Peru Leads the Fishmeal Market

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During the past 15 years fishmeal has become a more significant component of feed rations for poultry, a factor which went hand-in-hand with the rapidly expanding and maturing commercial broiler industry. The fact that fishmeal is exceptionally high in certain important natural proteins gives it special significance even when priced higher than other feed ingredients per unit of total protein. Another consideration is freight. A large part of the poultry enterprise is located close to ports where imported or domestically produced fishmeal is more readily accessible than other protein ingredients.

Poultry rations account for 90% of the fishmeal consumed, and up to 10% of poultry feed can be fishmeal. Hog rations account for the remaining 10% of consumption. Cattle feeds avoid fishmeal since this class of animals finds the odor disagreeable.

The purpose of this article, however, is not to explain the use of fishmeal as a feed ingredient, which has been covered thoroughly in papers from other sources. Rather it is intended to bring some information on production and marketing which have been less thoroughly treated elsewhere, with special emphasis on the Peruvian fishmeal industry since Peru supplies about half of the total amount in international commerce. Other important sources are South Africa, Scandinavia and Japan.

Peru's production of fishmeal began its growth phase in the late 1950's, surpassing the 100,000 ton mark in 1958. By 1962 it exceeded one million tons. Almost two million tons were produced in 1968 and that figure will probably be reached in 1970 (the Jan.-Sept. estimate is 1.6 million tons). In most recent years fishmeal exports have been the leader in foreign exchange earnings, even exceeding those of copper (Table I).

Private investment, mostly of foreign origin, quickly responded to the apparent profit incentive in this fast growth industry, and processing installations blossomed at every possible port up and down the Peruvian coast and into the northern portion of Chile. There are 120 plants at 23 Peruvian ports with such installations. This sudden surge of production quite understandably caused marketing problems as supplies exceeded consumption possibilities except at distress prices in some years.

It soon became evident that this aggressive competition would result in such exploitation that fish reproduction could not keep pace with the catch from year to year and the entire industry would suffer. Scientific studies have determined that a limit of 10 million tons of fish is all that can be caught annually so as not to destroy nature's equilibrium. (Five tons of fish equal one ton of fishmeal.) The fishing fleet is capable of catching twice that amount if it could work to capacity each working day, but of course this is impossible because of the natural elements. The processing plants could handle two to three times this amount.

To overcome the marketing problems surrounding the industry in its fast growth phases, with radically fluctuating prices, marketing groups or cooperatives were established which brought some price stability into the market. But competition was still keen between groups and especially from independent producers. Finally, in May of 1970 the government imposed strict regulations on production and marketing. All sales of fishmeal and fishoil are now handled by an agency of the government. There are severe penalties to be imposed by those who are found to be in violation of these production and marketing provisions.

Peru's Humboldt Current

Fishing resources off the coast of Peru are unique, as might be expected to support an industry of this size. The

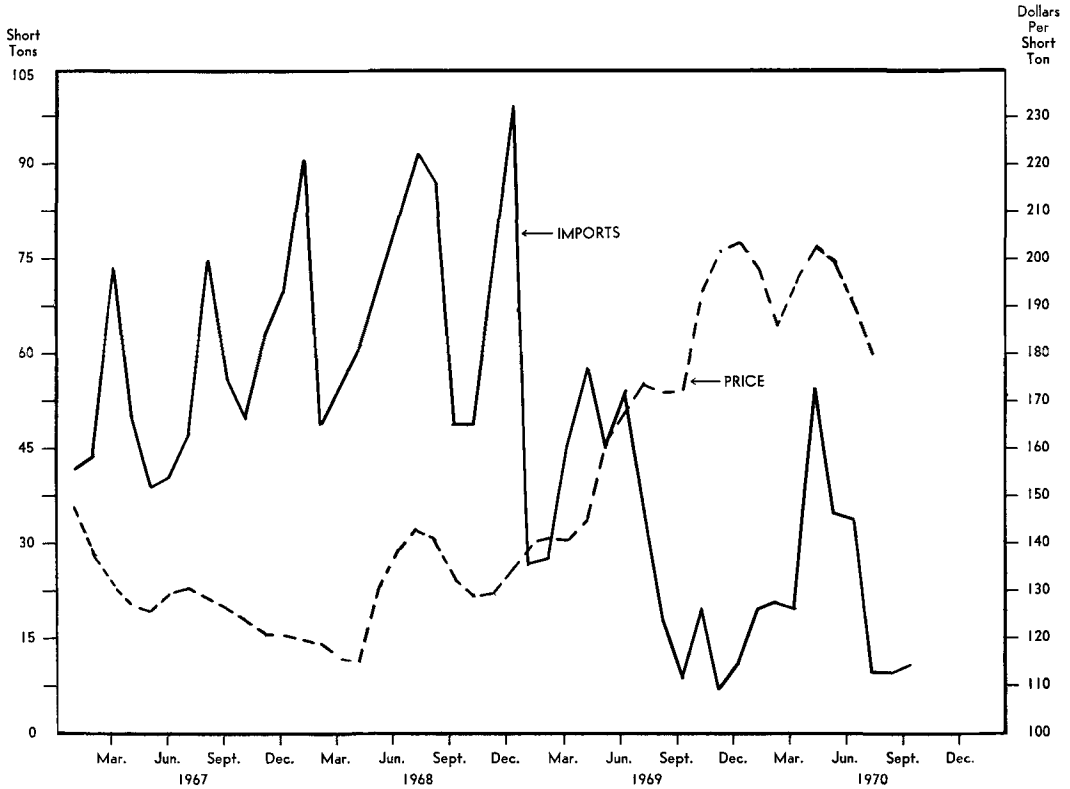

Fig. 1. U.S. fishmeal imports and price 60% New York fishmeal.

principal fish are the anchovy which live in the Humboldt Current and move in huge schools in this favorable environment. This Current flows north along the West Coast of South America. Southeastern winds prevail which carry surface water away from the coast. The warm surface water is replaced by cooler water which brings plankton and nekton to the surface on which the anchovies feed. The volume of the anchovy catch is largely dependent on two natural factors: changes in the Humboldt Current and the number of guano birds that prey on the anchovy.

In 1965 it is estimated that the guano bird population was 18 million and that they consumed 3.5 million tons of anchovy. The following year the guano bird population dropped to 3 million consuming only 0.6 million tons of fish. The drop in bird numbers resulted from a change in the Humboldt Current. Cool waters carrying food for the anchovy did not rise to the surface so the fish had to swim deeper to secure food. Consequently the guano birds could not feed on the fish and many perished.

Finding the Fish

Since anchovy travel in schools, the secret to success is finding the location of these schools on any given day. Once this is done it is a relatively simple matter to drop the nets, surround the fish and haul them out of the water by means of hydraulic pumps.

School movements are erratic, but they can be plotted with a fair degree of accuracy by marine scientists. These determinations indicate the general area where the most fish are likely to be found. Once the boats arrive in that area, electronic gear such as echo sounders and sonar are utilized to determine the exact location where the nets are to be placed.

Vedas

Fishing is not allowed during two periods of the year. One is usually June thru August, which is called in Spanish the Veda Grande. The other is from 30 to 60 days in the January-March period and is called the Veda Chica. These are for the purpose of allowing spawning and the growth of small fish. The precise dates are established each year according to actual conditions prevailing. Among the considerations are fish length, success toward achieving the quota, and calculations of above or below normal quantities of fish remaining.

Processing Fish Into Meal

Fish brought into Peruvian ports by the fleet of over 1,300 boats are quickly put thru the steam cooking, pressing and drying facilities of a processing plant. Steps are being taken to retard the enzyme and bacterial action, which begins in the ship's hold, in an effort to improve both quality and yield. Further efficiency measures are being employed to salvage the waste material which used to be discarded. Water extracted by screw presses and centrifuges contains about 20% of the dry fish solids. This is referred to as "stickwater." By installing stickwater evaporators it is estimated that fishmeal production can be increased by 10% at least, thereby improving efficiency and providing a higher rate of return without enlarging the fish catch.

Some countries are using floating factory ships for fishmeal production. In this technique fishing boats bring fish to the "mother" ship where the transformation to fishmeal and oil is made, and the end products are transferred to other ships which move them directly to the destination or to storage on land. Peru has not utilized this procedure because the fish supply is so conveniently located.

Shipping Fishmeal

Fiber bags were used exclusively for shipping fishmeal until recently. Now these are being replaced by bulk shipment in some instances. But where bagging is still desired, polypropylene material is taking over. This is a petroleum derivative. It is cheaper, lighter weight and more durable.

Bulk shipments are being utilized where possible because of reduced handling and shipping costs. Ocean freight of bulk carrier is about half as expensive as general cargo vessels but loading and unloading must be accomplished swiftly because of higher demurrage costs. There are other limitations to bulk handling. Not all ports of loading and unloading can accommodate bulk materials. Dust accumulations increase the fire and explosion risk. Tight lumps may

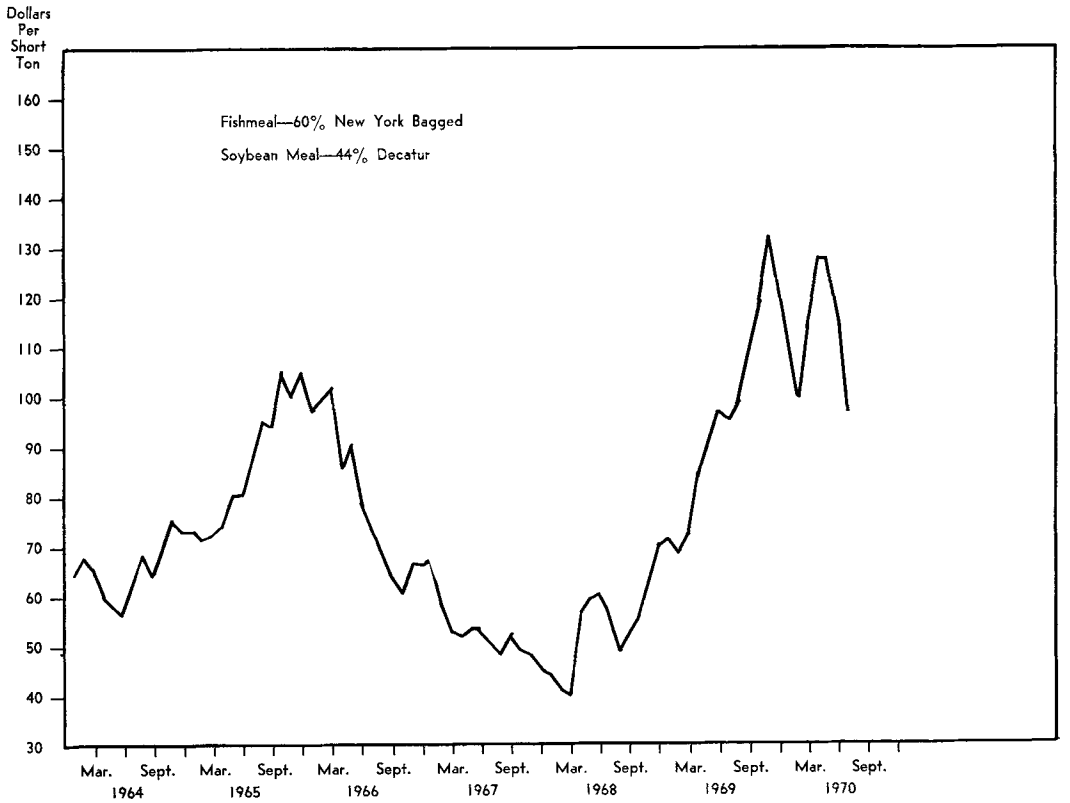

Fig. 2. Fishmeal price over SBM price.

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TABLE I

Peru—Fish Meal Production

Year	Thousands of metric tons
1951	7.2
1952	9.2
1953	12.1
1954	16.5
1955	20.0
1956	30.9
1957	64.5
1958	126.9
1959	332.4
1960	558.3
1961	863.8
1962	1,120.8
1963	1,159.2
1964	1,552.2
1965	1,282.0
1966	1,470.5
1967	1,816.0
1968	1,922.0
1969	1,610.8

form which make loading and unloading difficult. To overcome these problems there is a transition to pelletizing. Pellets have the further advantage of having a higher density which further reduces shipping costs.

Fishmeal usually contains about 10% fat which makes it very susceptible to spontaneous combustion. This is usually controlled by the use of antioxidant compounds to control oxidation.

Exports of fishmeal go principally to Europe, United States and Japan. The leading countries of destination are shown in Table II, but it must be recognized that in the case of European countries named there was undoubtedly trans-shipment to other interior countries.

U.S. Imports

The amount of fishmeal imported into the United States is dependent upon several factors. The first, of course, is price. It is easy to demonstrate that as price goes up, imports go down; or as price goes down, imports go up (Fig. 1). This supply vs. price relationship is much more closely related than is the price of fishmeal vs. the price of soybean meal (Fig. 2). There is no simple parallel relationship to these two price patterns because soybean meal is produced domestically with widely fluctuating periods of surplus aand shortage of supply.

Other factors relating to imports of fishmeal include expansion or contraction of poultry numbers and other

TABLE II

1969 Exports of Fishmeal From Peru by Destination

Destination	Thousands of metric tons
Western Germany	384.2
Holland	216.0
U.S.A. East Coast	189.0
Spain	130.0
Italy	87.6
Eastern Germany	79.6
Poland	77.2
Mexico	57.9
Yugoslavia	55.1
Japan	54.2
England	42.3
Belgium	30.4
Czechoslovakia	27.6
Hungary	25.8
Venezuela	25.1
Total	1,655.6

high protein feed ingredients. There also is the quality factor of salmonella contamination. In recent months the U.S. Food & Drug Authorities have embargoed several shipments with this infection and would not release them until reprocessed to raise the level of purity. This had the effect of raising cost and disrupting flow of supply, both of which factors tended to influence feed mixers to be reluctant to depend on this source for future protein supplies.

Another factor affecting imports is the quantity of domestically produced fishmeal which fluctuates within the year and between years for natural and other reasons.

Fish Oil

Oil is also derived in the production of fishmeal, just as both meal and oil are derived from the crushing of oilseeds. Even though some oil remains in fishmeal, some is removed to enhance the keeping quality of the meal and also to reduce the hazard of spontaneous combustion. The oil yield is about 2% to 3% but occasionally runs as high as 8%.

Most of Peru's exports of fish oil go to Germany and the Netherlands for distribution in Europe. Its primary use is in margarine at a rate of 5% to 7% of the oil content. The other important recipient is Colombia.

Fish oil has a longer storage life than fish meal. Peru has storage capacity of 150,000 tons. Supply of and demand for other oils is the most important factor determining fish oil prices.

Protein Foods Association (PFA) of India

(The following is excerpted from a speech delivered by Shri R. Ramaswami, Chairman of PFA of India, on March 30, 1970, at Bombay.)

Now the atta sold in Bombay is fortified with proteins from peanut flour and with essential vitamins and minerals. The cost of fortification (four paise/kg) is absorbed by the Government.

Our Association has been involved with the project in that the Government accepted our fortification formula and some of our members produce the flour, peanut protein or vitamin-mineral mixes. Looking into the future, fortification promises to make an effective impact. It can reach the maximum number of the vulnerable sections of the population at little cost and has the added advantage of not requiring change in food habits. A quick extension of the fortification project where feasible will be desirable. Research on the field is well underway.

Collection of information and data to help the food industry to introduce low cost protein foods is an important objective of the Association. To fulfill this objective, a food-habits-and-attitudes survey in Maharashtra and Gujarat was conducted last year. The data corroborated the existence of the protein gap, particularly among children and gave estimation of the degree of deficiency, which in some cases is startling. The per capita daily protein intake of children between the ages of six months to one year is less than half the requirement. For children between one to three years, it is less than three quarters and for children between three to five years about 60%. The nutritional deficiency is acute among the lower income groups.

The incidence of vegetarianism is not as high as one would expect. Thirty per cent of the families in Gujarat and 60% in Maharashtra eat egg, fish, or meat, occasionally, and the low frequency is more a matter of economics than social inhibitions and taboos. Bread has deep penetration in the urban areas and as much as 45% of the families in the lower income groups consume bread. No packaged food or bottled beverages, however, have been able to reach more than 5% of the total population. Among the prepared dishes, rice khichri, sheera, methi pak, gunder pak and shirkhand, are the most accepted ones.

The survey brought out the disturbing fact that there is hardly any weaning concept in these two states. Mother's milk is given to the child for as long as 18 months. A great deal of education is required to change child feeding habits. Introduction of weaning foods is an area where industry must immediately turn its attention because it has both social purpose and commercial potential.

Preservation of Fatty Foods: The Role of Antioxidants

Fat-containing foods are susceptible to undesirable oxidative change caused by the oxygen in the atmosphere. These chemical reactions take place upon the fat molecules of food. The organoleptic effects of such reactions are evidenced by off flavors and off odors. A typical off flavor resulting is that of bitterness. The generic expression for this type of organoleptic unpleasantness is "oxidative rancidity."

The compounds first formed from the alteration of the unprotected fat are fatty peroxides. These not only taste bad but are also quite toxic. Therefore, the use of "antioxidants" (which interfere with the development of these peroxides) not only serve to preserve the desirable eating quality of fatty foods, but also help to preserve their wholesomeness.

Many fruits, seeds, vegetables and oils contain natural antioxidants. Vitamin E is itself an antioxidant. However, in terms of food preservation, it is desirable to use a relatively pure compound so that a minute amount will suffice to protect the food in question without altering its flavor or texture. In the USA, the most widely used antioxidants are, in decreasing order, butylated hydroxyanisole (BHA), butylated hydroxytoluene (BHT), and propyl gallate. Also used, to a lesser extent, are nordihydroguaiaretic acid, tocopherols (related to Vitamin E), ascorbic acid (Vitamin C) and erythorbic acid. BHA has been in use as a food antioxidant for 23 years and BHT for 16 years.

BHT has been the subject of some controversy, apparently based on a report in the *Australian Journal of Preventive Biology and Medical Science* in 1959. According to this report, BHT, when fed in very high doses to rats, caused deleterious effects and was stated to be unsafe for food use.

In 1965, after thorough review by a joint committee of FAO and WHO, the safety of BHT was accepted when used at the recommended levels. Subsequent evaluation by the U.S. Food and Drug Administration indicated that the adverse effect of high levels of BHT was related to the high fat content of the diets used. Low levels of BHT, even in high fat diets, had no adverse effect on the growth of rats through two generations. The actual calculated consumption of BHT in the American diet is several times less than the daily acceptable intake level set by the FAO/WHO review committee. The recommended usage levels for BHT or BHA do not exceed 0.1% and for most food uses are in the range of 0.0002% up to a maximum of 0.1%.

The incorporation of antioxidants in packaging materials has been an effective means of retarding oxidative rancidity development in foods. However, it cannot be expected that such a procedure will eliminate the need for adding antioxidants to fatty foods. After the package is opened, the food may still need protection. One must also expect some migration of the antioxidant from the packaging material into the food. Therefore, it still remains necessary to establish acceptable levels for any antioxidant to be used in conjunction with foods.

Generally speaking, there is a gradually emerging literature which seems to indicate favorable and somewhat expected effects of antioxidants. There is a report of a gerontological study with mice indicating that life expectancy was significantly increased through the addition of antioxidants to their food. There is also a recent study which indicates that the survival time of rats exposed to atmospheric pollution resulting from ozone was increased by addition of an antioxidant to their food. It has also been indicated that antioxidants can protect vitamins of the B complex during food processing. The benefits derived from the use of the current major food antioxidants, at their recommended levels, outweigh any evidence of possible hazards from their use in foods.

For further information, write to L.I.F.E. and request a copy of "Current Status of Antioxidants for Food Preservation."