might be coused by stablishment of new organization structure related to the development of fisheries sector as a consequence of the implementation of decentralization system as a whole, so that the extension programs conducted by JICA project has less respons from the local fishery agency especially at province level. To get the harmony relationship between Project and Government Agencies, the Project must be have a Project Officer in each district to help and made a good coordination in program and implementation.

8.2. Recommendations

1. There is strong linkage between technical aspects and socio-economic aspects in developing aquaculture activities. Therefore, developing technical and socio-economic aspects should be done in harmony and sustainable way. From this

context, it is revealed that improving technical skills and experiences among fish farmers in order to increase production can be recommended to be higher priority since there is relatively no problem in marketing the productions. In the same time, sustaining market demand on fish cultured in the model extension areas is also another important and vital effort in ensuring sustainability of aquaculture system in the locations.

2. It is recommended also to provide not only technical training and model extension but also training and model extension on small-scale business development and management, especially which is related to aquaculture and other fish farming.

3. In order to solve the problem of feed cost, some activities could be done:

   a. Disseminate proper feed composition/feeding technique as resulted of feeding trial done by the project

   b. Continue feeding experiment to produce cheap feed, especially use material that is available in the village.

   c. Sawahlunto Sijunjung District fishery agency has a program to produce artificial feed (pelleted feed). It is suggested that the project to coordinate with the agency in producing the cheap feed and also medical feed.

4. To overcome effect of the diseases problem, the project should:

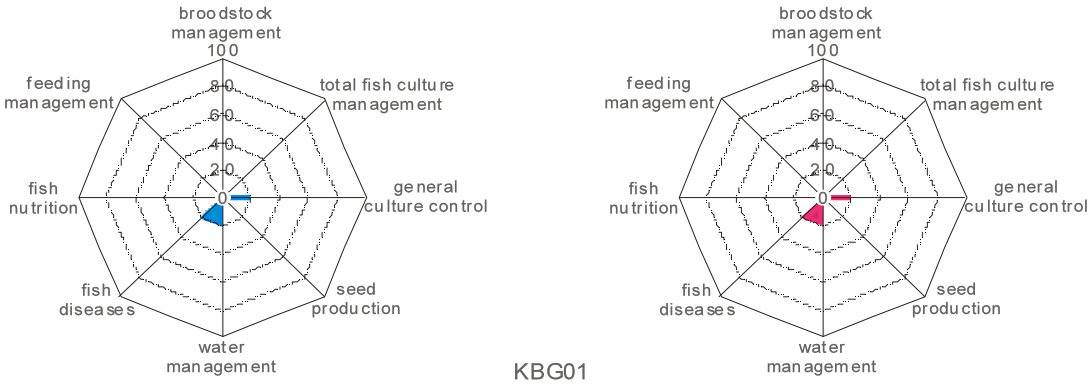
   a. Create crash program to eliminate the diseases problem, especially increasing capability fish farmer to prevent diseases attack.

   b. For the temporary moment, support fish farmers to culture nile tilapia through increasing capability culture and post harvest management, especially that related with proper nile hatchery, feed, harvesting, holding and transportation. At this moment fish farmers still have difficulty in culturing nile tilapia, so that productivity is still low.

=F=

Appendix 1. Condition of Aquaculture Technology Farmers 2001 - 2004 in Bungo District (Shown by Kite Diagram)

(2001) (2004)



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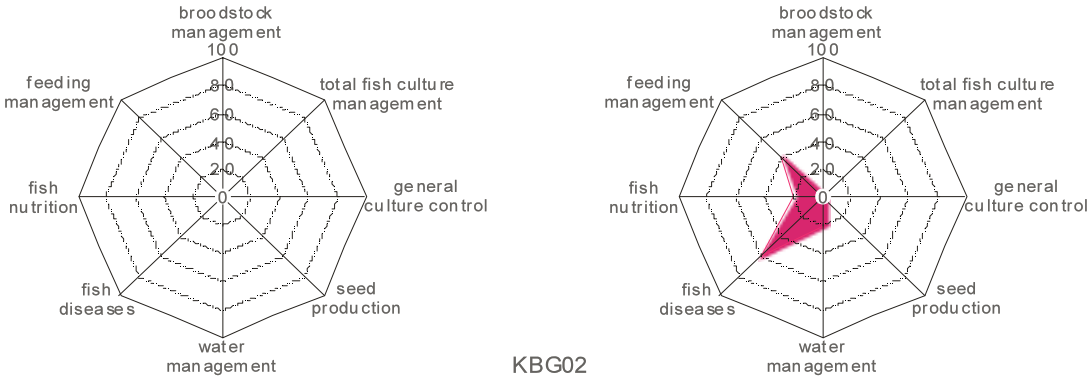

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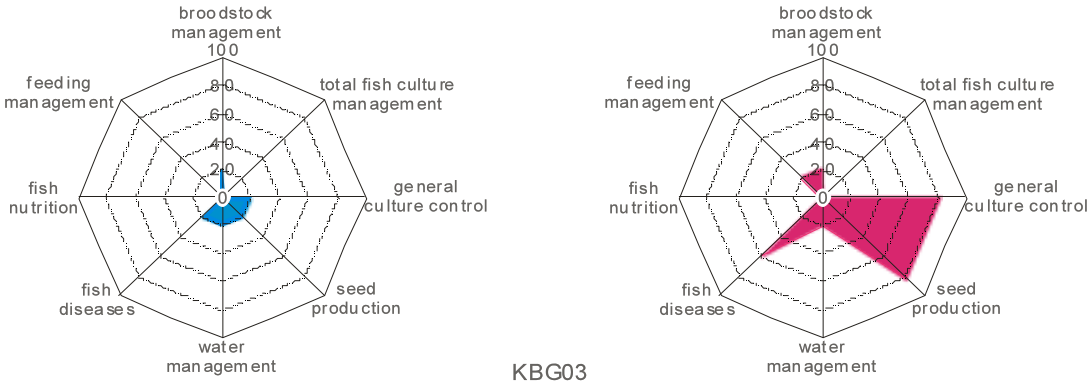

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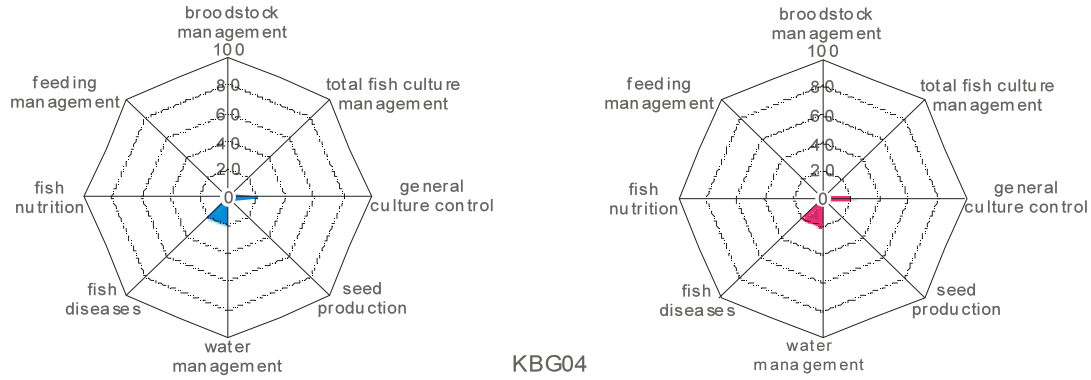

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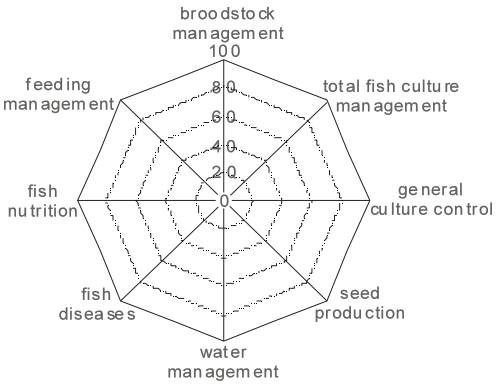

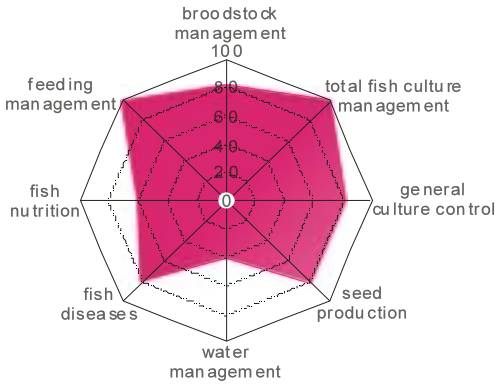

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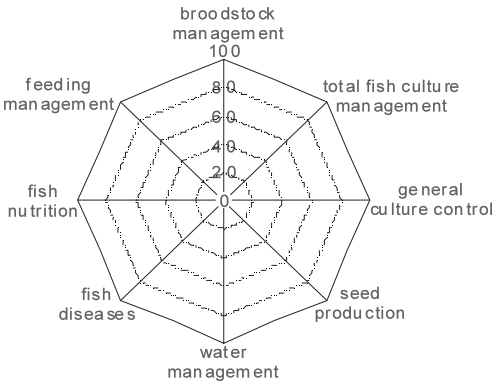

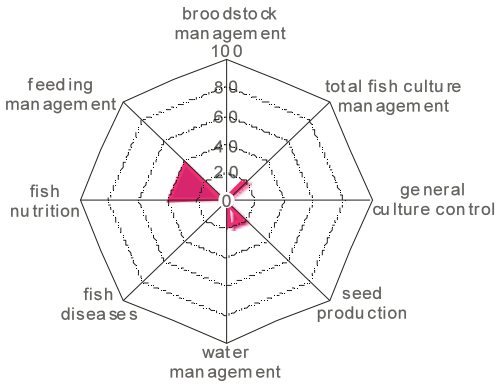

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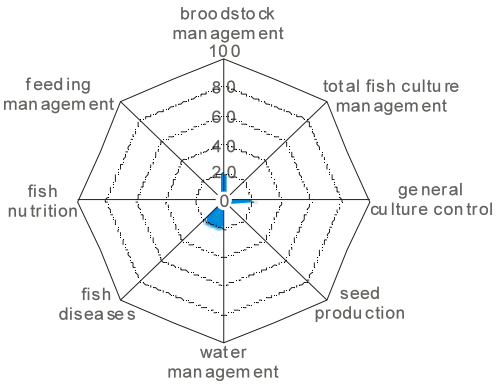

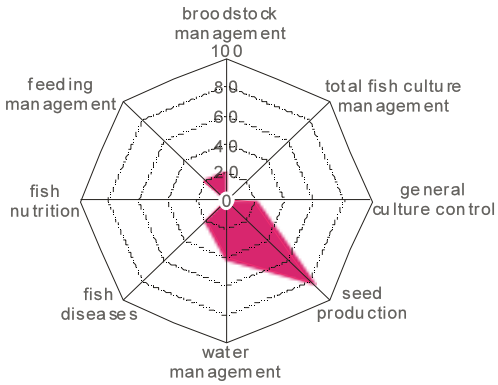

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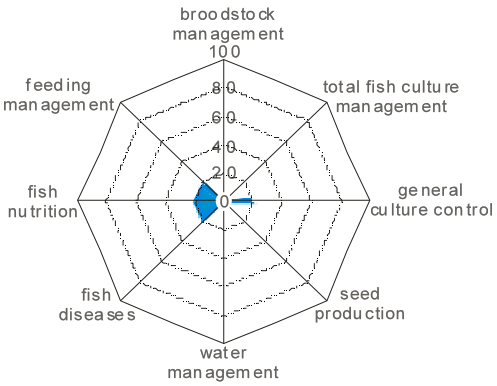
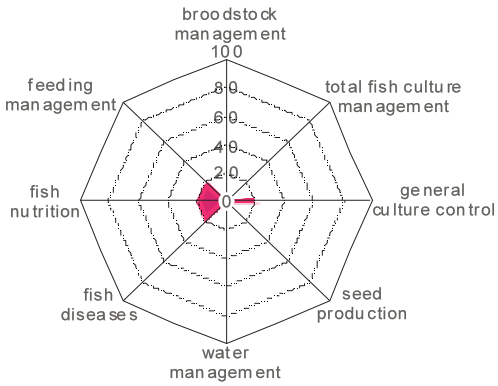
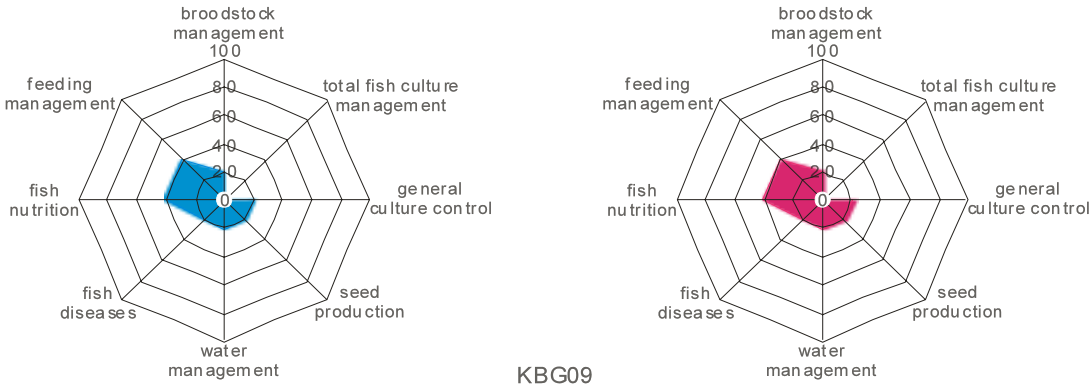


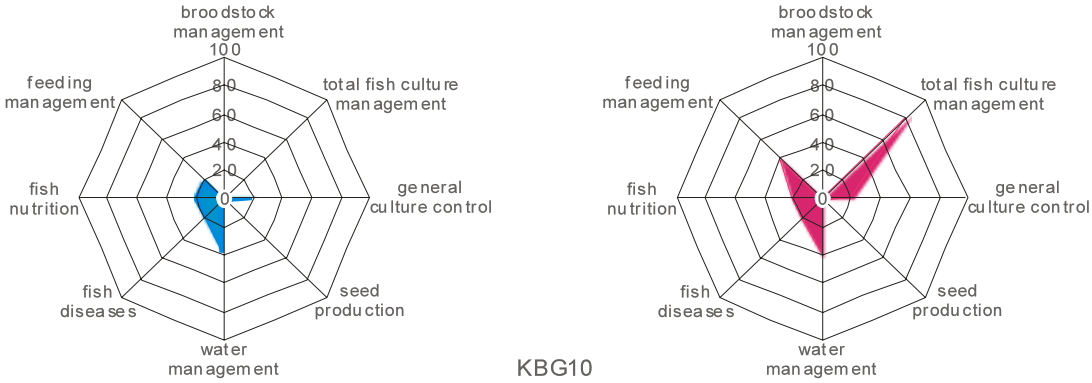


KBG08

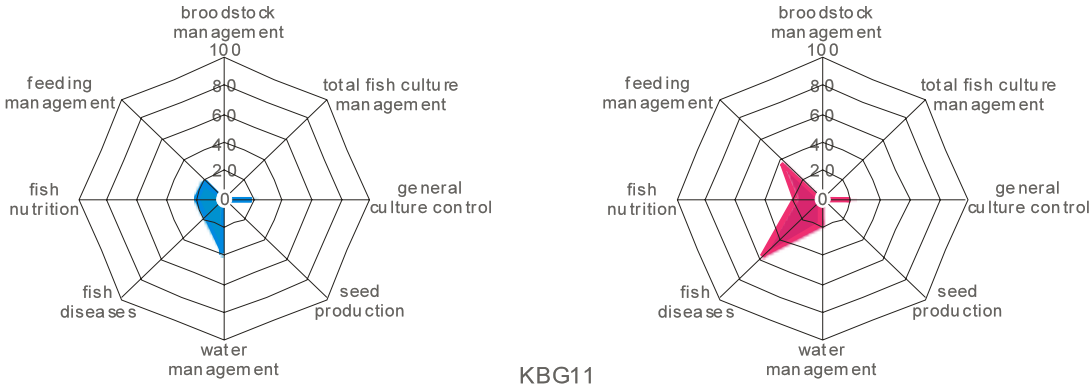
(2001) (2004)



KBG09



KBG10



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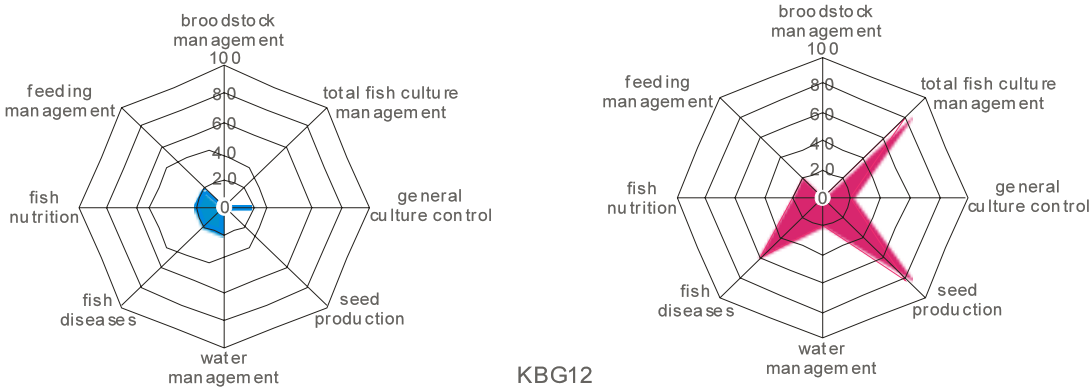
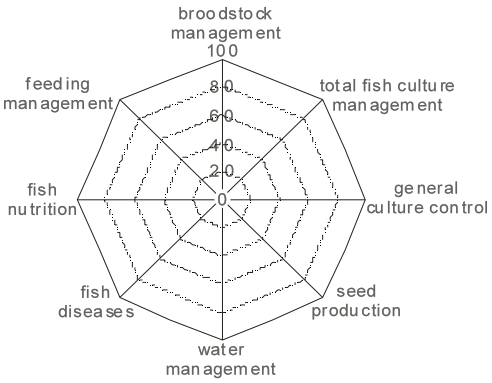
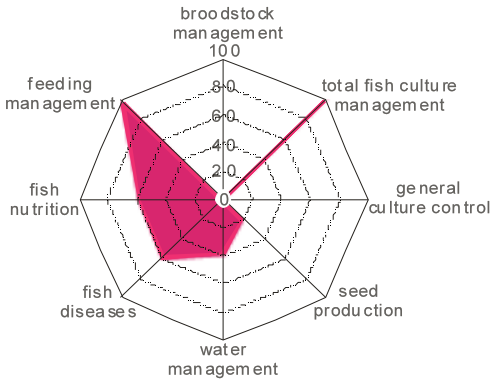


KBG12

(2001) (2004)





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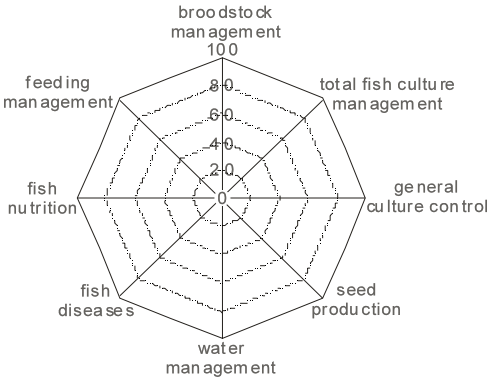

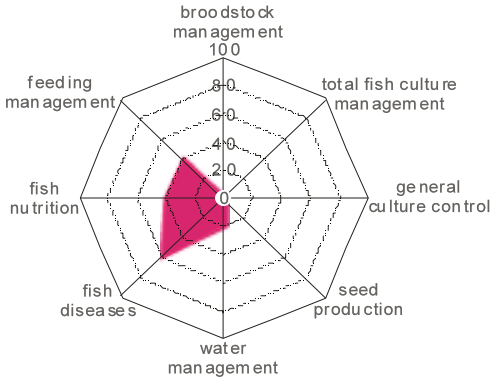

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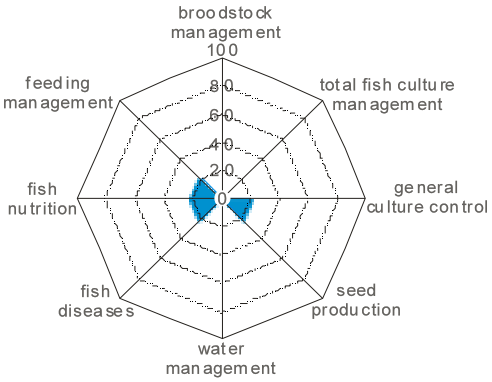

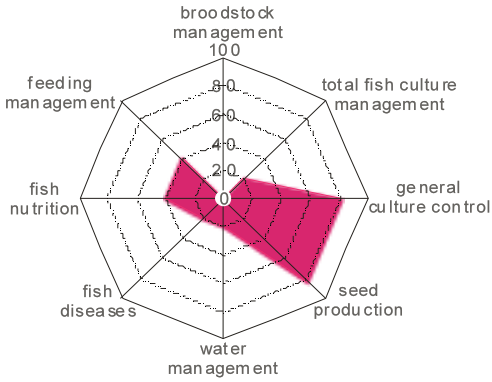

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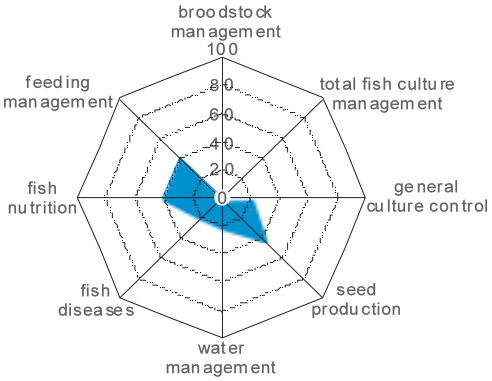
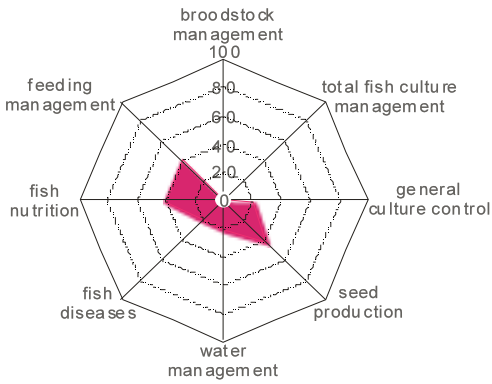
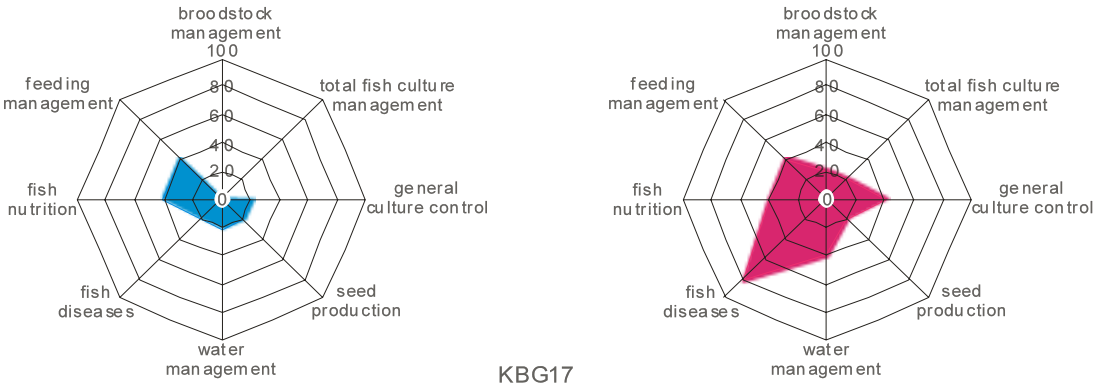




KBG16

(2001) (2004)



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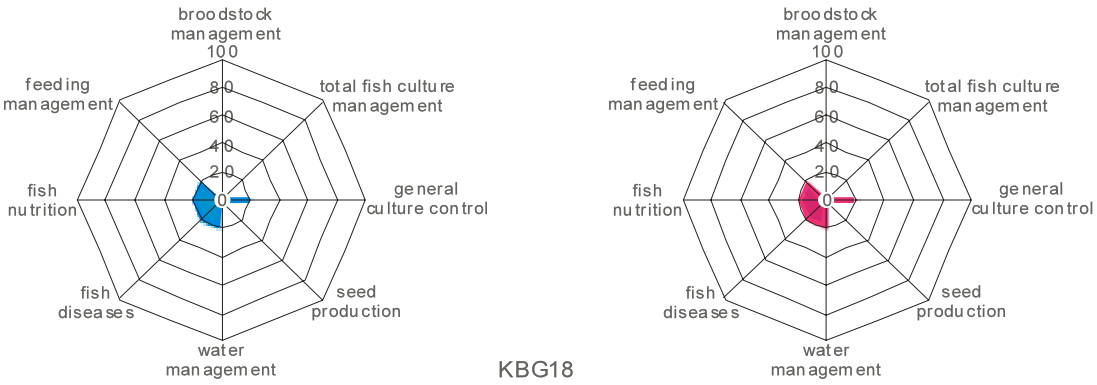

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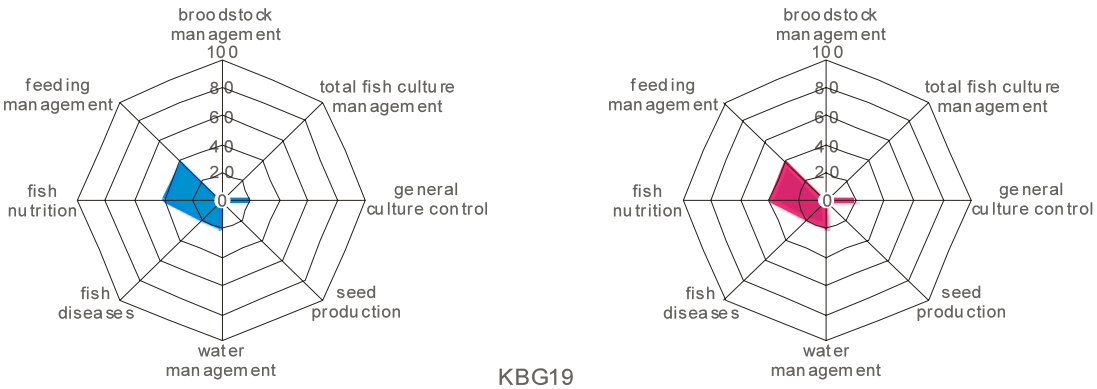

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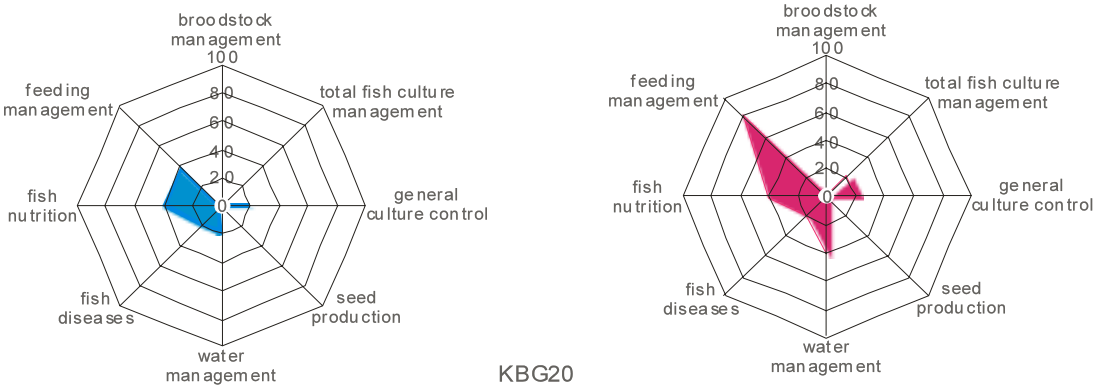

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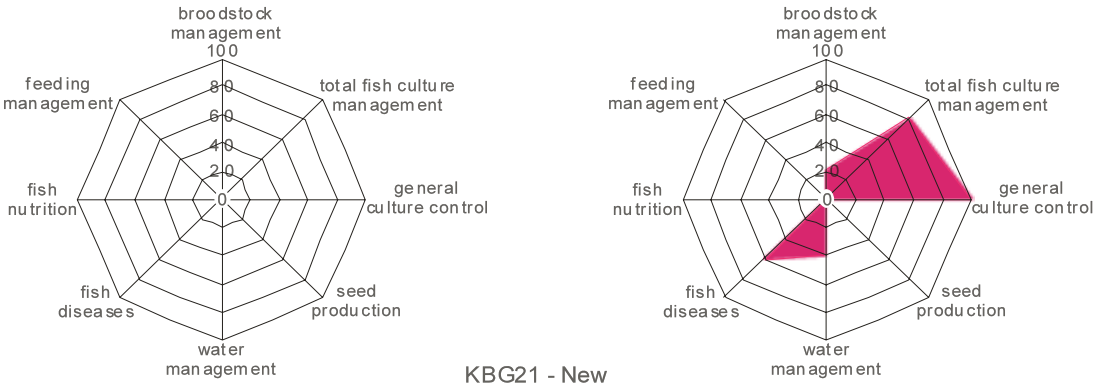
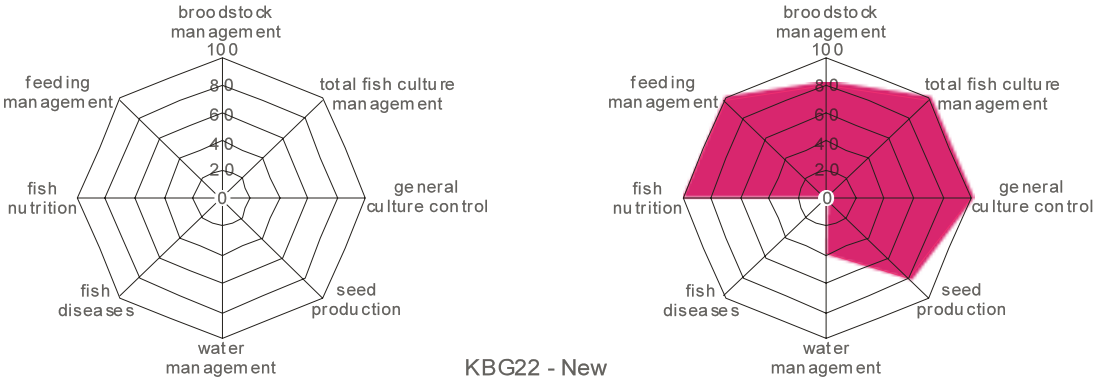
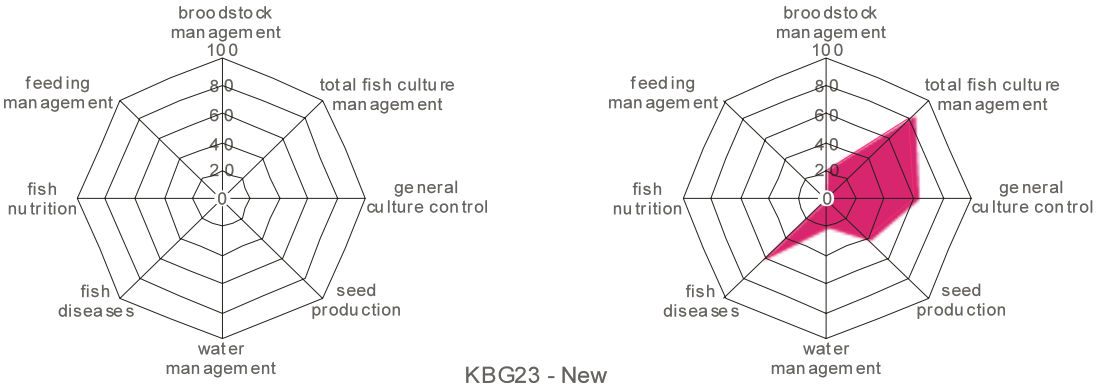
(2001) (2004)



KBG21 - New



KBG22 - New



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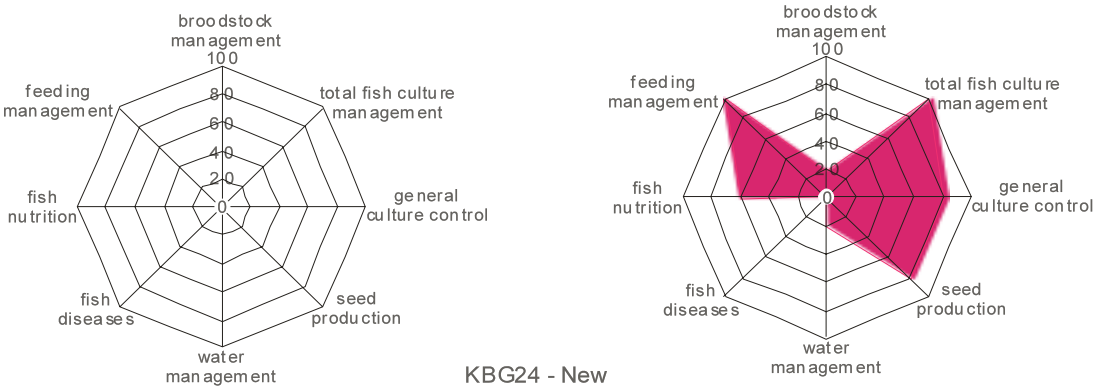
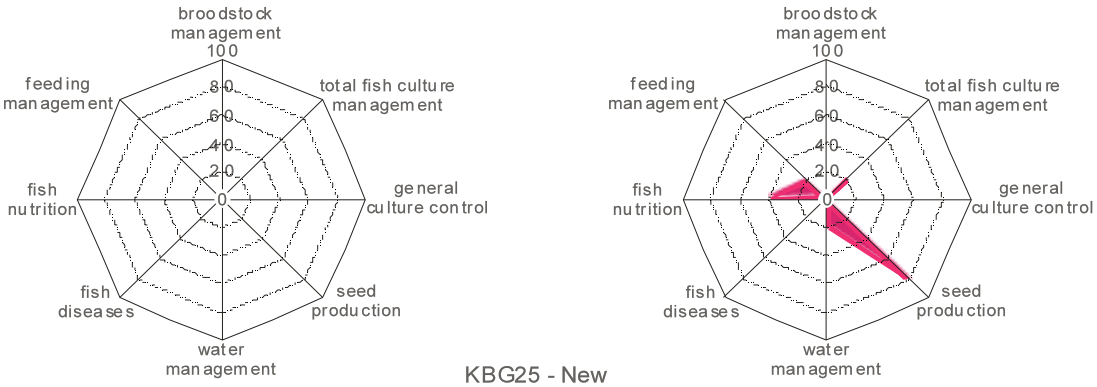
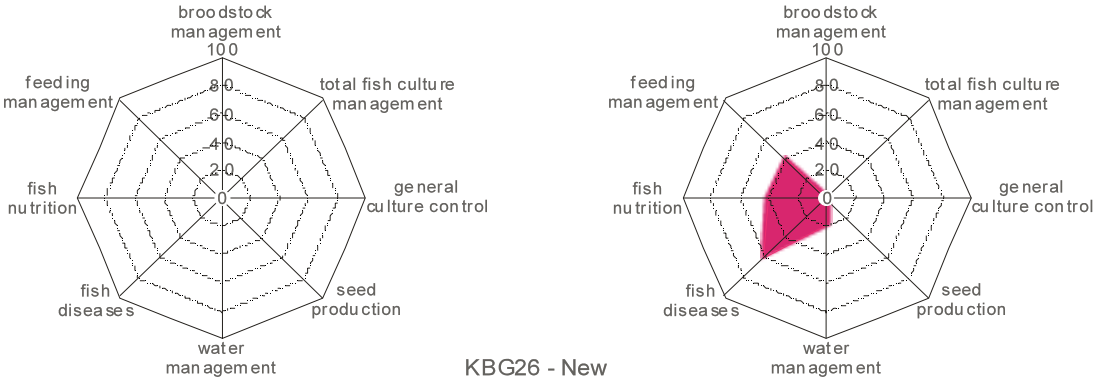


KBG24 - New

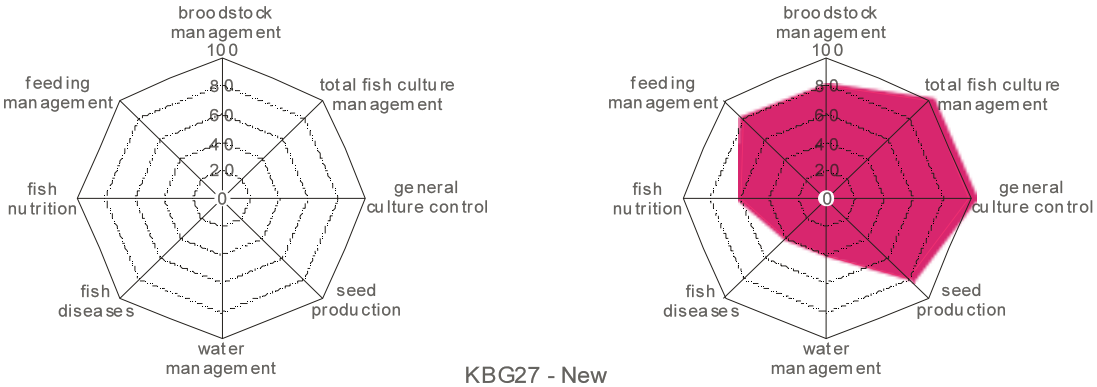
(2001) (2004)



KBG25 - New



KBG26 - New



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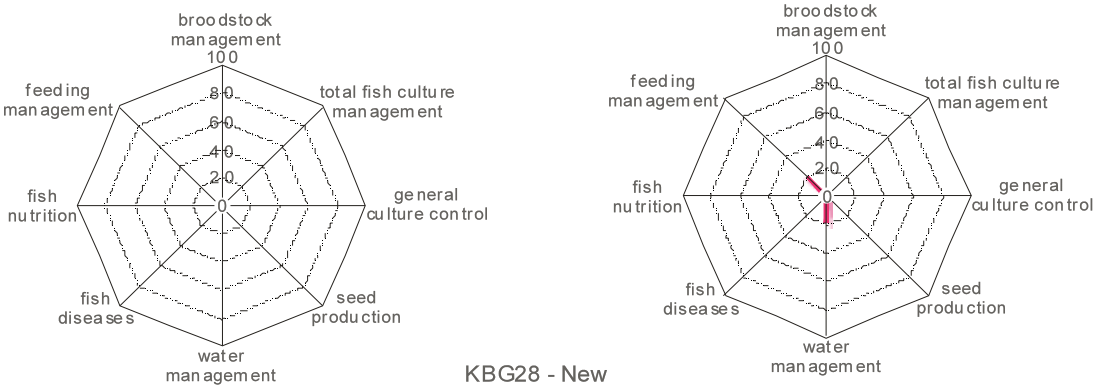
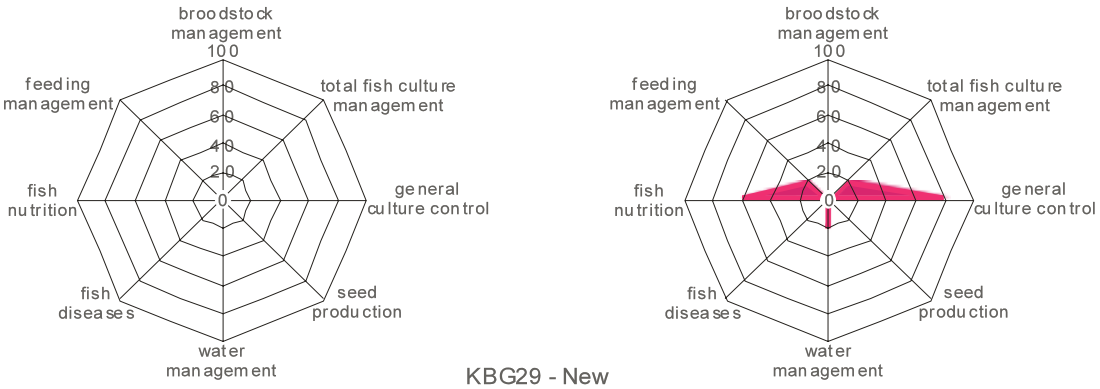
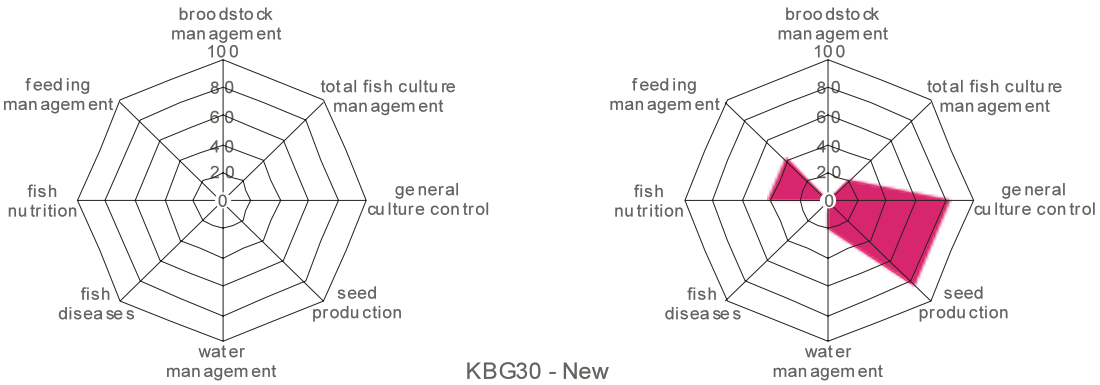


KBG28 - New

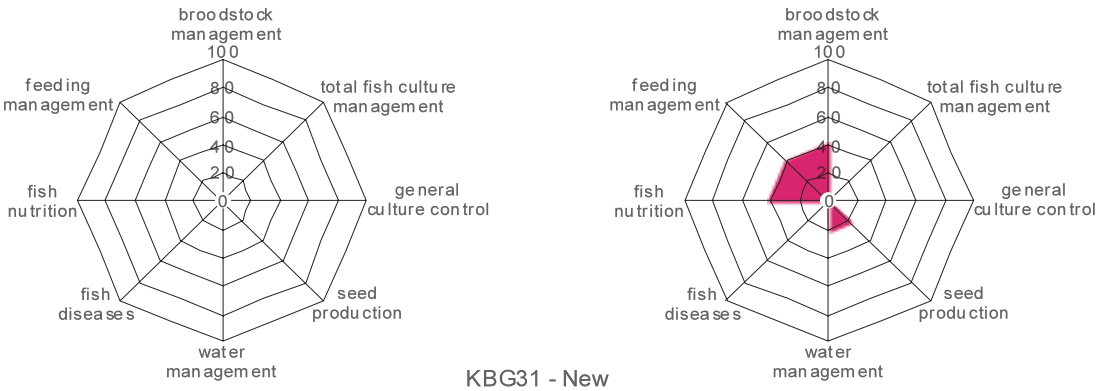
(2001) (2004)



KBG29 - New



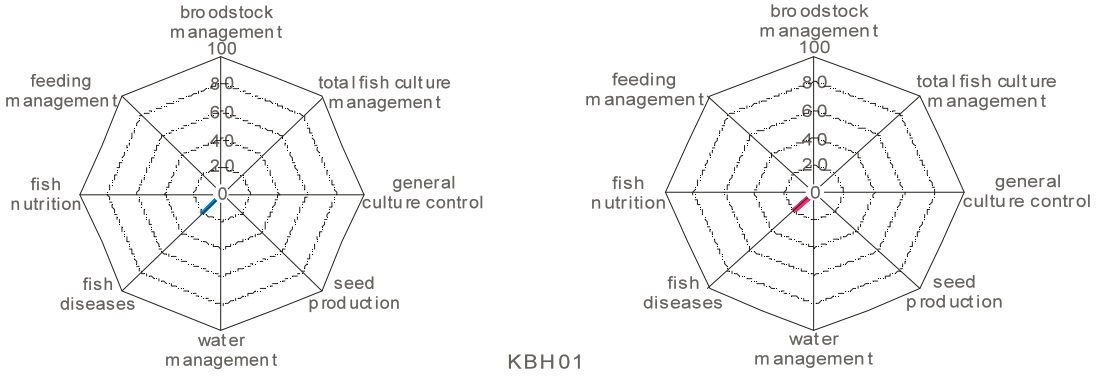
KBG30 - New



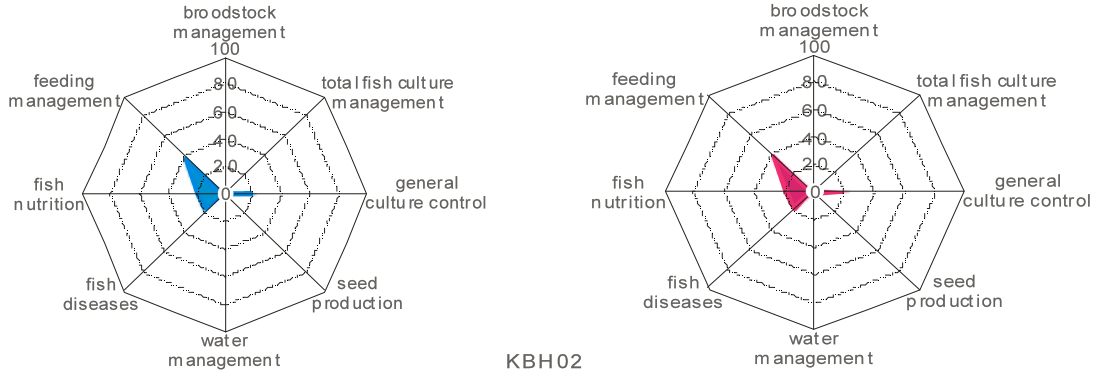
KBG31 - New

Appendix 2. Condition of Aquaculture Technology Farmers 2001 - 2004 in Batanghari District (Shown by Kite Diagram)

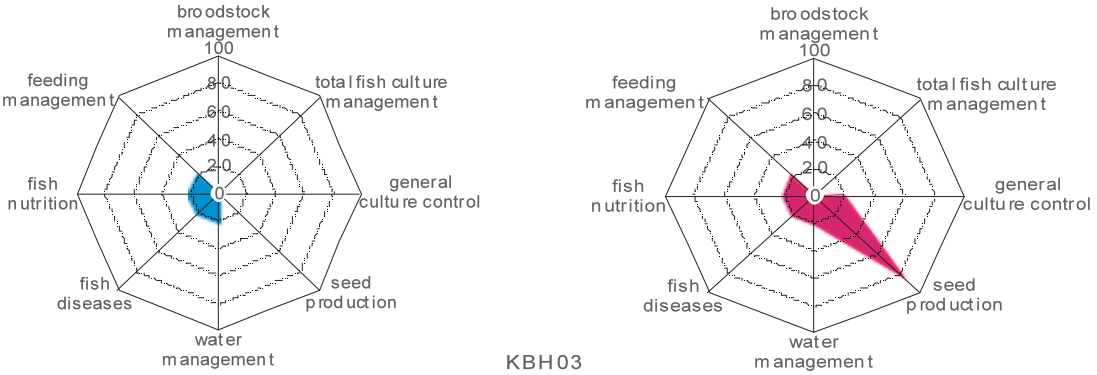
(2001) (2004)



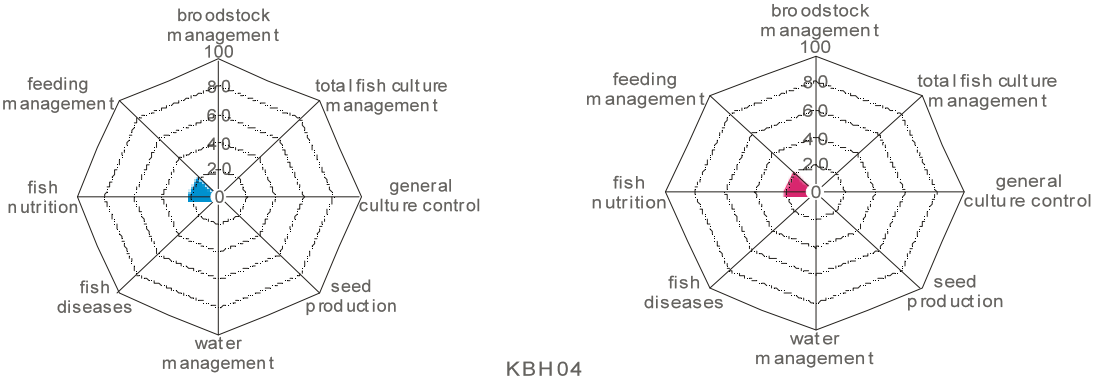
KBH01



KBH02

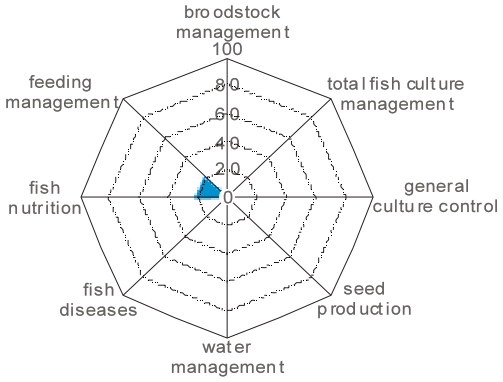


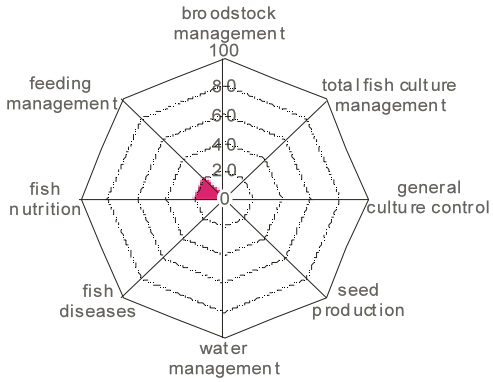
KBH03



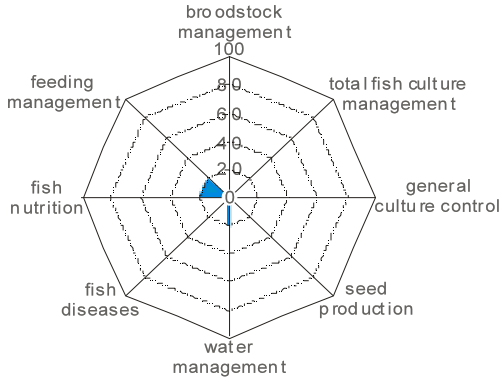
KBH04

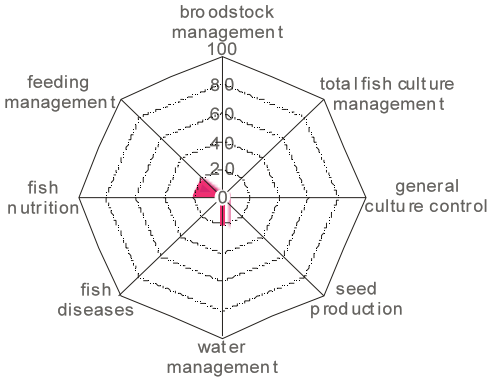
(2001) (2004)



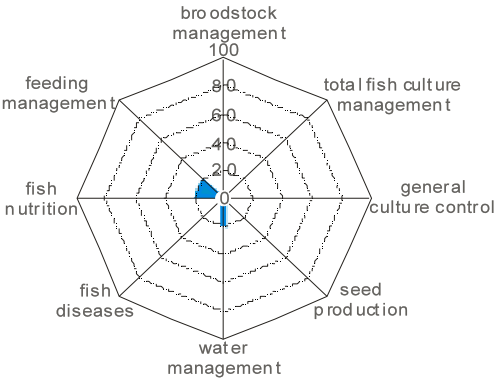


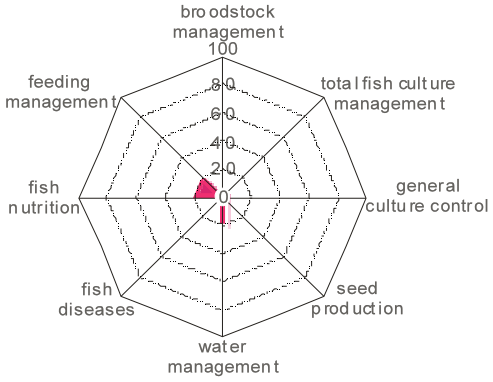
KBH05



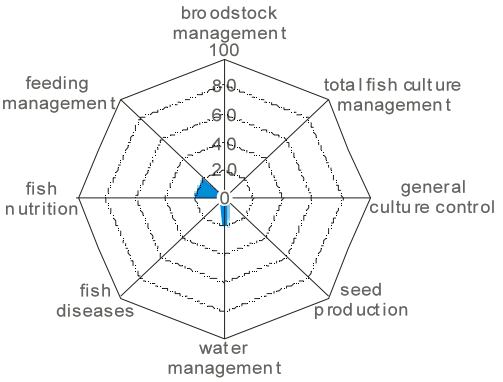


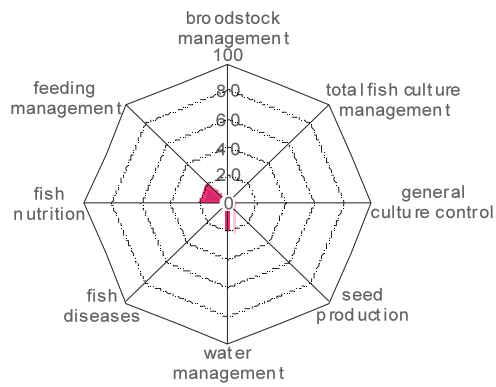
KBH06





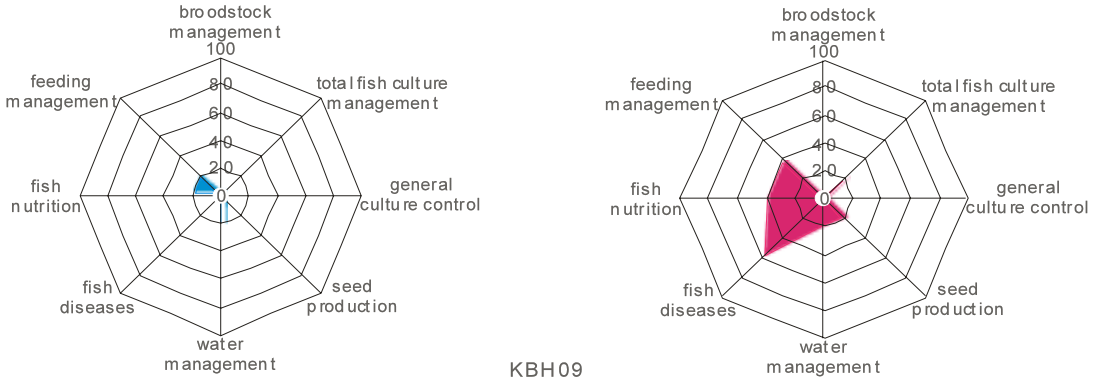
KBH07



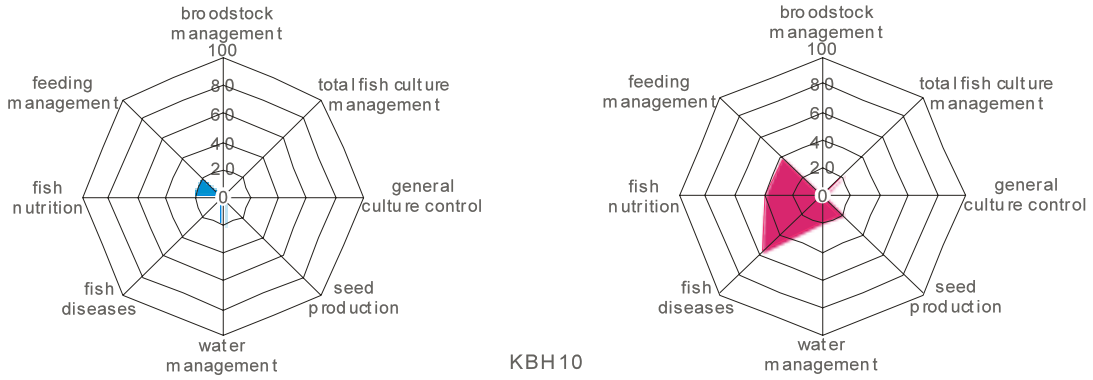


KBH08

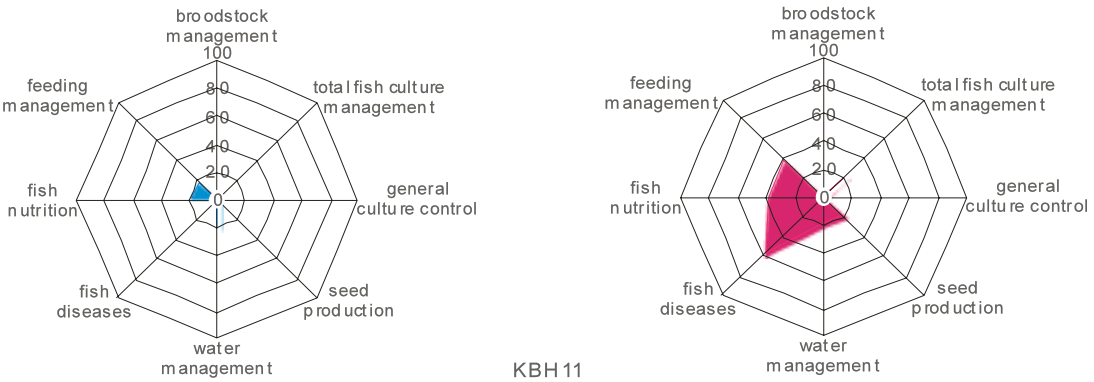
(2001) (2004)



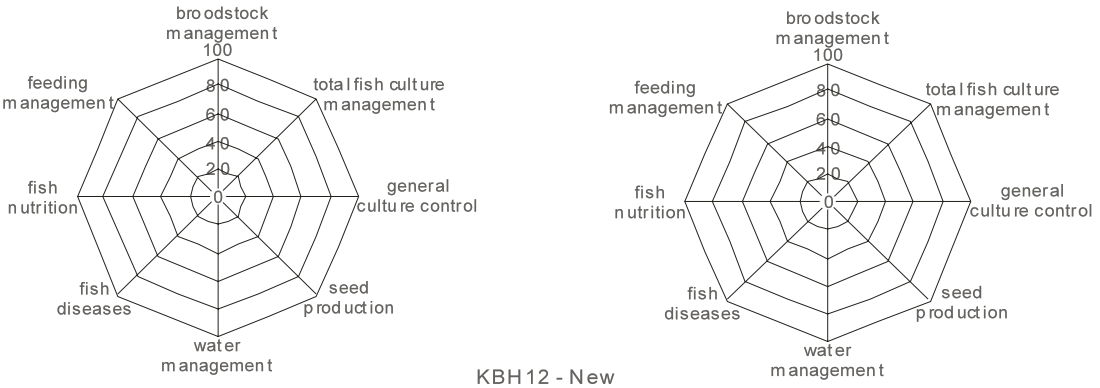
KBH09



KBH10

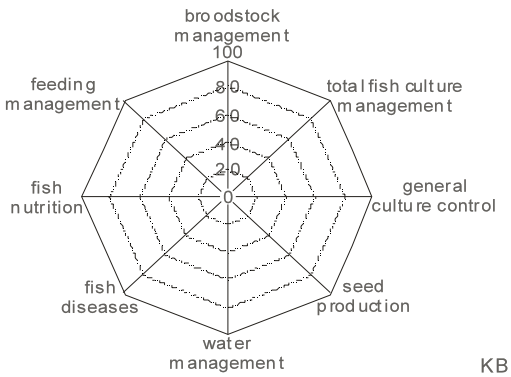


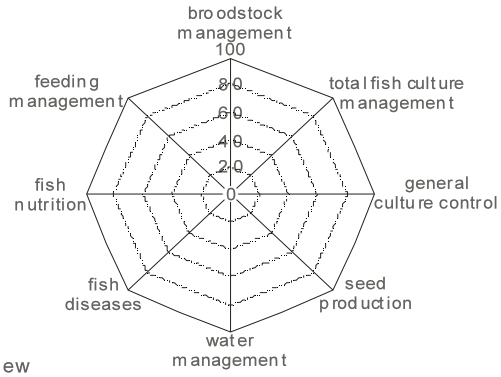
KBH11



KBH12 - New

(2001) (2004)





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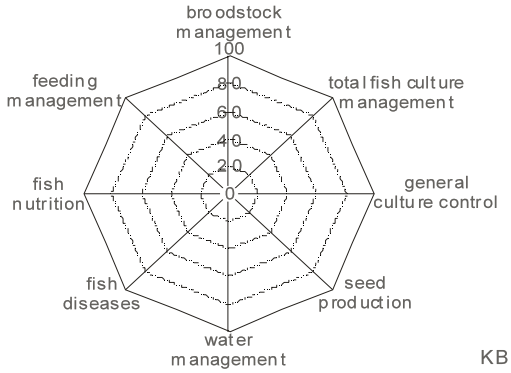
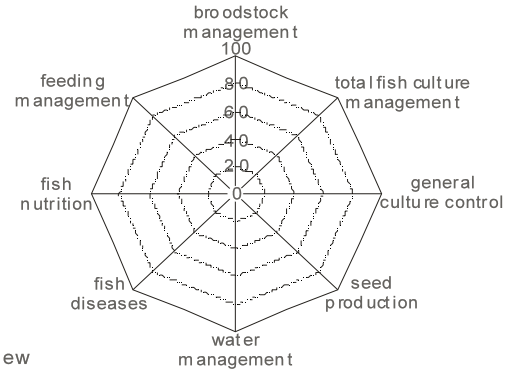
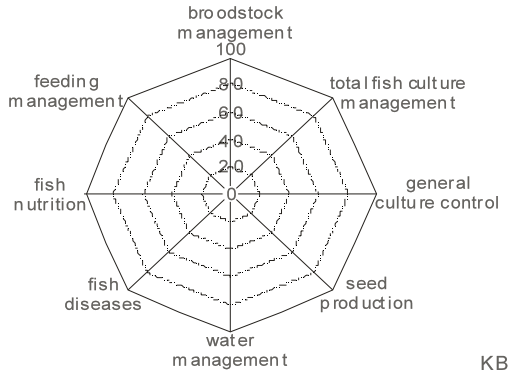
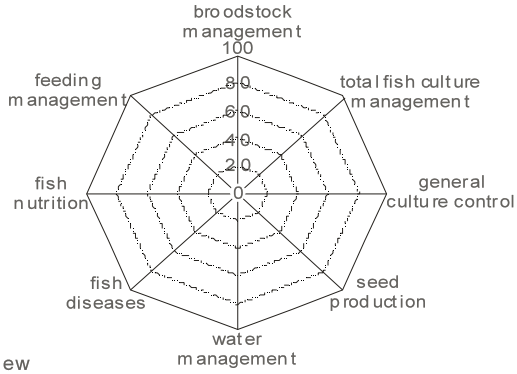


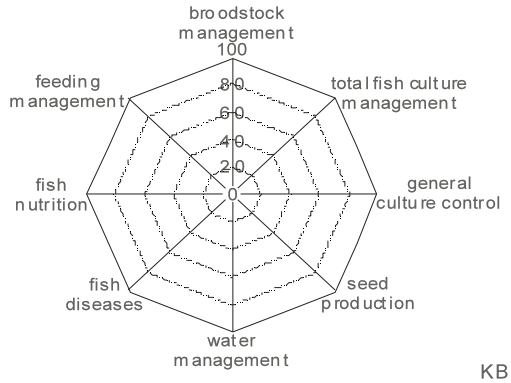


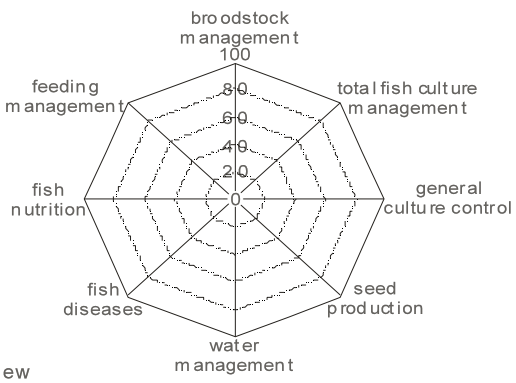
KBH14 - New





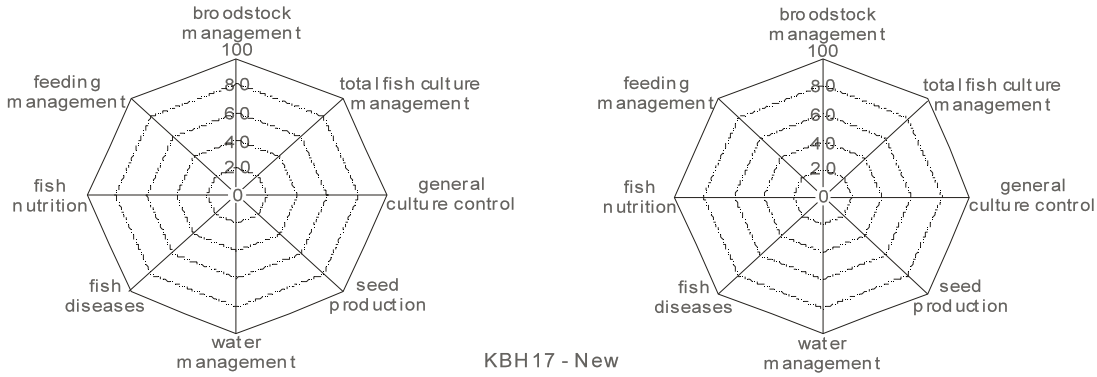
KBH15 - New





KBH16 - New

(2001) (2004)



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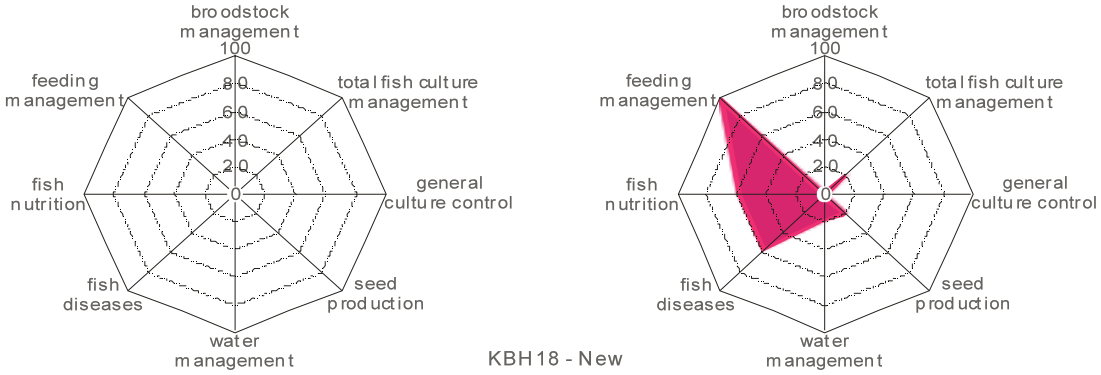

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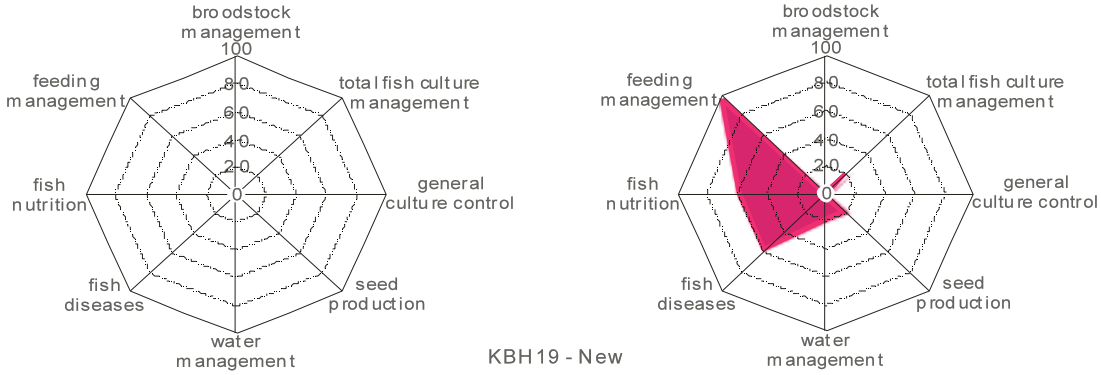

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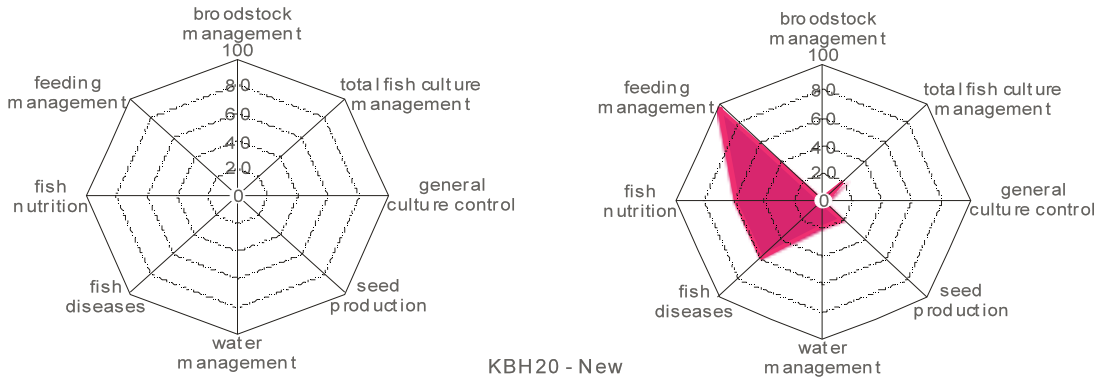

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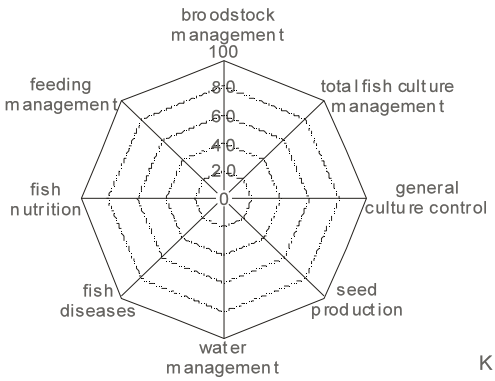
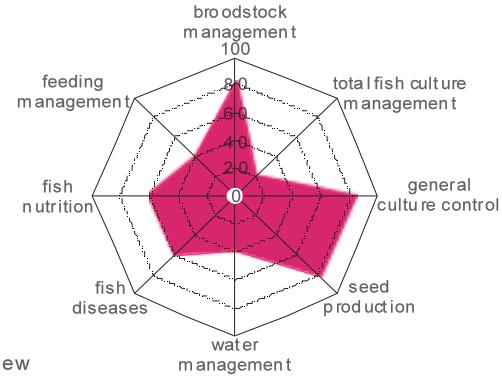
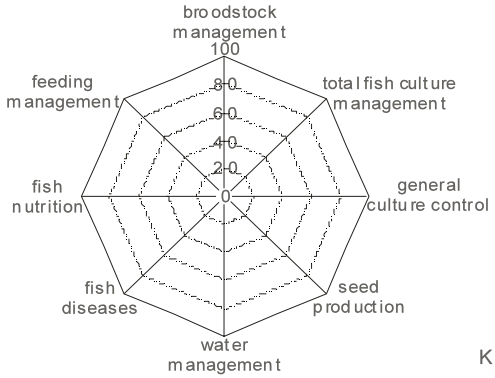
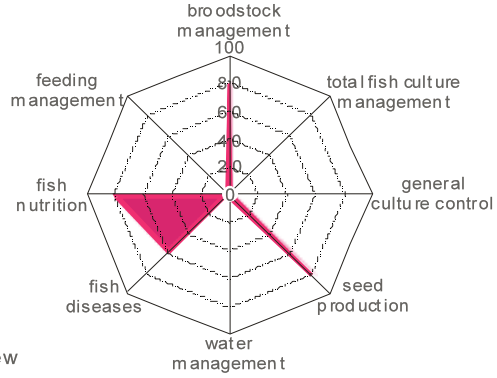


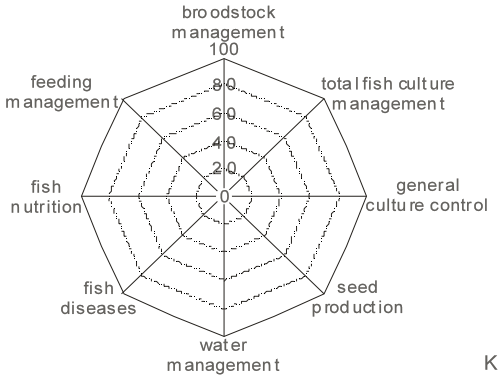


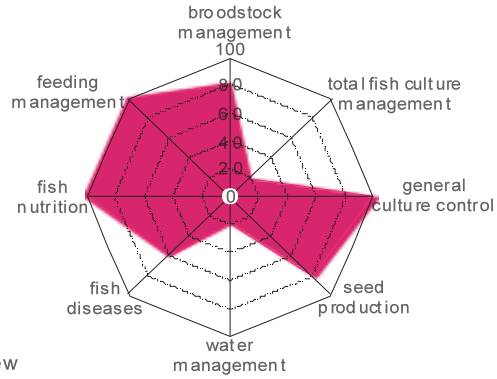
KBH21 - New



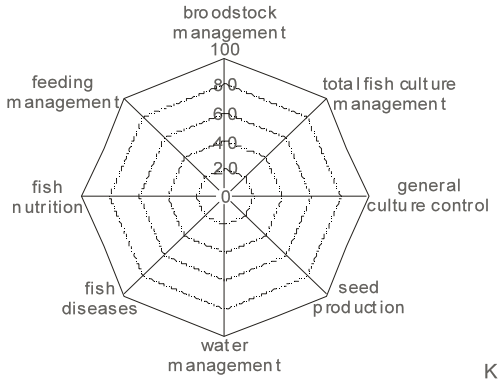


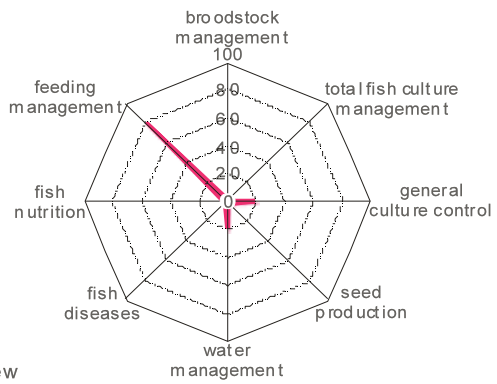
KBH22 - New





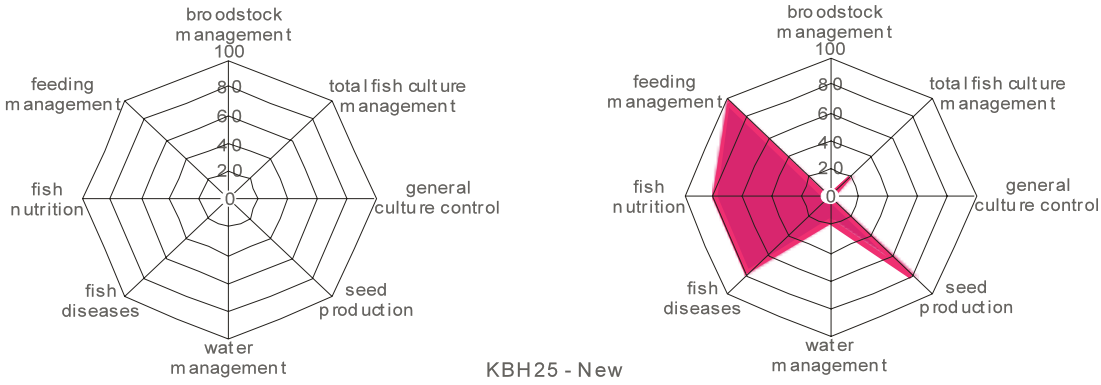
KBH23 - New



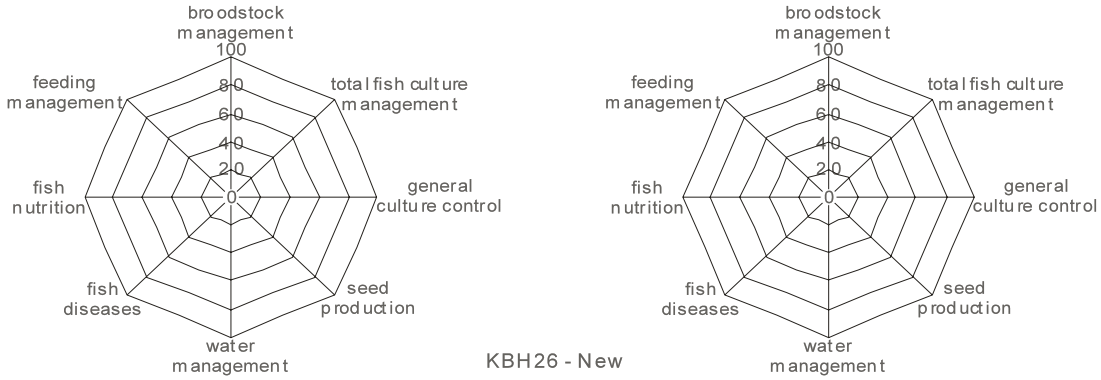


KBH24 - New

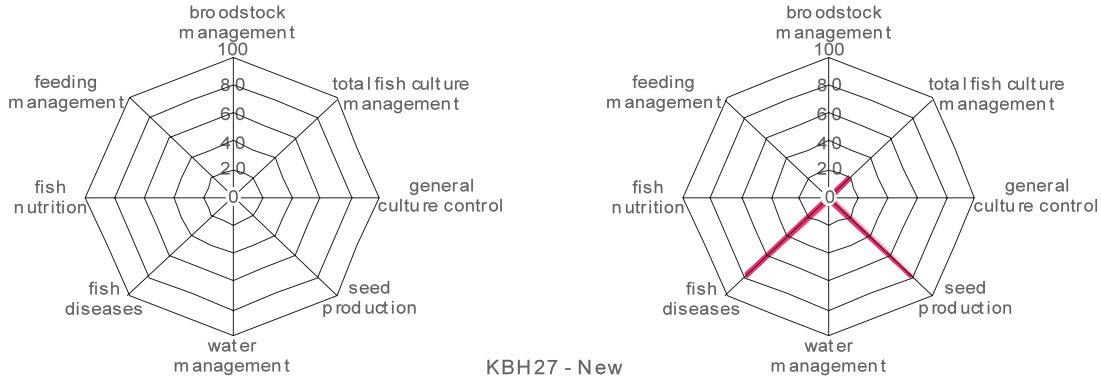
(2001) (2004)



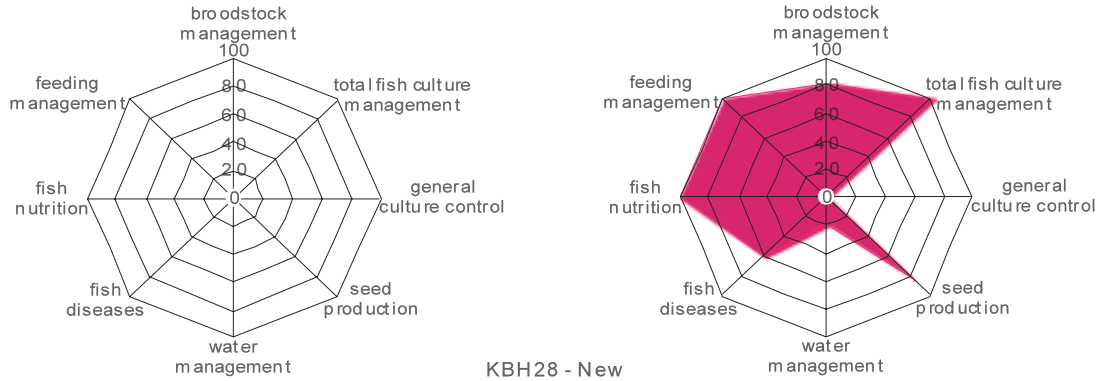
KBH25 - New



KBH26 - New

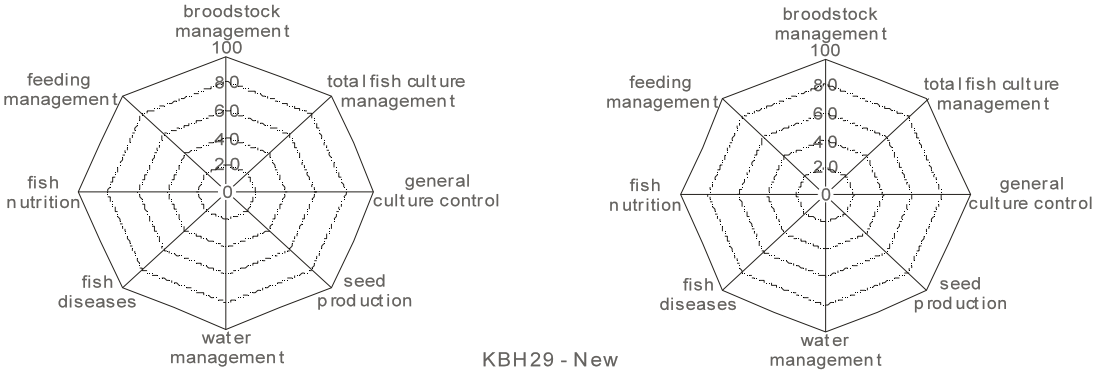


KBH27 - New



KBH28 - New

(2001) (2004)


broodstock management
100
80
60
40
20
0
total fish culture management
general culture control
seed production
water management
fish diseases
fish nutrition
feeding management
KBH29 - New