Curing and Canning of Fishery Products: A History

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Introduction

Fish curing comprises all methods of preservation except refrigeration and canning. It includes 1) the drying, smoking, salting, and pickling of fish, 2) various combinations of these methods, and 3) miscellaneous methods such as the use of vinegar and fermentation processes or ripening.

The drying and smoking of fish are ancient processes. Archaeologists and anthropologists tell us that drying and smoking were probably developed shortly after the discovery of fire and before man learned to make pictographs on rocks. The art of salting is also very old, going back to the Stone Age. The use of vinegar and spices goes back, at least, to the Greeks and Romans (Radcliffe, 1921; Smidth, 1873).

Fish curing has been an important factor in the development of all great maritime nations. From the Middle Ages until well into the nineteenth century agricultural methods were poor. Livestock were wintered with difficulty, and meat curing methods were so poor that there was little meat during the winter; also, other protein foods were scarce. Canning and freezing had not yet been developed. The people needed a fairly low-priced protein food which would remain in good condition for some time. Dried, salted, and smoked fish supplied this need.

Before the beginning of the industrial age, international commerce was largely in natural products. The wine of Spain was exchanged for the dried and salt fish of England, the Netherlands, and Norway. The smoked herring of England was traded throughout central Europe. Even in the sixteenth century, when England was fighting Spain, her trade in dried fish with Spain was continued. It has been reported that England gained more wealth from cured fish products in the sixteenth century than Spain obtained in gold from the Americas.

Despite the importance of fish curing since prehistoric times, information on methods of the industry is scattered and exact data are lacking. Great interest has been exhibited in fish curing, as it does not require the equipment or capital needed for canning or freezing. An individual with a little capital may dry, salt, or smoke fish, using only homemade equipment. Species of fish may be utilized that are not suitable for canning. Localities not adaptable to the operation of canning or freezing plants may be used for fish curing. Dried and salt fish are not only good sources of protein but may be produced at a lower cost than other animal protein foods.

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Fish Curing Importance in the History of the United States

Atlantic Coast

The fish curing industry of the North Atlantic coast of North America dates back at least to the year 1500. There are authentic records of fish curing activities as of that period, and legends of activities at much earlier date. An extensive fish curing industry along the North Atlantic coast of North America was carried on for more than 100 years before there was any permanent settlement. As early as the year 1580 more than 300 ships from Europe were salting cod in this area. Newfoundland, "the oldest British colony," owes its origin to the fish curing industry.

The early colonists in New England and the Maritime Provinces would not have been able to survive without the salt cod and smoked herring they could prepare, for soil was poor and the climate uncertain. While fish meant food to the early colonists, cured fish soon became their capital resource and their stock in trade for the purchase of supplies. Their most abundant fish, Atlantic cod, could be manufactured into a durable protein food product, withstanding the primitive shipping and storage conditions of the day, and was comparatively low in price. Other cured fish such as smoked halibut and herring, pickled sturgeon, and salt salmon were soon being shipped abroad. Out of this grew the "triangular trade": Salt fish to Europe, manufactured goods from Europe to the West Indies, and sugar, rum, and molasses to New England. The trade in salt fish stimulated other industries and capital was gradually accumulated so that the colonists could go into shipping. Later, other natural resources such as timber were exploited, and the first attempts were made to create other local manufactures. The importance of fish curing in the development of trade and industry in early New England is discussed at some length by Ackerman (1941), who describes how various New England industries owe their origin to the foreign trade in cured fish.

The fish curing industry continued to grow and prosper, dominating the economic life of the New England colonies in the late 17th and 18th centuries. The French government was also concerned. It was attempting to expand the fisheries in the northwestern Atlantic in order to build up a large fish curing industry in its colony in Canada. Both the British and French attempted to dominate as much of the North American fishing grounds as possible, to secure the trade in salted and dried fish for themselves. Attempts were made to establish boundaries, but they were poorly defined, so that the fishing rights over a wide area were the cause of frequent bickering, sometimes flaring up into undeclared warfare. Indeed, the series of wars between France and England were in part

due to disputes over fishing grounds and fish curing locations. The fishermen and fish curers of New England and Nova Scotia played an important part in England's conquest of Canada, for to them the fishing rights meant life or death.

The disputes did not end with the ousting of France from Canada, but continued with the New England colonists on the one hand, and the English on the other. Parliament passed a bill in 1775 which prohibited the New England colonies from trading directly with foreign countries and prevented New England vessels from fishing on the banks of Newfoundland, in the Gulf of St. Lawrence, and on the coasts of Labrador and Nova Scotia where they had been accustomed to go. This meant ruin to the New England fish curing industry, and the edict was one of the leading causes of bringing the New England colonies into the Revolutionary War.

The treaty of peace negotiated in 1783 was delayed by the insistence of the American delegates on securing favorable fishery rights. They regarded these so important that they refused to sign a general treaty of peace, leaving the fishing rights for later adjudication. The British proposed to exclude the New England fish curing industry from grounds and areas where New Englanders had fished and cured fish extensively as colonists. Finally, however, the American delegation was able to obtain a treaty article on fisheries which granted favorable conditions to the United States.

The New England fish curing industry generally prospered under the new Republic, taking salt cod markets in southern Europe and the Mediterranean from the British and Scandinavians. Disputes arose with Great Britain over trade, the interpretation of fishery rights, and the impressment of American fishermen and seamen into the Royal Navy. Restrictions and embargoes were imposed by both Great Britain and the United States, resulting in a decline in the salt fish industry after 1807. The War of 1812 almost ruined the industry. The war was so unpopular among shipping, commercial, and fish curing groups that there was a move toward secession in some of the New England States.

At the end of the War of 1812 the British claimed that the war abrogated the treaty of 1783. The United States claimed that this treaty was still valid. Seizures of American fishing vessels were made and it seemed for a time that a new war might break out. Tension was eased by the signing of a new fishery convention in 1818. It was followed, however, by a whole series of disputes on interpretation, at times resulting in severe diplomatic tension. The rights involved in our fish curing industry in the northeastern Atlantic off the coasts of Canada and Newfoundland were probably the most important single cause of disagreement during most of the nineteenth century between the United States on the one hand, and Great Britain, with the Dominion of Canada, on the other.

Trouble occurred less frequently and with less intensity in the last decades of the 19th century, as refrigeration developed and a wider market was created in the United States for fresh fish, making salting and drying of fish on the northeastern coast less important. It was also possible to conduct all operations at sea away from the coast. While the feeling was not so intense, the points of difference in interpretation of the Convention of 1818 remained unsettled, and it was decided to submit the points at issue to arbitration under the Hague Convention. A decision was rendered in 1910.

Pacific Coast

The fisheries on the Pacific coast of North America did not affect U.S. international relations to the same extent as the fisheries of the Atlantic. This is because 1) their development was much more recent and 2) the development was different in character. The second factor is possibly due to the fact that development occurred at a period when canning and refrigeration were replacing curing as the principal methods of preservation. Then, too, more of the fishing took place in more clearly defined territorial waters.

There have been a number of disputes between Canada and the United States over Pacific fishery problems but they have been minor in character when compared with those in the Atlantic, and none concerned fish curing. In the 1930's, Japan invaded fishing grounds off the coast of Alaska, and interferred with our vessels which were catching and salting cod. The cod fishermen threatened to shoot any Japanese obstructing their operations. Japanese fishing was a matter of great concern to the Pacific Coast fisherman, but little notice was taken nationally until it was proved that the Japanese were catching salmon despite an undertaking to the contrary. The controversy was still unsettled when Japan went to war with the United States. The fishery dispute may be regarded as a contributory, though minor, cause leading to war with Japan.

Cured fish of various types were the first manufactured products prepared on the Pacific coast. The Indians had a considerable dried-salmon industry at The Dalles, on the Columbia River, long before the coming of the white man. The fish were traded to the plains tribes of the interior. According to Cobb (1930) the Russians operated a commercial salt salmon industry in Alaska at the beginning of the 19th century. Salt salmon was shipped as far as St. Petersburg. Soon afterward the Northwest Fur Company started a salmon salting business on the Columbia River. The Northwest Company merged with the Hudson's Bay Company which shipped salt salmon to Hawaii, Australia, China, Japan, and the eastern United States. American fishermen salted salmon in Alaska while it was still a Russian possession. A number of the large salmon canneries of the 1940's were originally established as salmon salteries.

The presence of cod off the coast of Alaska was established in the 1860's, and the possibility of building a prosperous salt cod industry there was one of the arguments advanced in Congress for the purchase of Alaska. More recent but still incomplete studies have established that the Pacific banks are larger and of greater potential production than the Grand Banks off the coast of Newfoundland. Yet, utilization in the 1940's was less than it was 30 years before.

During World War II the Pacific coast fish curing industry was much more adversely affected than that on the Atlantic coast. When the Alaska area became a combat zone, almost all fishing and

fish curing activities were stopped. All but one of the cod salting vessels was requisitioned by the Government. Herring salting in southeastern Alaska was almost impossible because of the great increase in costs, the scarcity of labor, and the necessity of using commercial vessels for war purposes. These causes also adversely affected the mild curing of salmon. The loss of foreign markets and the effect of pricing regulations were other unfavorable factors.

Fish Curing Data

Complete statistical data on the production of cured fish in the United States between the 1880's and the 1940's, or any consecutive series of years within the period, are lacking. This is unfortunate as both canning and refrigeration industries were being developed during this period; in fact, many changes were taking place in food habits and food products, with great effect on the fishing industry.

The first production figures available on the fish curing industry were reported by Goode (1884), but the data do not cover the entire United States and are reasonably complete only for the New England states. The first complete figures on manufactured fishery products are for 1908. It is the first reasonably complete and accurate statistical record on the production of cured fish in the United States. In 1908 the total production amounted to 187,299,000 pounds with a value to the producer of $11,018,000. In 1940, production decreased to 97,439,000 pounds, but the value increased to $14,235,000. The decline in the production of salt groundfish is even more startling if the New England area, historically the most important, is considered separately. From 79,009,000 pounds in 1880 the production fell to 4,742,000 pounds in 1919.

In 1908, dried and salted groundfish (cod, haddock, cusk, hake, and pollock) totaled 84,642,000 pounds while in 1940 it was 17,697,000 pounds. It is believed that a portion of the boneless salt cod reported in 1940 was prepared from green-salted fish imported from Canada and is, therefore, not entirely a product of the U.S. fisheries. Pickled or hard-salt salmon amounted to 14,595,000 pounds in 1908 while in 1940 it was 829,000 pounds. The production of mild-cured salmon showed little change since it equalled 8,483,000 pounds in 1908 and 7,770,000 pounds in 1940. Incidentally, 1940 was a war year, and foreign markets which usually absorbed an important share of the production had been eliminated. More than 1,200,000 pounds of halibut were smoked in 1908, while only a few hundred pounds were prepared in 1940. Production of smoked herring was 13,311,000 pounds in 1908 but it totaled only 3,629,000 pounds in 1940. On the other hand, no smoked kippered sablefish was prepared in 1908 while there was a production of 1,176,000 pounds in 1940. The production of dried shrimp is given as 342,000 pounds in 1908 and 2,069,000 pounds in 1940. Herring pickled in vinegar and spiced herring were not reported in 1908, while production of these two items totaled 3,537,000 pounds in 1940. This is believed to involve some duplication as herring pickled in vinegar is used in the production of spiced herring. Kippered salmon is not reported in 1908 while 2,543,000 pounds were produced in 1940. Production of smoked salmon amounted to 4,297,000 pounds in 1908 and it was 8,423,000 pounds in 1940. No smoked buffalofish, butterfish, or carp are listed in 1908, while production of these three items totaled 1,004,000 pounds in 1940.

In 1908, cured fishery products represented 42 percent of the manufactured fishery products while canned fish and sea foods amounted to 57 percent. In 1940 production of cured fishery products amounted to 97,439,000 pounds with a value to the primary producer of $14,235,000 while production of canned products amounted to 708,930,000 pounds with a value of $94,182,000. Thus, in 1940, cured fish accounted for 9 percent of the quantity and 10 percent of the value.

The fish curing industry is much more important in other countries with large fishery industries than in the United States, and fish curing in those countries does not show a decrease to the same extent as in the United States. Japan was the world's largest producer of cured fishery products at the outbreak of World War II. In 1936, Japanese data showed a production of 1,234,709,000 pounds of cured fishery products with a value of $49,609,000. The production of canned fish amounted to 223,899,000 pounds, with a value of $20,318,000. It is understood that cured products were prepared largely for home consumption, and the greater portion of canned products was exported. Fish paste was the most important single item, with a production of 203,856,000 pounds. Seaweed prepared by several different methods was also an important cured product in Japan. The only method of curing not greatly favored in Japan was smoking. The total amount cured by this method was only 1,847,000 pounds.

The production of cured fishery products in Canada was greater than in the United States but the value to the producer was less. The total of cured products in 1938, the last year of normal prewar production, amounted to 125,451,000 pounds with a value of $4,250,000. Difference in value of production is believed due to the fact that items produced in Canada are largely the standard low-priced products, while the United States prepared more high-priced cured fish specialties. For instance, in Canada the total production of smoked and kippered salmon in 1938 was reported as 26,000 pounds with a value of $3,000, while the United States production of smoked and kippered salmon in 1940 was 10,966,000 pounds with a value of $3,563,000. Canadian statistics did not show any production of such articles as smoked sturgeon and spiced herring.

Canning Fishery Products

While a number of individuals contributed to the early development of the canning industry, it is generally agreed that the original inventor of the art of canning was Nicolas Appert, a Frenchman, and that the basic methods of the industry are the result of his work.

In 1795 the revolutionary French Government was at war on land and sea with most of the other European governments in areas as widely separated as the West and East Indies. Few ports were open to the French, who therefore had to depend largely on dried, smoked, and

pickled foods brought from France. These products were subject to spoilage and their use resulted in widespread incidence of deficiency diseases, such as scurvy, which greatly weakened the military forces. The French Government therefore offered a prize of 12,000 francs to anyone who would develop a new method of preserving food so that decomposition would be reduced and more of the original characteristics of fresh food retained.

Nicolas Appert, a confectioner, brewer, distiller, and wholesale caterer was interested in this problem. Appert worked until 1804 before he attained his first measure of success, and not until 1809 was his method finally developed. He was awarded the prize in that year after a thorough investigation of his method, and as required by the terms of the award his results were published in 1810 (Collins, 1924).

The house of Appert was still in operation in the 1940's under the management of the fourth generation of the family. Appert never became a great commercial success as he was interested in improving his products and processes to the exclusion of almost everything else, and devoted most of his time and money to this end.

Peter Durand, an Englishman, in 1810 obtained a patent on a process for preserving "animal, vegetable and other perishable foods in vessels of glass, pottery, tin or any fit materials." This was the first mention of tin as a container for sterilized foods, although tin containers had been in use before 1800 for packing salt and kippered fish. Durand is said to have obtained his patent through knowledge imparted by a foreigner who is believed to have been Appert. Durand's method came into extensive use only after 1820 when Pierre Antoine Angilbert invented a tin container less subject to leakage, and which could be made more rapidly.

Canning was first developed on an extensive commercial scale in the United States, and most of our pioneer canners were primarily packers of fish and seafoods, with fruits, vegetables, and preserves packed as secondary or incidental items. Strangely enough, the packing of fishery products presents more difficulty than processing other types of foods.

Canning is said to have been introduced into the United States by Ezra Daggett and Thomas Kensett in 1819 when they packed oysters and other seafoods in New York (Cobb, 1919). William Underwood is credited with establishing a plant in Boston in 1820, packing lobster and fruit in glass. It is understood that these men learned the art in England before emigrating to this country. The Underwood plant was later reorganized into the firm of Wm. Underwood's Sons and, still in existence in the 1940's, was the oldest in the United States.

Thomas Kensett was the first to break away from home kitchen methods and deserves credit for the development of the first canned product to receive wide distribution, namely, the oyster. The pioneer development of the industry in the Chesapeake Bay area, the first important canning center, is due to his efforts. Others are said to have engaged in the industry in the Baltimore area before Kensett, and as stated above, it is believed that oysters were canned as early as 1819. The first systematic effort at the large-scale development of a product was made by Kensett in 1844, when he began packing oysters in Baltimore. Collins (1924) reported:

"Oysters and seafood were the first products that became popular. Inland cities could get fresh Baltimore oysters packed in ice through the winter; but folks in smaller places seldom enjoyed such a luxury—the countryman's greatest treat when he went to town was an oyster stew. Baltimore and Boston canned oysters so they would keep for months, and could be bought at any country grocery store by people who had never eaten a fresh oyster."

Increase in production was gradual over a period of about 20 years beginning in 1844. The first big increase in demand came with the Civil War. Preserved foods were needed for feeding the troops, thus enormously increasing the demand and creating additional consumers for canned seafoods. Men who became acquainted with these products in the Army demanded canned foods on their return home and introduced them among their neighbors.

Our most important fish canning industry, namely salmon, had its beginning during this Civil War period. Salmon is said to have been canned first in Aberdeen, Scotland, in 1824 and it is claimed that the first salmon canned on the American continent was packed at St. Johns, N.B., in 1839, and in Maine shortly afterward. However, it was never packed on an extensive scale as were lobsters and oysters. At no time has the packing of salmon been of any importance on the U.S. Atlantic Coast. The industry had its real beginning in California, first became important on the Columbia River, and reached full development when salmon canning spread to British Columbia, Alaska, northern Japan, and Siberia, in that order.

George and William Hume with their friend A. S. Hapgood were the creators of the Pacific salmon canning industry (Hume, 1904). The Hume brothers, who had worked as fishermen at their home in Maine, went to California as "Forty-niners." They noticed that salmon were plentiful in the Sacramento River and believed that money might be made canning the fish. They went back to Maine on a visit, induced A. S. Hapgood, a lobster canner, to return west with them, and the first Pacific salmon pack was made at Sacramento, Calif., in 1864. The pack was a failure the next year, but conditions were reported to be extremely favorable on the Columbia River, so the Hume firm moved their equipment to Eagle Cliff, Wash., about 40 miles up the river from Astoria, Oreg., and made the first pack of Columbia River salmon in 1866.

Canned salmon was introduced to England and Germany where the first large market for this product was established by ships loading wheat and lumber for European ports. Canneries became numerous along the Columbia River, and as the sale of canned salmon steadily increased, the industry sought new and profitable locations, first at New Westminster on the Fraser River in British Columbia in 1867; then at Mukilteo, on Puget Sound, Washington Territory, in 1877; and while Alaska was the most important salmon canning area

in the 1940's, its first cannery was not built until 1878 at Klawak, on Prince of Wales Island.

Salmon is said to have been canned as early as 1877 in northern Japan, but commercial operations date from 1890 in that area (Anonymous, N.d.). The salmon canning industry was established in Siberia in about 1906. The largest pack of canned salmon was made in 1936, when production amounted to a world total of 13,720,423 cases of 48 1-pound cans.

Sardines were first packed at Nantes, France, in 1834, and by 1860 a fairly good market had been created for French sardines in the United States. Efforts were made to establish an American industry in 1871, utilizing young menhaden as raw material. In 1877 Julius Wolff began canning small herring at Eastport, Maine, and is credited with starting the first really successful American sardine cannery. In a few years a large number of sardine canners were operating in northern Maine and nearby Canada.

Several efforts were made during the 1890's to establish sardine canning on Puget Sound or in Alaska where large quantities of herring were available, but all of these operations were shortlived. The first successful Pacific Coast sardine cannery was established at San Pedro, Calif., in 1896 (Bitting, 1937). The industry developed slowly until 1917 when the pack was suddenly increased to a large amount by the demands of World War I. After the war, production was maintained and increased by extensive cultivation of the export trade. When the depression of the 1930's destroyed the export market, a slump in production occurred, but this was largely overcome by development of the domestic market. The Pacific sardine industry was centered almost entirely in California in the 1940's where it originated, with a small pack canned on the Columbia River and in British Columbia.

Shrimp were first packed in the Gulf of Mexico area. G. W. Dunbar of New Orleans, canned shrimp as early as 1867 but had difficulty with blackening and discoloration. He solved this problem in 1875 with the invention of a can lining which aided greatly in overcoming blackening. Shrimp packing soon became, and remained in the 1940's, the principal fishery canning industry of the Gulf coast. Shrimp were also canned on the Atlantic Coast in Florida, Georgia, and South Carolina, but the amount packed on the Atlantic Coast was much smaller than on the Gulf Coast.

While Baltimore, Md., was the center of the oyster canning industry for a long period, oysters were being packed there in the 1940's only occasionally. The catch of the Chesapeake Bay region had decreased greatly and the oysters of this area were more profitably marketed in the fresh state. The greater portion of the oyster pack was then prepared on the Gulf Coast, the industry centering around Biloxi, Miss. Another development in the oyster industry was the establishment of oyster canning on the Pacific Coast. The introduction of the Japanese or "Pacific" oyster created a surplus, unmarketable in the raw condition. After several years of experimental work, this oyster was canned commercially in 1931. The pack in that year was 7,930 cases, increasing to 118,853 cases in 1936.

Burnham and Morrill are credited with establishing the first clam cannery in the United States in 1878 at Pine Point, Maine (Stevenson, 1899). The pack of canned clam products was small for some years as considerable difficulty was experienced with discoloration, but production slowly increased when this difficulty was overcome. P. F. Halferty developed a method for canning minced razor clams about 1900, building up a commercial clam canning industry in Oregon, Washington, and Alaska. The inclusion of minced clams, broth, and clam chowder in the list of clam products increased the value of canned clam products until, in the early 1940's, they ranked fifth in order of importance of the canned fishery products, thereby displacing oysters.

Crab was first canned in this country by James McMenamin of Norfolk, Va., in 1878. The canning of crab meat never became important on the Atlantic Coast, and the quality of the pack has been variable. The greatest obstacle has been discoloration. In 1936, a method to overcome discoloration was developed by Fellers and Harris, and in 1938 Harris packed the common or blue crab of the Atlantic coast commercially. The principal obstacle to a greater development was believed to be the competition offered by imported crab meat.

Canned crab was in considerable demand in the United States, but most of the supply originated in Japan. Indeed, this country was the most important market for Japanese canned crab, which is a different species from the common American varieties.

While the crab canning process is said to have been developed in 1892, the Japanese industry was not established on a commercial scale until 1908 (Anonymous, N.d.). Japanese canned crab began to enter the United States markets in appreciable quantities during the World War I years, until in 1931 imports amounted to almost double the domestic production of fresh and canned crab meat.

A domestic crab canning industry has been developed in the latter 1930's in Alaska, Oregon, and Washington. Processing and other technical difficulties were overcome and a market was developed in the Pacific Coast States. It was not believed in the early 1940's that the Pacific Coast crab canning industry could be expanded sufficiently to supply the domestic demand for canned crab.

The large supply of groundfish in the North Atlantic has been the basis of numerous attempts to develop a canning industry, which have not been particularly successful because of competition with other canned fishery products or insufficient advertising. Cod and haddock products such as fish flakes, fish cakes or balls, and finnan haddie have not found a wide market outside the New England area and are packed on a limited scale. Fish cakes were first packed in Boston in 1878. Finnan haddie (smoked haddock) was first packed about 1890, and a steady but not large demand existed in the early 1940's. Fish flakes or "salad fish," the flaked meat of cod and haddock, are believed to have been developed by Burnham and Morrill of Portland, Maine, in 1898.

At the turn of the century, the industry was experimenting with a variety of

products. A number of articles were sold commercially that were not found on the market in the 1940's, such as pickled sturgeon, smoked lake trout, carp, shark meat, menhaden, and a variety of specialty or delicatessen products. Some of these packs did not make a good product, others were not in sufficient demand, while in other instances the cost of raw material became too great for profitable operation. About 1900, the annual pack of canned fishery products was less than half of the amount produced in the early 1940's and it was thought that production could not be increased greatly or even maintained. The lobster canning industry, once almost exclusively confined to the United States, passed almost entirely over to Canada after 1896 (Cobb, 1919). While these gloomy predictions were being made, the canning industry of fishery products was on the threshold of its greatest development. Production of the standard varieties has been greatly increased and new products have been developed on a considerable scale.

Canned tuna is one of the more recently developed canned fishery products, first packed commercially in 1909. O.W. Lang (1935) stated:

"According to those who are intimately connected with California fisheries, the packing of tuna had its inception in the Southern California Fish Co. . .This company, between its date of incorporation in 1892 and until 1905, was interested only in the production and marketing of one-quarter and one-half pound square cans of sardines in oil and the one pound oval pack of the larger sardines. Serious foreign competition, principally from Norway, encroached upon the business, and it was through the resourcefulness and ingenuity of one of its officers that experiments were conducted during 1905, 1906, and 1907 on the canning of tuna. The tests were conducted under the direction of Mr. Lapham, the president, with Wilbur F. Woods and James McMann as the active investigators. Their source of raw material was albacore, which when cooked, they all agreed, resembled chicken in taste and flavor. This characteristic flavor, no doubt, added impetus to their experiments, but it was not until 1907 that their efforts were rewarded. . . ."

"The first successful pack was produced in 1909 when 2,000 cases were packed which were marketed by Sigmund Seeman, Seeman Brothers, New York."

Mackerel was canned in small quantities in New England as early as 1843. The introduction of mackerel into the general canned food market occurred in 1927 when George Ogawa put up a pack of 10,725 cases of California mackerel "salmon style" which was sold at a price to compete with the cheaper varieties of salmon. Production of Pacific mackerel increased to 388,500 cases in 1928, and rapidly reached a peak of 1,795,700 cases of 48 1-pound cans in 1935.

The most recently developed canned fishery product is not intended for human consumption, but is prepared for feeding pets and fur animals and for use in fish hatcheries. In 1938, 413,434 cases of pet food made from fishery products were packed. Production is divided between California, where mackerel or whale meat is utilized as the basic ingredient, and in New England where pet food is a by-product in the packing of fish fillets.

The total market value of all fish and fishery products to primary handlers in 1938 was established at about $214,000,000. The fish canning industry accounted for $83,446,000 or 39 percent of this total. About 160 species of fish are utilized regularly for food in the United States. Fifteen are canned regularly on a large commercial scale while a number of others are packed occasionally or in quantities too small to merit separate record in statistical reports. The record domestic pack of canned fishery products [up to the early 1940's] was produced in 1936 and amounted to 794,707,014 pounds valued at $94,564,254. Salmon is the most important canned fishery product, its value in 1938 amounting to 50.8 percent of the total value of all canned fishery products. Next in importance are tuna and tuna-like fishes, sardines, shrimp, clam products, mackerel, and oysters, in the order named. The seven varieties listed above account for 96 percent of the value of the total pack. While canned sardines ranked second in value in 1929 and oysters fifth, these products had dropped to third and seventh places, respectively, in 1938.

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