

AN EVALUATION OF GOVERNMENT POLICIES ON THE DEVELOPMENT OF FISHERIES IN INDONESIA

By

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RINGKASAN

Tujuan pembangunan perikanan adalah pemanfaatan sumberdaya perikanan untuk kesejahteraan dan kemakmuran rakyat banyak. Dalam pelaksanaannya tujuan pembangunan perikanan tersebut dijabarkan dalam beberapa sasaran yang sifatnya bertentangan, sehingga sulit untuk mencapai seluruh sasaran tersebut secara bersamaan. Pemerintah harus memberikan suatu prioritas pembangunan perikanan yang didasarkan pada ketersediaan sumberdaya, teknologi, pendanaan, ekonomi politik dan faktor-faktor kendala yang dihadapi. Pembangunan perikanan selama 1980-1985 yang dipengaruhi oleh kebijakan periode sebelumnya nampak adanya kecenderungan berorientasi pada pertumbuhan produksi dan ekspor serta kurang memberikan perhatian yang memadai pada aspek keberlanjutan dan pemerataan sosial dari hasil pembangunan perikanan.

1. INTRODUCTION

1.1. Present Status and Problem Statement

The fisheries sector has received increasing attention from the government of Indonesia (GOI) and the Indonesian private sector, as concern over increasing non-traditional exports and rural employment has risen. The Directorate General of Fisheries (DGF) is the government agency primary responsible for management and development of fisheries sector in Indonesia. The DGF deals with all matters relating to fisheries administration at the central, provincial, district and subdistrict levels. These matters include collection of statistics, training and extension, provision of infrastructure facilities, and development and control enterprises.

As the largest archipelagic nation in the world, Indonesia has a huge fishery resource contained in 5.6 million km² of ocean, 81,000 km of coastline and thousands hectare inland open water (see Appendix 1). Within the fisheries, in 1985,

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the marine fisheries production continues to dominate, accounting for 76% of tonnage, inland open water fisheries 11% and aquaculture 13% (brackishwater 6.8% and freshwater 6.2%. According to DGF, the Maximum Sustainable Yield (MSY) for all marine resource in Indonesia's jurisdiction is 6.5 million ton per year. In 1985, approximately over 3.0 million people are employed in fisheries sector. Fish provides more than 60% of the animal protein intake of the average Indonesian and is the only affordable source for the majority of the population. In addition, fisheries product are becoming increasingly important as source of export earning, in 1985, total fisheries product exported was US\$ 245.1 million, with shrimp accounting for 83% of this value.

The fisheries sector is characterized by dualistic industrial structure which is a large numbers of small-scale producers using traditional technology (81%) and a newly established large-scale producers. During past two decade, the Indonesian government supported by international development agencies has made a series concious policy decisions to encourage fisheries development. Despite the rapid technological and structural change, the benefit of fisheries development of Indonesia have not been equally shared, most small-scale producers are among the poorest of the poor in Indonesian society.

Research on marine fisheries resources indicates that several fishing ground in the West Indonesian's waters (most populated) experienced over-exploitation, hence, the eastern waters has an abundant of resource but sparsely populated. Viewed from DGF is the fisheries development aimed at increasing production that can be seen from two-thirds of the DGF's total expenditures under Repelita IV (the fourth of Five-Year Plans, 1983-1988) were allocated to increase production and less than 3% was targeted for fisheries resource management and environmental protection. As consequence of development policy that did not give serious attention to fisheries management, some fishing grounds and species were depleted and when government realized, a tough decision must be made that shocked the entire fisheries sector. For example in the case of the trawler ban in 1980, it was a hard choice that must be decided to protect the marine shrimp resource and small-scale fishermen interests by loosing export earning and investment in trawl industry resulted from mis management in resource policy.

The performance fisheries development in the period 1980-1985 shows that fisheries export growth was the fastest with growth 13.8% annually interms of output and 18.1% interms of its value. While fish production expanded at 4.8% annually, fish consumption increased by 2.3%, and employment grew at the level 3.2%. The DGF's emphasis on export-oriented development is mirrored by external development assistance agencies, which are able to justify their investments on the basis of potential foreign exchange earning. This policy less concern that fisheries sector also as source of employment opportunities and source of animal protein, by supporting capital-intensive marine and brackish water fisheries which produce export-oriented

products. In this case, the government has problems in implementing the conflicting goals.

Despite the incompatibility of goals in fisheries development, the government has to decide the hard choices, in order to achieve sustainable and socially equitable fisheries development.

1.2. Objective

This paper reports an attempt to analyze the performance of fisheries development and to evaluate government policies on the development of fisheries sector in Indonesia (1980 - 1985).

1.3. Methodology

In analyzing the performance of fisheries development, time series data from 1980 - 1985 published by DGF was used and also a review of existing literature, statistic of fisheries sector in Indonesia, articles and textbooks related to the topics led to several alternatives of the government policies on the development of fisheries of Indonesia.

2. THEORETICAL FRAMEWORK

One of the principal factor for development is the mobilization of domestic and foreign saving in order to generate sufficient investment to accelerate economic growth. The economic mechanism by which more investment leads to more growth can be described in terms of Harrod-Domar model. In order to grow, new investments representing net additions to the capital stock are necessary. If we assume that there is some direct economic relationship between the size of the total capital stock, (K), and total output or income or GNP, (Y), that is any net additions to the capital "stock" in the form of new investment will bring about corresponding increases in the "flow" of national output (GNP). This relationship, known in economics as the capital / output ratio, (k).

Assume that the national savings ratio, (s), as a fix proportion of national output, (Y), and total new investment is determined by level of total savings, then, the simple model of economic growth could be constructed (Todaro, 1989):

(a) $S = s \cdot Y$, Saving is some proportion of national income.

(b) $\Delta K = I$, Investment is the change of capital stock (K).

$$\frac{\Delta K}{Y} = k, \text{ so } \frac{\Delta K}{Y} = k \text{ and } \Delta K = k \Delta Y$$

(c) $S = I$, total national saving must equal to total investment.

(d) $S = s \cdot Y = k \Delta Y = \Delta K = I$, or simply as $s \cdot Y = k \Delta Y$

$$\frac{\Delta Y}{Y} = \frac{s}{k}$$

Equation (e) is the Harrod-Domar model that states the rate of growth of GNP ($\Delta Y/Y$) is determined jointly by the national saving ratio, (s), and the national capital output ratio, (k). More specifically, it says that the growth rate of national income will be directly or "positively" related to saving ratio, (s), and inversely or "negatively" related to capital/output ratio, (k). In order to grow, economies must save and invest a certain proportion of their GNP. The more they can save and, therefore, invest, the faster they can grow. Suppose the capital/output ratio constant, therefore, in order to increase GNP/GDP growth, government should increase saving/investment. In developing fisheries sector, DGF pushes the investment by encouraging private investment, foreign aid from multilateral and bilateral donors, and support export oriented product.

The objective on supporting export oriented product especially shrimp is to gain of foreign earning from trading, so that income can be used for investment. This policy is related to **Ricardo's law of comparative advantage**, that every country has a comparative advantage, an ability to find some good which it can be produced at a lower relative cost than other goods. In order to get gain from trading, this good it should export in exchange for some the others. Using hypothetical data (adopted from Kindleberger and Lindert, 1978), this theory could be explained as follows:

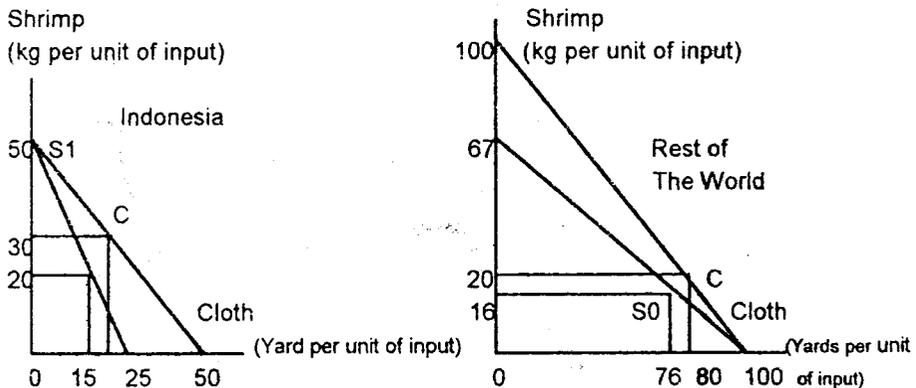


Figure 1. Comparative advantage and the gains from shrimp and cloth trade.

With trade possible, Indonesia can produce shrimp for only half a yard of cloth and shipped and sold abroad for one and half yard of cloth ($1.5 = 100/67$). Shrimp will start flowing from Indonesia in exchange for cloth from other countries, without regard how many inputs it took to produce each good in each country. Soon the expansion of trade will tend to bring the to countries' price ratio into line. Trade will be profitable to both side only at an international price ratio somewhere between Indonesia no-trade ratio (0.5 yard per kg) and the rest of the world's no-trade ratio (1.5 yard per kg). It will pay each side to specialize completely so as to reach the highest consumption possibilities, Indonesia specializing in shrimp and the rest of the world specializing in cloth. If the international price ratio turns out to be one yard per kg, trade might result in each side's settling at its point C, with Indonesia exporting 20 kgs of shrimp in exchange for 20 yards of foreign-made cloth. The gains from trade are the extra consumption possible at points such as C but not possible without trade at points such as So.

These theories can be applied in analyzing growth and trade in fisheries sector. Because of limited data, these analysis is presented qualitatively. The highly concentrated development policy on growth which is stressed in investment on exported fisheries products, affected the achievement of other development objectives such as: to increase fish consumption, to create employment opportunities, to increase income of fishermen and fish farmers, and to improve fishery resource conservation and management.

3. REVIEW OF FISHERIES DEVELOPMENT : AN OVERVIEW (1980 - 1985).

3.1. Past Fisheries Development Plans

Government development planning for the fisheries sector as reflected in the Five-Year Development Plans III (Repelita III) involved the setting of development goals are to:

- (a) increase fish production to meet domestic demand and export;
- (b) improve living standards of fishermen and fishfarmers;
- (c) provide employment opportunities through diversification and development of supporting industries; and
- (d) improve fishery resource conservation and management.

The plans also presented broad strategies for reaching the goals and targets, e.g. Indonesia's fish production was projected to grow at about 5.7% annually, along with budgets for government development expenditure. No attempt was made in the Repelita III plans to quantify the total fisheries sector investment required to reach the state target.

The central role of the private sector in ownership and operation of fishing vessels, fish farms, handling and processing, and marketing and distribution of fish was not explicitly a knowledge in the planning process, nor were capital requirements of the private sector estimated.

External assistance agencies have been very influential in shaping the direction of fisheries policy in Indonesia.

Total external assistance to Indonesia to 1985 estimated about \$207.3 million. Multilateral sources have provided \$139.5 million (e.g. ADB, World Bank, FAO), while the remaining \$67.8 million was provided by bilateral donors (USA, Japan, Germany, France, New Zealand, Italy and United Kingdom). The largest source of external financing for the fisheries development has been the Asian Development Bank (ADB); about \$95.4 million. Most of the external assistance emphasis on export-oriented development such as: to support the establishment of state enterprises to exploit tuna and shrimp, construction of modern fishing gear, fishing ports, refrigerator plant, and other infrastructure necessary to support fisheries industries.

3.2. Role of Fisheries in the Economy

While the fisheries sector contributes a relatively small share of Indonesia's GDP, the sector makes an important contribution to employment, export earnings, and supplies the principal source of animal protein in the Indonesian diet. The real GDP of fisheries sector grew at 5.1% compare to 3.6% in total agricultural sector. Growth in the fisheries sector during the 1980s has kept pace with the relatively rapid growth in the agricultural sector overall, but has lagged behind growth in total GDP. As a results the share of the fisheries in total GDP has slipped from 3.4% in 1970 to 1.6% in 1985.

(1) Production, Employment and Income

Total volume of fisheries production grew by 30% between 1980-1985. Within the fisheries sector, aquacultural production has shown the greatest dynamism; production growth average 8.7% per year, compared with 4.8% for all fisheries. Marine fisheries continued to account for the largest tonnage share of production, providing 76% of the 2.395 million ton, however, this tonnage was only 52% of the harvested value. Inland open water fisheries (inland capture fisheries) has continued to stagnate. Freshwater landing grew by only 1% per year, this growth barely

outpaced inflation (2.5% per year in real term). Marine shrimp production had nearly recovered to the 1980 level which trawlers were banned and total shrimp production had exceeded it. Although aquacultural shrimp production expanded at a rapid rate throughout the period (more than 10% annually), it still accounted for less than one-quarter of the total 1985 shrimp output, the rest were coming from marine shrimp capture fisheries. Tuna/skipjack landing has approximately doubled, despite this growth, Indonesian tuna canneries continued to experience considerable difficulty in generating sufficient tuna supply because most tuna/skipjack were exported.

Total employment in fisheries kept pace with the expansion of output, totaling over 3.0 million includes fishermen, aquacultural farmers, marketing and processing. This figure is equivalent to about 5% of Indonesia total labor force. For the first time the number employed in aquaculture equalled the marine workforce. Part-time fishermen continued to make up the majority of capture fisheries worker (56%). In 1985, the average income of laborers is still relatively low, about US \$480 which was lower than GNP per capita US\$ 550. The number of boats in the marine fisheries grew by roughly 3% annually, however, number of non-powered boats declined as increasing numbers of small-scale fishermen used outboard engine. The largest number of outboard boats (42%) are located in North Java, with Bali/East Nusatenggara and South Sulawesi sharing second place at about 11% each. Non-powered boats are more evenly distributed. The total number of farmers employed in aquaculture grew by 8.6% annually, brackish water aquaculture ("tambak") grew by 3.5%, actually somewhat slower than the rate of expansion in pond area which grew 4.8 percent annually to reach 239,000 ha. Fresh water aquaculture employment grew at 10% and fresh water pond ("kolam") grew at 3% annually expanded to 44,800 ha.

(2) Export Earnings and Consumption

Exports of fisheries product have increased dramatically over 1966-1980, providing an important source of foreign exchange earnings, but during 1980-1985 export performance was somewhat mixed. Combined exports grew only 7.4% in volume, the growth of export was hit seriously by the ban on shrimp trawling nationwide except Arafuru sea which was implemented over in 1980-1983. Shrimp exports declined at annual rate of 0.6% but the average price of shrimp exports increased by 15%. Tuna exports, on the other hand, increased substantially, growing at annual rate of more than 6%. The value of these exports grew much more slowly than the volume, because of a drop of 33% in the average f.o.b price. During the period Indonesia also began to export canned tuna and also fresh sashimi-quality. Canned tuna exported in 1985 amounted to 1,216 ton, only 7% of the total fisheries export

volume. Moreover, canned tuna exports had declined from their 1983 peak of 2,227 ton because of supply difficulties.

Other exports (frog legs, crab, jelly fishes, and ornament fishes) continued to increase slowly, growing 1.4% annually in volume and 2.8% in dollar value. The value composition of exports remained quite stable over the period: shrimp accounted for a slightly lower share 78% in 1985 than 80% in 1980, tuna export increased from 5% to 6% of export value, and other export increased slightly from 14% to 16% of the total.

Indonesia imports of fish products (primarily fish meal) are insignificant. As a result, the balance of foreign exchange generated by the fisheries sector is sharply positive. In quantity terms, the domestic market still absorbs about 95% of total fish production. The central role of fish in the diet of Indonesian families of virtually every income group, ethnic origin and geographic area is no doubt the most significant contribution of the fisheries sector to the Indonesian economy. With the population of 160 million, Indonesia need source of animal protein and fish provides about 62% of total domestic animal protein supplies. Annual fish consumption per capita was 14.24 kg/capita/year an increase 2.3% annually, this figure was lower than an increase in production (5%). The price of fish has become more expensive, both in real term and relative to its primary competitors, this condition could be interpreted as the first sign of increasing market place scarcity. The current emphasis on fisheries products exports is an appropriate response to Indonesia's serious balance problem but government should consider that the future availability of the main source of animal protein to the bulk of the population cannot be ignored.

4. EVALUATION OF GOVERNMENT POLICIES AND DEVELOPMENT ISSUES

The first step in formulating sustainable and socially equitable fisheries development policies is to recognize fishery resource limitations (Bailey,1988). Fishery resource has a specific biological and institutional characteristics. Foremost among these are: (1) biological renewability, fishery resource can be continuously exploited up to certain level without adverse effect, beyond the level of fishing effort which produce maximum sustainable yield (MSY) will not result in further increase in catch but rather can lead to the catastrophic collapse of an entire fishery; (2) uncertainty of scientific data, stock assesment methods depend on quantities and qualities of the data, uncertainty regarding the status fish stock has negative consequences for fisheries development; and (3) property rights, fishery resources generally are open acces resources, the absence of enforceable property rights over the resource results in misusing the resource because fishermen only maximize personal advantage even at the expense of resource sustainability and long-term societal good.

The MSY concept is used by the DGF to justify expanded investment in the productive capacity of the fisheries sector. However, the estimates based on indirect measures is very much doubt. Moreover, the concept of MSY used is not the efficient allocation of fishery resources because it is not considering the costs and benefits of harvesting the resource (Anderson, 1986). Tietenberg (1984), Anderson (1986) states that the proper goal in fisheries management is the maximum economic yield (MEY) which is allocation that maximizes the constant net benefit and it would be happen where marginal benefit is equal to marginal cost (at the point less than point of MSY). The MEY guarantee that society's resources are being so allocated as to maximize the satisfaction or welfare of its people (see Appendix 2).

The DGF's official estimates of resource potentials are misleading. As guides to policy, these estimates are actually dangerous in that they encourage continued emphasis on production-oriented development program. When compared to current catch data, available inventory data suggest that Indonesian fishermen captured between 25%-50% of the potential catch depending on species and area. Research on fishery resource shows that several fishing ground especially in the west region are over-exploited. The concept MSY used tend to promote exploitation beyond that necessary, especially if there is lack in enforcement capabilities. In order to make a better decision making in fishery management, information of the status and potential resource is very important and the MEY concept can be used in regulating fisheries resource.

In the inland capture fisheries, the potential for expansion is even more limited. Environmental degradation and overfishing are rapidly depleting the stock in Java. Deforestation and accelerating overfishing are putting unsustainable pressure on inland capture system in the Kalimantan, which currently supplies 52% of the nation's inland capture fisheries. This phenomenon occurs because of lacking in coordination with other sectors that may affect fisheries sector and also DGF policy stressed on increasing production and less policy targeted for fisheries resource management and environmental protection.

The marine shrimp capture in the western regions has nearly recovered to the levels before trawler ban in 1980. This industry is built around capture by small-scale fishermen and there is only little room for expansion of catch, although there remains opportunity for increasing value through better handling and processing.

There is a potential to expand the tuna catch, within Indonesia Economic Exclusive Zone (EEZ) has a rich and least exploited tuna fishing ground. The potential addition to income and employment is large because much of the current catch is exported virtually unprocessed. The expansion of tuna should integrates small-scale and large-scale, in order to increase tuna value-added, export earning, and employment opportunities.

The other area with potential for growth is aquaculture, both brackish water and fresh water. While brackish water aquaculture advanced strongly in the first half

of the 1980's, with 27% annual growth rate in the real value of production. The focus on increasing production neglected the social and ecological consequences. Most official effort is directed toward increasing production through capital-intensive systems beyond the financial and technical abilities of small-scale producers (Bailey, 1988). Moreover, in the process of encouraging development of pond-produced shrimp (tambak), large areas of mangrove in Sumatra, South Sulawesi, and North coast of Java were being cleared. Massive mangrove conversion threatens the sustainability marine shrimp and other valuable commercial species which are dependent upon mangrove habitat during critical periods in their life cycles (Martosubroto and N. Naamin, 1977). Smith and R. Pestano Smith (1985) state that large scale aquaculture enterprises frequently displace small-scale farmers and aquaculturist through subsidized financing and institutional arrangements that favor the large-scale or corporate investor. Therefore, the development of brackish water aquaculture must be devoted to optimal resource allocation given economic and social factors in the area.

Freshwater aquaculture has generally not received the attention it merits, however, this subsector plays important role in supply protein in rural area and employment opportunities. Fresh water pond ("kolam") employment grew at 10% annually and accounted for 28% of all fisheries employees in 1985, compared to "tambak" employment that grew by 3.5% and "tambak" area grew at 4.8% annually. "Kolam" area expanded 3% annually, less than one-third the rate of employment growth. Thus "tambak" production become slightly less labor intensive while "kolam" production intensified. Freshwater aquaculture offers considerable promise for expanding employment, rural income, and supply protein without the large investments necessary. The market constraint may be encountered if freshwater production growing too fast.

The development of the fisheries sector is closely linked to developments in other sectors : agriculture, forestry, and industry. In general fisheries development competes with these sectors for use of resources (especially water), but fisheries also provides support to the other sectors, particularly industry. For example, siltation and flooding caused by upland agriculture and forest clearing threatens the financial and technical viability of brackish water aquaculture. Coordination with other sectors is needed to eliminate conflict in resources use and environmental problem for future development. Closer coordination with the private sector is also necessary to ensure that the limited funds available for infrastructure are invested in ways providing maximum support to productive private sector investment. The particular investments is needed from larger firms to invest on creating markets for smaller firms and small-scale producers.

It is necessary government encourage and support an effort to diversify markets for products exports, rather than dominantly exports to Japan, in order to protect against price collapse. While the emphasis should remain on frozen shrimp

and tuna (fresh and frozen), consideration should also be given to such product that contributes the value-added to fisheries sector. Indonesia can not reasonable expect sharply higher export prices for fisheries product, therefore, concentrate on improved quality and lower costs to compete in international markets which will likely become more competitive in the future without neglecting domestic markets.

5. CONCLUSIONS AND RECOMENDATIONS

The goal of fisheries development is, in its broadest sense, to use the fisheries to improve the well-being of people in a country (Royce,1987). Since such objectives frequently conflict one with another, it should be noted that it is impossible to maximize more than one objective at one time. It will rarely be possible for each country to pursue all its objectives simultaneously and some priority must be recognize. This will depend on many factors, the politics involved, the relative costs and benefits of each objective, the external aid received, the constraints to implementation, the cooperation government received from those outside its control whose agreement is essential (Lawson,1984). Bailey and S. Jentoft (1990) argued that there are often fisheries sector goals are incompatible but because there is a great diversity in biological, social and economic circumstance which may make some of the goals less urgent or relevant. The government should makes priority that it has to be addressed in fisheries development policy and implementation.

The performance of fishery sector is reflected from development policy of the government, DGF stated clearly the goals, targets and priorities of Indonesian fisheries development but because of the incompatibility of the goals,therefore, the implementation some goals were diverted. For example, the goals to increase income of fishermen and provide employment, a development strategy to increase income fishermen through the introduction new production technologies that are capital rather than labor intensive so increasing technology means reducing employment opportunities in the fisheries sector as a whole. It is important that standard argument favouring technological innovation has profound consequences for social welfare, means that introduction of new technologies will make all members in the society better off.

Resources, In the marine resource, DGF should consider the concept of MEA in fishery management, this concept is safer for the resources and guarantee that society's resources are being allocated as to maximized the social welfare. The problem is going to be faced in applying this concept is the limited data available for that analysis, because collecting good information on the status, potential, and economic of fisheries resources is time consuming and expensive. In the freshwater capture fisheries is coming under increasing strain from environmental pollutants and deforestation. Unfortunately, the financial and organizational resource available are

not sufficient to have significant impact on these problems. DGF should take initiative to work with other sectors related e.g., agriculture and forestry to deal these problems. In the "tambak" expansion government should consider the social and ecological consequences. Massive conversion of mangrove to pond will threatens the sustainability of marine resource habitat in coastal area. Social impact of giving property rights for "large scale" producers should be reconsider.

Exports, the two export markets with the greatest potential are clearly shrimp and tuna. While other markets, such as fresh fish for other Asian markets, show promise for the future. Government actions are urgently needed during this period to ensure continued growth in the shrimp and tuna subsectors. Indonesia currently has comparative advantage and has the potential to increase its output and market share. Export markets will become increasingly competitive during the next few year because increasing global supply is faster than increasing demand for these products. Indonesia must position itself to meet this challenge by strengthening its low cost producers in the shrimp and tuna industry. In the expansion of the export products, government must ensures the integration between large-scale and small-scale producers in the production, processing and marketing. Government should encourage and support an effort to diversify markets and products to protects against price collapse.

Employment, Income and Consumption, In contrast to inland water capture, inland water culture shows considerable promise for expansion in employment, incomes and production of food for domestic markets (consumption). Employment in this sector has increased more rapidly than in any other subsector, expanding by 10% annually. Trend in area and production are mixed, but the end result is that fresh water aquaculture, already much more labor intensive than either brackish water and capture system. Incomes, however, are not increasing as quickly as in other subsectors. The DGF should encourage this trend, given the suitability of this subsector for increasing rural employment, incomes and supply animal protein with limited capital investment. The freshwater aquaculture has received relatively little attention to date. Similarly, greater attention must be paid to brackish water and artisanal marine capture fisheries role in providing local markets with larger fish supplies at acceptable prices. The development of processing industry for export products also will contributes to the expansion of employment in the fisheries sector.

Infrastructures and Institutions, The underlying foundation of the fisheries sector in Indonesia is an expanding network of facilities accross the archipelago to support fisheries development. At the present time, only about half of the catch is handled as fresh fish, while about 46% is dried/salted. Freezing capacity required for export and long distance internal trade is limited and frozen products thus account for less than 3% of total disposition. The development of feed industry, processing industry, tambak irrigation and other infrastructures is important in supporting the development of fisheries sector. Government policies should be designed to

encourage private sector confidence, initiative, and investment. It is the private entrepreneurs who have been largely responsible for the past growth of this sector. Their efforts require continued strong government support in terms of improved infrastructures, research, training, extension, regulation, and credit. The commercial sector with support in infrastructures and institutions from government and society should direct the path toward sustainable and socially equitable fisheries development.

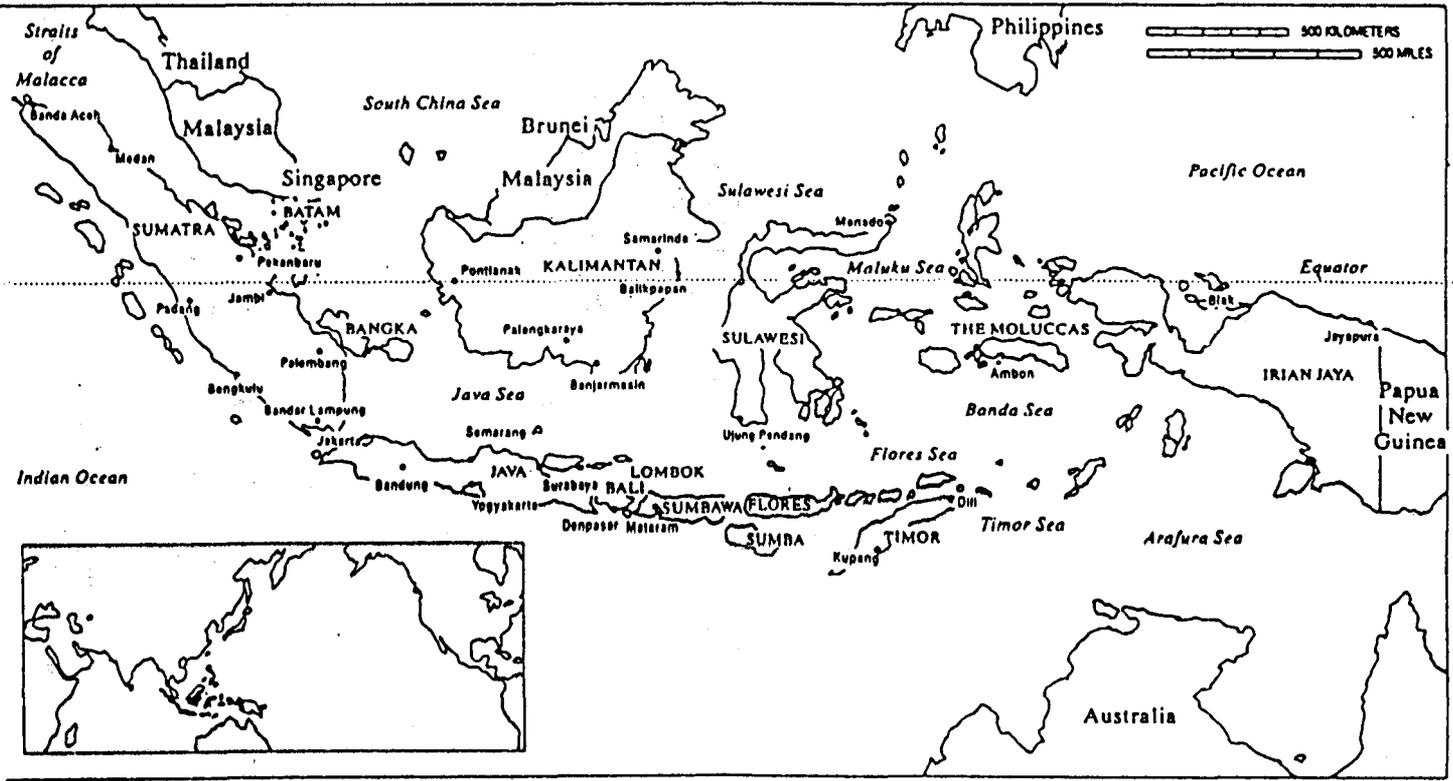
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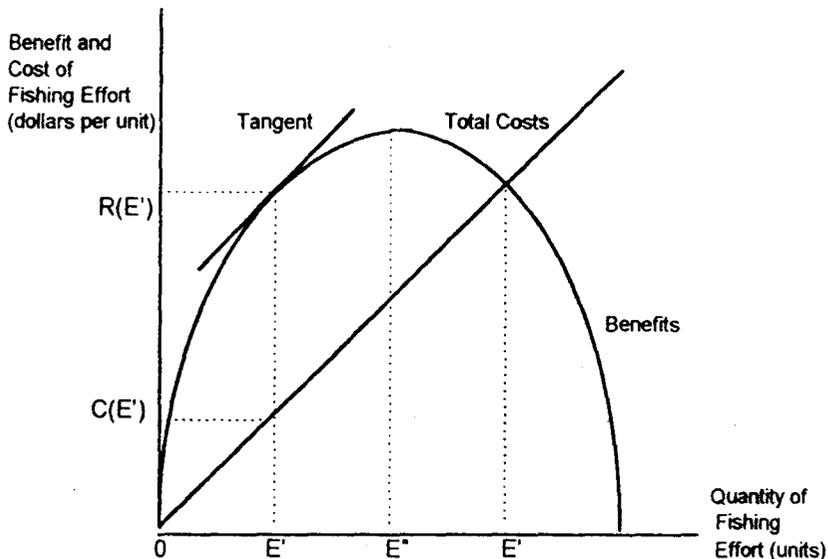


Figure 1. The Efficient Sustainable Yield and The Maximum Sustainable Yield (Tietenberg, 1984)

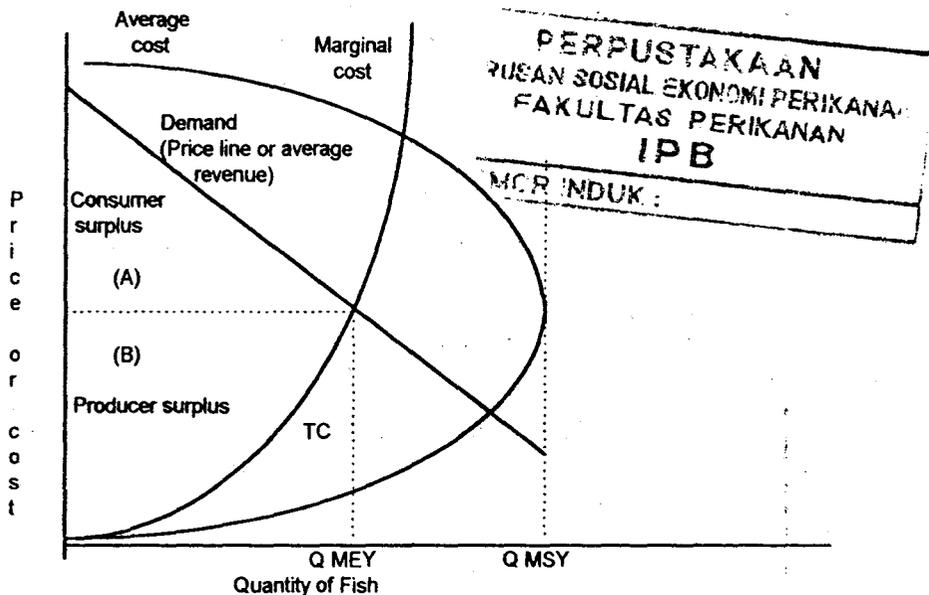


Figure 2. The maximum economic Yield (MEY) and The maximum Sustainable yield (MSY) (Anderson, 1981).