

solución congelante, los camarones quedan sólidamente congelados, siendo después almacenados en cartones de 50 libras, en la bodega refrigerada. Experiencia práctica con este equipo a bordo de botes pesqueras comerciales, demuestra un ahorro en fuerza manual, así como mejor calidad y más facilidad en el manejo del producto congelado.

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## **Fish Oils and Proteins: Their Contributions to the World's Feed Supply**

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In the United States the total supplies of high protein feeds for 1953-54 and 1954-55 are estimated at a little more than 13 million tons. Of these totals, fish meal represents slightly more than 2.6 percent, but if expressed in terms of oilseed equivalent the figure would be 3.6 percent. Admittedly, these appear to be insignificant parts of the whole, but without this ingredient, with its multiple values, it is highly probable that we would not have been able to achieve the extraordinary improvements in feed conversions, especially in broiler and turkey starters, which we have witnessed since 1946. For instance, in these eight short years there has been a 28 percent improvement in feed conversion so it is now possible to raise broilers at a rate of one pound of meat for each 2½ pounds of feed. Similar, though less spectacular, gains are seen in other livestock growth trends. This is one major reason why apparent civilian consumption of eggs is up 39 per cent, chickens 85 per cent, and turkeys 114 per cent in 1954 by comparison with 1935-39 averages.

Fish meal of good quality provides more of the essential amino acids, which are most likely to be of dubious availability or short of requirements when vegetable sources are relied upon, than any other protein ingredient. Three of these—lysine, methionine, and tryptophane—show to particular advantage in fish meal. In fact, fish meal normally contains twice as much, or more, of the first two and fifty per cent, or more, of tryptophane than any of the commonly-used vegetable protein products which make up nearly 80 per cent of all high-protein supplies.

In addition to its peculiar amino acid qualities and highly available protein there are present in fish meal abundant supplies of B-complex vitamins, especially vitamin B<sub>12</sub>, phosphorus and trace elements, the unknown "fish factor(s)", in some cases vitamin A and D, and energy in the form of fat. Much has been said and written of their value over the years and it is now acknowledged that these fish products are difficult to replace in our modern complex feeding program. Few products have ever been studied as intensively as fish meal and fish solubles have been in the past five years. If it were not for the recognized factors, known and unknown, which these products contribute to feeds, efforts would not have been expended to isolate and produce them synthetically, by fermentation, or otherwise. Undoubtedly the time is not distant when the unknowns will become knowns, but the fish products

need never again be sold purely on the merits of protein evaluations. Fish meal is a natural concentrate of exceptional worth, and, as we learn more of its components and their inter-relationships with the factors in all other feed ingredients, there is every reason to believe that this product will continue as a key to most efficient nutrition. This is one reason why we are determined to develop a quick chemical method of assay for protein evaluation. This is a critical need of processor and consumer alike and it is difficult to achieve, as shown by the limited success realized on similar soybean meal projects which have been in progress for a number of years. Surely a product which can have such an impact on our entire agricultural and food economies should have priority to proceed with this vital research program.

Fish meal has been discussed first because of its top rank as a protein feed ingredient. Another product of the fisheries, which has played a leading role in animal and poultry nutrition, is condensed fish solubles. This material is not generally looked upon as a protein ingredient because it usually contains less than half as much by volume as fish meal, it is commonly used at rather low levels in feeds, and its protein is not as readily available as that of fish meal. In fact, as a provider of lysine, methionine, and tryptophane, condensed fish solubles is only one third as useful as fish meal; however, it is a substantial contributor to nutrition because of its exceptional content of vitamins, notably those of the B-complex, and the unknown fish factor(s). That it is also the richest natural source of vitamin B<sup>12</sup> is common knowledge.

Comments on so-called "whole" or "full" meal are warranted because of the widespread use of these names and the frequent questions we receive concerning their meanings. A study is currently being made of proper designations for fish meal to which fish solubles have been added, and fish meals which have been processed without removal of stickwater. Clearly, feed control officials must have reasonable definitions and workable methods of determining the presence of guaranteed values. This problem is complicated by the numerous species of fish which are utilized throughout the world and by whether they are reduced from the round state or from cuttings of edible fish. Other contributing difficulties are: (1) blends of several varieties of raw materials; (2) seasons during which fish are caught; and (3) processing techniques. An excellent treatise of this subject by C. F. Lee appeared in the September issue of *Commercial Fisheries Review* under the title, "Technical Note No. 30—Proposed Method for Estimating Amount of Solubles Added to Whole Fish Meal". This is a problem not easy of solution and there are many who do not feel that it is important since they consider fish meal and solubles to be too valuable to place in a single package. If neither is to be wasted they should be used on the basis of their individual merits, fish meal primarily as a high protein supplement and solubles for its special vitamin and fish factor(s) values. It should not be overlooked, however, that research may develop new values for solubles or show us how to recover values presently being lost.

Fats and oils have been used as feed and food since the times of our earliest knowledge. Fish oils were used in earlier times without comprehension of what they contributed. It was known that growth was promoted and that was the principal need. It is now realized energy is also provided and that the oils frequently carry the fat-soluble vitamins. Now one hears constantly about improvements made possible in feeds by the addition of fat. Almost without

exception research has shown greater feed efficiencies with broilers, layers and swine when fats have been added to rations of the high-energy type so popular since the beginning of World War II. A practical maximum of vegetable energy from corn has probably been reached. It is known that, with the increase of the energy factor, higher levels of essential nutrients, such as proteins and vitamins, are required because of the lowered feed intake. Soybean meal has become the principal protein source, and another problem has thus been introduced. It is only possible to produce soybean meal with a protein level of 50-52 percent by the extraction process, but to achieve this point the oil level is necessarily reduced, making it difficult to hold the desired energy.

Good quality fish meal of average nutritive value provides the one opportunity for building up protein and, simultaneously, adding energy through its oil content. Even this oil, when fish meal is fed at practical levels, cannot provide the required energy for the ultra high-energy feeds of the future, so feeds undoubtedly will be augmented by supplemental oil and fat.

It is not impossible that, in spite of the record soybean crop of approximately 330 million bushels in the United States during 1954, there may be a shortage of protein feeds in the present crop year 1954-55. Only the release of government-held stocks of cottonseed meal and dried milk solids prevented chaotic conditions during the past summer. This was evidenced by violent fluctuations in soybean prices with every change in predictions of the new crop as the weather varied from dry heat to showers. To feed the poultry and animals currently on our farms at optimum protein levels, it is reliably stated that we need a soybean crop of 500 million bushels—an increase of 50 percent over this year's record. Scientists warn us that we cannot assume that necessity is the mother of invention, particularly when weather plays such a large part. A survey of the soybean acreage in the United States shows that 85 percent of the 1953 and 1954 crops came from the six states of Minnesota, Iowa, Missouri, Illinois, Indiana and Ohio. Is it not clear that, if crops are to be raised to supply anything like the ideal volume of protein for poultry and livestock feeds required to build food for 25 percent more people in 1975, all our scientific and management acumen must be put to full use?

It is believed that average protein use per animal unit is higher in the United States than elsewhere, but there is no reason why, if given the opportunity for development, there should not be enormous expansion of soybean plantings in many lands. This one item undoubtedly will be the base protein for many years to come.

Other countries, notably Norway, Iceland, the United Kingdom, and Japan, which are more dependent on the sea, will put still greater effort into effective utilization of marine products. There are riches in the sea which have hardly been tapped and the over-all future of this immense resource which covers more than half the globe yet supplies only 1 percent of the foods its peoples consume must be considered. Fishery resources have been seriously depleted in places because of carelessness or plain lack of knowledge. This ignorance must not continue as the demand for sea products mounts rapidly with our population. The folly of delayed or insufficient research is too clearly depicted by enormous economic losses in such fisheries as the California sardine and the Maine herring. On the opposite side of the ledger are certain fish about which enough has been learned that, by intelligent regulation and cooperation, frequently international in scope, the fisheries have been re-

covered in spectacular manner. Among these are the haddock in the Atlantic and the halibut of the north Pacific.

Also, progress is being made in the Alaskan herring and west coast salmon fisheries, and a start has been made on the Maine herring problem. Studies on the California pilchard have been carried out for many years, but on a totally inadequate basis. A similar disappearance of sardines may be occurring in South Africa and Angola, an area where international cooperation will be essential if there is only one stock.

In general, practically nothing is known about most of our commercially important fish. This is especially true of those species which contribute most heavily and directly to our world feed supplies—the menhaden, pilchard, and herring. If we are to maintain or expand the essential supplies of those products which are so needed to balance high-efficiency feeds, in order that we may produce high-protein foods, industry and government must work together on their comprehensive research programs. Only then will this great resource, the sea, be fully exploited, and with wisdom born of knowledge.

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## **Aceites de Pescado y Proteínas: Su Contribución al Abastecimiento de Forrajes del Mundo**

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### *Abstracto*

La harina de pescado representa únicamente 3.6 por ciento de los forrajes proteínicos producidos en los Estados Unidos; pero la dicha harina es mucho más importante de lo que estas cifras indican.

Esta harina ha ayudado con sus varios suplementos, a mejorar la industria de las aves de corral.

Una de las necesidades más grandes de esta industria es el desarrollo de un método químico rápido para la evaluación de las proteínas.

A pesar de una cosecha record de frijol soya, este país puede tener que hacer frente a una merma de forrajes proteínicos el próximo año. Bien puede ser que el mar pruebe ser una fuente de alimentos proteínicos.

Investigaciones científicas son necesarias para proteger y desarrollar estas fuentes.