WORKING PAPER 99.24

THE IMPACT OF THE ECONOMIC CRISIS ON PRODUCTION AND EXPORTS OF FISH

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March 1999

A joint research project on

Linkages Between Indonesia's Agricultural Production, Trade and the Environment
funded by the Australian Centre for International Agricultural Research,

between

CASER (Bogor) • CIES (Adelaide) • CSIS (Jakarta) • RSPAS (ANU, Canberra)

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CASER/CSIS/CIES/ANU
joint research project on

Policy analysis of linkages between Indonesia's agricultural production, trade and environment

Rapid economic growth in Indonesia has been accompanied by significant structural changes, including for its agricultural sector and its unique natural environment. Recently questions have been raised about the impact of Indonesia's agricultural, industrial, trade and environmental policies on sustainable rural development. The nature of interactions between the economic activities of different sectors and the environment are such that an intersectoral, system-wide perspective is essential for assessing them. An international perspective also is needed to assess the impact on Indonesia of major shocks abroad, such as the implementation of the Uruguay Round agreements, APEC initiatives, or reforms in former centrally planned economies. There is increasing pressure on supporters of liberal trade to demonstrate that trade reforms at home or abroad affecting countries such as Indonesia will not add to global environmental problems (e.g., deforestation, reduced biodiversity). Again, this requires system-wide quantitative models of the economy and ecology, because typically there are both positive and negative effects at work, so the sign of the net effects ultimately has to be determined empirically.

To begin to address these issues, the Australian Centre for International Agricultural Research (ACIAR) has generously provided funds for a collaborative 3-year project (to mid-1999) involving the University of Adelaide's Centre for International Economic Studies (CIES) as the lead institution, Bogor's Centre for Agro-Socioeconomic Research (CASER) which is affiliated with the Ministry of Agriculture, Jakarta's independent Centre for Strategic and International Studies (CSIS), and the Economics Division of the Research School of Pacific and Asian Studies (RSPAS) at the Australian National University in Canberra. Being based on Indonesia with its rich diversity of environmental resources (and on which there are relatively good data) and its rapid economic growth, the project could also serve as a prototype for similar studies of other developing countries in Southeast Asia and elsewhere.

The key objective of the project is to assess the production, consumption, trade, income distributional, regional, environmental, and welfare effects of structural and policy changes at home and abroad particularly as they will or could affect Indonesia's agricultural sector over the next 5-10 years. Among other things, the analysis will focus both on the effects of economic changes on the environment, and on the impacts on Indonesia's agricultural production and trade of resource and environmental policy changes. The implications of regional and multilateral trade liberalization initiatives and Indonesia's ongoing unilateral trade reforms will be analysed, along with other potential domestic policy changes and significant external shocks such as the entry of China and Taiwan into the World Trade Organization. The analysis will draw on and adapt computable general equilibrium (CGE) models such as the national INDOGEM Model (built as part of an earlier ACIAR project) and the global GTAP Model.

The project is being undertaken in close collaboration with the Indonesian Ministry of Agriculture and ministries involved in trade, planning, and the environment. A Research Advisory Committee has been established to encourage close collaboration of representatives from those and other ministries.

ACIAR INDONESIA RESEARCH PROJECT

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Introduction

Fishery is one of agricultural sub-sectors whose coverage of activities are very broad. Fish production activities include capture and culture, both at marine, fresh water, and brackish water environments. The production activities are normally followed by processing and marketing which entail certain characteristics and hence need special treatment as fish are highly perishable and deteriorated. Fish processing are gone through both traditional and modern methods. They are not only undertaken to generate added value but rather to preserve fish from further deterioration. However, since fresh fish are often valued higher than processed fish, preservation then means maintaining added value. Fish marketing embrace collecting products from a very spacious areas and further sending and distributing them to retail markets in medium and large cities. The marketing also includes international trade, especially selling high value fish to export markets and importing noncompetitive domestically-produced goods.

Aside from fish production and its forward related activities, fishery also includes supply and procurement of input factors, usually considered as backward or upstream activities of fish production. The input factors that should be provided by fishers and fish farmers include fishing boat and its equipment, bait, seed, feed, and chemicals. Meanwhile, other inputs such as irrigation canals for fish pond, fishing ports, processing facilities, ice plant, and fisheries industrial complex are the examples of important infrastructures whose procurement and availability thus far are mainly under the responsibility of the government. The government also has prominent roles in undertaking research, development, and extension. Besides, the government plans and carry out programs and projects to develop the sub-sector directly and indirectly.

With the aforementioned broad spectrum of fisheries activities and under the framework of five years development plan (PELITA), the government of Indonesia stipulates the objectives of developing and promoting fisheries sub-sector. The objectives are to increase fish production, to improve well-being of fishers and fish farmers, to provide fish as cheap protein source in order to raise per capita fish consumption, to increase export earnings, and to apply rational and sustainable fisheries management. Since the first PELITA onward, the set objectives seemed to be unchanged in items but shift in priority.

At the early years of the new order regime *(Orde Baru)*, the priority of the sub-sector development was placed on increasing fish production and having more foreign exchange. Sticking on that priority, however, the other objectives were apparently left behind. Fishers are still being considered as the poorest of the poor. Meanwhile, excessive

and irrational utilisation of fisheries resources make some fishing grounds become overexploited. Only recently, the government has paid more attention on the sustainability of the resources and the importance of fisheries as a source of income for the people who are living by the edge of the resources.

Like other natural resource-based production processes, the activities of fisheries rely very much on the availability of resources. The more resources are available, the more fish can be harvested. However, it should be kept in mind that fisheries resources (wild and culture) are limited in number. Therefore, increasing fish production cannot be realised all the time. Although, the resources are renewable, they are not guaranteed to be sustained if they are not utilised in properly manner. In other words, targets that should be achieved or burdens shouldered by the sub-sector may be carried on only if long term resources availability is taken into consideration. In technical terms, it means that the resources should be utilised in sustainable basis or a responsible fisheries should be applied (FAO, 1995).

Putting the resources availability as a consideration in the development of the sub-sector is getting much more attention right now, particularly in country struggle to generate foreign exchange from exploitation of its natural resources. As a response of declining foreign exchange reserve impacted by unfinished economic and monetary crises, the government has programmed to quadruple foreign exchange earnings of the exportation of fish and fish-based products from about US$ 2.5 billion now to US$ 10 billion in 2003. This launched program is named *Gema Protekan 2003,* (Mass Movement to Increase Fisheries Export). The target of the program is simply to reach US$ 10 billion export value at the 2003. This target automatically will have implication on fish production. It will also have consequences and may change, if not radically, the ways fish are harvested, structure of technologies used, as well as distribution, accessibility and management of the resources. Although efforts are directed to improve post harvest activities so that the exportation will shift from low to high value commodities, and despite the management of data collection and export reporting system are reformed, those will unlikely attain US$ 10 billion without increasing fish production.

In the same time, increasing of export volume will inversely affect supply of fish for domestic consumption. In other words, the current state of per capita fish consumption of about 16 kg per year which is still considered low, and indeed the lowest among the ASEAN countries, will be difficult to increase. Coupled with declining supply of meat from livestock, the impact of promoting fisheries export on domestic animal protein consumption will be considerably high.

Production and export may be determined by both internal and external factors. As fish are highly migrate to cross the borders of different countries and the facts that proper monitoring and surveillance on fishing grounds are not that easy tasks for developing countries like Indonesia, it is possible that external factors especially production technology of the neighbouring countries also influence production of Indonesian fishery. Fish production and consumption levels in both competing and trading countries are the external factors that could affect the production and consumption of Indonesian fisheries. The structure of production, number of small and medium scale firms, availability of and accessibility to capital, supply of skilled labours, technologies, and bureaucratic procedures are the internal factors that likely determine domestic fish production and export. Those internal and external factors need to clearly understand in a bid to develop fishery sub-sector in Indonesia. A better understanding of the sub-sector and its affecting factors will help in describing challenges and opportunities to develop the sub-sector in the future.

This paper attempts to explain possible change in the state fishery sub-sector as a consequence of economic and monetary crises. Realising that there are many aspects that may affect fishery sub-sectors, discussion will focus on the production and export. Besides, as it is difficult to discuss all commodities which are resulted from various production activities, only shrimp and tuna are taken as examples. After all, these two species (or group of species) are the main export items and contribute about 75% export volume and value. Tuna (including tuna-like species) are resulted from fishing. Farm-raised tuna are not produced in Indonesia yet. Whereas shrimp are produced by both fishing and fish farming. The two commodities are found throughout Indonesian waters. Hence, discussion of the two commodities covers the whole Indonesian provinces.

The ultimate objective of this paper is to understand impact of current economic crisis on fishery sub-sectors. To address that objective, the paper is organised in a way to meet the following intermediate objectives: (1) find out factors affecting production and export performances, (2) understand possibilities of expanding fish production and export by taking into account the world fish production and consumption, and (3) formulate future alternative strategies to develop fisheries as a livelihood of grass-root people, and also as one of the country foreign exchange sources. Before these three specific aspects are explained in detail, the past and current performances of fishery sub-sector is shortly elaborated in order to bring the readers to get insight to the sub-sector.

Performance of fishery subsection

As the biggest archipelago country in the world, Indonesia consists of 17.508 small and big islands and has coastal line of 81.000 km, placing Indonesia second to Canada in terms of length of coast. Having such many islands, Indonesia is endowed with hundreds of bays, seas, and straits. In total, Indonesia has marine waters area of 5.8 million km^2, consisting of 3.1 million km^2 territorial waters and 2.7 million km^2 EEZ. The waters areas which are about 75% of the whole Indonesian territorial, are habitat for variety of wild fish and other aquatic organisms. The waters are also potential for development of fish farming.

The latest attempt to estimate potential of marine fish resources found out that altogether the EEZ and territorial waters contain around 6.1 million ton of fish that can be taken out every year without disturbing sustainability of the resources. These fish resources consist of various species which are distributed in nine regional waters of Indonesia (Appendix 1). Locating in the tropics, the waters of Indonesia has high degree of biodiversity which means that there a lot of aquatic organisms that can be used for humankind. According to Gunarto and Ahmad (1998), there are about 7,000 species of marine fish that could be found in Indonesian waters. However, as reported in the Fisheries Statistics of Indonesia issued every year by the Directorate General of Fisheries (DGF), number of species that have high economic value and thus far have been regularly utilised are only 44 fish, 7 crustacean, and 7 mollusc (Table 1). The main species are tuna, skipjack, group of small pelagic and demersal fish, and shrimp.

Various technologies are used to catch marine fish, ranging from the modern and labor-saved ones like trawl (local name is fishnet), the labor intensive technologies such as purse seine and pole and line, down to traditional technologies like spearfishing. Before 1983, all types of fishing gear basically could be operated throughout Indonesian waters. But by the Presidential Decree Number 39/1980, trawl fishery was banned. With being modified by adding a small equipment (BED) in the net, trawl is renamed fishnet and now can be operated in the EEZ with shrimp as main target catch.

The development fishing gears is very significant, based on the fact of longer fishing trip and higher productivity. However, ambiguity in fishing cannot be avoided. In one hand, there are more than 90% fishing fleets that are traditional and small-scale in nature which share smaller proportion of production. On the other hand, about 10% large-scale and modern fishing fleets get bigger pie of the total fish production. The ambiguity continues as the large-scale fleets normally

catch high value fish whose market outlet are international cities, while the small-scale fleets catch lower value fish whose target market confined to nearest places to fishers community. Also, the large-scale fleets mostly operate in east Indonesian region which are indeed less populated, whereas most of the small-scale fleets are more concentrated in west Indonesia densely region. Consequently, small-scale fishers in west Indonesia have low productivity and earn less income.

Indonesia also has huge potential of inland waters fishery. Unfortunately, there are not so much information regarding this fishery. By limited research activities on the inland waters, the total areas of lake is estimated 425,710 ha, consisting of 162,960 ha in Sumatra, 97,750 ha in Kalimantan, 128,550 ha in Sulawesi, 1590 ha in Bali, and 34,860 ha in Irian Jaya (Kertamihardja, 1998). According to Sarnita (1998), the total areas of Indonesian rivers, lake, and reservoir is about 14,6 million ha, while swamp area approximates 33.4 million ha. Although Indonesian has in total about 48 million ha inland waters, its fishery is less developed. Fishing technologies employed in the waters are relatively simple, usually gill net and use non-motorised boat, while fish farming is mostly done in lake and man-made reservoir.

Beside wild species that become fishing target, Indonesia also has 23 species that so far have been reared in farm. The main species of farming are shrimp and milkfish, carps, tilapia, catfish, and gourame. The technologies used for fish farming are brackish water pond, running water pond, floating cage, and paddy-cum-fish. Comparing to capture fisheries, however, fish farming is relatively less developed. Yet shrimp farming is intensively developed throughout the country, particularly in the north coast of Java and west coast of South Sulawesi. The technology of shrimp farming shown by high stocking rate and intensive feeding recently has been abandoned by farmers due to acute disease problems and increased price of feed. Almost all fish farming technologies that are being practiced now are highly depending on natural or non-manufactured feeds.

In the course of the last 30 years, total fish production has increased by about 6.33% per year. The trajectory of production shows an increasing trend, simply meaning that production can be expected to increase. However, some notes on production trend should be added as one looks at the composition and spatial distribution of production. Table 2 compares fish production by ecosystems and technologies at two different periods. It can be seen from the table that the share of marine fishery was about three-forth of the total production. Together with capture fisheries from inland water, fishing of wild fish contributed about 84% of the total production, leaving 16% for the contribution of fish farming. Except for paddy-cum-fish, production of other fish farming technologies increased substantially. However, it

should be pointed out that those technologies are highly manufactured feed depending. It implies that before 1996 (prior to economic crisis), the technologies might have been used appropriately. However, it might not be the case now. Although official data on 1997 and 1998 are not available yet, by several short trips to the fields in West Java, it was found that fish farming, particularly in floating cages, sharply declined because farmers did not affordable to buy manufactured feeds any more. The situation may plainly tell us that the future of fish farming is gloomy if feed price is still high.

Fish production varied by islands (Table 3). Grouping islands of Sumatra, Java, and Kalimantan as west Indonesian region, and Sulawesi, Bali, Nusa Tenggara, Maluku, and Irian Jaya as east Indonesian region, it can be counted that the west Indonesia contributed about 67% of fish production both in 1992 and 1996. With contribution of 33% by the east Indonesia while in fact it has more waters, one may affirm that there is a disparity in fish resource exploitation. In technical words, it means that fish resources in west Indonesia has been intensively exploited compared to east Indonesia. The impact is quite clear, that is declining in productivity in west Indonesia. Under such circumstance, earnings or returns to fishers is small. This low productive and open access industry can get worse if displaced labours from other sector enter the industry and embarrass the situation.

In total, there were 2.07 million people who work directly as marine fishers. They were almost equally divided into full time and part time fishers and working for 45.000 fishing establishments. Adding 500 thousand fishers in inland waters, altogether there were 2.5 million people who worked as fishers. Say if each fisher has 3 dependents, there were approximately 10 million people directly depending their life on fishing. The number of fishers constantly increased by about 5% a year.

Number of fish farmers also has gone up steadily during the last 20 years. In 1996, there were 2.1 million fish farmers, 5% more than previous year's two million. They were working in brackish water ponds, freshwater ponds, cages, and paddy-cum-fish culture. So it was possible that not all farmers depended only on fish farming as some of them had alternative income sources. Considering technologies applied and nature of farming, therefore, perhaps only farmers running brackish waters ponds who might be categorised as full timers. If so then there were about 200 thousand full time fish farmers in 1996. Adding them up with 2.5 million fishers, then approximately there were 2.7 million people who were economically relying on fisheries. The amount was the same as 3% of the total national labor forces of 90.1 million peoples in 1996 (CBS, 1997).

Aside from those 2.7 million people who directly depend on fishery, there were also those who work in forward- and backward-

linked activities. The backward-linked activities are the ones dealing with supply and procurement of production factors and management of infrastructures, while the forward-linked activities are post production activities, usually marketing and processing. Unfortunately, there are no accurate information or official statistics available on these activities, so the information should be found form an estimate. To have a more reliable estimate, experience of PT Usaha Mina (a state-owned enterprise based in east Indonesia) was taken as a sample. In this company, for every 100 fishers, there are 40 supporting workers in backward-linked activities and fish processing. Also, for the same amount of fishers, there are additional 5 people working in marketing, finance, and management. Therefore, altogether there are 45 peoples who should work in backward- and forward-linked activities to support and facilitate every 100 fishers. Using this information, it can be estimated that in 1996, there were 1.3 million peoples indirectly worked in fisheries. Thereby, in total approximately 4 million people (4.4% of national labor forces) who directly and indirectly worked in fishery in 1996.

The fishery sub-sector has a significant contribution as foreign exchange earnings. The export of fisheries products has steadily grown in the last five years, going from 421 thousand ton, valued at US $1.3 billion in 1992, to nearly 600 thousand ton, worth US $1.8 billion in 1996. The main export species were shrimp and tuna. In recent years, some other species have been introduced and tried to penetrate very tough markets. However, their volume and value were considerably small. In addition, export items also have been diversified from just frozen products to more higher value products such as *block sashimi, tataki*, and even fresh fish. It should be pointed out, however, that these new processed products require huge investment and advanced technologies operated by discipline skilled labours. As a result, although the products have attractive prices, the adoption of the technologies are confined to big enterprises.

Export market penetration could be regarded as successfully done, looking from more diversified products and countries of export destination. Number of countries of destination substantially rose to 74 in 1996, up from 44 in 1992. Although market penetration shows a success performance, in fact the market may be said inefficient as its structure tended to be more oligopsony. The concentration ratio of the biggest four buyer was 80.67% in 1992, going up to 82.31% in 1996. Three of the biggest four importers which always appeared were Japan, USA, and Singapore. Whereas the forth was either Thailand or Hong Kong.

Indonesia also still imports some fishery commodities, although in balance it is always a net exporter. The main commodities imported

are fishmeal, fish oil and fat. Some kinds of temperate species like salmon indeed should be also imported for hotels, restaurants and special consumers who live in big cities. The imports surged dramatically from 73 thousand ton in 1992 to 277 thousand ton in 1996. The 1996's import was valued at US $ 137 million, from only US $ 48 million in 1992, or 185% increased at nominal price. The countries of origin for these imports items were Peru, Chile, Germany, and Denmark.

The performance of fishery sub-sector may be seen from its contribution to the national GDP. As generally applied in Indonesia, the GDP of agricultural sector and its sub-sectors are counted based only on production of unprocessed or primary products. The value of activities resulted from fish processing, fish marketing and other fish-based products which are essentially important parts of fishery system are considered as the GDP of non-agricultural sectors. Therefore, the GDP of agricultural sector and its sub-sectors counted under this system tend to be underestimate. Nevertheless, the prevailing counting system may be able to explain the change in performance and contribution of fishery sub-sector.

As happened in fish production, fishery's GDP at current price also shows an increasing trend. In 1969, the fishery's GDP was Rp 146 billion, increased to Rp 9,041 billion in 1996. During the 1st Pelita, annual average growth -92%, jumped substantially to 22.90% at 2nd Pelita, but then decreased thereafter. The share of fishery's GDP averaged 3.63% per year during the 1st Pelita. A few years thenceforth, the share dwindled to be less then 2% (Appendix 2). By this virtue, one may say that fishery's GDP grew at slower pace than the national GDP. Nevertheless, one may not say that fishery became less important because in fact this less then 2% GDP sub-sectors absorbed and sustained 4.4% labor forces and their families.

Factors that influence fish production

Understanding factors that influence fish production is that important because it can be used for prediction or forecast what will happen in the future. Once the influencing or determining factors are understood, the next step is to find possible change in fish production given the changes in the determining factors. Generally there are two main steps that should be under concern if one wants to do this exercise. First is to build a model that can correctly explains nature of the system, and secondly is to seek and define variables as well as corresponding data that can be used to run the model. Considering all these aspects, the following approach is taken to find out factors that most likely influence fish production. As glimpsed before, only production of tuna and shrimp

are considered as they contributed about 75% of export value.

The relationship between catch or harvest (Y) and fishing efforts as inputs (E) and fishable stock (X) may be defined, after Panayotou (1985), as:

$$(1) \quad Y = f(E, X);$$

Although the size of the fish stock , or resource abundance, varies among time periods, in the short-run, the fishable stock (X) in equation (1) can be assumed to be constant and eliminated from the equation as an explanatory factor of variations in catch. Hence catch can be shown as a function of fishing effort. The fishing effort, or inputs in fish farming, can be broken down into technical and managerial elements (Panayotou, 1982). The technical elements are inputs physically required in production process, while managerial elements are the factors which underlie fishers (farmers) decision-making. By virtue of this, equation (2) is formulated to explain relationship between catch (harvest) and the physical and managerial factors:

$$(2) \quad Y_t = f(P_t, R_t, LX_t, G_t, A_t, LY_t)$$

where: Y_t is total catch or harvest, P is export (fob) price in US dollars deflated by consumer price index of Japan, R is exchange rate (Rp per \$1), LX_t is lag-one variable of export volume, G is number of standard fishing gear, A is the area of shrimp farming (brackish water pond). LY_t is lag-one variable of catch or harvest. The subscript t denotes time (year). The fob price is considered rather than farm-gate price or other domestic prices because tuna and shrimp are exportable commodities. Tuna and shrimp products often go through a very short marketing channel to reach export markets. So it is assumed that fob price is positively transmitted to farm-gate level. The exchange rate is included in order to find out if macroeconomic policy has an impact to catch or harvest. G_t and A_t are physical inputs for fishing and farming, respectively. As there are various fishing gears used to catch shrimp and tuna, they should not be horizontally summed up but has to be standardised first to get correct amount of fishing effort. The standardisation, following Gulland (1983), is:

$$(3). \quad Gt = (\sum_j B_{jt}. F_{jt}) / F_{st}$$

where B_{jt} is number of $_j^{th}$ fishing gear at time t. F_{jt} is catch per unit effort of $_j^{th}$ fishing gear at time t. F_{st} is catch per unit effort of standard fishing gear at time t, where trawl (fish net) and pole and line are standard gears

for shrimp and tuna, respectively.

Using double natural log regression, equation (2) is estimated for tuna and shrimp, and the results are given in Table 4. The adjusted coefficients of determination are 0.94 and 0.97. Taking them together with significant F-statistics, the equations hence are powerful enough to explain variation in tuna and shrimp production. The Durbin-Watson statistics indicate that there is no serious serial correlation problem. Moreover, all the significant coefficients have expected signs.

For both equations, exchange rate was found statistically significant but inelastic in short run. Hence a percentage increase (decrease) in exchange rate will drive up (down) production at a lower percentage. In the long run, production of tuna is elastic with respect to the change of exchange rate, but it will not be the case for shrimp. Production of tuna reacted to movement of its fob price and it was elastic in the long run. The response of tuna production to changes in fob price and exchange rate may affirm external or international factors as important determinants.

Production of shrimp in particular year was affected by its previous year export quantity. This may happen because, compared with tuna whose domestic market is bigger, shrimp relied so much on international market. According to Globefish (1998), Indonesia was second to India in terms of share in the 1997 Japanese import market and ranked at sixth in the 1997 USA import market. The production of shrimp, therefore, may be said partly affected by international factors as export volume and exchange rate were found to be significant variables.

Technology variables were found to affect shrimp production but not affect tuna production. The technology variables are basically composed of technical capability of fishing equipment as well as decisions and management strategies of fishers as entrepreneurs and government as the owner of fish resources. The decision to expand fishing effort by adding another boat, for instance, is undertaken by entrepreneurs. However, it will only be realised if they get fishing permit and license from government. The decision of government to issue permit indeed depend on its overall strategy to develop national fishery. Contrary, even if government has planned to intensify the utilisation of fish resources. However, if it cannot be afforded by entrepreneur, again the plan can not be realised. As can be noticed from Table 4, in fact the technology variable, in this case was number of standardised fishing gear, did not significantly affect the production of tuna. This finding could be an indication that tuna resources has been fully exploited, so that at a very short run the production was saturated. Yet, as given in Table 5, the 1997 utilisation rate was still under the potential MSY which theoretically means that production can be increased if fishing effort is intensified. These opposing information

may be reconciled by the assumption that there might be catch which were not recorded by official statistics. The unrecorded tuna catch might be resulted from the operation of foreign fishing boats in EEZ and territorial waters, legally and illegally, which were not landing their catch in any of Indonesian fishing ports.

Meanwhile production of shrimp was positively determined by number of fishing gear, meaning that intensification of fishing effort will lead to an increasing of shrimp catch. This finding was ascertained by the fact that utilisation rate of shrimp resource was about 74% of the MSY. A peculiar finding is that shrimp cultured areas did not significantly affect shrimp production. Although there are slightly more than 332 thousand ha shrimp ponds now, their average productivity was only around 400 kg per ha per year, or per two cultivating seasons (DGF, 1997). This low productivity might cause the insignificance of cultures areas on shrimp production.

Determinant of export earnings

Export of fishery commodities began to intensively develop at the late 1960's and early 1970's, coinciding with the establishment of state-owned fishery enterprises and the opening of the sub-sector to foreign investor. Thereafter export tremendously developed in volume, value, and number commodity items. Now, fishery commodities are among few agricultural products that can consistently enter international markets and have positive trade balance. For shrimp and tuna, Indonesia may be regarded as big countries. However, that is not the case for many other commodities and species whose biological potential are large enough and basically can be further developed. At this point, one may say that natural potential itself does not guarantee an export development. Beside the natural potential, ways to harvest them which eventually reflect production costs and their demand by foreign consumers are factors that may determine export. In other words, there exist internal and external factors that altogether affect the variation of export. This section is to understand external and internal variables that likely affect export of Indonesian fisheries commodities in the last 20 years. As before, tuna and shrimp are taken as examples simply because their data are available.

Let V is export value, it then can be written into its components as,

$$(4). \quad V_t = (PR)_t . X_t$$

where P is fob price, R is exchange rate, X is export volume and

subscript t denotes year. As commodities under concern have higher international price and demand than the domestic ones, there should be efforts to increase X by improving quality and/or reducing amount domestically consumed. Hence (4) can be stated by:

$$(5). \quad V_t = (PR)_t . (KL)_t$$

where K is percentage of landings (production) that fulfil export quality requirement, and L is total production. Variable K partly shows the state of post-harvest technology. A better post-harvest technology will lead to a higher K. Since L is determined by number of fishing gear used (G) and the productivity of the gear (F), (5) turns to be:

$$(6). \quad V_t = (PR)_t . K_t . (GL)_t.$$

Taking natural logarithm of (6), and then taking first difference, we have:

$$(7) \quad \ln V_t = \ln P_t + \ln R_t + \ln K_t + \ln G_t + \ln F_t$$

Equation (7) says that change in export earnings can be decomposed into five components; change in border price, exchange rate, the extant of post harvest technology, number of fishing gear, and productivity of fishing gear. The first two component may regarded as external factors and the others as internal factors.

As shown in Table 6, variation of tuna export value during the last four Pelita, was largely due to variation of post-harvest or processing technology. Other variables that had sizeable effect were price, number of gear, and exchange rate. Productivity of fishing gear seemed to be the least important factor that determine variation of export. Segregation by Pelita, the post harvest technology is extremely important factor at 3rd and 6th Pelita. The exchange rate and number of fishing gear highly governed the variation of export value in 4th and 5th Pelita, respectively.

For shrimp, post harvest technology had the biggest overall effect, followed by the exchange rate (Table 7). Variation of price, number and productivity of fishing gear seemed to be less important. By Pelita, it is shown that productivity and number of fishing had big impacts on the variation of export whose direction of effect often change between positive and negative. This might have been related to the internal policy to ban and control number and type of fishing gears used to catch shrimp. As of 1983, trawl fishing was being practiced. The ban of trawl in 1983 has brought about modified trawl (fish net) to be operated mostly by large-scale fishers. However, the ban also provided the chance for small fishers to modify traditional gears so that they could be

effectively used to catch shrimp. Some of those modified traditional gears were trawl-like gear so that they sometimes were not accepted by certain group of fishers in certain areas. As a consequence, number and average productivity of gears used to catch shrimp always changed.

For both tuna and shrimp, it may be said that internal factors especially post harvest technology was very important in determining variation of export value. This is true since there are high quality standards imposed by importing countries. Automatic detentions were often encountered by Indonesian fisheries products because of their low quality. The attempts to improve the quality and raise export volume got difficulties provided that fish processing were hardly controlled as they were widely distributed and undertaken by unskilled and unaware labors.

Change in price was relatively more important to tuna than to shrimp. On the other hand, change in exchange rate was relatively more important shrimp than to tuna. The findings were in line with production analysis on the effect of the two variables on tuna and shrimp production. Based on the trend and share of price and exchange rate, it can be inferred that external factors were important. Although they were not so forceful as the internal factors, the changes on the external factors still will have effect on export value.

World fish production and consumption

This section is to understand world position on fish production and consumption. For Indonesia, the rest of the world may grouped into either competitors or target markets. The competitors are countries that produce the same commodities and send the them to the same markets. While the target markets are the countries that have trade relations with Indonesia. Knowing position of competitors and trading partners will help Indonesia define its future path of fishery development.

The world fishery production figures were gleaned from various statistics of the FAO Fisheries Department. Based on the production data of 1950 to 1996, trend of fish production was estimated for each considered country and region. Although data on species were available, to get a broad information, only trend of the total fish production was estimated. Countries included were those thus far have been the competitors or partners. Only 8 partners that traditionally have major shares were considered. They were USA, UK, Germany, Japan, Hong Kong, Singapore, Netherlands, and Denmark. The partner countries in fact were usually grouped into developed or newly-industrialised countries. For the competitors, only big Asian countries were included.

Certainly, it did not mean that competitors in other regions were not significant.

The trend estimation was undertaken by finding the best fitted out of three types trend functions. The three trend functions were linear, parabolic, and exponential. Total fish production was the dependent variable, while year index was the explanatory variable. Based on the trends, 1998 production was estimated for each country. The average annual growth of production was also counted. The results are given in Table 8.

Overall, the estimated functions have good enough R^2, indicating that estimated functions could be accepted to explain the trends and use for forecasting. The average annual growth of developing countries fish production was threefold that of developed countries and nearly double the growth of the world production. The production growth in Asian countries was higher than that in the developed countries. It also can be seen from the table, those conceived as trading partners certainly had lower annual growth rate than that of Indonesia. In fact UK and Germany had negative growth rate meaning that their total fish production tended to dwindle. Based on the growth, it can be said also that the USA and Japan, as two of the biggest producers and consumers, apparently could maintain their domestic production. Meanwhile, those categorised as competitors had experienced growth rate almost comparable to Indonesia's. In term of total production, Indonesia placed third rank after China and India and played as the biggest world producer among ASEAN countries.

Based on the fitted trends, fish production of the world, developed countries, UK, Japan, Germany, Singapore, Vietnam, and Denmark followed negative parabolic functions, indicating that their production will tend to decline in the years to come. In contrast, developing countries, Asia, other competitors had positive production trends, meaning that their production can be expected to increase. Since productions of UK, Germany, and Japan as Indonesian trading partners are predicted to downsize, providing that their fish demands are unchanged, the opportunity to boost trade is opened for Indonesia. However, it should be pointed out that this opportunity may also be grasped by the competitors given that their production also are expected to increase.

Information on demand for fish as presented in Tables 9, 10, and 11 can be used to corroborate if there are opportunities to expand world fisheries export. Information in Table 9 focuses on fish consumption in developing and Western Europe countries. Japan as a developed country in Asia was not included in the analysis. So in this particular case, the Western Europe countries are considered as developed country group. In replace to that, Table 10 and 11 provide information on fish

consumption in the USA and Japan, respectively. The information on the USA is about 10 years outdated. Therefore, use of the information in Table 10 should reckon changes that may have taken place.

Based on the expenditure elasticity in Table 9, marine fish tended to be inferior good in all regions, except in WANA and South Asia. Increase in total expenditure, therefore, will reduce consumption of marine fish. In East Asia, change in expenditure did not significantly affect marine fish consumption. Contrary to marine fish, freshwater fish, beef and poultry were considered as normal good in almost all the regions. In East Asia, freshwater fish, beef, and poultry were income-elastic in demand, where consumption increased faster than total spending.

In the USA, increase in income will raise consumption of crabs and oyster but will not significantly affect the consumption of other fish. (Table 10). Poultry products were found to be substitutes of shellfish and independent of finfish consumption. Increase in poultry price by 1% would make demand for shellfish rise by about the same percentage. On the meantime, change in price of red meat did not significantly affect finfish and shellfish consumption.

To Japanese households, all ranges of fish can be regarded as normal to luxury goods, indicating that fish products have an important place in their consumption pattern. A survey conducted on 1994 revealed that Japanese households spent 13.3% of their average monthly food budget on fish and seafood products (Eales, et al. 1997). Demand for shrimp was unitary elastic to income, while demand for tuna was inelastic. Interesting fact about the demand was that sardines, other small pelagic fish, and shellfish have been deemed as luxury goods. Increase of income by 1%, for instance, will raise the consumption of those commodities by 2.04% and 1.25%, respectively. This was really a revealing fact since those commodities were grouped as low value fish (Table 11).

Tables 9, 10, and 11 also show that fish in all kinds were fairly price inelastic. Some price responses were positive, meaning price and consumption moved to the same direction. This may happen if there exists income effect due to relative changes in bundle of commodities that finally raise real income. Beef and poultry might be grouped also as necessity. They were more price responsive in East Asia than other part of the world. In the USA, both shellfish and finfish were necessity, suggesting that their amount of consumption would change in opposite direction less proportionally than the change in prices. Oyster and snapper tended to be unitary price elastic.

All the consumption information reveal that raise of income will not significantly affect the demand for fish in USA and East Asia but will have positive effect in Japan. However, demand for freshwater fish

likely increase as per capita income in East Asia get higher. In Europe and other developing counties, fish were considered as inferior goods. The increase in per capita income certainly will drive up consumption of poultry and beef but will reduce fish consumption. Poultry products appeared as perfect substitution of shellfish, while consumption of red meat and fish almost entirely independent each other. The findings imply that, except Japan, the expected economic growth in all over the world will not increase fish consumption but likely shift animal protein consumption from fish to poultry products.

Assessment of crisis-induced impacts

Economic and other derived crises began to hit Indonesia on the mid of 1997. Until March 1999, therefore, the crises have attacked the country for almost two years. Within those time framework, there should have been some changes in welfare and development indicators. In the national economy, welfare and development indicators that may be used to trace the impacts of the crises are foreign exchange reserved, trade balance, foreign direct investment, national private investment, unemployment rate, production of real sectors, banking interest rate, exchange rate, GDP, per capita income, number of the poor or those below poverty threshold, as well as the availability and accessibility of nine-basic-necessities. To use all those indicators to explain impacts of the crises on fishery sub-sector is not that easy and appropriate. Beside specific fishery data are not available, the indicators are too macro in nature to capture occurrences that regard with the sub-sector.

Hence for the fishery sub-sector, indicators that should be used are those directly relating to fisheries activities such as process of production, fisheries output, export, price, income, and employment. Although these indicators are finally chosen, not all of which can be thoroughly assessed, simply because current data and information are unavailable[1)]. A rather compromise approach is then taken in order to have data for the assessment. Some information are taken from Monthly Statistical Bulletin of CBS. Others are gleaned from various newspapers. Another approach is to use past trends and information as the bases to assess current and future phenomena. In this regards, an *ex ante* analysis is entertained.

As has been explained before, during the last 30 years fish production has increased by 6.33% per year. If this trend of production continues, *ceteris paribus,* then production will grow by the same rate. In other words, if the crises had not taken place, the production might have increased by 6.33%. This way of thinking follows concept of with and without project analyses usually used in project impact assessment.

In truth, as shown in Table 12, there are tremendous increase in production of the 1st and 2nd quarters 1997 compared to the same period in 1998, suggesting that recent economic crisis has a positive impact in driving fish production up.

Unlike fish, production of manufactured fish feeds considerably decreased at the same period (Table 12). Fish feeds are made of fishmeal and other ingredients such as soybean oil and maize whose supply are highly depended on importation. The depreciation of rupiah against dollars makes import of fishmeal become considerably expensive. As a consequence, feed manufactures decrease substantially. By this reason, it might be said that the economic crisis has a negative impact on production of fishery components which contain imported items. Therefore, the economic crisis bring about both positive and negative impacts on fishery production, depending on input components used in production. If production process requires less amount of imported items, the impact of the crises is positive. Contrariwise, the impact will be negative if products contain high imported inputs.

The economic crisis may have affected price of commodities. Table 13 provides information on wholesale prices of domestic and export goods. Until the end of 1997, it appeared that prices of these two types of goods harmonically increased. However, comparing the prices of August 1997 and 1998 for the two types of goods, it is very clear that price of export goods has experienced a dramatic increase. Assuming that the prices are proportionally transmitted from wholesalers to producers, then one may say that economic crisis has brought a bigger impact to producers of exportable goods. Certainly, the wholesale price of domestic goods also rose by 77% in the same period. Yet this almost meant nothing to fish producers since it was outmatched by the inflation rate raised by about the same percentage.

The increase in fish production and price were seemingly followed by a raise in export volume and value (Table 14). A tendency of declining export in the period of 1996-1997 in fact was overturned by better export performance in the early 1998. Again, the figures may indicate that the crisis unintentionally helped producers or exporters to regain their previous track. Several cases reported by Indonesian news stressed the positive impact of the crisis to producers of exportable commodities. For instance, in South Sulawesi shrimp price increased from Rp 20,000 per kg before the crisis to about Rp 80,000. In Tangerang, West Java, shrimp price surged dramatically to Rp 160,000 per kg up from Rp 20,000 per kg. These price hikes encouraged shrimp farmers to invest in new ponds to revitalize their abandoned farms (Sinar Tani, 29 Juli 1998). Another report says that more than 100 fish traders from Jakarta came to Ujung Pandang and other small towns in East Indonesia to buy all kinds of fish that had possibility to export. As a

result, fish price increased and local consumers had difficulty to afford to fish as before (Kompas, 8 December 1998).

Increase of price of shrimp and other economically important fish, however, bring about some afflicted impacts. Many farms along the north coast of Java are plundered by unidentified mass, allegedly live in the vicinity of the farms. The plunderers are often said as the previous landlords before the lands were transferred to new owners and converted to fish ponds. They are sometimes identified as the unemployed or displaced labors from other sectors. They come and ransack at night or day time often neglecting farm owners and people who look after the farms (Kompas, 13 August 1998). Absolutely it cannot be said that better performance and sustained activities of fisheries sub-sector are the only reasons for these negative occurrences. There might be many other reasons emanating from disorder political and economic situations. Yet the realities are clear enough that fish farmers enjoy windfall of shrimp price hike but due to the loots they are discouraged to cultivate their ponds.

In capture fisheries, the similar phenomenon is taking place. However unlike in farming where raised fish are ransacked, in capture fisheries wild fish resources are destructively taken out. To get as many, fast, and cheap fish as possible, destructive fishing gears and methods are employed. Reports said that newcomers, or those who were prompted by situation to become fishers as they did not get opportunity to earn money in other fields, joined the fisheries by using destructive methods such as dynamite, bomb fishing and potassium cyanide (Kompas, 18 Januari 1999). Besides, trawl or fishnet which were supposed not to enter coastal waters, trespassed the waters and unfairly competed with traditional fishers (Kompas 22 Januari 1999). Those fishing methods did not only kill consumption fish, but also juveniles, fish larvae, micro organism, and devastate environment. With those patterns of fish resource exploitation, fishers can easily catch fish . However, the practices absolutely damage the resources and eventually can stop fishing at all.

Theoretically under the condition of *de facto* open access of fish resources, although *de jure* the resources are thoroughly managed, displaced labours from other sectors can easily enter fishing industry (Anderson, 1977). This argument was recently proved by the fact that 2,753 displaced farmers in Kandanghaur District, Indramayu Regency, entered fishing industry because of failure in food cropping (Kompas, 9 July, 1998). The coming of new fishers will drive up fish production and total income if marginal productivity of fishers is higher than their opportunity costs. Since opportunity costs of new fishers is very low, due to severe unemployment, fish production may increase in the short run. However in the long run, production will drop simply because of

excess fishing effort shown by too many fishers already in the industry. Therefore, if influx of labours from other sectors keep on going, fisheries will carry heavy burdens and eventually will curtail fish production preceded by degradation of fish resources.

Development prospect

Understanding past and current situations of fishery sub-sectors, factors affecting its production and export performances, production and consumption of trading partner and competitor states, as well as possible changes in production incentive and disincentive due to the current economic slowdown, a prospect of fishery sub-sector may be assessed. The followings are discussion on the anticipation of production, export, employment, and income of the fishery that may take place in the future. By virtue of this assessment, role of fishery sub-sector in the endeavours to cope with the country economic slowdown may be understood.

Production

Fish production may be expected to increase. However, production growth is likely slower than the current trend of 6% per year. Although marine fish production is now below MSY, suggesting that production of marine fish may be increased, this requires more efficient and modern technologies since addition of the same type of fishing gears currently employed will not significantly increase fish production. The efficient and modern technologies will facilitate fishers to go farther to hunter fish and not just confine to the inshore waters that seem to have been fully exploited. However, such technologies requires huge investment capital and skilled labours. In the situation where banking loan is very costly and foreign investors are reluctant to come because of unstable political, peace and order situation, new investment is hard to realise. Under the same situations, labours face difficulties to invest in knowledge, skill, and education to grasp the potential since the returns on the investment take longer time while, at the same time, they are trapped by a short life subsistence condition that should be prioritized and fulfilled first. Considering these difficulties, it could be predicted that fish production will increase at a lower rate.

While marine fish production will not substantially increase, production of fish farming may be pushed up since average production is quite low. To increase productivity of fish farming implies that farm or culture areas should be intensively used. The problem is that intensive culture requires manufactured feeds whose supply are now

getting low, expensive, and inefficiently produced in the country. Again, uncontrolled peace and order situations shown by ransack and plunder unceasingly hit fish farmers are disincentive to run the business. If these problems cannot be overcome, raise in productivity of fish farming cannot be so much expected. Hence, production of fish farming also can be increased but it may be still under the optimum production frontier.

Although Indonesia has huge potential of fish diversity, their utilisation is very limited. Both fishing and farming are confined to few species only. Some species are really low in number but have high economic value. Hence limited supply of and high demand for such species create premium price and so provide incentive to development of such fisheries. Some other species are plenty and supposed to contribute more to the total fish production. Nevertheless, lack of information and methods to exploit the resources hinder the development of those fisheries. To use optimally the resources, therefore, technology should be developed.

Spatially, fish resources in west Indonesian region have been apparently fully exploited, while in the east Indonesian region and the EEZ of Indian Ocean, the resource are underutilized. Therefore, production efforts should be directed to the east. The fishery development in the east, however, should be preceded by or coincided with establishment of fishery infrastructures and institutions that may bring fish from the east to more lucrative markets in the west region of Indonesia. Besides, there should be also commitments and actions to do export as much as possible directly from producer areas in the east. If so then the remote and isolated places in the east will have greater chance to enjoy impact of fishery development. In other words, it means that fishery plays its important role as a trigger regional economic development.

High export volume and international price encourage fishers and fish farmers to produce more. Yet it only the case for exportable commodities. Learned from that fact, one may say that if downstream activities are well developed, it functions as incentive to raise fish production. This argument justify the development and improvement of production, distribution, and marketing infrastructures, especially in the east Indonesian region.

Export

Decreasing trend of the world fishery, especially experienced by traditional importing countries, do not automatically imply that export demand for Indonesian fish and fish-based products will increase. There are two reasons for that. First, there exists tougher competition to enter international markets as production of all exporting countries in

southeast Asia are getting higher. Second, there is a tendency for importing countries to alter their consumption pattern from fish to poultry products as income or total expenditure increase. Another trend of international demand for fish is that it tends to concern more with species and quality. In this regard, consumption of common marine finfish will be gradually abandoned and replaced by crustaceans, molluscs, and freshwater fish. In Japan, demand for small pelagic fish and shellfish are expected to increase as income rises. Therefore, export items should be no longer dominated by shrimp and tuna. Diversifying of export items is a must if Indonesia wants to maintain or improve export performance.

Quality of the products will become main consideration by many importing countries. Quality requirements are established in a way that they can safely protect consumers. However, quality requirements may also functions as non-tariff barriers in protecting local producers. The Hazard Analysis on Critical Control Point (HACCP) initiated by the USA in 1994 and now widely adapted by many developed countries that requires producer countries to analyse, inspect, and document all the production lines is an approach used now by the developed countries to protect their consumers. The HACCP procedures should be applied by exporting countries and opened to be examined by inspectors from the importing countries. There is no choice for Indonesian government and fishery companies except to apply the HACCP procedures if they want their products to safely enter international markets.

A high quality product can only be resulted from sound post harvest activities. Although post-harvest activities that stretch from handling at sea , processing, distribution up to marketing are undoubtedly important factors in determining export earnings, they in fact get less attention. As shown in the previous sections, variation of export earnings was influenced more by post harvest activities than by fishing or farming itself. This finding indicates that to earn more foreign exchange it is more advantageous for Indonesia to develop fish processing industry as compared to expand fishing or fish farming. The development of processing industry will increase type and volume of value-added products, reduce post harvest losses, and generate more employment opportunity.

Although they are not so important as the post harvest and production technologies, macro economic condition indicated by realisation of international price of fishery commodities are also important export determinants. The increase in the adjusted border price due to depreciation of rupiah (or appreciation of dollars) has driven up export value and volume. The implication is that fisheries commodities may be expected as a foreign exchange source under the circumstances of slowdown macro economic situations.

Employment and Income

As discussed before, in the short run economic crisis seems to have a positive impact to fishery, looking form the production and export. The increase in the production and export means that there are additional employment opportunities provided by fishery. However, it has been also discussed that temporary or permanent increase in number fishers will not guarantee sustainability of the fishery as the incoming fishers expand their fishing effort and eventually reduce average fish production. Therefore, for the short run, fishery sector may function as a safety valve. However, in the long run, as economic situation is getting better, some fishers should be displaced from fishery in order to reach a rational utilisation of fish resources.

Unlike in fishing, post harvest or processing activities basically provide more permanent employment opportunities. But since the post harvest activities have not been well developed yet, the whole employment potential cannot be realised. In other words, economic crisis has attracted new comers to enter fishing industry but not provided chances to them to get into processing industry. This could be attributed to the fact that access to fishing is relatively easy while, on the other hand, there are capital and technical constraints to enter fish processing industry. The development of fish processing industry, therefore, should be prioritized as it will generate more employment opportunities and increase added value of the products. Also, the development of the industry will avoid labours from uncontrolled entries to fishing activities.

Increase of fish production and price are able to heighten income of fishers and fish farmers. A more positive impact is certainly experienced by producers of export commodities. In the same time, benefits also go the other fishers because fish prices are driven up, although they are sold to domestic consumers. While the short run impact is clearly understood, the long run impact is arguable. As there are many entrants to fishery, they all compete for certain amount of income. As a result, per capita income will eventually decrease. To maintain or even to increase income, productivity should be increased. It has been pointed out before that increase in productivity can be realised if fishers use more efficient and modern fishing gears that can facilitate them to fish in offshore waters and the EEZ. Therefore, to increase income of fishers, programs or schemes that enable fishers to increase productivity should be given first priority.

Concluding notes

This paper has discussed the impact of economic crisis on fishery sub-sector. Overall, it can be concluded that in the short run the impact is positive, suggesting that fishery sub-sector can survive and turn to take benefits from the macroeconomic free fall that strikes the country. With high export demand at the moment combined with depreciation of rupiah, fisheries export surged dramatically in volume and value. This export performance may regarded as an impetus to increase production. As a result, fishing and fish farming burgeon and serve as a safety valve of severe unemployment while sustain the life of fishers and farmers who have been stayed in the industry before. Fishers and farmers who work for export commodities derive tremendous gain from the economic crisis. While their companions dealing with domestically-marketed products also gain from the laxity of fish substitutes in local markets. While the increase in price makes fishers and fish farmers be better off, domestic consumers perhaps get worse off.

A better performance of fishery sub-sector, however, may not be sustained in the long run under the circumstance where the industry is continuously opened to new entrants. Naturally, marine fish resources are bounded. So with uncontrolled entries, number of fishers will increase and productivity eventually will dwindle. The decrease in marine fishery productivity in the long run may be compensated by productivity improvement in fish farming. In this regard, great dependency on manufactured feeds that have big percentage of import components should be phase out.

Reallocation programs should be implemented by the government in order to meet a rational fishery management that guarantee sustainability fishing activity. In that line, development of fishery in east Indonesia should be prioritized. Since investment in new fishing gears and boats are unpopular decision now, it is recommended that government launch reallocation program by which excessive fishing efforts in west Indonesia are shifted to be operated in east Indonesia. The reallocation program will relax resource utilisation in west Indonesia and thus can increase productivity. Therefore, reallocation of fishing efforts as a whole may increase total fish production.

Target of the government to reach US $ 10 billion export value at 2003 seems to be a very difficult task if it is only based on increasing fish production. As pointed out before, fish production both from fishing and fish farming may grow at a lower rate. Therefore, government should promote fish processing industry in order to produce high value commodities that satisfy international demand. Since fish tend to be inferior goods as compared to other protein sources in many developed countries, it should be a good reason for the government to diversify

export market. The position of Japan as the biggest market for Indonesian export commodities should be maintain by, again, diversifying export items. Heretofore, export to Japan was dominated by shrimp and tuna. In the near future, other commodities, especially small pelagic and shellfish, should be given first priority to penetrate Japanese market, as there are evidences that demand for those commodities will increase if per capita income is getting higher.

Government needs to pay more attentions on the monitoring, control, and surveillance (MCS) in the EEZ and remote waters. The MCS should be directed to the activities of foreign vessels allegedly often operate illegally. The implementation of rules and regulations, principally the ones that require foreign vessels to unload their catch in Indonesian fishing ports, should be under main concern of the government. If all foreign vessels unload their catch in Indonesian ports before being exported to other countries, the export target US$ 10 billion may likely be achieved. It is a hope for the government to seriously implement regulations so that all fishers will comply with them.

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Table 1. Indonesian fisheries potential

Variable	Magnitude
1. Number of island	17.508 islands.
2. Coast length	81.000 km
3. Mangrove forest area	2,490,035 ha
4. Area of territorial waters	3.1 million km^2
5. Area of Exclusive Economic Zone (EEZ)	2.7 million km^2
6. Marine Fish Potential (MSY)	6.1 million ton per year
7. Economically important marine species: ∑ Fish ∑ Crustacean ∑ Mollusk ∑ Other animal ∑ Sea weed	 44 species / group of species 7 species / group of species 7 species / group of species 3 species / group of species 2 species/ group of species
8. Economically important inland waters species ∑ Fish ∑ Crustacean ∑ Mollusc ∑ Other animal	 14 species / group of species 3 species / group of species 3 species / group of species 3 species / group of species
9. Cultured species in brackish water • Fish • Crustacean	 5 species / group of species 6 species / group of species
10. Cultured species in freshwater • Fish • Other animal	 10 species / group of species 2 species / group of species.

Sources: DGF, 1998; Soekarto et al. 1996., Mustafa et al. (1998).

Table 2. Fish production by ecosystem and technologies

Ecosystem / Technologies	1992		1996	
	Ton	%	Ton	%
Capture marine	2,692,068	75.97	3,383,457	75.99
Capture inland waters	300,896	8.49	335,706	7.54
Farming				
• Brackish water pond	337,431	9.52	404,335	9.08
• Freshwater pond	116,707	3.29	182,918	4.10
• Cage	8,815	0.24	44,630	1.00
• Paddy-cum-fish	87,415	2.46	101,212	2.27
Total	3.543.332	100.00	4.452.258	100.00

Source: DGF (1998).

Table 3. Fish production by main islands

Islands	1992		1996	
	Ton	%	Ton	%
Sumatra	962,436	28.16	1,255,564	28.20
Java	1,017,177	28.71	1,237,339	27.79
Bali & Nusa Tenggara	287,736	8.12	320,346	7.20
Kalimantan	398,871	11.17	449,389	10.09
Sulawesi	606,126	17.11	747,393	16.79
Maluku and Irian Jaya	273,986	7.73	442,226	9.93

Source: DGF (1998).

Table 4. Factors determining production of tuna and shrimp.

Variable	Tuna	Shrimp
Intercept	1.002	2.804
Export (ton)	-0.068	0.262 *
Exchange rate (Rp/$)	0.509 **	0.153 *
Deflated FOB price ($)	0.502 *	0.023
Standardised fishing gear (number)	0.101	0.107 *
Area of shrimp pond (hectare)	-	-0.199
Adjusted R^2	0.94	0.97
DW-statistic	2.37	2.04
F-statistic	57.79	120.34
Long-run elasticity		
• Export	NS	0.64
• Exchange rate	1.19	0.37
• FOB price	1.17	NS
• Standardised gear	NS	0.26

Remarks: NS = no statistically significant, * and ** are statistically significant at ✂ = 5% and 10%, respectively.

Table 5. Potential and utilisation rate of shrimp and tuna

	Tuna	Shrimp
Potential MSY (ton)	526,000	114,000
1997 Production (ton)	292.658	84561
Level of utilisation (%)	0.57	0.74

Source: Processed by authors from Fisheries Statistics of Indonesia.

Table 6. Decomposition of change in export value of Indonesian tuna

Period	✆ ln P_t	✆ ln R_t	✆ ln K_t	✆ ln F_t	✆ ln G_t
3^{rd} Pelita (1979 - 1983)	0.143	0.090	0.794	-0.103	0.187
4^{th} Pelita (1984 - 1988)	0.098	0.112	0.087	0.183	-0.114
5^{th} Pelita (1989 - 1993)	0.065	0.040	-0.133	0.097	0.163
6^{th} Pelita (1994 - 1996)	0.005	0.040	-0.139	-0.032	0.127
1979 - 1996	0.086	0.074	0.185	0.044	0.087

Remarks: ln P_t = change in border price, ln R_t = change in exchange rate; ln K_t = change in post harvest technology, ln F_t = change in fishing gear productivity (catch per unit effort, ln G_t = change in the number of standard fishing gear.

Table 7. Decomposition of change in export value of Indonesian shrimp

Period	∂ ln P_t	∂ ln E_t	∂ ln K_t	∂ ln F_t	∂ ln G_t
3rd Pelita (1979 - 1983)	0.037	0.090	-0.026	-0.121	0.092
4th Pelita (1984 - 1988)	0.020	0.112	0.053	0.046	0.019
5th Pelita (1989 - 1993)	0.020	0.040	0.062	0.300	-0.296
6th Pelita (1994 - 1996)	0.042	0.040	-0.058	-0.219	0.311
1979 - 1996	0.018	0.074	0.1015	0.026	0.001

Remarks : ln P_t = change in border price, ln R_t = change in exchange rate, ln K_t = change in post harvest technology, ln F_t = change in fishing gear productivity (catch per unit effort), ln G_t = change in the number of standard fishing gear.

Table 8. Trend of production of the world fishery

Country / Region	Annual growth (%)	Trend (Y = production, X = year index)	R^2	Production 1998 (ton)
World	3.87	$Y = -869X^2 + 1988488X + 16436063$	0.98	111,784,054
Developed countries	2.03	$Y = -16659X^2 + 1444578 X + 10155797$	0.93	40,950,401
Developing countries	6.14	$Y = 15789X^2 + 543729 X = 6280265$	0.95	70,833,653
Asia	4.85	$Y = 1461 X^2 + 462118 X + 7409198$	0.99	57,573,171
Indonesia	6.33	$Y = 1593 X^2 - 6912 X + 621955$	0.98	4,108,947
Trading Partners				
USA	1.92	$Y = 3745X^2 - 84908X + 2881043$	0.93	7,712,709
UK	-2.16	$Y = -185X^2 - 6103X + 769480$	0.90	26.092
Germany	-1.44	$Y = -755X^2 + 23177X + 684381$	0.87	10,667
Singapore	2.46	$Y = -20X^2 + 1170X + 1231.$	0.72	9,930
Netherlands	1.69	$Y = 262895 e^{0.0129X}$	0.67	494,469
Japan	2.35	$Y = -6035X^2 + 460488X + 1835760$	0.90	9,907,824
Hong Kong	4.34	$Y = 33X^2 + 3973X + 15940$	0.96	292,019
Denmark	4.27	$Y = -1096X^2 + 92976X - 101271$	0.92	1,821,840

Competitors in Asia				
Thailand	6.90	$Y = 688X^2 + 46730X - 103763$	0.96	3,790,983
Vietnam	6.46	$Y = -281X^2 + 31747X + 72423$	0.80	952,230
Philippines	5.40	$Y = 369X^2 + 35830X + 119449$	0.98	2,762,713
Malaysia	3.57	Y = 108585 e^0.051X.	0.87	1,267,364
India	4.13	$Y = 1548X^2 + 6551X + 79411$	0.97	4,832,776
China	6.96	$Y = 11782X^2 - 285665X + 3514206$	0.88	17,807,473

Remarks: 1998 production is the estimate based on trend.

Table 9. Summary of expenditure and own-price elasticities across regions from cross-country regressions, 1970 - 1995

Regional grouping	Expenditure elasticity	Own-price elasticity	Expenditure elasticity	Own-price elasticity
	Beef		Poultry	
All regions	0.74	-0.21	0.45	-0.21
Developing countries	0.65	-0.14	0.27	-0.17
Latin America	0.38	-0.13*	0.45	0.24
Sub-Saharan Africa	0.83	-0.14*	0.17	-0.26
WANA & South Asia	0.43*	-0.05*	0.73	-0.23
East Asia	1.15	-0.64	1.06	-0.40
Europe	0.72	-0.64	0.42	-0.05*
	Marine fish		Freshwater fish	
All regions	-0.70	0.43	0.44	-0.22
Developing countries	-0.94	0.53	0.25*	-0.15
Latin America	-0.84	1.35	0.25	0.00*
Sub-Saharan Africa	-1.05	-0.31*	0.06*	-0.04
WANA & South Asia	0.56	-0.47	0.77	-0.34
East Asia	0.91*	-0.24	1.04	-0.37
Europe	-0.30	0.43	0.70	-0.47

Source : Delgado and Courbois, 1998.

Notes: Asterisk (*) means statistically insignificant at 10%. All other coefficients significant at 10% or better. Western Asia and North Africa (WANA) includes Algeria, Cyprus, Egypt, Morocco, Saudi Arabia, Syria and Tunisia. South Asia includes Bangladesh, India, Pakistan, Sri Lanka, East Asia includes Brunei, China, Hong Kong, Indonesia, South Korea, Macao, Malaysia, Philippines, Thailand, Europe includes Austria, Belgium, Luxemburg, Denmark Finland, France, Germany, Greece, Iceland, Ireland, Italy, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland, United Kingdom,

Table 10. Own-price, cross-price, and household income elasticities for fish products in USA

Fresh and frozen products	Own-price elasticity	Cross-price elasticity (poultry)	Cross-price elasticity (red meat)	Household income elasticity
Shellfish				
Crabs	-0.77*	0.12	0.03	0.46*
Oysters	1.13*	0.31	0.20*	0.18*
Shrimp	-0.70*	0.34	0.03	0.04
Total shell fish	-0.89*	0.96*	0.03	0.11
Finfish				
Cod	-0.54*	0.61	0.17*	0.06
Flounder/Sole	-0.45*	-0.55	-0.06	0.04
Haddock	-0.56*	-0.40	0.01	-0.01
Perch	-0.70*	0.32	-0.10	0.02
Snapper	-0.97*	-1.78*	0.16*	-0.11
Total finfish	-0.67*	0.04	0.02	0.15

Source: Cheng and Capps, 1988. Remarks: asterisk indicates significant at 10% level.

Table 11. Elasticities of fisheries commodities in Japan estimated by using marshallian demand function, 1997

Commodities	Own-price elasticity	Income elasticity
High Value Fish (tuna and the likes)	-0.99	0.70
Medium Value Fish (horse mackerel, etc)	-1.18	0.90
Low Value Fish (Sardine and small pelagic)	-0.67	2.04
Lobster, Shrimp, and Crab (LSC)	-0.85	1.08
Cuttlefish, Squid, and Octopus (CSO)	-1.09	1.00
Shellfish (Oyster, scallop, etc)	-0.92	1.25

Source: Eales, et al. (1997).

Table 12. Change in fishery production possibly induced by economic crisis

Period	Fishery production index (1993=100)	
	Frozen fish and similar products	Manufactured fish feed
1st quarter 1997	142.58	123.73
2nd quarter 1997	136.86	114.99
1st quarter 1998	144.16	81.82
2nd quarter 1998	183.07	54.70
Change of 2nd quarter 1997 to 1998.	34%	-52%

Source: Computed by authors from Monthly Statistical Bulletin, September 1998.

Table 13. Change in fish price possibly induced by economic crisis

Period	Wholesale price index (1983=100)	
	Domestic goods	Export goods
1996	358	340
1997	403	417
August 1997	410	401
August 1998	724	1414
Change of August 1997 to 1998	77%	253%

Source: Computed by authors from Monthly Statistical Bulletin, September 1998.

Table 14. Change in fishery export possibly induced by economic crisis

	Shrimp	Finfish
Export Volume (ton)		
1996	99.9	336.2
1997	92.1	369.3
1st quarter 1997	43.9	159.2
1st quarter 1998	65.3	175.0
Change of 1st quarter 1997 to 1998	49%	10%
Export Value ($ 1 million)		
1996	1,015.7	375.4
1997	1,007.9	381.4
1st quarter 1997	452.8	159.9
1st quarter 1998	537.9	196.2
Change of 1st quarter 1997 to 1998	19%	23%

Source: Computed by authors from Monthly Statistical Bulletin., September 1998.

Appendix 1. Potential of marine fish resources in Indonesia

Species	MSY (ton)	1997 Production (ton)	1997 Level of utilisation (%)
Demersal	1 792 000	1 113 000	0.62
Small pelagic	3 177 000	1 415 800	0.45
Tuna	152 000	101 688	0.67
Skipjack	374 000	191 000	0.51
Eastern little tuna	205 000	186 486	0.91
Mackerel	127 000	74 640	0.59
Marlin	19 000	na	-
Sailfish	6 000	na	-
Sharks	11 000	na	-
Shrimp	114 000	84 561	0.74
Lobster	5 000	2 021	0.40
Coral fish	76 000	na	-
Squid	22 000	26 216	1.19
Ornamental fish	60 000	na	-
Unidentified		518 915	-
Total	6 010 000	3 810 999	0.63

Remarks: na = no data available
Source: Nurhakim et al. 1998.

Appendix 2. Contribution of fisheries to the national GDP

Year	National GDP (Rp Billion)	Fishery GDP	
		Rp Billion	% of national
1969	2891	146	5.05
1970	3657	152	4.16
1971	4270	160	3.75
1972	5599	180	3.21
1973	6753	134	1.98
Average	-	-	3.63
Growth (%)	-	-0.92	-
1974	10708	179	1.67
1975	12642	191	1.51
1976	15467	215	1.39
1977	19011	328	1.73
1978	21967	393	1.79
Average	-	-	1.62
Growth (%)	-	22.90	-
1979	30601	652	2.13
1980	45446	803	1.77
1981	54027	912	1.69
1982	59633	1053	1.77
1983	77676	1220	1.57
Average	-	-	1.79
Growth (%)	-	17.01	-
1984	89750	1773	1.98
1985	96850	1595	1.65
1986	102546	1921	1.87
1987	124539	2249	1.81
1988	139452	2589	1.86
Average	-	-	1.83
Growth (%)	-	10.65	-
1989	167185	3027	1.81
1990	195597	2352	1.20
1991	227450	3823	1.68
1992	259884	4353	1.67
1993	302017	5385	1.78
Average	-	-	1.63
Growth (%)	-	8.82	-
1994	382220	6544	1.71
1995	454514	7561	1.66
1996	532631	9041	1.70
1997	-	-	-
Average	-	-	1.69
Growth (%)	-	17.56	-

Notes: Compiled by authors from Statistics of Indonesia.

[1)] There are three annual statistics issued by the Directorate General of Fisheries; the Fisheries Statistics of Indonesia, Export Statistics of Fisheries Commodities, and Import Statistics of Fisheries Commodities. The three statistics contain information two years back. So for 1998 publications, the recent information are on 1996.