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

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Acceptability and Storage Characteristics of Frozen, Minced Products from Mexican By-Catch

M.A. Tableros1 and R.H. Young
ITESM/TPI Project, Instituto Tecnológico y de Estudios Superiores de Monterrey (ITESM), Guaymas, Sonora, Mexico, and Tropical Products Institute (TPI), London, England

Deboned, minced products in frozen form are one focus of the shrimp by-catch program at ITESM. Our studies examined the suitability of selected species for processing and storage as frozen fish minces. Reductions in the extractable, salt-soluble proteins occurred to various degrees in the minced flesh of all the species studied during storage at -10°C and -20°C. These changes minimally influenced the texture of the minces. Considerable variability in the colour of minces from different species was apparent, and a washing procedure has been developed to remove dark pigments. Washing may standardize the properties of minces prepared from mixtures of by-catch fish species. Market testing of breaded fish sticks elaborated from these minces has provided promising results. Thus, deboning followed by freezing offers a potential means of converting currently wasted by-catch fish into human food.

As part of the joint ITESM/TPI shrimp by-catch project, studies have been carried out on the freezing of deboned minces prepared from fish species commonly found in the by-catch from the Gulf of California. Secondary processing into breaded fish sticks could be an appropriate means of introducing new fishery products into the Mexican market, especially as children's food. The studies assessed the suitability of different species for processing into frozen minces and examined the characteristics of the minces during storage. Biochemical changes occurring during storage may subsequently influence the texture and sensory properties of the fish minces (Sorensen 1976). Attention has also been devoted to the possibility of using a mixture of fish species in these products as a means to minimize the sorting of the by-catch. In this context, washing has been evaluated as a technique for standardizing the minces. Processes for manufacturing acceptable breaded fish sticks from frozen by-catch minces have been developed, and some market information on the products is available (Tableros and Young 1981; Young and Tableros in press).

Preparation of Products

For experiments on storage, fish were headed and gutted by hand, with particular care being given to the removal of the swim bladder, kidney tissue, and excess blood. Fish were then thoroughly washed and stored in ice until deboning by the Paoli flesh-and-bone separation system. The deboned flesh was packed in rectangular, metal trays and frozen at -40°C. Later, the flesh was removed from the trays and cut into rectangular portions, which were wrapped individually in aluminum foil and stored at -10°C or -20°C.

In the flesh-and-bone separation system, the fish are initially ground by a heavy-duty mincer. Washing has proved useful at this stage, promoting a uniform product. The washed mince is then deboned. This technique was used in the products prepared for both storage and market testing, but we incorporated salt, garlic and onion salts, and pepper into the deboned mince for market tests. We found that the concentration of each condiment may be varied between 0.7% and 1.0% (w/w), the total amount not exceeding 3% (w/w). After being frozen, this mince is ready to be processed into fish sticks. The frozen blocks are cut into rectangular portions (1.5 cm x 2 cm x 10 cm) and each portion dipped in batter and bread crumbs. The breaded sticks are then flash fried in deep fat for 1 minute until they are golden brown. They then can be refrozen and stored at -25°C.

1Present address: Schwartz-Strasse 2/501,7000 Stuttgart 70, West Germany.
Even when care is taken to remove visceral tissues and excess blood from the fish abdominal cavity, the minces from different by-catch species vary in colour. Minces prepared from bronzestriped grunt or rayadillo (Orthopristis sp.), a common fish in the by-catch of the area, are particularly dark. Other species, such as flatfishes (Bothidae) and orangemouth corvina (Cynoscion sp.), provide light-coloured minces. Darkening effects are probably caused by contamination of the mince by pigments from the skin of the fish or by the presence of greater concentrations of heme compounds associated with the flesh of certain species.

In an attempt to remove pigments from the fish mince, we devised a washing procedure that is carried out in two stages on the material recovered from the mincing section of the Paoli flesh-and-bone separation system. Washing is easier if done before deboning, and losses of solids during the procedure are minimized. The ground fish is stirred in distilled water in a stainless steel tank lined with cheesecloth. Throughout, the temperature should be maintained at 3 ± 2°C by the addition of ice. In the first washing stage, the ratio of mince/water is 1 : 2, and, in the second stage, equal parts of mince and water are used. Each stage is 10 minutes, and the water–mince mixture should be stirred gently and continuously. After each stage, the cheesecloth holding the mince should be lifted from the water and squeezed by hand. This washing technique lightens the colour so that washed minces prepared from various mixtures of by-catch are relatively uniform.

**Biochemical and Organoleptic Changes**

Protein aggregations may occur in minced fish muscle stored at low temperatures, altering the texture of the minces and lowering their acceptability for food uses. Our studies examined the extent of the changes in frozen minces prepared from different by-catch fish species; the storage characteristics of mixtures of fish species; and the influence of washing the mince.

Reductions in extractable protein nitrogen (EPN) and water-holding capacity (WHC) occurred in the fish minces during prolonged storage (up to 6 months) at -10°C or -20°C. The losses appeared to be species dependent and did not seem to be caused by formaldehyde (Amano and Yamada 1964) because production of dimethylamine and formaldehyde in the flesh during storage was minimal. Despite the losses, only small changes in textural characteristics were observed during frozen storage, and acceptable scores have been obtained in taste-panel tests carried out at intervals during storage.

Mince washed before being deboned appeared less susceptible to deterioration during frozen storage than was unwashed mince. The EPN losses were minimal, and the texture remained stable. Moreover, the washed mince was generally smoother and softer than was unwashed mince. The drawback was that washing promoted flavour losses and introduced an effluent to the process.

**Commercialization**

Market testing of breaded fish sticks prepared from frozen by-catch minces was carried out in local supermarkets. The results indicated good market potential for the product. The cooked product was judged as very good to excellent, and scores indicating the consumer's willingness to purchase were high. In general, the Mexican consumer is not familiar with the product concept but seems to be attracted to the ease of preparation of the product and its complete lack of bones. In the trials undertaken so far, texture has not been a particularly important consideration for the consumer. More emphasis has been placed on odour and flavour, regularly cited as the preferred characteristics of the fish sticks. In this respect, the condiments that were added to the washed minces seemed to be especially beneficial.

Additional market information has indicated that the local demand for this kind of product is steadily increasing. Particularly advantageous characteristics of the product are that it is convenient to prepare, it lacks bones, and it is suitable for promotion as a children's food. A similar product, manufactured from other underutilized fish species, has recently been launched in Mexico by the national industry. This product, which retails for about 60 pesos/kg, is said to be well accepted and growing in demand.