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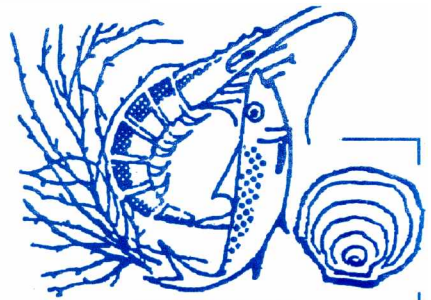
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# AQUA FARM NEWS

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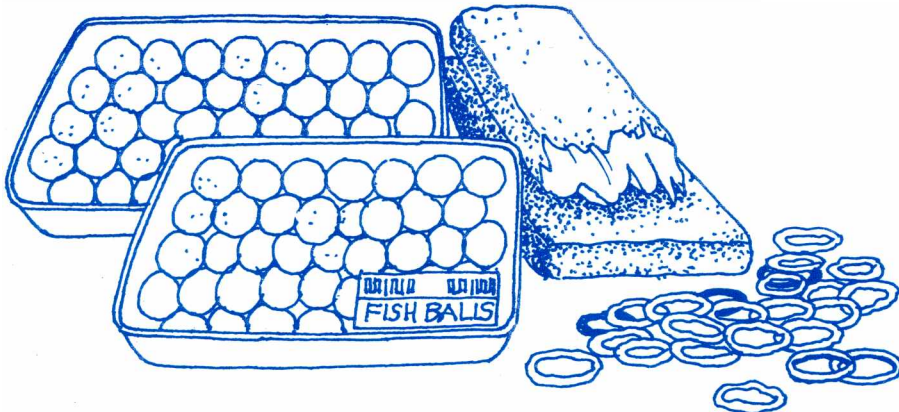
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## Consumers' Delight



## Value-added fish products

Processed food immediately comes to mind when one hears of **value-added products**. This is because the term refers to value that is added to a product from the time it enters the processing plant to the time it leaves. Thus a freshly harvested kilo of prawns costing P200 would sell at P400 packed, breaded, and battered and ready for frying.

Changing lifestyles, such as the increase in leisure pursuits, have shrunk the time allotted to kitchen chores. Nowadays housepersons prefer to assemble **heat-and-eat** meals instead of preparing dishes from a variety of ingredients. Selecting and buying ingredients is by itself already time-consuming in addition to the more demanding preparation of home-cooked meals. Convenience is the bottomline for the success of value-added products, the same thing that has made **fast food** counters popular worldwide.

The proliferation of convenience foods has given rise to food safety issues. The government, along with NGOs, e.g., consumers' organizations as watchdogs, has come up with regulations to ensure that products meet consumers' expectations of safety and quality.

Fish products development, marketing, food manufacturers and consumers' concerns are discussed in this issue as well as innovations in taste and appearance that have flourished with the growth of the value-added products industry.

## Overview

# *Fish* products of 6 Asian countries

To update basic information on fish products, six ASEAN countries participated in a 1989-90 survey which also identified product quality level and the constraints in marketing and promotion. Presented here is an overview of the 11 main categories (alphabetical order) of fish products resulting from the survey in Brunei Darussalam, Indonesia, Malaysia, Philippines, Singapore and Thailand.

### **Boiled products**

Boiled products are available in all participating countries except in the Philippines and Brunei Darussalam. They are produced either by cooking in boiling water or steam. They are also generally described by most countries as salted and boiled fish and can be eaten either plain, with chili paste or curry and are consumed together with rice or porridge.

Pelagic fish are most commonly used, e.g., Indian mackerel, horse mackerel, scad, anchovy or trevallies. The fish is cleaned and arranged on bamboo baskets or ceramic basins. Salt can be added in between the layers of fish. Cooking is done by steaming or by immersing the basket of arranged fish into the boiling brine water.

### **Canned products**

Canned products are processed in Indonesia, Philippines and Thailand. The principle of canning is similar in most countries. Cleaned and gutted, the fish is packed in cans and precooked before sauce or liquid is added. After seaming, the canned product is sterilized and cooled before labelling. Canned sardine in tomato sauce is exported in increasing volume from the Philippines.

### **Comminuted products**

Comminuted products are produced and consumed in all six countries. Made from minced meat and *surimi*, they include fish jelly products, fish and prawn sausages and burgers. These are eaten by themselves, or in soups, and cooked with noo-

dles, rice or vegetables.

Comminuted products are often produced directly from fresh fish such as wolf-herring, barracuda, bigeye snapper, threadfin bream, lizardfish, round herring, scad, Indian mackerel and tuna. The main machineries used are meat-bone separator, mincer, mixing/grinding machine, forming machine, and water-bath and cooking facilities. The ingredients used are salt, sugar, oil, flour, monosodium glutamate, water and vegetables.

The products are normally packed in polyethylene bag, palm leaf, styrofoam tray with wrapping film, vacuum pack or wrapped up at time of sale to consumers.

### **Cured products**

Cured products are only consumed and produced in the Philippines. They are generally processed by pickling or salting without drying. The fishes used are skipjack, herring, roundscad, sardine and mackerel.

The process involves washing the raw materials and saturating these with salt. It is then washed with 2% salt. The cured product is packed in glass bottles, wooden boxes or plastic containers. If wooden boxes are used, salt water is drained away before packing.

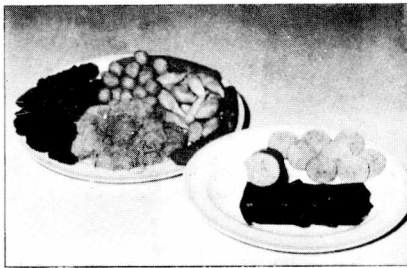
### **Dried products**

Dried products are widely available and popular in all six countries. These are salted dried products which are usually deep fried or broiled before serving. They are also used in soup and porridge or cooked with noodles, vegetables and meat.

Dried products are usually packed in polyethylene bags, hard cardboard boxes, wooden boxes, braided rattan/bamboo baskets, paper bags, sacks or barrels.

### **Fermented products**

Fermented products are processed in all six countries except Singapore. The process involves the addition of salt to fish or shrimp or the liquefaction of fish which is then allowed to ferment. This will result in



Sriatik Suberwingsai



Dept. Fish. Malaysia

the production of fermented fish, fish paste or shrimp paste (*bago-ong*). The salt-fish mixture can be sun-dried or left to ferment in a fermenting vat, earthenware jar, concrete tank, plastic drum, oil drum or oil can.

Fermented products are packed in glass bottles, jars or cans, polyethylene bags, glazed earthenware pots, bamboo baskets tins, banana leaves or plastic boxes. They can be eaten with rice, cooked with vegetables, prepared with onion, chili, spices or used in other ways.

### **Fish meals**

Fish meals are produced in all participating countries except Brunei Darussalam. These are used as animal feed and fertilizer, not for human consumption. Raw materials used are trash fish/trawl by-catch, sardine and scraps from fish processing plants. The raw materials undergo washing, cooking or boiling, pressing, crushing, drying, mincing and packing.

Production of fish meal has increased in recent years to supply the demand of a flourishing aquaculture industry among the countries surveyed.

### **Frozen products**

Frozen products are produced and exported from all the participating countries except Brunei Darussalam. These are quick frozen in blocks or individually and are boiled, fried, steamed, pickled or cooked in various ways before serving.

Fishes used are generally red snapper, painted sweetlip grant, malabar snapper, tilapia, catfish, dory, shark, sword fish, tuna, red mullet, grouper, mackerel, pomfret and sea bream. The shrimps used are white shrimp, pink shrimp, black tiger shrimp and sand shrimp. The raw materials are cleaned, cut/filleted, cooked or raw, packed and finally frozen by air-blast, contact or IQF (individual quick freezing) freezer.

### **Powdered products**

Powdered products are also known as floss, granulated or flaked products. They are made from by-products of dried

prawn or the mince from shark, ray, snapper, or threadfin bream and mixed with ingredients to taste. They are served with bread or rice, used in soup or as a snack.

The process involves cutting the fish and soaking it in 2% brine for 10-15 minutes twice. The mince is then separated from the bones and skin. The fat is removed by washing the meat. The excess water is then removed by passing the washed mince through a screw press. The mince is heated and mixed with ingredients (soy sauce, salt and sugar) before finally drying.

### **Smoked products**

Smoked products are produced in all participating countries except Singapore. These are fish products preserved by smoking and can be served fried or cooked with ingredients such as chilli, tamarind and salt and can be eaten with rice, salads or noodles.

The fish is washed, soaked in brine, and precooked and dried before smoking, cooling and packing. The products can be stored in polyethylene bags, wrapped with paper, or packed in basket with banana leaves or newspaper. These are stored at room temperature, refrigerated or frozen.

### **Other fish products**

Other fish products include crackers made from prawn, squid or fish; barbecued fish (*satay* in Malaysia and Thailand), prepared cuttlefish and seaweed (*gulamang dagat* in the Philippines)

Fish crackers are usually deep fried till expanded and give a crispy bite. Shrimps and squids are generally used. Ingredients added are tapioca flour, pepper, salt, baking powder, taste enhancer and water. The process involves mincing, mixing, forming, steaming, cooling, adding of color, slicing or cutting, drying and finally packing.

Source: 1991. **Southeast Asian Fish Products**, compiled by Ng Mui Chng, Hooi Kok Kuang & Katsutoshi Miwa. Second edition. SEAFDEC/Marine Fisheries Research Dept., Singapore.

## *Convenience food products*

Popularly known as bighead carp, *Aristichthys nobilis*, is cultivated in freshwater ponds, pens and cages in the Philippines. It is utilized in the preparation of a variety of convenience products or "ready to cook foods." Fish sticks, fish spread, fish flakes (plain and salted), fish powder (smoked and unsalted), smoked fish fillet, pickled smoked carp, ham-cured carp fillets and fish sausage are prepared as follows:

### **Fish Sticks**

(1) Scale, degut, eviscerate, and wash the fish thoroughly

(2) Precook the fish under steam for at least 30 min.

(3) Fillet and flake the fish flesh before mixing with batter.

(4) Mix the batter and fish at a ratio of 1:1.

The batter is prepared as follows:

(a) Mix 72.3 g all purpose flour, 3 g salt, 1.7 g baking powder, 21 g fresh eggs, 6 g skim milk powder, and 1.85 g monosodium glutamate.

(b) Add 9 g melted hydrogenated vegetable shortening and mix.

(c) Chill in a freezer

(d) Break all lumps by mixing again.

(e) Prepare batter by stirring in water at a ratio of 1:1.5 (water:dry ingredients)

(5) Mix the ingredients in small baking pans to a height of 1.5 cm.

(6) Freeze the baking pans overnight or until the mixture hardens.

(7) Slice the frozen blocks into sticks measuring 7 cm long each.

(8) Roll over the sticks on bread crumbs.

(9) Deep-fry the sticks for 1 min.

(10) Pack the fish sticks in plastic bags and freeze.

(11) Deep fry the frozen fish sticks for 2 min before serving.

### **Fish Spread**

(1) Wash the fish thoroughly and fillet.

(2) Cut the carp fillet into cubes.

(3) Soak the carp fillet in 1 liter of water with

60 ml of vinegar for 10 min, wash and then drain.

(4) Mix 1 kg cubed carp fillet with 0.33 kg of pork fat, 16 g of corn starch, 15 g of salt, 4 g of monosodium glutamate, 0.50 g (or 4 g if hot spread is preferred) of black pepper, 35 ml of soy sauce, 60 ml of vinegar, and 200 ml of water.

(5) Cook the mixture using a pressure cooker at 15 psi for 1 hr.

(6) Cook and pass through a meat grinder to produce a spread-like consistency.

(7) Fill into 307 x 201.25 cans and exhaust at 82°C.

(8) Seal the cans and process at 15 psi for 1 hr.

(9) Cool, label and store.

### **Fish Flakes (Salted)**

(1) Scale, eviscerate, degut, and cut the fish into portions prior to use.

(2) Immerse the fish in brine at 1:3 salt to water ratio for 1 hr.

(3) Steam the samples for 10-15 min and then flake.

(4) Dry the samples at 55°C for 3-4 hrs.

(5) After cooling, thinly flake the samples using a blender.

### **Fish Flakes (Plain)**

(1) Wash the fish and fillet.

(2) Precook the fillet in steam for 1.5 min and then flake.

(3) Smoke the fillet for about 1 hr.

(4) Fill the fish fillet into 307x 201.25 cans and pack with vegetable oil or 2% brine solution.

(5) Exhaust the cans at 82°C.

(6) Seal the cans and process at 1.5 psi for 1 hr.

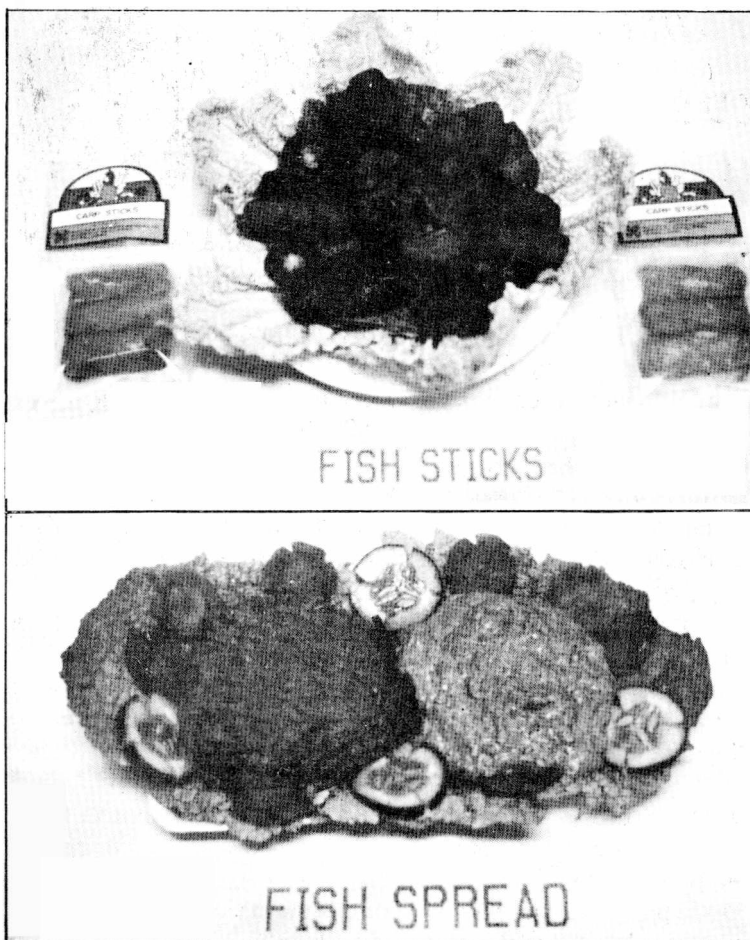
(7) Cool, label and store.

### **Smoked fish Fillet (Plain)**

(1) Clean and eviscerate the fish immediately after procurement.

(2) Wash the fish thoroughly and slice crosswise, pack in polyethylene bags and store immediately in the freezer.

(3) Partially thaw the fish before filleting.



(4) Debone the fish by cutting along the backbone. Do not remove the hairbones embedded in the flesh to preserve the integrity of the fillet structure.

(5) Cut the fillets into 6-inch slabs and soak in 5% brine solution to remove excess blood and slime.

(6) Drain the fillets for 30 min before curing. One kilo of bighead carp fillets is cured in 500 ml water. Salt is added to taste.

(7) Cure the fillets overnight in a refrigerator.

(8) After curing, wash the fillets thoroughly to remove excess salt and drain for 30 min.

(9) Dry the fillet at 55°C for 2 hr and smoke for 2 to 3 hr or until golden brown.

(10) Cook the samples at room temperature, pack in polyethylene bags and then store in the refrigerator.

### Pickled Smoked Carp

(1) Clean and eviscerate the fish immediately after procurement.

(2) Wash the fish thoroughly, slice crosswise, pack in polyethylene bags, and store immediately in the freezer.

(3) Partially thaw the fish before filleting.

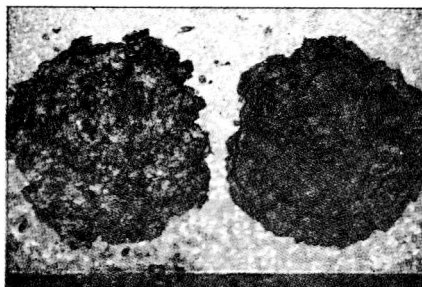
(4) Debone the fish by cutting along the backbone. Do not remove the hairbones embedded in the flesh to preserve the integrity of the fillet structure.

(5) Cut the fillets into 6-inch slabs and soak in 5% brine solution to remove excess blood and slime.

(6) Drain the fillets for 30 min before curing. A kilo of bighead carp fillet is cured in 8 g sugar, 2 g pepper, 5 g garlic, 2 g MSG, and 500 ml vinegar. Salt is added to taste.

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# *Surimi:* status and prospects



*Minced sardine meat*

*Surimi*, minced fish meat, is a raw material for a wide array of convenient food to the delight of time-pressed but health-conscious consumers.

Although the *surimi* industry has spread around the world, Japan still remains the world's largest producer and consumer.

Consumption is usually focused on four major product forms, namely:

- *chikuwa* - tube-shaped fish paste;
  - *kamaboko* - boiled fish paste;
  - *satsumaage* - fried fish paste product;
- and
- *hampen* - floating-type boiled fish paste.

Although total household expenditure on *surimi* has not grown at all, those for some products like *kamaboko* has increased slightly. In addition to the traditional products, *kanikama* or artificial crab legs has been developed during the past decade. The growth in the *kanikama* market has not been as much as previously anticipated, with consumers always preferring real crab to imitation if the real one is available. New products include cheese sandwiched by *hampen*; easy-to-eat *kamaboko*; *satsuma-age* with *hampen* taste; squid-*surimi kamaboko* and hi-tech *kanikama* - all of which are selling well.

The development of Alaska pollock *surimi* fueled the Japanese *surimi* industry. Domestic production plus imports peaked at 509 000 tons in 1987 but declined thereafter due to shortages in pollock supply and the development and growth in other markets such as the Republic of Korea and USA.

The *surimi* situation is summarized as follows:

(1) Total supply for 1992 is expected to be 120 000 - 130 000 tons of pollock and 30 000 tons of others such as Atka mackerel and fall salmon.

(2) USA is the major on-board *surimi* supplier for Japan. Imports of Alaska pollock

*surimi* in 1991 was at 75 000-85 000 tons. In addition, hake *surimi* produced off Washington and Oregon states in the USA was about 20 000 tons.

(3) The USSR is another source of pollock *surimi*. A Japan-USSR joint-venture company is producing *surimi* in the USSR waters: 6378 tons in 1990 and an estimated 5000 tons in 1991.

(4) Hoki *surimi* from New Zealand has decreased from 17 000-19 000 tons in 1990 to 8000 tons in 1991 due to declining resources and a growing demand for fillets.

(5) Southern blue whiting *surimi* from Argentina has increased from 5 820 tons in 1990 to over 10 000 tons in 1991. According to industry sources, the Argentine government may allow more *surimi* trawl vessels to operate in Argentine waters in the future.

In view of the above, *surimi* manufacturers are constantly looking for other new *surimi* sources. Recently, two Japanese companies have obtained exclusive sales contracts of about 6000 tons *surimi* made of Chilean horse mackerel for the Japanese market. Other companies will reportedly engage in similar ventures in Chile. So far almost all *surimi* raw materials are cold water species. One significant exception is *itoyori* or threadfin bream.

The dominant supplier of *itoyori surimi* is Thailand (99.9% of total 1990 imports) which has 9 *surimi*-plants in operation. Thailand also makes block-frozen *surimi* out of various other species such as cods, lizardfish, barracuda, conger eel, wolf herring, croakers, jewfish and shark.

More and more products are entering the market that require new *surimi* materials. With the recent shortage of pollock *surimi*, tropical *surimi* is an attractive alternative.

Source: Ichiro Kano, "Tropical *surimi*," *INFOFISH International*, January-February, 1992.

## From sardine

# *Novel surimi*

Research is presently being undertaken to produce *surimi* from small pelagic species such as sardine, mackerel, herring etc. because of poor whitefish supplies and consequent price increase. Sardines have long been used in Japan to produce *surimi*-based products, in which whiteness is not a crucial factor.

A new processing technology (see box) developed by the National Research Institute of Fisheries Science of Japan opens up new vistas in the use of small pelagic species such as sardine in the production of quality *surimi*.

### **In comparison**

Gel strength and fat content are the two basic criteria which determines *surimi* quality. However, for most products, in addition to the above quality criteria, raw material *surimi* has to be white in color, and should be free of any fish taste and odor. Sardine *surimi* made by the new process have a good gel strength and has a fat content less than 1%, satisfying two important quality criteria for *surimi*. However, it is darker in color than *surimi* made of white fleshed fish, recording 22% in the Hunter Whiteness scale. Even though sardine *surimi* is free of any odor, it exhibits a strong taste.

### **Patent**

The new process differs from the traditional *surimi* process due to the fact that it allows the use of fish with red colored flesh and also the red meat of various species. Unlike the traditional process which requires 2-3 leaching cycles, the new process minimizes the leaching requirements needing only one cycle of leaching. In a consumer survey carried out in Japan, *kamaboko* made of sardine *surimi* kept for 6 months in frozen storage has been rated as comparable in odor and color to *kamaboko* made of fish species used traditionally. The new method is awaiting patent rights in Japan and USA.

Source: Fujio Nishioko, "Frozen *surimi* from sardine," **INFOFISH International**, January-February 1993.

## **FROZEN SURIMI PRODUCTION USING SARDINE**

**Frozen Raw Material-Sardine  
(-25°C)**

**partial thawing  
(-5°C)**

**heading/gutting & removal of  
backbone**

**remove skin & bones using  
double step separator  
(5mm-2mm die)**

### **MINCED MEAT**

**mix with 3 volumes of leaching  
water containing 0.2%  
sodium carbonate and 0.1%  
sodium pyrophosphate**

**vacuum homogenize at 5mm  
Hg to remove crude fat**

**clean filter**

**dehydrate using decanter**

### **LEACHED MEAT**

**leached meat mixed  
with additives  
(sugar, sorbital, sodium  
pyro/tripolyphosphates)**

**shape**

**freeze**

**FROZEN SURIMI**



## Market potential

# *Value-added SHRIMP products is tops*

### **European Economic Community**

Among seafoods, value-added shrimp products are considered to have the best potential for export from developing countries to the EEC countries. European shrimp consumption has increased by an estimated 33% between 1986 and 1990, attributed partly to rising demand for lower priced cultured tropical shrimp from Latin America and Asia.

The traditional value-added shrimp products are IQF (Individual quick freezing), breaded and battered. Within these groups there have been sophistications in glaze level, flavoring and preparation techniques. At present, there is a real expansion in the European market for a wide range of value-added shrimp products in large varieties of final preparation. Two groups are identified:

1) products for which the country of production has no real significance or products that can be adapted into a number of recipes of any origin: e.g. IQF peeled shrimp, tray consumer packs, breaded/battered tail-on shrimp, microwavable packs.

2) products for which the processing country or the country from which the recipe originates is of prime importance such as prepared regional needs - Chinese or Indian or spiced shrimp such as chili.

Value-added shrimp consumption is heavily increasing in UK, France and Germany, while South European countries are lagging behind. The main reasons behind the expansion in Northern Europe are:

- more information - there is increasing commercial coverage of food subjects on television and in newspapers and magazines;
- changing lifestyle - more working mothers, who do not have time to cook, plus an increasing number of microwave ovens;
- restaurants - most Northern European towns have ethnic restaurants;
- travel - through travel, the consumer gets used to foreign food, especially shrimp dishes;
- health factor - the trend towards healthy

eating is having a considerable effect on European food habits and shrimp products are now accepted as healthy, dietary and environmentally accepted food.

Source: Helga Josupeit and Luc de Franssu, "EEC markets for value-added shrimp from developing countries," **INFOFISH International**, March-April, 1992.

### **Thailand**

Thailand is currently one of the world's major exporters of fish and fishery products, and seafood is one of the country's most important and successful industries. Due to excellent product quality and competitive prices, the industry has been able to expand and diversify its markets.

To date, an estimated 40% of exported seafood products are either processed and packed into consumer packs or made into prepared seafood products for direct institutional/retail sale in major world markets. Diversifications are done mainly on shrimp and cephalopods.

Currently, shrimp is value-added into the following forms:

- cooked-and-peeled shrimp;
- cooked whole shrimp;
- peeled butterfly-cut;
- tail-on;
- peeled tempura;
- battered-and-breaded shrimp;
- shrimp skewer; and
- processed products.

The processed products include:

- shrimp *snaomai*;
- *hargao*;
- shrimp spring roll;
- shrimp on sugar cane;
- shrimp dumpling;
- shrimp patties; and
- *tom yam kung* (Thai-style shrimp soup)

Cephalopods are mostly processed into convenience products and delicacies such as cooked squid ring, squid/cuttlefish skewer, stuffed squid and breaded squid ring.

## Shelf Life of Comminuted Products

Cuttlefish ball	6 months at -20°C
Cuttlefish sausage and cocktail	6 months at -20°C
Cuttlefish/squid ball	3-6 months at -18°C or below
Fish burger	6 months at -20°C
Fish burger	1-3 months at (2-3)°C or -10°C
Fish noodle	3 days at room temperature or 7 days in refrigerator
Fish sausage	6 months at -20°C
Fishball	1-2 weeks in refrigerator
Fishball	3 weeks in a cool, dry place
Fishball	NA
Fishball	1-6 days at 5°C
Fishball	3 days in refrigerator
Fishball/fishcake	2-3 days at chilled condition
Fishcake	1-2 weeks in refrigerator
Fishcake	NA
Fresh prawn dumpling	3 months at -20°C
Fresh prawn wantan	3 months at -20°C
Imitation crabmeat	NA
Imitation crabmeat sticks	6-12 months at -18°C or below
Native sausage	1-6 months at 5°C
<i>Otak-otak</i>	NA
Prawn burger	6 months at -20°C
Prawn sausage	6 months at -20°C
Scallop flavor fishcake	6 months at -20°C
<i>Surimi</i>	NA

Source: 1991. Southeast Asian Fish Products. Compiled by Ng Mui Chng, HooiKok Kuang, Katsutoshi Miwa. Second Edition. SEAFDEC/MFRD, Singapore.

### India

Value-addition and diversification have boosted export volumes. India's earnings of foreign exchange from the export of marine products exceeded US\$500 million for the first time in 1991-92. During this period, the country exported 171 820 mt of marine products valued at US\$558.13 million. This was an increase of 12.10% in terms of dollar earnings and 23.24% in terms of quantity over the previous year (1990-91). Product diversification and export of value-added items contributed to the growth.

Accelerated freeze-dried (AFD) marine products, (especially shrimp) fish in sauce and fish salads are two important groups of ready-to-serve value-added products. Fish fillets, cuttlefish cubes, squid rings, cooked shrimps and boiled clams are similarly processed.

New processing plants that have come up recently are rated among the best in the world. Educated, trained and skilled labor force have added to the overall performance of the modern seafood processing units in India. All

these technology upgrading and modernization activities have helped to protect India as a processor of high quality seafood products

Primary and advance value-added products, e.g., retail packs of shrimp, squid, cuttlefish, etc. and consumer bags of fish fillets, cooked IQF shrimp and other marine products as well as raw material in retail packs have found good demand in the global market.

### Joint ventures

Many joint ventures in processing and marketing marine products are already in operation and many more are in the offing. With substantial increase in the labor cost in the advanced countries, many processors have started shifting their facilities to countries such as India, Malaysia, Indonesia, Thailand, the Philippines and China.

Source: Ram Varna, "The Indian Seafood Processing Industry," **INFOFISH International**, May-June 1993.

# Value-adding through *coatings*

Selecting the right coating for the right market can be absolutely critical when exporting, since product appearance and texture often mean success or failure depending on consumer preferences and expectations.

Food coatings are the most common way of value-adding a food item, i.e., surrounding a high-value substrate such as shrimp, with a low-value crust such as batter.

There is an almost universal acceptance of coated (fried) foods because consumers find the appearance, aroma, flavor and texture appealing. Coating food products results in a range of advantages: enhanced appearance; more appealing flavor; aids moisture retention when cooked (juicier product); allows incorporation of herbs and spices for variety; increases product weight and size; simplifies preparation by end consumer; and improves product differentiation in the market place.

These advantages are perceived by the consumer as added value and coincide with well-documented demographic trends which have resulted in rapid growth in consumption of all kinds of convenience foods.

Three categories of food coatings are used, individually or in combination, to produce battered and breaded foods.

## Predust

Predusts are usually a blend of flours, starches and other functional ingredients such as proteins, vegetable gums and seasonings or flavors. The function of predusts are generally one or a combination of the following:

*Adhesion* - to improve bonding between the substrate and subsequent coating layers.

*Texture* - by forming a moisture barrier, the substrate texture and outer coating texture can be enhanced.

*Flavor* - predusts are a convenient means of introducing flavors into a coating system, particularly when heat-sensitive or volatile flavor components would be lost during processing and cooking.

Machinery used to apply predusts should be either of the *Drum Breeding* or *Flour Breeding*

type. *Flour Breeding* machines may include a sifter conveyor with flip facility to improve evenness of coverage.

## Batters

Broadly defined, batters are blends of flours, starches, leavening agents and seasonings which, when mixed with water, forms a viscous liquid used to evenly coat a food item. Batters can serve a range of functions:

*Adhesion* - adheres the outer breeding layer to the predust or food item.

*Texture* - contributes to texture and structural integrity (cohesion) of the product.

*Product extension* - adds weight to the product.

*Appearance* - dictates appearance of finished product in the case of tempura battered products, and affects appearance to a lesser extent if product is breaded.

*Flavor* - may be seasoned to improve product flavor.

Depending on formulation and required functionality, batters may be further categorized as:

*Adhesion batters* - containing high levels of modified starch to set or dry quickly and improve adhesion on difficult-to-coat food items prior to the final breeding step.

*All-purpose batters* - generally based on wheat flour, these dry more slowly and are used on a wide range of foods before the final breeding layer.

*Tempura batters* - also known as puff batters, tempuras are usually wheat flour-based and contain a relatively high percentage of leavening to give the characteristic texture and appearance.

*Oven-ready batters* - specially formulated to produce foods which can be reheated in conventional or convection ovens, these batters contain moderate leavening level and often some shortening and emulsifier to improve crispness.

Adhesion and all-purpose batters are commonly applied to foods using curtain- or *waterfall-type* batter machines. *Tempura* and oven-ready batters are applied using a top

submerger batter machine. It is important to note that batters containing leavening are not generally suited to recirculation by pumping as the delicate leavening system will lose its functionality. Equally important is the selection of equipment to mix the dry batter with water before transfer to the batter machine. Generally, non-leavened batters require high speed/shear mixing whereas leavened batters require low speed/shear mixing.

### **Breadcrumbs**

Crumb coatings are defined as baked or otherwise thermally processed cereal-based ingredients which are applied to a moistened food item prior to cooking. Breadcrumbs form part of a broader category known as breadings which includes products based on blends of flours with other ingredients.

Crumbs functionality is related to the texture and appearance imparted to the final product. By selecting from the vast range of available crumbs and then further customizing, for example adding herbs or spices it is possible to market a product which is unique; both in appearance and in texture.

Breadcrumb categories are easily distinguished by their methods of manufacture which dictate crumb appearance and textural character:

*Traditional breadcrumbs* - produced from loaves of bread using traditional breadmaking techniques. Texture, color and particle size can be regulated to some extent by ingredient and processing adjustment. Texture is typically crunchy.

*Extruded crumbs* - not strictly breadcrumbs as they are produced using a continuous cooking extruder rather than by baking a leavened dough. Texture is quite variable from dense/hard to crunchy.

*Cracker crumbs* - Dough is blended, sheeted through rollers and baked in one continuous operation. The resulting crumb has a short, biscuit-like texture and a chunky to flaky appearance.

*Japanese-style breadcrumbs* - Oriental-style crumb is produced from a highly yeast-leavened dough using a unique electrical resistance baking method. Resulting crumb is low in density with a needle- or splinter-like shape and is completely free of crust. It is the most versatile crumb-type available, being suitable for deep

frying, oven and microwave cooking, which explains its rapidly growing popularity in all western markets. Texture is light and crisp with excellent holding qualities after cooking.

### **Production of battered and breaded foods**

There is a myriad of possible combinations of coating systems and processing layouts which would be required to supply the diverse range of coated products in today's market.

A further processing development in recent years has been the advent of continuous in-line cooking after the partial-fry step. These continuous cooking ovens utilize controlled temperature and humidity with high air velocities to cook uniformly with minimal yield loss. Fully cooked products have extended shelf life, particularly when distributed chilled, and final cooking time by the consumer is reduced as the product simply requires reheating.

### **New developments in coating**

Two recent food coating trends are the demands for more convenience (microwave coatings) and healthier eating (low fat coatings.)

*Microwave coatings.* Moisture migration during frozen storage and subsequent microwave cooking results in excessive moisture on the surface of the breaded product. This moisture cannot evaporate quickly enough in a microwave oven due to the low ambient temperature which is compounded at the product surface by the evaporative cooling effect. The result? Soggy breading which is unacceptable to the consumer. Every batter and breading supplier in the world has worked on this problem for the past decade. This is answered by a patented coating process which consists of a number of moisture barriers layered within the coating as well as a means of absorbing excess water vapor at each layer.

*Low-fat coatings.* A very real dietary concern in most western countries is the issue of the role of fats in the diet and heart disease. Consumers are now demanding lighter processed foods with reduced fat, calories and sodium. Battered and breaded foods form part of this debate because fried foods can contribute significantly to dietary fat. This coating encompasses all of the advantages of traditional battered and breaded foods such as enhanced appearance, appealing flavor, moisture retention and ease of preparation, while imparting a significant decrease in fat content.

Source: Geoff Hunter, "Coatings for seafood - some technical aspects," **INFOFISH International**, May-June 1991.

# New food processing \_\_\_\_\_ \_\_\_\_\_ equipment

With the expansion of value-added products, machinery manufacturers have found the need to develop a greater variety of batter-and-breading equipment.

Developments have fallen on three basic categories: (1) predesters, (2) liquid enrobers, and (3) applicators for large-particle crumbs - the Japanese-style crumbs.

## **Pre-desters**

The earlier forms of predesting equipment had simply to ensure the uniform application of dry batter powders.

The newer machines handle products on a continuous basis and also eliminate the transfer of dust to the atmosphere while ensuring a consistent, uniform coating.

Products enter the machine onto a bed of predest and pass below a shower of predest which may be adjusted by means of a gate and vibrating plate to control pick-up and ensure consistent coverage. This control minimizes the excess dust that has to be removed by air knives or vibrators thus reducing wastage.

The products are transferred smoothly within the machine to reduce damage while continuous filtration ensures the removal of lumps from the predest.

Modern predest often contains flavoring and seasoning ingredients making it even more essential to control dust in the work atmosphere.

## **Liquid enrobers**

The early forms of liquid enrobers consisted of single machines capable of applying thin batter to products on a continuous basis.

The industry found that two further machines had to be developed, one for the application of thick pumpable batters and the other for Tempura batters which contain raising agents and should not be pumped.

Continuous pumping removes the carbon dioxide and inhibits the characteristic "rise" of the batter.

Conventional pumpable batters are nor-

mally recirculated within the applicator or pumped continuously between a batter make-up system and the applicator.

Product enters the machine on a conveyor passing through a shallow batch of batter. Batter is also applied from above.

In the Tempura application machine, products enter onto a layer of Tempura batter. They are then submerged by a top conveyor ensuring complete enrobement. Excess batter is carefully blown off.

## **Applicators for large-particle crumbs**

The introduction of large-particle crumb has proved to be the greatest catalyst of the decade in coated product development. It has necessitated the development of special application machines to minimize breakdown and improve product quality.

The ultimate objective is to present a product with the surface area covered totally, retaining the crumb which when flash-fried gives the impression of spikes, with the higher part of the crumb browned to a darker color than the main body of the product.

The basic principle in the design of breading machines is the recirculation of the crumb to provide a bottom bed as well as a top flow so as to completely encapsulate the product.

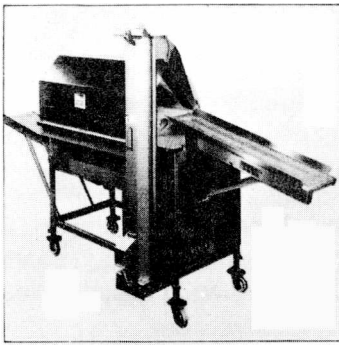
Japanese-style crumbs are a mixture of coarse and fine particles. The mechanical problem such a mixture creates is that of coating all sides of the product evenly with the same proportions of particle sizes.

Unless the applicator is correctly designed, the product will have fine particles on the one side and be sparsely coated with large particles on the other.

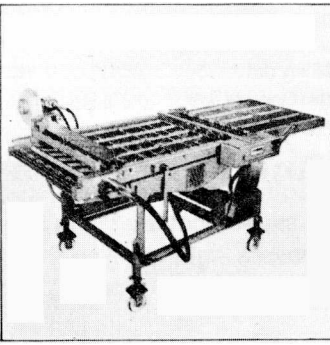
## **FLASH FRYING**

Frying completes the production phase of ready-to-serve portions. Heating of edible oil, a critical feature in flash-fry operations, is done three ways:

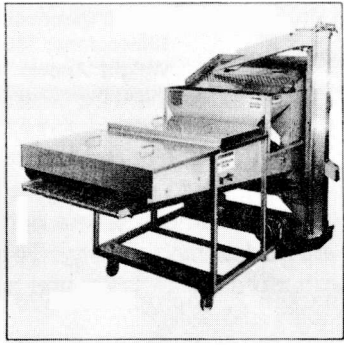
*Electrical*



*Rotary drum pre-dust applicator*



*Tempura batter applicator*



*Breading applicator*



*Food made attractive and appetizing through coating and frying.*

The electrical elements are encased in stainless steel tubes and manifold mounted within the fryer. Temperature is maintained by proportional stepping up or down, if some heating elements fail to function.

#### *Thermal oil*

The system consists basically of a remote oil or gas-fired boiler providing controlled temperature and low-pressure flow of a suitable heat transmission fluid into a heat exchange process which may be either internal or external.

#### *Steam*

This system also consists basically of a remote oil or gas-fired boiler providing a controlled temperature and low-pressure flow of a suitable heat exchange process which may be either internal or external.

Depending on the required frying temperature, a steam pressure of 20-25 bar is usually necessary.

Steam systems are not commonly used in smaller operations.

The new coatings have demanded greater efficiency of oil filtration to minimize FFA (free fatty acid), increase oil life and improve product quality. To give effective and economical results in the frying operation, the filtration system must: (1) be self-cleaning; (2) remove sediment continuously; (3) unload sediment without stopping the process; and (4) be designed to extract the size of particles generated by the process.

The author who is connected with the food processing equipment of the Alfa-Laval Convenience Food Division in Singapore, also mentioned a new generation of cookers, the hot-air ovens, which allow food products to be fully cooked, yet without the normally accepted cooking loss. Moreover, this cooking system does not use oil. Operating costs are therefore greatly reduced.

Source: Albert Dikhooff, "Developments in equipment used for coating and frying." *INFORISH International*, May-June, 1990.

## A mandate for the food industry

### **Satisfy and Protect Consumers**

Consumers have a right to expect that the foods they purchase and consume will be safe and of high quality. They have a right to voice their opinions about the food control procedures, standards and activities that governments and industry use to ascertain food quality and safety.

The ultimate responsibility for implementing appropriate controls lies with the food industry - to continuously oversee the manufacture and processing of foods, from raw ingredients to finished product, day in and day out.

Private enterprise recognizes that its success - measured in terms of profitability - is completely dependent on consumer satisfaction. A reflection of consumer's satisfaction is their continuing purchase of the same products. Food manufacturers and marketers thus have an investment in their product identities (brand names) that they naturally wish to protect. It is in their interest, therefore, to establish and administer the controls that ensure that their products do indeed meet consumer expectations of safety and quality.

The United Nations' *Guidelines for consumer protection* reinforces the right to participate. In its general principles, the document states that consumer groups should be free to organize themselves. These groups should be given opportunities to present their views in the decision-making (United Nations, 1986).

(The Philippines has the *Kapisanan ng Mamimili sa Pilipinas* for the protection and advancement of consumers' rights.-Ed.).

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### **Major Consumer Concerns about Food Quality and Safety**

• **Standards.** Consumers feel that they do not always get fair value for their money. They are discontent with food that spoils or fails to meet expectations in taste, aroma and palatability.

• **Nutritional quality.** In many developing countries, adulteration deprives consumers of nutritional value. In developed countries, consumers are dissatisfied with inadequate nutrient information on labels.

• **Food control processes.** While the consumers are aware that food control regulations exist, they are not convinced that they are applied effectively. Some food producers and distributors feel that they can ignore the law with impunity.

• **Information.** Consumers believe that the government and industry do not provide enough information to enable them to make an informed choice. Very often, labels of food do not carry adequate, easy-to-read information. Information from government, industry and other sources is often not clear or may be conflicting.

• **Environmental contamination.** Consumers' concern has grown rapidly over possible environmental contamination of the food supply during the various stages of production, harvesting, processing, storage and distribution. They lack confidence in the ability of the food control services to provide the necessary protection.

• **Irradiation and biotechnology.** Consumers feel that some processes using new technology are unsafe because they have not been adequately evaluated. Reliable information about newer technologies is not always available.

Source: Food, Nutrition and Agriculture, FAO, 8/9,1993

# Fishy snack items

Snack items are convenient products taken in-between meals or during recreation or relaxation. Taking snacks has been part of the Filipinos' eating habits.

To meet the protein requirement in the Filipino diet, the Bureau of Fisheries and Aquatic Resources (BFAR) has come up with different snack items using seafoods as the main ingredient. BFAR's Fisheries Extension Division has developed procedures for spicy *dilis*, fish balls, shrimp kropeck, squid rings, *tropang sitsaron*, fish *embutido*, and *bangus relleno*. Two recipes popular for snacks are featured below:

## Fish Lumpia

### Ingredients

1 cup fish flakes  
(any species of fish)  
1 medium-sized onion  
2 segments garlic  
1/2 cup pickle relish  
5 pieces tomatoes  
5 tsp. soy sauce  
lumpia wrapper  
oil for frying

### Equipment/Utensils

burner  
colander  
chopping board  
knives  
measuring cup  
mixing bowls  
skillet  
turner

### Procedure:

Crush garlic, chop onions and tomatoes. Steam the fish and flake. Saute garlic, onions, tomatoes and pickle relish. Then add the fish flakes. Season with soy sauce. Let it cook. Remove from fire and cool. Wrap in lumpia wrapper and fry in deep fat. Drain. Serve with sweet sour sauce.

## Crusty Fishwiches

### Ingredients

1 1/2 cups cooked flaked tuna meat  
1/2 cup mayonnaise  
1/4 cup minced green pepper  
1/4 cup minced piment  
1 tsp. salt  
1/8 tsp. pepper (powder)  
1/8 tsp. MSG (vetsin)  
1 egg, slightly beaten  
dash of Worcestershire sauce  
2 regular-sized bread loaves  
Mayonnaise

### Equipment/Utensils

measuring cup  
measuring spoons  
mixing bowl  
muffin pan  
oven

### Procedure:

Mix the first nine ingredients; set aside.

Trim crusts of bread slices and spread mayonnaise. Fit bread snugly into buttered muffin pans. Spoon tuna meat mixture over bread cups. Dot with remaining mayonnaise. Bake at 350°F for 15 min or until bread becomes golden brown. Serve hot.

## Crackling or powdery from FPC

Fish protein concentrate or FPC, originally called fish flour, increases the quality and quantity of protein in a variety of food products. Intended mainly as a protein supplement, it contains 80-90% protein. It is also rich in minerals such as calcium and phosphorus. A stable product, it can be kept for a long period of time with the protein content unimpaired. It is ideal for fish crackers or fish polvoron.

Steps in the preparation of fish protein concentrate (from UP-NSDB-DPI):

1. Clean thoroughly fresh whole fish in running water (any species of fish).
2. Steam the fish for 30 min or depending on the size of the fish.
3. Grind or mince the steamed fish to homogenize the pieces.
4. Prepare solvents as follows (this is for 4 1/2 cups or one liter of solvent):  
Ethyl and isopropyl alcohol - for every 3 cups alcohol, add 1 1/2 cups of water.  
Citrate buffer - dissolve 1/4 cup sodium citrate and 1/4 teaspoon citric acid in 4 1/4 cups water.  
Mix solvents and minced fish (1:1).
5. Extract the mixture by letting it boil for 30 min to one hour.
6. Press the mixture manually, if no mechanical press is available. This is done to remove effectively the oils and water.
7. Dry under the sun or in a cabinet drier.
8. Pulverize in corn grinder, pulverizer, mill, etc.

*"I love fish lumpia and fishwiches.  
They are cholesterol-free!"*





# *Fish* leather, anyone?

## SHARK LEATHER

Previously regarded as a by-catch of limited potential, shark is now targeted by small-scale fishermen in the Bay of Bengal for leather production.

Fish, let alone shark, does not conjure up images of leather goods unlike cow, goat or crocodile:

The method of obtaining the raw material and the specialized nature of the market hamper success in this field and general awareness of potential.

Shark is a hunted resource often captured by small-scale fishermen only as by-catch, and primarily landed for its meat. It may therefore be difficult to obtain a regular supply of raw material for what is a totally different industry.

Aside from the technical problems which have haunted would-be processors for many years, the demand for such exotic goods as shark and other fish leathers can only be regarded as specialist and limited in nature. A shark tannery in Guaymas, Sonora in northern Mexico processes vast quantities of skins into expensive Texan cowboy boots for the nearby US market. A US patent suggests the use of shark leather for astronaut suits, boots and gloves for providing abrasion resistance during lunar exploration. Effort has been made to develop processes to remove denticles in order to render the final product as soft and flexible as normal leather.

Those who have most successfully cornered the lucrative market for fancy leathers appear to be those who have mastered the technology of denticle removal. The pioneers were Ocean Leather Corporation of Newark, New Jersey, USA, who held the market to themselves for several decades. More recently, European, Thai and Japanese tanneries have encroached on this terrain. Without the benefit of a full market survey, it is difficult to say whether existing supply is meeting demand or whether there is potential for expansion.

Countries such as India, however, could become competitive in this field since:

a) the existing leather tannery infrastructure is well-developed especially around Madras;

b) operating costs are relatively low; and

c) offshore resources of sharks are not sufficiently tapped at present.

An environmentally significant point is that shark and fish leathers in general are essentially food industry by-products which would otherwise be wasted. Other exotic leathers produced from crocodile and snake, for example, have negative connotations in this respect in spite of their increased production through culture.

### Offshore resources

The offshore zone is the realm of the large sharks, both pelagic and demersal varieties. For the production of leather, large-sized sharks (>1.5m) are preferred as these have larger usable surfaces.

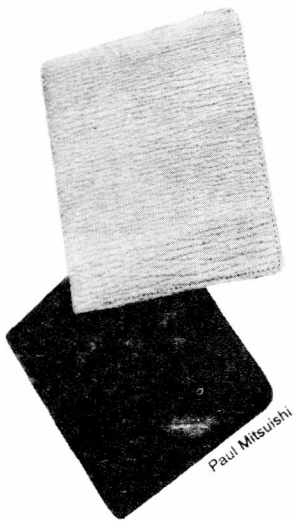
### Processing

In Madras, the species used are black tip shark (*Carcharhinus limbatus*) hammer-head shark (*Sphyrna* spp), Indian dog shark (*Scoliodon laticaudus*), thresher sharks (*Alopias* spp) and squalus sharks (*Centrophorus granulosus*) obtained from the small-scale fisheries of the Addaman Islands and the East Coast of Tamil Nadu. Traditionally, shark meat is salted and dried for export while the skin is merely thrown away. Careful removal and preservation of the skin can considerably improve the producer's income.

Leather development work is carried out in collaboration with the Central Leather Research Institute in Madras. Considerable variations are encountered between species and corresponding adjustments are being made depending on the nature of the denticle structure.

### Market acceptance

Good quality leather can be produced by small-scale tanneries in India using sharks caught by artisanal fishermen as long as fish quality is maintained and adequate training provided in



*Shark leather goods are becoming very well accepted.*

skinning skills. The price of the finished leather is currently working out to about US\$2.00-2.90 per sq ft ( depending on size, finish and quality) and this includes what would be locally regarded as a suitable producers margin. This compares favorably with goat, sheep and cow/buffalo.

An exotic leather, it is undergoing market trials in Europe both in the form of hides as well as finished goods.

Source: Tim Bostock, "Shark Leather," *INFOFISH International*, March-April 1991.

## **BARRAMUNDI**

Available in a wide variety of finfishes and being stronger and more durable than normal leather, this marine leather is making a definite impact.

Large fish species, such as the *barramundi* or sea bass, make the best fish leather. Skin from the large fish swell in the tanning process, giving them good body weight. The main feature is the scale pattern which forms pockets once the scales are removed chemically. Removal of scales chemically is by far the best method as it leaves the delicate skin forming the scale pockets beautifully.

Although the *barramundi* is found all over Asia, no other country has at present a supply of commercial quantities of large fish skins that Australia has. This is possibly because the fish is in most Asian countries a delicacy. Where it is farmed, it hardly is ever grown beyond the accepted marketable size of 600-800 g/piece.

In the 1989 *International Leather Guide*, there were 21 companies and tanneries listed

as being processors of fish skin. In the 1991 *Guide*, there were 56, an increase of over 100 %.

Very affordable, fish skin is made into a range of leather goods, shoes, fashion designer dresses and apparel. The more innovative entrepreneurs see it as a new product with great potential for future growth. Now that it has been recognized, it holds good promise to finding its niche in the leather world. It has been reported that the Italian company, Gucci, is now contemplating the use of fish leather.

Australia has at present five marine skin tanneries with at least two more preparing to get underway. For the five in existence now, there have been many trials and disappointments in finding markets and convincing buyers. The particular fish species used in making fish leather make all the difference; the bigger the scale pattern the more pleasing effect of the finished leather. *Barramundi*, carp, perch, wrasse, snapper and mullet have good scale patterns along with the many reef fish species.

US fish tanneries, most of whom use salmon skin, are doing very well now. However, most people still do not know that fish skin may be tanned nor of its fantastic qualities although once having seen the product, most agree on its potential.

Companies involved in tanning fish leather guard their formulas and processors most jealously. There are two main types of fish leather: one is in the form of soft ruffled which is used in a variety of ways for apparel, shoes,

*(to page 18)*

## Convenience food products

(from page 5)

(7) Cure the fillets overnight in a refrigerator.

(8) After curing, wash the fillets thoroughly to remove excess salt and drain for 30 min.

(9) Dry the fillet at 55°C for 2 hr and smoke for 2 to 3 hr or until golden brown.

(10) Cook the samples at room temperature, pack in polyethylene bags, and then store in the refrigerator.

### Ham-Cured Fillets

(1) Clean and eviscerate the fish immediately after procurement.

(2) Wash the fish thoroughly, slice cross-wise, pack in polyethylene bags, and store immediately in the freezer.

(3) Partially thaw the fish before filleting.

(4) Debone the fish by cutting along the backbone. Do not remove the hairbones embedded in the flesh to preserve the integrity of the fillet structure.

(5) Cut the fillet into 6-inch slabs and soak in 5% brine solution to remove excess blood and slime.

(6) Drain the fillet for 30 min before curing. A kilo bighead carp fillet is cured with 11 g sugar, 9 g prague powder, and 400 g of water. Salt is added to taste.

(7) The fillets are cured overnight in a refrigerator.

(8) After curing, wash the fillets thoroughly to remove excess salt and drain for 30 min.

(9) Dry the fillet at 55°C for 2 hr and smoke for 2 to 3 hr or until golden brown.

### Fish Sausage

(1) Cut the fish fillet across the grain to remove all the hairbones.

(2) Mix the fish and the cubed back fat at a ratio of 70:30 and pass through a meat grinder.

(3) Mix the fish-fat mixture with 22 g of salt, 1.5 g of garlic, 7 g of black pepper, 4 g of MSG, 4 g of prague powder, 21 ml of vinegar, and 1 ml of accord.

(4) Cure the mixture for 48 hr and stuff them into polyethylene bags.

### Qualities of new Products

The flavor, aroma and eating qualities of developed products from bighead carp are generally acceptable.

Fish sticks and fish spread prepared from bighead carp are generally acceptable in terms of sensory qualities. The fishy aroma and flavor of the products are masked by preparing comminuted products and using proper formulation.

Dehydrated and smoked products, namely, unsalted fish powder, salted fish flakes and smoked fish powder from bighead carp are likewise acceptable.

Smoked products from bighead carp, namely, plain smoked, pickled and ham-cured fillets were found to be highly acceptable.

Source: PCAMRD. 1991. **Processing of Bighead Carp into Food Products**. Dept. of Science and Technology, Los Baños, Laguna.

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## Fish leather...(from page 17)

handbags and so on; and two plated leather where the scales are lacquered and laid flat. This leather has a firmer texture for increased durability and is used in handbags, wallets, executive briefcases and corporate gifts. Whatever way it is used, fish leather products look great.

To start a reasonable size fish skin tannery would require at least A\$500 000 capital and a strong supply of raw materials. Which is why most tanneries diversify and simultaneously process other exotic skins such as eel, shark, stingray, sea snake, crocodile, emu, ostrich,

cane toads, frog and whatever else is available in quantity.

### Industry forecast

The future for the marine tanning industry is optimistic. Environmental and animal rights organizations will no doubt approve of fish skin because it brings no harm to nature or the environment. Everyone can own exotic leather goods which is otherwise normally discarded by the fishing industry.

Source: Terry Selwood, "Barramundi skin," **INFOFISH International**, January-February 1992.

## Round Table Discussion recommends

# Research Plans for 1995

Representatives from the government, the academe, and the private sector sat down with SEAFDEC/AQD scientists and researchers in a round table discussion on the research institution's plans for the year.

Held last February 6-7, 1995 at the Tigbauan Main Station of SEAFDEC/AQD, the discussion redound to the following research areas:

### **I. MILKFISH**

- a. Broodstock management
  - 1. Verification of optimum protein level
  - 2. Age and productive performance of broodstock
  - 3. Monitoring of egg, larval and fry quality of captive broodstock
- b. Off-season spawning
  - 1. Compressed annual photoperiod to induce off-season spawning
- c. Evaluation of commercial fry production
  - 1. Biotechnical and economic assessment of integrated broodstock and hatchery operation
- d. Refinement of hatchery techniques
  - 1. Enhancement of algal and copepod production in extensive larval rearing
  - 2. EFA and vitamin C enrichment of larval diets
  - 3. Possible causative factors of fry abnormalities
  - 4. Verification of SEAFDEC-formulated larval diets in commercial hatchery production
  - 5. Bacterial flora equated as to egg development and larval performance
- e. Brackishwater pond production
  - 1. Pond evaluation of tobacco dust as molluscicide
  - 2. Sulfide tolerance under hypoxia and acidic conditions
  - 3. Grow-out performance of hatchery-produced fry
- f. Bioenergetic and nutrient cycle
  - 1. Determination of respiratory values for evaluation of natural food contribution to energy and protein balance

### **II. GROUPEL/SNAPPER/SEA BASS**

#### **GROUPEL**

- a. Breeding and seed production
  - 1. Egg quality criteria
  - 2. Influence of season on hormone induced sex-inversion
  - 3. Influence of metabolic hormones on larval development and metamorphosis
  - 4. Improved water management and feeding schemes for older larval stages
  - 5. Effects of EFA and vitamin C enrichment of live food organisms on growth, survival, stress resistance and incidence of abnormalities
  - 6. Testing of various tank systems (semi-flow thru, static, closed recirculating system) for use in larval rearing
- b. Farming
  - 1. Comparison of growth and survival of hatchery-bred and wild grouper juveniles in ponds
  - 2. Stock management and improved feeding schemes for pond and cage culture
  - 3. Improved handling, holding, and transport methods for wild grouper fry
- c. Nutrition and feeds
  - 1. Development of broodstock feed
  - 2. Improved feed formulations for testing in grow-out cultures
- d. Fish health
  - 1. Monitoring of disease occurrences
  - 2. Maintenance of grouper cell lines for future viral studies

#### **SNAPPER**

- a. Breeding and seed production
  - 1. Continuation of studies on reproductive biology of captive snapper
  - 2. Improved broodstock management techniques
  - 3. Improved feeding and water management schemes for early larval stages
- b. Nursery
  - 1. Growth and survival of fry in illuminated cages

*(next page)*

- c. Farming
  - 1. Development of cage and pond culture techniques
- d. Feed development
  - 1. Feed formulation for juveniles

### SEA BASS

- a. Seed production
  - 1. Improvement of culture methods for *Diaphanosoma celebensis*
- b. Nutrition and feed development
  - 1. Determination of requirements for essential amino acids and fatty acids
  - 2. Testing of feed formulations using indigenous feed ingredients
  - 3. Digestibility of processed plant protein *in vivo*

### III. CATFISH, CARP, TILAPIA

- a. Refinement of induced maturation and spawning techniques
  - 1. Hormonal regulation of the final stages of maturation and spawning (more work on hormonal changes in males)
  - 2. Spontaneous spawning (physiology of male catfish)
- b. Refinement of hatchery and nursery techniques
  - 1. Improvement of hatching efficiency (stocking density, total water hardness, incubator type)
  - 2. Production and nutritive value of zooplankton species as fry feed (new)
- c. Feed development
  - 1. Evaluation of practical broodstock diets: modification of diets - protein and lipid levels
- d. Collaborative projects
  - 1. Ecological impact of the African catfish *Clarias gariepinus* in an open body of water: Stock assessment of Laguna Lake (SEAFDEC/AQD, BFAR, LLDA)
  - 2. Laguna de Bay, Philippines: an ecological approach to sustainable management (SEAFDEC/AQD, IESAM-UPLB, Hohenheim University, Institute of Geography-University of Hamburg, Institute of Industrial Chemistry-Padua University, The Royal Danish School of Pharmacy-Copenhagen, Denmark)

### IV. FISH GENETICS

- a. Genetic characterization of farmed and indigenous fishes

- 1. Characterization of Nile tilapia and bighead carp
- 2. Biochemical genetic variations in red tilapia
- 3. Genetic variation in the native catfish, *Clarias macrocephalus*
- 4. Genetic variation in the Manila catfish *Arius manilensis*

- b. Selective breeding and broodstock management

- 1. Size-specific selection for growth rate in the Nile tilapia
- 2. Development of high yield red tilapia through introgressive hybridization
- 3. Development of a red tilapia strain for culture in brackish/seawater
- 4. Development of techniques for broodstock management of bighead carp

- c. Collaborative international project

- 1. Genetic diversity in aquaculture: A programme for economically and socially sustainable conservation and development (Phase II)

### V. SEAWEEDS

- a. *Gracilaria*

- 1. Polyculture of *G. heteroclada* and shrimp with supplemental feeding
- 2. *G. heteroclada* and *Perna veridis* as biofilters in semi-intensive shrimp culture
- 3. Agar and agarose characterization from farmed stocks
- 4. Village level of agar extraction

### VI. MOLLUSC

#### ABALONE

- a. Resource evaluation/site selection

- 1. Nationwide survey of the abalone industry

- b. Seed production

- 1. Continuation of studies on larval and juvenile rearing
- 2. Optimum stocking density of juveniles in tanks

#### WINDOW-PANE OYSTER

- a. Effect of salinity and various species of natural food on larval growth and survival

#### OYSTER AND MUSSEL

- a. Continuation of participatory research on oyster and siganid polyculture in cages

## VII. FISH MICROBIOLOGY

### a. Virology

1. Infection experiments
2. Characterization of the virus

## VIII. COMMUNITY FISHERY RESOURCE MANAGEMENT PROJECT

a. Impact analysis on the environment, social and economic conditions of the fisherfolk, and institutional arrangements among the Fishermen's Association of Malalison Island (FAMI), barangay council, municipal government, non-government organization, and other involved agencies.

## IX. CRUSTACEAN

### GIANT TIGER SHRIMP

#### a. Development of pond-reared broodstock

in ponds

1. Pilot testing of broodstock production

2. Determination of astaxanthin requirement for pond-reared broodstock

3. Effect of hormones on reproductive performance

4. Improvement of male quality

#### b. Genetic characterization of local strains

c. Collation and packing of available data on pesticides, antibiotics, and other chemicals for shrimp culture

1. Survey and pathogenicity of viruses

#### d. Fish health management studies

1. Luminescent vibriosis

#### e. Feeding Management studies

1. L-carnitine supplementation in ponds
2. Amino acid requirements
3. Bio-availability of phosphorus
4. Performance of diets with seaweeds as binders in shrimp ponds

#### f. Soil quality studies

g. Impact of pond culture on the carrying capacity of the environment

h. Aqua-silviculture technology for rehabilitation of abandoned ponds

### MUDCRAB

#### a. Broodstock and larval rearing techniques

1. Feed development for broodstock
2. Feeding tests for larvae
3. Water management schemes in larval rearing

#### b. Farming techniques

#### c. Alternative species - white shrimp

1. Feed development and management

The discussants also recommended the following for study:

### MILKFISH

Broodstock nutrition

1. EFA requirement
2. Vitamin C and E requirements

Integrated broodstock-larval technology

1. Monitoring of environmental impact
2. Comparison of larval performance of fry from induced vs natural spawning
3. Investigation of factors leading to fry abnormalities
4. Determination of the influence of low levels of pollutants on fry quality and development of abnormality

Molluscicides

1. Investigation of indigenous plant as molluscicide
2. Testing of molluscicides available in the market and monitoring of environmental impact
3. Study on the life history, biology, and ecology of pond snails

### TILAPIA/CATFISH/CARP

Nutrition

1. Development of less polluting diet for tilapias and other fishes (low protein/high energy)
2. Use of African catfish as biological control agent in tilapia farms

Ecology

1. Stock assessment of Laguna de Bay in relation to the introduction of African catfish
2. Stock assessment of other introduced species in the lake - *ayungin*, *kanduli*, *biya*
3. Development of long-range plans/solutions for lake preservation in collaboration with other institutions

### GENETICS

1. Comparison of growth of tilapia reared in lake water at BFS and in other cleaner culture environment

2. Genetic study on *Arius manilensis* (3 species)
3. Comparison of DNA fingerprint of NIFI, FAC, other strains
4. Selective breeding by disease resistance and saline tolerance

## SEA BASS

1. Sea bass as biological control for tilapia

## FISH MICROBIOLOGY

1. Identification of primary causative agent of EUS

## COMMUNITY FISHERY RESOURCE MANAGEMENT (CFRM)

1. Use of existing resources in the area to determine livelihood projects
- 2., Resource assessment including beach front
3. Alternative livelihood for wives and children: entrepreneurial activities for which capital is needed: swine-raising, salt making, aquarium fish, shellcraft; active support
4. Rabbit fish cage culture
5. *Caranx maliputo* (Study reports available in BFAR); *pigik* (culture in ponds have been studied also)
6. Strategies for sustaining the project after AQD leaves
7. Specific indicators for impact assessment: biological - MSY/regeneration of fish stocks; should be participatory
8. Environment/population growth: point of comparison since there is only one environment in the island
9. Extent of agricultural activities: 90% comes from fishery; groundwater resource; integrated fishery resources in the island
10. Women's role: gender sensitivity - providing chance for leadership to women

## SEAWEEDS

1. Use of *Gracilaria* and *P. Veridis* as biofilter (also a BFAR study)
2. Diurnal changes in environmental parameters
3. Role of organic nitrogen and phosphorus in coastal areas (most of the N & P are in the form of organic N & P)
4. *Sargassum* culture
5. Use of *Tridacna* as biofilters
6. Semi-intensive farming of shrimp with biofilters

7. Bioremediation techniques: may be considered under environmental management studies of inland and coastal waters from aquaculture systems

## MOLLUSCS

1. Survival of *Haliotis asinina* trocophores (settlement stage)
2. Habitat/site selection for abalone
3. Sensitivity of larval abalone to GABA as a settlement agent
4. Transplantation: assuring that seeds used for transplantation should come from red tide-free areas since algae that causes red tide may also be transplanted
5. Growth rate of abalone (time to reach market size)
6. Ecology of *P. placenta* in the wild (abundance/occurrence)
7. Alternatives to depuration of oysters: cleaning of culture areas for coliform-free oysters

## CRUSTACEANS

1. Habitat/vegetation/density of mudcrab and shrimp
2. Prevention and control of bacterial diseases of PL 1-30 shrimps and 18-23 grams
3. Health of prawn industry: multidisciplinary approach - environmental impact of aquaculture system; environmental management; water treatment before discharge into rivers (DENR); other aquaculture systems such as closed system; use of biofilter
4. Survey of luminous bacteria infestation of prawn ponds and the factors involved: extent of antibiotic resistance
5. Dynamics in prawn ponds in relation to luminous vibriosis: soil/water chemistry, biochemistry, microbiology (UP should give priority to this area. DOST is willing to provide funds to this study)
6. Effluents in milkfish ponds: waste water treatment

## Second World Fisheries Congress

The **Second World Fisheries Congress** will be held in Brisbane, Australia, July 28 to Aug. 2, 1996, with the theme *Developing and Sustaining World Fisheries Resources: the state of science and management*.

Information may be requested from:  
 The Secretariat  
 Second World Fisheries Congress  
 PO Box 1280  
 Milton QLD 4064  
 Australia

## Gracilaria study presented

A SEAFDEC/AQD *Gracilaria* study was presented by Dr. Anicia Q. Hurtado-Ponce, Scientist, in the *Final Workshop on the Taxonomy, Ecology and Processing of Economically Important Red Seaweeds*, January 24-27, 1995 at the National Inland Fisheries Institute in Bangkok.

A study conducted from 1988-1994, it gave a good description of the production ecology, agar yield and quality, and culture of selected *Gracilaria* species, including the socioeconomic aspects of culture.

Polyculture of *Gracilaria* with finfish (*Lates calcarifer*) and also with *Penaeus monodon* was discussed. An interesting aspect explained was that in the agar quality change measured over the year, a seasonal difference of 10-fold could be observed, suggesting the need for seasonal studies for all candidates for culture and agar production.

Prof. Chen Jiaxin commended the study of the economics of culture, pointing out that countries should pay more attention to this aspect.

Prof. Alfsen observed that the SEAFDEC study is "a model study for all countries and the training facilities and technology available should be made use of by the other countries. Socioeconomic benefits of the operations of culture should be made available to the countries and the producers, the small farmers and fishermen."

Recommended for farming were *Gracilaria heteroclada*, *G. tenuistipitata* and *G. firm* which give good agar quality and high yields (16-20%).

Other recommendations for the Philippines included training in processing, specifically on chemistry of agarophytes, for the purpose of developing new value-added products.

The follow-up program suggested:

(i) continuing research on processing and agar extraction techniques suitable for each of the *Gracilaria* species identified for culture, and maintaining standard qualities;

(ii) introduction of village-level processing techniques;

(iii) further studies on taxonomy and ecology;

(iv) further development of culture techniques; and

(v) continuing study of the seaweed resources of the country. Training in molecular taxonomy techniques was also requested.

Mentioned was a plan to establish a research and development center for seaweeds to serve national needs and which could also become a regional resource for collaborative activities.

## SEAFDEC/AQD and UPV sign Memorandum of Understanding

Cognizant of their common goals and objectives in "fostering instruction, research, training and extension programs in fisheries and marine sciences, SEAFDEC/AQD and UPV (University of the Philippines in the Visayas) signed last February 7, 1995 a Memorandum of Understanding to further the following objectives:

1. To develop collaborative activities in the furtherance of the common goals and objectives of SEAFDEC/AQD and UPV;

2. To undertake collaborative instruction, research, training and extension programs;

3. To promote the exchange of scientists and researchers between SEAFDEC/AQD and UPV for instruction, research, training and other related activities; and

4. To strengthen the capabilities of SEAFDEC/AQD and UPV in the field of aquaculture, fisheries and marine sciences with emphasis on environmental concerns through the cooperative use of materials and facilities.

Dr. Efren Ed. C. Flores, Department Chief, signed for AQD while Dr. Arsenio S. Camacho, Chancellor, signed for UPV.

## New Information Officer for SEAFDEC Secretariat

To strengthen the information activities of the Bangkok-based SEAFDEC Secretariat, SEAFDEC Secretary-General Maitree Duangawasdi appointed Gloria P. Gonzales, Feb. 1, 1995, as the Secretariat's Information Officer.

Ms. Gonzales shall take charge of SEAFDEC's information programs as approved by the SEAFDEC Council. She shall prepare an annual progress report on the activities of the Secretariat and of all SEAFDEC departments for submission to the SEAFDEC Council and for general distribution. She shall assist in the preparation and publication of the reports of the Council, the *SEAFDEC Newsletter*, and other documents on the activities of the Center.

Ms. Gonzales is also tasked to gather and disseminate the documents and publications issued by the various SEAFDEC departments with a view to standardizing the format and presentation of the publications.



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AFN is a production guide for fishfarmers and extension workers. It discusses the technology for cultured species and other recent information excerpted from various sources.

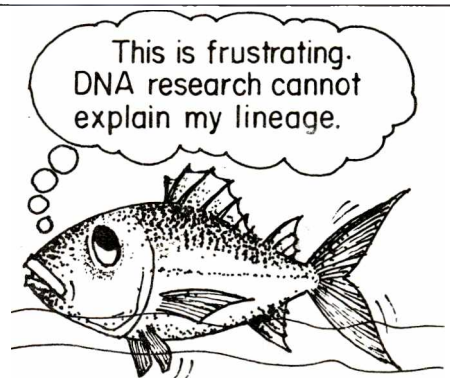
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Is there a technology gap you wish solved? Is your problem covered? See SEAFDEC/AQD research plans for 1995, complete in this issue. Write for inquiries. A solution to your problem might already exist, or one could be forthcoming.



E. Ledesma