Fish By-Catch ... Bonus From The Sea
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Fish By-Catch... Bonus from the Sea

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Financial Projections for Industrial Production of Minced By-Catch Fish

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On the basis of technological and marketing studies, industrial designs for by-catch retrieval and processing were drawn up. Financial analyses of the industrial models indicated that the products could be competitively marketed at prices that allow an incentive to be offered to the fishermen to bring in the by-catch. The industries should thus be economically viable. These findings support plans to install pilot factories at Guaymas to demonstrate the commercial utilization of by-catch.

Previous studies of the ITESM/TPI program developed several techniques for processing by-catch fish and demonstrated market potential for the products. As a basis for possible commercialization of these projects, two distinct industrial models have been designed and financially evaluated (Street et al. 1980; Young and Marter 1981). Model I is an industrial profile for the processing of by-catch fish into a dried and salted, deboned product for human consumption, with waste material being converted into silage. Model II is a commercial-scale demonstration plant to process by-catch fish into frozen and canned products, as well as salted, dried mince and silage. Both industrial models would utilize 100% of the by-catch fish landed.

Model I

Model I was designed to process $2.4 \times 10^8$ t of fish annually into $3.8 \times 10^8$ t of dried fish cake and $1.35 \times 10^8$ t of wet silage. Fish are gutted by hand and mechanically deboned, the recovered mince being mixed with salt and pressed automatically into cakes. Waste material is fed to the silage plant.

Wet cakes are precooked at $100^\circ C$ for 1 hour and then gently dried at $40^\circ C$. Drying is in a two-stage, continuous tunnel system incorporating a series of trucks containing the wet material. The first stage of this dryer (at $100^\circ C$) is isolated from the dehydration section. Suitable dryers are already being used in the food and chemical industry and require only minor modification. The entire processing plant would occupy about $3 \times 10^3$ m$^2$.

Establishment costs for the plant are projected to be 22.34 million pesos (1980 prices), although they would be lower if the operation were part of an existing fish-processing plant. Total annual operating costs amount to 7.5 million pesos.

The break-even selling price for dried, salted fish cakes under the most optimistic conditions — i.e., for a zero raw-material cost and a silage value competitive with those of other protein feeds (3000 pesos/t) — was projected to be 0.91 peso each. This amount assumes capital borrowed at 16%. The price would be 1.64 pesos if the opportunity cost of capital were 24%. At a raw-material cost of 6000 pesos/t, which would provide a realistic incentive to the shrimpers, the cakes would be sold for 2.57 pesos each if interest rates were 16% or at 2.75 pesos each if interest rates were 24%. These prices are based on a unit weight for the cakes of 45 g, containing about 22 g protein.

Model II

Processing in model II includes flesh-and-bone separation systems identical to those of model I. In this model, however, the annual input of $2.4 \times 10^8$ t fish would yield 138 t dried, salted mince; 388 t frozen, breaded sticks; and 459 t canned fish picadillo (or 514 t canned fish sausage or 514 t canned fish pâté); and 1323 t fish silage. Full details concerning building requirements, handling, equipment specifications, and resource use have been provided elsewhere (Young and Marter 1981).

Total establishment costs for this model are about 26 million pesos (1981 prices). Drying, salting, freezing, and ensiling are the least
expensive processes to install and operate. Canning is more costly, particularly because the cans represent a major operating cost, accounting for 62–80% of the total cost of consumable goods.

This model offers an opportunity to operate different combinations of processes. The financial analysis, therefore, was designed to indicate the break-even product prices for various mixes of processing lines, with adjustments for optional cost sharing of equipment and other items. The joint options selected were:

- Two lines producing dried, salted fish cakes, which are here being removed from the mechanical dryer, are integral components of both industrial models.
cakes and one line producing frozen fish sticks;
- One line each for fish cakes, fish sticks, and canned picadillo;
- One line each for fish cakes, fish sticks, and canned fish sausage;
- One line each for fish cakes, fish sticks, and canned fish pâté; and
- One line each for fish cakes, fish sticks, and all three canned products.

The first option can be established and operated at the lowest cost; the combinations of three products — dried fish cakes, frozen fish sticks, and one canned item — are intermediate; and the final option requires the highest expenditure but has the greatest flexibility in end-product output. Both capital and operating costs for combined options are only marginally lower than the total cost of individual product lines. Thus, opportunities for sharing of equipment and consumable items are relatively few.

Break-even product prices for model II were calculated to be: salted fish cakes 51 pesos/kg; frozen fish sticks 22 pesos/kg; canned picadillo 25 pesos/kg; canned pâté 26 pesos/kg; and canned sausage 33 pesos/kg.

The raw-material cost is taken to be 3000 pesos/t. When raw material costs change from 3000 pesos/t to 5000 pesos/t, fish-cake prices rise by 22.5%, frozen fish stick prices by 18.6%, and canned product prices by 9.3–14%.

**Product Pricing and Market Potential**

When raw-material costs are 5000–6000 pesos/t, break-even prices for dried, salted fish cakes for model I and model II are 56.5 pesos/kg and 62.5 pesos/kg respectively. At these prices, with allowances for distribution costs and profit, fish cakes would be extremely competitive with other animal-protein foods in Mexico. In particular, the low price of cakes per unit of protein is an important consideration for institutional markets. The prices of the products manufactured by the model-II system also compare favourably with current (July 1981) retail prices for equivalent, local food items. At an exfactory price of 2000–3000 pesos/t (or 17–19 pesos/kg protein), the silage by-product is competitive with alternative livestock rations available in the region.

Recently, the market for by-catch products has been further evaluated in an attempt to fix appropriate selling prices and to calculate the profitability of these industrial models. The data show a steadily increasing demand for dried, salted and frozen fishery products in Mexico. The market for canned products is less certain because of excess capacity for sardines and tuna. There is certainly a potential market for silage. Imports of animal feed are substantial, and livestock production is continually increasing. Feeding trials in the Guaymas region have effectively demonstrated the value of using by-catch silage in pig and poultry feeds.

This market information and the projected selling prices for the products indicate that these by-catch processing industries would be profitable. Moreover, the assumed raw-material prices would contribute an attractive revenue to the shrimping industry.

**Project Implementation**

The Mexican fisheries development bank (BANPESCA) undertook an independent evaluation of the model-I industrial design and approved its promotion to potential investors. The bank will act as a coinvestor or provide loan capital to private-sector investors and is optimistic that this venture will prove profitable, with scope for further development.

The model-II system will be implemented by the Dirección de Fomento Pesquero of the state government of Sonora. The project aims to attract potential investors by:
- Creating a model plant for alternative uses for by-catch;
- Manufacturing a range of products for wider market promotion; and
- Operating a viable self-financing plant to utilize by-catch for human food.

The financial evaluations on which the product costs provided in this paper are based were carried out by Peter Street and Alan Marter of the Marketing and Industrial Economics Section, Tropical Products Institute, London, England.