THE ECONOMIC LOSS OF TRASHFISH FISHERIES IN THAILAND

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Abstract

Trashfish has been used as a major raw material for fishmeal production. Demand for fishmeal increases due to the growth of the livestock industry. So fishermen increase their trashfish fishing. The trashfish fishing leads to the loss of marine fish resources as well as the economic loss by overexploitation. The objectives of the study are to find the optimal catch and effort in trashfish fishing and to estimate the economic loss due to overexploitation of trashfish fishing. The results of analysis indicate that the optimal catch and effort in trashfish fishery at present and maximum economic yield are 924,507 and 280,646 metric tons at the efforts of 7,068.350 and 1,243.194 thousand standard fishing hours. The total loss from trashfish fishing is 1,859.88 million baht per year.

Introduction

Thailand's experiences on fisheries is of particular relevance to developing countries, which are trying to develop large-scale fisheries capable of fully exploiting their extended fishery jurisdictions, often without paying attention to developing commensurate management capabilities. Several lessons can be learned from studying Thailand's overextended and refractory trawl fishery and depleted demersal resources, especially trashfish fishing.

Fishmeal is an important ingredients for feed because it contains the essential protein for animal maturation. Generally, the main raw materials for fishmeal production is trashfish because its price is much lower.

The growth of livestock industry has been growing rapidly and leads to increase in the fishmeal demand for animal feed. From 1988 to 1994, annual growth rate of fishmeal demand for feed increased by 11.18%. This rate is higher than the growth rate of fishmeal production. Whereas from 1988 to 1994, fishmeal production increased at an annual rate of 6.60%.

From the above details, it can be seen that domestic fishmeal industries accelerated fishmeal production in response to increase in demand for feed in the livestock industry. Thus, when the demand for fishmeal increased due to the growth of the livestock industry, fishermen increased their trashfish fishing. Besides, the result of the study shows that trashfish from marine fishing in Thailand is mainly caught by trawlers. Trashfish fishing leads to the loss of marine fish resources and also the loss of economy by overexploitation. About 40% of trashfish are juvenile economic species, such as threadfin breams, lizard fish, bigeye, barracuda, crocker, seaperch, grouper, and others. These losses are directly relevant to the overexploitation of trashfish because a catch per fishing trip, a trawler makes, is composed of trashfish for more than 50%.

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Materials and Methods

This paper specifically analyses the fishmeal manufacturers and trashfish exploitation of trawler fishing. Demand for fishmeal is derived from the growth of livestock and also the effect on the trashfish overexploitation. So the demand for fishmeal has direct effect on trashfish overexploitation. The overexploitation of trashfish lead to social costs.

Secondary data are used in this study. The data are taken from the related documents and statistics on the fishmeal industry, animal feed industry, livestock industry, and trashfish fishing. They are given by the government and private agencies such as the Office of Agricultural Economics, the Department of Fisheries, the Department of Business Economics, The Department of Livestock, the Faculty of Fisheries (Kasetsart University), the Feed Mill Association of Thailand, the Thai Fishmeal Producers Association, and the Office of the Economic Adviser of Charoenpokphan Group.

Econometric model, a bio-economic fishery model, is employed to identify the optimal level of fishery, and the loss due to overfishing. Maximum economic yield is identified and compared with the catch and effort of trashfish fisheries at present. Relationship between trashfish fishery and fishmeal industry is also estimated as to identify the loss occurring from development of trashfish fisheries in Thailand.

Results

The fishmeal industry and trashfish fishery in Thailand are appropriate to find the optimal catch and effort in trashfish fishing. This optimizing framework determines the optimum resource use which should be the objective of fisheries management. The optimum catch and effort at maximum economic yield (MEY) gives maximum benefits to the consumers and the fishermen. The ordinary least square (OLS) and the numerical analysis techniques, methods of estimation, are employed to estimate the model. The models are shown as follow:

1. The estimated linear model with trashfish catches per unit effort (Y/E) and fishing effort (E) data is as follows:

$$\begin{aligned} Y/E &= 246.0095 - 0.0163E \\ \text{(t-value)} &\qquad (6.522) \\ R^2 &= 0.77 \end{aligned}$$

2. The estimated log-linear model with trashfish price (P), quantity of trashfish (Y), and domestic fishmeal price (P_{DFM}) data is as follows :

$$\begin{aligned} \ln P &= -1.2351 - 0.1489 \ln Y + 1.1619 \ln P_{DFM} \\ \text{(t-value)} &\qquad (1.574) \qquad (2.331) \\ R^2 &= 0.94 \end{aligned}$$

The price of fishmeal would be 14.35 baht per kilogram or 1,435 baht per ton. Substituting this value for P_{DFM} in equation, we have

$$P = 1{,}353.7832\ Y^{-0.1489}$$

In contrary, the fishing effort on trashfish fishing includes many kinds of fish which have high values, so the average revenues (AR) or price line (P) of trashfish is adjusted by the ratio between the value of trashfish and the other fishes by otter board trawl. This ratio is 13.04. The result of adjustment is as follows;

$$P = AR = 10{,}381.7730\ Y^{-0.1489}$$

3. From (1), to find the optimal point of cost function.

$$E = \frac{246.0095 \pm (60{,}520.6741 - 0.0652Y)^{\frac{1}{2}}}{0.0326}$$

$$TC = \text{Total Costs} = c\,E$$

where, c = trashfish cost per unit effort which is equal to 329.468 thousand baht per hour or 329,468 baht per hour. (This figures is calculated from survey data by the Office of Agricultural Economics.)

$$\text{so} \quad TC = 329{,}468 \left\{ \frac{246.0095 \pm (60{,}520.6741 - 0.0652Y)^{\frac{1}{2}}}{0.0326} \right\}$$

$$\text{and} \quad MC = \frac{dTC}{dY} = \pm \frac{(329{,}468)\ (0.0652)}{2(0.0326)\ (60{,}520.6741 - 0.0652Y)^{\frac{1}{2}}}$$

4. To obtain maximum economic yield (MEY), we need average revenues (AR) and marginal cost (MC). We may now proceed to estimate the level of catch which maximizes social benefits by setting P = AR = MC.

$$10{,}381.7730\,Y^{-0.1489} = \pm \frac{(329{,}468)\ (0.0652)}{2(0.0326)\ (60{,}520.6741 - 0.0652Y)^{\frac{1}{2}}}$$

Thus, Y_{MEY} = 280,646 metric tons

From this MEY, the effort is 1,243.194 x 10^3 standard fishing hours.

5. The equilibrium solutions as discussed above are long-run equilibriums which can be reached only when trashfish fishing is allowed to adjust on the basis of sustainable yield. Nevertheless, trashfish is more like by-catch in sprite of its catch composition being half of total catches. Fishermen may not adjust their fishing behavior in response to the returns from trashfish fishing. Based upon this explanation, we will consider the scenario where effort is maintained at the present actual level. At such level, it has been found that catch is 924,507 metric tons per year while effort is 7,068.350 x 10^3 standard fishing hours. At this actual level, fishermen cannot earn profit from trashfish fishing and there is a loss of 1,087.54 million baht per annum from this fishing, since the cost is greater than the revenue. At a catch of 924,507 metric tons, price of trashfish as estimated from AR function is 1,342.60 baht per ton which is lower than the price and catch at MEY. There is an associated consumer surplus of 217.16 million baht. Society as whole lost from this fishing at the present effort level. The loss is estimated to be 870.38 million baht.

If fishing effort is maintained at the actual level, 7,068.350 x 10^3 standard fishing hours, lower than the effort at maximum sustainable yield (7,546.303 x 10^3 standard fishing hours), there is a loss due to marginal cost of fishing being greater than average revenues. (Figure 1). This loss is caculated to be 989.50 million baht per year.

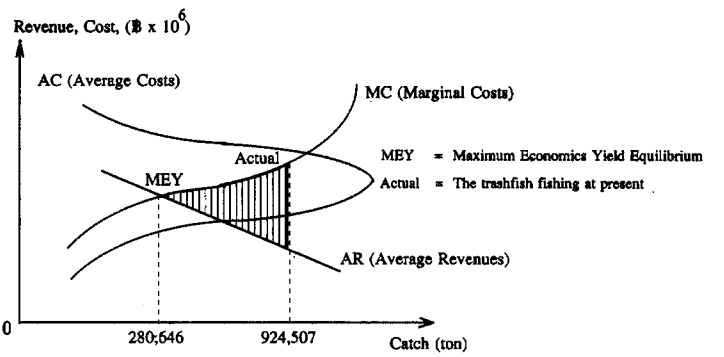

Fig. 1 The social cost of overexploitation from trashfish fishing in Thailand.

Note : ◀ is about 989.50 x 10^6 million baht coming from ;

$$\int_{280,646}^{924,507}(MC-AR)dY = \int_{280,646}^{924,507}\left\{\frac{(329,468)(0.0652)}{2(0.0326)(60,520.6741-0.0652Y)^{\frac{1}{2}}}\right\}dY$$

$$-\int_{280,646}^{924,507}(10,381.7730Y^{-0.1489})dY$$

$$= 989,498,342 \text{ baht.}$$

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