

A photograph of a fishing boat deck. Two men are visible: one in the foreground wearing a light-colored shirt and dark trousers, and another in the background wearing a light-colored shirt and dark trousers. A large pile of small fish is in the foreground. The background shows the ocean and a cloudy sky. The title "Fish By-Catch . . . Bonus From The Sea" is overlaid in white text.

Fish By-Catch . . . Bonus From The Sea

Fish By-Catch . . .
Bonus From The Sea

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Fish By-Catch... Bonus from the Sea

Report of a Technical Consultation
on Shrimp By-Catch Utilization held in
Georgetown, Guyana, 27-30 October 1981



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Development of a Salted, Minced Product from Mexican Shrimp By-Catch

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The technique of rapid salting and dehydration may be applied to deboned minces obtained from shrimp by-catch to prepare a stable, low-cost food suitable for distribution in rural or urban areas. The process involves mixing the deboned mince with 20% (w/w) salt, cooking the mixture, and drying it at low temperatures. The cooking considerably reduces drying times and improves the appearance, flavour, and mechanical properties (including texture) of the product, which can be stored at ambient temperatures without adverse effects on its microbiological or organoleptic quality. Moreover, the high food value of the fish protein is retained even after storage for several months. When the product is soaked and boiled, it is reconstituted and can be used in a number of recipes. Market tests have indicated favourable consumer responses toward the product.

Initially, the general objectives of processing studies on Mexican shrimp by-catch were:

- To maintain processing costs as low as possible;
- To develop products with maximum retention of nutritional value;
- To develop products with good keeping qualities in the absence of refrigeration or freezing; and
- To develop products acceptable to the Mexican consumer.

In view of the nature of the by-catch, i.e., a complex mixture of small demersal fish,

mechanical deboning was considered an appropriate preliminary operation that would permit the fish to be converted into food products for local distribution.

Previous work on the development of dried fish products included the drying of precooked minces (Cutting et al. 1956) and mixture of comminuted fish flesh with salt for effective and simple preservation (Del Valle and Nickerson 1968; Andersen and Mendelsohn 1972). Salted minces may be pressed, dried, and stored for long periods at ambient temperatures without risk of spoilage. At ITESM, this salting and drying principle was applied to deboned by-catch minces and the procedure modified to improve rehydration, texture, and flavour of the final product.

Product Development

The technology comprises two stages — mechanical deboning and product formulation. Elimination of the bones, skin, and scales of by-catch fish has been carried out on a pilot scale with a Paoli automatic flesh-and-bone separator, which produces a finely minced flesh. The comminuted fish flesh is initially mixed with a high concentration of salt. This promotes a loss of water-holding capacity of the muscle proteins and provides immediate protection against spoilage. It is important to control salt concentration to obtain adequate drying rates and acceptable texture and colour in the product. Addition of 20% (w/w) salt to the mince promotes optimum product characteristics. The speed and time of mixing the fish with salt are also critical, affecting the binding properties of the mixture.

Originally, the salt-fish mix was simply pressed into cakes and dried at a low temperature (40°C) in ovens. Drying times were lengthy, usually 50–60 hours. Later, it was found that, if the mix was cooked before being dried, drying times were reduced and appearance, flavour, and texture of the product were further improved (Young et al. 1979). Moreover, the cooking eliminates the need for pressing the wet minces and discourages undesirable changes in colour and flavour during dehydration and product storage.

Heating at 70–100°C for 1–2 hours, then drying at 40°C, reduces the drying time to 30 hours. Samples heated at 100°C for 1 hour and subsequently dried at 40°C exhibit the opti-

mal organoleptic properties (Young et al. in press). It should be possible to increase drying rates with appropriate commercial equipment.

Microbiological Aspects

Microorganisms in the fish mince were enumerated at various stages during processing (Young et al. in press). Fish with a high bacterial load were used in experiments so that the effects of the process could be easily observed. Higher counts of microorganisms are found in the deboned mince than in the raw material, but, on addition of 20% salt, the counts decrease and eventually fall to fewer than 10 organisms/g after cooking and drying. The process, thus, virtually sterilizes fish minces, and the dried product remains sterile even after several months' storage at tropical temperatures. Bacterial counts in the final product are equally low whether gutted or whole, ungutted fish are used as raw material.

Product Characteristics, Composition, and Nutritive Value

An important function of this technology is that it confers texture on the finely ground tissue so that the final product is of meaty consistency. Taste-panel testing has indicated that this effect is more pronounced when cooking is carried out for 1 hour at 100°C.

Precooked cakes are normally regularly shaped, smooth-surfaced, light-coloured, pleasant smelling, and compact. Uncooked cakes tend to be darker, less regular, and less compact, having a granular surface and a stronger odour.

The salted fish cakes contain almost 50% (dry weight) protein, and the fat content is low. Nutritional studies have demonstrated good retention of essential amino acids and high protein quality of the product (Young et al. in press). Freshly prepared products have a net protein utilization (NPU) between 86.3 and 91.5, a level comparable with that for egg protein. Varying the processing conditions has little effect on the NPU, although some reduction in protein quality occurs during storage. Nevertheless, even after 6 months' storage at ambient temperature, NPUs of 75

have been recorded in the product, this value slightly exceeding that of beef muscle.

Reconstitution and Preparation for Consumption

The final product is soaked and boiled before being eaten. Salt is thus removed, and the reconstituted cakes have no salty taste. Increased in bulk, these cakes contain approximately the same quantity of protein as fresh fish (16–20%).

Cakes that have not been cooked during their manufacture tend to disintegrate on reconstitution. Precooked cakes have superior mechanical properties and remain intact during preparation. They are suitable for various traditional food preparations, having a texture similar to cooked, minced meat.

Acceptability and Market Testing

Initial studies assessed general acceptability and compared precooked and uncooked cakes (Young et al. 1979). Taste panels were drawn from ITESM staff and lower-income residents of Guaymas. A popular recipe was used with locally available ingredients. Tasting took place at four separate sessions, with groups of 10–20 assessors. Despite the general acceptability of all products, the results from the panels indicated a significant preference ($P < 0.01$) for meals incorporating precooked cakes. Comments indicated that their flavour and texture were preferred.

This initial study formed the basis for more extensive market testing of salted fish cakes in Mexico. The subsequent tests covered a wider range of consumers, evaluating response to the product, projected price, and other factors associated with presentation and preparation. A recipe booklet was produced for these trials.

Testing in local supermarkets has provided promising results. Through a questionnaire, about 600 homemakers were interviewed, and the results indicated good market potential for the product (ITESM 1980). Flavour and odour were judged to be especially attractive.

For testing of home usage, samples of the product and a recipe booklet were left in 51 homes, and the homemakers were subsequently interviewed (De Villa and Associates

1980). The product was well accepted, and 90% of the homemakers stated that they would be willing to pay at least 5 pesos per fish cake. This price is well above the projected selling prices for the product, suggesting that its low cost may be particularly advantageous.

Commercialization

These results have encouraged the development of commercial operations, particularly because an appropriate marketing infrastructure already exists in Mexico. Under Sistema Alimentario Mexicano, emphasis will be di-

rected to the efficient distribution of food products to all regions of the country, and the state trading company CONASUPO (Sistema de Distribuidores Conasupo) has retail outlets stocked with basic foods to supply the lower-income groups. There are several thousand rural and urban shops, and more are being set up in cooperation with COT-LAMAR (Coordinación para el Desarrollo de las Zonas Marginales). Another government organization — DIF (Sistema Nacional para el Desarrollo Integral de la Familia) — provides nutrition education and distributes cheap and basic foodstuffs. These organizations serve as channels through which this dried, salted fish product may be widely distributed throughout the country.