The Fish Processing Industry in the Philippines: Status, Problems and Prospects

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Background

The Philippines is fortunate to be endowed with rich fisheries and aquatic resources where its population can always turn to for food. Fish is very important as a cheap source of animal protein in the diet. Our consumption of food fish is comparatively high by world standards. Our average per capita consumption of 41 kg annually is one of the highest in Southeast Asia. Table 1 shows our mean per capita fish consumption by geographical area.

The fish processing industry not only provides the valuable animal protein requirement but also generates employment opportunities to over a million Filipinos. It is also an important foreign currency earner and holds considerable potential for development.

Fish production showed an increasing trend from 1.3 million mt in 1975 to over 2.0 million mt in 1986 (Table 2). The increasing fish production is the basis of the fish processing industry. Inspite of the many obstacles and problems, the industry has expanded significantly over the past years. Export likewise steadily increased from 25,988 mt (₱328M) in 1975 to 101,448 mt (₱4,863M) in 1986 (Table 3). On the other hand, importation declined from 23,038 mt (₱111M) in 1983 to 6,097 mt (₱50.2M) in 1984 as shown in Table 4. The country's major imports in 1981 were canned sardines and mackerel mostly from Japan and Thailand and fishmeal from Peru.

Given the much-needed incentives to carry out the desired improvement, the industry possesses the necessary success factors towards national recovery.

Table 1. Mean per capita fish consumption in the Philippines by geographical area

Geographical Area	Fish Consumption kg/yr
All Urban	41
Metro Manila	34
Other Urban	45
Rural	41
Luzon	37
Visayas	38
Mindanao	45

Source: Fisheries Statistics of the Philippines, BFAR 1984.

Table 2. Total fish production by quantity & value 1975-1986

Year	Quantity (mt)	Value (₱)
1975	1,336,803	5,919,127
1976	1,393,483	7,297,946
1977	1,508,855	8,809,203
1978	1,580,404	9,477,276
1979	1,581,303	10,536,747
1980	1,672,254	11,644,350
1981	1,772,897	13,953,798
1982	1,896,983	15,063,966
1983	2,110,230	18,981,459
1984	2,080,439	25,649,933
1985	2,052,111	31,297,268
1986	2,089,484	37,331,483

Source: Fisheries Statistics of the Philippines BFAR.

Table 3. Total export of fish & fishery products by quantity & value 1975-1986

Year	Quantity (mt)	Value (₱)
1975	25,988	327,995,971
1976	23,974	330,272,807
1977	37,534	395,365,033
1978	48,438	532,213,555
1979	64,890	781,736,033
1980	76,179	939,294,463
1981	83,736	1,251,142,136
1982	68,265	1,119,685,276
1983	75,589	1,592,884,033
1984	63,055	2,179,380,361
1985	95,077	3,496,095,733
1986	101,448	4,862,738,898

Source: Fisheries Statistics of the Philippines BFAR.

Table 4. Total importation of fish & fishery products by quantity & value, 1975-1986.

Year	Quantity (mt)	Value (₱)
1975	86,910	294,730,712
1976	64,111	266,021,297
1977	38,557	205,082,803
1978	47,955	229,528,950
1979	45,874	207,038,680
1980	53,401	274,077,361
1981	46,850	288,434,119
1982	83,445	443,677,138
1983	23,038	110,908,875
1984	6,097	50,269,335
1985	28,755	118,180,573
1986	69,085	385,657,601

Source: National Census & Statistics Office, 1986

Existing Fish Post-Harvest Technologies

1. Fresh Fish Handling Practices in the Philippines

It is estimated that up to 30% of fish landed at Navotas are physically damaged prior to auctioning and most damages occurred even before the fish is landed (Kamari and Sayers, 1979). Such huge damage can be attributed to the various improper practices employed during the subsequent activities after landing the catch.

Due to lack of proper facilities for icing, transportation and cold storage, a considerable amount of fish spoils during distribution.

Handling on Board

In most fishing areas, the degree of care exercised in the handling of fish on board the vessel and off-shore depends directly on the value of species. High value species are better taken care of than low value ones, thus the intrinsic quality of these species is usually quite good. Low-value species are poorly iced and little protection from contamination is provided; hence, the quality on landing ranges from poor to rejects.

Some fishing vessels are not properly cleaned and sanitized in addition to the widespread use of tubs, baskets, wooden boxes as fish containers causing contamination during storage of fish resulting in poor quality, spoilage, off-odours and reduced shelf-life.

Handling at Landing Site & Auction Halls

When fish are unloaded at the landing ports, the ice are often discarded. The fish are transferred to other containers for auction. More often, they are unloaded on floors under direct sunlight with little or no ice, thereby exposing them to further contamination.

Water from the harbour is sometimes used to wash the fish. Harbour water is usually contaminated, thus aggrevating the spoilage of fish.

Packaging and Transportation

The dominant type of containers used for fish handling and distribution is a conical steel tub known locally as *"banera"*, having a capacity of approximately 30 to 40 kg of fish. A bigger *banera,* approximately 70 kg capacity is used for transporting fish to some landing areas and retail markets. Other types of containers are also used, such as those made from rattan, bamboo, timber, styrofoam, and plastic containers. These vary from one region to another although the *banera* still remains the most common.

The fish is iced in *banera* on board the vessels and transferred to auction halls in the same containers. The *baneras* are usually

owned by resident brokers, some of whom also own fishing boats. Some boat owners market their fish through regular brokers who charge a 7-10% commission on sales. Some brokers lease/rent *baneras* to their established wholesale and retail clients and charge a minimum deposit. Some buyers provide their own fish containers.

Fish for transportation to distant markets is repacked and iced in the *banera* and loaded into insulated trucks. Timber planks are placed between successive layers of *baneras* to facilitate stacking but because the *baneras* are always overfilled, damage to fish at the bottom layers due to crushing becomes inevitable.

Large rigid trunks, both insulated and open ones are commonly used for medium to long distance transportation. When open trucks are used, the fish are packed in styrofoam boxes with ice. The use of this type of container is now becoming popular. To make them more durable, wooden frames are provided for support and protection against rough handling.

Fish for local distribution is normally transported either by privately-owned *jeepneys* or small pick-up trucks with a capacity of one ton or less.

The introduction of high density polyethylene plastic (HDPE) containers has improved the fish handling practices in the fishing industry. Trials have been successful in Iloilo and Bacolod and they have been found to be ideal for handling and distribution of milkfish from the production areas to the auction centers. These containers offer the following advantages: 1) ease of handling 2) better presentation of produce at auction, and 3) better utilization of space in vessels (Sayers, 1983).

2. Fish Processing Technologies

Table 5 shows the approximate number and type of fish processing plants in the Philippines by region. It is interesting to note that the fish processing industry has expanded as shown by the increasing variety of fishery products, utilization of non-traditional resources and production of new fish products. This indicates that the industry has promise for potential development.

Traditional Fish Processing Methods

The fish processing industry in the Philippines generally ranges from small to medium cottage industry level employing the traditional methods of salting, drying and smoking with the small units operating in strategic locations all over the country. The industry absorbs surplus fish catch during the peak season, offers a ready market at almost the same price as fresh fish during the lean months and provides storable protein diet items. The species of fish most commonly used and their product forms are shown in Table 6.

Drying

Drying is one of the oldest and simplest methods of preserving fish in the Philippines and in many tropical countries. This industry plays an important role in stabilizing the utilization, distribution, and marketing of fish resources. The product is acceptable to all income groups and has high export potential.

Sun-drying as a method of preservation remains popular in the country because of its low-capital investment and other advantages. The techniques are usually simple and do not require high technology or expensive equipment. At present, approximately 38% of the total catch is processed into dried fish products. There are 658 dryig plants in the country today, 415 of which are registered. The Philippines showed the highest per capita consumption of dried fish in Southeast Asia or 4.4 kg annually (FAO, 1980).

Fish drying activities in the country vary according to the availability and suitability of raw materials for drying. As the processors are generally small scale family establishments, most of them have limited capital and do not receive assistance provided by various government agencies and financing institutions. These factors coupled with existing conditions in areas difficult to reach limit the development and improvement of the industry. Nevertheless, in some areas in Palawan and Cagayan, some processors have realized the relative benefits of using artificial dryers for fish. In Cagayan, oven-type agro-waste dryers are used for drying tiny shrimps which are consumed locally or even exported to Japan. The use of these artificial dryers was introduced in the mid-seventies.

Salting (Fermenting)

The manufacture of fish sauce *(patis)* and fish paste *(bagoong)* is a major industry in eight regions of the country namely: Region 1,2 3, 4, 5, 8, 11 and 12. (Macalincag-Lagua and Payofelin, 1978). Production peaks during the month of April and decreases in October. By-

catch market surpluses, like tiny shrimps, *Acetes* sp. and other species of low-commercial value are also absorbed by the industry, thus preventing wastage of resources.

The technology employed by the processors is simple, which consists basically of mixing the salt and fish or shellfish and allowing it to ferment for a certain period of time, depending on whether fish sauce or fish paste or both are desired as products. The containers used to stack the mixture vary from earthenware jars to plastic containers and concrete tubs.

To hasten the fermentation process, some processors have adopted techniques such as exposing the containers of salt-fish mixture to sunlight with the containers covered, and burying the containers partly into the ground, on the principle that fermentation is faster at higher temperatures. Artificially produced enzymes, such as pepsin in powdered form is now manufactured and some fish processors are already using it. The use of enzymes from papaya was introduced by Guevara *et. al.* in 1973.

Poor product quality and the presence of extraneous materials are among the reasons for rejecting fish paste and fish sauce exported in 1980 (Orejana, 1983). This is primarily due to the fact that proper hygiene and sanitation is hardly practised by some of our processors.

Table 5. Approximate number & type of fish processing plants in the Philippines by regions, 1986

Regions	No. & Type of Fish Processing Plants							
	Drying	Smoking	Fish Paste Manufacture	Fish Sauce Manufacture	Canning	Fishmeal Manufacture	Others	Total
1. Dagupan	5	24	72	72	—	—	—	173
2. Gagayan	19	24	21	21	—	—	2-shrimp noodles	87
3. Pampanga	7	96	23	—	—	—	4-salted fish	130
4. Southern Tagalog	132	115	39	85	1	—	7-shellcraft	379
5. National Capital Region (Metro Manila)	20	11	48	48	21	4	—	152
6. Naga	254	128	66	1	2	1	4-shrimp cake 2-jellyfish	458
7. Iloilo	136	12	9	8	4	—	1-shrimp *kroepeck*	170
8. Cebu	/	/	/	/	2	—		2
9. Tacloban	17	—	13	—	—	—		30
10. Zamboanga	39	1	9	10	5	—		64
11. Cagayan de Oro	/	/	/	/	1	—	1-shrimp *kroepeck*	2
12. Davao	3	15	35	7	—	—	5-shrimp *kroepeck*	60
13. Cotabato	26	14	29	-	—	—		69
TOTAL	658	440	364	247	36	5	26	1776

Note: — none
/ presence of fish processing plants; number not given

Table 6. Most common species & their product forms

Species	Product Forms								
	Fresh/ Chilled/ Iced	Dried	Salted-Dried	Smoked	Fermented	Pick-led	Canned	Fish meal	Others
1. *Stolephorus commersonni* (anchovies)	x	x	x	x	x				x boiled-dried
2. *Caranx crumenophthalmus* (Big-eyed scad)	x		x	x					
3. *Caranx* sp. (Cavalla)	x		x						
4. *Leiognathus fasciatus* (Common slipmouth)	x	x	x		x			x	x boiled-dried
5. *Sciaena dussumieri* (Croaker)	x		x		x				
6. *Sardinella perforata* (Deep-bodied herring)	x		x	x	x				
7. *Sardinella fimbriata* (Fimbriated herring)	x		x	x	x				
8. *Cypselurus oligolepis* (Flying fish)	x		x		x			x	
9. *Anodontostoma chacunda* (Gizzard shad)	x		x						
10. *Epinephelus* sp. (Grouper)	x		x						
11. *Oxyunchthys microlepsis* (Goby)	x		x						
12. *Megalepsis cordyla* (Hairtail)	x		x						
13. *Scombeeides lysan* (Leather jacket)	x		x	x					
14. *Ophicephalus striatus* (Mudfish)	x								
15. *Mugil* sp. (Mullet)	x		x	x	x				
16. *Decapterus macrosoma* (Roundscad)	x		x	x	x		x	x	
17. *Sardinella longiceps* (Sardines)	x	x	x	x	x		x	x	x boiled-dried

Table 6. (continued)

Species	Product Forms								
	Fresh/ Chilled/ Iced	Dried	Salted-Dried	Smoked	Fermented	Pick-led	Canned	Fish meal	Others
18. *Teuthis javus* (Siganid)	x	x	x						
19. *Scoliodon* sp. (Shark)	x								x shark liver-
20. *Lutjanus* sp. (Snapper)	x		x						
21. *Nemipterus japonicus* (Nemipterid)	x		x		x				
22. *Datnia pumbea* (Silver perch)	x	x	x		x				
23. *Rastrelliger brachysomus* (Short-bodied mackerel)	x		x	x					
24. *Euthynnus* sp. (Tuna)	x		x	x			x	x	x boiled
25. *Scomberomorus* sp. (Spanish mackerel)	x			x					
26. *Callinectes* sp. (Crabs)	x								
27. *Sepia* sp. (Cuttlefish)	x								
28. *Ripilema* sp. (jellyfish)			x		x				
29. *Perna veridis* (Mussels)	x	x		x		x			
30. *Penaeus monodon* (Prawns)	x								
31. *Holothoria* sp. (Sea cucumber)	x			x		x			
32. *Gracilaria* sp. (Seaweeds)	x	x							
33. *Penaeus* sp. (Shrimps)	x	x							x *polvoron* x *kroepeck*
34. *Loligo* sp. (Squid)	x	x	x						
35. *Acetes* sp. (Tiny shrimp)	x	x			x				x *kroepeck*

Smoking

Fish smoking is believed to be introduced into the Philippines by the Chinese. This method preserves the fish, enhances its flavour and improves its appearance. The method is simple and may not require expensive machinery. The raw materials are locally available and the products are widely acepted. The total production of smoked fish in 1982 was 455.6 mt valued at ₱6,367,802 (BFAR, 1982) of which 46% was marketed locally and 54% was exported (Mendoza, 1986). Exports were mainly smoked tuna and milkfish.

Fish smoking is not practiced throughout the country and many coastal areas prefer to dry or ferment excess fish than to smoke them (Mendoza, 1986). Six of 12 regions of the country process smoked fish (Macalincag and Payofelin, 1982); they are Central Luzon (Region 3), Taglog Province (4), Bicol Region (5), Central Visayas (6), Negros Oriental (7) and Southern Mindanao (9). Milkfish is smoked either whole, split, boneless and soft-boned and is sold locally while smoked-dried tuna *(katsuobushi)* is mainly for export to Japan.

Some fish sold in Metro Manila come mostly from Salinas, Navotas and Mercedes, the former source being preferred in Metro Manila (Mendoza, 1986).

Due to non-uniformity in the processing method, smoked fish show varying degrees of product quality, shelf-life and acceptability.

3. New Fish Processing Methods

Fish Canning

Canning has grown to a certain degree. A number of canning factories are now operating in Metro Manila and in some provinces. At present there are 30 fish canning plants in the country 21 of which are operating in Metro Manila while the rest are located in other provinces. However, operation still vary from excellent to poor; that is from high degree of technological sophistication to primitive manual operations. The most commonly used species are those utilized by the fish curing industry such as milkfish, sardines and mackerel which poses a problem on the raw material supply during some time of the year. Other raw materials like shrimps, squid and crabmeat still need to be tapped. Assessments made by BFAR technologists showed that the most common defects in local canned sardines are:

a) Mislabelling — contents are not the same as those stated on the label.

b) Fish are not processed immediately after thawing, resulting in off odours and mushy texture of products.

c) Proportion of solids to sauce is not within the required proportion of 60/40.

d) Cans are defective. Fracture on can seams occurs due to too tight preasure on the rollers. Cans are sometimes dented.

Considerable attention should be given to this industry to improve product quality to enable it to be more competitive in the export market and at the same time satisfying the demands of the local consumers.

Freezing

Freezing is a big help to the fish processing industry in two ways. It provides efficient preservation and storage of the catch for future processing and caters to the needs of the export of frozen fish such as tuna, shrimp, and other products.

A majority of Filipinos have strong preference for fresh fish to frozen ones because of the undesirable freezing procedures in some establishments which result in sub-standard frozen products. Contact plate freezers are widely used while air blast freezers are employed only by a few exporters.

Manufacture of Minced Fish Products

Fish balls are the most popular among the minced fish products. It is prepared from white meat species which is seasoned with sugar, salt, monosodium glutamate and starches as thickening agents. However, most plants engaged in the industry lack education on proper sanitation and flies appear to be a major problem in the processing area. Products are sold locally. This industry may absorb trash fishes and market surpluses including fresh water species.

Studies are now being done by BFAR to maximise the utilization of by-catch such as croakers, lizardfish and sharks into comminuted forms, and extruded as breaded products. Fish balls are popular products and are now sold almost everywhere. Fish *quekiam* and fish burger are now being promoted in the

market. By-catch are also good raw materials for the manufacture of other fishery products like fish salami, fish noodles, *kroepeck*, fish sticks and others. With appropriate processing technology, by-catch can become an important potential source of protein for human consumption.

Shellfish Processing

Processing of shellfish is confined mainly to the more popular crustaceans and molluscs. Shrimps and prawns, because of their high market value are mostly exported in fresh, frozen or chilled forms; similarly with lobster tail and crabmeat. Dried shrimp, crabmeat and tiny shrimps *(Acetes* sp.*)* are also exported to Japan, U.S.A. and other countries. Molluscs like abalone, mudsnail, mussels, oysters, cuttlefish, squid, octopus and arkshell are also exported in their live or processed forms such as dried, salted and frozen/chilled. Processing technologies fot shellfishes have been developed but most of them are exported either because of high export demand and abundance in catch or because they have no local demand at all. However, considering the present availability of appropriate technologies, utilization or other potential species shows promising prospect.

Bangus Deboning

The changing tastes of consumers and their demands for improved acceptability of bangus, a bony fish, gave rise to the milkfish deboning industry. This industry caters for the institutional markets such hotels and restaurants which have gained popularity in their broiled fish products *(inihaw)*. It also caters to the demand of Filipino communities abroad who have marked preference for convenience items. Today, this industry generates employment and adds to the foreign currency earnings through exports. The product is exported in frozen, marinated, dried and smoked forms.

Manufacture of Boiled Tuna
(Sinaing na Tulingan)

The industry is a lucarative business in the Tagalog Region. It utilizes frigate tuna, bullet tuna and eastern little tuna. The process or boiling the fish with salt enables the fishermen/producers to sell the product to other areas where the demand is high without the risk of spoiling the fish as it keeps for 4-7 days at room temperature. The technology is now being promoted especially in areas where the catch is abundant. However, the product is consumed locally only.

Processing of Boiled-Dried Fish

This is a new product; the technology was introduced by the Japanese. Small species like slipmouth *(Leiognathus* sp.*) locally known as "sapsap"*, and anchovies *Stolephorus commersonii* are manufactured into boiled-dried products. The fish are boiled in a concentrated brine solution and dried under the sun. This methods preserves the product and enables the processors to market them in areas where they are in demand.

4. Other Fishery Products and By-Products

These are generally produced by small-scale factories, and the product are either consumed within the locality where the product is produced, and for the export market, both for direct human consumption and for industrial purposes.

Utilization of By-Catch

Trash fish landed as by-catch comprises as much as 50% of the total marine commercial catch in most ASEAN countries (CIDA, 1985). Most of them are now sold at relatively low prices for reduction to fishmeal, fish sauce/paste processing or for consumption by low-income groups.

Fishmeal Processing

Fishmeal production also depends to some extent on by-catch in addition to the fish scraps and wastes in processing, particularly from the fish canning industry where such wastes constitute approximately 40% of the raw materials. In the frozen food industry, the waste materials constitute 80% of live crabs and 30% of shrimps (PCARRD, 1982). Rejects in dried and smoked fish and fish offals from filleting are also absorbed by the fishmeal industry. However, there is a need to improve the processing techniques in fishmeal production as its quality is believed to be inferior to imported meals. Nevertheless, our importation of fishmeal was drastically reduced from 24,621 mt (₱25,232,047) in 1980 to 4,816 mt (₱30,712,389) in 1984 (Fisheries Statistics, 1984).

Shark Liver Oil Extraction

Shark fishing for squalene oil started in Cagayan in 1980. The extraction of oil from

shark liver was practiced during this year when there was high demand of shark oil in Japan and France. The process is crude because of the inavailability of appropriate processing equipment. The total oil production from January to May 1986 was 5.4 mt. The price is ₱7,000.00 per drum weighing 180 kg. The productive areas for shark fishing are Babuyan Channel and Pacific Ocean. There are two operators engaged in the business which are both located at Aparri, Cagayan.

Problems Facing The Fish Processing Industry

The fish processing industry is bugged by many problems which are either industrial, socio-economic, institutional or political in nature. Nevertheless, inspite of them the industry continues to grow and it has gone a few steps ahead towards its full development. The various problems of the fish processing industry are summarized below:

1. Huge losses in value of fish and fishery products due to poor handling practices, sanitation and hygiene which results in inadequate supply of raw materials for processing and inferior quality of fishery products. This is also attributed to lack of adequate facilities necessary for handling, processing and distribution.
2. Poor hygiene and sanitation and non-standardized procedures encourage insect infestation of cured products and non-uniformity of product quality.
3. Slow transfer of new technologies and strong resistance to new techniques due to lack of proper education and training on proper fish handling, processing and quality-consciousness among the fish processors. The lack of facilities and equipment needed for extension and technology dissemination also hinders technology transfer. Thus, the processors still cling to the traditional methods which are in most cases crude and sub-standard resulting in either poor quality or product rejects.
4. Lack of capital limits the processors' ability to expand their business and explore the utilization and processing of other fishery resources. Thus, most operations are confined mainly to traditional processing methods good for small to medium-scale operations.
5. Lack of proper coordination among agencies and other institutions involved in the fishery industry resulting in gaps and duplication of some functions while neglecting other important areas.
6. Lack of government funds to carry out effectively and efficiently the much needed extension service and other forms of technical assistance that the industry needs.

Government Programs and Projects

The government through the Bureau of Fisheries and Aquatic Resources (BFAR) implements the Fish & Fishery Products Utilisation Project under the Expanded Fish Production Program. This program is implemented hand-in-hand with other programs and projects of other research and development institutions. The programs aim primarily at promoting import substitution and expanding fishery exports. To realize these objectives, the following activities are being undertaken.

Research

To maximize the utilization of fish and fishery products, research studies directly concerned with converting the once non-utilized fish species and other minor sea products are being conducted. Studies on the improvement of handling and processing techniques of traditional products to suit consumers' demands are likewise being done.

Extension Service

Results or research studies in fish handling, processing and utilization are disseminated through lectures, demonstrations, seminar/workshops and technical information services in order to encourage the processors to adopt new technologies and the private investors to engage in fish processing industry. Such medium of technology transfer helps promote import substitution and develop export products and at the same time upgrade the quality of fish and fishery products.

Product Development

Corollary to research activities, studies on producing other products that could be derived and developed from various fish and fishery products are being undertaken. Likewise, traditional processing methods are improved by applying appropriate technololgy and using suitable processing equipment. Available tech-

nologies and new ones are verified and pilot scale production of fishery products are being undertaken.

Training

Training courses and seminars/workshops are conducted for interested parties by the staff of the Fisheries Extension Division and the Fisheries Utilization Division of BFAR. The former conducts training courses on improved fisheries extension methodologies for trainers and extension officers while the latter conducts training on fish handling and processing for operators. A one-week training course on fish handling and processing is an on-going project of the BFAR through the Fisheries Utilization Division where proper fish handling and processing methods are taught to housewives, processors, businessmen, students and industrialists. This serves as a medium of technology transfer to disseminate the technology to the industry. Training courses on fish handling and processing are given to upgrade the skills of the technologists and extension officers and make them more effective in their jobs. Other academic and research institutions implement similar trainings.

Recommendations For Further Development of The Industry

1. Implement an intensive educational information and technology dissemination program nationwide designed to:
   a. effect technology transfer on product development and improvement.
   b. demonstrate proper handling, hygiene, sanitation and standard processing procedures.
   c. encourage quality-consciousness in fish processing. This may include print media, TV and radio programs, training courses and workshops.
2. Provision of trained fish inspection staff to advise and provide quality control guidance in the regions.
3. Appropriation of sufficient funds for research and development projects to support the fish processing industry.
4. Expansion of fish inspection and quality control laboratories in the regions as a show-window to the industry where appropriate fish processing technologies may be demonstrated.

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